

HARARE MASTER PLAN [2025-2045]

Report of Study

June 2025

15 April, 2025

DSA Consortium
HARARE MASTER PLAN
REPORT OF STUDY

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This Master Plan has been prepared in terms of Part IV of the Regional, Town and Country Planning Act, Chapter 29:12, Revised Edition, 1996 and the Regional, Town and Country Planning (Master and Local Plans) Regulations, Government Notice No. 248 of 1977. It is hereby certified that this is a true copy of the City of Harare Master Plan as Adopted by the Council on by Council Resolution Number

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Preface

Harare City Council as the Local Planning Authority at its 1923rd Ordinary Full Council Meeting held on the 29th of February 2024, Minute Item 30, as guided by the provisions of Part IV of the Regional, Town and Country Planning Act, Chapter 29:12, Revised Edition, 1996 and the Regional, Town and Country Planning (Master and Local Plans) Regulations, Government Notice No 248 of 1977 resolved to prepare the City of Harare Master Plan. The preparation of the City of Harare Master Plan has been necessitated by the fact that the existing Harare Combination Master Plan of 1993 has become defunct and Combination Local Authorities has abandoned the same necessitating the need for the City of Harare to prepare its own Master Plan. The City of Harare Master Plan is aimed at addressing constraints facing the city, residents and space users and tapping on emerging opportunities for spatial planning, environmental conservation, socio-economic and infrastructural development key in improving service delivery in the Planning Area. In Compliance to the provisions of Part IV of the Regional, Town and Country Planning Act, Chapter 29:12, Revised Edition, 1996 as read with Part I to III (Sections 3-6) of the Master and Local Plans Regulations (RGN) 248 of 1977 and the Call-to-Action Blue-Print on Service Delivery and standard practice the Report of Study outlines the study findings in relation to a scientific investigation on:

- the environment,
- principal social and demographic characteristics,
- Economic Characteristics,
- Real Estate and Land Markets,
- spatial land use characteristics,
- public utilities (Portable Water, Waste and Storm Water, Roads, Waste Management and Energy) and communications (Traffic and Transportation, information communication technologies),
- the City of Harare's corporate governance structure, finance and institutional framework,
- as well as provide a summary of issues emerging critical in informing the Written Statement.

The study findings that highlight the planning issues, challenges, perceptions and aspirations of property owners and space users will inform the Master Plan Written Statement and Proposals.

List of Acronyms

AFCFTA	African Continental Free Trade Area
AfDB	African Development Bank
AI	Artificial Intelligence
API(s)	Application Programming Interface(s)
ATM	Automated Teller Machines
AU	Africa union
AA100	Accountability Assurance Standard
AI	Artificial Intelligent
API(s)	Application Programming Interface(s)
AWS	Amazon Web Services
BESS	Battery Energy Storage Systems
BRT	Bus Rapid Transit
BOT	Build-Operate-Transfer
CEO	Chief Executive Officer
CCGT	Combined-Cycle Gas Turbine
COVID 19	Coronavirus disease 19
CAGR	Compounded Average Growth Rate
CZI	Confederation of Zimbabwe Industries
CAAZ	Civil Aviation Authority of Zimbabwe
CBD	Central Business District
CBO	Community-Based Organizations
CSO	Civil Society Organizations
COBIT	Control Objectives for Information and Related Technology
CBD	Central Business District
CIC(s)	Community Information Centres(s)
CSP	Concentrating Solar Power
CSO	Civil Society Organizations
CVO	Commercial Vehicle Operations
DGI	Development Governance Institute
DoR	Department of Roads
DDoS	Distributed Denial of Service
DSPD	Department of Spatial Planning and Development
ESKOM	Electricity Supply Commission
ESI	Electricity Supply Industry
EIA	Environmental Impact Assessment
ENT	Ear, Nose and Throat care
ENS	Energy Not Supplied
EMDE	Emerging Market and Developing Economy
ERRP	Emergency Road Rehabilitation Program
EASS	East African Submarine System
EIA	Environmental Impact Assessment
EMA	Environmental Management Agent
EMDE	Emerging Market and Developing Economy
ENS	Energy Not Supplied
ERRP	Emergency Recovery and Reconstruction Project
ESAP	Economic and Structural Adjustment Program
ETs	Emergency Taxis
EV	Electric Vehicle

FDI	Foreign Direct Investment
FiT	Feed-in Tariff
GIS	Geography and Information Systems
GDP	Gross domestic product
GHG	Green House Gas Emissions
GMP	Growth Monitoring and Promotion
GoZ	Government of Zimbabwe
GV8FC	Glenview 8 Furnisher Complex
GVC	Global Value Chain
HCC	Harare City Council
HDI	Human Development Index
HGV	Heavy Goods Vehicle
HMP	Harare Municipality Police
HPCS	High-Performance Computing System
HUOC	Harare United Omnibus Company
HVAC	HEATING VENTILATION AND AIR CONDITIONING
ICT	Information and Communication Technology
IDD	Iodine Deficiency Disorders
IIP	Index of Industrial Production
IMAM	Integrated Management of Acute Malnutrition
IMF	International Monetary Fund
IMS	Incident Management Systems
IoT	Internet of Things
ITS	Intelligent Transportation Systems
IYCF	Infant and Young Child Feeding
IRENA	International Renewable Energy Agency
IAEA	International Atomic Energy Agency
IPP	Independent Power Producer
IYCF	Infant and Young Child Feeding
IaaS	Infrastructure as a Service
ICDL	International Computer Drivers Licence
ITIL	Information Technology Infrastructure Library
IoT	Internet of Things
ISPs	Internet Service Providers
LA	Local Authority
LDP	Local Development Plan
LMV	Light Motor Vehicle
LOS	Level of Service
LPA	Local Planning Authority
LR	Light Rail
LPG	Liquefied Petroleum Gas
LTE	Long Term Evolution
Mbps	Megabits per Second
ML	Machine Learning
MNO/s	Mobile Network Operators
MPLS	Multiprotocol Label Switching
MEPS	Minimum energy performance standards
MLGPW	Ministry of Local Government and Public Works
MoE	Measures of Effectiveness
MoTID	Ministry of Transport and Infrastructural Development

MR	Mono Rail
MSMEs	Micro Small & Medium Enterprises
MVA	Manufacturing Value Average
MHI	Manitoba Hydro International
MW	Mega Watts
MSMEs	Micro Small & Medium Enterprises
MVA	Manufacturing Value Average
NDS1	National Development Strategy 1
NGO	Non-Governmental Organization
NMT	Non-Motorised Transport
NRCS	National Road Condition Survey
NREP	National Renewable Energy Program
NRZ	National Railways of Zimbabwe
NRW	Non-Renewable Water
NHDP	National Housing Development Program
NDC	Nationally Determined Contributions
NIERP	National Integrated Energy Resource Plan
NMR	Nano Modular Reactors
NREP	National Renewable Energy Policy
OD	Origin-Destination
ODIN	The Operate Data Inventory
PCE	Passenger Car Equivalent
PPP	Private Public Partnership
PPP	Public Private Partnership
PSV	Public Service Vehicle
PaaS	Platform as a Service
PoE	Power over Ethernet
POS	Point Of Sale
POTRAZ	Postal and Telecommunications Regulatory Authority of Zimbabwe
PPA	Power Purchase Agreement
PV	Photovoltaic
RA	Road Authorities
RBZ	Reserve Bank of Zimbabwe
RIDA	Rural Infrastructure Development Agency
RTA	Road Traffic Accidents
RDC	Rural District Council
RE	Renewable Energy
REAZ	Renewable Energy Association of Zimbabwe
REC	Renewable Energy Certificates
SADC	Southern African Development Commit
SAIDI	System Average Interruption Duration Index
SDGs	Sustainable Development Goals
SEZs	Special Economic Zones
SIDRA	Signalised and Unsignalized Intersection Design and Research Aid Software
SMEs	Small & Medium Enterprises
SUOC	Salisbury United Omnibus Company
SaaS	Software as a Service
SEACOM	South East Asia Communication

SWH	Solar Water Heater
SEZs	Special Economic Zones
SAPP	Southern Africa Power Pool
SNR	Small Nuclear Reactors
SMR	Small Modular Reactors
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
STEM	Science Technology Engineering and Mathematics
TSCZ	Traffic Safety Council of Zimbabwe
TVET	Technical and Vocational Education Training
UC	Urban Council
UN	United Nations
UNECA	United Nations Economic Commission for Africa
UNICEF	United Nations Children
UPS	Uninterrupted Power Supply
USAID	United States Agency for International Development
UNIDO	United Nations Industrial Development Organisation
V/C	Volume to Capacity Ratio
V2E	Vehicle to Everything
V2I	Vehicle to Infrastructure
V2V	Vehicle to Vehicle
VCI	Visual Condition Index
VID	Vehicle Inspectorate Department
VoIP	Voice over Internet Protocol
VPN	Virtual Private Network
VAT	Value Added Tax
VAPT	Vulnerability Assessment and Penetration Testing
VSAT	Very Small Aperture Terminal
WHO	World Health Organisation
WTW	Water Treatment Works
WASH	Water, Sanitation, and Hygiene
ZCHPC	Zimbabwe Centre for High-Performance Computing
ZESA	Zimbabwe Electricity Supply Authority
ZIMSWITCH	Zimbabwe's National Electronic Funds Switch
ZERA	Zimbabwe Energy Regulatory Authority
ZIDA	Zimbabwe Investment and Development Agency
ZILGA	Zimbabwe Local Government Association
ZIMSTAT	Zimbabwe National Statistics Agency
ZINARA	Zimbabwe National Road Administration
ZIMRA	Zimbabwe Revenue Authority
ZINWA	Zimbabwe National Water Authority
ZIRGP	Zimbabwe Industrial Reconstruction and Growth Plan
ZRP	Zimbabwe Republic Police
ZUPCO	Zimbabwe United Passenger Company
ZPC	Zimbabwe Power Company
ZIRGP	Zimbabwe Industrial Reconstruction and Growth Plan
ZTA	Zimbabwe Tourism Authority

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1. CHAPTER 1: CONTEXT AND BACKGROUND TO THE MASTER PLAN

1.1. General Background

Part IV of The Regional, Town and Country Planning Act Chapter 29:12 of 1996 and The Regional, Town and Country Planning (Master and Local Plans) Regulations, Government Notice No. 248 of 1977 mandates all Local Authorities to prepare Master and Local Plans. Master Plans are spatial planning frameworks that provide for the control, coordination, and harmonisation of development in space and time with the object to promote order, amenity, convenience, economy, improvement of communications and protection of the environment including but not limited to the provision of basic services and infrastructure in local authorities. By their nature master plans anchor sustainable human development by regulating uses of the land, control, harmonisation and coordination of the process of development.

Harare City Council (hereafter HCC) has evolved through the Harare Combination Master Plan of 1993. The need to review the Combination Master Plan has been long overdue. Over the years local authorities constituting the Harare Combination Authority failed to agree on the need to reconstitute the combination authority instead prepare independent master plans. For Harare the absence of an up-to-date master plan does impede the city's ability to coordinate development and land management including the provision of basic services and infrastructure. The City of Harare like any other urban settlement in Zimbabwe is experiencing significant transformation in terms of demographic, economic, social and administrative profiles with a bearing service delivery. Unlike medium sized cities Harare exhibit both characteristics of a primate city and a metropolitan city. It is therefore imperative their forward planning frameworks are not only in place but up-to-date so as to provide a timeless framework to guide spatial development and integrate all of the city's functions. Master and Local Development Plans (spatial development frameworks) are thus critical as they enable Local Authorities deliver planned land and create a works programme for service delivery for councils for prolonged periods as well as forecasts and responds to disruptive trends.

Urban land use and development patterns are a result of a complex interaction of demographic trends, natural resources base, economic circumstances and opportunities, social attitudes, institutional establishments that direct development and environmental factors among numerous factors. These factors that influence development decisions are constantly evolving. For Harare the determinants of development in the city and the area immediately adjacent to it are now different from the factors that shaped development say, in the eighties, nineties and the turn of the new millennia.

In order to achieve sustainable, inter and intra generational development patterns, the laws and practices governing development must constantly be reviewed and adapted to meet ever changing development imperatives and service needs. Upon this observation the Government of Zimbabwe issued a Call-to-Action Service Delivery Blueprint¹ for Local Authorities as the First Stage of Interventions to Modernise the Operations of Local Authorities towards Vision 2030 of Zimbabwe achieving an upper middle-income economy. The upper middle-income economy will be defined by the income per capita and quality of life. The quality-of-service provision by Local Authorities is thus expected to be in line with an Upper Middle-income economy. An integrated approach and program have thus been put in place to ensure that all

¹ Call-to-Action Service Delivery Blue Print

Local Authorities deliver a service in sync with an Upper Middle-income economy. An urgent and immediate requirement is for all Local Authorities to achieve acceptable service delivery levels and observe all applicable laws. In particular Article 6 of the blue-print recognises that Local Authorities must prepare master plans and should have operative master plans by 30th of June 2024. The Government of Zimbabwe recognised that development and abiding by a Master Plan is key to the sound management of every Local Authority as well as enabling the Local Authority to develop to its potential.

The City of Harare Master Plan has thus been prepared in terms of Part IV of The Regional, Town and Country Planning Act Chapter 29:12 of 1996 and The Regional, Town and Country Planning (Master and Local Plans) Regulations, Government Notice No. 248 of 1977. The City Master Plan is a statutory framework to direct and control development with the ultimate aim of achieving sustainable development in the city being cognisant of the city's aspirations, national and regional setting, development imperatives and the interaction of a whole host of factors.

1.2. Historical Background – the Growth and Problems of the City

1.2.1. From Pre-Colonial Period City of Salisbury to Present Day Harare

1890-1979 Period

The city was founded on 12 September 1890 by the Pioneer Column, a small military force of the British South Africa Company organised by Cecil John Rhodes, and was named Fort Salisbury after the British Prime Minister Lord Salisbury. Company administrators demarcated the city and ran it until Southern Rhodesia (modern day Zimbabwe) achieved responsible government in 1923. The Salisbury Polo Club was formed in 1896. Salisbury was declared a municipality in 1897, and it became a city in 1935. Salisbury was thereafter the seat of the Southern Rhodesian (later Rhodesian) government and, between 1953 and 1963, the capital of the Central African Federation and Nyasaland. This growth ushered in a wave of liberalism, investment and developmentalism thereby transforming the city's skyline in the process. The rapid rise of motor vehicle ownership and the investment in road development greatly accelerated the outward sprawl of suburbs such as Alexandra Park and Mount Pleasant. At the same time, mostly black suburbs like Highfield suffered from overcrowding as their populations boomed. The optimism and prosperity of this period proved to be short-lived, as the Federation collapsed, which hindered the city's prosperity. The Federation of Rhodesia and Nyasaland was dissolved in 1963. Ian Smith's Rhodesian Front government declared Rhodesia independent from the United Kingdom on 11 November 1965, with Salisbury retained as the capital.

1980 to present

On 18 April 1980 the country got its recognition as independent Republic of Zimbabwe and at this juncture the city retained the name Salisbury until 1982 when it was renamed Harare on the second anniversary of Zimbabwe's independence. The city initially boomed under a wave of optimism and investment that followed the country's independence in 1980. The name of the city was changed to Harare on 18 April 1982, the second anniversary of Zimbabwean independence, taking its name from the then native village near Harare Kopje of the Shona chief Neharawa, whose nickname was "he who does not sleep". Before independence, "Harare" was the name of the black residential area now known as Mbare.

At the time of the city's founding, its site and surroundings were poorly drained. The earliest development was on sloping ground along the left bank of a stream, in an area where the Julius Nyerere Way Road runs today. The first area to be fully drained was near the head of

the stream and was named Causeway. Causeway is now the site of many important government buildings, including the Senate House and the Office of the then Prime Minister. After the position was abolished in January 1988, the office was renamed for the use of the President. The national parliament moved out of Harare upon completion of the New Parliament of Zimbabwe in Mount Hampden in April 2022.

The City of Harare being the commercial capital of Zimbabwe, it remains an important centre of commerce and government, as well as finance, real estate, manufacturing, healthcare, education, art, culture, tourism, agriculture, mining and regional affairs. The city has the second-highest number of embassies in Southern Africa and serves as the location of the African headquarters of the World Health Organization, which it shares with Brazzaville. Harare has hosted multiple international conferences and events, including the 8th Summit of the Non-Aligned Movement in September 1986, Commonwealth Heads of Government Meeting 1991, 1995 All-Africa Games, the 1998 8th Assembly of the World Council of Churches and the 2003 Cricket World Cup.

However, by 1992, Harare began to experience an economic downturn and the government responded by enacting neoliberal reforms. These policies inspired a boom in banking, finance and agriculture, but also led to significant job losses in manufacturing, thereby greatly increasing unemployment and income inequality. Domestic firms struggled to compete with foreign imports, leading to the collapse of several institutions, particularly in the textile industry. Between 1999–2008 Zimbabwe experienced economic difficulties and hyperinflation. In the early 21st century, Harare was adversely affected by the political polarisation and economic challenges that plagued Zimbabwe. In 2005, an elected council was replaced by a government-appointed commission due to alleged inefficiency. Still, essential services such as rubbish collection, water supply and street repairs rapidly worsened, and are now virtually non-existent in poorer parts of the city. In May 2005, the Zimbabwean government demolished shanties, illegal vending sites, and backyard cottages in Harare, Epworth and other cities in Operation Murambatsvina

In 2018, Harare was ranked as a Gamma World City. It is also home to Dynamos FC, the club with the most titles in Zimbabwean football. Significant investment in education and healthcare produced a confident and growing middle class, evidenced by the rise of firms such as Econet Global and innovative design and architecture, exemplified by the Eastgate Centre. A notable symbol of this era in Harare's history is the New Reserve Bank Tower, Angwa City and Joina City buildings which stand out as some of the city's major landmarks.

Despite periods decline, particularly in the 2000s, the post 2010 has been characterised by stability, significant population growth and uneven economic growth. There has nonetheless been substantial international investment and activity in the city's financial and property markets. Development on the urban fringes of the city has occurred in areas such as Borrowdale, Glen Lorne, The Grange, Mount Pleasant Heights, as well as in the new suburbs of Hogerty Hill, Shawasha Hills, Bloomingdale and Westlea. Urban sprawl has also expanded into the nearby areas of Mount Hampden, Ruwa and Norton driven by subdivisions at the urban fringe by adjacent local authorities. In addition, inner city areas such as Avondale, Eastlea, Belgravia, Newlands and Milton Park have seen increased gentrification resulting in high property prices and widespread rent increases. Harare's property market remains highly priced, more so than regional cities such as Johannesburg and Cape Town Harare sustained the highest population increase and urban development of any major Zimbabwean city since 2000, with other cities such as Bulawayo, Gweru, and Mutare characterized by stagnation and

high unemployment due to the collapse of many of its heavy industries. Predictions that by 2050 the metropolitan area population will reach 4 to 5 million have sparked concerns over unchecked sprawl and unregulated development.

1.2.2. Location in the National and Metropolitan Context

The City of Harare is the capital of Zimbabwe. It is located in Harare Metropolitan province with three satellite towns, Chitungwiza, Ruwa and Epworth, wherein it is the dominant urban settlement in terms of both population and spatial extent. Harare enjoys all the characteristics of a primate city making it the administrative capital, the centre of commerce and industry. Harare is Zimbabwe's largest city. As the country's capital, Harare city has a significant economic contribution to the country. Most of the country's economic processes are concentrated in Harare (Masimba, 2021). Harare dominates the Metropolitan province which has 2,427,209 people making Harare city's population 76.2% of the provincial population. At 960.6 km², Harare City is a huge arena for local and national political and economic processes. The city has a daytime population that almost doubles its regular population as inhabitants of nearby towns and surrounding rural areas spend their working days in the city. The highest population densities are in Chitungwiza, Epworth and Norton.

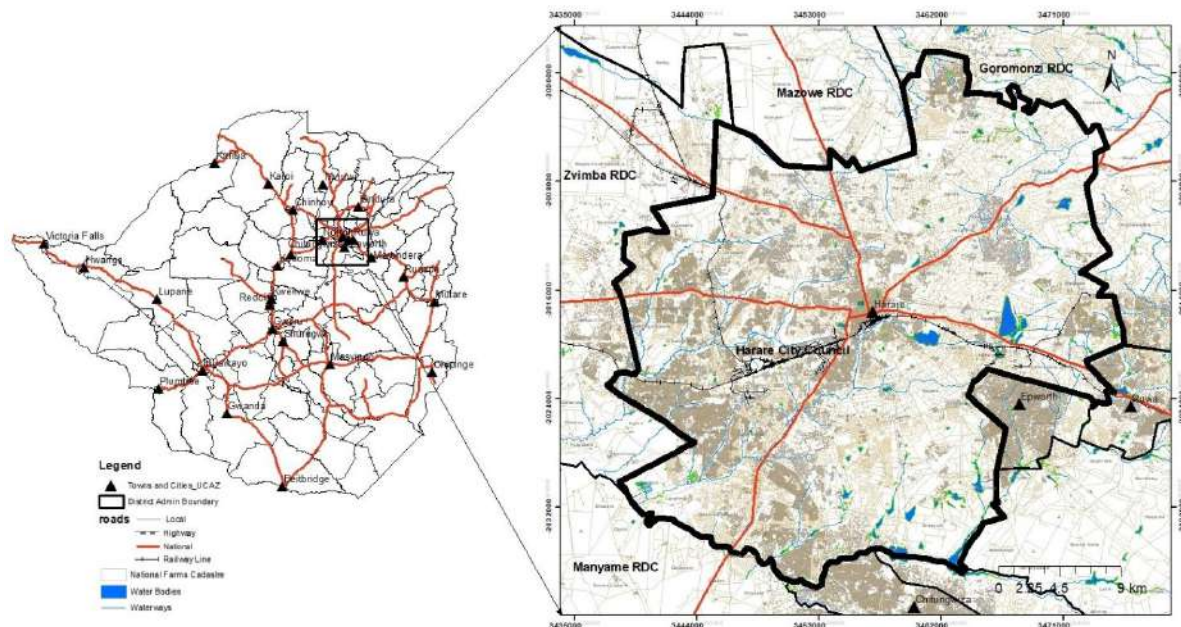


Figure 1.1: Location and planning context

The city is the administrative hub of Zimbabwe and has been the administrative hub of the greater Mashonaland region even after the introduction of Harare Metropolitan province in 2003 through the Statutory Instrument 15E of 2003. This is because Harare city remains the headquarters of businesses and corporates in the Mashonaland region because before 2003, it was the capital of the Mashonaland region. Going into the future, the national administrative functions of Harare are going to recede following the establishment of the new city in Mount Hampden. Harare is the main gateway into Zimbabwe for international visitors through the largest airport in the country, Robert Gabriel Mugabe International Airport. Additionally, the airport is the alternate entry point into Central and Southern Africa. Harare city houses diplomatic missions in the country, UN agencies, headquarters of banks and Zimbabwe stock

exchange. As a result, there are business tourism opportunities for Harare². Harare has strong economic ties with its neighbouring local authorities, driven by thriving agricultural, mining and trade linkages in its surround areas. The city significantly benefits from the fertile agricultural regions of Goromonzi, Manyame, Mazowe, and Zvimba, which supply a substantial portion of the fresh produce sold at major markets such as Mbare, Jambanja, Hatcliffe, Lusaka, and other smaller marketplaces. Conversely, farmers from these areas rely on Harare for essential inputs, including seeds and farming equipment, demonstrating a mutually beneficial relationship. The city's employment base is significantly bolstered by a substantial influx of workers from surrounding local authorities. Economically active residents from Chitungwiza, Ruwa, Epworth, Manyame, Mazowe, and Zvimba commute daily to Harare, seeking employment opportunities in various sectors, including government institutions, manufacturing, and informal trading of clothing and food supplies. This diverse workforce from the greater Harare area contributes to a rich cultural tapestry, while also driving the city's economic growth, which remarkably accounts for 40% of Zimbabwe's national Gross Domestic Product (GDP).

1.3. The Planning Framework

1.3.1. Policy and Legal Framework

The preparation of the City of Harare Master Plan is substantively and procedurally in response to the legal requirement for all local authorities to prepare master plans and keep them under constant examination in terms of Part IV of The Regional, Town and Country Planning Act Chapter 29:12 of 1996 and The Regional, Town and Country Planning (Master and Local Plans) Regulations, Government Notice No. 248 of 1977.

1.3.2. International Frameworks

The preparation of the Harare Master Plan is informed by Sustainable Development Goals (SDGs) specifically:

- (a) Goal 1: No Poverty,
- (b) Goal 2: Zero Hunger
- (c) Goal 3: Ensure healthy lives and promote well-being for all at all ages,
- (d) Goal 4: Quality Education,
- (e) Goal 5: Gender Equality,
- (f) Goal 6: Clean Water and Sanitation,
- (g) Goal 7: Affordable and Clean Energy,
- (h) Goal 8: Decent Work and Economic Growth,
- (i) Goal 9: Industry, Innovation and Infrastructure,
- (j) Goal 10: Reduced Inequalities,
- (k) Goal 11: Sustainable Cities and Communities,
- (l) Goal 12: Responsible Consumption and Production,
- (m) Goal 13: Climate Action,
- (n) Goal 14: Life Below Water and
- (o) Goal 15: Life on Land among others

² Makoni, L., Rogerson, C. M., & Tichaawa, T. M. (2023). Harare as A Destination for Informal Business Tourism: Perspectives of The Cross-Border Traders. *GeoJournal of Tourism & Geosites*, 50(4).

1.3.3. Regional Frameworks

1.3.3.1. *Agenda 2063*

The Harare Master Plan will be informed by priority areas for Africa's Agenda 2063 namely:

- a) A Prosperous Africa, based on inclusive growth and sustainable development,
- b) Well Educated Citizens and Skills revolution underpinned by Science, Technology and Innovation
- c) Healthy and well-nourished citizens
- d) Transformed Economies
- e) Modern Agriculture for increased productivity and production,
- f) Environmentally sustainable and climate resilient economies and communities
- g) Continental Financial and Monetary Institutions are established and functional,
- h) World Class Infrastructure crisscrosses Africa,
- i) Capable institutions and transformative leadership in place,
- j) Full Gender Equality in All Spheres of Life
- k) Engaged and Empowered Youth and Children

1.3.4. National Policy Frameworks and National Blueprints

The preparation of the City of Harare Master Plan was driven by the Government of Zimbabwe (GoZ)'s various policy pronouncements and frameworks which define and set guidelines for the development planning trajectory. Key among these is Vision 2030 through which GoZ seeks to transform the country into a middle-class economy by year 2030. Vision 2030 is anchored by various policies such as the National Development Strategy One and Two (NDS1 & 2), National Tourism Master Plan, ZESA Master Plan, Zimbabwe National Industrial Development Policy (2019-2023), Devolution and Decentralization Policy 2020, Local Authority Strategic Plans, Provincial Development Plans, Wetlands Master Plan, the Human Settlement Policy and the Call to Action Blue-Print on Service Delivery which directs LPAs to prepare master plans by 30 June 2024 to inform improved service delivery, sound management and ensure council abide by the operative master plan in line with vision 2030.

1.3.4.1. *Vision 2030*

Vision 2030 is a socio-economic blueprint adopted by the GoZ in 2018 to guide national development "Towards a Prosperous and Empowered Upper Middle-Income Society by 2030, with Job Opportunities and a High Quality of Life for its Citizens" with a per capita Gross National Income of over US\$5000 in real terms by 2030, up from the current US\$1 440. The objectives of Vision 2030 align with those of Agenda 2063 an African Union's 50-year Vision providing a strategic framework for socio-economic transformation running from 2013 to 2063 and the United Nations' Sustainable Development Goals covering the period 2016-2030. The preparation of the City of Harare Master Plan is consistent with Vision 2030's call for Short and Medium-Term National Development Plans that will trigger high economic and social impact flagship projects, generating increased business activity resulting in rapidly localized and inclusive growth (See Table 1.1).

Table 1.1: Master Plan Objectives aligned to Vision 2030 and SDGs

Vision 2030 Pillar	SDG	National Priority	Report of Study Objective
Inclusive Growth	2,3 6,8,11 8,9,12	Food and Nutrition Infrastructural utilities Moving the economy up the value chain and structural transformation	- food security in the city - identify economic infrastructure gaps and opportunities for growth - value chain activities and structural transformation - opportunities
Governance	10,16 11,12,13,14,15	Governance Environmental Protection, Climate Resilience and Natural Resource Management	- streamlining governance issues - strategic environmental assessment (sea) - agricultural production and productivity through improving land and water utilisation; - adoption climate smart agricultural innovations - water bodies condition survey - environmental management practices on land uses
Infrastructure and Utilities	10,11	Housing delivery	- assessment of housing delivery and opportunities for growing the housing stock in the district.
Social Development	3,5,6 4,8,17 1,2,10,11 8,10	Health and wellbeing Human capital development Social Protection Devolution	- assessment of universal health coverage through sustained investment in public health infrastructure, equipment, capacitation of human resources for health, procurement and distribution of medicines and sundries in the district. - assessment of full and productive employment and decent work in the district. - streamlining informality; casualisation of labour ,etc, - as part of evaluation of huma capital wellbeing and social protection - assessment utilization of devolution funds to improve livelihoods
Macro-Economic Stability	8,10,17	Economic growth and stability	- identifying landuse opportunities for economic growth in the district. - Ascertain Micro, Small and medium operations and contribution to towards economic - growth, value addition, and decent employment creation.
Cross Cutting	11	Youth, sports, culture and digital economy	- assess the provision of youth infrastructure, access to digital platforms and network coverage in the district. - participation and access to productive and financial resources by women.

Source: Master Plan Study 2024

1.3.4.2. National Development Strategy 1 (NDS1) 2021 – 2025

NDS1 is a 5-year economic blueprint underpinned by the Integrated Results Based Management (IRBM) system, which inculcates a culture of high performance, quality service delivery, measurement, goal clarity, continuous improvement, and accountability across the public sector. During the implementation of the NDS1, cross cutting issues such as gender, youth, people living with disabilities, arts and creative industry, environment and information communication technology will be mainstreamed in all Thematic Working Programmes to ensure that the aspirations are realised within the context of the NDS1. This Report of Study aligns with the key thematic areas in NDS1 by setting out to investigate and identify developmental gaps and revenue streams as part of enhancing service delivery by the City of Harare.

Both Vision 2030 and NDS1 speak of an inclusive development strategy; building climate resilience; natural resources management; value addition and beneficiation; sustaining macroeconomic stability; investment promotion and infrastructure development as key enablers for the attainment of the country's Vision 2030 and the SDGs. Provision of Improved Infrastructure and Services is key to achievement of SDGs. The prioritized infrastructure and utilities areas within the NDS1 include Energy, Mining, Water & Sanitation, Housing, Information Communication Technology and Transport sectors.

1.3.4.3. National Tourism Master Plan (NTMP) (June 2017)

The National Tourism Master Plan seeks to promote the development of community-based tourism enterprises (CBTEs) in order to increase national tourism competitiveness, support the alleviation of poverty, increase environmental conservation, and preserve local cultures and heritage. The study objectives align with the need to examine provision of Recreation Parks and tourist attraction centers and support amenities.

1.3.4.4. Zimbabwe National Industrial Development Policy (ZNIDP) (2019-2023)

The Zimbabwe National Industrial Development Policy considers urban centers as economic nodes with high population concentration essential for guaranteeing labor force and market. The high population concentration is a factor on its own for industrialization leading to value addition and beneficiation of our local resources. In that regard, the policy prioritizes the need to empower and improve standards of living for people in these economic centres. The policy seeks to promote industrialization through provision of incentives and targeted financing, policy support and business development services for the establishment of micro, small, medium, and large-scale manufacturing industries in line with available local resources. The City of Harare Master Plan examines the city's economic base, space requirements and industrial development as a first step towards directing policy and regulatory interventions.

1.3.4.5. Zimbabwe National Transport Master Plan (TMP)

The Zimbabwe National Transport Master Plan is a primary guide road infrastructure survey in the planning area. The TMP stresses integration of the transport subsectors with other productive sectors such as mining, agriculture, trade and industry, tourism as well as regional integration. The TMP's trust is on:

- creating or improving access through both motorized and non-motorized means.
- improve access to services, in areas without proper road access;

- provide all-weather access; and
- provide road infrastructure within 2 to 5 kilometers from human settlements.

1.3.4.6. Devolution and Decentralization Policy (2020)

The GoZ devolution and decentralization policy requires Local Authorities exercising devolved powers to consider National Development Plans in crafting their own Local Development Plans. In terms of this policy, decision-making and authority in the provision of most basic services will be delegated and decentralized to Provincial and District levels. The Devolution and Decentralization Policy recognizes the need for the empowerment of communities to have a capacity to demand quality services from elected Councilors, including legal recall powers. This policy also calls for the inclusion of disadvantaged groups such as the youths and women. Their participation will broaden community participation in economic activities in their respective areas. The Master Plan's Report of Study derived its content from socio-economic studies and stakeholder surveys to generate stakeholder perception on service delivery, highlight existing gaps in women participation and to respond to the needs of the community generated through primary data collection. The study highlights opportunities for improved service delivery and spatial land use management in conformity to the devolution and decentralization policy.

1.3.4.7. Human Settlement Policy (HSP)

The Human Settlement Policy recognizes that land is a finite resource which require to be used efficiently and conservatively for the benefit of future generations. Most urban centres have depleted their land banks thus urban sprawl is inevitable. The dwindling land resource within the city boundaries continue to call for numerous considerations in availing the same (regeneration, urban renewal, vertical expansion, incorporation and infilling). In response to the HSP, the Study shall make recommendations for densification, the upgrading of commercial centers, zoning of industrial sites, cemeteries, dumpsites and wastewater treatment plants as a way of modernization and improvement of services offered at urban centers.

1.3.4.8. Smart Zimbabwe 2030 Strategy on ICTs.

The ICT Strategy stresses the need to embrace ICTs in order to derive benefits and relative quick wins which include deploying the basic communications infrastructure, enhancing the universal mobile access, building national optic fibre backbone, scaling up the public cloud platform and deploying the smart energy grid system and transport network i.e adequate energy and road network infrastructure.

1.3.5. Regulatory Framework for Master Plan Preparation

The Report of Study was undertaken with the objective of producing a legally compliant master plan. The guiding legal frameworks for master plan preparation are summarized on Table 1.3.

Table 1.2: Legal Framework guiding master plan preparation

No.	Legal Instrument	Effect on Master Plan
1 (a)	Regional, Town and Country Planning Act, (Chapter 29:12)	Part IV of the Act (Section 14 (1) of the Act Section 14-21 directs a local planning authority to prepare and submit to the Minister a master plan in respect of the area for which it is the local planning authority.
1(b)	RGN 248 of 1977	Provides the framework with which a master plan should be undertaken and defines minimum data thresholds in master plan preparation.
1(c)	SI 175 of 1999	Delegates powers to Local Authorities for the preparation of Master and Local Plans.
2	Urban Councils Act [Chapter 29:15]	provides for the establishment of municipalities and towns; the conferring of town and city status on growth points.
3	Land Acquisition Act [Chapter 20:10]	empowers the President and other authorities to acquire land and other immovable property compulsorily in certain circumstances; and to make special provisions for the compensation payable for agricultural land required for resettlement purposes.
4	Roads Act [Chapter 19:05]	provides for the planning, development, construction, rehabilitation and management of the roads network of Zimbabwe and the regulation of the standards applicable in the planning, design, construction, maintenance and rehabilitation of roads with due regard to safety and environmental considerations.
5	ZINWA Act (Chapter 20:25)	provides for the maintenance of underground and surface water; raising of charges for the provision of water and other services by the ZINWA Authority; imposition and collection of a water levy
6	EMA Act [Chapter 20:27]	ensures that landuses such as agriculture, mining, residential and commercial take place in a manner that sustainably protects the environment;
7	Water Act [Chapter 13:18]	Regulates the use and control of water bodies and the requirements for a water permit needed in farming, mining and township projects;

1.4. Scope of Master Plan Preparation

The Master Plan has been prepared in terms of Part IV of the Regional, Town and Country Planning Act Chapter 29:12 of 1996 Revised Edition and the Regional, Town and Country Planning (Master and Local Plans) Regulations, Government Notice No 248 of 1977 which requires the Local Authority to prepare and submit to the Minister a Master Plan in respect of the area within its jurisdiction. The Regional, Town and Country Planning Act Chapter 29:12 of 1996 Revised Edition provides for the planning of regions, districts or local areas with the objective of conserving and improving the physical environment and in particular promoting health, safety, order, amenity, convenience and general welfare including efficiency and economy in the process of development and the improvement of communications. A Master Plan establishes aims, policies and general proposals and provides a broad framework for the future development of the plan area, setting the context for the preparation of detailed local plans.

1.5. The Need for Master Plan Preparation

The Regional, Town and Country Planning Act Chapter 29:12 of 1996 as revised (hereafter the Act) in Part IV specifically Section 13 requires Local Planning Authorities to prepare Master and Local Plans Specifically, Section 17 (1) further elaborates that the Local Planning Authorities should at all times determine the desirability of preparing or reviewing a Master or Local Plan for any part of the area for which it is the Local Planning Authority as well as keep Master and Local Development Plans under constant examination. If as a result of such

determination the assumptions under which the Master or Local Plan are based, are found to be no longer valid the Local Planning Authority is mandated to consider appropriate proposals for the alteration, or repeal of such a plan. Over time Local Authorities have not been preparing Master Plans despite their importance in coordinating development and service delivery. The Government of Zimbabwe incensed by the deteriorating level of service delivery and the centrality of Master Plans in sound management of Local Authorities launched the Call-to-Action Blue-Print on Service Delivery towards attainment of Vision 2030. Action Point 6 requires all Local Authorities to have Master Plans by 30 June 2024.

The City of Harare Master Plan is thus prepared in terms of the Part IV of The Regional, Town and Country Planning Act Chapter 29:12 of 1996 and The Regional, Town and Country Planning (Master and Local Plans) Regulations, Government Notice No. 248 of 1977 as read with the Call-to-Action Blue-Print. In pursuance of these provisions the City of Harare has resolved to prepare the City of Harare Master Plan to rationalize, coordinate and harmonise land uses and control the process of development in space and time in the city. This Report of Study has been prepared to examine and capture development dynamics in the City of Harare (being the Study and Planning Boundary Area as defined in this report) with a view of unpacking development trends, efficacy of regulating mechanisms, infrastructure capacities and gaps with a view to unlock the development potential, invigorate and rejuvenate the way of life, guide and control the growth centres, natural resources, and development character whilst balancing that with the need to conserve and preserve where possible the existing development.

1.6. Aim of Study

To examine principal social, economic, population, environmental and spatial land use characteristics, real estate and land markets, public utilities and communications, finance and institutional framework for the City of Harare Master Plan study area in terms of Part IV of the Regional, Town and Country Planning Act Chapter 29:12 Revised Edition 1996 as read with Part I to III (Sections 3-6) of the Master and Local Plans Regulations (RGN) 248 of 1977 and the Call-to-Action Blue-Print on Service Delivery.

1.6.1. Objectives

Specifically, the Report of Study seeks among other things to:

1. fulfil the requirements of Section 13 of the Regional, Town and Country Planning Act Chapter 29:12 of 1996 as revised,
2. to fulfil the requirements of Section 3-6 of The Regional, Town and Country Planning (Master and Local Plans) Regulations, Government Notice No. 248 of 1977 in terms of form and content,
3. to review the Harare Combination Master Plan 1993-2013 (2024), Situation Analysis and Issues and Challenges,
4. to assess the variation between Harare Combination Master Plan 1993-2013 (2024)'s planning intentions and implementation outcomes.
5. to characterize principal environmental characteristics of the study area,
6. to characterise principal social (i.e housing, recreational, health, educational facilities and levels) characteristics of the study area,
7. to characterize principal population characteristics of the city in terms of size, composition, distribution, structure, fertility, growth rate, mortality, poverty atlas [indicators of poverty], access to services in the study area,
8. to examine principal spatial land use characteristics of the study area,
9. to quantify principal economic, real estate, land development and land markets characteristics of the study area,

10. to examine principal traffic and transportation characteristics of the study area,
11. to examine public utilities (bulk infrastructure scoping i.e water, sewer, roads, energy) and communications (information communication technologies) in the study area,
12. to examine service delivery levels, level of satisfaction of residents and adequacy of services in the city as per the requirements of Call-to-Action Blue-Print on Service Delivery,
13. to access the City of Harare's corporate governance regime, structure, finance and institutional framework,
14. to synthesize key findings and provide a summary of issues in the study area,
15. inform the Written Statement in terms of opportunities and constraints needed to inform and guide policy prescriptions or proposals,
16. identify projects and resources that will drive the implementation of the plan.

Overall, the fulfilment of these objectives will provide an evidence-based support system to inform policy proposals as contained in the Written Statement.

1.6.2. Approaches and Methods

Master plan preparation is prescribed in terms of Part IV of the Regional, Town and Country Planning Act, Chapter 29:12, Revised Edition, 1996 and Part I to III (Sections 3-6) of the Regional, Town and Country Planning Master and Local Plans Regulations, Government Notice Number 248 of 1977. These statutes prescribe form and content of a master plan. The preparation of a master plan is generally predicated around a scientific rationale of study, analyse and plan. The study acquired primary and secondary data (aspatial and spatial) for the thematic areas identified and standard scientifically acceptable units of analysis and methods of data collection and analysis were adopted.

a) Environment

Principal environmental characteristics we identified and quantified namely: Climate [urban micro-climate) and Climate Change, Geology, Soils, Elevation Profile, Drainage [rivers, water bodies, catchments and sub-catchments, stormwater drainage and management, Wetlands, contamination of underground water sources, water table], Biodiversity, Vegetation [land cover], Disaster risk on cross-cutting basis, Air quality, Water quality and Waste [Solid and Liquid]. The combination of primary and secondary data and satellite remote sensing and geospatial and statistical analysis were adopted. Satellite Data was acquired analysed using Remote Sensing and Spatial Analysis techniques in a Geographic Information System. Further statistical analysis was done using regression analysis techniques.

b) Spatial Land Use and Socio-Economic Data

Principal spatial land use characteristics were identified and quantified using primary and secondary data sources. Satellite Data was acquired analysed using Remote Sensing and Spatial Analysis techniques in a Geographic Information System. Household and Land Use Surveys were carried out using a near real time mobile data collection application and crowd-sourced to a server for data storage, sorting and analysis. Standard statistical and spatial analysis techniques were deployed for data analysis.

Land use data was collected for each property using Near Real Time Mobile Data Collection Tool deployed for ground surveys and existing land use maps coupling the Surveyor General's Topographic Maps and Cadastral Diagrams. Socio-Economic Surveys were administered using Near Real Time Mobile Data Collection Tool onboard an android phone and crowd-sourced in near real time to a Cloud Server. Data was collected using stratified random sampling protocol. The socio-economic survey was carried out to establish the Land

Use, Demographic and Socio-economic profile of the study area. Statistical Software XLT Stats was adopted for data analysis. Spatial statistical techniques including spatial overlay analysis and Hotspot Analysis were adopted in a GIS. The Getis-Ord Gi* Hot Spot Analysis spatial statistic was adopted to quantify the spatial clusters of various socio-economic variables including how the experiences of space users vary in space and time. Whereas the Cohen kappa statistic was used to measure development conformance i.e. to measure agreement between the existing master plan intentions and plan implementation outcomes. The Cohen's Kappa Coefficient determines errors of omission and commission based on the equation:

$$K = \frac{\text{Pr}(a) - \text{Pr}(e)}{1 - \text{Pr}(e)}$$

Where Pr(a) is map of planning intentions and Pr(e) is map of implementation outcomes and the value of Kappa is interpreted as shown on table 1.14:

Table 1.3: Conformance Measurement Interpretation table

Value of Kappa	Level of Agreement	% of Data that are reliable
0-20	None	0-4%
21-39	Minimal	4-15%
40-59	Weak	15-35%
60-79	Moderate	35-63%
80-90	Strong	64-81%
Above 90	Almost Perfect	82-100%

Makov Chain Analysis Urban Growth Modelling and Forecasting

Makov Chain Analysis was used for Urban Growth Modelling and Forecasting, specifically to analyze the driving factors of land use/cover changes (e.g., population growth, distance to city centre or major roads), Assess the environmental impact of urban expansion (e.g., loss of agricultural land) and Simulate "What if" scenarios for urban growth to guide urban planning decisions. Makov Chain Analysis was selected based on the fact that it's one of the most spatially explicit, robust and discrete dynamic models for simulating spatial phenomena.

Cellular Automata (CA) are bottom-up and originally conceptualized by Ulam and Von Neumann (1940). Components of CA includes (see figure 1.2):

- Cell space: A grid of cells representing the study area
- Cell states: Discrete categories (e.g., urban)
- Neighbourhoods: A collection of cells based on adjacency
- Time steps: Discrete intervals at which changes occur
- Transition rules: Define how cells change state based on the states of neighbouring cells

CA model can be expressed as:

$$St+1 = f(St, Nt, TP)$$

where:

St+1 = state of the cell in time t+1 (2020);

St = state of the cell in time t (2000);

Nt = the cell's neighbourhood situation in time t; and

TP = the transition rules

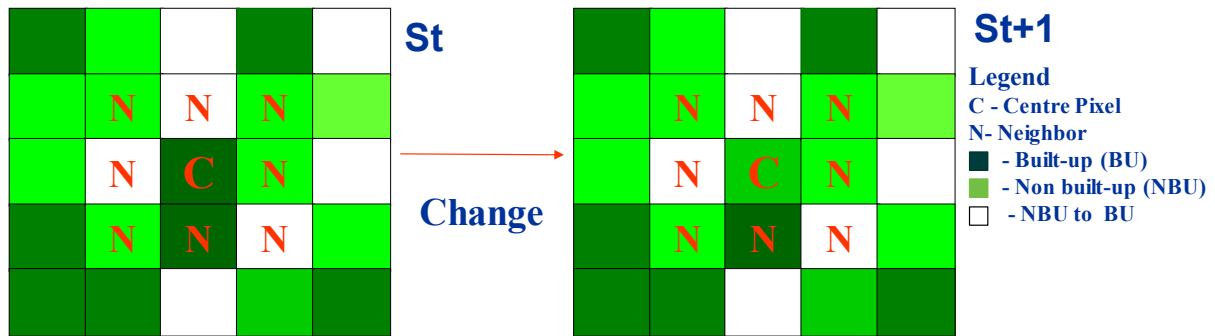


Figure 1.2: Cellular Automata (CA) Model

The study adopted Markov-Cellular Automata Model (MCA) which combines Machine Learning (ML), Markov chains, and cellular automata (CA) model (see figure 1.3).

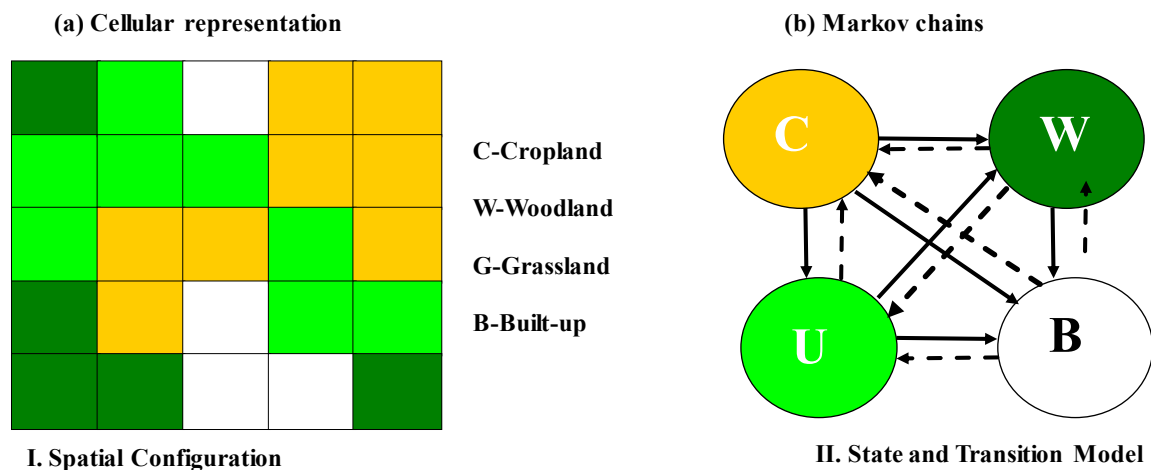


Figure 1.3: Markov-Cellular Automata Model (MCA)
Source: Li and Reynolds, 1997

Model Assumptions are that:

- Transition probabilities remain constant over time
- Future states depend only on current states (memoryless)
- Changes are influenced by neighbouring cells
- Same rules apply across the entire study area
- Transition matrix is fixed for the simulation period
- Uses a raster/grid model of space
- Each cell's transition is independent of others
- Past land cover changes predict future changes

Implementation of the RF-CA Model

Land cover maps were classified from Landsat imagery for 1984, 1990, 2000, 2010, 2020, and 2024 (Figure 1.3). Table 1.4 describes the land cover classes. For accuracy assessment, the 1984 land cover map was validated using aerial photographs from 1986, while the 2000, 2020 and 2024 land cover maps were cross-checked against anniversary and near-anniversary reference datasets. The land cover maps for 1984, 2000, 2020, and 2024 have overall accuracy levels ranging from 86% to 93%.

Table 1.4: Land cover classes

Land cover class	Description
Built-up	Residential, commercial and services, industrial, transportation, communication and utilities, and construction sites.
Non-built-up	All wooded areas, riverine vegetation, shrubs and bushes, grass cover, golf courses, parks, cultivated land, fallow land, land under irrigation, bare exposed areas, transitional areas and water.

Additional data layers were integrated for urban land change modeling and simulation (Table 1.5). Major roads for the period 1984–2020 were derived from OpenStreetMap, and elevation data were sourced from ASTER GDEM. Population density data were obtained from the Zimbabwe Statistical Office (ZimStats). Key spatial variables, such as "distance to built-up areas," "distance to major roads," and "distance to city center," were computed using Euclidean distance procedures. These spatial variables leverage built-up areas extracted from the land cover maps, road networks, and city center locations. Notably, "distance to built-up areas" was analyzed over time (1984–2020) to account for the dynamic nature of urban expansion as a driving factor. Furthermore, "access to electricity," derived from World Bank datasets, was included as a driving factor to provide insights into urban density and infrastructure access. All driving factors were resampled to a 30×30 m spatial resolution to align with the Landsat-derived land cover maps (Figure 1.5). This integrated and detailed approach ensures consistency and provides a robust foundation for further urban growth modeling and analysis.

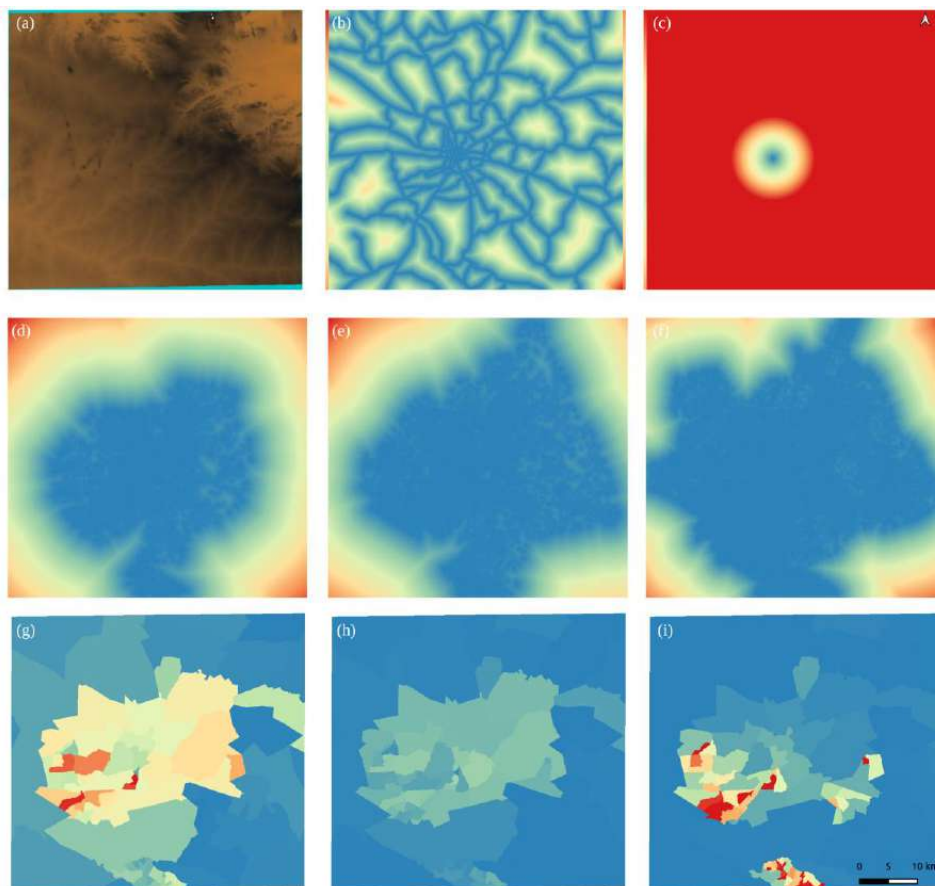


Figure 1.4: Figure 2. Selected driving factors used to compute transition potential maps: (a) elevation; (b) distance to major roads; (c) distance to city center; (d) distance to built-up areas (1986); (e) distance to built-up areas (2010); (f) distance to built-up areas (2020) (g) access to electricity; (h) access to electricity; and (i) population density (2002).

Table 1.5: Input data for calibrating and simulating land cover change

Variable	Source
Land cover change maps (1984 to 2024)	Classified from Landsat data
Distance to built-up areas (1984, 1990, 2000, 2010, 2020)	Derived from land cover maps
Distance to major roads (1984–2020)	Derived from land cover maps
Distance to city center	Derived from OpenStreet map
Elevation	Digitised from Google Maps
Population density (2002 and 2012)	Derived from ASTERGDEM
Access to electricity	Derived from ZimStats
	World Bank database

The following procedures were used to implement the RF-CA for Model, calibration and simulation:

- computing of transition rates;
- transition potential modelling and
- CA simulation, as well as model validation (see figure 1.5). The random forest algorithm available in Python were used to model transition potential. We then developed CA transition rules to simulate future land cover using function in Python.

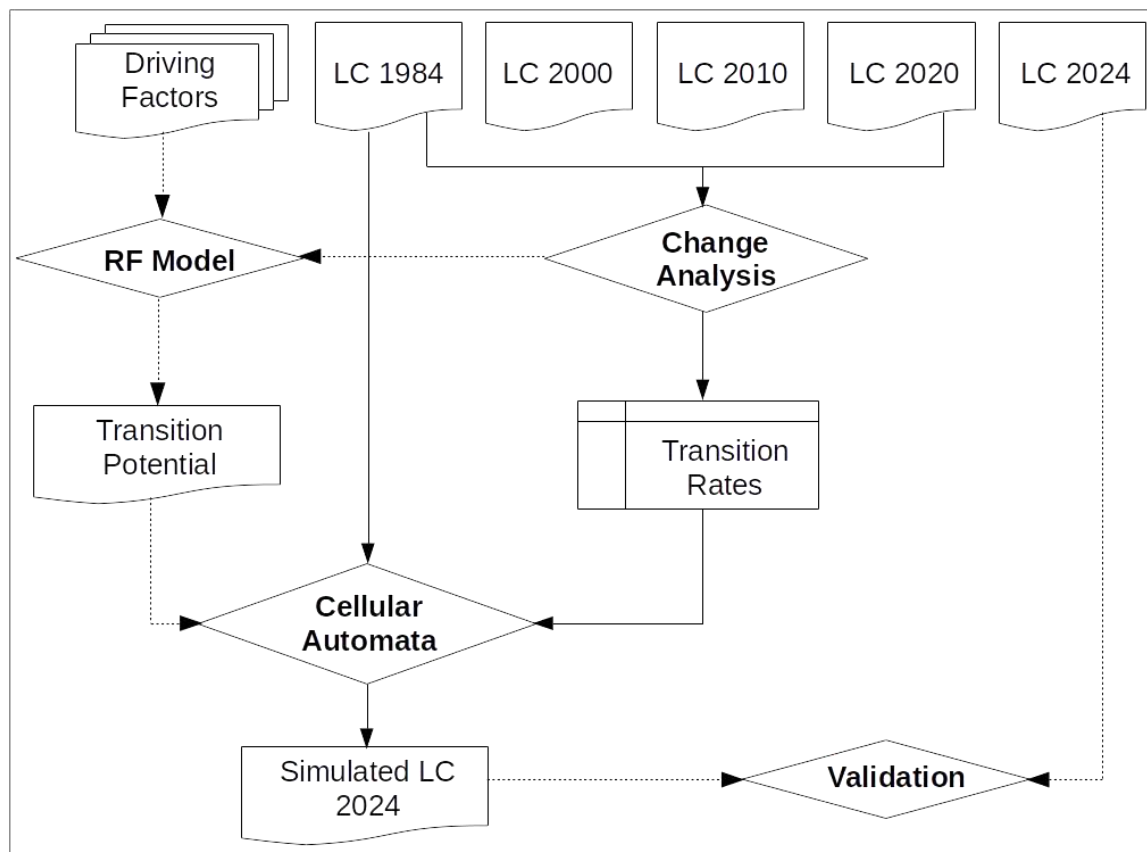


Figure 1.5: Random forest-cellular automata (RF-CA) model Note LC refers to land cover.

To Compute transition rates we utilized land cover maps from 1984 and 2020 to derive single-step transition rates, representing absolute aggregate changes over 34 years. During the CA model calibration, the "1984–2020" single-step transition rate produced good simulation accuracy for aggregate change, particularly for transitions from non-built-up to built-up areas. However, spatial allocation accuracy using single-step rates remains problematic, highlighting the need for multiple-step transition rates to enhance precision. Therefore, the next simulation model (in phase 2) will use multiple-step transition rates to provide a finer temporal resolution. We will use multiple-step transition rates from 1984–1990, 1990–2000,

2000–2010, 2010–2020 for RF model calibration, and the 2020–2024 transition rate for model validation. We developed the random forest (RF) model using training points randomly sampled from areas transitioning from non-built-up to built-up and areas with no change (persistent built-up and non-built-up areas) between 1984 and 2020. All driving factors (Table 1) were included after a multicollinearity test confirmed no redundancy, with correlation coefficients below the threshold of 0.7. The training dataset was split, with 70% used for model development and 30% reserved for cross-validation.

In order to optimize model performance, RF parameters were carefully adjusted. The algorithm initially generated large, complex trees by splitting input variables into independent groups through binary decisions. However, large trees often overfit the training data, compromising predictive accuracy. To mitigate this, we tuned the RF model by varying the number of variables considered at each node split and the total number of trees (25, 50, 100, 200, 300, 400, and 500). Following calibration, the final RF model was constructed using 100 and 200 trees, balancing accuracy and generalizability. The optimized RF model was then used to generate the "non-built-up to built-up" transition potential map, forming the foundation for future simulations. This iterative approach ensures robust and reliable urban growth modelling and simulation.

To simulate land use and cover changes, we utilized three key datasets: (1) the initial land cover map from 1984, (2) transition potential maps for 1984–2020, and (3) single-state transition and multiple-state transition rates for 1984–2020. The simulation, which projected changes up to 2024, relied on two core CA functions—Expander and Patcher—to model transitions. The expander function expands or contracts existing land cover patches by transitioning cells from state *i* (non-built-up) to state *j* (built-up) only near existing state *j* cells, thereby growing or shrinking patches. In contrast, the patcher function creates new patches by transitioning cells from state *i* to state *j* only in neighbourhoods not already dominated by state *j*. Both functions use a stochastic mechanism to select cells with the highest transition potential, ensuring variability and realism in the simulation. The size and distribution of new patches were determined using a lognormal probability function defined by three parameters: mean patch size (MPS), variance (VAR), and isometry (ISO). Adjusting these parameters allowed us to create varied spatial land cover change patterns. For this project area, the CA model was calibrated through iterative adjustments of the expander and patcher parameters using a trial-and-error approach. The simulation began with the 1984 land cover map and iterated annually, spanning 34-time steps to project changes up to the final reference year of 2024. This approach ensured that the simulation captured both the expansion of existing urban areas and the emergence of new developments, reflecting the dynamic nature of urban growth. The iterative calibration process improved the model's ability to replicate observed patterns, making it a robust tool for analyzing and forecasting land cover changes in the project area.

c) Economy and Employment

Units of Analysis of focus for economic and employment characteristics in the planning area include Spatial Units namely Harare's suburbs and neighbourhoods and Economic Units namely Households, businesses, industries, institutions and informal sector. Several variables were considered namely economic variables (GDP and sectoral contribution, Investment patterns and trends, Infrastructure development) Unemployment rates and labour market dynamics (Poverty rates and income inequality and Inflation rate), Fiscal Variables (City revenue and expenditure patterns, Taxation and revenue collection efficiency and Public

expenditure and budget allocation) and Development Variables (Economic growth and development indicators).

Economic characteristics and employment Primary Data was collected through Socioeconomic, MSMEs/SMEs and Formal Business (Corporate) Questionnaires/Surveys. This was conducted for us to gather information on economic activities, perceptions of urban development and service delivery. Night Trading Informal Sector Questionnaires/Surveys: This was done for us to gather data on the characteristics, operations and challenges of the night trading informal sector activities, thus suggesting policy and intervention strategies to support their growth and development.

Questionnaires/Surveys were administered for the Fruit and vegetable value chain; Metal and metal fabrications; and Meat Industry value chain. These surveys were done to collect data on the structure, conduct and performance of the Fruit and Vegetable, Metal and Metal Fabrications, and Meat Industry value chains to inform formulation of strategies to enhance their competitiveness, productivity and contribution to the local economy.

Key Informant Interviews were conducted through in-depth interviews with stakeholders, experts and community leaders, in order to gather insights on economic development, infrastructure development and challenges. Whereas Focus Group Discussions were held at the Master Plan Command Centre with community members, business owners and other stakeholders to gather information on their thoughts in relation to the city's economic growth and development. The main objective was to get a better understanding of their ideal economy 20 to 30 years from now.

Secondary Data was obtained from Zimbabwe National Statistics Agency (ZimStat) mainly economic indicators, census data, and social statistics. Harare City Council Records were extract on Budget reports, revenue and expenditure data and infrastructure development records. Ministry of Finance documents were accessed to examine Economic policy documents, budget reports and investment data. Zimbabwe Investment and Development Agency (ZIDA) records on Investment promotion and attraction were assessed. International Organizations such as the World Bank, African Development Bank (AfDB), International Monetary Fund (IMF) and United Nations (UN) reports on economic development, poverty reduction and infrastructure development were also used to derived secondary data.

Data Analysis Methods such as Regression Analysis were used to examine the relationships between economic variables, such as GDP, inflation and unemployment. Time Series Analysis: We analysed economic data over time to identify trends and patterns. Cross-Sectional Analysis was used to compare economic data across different groups, such as industries or neighbourhoods. Survey Analysis was used to analyse data from household and business surveys to understand economic attitudes and behaviours and Focus Group Analysis was used to analyse data from focus groups to understand economic perceptions and opinions.

d) Real Estate and Land Markets

The Real Estate profile of the city and land markets were assessed using primary and secondary data.

e) Bulk Infrastructure (Water and Sewer, Roads and Roads Network, Energy, ICT)

Bulk Infrastructure Assessment was undertaken for public utilities (bulk infrastructure scoping i.e water, sewer, roads, energy) and communications (information communication technologies) in the study area. Information on the existing bulk water, sewer, solid waste management facilities, traffic and transportation and telecommunication infrastructure was collected from Harare City Council Records and site inspections. The rest of the information was gathered from stakeholders mentioned in the corresponding sections. The assessment focused on bulk raw water sources, potable water supply infrastructure, water treatment facilities, sewer network infrastructure, sewer treatment works, effluent disposal, solid waste management facilities, roads and stormwater drainage. The data collected also included the volumes of potable water supply, sewer outfalls and waste disposal. Data types included maps, statistics, coordinates of locations, reports and surveys. The information was reported and analysed. The estimated demands for water and sewer outfall volumes corresponding to the reviewed masterplan were calculated using the Swedish Association of Local Authorities (SALA) & Ministry of Local Government Rural and Urban Development Zimbabwe manuals. The current population was also used to estimate present water demands and sewer volumes. Existing facilities' capacity and water sources were assessed regarding the current analysed demands to establish the deficit or surplus. This analysis framed the planning of the water supply, sewer treatment, roads, stormwater conveyance and solid waste management required in the proposed master plan for Harare. The techniques adopted were standard methods for profiling the bulk infrastructure needs of the metropolitan area.

Traffic and transportation was assessed for Intersection Capacity Performance Analysis. A 15-hour traffic survey was conducted at selected 104 intersections with the aim of determining their operational performance (capacity performance). The intersections were selected based on the observation that they witness traffic congestion and reduced Level of Service, (LOS). Thus, it was imperative to conduct a capacity analysis at the intersections shown in Table 1.4. Two (2) Measures of Effectiveness for lane group performance were assessed for 104 intersections.

Capacity and volume-to-capacity ratio (v/c ratio) and Level of Service (LOS) as assessed for the intersections studied. Capacity is defined as the rate at which vehicles pass through a given point or any measurement area per unit of time usually measured per hour under prevailing conditions; it is often estimated based on assumed values of saturation flow. The V/C ratio, also referred to as degree of saturation, represents the sufficiency of an intersection to accommodate the vehicular demand. The HCM 2022 states that a V/C ratio of less than 0.85 generally indicates that adequate capacity is available, and vehicles are not expected to experience significant queues and delays. As the V/C ratio approaches 1.0, traffic flow may become unstable, and delay and queuing conditions may occur. Once the V/C ratio is greater than 1 then unstable and excessive delay and queuing is expected.

Level of service (LOS) for an intersection is defined by the HCM (2022) as a qualitative measure to quantify driver perception for such elements as travel time, number of stops, total amount of stopped delay, and impediments caused by other vehicles. There exists a well-developed scale to compare intersections with each other. The LOS scale ranges from "A" which indicates little, if any, vehicle delay, to "F" which indicates substantial vehicle delay and traffic congestion. Tables 3 and 4 show the different LOS criteria for unsignalized intersections and signalized intersections respectively.

Table 1.6: LOS criteria for unsignalized intersections

Control Delay (Sec/Veh)	LOS by Volume-to-Capacity Ratio	
	$v/c \leq 1.0$	$v/c > 1.0$
≤ 10	A	F
>10-15	B	F
>20-25	C	F
>35-35	D	F
>55-50	E	F
>50	F	F

At signalised intersections, the LOS is based upon the control delay, as well as the corresponding volume-to-capacity ratio for each movement / lane group. Table 2 provides a summary of the relationship between the LOS, control delay and, v/c ratio for signalised intersections.

Table 1.7: LOS criteria for signalised intersections

Control Delay (Sec/Veh)	LOS by Volume-to-Capacity Ratio	
	$v/c \leq 1.0$	$v/c > 1.0$
≤ 10	A	F
>10-20	B	F
>20-35	C	F
>35-55	D	F
>55-80	E	F
>80	F	F

Source, HCM 2022.

A 3-day, 15-hour traffic volume, classification and directional distribution survey was conducted at a total of 99 intersections within the study area to determine their prevailing capacities. Fifty-two (52) of these were primary (along major arterials) and the other forty-seven (47) were along on secondary road networks. Tables 1.8 and 1.9 shows the studied intersections.

Table 1.8: Studied primary sites for traffic volume, classification and directional distribution survey

A. Primary Intersections	
Intersection I. D	Name of Intersection
1	Harare Dr / ED Mnangagwa Rd
2	Harare Dr / Alpes Rd
3	Harare Dr / Borrowdale Rd
5	Harare Dr / Arcturus Rd
6	Harare Dr / Mutare Rd
7	Mutare Rd / Donnybrook Rd
8	ED Mnangagwa Rd / Glenara Avenue
9	Churchill Ave / ED Mnangagwa Rd
10	Churchill Ave / Borrowdale Rd
11	Sam Nujoma St EXT / Churchill Ave

12	Sam Nujoma St EXT / Nemakonde Rd
13	Nemakonde Rd / Harare Dr
14	Nemakonde Rd / Old Mazoe Rd
15	Nemakonde Rd / Sandton Rd
16	Solomon Mujuru Rd / Dzivarasekwa Ext Rd
17	Solomon Mujuru Rd / Tynwald Rd
18	Solomon Mujuru Rd / Harare Dr
19	Princes Rd / Bishop Gaul Rd
20	Sam Nujoma St EXT / Josiah Tongogara Ave
21	Samora Machel Ave / ED Mnangagwa Rd
22	Samora Machel Ave / Glenara Avenue
23	Robert Mugabe Rd / Glenara Avenue
24	Chiremba Rd / Robert Mugabe Rd
25	Chiremba Rd / Glenara Avenue
26	Vitalis Zvinavashe Rd / J Nkomo
27	Vitalis Zvinavashe Rd / Seke Rd
28	Masotsha Ndlovu Way / Seke Rd
29	J Nkomo / Harare Drive
31	Forbes Rd / Chitungwiza Rd
32	Chitungwiza Rd / Simon Mazorodze Rd
33	Stoneridge Rd / Chitungwiza Rd
34	Willowvale Rd / Simon Mazorodze Rd
35	Simon Mazorodze Rd / Remembrance Dr
36	Simon Mazorodze Rd / Cripps Rd / Lytton
37	Samora Machel / Adbel Gamal Nasser Rd (Rotten Row)
38	Samora Machel / Sam Nujoma St
39	Julius Nyerere Ave / Kenneth Kaunda Ave
40	Rekayi Tangwena Ave (Paisley Rd) / Bishop Gaul Ave
41	Samora Machel Avenue / Rekayi Tangwena Ave
42	Kambuzuma Rd / High Glen Rd
43	Bulawayo Rd / High Glen Rd
44	Bulawayo Rd / High Glen Rd
45	Bulawayo Rd / Whitecliffe Rd (Oatlands Rd)
46	Willowvale Rd / High Glen Rd
47	Samora Machel Ave / Leopold Takawira Ave
48	ED Mnangagwa Ave / Robert Mugabe Rd
49	Arcturus Rd / Sinini Street
50	Shamva Rd / Mutoko Rd
52	Borrowdale Rd / Scam Way

Table 1.9: Studied secondary sites for traffic volume, classification and directional distribution survey

B. Secondary Intersections	
Intersection I. D	Name of Intersection
53	King George Rd/Nemakonde Rd
54	Quendon Rd/ West Rd
55	Sherwood Rd/ Quendon Rd

56	Masotsha Ndlovu Way/ Sixth ave
57	Arcturus Rd/ ED Mnangagwa Rd
58	Borrowdale Rd/ Whitwell Rd
59	College Rd/ Churchill Ave
60	Sherwood Dr/ Kirkman Rd
61	Westwood Dr/ Kambuzuma Rd
62	Heany Rd/ High Glen Rd
63	George Rd /Chiremba Rd
64	Airport Rd/ George Rd
65	Seke Rd/ Cranborne Rd
66	Boshoff Rd/ Ardbennie Rd
67	Remembrance Rd/ Ardbennie Rd
68	First Ave/ Masotsha Ndlovu Way
69	Harare Dr/ Willowvale Rd
70	Borrowdale Rd/ Scam Way
71	Willowvale Rd/ Patrenda Way
72	Willowvale Rd/ Glen View Way
73	Domboshava Rd/ Glen Forest Rd
74	High Glen Rd/ Gumbie Rd
75	Glen View Way/ Amalinda Rd
76	Amalinda Rd/ Simon Mazorodze Rd
77	High Glen Rd/ Sebakwe Rd
78	Willowvale Rd/ Mangwende Dr
79	Gaydon Rd/ Harare Dr
80	Herbert Chitepo Ave/Seventh St
81	Borrowdale Rd/ Crowhill Rd
82	Herbert Chitepo Ave/ Sam Nujoma
83	Highland Glen Rd/ ED Mnangagwa Rd
84	Robert Mugabe Rd/ Rotten Row
85	Drew Rd/ED Mnangagwa Rd
86	ED Mnangagwa Rd/ Gletwyn Rd
87	Chiremba Rd/ St. Patricks Rd
89	Airport Rd/ Delport Rd
90	J. Tongogara Ave/ Prince Edward St
91	The Chase/ Alpes Rd
92	Quorn Rd/ The Chase
93	Harare Dr/ Stansted Rd
94	Whitwell Rd/ Alpes Rd
95	West Rd /Nemakonde Rd
96	Douglas Rd/ Kambuzuma Rd
97	Coventry Rd/ Rekayi Tangwena Ave
98	Lytton Rd/ Paisley Rd
99	Rotten Row/ Bishop Gaul Rd

Intersection capacity analyses were done with the aid of a micro-analytical traffic evaluation tool that employs lane-by-lane and vehicle drive cycle models known as SIDRA INTERSECTION VERSION 9.1 which is the latest version. This analytical tool has the

capability of analysing all types of intersections (signalised, unsignalized, stop controlled, grade separated and roundabouts. Furthermore, SIDRA INTERSECTION allows modelling of separate Movement Classes (Light Vehicles, Heavy Vehicles, Buses, Bicycles, Large Trucks and six User Classes) with different vehicle characteristics. These movements can be allocated to different lanes, lane segments and signal phases; for example, for modelling bus priority lanes and signals. Figure 1.6 shows an impression of the SIDRA INTERSECTION 9.1 user interface.

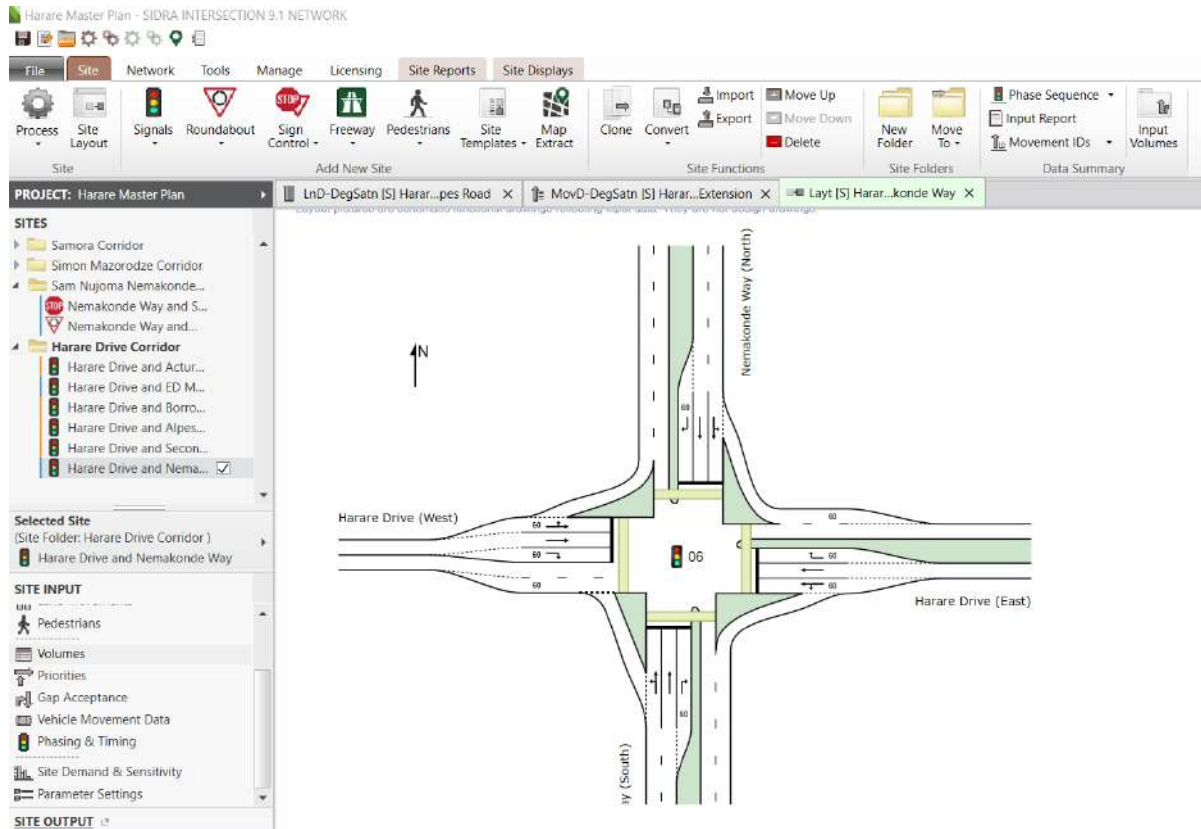


Figure 1.6: SIDRA INTERSECTION 9.1 user interface
Source: SIDRA, 2025.

1.7. Structure of the Report

The Report of Study is made up of 6 chapters i.e. Chapter 1 outlines Introduction and Background, Study Aim and Objectives and Study Approaches and Methods. Chapter 2 outlines environmental characteristics, Chapter 3 outlines social and demographic characteristics, Chapter 4 outlines spatial land use characteristics, Chapter 5 outlines economic characteristics, Chapter 6 outlines real estate and land markets profile of the city, Chapter 7 outlines public utilities and communications characteristics and Chapter 8 outlines the summary of study findings.

2. CHAPTER 2: ENVIRONMENT

2.1. Climate

2.1.1. Precipitation

The rainfall pattern is predominantly similar to the rest of Region 2 areas in Zimbabwe with an average of 800mm received annually and approximately 80% of the rain falling between November and March. January is the wettest month with an average of more than 200-mm. The daily precipitation of Harare exhibits a negative trend from 2021 to 2023 (See Figure 2.1). The rainfall amount received varies with latitude with the southern part receiving slightly less annual rainfall than the northern part of the city.

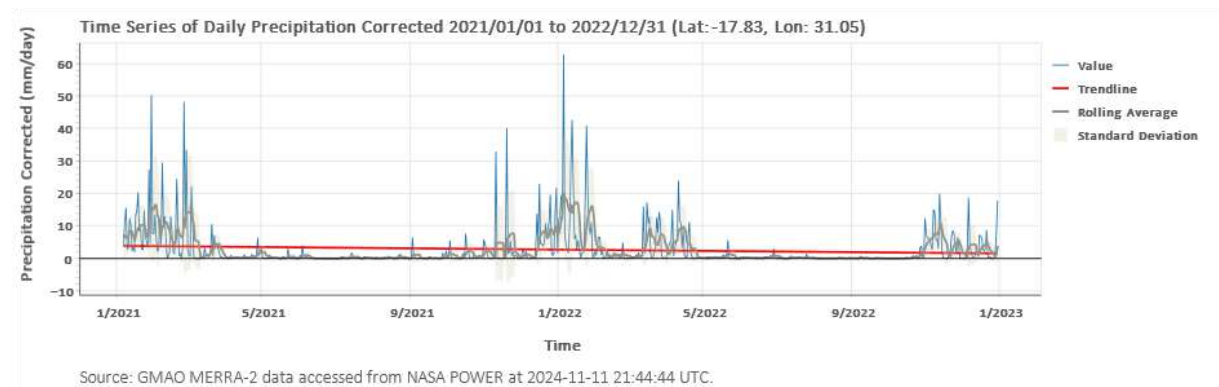


Figure 2.1: Longitudinal (2021-2023) variation in rainfall patterns

2.1.2. Temperature

Surface temperature for the City of Harare varies with seasons with the mean annual average being 20 °C. Mean maximum monthly temperatures exceed 30°C in October while the mean monthly minimum is below 10°C for June, July and August. The mean daily temperature fluctuates widely but a positive trend is observed from 2021 to 2024 (Figure 2.2). The average annual temperature exhibits an east-west gradient with the west being slightly warmer than the east.



Figure 2.2: Longitudinal (2021-2024) variation in temperature patterns

2.1.3. Wind Speed

Wind speeds peak prior to the rains and are generally northerly to north-easterly. The 2012-2023 data show an upward trend in wind speeds in Harare (Figure 2.3).

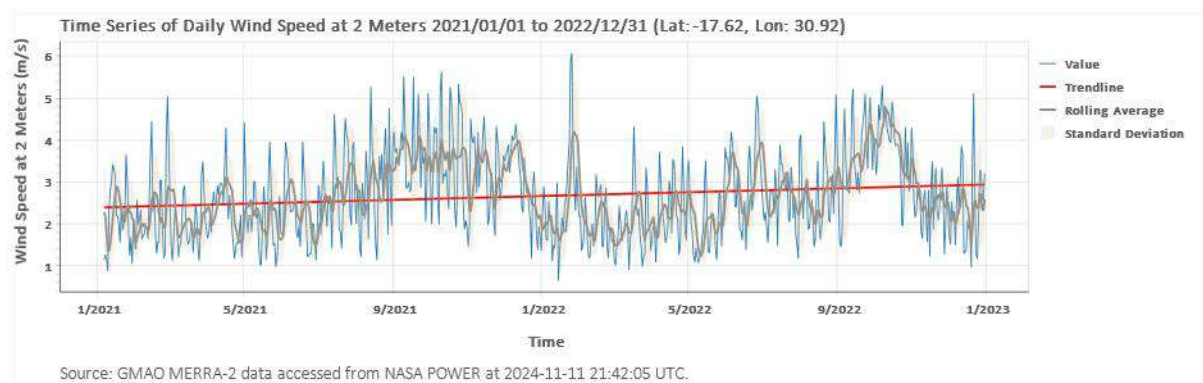


Figure 2.3: Temporal variation (2021-2023) in daily wind speed

2.1.4. Insolation

Insolation/solar intensity is also an important variable in the development of Harare. The solar energy received shows an upward trend (Figure 2.4), suggesting increased solar energy received over time. The city is getting warmer over time.

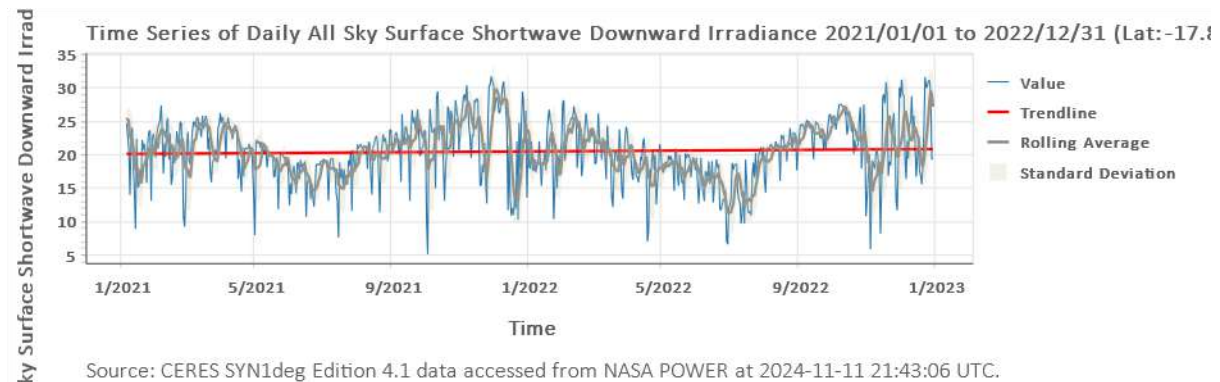


Figure 2.4: Time series of daily all sky surface shortwave downward irradiance for 2021-2022

2.2. Air Quality

Air quality is a critical environmental concern for Harare, as the city continues to grow and industrialize. Various pollutants contribute to the deterioration of air quality, posing risks to public health and the environment. Addressing air quality issues is not only vital for improving the health and well-being of Harare's residents but also plays a key role in shaping the city's sustainable development trajectory. Air quality directly affects public health, with poor air quality leading to respiratory illnesses, cardiovascular diseases, and other chronic health conditions. These health issues disproportionately affect vulnerable populations, including children and the elderly, placing additional strain on the city's healthcare systems. Poor air quality contributes to climate change, disrupts ecosystems, and diminishes biodiversity, undermining efforts to create a resilient and liveable urban ecosystem. Pollutants such as methane, carbon dioxide, and aerosols exacerbate global warming, while sulphur dioxide and nitrogen oxides lead to acid rain, which damages soil, water bodies, and vegetation.

The key pollutants of concern include:

- **Methane:** A potent greenhouse gas that contributes to climate change and is released through waste decomposition and other urban activities.

- **Sulphur Dioxide (SO₂):** Emitted primarily from industrial processes and fuel combustion, SO₂ has significant impacts on respiratory health and contributes to acid rain.
- **Carbon Monoxide (CO):** Produced from incomplete combustion of fossil fuels, CO can be harmful to human health even at low concentrations.
- **Carbon Dioxide (CO₂):** A major greenhouse gas released from burning fossil fuels, industrial activities, and deforestation, CO₂ significantly contributes to global warming and climate change.
- **Formaldehyde:** Commonly released from industrial activities and vehicular emissions, formaldehyde poses risks to respiratory health and has been classified as a carcinogen.
- **Nitrogen Aerosols:** These are formed from nitrogen oxides (NO_x) released during combustion processes, contributing to smog formation and respiratory problems.
- **Aerosol Index:** A composite measure of airborne particulates that influence visibility, climate, and human health.

The main polluting gases in Harare include SO_x, NO_x, Particulates and Carbon monoxide. These gases are emitted from the industries, boilers, generators, vehicles and fires from the illegal solid waste dumpsites in residential areas. The emission levels are classified and measured in line with SI 72 of 2009 of the Environmental Management Act (Atmospheric Pollution Control) regulations SI 72 of 2009 (See Table 2.1).

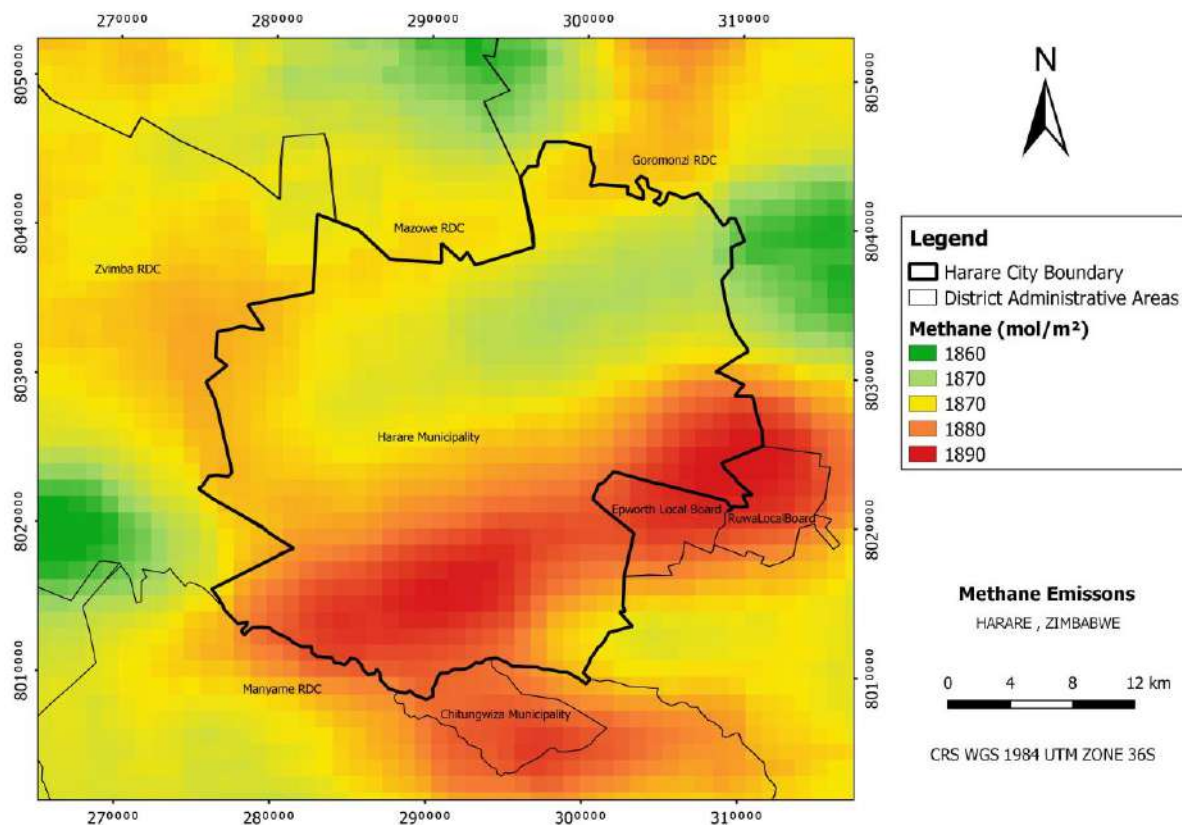
Table 2.1: Air pollution limits

Pollutant	Blue	Green	Yellow	Red
Particulates,	<60mg/m ³	<90mg/m ³	<100mg/m ³	<120 mg/m ³
SO ₂	<30mg/m ³	<40 mg/m ³	<45mg/m ³	<50 mg/m ³
NO ₂	<70mg/m ³	<100mg/m ³	<130mg/m ³	<150mg/m ³

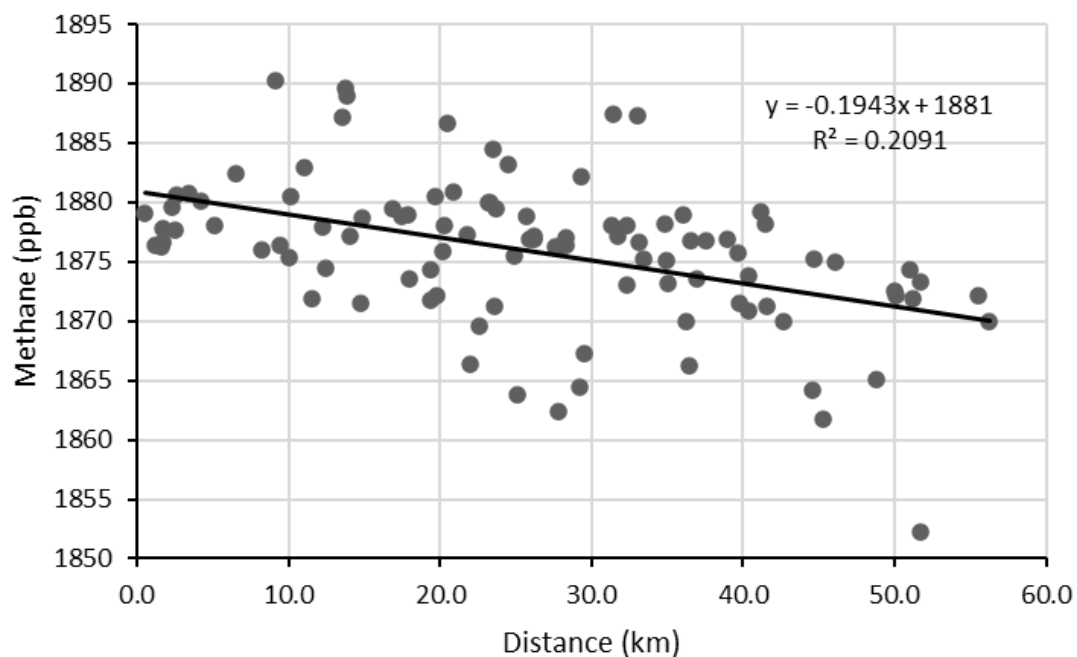
In the following subsections, each of these pollutants is explored in detail to understand their sources, impacts, and potential mitigation strategies.

2.2.1. Distribution of Methane Emissions

Methane is a potent greenhouse gas with a global warming potential significantly higher than carbon dioxide over a shorter time frame. It plays a critical role in accelerating climate change and is a significant contributor to air quality degradation. In Harare, methane emissions primarily originate from the decomposition of organic waste in landfills, wastewater treatment facilities, and agricultural activities. The lack of adequate waste management infrastructure exacerbates methane release, as organic waste is often left to decompose in open dumps. The environmental impacts of methane include its contribution to the greenhouse effect, which intensifies global warming. Methane also influences the formation of ground-level ozone, a harmful pollutant that poses risks to human health and vegetation. Addressing methane emissions is therefore essential for mitigating climate change and improving air quality in Harare. The distribution of methane in Harare varies with distance from the city centre. The study established that methane levels remain relatively consistent across different distances, with slight fluctuations. Methane concentrations range from approximately 1,867 to 1,879 CH units, indicating notable emissions throughout the city and its surroundings (see figure 2.5).



Figures 2.5 and 2.6 illustrates the distribution of methane levels with respect to distance from the city centre. Methane concentrations are highest closer to the city centre and decrease slightly as the distance increases, reflecting the urban activities and waste management practices contributing to methane emissions.



2.2.2. Distribution of Sulphur Dioxide Emissions

Sulphur dioxide (SO₂) is a significant air pollutant known for its harmful impacts on human health and the environment and primarily emitted from industrial processes, fossil fuel combustion, and vehicular emissions. SO₂ contributes to the formation of acid rain, which can damage ecosystems, corrode infrastructure, and reduce agricultural productivity. The distribution of sulphur dioxide in Harare reveals variability in concentrations across different distances from the city centre. SO₂ levels are generally low, with minor fluctuations. Concentrations range from approximately -0.00002 to 0.00005 units, reflecting the localized nature of SO₂ emissions and their dependence on industrial and vehicular activities (see figure 2.7).

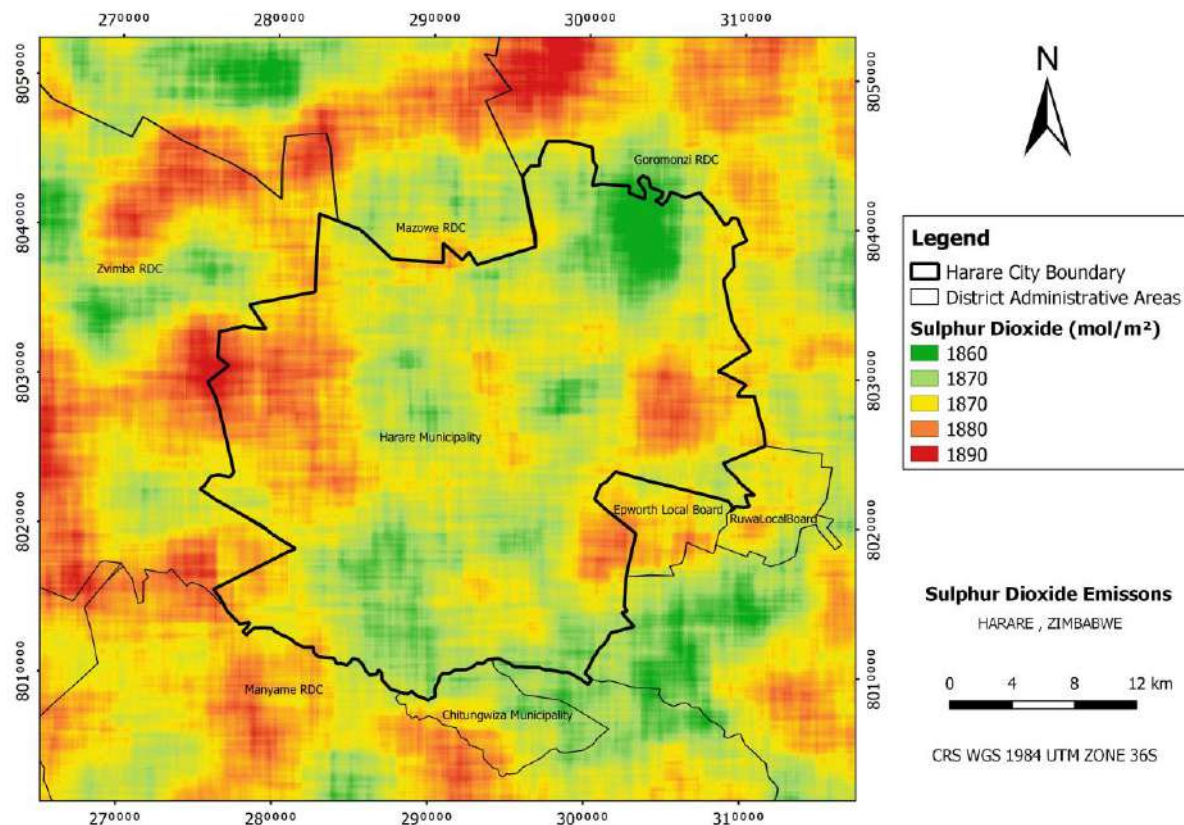


Figure 2.7: Distribution of Sulphur dioxide emissions across Harare

Figure 2.7 illustrates the distribution of sulphur dioxide levels with respect to distance from the city centre. The data suggests that emissions are concentrated near residential and industrial areas, tapering off as one moves further from the city centre.

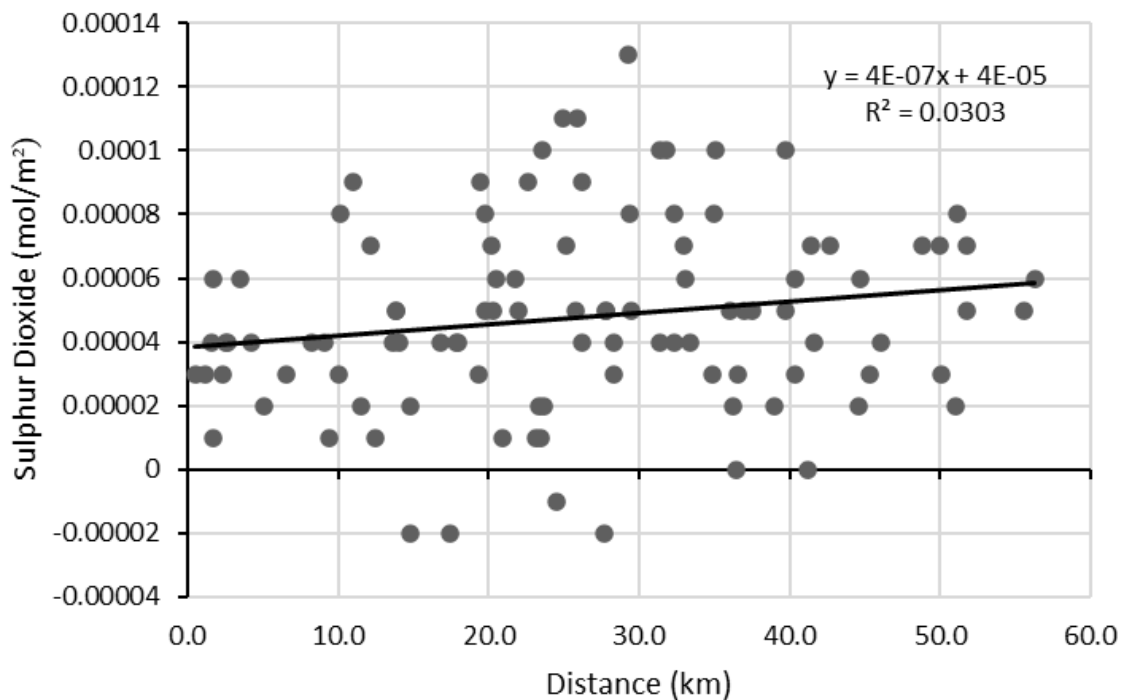


Figure 2.8: Correlation of Sulphur dioxide emissions with distance from the city centre

2.2.3. Distribution of Carbon Dioxide and Carbon Monoxide

Carbon dioxide (CO₂) is a significant greenhouse gas contributing to global warming and climate change. It is emitted primarily from the combustion of fossil fuels, industrial processes, and deforestation. Elevated levels of CO₂ exacerbate the greenhouse effect, leading to rising temperatures and associated environmental challenges. CO₂ is also closely linked to the urban heat island (UHI) effect, where urban areas experience higher temperatures than their rural surroundings due to human activities and modified land surfaces. The UHI effect intensifies energy demands for cooling, exacerbates heat-related health problems, and contributes to deteriorating air quality. Elevated CO₂ levels and the associated heat can worsen respiratory and cardiovascular diseases, increase instances of heatstroke, and exacerbate conditions such as asthma. Vulnerable populations, including children, the elderly, and those with pre-existing conditions, are particularly at risk. The distribution of carbon monoxide in Harare shows consistent levels across various distances from the city centre, with minor variations. CO₂ concentrations range from approximately 0.0276 to 0.0294 units, reflecting emissions from vehicular traffic, industrial activities, and energy production.

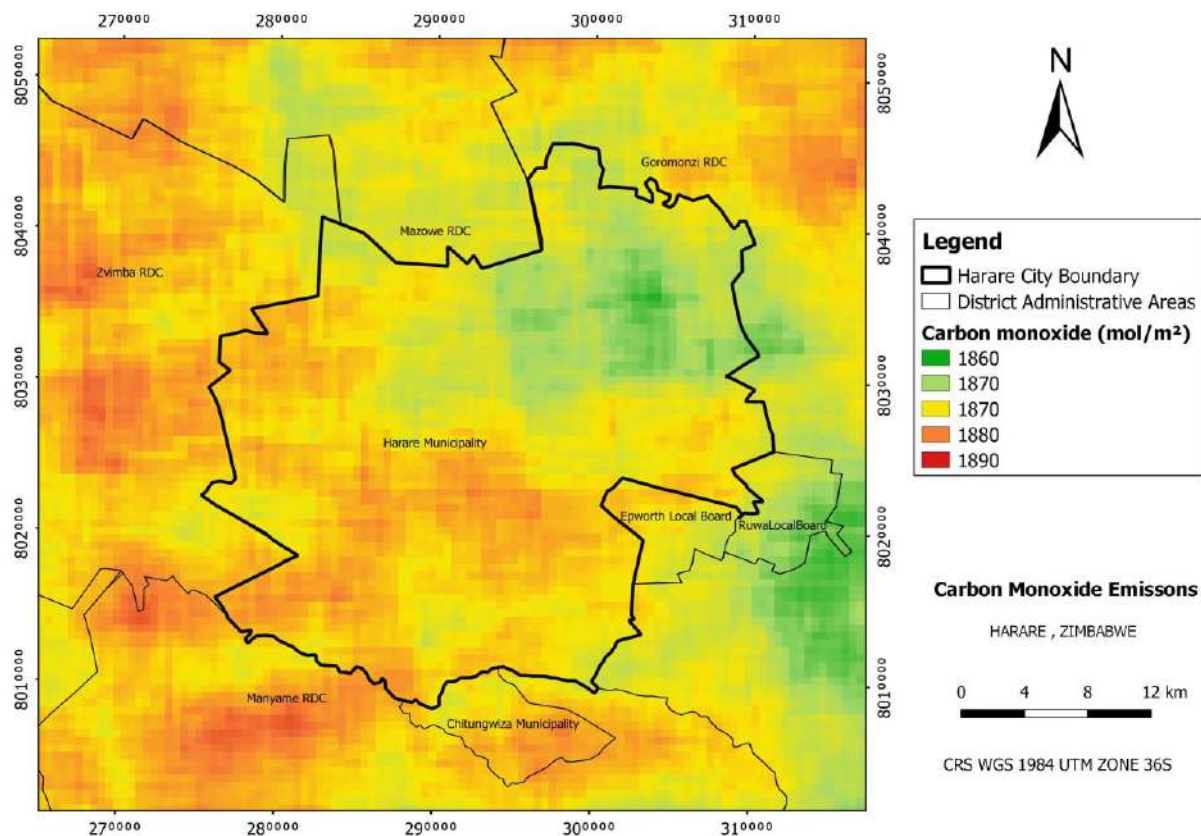


Figure 2.9: Distribution of Carbon monoxide emissions

Figure 2.9 and 2.10 illustrates the distribution of carbon dioxide levels with respect to distance from the city centre. The data highlights that emissions are more concentrated in high density residential and industrial areas, where economic activities and fossil fuel consumption are highest.

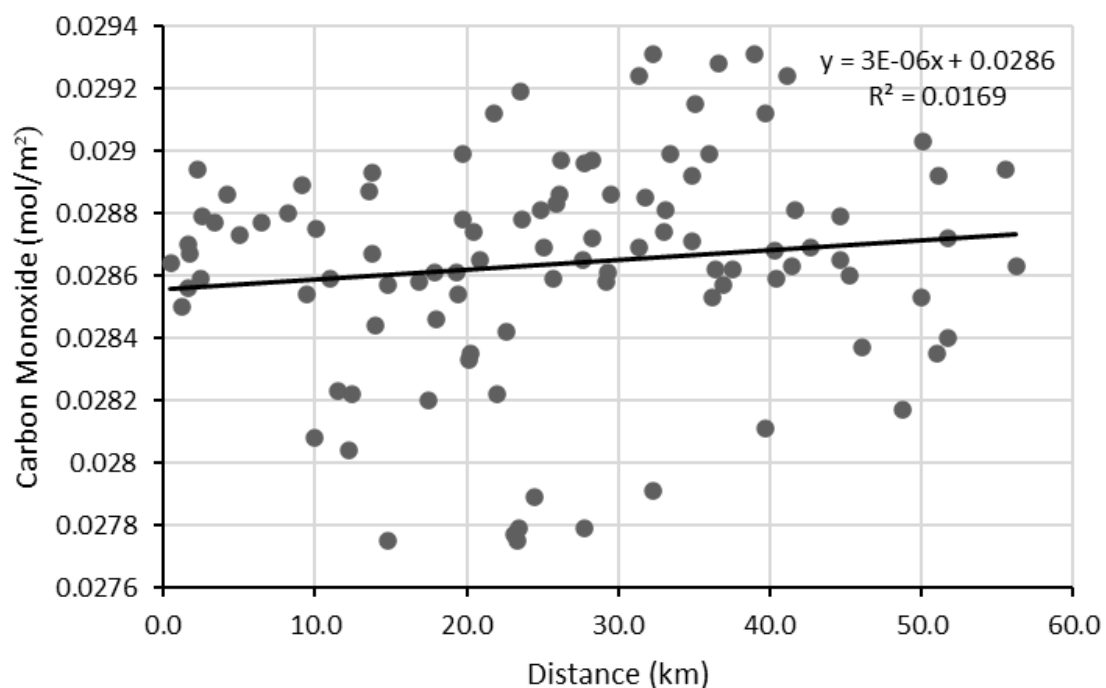


Figure 2.10: Correlation of Carbon monoxide emissions with distance from the city centre

2.2.4. Distribution of Formaldehyde Across Harare

Formaldehyde is a volatile organic compound (VOC) commonly released into the atmosphere through industrial activities, vehicular emissions, and waste burning. It is a known human carcinogen and poses significant health risks, particularly to the respiratory system. Long-term exposure to formaldehyde can lead to chronic respiratory conditions, eye irritation, and other health problems. The distribution of formaldehyde in Harare shows slight variations across distances from the city centre. Concentrations range from approximately 0.00013 to 0.00016 units, reflecting emissions from urban and industrial activities (see figure 2.11 and 2.12).

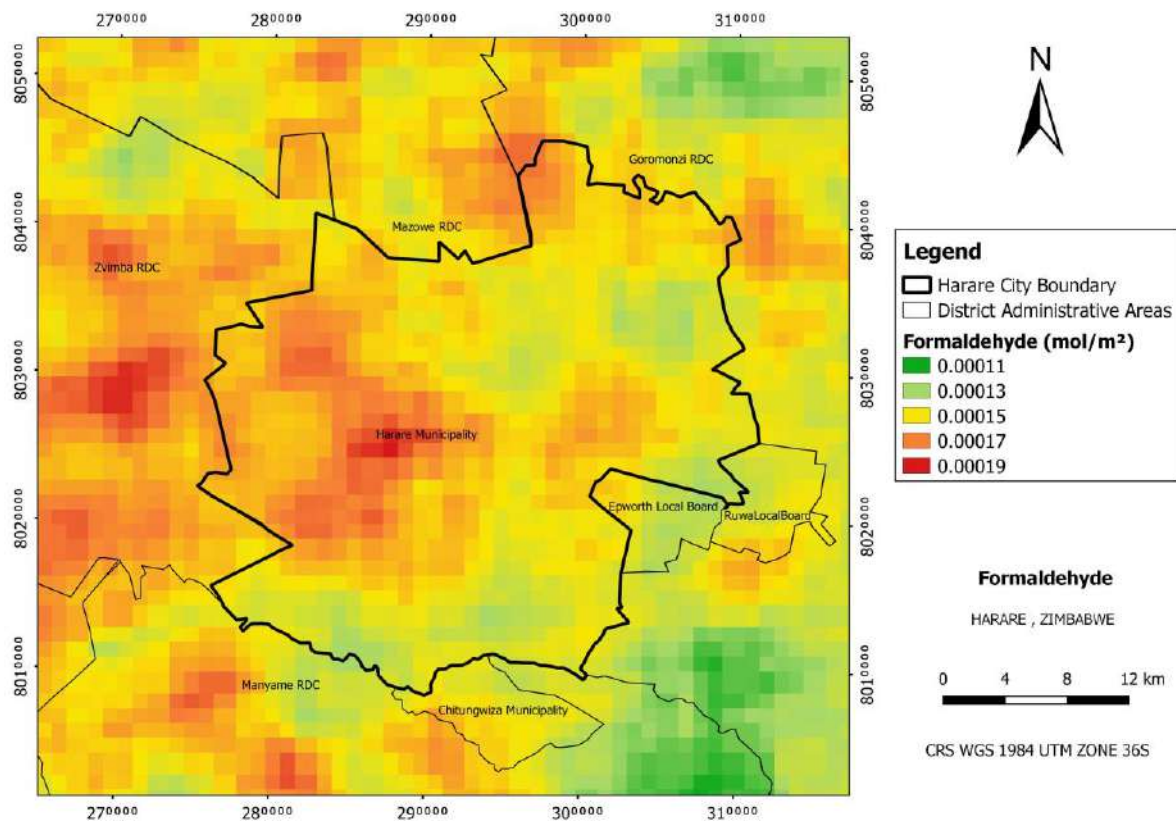


Figure 2.11. Distribution of Formaldehyde emissions across Harare

The highest levels are observed closer to the city centre, where industrial and vehicular activities are more concentrated. The data suggests that the distribution of formaldehyde levels with respect to distance from the city centre show that emissions taper off as one moves further from urbanized areas.

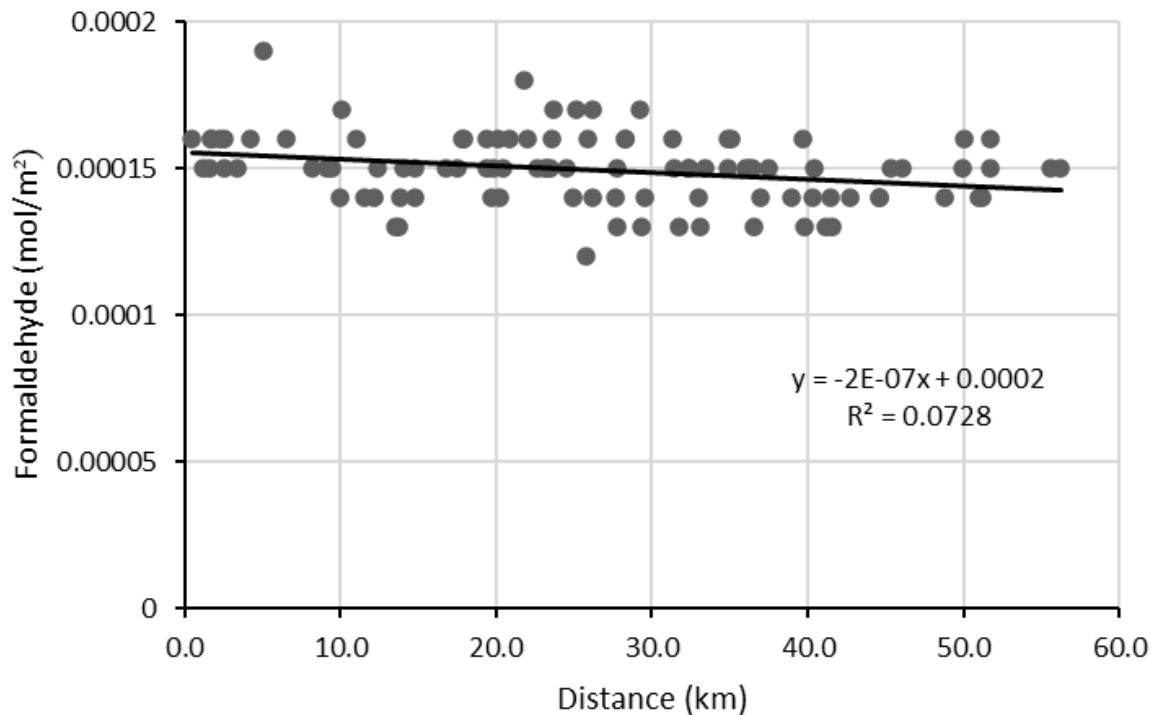


Figure 2.12: Correlation of Formaldehyde emissions with distance from the city centre

2.2.5. Nitrogen distribution across Harare

Nitrogen oxides (NO_x), including nitrogen dioxide (NO₂), are significant contributors to air pollution. These compounds are primarily emitted during the combustion of fossil fuels in vehicles, power plants, and industrial processes. Nitrogen oxides play a key role in the formation of smog and acid rain, both of which have detrimental impacts on the environment and human health. Exposure to nitrogen oxides can exacerbate respiratory conditions such as asthma and bronchitis and can impair lung function over time. Additionally, nitrogen oxides contribute to the formation of ground-level ozone, which poses further health and environmental risks. The distribution of nitrogen in Harare indicates relatively stable concentrations across different distances from the city centre, with significant increases in central business district, high density residential areas and industrial zones. Nitrogen levels range from approximately 0.00002 to 0.00006 units, reflecting emissions from vehicular traffic and industrial activities.

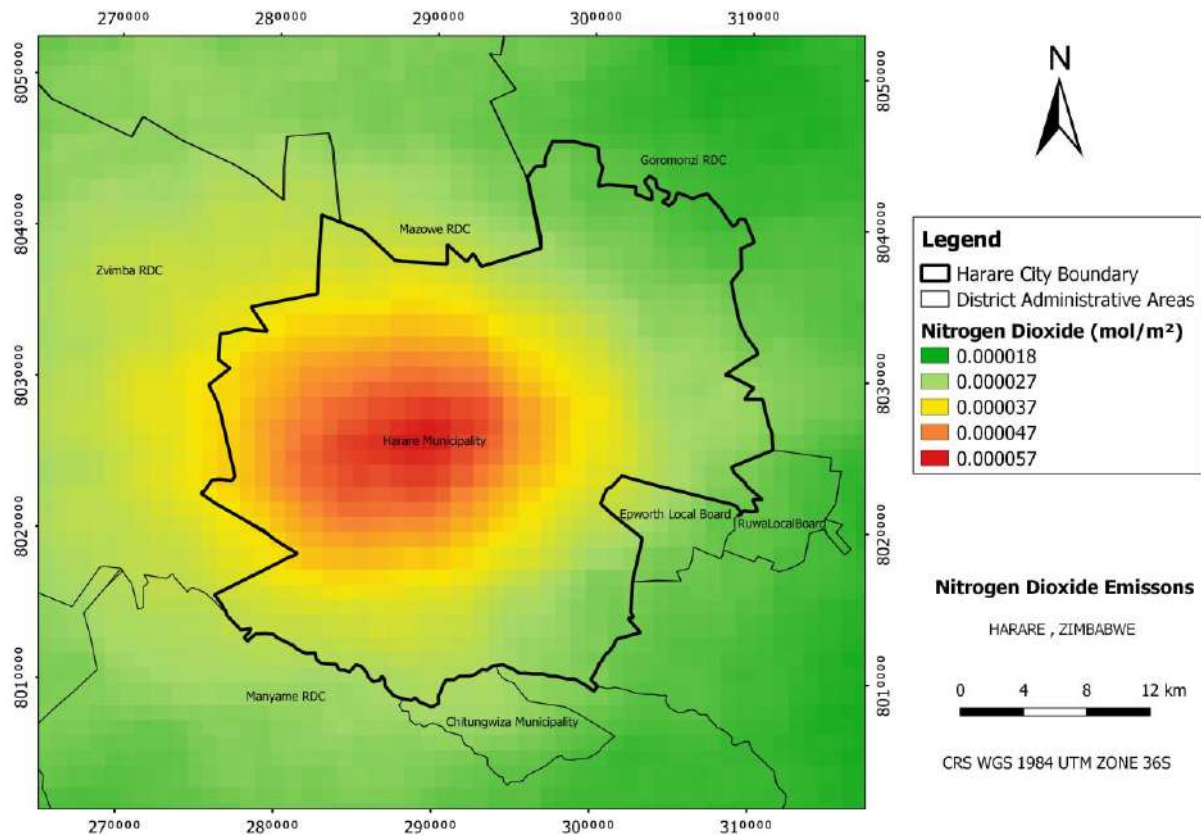


Figure 2.13 Distribution of Nitrogen oxide emissions across Harare

Figure 2.13 illustrates the distribution of nitrogen levels with respect to distance from the city centre. The data underscores the importance of controlling emissions in residential, shopping and industrial areas to reduce nitrogen-related pollution.

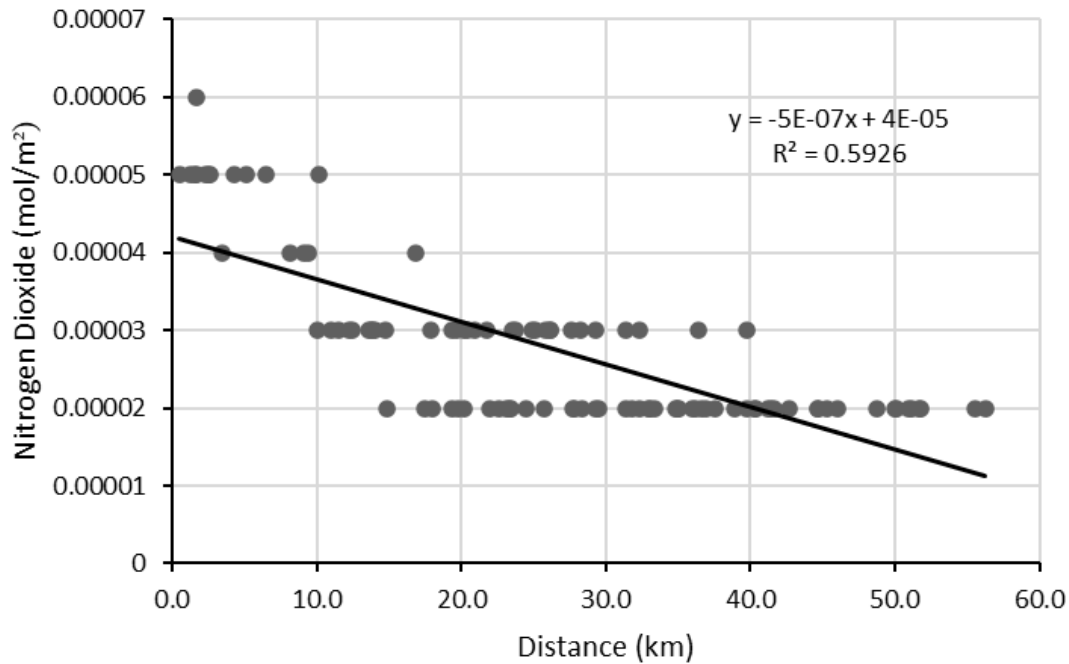


Figure 2.14: Correlation of Nitrogen oxide emissions with distance from the city centre across

2.2.6. Aerosols Concentration and distribution in Harare Atmosphere

Aerosols are tiny particles or droplets suspended in the atmosphere, originating from both natural and anthropogenic sources. In Harare, aerosols are primarily produced by industrial emissions, vehicular exhaust, construction activities, and biomass burning. These sources contribute to degraded air quality, reduced visibility, and climate impacts due to the scattering and absorption of sunlight. Aerosols are known to exacerbate respiratory and cardiovascular conditions. Prolonged exposure to high levels of aerosols can impair lung function, trigger asthma attacks, and increase the risk of heart diseases. Vulnerable populations, including children and the elderly, are particularly at risk. The distribution of aerosols in Harare shows variability across different distances from the city centre. Concentrations range from approximately -0.75537 to -0.52664 units, with higher levels observed in high to medium density residential areas, central business district and industrial zones (see Figure 2.15 and 2.16). This trend reflects the contributions of human activities to aerosol emissions.

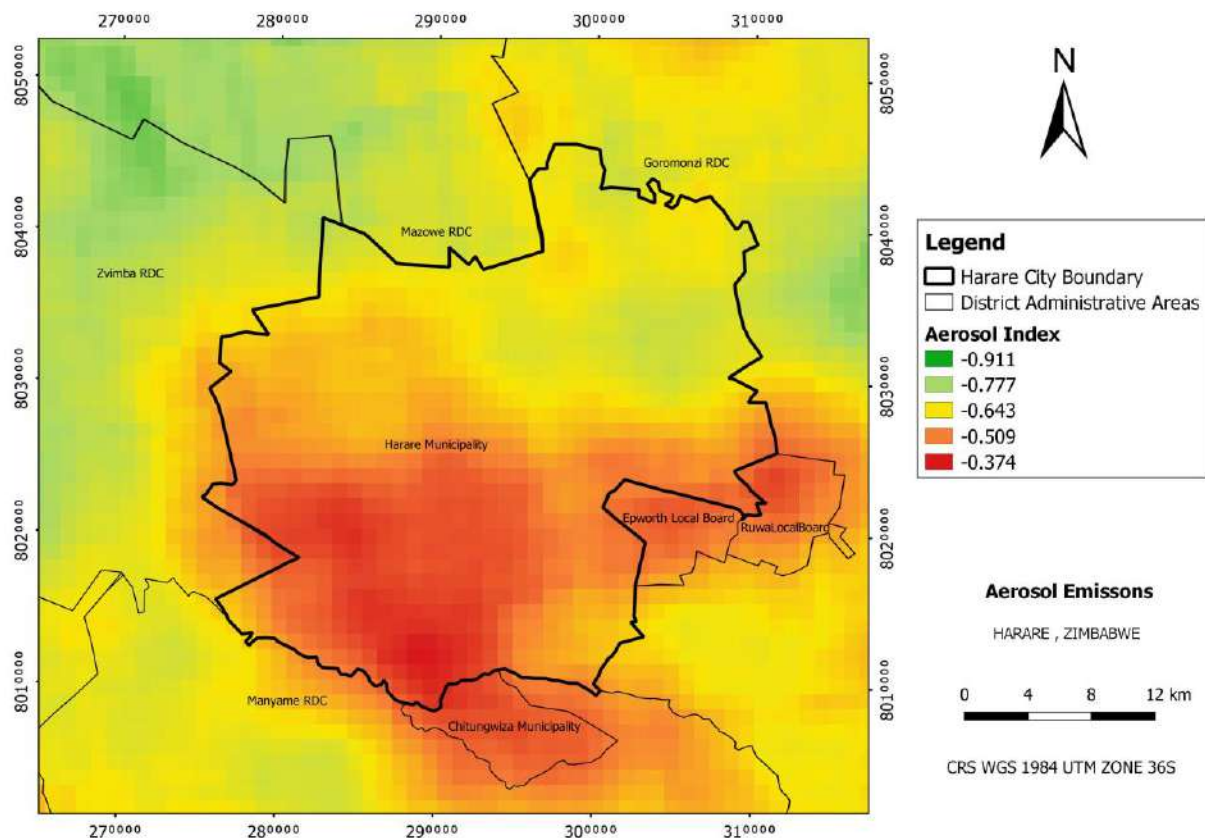


Figure 2.15: Distribution of Aerosols across Harare

Figure 2.15 illustrates the distribution of aerosol levels with respect to distance from the city centre. The data highlights the need for effective pollution control measures to manage aerosol emissions in Harare.

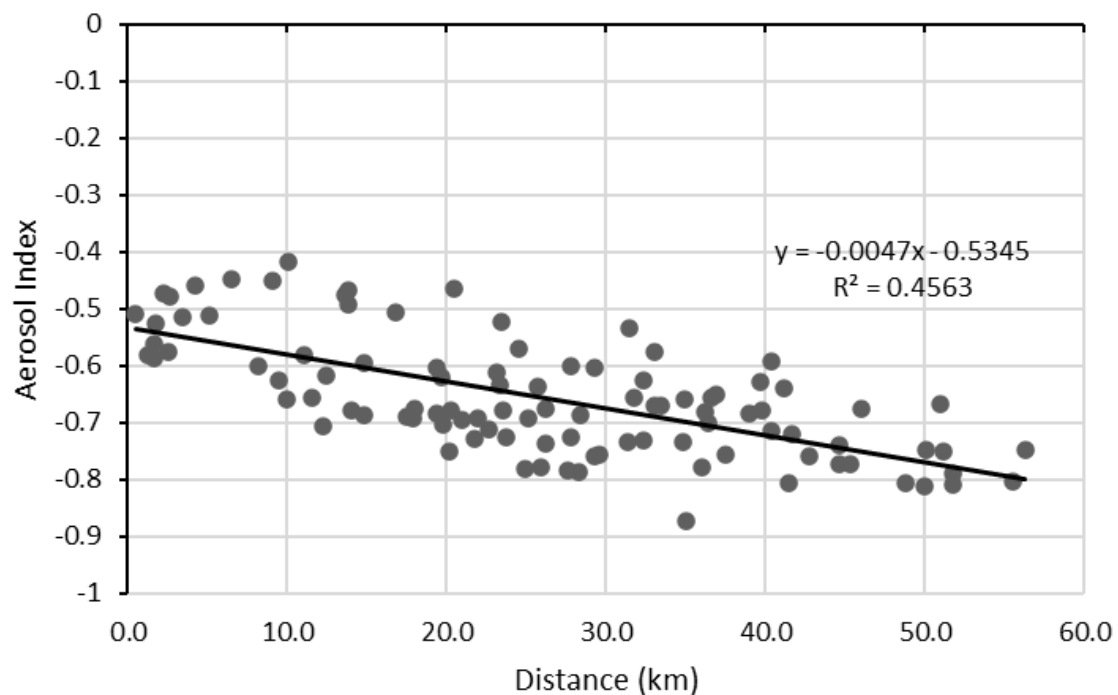


Figure 2.16: Correlation of Aerosols emissions with distance from the city centre

2.3. Geology and Soils

2.3.1. Rock and soil formation

The geology of study area shows unjointed or weakly jointed granitic and gneissic rocks of the basement complex. The proportion of rock outcrops tends to be lowest in terrain predominantly gneissic or where granitic rocks are relatively low in potash feldspar. The geology of the schist or belts represented in some districts comprise mafic metavolcanics or less commonly gabbro. Dolerite and epidiorite dykes and sills are particularly common. Soils are mainly well drained, shallow to moderately deep, fine or medium grained loams over brown to red loams, dark Basaltic soils and supported by gravel in some areas within the city. The parent material is Gneiss or old alluvium derived from gneiss. The gneiss outcrop that covers Harare also gives sandy loamy soils and the gravel aspect in other parts of the city. However, in areas where wetlands are prevalent, the soils tend to be dark grey to black due to anaerobic respiration in the area. In areas where vegetation is dense, there are well-drained, shallow to deep, typically dark reddish brown sandy loams, sandy clays, clay loams or clay over reddish brown, red or dark red, well- structured soils. Some soils with relatively high proportion of fine sand or silt in the topsoil may develop a platy surface structure, indicative of poor structural stability and liable to induce poor rainfall acceptance. The soils however vary with depth as follows:

- From 0-10cm there are brown coarse sandy loam soils, few medium strong brown mottles with a platy structure.
- From 10-68cm there are dark grey coarse sandy clay.
- From 68-117cm there are light yellowish-brown clay, few medium brownish yellow mottles.

2.3.2. Soil pH distribution

Soil pH is a critical factor influencing agricultural productivity, vegetation growth, and overall soil health. The primary sources of soil pH variation in Harare include industrial emissions, agricultural practices, and urban runoff, which can lead to soil acidification or alkalinity. The pH level determines the availability of essential nutrients and affects microbial activity within the soil. In Harare, understanding soil pH distribution is vital for sustainable land management and agricultural practices downstream. The distribution of soil pH across Harare indicates increased variability, reflecting the diverse land uses and soil types in the area. Soil pH levels range from approximately 5.5 to 6.4, with slightly more acidic soils in high density residential areas, central business district and industrial zones. These variations are influenced by factors such as pollution, land use practices, and natural soil composition.

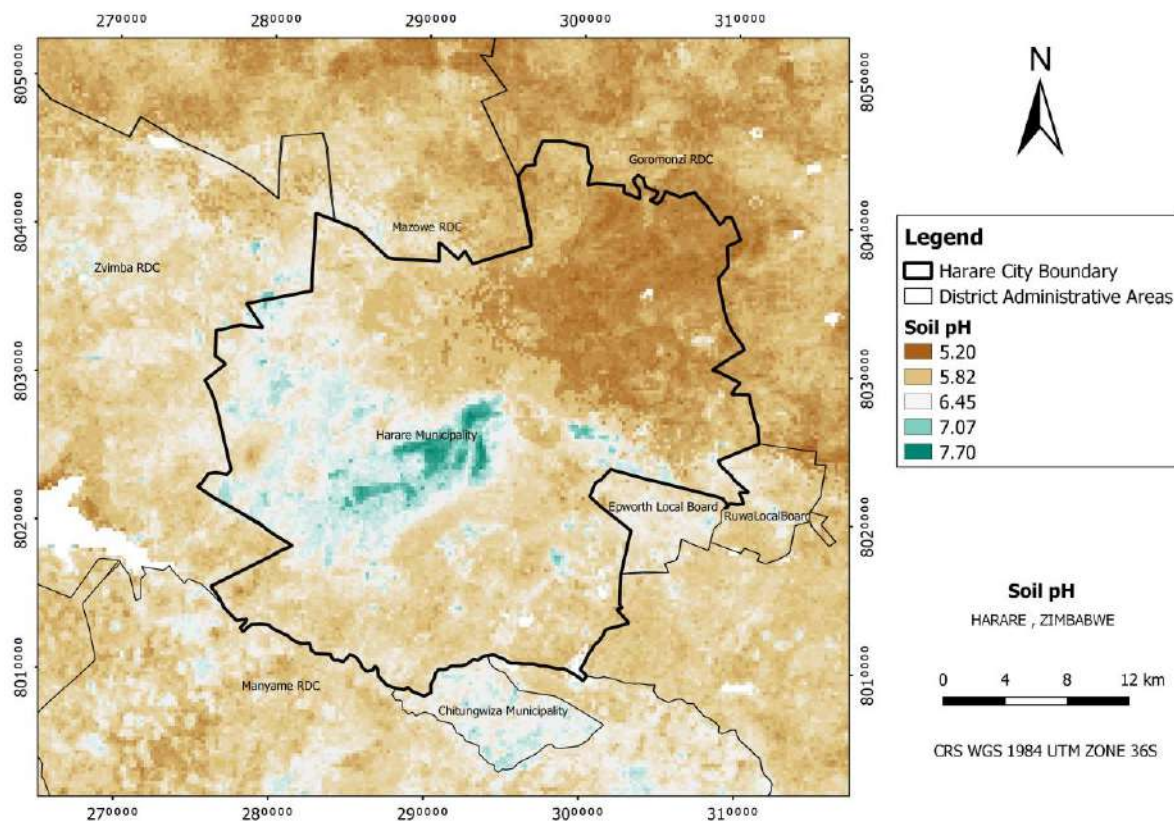


Figure 2.17: Spatial variation of soil pH across the Harare Metropolitan

Figure 2.17 and 2.18 illustrates the distribution of soil pH with respect to distance from the city centre. The data highlights the need for targeted soil management strategies to maintain fertility and address areas affected by acidity.

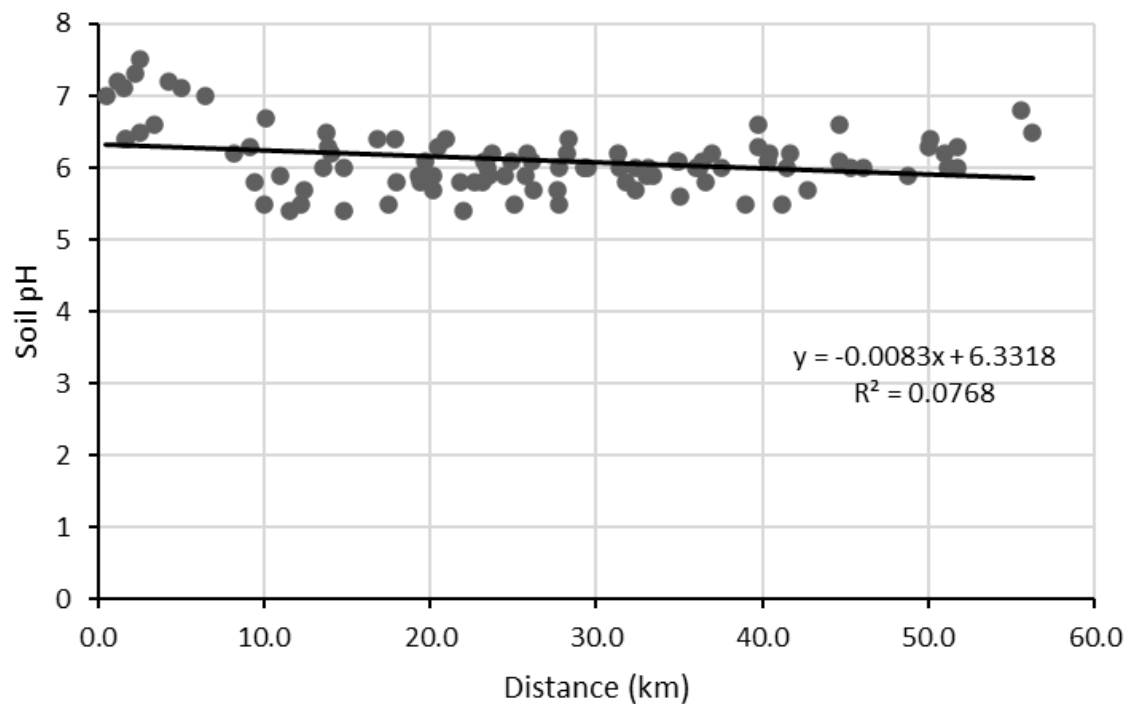


Figure 2.18. Soil pH profile showing soil alkalinity close to the city centre.

2.4. Biodiversity

2.4.1. Tree Cover and Canopy Height

The natural vegetation, which doesn't exist anymore in many parts of Harare Miombo, comprising *Brachystegia spp* – *Julbernardia globiflora* woodland. Other species becoming common in drier areas of the district at lower elevations include *Vachelia sieberana*, *V. polyacantha*, *Bauhinia petersiana*, *B. thonningii* and *Combretum spp*. *Combretum Terminalia-Colophospermum* mopane starts to be dominant in the drier areas in some area the mopane is dominant but elsewhere may be absent, commonly where the soils are shallow and relatively sandy. The generally open woodland in 5-10m in height, locally with good, tufted grass cover. Species found include *Terminalia stuhlmannii*, *T. Pterocarpus brenanii* and *Commiphora spp*. The built-up area is dominated by exotic trees that are used for landscaping. Overall, the tree cover for Harare shows high tree cover in the built-up area and nothing in the periphery except for the Protected areas of Heroes Acre, Harare Kopje, Mukubisi Woodland and Cleaveland Dam. Likewise, the canopy height also is high within the built up area and low to nothing in the open land (see Figure 2.19). There is an inverse correlation between tree canopy height and distance away from the city centre.

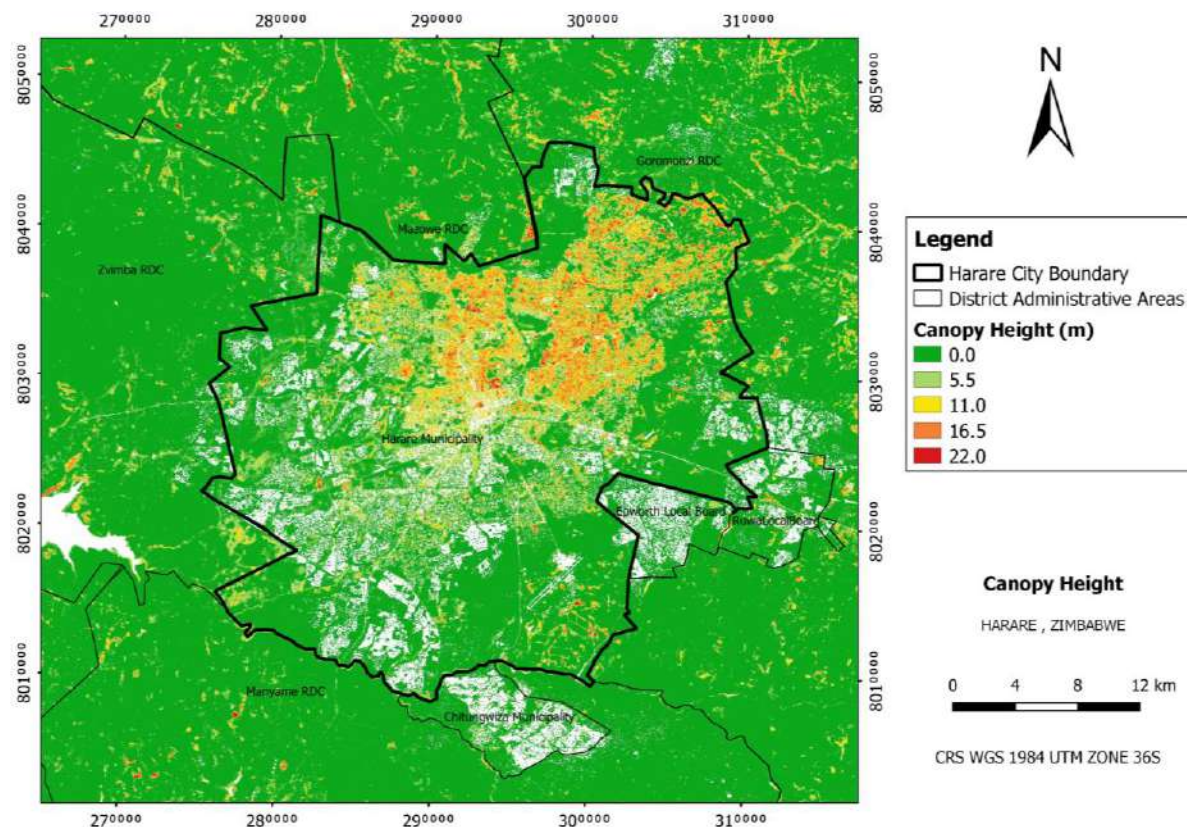


Figure 2.19: Spatial distribution of Tree Canopy Height (CH) across Harare was reduced by a factor of 4 for mapping efficiency

2.4.2. Exotic tree cover

The Harare Master Plan outlines strategies for the city's expansion and urban management, which includes addressing the impact of exotic vegetation on Harare's environment and landscape. Exotic vegetation - non-native plant species introduced intentionally or accidentally - plays a mixed role in Harare's urban development. Jacaranda Trees: Known for their vibrant purple blooms, jacarandas are prominent in Harare, lining many streets and parks. They have become an iconic feature of the city's landscape but are non-native,

originally from South America. Eucalyptus: Commonly planted for shade and fast growth, eucalyptus trees also support local construction and fuel needs. Native to Australia, these trees can negatively impact soil moisture levels, exacerbating water scarcity in certain areas. Pine Trees: Pine species, often planted for timber and landscaping, are also exotic to Harare. Their needles and low-growing branches can hinder undergrowth and native plant diversity, impacting local ecosystems.

2.4.2.1. Implications for Urban Ecology

Biodiversity Impact: Exotic vegetation can outcompete native species, potentially altering the city's biodiversity. While they contribute to the aesthetic and economic value, exotic plants can disrupt the balance of local ecosystems by suppressing native flora.

Water Consumption: Many exotic species, especially eucalyptus and pine, have high water consumption rates, which can exacerbate water shortages and affect nearby wetlands, rivers, and reservoirs.

Soil Health: Some exotic species may alter soil composition, making it less suitable for native plants. Eucalyptus, for instance, releases allelopathic chemicals that inhibit the growth of other vegetation, potentially degrading soil health.

2.4.3. Distribution of Biomass

Biomass refers to the total mass of living plants, particularly above-ground vegetation, which plays a crucial role in carbon sequestration, biodiversity conservation, and ecosystem services. In Harare, biomass levels are influenced by deforestation, urban development, and agricultural expansion. Green spaces in Harare are increasingly being encroached upon due to urbanization, leading to reduced biomass levels in the city centre. Conversely, peri-urban areas maintain higher biomass levels due to the presence of natural vegetation and agricultural practices.

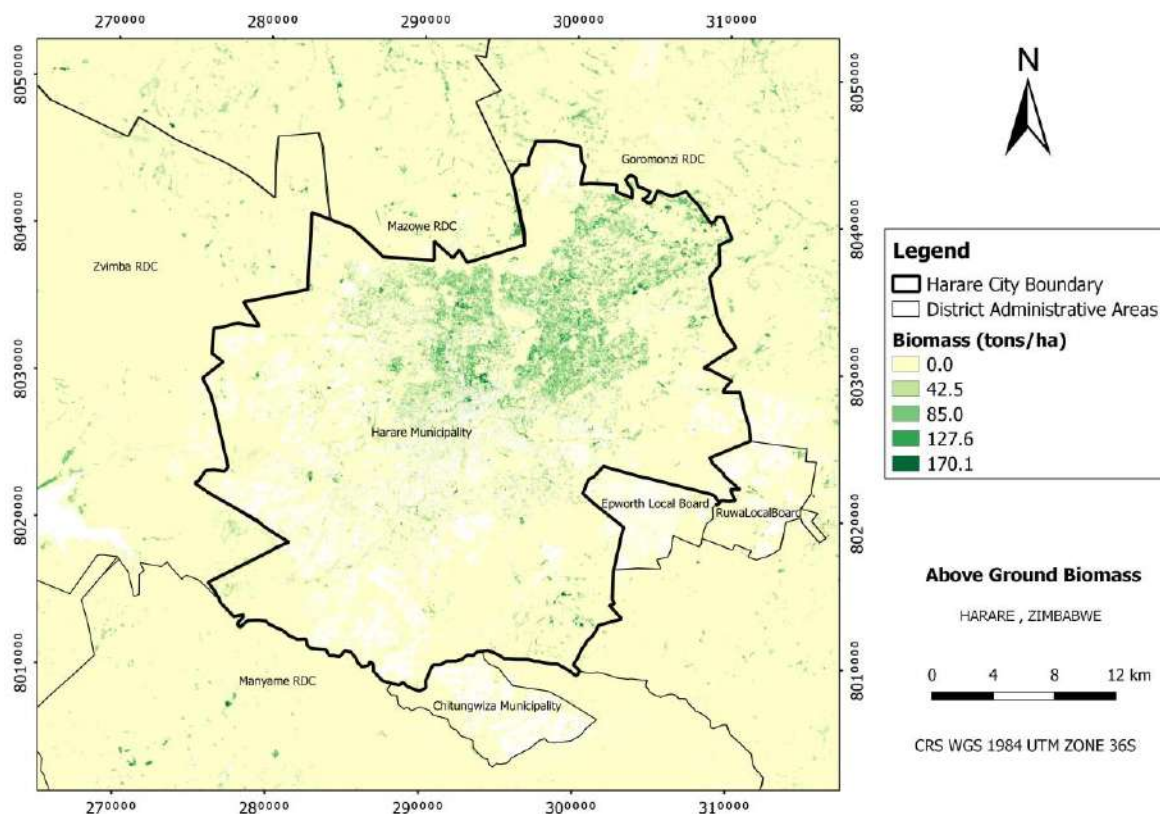


Figure 2.20: Spatial distribution of living plant biomass across Harare

Biomass levels range from approximately 15.2 to 37.5 units, with higher values observed in peri-urban and less-developed areas particularly high-density residential areas. Urban centre tend to have lower biomass levels due to reduced vegetation cover. Figures 2.20 and 2.21 illustrate the distribution of biomass with respect to distance from the city centre.

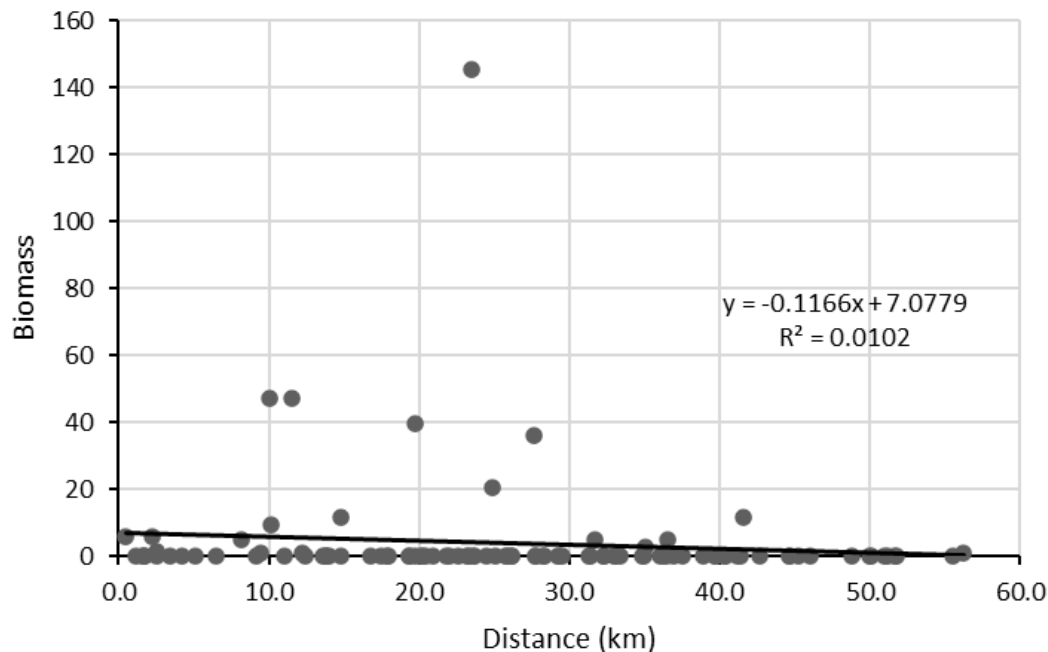


Figure 2.21: Correlation of plant biomass with distance from the city centre

2.4.4. Distribution of Biodiversity Intactness Index (BII)

The Biodiversity Intactness Index (BII) is a measure of the extent to which native biodiversity is maintained in a given area. It reflects the impact of human activities, such as urbanization, agriculture and industrial development on ecological integrity. In Harare, the BII is influenced by habitat loss, pollution, and land-use changes. Urban expansion and deforestation have resulted in fragmented habitats, threatening species diversity and ecosystem functionality. Efforts to restore and protect natural habitats are essential for maintaining biodiversity. The distribution of the BII across Harare shows that biodiversity is higher in peri-urban and rural areas compared to the city centre. This is due to the presence of natural vegetation and less intensive human activity in these regions. In contrast, highly urbanized areas exhibit lower BII values due to habitat degradation and pollution.

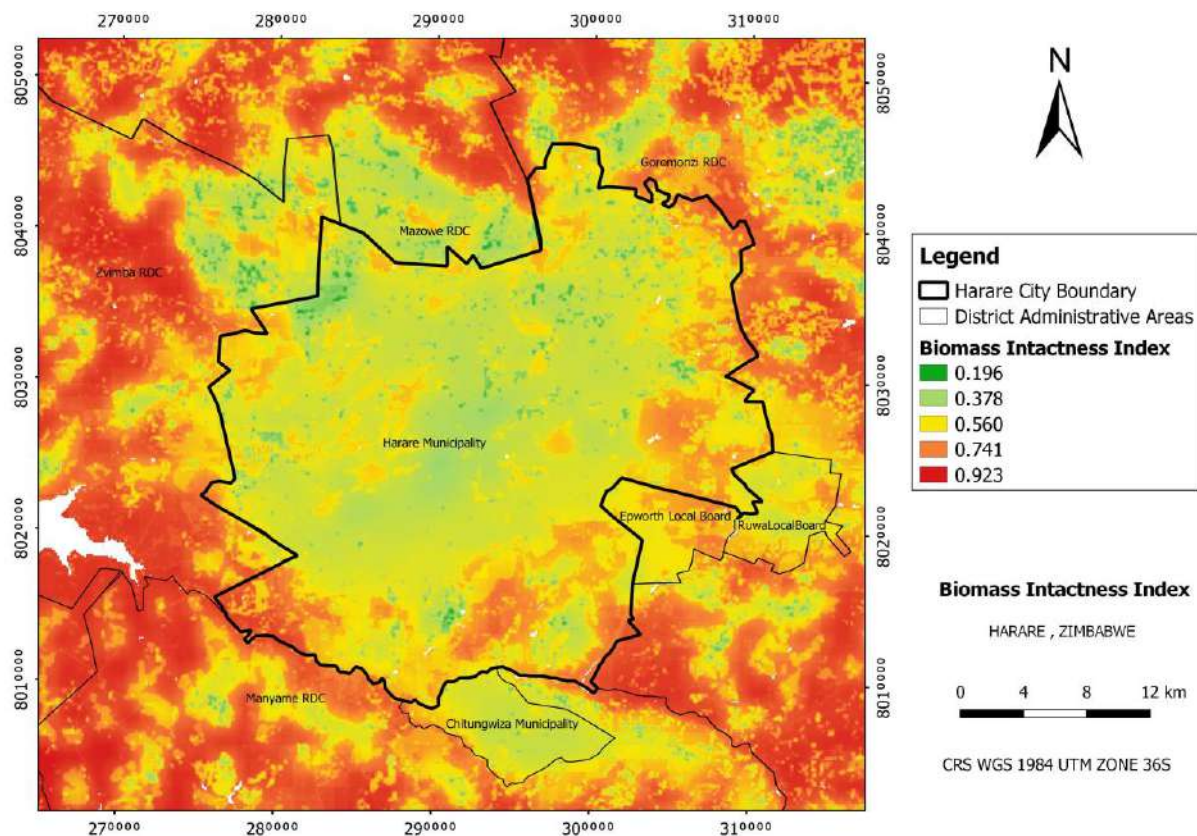


Figure 2.22: Spatial distribution of ecosystem health as measured by Biomass Intactness Index

Figure 2.22 and 2.23 illustrates the distribution of BII with respect to distance from the city centre. The data underscores the need for conservation initiatives and sustainable land-use planning to preserve biodiversity in Harare.

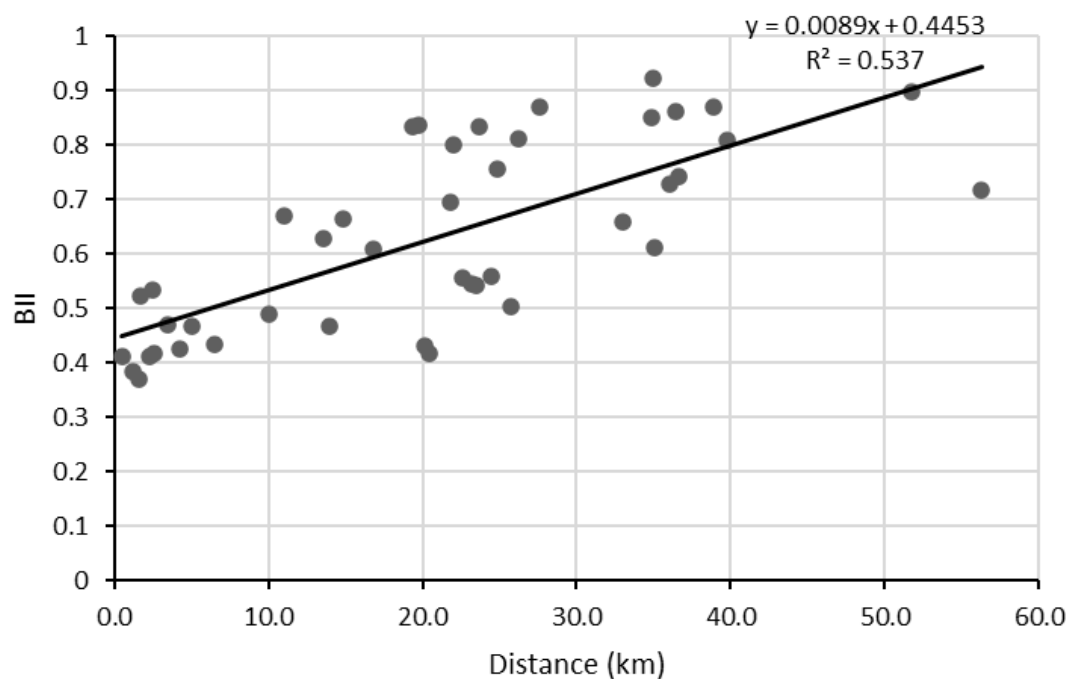


Figure 2.23: Correlation between Biodiversity Intactness Index and distance from the city centre

2.5. Hydrology and Drainage Systems

2.5.1. Catchments and drainage delineation

Harare's hydrological regime is significantly influenced by its location on the watershed of its main water source, Lake Chivero. The city is in the Upper Manyame River Basin, which consists of two primary tributary catchments: the Marimba and Mukuvisi River catchments. These river systems play a crucial role in channelling surface water towards Lake Chivero, which serves as the main reservoir supplying water to the city. The topography of Harare varies between flat landscapes and hilly portions, with an altitude ranging between 1350m and 1550m above mean sea level. The elevation differences affect the movement of surface runoff, particularly during the rainy season. Harare receives an average annual rainfall of approximately 760mm, with some years exceeding 810mm. However, high potential evapotranspiration rates of around 1600mm per year contribute to significant water losses. The drainage patterns in Harare have been altered by the expansion of built-up areas and impervious surface area, reducing natural infiltration, and increasing surface runoff. This has led to frequent urban flooding, particularly in low-lying areas where stormwater drainage infrastructure is inadequate. The Mukuvisi catchment covers approximately 223.1 km² with a longest flow path of 44.7 km, while the Marimba catchment spans 220.5 km² with a longest flow path of 38.6 km. Both catchments have been heavily impacted by urban development, leading to pollution, sedimentation, and reduced water quality in Lake Chivero. Given the city's strategic location on a watershed (see Figure 2.24), it is essential to implement sustainable drainage management strategies. Measures such as wetland conservation, stormwater management, and improved wastewater treatment can help mitigate the impact of urbanization on the city's drainage system and ensure the long-term sustainability of its water resources.

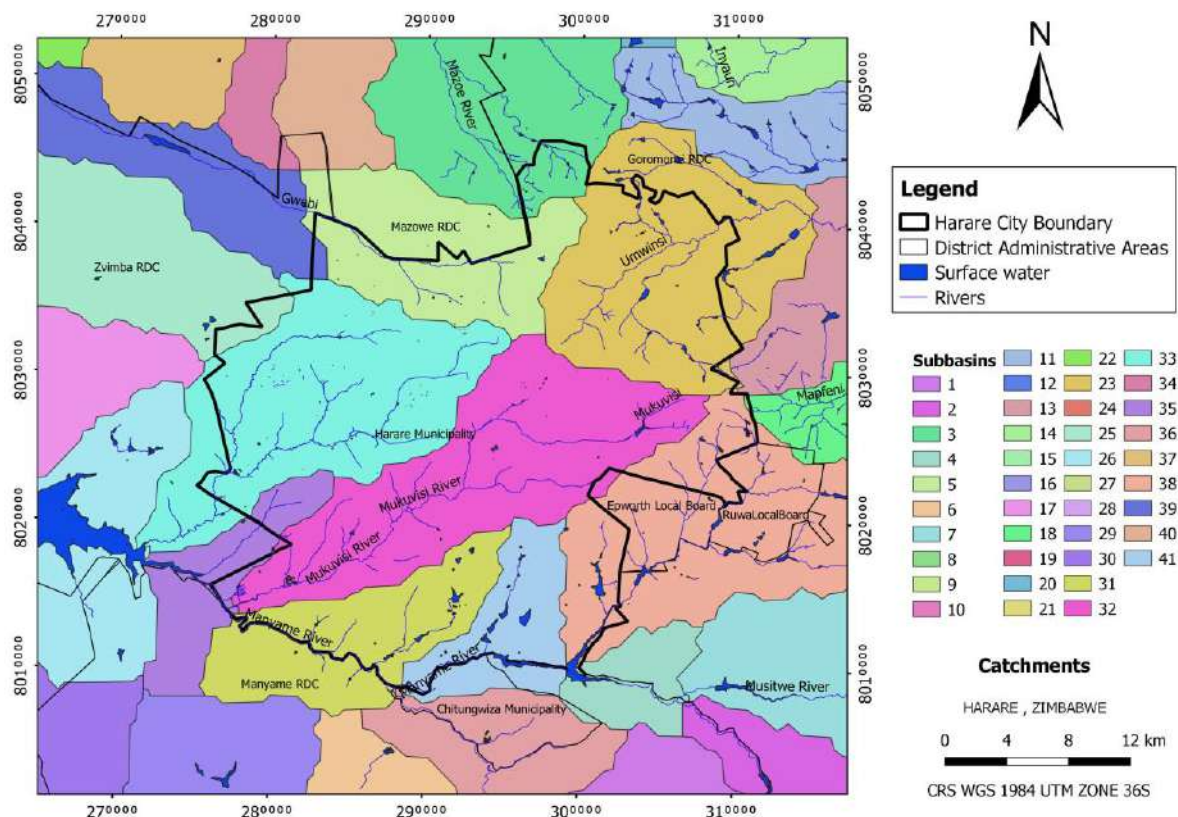


Figure 2.24: Drainage and watersheds of Harare

2.5.2. Flood Risk

The city is highly susceptible to flooding risk due to its geographical location on the watershed coupled with rapid urbanization, poor drainage infrastructure, and climate variability. The flood risk is particularly high in the Central Business District (CBD) and southern suburbs (see Figure 2.25), where inadequate stormwater drainage systems lead to frequent flooding. Encroachment of urban development on wetlands, which naturally absorb excess water, has exacerbated surface runoff, increasing the severity of flooding. Informal settlements, often built in flood-prone areas, are especially vulnerable. Clogged drainage systems from plastic waste further worsen flooding during heavy rains. Climate change is intensifying extreme weather events, increasing flood frequency and severity. Addressing flood risks requires improved urban planning, wetland restoration, and enhanced drainage infrastructure to mitigate impacts on property, livelihoods, and public health.

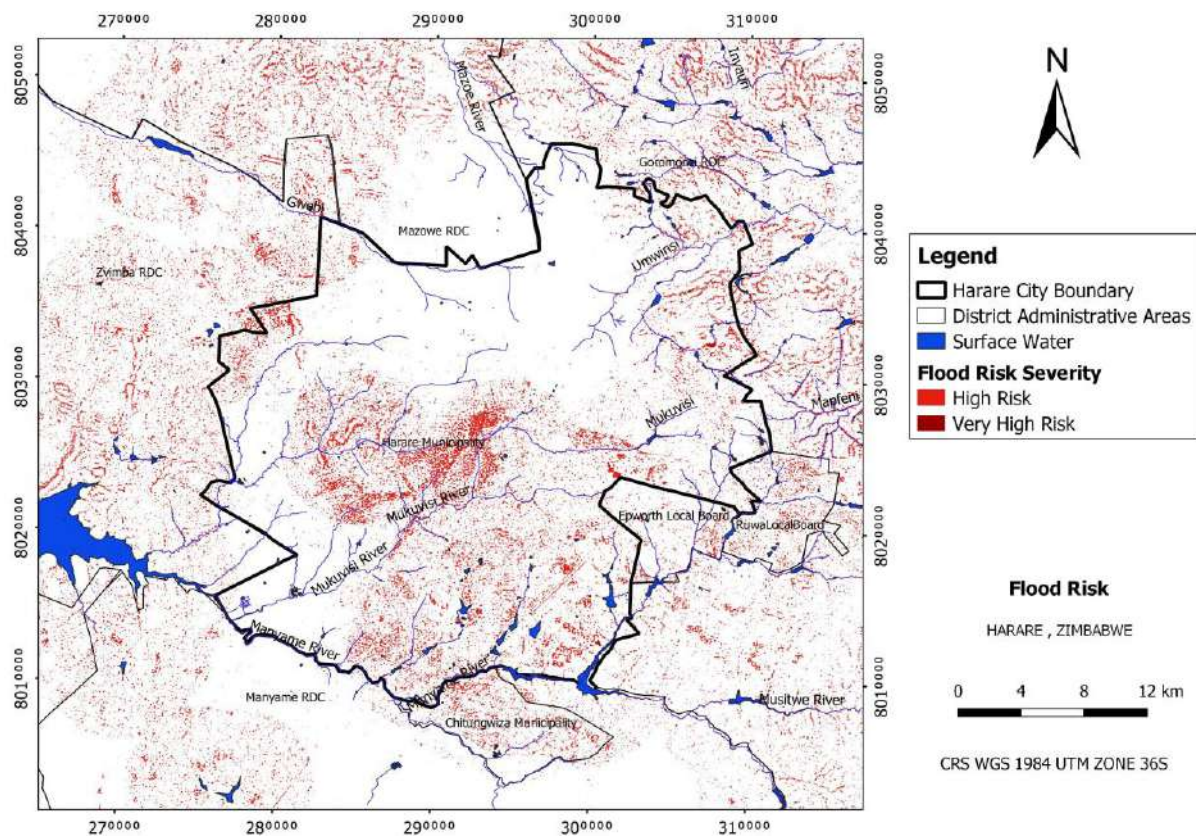


Figure 2.25: Distribution of at risk of flood areas across Harare

2.5.3. Wetlands distribution and policy imperatives

2.5.3.1. Overview of the Zimbabwe Wetland Policy

The Zimbabwe Wetlands Policy underscores the importance of wetlands in supporting biodiversity, managing water resources, and sustaining livelihoods. However, it also emphasizes the critical need for protection amidst urban expansion. The policy advocates for wetlands as “national assets” and mandates their integration into spatial planning, reflecting an awareness of the ecological role wetlands play in flood control, groundwater recharge, and water purification. The implications of the Wetland Policy to urban Development include among other things:

- (a) **Development Restrictions:** It discourages wetland drainage and prohibits certain activities like construction, mining, and intensive agriculture within or near wetlands.

This can limit urban expansion in areas with wetland ecosystems, potentially constraining land use for new infrastructure and housing.

- (b) **Enhanced Regulatory Oversight:** The policy requires that urban planning incorporate ecological considerations, meaning development projects (even if developed on non-wetland) undergo stricter environmental assessments to minimize impact on wetlands. Developers may face penalties under the “polluter pays” principle if they degrade wetland environments.
- (c) **Community and Stakeholder Involvement:** The policy supports a participatory approach, encouraging **collaboration** between government, private sectors, and communities. This means that urban development plans must involve multi-stakeholder discussions, which could extend project timelines but foster sustainable outcomes.
- (d) **Climate Resilience:** By protecting wetlands, the policy indirectly supports urban resilience to climate change, as wetlands help mitigate flooding and manage stormwater. This aligns urban development with climate **adaptation** strategies, particularly valuable for Harare and other rapidly growing cities vulnerable to seasonal rains and droughts.

Overall, the Zimbabwe Wetlands Policy serves as both a protective and a guiding framework, aiming to balance the need for urban growth with ecological preservation to secure long-term environmental sustainability.

2.5.3.2. Wetlands in Harare

Harare is characterized by a mix of moderate (seasonal) wetlands and a few perennial wetlands (See figure 2.26). These wetlands are primarily located in low-lying areas and within green spaces. The recently approved wetland policy mandates their protection, recognizing their ecological and socio-economic significance. Many wetlands in Harare have been disturbed due to their location within older suburbs. Some have been repurposed for urban agriculture, with residents using them for gardening and crop cultivation for personal consumption. Despite these pressures, there are 49 officially gazetted wetlands in Harare, which cannot be developed unless approval is granted by the Environmental Management Agency (EMA). Wetlands in Harare serve as critical ecological assets, acting as water filtration systems, flood mitigators, and biodiversity hotspots. They have also provided a food source for both humans and wildlife. However, the increasing encroachment and unsustainable utilization threaten their integrity. The wise use of wetlands should be prioritized to ensure their continued benefits for future generations. To effectively manage and protect these wetlands, it is imperative for the city, stakeholders, and residents to take an active role in their conservation. By implementing sustainable practices and enforcing environmental policies, Harare can safeguard its wetlands from further degradation while ensuring their ecological and economic contributions remain intact. The city has a total of forty-nine (49) gazetted wetlands (ecological sensitive areas) which are as follows (See Table 2.2):

Table 2.2: Inventory of Wetlands in Harare

Wetland name	Description
1. Ashbrittle Ecologically Sensitive Area (AB)	The area of land to the north of Emerald Hill and north east of Avonlea. The area is bordered by the Golden Stars Road to the east. To the north it extends to Edinburgh Drive. The area drains into Marlborough wetland, Gwebi River and then Lake Manyame.
2. Borrowdale Brooke Ecologically Sensitive Area (BB)	An area of land located in a north-easterly direction from the Harare City Centre. It is bordered by Crowhill Road to the north and Prince Drive to the south. The area is also bounded to the east by Borrowdale Brooke Road.
3. Budiriro wetland Ecologically Sensitive Area (BD)	An area of land north of Budiriro 1 and Budiriro 3 and lies to the south of Budiriro 5. It is the headwaters of a stream that feeds into Lake Chivero.
4. Bluff Hill Ecologically Sensitive Area (BF)	An Area of land located to the west of Monavale Road and bordered by Lorraine Drive to the north and extends north up to Nell's Way. The area is upstream of Dzivaresekwa wetland and recharges Marimba River and Lake Chivero.
5. Braeside Wetland Ecologically Sensitive Area (BS)	An area lying north-east of Seke Road and bordered by Arcadia and Braeside to the east. Feeds into Mukuvisi River and downstream of Mukuvisi wetland.
6. Belvedere Ecologically Sensitive Area (BV)	The Area of land bounded to the north by Bulawayo Road while Lyton Road demarcates the area on the southern side. On the western side Fourth Avenue bounds the area and Bishop Gaul Avenue to the east.
7. Borrowdale West Ecologically Sensitive Area (BW)	An area of land located to the west of Borrowdale Road and to the east of Groombridge. Teviodale Road borders the wetland to the west while Whitwell Road demarcates the wetland on the Northern side. Connected with the Vainona wetland and being headwaters of a stream that feeds into Gwebi River.
8. Carrick Creagh Ecologically Sensitive Area (CC)	An area of land bounded by Enterprise Road to the north and Arcturus Road to the south. The western side is bounded by the Eastern Road and the area extends to the City of Harare Boundary on the eastern side.
9. Caledonia Ecologically Sensitive Area (CD)	An area of land located to the east of Tafara Suburb and is bounded by Arcturus Road to the north and Sinini Street to the west. Tarisa Road bounds the area to the South and the area extends eastwards till it reaches the boundary of the city of Harare.
10. Chisipite Ecologically Sensitive Area (CS)	An Area of land located to the east of Enterprise Road. The area is bounded by Shortheath Road and Mortimer Close and partially forms the headwaters of Umwidisi River.
11. Cleveland Ecologically Sensitive Area (CV)	An area lying around Cleveland Dam and to the north is bordered by Arcturus Road while Mutare Road forms its boundary to the south. The area is also bounded to the west by Harare Drive. The area forms the headwaters of Mukuvisi River which drains into Lake Chivero.
12. Dzivaresekwa Ecologically Sensitive Area (DZ, DZI)	An area of land north-west of Kuwadzana Phase 3 and north of Bulawayo Road. The area extends to Dzivaresekwa Extension to the north and Glaudina to the west. The wetland drains into Marimba River and then Lake Chivero and is connected to Bluff Hill wetland.
13. Eastlea Ecologically Sensitive Area (ES, ESI)	An area of land lying north of Samora Machel Avenue and on the west side of Newlands and is bordered to the east by Glenara Avenue north. The area drains to Nyarawanga stream and into Mukuvisi River.
14. Green Groove Ecologically Sensitive Area (GG)	An area of land lying north of Mutare Road bordered by Cleveland Road to the east and Wilson Drive to the west. It drains into Mukuvisi River and is connected with Mukuvisi wetland.
15. Glenlorne Ecologically Sensitive Area (GL)	An area of land bounded by Enterprise Road to the north and extends easterly till it reaches the city of Harare boundary.
16. Glen Norah Ecologically Sensitive Area (GN)	An area of land bounded by High Glen Road to the north, Simon Mazorodze Road to the east and Gumbe Road to the east. The wetland drains into Marimba River.
17. Greystone Park Ecologically Sensitive Area (GS)	An Area of land at Greystone Park in Harare to the north of Harare Drive between the Grange and Borrowdale Road concentrated along Umwindisi River and connected with Hellensvale wetland.
18. Glenview	An area of land bounded by Willowvale Road to the north, Gumbe Road to the east

<i>Ecologically Sensitive Area (GV)</i>	<i>and Amalinda to the south. The wetland drains to Marimba River.</i>
<i>19. Highfield Ecologically Sensitive Area (HF)</i>	<i>An area of land in Highfield suburb bounded by Simon Mazorodze Road to the east and Willowavale Road to the north and extends up to High Glen to the south. The wetland drains to Marimba River.</i>
<i>20. Highlands Ecologically Sensitive Area (HG)</i>	<i>An area of land located to the east of Borrowdale Road and bordered by Churchill and Enterprise Road and Orange Groove Drive. The area extends up to Borrowdale Race Course. Wetland drains into Chiripaguru stream and then Mukuvisi River.</i>
<i>21. Houghton Park Ecologically Sensitive Area (HP, HP1)</i>	<i>An area of land lying to the South of Waterfalls Avenue with its centre being Mukuvisi River. It is bordered by Masotsha Ndhlovu Way the south and Park Town to the east, the area extends in a north-easterly direction up to Sixth Avenue in Park Town. The area also extends in a north-easterly direction from Strachans Street up to New Prospect Park. Head waters of a stream that drains into Mukuvisi River.</i>
<i>22. Harare South Ecologically Sensitive Area (HS)</i>	<i>An area of land around Retreat Suburb and Zororo Memorial Park. The area is bounded by Seke Road to the east and Chitungwiza Road to the west.</i>
<i>23. Hatfield Ecologically Sensitive Area (HT)</i>	<i>An area of land located in Hatfield and bounded by Cranborne, Msasa Park and Epworth Suburbs. Joshua Nkomo Road demarcates the land to the west.</i>
<i>24. Helensvale Ecologically Sensitive Area (HV)</i>	<i>An area of land north-east of Harare City Centre and lying to the east of Borrowdale Brooke, bordering Chilern Hills on the eastern side and Grey Lichen. The Helensvale wetland covers Eland Park and Carrick Creagh area in Harare. Downstream of Greystone wetland.</i>
<i>25. Kutsaga Ecologically Sensitive Area (KT)</i>	<i>An area of land sharing boundaries with Hatfield Suburb to west. The area is bounded by Chiremba Road to the north, Joshua Nkomo Road to the west and the City of Harare boundary to the south.</i>
<i>26. Kuwadzana Ecologically Sensitive Area (KW)</i>	<i>An area of land bounded by Bulawayo Road to the north and High Glen Road to the east. The piece of land extends westwards till it reaches the boundary of the City of Harare.</i>
<i>27. Mabvuku Ecologically Sensitive Area (MB)</i>	<i>An area of land lying south of Mutare Road and east Delport Road. Headwaters of Chavaroyi River and drains into Ruwa River then Manyame River.</i>
<i>28. Mbare Ecologically Sensitive Area (MBR)</i>	<i>An area bordered by Cripps Road to the south and Seke Road to the north-east. Siya-so Home Industries borders the wetland to the west. feeds into Mukuvisi River and downstream of Braeside, Mukuvisi, Green Grove and Cleveland wetlands.</i>
<i>29. Midlands Ecologically Sensitive Area (MD)</i>	<i>An area of land lying east of Simon Mazorodze Road and north of Chitungwiza Road and extends up to Waterfalls.</i>
<i>30. Mufakose Ecologically Sensitive Area (MF)</i>	<i>An area of land located in Mufakose Suburb and bounded by Bulawayo Road to the north and High Glen Road to the east. The area extends southwards towards Kambuzuma Road.</i>
<i>31. Mukuvisi Ecologically Sensitive Area (MK)</i>	<i>An area of land covering Mukuvisi Woodland extending north up to Samora Machel Avenue and bounded by Chiremba Road to the south.</i>
<i>32. Malborough Ecologically Sensitive Area (ML)</i>	<i>An area of land located to the north of Harare Drive and bordered by Admiral Tait Road and Sawley Close. The wetland drains into Gwebi River and then Lake Manyame.</i>
<i>33. Milton park Ecologically Sensitive Area (MLP)</i>	<i>An area of land located in Milton Park and bounded by Princess Road to the south and Prince Edward Street to the east. The area shares boundaries with Monavale and extends westwards till it reaches West Road.</i>
<i>34. Mount Pleasant Ecologically Sensitive Area (MP)</i>	<i>This is a piece of land located in Mount Pleasant suburb and is bounded by Harare Drive to the north and Second Street Extension to the west. It also shares boundaries with Northwood to the North.</i>
<i>35. Monavale Ecologically Sensitive Area (MV)</i>	<i>A piece of land located in Monavale and bounded by Kirkman Road to the south and Harare Road to the west. The land extends to West Road to the west and Lomagundi Road to the north.</i>
<i>36. Manyame Ecologically Sensitive Area (MY)</i>	<i>An area of land lying to the west of Twentydales Road and South-east of Kutsanga Tobacco Research Station. The area covers the food plains Nyahuku River.</i>
<i>37. National Sports</i>	<i>An area of land lying to the north of Bulawayo Road and south of Princess Road.</i>

<i>Ecologically Sensitive Area (NS)</i>	<i>The area is bordered by the National Sports stadium to the west and Mutley Bend Road to the east. The wetland is the middle of Avondale and Belvedere wetlands along Marimba River.</i>
<i>38. North Wood Ecologically Sensitive Area (NW)</i>	<i>An area of land north of Harare Drive in Northwood bordered by Betsize Road, Bannockburn Road and extending up to Borrowdale Road. Forms part of the headwaters of the Gwebi River around North Wood suburb and Pomona.</i>
<i>39. Prospect Ecologically Sensitive Area (PP)</i>	<i>An area of land between Cripps Road to the north and Boshoff Drive to the south. The west side of the wetland is bordered by Harare Road South and Howman Road. The wetland is connected along the Mukuvisi River with Mbare and Houghton Park wetlands.</i>
<i>40. Rockview Ecologically Sensitive Area (RV)</i>	<i>An area of land mostly along Ruwa River forming the boundary between Ruwa and Sunway City. The site is to the east and south-east of Sunway City suburb.</i>
<i>41. Sunway city Ecologically Sensitive Area (SC, SCI)</i>	<i>An area of land bounded by Samora Machel Avenue to the north, Chiremba Road to the south and Delport Road to the west. The area extends east wards and shares boundaries with Ruwa.</i>
<i>42. St Patrick Ecologically Sensitive Area (SP)</i>	<i>An area of land sharing boundaries with waterfalls to the west, Houghton Park to the north and Seke Road to the east.</i>
<i>43. Tafara Ecologically Sensitive Area (TF)</i>	<i>An area of land located in Tafara high density suburb. It bounded by Damofalls and City of Harare boundary to the east while Arcturus Road is the boundary to the north.</i>
<i>44. Grange Ecologically Sensitive Area (TG)</i>	<i>An area of land at the Grange in Harare to the east of Enterprise Road. The area is bounded by Arcturus Road to the south, Eastern Road to the west and Gletwyn Road and centred along Rumbabvu River. Forms the drainage pattern of Rumbabvu, Mandara and Manyonga rivers which feeds into Umwindisi River.</i>
<i>45. Tynwald Ecologically Sensitive Area (TW)</i>	<i>An area of land bounded by Bulawayo Road to the south, Tynwald Road to the east and Kirkman Road to the north. The area extends westerly and shares boundaries with Kuwadzana.</i>
<i>46. University of Zimbabwe Wetland (UZ)</i>	<i>An area of land north of Churchill Avenue East Road and located south-east of the University of Zimbabwe. Headwaters of Avondale stream and drains into Marimba River.</i>
<i>47. Vainona Ecologically Sensitive Area (VN)</i>	<i>An Area of land that lies in the corridor between Groombridge and Borrowdale West. To the north it extends till Harare Drive while to the south it extends up to Teviotdale Road. Connected with the Borrowdale wetland and feeds into Gwebi River.</i>
<i>48. Waterfalls Ecologically Sensitive Area (WF)</i>	<i>49. A piece of land bounded by Chitungwiza Road to the south and Simon Mazorodze Road to the west. The area shares boundaries with Midlands.</i>
<i>50. Westlea Ecologically Sensitive Area (WL)</i>	<i>An area of land south west of Kirkman Road extending up to 12th Avenue in Westlea. This piece of land is bordered to the north-west by Tynwald Road and forms the head waters of Nkwisi stream which flows into Marimba River.</i>

2.5.3.3. *Spatial Distribution of Wetlands in and around Harare*

The wetlands of Harare are widely distributed across the entire city area, occurring in low-lying regions and along river systems (See figure 2.26). These wetlands play a crucial role in water regulation, biodiversity conservation, and flood mitigation. However, rapid urbanization has led to significant encroachments, with residential and commercial developments being established on wetland areas over the past decade. Historically, wetlands in Harare have been critical for groundwater recharge, water purification, and flood control. The Mukuvisi and Marimba River catchments, which drain much of the city, contain numerous wetlands that contribute to the health of the urban ecosystem. However, these vital ecosystems are increasingly under threat due to land conversion and inadequate urban planning. The depletion of these wetlands poses a direct challenge to sustainable urban development and water security in Harare.

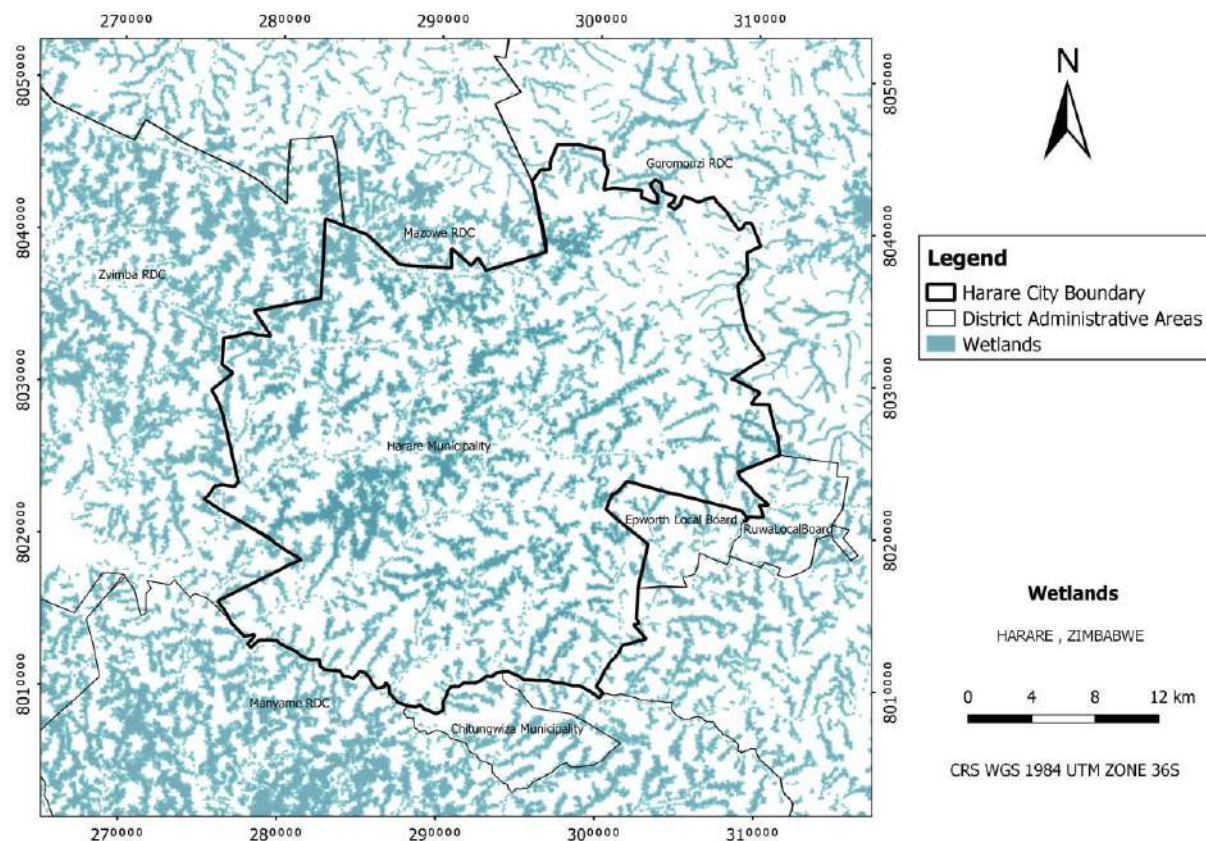


Figure 2.26: Harare wetlands map

Source: EMA

The loss of wetlands affects the city's already strained water resources, increasing the risk of water shortages and reducing the city's capacity to manage extreme weather events. Without effective wetland protection, city will face worsening urban floods, water pollution, and biodiversity decline. Restoring degraded wetlands and enforcing environmental policies will enhance the city's resilience to climate change, secure clean water supplies, and support long-term urban sustainability. Sustainable wetland management is essential not only for environmental protection but also for the economic and social well-being of Harare's residents. By prioritizing wetland conservation, Harare can build a more resilient and liveable city for future generations.

2.5.3.4. Conflict between urban development wetland conservation

The study observed that there exists conflict between urban development wetland conservation (see Figure 2.27). There are areas designated for various urban land uses that have been blighted by the wetland gazette. Errors in designation of wetlands were observed with some areas are rocky and dry areas and yet designated [inherent error] wetlands. Whereas some wetlands are of an anthropogenic origin e.g. sewer blockages and poor drainage of stormwater. Overall, Harare is a wetland city and thus inherent conflict between urban development and wetland conservation is inherent.

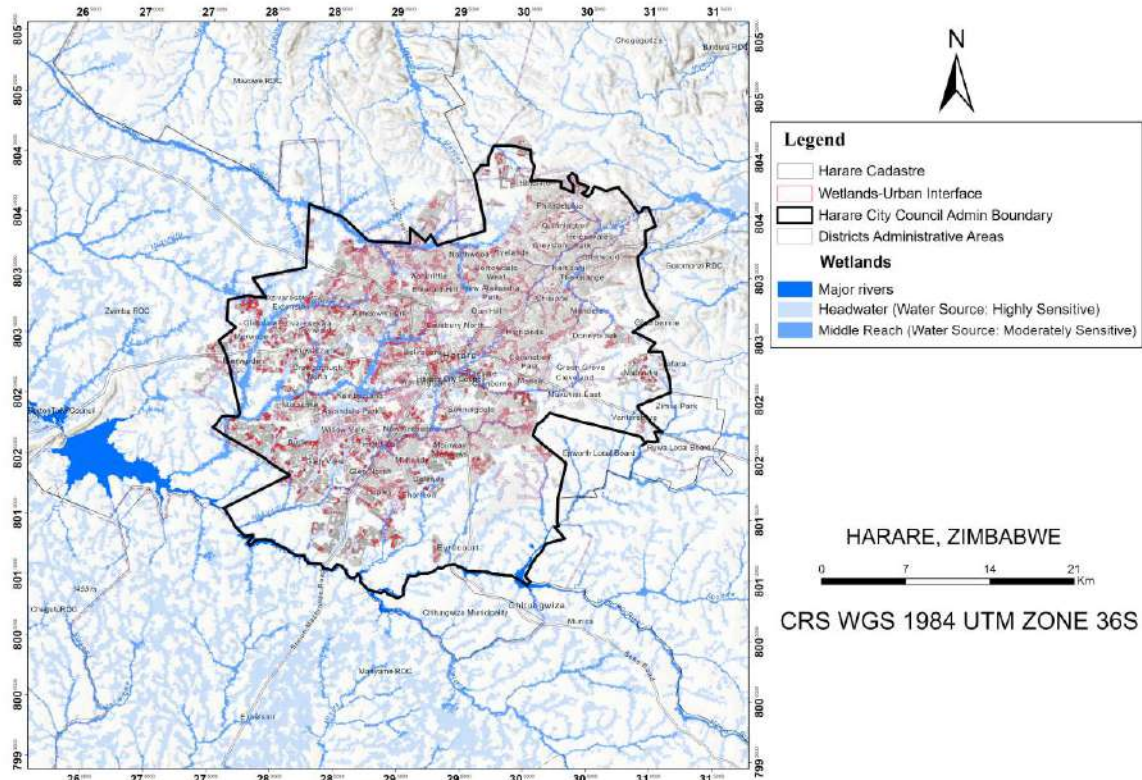


Figure 2.27: Conflict between urban development wetland conservation

2.6. Solid Waste Management

The City faces significant challenges in municipal solid waste disposal due to rapid urbanization, inadequate infrastructure, and weak enforcement of waste management regulations. The city generates approximately 1,000 to 1,200 tonnes of solid waste daily, with collection rates fluctuating between 40% and 60%. This means that a substantial portion of waste remains uncollected, leading to illegal dumping and environmental degradation. The composition of municipal solid waste in Harare includes:

- Organic waste (50–60%) – Mostly from households and markets.
- Plastics (10–15%) – Generated from commercial activities and packaging materials.
- Paper and cardboard (5–10%) – From offices, schools, and businesses.
- Glass and metals (5–8%) – Mainly from industries and beverage packaging.
- E-waste and hazardous materials (2–5%) – From electronic devices, batteries, and medical waste.

The city's waste collection system is hampered by logistical constraints, including a limited fleet of refuse trucks and irregular collection schedules. Some areas, particularly high-density suburbs and informal settlements, and high commercial activity centres like Mbare Musika, receive infrequent or no formal waste collection services, forcing residents to resort to open dumping and burning.

Harare has only one officially designated landfill, Pomona Dumpsite, which is operating beyond capacity and lacks modern waste management infrastructure such as leachate control and methane capture systems. Several illegal dumping sites have emerged in response to the inefficiency of formal waste collection, further worsening pollution in urban and peri-urban areas.

2.7. State of Wildlife in Harare and Surrounding Areas

Unlike rural and wilderness areas, Harare does not have free-roaming quadrupedal mammals such as impalas (*Aepyceros melampus*), kudu (*Tragelaphus strepsiceros*), or warthogs (*Phacochoerus africanus*). Large herbivores and carnivores are confined to managed spaces such as:

- Mukuvisi Woodlands – A key conservation area housing species such as giraffes (*Giraffa camelopardalis*), eland (*Taurotragus oryx*), and zebras (*Equus quagga*).
- Lake Chivero Recreational Park – A fenced area that supports white rhinos (*Ceratotherium simum*), buffaloes (*Syncerus caffer*), and various antelope species.
- Lion and Cheetah Park – A private facility that houses big cats, including lions (*Panthera leo*), cheetahs (*Acinonyx jubatus*), and leopards (*Panthera pardus*).

Birdlife is abundant across Harare, thriving in urban parks, wetlands, and riverine areas. Common free-roaming bird species include:

- African Fish Eagle (*Haliaeetus vocifer*) – Found near Lake Chivero and wetland areas.
- Pied Crow (*Corvus albus*) – A common urban scavenger.
- Hadedda Ibis (*Bostrychia hagedash*) – Frequently seen in residential areas and golf courses.
- Sacred Ibis (*Threskiornis aethiopicus*) – Often found in wetlands and shallow water bodies.
- Speckled Pigeon (*Columba guinea*) – A ubiquitous city dweller.
- Weaver Birds (*Ploceidae spp.*) – Active around trees in parks and gardens.
- Barn Owl (*Tyto alba*) – Found in suburban areas and old buildings.

Wetlands such as Monavale Vlei, Cleveland Dam, and Mukuvisi Woodlands support migratory bird species and play an important role in avian biodiversity conservation.

Harare's aquatic ecosystems, particularly in reservoirs and lakes such as Lake Chivero, Cleveland Dam, and Manyame Dam, support a variety of fish species. These fish populations contribute to local livelihoods through recreational fishing and subsistence fishing activities.

Common fish species in Harare's water bodies include:

- Common Tilapia (*Oreochromis niloticus*) – A dominant fish species used for commercial and subsistence fishing.
- Mozambique Tilapia (*Oreochromis mossambicus*) – Widely found in Harare's lakes and dams.
- African Catfish (*Clarias gariepinus*) – A hardy species capable of surviving in varied water conditions.

Wildlife in Harare is primarily protected under the **Parks and Wildlife Act (Chapter 20:14)**, which governs the conservation and management of Zimbabwe's flora and fauna. The law provides for the establishment of protected areas, regulation of hunting and poaching, and the preservation of endangered species. In urban areas, the Environmental Management Agency (EMA) and local authorities enforce policies aimed at preserving green spaces and wetlands, which serve as critical habitats for bird species and other urban wildlife.

Despite legal protections, habitat degradation due to urban expansion, pollution, and wetland destruction threatens wildlife in Harare. Conservation organizations and city authorities are working to promote habitat restoration, enforce anti-poaching measures, and raise public awareness about the importance of urban biodiversity. Ensuring the sustainable coexistence of wildlife and human populations remains a critical goal for Harare's environmental management strategies.

2.8. State of Land Degradation in Harare

The city is experiencing severe land degradation due to a combination of human activities and inadequate land management practices. Rapid urbanization, illegal resource extraction, improper waste disposal, and unsustainable agricultural practices have significantly contributed to the deterioration of land quality in and around the city. For example, unregulated quarrying and pit sand mining have caused extensive land degradation in Harare's peri-urban areas (See Figure 2.28). The extraction of sand and stone for construction purposes has led to large open pits, soil destabilization, and loss of vegetation cover. These activities not only degrade the land but also create hazardous landscapes, increasing the risk of accidents and limiting future land use.

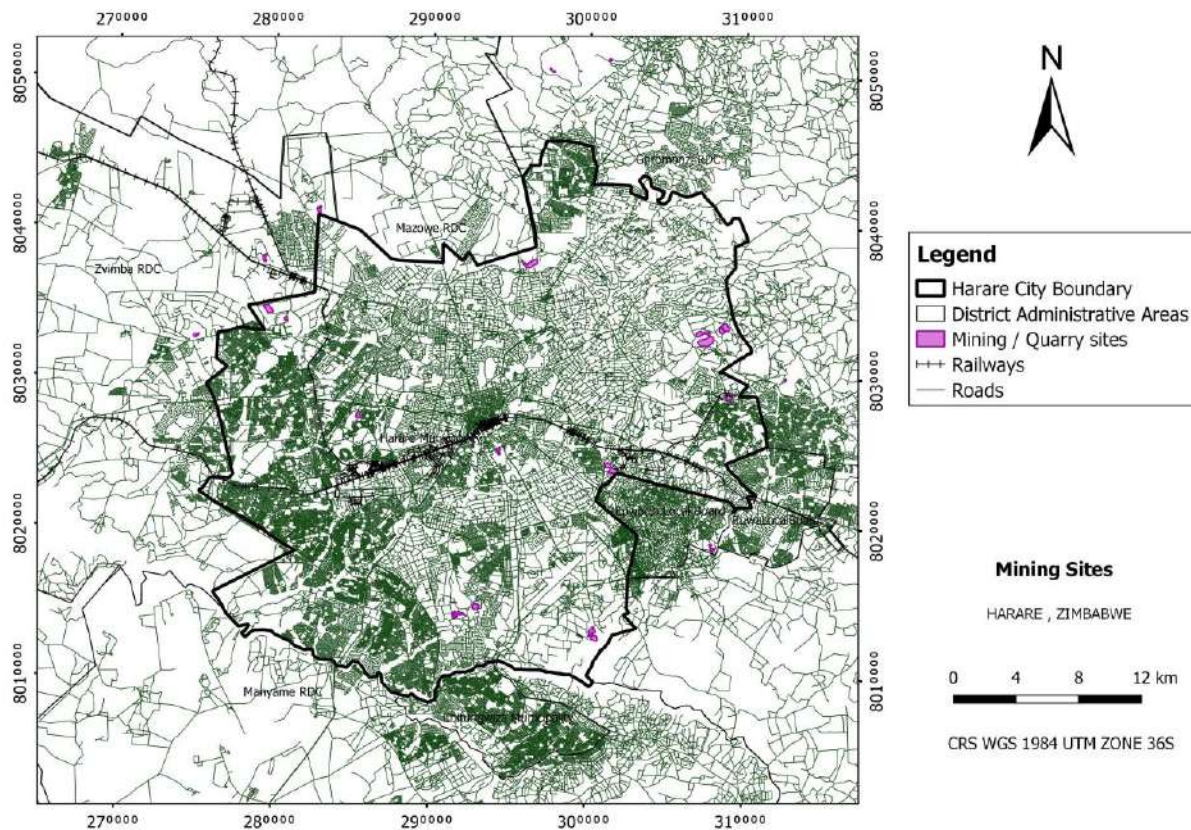


Figure 2.28: Spatial distribution of sand and quarry pits in Harare

Soil erosion is a major issue, particularly in areas affected by deforestation, illegal settlements, and unsustainable urban agriculture. The loss of tree cover due to land clearing has left many areas vulnerable to surface runoff, resulting in severe gully formation. In high-density suburbs, the lack of stormwater management exacerbates soil erosion, washing away fertile topsoil and causing sedimentation in rivers and drainage systems.

Illegal dumping of building rubble and waste is rampant in Harare. Construction debris is often discarded in undesignated areas, blocking storm drains and creating unsightly landscapes. Street littering, including plastic waste, further contributes to environmental degradation by polluting public spaces, wetlands, and water bodies. The accumulation of waste reduces land productivity and poses health risks to residents.

Urban agriculture, while providing food security, has contributed to land degradation when practiced unsustainably. Cultivation on steep slopes and wetlands without proper soil conservation techniques leads to land degradation, siltation of water bodies, and loss of

biodiversity. Additionally, illegal settlements encroach upon fragile ecosystems, including wetlands and forests, further destabilizing land structures and increasing environmental risks. Oil spills and improper disposal of industrial waste in Harare's industrial zones and service areas contribute to land degradation. Mechanics and fuel stations often discharge used motor oil directly onto the ground, contaminating soil and groundwater. These pollutants reduce soil fertility and pose long-term environmental hazards.

2.9. Surface Water Pollution in Harare

Surface water pollution is a critical environmental issue in the city, impacting rivers, wetlands, and surrounding lakes such as Lake Chivero and Manyame Dam, which serve as the primary water sources for the city. Contamination arises from industrial discharge, sewage effluent, agricultural runoff, and illegal waste dumping.

2.9.1. Major pollutants and their sources

The major pollutants and their sources are:

- **Sewage Effluent:** Harare's wastewater treatment plants, such as Firle and Crowborough, operate below capacity, leading to untreated or partially treated sewage being discharged into the Mukuvisi and Manyame Rivers. Studies indicate that over 60% of effluent entering Lake Chivero is untreated or inadequately treated.
- **Industrial Waste:** Factories and processing plants discharge heavy metals such as lead, mercury, and chromium into urban waterways, affecting aquatic ecosystems and human health.
- **Agricultural Runoff:** Excess fertilizers and pesticides from peri-urban farms contribute to eutrophication, leading to algal blooms covering 70% of Lake Chivero's surface during peak seasons.
- **Plastic and Solid Waste:** An estimated 300 tonnes of plastic waste enters Harare's waterways annually, blocking drainage systems and degrading aquatic environments.
- **Oil and Hydrocarbons:** Runoff from roads and garages introduces hydrocarbons into rivers, further contaminating water bodies.

2.9.2. Impacts of Surface Water Pollution

The major impacts of surface water pollution in Harare include:

- **Eutrophication:** Nutrient pollution has led to excessive algal growth in Lake Chivero, reducing oxygen levels and threatening fish populations.
- **Waterborne Diseases:** Contaminated water sources contribute to the spread of cholera, typhoid, and dysentery, particularly in high-density suburbs with limited clean water access.
- **Biodiversity Loss:** Pollutants such as heavy metals and untreated sewage reduce aquatic biodiversity, affecting fish populations like tilapia (*Oreochromis niloticus*) and African catfish (*Clarias gariepinus*).
- **Reduced Water Quality:** The increased presence of suspended solids and chemical pollutants necessitates expensive water treatment, burdening the municipal supply system.

2.9.3. Pollution State of Lake Chivero

Lake Chivero, Harare's primary water supply source, is experiencing severe pollution due to unchecked human activities, industrial discharge, and untreated sewage effluent. The lake, which supports municipal water needs, fisheries, and recreational activities, has been heavily affected by eutrophication, declining water quality, and biodiversity loss.

Lake Chivero has experienced significant ecological changes over the years. Central to these changes has been the dynamics of cyanobacteria, which play a critical role in the lake's ecosystem. This document delves into the long-term trends observed in the cyanobacterial populations within Lake Chivero, examining the factors that drive these trends and their broader ecological implications.

2.9.3.1. Historical Trends in Cyanobacterial Populations

The cyanobacterial population in Lake Chivero has undergone noticeable fluctuations over the past few decades. Historical data indicate periods of both proliferation and decline, influenced by a variety of environmental and anthropogenic factors (see figure 2.29).

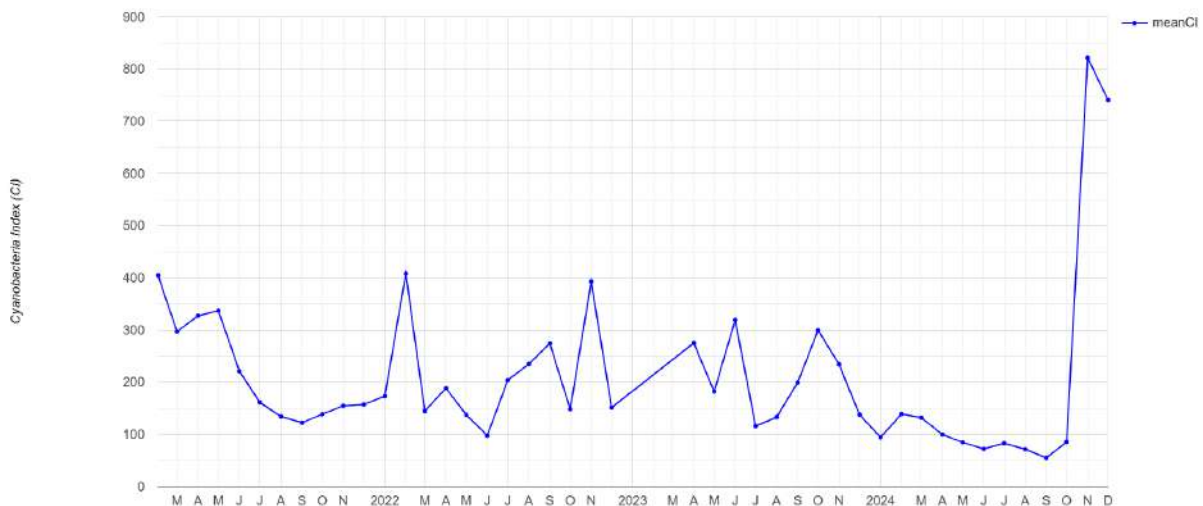


Figure 2.29: Historical Trends in Cyanobacterial Populations – 2021 -2024

A number of factors contribute to the long-term dynamics of cyanobacteria fluctuations in Lake Chivero. These include both natural processes and human activities namely:

- Temperature and Climate:** Change Cyanobacteria are highly responsive to temperature changes. Warmer temperatures generally promote their growth, leading to more frequent and severe blooms. Climate change, with its associated rise in global temperatures, poses a significant threat by potentially exacerbating these blooms.
- Nutrient Loading:** As expected, nutrient loading from agricultural runoff and sewage is a primary driver of cyanobacterial proliferation in Lake Chivero. Efforts to manage and reduce these nutrient inputs are crucial in controlling cyanobacterial populations.
- Hydrological Changes:** Changes in water levels and hydrological patterns can also impact cyanobacterial dynamics. For example, periods of drought or significant water extraction can concentrate nutrients, further promoting cyanobacterial growth.

2.9.3.2. Ecological and Social Implications

The dynamics of cyanobacteria in Lake Chivero have far-reaching implications for both the ecosystem and the surrounding human populations.

- (1) Cyanobacterial blooms can lead to hypoxia (low oxygen levels) in the water, which adversely affects fish and other aquatic organisms. The production of cyanotoxins during some blooms poses additional risks to aquatic life and biodiversity including the December 2024 death of rhinos and zebras.
- (2) For the Harare residents who depend on Lake Chivero water, cyanobacterial blooms can impact water quality, making it unsafe for drinking, recreation, and irrigation. This not only affects public health but also has economic repercussions, particularly for those reliant on the lake for their livelihoods.

2.9.3.3. Water Quality in Harare Streams and Rivers

Water quality is measured from the physical, chemical and biological characteristics of water based on acceptable standards of its usage. Certain parameters are used to determine the quality of water so as to establish as to whether it is palatable, portable, polluted or infected. The standards that have been set have been assigned limits by different professional and international bodies. Water quality is of critical importance to any population and in this case, Harare cannot be spared.

The City of Harare sits on a Watershed and is supported by rivers and streams that allow for the flow of water into Lake Chivero. The rivers that are common in and around Harare are Mukuvisi, Marimba, Manyame, Jacha, Chavaroyi Rivers amongst others. These rivers feed into Lake Chivero but, they pass through the City of Harare and parts of Chitungwiza. As they trickle through the City of Harare they go through suburbs, industries, institutions and in some cases agricultural land. It is in these locations and activities that the state of the rivers is altered due to the introduction of chemicals and biological elements. It is against this premise that the quality of water in Harare is analyzed against the parameter and limits that have been set either by Standards Association of Zimbabwe (SAZ) or World Health Organization (WHO). There are parameters that are key to determining the Quality of Water in any water body or reservoir.

2.9.3.4. Water Quality Parameters and Limits

To determine the water quality, parameters such as Electrical Conductivity (EC), pH (Acidity), Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Nitrates and Sulphates. These have varying concentrations depending on the chemicals that have been released into the water bodies and the associated reactions. The study established that there are deviations in terms of the quality of water during the wet season (Summer) and during the dry season (Winter). Of note the quality of wastewater shows that there is a high level of both electrical conductivity and chemical oxygen demand in the rivers and streams. This means Electrical Conductivity and Chemical Oxygen Demand have a huge deviation of approximately 40% to 50% in both seasons respectively. This is because the Chemical Oxygen Demand measure above 100mg/l in different samples against an acceptable measure of 60mg/l (see Figure 2.30).

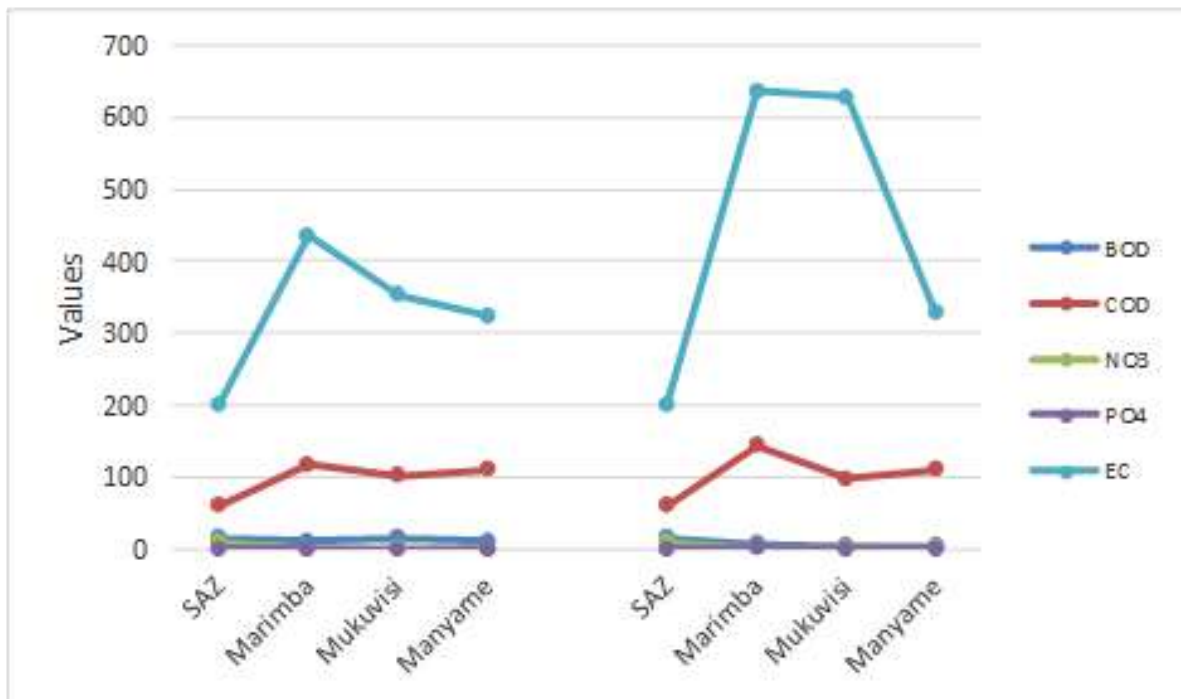


Figure 2.30: Stream and river water quality in Harare

The Conductivity levels are above the acceptable levels in Mukuvisi River and Marimba Rivers proving that there are more undiluted dissolve ions in the water bodies. The levels of conductivity are high in winter to the dry season against the figures in the wet season wherein dilution is higher. pH levels are generally neutral at times especially due to the fact that wastewater is emanating from sewer system. This is because dilution will contribute to the level of hydrogen potential in the water. On the other hand, the phosphates and nitrates are present both during the summer and winter season. Their deviations are slightly above the SAZ standards in the summer season because most pesticides and fertilizers are being used in high concentration. These deviations however do sound normal from a seasonality point of view but the fact that the water is polluted is undeniable.

The study also established an increase in Biological Oxygen Demand (BOD) in Mukuvisi River during the winter into the dry season due to the fact that the water is heavy laden with organic waste, detergents and nutrients from raw sewage from houses and chemicals from industries. A deviation of 10-15% was observed due to the fact that some of the untreated sewage finds itself in the flowing rivers. Other informal activities have also contributed to the quality of water as they operate without proper regulations.

2.9.3.5. Human Impact of water pollution

The high levels of pollution that have been recorded in the study area have a negative effect to the humans in and out of Harare. These pollutants have a highly likelihood of causing diseases (dysentery, typhoid and cholera) due to the raw sewage that has been released in the rivers. The fish that is in Lake Chivero has been equally affected by pollutants. The human populations in Harare and those purchasing the fish for cooking purposes to end in sickness. The e-coli that emanates from the raw sewer has potential to cause sickness to humans too. The polluted water is not safe for drinking unless treated with chemicals that are expensive to purchase by the local authority. Households in the city have resorted to buying water from

other borehole sources so as to safeguard their health against contamination and sickness. In some instances, communities endure the inconvenience of waiting in queues for water in boreholes so as to access clean water that is consumable by humans despite the fact that the residents are paying rates to the local authority.

The water in distribution mains is dirty to due to the old pipe that carry algae and dirt from the pollutants that flow through the pipes. One has to allow the water to settle in containers or buckets before they are used. Further to this the ecosystem is directly affected by chemicals that emanate from industries thus resulting in eutrophication within water bodies. This has been evidenced by algal bloom in Lake Chivero.

2.9.3.6. Sources of pollutants

The water quality was pre-determined for surface water and it shows that the Rivers are polluted in Harare. Lake Chivero as a wetland is highly polluted due to the Raw Sewage and Effluent that is being released into it from different Rivers and streams that feed into it. Raw Sewage from residential houses and Effluent from Industries have been the major culprits of pollution in Harare. Urban Agriculture has its own contribution in polluting the water bodies if the pesticide usage is not controlled. The study established that the Rivers and the Lake are heavily polluted. The data collected after the dam wall of the Lake show that the water that is proceeding to Darwendale dam is equally polluted. On the other hand, the quality of water is poor because chemicals are released daily into the water courses and the entire network of rivers associated with Harare's environs. When it rains during summer is anticipated that there will be dilution of water to reduce the concentration of pollution but it seems the rate of pollution into the lake versus the dilution factor is alarming. Water that gets into the Morton Jafray Water Works requires several chemicals for it to be treated before it can be consumed by humans. The water in Harare is heavily polluted. The main pollutants are emanating from Raw Sewage, Effluent from Industries and Chemicals associated with Urban Agriculture. The City's high-density suburbs have experienced sewer bursts and blockages over the past decade or two. This means that raw sewage flows and finds itself at the nearest lowest point and in this case its either a river or stream nearby. The same sewage is then channeled to the receiving end which is Lake Chivero.

Table 2.3: SAZ Standards for wastewater

PARAMETER	Blue		Green	Yellow	Red
	Sensitive	Normal			
Alkalinity mg/l	*	*	*	*	<500
Arsenic as mg/l As	<0.05	<0.05	<0.1	<0.3	<0.3
Biological Oxygen Demand mg/l	<15	<30	<50	<100	<120
Cadmium as mg/l Cd	<0.01	<0.01	<0.05	<0.1	<0.3
Calcium as mg/l Ca	*	*	*	*	*
Chemical Oxygen Demand mg/l	<30	<60	<90	<150	<200
Chloride as mg/l Cl	<200	<250	<300	<400	<500
Chromium Hexavalent as mg/l Cr6+	<0.05	<0.05	<0.1	<0.2	<0.5
Cobalt as mg/l Co	*	*	*	*	<2
Conductivity (uS/cm)	<200	<1000	<2000	<3000	<3500
Copper as mg/l Cu	<1.0	<1.0	<2.0	<3	<5
DO % Saturation	>75	>60	>50	>30	<15
Fluoride as mg/l F	<1	<1	<2	<4	<6

Free Cyanide as mg/l CN	<0.07	<0.07	<0.1	<0.15	<0.3
Grease & Oil mg/l	nil	<2.5	<5	<7.5	<10
Iron as mg/l Fe	<0.3	<1	<2	<5	<8
Lead as mg/l Pb	<0.05	<0.05	<0.1	<0.2	<0.5
Magnesium as mg/l Mg	*	*	*	*	*
Manganese as mg/l Mn	<0.1	<0.1	<0.3	<0.4	<0.5
Mercury as mg/l Hg	<0.01	<0.01	<0.02	<0.03	<0.05
Nickel as mg/l Ni	<0.3	<0.3	<0.6	<0.9	<4.5
Nitrate as mg/l N	<10	<10	<20	<30	<50
Nitrite as mg/l NO ₂	<3	<3	<5	<8	<10
Oxygen absorbed (P.V) mg/l	<5	<10	<15	<25	<40
pH units	6 - 7.5	6 - 9	5 - 6 9 - 10	4 – 5 10-12	0-4 12-14
Phosphates as mg/l P	<0.5	<0.5	<1.5	<3	<5
Potassium as mg/l K	*	*	*	*	<500
Sodium as mg/l Na	<200	<200	<300	<500	<1000
Sulphate as mg/l SO ₄	<100	<250	<300	<400	<500
Temperature deg C	<25	<35	<40	<40	<40
Total Dissolved Solids mg/l	<100	<500	<1500	<2000	>3000
Total Hardness mg/l CaCO ₃	*	*	*	*	*
Total Suspended Solids mg/l	<10	<25	<50	<100	<150
Turbidity NTU	<5	<5	*	*	*
Zinc as mg/l Zn	<0.3	<0.5	<4.0	<5.0	<15

2.10. Key environmental concerns to from Industrial Areas

2.10.1. Clean energy

Use of clean energy sources remains comparatively high in the industrial properties (54%). Solar remains the most preferred clean source of energy while wind and bioenergy remains unpopular. Solar equipment in Harare has over the years become cheaper to procure due to increasing supply. There has been a notable increase in the number of solar equipment supplier. This trend is mainly driven by low supply of electricity which has increased load-shedding periods especially during winter.

2.10.2. Fire safety

Sixty percent of the industrial properties indicated that they have fire safety plans. The bulk of the respondents use fire extinguishers (see figure 2.31). The popular precautions include alarm systems, assembly points, emergency exits in the case of fire outbreaks, safety health education, smoke detectors, and fire hydrants, among others. What remains alarming is the fact that 40% of the industrial properties generally do not have a fire safety plan. In the recent past, fire outbreaks have been prevalent in Harare, and these have mainly been caused by poorly installed or damaged electrical wiring can cause sparks and ignite fires. Malfunctioning or poorly maintained electrical appliances can cause fires.

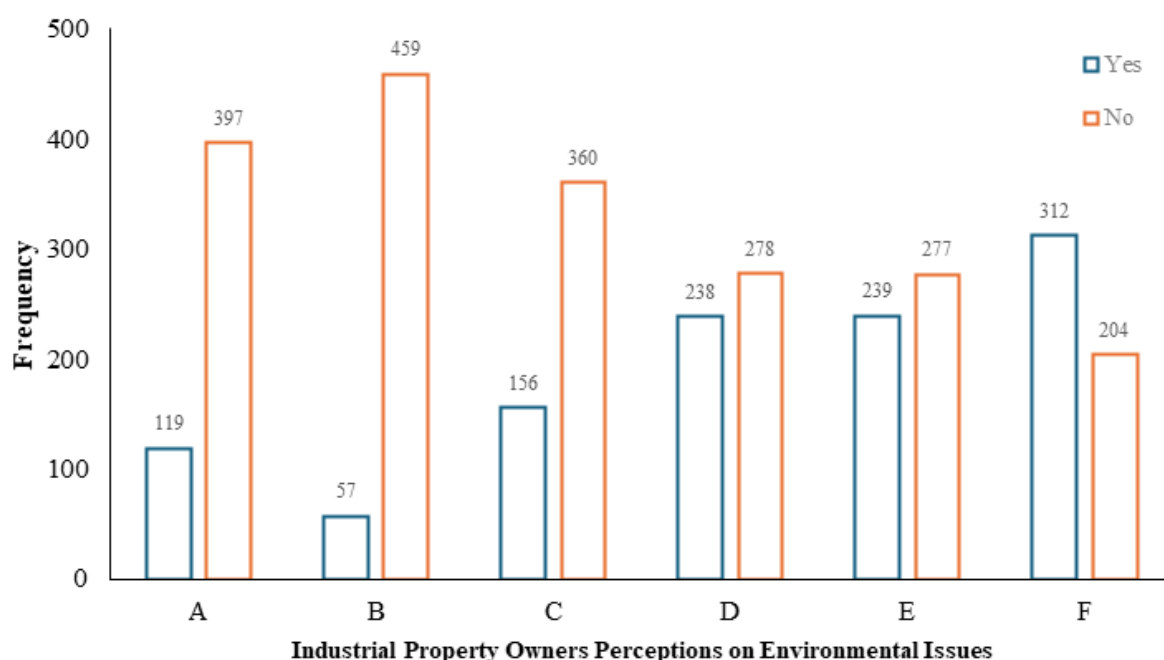


Figure 2.31: Summary of observations from the Industrial properties: A (Do you treat your water), B (Faced with flooding incidents), C (Do you have access to green spaces), D (Do you use clean energy), E (Do you segregate your waste), F (Do you have a fire safety plan)

2.10.3. Flooding

The prevalence of flooding events in industrial areas remains low (11%). Low rates of flooding could be driven by optimal location of industrial sites in no flooding areas. Another contributing factor could be efficient management of storm drainage through good engineering practices. However, the study observed a recent trend of opening of industries in wetland areas. Examples include Pomona Park. Poor disposal of waste has also clogged drains and pipes leading to flash floods especially in heavy rain situations.

2.10.4. Green space

The proportion of green spaces in industrial properties with green spaces constitute 30% of the total industrial area whereas, 70% of the industrial properties have no green spaces. One of the contributing factors to presence of green spaces is property size. The big properties owners can afford to leave green spaces in the properties while the opposite is also true. Proliferation of small to medium enterprises has generally favored establishment of smaller size industrial areas and these generally lack green spaces.

2.10.5. Municipal solid waste

Although waste segregation on the industrial properties remains comparatively low (46%) it should be noted that this figure is quite promising. Notably, waste is collected regularly on industrial sites, and this has helped to keep these areas clean. The study observed that 46% of the industrial properties use on-site recycling methods to deal with waste. On-site recycling of waste involves processing and recycling waste materials at the point of generation, rather than transporting them to a separate recycling facility. One of the advantages of this approach is that you can avoid the costs associated with transporting waste to a separate recycling facility. In Harare, waste management has resulted in the contamination of water sources such as Chivero as well as the streams like Mukuvisi.

2.10.6. Drinking water quality

77% of industrial properties do not use water treatment technologies and three quarters of these also use the water without testing it. The few properties that test water mainly use the chemical test. The bacteriological and physical tests remain least used. Eutrophication of lake Chivero has partly been attributed to deposition of chemicals and nutrients from industry.

2.11. Key environmental concerns for Commercial Properties

2.11.1. Waste Management

76% of commercial properties generate biodegradable food waste. Biodegradable food waste refers to organic waste materials that can be broken down naturally by microorganisms, such as bacteria and fungi, into carbon dioxide, water, and biomass. Examples include fruits and vegetables, bread, eggshells, and left over food. One advantage of this type of waste is that it reduces greenhouse gas emissions since it can be composted, reducing the production of methane. However, deposition of huge volumes of this waste into the environment could result in super nutrient rich water bodies like Chivero. High proliferation of water hyacinth on the lake could be traced back to this effect.

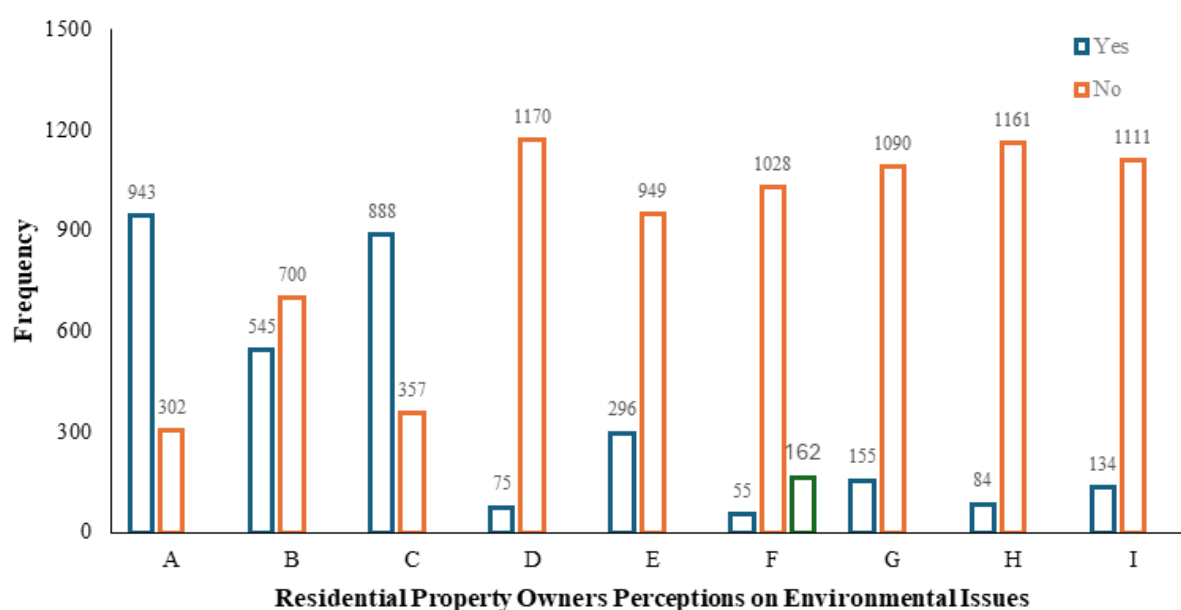


Figure 2.32: Environmental concerns in commercial properties: A (Do you generate biodegradable waste), B (Do you use clean energy sources), C (Do you have fire preventive measures on your property), D (Do you have flooding incidents), E (Do you have access to green spaces), F (Do you generate hazardous chemical waste), G (Do you monitor air pollution), H (Do you monitor and control noise pollution, and I (Do you monitor and control water pollution)

2.11.2. Energy supply

44% of the respondents from the commercial properties indicated that they use clean energy sources. Similar to the observations made during the industrial surveys, solar remains the most popular clean source of energy in the commercial properties. Harare is located in a place where there is good supply of electromagnetic energy throughout the year, making it a suitable location for generation of solar energy. In recent years, due to shortages in the supply of grid electricity, many companies have increased their investment towards solar. This trend had also been pushed by an increase in the supply of solar equipment on the local market.

2.11.3. Risk of fire

71% commercial properties have fire plans. Fire management systems include, but are not limited to, fire extinguishers, fire hydrants, and fire assembly points, fire exit doors and fire alarms. Despite availability of systems for fire management, fire incidents which destroy property worth thousands of dollars still occur in the city.

2.11.4. Risk of flooding

6% of commercial properties have recorded flooding incidences in the past. The only flooding which occurs is associated with heavy rains. Maintenance of drainage systems has been a major challenge in the city with most drains being closed by uncollected waste. Occasionally, silt washed away on the roads also worsen the situation. However, while flooding is most evident on roads, most commercial properties remain safe. Along the major drainage lines and wetlands, flooding could still be considered to be prevalent.

2.11.5. Green space

Similar to the industrial areas, 24% of the respondents from commercial properties indicated that they have green spaces. These green spaces include gardens, trees, and lawns. Green spaces (such as parks, gardens, and green roofs) in urban areas are essential for maintaining a healthy and sustainable environment provide numerous benefits to residents, including improved air quality, reduced noise pollution, and enhanced mental health. Green spaces also help to mitigate the urban heat island effect, reduce stormwater runoff, and support local biodiversity. Furthermore, they offer opportunities for recreation, socialization, and community engagement, fostering a sense of place and belonging among urban dwellers. The city is faced with a general decline in the size of green spaces due to expansion of infrastructural developments. However, areas located in the northern suburbs have performed well in maintaining green areas and parks.

2.11.6. Hazardous waste

Generation of hazardous chemical waste remains low in Harare's commercial properties (17%). The effects of hazardous chemical waste on the environment and human health are devastating and far-reaching. When improperly disposed of, toxic chemicals can contaminate soil, groundwater, and air, leading to widespread pollution and ecological damage. Exposure to these hazardous substances can cause severe health problems, including cancer, neurological damage, and reproductive issues. Moreover, chemical waste can also have catastrophic effects on wildlife, leading to the decline or extinction of vulnerable species. Recent deaths of animals in the Chivero Recreational park have been linked to proliferation of cyanobacteria. Heavy metals have also been detected in fish from Chivero. The impact of hazardous chemical waste can persist for generations, making it essential to adopt sustainable waste management practices, enforce strict regulations, and promote environmentally responsible behaviors to mitigate this pressing environmental and public health concern.

2.11.7. Land, water and air pollution

The study observed a general lack of pollution monitoring on the commercial properties. Monitoring levels range from 7% to 12% for air, noise and water pollution. Noise pollution is rarely monitored and this could be linked to inadequate equipment. Monitoring air, noise, and water pollution is crucial for identifying and mitigating the harmful effects of environmental pollution on human health and the ecosystem. Advanced technologies, such as sensors, satellites, and monitoring stations, enable real-time tracking of pollutant levels, allowing for swift action to be taken when thresholds are exceeded. Air quality monitoring detects

pollutants like particulate matter, ozone, and nitrogen dioxide, while noise pollution monitoring measures sound levels to prevent hearing damage and disturbance. Water quality monitoring assesses parameters like pH, turbidity, and bacterial contamination to ensure safe drinking water and healthy aquatic ecosystems. By continuously monitoring these environmental pollutants, governments, industries, and communities can work together to implement effective pollution control measures, enforce regulations, and promote sustainable practices to protect public health and the environment. In Harare, water pollution is better monitored than the other two due forms of pollution probably due to the cost of equipment .

2.12. Key environmental concerns from Residential Properties

2.12.1. Municipal solid waste management

Seventy-two percent of the respondents indicated that household waste is rarely or never collected. The poor collection of urban residential waste poses significant environmental, health, and economic challenges. Inadequate waste management systems lead to overflowing garbage bins, litter-filled streets, and uncontrolled dumping in unauthorized areas. This not only creates unsightly conditions but also attracts pests, contaminates water sources, and spreads diseases (see Figure 2.33). Moreover, the lack of proper waste segregation and recycling facilities results in valuable resources being sent to landfills, contributing to greenhouse gas emissions and wasting opportunities for energy recovery. The consequences of poor waste collection are far-reaching, affecting not only urban residents' quality of life but also the overall sustainability and livability of cities. The city remains underequipped to handle the ever-increasing waste generated by increasing urban population and expanding industry.

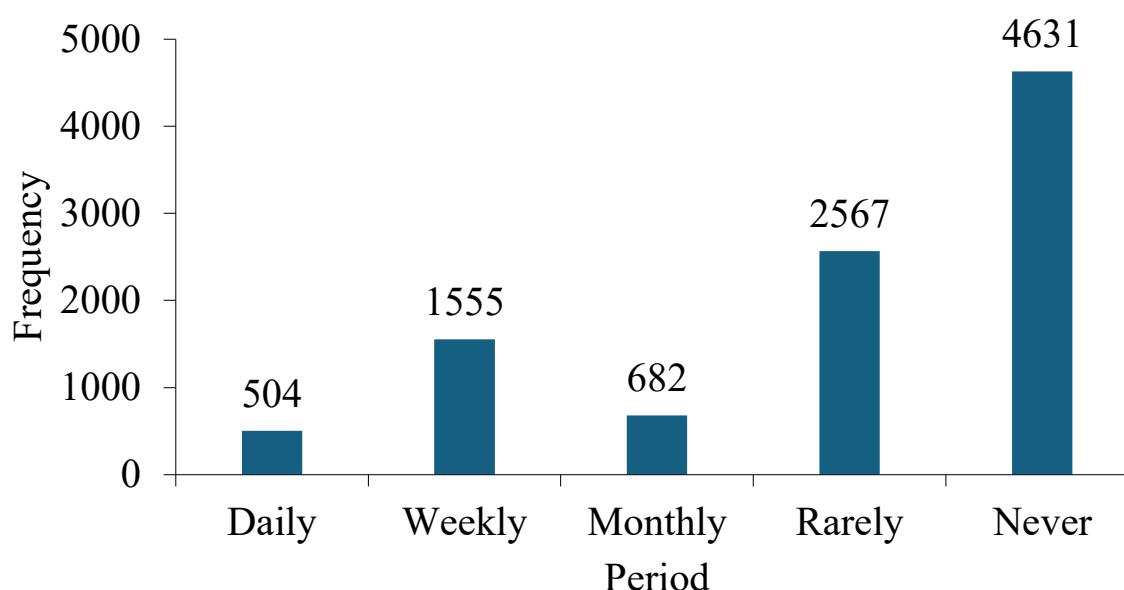


Figure 2.33: Residential waste collection frequency

2.12.2. Access to parks and green spaces

About 60% of the residents in Harare have no access to parks and green spaces Access to parks and green spaces in urban areas is essential for promoting physical and mental well-being, social cohesion, and environmental sustainability. These natural havens provide a tranquil escape from the stresses of urban life, offering opportunities for recreation, relaxation, and community engagement (see Figure 2.34). Research has shown that proximity to parks and green spaces can reduce rates of obesity, anxiety, and depression, while also

fostering a sense of community and social connection. Furthermore, urban green spaces help mitigate the urban heat island effect, improve air quality, and support local biodiversity. However, unequal access to these spaces can exacerbate existing health and social disparities, particularly in low-income and marginalized communities. Recent trends in Harare indicate that the land available as parks and green spaces has been shrinking as a result of expansion of the built environment.

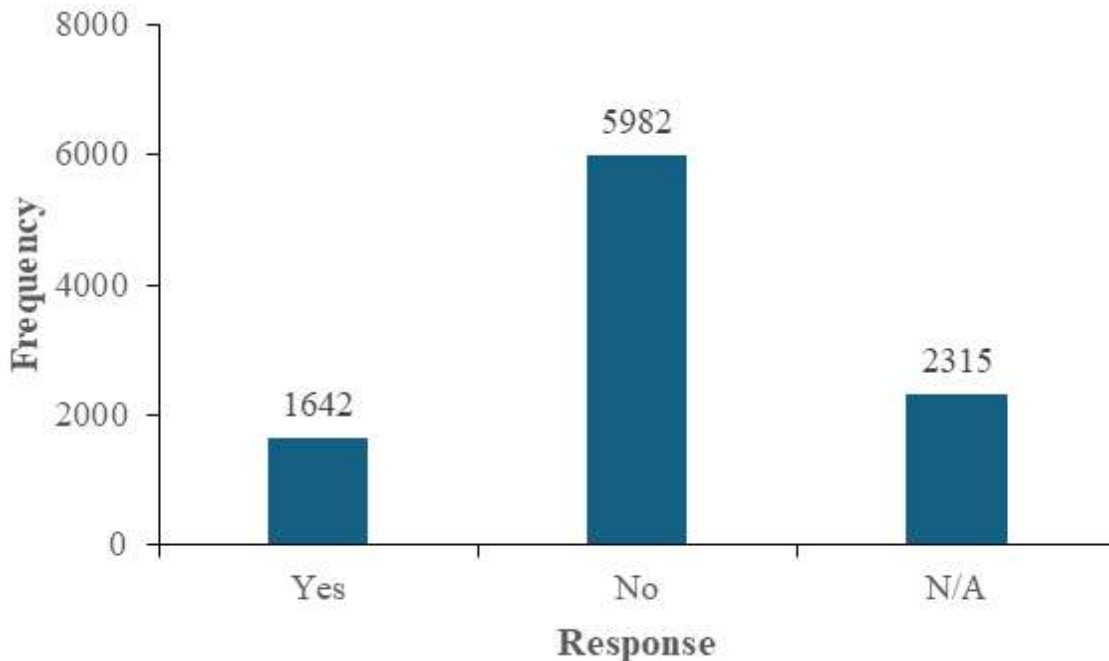


Figure 2.34: Access to parks and green spaces based on the residential property.

2.12.3. Urban Resilience and Risk

Environmental pollution (air, water and land) is being experienced in Harare. The degradation of and encroachment on wetlands in Harare is directly causing water stress as the city depends on ground water to a large extent (Government of Zimbabwe, UNICEF and 2019). Environmental pollution risk emanates from the coordination challenges between public institutions involved in pollution regulation and management e.g. City of Harare, Environmental Management Agency, and the users (citizens, corporates and business operators). Forest loss in urban settings has been associated with increases in air pollution. Trees provide a natural filter for dust and carbon sequestration thus improving air quality. Other impacts have been linked to reduced carbon sequestration, increased soil erosion, and a general loss of habitats and biodiversity. Temperature increases associated with the urban heat island have also been reported where forests have been lost. In Harare, the new suburbs located to the south-west contributed to forest loss (See Figure 2.35). Specific areas where forest loss has been significant include New Cerney, Saturday Retreat, Eyre Court Estate, Odar of Stoneridge, Mainway Meadows, Retreat, and Caledonia.

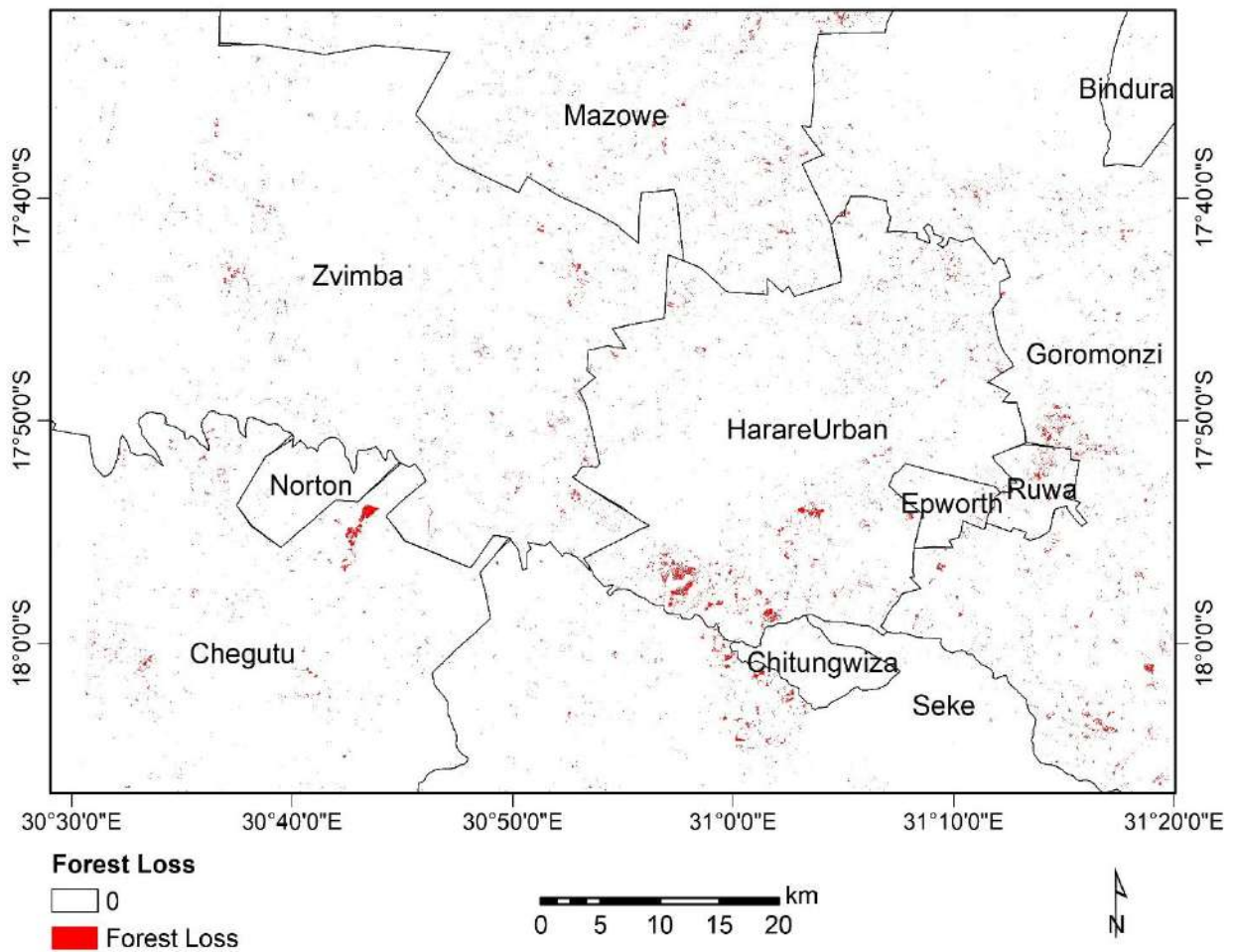


Figure 2.35: Forest loss in Harare and surrounding areas

Risks of flooding because of poor drainage systems and structures built in flood prone areas is an issue of concern in the City. Cases of flooding risks in Harare include the low-lying areas of Budiriro 5B and Kuwadzana Paddocks which are perennially affected (Zimbabwe Gender Commission, 2023)³. The precarious state of the settlements associated with limited infrastructure development (road, bridges, drainage) exacerbate the risks of flooding. In addition, urban markets e.g. Gazaland, GV8FC and Hatcliffe markets in the city are yearly affected by summer flooding. Another urban risk in Harare is the collapse of buildings, though not many cases have been experienced. In 2024, Harare experienced a building collapse. Buildings usually collapse because of the structural failure of a building, culminating in its collapse. This results from non-adherence to building regulations. Additionally, property owners may default property maintenance because of inadequate funding.

Heat related illnesses are urban risks anticipated in Harare. A high temperature region in the Harare District could be related to low vegetation cover and built-up surfaces in the western suburbs in line with the urban heat island (See figure 35). In addition, climate change projections have consistently reported a global increase in temperatures. In Zimbabwe, the prevalence of heat waves has also increased in the recent past. High temperatures may result

³ Zimbabwe Gender Commission (2024). Assessment Report on Gendered Impact of Floods in Budiriro and Kuwadzana Suburbs. Available at: <https://zgc.co.zw/wp-content/uploads/2024/09/Assesment-Report-on-Gender-Impact-of-Floods-in-Budiriro-and-Kuwadzana-Suburbs.pdf>

in an increase in heat-related illnesses which include heat exhaustion and skin cancers. The demand of electricity for air-conditioning may also increase in hot areas. Architectural designs and supply of electricity to match increased demand for air-conditioning must be considered in light of projected increases in environmental temperatures as a result of climate change.

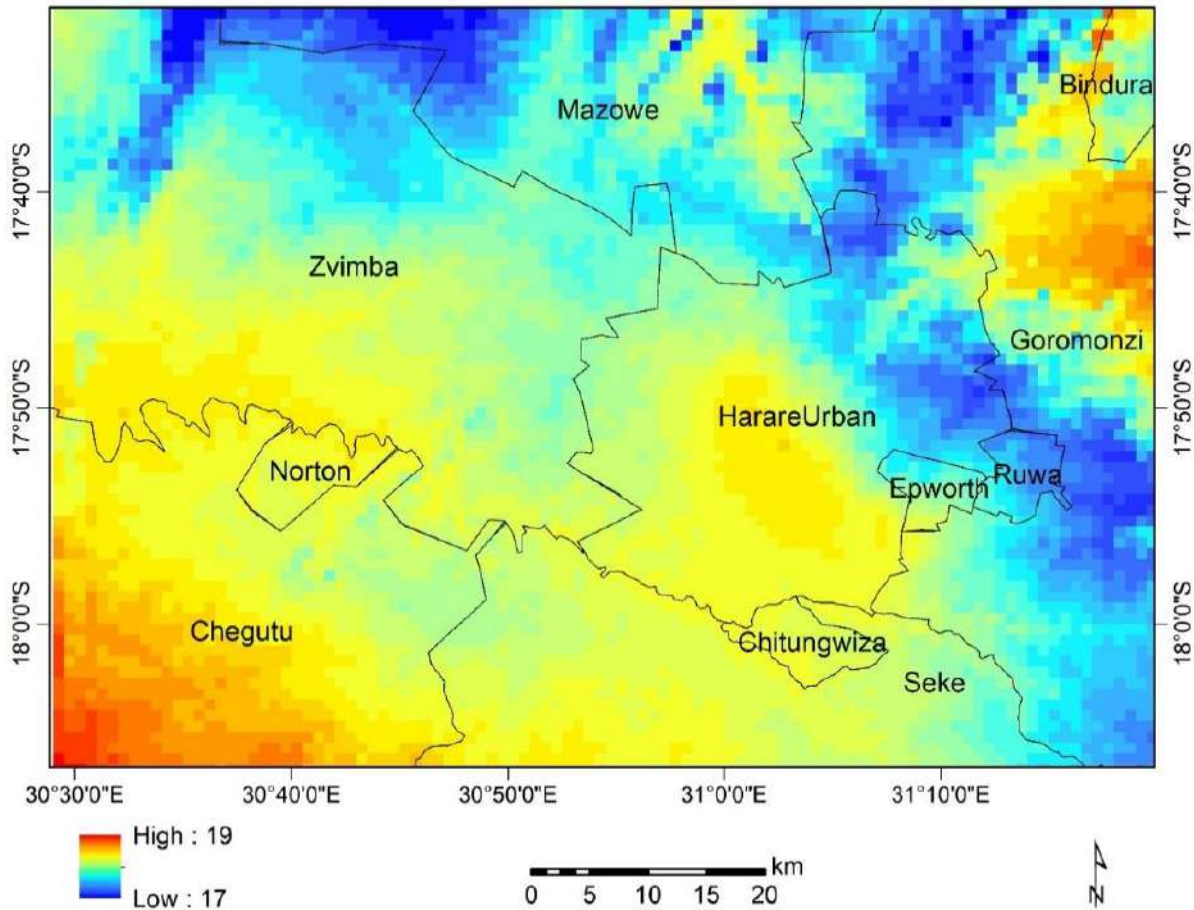


Figure 2.36: Long-term temperature in Harare and surrounding areas

As has been noted, the above risks are largely resulting from urban management gaps. An example to note is the Council water supply gaps that are experienced in Harare. Existing evidence suggests that there has been a steady increase in the use of groundwater as residents seek for alternatives to council water. In Zimbabwe, and indeed most regions in the world, the prevalence of drought has been on the rise. This has a direct impact on availability of both surface and ground water. Planning for urban expansion should take these trends into consideration. Ground water availability is threatened by the changing rainfall patterns. Rainfall increases from south-west to north-east. The lowest values are found in Chitungwiza, Seke, Chegutu, Zvimba. Highest rainfall is in the Goromonzi, Ruwa, and Mazowe districts. High rainfall areas are climate resilient and are associated with enhanced agricultural productivity when compared to the lower rainfall areas. It is also assumed that ground water re-charge is higher in the high rainfall areas and therefore ground water potential is much higher.

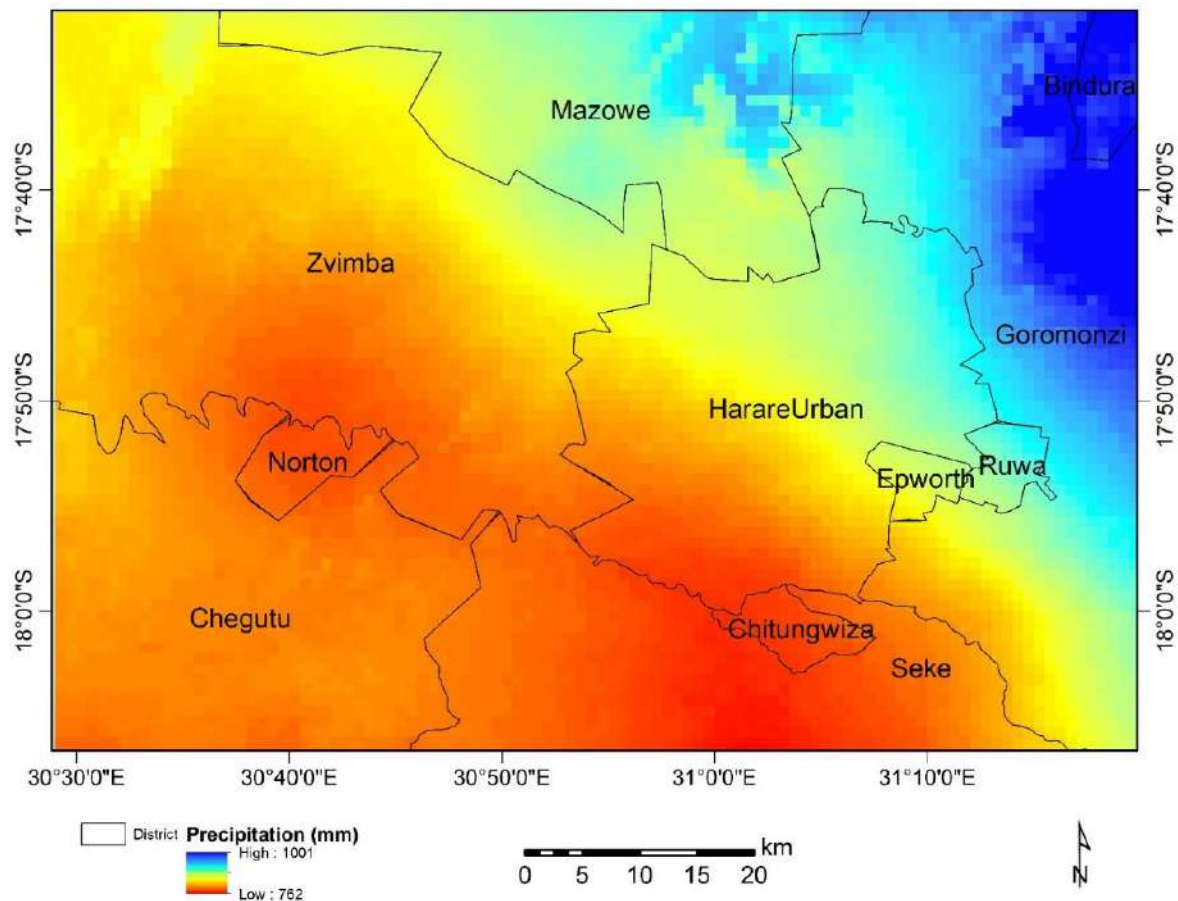


Figure 2.37: Long term precipitation in Harare and surrounding areas

2.13. Summary of issues

The study observed the following environmental concerns:

- a) Accute levels of pollution: Water, Air and Land,
- b) Biodiversity Intactness Index is at 0.53 indicating biodiversity is severely stressed,
- c) Biomass is at 297 t/km² which is very low, but expected for an urban area
- d) Built up or impervious surface area is at ~69% indicating large expanse of impermeable surface/susceptible to flooding,
- e) Soil pH is at 7.6 indciatng that the city's soils are acidic
- f) Nitrogen Oxide (N₂O) 1.0 µg/m³ is moderate
- g) Carbon Monoxide (CO) is at 126 µg/m³ (cubic meter of air contains a unit grame of CO), which is way above WHO limits on CO of 10 mg/m³
- h) Sulfur Dioxide (SO₂) is 33.32µg/m³ is moderate. The WHO upper limit is 125 µg/m³
- i) Methane (CH₄) is at 30.16×109µg/m³ indicating high levels of methan emmission into the atmosphere.
- j) Aerosol Concentration (Particulate Matter) PM_{2.5}: = 3.0 µg/m³ is at PM₁₀: = 4.0µg/m³ observations between 3 - 5 indicate a significant aerosol event, wildfire smoke, dust storms.
- k) The city is located in the watershed and a wetland city.
- l) Significant loss of public open spaces
- m) High levels of water pollution.

3. CHAPTER 3: SOCIAL AND DEMOGRAPHIC CHARACTERISTICS

3.1. Population trends

3.1.1. Harare Metropolitan Population Trends

Global population figures indicate that the City of Harare is the most populous urban settlement in Zimbabwe with a resident population of 1,849,617 people and an estimated 2,487,209 people in its metropolitan area (comprising of Harare, Chitungwiza, Epworth and Ruwa). The Harare Metropolitan area has over time grown to be the most densely populated urban conurbation in Zimbabwe. Population trends for Harare Metropolitan area indicate an exponential trajectory between 1969 and 2022 for the three urban local authorities. Census data indicate that the City of Harare has been growing exponentially between 1969 and 2002 and began to plateau, or level off (steady slow growth i.e. flattening curve). Similar characteristics are also observed for Chitungwiza and Epworth, meanwhile Harare Rural has been experiencing an exponential population growth since the year 2002 owing to growth at the urban fringe (See Figure 3.1). The population for Harare is projected to reach 3 299 100 by 2050.

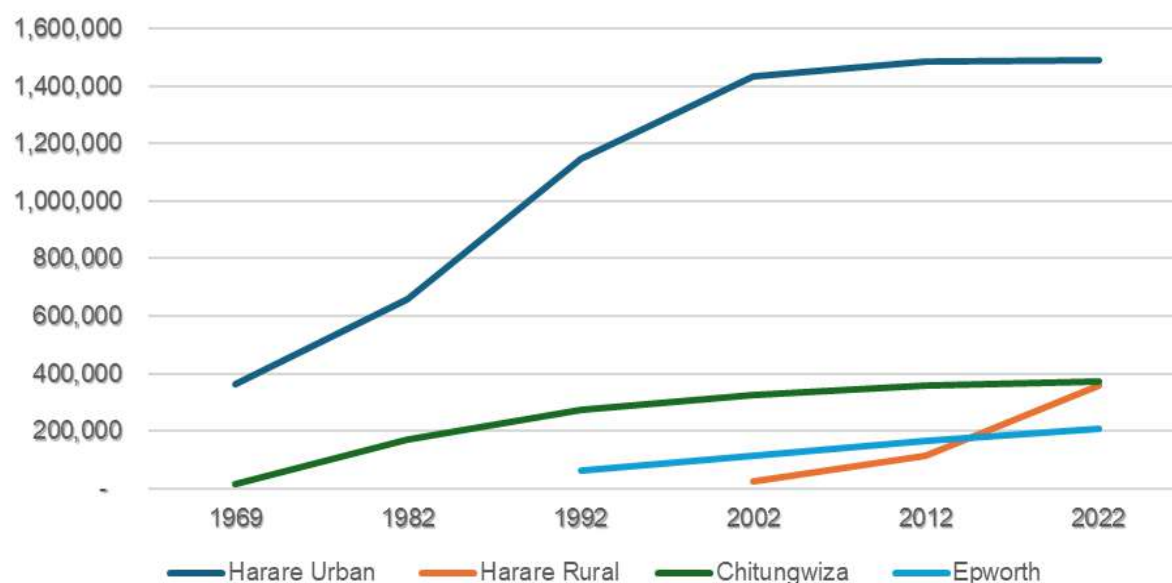


Figure 3.1: Harare Metropolitan Population Trends

Source: Collated from Zimstats Census Data

3.1.2. Population Structure

In terms of population structure the 0-19 age group constitute 42.74%, 20-74 age group constitute 56.57% while 0.68% constitute 75+ age group. Figure 3.2 illustrates the city's age-sex structure. 53.2% of the city's population are female and 46.8% are male.

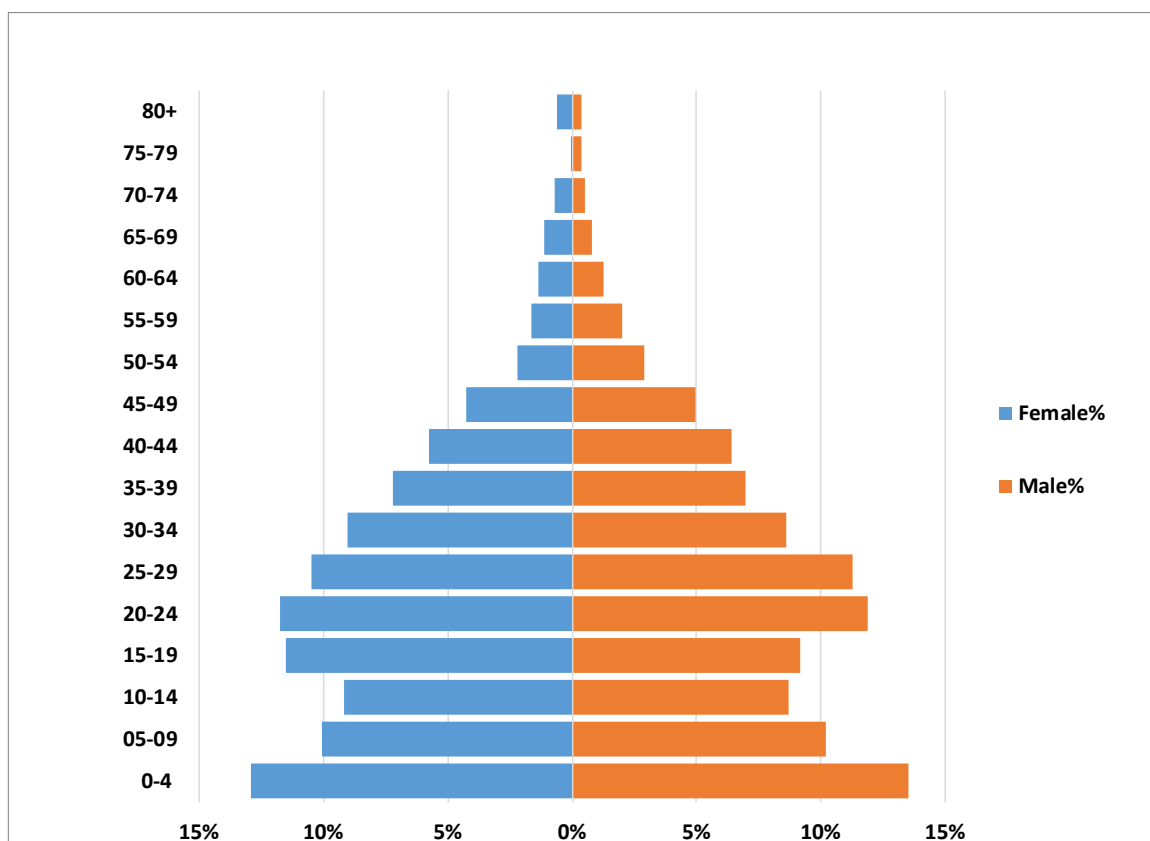


Figure 3.2: Age-sex Structure for Harare

3.1.3. Fertility and Mortality rates

The crude death rate for the city is 5.8 deaths per 1,000 people. Under-five mortality rate: 39.8 deaths per 1,000 live births, Neonatal mortality rate: 9.5 deaths per 1,000 live births, post-neonatal mortality rate: 14.7 deaths per 1,000 live births, Maternal mortality ratio: 363 per 100,000 live births. Leading causes of death are HIV/AIDS, Stroke, Lower respiratory infections, COVID-19, and Ischaemic heart disease. The crude birth rate is 27.4 live births per 1000 women, while the general fertility rate is 91 live births per 1000 women, whereas the total fertility rate is 2.9 children per woman, slightly higher than the national urban average of 2.8.

3.1.4. Household Profiles

3.1.4.1. Household size

The city has a total of 500,651 Households. The average household size is 5 persons. There are a few families with outlier household sizes (see figure 3.3).

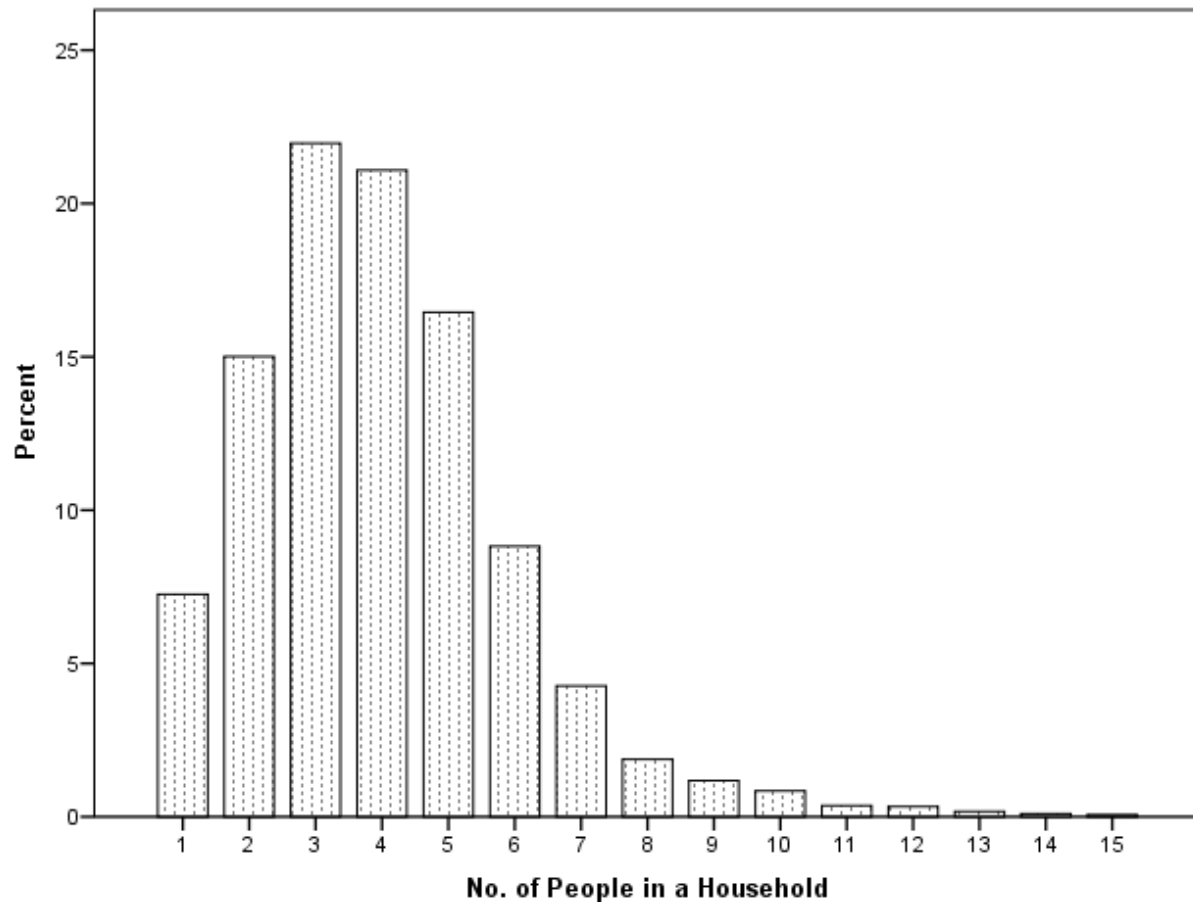


Figure 3.3: Household size

Source: Harare Master Plan Household Survey 2024

3.1.4.2. Marital Status

The study observed in terms of marital status 72.8% of the respondents were married, 15.2% were single, 6.6% were widowed, 2.8% were single parents and 2.7% were Divorced in the city.

3.1.4.3. Level of Education

In terms of highest level of education 55.3% of the respondents had attained Secondary Educational level, 21.9% University, 16.6% College, 4.3% Primary education and 1.82% had never been to School. Figure 3.4 shows that the central, north and eastern parts of the city have a highly educated population, whereas, the southern and western most parts of the city have low levels of education.

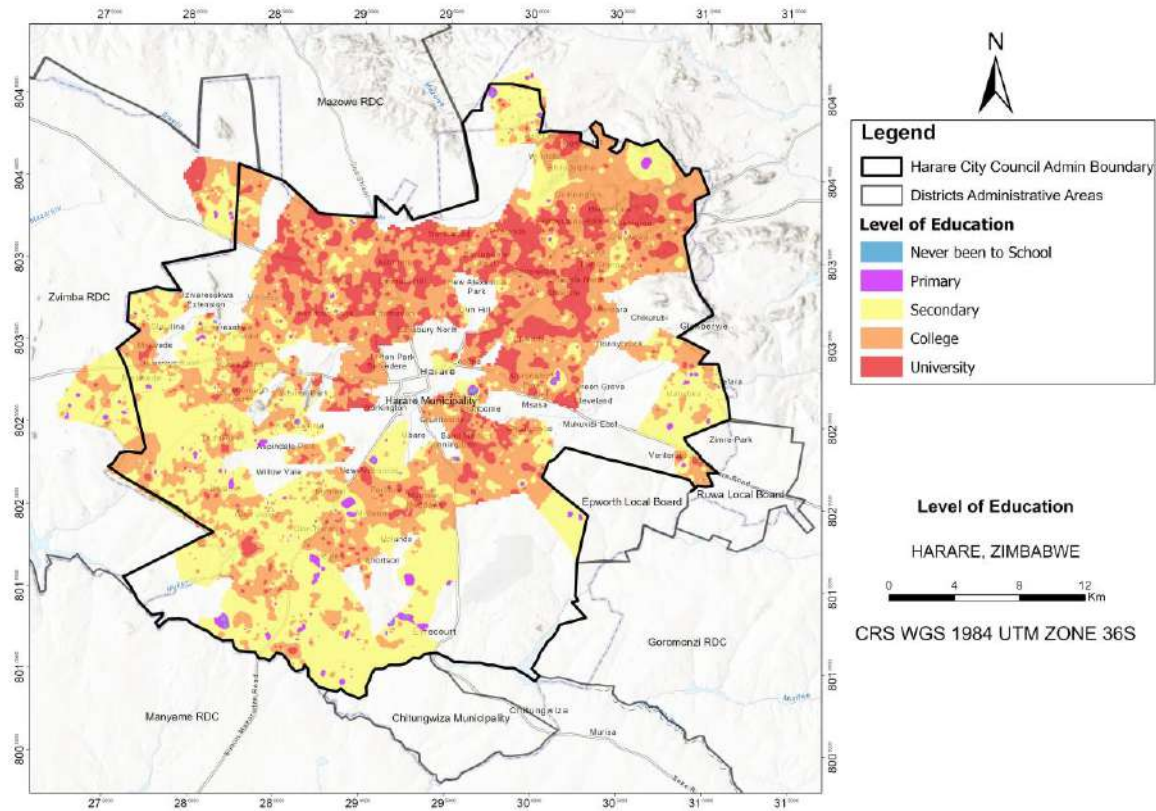


Figure 3.4: Spatial characterisation of education levels in Harare

3.1.4.4. *Occupation and Sector*

The dominant occupations are Self-employed (Entrepreneur/small business owners) which constitutes 31%, General Workers (23.1%), Pensioners (7.65%), Informal traders/Vendors (6.45%), Farmer (2.34%), Accountant (2.24%), Gardener (2.09%), (Students (1.84%) respectively. Figure 3.4 illustrates the diversity of occupations of Household Heads in the city.

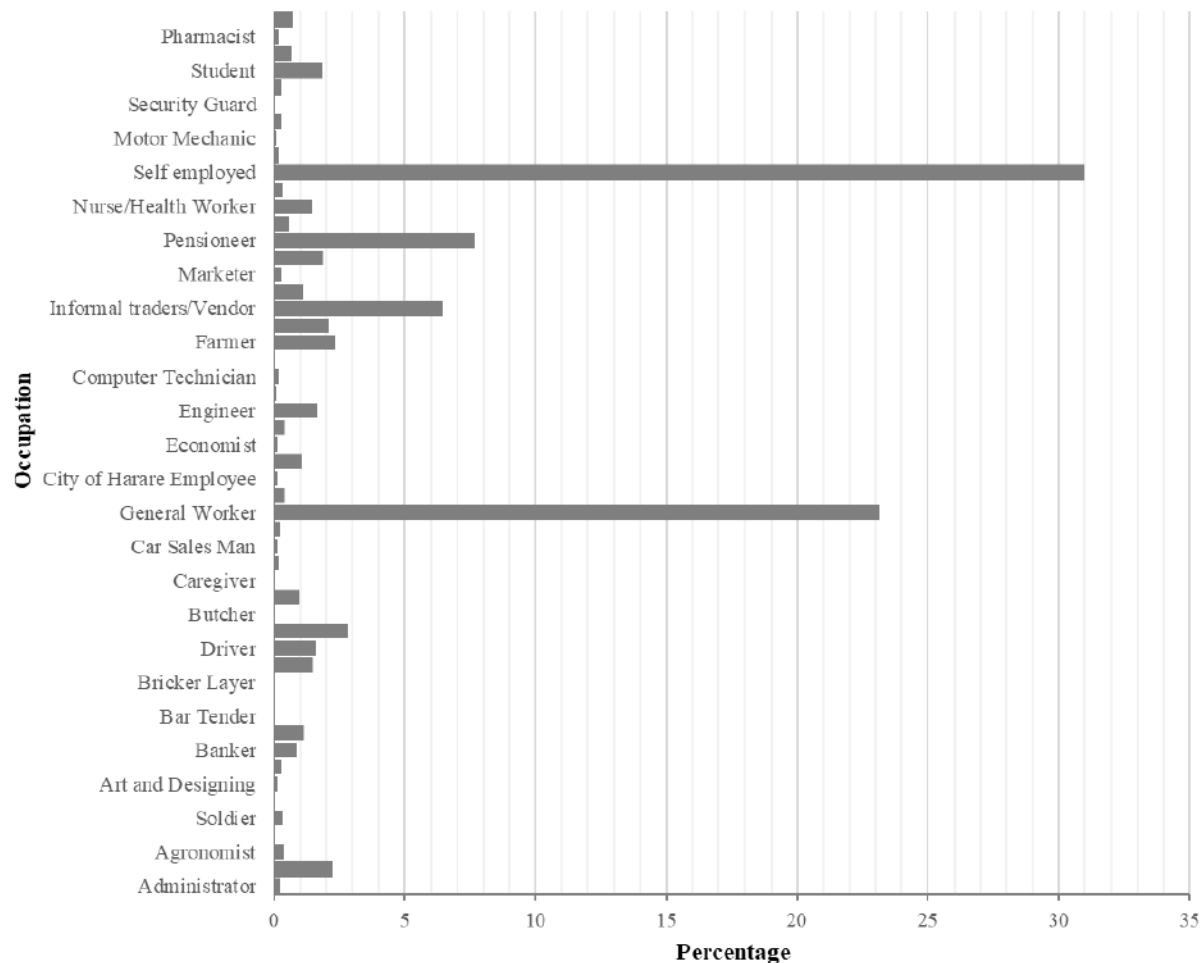


Figure 3.5: Occupation of Household Heads

6.2% are in Agriculture Sector, 7.3% Commerce and Banking, 7.9% Education, 32.1% Informal Sector, 8.7% Manufacturing, 2% Mining, 15.2% Public Service, 2.9% Security and 17.7% are Small Medium Enterprises. 20.7% work 7 days a week, 24.8% 6 days a week, 29.8% 5 days a week, 4.4% 4 days a week, 3.1% 3 days a week, 1.45 2 days a week, 0.8% 1 day a week, whereas 14.8% do not work at all.

3.1.4.5. Job Opportunities

80.3% of the respondents noted that there are no sufficient job opportunities in the city, whereas 19.7% of respondents noted availability of job opportunities.

3.1.5. Population Density

The city has an average population density of 22 people per square kilometre. The population density for the City of Harare and Ruwa Local Board is relatively lower than that of Epworth Local Board and Chitungwiza Municipality which is 79 and 87 people per square kilometre respectively. Figure 37 illustrates the spatial variability in population density for the Harare Metropolitan Area. Harare dominates the Urban Settlements in the Harare Metropolitan province

(see figure 3.5). Harare city's population 76.2% (2,427,209 people) of the provincial population and the most populous urban settlement in the country. Its spatial extent spans over 960.6 km². Harare City is a huge arena for local and national political and economic processes. The city has a daytime population that almost doubles its regular population as inhabitants of nearby towns and surrounding rural areas spend their working days in the city. The highest population densities are in Chitungwiza, Epworth and Norton. Selected sections of Harare also exhibit high population densities. Important to note is the spread of population along major road networks radiating from Harare.

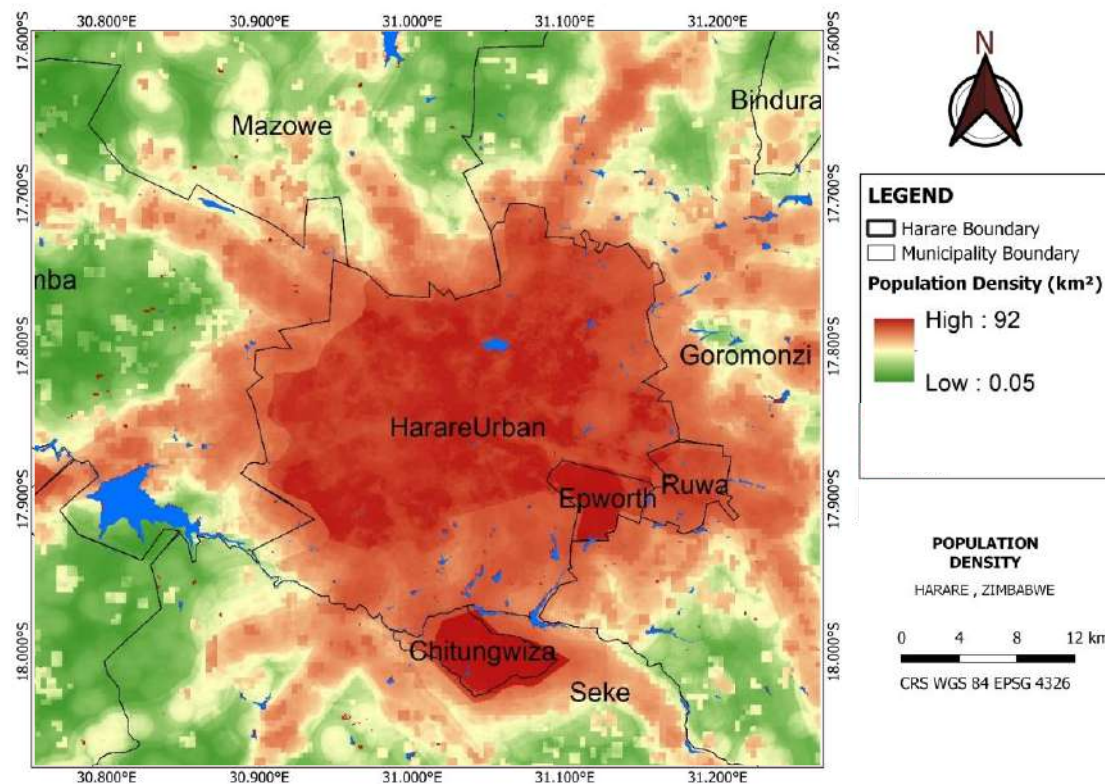


Figure 3.6: Population Density for Harare and its surrounding settlements

Source: Census Data ZIMSTATS

3.1.6. Migration Patterns

In terms of population movement the study established that 56.76% of the respondents have been staying within Harare i.e. in migration (despite moving from one neighbourhood to another), 23.37% migrated from other towns, 17.46% have always stayed in same neighbourhood and 2.41% have migrated from outside Zimbabwe (see figure 3.6).

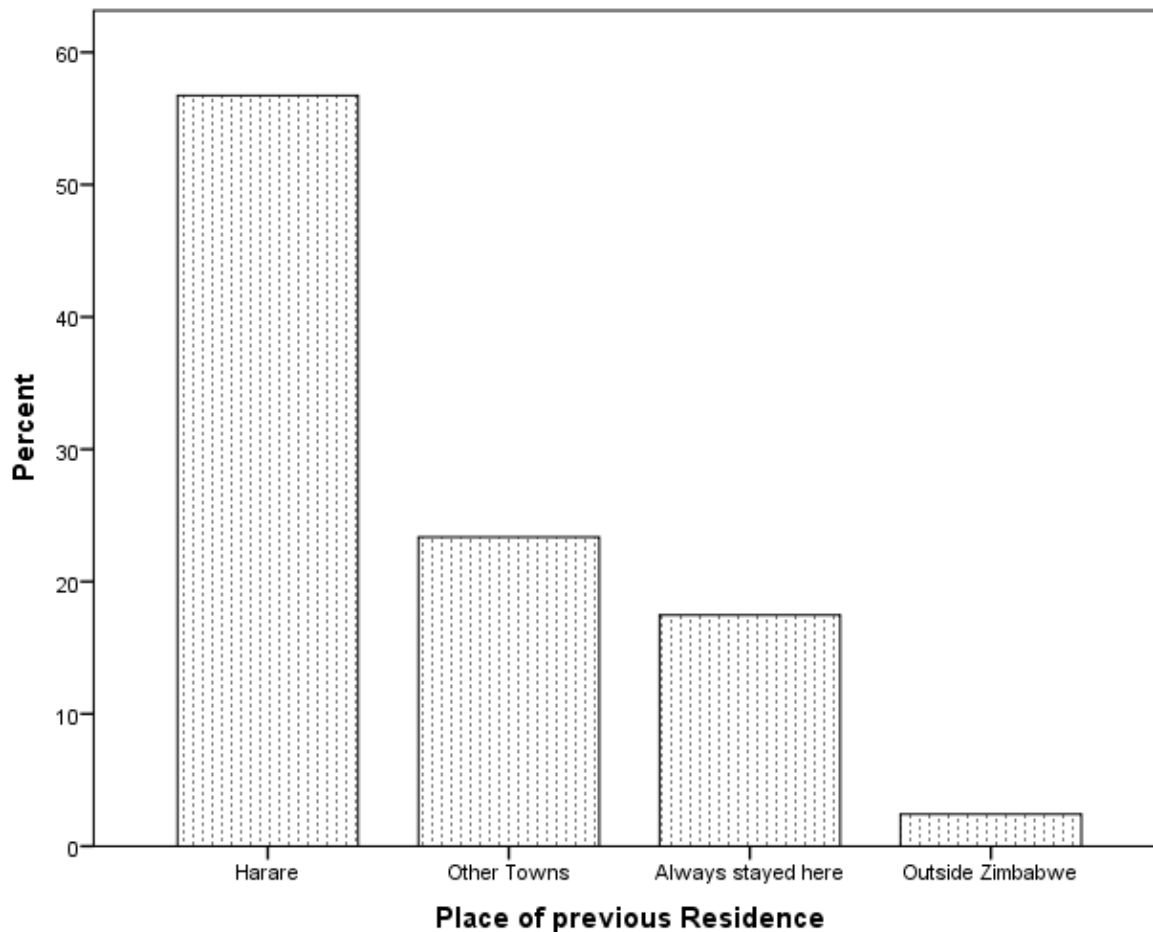


Figure 3.7: Population movement patterns

The pull factors included affordability (66.7%), proximity to work place (28.7%) and proximity to education (4.6%).

3.2. Social services

3.2.1. Health

In terms of health provision 71.4% of the respondents seek modern health services, whereas 28.6% do not i.e. rely on alternative medicine or faith healing. The city has a total of 142 health facilities both private and public. The study established that 96 are private, 42 are council and 4 are government health facilities (see figure 3.5). Harare districts' namely Hatfield, Borrowdale, Waterfalls, Hopley, Glenview, Greendale, and Marlborough have areas outside the 2km and 5km service radius of existing health facilities, leaving them without accessible council healthcare services. However, all the districts have full coverage by private health facilities within a 5km radius, except for parts of Hatfield and Waterfalls districts. Harare City has few government health facilities located within and close to the central districts.

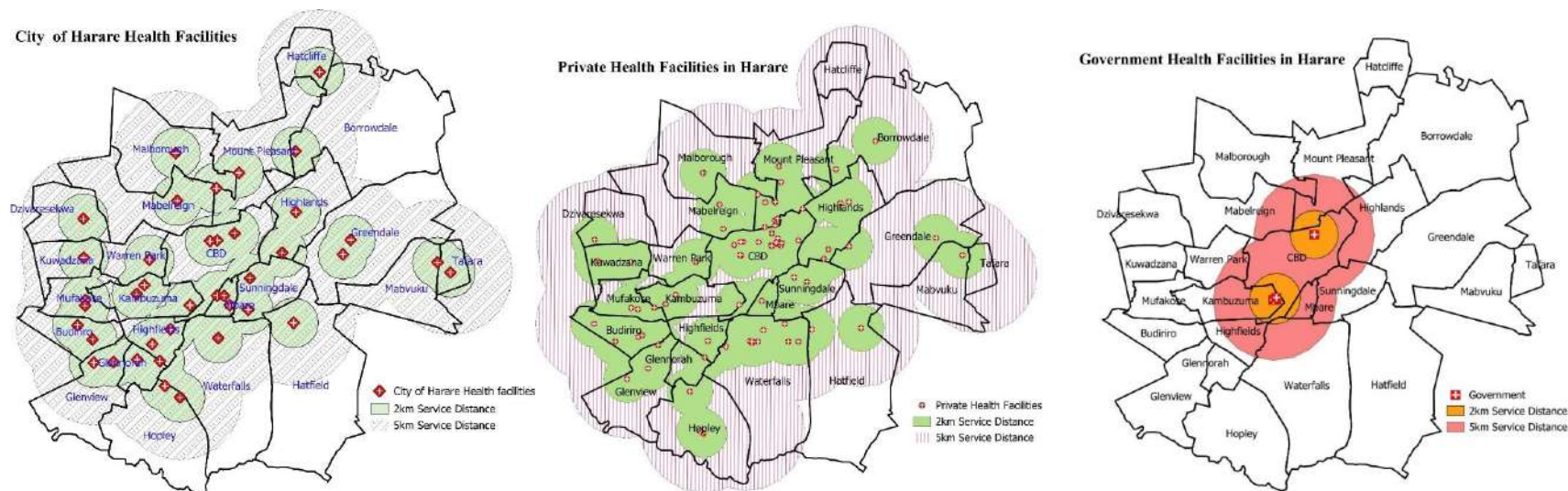


Figure 3.8: Distribution and service adequacy for Council and Government Health Facilities in Harare

Source: City Health Department (2024)

Over the years the number of visits to council health facilities significantly decreased between 2014 and 2024 (See Figure 3.6). Whereas the outpatient department has been fluctuating across districts (see figure 3.7).

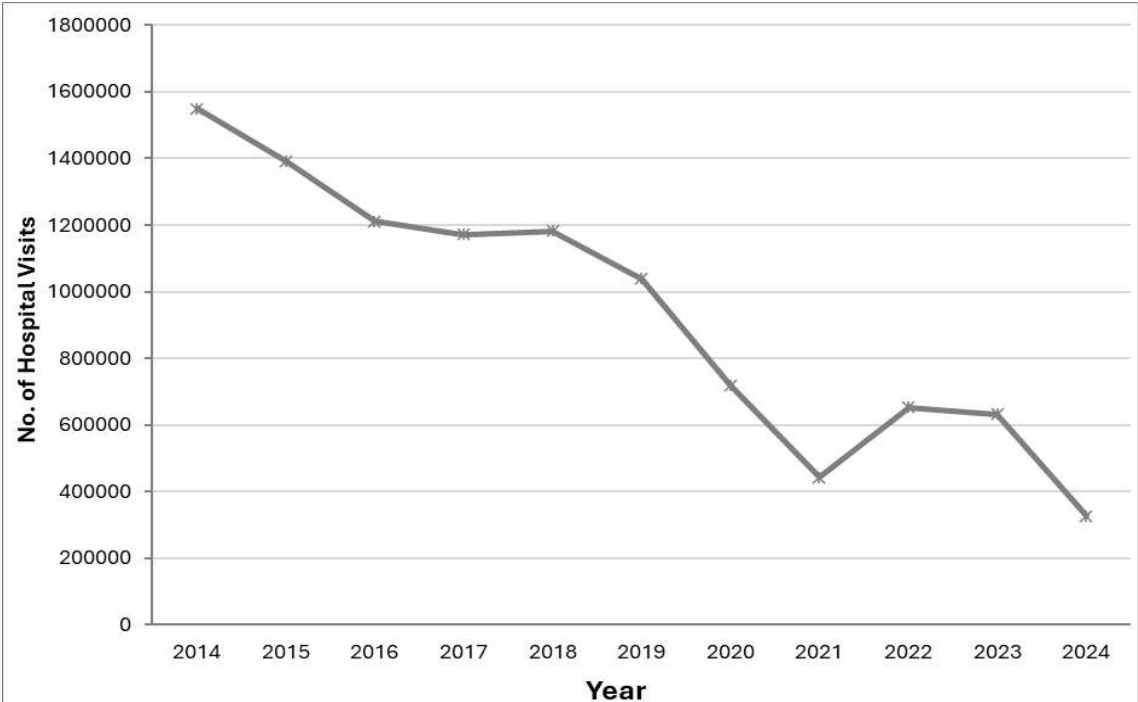


Figure 3.9: Health Facility Attendance Trends
Source: City Health Department (2024)

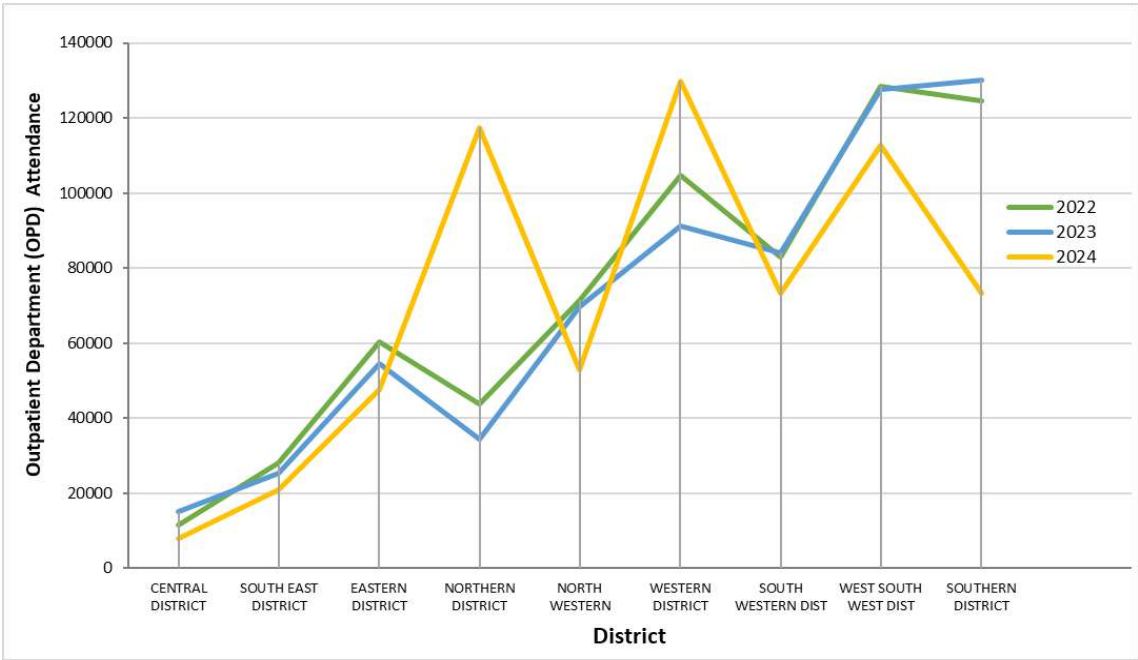


Figure 3.10: Outpatient Department Attendance
Source: City Health Department (2024)

3.2.2. Nutrition

As part of improving the health status of residents, the City of Harare has been supporting nutritional programs in partnership with CSOs and donors. Data from the City of Harare's Health department shows that there are several nutritional programs conducted in the city. These programs are operative in district's family health services facilities, central hospitals, clinics as well as communities. Some of these programs are location based to address localized nutrition challenges, as with the case of the iodine and sentinel surveillance system, which is specific to Tafara 5, Chitsere and Dzivarasekwa. Nutrition programs are mainly focused on child growth and development, micronutrient deficiencies, infant and young child feeding, school nutrition as well as emergency response programs. The programs and initiatives include Growth Monitoring and Promotion (GMP), Integrated Management of Acute Malnutrition (IMAM), Micronutrient Deficiency Control, Infant and Young Child Feeding (IYCF), School Nutrition Program, Iodine Deficiency Disorders Sentinel Surveillance system- IDD, Supplementary feeding program, and Nutrition During Emergencies Programs. There are significant partnerships in the nutrition sector, as evidenced by the engagement of various organizations in the NGO sector, such as the World Food Program and Goal Zimbabwe, to augment the City's efforts and ensure comprehensive development. Additionally, several initiatives are being carried out at the community level, highlighting the amplified role that communities can play in nutrition matters. Several programs, such as routine surveys and emergency nutrition programs, are specifically targeted at emergency response, indicating the importance of preparedness in responding to nutrition and health emergencies.

3.2.3. Educational Facilities

3.2.3.1. *Number of School going children*

The study observed that 58.8% of the households had school going children, 41.2% did not have any school going children. 24.7% of the households had at least one child attending school, 8.7% had 3 children, 2.8% had 4 children, 0.8% had 5 children, 0.3% had 6 children, 0.1 had 6 school going children and 0.1% had none respectively.

3.2.3.2. *Distribution of Educational Facilities*

The city has 104 secondary schools and 128 Primary schools. In terms of proportions 35% of secondary schools are public schools and 64% are private schools, whereas for primary schools 70% are public and 29% are private schools. The schools are not evenly distributed across all districts based on number of schools per district (see figure 3.9). There are fewer public schools in the northern, eastern and southern districts of the city. Central Business District, Waterfalls District and Hopley District have the highest number of private schools for both primary and secondary education.

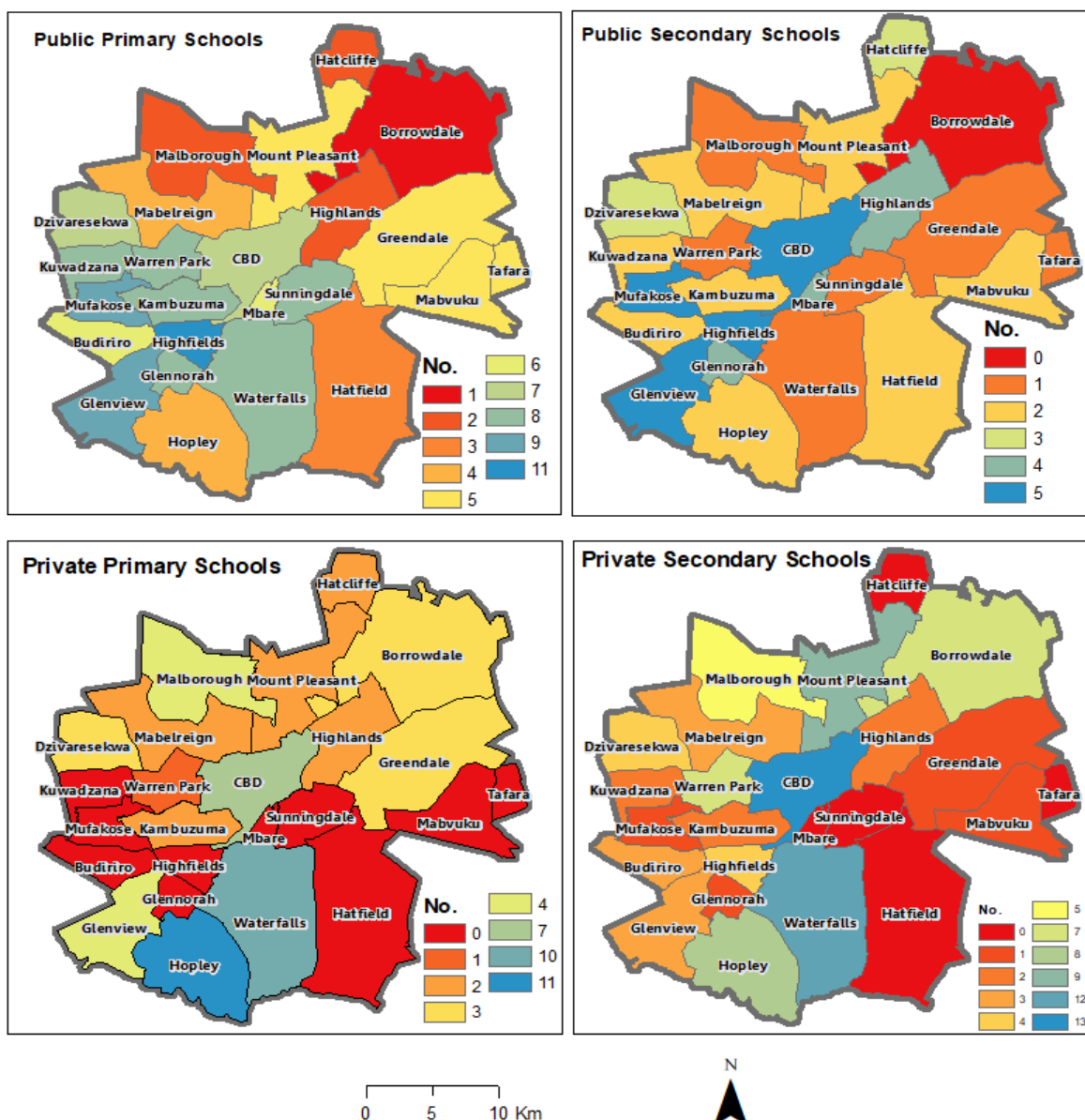


Figure 3.11: The Distribution of Educational Facilities in Harare

Source: DHCS (2024)

Most districts have more public primary schools than secondary schools, fitting within the ratio of 1 secondary school for 3 primary school except for Highlands, Hatcliffe and Borrowdale districts. Pupils in these areas either travel to other nearby districts for education or are enrolled in private schools. Peripheral districts such as Hopley and Waterfalls with high records of private schools reveal stress on education, as most of these school in Harare are a result of rapid population growth (see figure 3.10).

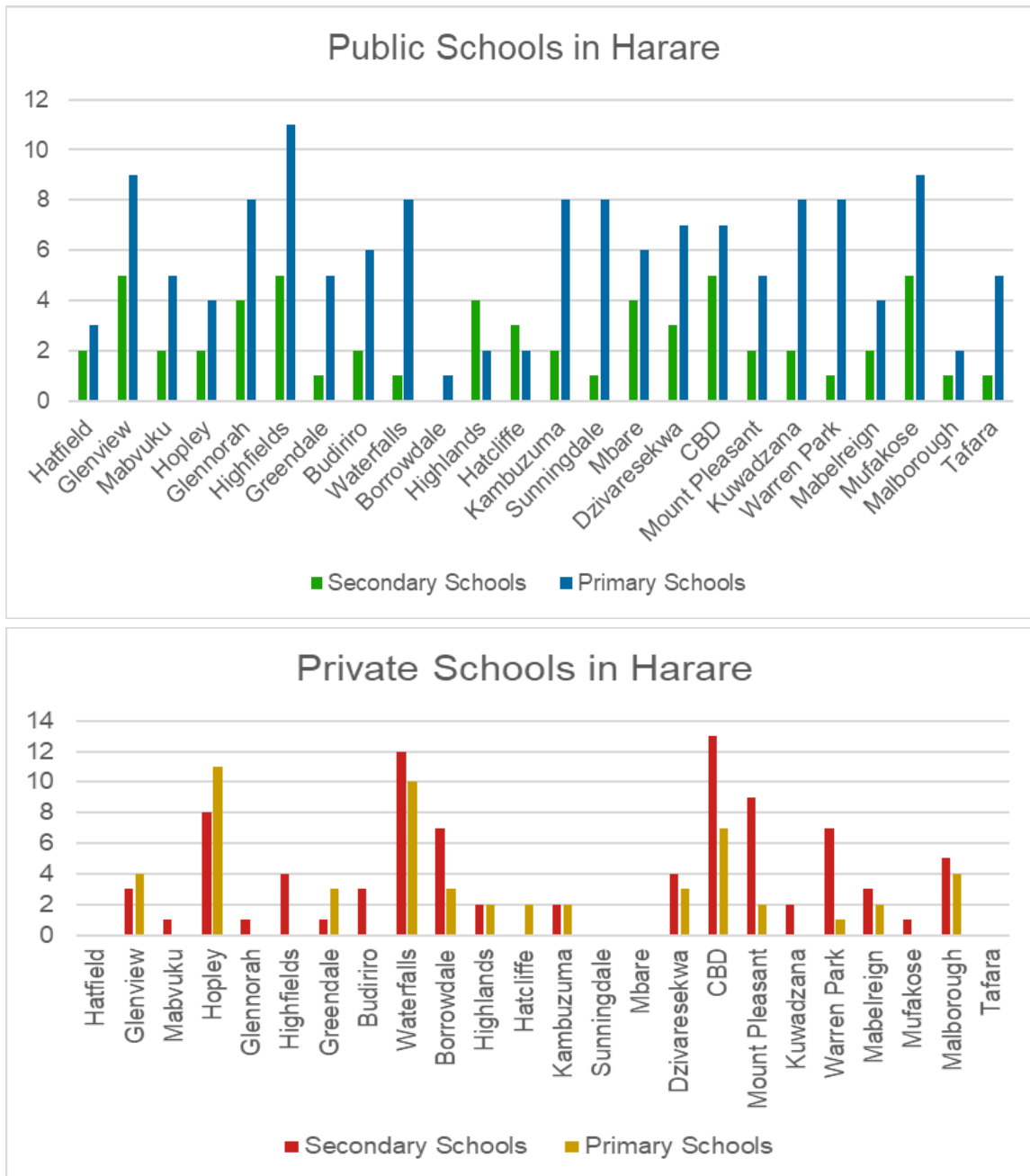


Figure 3.12: Public and Private Schools in Harare City
Source: DHCS (2024)

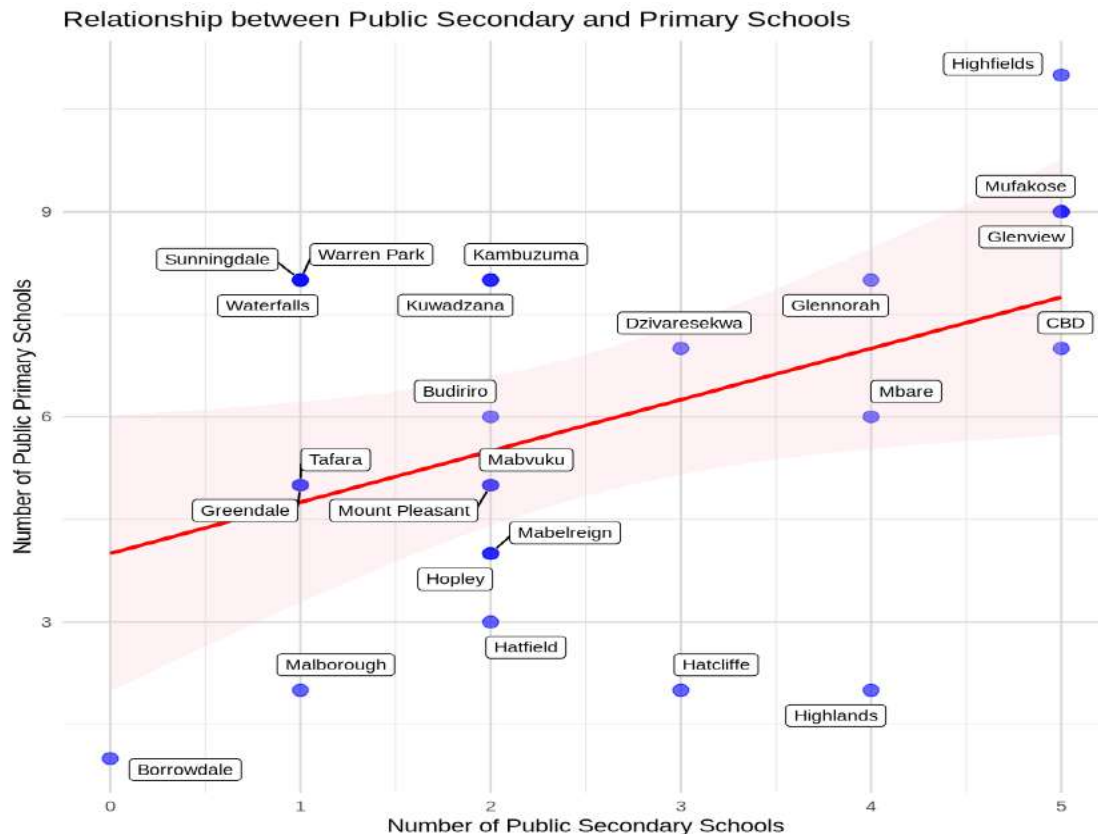


Figure 3.13: Statistics for the distribution of Public Schools
Source: DHCS (2024)

The scatter plot shows a moderate positive correlation (Pearson Product Moment correlation coefficient (r)= 0.432) between the number of Public Secondary Schools and Public Primary Schools across districts. The average number of Public Primary Schools per district is 5.88 (see figure 3.11). The average number of Public Secondary Schools per district is 2.5. The average ratio of Primary to Secondary Schools is approximately 2.35.

3.2.3.3. Adequacy of educational facilities

51.7% consider educational facilities as adequate in their area, whereas 35.2% cite inadequacy and 13.1% do not know. The reasons for inadequacy include 3.4% distance travelled to school, 6.3% fewer schools, 5.6% fewer government schools, 4.8% no schools at all, 3.6% overcrowding, 1.3% no secondary schools, 0.2% no primary schools, 1.3% limited space for schools, 0.5% hot seating, 0.2% fewer blocks, 1.9% poor standard and 2.9% are unaffordable.

3.2.4. Recreational Facilities

Harare has 146 recreational facilities (See Table 3.1 and figure 3.11). Except for basketball courts, council run recreational facilities are in a poor state. Stadiums in the city are functional but in need of repairs. All basic soccer fields are in poor but useable condition. Of the 45 community halls, 43 are functional and 2 are closed due to dilapidated condition. Due to lack of water, chemicals and maintenance 2 of the 13 pools are closed, with the remaining 11

operational. Most of the courts are multipurpose for volleyball, basketball and netball. The 9 basketball courts are in good condition as they were upgraded by Hoops4Hope.

Table 3.1: Recreational facilities in the City

Basic Soccer Fields	Community Halls	Swimming Pools	Tennis Courts	Volleyball Pitches	Netball Pitches	Basketball Courts
38	45	13	5	12	24	9

Source: DHCS (2024)

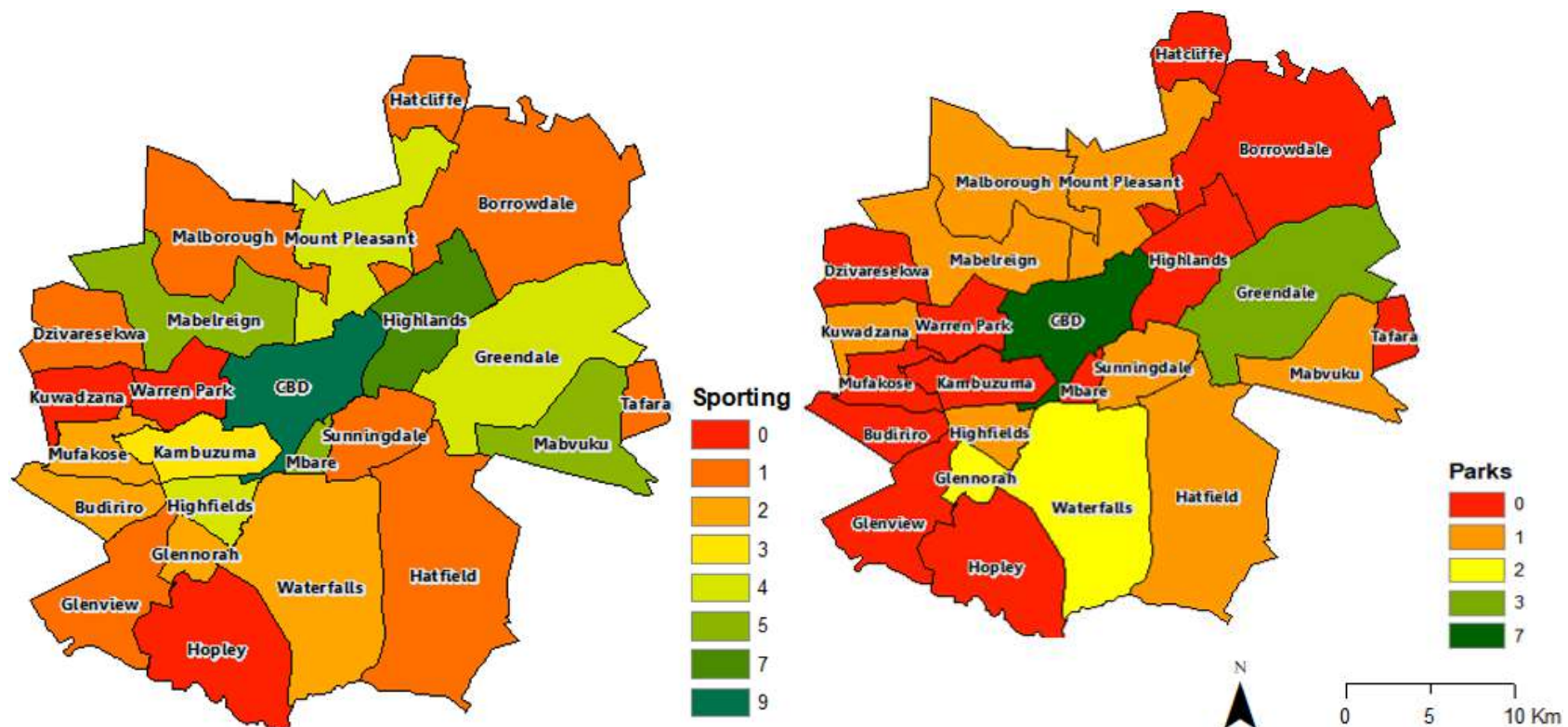


Figure 3.14: Distribution of Recreational Facilities in Harare City by District

3.3. Housing

The housing waiting list in the city has been growing, against an erratic and limited council housing supply. Table 3.2 shows the increase in people registering on the waiting list against council delivered houses for high, medium and low density stands. There is a huge variance between housing delivery and the number of people in the waiting list.

Table 3.2: Housing demand (waiting list) and delivery

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Waiting list	150855	171303	190752	210046	216502	224003	230133	239228	254265	281563	300000
Delivered	34	84	0	328	1458	0	237	109	161	1274	212
% (demand/supply)	0.02	0.04	0	0.15	0.67	0	0.1	0.04	0.06	0.45	0.07

Source: DHCS (2024)

City's efforts to address housing delivery are acknowledged, though the current gaps need to be addressed. Harare City is known for having led on supporting establishment, capacity development and Municipal land allocation to cooperatives for housing from 1985. Community-based organisations (CBOs) like cooperatives to some extent enhanced easy access to land for the urban poor. Housing cooperatives have always been used by the city as a vehicle for housing development. The first housing cooperative that was supported by the city was Kugarika Kushinga in Mabvuku in 1985. Control of the cooperatives became a challenge, resulting in the city making radical changes on how cooperatives operate. Based on repeated challenges with housing cooperatives over non-compliance with development standards, non-payment for city land, multiple allocations leading to project-level conflicts, and abuse of beneficiary resources the city adopted the policy of Housing Pay Schemes in 2016. It stopped allocating Municipal land to cooperatives. However, despite change of name the model is based on the same concept as cooperatives. However, major differences relate to financial management where the Director of the Department of Housing and Community Services and one member of a Scheme are signatories to the account. Direct city involvement including on procurement for land development is seen as helping with alignment with city land allocation transparency, equity, and project efficiency objectives. However, macro-economic instability is threatening viability of schemes with the city being accused of being bureaucratic and thus resulting in savings/contributions losing value.

3.4. Service Delivery and Consumer Perceptions

The ability of City of Harare to perform its service delivery functions is constrained by urbanisation pressure. As a result, the residents are generally dissatisfied with the services they get from the city (CHRA, 2022⁴; We Pay You Deliver Consortium, 2017⁵). The perceptions of residents on water and sanitation, health, education and roads, housing and land management were below 50% (CHRA, 2022). In 2020, the City of Harare's budget had targeted to reach a 75% customer satisfaction (City of Harare, 2020⁶). The customer satisfaction gaps experienced explain why the 2023 City budget had a focus on recapitalisation of service delivery operations

⁴ Combined Harare Residents Association (2022). City of Harare Customer (Household) Satisfaction Survey Report.

⁵ We Pay You Deliver Consortium. (2017). State of Service Delivery Report: Cities at the Crossroads. Volume 1. Harare: Danish Church Aid

⁶ City of Harare (2020). Budget Statement: 2020 Budget: New Hope: Towards A Smart City

under the theme ‘Back to Basics: Towards Sustainable Service Delivery’ (City of Harare, 2023)⁷. This shows that there is still more to be done to improve service delivery to meet the minimum standards expected by the residents. Residents of Harare expressed mixed satisfaction with educational facilities, with primary and secondary schools receiving relatively better ratings, but pre-school facilities and libraries facing significant dissatisfaction.

3.5. Public engagement and communication strategies

There are various ways in which residents can engage the City of Harare for accountability and participation in the management of the city’s affairs. Studies by CHRA (2022) and We Pay You Deliver Consortium (2017) portrayed residents’ willingness to engage with City of Harare and co-devise solutions. Available options include individuals directly engaging with the city, organized residents working with the city, residents selecting their representatives through elections, and accountability platforms where residents can approach institutions e.g. the ZRP, judiciary, and Commissions under S232 of the Constitution of Zimbabwe Amendment Number 20. The critical challenge is that the residents have struggled to find a lasting solution to the shortfall in their organised involvement in the affairs of their public institutions. Individually, residents have been trying to participate in the affairs of the city. Their participation is however limited to address day-to-day problem symptoms and not strategic problem identification and solution making. One example to note is that individual residents are resorting to drilling boreholes on their properties in order to address the community-wide water shortages. Residents are yet to devise ways of enhancing community coherent participation approaches.

There is positive impact to participation for organized residents. Residents have organised themselves into neighborhood watch committees, water point committees and residents’ associations tackling the issues of a particular suburb only or being part of bigger residents’ organisations like the Combined Harare Residents’ Associations or the Harare Residents’ Trust. However, the representation of all city residents in the associations is still minimal. In addition, the organized residents have focused more on the services that they need from the City of Harare, without much attention being paid on how they can effectively engage with the different structures of the City of Harare. The engagements have been patronising, seeking favors in public services, or alerting other agencies about the failures of the council, thus the residents’ engagement with the council has largely been peripheral, without much input into how the council operates and functions.

From the Council side, there is room to strengthen public engagement strategies. The current approaches used include feedback meetings with councillors, budget consultations, council departments meeting with residents, full council meetings where residents are invited as observes, newsletters and newspaper adverts, and open-door policy where residents can walk in and approach relevant council structures. These available strategies require strengthening to give room to residents to facilitate development and enhance effective participation. One of the strategies used by Council to engage residents is through the budget formulation process. This participation approach continues to face some gaps where residents feel that their participation is peripheral where decisions had already been made. Whilst residents are given options to object to the budget provisions after it has been advertised, City of Harare technical staff determines the validity of objections raised. The residents are not involved in the evaluation of the objection

⁷ City of Harare (2023). Budget Speech. 2023 Budget Back to Basics: Towards Sustainable Service Delivery

letters. This absence of an adjudication structure for the objections is a major source of conflict between the City of Harare and the residents in the budget formulation process. Similarly, this same process applies to several other council adverts for instance those guided by the Urban Councils Act and Regional and Town Country Planning Act on town planning issues. Overall, it can be noted that there is more emphasis on upward accountability and not local accountability. Another approach City of Harare facilitates residents' participation is through the departments of council. Heads of departments and council managers occasionally facilitate engagements with different interest groups. For example, the City Health department engages residents' leaders when they seek help with community mobilization.

3.6. Public Safety and Security

Public safety and security is provided by the Zimbabwe Republic Police and Harare Municipal Police (HMP). Types of offenses HMP deals with are described fully in their by-laws. They include public nuisance, illegal transport operations such as pirating and toutting, illegal hawking and vending, environmental degradation and animal abuse, illegal food and meat selling, illegal shop operators, illegal parking and the use of unlicensed vehicles and unregulated construction and land-use violations. HMP deals with offenses while crimes are handled by ZRP. If the HMP encounters serious crimes, they refer them to the ZRP. HMP and ZRP sometimes have joint operations when they are confronting illegal public operations. An area of concern for HMP is that most residents do not have full knowledge of the by-laws, making it difficult for them to observe them. As a result, some offenses are difficult for residents to accept resulting in conflicts between residents and HMP officers. Another area of concern is staff establishment. The current staffing of HMP is 1287 against an establishment of 1599 police officers, creating a shortage of 272 officers. With ZIMSTAT's 2022 estimate population of 2 427 231 for Harare city, one HMP officer should serve 1886 people as guided by the standard benchmark of approximately 1:450. Using this benchmark, Harare city requires approximately 5394 officers.

In terms of crime occurrence the study established that in Harare Province Harare Central, Harare East, Harare South and Chitungwiza are the major hotspots of crime occurrence (see figure 3.13 and 3.14). The dominant types of crimes include Theft (35.3%), Assault (22.5%) Domestic Violence (9.31%), Material Damage of Property (3.82%), Fraud (1.68%), whereas the rest were below 0.01% thresholds.

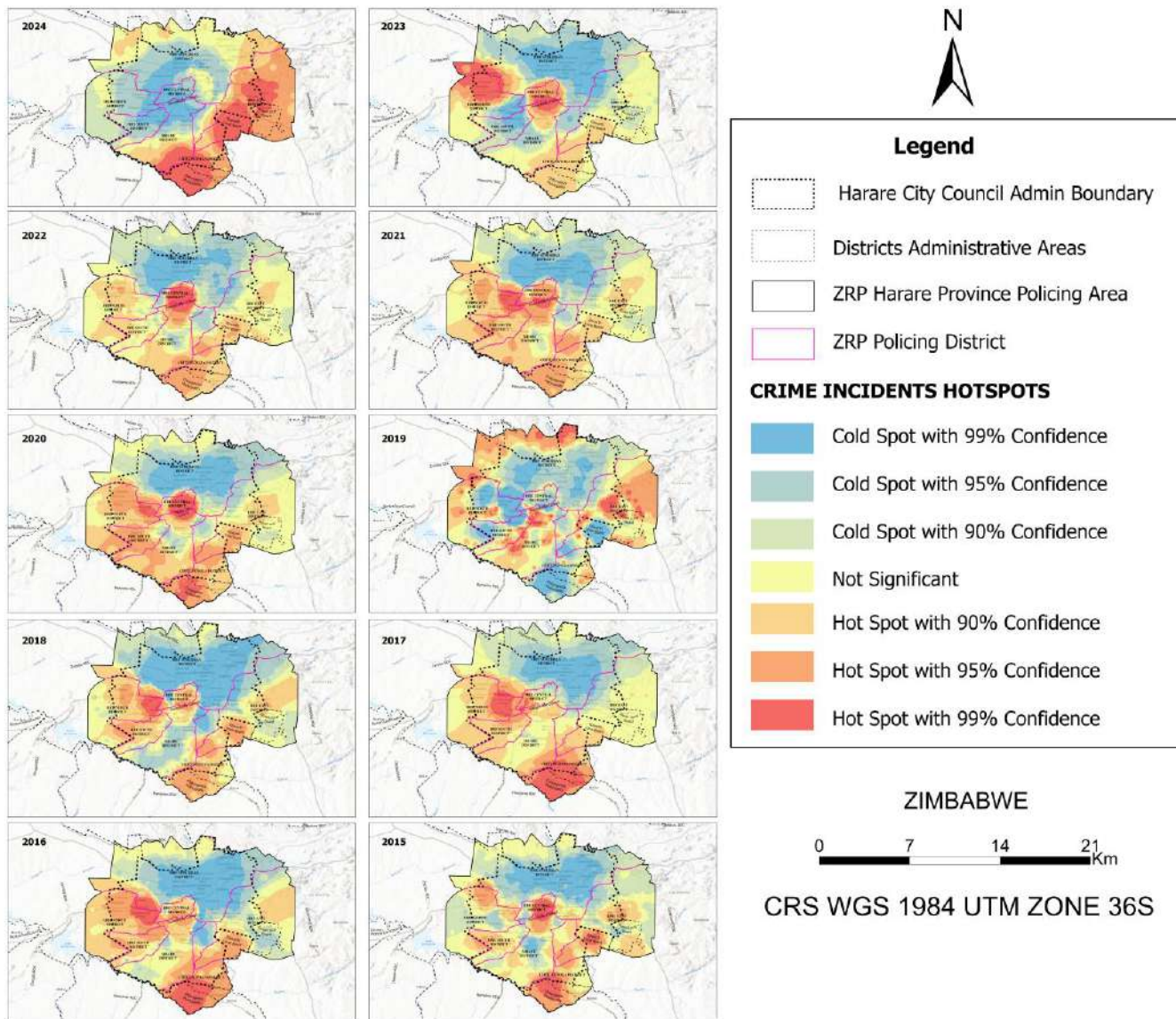


Figure 3.15: Spatio-temporal Patters of Crime Occurrence Incidences in Harare Province

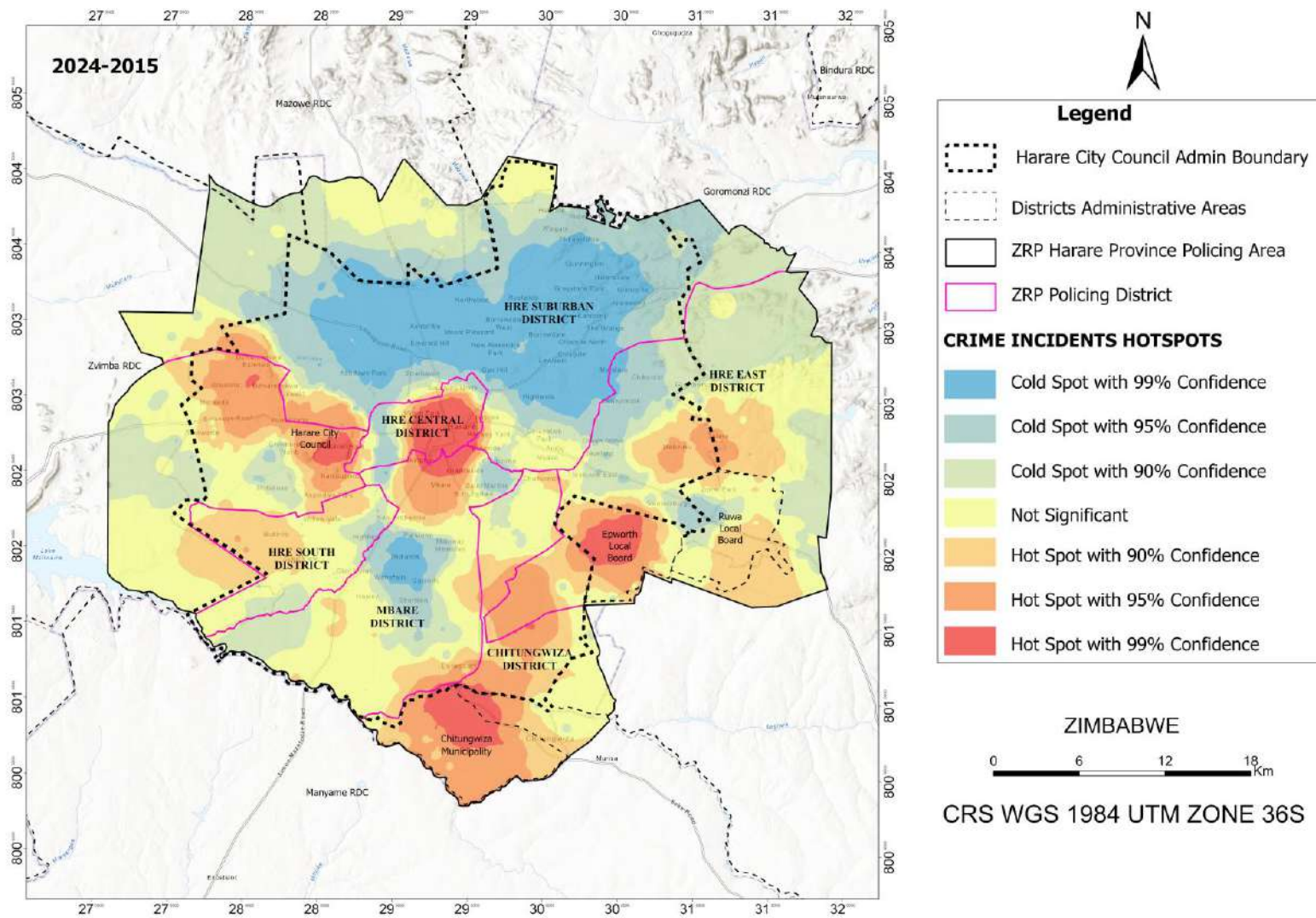


Figure 3.16: Spatio-temporal Patterns of Crime Occurrence Incidences in Harare Province

3.7. Summary of issues

The study observed the following:

- The city's population growth is plummeting but remains the most populous urban settlement in the province and nationally, household sizes are declining and lower than the national average of 6. The city's population structure is youthful and has a declining aging population.
- The city's 42 health facilities are not adequate and not performing well. City health data show an 80% drop in patient numbers over the 10 years to December 2024. The decline is a result of loss of service at council health facilities. The city has lost competent staff and is unable to stock its facilities with medicines and other essentials. Patients are resorting to private service providers which now make up 70% of the total health facilities in the city. The private health services are preferred because they enhance reach of services and complement coverage where city facilities are not available. Because of failing urban services and non-coverage in parts of the city cholera and typhoid for instance have become endemic to the city.
- For all practical purposes direct city housing delivery has halted. This explains why the waiting list doubled between 2014 and 2024 to the current 300,000 (some sources cite 500,000). Over the same period city delivery was 34 in 2014 and 212 in 2024. Much of the housing is being delivered from by the private sector and through informal housing. Total current housing stock is between 270,000 and 300,000. Homelessness is not yet a big issue in the city. With a housing stock estimated at 284,000, assuming there are 2 families with average household of 4 staying at each unit, approximately 2,272,000 people have accommodation. Those on the waiting list may simply be occupying indecent houses or are in informal housing. Provincial and city government estimate informal settlements of between 63 and 144 with 12 000 to 26 000 residents respectively.
- The city area is served by 104 secondary and 128 primary schools with 35% and 70% being public schools. Underserved areas (both primary and secondary schools) are in the city's north, east and southern sides. Tertiary institutions in the city are not decentralised. In addition, there are not enough vocational training centres (VTC) in the city. The available VTCs are underfunded and lack required faculty, tools and appropriate technologies.
- Regarding recreational facilities, the city has 146 different recreational facilities. Except for basketball courts, Harare's council run recreational facilities are in a poor state. For instance, 2 of 45 community halls, and 2 of 13 swimming pools are currently out of service over poor conditions.

4. CHAPTER 4: SPATIAL LAND USE CHARACTERISTICS

4.1. Review of Existing Statutory Plans

The major spatial statutory plans affecting the study and planning area include the Harare Combination Master Plan, City of Harare Local Development Plans, and master plans for surrounding local authorities. The thrust of this section is to highlight key major issues, changing requirements as well as determine a range of strategic planning considerations.

4.1.1. The Harare Combination Master Plan 1993-2013 [2024]

4.1.1.1. Background and Broad Provisions

In 1987 the Government of Zimbabwe established the Combination Authority (through Statutory Instrument 516 of 1983) to prepare the Harare Combination Master Plan. The Combination Authority consisted of eleven local planning authorities and two ministries namely: (1) Chitungwiza Town Council, (2) Goromonzi-Kubatana D.C., (3) Harava D.C., (4) Beatrice Harare R.C. (5) Norton Selous R.C., (6) Norton Selous R.C, (7) Banket-Trelawney R.C., (8) Harare West R.C., (9) Mazowe R.C., (10) Arturus R.C., (11) Bromley-Ruwa R.C., (12) City of Harare, (13) Minister of Natural Resources and Tourism and (14) Minister of Local Government, Rural and Urban Development. The Harare Combination Master Plan provided 57 proposals, 27 Policies and 9 thematic areas namely: Population, Infrastructure and Land Development Potential, Traffic and Transportation, Housing, Industry, Commercial Facilities, Employment, Community and Recreational Facilities, Environment, Statutory Plans, Administration and Finance (see Table 4.1). The issues arising from these thematic areas informed the Harare Combination Master Plan's 56 proposals. Table 4.1 provides an outline of thematic issues and their associated proposals.

Table 4.1: The Harare Combination Master Plan proposals review

	Thematic Area	Proposals	
1.	Population and Social	Proposals > 1-3; 40-42	
2.	Land Use Patterns	Proposals > 4-7	
3.	Water and Sewerage	Proposals > 8-11	
4.	Traffic and Transportation	Proposals > 12-23	
5.	Housing	Proposals > 24-28	
6.	Economy and Employment	Proposals > 29-33; 35-37	
7.	Informality	Proposals > 34	
8.	Agriculture /Farming	Proposals > 38-39	
9.	Conservation (Heritage properties, Natural Environment)	Proposals > 43-44; 51	
10.	Tourism	Proposals > 46-47	
11.	Environmental Impact Assessment and Degraded Land Restoration	Proposals > 48; 50	
12.	Pollution	Proposals > 52-53	
13.	Protected Areas	Proposals > 54	
14.	Statutory Plans	Proposals > 55	
15.	Development Control	Proposals > 56	
16.	Monitoring and Implementation	-	

4.1.1.2. Plan Performance Appraisal

The proposals of the Harare Combination Master Plan were not fully implemented (see table 4.2). There is scope for this current Master Plan to consider some of the proposals that were not implemented.

Table 4.2: Review of the Harare Combination Master Plan

Harare Combination Master Plan Appraisal			
Population	Thematic Appraisal		
Proposals	Implementation Status		Comment
	Yes	No	
Improve access to family planning services by planning to establish family planning and health centres.	✓		Integration of family planning services into primary healthcare clinics by council and government. Also, HCC permitted different partners to expand family planning services e.g. NGOs.
Identify suitable land for the development of centres to rehabilitate the aged and the disabled and screen the able-bodied for resettlement.	✓		The development of Dandaro Retirement Village was completed in 2000.
Infrastructure			
Maximizing land use in existing low-density areas by permitting a harmonious mix of technically feasible smaller subdivisions to enable the development of all types of residential layouts and housing types without devaluating the environment	✓		Permitting cluster homes supported by the National Housing Policy (2012) and Zimbabwe National Human Settlements Policy (2020) etc.
Permit small agricultural productivity within and at the periphery of all urban areas. Liaise with Agritex, to meet the day-to-day needs of the city.	✓		In 2003, a Harare Declaration on Urban and Peri-Urban Agriculture was signed.
Speed up the servicing of land with high potential for urban development.	✓		Several suburbs developed e.g. Westgate, Ridgeway, Avondale West, Eastlea (expansion), Highlands (expansion), Greendale (expansion), Alexandria Park, Glen Lorne, Vainona. Chisipite expansion, Borrowdale West. Pomona, Budiriro (Phase 2), Glenview (Phase 3) etc.
Traffic and Transportation			
Develop an integrated traffic and transport system that serves all areas effectively			
Develop a traffic and transport system which provides for: highest practicable level of service; optimum operational efficiency, choice of mode of travel; economy for users and operators; convenience in use; safety in operation			
Provide transportation routes which form part of an efficient circulation and distribution system, each link fulfilling purpose as part of a planned hierarchy.	✓		Creation of One-way streets in the CBD (2011): Inez Terrace, Robert Mugabe Road, Leopold Takawira, Chinhoyi Street
Provide a road system that diverts Heavy Goods Vehicles and rural buses from the core of the Central Business District.			
Realign any existing main roads and proposed freeways that cut across built-up areas or pass over difficult terrain. If such re-alignment is possible, the former freeways should be cancelled.	✓		1. Expanding Forbes Road (2023) from Chitungwiza Road to Granville cemetery 2. Extension of Harare Drive in Houghton Park (2024) ERRP
Identify and develop sites for long distance bus interchanges, overnight parking of inter-urban, inter-regional and international heavy goods vehicles	✓		1. Road Port at 5th street (1995-1997) 2. Truck stop – Lochinvar Truck Stop, Aspindale Truck stop, Harare Truck Stop (Willowvale)
Commit adequate amounts of foreign currency on a regular basis to increase and maintain the motor vehicle fleet in the planning area.			
Urban transport buses that have outlived their usefulness must be replaced and at the same time the bus and minibus must be increased	✓		Increased minibuses are unregistered and are operating on illegal pick-up points in CBD
Provide and promote the use of integrated bicycle routes in urban areas, including the necessary grade separations at road intersections and rail crossings.			

Housing			
Land banking and servicing such land			Most of the land in Harare has been illegally occupied.
Private sector to have access to land for housing development	✓		
Development of new housing estates synchronised with provision of employment, commercial, social, and community facilities	✓		
Densification in low density housing areas	✓		Cluster development approaches adopted, and national government projects are evident
Local authority to identify and service sites for self-help housing development	✓		There are 73 pay-schemes with an estimated 70000 people.
Government and local authorities to provide houses, flats, and hostels for rental purposes for low-income groups	✓		
Computerize housing waiting lists	✓		
Residential mix	✓		
Multi-prong approach for the provision of housing for all sectors	✓		Housing provision models: Private Partnerships ii. Private individual participants iii. Credit financing from the government iv. Social housing v. Vertical development calls for investment in offsite infrastructure that will support densification - Cluster housing is mainly being developed in low density by individuals and private players
Industry and Employment			
Prevent the future expansion of noxious industry in the Mount Hampden area			
Designate some areas between Chitungwiza and Harare as high-tech, office parks, commercial, industrial, and free port development zones.	✓		
Insist that building plans and/or proposals use full development potential factors	✓		
Commercial Facilities			
Remove conflict between the informal and formal sectors. Designate sites (streets/roads) from where vendors can operate hygienically throughout the CBDs of urban centers of the planning area.	✓		Copacabana market stalls, Avondale flea market Street Markets: Park Street (weekends), Rezende & Robert Mugabe St.
Local authorities must tender or develop a full shopping center simultaneously with the development of housing.	✓		Aspindale Pick n Pay, Long Cheng Plaza, Madokero Mall
Provide local shopping centers within walking distance.	✓		Old suburbs boast shopping centers, while new settlements fall short.
Community and Recreational Facilities			
Easily accessible communal and social facilities throughout the planning area	✓		Accessible but in need of an upgrade
Provide health and educational facilities throughout the planning area to national standards	✓		
Upgrade Norton Hospital to a district hospital	✓		In 2018 the government took up the upgrading of Norton Hospital to a district hospital
Development of Mukuvisi and Manyame River corridors into the major residential recreational belt			
Develop a systemic program of open space and recreation in all low-cost housing areas			Several open spaces are located within the city, and these provide for open spaces and recreation
Environment			
Designate areas of outstanding natural beauty and natural habitat as protected areas, and where feasible create nature reserves and parks			
Contain urban sprawl with greenbelts			
Develop or permit the development of the Mukuvisi and Manyame River Corridors into a major residential recreational belt	✓ ;		
Local plans for the development of recreational facilities especially in high density areas which are backed by financial commitment.			
Introducing a refuse transfer station system at Golden Quarry in Harare in short term and incineration in the long term	✓		The establishment of the transfer station system took place at Golden Quarry. The Pomona landfill is also acknowledged

Within 5 years connect unsewered and sewer-able areas of Hatfield, Waterfalls and parts of Greendale into Firle works.	✓		The connections were done but Firle works is now facing challenges and is currently undergoing rehabilitation.
Introduced EIAs of major developments	✓		EMA Act was enacted
Conservation of river courses and water supply resources, introduction of buffers on major rivers.			Water sources in Harare are impinged with pollution, water is flowing downstream of Harare, to pollute Lake Chivero.
Continuous upgrading of public utilities			The City is facing service quantity and quality problems, with issues of pollution, rapid population growth, inadequate maintenance of utilities infrastructure, inadequate technologies and a poor institutional framework.
Strengthen agencies that deal with environmental pollution control	✓		Environment Management Act.
Uphold and enforce legislation measures relating to streambank cultivation.			
Statutory Plans			
Each member Local Authority to develop a development control policy to channel and guide development and effectively control advertisement and misuse of land.	✓		To date the city has prepared 60 local development and subject plans
Continuously monitor and review the combination master plan and prepare local plans:			Local Development Plans need to be reviewed every five years, however most Local Development Plans have not been reviewed.
Development of land between Airport, Harare and Chitungwiza			
Enterprise zones, simplified planning zones, airport zones, high-technology industrial sites, and office parks	✓		LDP 60 Enterprise Corridor was established and is operational.
CBD and Avenues	✓		The Avenues area had a Local Plan LP/10 which is now superseded. The City Center has an operative Local Plan (LP/22).
Mt Hampden Area	✓		Mt Hampden has an approved Local Development Plan No: 1
Overnight heavy goods parking sites in Harare			
Conservation Areas			Open Spaces were guided by Local Plan number 29, which has since been abandoned.

4.1.1.3. Development conformance Measurement

The proportion of conforming and non-conforming uses was quantified through development conformance measurement by testing whether and to what extent the operative zoning framework representing the Harare Combination Master Plan's intentions conform to the zoning framework's implementation outcomes. The Cohen's Kappa Coefficient of determination's errors of omission and commission was used to quantify the agreement between plan intention and outcomes (see Table 4.3). The Cohen's Kappa Coefficient determines errors of omission and commission based on the equation:

$$K = \frac{\text{Pr}(a) - \text{Pr}(e)}{1 - \text{Pr}(e)}$$

Where the value of Kappa is interpreted as:

Table 4.3: Conformance Measurement Interpretation table

Value of Kappa	Level of Agreement	% of Data that are reliable
0-20	None	0-4%
21-39	Minimal	4-15%
40-59	Weak	15-35%
60-79	Moderate	35-63%
80-90	Strong	64-81%
Above 90	Almost Perfect	82-100%

The planning intention for the 1993 Master plan as to create a structured urban settlement pattern for the City of Harare and the then Chitungwiza Town Council. It provided for commercial centres and nodes industrial zones, low density residential, medium density residential, high density residential, residential agricultural plots, flats zones (densification zones), cemetery sites, areas reserved from development and areas for institutional establishments (see figure 4.1 and 4.2). During its conception settlements such as Ruwa Local Board, Norton Town Council and Nyabira were controlled growth centres. It was assumed these centres would follow the growth point policy model of development. Epworth and Domboshava were predominantly rural areas. With the turn of the millennium major changes occurred, Domboshava has grown into a major urban informal settlement, much of Goromonzi Rural District Council Area has been developed into urban settlements and informal settlements, Ruwa, Epworth and Southern Areas in Manyame RDC have been developed as is the west and north-western boundary of Harare up-to Nyabira has been developed into urban settlements predominantly residential.

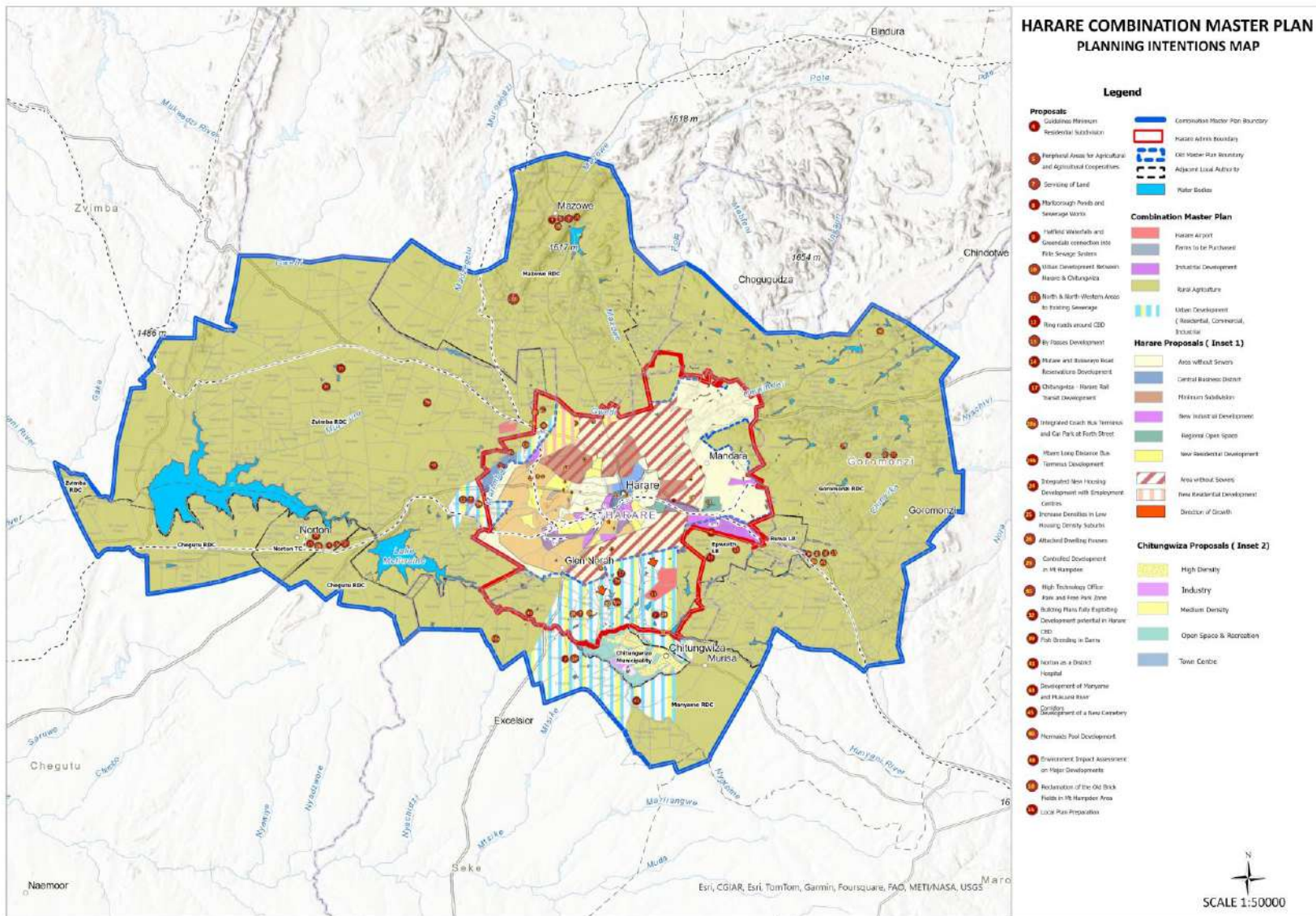


Figure 4.1: Planning intentions - 1993.

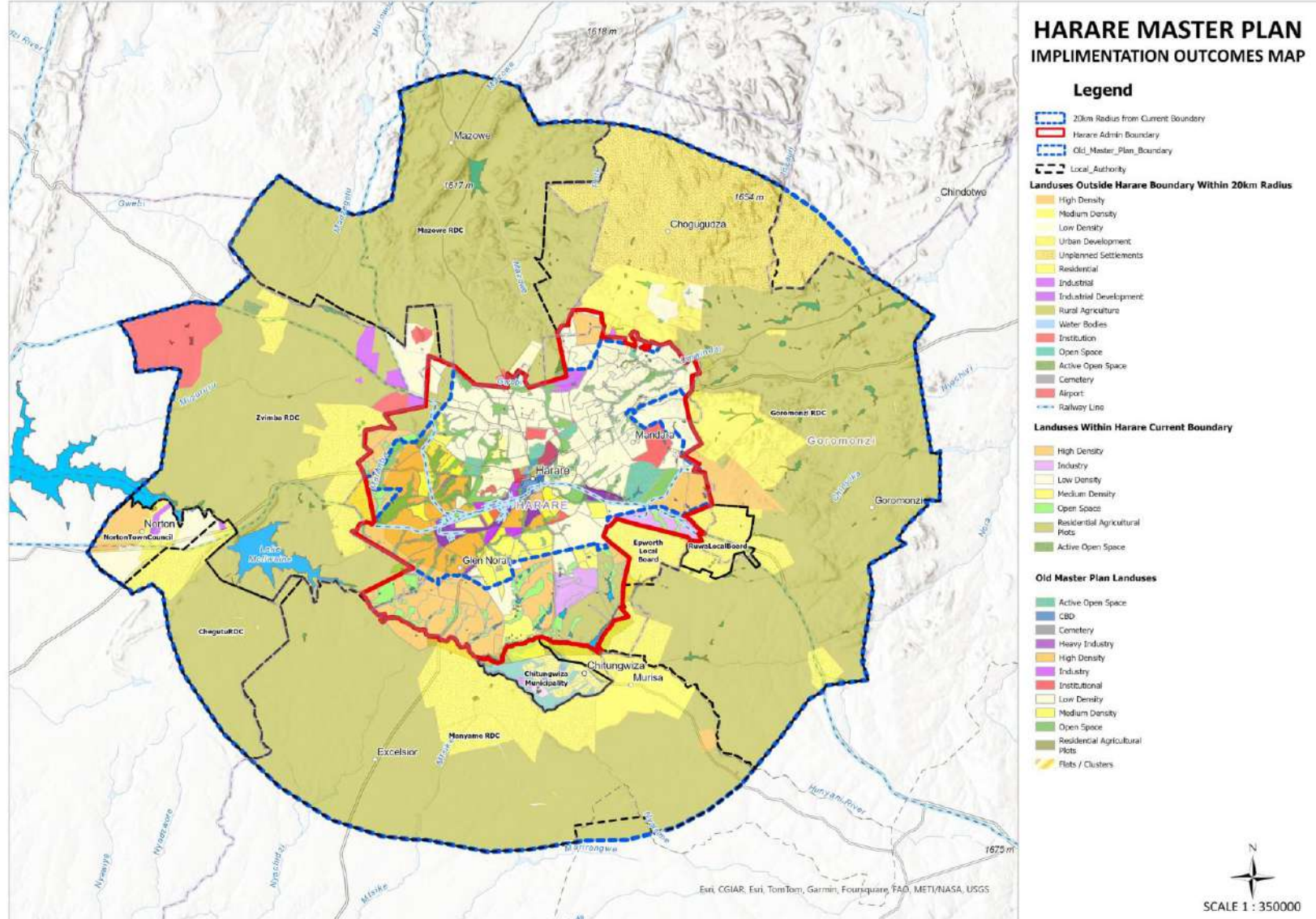


Figure 4.2: Implementation Outcomes - 2024

Table 4.4: Error Matrix for Development Conformance to Harare Combination Master Plan

Existing Land Use Developments										
Land Use Proposals	Commercial	High Density Residential	Medium Density	Low Density	Flats	Institutional	Industrial	Open Space	Total	%
Commercial	0	125	66	21	0	0	33	452	697	4.08
High Density Residential	235	0	446	89	6	34	68	2342	3220	18.84
Medium Density	104	234	0	174	21	18	4	1321	1876	10.97
Low Density	67	7	134	0	0	2	0	741	951	5.56
Flats	3	44	207	1428	0	0	0	14	1682	9.84
Institutional	3	13	8	14	0	0	0	429	467	2.73
Industrial	4	9	23	3	0	0	0	54	4101	23.99
Open Space	6	668	68	641	3	2371	344	0	4101	23.99
OC Total	422	1100	952	2370	30	2425	449	5353	17095	100.00
									Proportions of units expected to agree by chance	0.518
									Overall Conformance	0.423
									Cohen's Kappa	0.4705

This is assuming that:

1. Planning decisions are subjective,
2. Zoning categories are nominal (i.e., they do not have a natural order),
3. No planning permits are issued where zoning provisions are prohibitive or intended uses are not ordinarily permitted,
4. The conformance assessment follows a 40km radius from Harare CBD and,
5. Development is regulated and follows a prescribed framework.

Figure 4.1 illustrates the planning intentions arising from the 1993 Harare Combination Master Plan planning area. Whereas figure 4.2 illustrates the master plan implementation outcomes arising from the implementation of the 1993 Harare Combination Master Plan as of 2024 following a 40km radius. Table 4.4 illustrates the error matrix illustrating conformance of developments to land use proposals. The diagonal cells in the matrix represents conformance and the off-diagonal cells represents non-conformance. The study observed an overall conformance of 42.3%. The Cohen's Kappa Coefficient of determination was 0.4705. This implies that there was weak agreement between plan intentions and plan implementation outcomes for the area spanning City of Harare and adjacent local authorities. It is apparent that adjacent local authorities disregarded the 1993 Harare Combination Master Plan and established developments at the urban fringe exacerbating urban sprawl as opposed to containment and densification strategies prescribed by the 1993 Harare Combination Master Plan. The same has manifested in creation of housing schemes of varying densities without requisite infrastructure, with some obtaining services from the City of Harare.

4.2. Master Plans for Surrounding Local Authorities

4.2.1. Planning Issues affecting Harare and adjacent local authorities

The City of Harare is surrounded by several local authorities, each with its own administrative structure, economic activities, and development challenges. The dominant of Harare as the capital city and metropolitan city creates a structural dependence to the city by surrounding local authorities. Estimates suggests that more than half of the human population from adjacent local authorities spend the day in Harare. The three local authorities surrounding Harare which are Chitungwiza, Ruwa and Epworth currently get reticulated water on from City of Harare. However, this dependence on Harare city's water strains the City's already inadequate water supply. A review of draft Master Plans for Chitungwiza and Epworth shows that the local authorities are devising long-term strategies to secure independent potable water sources. For instance, Chitungwiza plans to harness water from Muda Dam, while Epworth and Ruwa is exploring options to tap into Muchekera Dam. By developing their independent raw water resources and treatment plans, these local authorities aim to achieve self-sufficiency and ensure reliable access to freshwater for their populations. For Harare's Master Plan implementation period, it is critical to note that water supply services to the 3 local authorities will be required.

There has been a rapid growth of Harare's peri-urban settlements. The governance of these settlements has been challenging. This expansion is placing strain on the already scarce resources in host authorities. Importantly, there is prospect for Harare City to leverage on infrastructure sharing and collaborative governance between the Council and adjoining LAs. By adopting a joint approach to infrastructure development, Harare city and surrounding local authorities can reduce costs and achieve economies of scale that would be unattainable alone. A notable example is Epworth's proposal for a co-managed sanitary landfill, which would not only augment existing landfills but also support the growing population in Harare's southern regions. This partnership would enable the sharing of resources, expertise, and financial burdens. Below is an overview of each local authority:

4.2.1.1. Chitungwiza Municipality

Chitungwiza Municipality is an urban local authority located at approximately 25 km southeast of Harare. The municipality has a population of over 350,000 people. It serves as a dormitory town for Harare, one of the largest high-density suburbs in Zimbabwe, with many residents commuting for work. The municipality has limited industrial activity but a growing small-to-medium enterprise (SME) sector. It struggles with water supply, sanitation, energy

and power, ICT issues, and road infrastructure. Health and education services are available but under pressure due to population growth.

Chitungwiza Municipality Master Plan

4.2.1.2. Manyame/Seke Rural District Council

Seke Rural District Council is a rural local authority. The local authority surrounds Chitungwiza and parts of southern Harare. Seke is situated to the south of Harare and is primarily a rural district. It is part of the larger Mashonaland East Province. Predominantly rural, with communal lands and resettlement areas. Agriculture-driven economy, with smallholder farming of maize, tobacco, and horticulture. Infrastructure challenges, particularly in road networks and water supply.

Manyame Rural District Council Master Plan

4.2.1.3. Ruwa Local Board

Ruwa Local Board is an urban local authority. It is located at approximately 22 km east of Harare along Mutare Road. It is one of the fastest-growing urban centers near Harare. It has a mix of residential, commercial, and industrial developments, attracting families due to its proximity to Harare. It hosts major companies, including agro-processing and manufacturing industries. The local authority is still developing water, sewer, and road infrastructure to match rapid expansion. Its major challenge is on managing rapid development while ensuring service delivery.

Ruwa Local Board Master Plan

4.2.1.4. Epworth Local Board

Epworth Local Board is an urban local authority arising from an informal settlement. The Local Authority is characterized by informal settlements and rapid population growth. It is located Southeast of Harare, near Msasa and predominantly a high-density suburb that has grown informally. Its population can be estimated over 200,000 people. It has been historically an informal settlement but now being regularized and has limited formal infrastructure. The major challenges are in infrastructure, housing, sanitation, roads, water, and refuse collection. Government has made efforts to improve housing and service delivery and efforts are being made to formalize land tenure and improve basic services.

Epworth Local Board Master Plan

4.2.1.5. Goromonzi Rural District Council

Goromonzi Rural District Council is a rural local authority located and North-East of Harare. It is predominantly rural with some peri-urban areas known for its agricultural activities, particularly horticulture and livestock farming. It has a mix of communal, resettlement, and commercial farming areas. Major crops include tobacco, maize, and horticultural produce.

Home to new housing developments catering to Harare's expansion. It also has large estates and private schools, such as Watershed College.

Goromonzi Rural District Council Master Plan

4.2.1.6. Mazowe Rural District Council

Mazowe Rural District Council is a rural local authority located North of Harare with three urban settlements ie. Christon Bank, Glendale, Concession and Mvurwi. Mazowe is a district known for its agricultural production, particularly tobacco and horticulture. The district is known for large-scale commercial agriculture, particularly citrus, maize, and tobacco. Mining activities, include gold mining especially in areas such as Jumbo Mine. It is rapidly urbanizing with new residential developments and home to educational institutions like Mazowe High School, Howard Mission School and Mazowe Veterinary College. Its major challenges include access to markets and infrastructure development.

Mazowe Rural District Council Master Plan

4.2.1.7. Zvimba Rural District Council

Zvimba Rural District Council is a rural local authority located West of Harare, including Murombedzi and Banket. Agriculture is a significant part of the local economy, with many residents engaged in farming. It has a mix of communal, resettlement, and commercial farming land. It is known for agriculture, especially maize and tobacco farming and home to former President Robert Mugabe's rural home in Kutama. The district has increasing residential developments as Harare expands westward.

Zvimba Rural District Council Master Plan

4.2.1.8. New City (Mt Hampden Development)

The New City is an emerging urban centre North of Harare, near Mazowe and Zvimba RDC. It planned to be Zimbabwe's new administrative capital and expected to house government offices, Parliament, and commercial districts. It has modern infrastructure projects, including roads and smart city designs and still in early stages of development.

New City (Mt Hampden Development)

4.2.1.9. Norton Town Council

Norton Town Council is an urban local authority and a small town that serves as a residential and commercial hub. It has a mix of urban and peri urban characteristics. It is located approximately 40 km west of Harare along the Harare-Bulawayo highway. It has a population of around 80 000 people. It is originally a small farming and industrial town, now a growing residential area and hosts some major industries. It faces water supply and infrastructure maintenance challenges and has a growing real estate development catering to middle-income earners. It is known for its proximity to the Harare-Bulawayo highway, facilitating trade and

transportation. Local governance focuses on service delivery, housing, and community development.

Norton Town Council Master Plan

These local authorities play critical roles in the broader Harare metropolitan economy. While urban areas like Chitungwiza, Ruwa, and Norton are expanding rapidly, rural districts such as Goromonzi and Mazowe remain vital agricultural hubs. The proposed New City in Mt Hampden represents the future of Zimbabwe's administrative planning. However, all these areas face common challenges, including infrastructure deficits, water shortages, and urban planning constraints.

4.2.2. Interdependencies and Resource Flows in the Harare Metropolitan Region

The Harare Metropolitan Province faces complex interdependencies between Harare City Council (HCC) and its dormitory towns (Chitungwiza, Ruwa, Epworth, Norton) and rural neighbors (Mazowe, Zvimba, Goromonzi RDCs). These relationships are strained by unplanned urban expansion, competing resource demands, and fragmented governance. Below is a structured analysis and proposed solutions.

4.2.2.1. Key Interdependencies and Resource Flows

Key interdependencies and resource flows do exist in land and water resources, Labor and Fiscal Flows among others and these are presented below:

1. Land Resources

Council	Flow Direction	Impact
Goromonzi/Mazowe/Zvimba RDCs	HCC → Rural (Mt. Hampden New City)	15,000+ hectares of farmland lost to urban sprawl (2015–2025)
Chitungwiza	HCC → Chitungwiza (informal sprawl)	68% of Chitungwiza's housing is informal, relying on HCC water/sewerage
Epworth	Epworth → HCC (labor migration)	78% of Epworth's workforce commutes to Harare daily
Ruwa	HCC → Ruwa (infrastructure strain)	Ruwa depends on HCC for 45% of its water via Harare's Morton Jaffray plant

2. Water Resources

Shared Infrastructure:

- HCC supplies 65% of Chitungwiza's water but recovers only 22% of costs due to non-payment.
- Ruwa's outdated sewer system (mechanical pumps) overloads Harare's waste treatment, causing pollution in Manyame River.

3. Labor and Fiscal Flows

- Labor: 320,000 daily commuters from dormitory towns strain HCC's transport systems.
- Fiscal Inequity:
HCC collects \$18M annually from cross-boundary rates but spends \$29M servicing dormitory towns.
- Norton subsidizes HCC via tobacco export fees but lacks infrastructure investment.

4. Impacts of Urban Expansion

a) Land Degradation

Mt. Hampden New City:

- i. Displaced 4,200 Mazowe farmers, reducing maize output by 18,000MT/year.
- ii. Deforestation increased flood risks in Zvimba (2024 floods cost \$7.2M).

b) Water Scarcity

- i. HCC's water demand (1.2B liters/day) exceeds supply (850M liters/day), forcing rationing in dormitory towns.
- ii. Epworth's Hoffmoor settlement lacks sewage systems, contaminating groundwater.

c) Labor Imbalance

- i. Rural-urban migration hollows out Mazowe/Zvimba's agricultural labor pool, lowering productivity by 25%.

d) Sustainable Resource Management Strategies

Unified Spatial Planning

Metropolitan Development Authority:

- i. Merge HCC, dormitory councils, and RDCs into a joint planning body.
- ii. Tool: Adopt Ruwa's GIS-based Master Plan (2024) to designate:
- iii. Urban growth boundaries (UGBs) around Mt. Hampden.
- iv. Agricultural protection zones in Mazowe/Zvimba.

5. Shared Infrastructure Investment

Project	Councils Involved	Funding Mechanism
Manyame River Cleanup	HCC, Chitungwiza, Ruwa	50% devolution funds + 50% World Bank loan
Mt. Hampden Greenbelt	HCC, Mazowe, Zvimba	Developer impact fees (\$2,500/ha)

6. Fiscal Equity Framework

- i. Cross-Boundary Revenue Pool:
- ii. HCC retains 60% of dormitory town rates; 40% redistributed to source councils.
- iii. Model: Epworth's title deed regularization program (2024) to boost local revenue.

7. Water-Energy-Food (WEF) Nexus

- i. HCC: Build solar-powered water recycling plants to reduce reliance on Mazowe Dam.
- ii. RDCs: Promote drip irrigation (e.g., Zvimba's 2023 pilot cut water use by 37%).

8. Labor Retention Programs

a) Rural Agro-Hubs:

- i. Mazowe/Zvimba to establish processing plants (funded by 5% tobacco levy) to retain youth labor.

9. Collaborative Governance Mechanisms

a) Harare Metropolitan Coordinating Committee (HMCC)

Composition:

- i. 2 reps from HCC, 1 each from dormitory towns/RDCs, 1 NGOs, 1 traditional leaders.

- ii. Mandate:
- iii. Approve all peri-urban land conversions.
- iv. Oversee shared infrastructure projects.

10. Legal Reforms

- i. Amend Urban Councils Act [Chapter 29:15] to:
- ii. Mandate joint master plans (per Ruwa's 2024 framework).
- iii. Criminalize illegal settlements (align with Charera v Chitungwiza judgment).

11. Community-Led Monitoring

- i. Deploy "Placard Accountability" system (tested in Epworth):
- ii. Public dashboards at council offices showing resource allocation.

12. Implementation Roadmap

2025–2026:

- i. Establish HMCC; adopt UGBs for Mt. Hampden.
- ii. Launch Manyame cleanup with \$12M World Bank funding.

2027–2028:

- i. Scale WEF projects to 20 rural wards.
- ii. Regularize 15,000 informal stands in Chitungwiza/Epworth.

Further analysis of interdependencies and resource flows between Harare City Council and affiliated local authorities

13. Key Interdependencies

a. Land Resources

- i. Urban Expansion: Harare's growth into dormitory towns (Chitungwiza, Ruwa, Epworth, Norton) and the new city at Mt. Hampden drives conversion of rural land (Goromonzi, Mazowe, Zvimba) into residential/commercial zones.
- ii. Impact: Loss of agricultural land in rural districts threatens food security, while dormitory towns face overcrowding and informal settlements.

b. Water Resources

- i. Supply Chains: Harare relies on water from Mazowe Dam and Manyame River, shared with Mazowe and Zvimba. Dormitory towns depend on Harare's overloaded water infrastructure.
- ii. Impact: Over-extraction depletes rural water sources, while urban areas face shortages and contamination from aging infrastructure.

c. Labor Resources

- i. Migration: Rural-to-urban migration from Mazowe and Zvimba to Harare and dormitory towns drains rural labor, straining agriculture.
- ii. Impact: Urban areas gain cheap labor but face pressure on housing and services; rural areas suffer productivity declines.

14. Resource Flows and Development Outcomes

a. Urban Areas (Harare and Dormitory Towns)

- i. Positive: Economic growth, job creation, and infrastructure development.

- ii. Negative: Overcrowding, service strain (e.g., water, waste management), and environmental degradation.
- b. Rural Areas (Mazowe, Zvimba)
 - i. Positive: Remittances from urban migrants; market access for agricultural goods.
 - ii. Negative: Land fragmentation, water scarcity, and labor shortages undermining rural livelihoods.
- c. Special Considerations for New City at Mt. Hampden and Surrounding Areas
 - i. Opportunity: Decongests Harare but risks replicating sprawl patterns, encroaching on Mazowe's fertile land.
The development of the new city in Mt. Hampden requires special attention to mitigate its impact on Mazowe and Zvimba Rural District Councils:
 - ii. Land Acquisition: Ensure transparent negotiations and fair compensation for displaced communities.
 - iii. Water Supply: Secure alternative water sources for rural areas affected by increased demand.
 - iv. Environmental Impact Assessments (EIAs): Conduct thorough EIAs before construction to minimize ecological damage.
 - v. Community Engagement: Involve local leaders and residents in planning to address their concerns and aspirations.

15. Proposed Sustainable Resource Management Strategies

a) Integrated Regional Land-Use Planning

- i. Action: Establish a Greater Harare Metropolitan Authority to coordinate zoning across urban and rural councils.
- ii. Tools:
 - GIS mapping to designate growth corridors, agricultural buffers, and conservation zones.
 - Strict enforcement against illegal settlements in ecologically sensitive areas (e.g., wetlands).

b) Equitable Water Governance

- i. Action: Create a Regional Water Trust to manage shared water resources.
- ii. Tools:
 - Invest in wastewater recycling plants in Harare to reduce pollution.
 - Drill boreholes in rural areas with solar pumps to offset urban dependency.

c) Labor Retention and Rural Development

- i. Action: Launch Rural Agro-Industrial Hubs in Mazowe and Zvimba.
- ii. Tools:
 - Subsidies for irrigation technology and agro-processing cooperatives.
 - Mobile job fairs linking rural workers to seasonal urban opportunities without permanent migration.

d) Transit-Oriented Development (TOD)

- i. Action: Prioritize public transport (e.g., BRT systems) linking Harare to dormitory towns and Mt. Hampden.
- ii. Tools:
 - Mixed-use zoning around transit nodes to curb sprawl.

- Pedestrian infrastructure to reduce reliance on private vehicles.

e) Circular Economy Partnerships

i. Action: Foster urban-rural waste-to-resource loops.

ii. Tools:

- Compost organic waste from Harare for rural fertilizer.
- Incentivize urban markets to source produce directly from Mazowe/Zvimba farmers.

16. Collaborative Governance Mechanisms

- a) Joint Technical Committees: Regular meetings between Harare, dormitory towns, and rural councils to align budgets and policies.
- b) Resource-Sharing Agreements: Formalize water and land quotas via binding memoranda (e.g., Mazowe Dam allocation caps).
- c) Community Land Trusts: Empower rural communities to lease land for urban expansion while retaining ownership.
- d) Data-Driven Monitoring: Shared digital platforms for real-time tracking of water use, land changes, and migration trends.
- e) Joint Planning Committees
 - i. Description: Form committees comprising representatives from HCC, dormitory town councils, and rural district councils.
 - ii. Purpose: Coordinate decisions on land use, water allocation, infrastructure development, and environmental protection.
- f) Knowledge Sharing Platforms
 - i. Description: Create forums for exchanging best practices in resource management.
 - ii. Purpose: Enhance capacity building and foster mutual understanding among stakeholders.
- g) Revenue-Sharing Agreements
 - i. Description: Agree on mechanisms for sharing proceeds from resource exploitation (e.g., water fees, land leases).
 - ii. Purpose: Ensure fair compensation for rural councils' contributions to urban growth.
- h) Conflict Resolution Frameworks
 - i. Description: Develop protocols for addressing disputes over resource usage.
 - ii. Purpose: Maintain harmonious relations and avoid escalation of tensions.
- i) Public Participation Initiatives
 - i. Description: Engage communities in decision-making processes through workshops and consultations.
 - ii. Purpose: Build trust and ensure solutions align with local priorities.

17. Mitigating Challenges

- a) Funding: Leverage public-private partnerships (PPPs) for infrastructure and seek international climate finance.
- b) Political Buy-In: Advocate for national legislation mandating inter-council collaboration (e.g., amended Urban Councils Act).
- c) Capacity Building: Train rural council staff in GIS and sustainable agriculture techniques.

18. Final Analysis and Recommendations

Expected Outcomes of Proposed Strategies

- a) For Harare City Council
 - i. Reduced strain on resources through efficient planning and collaboration.
 - ii. Enhanced reputation as a leader in sustainable urban development.
 - iii. Stronger ties with surrounding rural areas, fostering regional cohesion.
- b) For Dormitory Towns and Rural District Councils
 - i. Preservation of critical resources (land, water, labor) while benefiting from urban growth.
 - ii. Improved economic opportunities through partnerships with HCC.
 - iii. Greater resilience to climate change and other external shocks.
- c) Harare's dominance as Zimbabwe's economic hub necessitates institutionalizing metropolitan-scale governance. By unifying spatial plans, redistributing fiscal resources, and prioritizing WEF nexus projects, the region can balance urban growth with rural sustainability.
- d) This approach mirrors lessons from Ruwa's master plan and Epworth's regularization while addressing legal precedents like *Charera v Chitungwiza*. The result: a 15% reduction in water deficits and 9,000+ hectares of protected farmland by 2030
- e) Harare's expansion need not come at the expense of rural districts. By institutionalizing collaborative governance, prioritizing equitable resource sharing, and investing in rural resilience, the Greater Harare region can achieve inclusive growth that benefits urban and rural communities alike.
- f) The new city at Mt. Hampden should serve as a model of sustainable design, integrating green infrastructure and transit links to avoid past sprawl mistakes.

4.3. Operative Local Development Plans and Schemes

The study established that the city prepared Local Development Plans for 77.27% of its land area since 1993, only 22.73% still under schemes pre-1980 statutes (see Figure 4.3). However, 88% of the Local Development Plans require review. The general provisions and key policy thrusts are premised around suburban development, densification, economic corridor development and mixed-use development. Examples include the Greendale Local development Plan No.56 which emphasized densification and subdivision of ultra residential plots to a minimum of 2000sqm and 500sqm for clusters as well as economic corridor development along Mutare Road. The Mabelreign Local Development Plan No. 20, Borrowdale Local Development Plan No. 32, Enterprise Corridor Local Development Plan No.60 also engenders a general policy thrust toward mixed use development, densification and reduction of minimum subdivision sizes. Whereas, the Avondale Local Development Plan made general provisions and key policy thrusts around suburbanisation of commercial uses and mixed use development. The Tynwald Local Development Plan lifted minimum subdivision restrictions for residential-agricultural plots to allow for medium density development as well as create economic corridors.

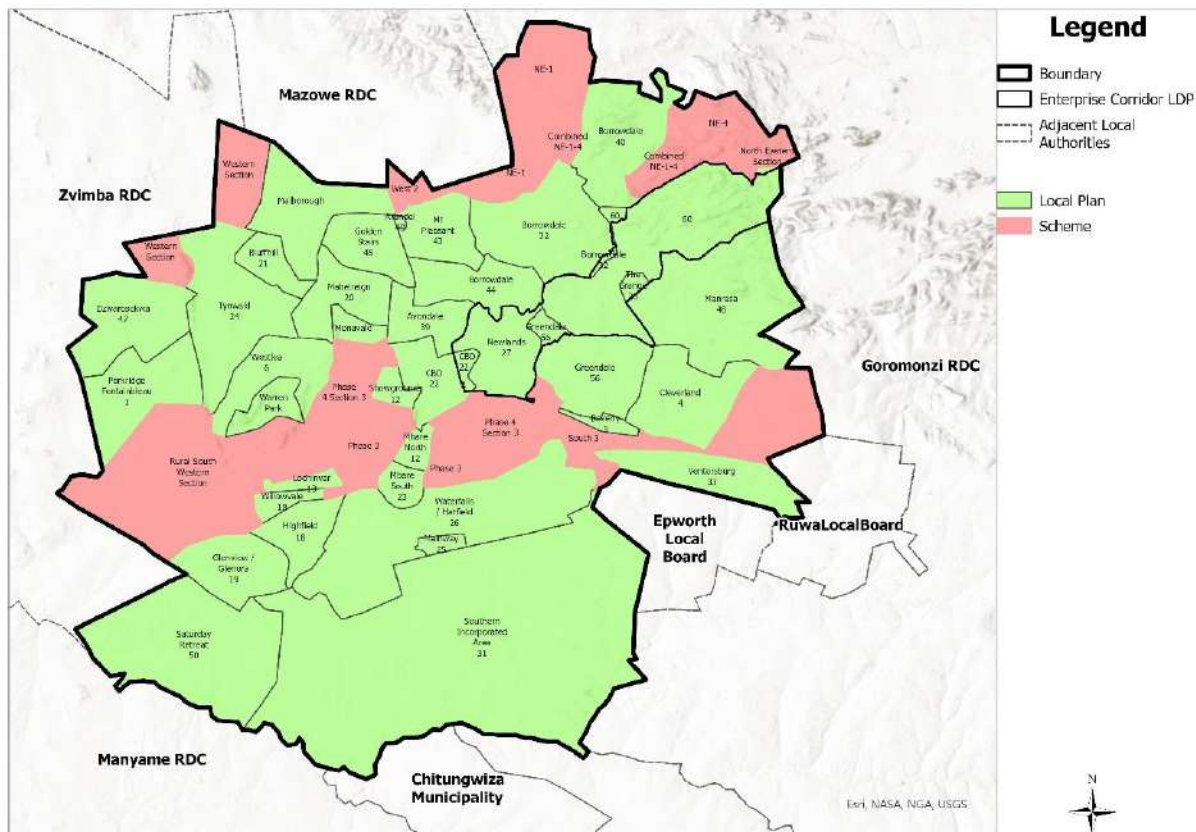


Figure 4.3: Area covered by operative Local Development Plans and Schemes

Source: City of Harare, Department of Urban Planning 2024

4.4. Existing Land Use Characteristics

The existing land uses for Harare exhibit a structured form and pattern following the historical legacy of the City. The north-west, north to the north-eastern part of the city is predominantly Low Density Residential (with the exception of Hatcliff High Density Area in the north). Whereas the southernmost central part of the city is medium density residential with some patches in the north-west and northern parts of the city. High density residential is predominant in the south and southern parts of the city. The central business district occupies the central part of the city with isolated commercial nodes (see figure 2.55). The industrial zones stratify the city along major historical industrial areas of Willowvale, Workington, Granite-side and Msasa. The fragmented greenspaces characterise city consistent with the city's hydrological regime. The city exhibit patterns a mono-centric zoning system.

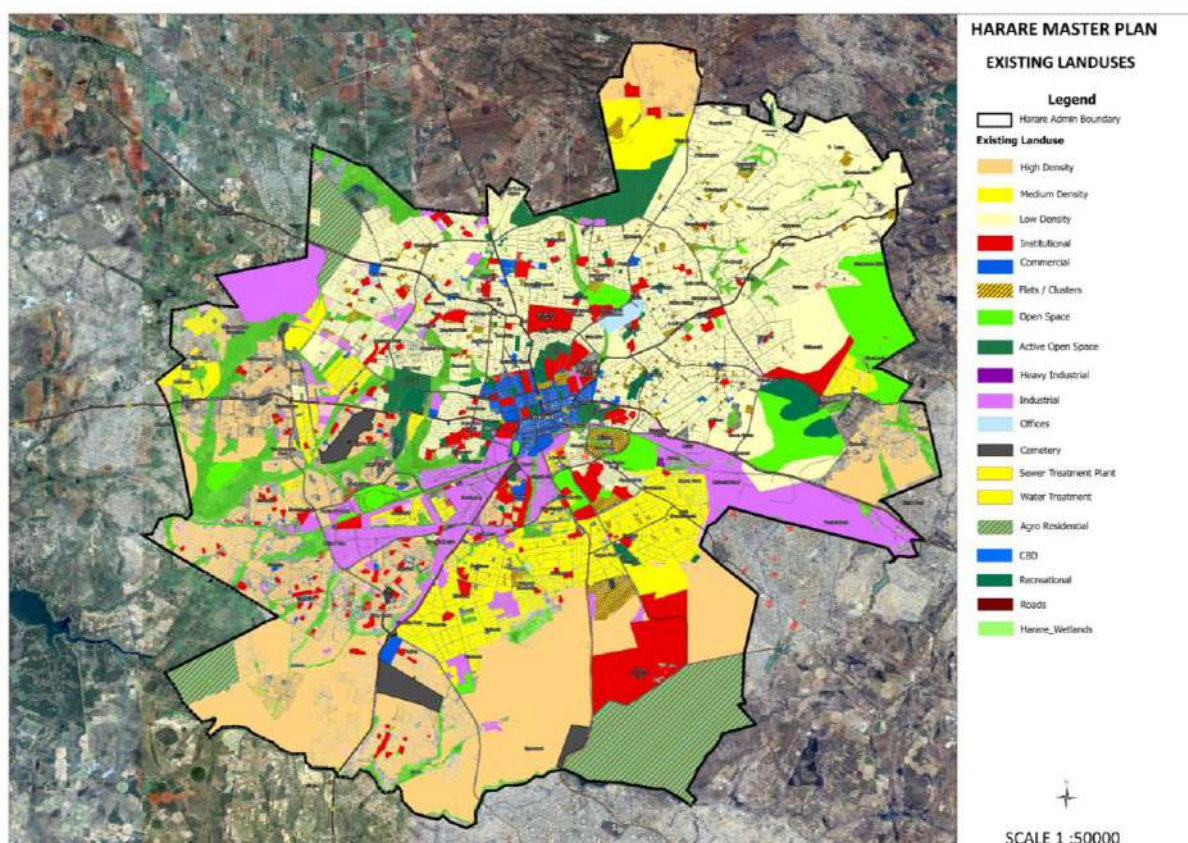


Figure 4.4: Existing Land Uses within City of Harare's Administrative Area

4.4.1. Land Use Schedule

The study established that Low Density Residential is the dominant land use in the city constituting 22.71% (19475.75 hectares) followed by High Density Residential constitutes 21.57% (18501.2 hectares) of the city. Industrial area constitutes 9.81% (8413.88 hectares), while Institutional constitutes 9.21% (7899.16 hectares), Medium Density Residential constitutes 8.69% (7455.41 hectares) followed by Open Space Reservations which constitutes 7.45% (6392.41 hectares) respectively. Another land use category to note is the area covered by Flats/Clusters which constitutes 3.93% (3368.7 hectares) in extent (see table 4.5). The proportion of Low-Density Residential coverage and the Flats/Clusters are indicative of the low levels of densification in the city.

Table 4.5: Land use schedule

	Land Use	Area (Ha)	Percentage
1	Active Open Space	4821.37	5.62
2	Agro Residential	5630.96	6.56
3	CBD	17.58	0.02
4	Cemetery	800.73	0.93
5	Commercial	840.14	0.98
6	Flats/Clusters	3368.7	3.93
7	Industrial	8413.88	9.81
8	High Density	18501.2	21.57
9	Institutional	7899.16	9.21
10	Medium Density	7455.41	8.69

11	Low Density	19475.75	22.71
12	Offices	296.18	0.35
13	Open Space	6392.41	7.45
14	Railway Reserve	895.3	1.04
15	Recreational	815.84	0.95
16	Sewage Treatment Plant	150.13	0.18
	Total	85774.74	100

4.4.2. Land Use Typologies on Residential Properties

The study established that 94.33% of residential properties surveyed had residential use only, while 0.573% were residential and office, 1.992% were residential and retail commercial, 0.463% were residential and horticulture, 0.916% had residential and poultry, 0.020% had other uses such as lodge, 0.070% were residential and church and 0.010% were residential and grinding mill (see figure 4.5). Despite the predominance of residential use only the range and variability of secondary uses operating on residential properties require conformance to municipal by-laws. It important to note the effect Statutory Instrument 216 of 1994 on residential properties.

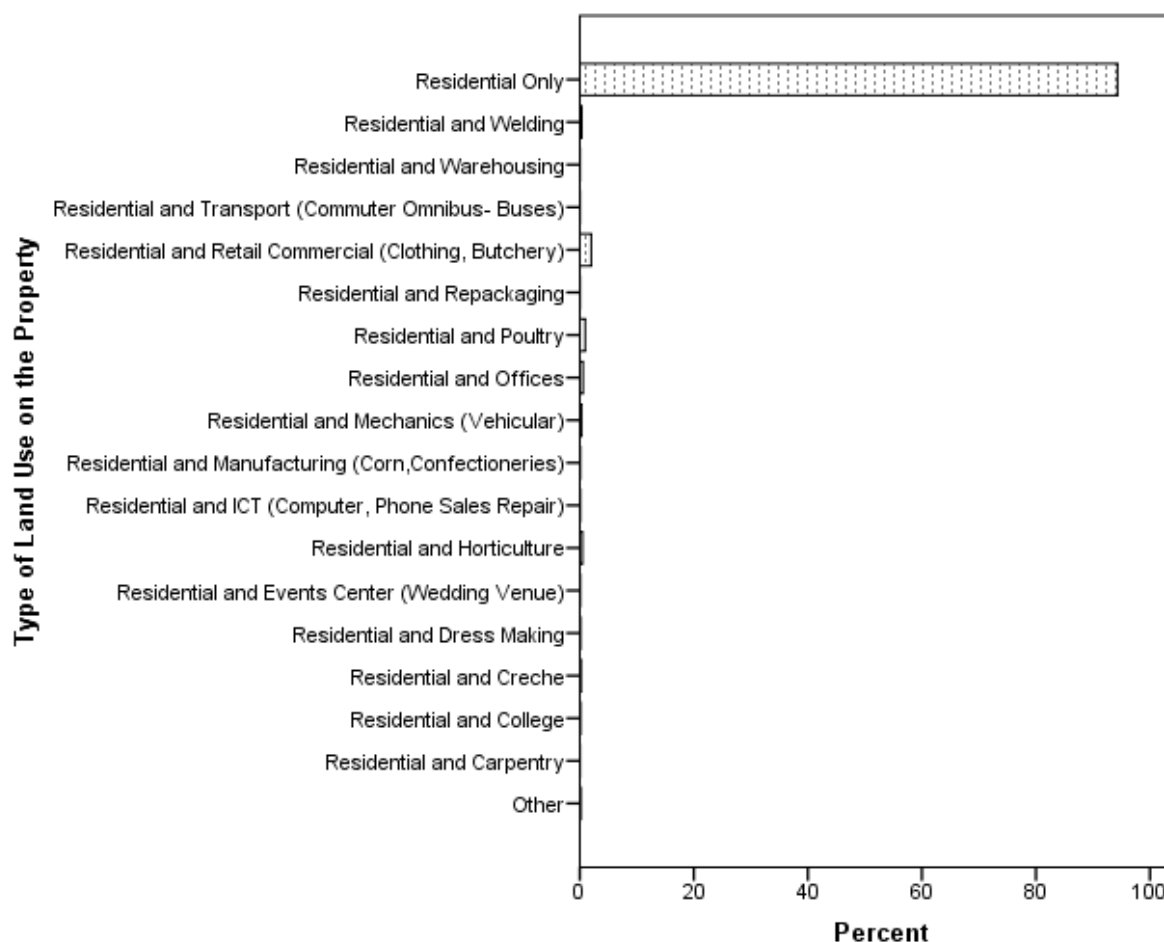


Figure 4.5: Land Use Typologies on Residential Properties

Source: Harare Master Plan Residential Survey 2024

4.4.3. Industrial land use typologies

The study established that the dominant industrial uses include agro-chemicals sales, agro-equipment sales, agro-processing and packaging, manufacturing, fuel storage distribution and sales, mining equipment retail, motor vehicle fitment and sales, motor vehicle sales, shops, trucking and logistics and warehouses. The major industrial areas identified include Pomona, Graniteside, Workington, Willowvale, Msasa, Sunway City, Bluff Hill, among others. Figure 4.6 illustrates the distribution of industrial use zones and their land use typologies in Harare's major industrial zones.

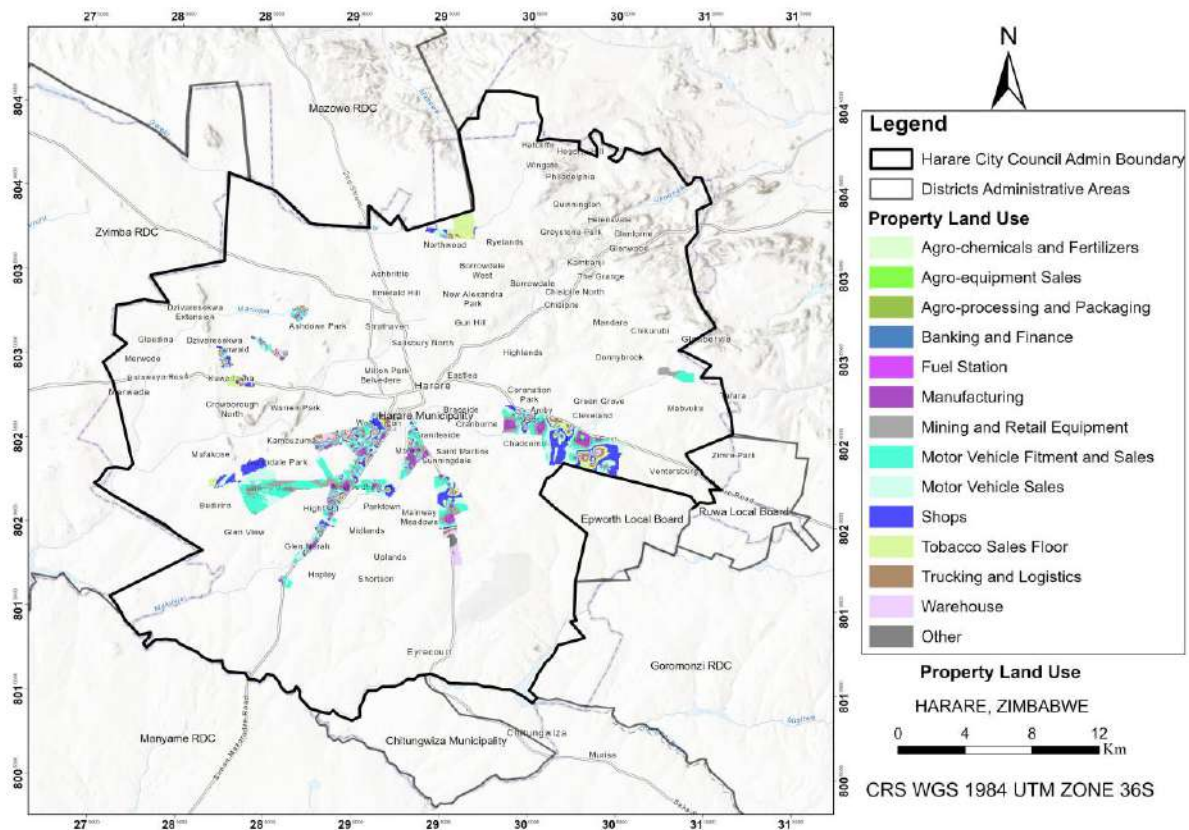


Figure 4.6: Industrial Land Use Typologies

4.4.4. Residential Building Typologies

4.4.4.1. Building Types

The study established that Single detached dwelling houses constitute 65.18% (dominant housing model), flats (apartments high-rise) 0.795%, Attached Dwelling House 11.49%, clusters 0.573%, cottage and main house under construction 6.248%, cottage 11.31%, cabin and main house under construction 1.177%, cabin 2.173% and other types of structures (main house offices, main house church etc) 1.056% (see figure 4.6).

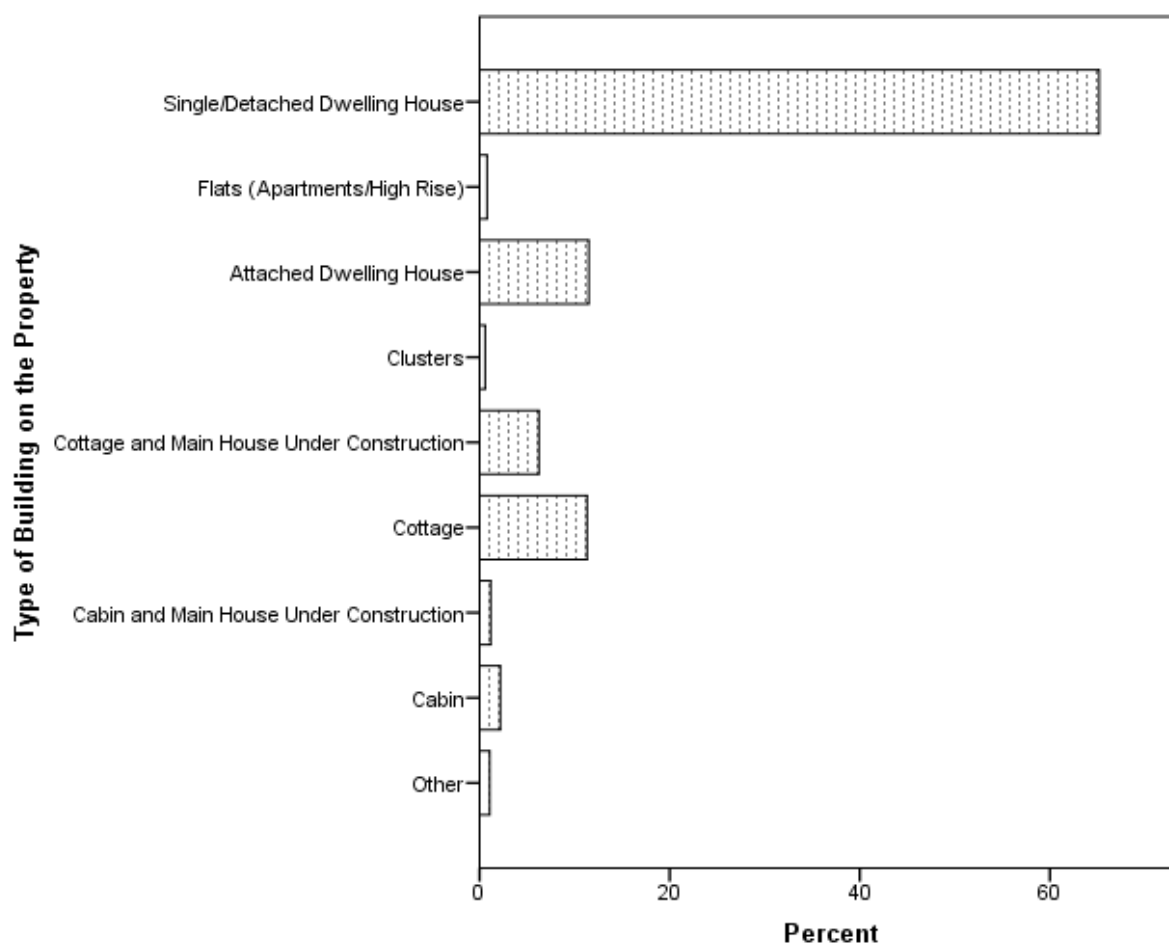


Figure 4.7: Land Use Typologies on Residential Properties

Source: Harare Master Plan Residential Survey 2024

In terms of other types of buildings on residential properties the study observed that there are cottages, churches, chicken run, creche, tuckshops, offices, garage and shops.

4.4.4.2. Number of Rooms for Residential Use

15.4% of the properties have at least 7 rooms for residential use, 11.6% had 5 rooms, 10.9% had 4 rooms, 10.6% had 3 rooms, 9.8% had 8 rooms, 7.7% had 2 rooms, 3.5% had 1 room, 3.4% had 10 rooms respectively. Whereas those above 10 rooms had <0.1% proportions.

4.4.5. Parking Space and Parking Requirements

4.4.5.1. Number of Car Per Household

22.7% have at least one car/vehicle parked on the property, 14.8% had 2 cars, 6.7% had 3 cars, 3% had 4 cars, 1.3% had 5 cars, while 1.1% had over 5 cars usually parked on their property. 24% park in a lock-up garage, 18.3% on onsite parking bays, 2.2% both garage and onsite parking bays, 1.4% on community parking garage and 1.2% on street parking.

4.4.5.2. Number of Parking Bays in Garage

73.8% had 1 parking bay per garage, 21.4% had 2 parking bays per garage, 1.9% had 3 parking bays, 1.4% had 4 parking bays, whereas above 5 parking bags constituted 0.3%.

4.4.5.3. Number of Parking Bays onsite

84.1% had 2 parking bays onsite, 8.5% have 1 parking bay, 2.1% have no onsite parking, 1.7% have 3 onsite parking bays, 1.2% have 4 onsite parking bays, while those with more than 4 onsite parking bays constitutes >0.7% respectively.

4.4.6. Change of Use

87.2% of the respondents do not want to change the use of their residential property, whereas 12.8% desire to change use. The use options preferred other than residential include 1.1% to residential clusters, 0.5% creche, 0.3% offices, 0.3% second dwelling house, 0.2% primary school, commercial retail 0.7%, 0.2% clinic or hospital, 0.2% industrial among others.

4.4.7. Shopping Patterns and Consumer Preferences

Majority of residents prefer to use neighbourhood shopping centres. 32.5% visit their shopping centre every day, 27.8% visit shopping centres twice a week, once a week 24%, Once a month 13.2% and 2.6% at uneven intervals or spontaneously. The preferred shops are mainly grocery shops or supermarkets i.e. OK (15.1%), Pic n Pay (10.1%), Spar (5.4%), Tuck Shops (11.8%), any open shop (4.8%) while others constitute (>0.1%). 72.8% visit neighbourhood shopping centres for low order goods and services, 17.2% for high order goods and services, whereas 10% for both high and low order goods and services. Figure 4.8 shows that majority of the population in the city either visit shopping centres daily, twice or once a week in terms of shopping frequency.

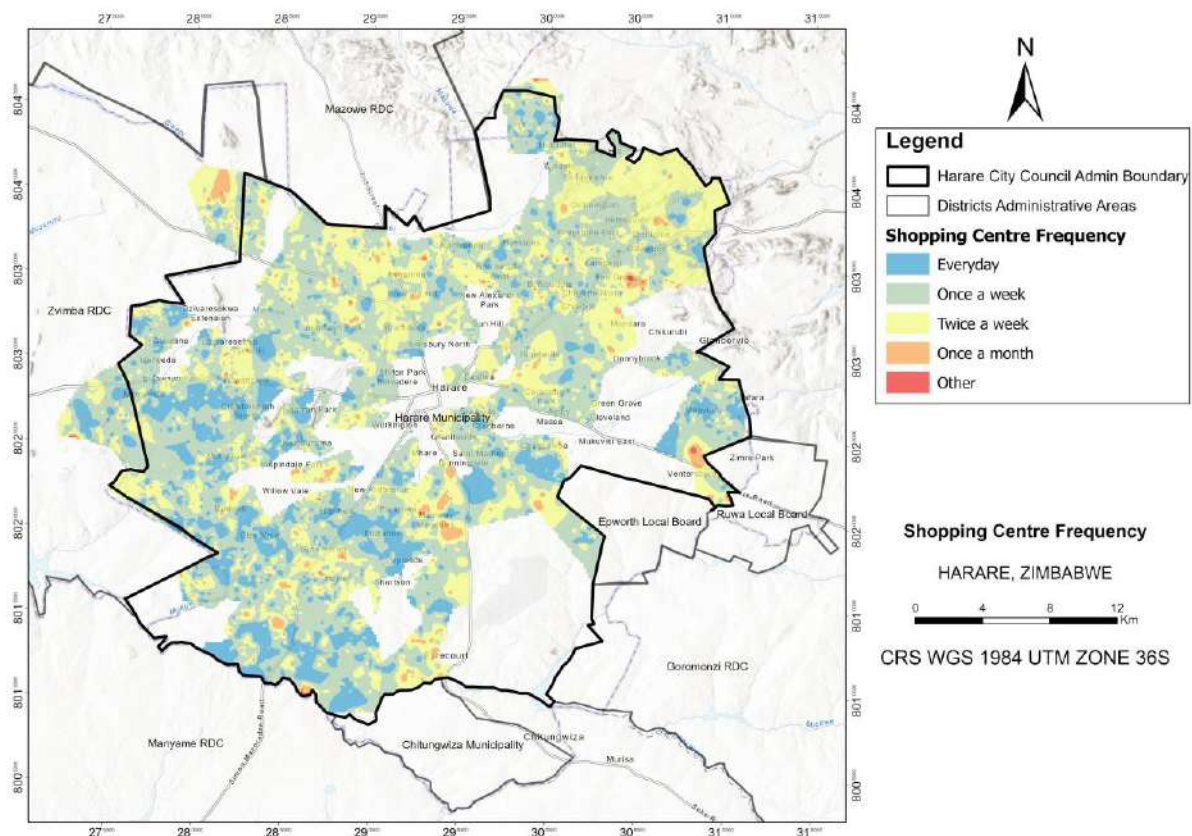


Figure 4.8: Spatial distribution of consumer behaviour and shopping frequency

4.4.7.1. Time Spent Shopping and Challenges

The average time spent shopping is 30 minutes (72.9%), 1 hour (20.7%) and 6.4% More than 1 hour. Common shopping challenges include longer distance from place of residence (2.3%), Fake products, Expired and Rotten Goods (0.9%), Local Currency Refusal (2.3%), Network (0.4%), No Adequate Parking Bays (2%), Noise Pollution (0.2), overcrowding (2%), Overpricing (12.3%), Poor Customer Care (1.5%), Poor Public utilities (Toilets and Water) (0.4%), Poor sanitation (1.5%), Poor Shopping facilities (3%), Rates and Change (4.9%), Shortage of Basic Commodities (2.5%), Street Beggars, Drunkards and Touts (0.4%), No Street lights (0.2%), Theft (1.9%), Traffic/Human Congestion and Pot Holes (1.5%), Vendors (0.4%), Violence of people and dogs (0.1%).

4.4.7.2. Shopping Centre Improvements

Desired shopping centres improvements include:

- Allowing Authorized Shops to Trade (50.8),
- Electricity Supply (0.4%)
- Employee Training (1.4%)
- Employment Creation (2.8%)
- Improve Network System (1.3%)
- More Public Utilities (1.6%)
- More Shops (9.7%)
- More Point of Sales (2.1%),
- Price Regulation (6.9%)
- Providing vending facilities (0.3%)
- Provision of Parking Bays (4.5%)
- Provision of Street and Tower Lights (0.7%)
- Removal of Vendors (0.3%)
- Security (2.1%)
- Use of Both foreign and local Currency (6.4%) and
- Waste Collection (0.6%).

4.4.7.3. Services Sufficiency and Improvements

63% of the respondents noted that services at shopping centres were sufficient, whereas 37% cited insufficiency. 78.2% noted that All Services should be improved, 9.9% required Shopping Facilities improvement, 1.6% Water Supply, 1.6% Garbage Collection, 1.8% Roads Infrastructure, Street Lights (0.2%), Security (0.2%), Price Control and Quality Control (1.8%), Electricity (0.2), Banking Sector (0.2%), Drainage Systems (0.1), Educational Facilities (0.2%), Electricity and Water Supply (0.4%), Health Facilities (0.2%), Infrastructure (0.4%), Parking Facilities (0.6%), Public Toilets (0.3%), Roads and Water Supply (0.4%), Sewer System (0.5%) and Transport (0.2%).

4.4.8. Land Development Indicators and Typologies

4.4.8.1. Change of Use Applications and Permits

The study examined key land development indicators to establish plan production, compliance to municipal by-laws and development thrusts. The Regional Town and Country Planning Act Chapter 29:12 section 40 and 43 stipulates that there shall be no change of use without a permit. Generally, over time there has been a reduction in town planning permits issued by special consent despite a spike in 2016 and 2017 respectively. The central region

constituting the area with a 5km radius from city centre has predominantly the highest number of change of use applications and permits issued between 2014 and 2017 (See figure 4.7). Overtime the western region had a constant number of special consent permits around 180 per year. Whereas, the eastern region had a constant decline in special consent applications between 2020 and 2024.

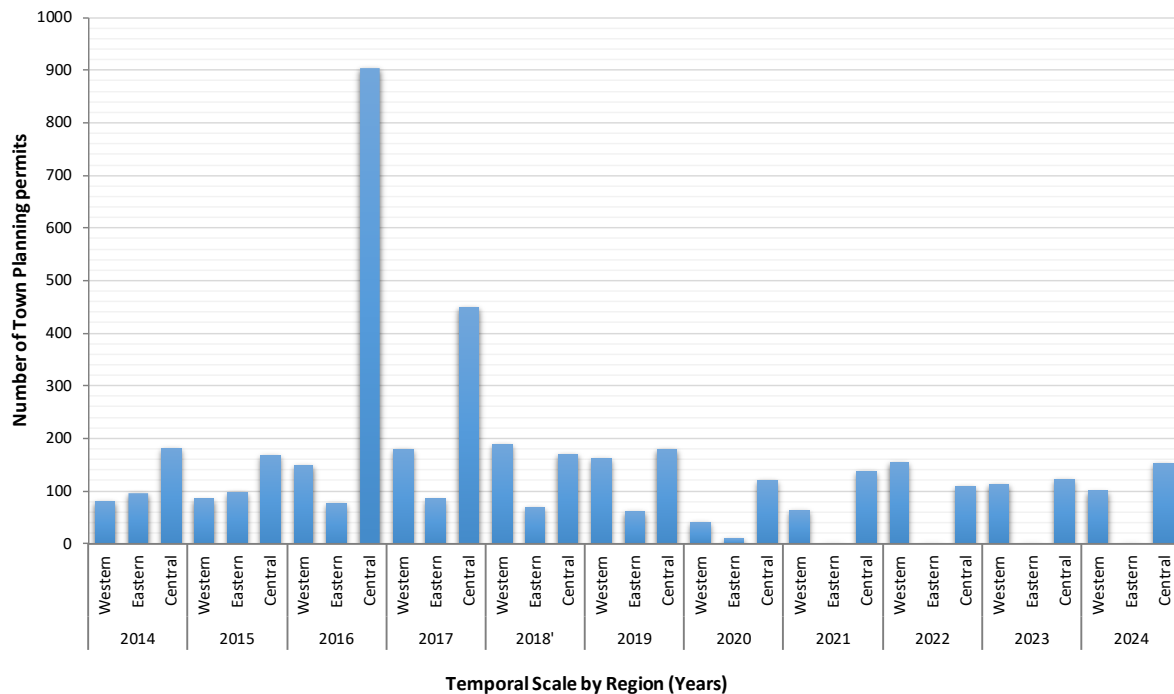
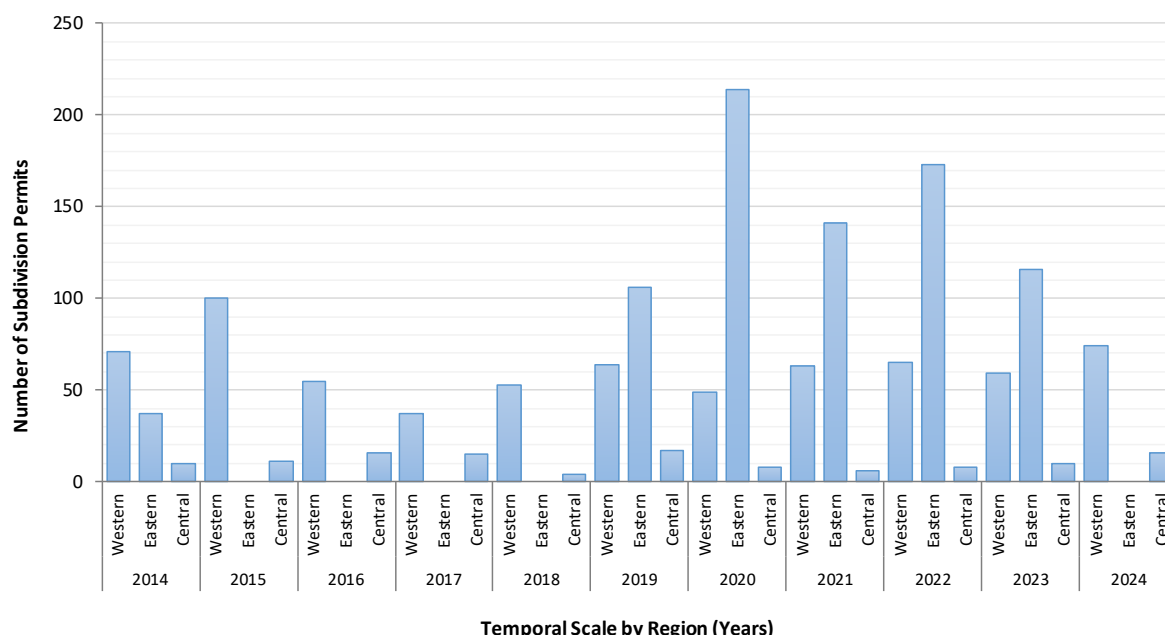


Figure 4.9: City of Harare Special Consent Application Trends by Year and Regions

Source: City of Harare, Department of Urban Planning, Planning Registers, 2024

4.4.8.2. Subdivision Applications and Permits

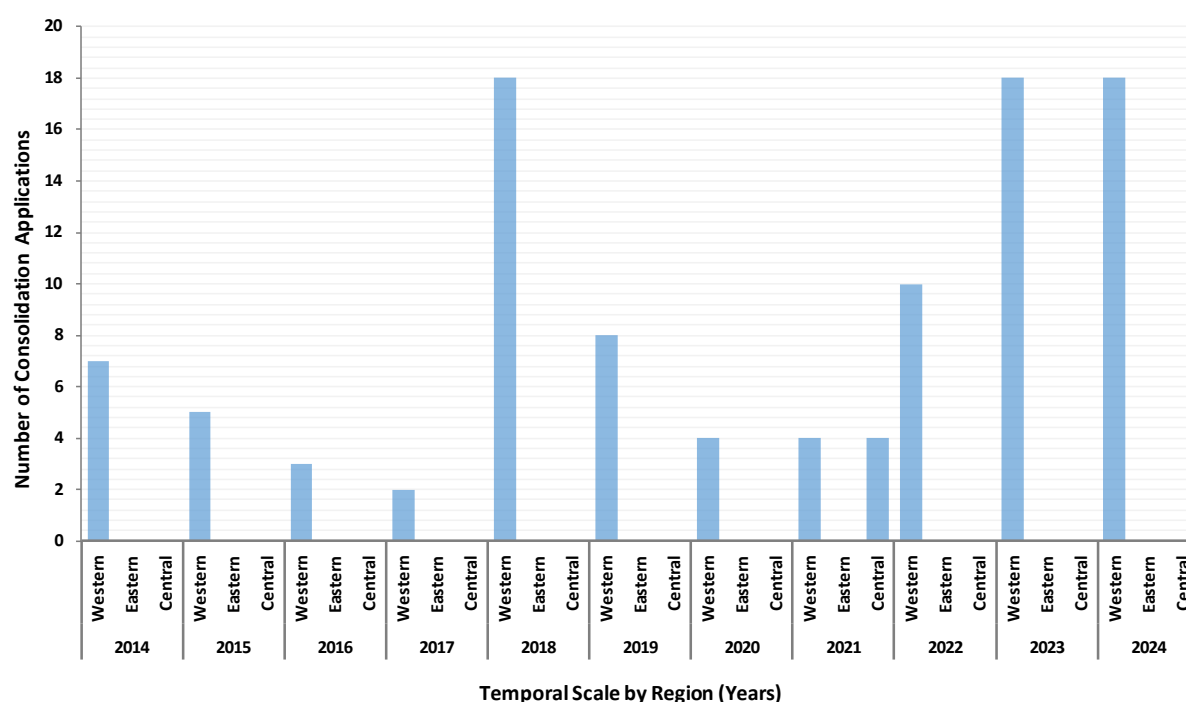
The number of subdivision permits processed over time is a useful stand supply and land development indicator. The Regional Town and Country Planning Act Chapter 29:12 section 40 and 43 stipulates that there shall be no subdivision without a permit. The study established that subdivision permits have been consistently high over the last 5 years (see figure 4.8). The highest number of subdivision permits were issued in the eastern region. The findings indicate increased subdivision of ultra low density residential into smaller subdivision sizes.



Temporal Scale by Region (Years)
Figure 4.10: City of Harare Subdivision Trends by Regions 2014-2024
Source: City of Harare, Department of Urban Planning, Planning Registers, 2024

4.4.8.3. Consolidation Permits Trends

Consolidation of properties is undertaken to increase area available for development and can be a useful indicator for large scale development projects being undertaken in the city. The study established that the western region has a constantly high number of consolidation permits issued over 10years (See figure 4.9). The Eastern region is dormant on consolidation applications and permits perhaps a result of their heritage of extremely ultra-low density character with stand sizes above 4000 square meters which does not require consolidation.



Temporal Scale by Region (Years)
Figure 4.11: City of Harare Consolidation trends by Regions 2014-2024
Source: City of Harare, Department of Urban Planning, Planning Registers, 2024

4.4.8.4. Clusters Permits

Cluster housing model is a type of landed houses that are built in a complex and consist of more housing units of a uniform shape and size and does not have a fence on the front. The model encourages neighborhood development and a greater sense of community can result from the cluster development design, because homes are typically placed closer together. Clusters are densification model of development and seemingly lost cost and a preferred model by developers as opposed flats high rise. In Harare clusters have been trending and at the centre of debate due to inadequate infrastructure upgrades and not in my backyard syndrome i.e detasted for conflating the low density – high density dychotomy. Over time cluster permits have been on a steady decline from a high of 179 permits in 2014, 38 permits in 2017, 122 permits in 2022 and 78 permits in 2024 (see figure 4.10).

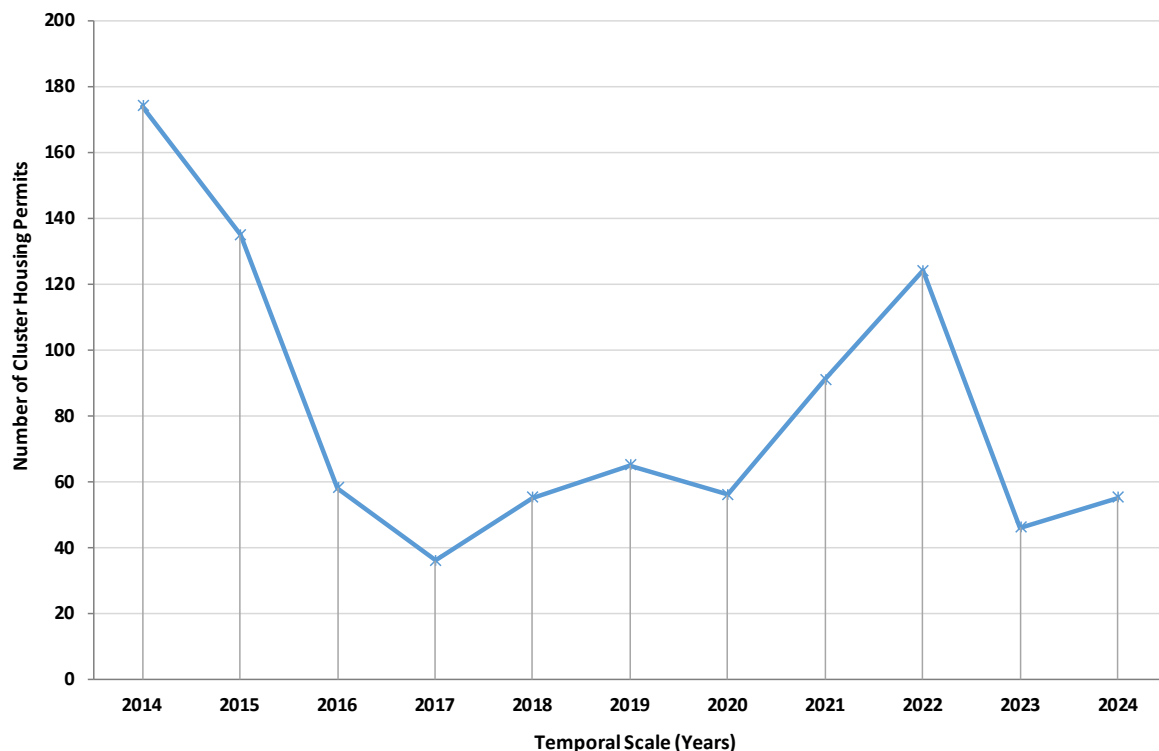


Figure 4.12: City of Harare Cluster Housing Application Trends 2014-2024

Source: City of Harare, Department of Urban Planning, Planning Registers, 2024

4.4.8.5. Building Plan Approvals

The number of building plans approved is a useful indicator for development and compliance to municipal by-laws and building codes. Building plan approvals serve as a crucial reference point for ensuring legal compliance and maintaining construction quality and safety during the construction process and beyond. The study observed that overtime building plan approval records indicates an exponential growth trajectory from 150 in 2014 to over 1900 in 2024 (see figure 4.11).

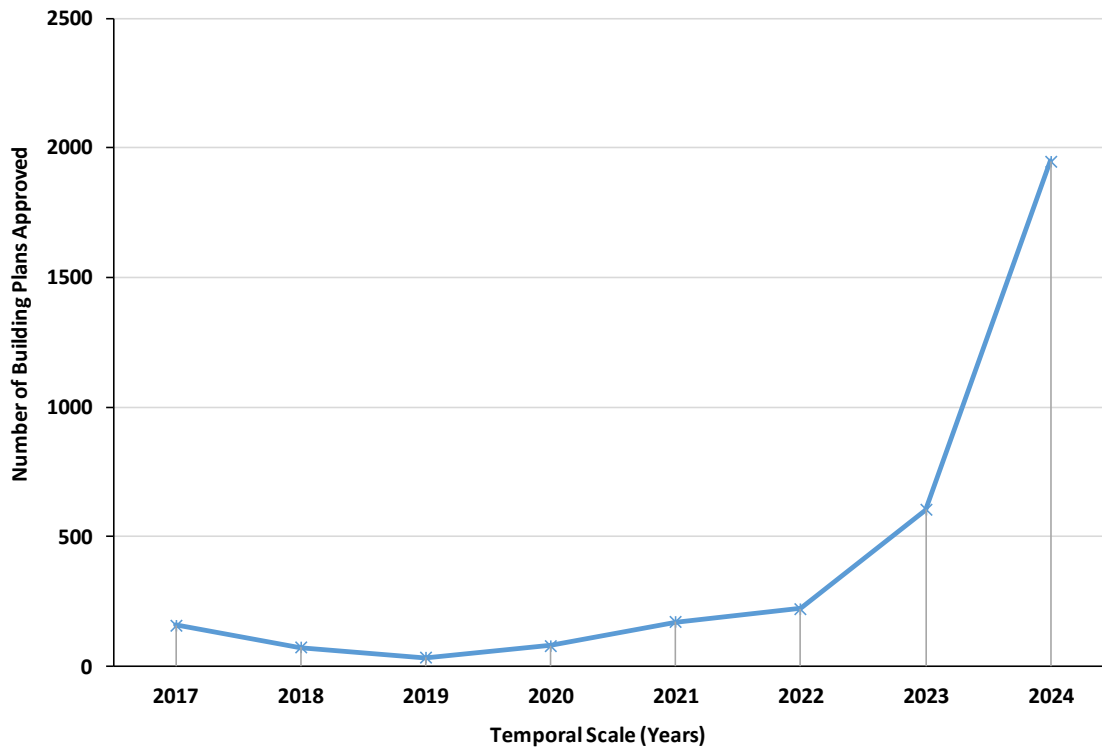


Figure 4.13: City of Harare Building Plan Approvals 2017-2024

Source: City of Harare, Department of Urban Planning, Building Inspectorate, 2024

4.5. Harare Urban Morphology and Growth Modelling

4.5.1. Urban Morphology

The physical structure and layout of the city is structured following street networks generating interesting urban tissue configuration, building footprints and building characteristics respecting natural features. The building footprints for Harare follow sector and concentric patterns structured along major roads and natural features. Figure 4.12 illustrates the city's morphology. The spatial structure of the city is defined by a radial road network centered on the central business district (CBD), with industrial areas located to the east and south. Low-density residential areas, with stand sizes of 1,000 m² or more, dominate the northern and northeastern parts of the city. High-density residential areas, with stand sizes of about 300 m², are found in the extreme east, south, southwest, and west, while medium-density residential areas with stand sizes ranging from 800 to 1,000 m², are concentrated in the city's southern parts and western parts.



Figure 4.14: Harare's urban morphology.

4.5.2. Land Use Land Cover Change

Harare Metropolitan Area is undergoing profound land surface transformation due to conversion of natural areas like forests and wetlands and agricultural landscapes into urban development, driven by population growth, leading to significant impacts on the ecosystem including habitat loss, increased stormwater runoff, and disruption of wildlife corridors. Urban built-up area has been growing exponentially between 1973 and 2023 (see Figure 4.13 and 4.14), while tree cover has been on a decline and bare land on the rise exacerbating the city's exposure to dust particulates and erosion.

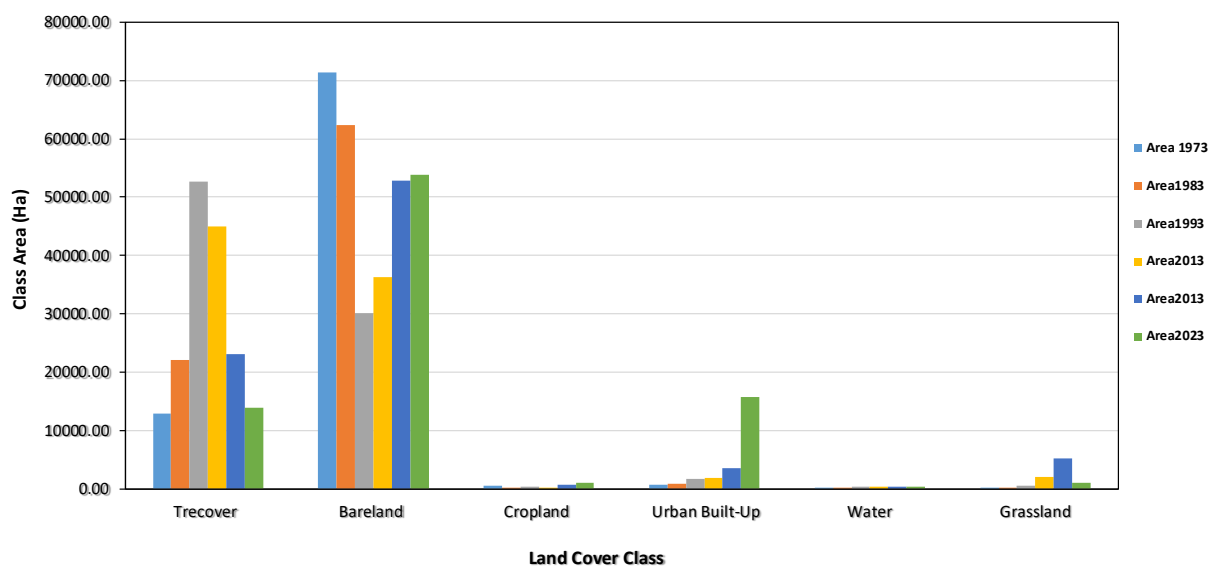


Figure 4.15: Land Use / Land Cover Trends

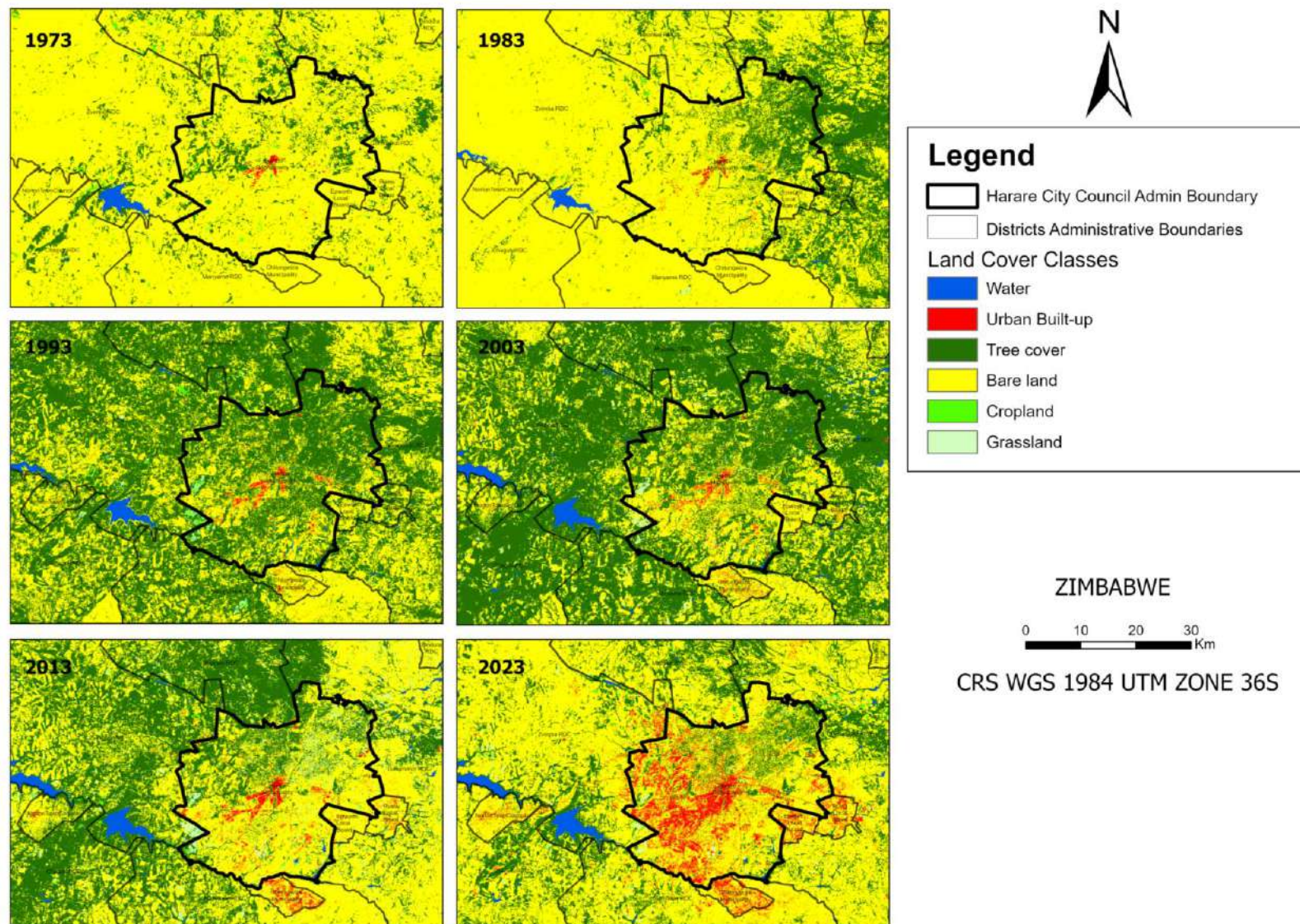


Figure 4.16: Land Use Land Cover Change Patterns

4.5.3. Impervious surface area trends 1984 - 2024

Multiple high-resolution Remote Sensing images were used to quantify the impervious surface area for Harare i.e area covered by concrete, asphalt, or rooftops. The results indicate rapid growth in built-up area between 1984 and 2024. Significant growth occurred between 2010 and 2024 mainly concentrated at the urban fringe and south-western parts of the city. The built-up area was 116.88 km² (11688.06 ha) in 1984, 132.57 km² (13257.32 ha) in 1990, 185.26 km² (18525.87 ha) in 2000, 229.73 km² (22972.98 ha) in 2010, 467.26 km² (46725.95 ha) in 2020 and 491.47 km² (49146.78 ha) in 2024 (see figure 4.15 and 4.16).

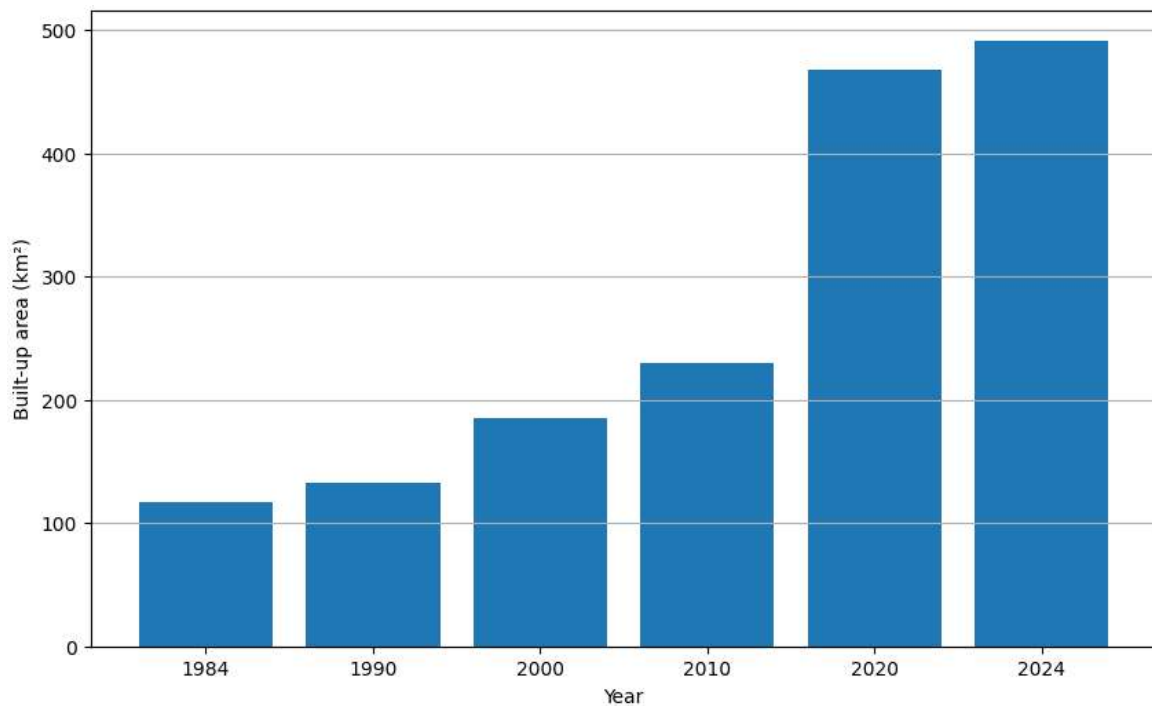


Figure 4.17: Urban footprint area temporal trends from 1984-2024

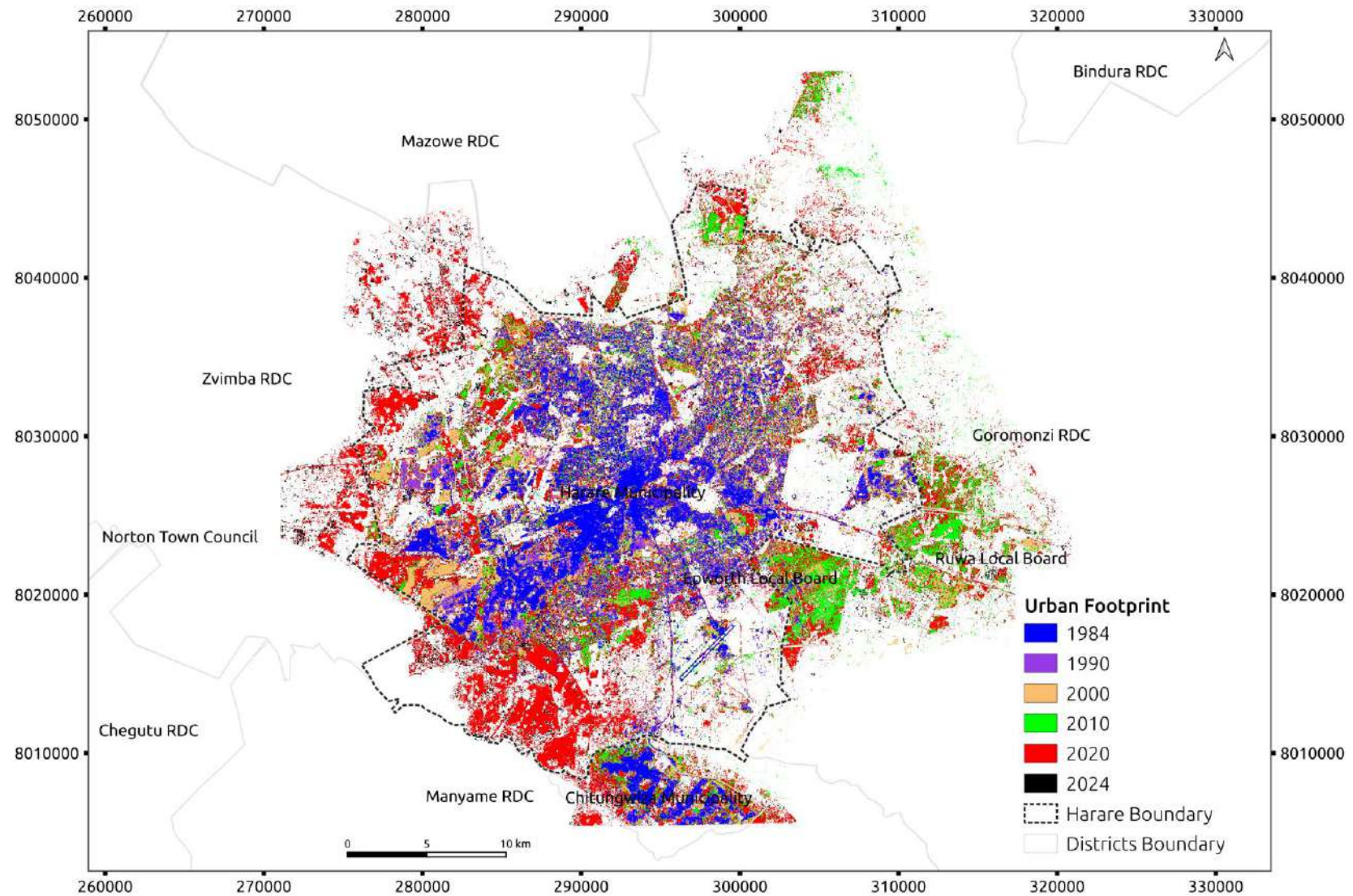


Figure 4.18: Impervious surface area spatio-temporal trends

4.5.4. City Growth Modelling and Forecasting

4.5.4.1. *Historical trends of urban growth in Harare Metropolitan Region*

Being able to quantify urban growth, predict, forecast where future growth will occur and directionality is critical in urban growth management. Rapid urbanisation and unplanned urban growth lead to informal settlements, loss of green spaces and increased vulnerability to natural disasters. Models help anticipate future changes and provide insights for evidence-based policy. To address these challenges, urban planners and policymakers need reliable land change models to simulate various urban growth and development scenarios. Using a Random Forest (RF) - Cellular Automata (CA) model coupling Machine Learning (ML) and Markov chains we computed (1) transition rates; (2) transition potential modelling; and (3) CA simulation, as well as model validation. The study observed that the between 1984 and 2024 Harare Metropolitan Area has undergone profound transformation (see figure 66). The driving factors influencing transition of urban built-up area include among others: (a) elevation; (b) distance to major roads; (c) distance to city center; (d) distance to built-up areas (1986); (e) distance to built-up areas (2010); (f) distance to built-up areas (2020) (g) access to electricity; (h) access to electricity and (i) population density (2002) (see Figure 4.17 and 4.18) which influence developer's land acquisition and selection criteria for development.

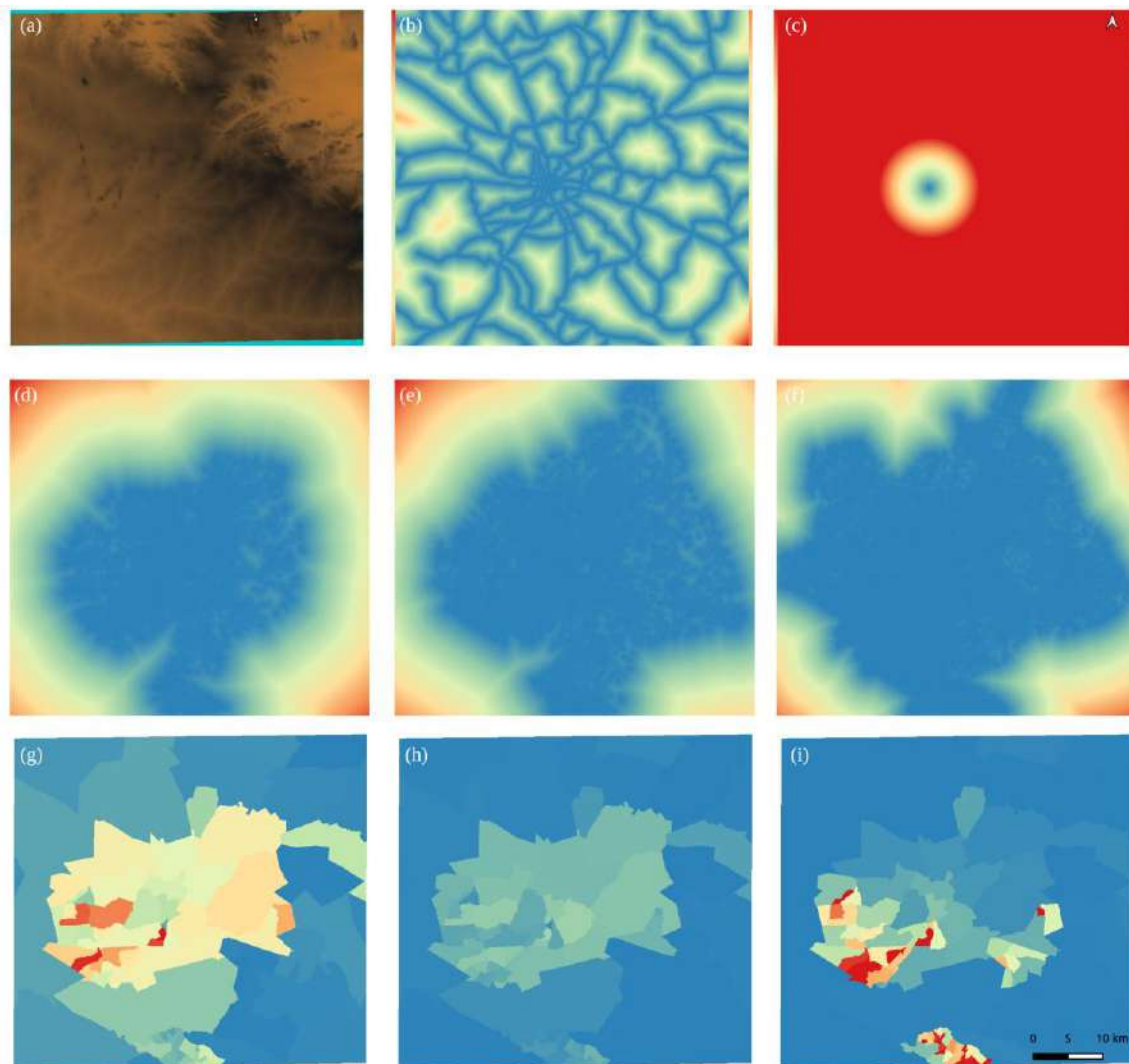


Figure 4.19: Selected driving factors used to influencing rapid urbanisation (a) elevation; (b) distance to major roads; (c) distance to city center; (d) distance to built-up areas (1986); (e) distance to built-up areas (2010); (f) distance to built-up areas (2020) (g) access to electricity; (h) access to electricity and (i) population density (2002)

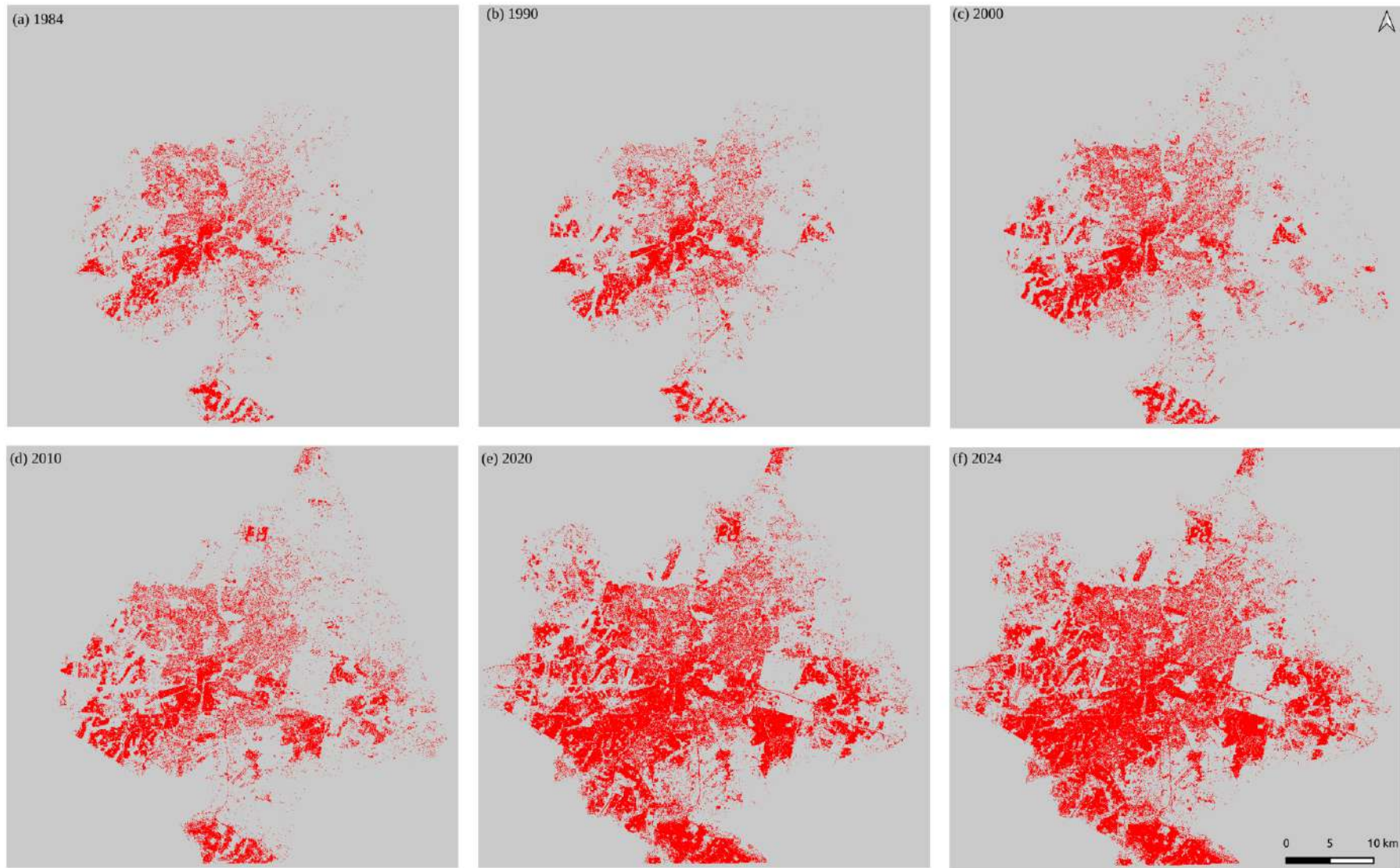


Figure 4.20: Urban footprint Land cover for (a) 1984, (b) 1990, (c) 2000, (d) 2010, (e) 2020 and (f) 2024

4.5.4.2. *Urban Transition Potential*

Figure 68 shows the "non-built-up to built-up" transition potential for Harare Metropolitan Area. It can be observed that urban growth areas, particularly for infill development and extensions near previously built-up areas from 1984 to 2020 can be predicted. Future growth will be more concentrated at the urban fringe and in high density residential areas in the south and western parts of the city. For areas outside the city's boundary future growth will be intense in Epworth, Ruwa, Goromonzi (Melfort, Caledonia and Domboshava), whereas in Zvimba future growth will occur in Whitecliffe and Hyadon Area. Infill development refers to the emergence of new built-up areas within already built-up area from prior periods, while extensions involve the outward expansion of built-up areas within the same built-up areas. The results highlight that the spatial patterns of urban growth are interlinked and connected. The region has incidences of unplanned leapfrog developments, which are isolated new built-up areas disconnected from existing built-up areas indicating that urban development in the region exhibit spatial and temporal nonstationarity.

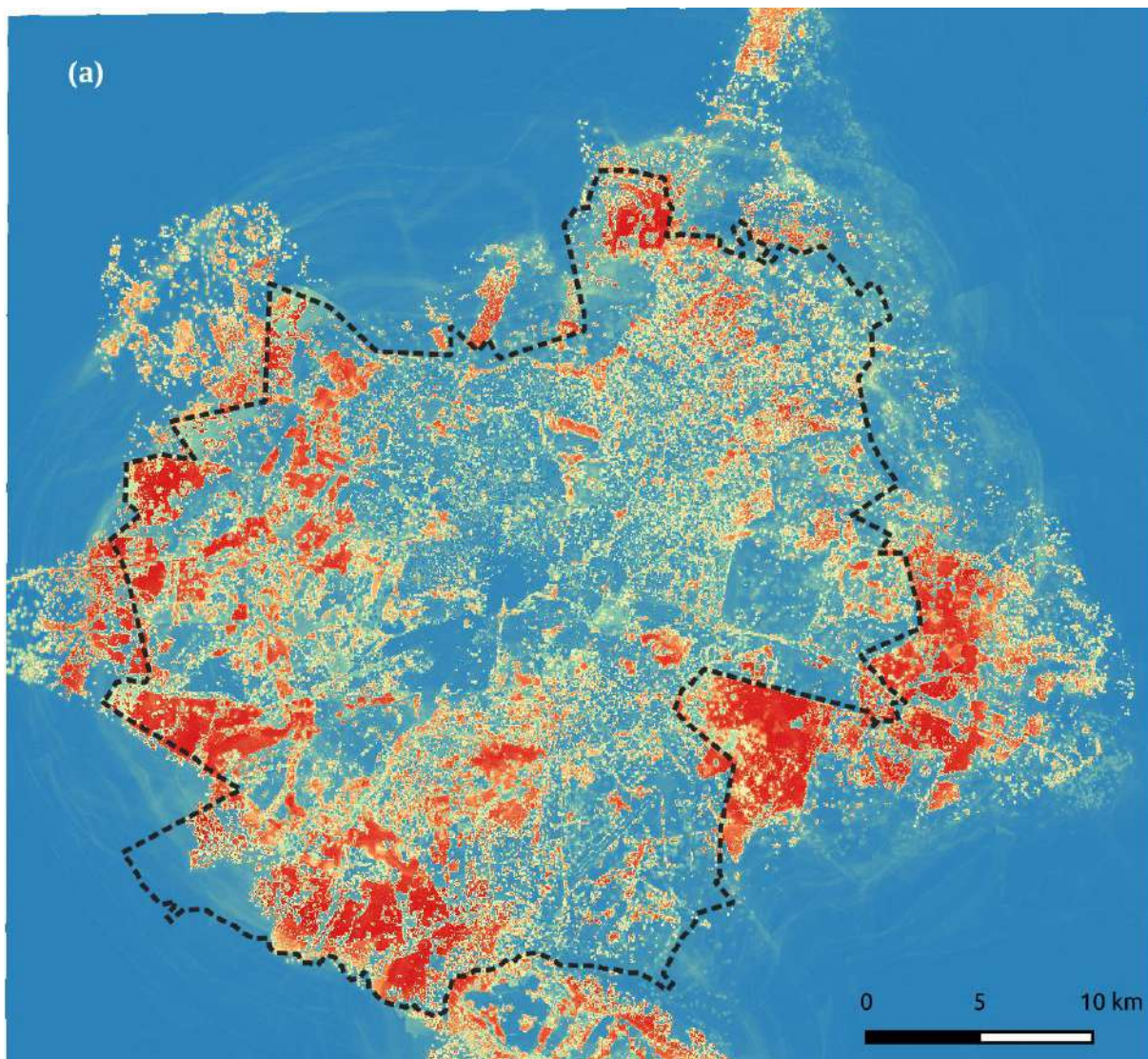


Figure 4.21 (a): Urban Transition potential map (a) produced with 100 trees

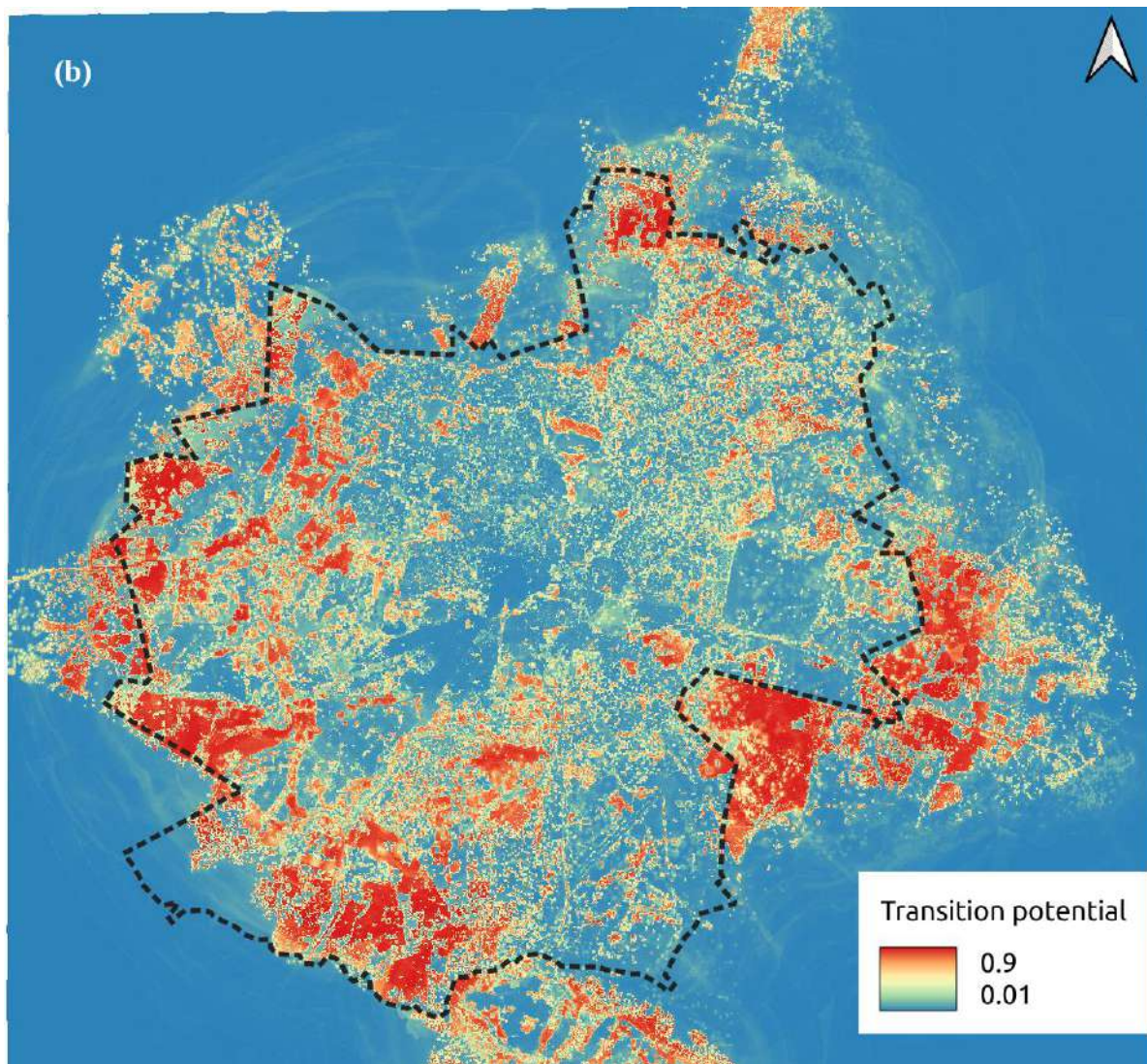


Figure 4.22 (b): Urban Transition potential map (b) 200 trees.

4.5.4.3. Forecasted urban growth in Harare

Figure 4.20 shows the reference (observed) and simulated land cover maps (2024) for the study area. Visual analysis indicates that the RF-CA model accurately captured overall urban built-up land cover changes, particularly in allocating "non-built-up to built-up" transitions and simulating infill development patterns and urban extension. However, discrepancies in spatial allocation are evident. Quantitative validation compared the observed and simulated land cover maps for 2024. The observed built-up class was 491.8 km², closely matched by the simulated class at 485.8 km². Similarly, the observed non-built-up class was 1,904.9 km², with the simulated class at 1,911.01 km². These results demonstrate that the RF-CA model performed well in simulating the land cover quantity. The results illustrates the significance of spatial model's in capturing complex urban growth patterns, such as leapfrog developments i.e. accurately predict disconnected leapfrog developments—new built-up areas that are isolated from existing urban zones. To predict where future growth will occur satellite observed growth scenario was compared to machine learning simulated growth scenario (see figure 4.21). The results indicate that there were no significant different between the two observations.

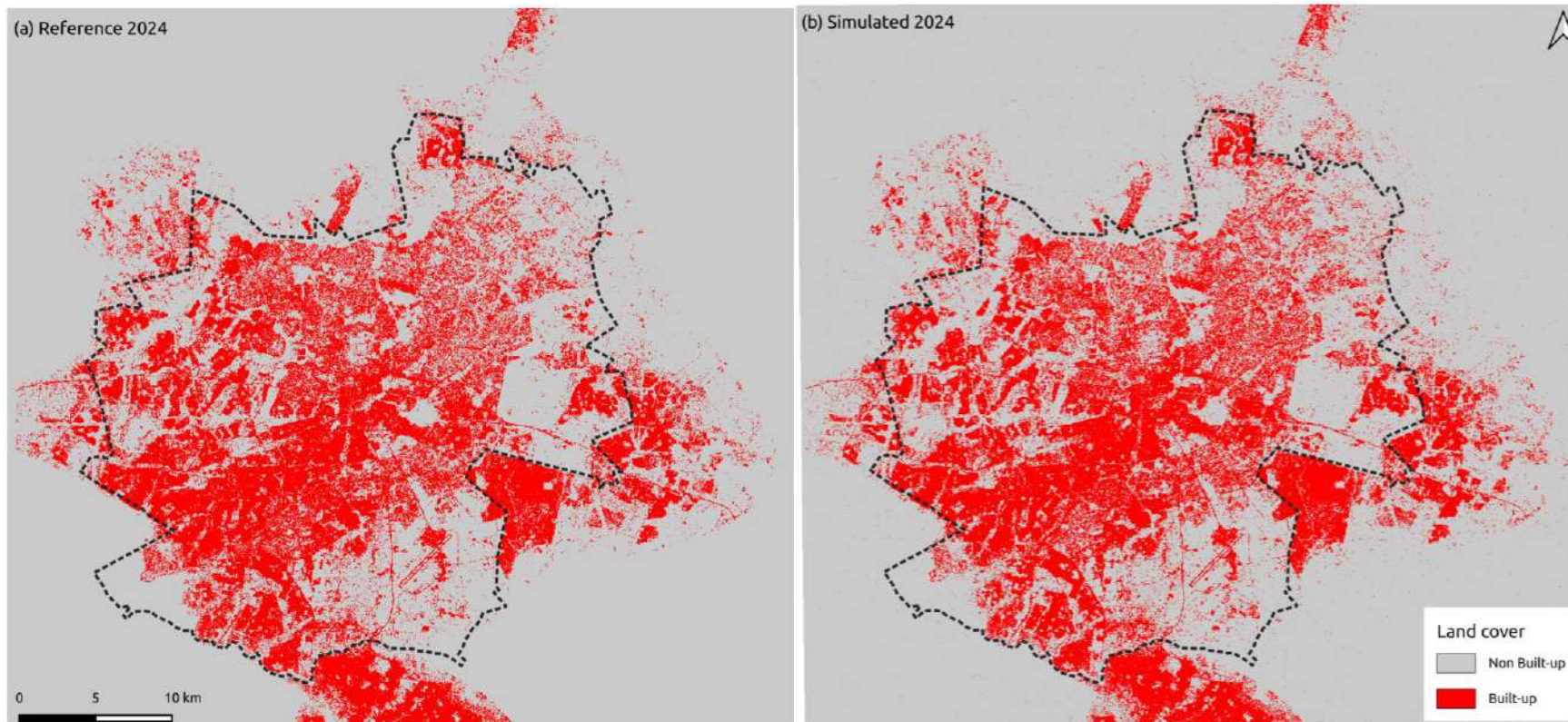


Figure 4.23: Comparison of reference and simulated land cover 2024.

4.5.4.4. *Urban Growth Trends and Projections*

Figure 70 shows the 2030 and 2040 scenarios for urban growth in Harare Metropolitan Area. It can be observed that the region will continue to experience rapid urbanisation over the next 2 decades.

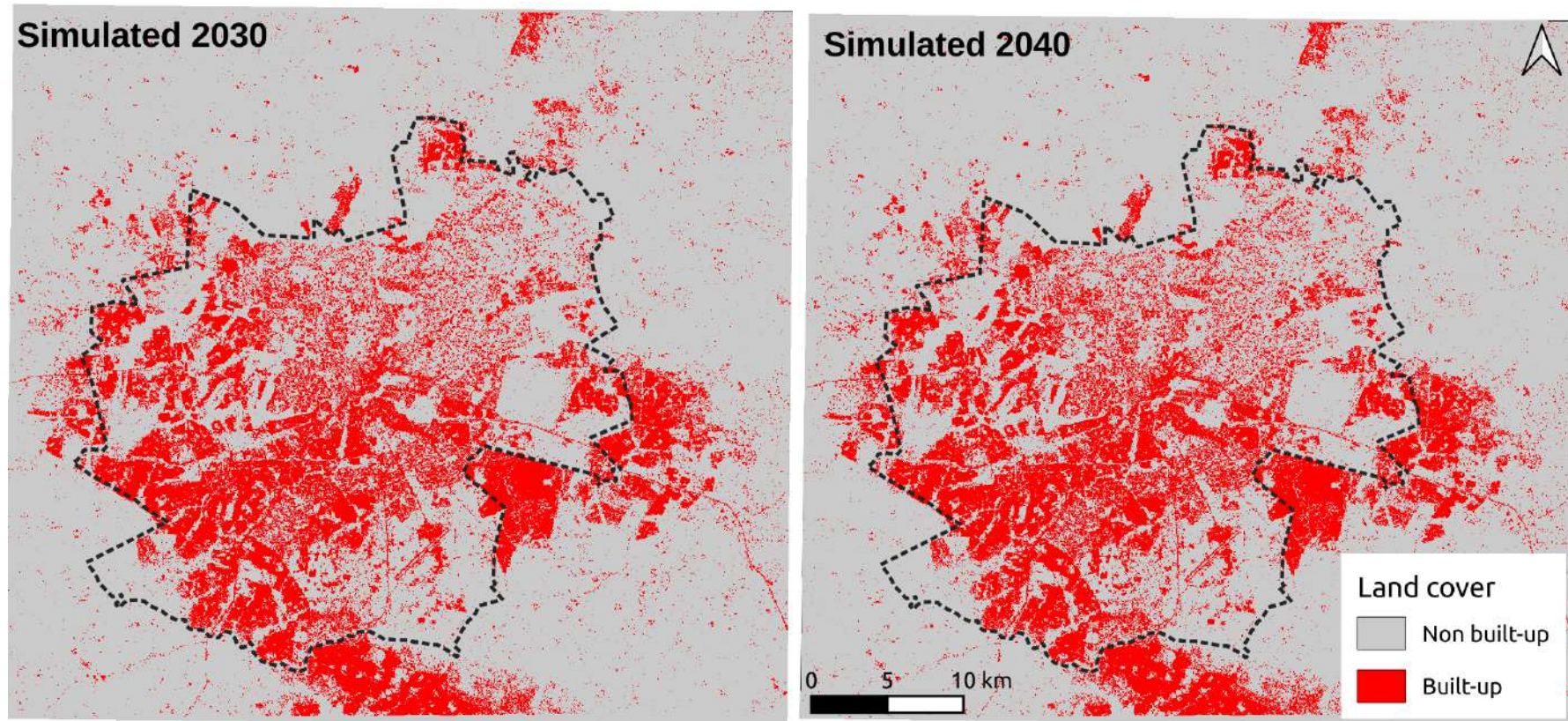


Figure 4.24: Simulated Urban Built-up Land Cover for 2030-2040

It can be observed that past urban land cover changes for Harare can be used to predict future changes. For Harare the study shows that historical non-built-up area will continue to decline. Whereas historical built-up area will continue to expand exponentially between 2024 and 2040 (see figure 71).

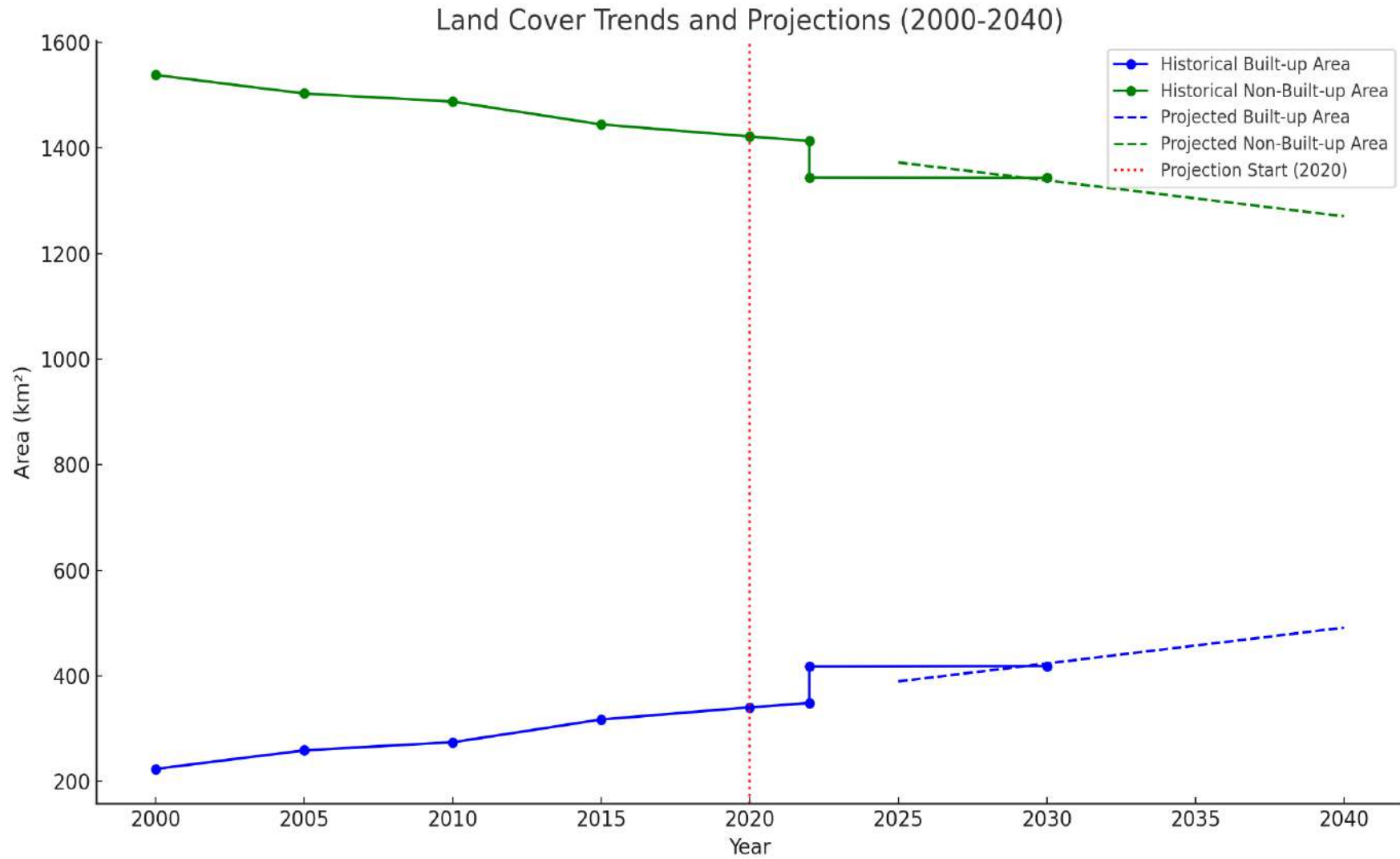


Figure 4.25: Urban land cover trends and projections for 2000-2040

4.6. Summary of issues

The study observed the following:

1. Development conformance of 42.3% was observed. The Cohen's Kappa Coefficient of determination was 0.4705. This implies that there was weak agreement between plan intentions and plan implementation outcomes for the area spanning City of Harare and adjacent local authorities. It is apparent that adjacent local authorities disregarded the 1993 Harare Combination Master Plan and established developments at the urban fringe exacerbating urban sprawl as opposed to containment and densification strategies prescribed by the 1993 Harare Combination Master Plan.
2. Implementation of the Harare Combination Master Plan faced challenges. Though 65% of the proposals were implemented, those not implemented were strategic and pertain mainly to bulk infrastructure necessary for sustainable urban growth. Strategic traffic and transportation, water, sanitation, and energy policies and proposals were not implemented. While scope exists to integrate some of the policies and proposals (adapted to current and projected realities) critical governance improvements will be needed.
3. The city prepared Local Development Plans for 77.27% of its land area since 1993, only 22.73% still under schemes pre-1980 statutes (see Figure 2.54). However, quite a number of Local Development Plans require review. The general provisions and key policy thrusts are premised around suburban development, densification, economic corridor development and mixed-use development.
4. Low Density Residential is the dominant land use in the city constituting 22.71% (19475.75 hectares) followed by High Density Residential constitutes 21.57% (18501.2 hectares) of the city. Industrial area constitutes 9.81% (8413.88 hectares), while Institutional constitutes 9.21% (7899.16 hectares), Medium Density Residential constitutes 8.69% (7455.41 hectares) followed by Open Space Reservations which constitutes 7.45% (6392.41 hectares) respectively. Another land use category to note is the area covered by Flats/Clusters which constitutes 3.93% (3368.7 hectares) in extent. The proportion of Low-Density Residential coverage and the Flats/Clusters.
5. The City is experiencing extremely low levels of densification. Single detached dwelling houses constitute 65.18% (dominant housing model), flats (apartments high-rise) 0.795%, Attached Dwelling House 11.49%, clusters 0.573%, cottage and main house under construction 6.248%, cottage 11.31%, cabin and main house under construction 1.177%, cabin 2.173% and other types of structures (main house offices, main house church etc) 1.056%. Despite the densification of the Harare Combination Master Plan, vertical space is rarely exploited and a weak densification thrust is being pursued.
6. The spatial patterns of urban growth are interlinked and connected. The region has incidences of unplanned leapfrog developments, which are isolated new built-up areas disconnected from existing built-up areas indicating that urban development in the region exhibit spatial and temporal nonstationarity. Urban growth will grow exponentially in the next 20 years with significant growth in the urban fringe.
7. No significant differences were observed for key land development indicators indicating weak land development patterns.

8. The city is experiencing severe pressure from surrounding local authorities limiting outward expansion due to parasitic peri-urban developments outside the city's administrative boundary.

5. CHAPTER 5: ECONOMIC CHARACTERISTICS

5.1. National to Local Economic Profile and Outlook

Zimbabwe is on a rebound, following years of economic instability. The economy has shown resilience post-Covid-19, recording high growth of over 5%. Between the years 2020 and 2022, the country experienced GDP growth rates of 8.5%, 6.5% and 5.4%, respectively. In absolute terms, GDP decreased from US\$12.65 billion in 2019 to US\$254.36 million in 2023Q1 (ZimStat, 2024). However, the economy is greatly exposed to climatic risks with the most recent being the 2023 El Nino disaster, which affected agricultural output resulting in growth projections being revised downwards to 2% by the African Development Bank (AfDB). In contrast, the Ministry of Finance and Economic Development of Zimbabwe suggested a modest growth forecast of 2.5%. On the other hand, the energy crisis, rise in geopolitical tensions, exchange rate fluctuations and weakening of commodity prices of key minerals, are some of the main challenges being faced by the economy. However, there is an optimistic view that the economy will strongly recover in 2025 and beyond, with the International Monetary Fund (IMF) suggesting a 6% growth for 2025, as normal to above normal rainfall is expected, which is likely to reverse the contraction of the agricultural sector. Cities and provincial capitals are more likely to face the same challenges, with the degree of exposure depending on regional economic and market structures.

Harare is the hub of economic activities and its performance has monumental implications for the welfare of all cities in Zimbabwe. At the end of 2022, Harare's economy was estimated to be worth US\$76.16 million and its share of the national GDP was approximately 24.2% (ZimStat, 2024), thus making it a key province in national development. The city has shown resilience to global and natural shocks as the economy is less inclined to commodity-based sectors. Figure 5.1 and Table 5.1 illustrate summary observations of the macroeconomic indicators for Harare and Zimbabwe.

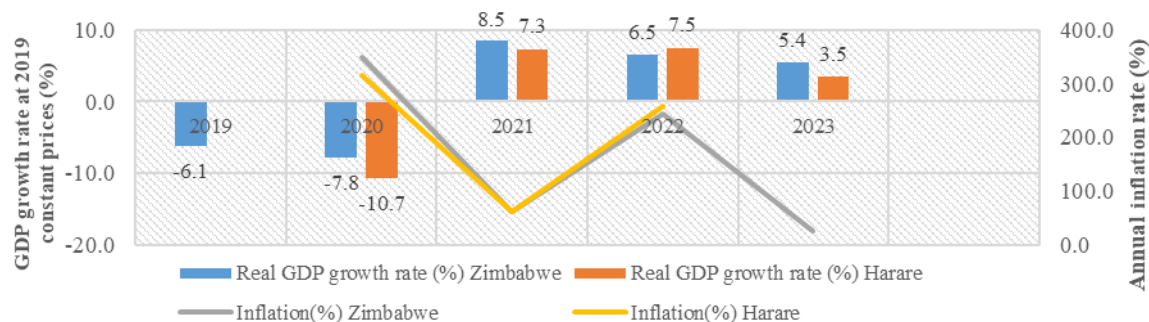


Figure 5.1: Real GDP growth and inflation data

Sources: National Accounts Statistics, ZimStat (2023).

Since 2020, the economy of Harare realized higher growth rates than the national average. The inflation rate for Harare was 1.2% and 14.5% higher than the overall annual inflation rates for the 2021 – 2022 fiscal years. The currency volatility, high exchange rate pass-through and rising production costs contributed to price instability. On most occasions, food inflation surpassed non-food inflation and food inflation was on average higher than the national and regional averages (ZimStat, Quarterly Digest of Statistics Q4 2022). However, Harare outperformed other cities like Bulawayo which had higher rates of both food and non-inflation during same the period. Inflation fluctuations promote higher demand for property development as real estate is considered the best asset for hedging portfolios. The city

recorded an upsurge in both residential and commercial property development during the period. The City of Harare is ranked 3rd in 2023 on the cost-of-living index (Numeo, 2024), showing that the economy is relatively cheaper with average-income households being able to access essential services, compared to regional cities like Johannesburg which is ranked number 1 (Numeo, 2024). In the outlook, the inflation rate is expected to stabilize, as the Government of Zimbabwe (GoZ) has implemented some measures for exchange rate stabilization and productivity enhancements. The price stability is quicker and more sustainable if the Reserve Bank of Zimbabwe (RBZ) maintains tight monetary policy and reduces quasi-fiscal operations.

Table 5.1: Harare's Gross Domestic Product (GDP) Contribution by Economic Sector at Constant Prices

Sectorial Contribution (%)	Growth Rate (%)						
	2019	2020	2021	2022	2020	2021	2022
Primary	2.3	2.3	2.7	2.5	-10.4	26.1	1.7
Secondary	30.2	30.3	28.3	26.6	-10.5	0.5	1.1
Tertiary	67.7	67.5	69	70.8	-11	9.8	10.4
GDP at Market Prices (Harare)	\$50,623,870,114	\$45,145,817,275	\$48,471,954,989	\$52,122,054,834	-10.8	7.4	7.5
GDP at Market Prices (Zimbabwe)	\$212,174,391,858	\$195,591,527,084	\$212,151,319,145	\$225,988,624,357	-7.8	8.5	6.5
Harare Share of overall GDP(%)	24.1	25.4	22.6	23.1	5.4	-11	2.2
GDP per Capita	\$19,606	\$19,375	\$17,343	\$21,582	-1.2	-10.5	24.4

Source: ZimStat, 2024

Over the past four years, between 2019 and 2022, the sectorial contribution to GDP has not changed significantly. The tertiary sector accounts for most of the city's economic activities, contributing on average 68.8% to GDP, whilst secondary and primary activities share 28.9% and 2.5%, respectively. Post-crisis dynamics in output show evidence of unbalanced sectorial recovery. The fastest growing sector in the post-COVID-19 era is tertiary (see Table 5.1 sectorial growth), and primary activities growth outperformed the secondary sector.

The top five industries that have dominated the economy of Harare are:

- i. Wholesale and Retail (25.3%);
- ii. Manufacturing (19%);
- iii. Finance and Insurance Activities (10.4%);
- iv. Information and Communication (7.3%); and
- v. Construction (4.34%).

The growth prospects of Harare are brighter if resources are availed to the tertiary (services) sector, which over the years has shown resilience to global economic shocks. Sustainable economic growth is usually supported by adequate energy and water supply and efficient transport systems. If the challenges in energy production are not quickly addressed, low growth regimes will persist.

5.2. Disposable Income and Consumption

Countries with higher disposable incomes attract high-quality investments and usually grow at faster rates than countries with high taxation and low purchasing power. The average

growth rate of GDP per capita in Harare between the years 2020 and 2022 was 4.26%, together with 7.4% for disposable income (see Table 6), which implies rising buying power with time. High-income taxes could explain the differences in the growth rates between per capita and disposable incomes. Higher income is likely to expand the size of the middle class with consequential effects on housing demand because real estate growth correlates with income levels. Given the higher marginal propensity to consume amongst Zimbabweans, this translates to higher market demand for necessities like fruit and vegetables, meat and building materials. The growth rate of household final consumption for Zimbabwe for the same period was 5.2%, meaning a growth in effective demand.

5.3. Socio-Economic Indicators

The Socio-Economic indicators for the economy of Harare have shown signs of improvement since 2019. Table 5.3 illustrates key economic indicators for the period between 2019 and 2023, wherein there has been a steady increase in GDP per capita for Harare (for the period 2019 and 2020) and in 2022 it reached 53% above the national per capita income. This indicates that on average Harare has relatively higher income levels per person, than the rest of the country, making it a preferred destination for rural-to-urban migration. However, in 2021, data from the Zimbabwe Poverty Atlas revealed high income disparity and poverty prevalence. The residents of Harare are 15.6% more likely to fall into poverty. In addition, a Gini coefficient indicates that the income gap between rich and poor households is 43.5% wider, which reveals an expanding gap between the rich and poor. According to the World Bank, the income gap is projected to reach 50.3% at the end of 2024. Overall, the economy of Harare is growing with high income inequality and unemployment.

Table 5.2: Selected Socio-Economic Indicators for Harare and Zimbabwe

Socio-Economic Indicators	GDP per capita				
	2019	2020	2021	2022	2023
Population (millions)					
Zimbabwe	14.70	14.90	15.11	15.20	15.40
Harare	2.58	2.79	2.79	2.42	
GDP per capita (ZWS\$ million)					
Zimbabwe	\$14,436.89	\$92,539.71	\$211,182.62	\$817,641.93	\$8,682,038.54
Harare	\$19,606.01	\$119,374.44	\$279,742.33	\$1,258,621.32	
Gini coefficient (%)¹					
Zimbabwe			43.5		
Harare			41.9		
Household Poverty Prevalence(%)¹					
Zimbabwe			15.6		
Harare			42.8		
Unemployment (%) ²					
Zimbabwe			19.9	19.1	20.7
Harare			24.0	21.2	18.3
Total Consumption Poverty Lines per Person per Month (ZWS\$) ³					
Zimbabwe	\$837.68	\$4,670.04	\$8,008.57	\$29,219.01	
Harare	\$840.26	\$4,865.20	\$8,025.84	\$31,357.50	
Sources:					
1. Zimbabwe Poverty Atlas 2021					
2. ZimStat (2024)					
3. Quarterly digest of statistics, Q4 2022					

5.4. Household Income distribution

The study established that the City has a skewed household income distribution. The skewed distribution shows that more than 80% of households earn less than US\$400.00 per month and approximately 1.2% earn more than US\$5,000.00 (see figure 5.3). This shows that there is a high-income disparity across the city of Harare.

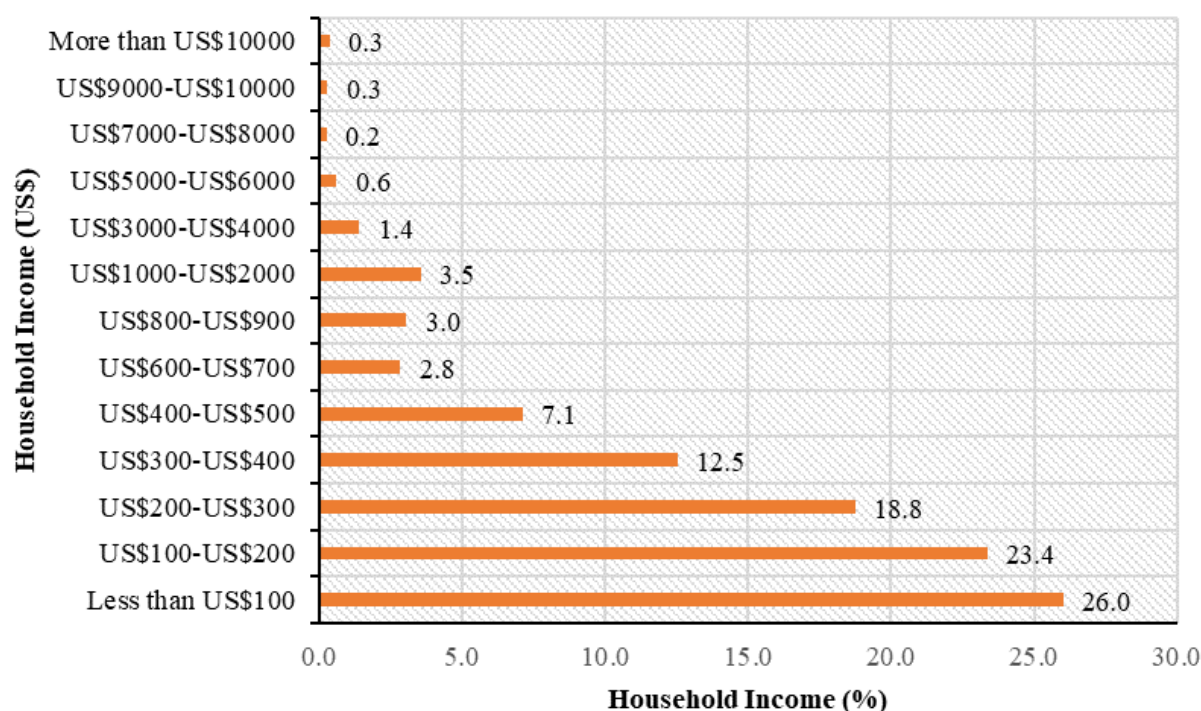


Figure 5.2: Percentage Household Income Distribution in Harare
Source: Harare Plan 2024-2044, Household survey conducted in 2024

5.5. Harare Municipal Finance: Budgets and Expenditures

5.5.1. City's Budget Performance

Cities with sustainable revenue streams tend to have high budget performance with minimum deficit, which in most cases meets the capital funding needs with their own resources. The budgeting environment for Harare between the years 2019 and 2023 was unfavourable. High inflation and rising informality in the economy made the goal of revenue mobilization very difficult, resulting in expenditure growth exceeding revenue growth. The size of the budget expanded slightly from 2% of GDP in 2019, to 3% as at 30 September 2024. The city has low fiscal space and the situation is complicated by the characteristics of tax rates and fee structures which are rigid, economically inelastic and often require central government approval. The average billing efficiency was 80%, implying a target average deficit of 20% per year, which also showed that the billing efficiency was higher for property taxes. A combination of rising population, economic and climate shocks resulted in a huge variance between planned and actual deficits. Weak enforcement and a decline in willingness to pay among residents resulted in low revenue mobilization and low average collection efficiency of 50%, which reveals the difficulties of revenue collection owing to macroeconomic instability, retrenchments and pandemics. These factors contributed to household and companies' failure to pay rates, together with the accumulation of creditors and debtors.

5.5.2. Revenue Mobilization

The revenue composition and their performance between the years 2019 and 2024 comprises of own and external sources. Own sources is the main source of revenue for Harare and its share to total revenues is almost 9 folds the contribution of its external source. Since 2019, the share was on an upward trend, with external sources decreasing and as of September 2024, the share was zero. The diminishing role of external sources is largely attributable to fiscal challenges at central government level.

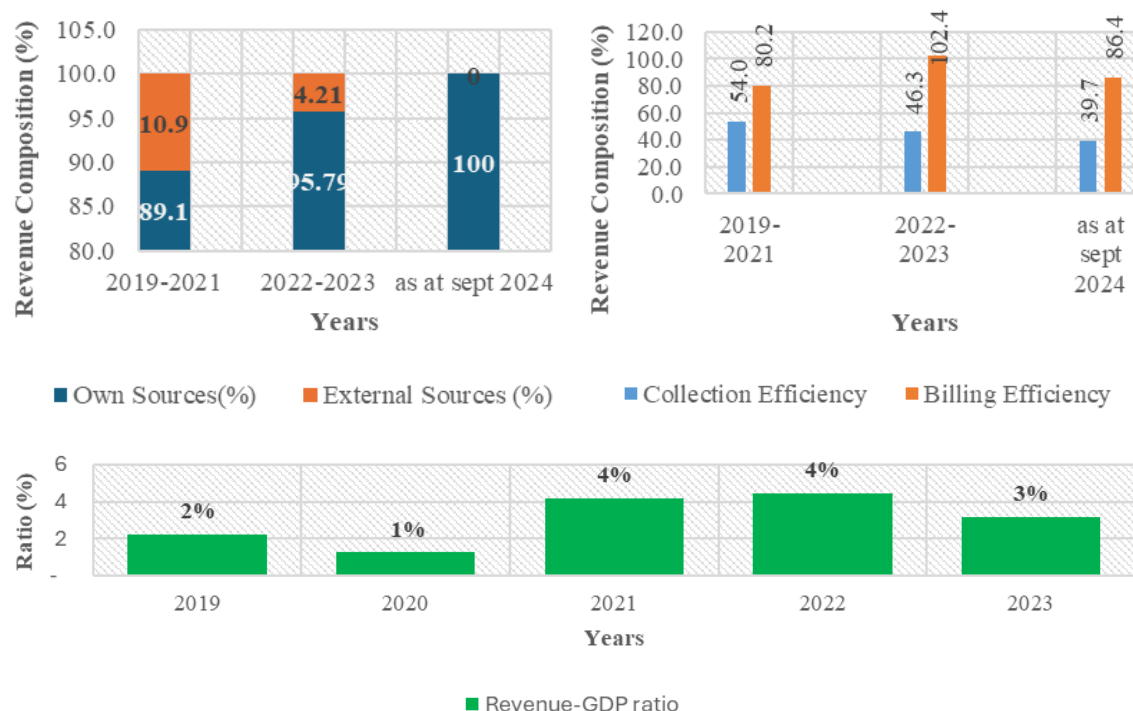


Figure 5.3: Revenue Composition and Budget Performance

Sources: Compiled from Harare Municipality consolidated Budgets 2019-2024.

Figure 5.4 shows that the revenue as percentage of the city's GDP (revenue-GDP ratio) is less than 5% (this increased from 1% (2020) to 4 % (2023) and in 2024 it decreased to 3%), which highlights that city revenue is less aligned to the size of economy. Harare is collecting less revenue despite an increase in economic activity. This is mostly due to under valuation of property, low tax rates and rigid fee structures.

5.5.3. Composition of Revenue Streams

The study examined the average composition of revenue for Harare between the years 2019 and 2024. Property tax is the main contributor to own revenue and its dominance increased after the introduction of the new currency in 2024, (see Figure 5.5). During the period under review, property tax obtained the highest growth rate of 40.1% or 12.8 basis points, in comparison to other sources. The property tax performances are attributed to property revaluation undertaken after every 2 years, changes to zoning and tax rates. The tax has the potential to surpass these levels if periodic property revaluations and regularisation of residential and commercial properties are undertaken. Service charges which constitute of water and sanitation, together with refuse collection, is the second main source of revenue and its share to total revenue has slightly increased, from 21.8% in 2019 to 25.3% in 2024. The low growth is explained by low collection efficiency as a result of economic challenges which is affecting companies' solvency and household income. The two sources accounted for 53.7% and 70% of total revenue for Harare for the period 2019 and 2024, respectively.

Whilst government grants and subsidies (which explains most of the external revenue) continue to show inconsistencies, there is a decrease in allocations and no provisions in other years, therefore it is an unpredictable source of revenue which could affect progress on capital projects, thus forcing the city to borrow from capital markets. The other own revenue streams include estate funds; administrative fees; fines, penalties and forfeits; Income Generating Projects; licenses and permits whilst for external sources it includes intergovernmental transfers especially from Zimbabwe National Road Administration (ZINARA) for road development. The latter is one of the new sources of revenue created over the past two years. The performance of the income generating projects depends on the profitability of the projects and the declarations of dividends.

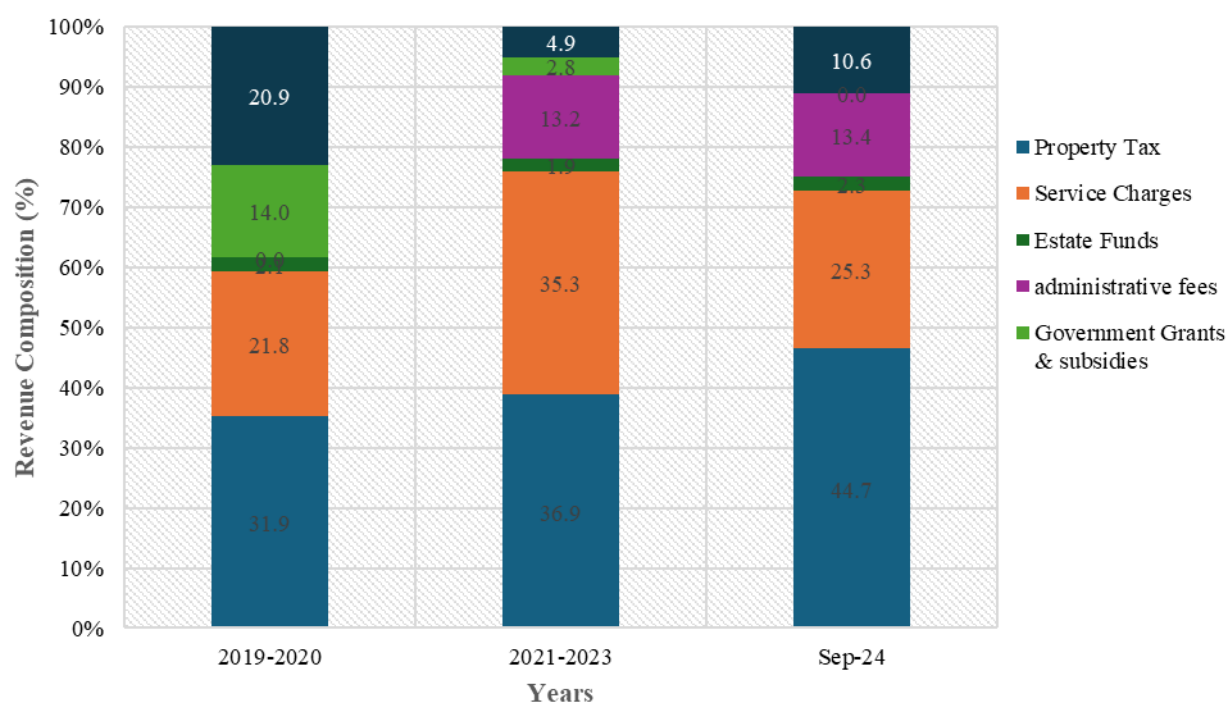


Figure 5.4: Revenue Composition

Source: Compiled from Harare Municipality consolidated Budgets 2019-2024

5.5.4. Expenditure Composition

Current expenditure share to total expenditure is three times capital expenditure. The average share increased from 74.5% to 77.4% between the 2019-2021 and 2022-2024 fiscal years (See Figure 5.6).

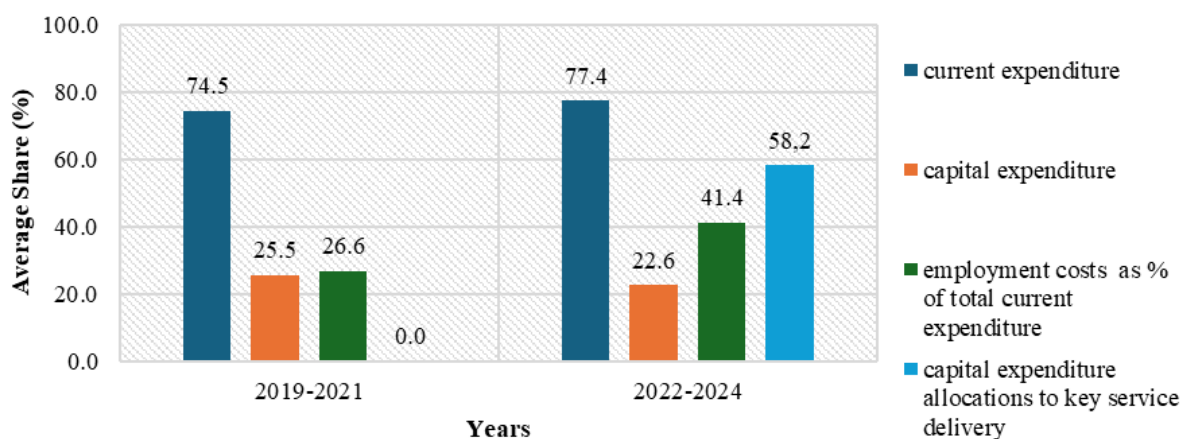


Figure 5.5: Expenditure Composition

Sources: Compiled from Harare Municipality consolidated Budgets 2019-2024

5.5.4.1. Key expenditure areas

(a) Salaries and wages

For the current expenditure, average employment costs increased from 26.6% (2019-2021) to 41.4% (2022-2024) for the period under review. The high proportion of employment costs is usually blamed for crowding out service delivery, however during the period it was necessary for staff retention and motivation against high labour turnover, whilst for some years it represents clearance of salary arrears.

(b) Service delivery percentage allocations

Most of the capital expenditure was allocated to service delivery. The allocations increased to 58.2% in 2024. A summary of capital expenditure allocations of key programmes such as Water and Sanitation; Roads; and Social Amenities is shown on figure 5.7.

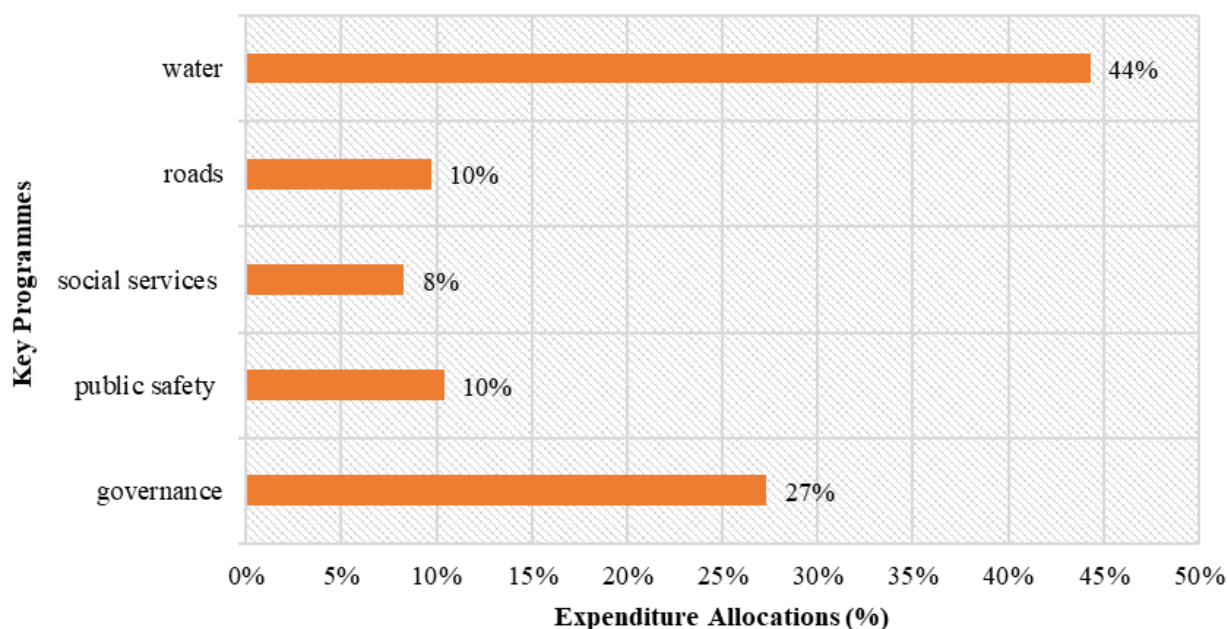


Figure 5.6: Top 5 Average Capital Expenditure Allocations for 2019

Sources: Compiled from Harare Municipality consolidated Budgets 2019-2024

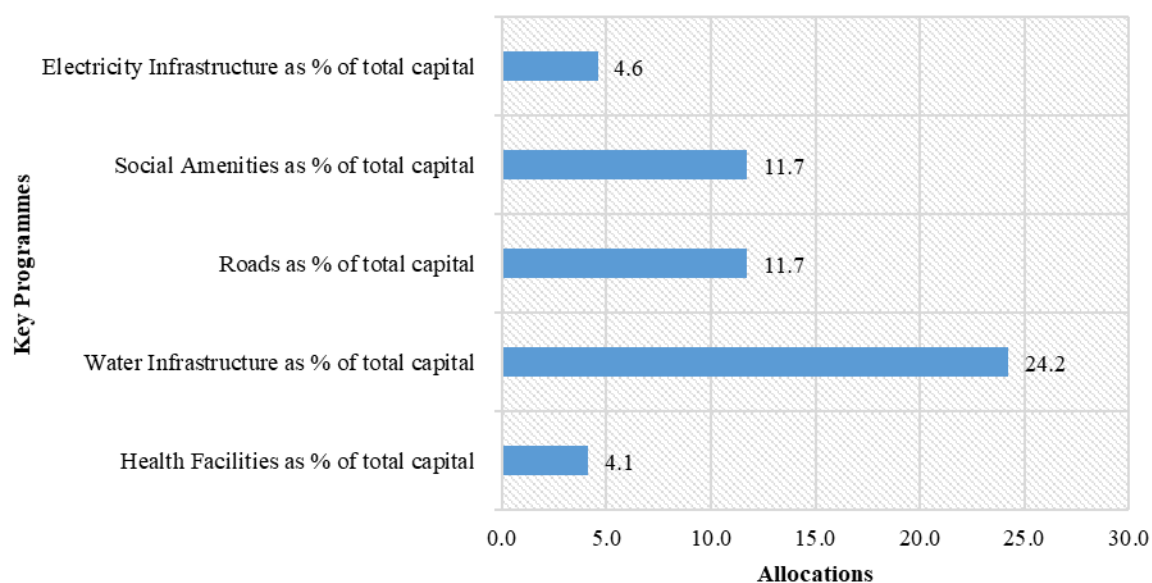


Figure 5.7: Top 5 Average Capital Expenditure Allocations for 2022-2024

Sources: Compiled from Harare Municipality consolidated Budgets 2019-2024

Figures 5.7 and 5.8 illustrate that the top 3 priority programmes between 2019 and 2024 were water and sanitation, roads and social amenities. The composition of expenditure and allocation priorities are aligned to most needs of residents and businesses, which are addressing water shortages and improving sanitation, as well as waste management and good road infrastructure. The city spent a higher percentage of the capital budget on Water, Sanitation, and Hygiene (WASH) programmes. For 2019 the share of allocation was 44%, and for the period 2022-2024, the allocation for WASH decreased to 24.2%. Despite this, it remained the first priority programme. The preference might be explained by high urbanization and population growth, which resulted in high demand for water and sanitation. The high-water infrastructure gap in most residential areas contributed to massive allocations. The Sustainable Development Goals (SDGs) put emphasis on accessibility of clean running water for sustainable development, resulting in WASH programmes becoming a priority. During the same period, the percentage allocations for roads and social services increased from 10% and 8% respectively, to 11.7%. Most of the city suburban roads have deteriorated, which would limit accessibility over time.

The per capita capital expenditure for the city is growing. It increased by 2,219% to \$16,830.61 in 2023, from \$725.69 in 2020, which implies that the city was spending on average \$16,830.61 per person on capital expenditure. This shows the city commitment towards the improvement of service delivery, even during periods of financial constraints. On average, low collection efficiency (less 50%) resulted in the reduction of capital expenditure by 20% to 30% per each fiscal year, with some budget statements highlighting that since service charges are not linked to the economic cost of production, this often results in an average billing efficiency of 80%, thus making the goal of sustained service delivery challenging.

Capital funding: Over the past 5 years ending 2024, a combination of government transfers, grants, development partners, loans, joint ventures and own sources propelled capital expenditure in the city. Own sources on average contributed over 60% of the capital funding requirements. Given low collection efficiency, the funding model can lead to stalled large-

scale projects. Moreover, there was less private sector involvement/ joint ventures, and more loans were preferred, which are regarded as high cost and risk source of capital funding.

5.5.4.2. Economic Future Forecast

The economy of Harare is projected to reach USD1.916 billion by 2040, at a 2023 exchange rate with a Compounded Average Growth Rate (CAGR) of 4.47% (see Figure 5.9). Household and firm surveys show most people prefer a USD50 billion economy by 2040. This is possible if the existing currency reforms succeed, foreign currency generation improves, and the energy crisis is resolved.

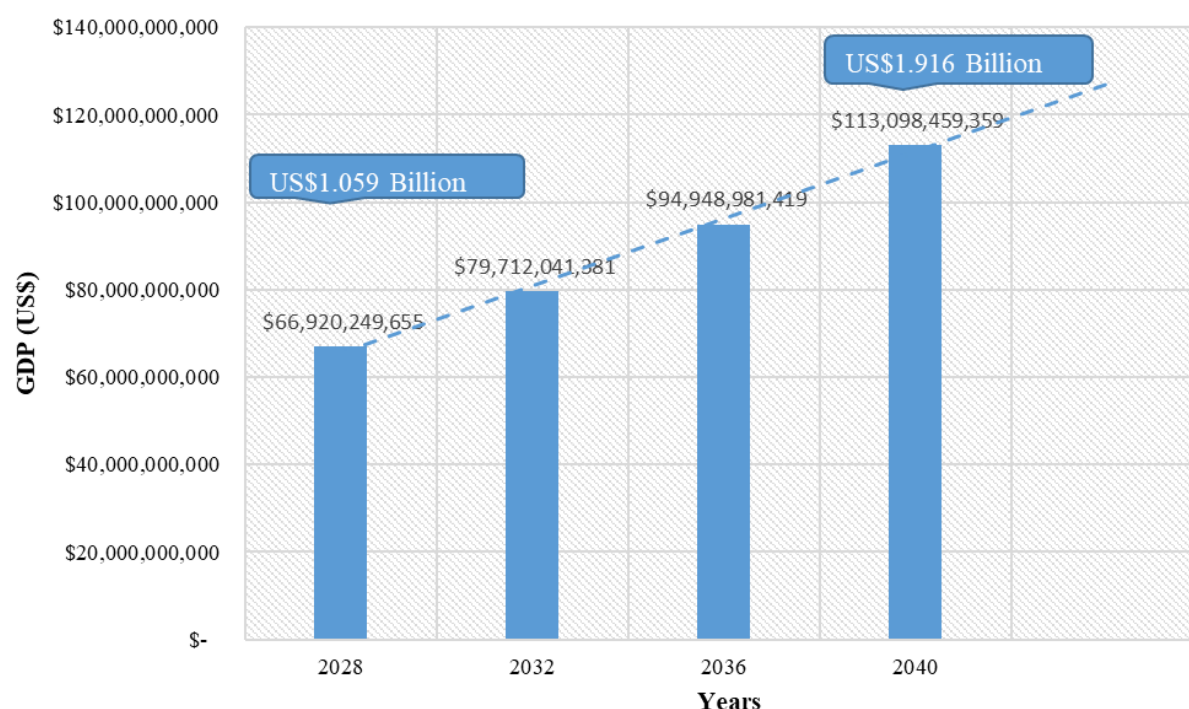


Figure 5.8: GDP Projections with Compound Average Growth Rate (CAGR) of 4.47% at 2023 exchange rate
Source: ZimStat (2024)

With population projections indicating a much slower growth rate, higher GDP levels translate to higher GDP per capita. In the outlook period, Harare is anticipated to have higher disposable income and rising market demand. Unemployment is expected to slow down in the long term as income inequality improves.

5.6. Economic Baseline Assessment

The economy of Harare is highly diversified and is showing signs of permanent shifts towards service-led growth, despite having strong links to agricultural performance. Formal and informal firms compete in the factor and product market. Structural rigidities in the form of infrastructure gaps and brain drain are affecting the economic transformation. In the last decade, the economy was hit by multiple shocks and amongst them Covid-19 had the severest impact on output, employment and municipal finances. The growth momentum of Harare surpasses several cities in Southern Africa. Between the years 2020 and 2023 the economy achieved an average growth of 6%.

5.6.1. Economic Sector Analysis

Like most Emerging Market and Developing Economy (EMDE) cities, the service sector accounts for over 65% of the city's GDP. Moreover, it has shown resilience, strong recovery and expansion, in comparison to the manufacturing sector (see Figure 42). Between the years 2019 and 2022, the sector recorded a 3.1% average growth (-10.87% in 2020 to 4.9% in 2022), with food and accommodation, finance and insurance, wholesale and retail trade industries driving the growth. Job creation in the sector is higher than in the manufacturing sector. In contrast, the industry which constitutes 26% to 31% of economic activities is on a downward trend (see Figure 5.10). The sectorial growth was -9.9 % in 2020 and -0.7% in 2022. The manufacturing industry which contributes more to secondary activities shows sluggish growth as the cost of production surges. Infrastructure gaps in energy, water supply, road and transport have directly contributed to high production costs, together with foreign currency shortages. According to CZI (2023), the challenges have reduced industrial competitiveness. Between the years 2021 and 2023, average net imports for electrical energy were approximately 15% of total energy consumption, with industrial divisions consuming more than 50%. The increased imports in the last 3 years imply reduced power generation (low energy productivity) and resulted in massive load shedding. The power supply deficit for Zimbabwe is approximately 30% (ZESA, 2024), with railway operating capacity below 60% and high road congestion with an average of 50 cars per 10-minute interval. The transport productivity is at its lowest in decades, with the transport networks not satisfying the market demand. In addition, the gap is extending as a result of lack of funding and persistent economic crisis. Modernization of city transport is a priority and deeply needed.

In the 1990s the city was in the thermal energy business producing 90 MW at Harare thermal plant. Over the past 20 years, it has diversified its energy business into biogas, the Crowborough and Firle biogas. Unfortunately, this has resulted in the delay of a wide range of energy projects. The modernization of key infrastructure in the economic enabling sector such as rail, air transport and energy presents great investment opportunities in the medium to long term, which calls for robust financing options under the Private Public Partnership (PPP) arrangement.

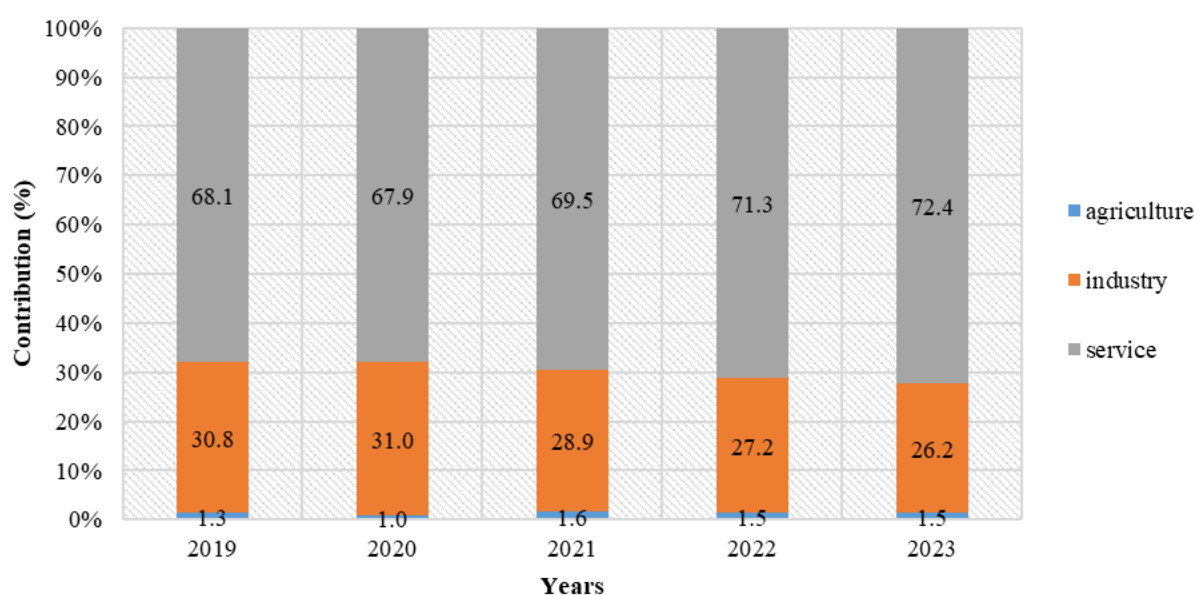


Figure 5.9: Contribution of Economic Sectors to GDP for Harare

Sources: National Accounts Statistics, Zimstat (2024)

Agricultural activities (urban agriculture), account for between 1% and 1.6% of GDP. The sector has been expanding slowly since 2019 (from -30.6% in 2020 to 0.43% in 2022) and is the source of livelihood for urban low-income households. High urban agricultural productivity enhances food security and health nutrition for infants and the elderly population. This has resulted in the City residents focusing most of their attention towards fruit, vegetables, fish and poultry production. The climate risks and frequency of drought (the El Nino weather) have contributed to output contractions for urban agriculture. Investment in green projects like precision agriculture reduces the macroeconomic effects of climate risk. Consequently, the uptake of digital agricultural products is low for Harare.

5.6.2. Employment and Wages

World Bank Development indicators (2024) revealed that the share of employment in service and manufacturing for Zimbabwe has gone up, from an average of 26% (between the years 2014 and 2018) to 30.5% (between the years 2019 and 2022). Whilst for the manufacturing sector it has risen from 8.7% to 12.7%. Most urban employees are in the service sector and employment in agriculture for the period recorded a decline from 65.5% to 56.9%. The labour market transformation is in line with global trends, which indicate that economies have transitioned from agricultural dependency towards the service sector. At sectorial level, industrial employment shows variations across the subsectors. Table 8 illustrates the distribution of employment and earnings between the years 2014 and 2018. Average employment was highest in Food and Beverages and lowest in Office, Accounting and Computing Machinery. The top 5 subsectors with high employment for the period were (i) Electrical and Machinery; (ii) Base Metals; (iii) Wearing Apparel; (iv) Furniture; and (v) Fabricated Metal Products. In the same period, these subsectors were amongst the top 5 sectors with higher wages and salaries.

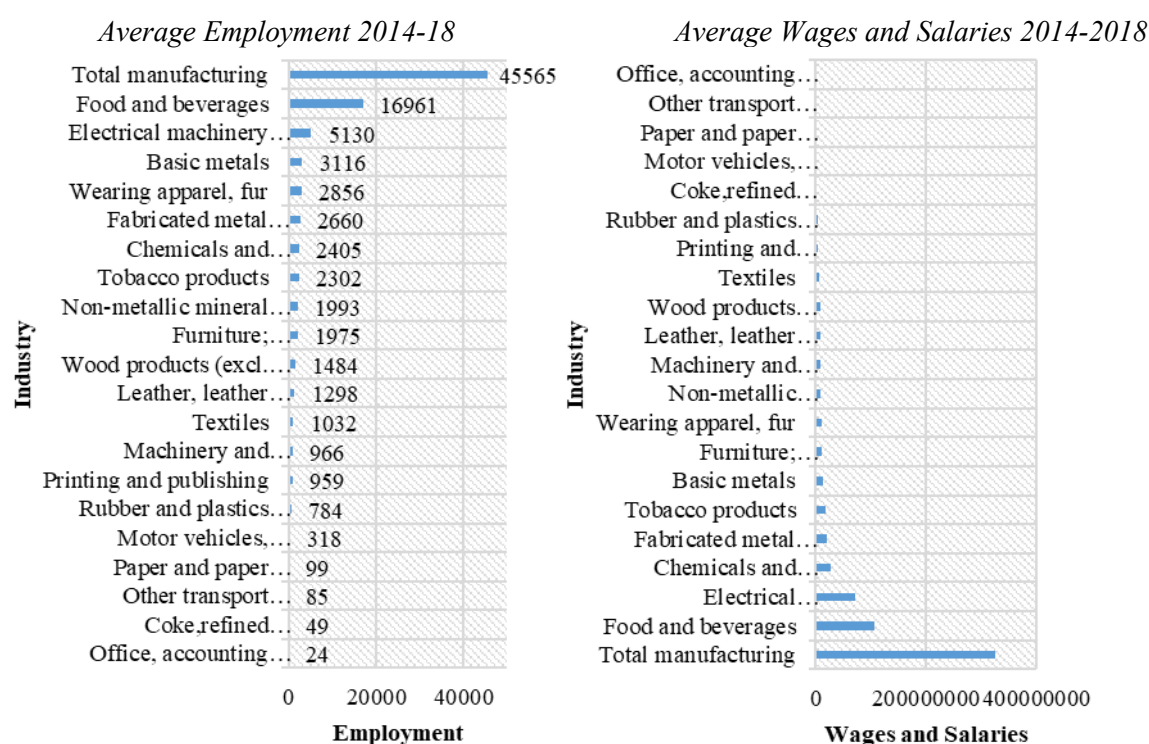


Figure 5.10: Manufacturing Data for Zimbabwe

Source: UNIDO, 2024

Between 2014 and 2018, employment creation was highest in Printing and Publishing; Paper and Paper Products; Textiles and Food and Beverages with the following employment rates 258.4%, 219.4%, 67.8%, and 15.7%, respectively. The top 5 subsectors with job contraction (negative employment rates) were (i) Coke, Refined Petroleum Products, Nuclear Fuel (-97.8%); (ii) Leather, Leather Products and Footwear (-77.5%); (iii) Tobacco Products (-70%); (iv) Office, Accounting and Computing Machinery (-71.4%); and (v) Electrical Machinery and Apparatus (-66.6%). The finding is consistent with claims that share of employment in highly productive and automated sectors is usually low. Between the years 2014 and 2017, the number of active firms was stable, averaging 507, thus showing limited entry of new firms in the manufacturing industry. In 2018, manufacturing firms decreased to 423 due to viability problems, however in 2020 the number surged to 819 (UNIDO, Industrial Statistics, 2024).

5.6.3. Employment Patterns for Harare

The number of employees for Harare decreased from 315,200 in 2018 to 307,200 in June 2023, whilst earnings significantly shifted to USD1,894,594.12 in June 2023 from USD2,488,300.45 in 2018. The decrease in number of employees is in line with the shrinking industry. On the other hand, rising earnings have implications on market demand, social welfare and economic well-being for the working class.

5.6.3.1. Sectorial Employment Distribution for Harare

Figure 5.11 illustrates that the services sector employs most workers and agriculture has the least share of employees in Harare. Hence, there tends to be more support for the services sector, since it's the main centre for employment creation. At national level, the share of employment in agriculture is the highest.

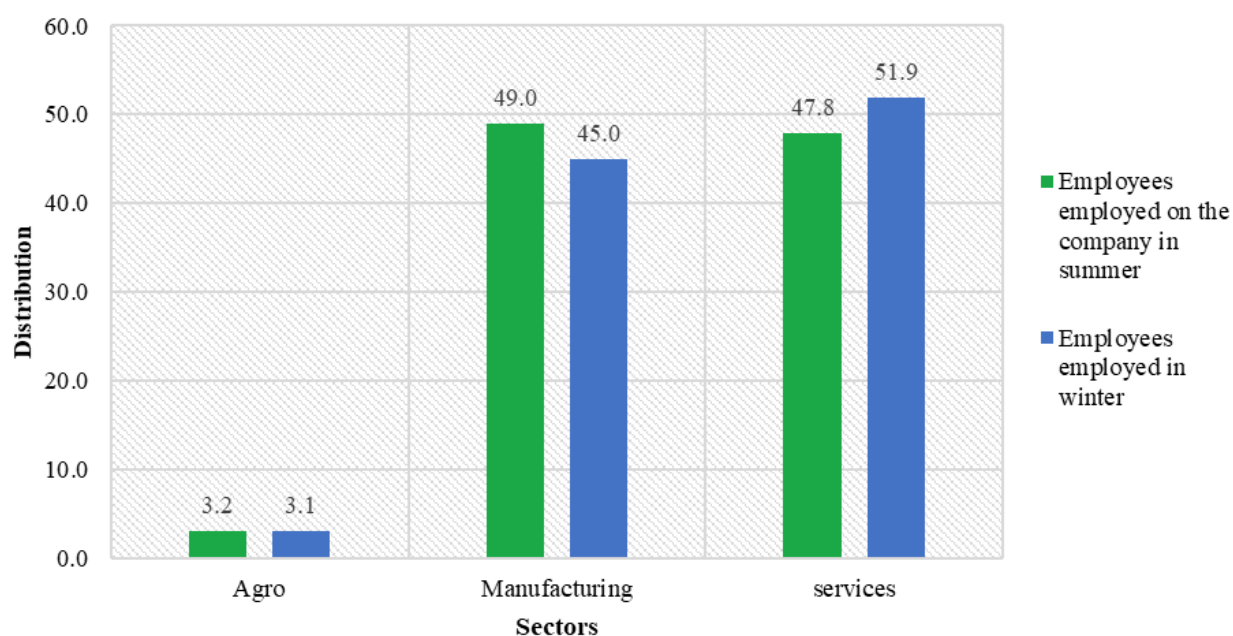


Figure 5.11: Sectorial Distribution of Employment Harare
Source: Harare Master Plan industrial survey conducted in 2024

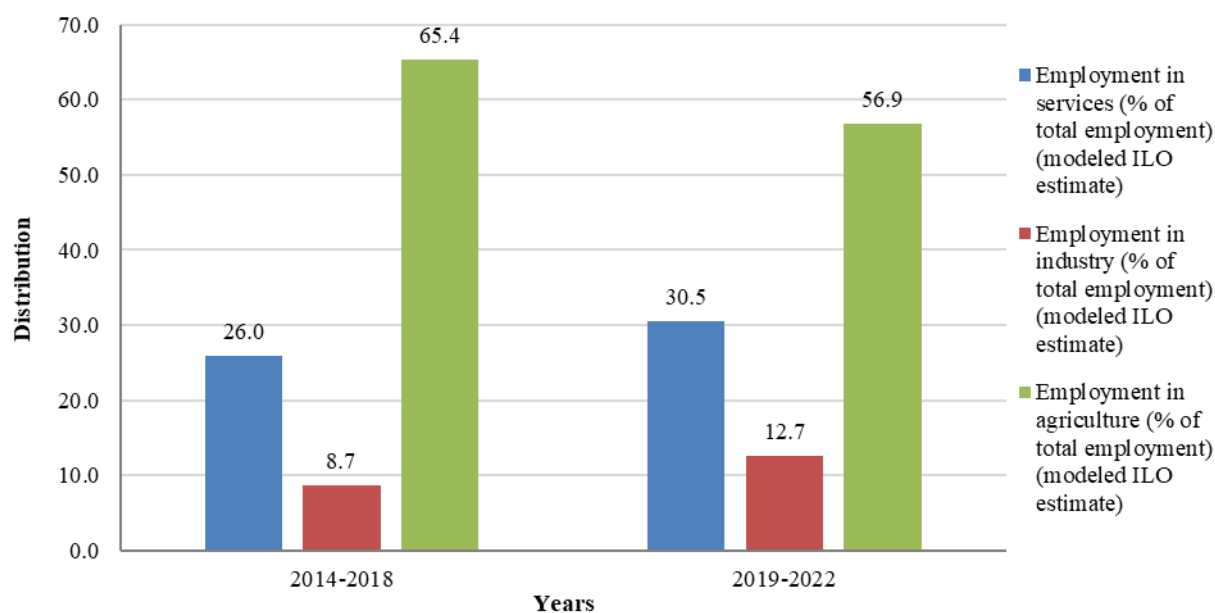


Figure 5.12: Sectorial Distribution of Employment Zimbabwe

Source: World Development Indicators, (2024)

5.6.3.2. Industrial employment at a Glance greater Harare

Figures 5.13 to 5.16 illustrates industrial employment patterns for the city and the major employers.

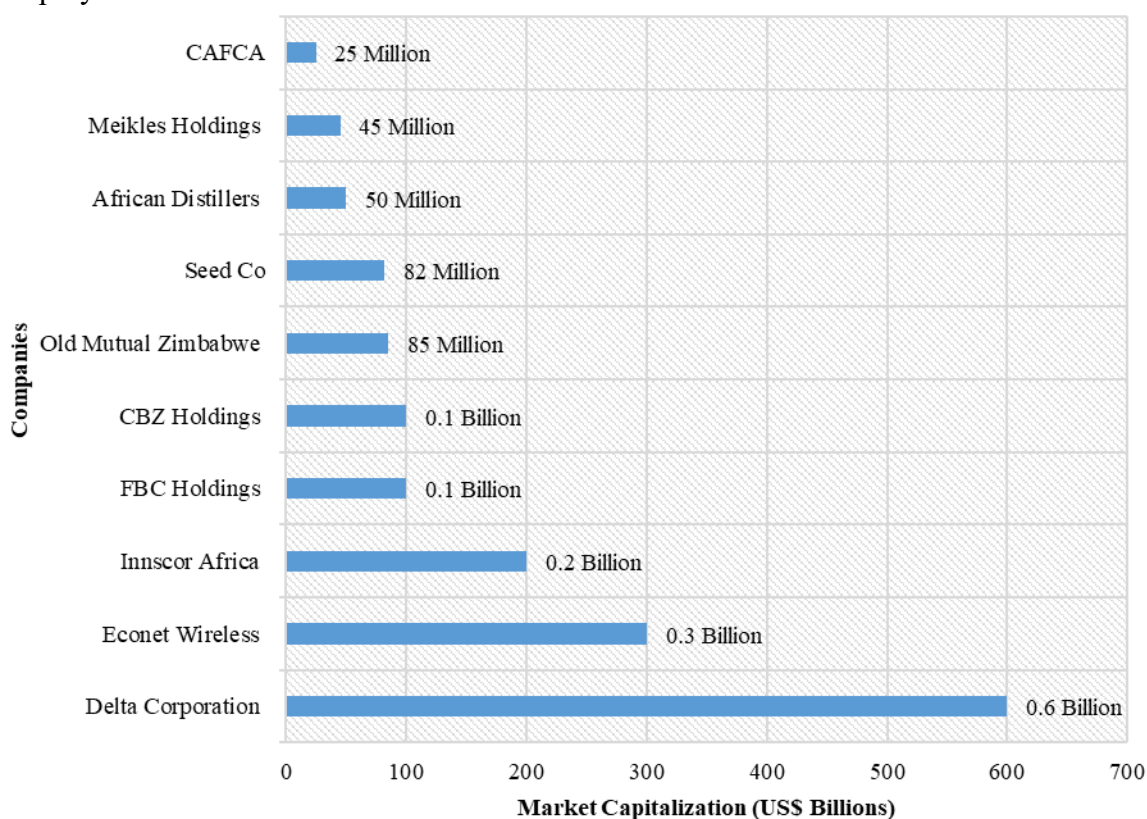


Figure 5.13: 2024 Top 10 Richest Companies in Harare

Source: compiled using data from ibzim.com/business/rankings/richest-companies. All Market Capitalization values are in USD. All companies are located in Harare.

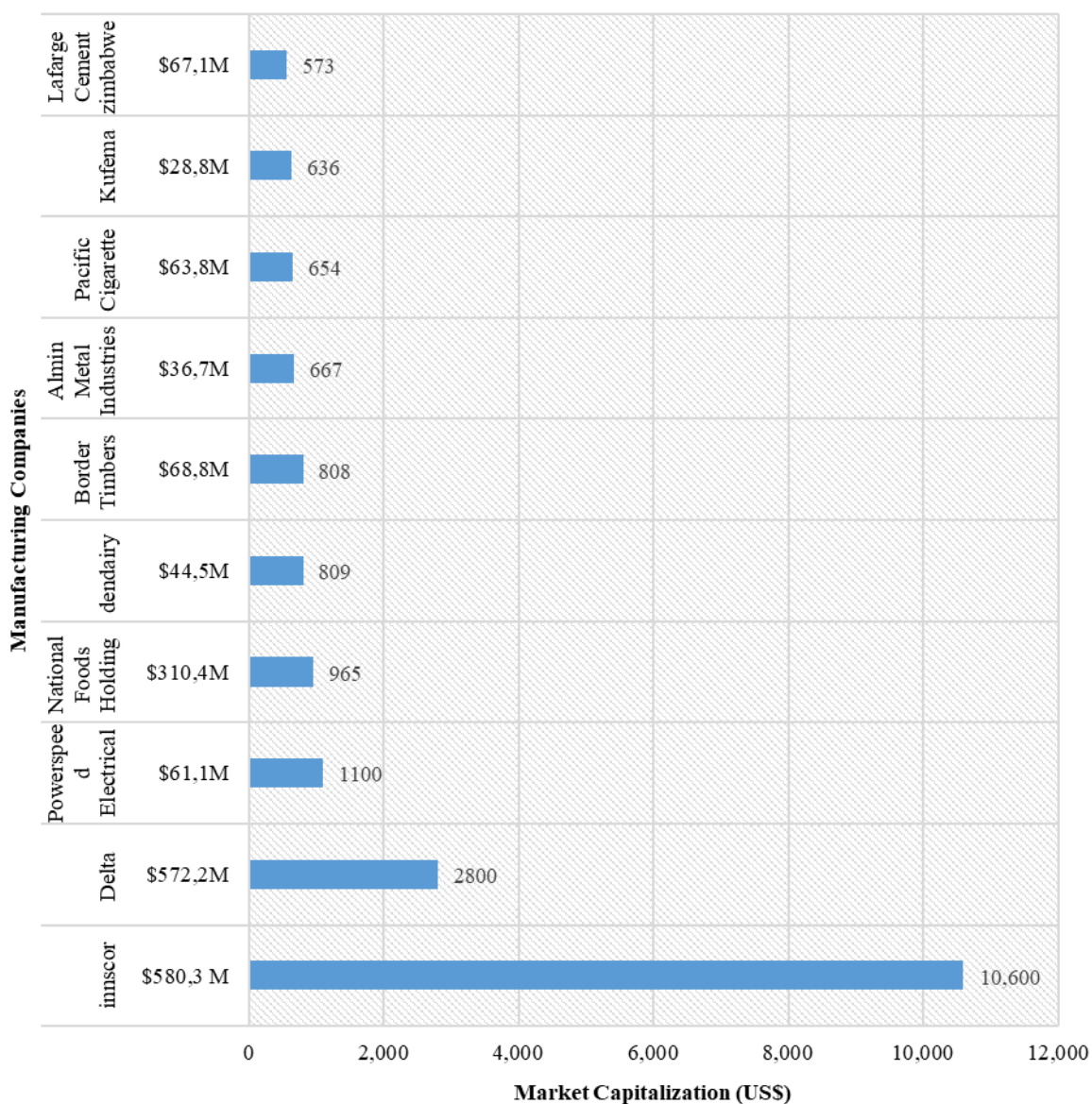


Figure 5.14: Top 10 Manufacturing Companies in Zimbabwe by Number of Employees Jan 2025
Source: Compiled using data collected from Zoominfo (2025). All revenue values are in USD.

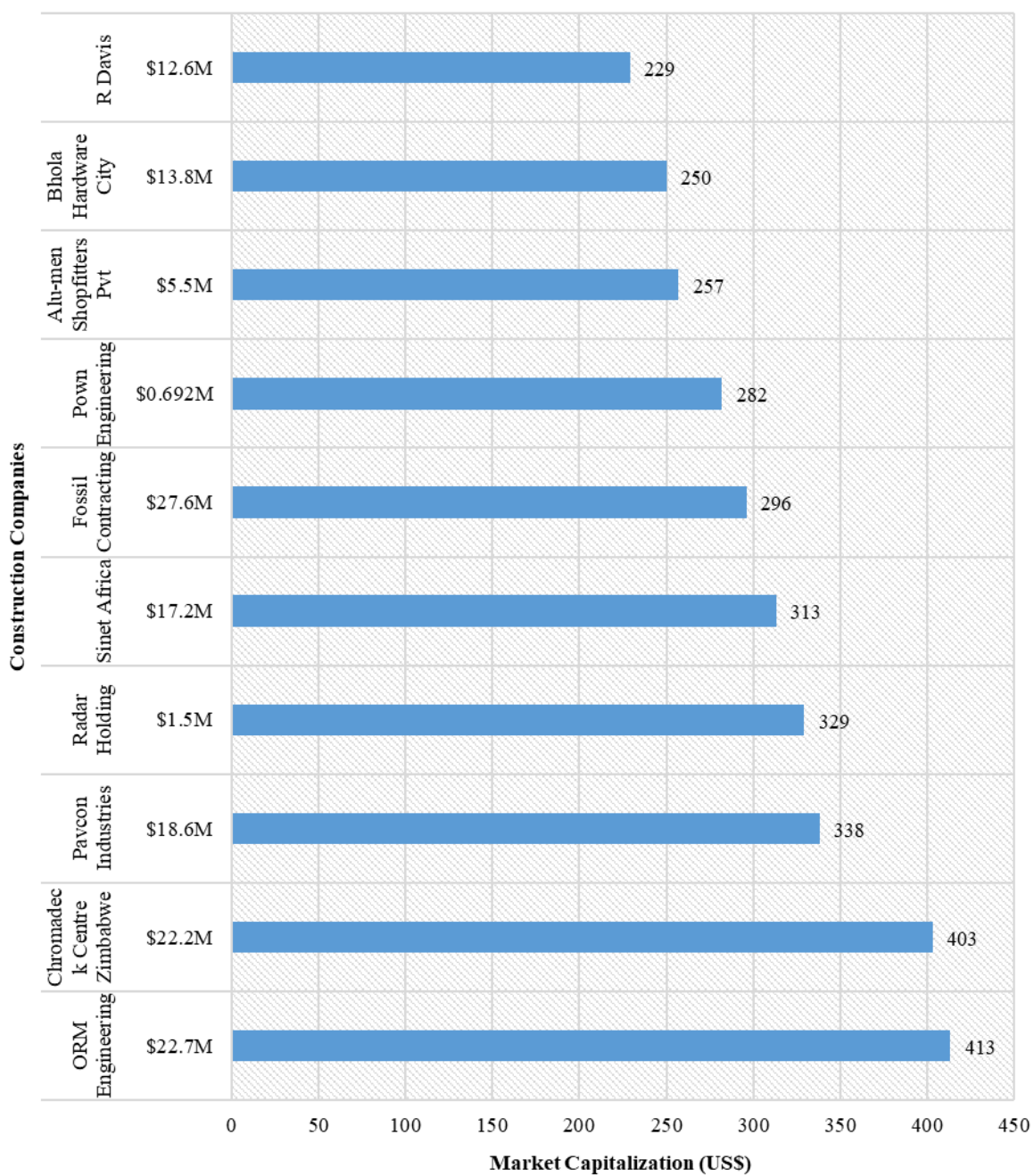


Figure 5.15: Top 10 Construction Companies in Zimbabwe by Number of Employees

Source: compiled using data collected from Zoominfo (2025). All revenue values are in USD. All companies are located in Harare except for ORM Engineering (Kwekwe).

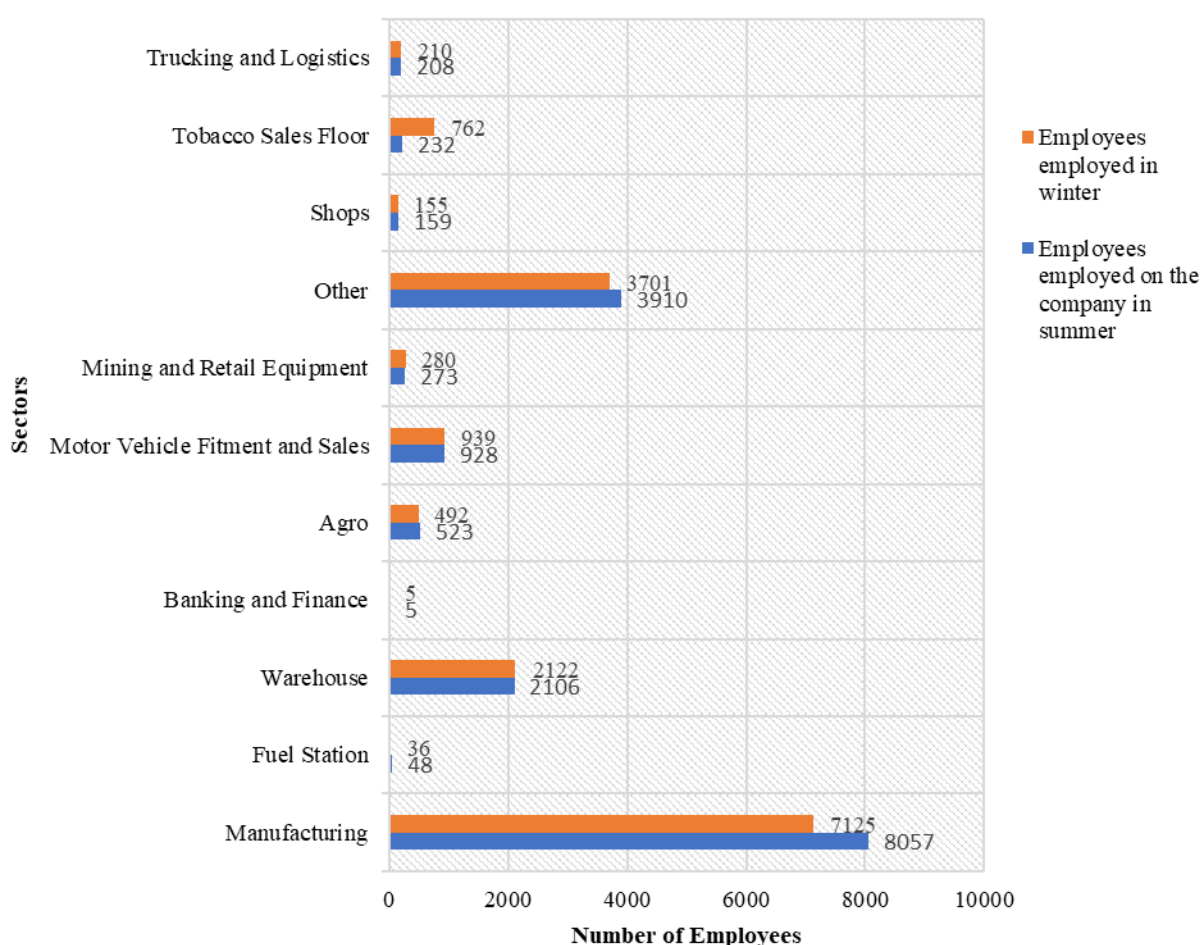


Figure 5.16: Seasonal variation of employment by industry in Harare

Source: Harare Master Plan industrial survey conducted in 2024

The economy has been having challenges with unemployment for more than two decades now. The unemployment rate increased significantly from 10.7% in 2011 to 24% by 2021 (ZimStat, 2021). The rate marginally decreased to 18.3% in 2023 but remains among the highest in the region. Female unemployment is almost double the unemployment rate for males, revealing the structural differences and gender norms prevailing in the economy (See table 9).

Table 5.3: Unemployment Rates by Province and Sex, as at 30 September 2024

	Male	Female	Total
Bulawayo	26.2%	31.6%	28.7%
Manicaland	24.2%	25.6%	24.8%
Mashonaland Central	19.3%	16.4%	18.3%
Mashonaland East	17.6%	23.0%	19.9%
Mashonaland West	15.5%	21.5%	17.9%
Matabeleland North	32.2%	28.0%	30.4%
Matabeleland South	24.9%	27.3%	25.9%
Midlands	20.9%	24.0%	22.1%
Masvingo	19.2%	17.0%	18.2%
Harare	16.2%	28.2%	21.4%
National	19.7%	24.6%	21.8%

Source: (ZimStat, 2024)

The factors affecting unemployment rates in Harare are highlighted below:

- **Economic Downturn:** Zimbabwe's economic instability is a major contributor to unemployment in Harare. The city's economy has faced significant challenges, including high inflation and a decline in key industries.
- **Lack of Education-Job Correlation:** There's a mismatch between education and employment opportunities, leading to a lack of correlation between education levels and job prospects.
- **Informal Sector Dominance:** Harare's informal sector is substantial, with many individuals engaged in informal activities such as vending and cross-border trading.
- **Youth Unemployment:** The city's youth are disproportionately affected, with unemployment rates among young people significantly higher than the national average.
- **Incompatibility between Skills and Industry Needs:** The skills acquired through education often don't align with the needs of Harare's industries, exacerbating unemployment.
- **Limited Access to Finance and Credit:** Entrepreneurs and small business owners in Harare face challenges accessing finance and credit, hindering job creation and economic growth.

5.7. Manufacturing Trade

The major threat to trade in recent years has been attributed to high import penetration, especially in the retail trade. Cheap influx of imported goods affects domestic industry growth potential, which also presents an opportunity for industrial development, through shifts in the Global Value Chain (GVC) participation. This positions the city industry from retail trade towards high value production nodes in GVC, such as assemblers of radios, cellphones, cars, automated agricultural implements, bicycles, motor vehicles and motorbikes. Moreover, since the Harare industries' share is above 50% of the overall trade, the statistics represent an overview of industrial trade for Harare.

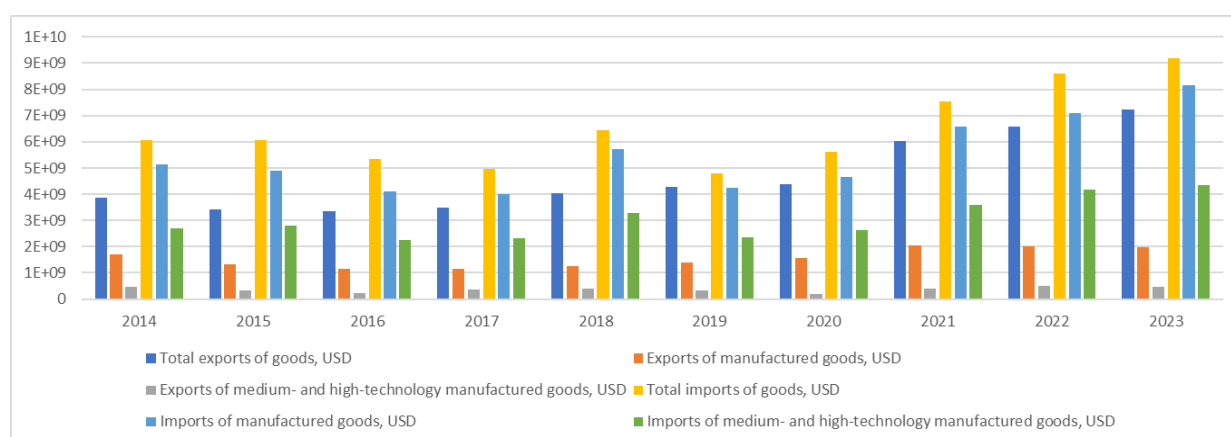


Figure 5.17: Manufacturing trade for Zimbabwe

Source: UNIDO, 2024

Zimbabwe's external position shows persistent current account deficits with deep troughs during periods of severe droughts. Figure 49 shows negative manufacturing trade balances for the past 10 years. There are no major shifts in composition of exports, with Zimbabwe exporting more primary goods and less sophisticated manufactured goods, thus importing medium and high technology manufactured goods, resulting in unfavorable terms of trade. The conditions have contributed to low export earnings and high trade deficit with major regional trading partners. CZI (2023) Manufacturing Survey reveals a low appetite for export in the manufacturing sector, with an average export quantity of 7% of gross output,

illustrating wood and wood product sub sector as the lead exporter with a share of 18%. The manufacturing sector is regarded as a high-cost producer in the region, creating opportunities for imports from low-cost producers like South Africa. Low trade competitiveness presents opportunities for industrialization through import substitution, in cases where the country has a competitive advantage and value chain development.

5.8. Production Networks: City Markets and Home Industries

The production networks for the city are confined in city markets and home industries, which tends to be more inclusive than other forms that may exist because these are micro-centred and help to eradicate poverty.

5.8.1. Fruit and Vegetable Value Chain

World fruit and vegetable production was 2.1 billion tonnes in 2022, of which Zimbabwe's share was 0.03%. Between the years 2011 and 2022, fruit production increased from 246,121 tonnes to 364,534 tonnes, whilst vegetable production rose from 197,848 tonnes to 235,485 tonnes. This shows that over the past 12 years, fruit production expanded significantly by almost 2.5 fold more than the growth rate of vegetable production. During the same period, the average per capita consumption for vegetables in Zimbabwe decreased from 15.71kg per capita to 13.48kg, whilst for fruits it declined from 15.79kg per capita per year to 14.42kg. The consumption of fruits and vegetables in Zimbabwe is below the 400g per capita per day, as per FAO recommendations. Bananas, apples and oranges dominate the composition of the per capita consumption bundle and the proportion has not changed significantly since 2011. The low intake and low consumers appetite for fruits is likely to reverse, as the health benefits of fruits and vegetables are aggressively communicated to consumers. Between the years 2011 and 2022, fruit exports accelerated from 33,000 tonnes to 120,000 tonnes. In comparison, the export of vegetables modestly rose from 1,000 tonnes to 6,000 tonnes, for the period under review. During the same period, there was a drastic fall of vegetable imports from 22,000 tonnes to 4,000 tonnes, whereas fruit import declined from 33,000 tonnes to 29,000 tonnes. The imports can further be reduced if investments in green houses and smart agriculture is accelerated, as most of the imported fruits can only be produced productively under green houses.

The economic contributions of fruits and vegetables for Harare are understood better through value chain analysis, in which city markets play a significant role. The markets differ in sizes, the major ones include Mbare, Coca-Cola, Hatcliffe, Highfields Lusaka, Kadada Dzivarasekwa, Matoko Mabvuku, Kuwadzana, Glen-View, Tynwald, Avondale and Domboshawa. These markets generate economic values in several dimensions and their influence is expected to grow largely because of an expanding population which is anticipated to push the demand for fruit and vegetables. The city markets are sources of livelihoods for low-income households and serve as a key avenue for advancing inclusive growth through economic empowerment. Figure 5.18 illustrates the economic impact, together with the backwards and forward linkages along the fruit and vegetable value chain for Harare.

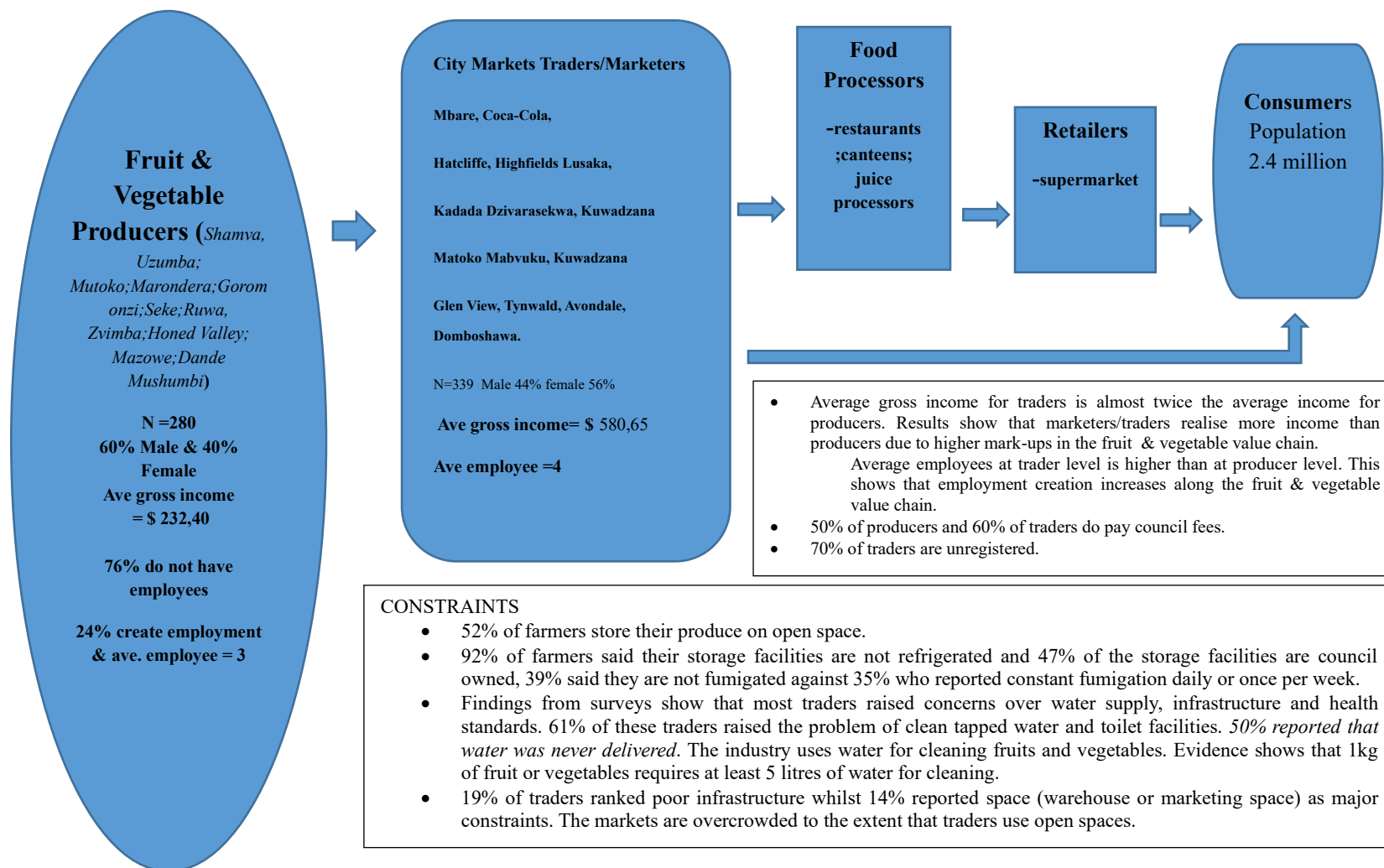


Figure 5.18: Fruit and Vegetable Value Chain Greater Harare

Sources: Harare Master Plan 2024-2044, survey on city market value chains 2024

5.8.2. Iron, Steel and Metal Industry

The world crude steel production was 1.89 million tonnes in 2023, an increase from 1.6 million tonnes in 2014, with Southern Africa accounting for 4.9%. Steel production for Zimbabwe registered a negative growth of 42.3%, with output plummeting from 6,759 tonnes to 3,900 tonnes for between the years 2011 and 2022. The world cast steel output was 1.82 million tonnes giving a material efficiency of 97.65%. In terms of the proportion of raw materials converted into steel products, China produced 50.4% of the global steel products, compared to 2% for Africa. The world steel use per capita between the years 2019 and 2023 shows a steady decline from 229.2 kg to 219.3kg, which could signal the effects of a rise in global population against stagnation in output. 62% of steel was used for building and infrastructure, 10% for metal products, and 16% for mechanical equipment. Globally, the current market size of the industry is estimated to be USD927.66 billion. For Zimbabwe, the market size was USD1.26 billion in 2021 and expected to reach USD6 billion by 2026. The steel industry is estimated to contribute more than USD1.2 trillion in value added at global level, either directly or indirectly (World Steel, 2024).

For Zimbabwe, the iron and steel industry is a beacon of engineering, creativity and a pillar for economic development as the sector has strong downstream and upstream linkages with many sectors including construction and built environment, automobile, agriculture and transport. Its close links to Technical and Vocational Education Training (TVET), help to transform technically talented graduates in the labour market into innovative entrepreneurs. The 2022 Zimbabwe Iron and Steel association commissioned Baseline survey found that employment for the sector was 13,100 in 2021 and projected to 50,000 at the end of 2026, if subsectors adopt new technologies, and 61% were employed in Harare and eastern region. Of the 486 active firms in operation, 51% operated in Harare. For Harare, the economic impacts are difficult to evaluate as iron and steel industry involves complex linkages within the formal and informal economy, with a lack of statistical database for such essential economic activities thus complicating the process. A Micro level analysis, at city's home Industry, of the economic benefits of metal and metal fabrications was adopted. The approach corroborates with the Iron and Steel Industry's 2022 Strategic Pillar, which is to establish product value chains that promote inclusive participation of local value chain actors in SMEs. The home industries are the city's engine for advancing economic empowerment and compliment government's goal of industrial development through the provision of space to low-income residents. In terms of a micro analysis there's Siyaso Mbare, which is a place where small scale firms produce metal products that include building materials (doors and windows) and small-scale farming tools (wires, nails, bolts and nuts). Over 80% of doors and windows for residential properties in Harare are believed to have been supplied by the metal and metal fabrication subsector. Moreover, this industry creates more than 1,000 jobs every quarter, thus adding more workers to become directly or indirectly involved in the value chain. The home industries have transformed the livelihoods of many households, through employment generation and entrepreneurship development. A large number of innovative entrepreneurs are believed to have emerged from the home industries. The value chain analysis in Figure 5.19 below is used to expound the socio-economic implications, opportunities and threats at city level.

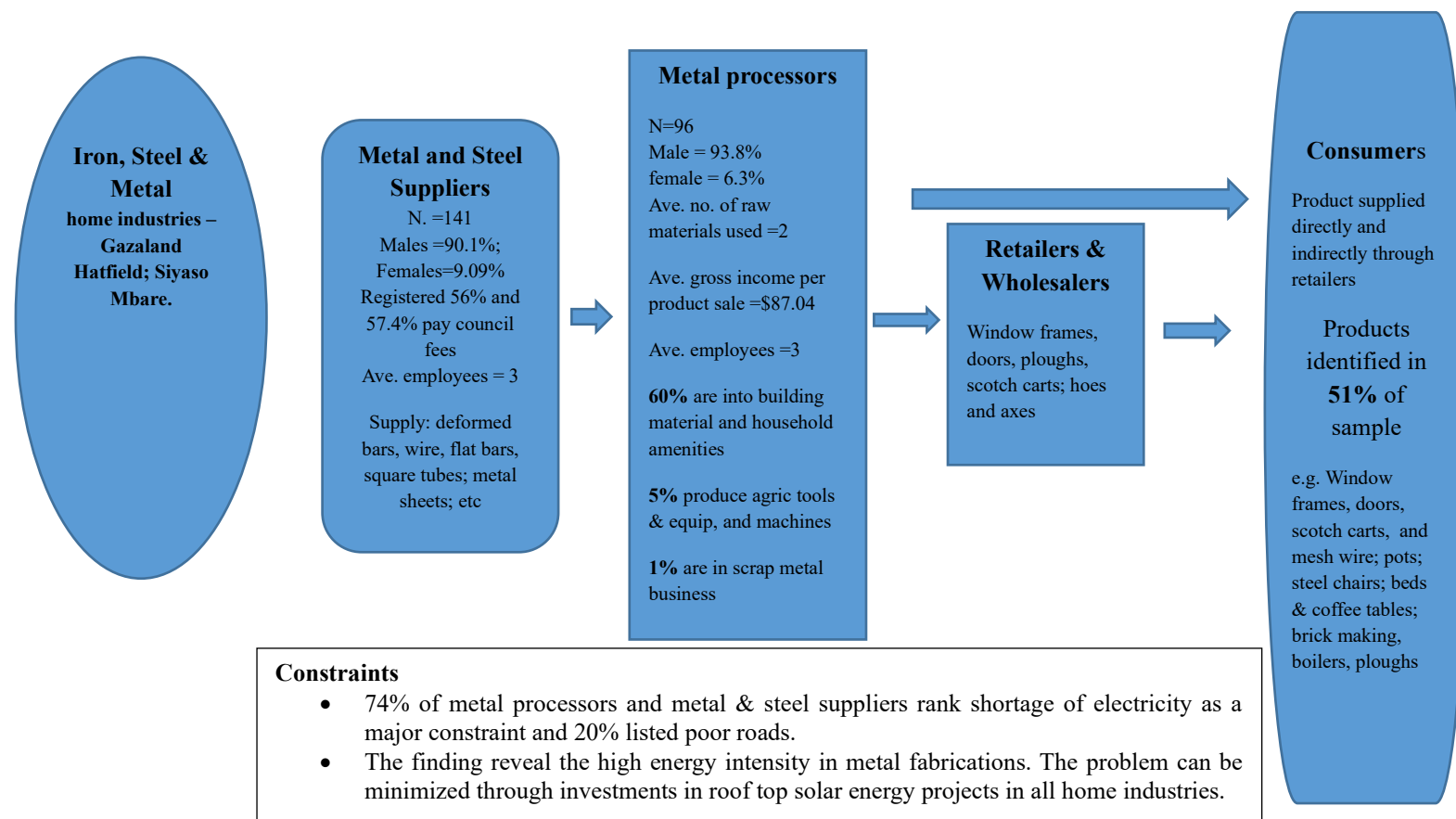


Figure 5.19: Iron and Steel Industry Value Chain Greater Harare

Sources: Harare Master Plan 2024-2044, survey on city Home Industry value chains 2024

5.8.3. Meat Industry

The production of meat for Zimbabwe reached 918,058.5 tonnes in 2021. The industry is one of the Government's priority sectors aimed at boosting the production of livestock under the Meat and Leather programme and the livestock growth and recovery plan. The meat consumption per capita between the years 2010 and 2021 fell from 62.28kg per year to 55.97kg per year, showing a 10.13% negative growth rate. Figure 5.20 below summarises the composition of meat consumption in Zimbabwe.

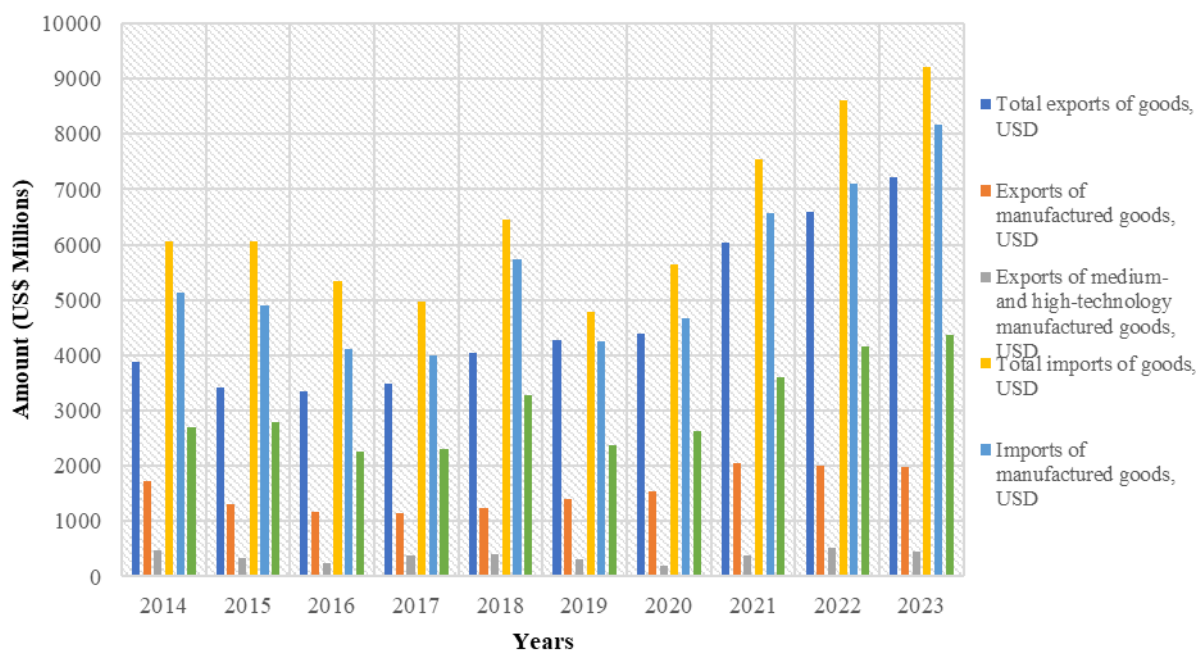


Figure 5.20: Per capita meat consumption by type of meat in kgs

Source: Our World in Data, 2024

The beef share in per capita consumption decreased from 50.14kg to 43.77kg, yet despite this 6.37kg decline, beef remains the most preferred type of meat by the market. On the other hand, a shift towards the consumption of poultry meat resulted in a 1.14kg increase in per capita consumption between 2010 and 2021. The rise in poultry meat in the dietary needs for consumers could reveal the health benefits associated with white meat and the reservations for red meat. There are no significant changes in the quantity of sheep and goat meat consumed per year and the share remains relatively stable for the period and the meat is more preferred to pork meat, whose proportion seemed to be on the decrease. Figure 5.21 below provides an outline for the meat value chain in Harare. The chart is used to expound on the economic benefits of the industry across the production nodes and along the value chain.

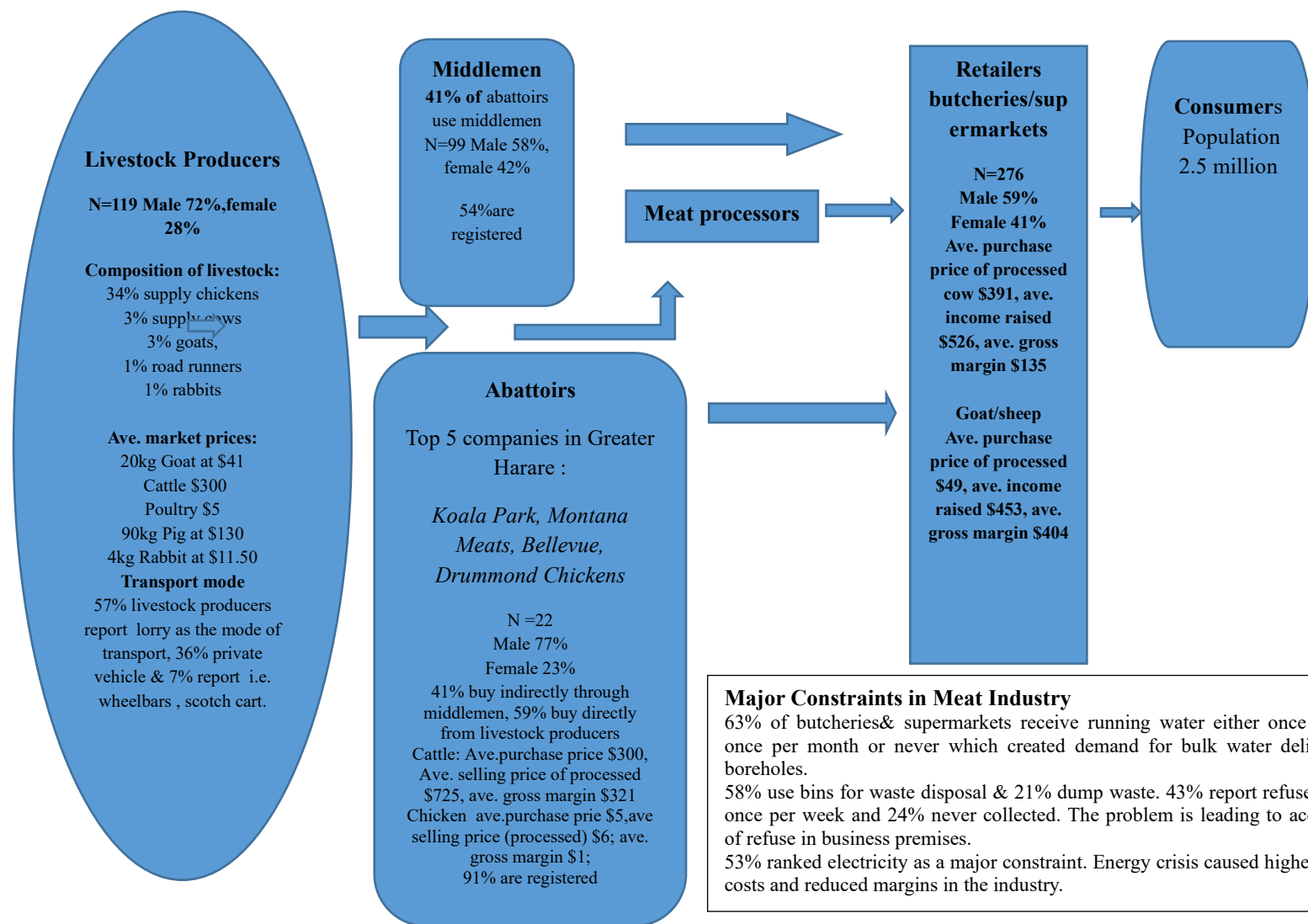


Figure 5.21: Meat Value Chain in Harare

Sources: Harare Master Plan 2024-2044, survey on city Meat Industry value chains 2024.

5.9. Global Production Networks (GPN)

Global Value Chain (GVC) participation is limited to supply of raw materials and wholesale activities e.g. auto parts distributors, household electronic appliances, groceries, clothing and footwear. Wholesalers and retail traders are amongst the major players. They participate in GVC as distributors of global output.

5.9.1. Informal Economy

The degree of economic informalization is on the rise. The size of Zimbabwe's informal sector increased from 33.7% in 2019 to 58.3% by the second quarter of 2024. The percentage increase in the formal economy was 10.9% compared to 7.4% for the informal sector. Higher degree of informality caused challenges in economic management and domestic revenue mobilization. The informal sector competition has the ability to lower formal productivity by almost 24% (World Bank, 2022). The sector employs about 90% of the total employees and Finscope (2022) found that MSMEs employed 1,704,454 employees and contributed USD 8.6 billion to GDP.

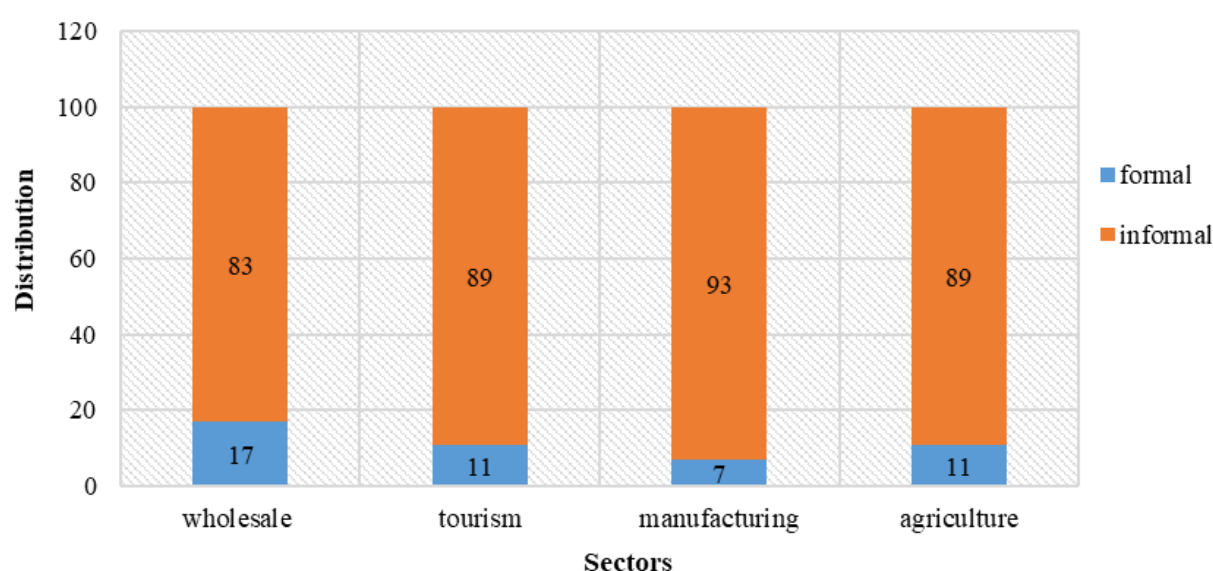


Figure 5.22: Informal Sector Overview

Source: ZimStat, 2024

The rise of informal employment is attributed to economic instability, firm closures and retrenchment the country is experiencing. Figure 5.22 reveals a high degree of informalization across the key industries in Harare, with manufacturing experiencing the highest level of informalization. Low cost and limited restrictions of starting businesses in the different sectors has contributed to the growth of informal sector.

5.9.1.1. Informal Night Trading in Harare

The Night Time Economy (NTE) in Harare has transformed significantly over the past five years. A vibrant informal economy has emerged, thus changing the nature and characteristics of the city's night economy, which was traditionally dominated by nightclubs, surgeries and taxi services, amongst other services. Globally, NTEs take the form of social hubs and formal night markets which support cultural tourism. This contributes to job creation and the city's overall economic development. The form of NTE which has emerged in Harare is summarized in Figure 5.23 and deviates from global or regional practices.



Figure 5.23: Informal Night Trading in Harare

Source: Harare Municipality Master Plan informal night trading conducted on - January 2025.

5.9.2. Port Capacity and Expansion Plans

Harare is host to the country's largest airport, Robert Mugabe International Airport. The Government undertook a massive US\$153 million investments for refurbishment and expansion of the airport, which doubled capacity to 6 million passengers per annum. The expansion turned the airport into a world class aviation asset, with the modern facilities boosting the airport's competitive advantage. Moreover, it is expected to contribute immensely towards tourism development. The airport's competitiveness is set to be strengthened further once the expansion plans in Table 5.4 materialize.

Table 5.4: Robert Mugabe International Airport Expansion plans

Project	Scope	Estimated cost
Cargo Terminal Development and Operation	Cargo Terminal building complete storage and cold chain facilities; forwarder facilities; offices and amenities; sorting and parking shed.	US\$20 million under BOT arrangement.
Airport Hotel	Five story, estimated 150 room capacity.	BOT arrangement.
Dry Port	Bonded warehousing (customs); Diplomatic duty-free shop.	US\$5 million, BOT arrangement.
Aviation Fuel Depot	To complement existing capacity, Aviation fuel storage facility.	US\$8 million.
Shopping mall		US\$5 million.
Business Park	Multi story building, offices, parking and ancillary facilities.	US\$5 million, BOT arrangement.
Airport agrobusiness	Horticulture, blueberry production for export.	Lease.
Light manufacturing pharmaceutical	Pharmaceutical manufacturing plant.	US\$8 million.
Solar farm	Proposed 2kWh energy generation capacity.	

Source: Compiled from Airport Company of Zimbabwe, 2025.

5.9.3. Cargo Volumes and Value

Figure 2.24 shows that freight services seemed to have stalled since 2014, while passengers and flights show significant correlation. Between 2011 and 2019 Robert Mugabe International Airport registered growth in both passengers and flights. The downward trend between 2019 and 2021 reveals a contraction in air travel as a result of the COVID-19 pandemic.

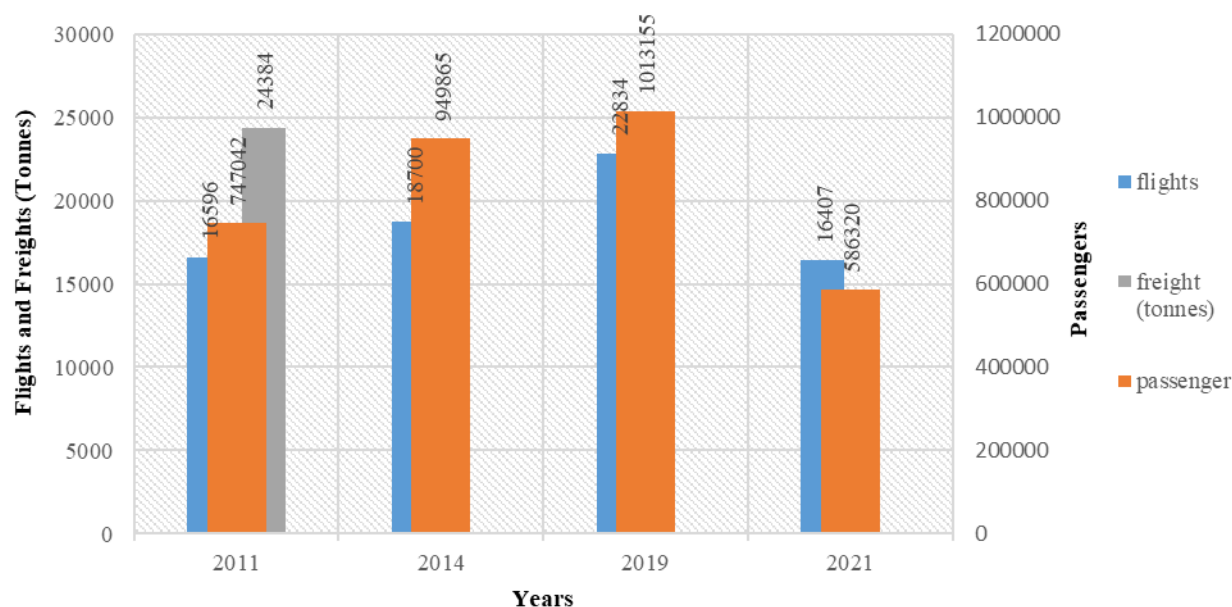


Figure 5.24: Cargo volumes for Robert Mugabe International Airport

Source: Quarterly Digest of Statistics 2014-2022.

5.10. Sectorial Economic Development and Positioning

Sectorial contribution to GDP shows no major changes between the years 2019 and 2023. Figure 5.25 shows the dynamic shifts in sectorial composition to GDP, where the top 10 industries are highlighted.

5.10.1. Key Economic Sectors and Performance

In 2019, Wholesale and Retail Trade; Manufacturing; Financial and Insurance activities; Information and Communication Technology (ICT); and Education dominated with 25.1%; 21.1%; 8.6%; 5.9%; and 5% contributions to GDP, respectively (see figure 5.25). The Construction sector was in the top 5 with a 4.5% percentage contribution to GDP and registered an average growth of 4.2%, compared to -5.4% for manufacturing and 2.8% for wholesale and retail trade. ICT, together with the Financial and Insurance activities had the highest growth rates of 14.7% and 12.4%, respectively. These sectors are on a positive growth trajectory except for manufacturing, even though the sector is key to the city's economic development.

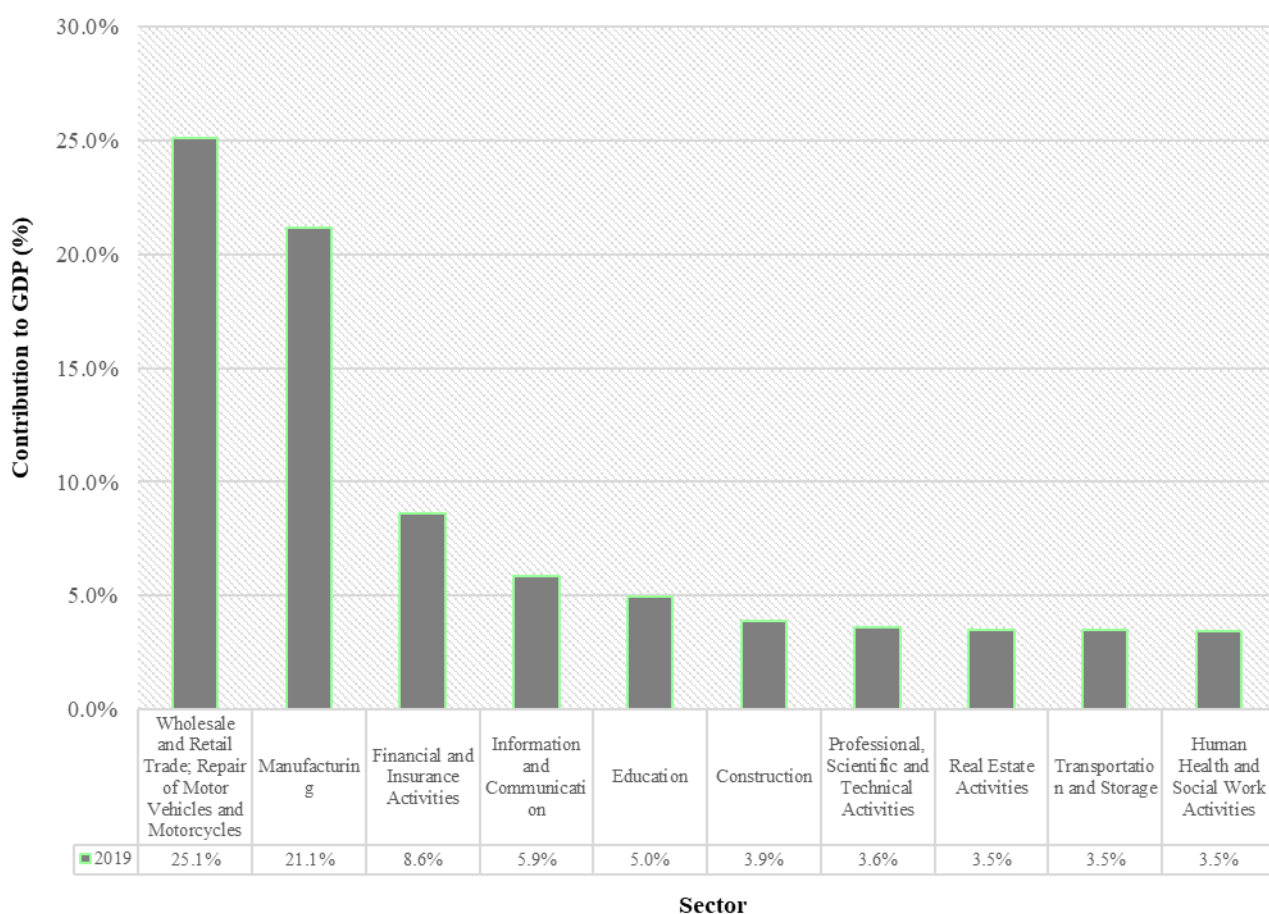


Figure 5.25: Sectorial Contribution to GDP in 2019

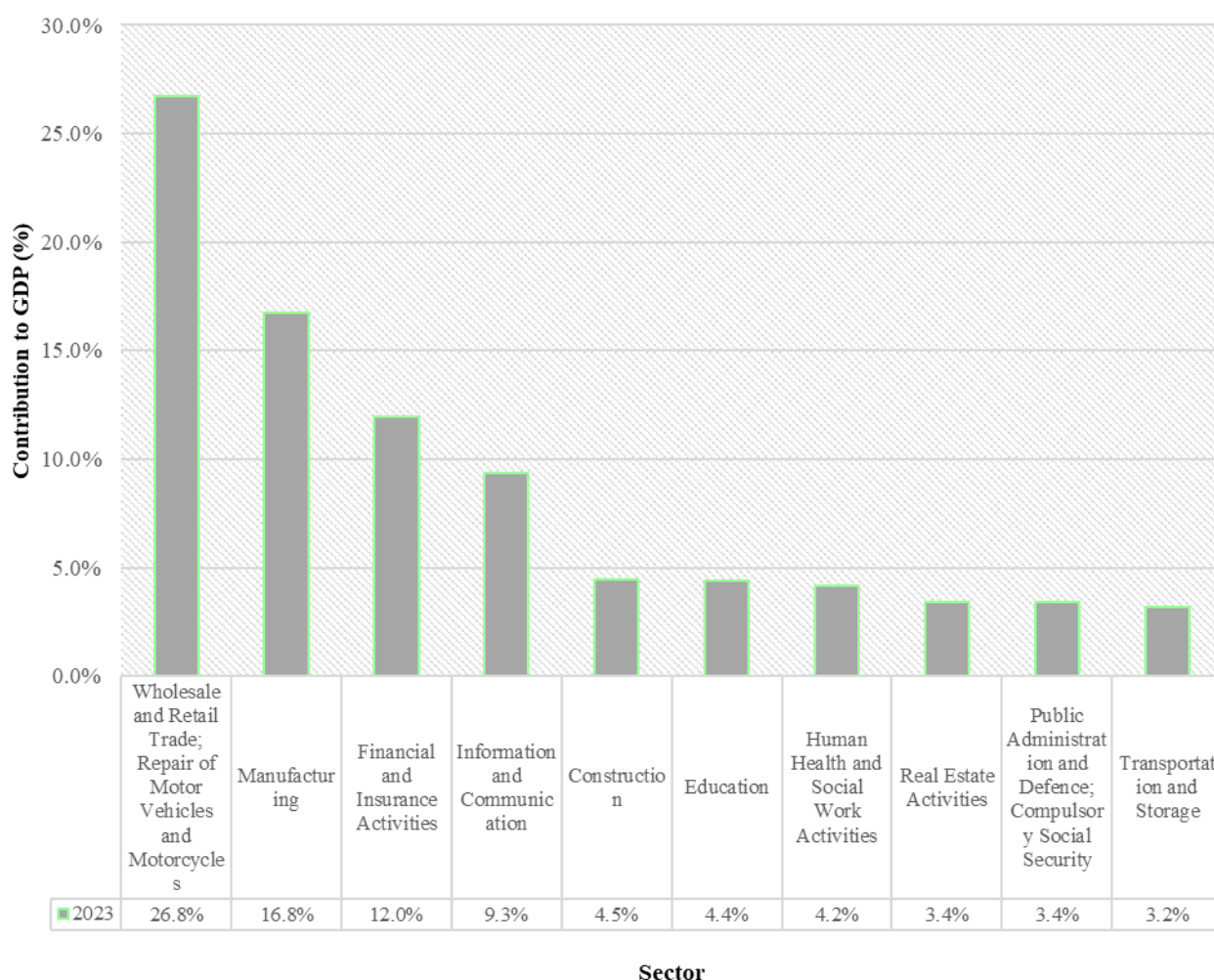


Figure 5.26: Sectorial Contribution to GDP in 2023

Figure 5.26 shows that variations exist across sectors as industries are affected with different economic shocks and foreign currency exposure, with the degree of economic resilience being highly dependent on the nature of industry, technology adoption and product demand. The Energy industry tends to be more capital intensive than the wholesale and retail trade. The latter is expected to have occasional growth spikes of longer time intervals as the sector requires huge capital outlays. Low growth in economic enabling sectors threatens economic recovery and price stability. Sectors that are heavily reliant on energy frequently face productivity challenges as high costs of production under extreme cases may force firm shutdowns and retrenchments.

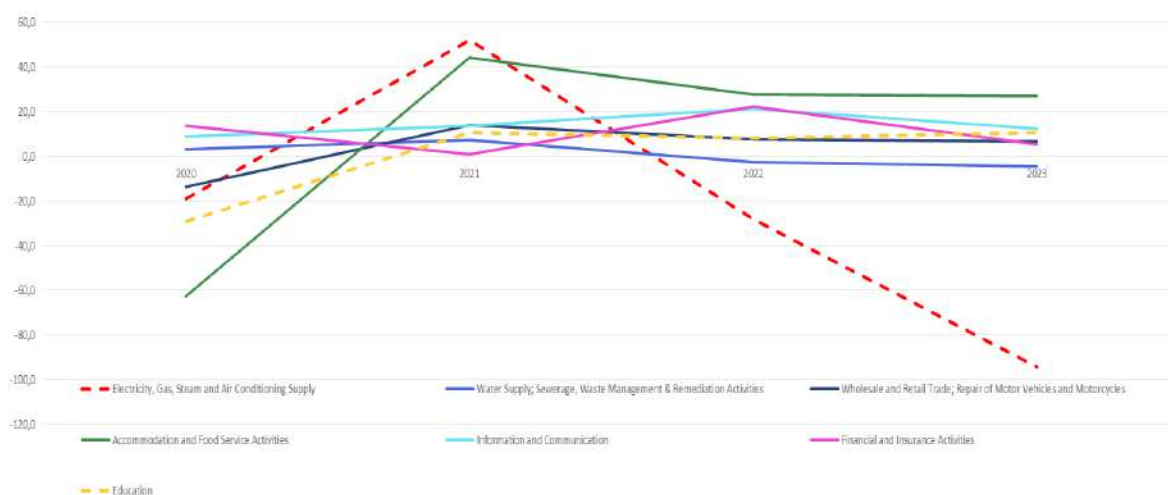


Figure 5.27: Sectorial Growth
Source: ZimStat(2024)

Figure 2.27 shows that the fastest growing industries in the post Covid-19 era are (i) Accommodation and Food Services; (ii) Information and Communication; (iii) Financial and Insurance Activities; (iv) Education; and (v) Wholesale and Retail. Whilst those with the lowest growth rate include (i) Electricity, Gas, Steam, and Air Conditioning Supply; (ii) Water Supply, Sewerage, Waste Management & Remediation Activities. These industries fall in the category of economic enablers. The slow growth in electricity, gas, steam and air conditioning supply explains the low energy productivity and shortages of electricity being experienced in Harare.

5.10.2. Sector Specific Assessments in Harare

5.10.2.1. Manufacturing Sector

A leading sector identified as a priority in the Zimbabwe Industrial Reconstruction and Growth Plan (ZIRGP) 2024-2025 is the manufacturing sector. Moreover, it's part of the Sustainable Development Goals (SDGs) target of promoting inclusive and sustainable industrialization by 2030, thus significantly raising the industry's share of employment and GDP, in line with national circumstances. The sector's five-year average share to GDP for Harare is approximately 19%. The Government Industrial Strategy (2024 – 2025) aims at strengthening domestic industries through value chain development, technology adoption and promotion of manufacturing exports. However, there were setbacks in the form of multiple shocks during the period which derailed the pace of industrial transformation. These include droughts, the COVID-19 pandemic, unavailability of foreign currency and energy. Capacity utilization and Index of Industrial Production (IIP) are on an upward trend, with steady growth recorded between the years 2019 and 2024. Despite this, less than 75% to 100% targets set in the Zimbabwe Industrial Reconstruction and Growth Plan have materialized. The capacity utilization is within the 50% to 55% range, whilst IIP is approximately 80%, which implies that manufacturing output is 20% lower than the 2019 production levels (see figure 5.28). The regression in manufacturing growth shows the deep crisis within the path for transformation, high important penetration and difficulties for industrial placements in the global value chain. The challenges imposed by imports are likely to persist as countries come closer to the implementation of the African Continental Free Trade Area (AfCFTA).

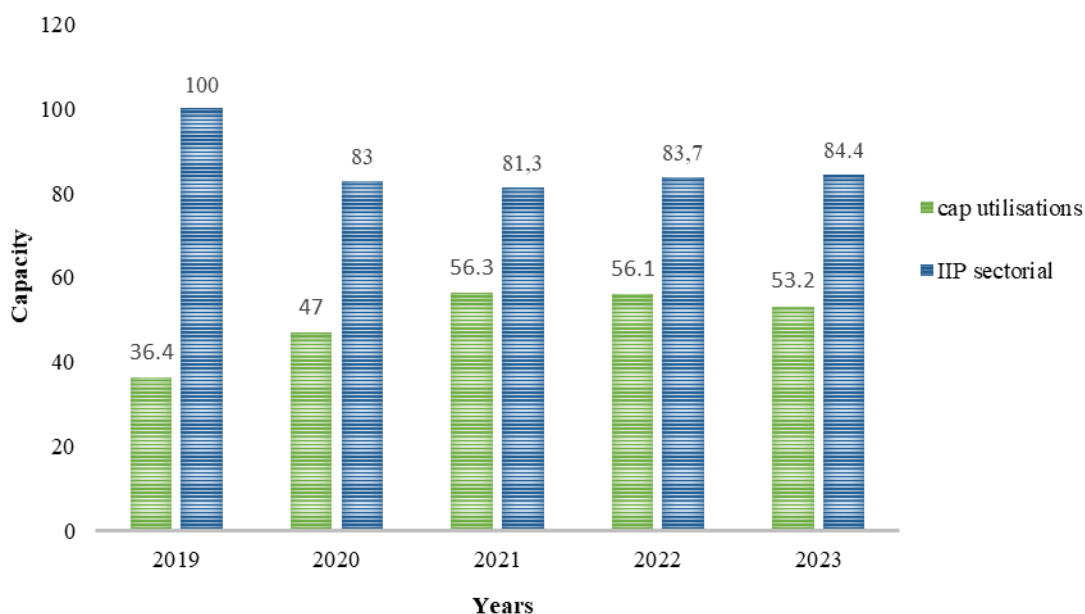


Figure 5.28: Capacity Utilization in Manufacturing Sector

Source: ZimStats, 2024. IIP are estimates from own calculations with 2019 as base year

Figure 5.29 shows that despite the degree of industrialization measured by the MVA per capita being higher for Harare than the national level, it is faltering. This confirms that Harare is the epi-centre of industrial development.

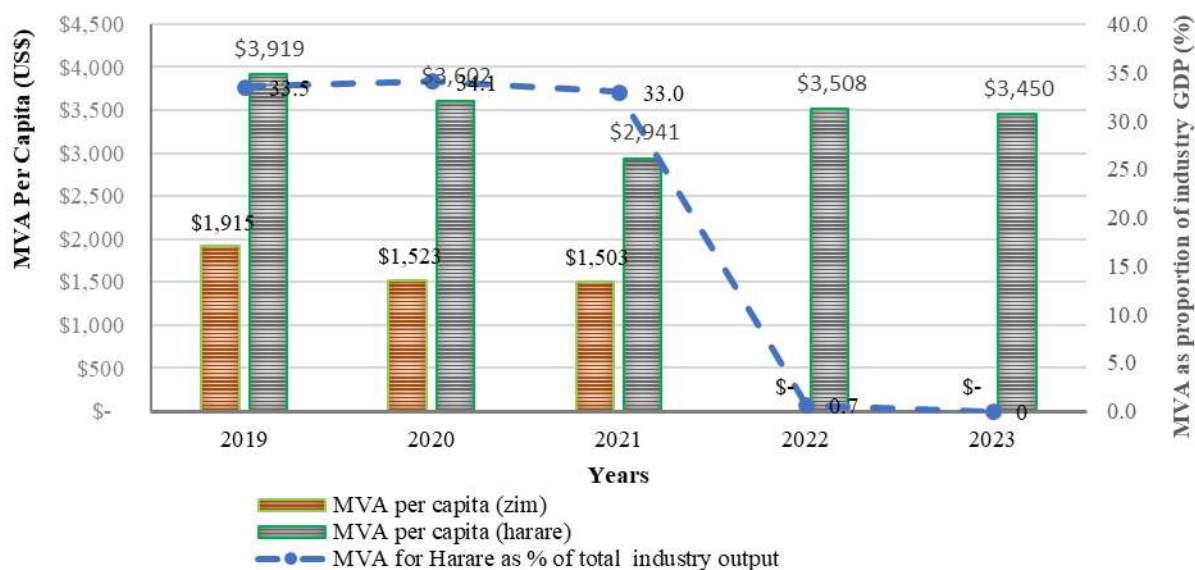


Figure 5.29: Manufacturing Performance

Source: National accounts for Zimbabwe and Harare, ZimStat, 2024 (per capita & MVA(Harare) for 2022-23)

Figure 5.29 illustrates the decline of both the MVA as a percentage of GDP and share of manufacturing employment to total employment. This is largely attributable to the slow pace of industrial recapitalization in capital intensive industries, low product innovation and high import competition in subsectors such as clothing and textile.

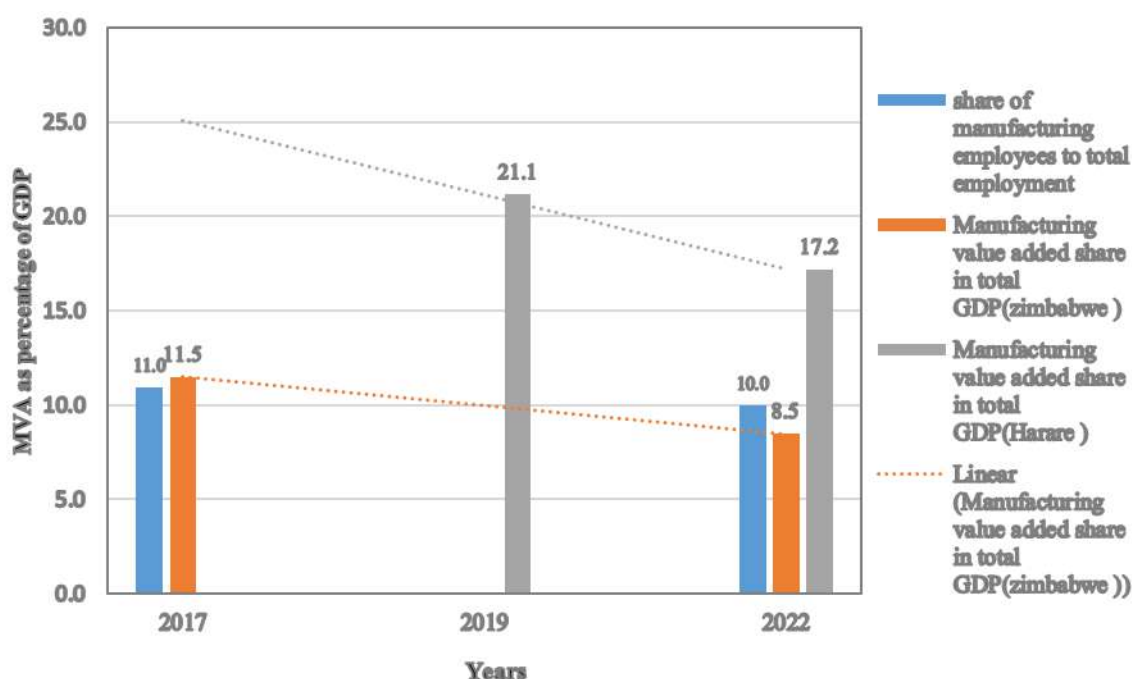


Figure 5.30: Manufacturing Performance
Source: National Accounts; ZimStats, 2022

The manufacturing sector is experiencing low growth due to several challenges such as high cost as a direct contribution of outdated technology, shortages of foreign currency and the energy crisis. Manufacturing firms import approximately 50% of raw materials and this high import content is against the objective of an export-led industrialisation strategy enshrined in the Zimbabwe Industrial Reconstruction and Growth Plan (ZIRGP) 2024-2025. Based on the above information, industrial inefficiency has been identified as the main structural weakness prevailing in the sector. Industrialization with a focus on technological adoption, innovation and export development has the ability to lead to sustainable manufacturing sector growth. The success of the strategy depends on proper sequencing of industrial reforms such as (i) Short-term recapitalisation and retooling; and (ii) Innovation in the medium and long-term. These are explained in more detail below.

- (i) Short term measures: Bank-facilitated capital import scheme that is inclusive, and benefits MSMEs and SMEs.
- (ii) Medium to long-term:
 - Tech-led industrialisation aimed at enhancing industrial competitiveness through product and process innovation.
 - New product development for export-oriented industries. This measure helps the transition towards the export of medium-to-high-tech goods.
 - Diversification of energy sources in manufacturing production. Firms may accelerate green energy transition for sustainable manufacturing growth.
 - In the long run, the recapitalisation gap can be filled by developing a local plant reserved for the production and supply of automated industrial equipment.

The successful implementation of these measures can contribute to a 5% annual growth in the manufacturing sector.

5.10.2.2. Technology

Technology diffusion and adoption is essential for productivity enhancement and industrial competitiveness. The adoption rate has improved in the manufacturing sector although critical sectors like clothing, textile and weaving have lagged behind. Figure 5.31 shows that over the past three years between 2019 and 2023, an average of 45.8% of manufacturing firms upgraded their technology, with the upgrading being the highest in foodstuff subsector, chemical and petroleum products and pharmaceutical industries.

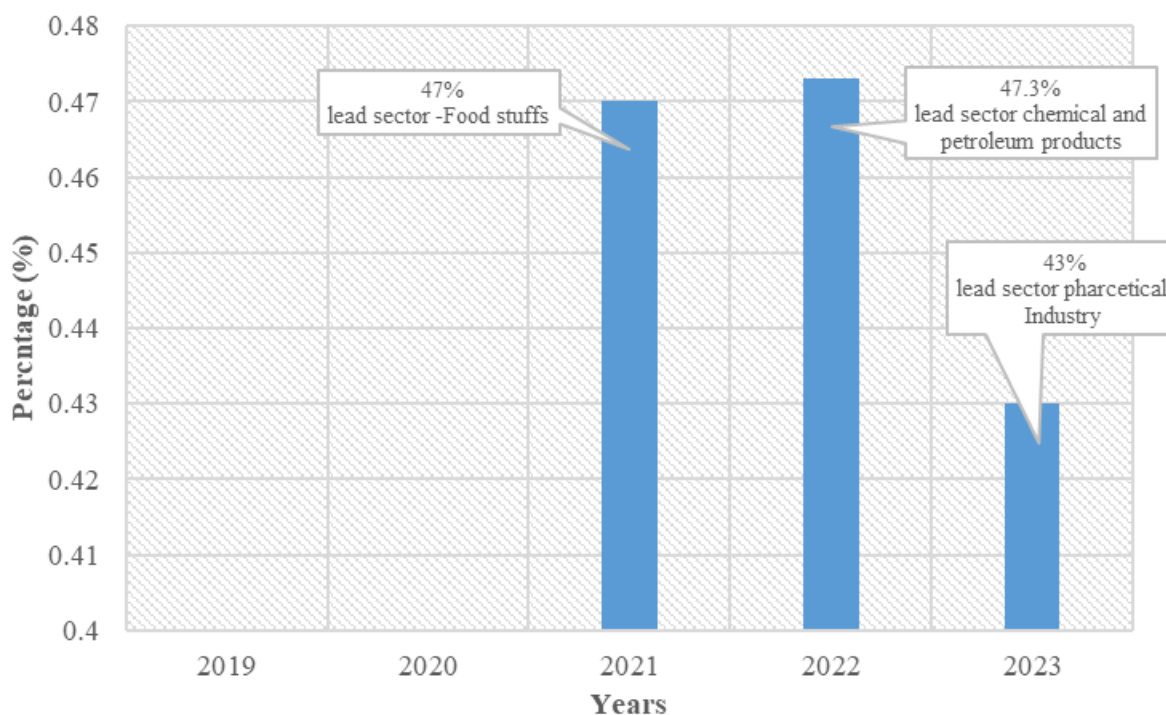


Figure 5.31: Technology upgrading in the manufacturing industry

Sources: CZI survey reports (2019-2023)

In 2022, 81% of MSMEs were found using some form of technology in their businesses. However, the uptake for productive technology is low in MSMEs, which might explain the reason behind the low labour productivity in small firms.

5.10.2.3. Tourism

Like most African countries, Zimbabwe is rich in natural resources, cultural heritage and historic sites. The country has developed a National Tourism Strategy for rapid sectorial growth through accelerated tourism investments, rebranding and promotion of seamless international travel arrangements. Moreover, the eVisa platform has made it easier for visa applications. Between the years 2019 and 2023, the sector navigated through a difficult economic environment and Figures 30, 31 and 32 are used to explain the sector performance and development. The tourism sector is on the rebound, with tourist arrival having doubled Post Covid-19 and achieving a record growth rate of 174.1% in 2022 (see Figure 5.32). This growth momentum is anticipated for the short to medium term. In addition, the percentage of tourists' receipts increased more than threefold post-pandemic, reaching US\$1.16 billion by 2023. A combination of global economic recovery, destination marketing and government fiscal interventions in the form of tax rebates to safari operators and massive tourism investments, explain the dynamic shifts overtime. The tourism investment reached US\$312.5 million in 2022. Investments undertaken by leading hoteliers such as ZimSun and Meikles

include hotel upgrading, refurbishments and modernization of ICT, acquisitions and construction of seven new hotels in greater Harare.

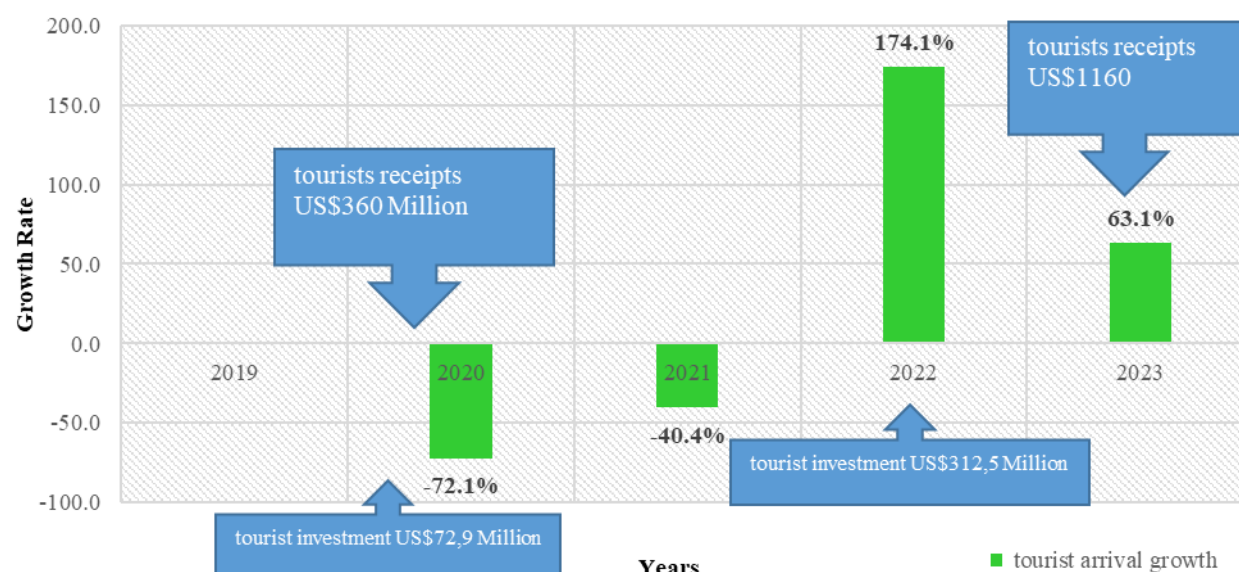


Figure 5.32: Tourist Arrival Growth Rate and Tourism Receipts
Source: ZTA tourism trends and statistics reports (2019-2024)

Figure 5.33 illustrates that post-pandemic hotel occupancy statistics show great improvements, with the occupancy rate for Harare being higher than the national average, thus doubling by the year 2023. Harare hosts at least 42 hotels which include leading brands such as Hyatt Regency (formerly Meikles), Holiday Inn, Rainbow Towers, Crowne Plaza, with room capacity in excess of 4, 981 representing approximately 33% of total national hotel room capacity.

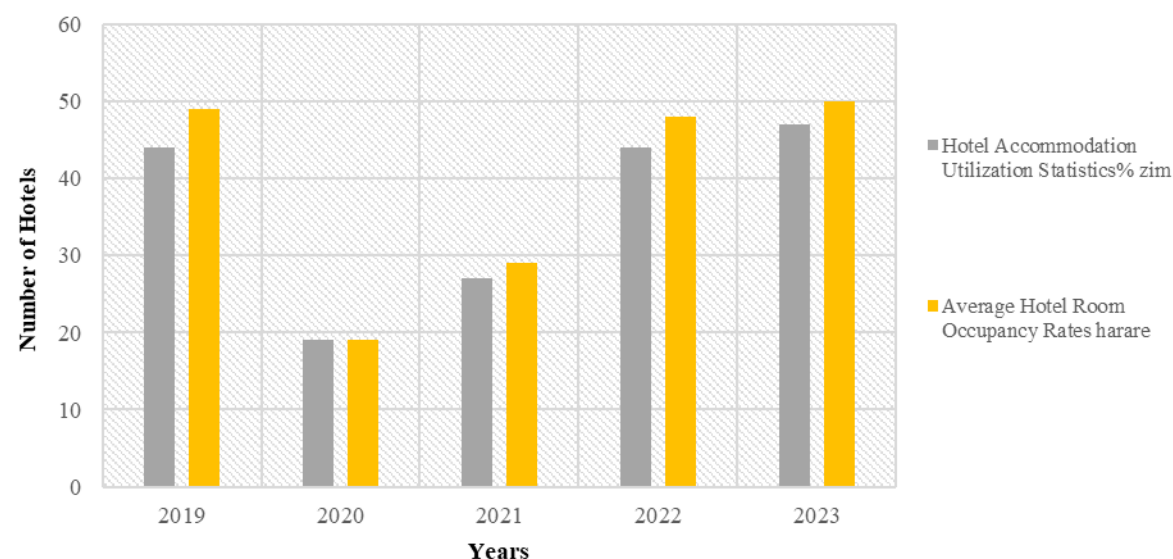


Figure 5.33: Hotel Accommodation Utilization Statistics
Sources: ZTA tourism trends and statistics reports (2019-2024)

Tourism's contribution to GDP and employment recorded a decrease of 1.5 and 1.7 percentage points respectively, between 2020 and 2023 (ZTA, 2024). This means that over the past four years there was a faltering in economic benefits from tourism activities.

However, sustainable interventions that address bottlenecks in the sector can reverse the negative trend and redirect the sector towards becoming a USD50 billion industry. Measures that strengthen the sector resilience become relevant as the risk of global economic uncertainty and natural shock remain high. On the other hand, domestic tourism is on an upward trend, with visits to museums and national parks for Harare recording a massive growth rate of 312.03%, between the years 2020 and 2023. Domestic tourist visits to museums increased by over 10% during the period under review, whilst visits to recreational sites like Lake Chivero and Darwendale plummeted (See Figure 5.34). Visitors have shown more appetite for historical tourism than recreational tourism.

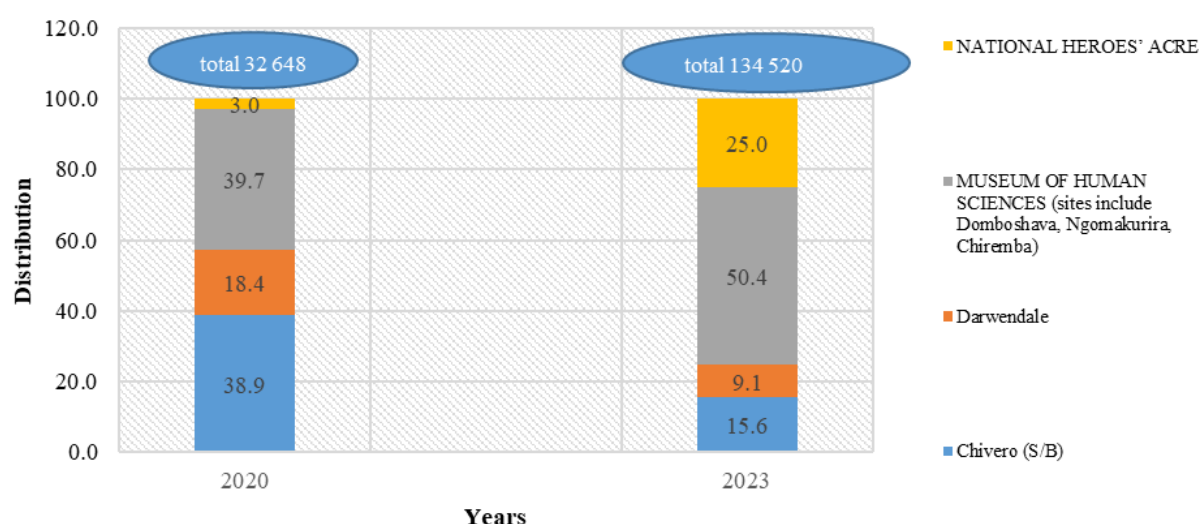


Figure 5.34: Domestic Tourist Visits for Museums and National Parks in the Harare Metropolitan
Sources: ZTA tourism trends and statistics reports (2019-2024)

The UN tourism confidence index for international tourism is positive, with a score of 120 for between August and December 2024, as the global economy shows a strong recovery despite the rise in global geopolitics. Furthermore, international tourism is expected to rise. Consequently, tourism for Zimbabwe is anticipated to rise in line with global expectations. Domestic tourism which recorded a significant jump, is likely to maintain the growth trajectory as inflationary pressures subsidise and the domestic economy stabilises in the medium term. A three-pillar strategy for development, renovation and promotion will resuscitate city tourism. The first and second pillars facilitate tourism infrastructure development and renovation for social, cultural and historic tourism in the city. The third pillar builds partnerships for promotion and marketing of city tourism, in both domestic and international markets. Growth targets of 4% to 5% for domestic and international tourism and 5% contribution to GDP per year are anticipated, as the economy stabilizes and geopolitical tensions weaken.

5.10.2.4. Wholesale and Retail Trade

Investments in wholesale and retail output correlate with commercial and residential property development, together with population growth. The 2022 census estimated population for Harare at 2.43 million. In the past 5 years, several residential areas were developed, which potentially increased consumer demand. The expansion of consumer base contributed to the growth of the wholesale and retail trade.

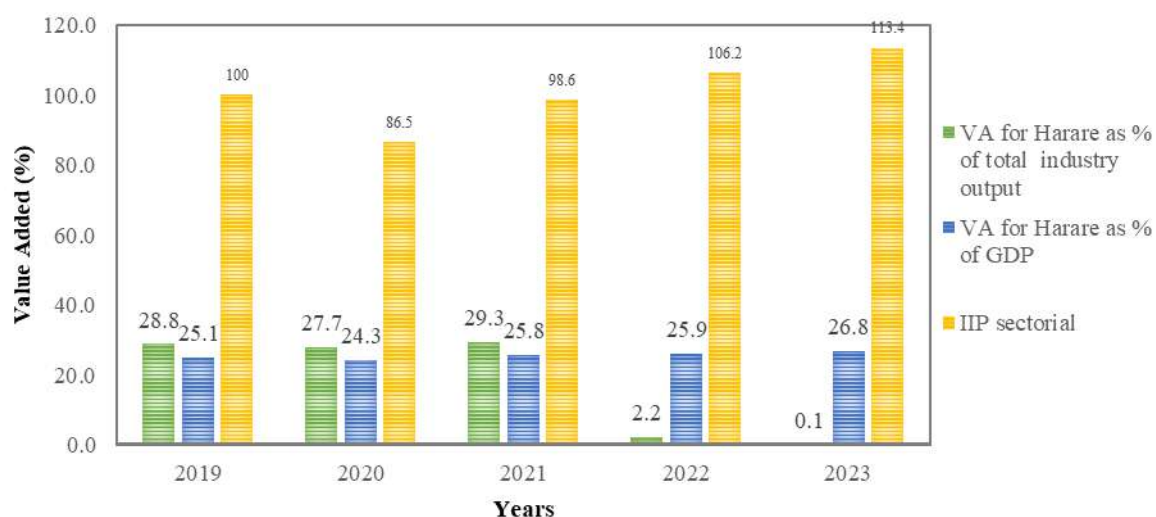


Figure 5.35: Wholesale and Retail Trade Performance

Sources: National statistics, ZimStat (2024)

Figure 5.35 shows that the value added for the sector as a percentage of GDP increased by 1.7 basis points to reach 26.8% between 2019 and 2023 for Harare. Against this background, the wholesale and retail sector has transformed significantly in the past decade, where dollarisation and market liberalization policies were implemented. In 2020 at national level, 493 active firms were in the wholesale subsector with total employment of 22,893. In the same year, retail trade had more than 1,369 formal firms and employed approximately 45,744 people (ZimStats, 2024). According to FinScope (2022), 37.3% of all MSMEs operate in wholesale and retail, of which 83% are informal and 17% formal. Competition is high in the sector as more and more firms join the sector. The lead wholesalers include Mahomed Mussa, Bhadella, N. Richards, Gains, Cash and Carry. Retail giants like Pick and Pay, OK supermarkets, Bon Marche, Spar, and Food World, compete for market share with small scale retailers and micro enterprises popularly known as tuckshops. Despite an increase in branch networks, under serviced areas exist which represents an opportunity for branch network expansion.

In Harare, the sector contributes approximately 29% to GDP and is among the subsectors which frequently creates employment. The sector is central in supply chain, market development and distribution of local products. Most firms shelf 80% of local goods which in the past was just above 20%. The increments are attributed to improvements in capacity utilisation in the manufacturing sector. The sub-sector has the potential to grow and assume the regional commodity broker, if sustainable macroeconomic stabilisation is achieved which eliminates currency and exchange rate volatility. The industry is expected to reach USD5 billion in 2025. The sector is very essential for Harare as it represents the heart of functional retail trade and distribution of manufacturing output, as well as a sustainable source of municipal revenue, provided all small firms are registered. Estimates show that over 2,000 MSMES operate without registration and compliance to health and food standards is often non-existent. According to Finscope (2022), there was a recent survey conducted which found a compliance rate of 8% by MSMEs to municipality fees. Revenue leakages in the wholesale and retail trade is substantial, given that only 34% of formal enterprises show compliance to municipality fees. A combination of non-registration, minimum of compliance enforcement and proper business accounting are the factors behind the revenue leakages.

On the other hand, new residential property development resulted in new suburbs and population growth means high demand for consumer goods. The new residential areas include (i) Hatcliffe and extension; (ii) Borrowdale; (iii) Western suburbs extensions; (iv) Eastern suburb developments; (v) Expansion in Chitungwiza and Ruwa among others. Some sections have low shop density, with residential to shopping centre distance in excess of 10km.

5.10.2.5. Information and Communication Technology (ICT)

One of the Government's priorities is infrastructure development for city modernisation and the smart city concept is already on implementation. Good ICT infrastructure is not only essential for connectivity enhancement across business communities but can attract FDI and boost the chances of a city being a preferred destination for industrial location.

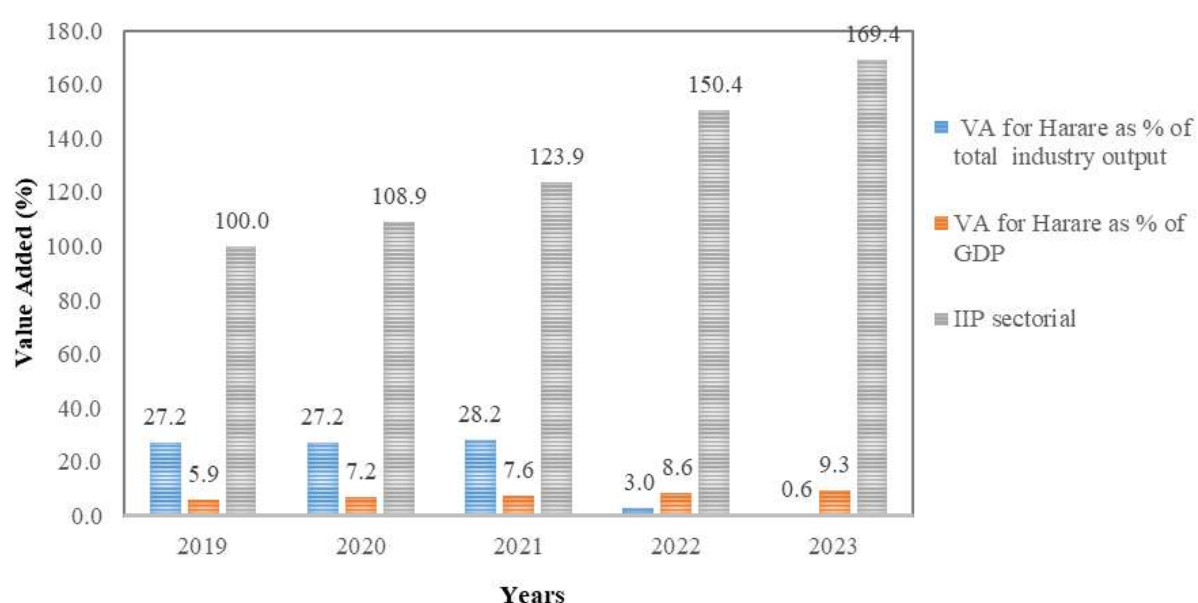


Figure 5.36: ICT Performance

Sources: National Accounts, Zimstats(2024)

Figure 5.36 shows that sector's share of value added to GDP steadily rose between the years 2019 and 2023. During the period under review, the sector achieved an average growth of 14.7% and has the potential to grow further than that. Using 2019 as the base year, the IIP for the sector exceeded 100% implying output growth since 2019. ICT infrastructure upgrades resulted in improved internet coverage of 100% for Harare and 60% to 80% at national level, depending on the area. Internet penetration increased significantly from 12.7% in 2011 to 73.3% in 2023 (Potraz, 2023). The sectors growth strategy put emphasis on ICT infrastructure development and proposed a number of investment incentives. The Government has put incentives such as tax credits and loosened registration requirements as mechanisms to speed up the sector's development. The strategy has paid dividends, as renowned firm Starlink joined the industry in Quarter 3 of 2024. This resulted in a drop of market prices, as competition for market share intensified. If measures to unlock finance for domestic small-scale players are put in place, the sector can experience rapid growth. The developments are in line with government's goal of affordable broadband internet connections across the country and accessibility to low-income households. Further price decreases are anticipated in the medium to long term as firms intensify market competition.

Harare has higher broadband prices in comparison to regional cities, with more players in the industry leading to price reduction. The sector facilitated fintech development and financial inclusion in the city. Fintechs (Ecocash, One Money, Telecash, Omari and Inn Bucks) have embarked on pro-poor inclusive growth programmes, thus championing financial inclusion through mobile money initiatives such as e-wallets, saving clubs and insurance coverage for low-income families and MSMEs. Fintech and tech hubs start-ups have emerged, with challenges of raising capital reducing the rate of scaling up some of the digital products. Investment opportunities are numerous as there are untapped fields such as city web of connected business activities; consumers and regulators; and software development can be prioritised and developed into a robust export business. A change in zoning regulation may pave the way for the creation of a smart city for Harare. The sector has great potential for expansion given the stock of human capital the city has at its disposal.

5.10.2.6. Number of Manufacturing Units

Figure 5.37 shows that the number of manufacturing firms contracted from 505 to 423 between 2014 and 2018. The rate of contraction was higher in food and beverages, and textile subsectors.

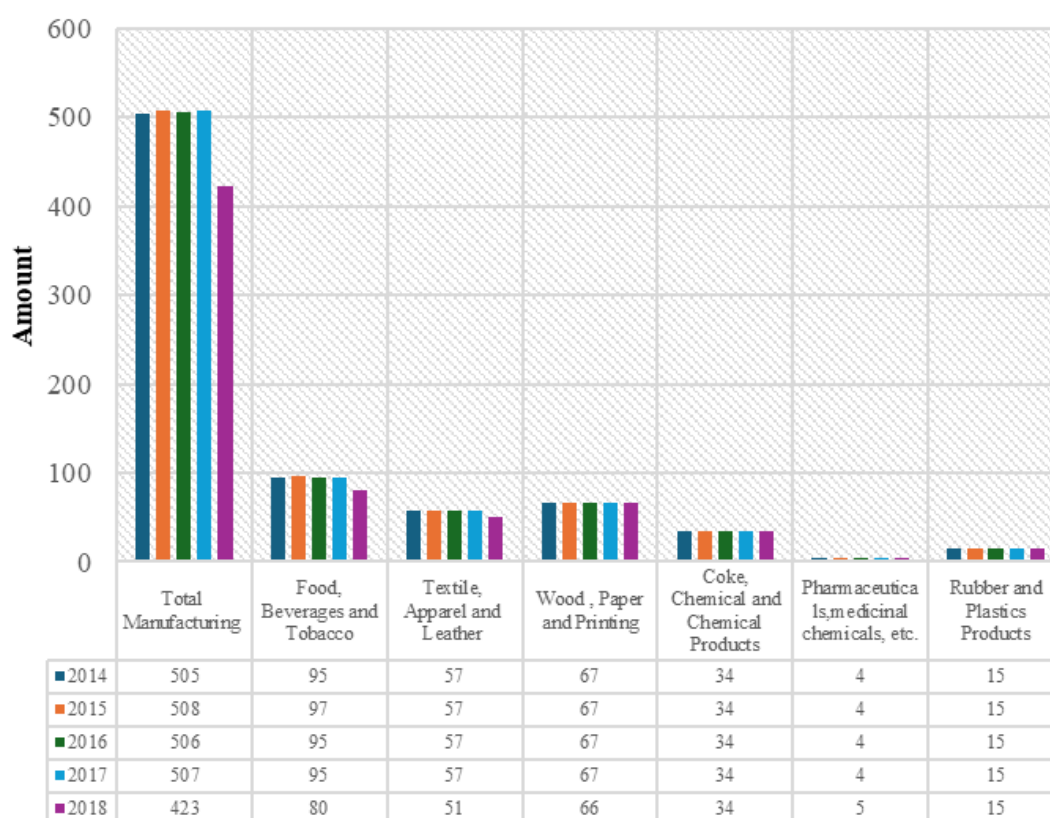


Figure 5.37: Manufacturing Establishments

Source: Own calculations using data from UNIDO (2024)

5.10.2.7. Value of Output

Manufacturing output was on upward trend with food, beverages and tobacco sectors contributing substantial amount of output (see figure 5.38).

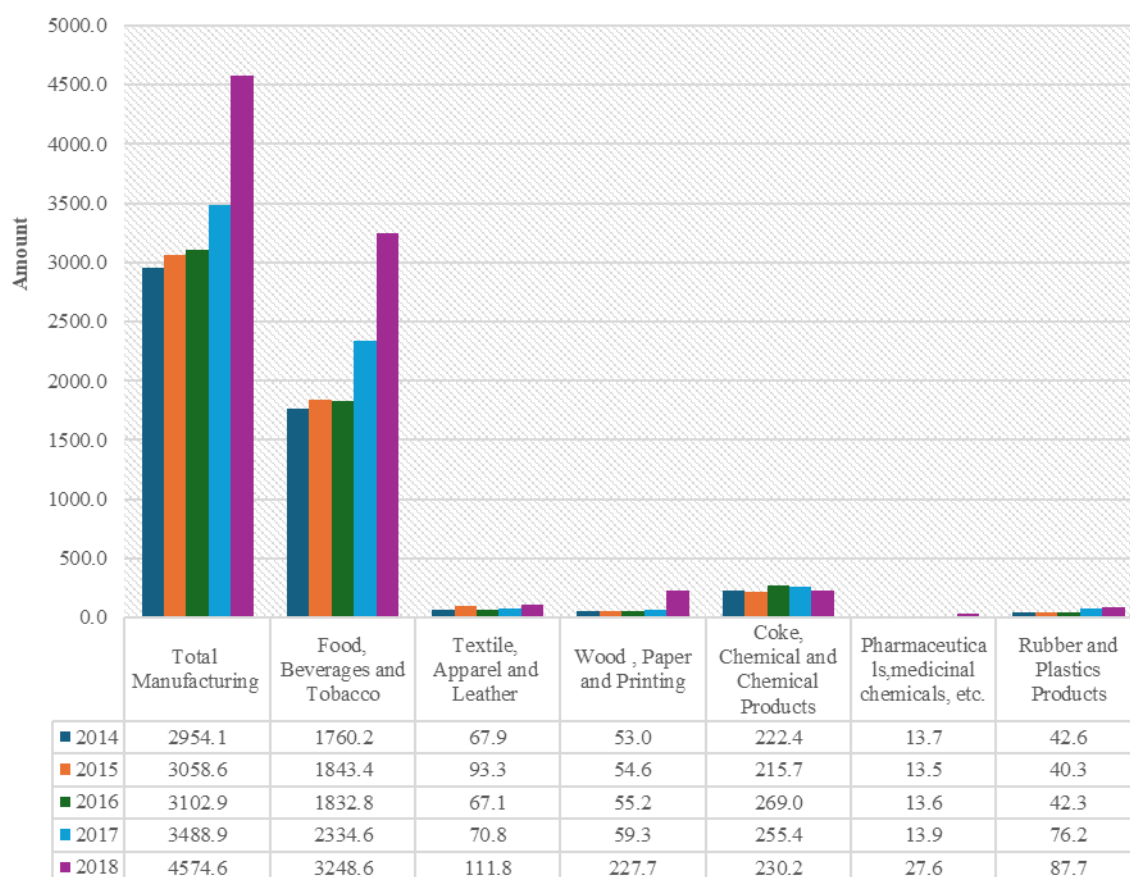


Figure 5.38: Manufacturing Output in Millions 2015 constant USD

Source: own calculations using data from UNIDO (2024)

5.10.2.8. Manufacturing Employment

During 2014-2018 period, total manufacturing employment decreased by 5.2% (see figure 5.39). Food and Beverages, Wood and Paper, Chemicals and Chemical products, Rubber and Rubber products sub sectors recorded a growth in employment, whilst Textiles and Pharmaceutical sub sectors experienced a contraction.

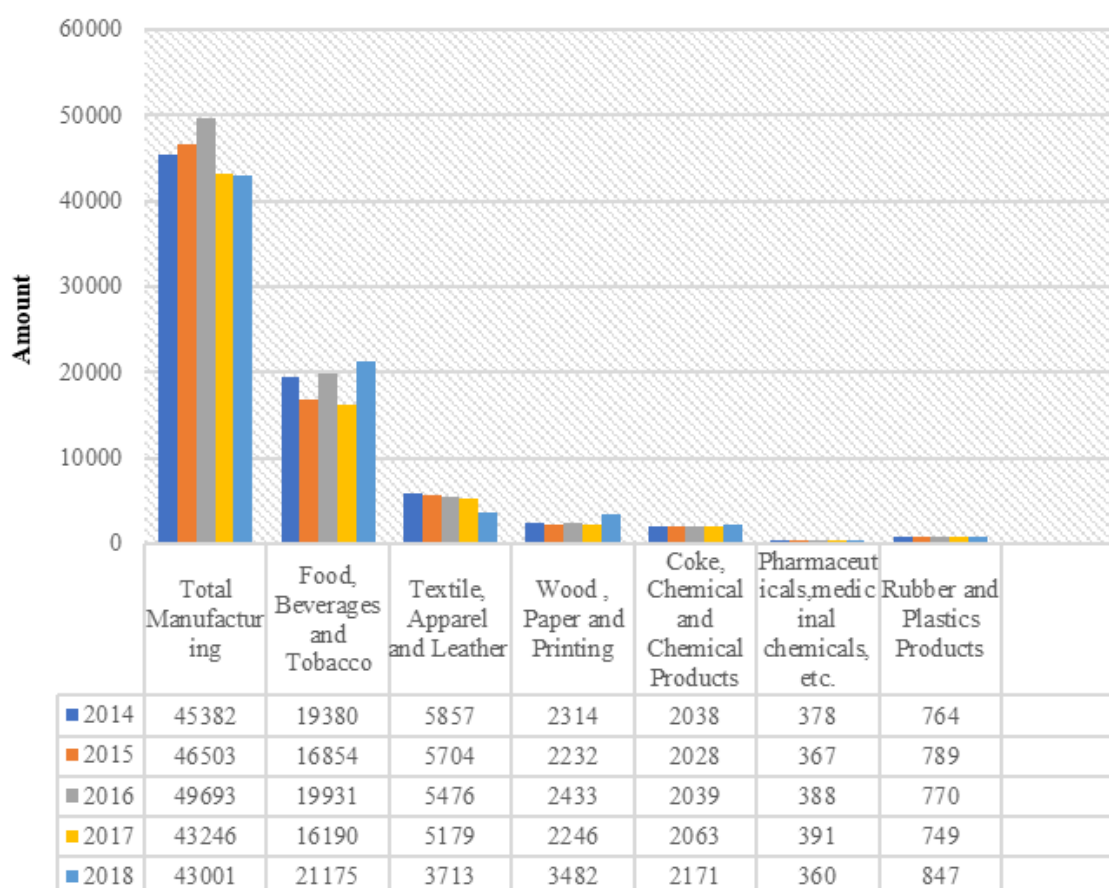


Figure 5.39: Manufacturing Employment

Source: own calculations using data from UNIDO (2024)

5.10.2.9. Manufacturing Gross Value Added

MVA was on a downward trend since 2018, and since then seemed to have levelled-off revealing the constrained manufacturing environment in Zimbabwe. The same trend is depicted for MVA of Harare (see Figure 5.40).

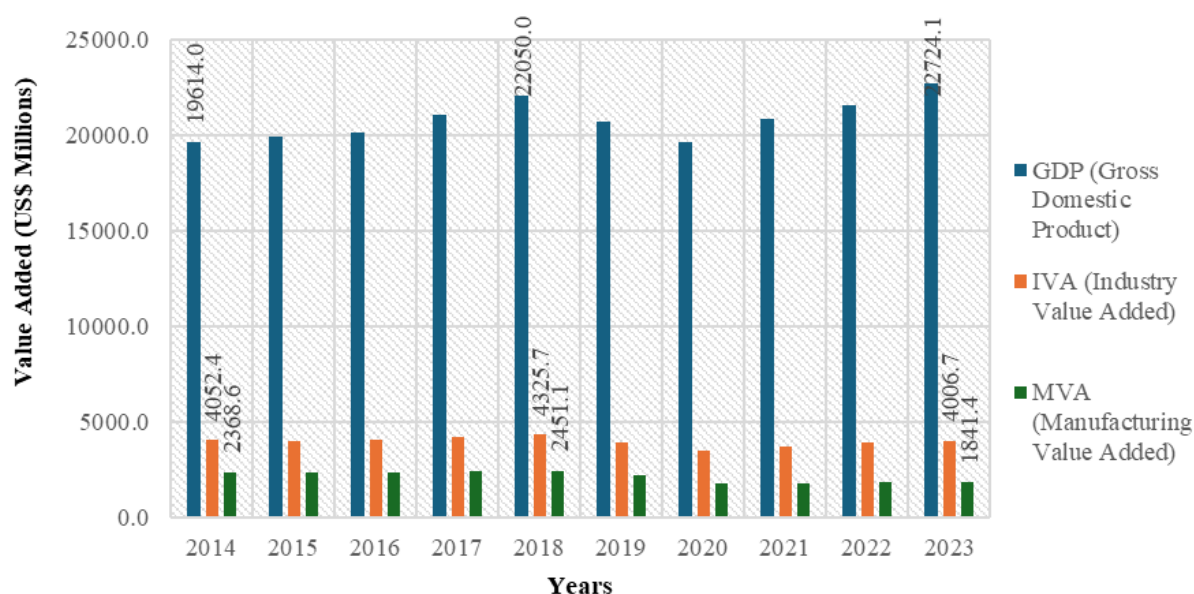


Figure 5.40: Manufacturing gross value added (Zimbabwe) in Millions 2015 constant USD
Source: Data collected from UNIDO (2024)

Figure 5.41 shows the manufacturing gross value added (Harare) in Millions constant 2019 USD converted using the official exchange rate.

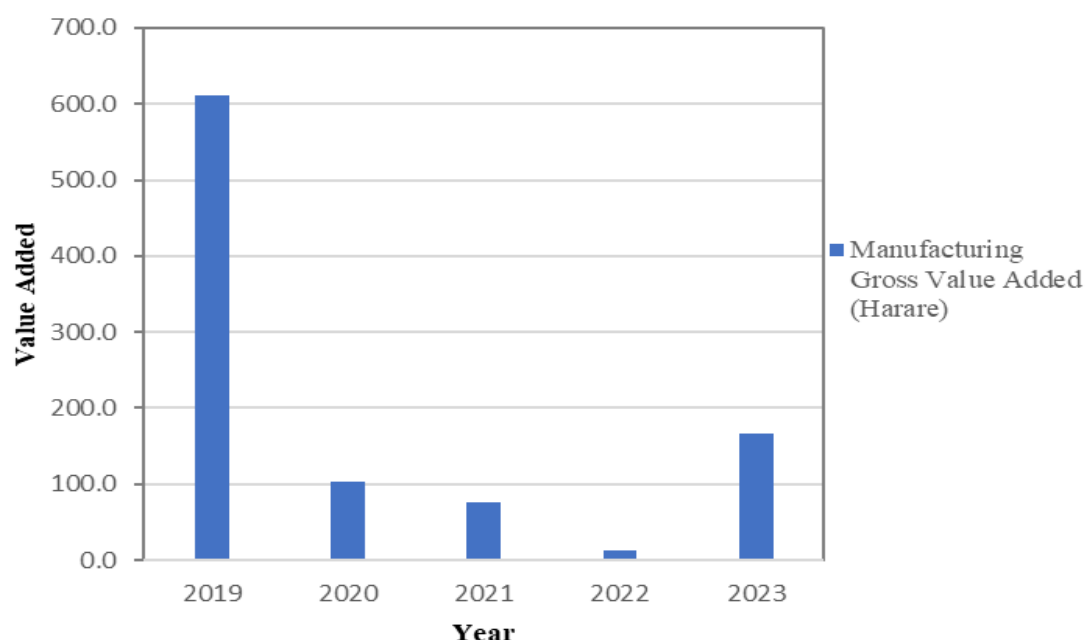


Figure 5.41: Manufacturing gross value added (Harare) in Millions constant 2019 USD converted using the official exchange rate.
Source: Data collected from ZimStat (2024)

5.10.2.10. Manufacturing Investments

Total manufacturing investment maintained an upward trend since 2014; however, a significant fall was experienced in 2018 (see figure 5.42). The investments were more pronounced in food and beverages, and electrical; and lowest in textiles, leather and footwear and motor vehicles. The differential levels of investments might explain the disparity in technological advancement between the food and beverages sector, and the textile industry.

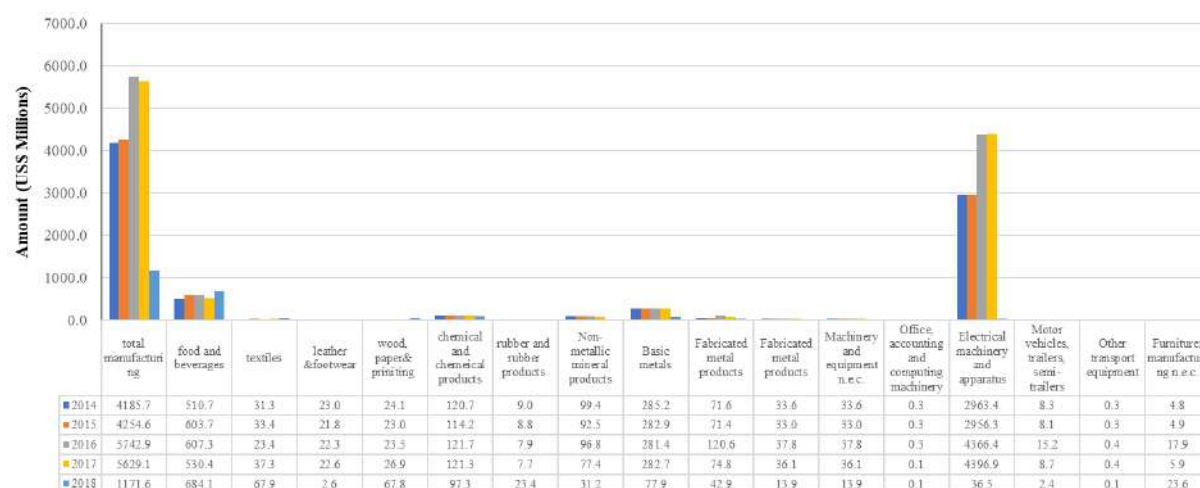


Figure 5.42: Manufacturing investments in Millions 2015 constant USD
Source: compiled using data from UNIDO (2025)

5.10.2.11. Consumption

Manufacturing apparent consumption was higher in sugar, malt, bakery and fertilizer products, showing high production and consumption of these products compared to plastic products and basic chemicals (see figure 5.43). Domestic production of the products is satisfying local demand and there is high potential for further trade creation and exports promotion.

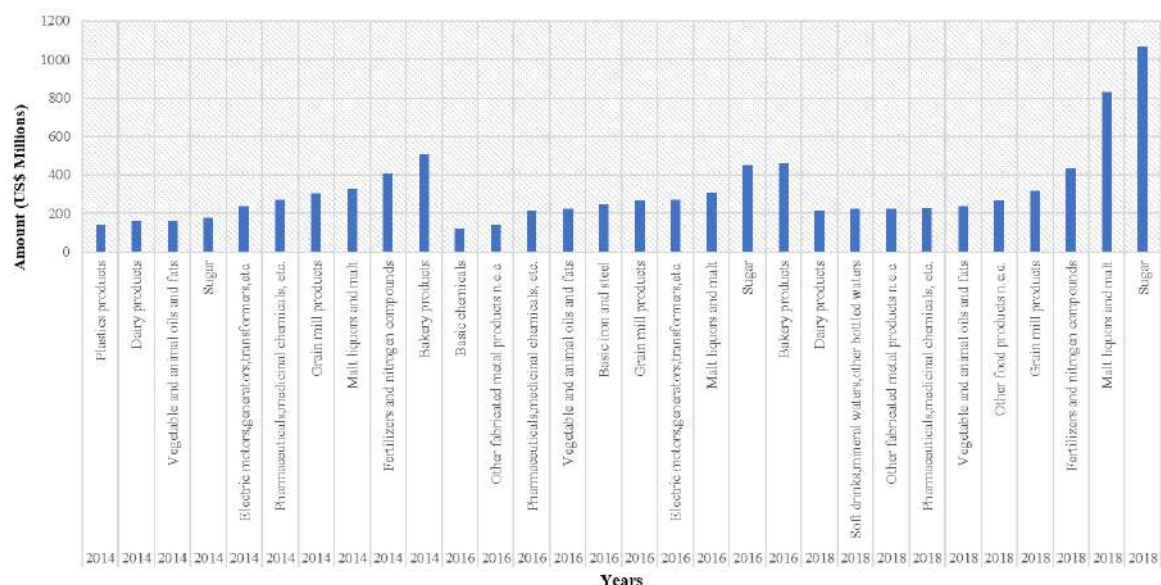


Figure 5.43: Manufacturing consumption of top 10 products in Millions 2015 constant USD
Source: compiled using data from UNIDO (2025)

5.10.2.12. Index of Industrial Production (IIP)

IIP for the period 2019-2022 was decreasing implying a fall in industrial output in comparison to 2015 production levels. Structural challenges in energy sector, high volatility in commodity prices and currency crisis contributed to low industrial production during the period (see figure 5.44). Low levels of production create opportunities for import penetration and further de-industrialisation.

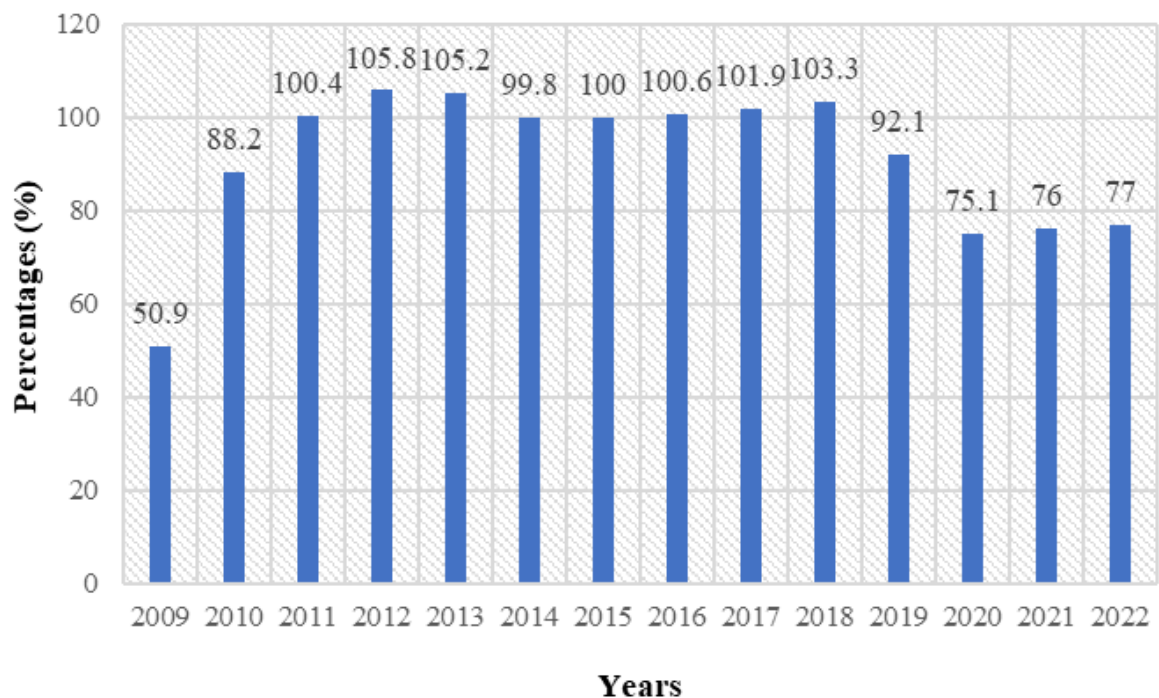


Figure 5.44: Index Of Industrial Production (IIP) (Zimbabwe) In Percentages

Source: Compiled Using Data from UNIDO (2025). All Value At 2015 Constant USD

For Harare, IIP maintained a downward trend during the period 2019-2023 (see figure 5.45). Manufacturing and electricity, gas, steam industries experienced output contraction whilst construction, mining and quarrying recorded an increase in output. The later are amongst the growing industries relevant for the built environment and infrastructure development.

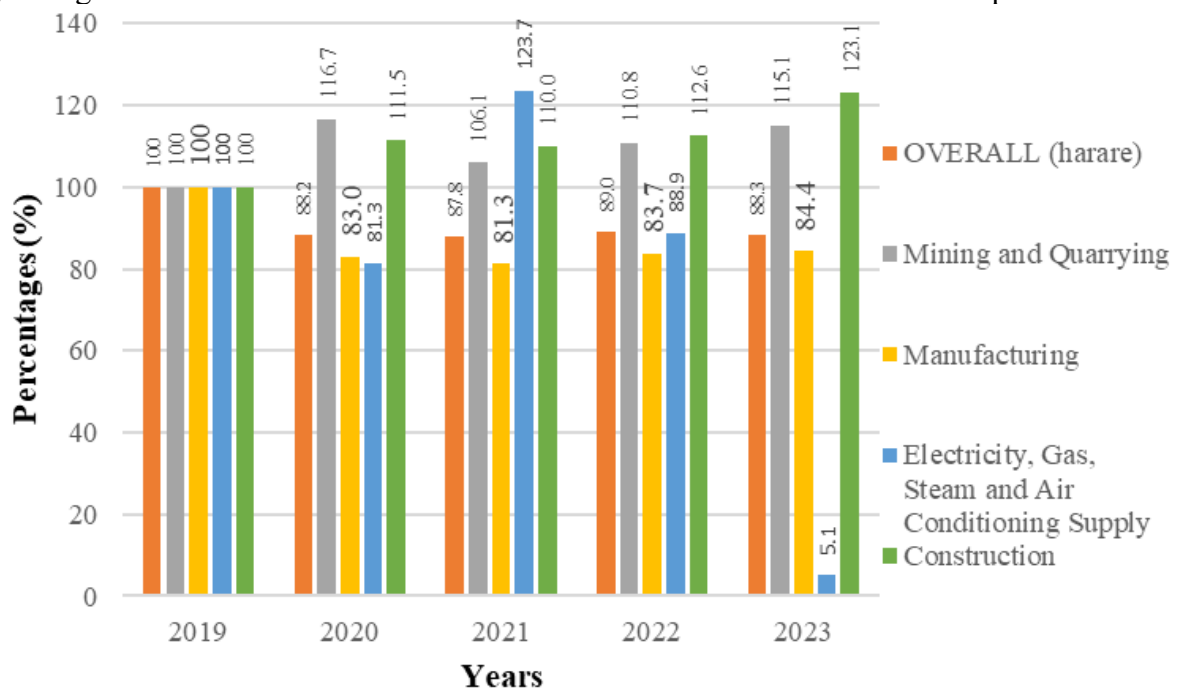


Figure 5.45: Index of industrial production (IIP) (Harare)

Source: Own calculations using provincial accounts, ZimStat (2024). IIP was computed with 2019 as base year

5.10.2.13. Industrial Investments and Major Investments Proposed in Tourism, Technology and Services Sectors (Work in Progress – still collecting data)

Table 5.5: Industrial Investments in Tourism, Technology and Services Sectors

Industrial Investments	Proposed Major Investments		
	Tourism	Technology	Services Sectors

5.11. Investment Attraction and Promotion

5.11.1. Foreign Direct Investment (FDI) Data

Figure 5.47 illustrates that Foreign Direct Investment (FDI) inflows have improved and net inflows growth have more than doubled, reaching 2.22% in 2023. The inflows help to build foreign currency reserves and financing of imports. Exchange rate instability has remained intermittent, showing a correlation with FDI inflows revealing inadequacy of FDI to dampen exchange rate pressures. The currency reform of March 2024 has minimum impact to exchange rate stability, as exchange rate pressures remain high due to high demand for foreign currency. Foreign currency gap for allotments at interbank markets has been widening, with companies expressing dissatisfaction of the arrangements (CZI, 2023).

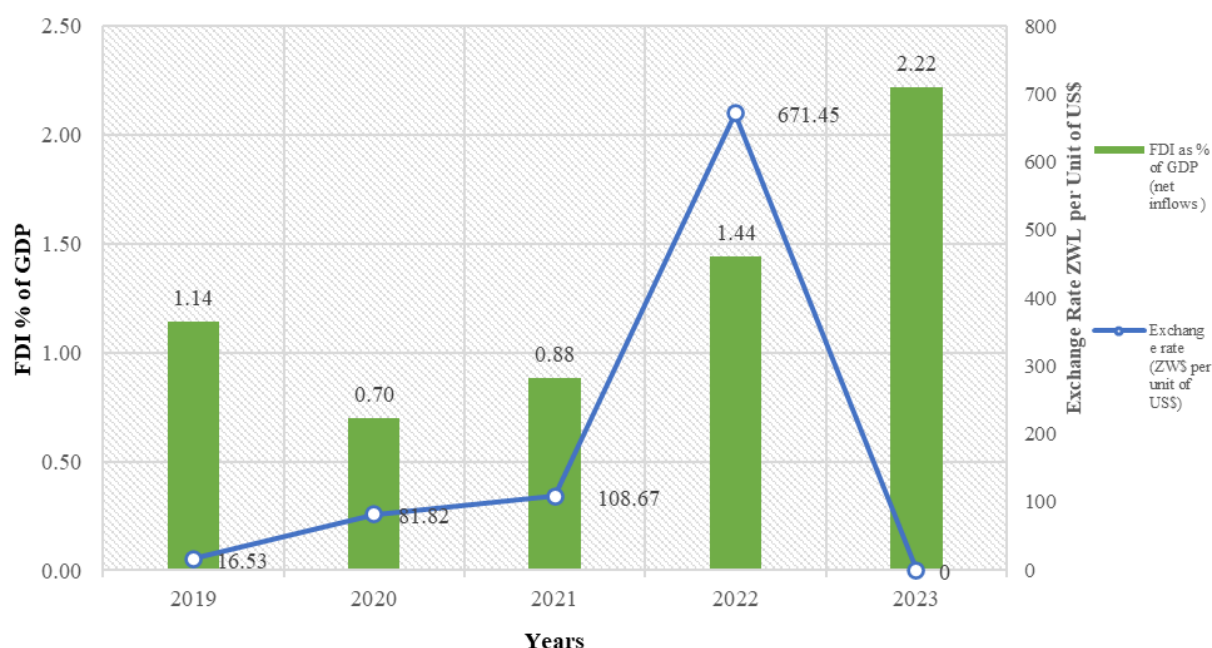


Figure 5.46: FDI and Exchange Rate for Zimbabwe

Sources: World Bank Development Indicators (2024); RBZ (2024)

Tables 5.6 and 5.7 illustrate the provincial distribution of investments and projected investment value by province, drawing the most interest from investors. Harare continues to be the most preferred province for location, due to the following reasons:

- ✓ **Economic Hub:** Harare is the economic centre of Zimbabwe, thus attracting more businesses, investments and entrepreneurs.
- ✓ **Infrastructure:** Harare has better infrastructure, including transportation networks, utilities, and communication systems, thus making it more conducive for investment.

- ✓ Access to Government Services: As the capital, Harare hosts most government ministries and agencies, including the Zimbabwe Development Agency (ZIDA), thus making it easier for investors to access services.
- ✓ Skilled Workforce: Harare has a larger pool of skilled professionals and expertise, attractive to investors.
- ✓ Market Size: Harare's larger population provides a significant market for goods and services.
- ✓ Networking Opportunities: Harare offers more opportunities for business networking, conferences, and trade events.
- ✓ Information Access: Harare has better access to information, technology, and financial services.

Table 5.6: Number of General Investment Licences Issued by Province between the years 2020 and 2024

	2024 Number of Licences Issued	2023 Number of Licences Issued	2022 Number of Licences Issued	2021 Number of Licences Issued	2020 Number of Licences Issued
Bulawayo	21	27	7	9	7
Harare	337	312	127	64	42
Manicaland	24	21	9	8	2
Mashonaland Central	49	30	13	6	4
Mashonaland East	34	65	21	4	4
Mashonaland West	50	37	32	14	8
Masvingo	18	32	15	3	0
Matabeleland North	25	23	12	2	2
Matabeleland South	24	10	7	14	0
Midlands	94	58	24	2	9
Grand Total	676	615	267	126	78

Source: ZIDA, 2024

Table 5.7: Projected General Investment Value by Province between the years 2020 and 2024

	2024 Projected Investment Value (US\$m)	2023 Projected Investment Value (US\$m)	2022 Projected Investment Value (US\$m)	2021 Projected Investment Value (US\$m)	2020 Projected Investment Value (US\$m)
Bulawayo	144.35	77.28	286	10.36	176.58
Harare	6,855.28	1,988.43	304	256.27	175.8
Manicaland	190.19	1,509.59	34	4.99	7.23
Mashonaland Central	258.50	230.91	21	4.69	360
Mashonaland East	429.69	515.46	60	7.97	20.35
Mashonaland West	1,872.36	2,383.12	127	77.43	17.78
Masvingo	600.03	1,845.07	542	17.45	0
Matabeleland North	192.18	701.61	23	3.69	100.78
Matabeleland South	394.03	15.51	7	173.46	0
Midlands	1,257.63	402.54	956	1.47	57.55
Grand Total	12,194.24	9,669.51	2,360.00	557.78	916.07

Source: ZIDA, 2024

Table 5.8 and 5.9 illustrate the number of licenses issued in different sectors, together with the projected general investments value by sector. The mining and manufacturing sectors in

Zimbabwe have historically attracted significant investment, leading to a higher number of investment licenses issued in these sectors. The reasons behind this are the following:

- **Mining Sector**
 - ✓ **Abundant Natural Resources:** Zimbabwe is richly endowed with a diverse range of minerals, including gold, platinum, diamonds, chrome and coal. This makes it an attractive destination for mining investments.
 - ✓ **Strategic Location:** Zimbabwe's location in Southern Africa provides easy access to regional and international markets, reducing transportation costs and increasing the competitiveness of its mining exports.
 - ✓ **Government Support:** The Zimbabwean government has implemented policies and initiatives to attract foreign investment in the mining sector, such as the Mines and Minerals Act, which provides a favorable legislative framework for mining operations.
- **Manufacturing Sector**
 - ✓ **Diversification Efforts:** Zimbabwe has been actively promoting diversification of its economy, aiming to reduce dependence on agriculture and mining. Manufacturing is seen as a key sector for achieving this goal.
 - ✓ **Availability of Raw Materials:** Zimbabwe's natural resources provide a reliable source of raw materials for manufacturing, reducing reliance on imports and increasing competitiveness.
 - ✓ **Growing Domestic Market:** Zimbabwe has a growing domestic market, driven by a relatively large and young population, which creates opportunities for manufacturers to produce goods for local consumption.

Table 5.8: Sector Licenses 2020 – 2024

Sector	2024 Number of Licenses Issued	2023 Number of Licenses Issued	2022 Number of Licenses Issued	2021 Number of Licenses Issued	2020 Number of Licenses Issued
Agriculture	14	13	16	9	6
Construction	38	27	5	13	5
Energy	26	20	2	3	3
Manufacturing	156	138	46	27	7
Mining	265	277	133	46	33
Services	117	119	49	23	22
Tourism	21	5	8	2	0
Transport	25	16	8	3	2
Financial Services	4	-	-	-	-
Health	3	-	-	-	-
ICT	4	-	-	-	-
Real Estate	3	-	-	-	-
Total	676	615	267	126	78

Table 5.9: Projected General Investments Value by Sector 2020 – 2024

Sector	2024 Projected Investment Value (US\$m)	2023 Projected Investment Value (US\$m)	2022 Projected Investment Value (US\$m)	2021 Projected Investment Value (US\$m)	2020 Projected Investment Value (US\$m)
Agriculture	157.85	32.48	179.30	38.77	95.19
Construction	6,397.00	1,961.33	4.30	114.05	66.84
Energy	2,009.68	3,525.30	281.85	15.1	455.61
Manufacturing	1,238.77	250.89	919.03	75.46	11.74
Mining	1,760.86	2,601.84	855.21	175.79	213.42
Services	186.6	1,275.76	105.80	109.57	71.68
Tourism	46.62	2.42	3.14	22.86	-
Transport	127.58	19.49	11.37	6.18	1.6
Financial Services	10.15	-	-	-	-
Health	138.56	-	-	-	-
ICT	96.11	-	-	-	-
Real Estate	24.46	-	-	-	-
Total	12,194.24	9,669.51	2,360.00	557.78	916.08

5.11.2. Strategies to attract Domestic and Foreign Investment in Harare

- Domestic Investment Strategies
 - ✓ Improve Business Environment: Streamline regulatory processes, reduce bureaucracy and increase transparency to encourage domestic investment.
 - ✓ Access to Finance: Establish affordable financing options for local businesses, such as low-interest loans, grants and seed funding.
 - ✓ Invest in Infrastructure: Develop modern infrastructure, including transportation networks, energy and communication systems, to support business growth.
 - ✓ Promote Entrepreneurship: Encourage entrepreneurship through training programs, mentorship and business incubators.
 - ✓ Tax Incentives: Offer tax incentives, such as reduced tax rates to encourage domestic investment.
- Foreign Investment Strategies
 - ✓ Zimbabwe Investment and Development Agency (ZIDA): Use ZIDA to showcase investment opportunities and provide support to potential investors. Moreover, the institution should continue to be used as a mechanism to streamline investment procedures, including licensing, registration and permitting, to reduce bureaucracy and increase efficiency.
 - ✓ Investment Incentives: Offer investment incentives, such as tax breaks, subsidies, or investment allowances, to attract foreign investment.
 - ✓ Special Economic Zones (SEZs): Establish SEZs in Harare with favorable business conditions, including tax exemptions, simplified regulations and modern infrastructure.
 - ✓ Diaspora Investment: Encourage Zimbabweans living abroad to invest in their home country through targeted marketing campaigns and investment incentives.
 - ✓ Investment Roadshows: Organize investment roadshows to showcase Zimbabwe's investment opportunities and build relationships with potential investors.
 - ✓ Public-Private Partnerships (PPPs): Promote PPPs to attract foreign investment in key sectors, such as infrastructure, energy and agriculture.

- Sector-Specific Strategies
 - ✓ Agriculture: Offer incentives for investment in agriculture, such as subsidies, tax breaks, or access to finance.
 - ✓ Mining: Streamline the mining licensing process, offer investment incentives and provide support for mining infrastructure development.
 - ✓ Tourism: Invest in tourism infrastructure, offer tax incentives for tourism-related investments, and promote Harare's tourism attractions globally.
 - ✓ Manufacturing: Establish special economic zones for manufacturing, offer investment incentives, and provide support for skills development and technology transfer.
- Governance and Institutional Framework
 - ✓ Investment Policy: Develop a clear and consistent investment policy that outlines the government's vision, objectives, and strategies for promoting investment in Harare.
 - ✓ Investment Laws: Reform investment laws to ensure they are modern, transparent, and investor-friendly.
 - ✓ Institutional Framework: Promote ZIDA as an institutional framework to support investment promotion in Harare.
 - ✓ Corruption Reduction: Implement measures to reduce corruption, including strengthening anti-corruption laws, increasing transparency and promoting accountability.

5.11.3. Incentives and policy reforms that position Harare as an attractive destination for investment.

- Generic Incentives
 - ✓ Tax Incentives: Offer tax breaks or exemptions for businesses that invest in Harare.
 - ✓ Investment Allowances: Provide investment allowances or grants to support businesses in setting up or expanding their operations in Harare.
 - ✓ Streamlined Licensing: Offer streamlined licensing and permitting processes to reduce bureaucracy and increase efficiency.
 - ✓ Access to Finance: Establish affordable financing options, such as low-interest loans or seed funding, to support businesses in Harare.
 - ✓ Infrastructure Support: Offer support for infrastructure development, such as roads, energy, and water, to facilitate business growth.
- Sector-Specific Incentives
 - ✓ ICT Sector: Offer incentives for investment in the ICT sector, such as tax breaks, investment allowances, or support for infrastructure development.
 - ✓ Manufacturing Sector: Provide incentives for investment in the manufacturing sector, such as tax breaks, investment allowances, or support for skills development.
 - ✓ Tourism Sector: Offer incentives for investment in the tourism sector, such as tax breaks, investment allowances, or support for infrastructure development.
- Policy Reforms
 - ✓ Simplify Business Registration: Simplify the business registration process to make it easier for investors to set up businesses in Harare.

- ✓ **Reduce Regulatory Burden:** Reduce the regulatory burden on businesses by streamlining regulations and eliminating unnecessary bureaucratic hurdles.
- ✓ **Promote Transparency and Accountability:** Promote transparency and accountability in government dealings to increase investor confidence.
- ✓ **Protect Property Rights:** Strengthen property rights and ensure that investors' assets in Harare are protected.
- ✓ **Encourage Public-Private Partnerships:** Encourage public-private partnerships to support infrastructure development and other key sectors.

5.12. Small and Medium Enterprise (SME) Assessment

The sector employs about 90% of the total employees and Finscope (2022) found that MSMEs employed 1,704,454 employees and contributed USD 8.6 billion to GDP.

5.12.1. Profile of the SME Sector in Harare

In Zimbabwe, SMEs are defined based on the number of employees, annual turnover and asset value. The SME sector in Harare includes:

- ✓ **Micro Enterprises:** 1-5 employees, annual turnover ≤ US\$10,000.00, asset value ≤ US\$20,000.00.
- ✓ **Small Enterprises:** 6-20 employees, annual turnover ≤ US\$100,000.00, asset value ≤ US\$200,000.00.
- ✓ **Medium Enterprises:** 21-50 employees, annual turnover ≤ US\$500,000.00, asset value ≤ US\$1,000,000.00.

- **SME Sector Contribution**

The SME sector in Harare contributes significantly to the city's economy:

- ✓ **Employment:** SMEs account for approximately 60% of employment in Harare's formal sector.
- ✓ **GDP Contribution:** SMEs contribute around 40% to Harare's GDP.
- ✓ **Innovation:** SMEs are key drivers of innovation in Harare, introducing new products, services and processes.

- **Key Sectors**

SMEs in Harare operate in various sectors, including:

- ✓ **Manufacturing:** Food processing, textiles, and metal fabrication.
- ✓ **Services:** Financial services, ICT, tourism, and hospitality.
- ✓ **Retail and Wholesale:** Formal and informal retail, wholesale trade, and distribution.

- **Challenges**

Despite their importance, SMEs in Harare face several challenges:

- ✓ **Limited Access to Finance:** High interest rates, collateral requirements, and limited financial products hinder SME access to finance.
- ✓ **Inadequate Infrastructure:** Poor road networks, unreliable energy supply, and limited access to water and sanitation facilities hinder SME operations.

- ✓ Competition: SMEs face intense competition from larger enterprises and other SMEs.

5.12.2. Recommendations for supporting SMEs

- Funding Opportunities
 - ✓ Access to Finance Programs: Establish programs that provide affordable financing options, such as loans, grants, or equity investments, to SMEs.
 - ✓ Venture Capital Funds: Create venture capital funds that invest in high-growth SMEs, providing them with the necessary capital to scale their businesses.
 - ✓ Crowdfunding Platforms: Develop crowdfunding platforms that allow SMEs to raise funds from a large number of people, typically through online platforms.
 - ✓ Business Incubation and Acceleration Programs: Offer business incubation and acceleration programs that provide SMEs with access to funding, mentorship, and business support services.
- Business Development Programs
 - ✓ Mentorship Programs: Establish mentorship programs that pair experienced entrepreneurs and business leaders with SME owners, providing them with guidance and support.
 - ✓ Training and Capacity Building: Offer training and capacity-building programs that enhance the skills and knowledge of SME owners and employees, enabling them to improve their business operations and competitiveness.
 - ✓ Networking Opportunities: Provide networking opportunities that allow SMEs to connect with potential customers, suppliers, partners, and investors, helping them to build relationships and access new markets.
 - ✓ Business Planning and Strategy Development: Support SMEs in developing business plans and strategies that enable them to achieve their goals and objectives.
- Accessible Infrastructure
 - ✓ Co-Working Spaces: Establish co-working spaces that provide SMEs with affordable and flexible office space, as well as access to shared resources and facilities.
 - ✓ Incubation Centers: Develop incubation centers that offer SMEs a supportive environment in which to start and grow their businesses, including access to funding, mentorship, and business support services.
 - ✓ Industrial Parks and Estates: Create industrial parks and estates that provide SMEs with access to affordable and suitable premises, as well as shared infrastructure and services.
 - ✓ Digital Infrastructure: Invest in digital infrastructure, such as high-speed internet and data centers, to support the growth of digital SMEs and enhance their competitiveness.
- Other Recommendations
 - ✓ Simplify Regulatory Frameworks: Simplify regulatory frameworks and reduce bureaucratic hurdles to make it easier for SMEs to start and grow their businesses.
 - ✓ Encourage Innovation and Entrepreneurship: Encourage innovation and entrepreneurship by providing support for research and development, as well as initiatives that promote a culture of entrepreneurship.

- ✓ Foster Partnerships and Collaborations: Foster partnerships and collaborations between SMEs, large enterprises, academia and government to promote knowledge sharing, innovation and growth.
- ✓ Monitor and Evaluate: Monitor and evaluate the effectiveness of SME support programs and make adjustments as needed to ensure that they are meeting their intended objectives.

5.13. Job Creation and Workforce Development

5.13.1. Status of Job Creation and Workforce Development in Harare

Persistent economic shocks have made the goal of job creation difficult. The unemployment rate for Harare increased from 9.2% to 20.5% between the years 2019 and 2023. The rate is higher amongst female and youth unemployment, which was 44.7% in 2023, a significant increase from 12.3% in 2019. Permanent job creation in the manufacturing sector decreased in 2023 to 11%, from 23% in 2022. Higher employment opportunities were created in small scale firms, which sat at 18% (CZI, manufacturing survey, 2023). The skills audit of 2018 showed an average skill deficit of -61.75% and the gap was highest for Natural and Applied Sciences (-96.91%), Medical and Health Sciences (-95%), Engineering and Technology (93.57%). The sectors experienced high brain drain during the economic crisis period, as a result of high inflation which eroded workers' earnings. Skills mismatch challenges remain high across all sectors.

5.13.2. Strategies that expand employment opportunities and build a skilled workforce

- Skill development Interventions
 - ✓ Creation of skill development centres in Harare in partnership with local industries that conduct rotational workforce training programmes. Continuous reskilling of workers minimizes chances of skill obsolete in a world of rapidly changing technological advancement.
 - ✓ Acceleration of skill-based job readiness programmes that link industry needs and (Technical and Vocational Education and Training) TVETs/University curriculum to minimize skills mismatch between job seekers and employment needs.
- Employment creation interventions
 - ✓ Development of youth and women empowerment programmes and funds which promote inclusive growth and economic participation of the disabled.
 - ✓ Promote entrepreneurial skills and advocate for cheaper start-up funds, incubators and workspaces for start-up development and business mentorship.
 - ✓ Easy of doing business in the city.
 - ✓ Leverage on emerging sectors such as the digital economy. Development of the sector creates opportunities for new jobs.

5.14. Infrastructure Investment Prioritization Framework

5.14.1. Critical infrastructure projects that will have the highest economic impact

- Transport Networks
 - ✓ Emergency Road Rehabilitation Program (ERRP): Upgrading roads in Harare can improve connectivity, reduce transportation costs and increase access to markets.
 - ✓ Mbudzi Interchange Project: This project can reduce traffic congestion, improve road safety and enhance the overall efficiency of Harare's transportation system.
 - ✓ Upgrading the Harare-Beitbridge Highway: This highway is a critical transportation artery and upgrading it can improve connectivity, reduce transportation costs and increase access to markets

- ✓ Developing a Mass Transit System: A well-designed mass transit system can reduce traffic congestion, improve air quality and enhance the overall quality of life in Harare.
- Industrial Parks
 - ✓ Development of Special Economic Zones (SEZs): Establishing SEZs in Harare can attract foreign investment, promote exports and create jobs.
 - ✓ Industrial Park Development: Creating industrial parks can provide SMEs with access to affordable land, utilities and other essential services.
- Digital Connectivity Improvements
 - ✓ Fiber Optic Cable Deployment: Expanding fiber optic cable networks in Harare can improve internet connectivity, reduce costs and increase access to digital services.
 - ✓ Development of Data Centers: Building data centers in Harare can provide businesses with secure, reliable and efficient data storage and processing services.
- Other Critical Infrastructure Projects
 - ✓ Hwange Power Station Upgrade: Upgrading the Hwange Power Station can increase electricity generation capacity, reduce power outages and improve the overall reliability of Harare's energy supply.
 - ✓ Water and Sanitation Infrastructure Development: Improving water and sanitation infrastructure in Harare can enhance public health, reduce the risk of water-borne diseases and increase access to clean water and sanitation services.
 - ✓ Developing New Water Sources: Developing new water sources can increase access to clean water and sanitation services, improving public health and quality of life.

5.15. Land Use and Zoning Recommendations for Economic Growth

Table 5.10 outlines the Special Economic Zone (SEZ) licensed projects in Harare. A notable trend in the table is the dominance of the manufacturing sector, accounting for the majority of the licensed projects. This is indicative of the government's efforts to promote industrialization and economic diversification. The manufacturing projects range from food processing and pharmaceuticals to textile production and metal fabrication. Other sectors, such as health services also has a presence in the SEZ licensed projects. The table provides a snapshot of the investment opportunities and economic activities in Harare's SEZ.

Table 5.10: Special Economic Zone Licensed Projects

Company Name	Sector	Licensed Activity	Location	Projected Investment (US\$m)
Davipel Trading (Pvt) Ltd	Manufacturing	Dried food manufacturing	Sunway City	50
Spadix Investments (Pvt) Ltd	Manufacturing	Soyabean Solvent Extraction	Harare	10
Tradeings Zimbabwe (Pvt) Ltd	Manufacturing	Detergent powder and paste production	Harare	20
Varun Beverages Zimbabwe (Pvt) Ltd	Manufacturing	Beverages Manufacturing	Harare	40

Vislink (Pvt) Ltd t/a Trauma Centre	Health Services	Trauma Centre	Harare	3

Source: ZIDA, 2024

5.15.1. Strategies for land zoning adjustments to promote business districts, industrial zones and mixed-use areas

- Business Districts
 - ✓ Central Business District (CBD) Revitalization: Revitalize the CBD by encouraging mixed-use development, pedestrian-friendly streets and vibrant public spaces.
 - ✓ Zoning for High-Density Development: Implement zoning regulations that allow for high-density development, including high-rise buildings and mixed-use projects.
 - ✓ Pedestrian-Friendly Infrastructure: Invest in pedestrian-friendly infrastructure, such as sidewalks, crosswalks and public transportation systems.
 - ✓ Business-Friendly Regulations: Streamline business regulations and reduce bureaucratic hurdles to encourage businesses to locate in the CBD.
- Industrial Zones
 - ✓ Designate Specific Industrial Zones: Designate specific areas for industrial development, taking into account factors such as access to transportation, utilities, and labor.
 - ✓ Zoning for Heavy Industry: Implement zoning regulations that allow for heavy industry, including manufacturing, logistics and warehousing.
 - ✓ Infrastructure Development: Invest in infrastructure development, including roads, utilities and transportation systems, to support industrial growth.
 - ✓ Environmental Regulations: Implement environmental regulations to ensure that industrial activities do not harm the environment or public health.
- Mixed-Use Areas
 - ✓ Zoning for Mixed-Use Development: Implement zoning regulations that allow for mixed-use development, including residential, commercial, and recreational uses.
 - ✓ Encourage Walkable Neighborhoods: Encourage walkable neighborhoods by promoting mixed-use development, pedestrian-friendly infrastructure, and public transportation systems.
 - ✓ Incentivize Mixed-Use Development: Offer incentives, such as tax breaks or density bonuses, to encourage mixed-use development.
 - ✓ Community Engagement: Engage with local communities to ensure that mixed-use development aligns with their needs and priorities.

5.16. Revenue Generation and Financial Sustainability Assessment

5.16.1. Revenue sources for Harare

The Harare City finances operate under the Municipal Finance Act which provides guidelines on revenue mobilization and expenditure restrictions/outlay. The act allows the city to generate revenue using taxes, fees and fines, and restricts the use of general taxes such as VAT and Income Taxes. The restrictions have repercussions on fiscal space and the overall performance of city's budget especially during periods of financial distress, where misalignment of the tax system to the city's economic activity worsened. Lessons from Covid-19 lockdowns revealed vulnerabilities in the city's financial systems. Moreover, the revenue performance has been hampered by persistent high inflation, reduced tax rates and

residents' unwillingness to pay which contribute to low revenue collection efficiency. In order to ensure financial sustainability, the city needs to build resilience in revenue generation and adopt innovative funding programmes.

- Revenue Interventions
- ✓ Widening of tax base by adopting electronic fiscal registers.
- ✓ Improve the performance of property taxes by adopting market-based property evaluation.
- ✓ Adopt innovative strategies for revenue mobilization and increase demand for property development in the city to widen the tax base.
- ✓ Automation of all fiscal transactions in order to speed up revenue collection and minimise revenue leakages.
- ✓ Lobby for tax broadening from central government for shared VAT or sales tax, for specific periods to meet critical developmental needs such as energy and water development projects.
- ✓ Review of tax and bills compliance frameworks and development of mechanism for debt collection.
- ✓ Relaxation of regulation to allow changes in land use. Land value capture strategies might include infrastructure development and zoning changes e.g. skyscraper, residential to industrial parks. Sustainable funding from residents' contribution and partnership with the private sector. High breed funding initiatives that combine tax revenue and private sector participation e.g. Monetization of assets. The targeted assets for medium and long term might include council halls and lease arrangements on sporting infrastructure e.g. swimming pools, football fields and transform them into modern sporting facilities like Rufaro and National Sports Stadiums.
- ✓ Develop revenue intervention strategies that face minimum resistance from residents that are economically viable and easy to implement such as new benefit taxes.
- ✓ Built resilience in city finances through creation of fiscal space depending on economic environment and uncertainty.

5.16.2. Financial model projecting long-term revenue

The City of Harare Master Plan aims to transform the city into a vibrant, sustainable and economically thriving metropolitan area. Our financial projections indicate that the city can generate significant revenue through a diversified range of streams. Property taxes are expected to increase steadily as the city's real estate market grows. Water and sewerage fees will also rise as the city invests in upgrading its infrastructure. Transportation fees, business licenses and advertising revenue will contribute to the city's coffers as the economy expands.

Assumptions:

- Population growth rate: 2% per annum
- GDP growth rate: 4% per annum
- Inflation rate: 3% per annum
- Average annual increase in property values: 5%
- Average annual increase in water and sewerage tariffs: 4%

Revenue Streams:

- a. **Property Taxes**
 - Residential property taxes
 - Commercial property taxes

- Industrial property taxes
- b. **Water and Sewerage Fees**
 - Residential water and sewerage fees
 - Commercial water and sewerage fees
 - Industrial water and sewerage fees
- c. **Transportation Fees**
 - Parking fees
 - Toll fees
 - Public transportation fees
- d. **Business Licenses and Permits**
 - Trading licenses
 - Liquor licenses
 - Construction permits
- e. **Advertising and Sponsorship**
 - Billboard advertising
 - Event sponsorship
 - Digital advertising
- f. **Other Revenue**
 - Fines and penalties
 - Interest on investments
 - Rent from city-owned properties

Table 5.11: Financial Projections

Year	Property Taxes (USD millions)	Water and Sewerage Fees (USD millions)	Transportation Fees (USD millions)	Business Licenses and Permits (USD millions)	Advertising and Sponsorship (USD millions)	Other Revenue (USD millions)	Total Revenue
2023	15	8	3	2	1	0.5	30
2024	16.5	9.2	3.6	2.4	1.2	0.6	33.5
2025	18.2	10.6	4.3	2.8	1.5	0.7	37.3
2026	20	12.2	5.1	3.3	1.8	0.8	41.4
2027	22	14	6	3.9	2.2	0.9	46.1
2028	24.2	16	7	4.6	2.6	1	51.4
2029	26.6	18.2	8.2	5.4	3.1	1.1	57.1
2030	29.2	20.6	9.5	6.3	3.7	1.2	63.5

5.17. Public-Private Partnerships (PPP)

5.17.1. Leveraging private sector involvement in public infrastructure and services

- Public-Private Partnerships (PPPs)
 - ✓ Transportation Infrastructure: Partner with private companies to develop and manage transportation infrastructure, such as roads, highways, and public transportation systems.
 - ✓ Water and Sanitation: Collaborate with private sector partners to improve water supply and sanitation services, including the development of new water sources and the rehabilitation of existing infrastructure.
 - ✓ Energy Infrastructure: Partner with private companies to develop and manage energy infrastructure, including power generation, transmission, and distribution.
- Private Sector Participation in Service Delivery

- ✓ Waste Management: Engage private sector companies to provide waste management services, including collection, transportation, and disposal.
 - ✓ Public Lighting: Partner with private companies to install and maintain public lighting systems, improving safety and security in public spaces.
 - ✓ Parks and Recreation: Collaborate with private sector partners to develop and manage parks and recreational facilities, improving the quality of life for residents.
- Framework for Private Sector Involvement
 - ✓ Clear Policy and Regulatory Framework: Establish a clear policy and regulatory framework that outlines the roles and responsibilities of private sector partners and ensures transparency and accountability.
 - ✓ Competitive Bidding Process: Conduct competitive bidding processes to select private sector partners, ensuring that they have the necessary expertise, experience, and financial capacity.
 - ✓ Performance-Based Contracts: Use performance-based contracts that incentivize private sector partners to deliver high-quality services and infrastructure.
 - ✓ Monitoring and Evaluation: Establish a monitoring and evaluation framework to track the performance of private sector partners and ensure that they are meeting their contractual obligations.
 - Benefits of Private Sector Involvement
 - ✓ Improved Efficiency: Private sector involvement can bring improved efficiency and productivity in the delivery of public services and infrastructure.
 - ✓ Increased Investment: Private sector involvement can attract new investment in public infrastructure and services, reducing the financial burden on the government.
 - ✓ Enhanced Quality of Life: Private sector involvement can lead to improved quality of life for residents, through better public services and infrastructure.
 - ✓ Job Creation: Private sector involvement can create new job opportunities in the construction, operation, and maintenance of public infrastructure and services.

5.17.2. Framework outlining PPP opportunities

- Project Identification and Prioritization: Identify and prioritize potential PPP projects based on their economic viability, social impact, and environmental sustainability.
- Project Preparation and Feasibility Studies: Conduct feasibility studies and prepare project proposals, including detailed project plans, financial projections, and risk assessments.
- Procurement and Tendering: Conduct transparent and competitive procurement processes to select private sector partners, ensuring that they have the necessary expertise, experience, and financial capacity.
- Contract Negotiation and Signing: Negotiate and sign PPP contracts that clearly outline the roles, responsibilities, and risks of each party, ensuring that they are fair, transparent, and enforceable.
- Project Implementation and Monitoring: Implement PPP projects efficiently and effectively, monitoring progress, addressing challenges, and ensuring that projects are completed on time, within budget, and to the required quality standards.

5.18. Resilience and Economic Diversification Strategy

5.18.1. Major shocks and stresses affecting Harare's economy

- **Economic Volatility:** Zimbabwe's economy has experienced high inflation rates, currency fluctuations, and a large informal sector, making it challenging for Harare's economy to stabilize.
- **Drought and Climate Change:** The city has been affected by droughts, including the 2024 El Niño-induced drought, which has impacted agricultural production, food security, and the overall economy.
- **Infrastructure Challenges:** Harare's infrastructure, including roads, water supply, and sanitation, is in need of upgrading and maintenance, hindering economic growth and development.
- **Dependence on a Few Key Sectors:** The city's economy is heavily reliant on a few key sectors, such as agriculture and mining, making it vulnerable to fluctuations in global commodity prices.
- **Brain Drain and Skills Shortage:** Zimbabwe has experienced a brain drain in recent years, with many skilled professionals emigrating to other countries, leading to a shortage of skilled workers in Harare.
- **Corruption and Governance Issues:** Corruption and governance issues have been a significant challenge for Harare's economy, discouraging investment and hindering economic growth.

5.18.2. Diversifying income sources and industries

- **Diversifying Income Sources**
 - ✓ **Tourism Development:** Develop Harare's tourism sector by investing in infrastructure, marketing, and product development, focusing on the city's natural and cultural attractions.
 - ✓ **ICT and Technology:** Foster the growth of the ICT and technology sector by providing incentives, investing in digital infrastructure, and promoting innovation and entrepreneurship.
 - ✓ **Manufacturing and Export-Oriented Industries:** Encourage the development of manufacturing and export-oriented industries, such as textiles, food processing, and pharmaceuticals, by providing incentives, investing in infrastructure, and promoting trade facilitation.
- **Diversifying Industries**
 - ✓ **Agricultural Diversification:** Encourage agricultural diversification by promoting the production of high-value crops, such as horticulture and floriculture, and supporting the development of agro-processing industries.
 - ✓ **Mining and Mineral Processing:** Develop the mining and mineral processing sector by investing in infrastructure, promoting exploration and extraction, and encouraging the development of downstream industries.
 - ✓ **Creative Industries:** Foster the growth of creative industries, such as arts, culture, and design, by providing incentives, investing in infrastructure, and promoting innovation and entrepreneurship.
- **Enabling Environment**

- ✓ Business-Friendly Regulations: Streamline business regulations, reduce bureaucratic hurdles, and promote transparency and accountability to encourage investment and entrepreneurship.
- ✓ Infrastructure Development: Invest in infrastructure development, including transportation, energy, water, and sanitation, to support the growth of diversified industries.
- ✓ Human Capital Development: Invest in human capital development, including education, training, and skills development, to ensure that the workforce has the necessary skills to support diversified industries.
- Implementation Roadmap
 - ✓ Short-Term (0-2 years): Conduct feasibility studies, develop business plans, and establish partnerships with private sector investors and development partners.
 - ✓ Medium-Term (2-5 years): Implement infrastructure development projects, establish business incubators and accelerators, and provide training and capacity-building programs for entrepreneurs and SMEs.
 - ✓ Long-Term (5-10 years): Evaluate the impact of diversification efforts, refine strategies, and continue to invest in infrastructure, human capital, and innovation to sustain economic growth and resilience.

5.18.3. Recommendations for broadening Harare's economic base

- Renewable Energy
 - ✓ Solar Energy: Invest in solar energy infrastructure, including solar farms and rooftop installations, to reduce reliance on non-renewable energy sources.
 - ✓ Wind Energy: Explore wind energy potential in Harare and surrounding areas, investing in wind farms and turbines to generate clean energy.
 - ✓ Green Buildings: Encourage the development of green buildings, incorporating energy-efficient design, materials, and systems to reduce energy consumption.
- Technology
 - ✓ ICT Infrastructure: Develop modern ICT infrastructure, including fiber-optic networks, data centers, and innovation hubs, to support the growth of the tech sector.
 - ✓ Software Development: Foster the growth of the software development industry, providing training, mentorship, and funding opportunities for startups and entrepreneurs.
 - ✓ E-Commerce and Digital Payments: Promote the development of e-commerce platforms and digital payment systems, improving access to markets and financial services for businesses and individuals.
- Eco-Tourism
 - ✓ National Parks and Wildlife: Develop and promote eco-tourism initiatives in national parks and wildlife areas, supporting conservation efforts and providing economic benefits for local communities.
 - ✓ Urban Eco-Tourism: Create urban eco-tourism initiatives, showcasing Harare's natural and cultural attractions, such as parks, gardens, and historical sites.
 - ✓ Community-Based Tourism: Support community-based tourism initiatives, empowering local communities to develop and manage their own tourism projects, promoting cultural exchange and economic benefits.

- Enabling Environment
 - ✓ Business-Friendly Regulations: Streamline business regulations, reducing bureaucratic hurdles and promoting transparency and accountability to encourage investment in sustainable sectors.
 - ✓ Investment Incentives: Offer investment incentives, such as tax breaks, subsidies, and grants, to attract businesses and investors to Harare's sustainable sectors.
 - ✓ Capacity Building and Training: Provide capacity-building and training programs for businesses, entrepreneurs, and government officials, enhancing their skills and knowledge in sustainable sectors.
- Implementation Roadmap
 - ✓ Short-Term (0-2 years): Conduct feasibility studies, develop business plans, and establish partnerships with private sector investors and development partners.
 - ✓ Medium-Term (2-5 years): Implement infrastructure development projects, establish business incubators and accelerators, and provide training and capacity-building programs for entrepreneurs and SMEs.
 - ✓ Long-Term (5-10 years): Evaluate the impact of sustainable sector development, refine strategies, and continue to invest in infrastructure, human capital, and innovation to ensure the long-term sustainability and resilience of Harare's economy.

5.19. Community Engagement and Inclusive Economy Development

5.19.1. Strategies that ensure economic growth benefits of all communities within Harare

- Inclusive Economic Growth
 - ✓ Targeted Investments: Invest in infrastructure, education, and healthcare in disadvantaged communities to address historical inequalities and promote inclusive growth.
 - ✓ Job Creation and Skills Development: Implement programs that create jobs and provide skills training for low-income residents, focusing on sectors with high growth potential, such as technology and renewable energy.
 - ✓ Support for Micro, Small, and Medium Enterprises (MSMEs): Provide access to finance, markets, and business development services for MSMEs, which are critical for job creation and income generation in low-income communities.
- Social Protection and Welfare
 - ✓ Social Safety Nets: Implement social safety nets, such as cash transfers and food assistance, to protect vulnerable populations from poverty and hunger.
 - ✓ Affordable Housing: Develop affordable housing programs, including subsidies, rent control, and community land trusts, to ensure that low-income residents have access to decent and affordable housing.
 - ✓ Healthcare and Education: Invest in healthcare and education infrastructure, including clinics, hospitals, and schools, to improve access to quality services for all communities.
- Community Engagement and Participation

- ✓ Participatory Budgeting: Implement participatory budgeting processes that allow communities to contribute to budget decisions, ensuring that their needs and priorities are addressed.
- ✓ Community-Led Development: Support community-led development initiatives, providing resources and technical assistance to community groups and organizations.
- ✓ Transparency and Accountability: Ensure transparency and accountability in governance and decision-making processes, providing accessible information and channels for feedback and complaint resolution.
- Monitoring and Evaluation
 - ✓ Data Collection and Analysis: Establish a data collection and analysis system to track progress toward inclusive economic growth, social protection, and community engagement.
 - ✓ Performance Metrics and Indicators: Develop performance metrics and indicators to measure the impact of initiatives on different communities, including low-income and vulnerable populations.
 - ✓ Regular Progress Reports: Publish regular progress reports, providing insights into successes, challenges, and areas for improvement, and informing data-driven decision-making.

5.19.2. Strategies for inclusive economic development that address disparities and provide opportunities across demographics

- Community Participation and Engagement
 - ✓ Participatory Budgeting: Implement participatory budgeting processes that allow communities to contribute to budget decisions, ensuring that their needs and priorities are addressed.
 - ✓ Community-Led Development Initiatives: Support community-led development initiatives, providing resources and technical assistance to community groups and organizations.
 - ✓ Public-Private-Community Partnerships: Foster partnerships between the public sector, private sector, and communities to develop and implement economic development projects.
- Employment Opportunities and Local Development
 - ✓ Local Economic Development Strategies: Develop local economic development strategies that prioritize employment opportunities for local residents, particularly in sectors such as construction, manufacturing, and services.
 - ✓ Job Training and Skills Development Programs: Implement job training and skills development programs that equip local residents with the skills needed to access employment opportunities in growing sectors.
 - ✓ Support for Micro, Small, and Medium Enterprises (MSMEs): Provide support for MSMEs, including access to finance, markets, and business development services, to promote entrepreneurship and job creation.
- Equitable Access to Resources

- ✓ Access to Finance: Implement initiatives that improve access to finance for disadvantaged groups, such as women, youth, and people with disabilities.
 - ✓ Land Reform and Access: Implement land reform initiatives that provide equitable access to land for all citizens, particularly for disadvantaged groups.
 - ✓ Access to Education and Training: Ensure equitable access to education and training opportunities, particularly for disadvantaged groups, to enhance their skills and competitiveness in the job market.
- Addressing Disparities
 - ✓ Disparities Analysis: Conduct a disparities analysis to identify areas of inequality and disparities in Harare, informing targeted interventions and initiatives.
 - ✓ Targeted Initiatives: Develop targeted initiatives that address disparities and inequalities, such as programs that promote women's economic empowerment, youth employment, and disability inclusion.
 - ✓ Monitoring and Evaluation: Establish a monitoring and evaluation framework to track progress in addressing disparities and inequalities, informing adjustments and improvements to initiatives and interventions.
 - Implementation Roadmap
 - ✓ Short-Term (0-2 years): Conduct a disparities analysis, develop targeted initiatives, and establish a monitoring and evaluation framework.
 - ✓ Medium-Term (2-5 years): Implement participatory budgeting processes, community-led development initiatives, and public-private-community partnerships.
 - ✓ Long-Term (5-10 years): Evaluate the impact of initiatives, refine strategies, and continue to invest in inclusive economic development, ensuring that all communities in Harare benefit from economic growth and development.

5.20. Monitoring and Evaluation Framework for Economic Initiatives

5.20.1. Indicators that track progress and success of economic and investment plans

Term	Indicator	Description
1. Yearly Figures	GDP	GDP Annual Growth Rate
		Annual growth rate of Harare's GDP.
		Real GDP
		Actual value of Harare's GDP, adjusted for inflation.
		GDP Per Capita
		Average GDP per person in Harare.
		GDP Data Quality Rating
		Reliability of Harare's GDP data.
2. Economic Growth	Inflation Rate	Tracks changes in the general price level of goods and services.
	Unemployment Rate	Measures the percentage of the labor force without jobs.
	Interest Rates	Influences borrowing costs and savings rates, impacting consumption and investment.
	Agricultural Output	Measures the volume of agricultural production, crucial for Harare's economy.
	Mining Production	Tracks the output of the mining sector, a significant contributor to Harare's exports.
	Trade Balance	Measures the difference between exports and imports.
	Current Account Balance	Tracks the balance of trade in goods and services, income, and transfers.
	Foreign Exchange Reserves	Measures the adequacy of reserves to cover imports

			and meet external obligations.
		Investment Rate	Measures the percentage of GDP invested in the economy.
		Consumption Expenditure	Tracks household spending patterns.
		Poverty Rate	Measures the percentage of the population living below the poverty line.
		Human Development Index (HDI)	Assesses long-term progress in three basic dimensions of human development: a long and healthy life, knowledge, and a decent standard of living.
3.	Employment in MSMEs	Number of Jobs Created	Measures the total number of jobs created by MSMEs in a given period.
		Employment Rate	Shows the percentage of the labor force employed in MSMEs.
		Labor Productivity	Measures the output per worker in MSMEs, helping to assess their efficiency.
		Wage Levels	Tracks the average wages paid to employees in MSMEs, providing insight into their earning potential.
		Skills Development	Measures the number of training programs and workshops provided to employees in MSMEs, helping to assess their skills development.
		Employment Creation Plans	Shows the number of MSMEs with plans to create new jobs, providing insight into their future employment prospects.
		Sectoral Employment	Tracks employment levels in specific sectors, such as agriculture, manufacturing, and services, where MSMEs are predominant.
4.	Registered informal businesses	Number of Registered Informal Businesses	Measures the total number of informal businesses registered with the relevant authorities in Harare.
		Informal Sector Registration Rate	Shows the percentage of informal businesses that are registered, providing insight into the level of formalization in the sector.
		Types of Registered Informal Businesses	Categorizes registered informal businesses by type, such as retail, services, or manufacturing, helping to identify areas of growth and opportunity.
		Geographic Distribution of Registered Informal Businesses	Maps the location of registered informal businesses across Harare, highlighting areas of high concentration and potential for economic growth.
		Growth Rate of Registered Informal Businesses	Measures the annual growth rate of registered informal businesses, providing insight into the sector's dynamics and potential for job creation.
5.	FDI per year	FDI Inflows	Measures the total amount of foreign direct investment flowing into Harare each year.
		FDI Stock	Tracks the total accumulated value of foreign direct investment in Harare each year.
		FDI as a Percentage of GDP	Assesses the contribution of FDI to Harare's economy, relative to its GDP.
		Number of New FDI Projects	Monitors the number of new foreign direct investment projects established in Harare each year.
		FDI by Sector	Breaks down FDI inflows to Harare by sector, such as manufacturing, mining, or services.
		Country of Origin of FDI	Identifies the countries of origin for foreign direct investment in Harare.
6.	Property Tax Revenue Performance	Property Tax Revenue	Measures the total amount of property tax revenue collected by the City of Harare.
		Revenue Growth Rate	Tracks the annual growth rate of property tax revenue.
		Number of Registered Properties	Measures the total number of properties registered for taxation in Harare.

		Property Values	Tracks the total value of properties in Harare, which serves as the base for property taxation.
		Collection Rate	Measures the percentage of property tax revenue collected out of the total amount billed.
		Arrears Rate	Tracks the percentage of property tax revenue in arrears.
		Taxpayer Registration Rate	Measures the percentage of property owners registered for taxation.
		Tax Return Submission Rate	Tracks the percentage of taxpayers submitting their tax returns on time.
		Exemption Rate	Measures the percentage of properties exempt from property taxation.
		Relief Rate	Tracks the percentage of properties receiving relief from property taxation.

5.21. Performance indicators and benchmarks for economic initiatives

Indicator		Benchmark
1.	Economic Growth Rate	A target growth rate of 3.5-5% per annum is considered ideal for Harare's economic development.
2.	Investment Levels	Foreign direct investment (FDI) inflows should reach at least US\$200 million per annum, while domestic investment levels should exceed 12% of GDP.
3.	Poverty Reduction	The poverty headcount ratio should decline by at least 5% per annum, with a target of reducing poverty to less than 15% of the population by 2030.
4.	Job Creation	The creation of at least 50,000 new jobs per annum in key sectors such as manufacturing, agriculture and services.
5.	Export Performance	Export growth rates should exceed 5% per annum, with a target of increasing exports to at least US\$500 million per annum by 2030.
6.	Private Sector Development	Business registration rates should increase by at least 10% per annum, while access to finance for small and medium-sized enterprises (SMEs) should reach at least 25% of the SME sector.
7.	Infrastructure Development	Investments in key infrastructure sectors such as energy, transport and water should exceed US\$100 million per annum, with a target of increasing access to electricity to at least 40% of the population by 2030.
8.	Fiscal Discipline	Fiscal indicators such as budget deficits and debt-to-GDP ratios should be kept within sustainable limits, with a target of reducing the budget deficit to less than 1.5% of GDP by 2030.

5.22. Summary of Issues

a) Zimbabwe's Economic Context

- The economy has shown resilience post-Covid-19, recording high growth of over 5% (ZimStat, 2024).
- Between the years 2020 and 2022, the country experienced GDP growth rates of 8.5%, 6.5% and 5.4%, respectively (ZimStat, 2024).
- In absolute terms, GDP decreased from US\$12.65 billion in 2019 to US\$254.36 million in 2023Q1 (ZimStat, 2024).
- The Ministry of Finance and Economic Development of Zimbabwe suggested a modest growth forecast of 2.5% (ZimStat, 2024).

b) Harare's Economic State

- At the end of 2022, Harare's economy was estimated to be worth US\$76.16 million and its share of the national GDP was approximately 24.2% (ZimStat, 2024).
- The inflation rate for Harare was 1.2% and 14.5% higher than the overall annual inflation rates for the 2021 – 2022 fiscal years (ZimStat, Quarterly Digest of Statistics Q4 2022).
- The city of Harare is ranked 3rd in 2023 on the cost-of-living index (Numeo, 2024), showing that the economy is relatively cheaper with average-income households being able to access essential services, compared to regional cities like Johannesburg which is ranked number 1 (Numeo, 2024).
- Over the past four years, between 2019 and 2022, the sectorial contribution to GDP has not changed significantly. The tertiary sector accounts for most of the city's economic activities, contributing on average 68.8% to GDP, whilst secondary and primary activities share 28.9% and 2.5%, respectively (ZimStat, 2024).
- The top five industries that have dominated the economy of Harare are (i) Wholesale and Retail; (ii) Manufacturing; (iii) Finance and Insurance Activities; iv) Information and Communication; and (v) Construction, with four-year average percentage contributions of 25.3%, 19%, 10.4%, 7.3% and 4.34%, respectively (ZimStat, 2024).

c) Disposable Income and Consumption

- The average growth rate of GDP per capita in Harare between the years 2020 and 2022 was 4.26%, together with 7.4% for disposable income, which implies rising buying power with time (ZimStat, 2024).

d) Socio-Economic Indicators

- In 2021, data from the Zimbabwe Poverty Atlas revealed high income disparity and poverty prevalence. The residents of Harare are 15.6% more likely to fall into poverty. In addition, a Gini coefficient indicates that the income gap between rich and poor households is 43.5% wider, which reveals an expanding gap between the rich and poor. According to the World Bank, the income gap is projected to reach 50.3% at the end of 2024 (Zimbabwe Poverty Atlas, 2021).

e) Household Income Distribution

- The Household survey data for Harare shows that more than 80% of households earn less than US\$400.00 per month and approximately 1.2% earn more than US\$5,000.00 (Harare municipality 2024 Masterplan industrial survey conducted in 2024).

f) Harare Municipal Finance: Budgets and Expenditures

City's Budget Performance

- The budgeting environment for Harare between the years 2019 and 2023 was unfavourable. High inflation and rising informality in the economy made the goal of revenue mobilization very difficult, resulting in expenditure growth exceeding revenue growth. The size of the budget expanded slightly from 2% of GDP in

2019, to 3% as at 30 September 2024 (Harare Municipality Consolidated Budgets, 2024).

Revenue Mobilization

- The revenue as percentage of the city's GDP (revenue-GDP ratio) is less than 5% (this increased from 1% (2020) to 4 % (2023) and in 2024 it decreased to 3%), which highlights that city revenue is less aligned to the size of economy (Harare Municipality Consolidated Budgets, 2024).

Composition of Revenue Streams

- Property tax is the main contributor to own revenue and its dominance increased after the introduction of the new currency in 2024. During the period under review, property tax obtained the highest growth rate of 40.1% or 12.8 basis points, in comparison to other sources (Harare Municipality Consolidated Budgets, 2024).

Expenditure Composition

- Current expenditure share to total expenditure is three times capital expenditure. The average share increased from 74.5% to 77.4% between the 2019-2021 and 2022-2024 fiscal years (Harare Municipality Consolidated Budgets, 2024).
- The city spent a higher percentage of the capital budget on Water, Sanitation, and Hygiene (WASH) programmes. For 2019 the share of allocation was 44%, and for the period 2022-2024, the allocation for WASH decreased to 24.2% (Harare Municipality Consolidated Budgets, 2024).
- In absolute terms, the per capita capital expenditure for the city is decreasing. It decreased by 221.38% to US\$2.76 in 2023, from US\$8.87 in 2020, which implies that the city was spending on average US\$2.76 per person on capital expenditure (Harare Municipality Consolidated Budgets, 2024).

g) Economic Future Forecast

- The economy of Harare is projected to reach US\$1.916 billion by 2040, at a 2023 exchange rate with a Compounded Average Growth Rate (CAGR) of 4.47%. Household and firm surveys show most people prefer a US\$50 billion economy by 2040 (ZimStat, 2024).

h) Economic Baseline Assessment

- The growth momentum of Harare surpasses several cities in Southern Africa. Between the years 2020 and 2023 the economy achieved an average growth of 6% (ZimStat, 2024).

i) Economic Sector Analysis

- Like most Emerging Market and Developing Economy (EMDE) cities, the service sector accounts for over 65% of the city's GDP (ZimStat, 2024).
- Between the years 2019 and 2022, the sector recorded a 3.1% average growth (-10.87% in 2020 to 4.9% in 2022), with food and accommodation, finance and insurance, wholesale and retail trade industries driving the growth. Job creation in the sector is higher than in the manufacturing sector. In contrast, the industry which constitutes 26% to 31% of economic activities is on a downward trend. The sectorial growth was -9.9 % in 2020 and -0.7% in 2022. (ZimStat, 2024).

- Agricultural activities (urban agriculture), account for between 1% and 1.6% of GDP. The sector has been expanding slowly since 2019 (from -30.6% in 2020 to 0.43% in 2022) and is the source of livelihood for urban low-income households (ZimStat, 2024).
- j) Employment and Wages
- World Bank Development indicators (2024) revealed that the share of employment in service and manufacturing for Zimbabwe has gone up, from an average of 26% (between the years 2014 and 2018) to 30.5% (between the years 2019 and 2022). Whilst for the manufacturing sector it has risen from 8.7% to 12.7%. Most urban employees are in the service sector and employment in agriculture for the period recorded a decline from 65.5% to 56.9%.
 - Between 2014 and 2018, employment creation was highest in Printing and Publishing; Paper and Paper Products; Textiles and Food and Beverages with the following employment rates 258.4%, 219.4%, 67.8%, and 15.7%, respectively. The top 5 subsectors with job contraction (negative employment rates) were (i) Coke, Refined Petroleum Products, Nuclear Fuel (-97.8%); (ii) Leather, Leather Products and Footwear (-77.5%); (iii) Tobacco Products (-70%); (iv) Office, Accounting and Computing Machinery (-71.4%); and (v) Electrical Machinery and Apparatus (-66.6%). The finding is consistent with claims that share of employment in highly productive and automated sectors is usually low (UNIDO, 2024).
- k) Employment Data for Harare
- The number of employees for Harare decreased from 315,200 in 2018 to 307,200 in June 2023, whilst earnings significantly shifted to US\$1,894,594.12 in June 2023 from US\$2,488,300.45 in 2018. The decrease in number of employees is in line with the shrinking industry. On the other hand, rising earnings have implications on market demand, social welfare and economic well-being for the working class (Harare municipality 2024 Masterplan industrial survey conducted in 2024).
- l) Industrial employment at a Glance greater Harare
- The economy has been having challenges with unemployment for more than two decades now. The unemployment rate increased significantly from 10.7% in 2011 to 24% by 2021. The rate marginally decreased to 18.3% in 2023 but remains among the highest in the region. Female unemployment is almost double the unemployment rate for males, revealing the structural differences and gender norms prevailing in the economy (ZimStat, 2021).
- m) Manufacturing Trade
- Manufacturing Survey reveals a low appetite for export in the manufacturing sector, with an average export quantity of 7% of gross output, illustrating wood and wood product sub sector as the lead exporter with a share of 18%. The manufacturing sector is regarded as a high-cost producer in the region, creating opportunities for imports from low-cost producers like South Africa (CZI, 2023).
- n) Fruit and Vegetable Value Chain Greater Harare
- Average gross income for traders is almost twice the average income for producers. Results show that marketers/traders realise more income than

producers due to higher mark-ups in the fruit & vegetable value chain (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).

- Average employees at trader level is higher than at producer level. This shows that employment creation increases along the fruit & vegetable value chain (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
- 50% of producers and 60% of traders do pay council fees (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
- 70% of traders are unregistered (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
- 52% of farmers store their produce on open space (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
- 92% of farmers said their storage facilities are not refrigerated and 47% of the storage facilities are council owned, 39% said they are not fumigated against 35% who reported constant fumigation daily or once per week (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
- Findings from surveys show that most traders raised concerns over water supply, infrastructure and health standards. 61% of these traders raised the problem of clean tapped water and toilet facilities. 50% reported that water was never delivered. The industry uses water for cleaning fruits and vegetables. Evidence shows that 1kg of fruit or vegetables requires at least 5 litres of water for cleaning (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
- 19% of traders ranked poor infrastructure whilst 14% reported space (warehouse or marketing space) as major constraints. The markets are overcrowded to the extent that traders use open spaces (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).

o) Iron, Steel and Metal Industry

- 74% of metal processors and metal & steel suppliers rank shortage of electricity as a major constraint and 20% listed poor roads (Harare Municipality Master Plan 2024-2044, survey on city Home Industry value chains conducted on the 24th & 27th of December 2024).

p) Meat Industry

- 63% of butcheries & supermarkets receive running water either once per week, once per month or never which created demand for bulk water deliveries and boreholes (Harare Municipality Master Plan 2024-2044, survey on city Meat Industry value chains conducted on the 24th & 27th of December 2024).
- 58% use bins for waste disposal & 21% dump waste. 43% report refuse collection once per week and 24% never collected. The problem is leading to accumulation of refuse in business premises (Harare Municipality Master Plan 2024-2044,

survey on city Meat Industry value chains conducted on the 24th & 27th of December 2024).

- 53% ranked electricity as a major constraint. Energy crisis caused higher operating costs and reduced margins in the industry (Harare Municipality Master Plan 2024-2044, survey on city Meat Industry value chains conducted on the 24th & 27th of December 2024).

q) Key Economic Sectors and Performance

- In 2019, Whole and Retail Trade; Manufacturing; Financial and Insurance activities; Information and Communication Technology (ICT); and Education dominated with 25.1%; 21.1%; 8.6%; 5.9%; and 5% contributions to GDP, respectively. The Construction sector was in the top 5 with a 4.5% percentage contribution to GDP and registered an average growth of 4.2%, compared to -5.4% for manufacturing and 2.8% for wholesale and retail trade. ICT, together with the Financial and Insurance activities had the highest growth rates of 14.7% and 12.4%, respectively. These sectors are on a positive growth trajectory except for manufacturing, even though the sector is key to the city's economic development (ZimStat, 2024).

r) Technology

- Over the past three years between 2019 and 2023, an average of 45.8% of manufacturing firms upgraded their technology, with the upgrading being the highest in foodstuff subsector, chemical and petroleum products and pharmaceutical industries (CZI, 2023).

s) Job Creation and Workforce Development

Status of Job Creation and Workforce Development in Harare

- Persistent economic shocks have made the goal of job creation difficult. The unemployment rate for Harare increased from 9.2% to 20.5% between the years 2019 and 2023. The rate is higher amongst female and youth unemployment, which was 44.7% in 2023, a significant increase from 12.3% in 2019. Permanent job creation in the manufacturing sector decreased in 2023 to 11%, from 23% in 2022. Higher employment opportunities were created in small scale firms, which sat at 18% (CZI, manufacturing survey, 2023).

6. CHAPTER 6: REAL ESTATE AND LAND MARKETS

6.1. Real Estate Market Analysis

Over the past ten years the real estate market has sluggishly mimicked the behaviour of the national economy. Property prices and rentals have been mixed across all the sectors of the property market. Consistent with trends in other developing countries, Harare has witnessed rapid urbanisation resulting in a myriad of socio-economic problems and a decaying-built environment. A weakened and corrupt land administration system has undermined Harare's ability to fully derive value from the city's growth. Informal and unplanned settlements have mushroomed within the City's environs resulting in "grey land markets". In 2018 the World Bank estimated that 33.5% of the urban population resided in informal areas. There are 144 informal sites with a total of 26 000 people which may require regularisation (City of Harare Department of Housing). The areas are without planned amenities such as reticulated water, sewerage, education, and health services with residents resorting to shallow wells and pit latrines. However, these informal settlements provide an opportunity for in situ upgrading at a minimum cost. The existing planned suburbs have also not escaped infrastructure challenges with old, reticulated water and sewerage systems having collapsed due to over-crowding.

6.1.1. Housing

Harare is experiencing a significant housing crisis with an estimated housing backlog of 288,885 persons. Since the dawn of independence, the supply of new houses has not kept pace with the increase in population and housing demand. Housing costs have risen faster than incomes resulting in a deterioration in affordability for both buyers and renters. The shortfall in housing supply has contributed to rising numbers of households who are living as part of another household (lodgers). According to ZimStat 2022 census approximately 43% of the 500 651 households in Harare were living as lodgers. A decade of high inflation and interest rates has increased house prices and yet salaries have remained relatively unchanged. The high house prices are an indication of a relative imbalance between the supply and demand for new houses and makes housing less affordable. The affordability of new houses is the best evidence that supply is not keeping up with demand.

The Zimbabwe National Human Settlement Policy (ZNHSP) sets a national capacity-based five-year target of 44,000 houses each year from 2020 to 2025, within a context of its assessment of need of around 1,500,000 houses. As of 31 May 2024 the Harare housing waiting list had 288,885 persons of which 185,000 were dormant and 103,885 active. (CHDHCS). In the past 10 years the housing development sector is relatively active with self-funded home construction continuing apace from high density areas to the affluent suburbs of the city. Of note is the increased development of cluster houses and townhouses across the medium and low-density suburbs. However, several incomplete housing projects abound in the city. Stands have been sold to beneficiaries without the requisite infrastructure services such as bulky water reticulation, sewerage system, paved roads etc. examples include Harare South, Eyecourt Estate, Saturday Retreat, Hopley, Stoneridge, Hatcliffe, etc. Some of the new residential communities have completely disregarded the environmental requirements and have been built on wetlands.

The housing situation is unlikely to improve unless drastic action is taken. There has been a reduction in the number of residential subdivision applications being approved, with data showing a reduction from 125 in 2014 down to 90 in 2024. A shrinking flow of planning permissions will reduce the overall pipeline that can be built-out in future years. The results of housing under-delivery have significant economic, societal and personal impacts, not least

on those who face no alternative option but living in shacks on squatter camps. However, the local authority is not the sole source of the problem: wider macro-economic conditions, infrastructure deterioration, political interference, viability difficulties, and planning resourcing pressures have all contributed.

6.1.2. Existing Housing Stock

The City has a housing stock of 271,135 units (see figure 6.1). The high-density housing dominates being 67% (180,810 units) of the total housing stock. Low density housing comprises 20% (54,333 units) with the medium density being 13% (35,992 units). This reflects limited housing options for middle- and low-income households who are predominantly housed in high and medium density areas.

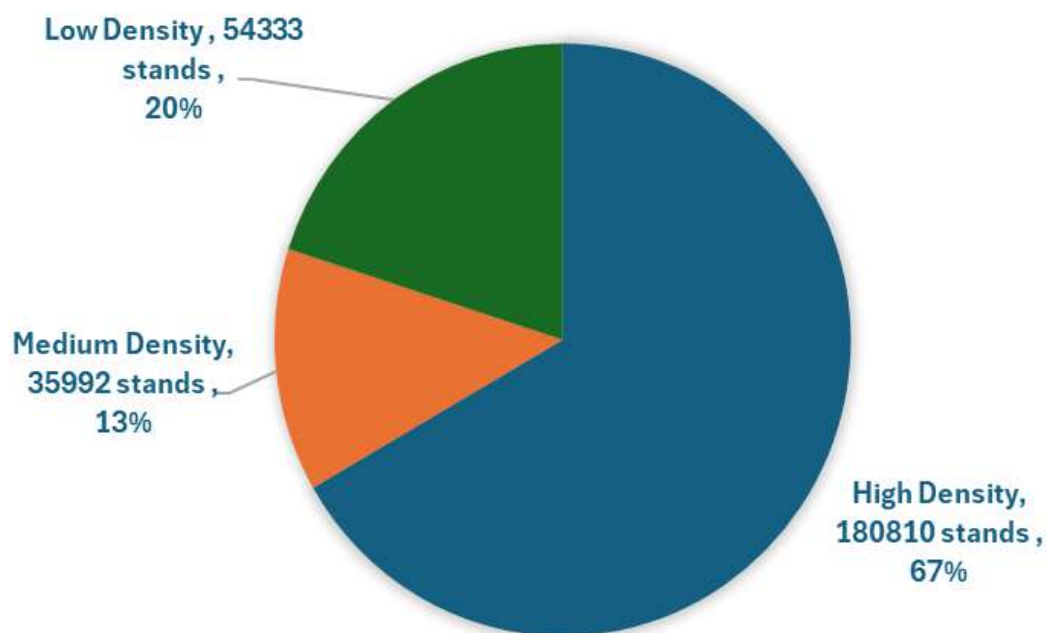


Figure 6.1: Existing Housing Stock

Source: City of Harare GVR 2020

6.1.3. Housing Tenure Types

The majority of the households are lodgers at 43% whilst the home ownership is at 33% of the households (see figure 6.2). About 12% of the households live with relatives with 6% and 5% living in tied accommodation and being tenants respectively.

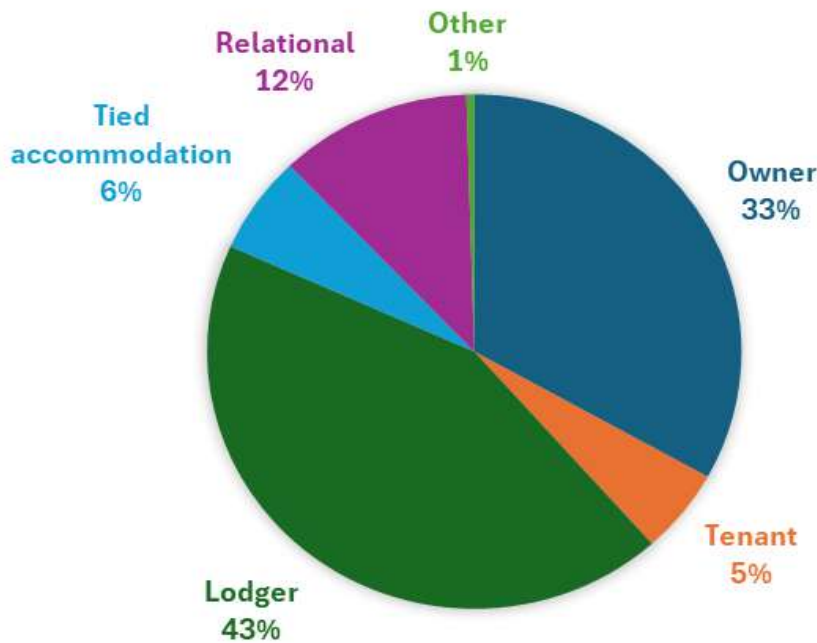


Figure 6.2: Existing Housing Tenure

6.1.4. New Housing Supply

A decadal trend of subdivision and cluster housing applications is provided in Figure 6.4 below. These numbers tend to significantly undercount housing supply in recent years given the uncounted supply in the “grey land markets”.

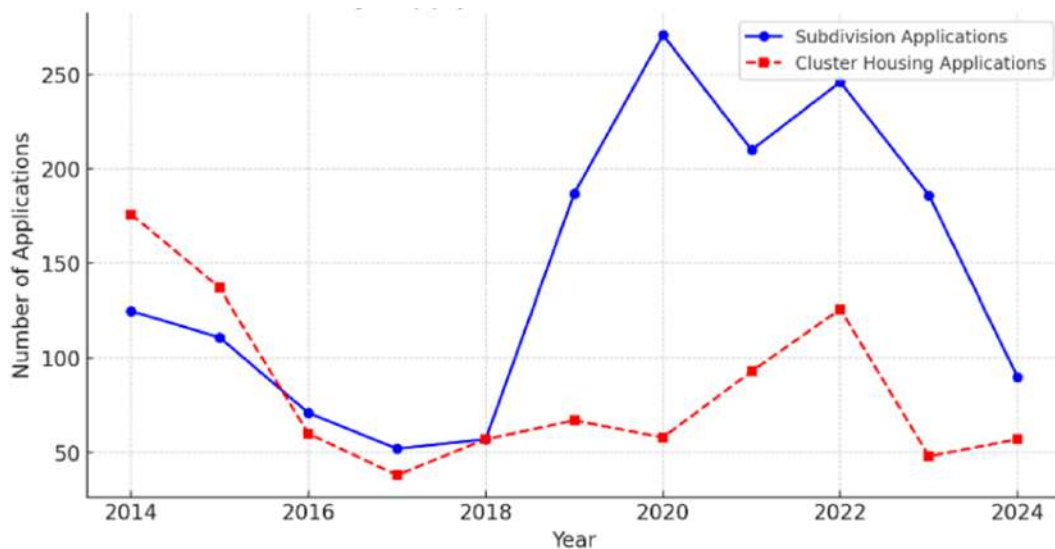


Figure 6.3: Subdivision & Cluster Housing Applications

Source: CoH Town Planning Application Registers 2024

The City of Harare does not publish a detailed breakdown of the housing schemes that contribute to housing supply. However, its residential subdivision and planning approval registers do provide details of scheme approvals which can be used as a proxy for housing supply. A closer look at a number of individual schemes and the above information further demonstrates the difficulty in relying simply on approvals as an indicator of the prospects for housing delivery, given the long lead time for the delivery of such projects in their entirety. A

number of the schemes are broken into phases and implemented over multi-year programmes extending well beyond the year of approval.

6.1.5. House Types

There majority of the housing units in Harare are detached houses comprising 73% of the total units. Semi-detached units are at 17% with flats and townhouses only at 6% (see figure 6.5). The Zimbabwe National Human Settlement Policy has now directed that on all new developments 60% of land can be used for detached housed with 40% being reserved for high rise or walk-up flats. This is an attempt to reverse the historical urban sprawl which has seen large tracts of agriculture land being converted to urban residential use.

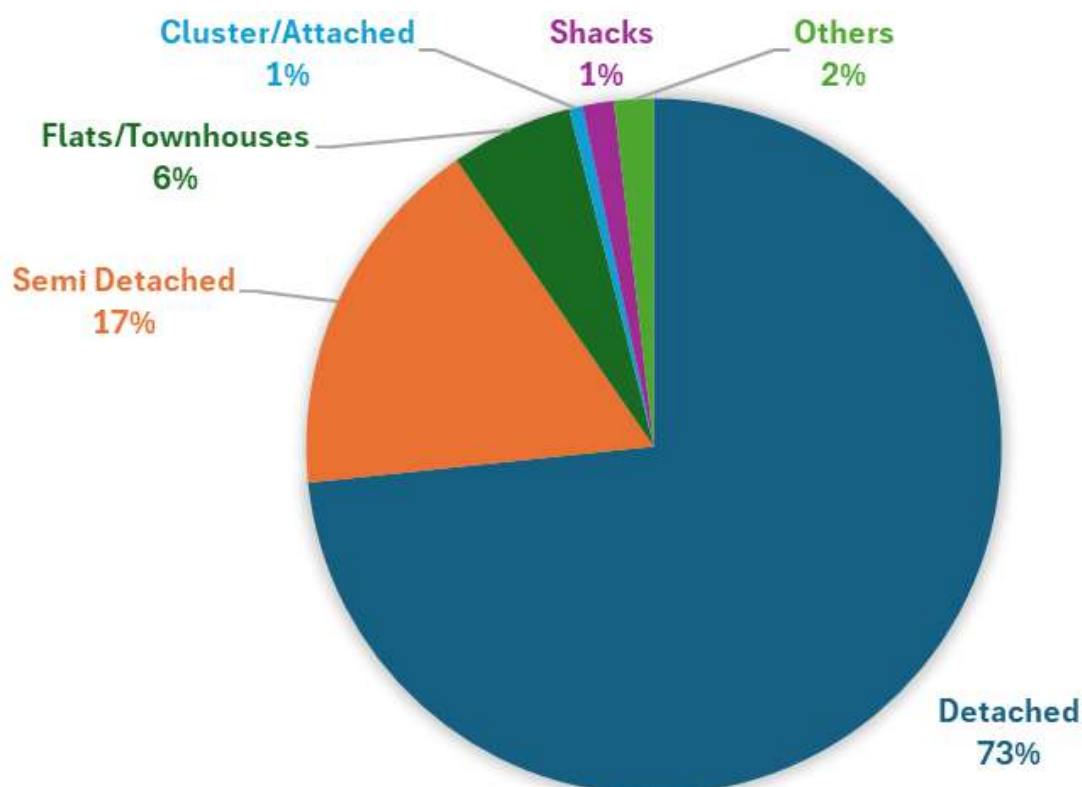


Figure 6.4: House Types

Source: ZimStat 2022 Census.

6.1.6. Condition of stock (age, repairs)

Overallly the housing stock is aging especially in those suburbs that were developed prior to independence. The deterioration of infrastructure and amenities in these suburbs has also contributed to the poor state of repair of most of the housing units.

6.1.7. Potential Sources of Housing Supply

There are three key sources of housing supply to inform the understanding of Harare's overall housing capacity:

- large greenfield sites (infills and peri urban areas > 1 hectare)
- small brownfield sites densification (below 1 hectare in size)
- grey sites (informal subdivisions)

There is anecdotal evidence that the majority of housing approximately 60% is being delivered on “grey sites” where significant amounts of future capacity comes forward on sites which currently do not have active land uses in the peri urban locations.

6.1.8. Causes of Housing Under Delivery

There is anecdotal evidence that the combined effect of the multiplicity of municipal policies/regulations have frustrated rather than facilitated the delivery of new houses, thus creating real challenges to the viability of local housing schemes:

- delays in the determination of planning applications.
- application process is expensive and time-consuming.
- public sector infrastructure investment is non-existent.
- absence of policy to encourage delivery of new houses on brownfield sites (densification and cluster houses in existing suburbs).
- disproportionately complex and cumbersome planning application process for small sites, negatively affecting residential development viability. This results in increased costs and disproportionately impacting small developments.
- many small developers expressed concerns about confusion arising from the potentially contradictory and inconsistent application of regulations by the City council.
- slow progress in reviewing Local Development Plans and the challenge of resources and levels of investment to bring forward developments in light of economic challenges, which have impacted on housing development viability. This problem is particularly acute for higher density, capital intensive projects which currently make up a much larger proportion of housing developments.

6.1.9. Housing Need/Demand

The assessment of housing need is not an exact science, and there is no single approach that will provide a definitive answer. The number of house sales and median prices are two simple ways of measuring demand in the housing market. The assessment of housing need has been carried out using the '*net stock method*'. The method estimates the number of houses required by considering projected household growth, the affordability of housing and the 'backlog' of existing need for new houses. The affordability tests take into account household income, cost of mortgage finance and the median price of houses. After comparing the stock of houses required in the future with the current stock, the annual requirement for new houses is calculated by averaging the total net requirement over the period of 20 years between 2024 and the end of the planning period in 2044. However, such data is not readily available in Zimbabwe thus local authorities tend to rely on housing waiting lists as a basis for assessing housing need. The “housing requirements/need” encompasses both the need for affordable housing and the demand for market housing.

6.1.10. Households on Housing Waiting List

The housing waiting list has 288,885 persons with the majority 185,000 persons being dormant, meaning there have not renewed their annual subscription. The remainder 103,885 are still actively seeking housing and this can be taken as the level of demand for housing in Harare. The high dormant number shows an increasing reluctance to continue on the housing waiting list partly motivated by the growing opportunities to access urban land without registration but through corrupt officials. Of the 52.9% who are registered on the council waiting list, 20.8% have been on the list for one to five years, 40.2% for five to ten years and 39% for over ten years (see figure 6.6).

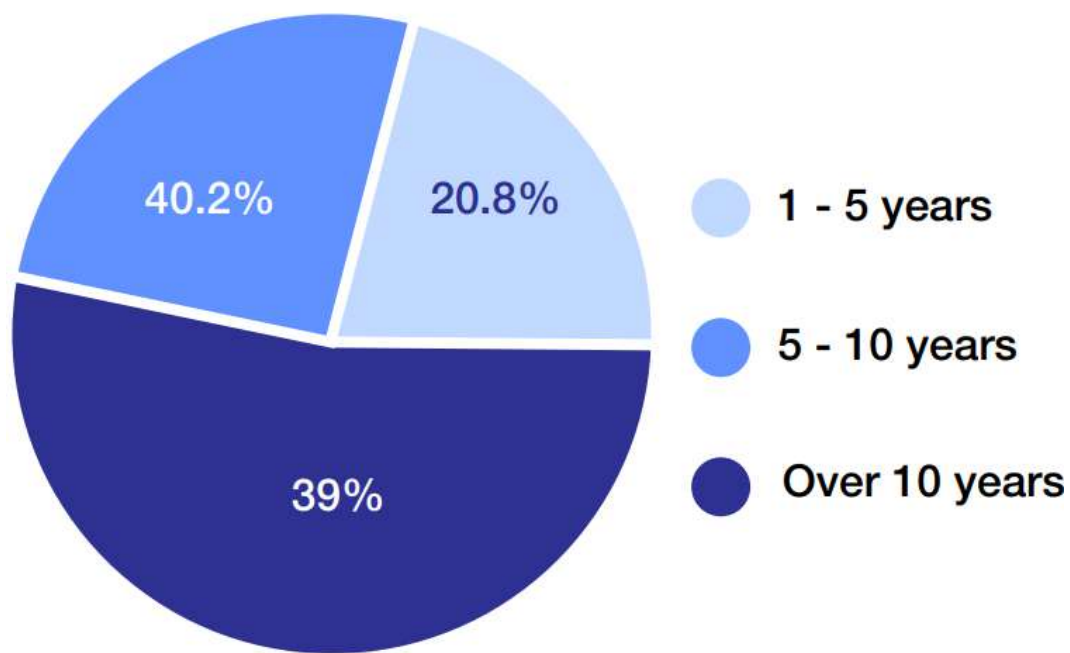


Figure 6.5: Number of years on Housing Waiting List

Source: TIZ & ZACC 2021

The registration of people on the waiting list for a longer period can be attributed to several factors:

- a. non-consideration of the housing waiting list by council officials in allocating stands.
- b. allocation of stands to people who are not registered on the list.
- c. subdued capacity of council to develop land and allocate stands.
- d. take over of stands development by “land barons”.

Other findings of the TIZ & ZACC survey are that 55.2% of the respondents who were registered on the waiting list indicated that council was not using the waiting list in allocating stands. Some of the reasons cited for failure to follow the housing waiting list are corruption and the grabbing of stands by politicians. Many cases were cited in which councils would allocate stands to applicants who are not registered on the waiting list rendering the waiting list redundant.

6.1.11. Households living in overcrowding conditions

More than 50% of households have one bedroom, indicating severe overcrowding and a lack of adequate housing space. These households are mainly lodgers who are hoping to get their own houses.

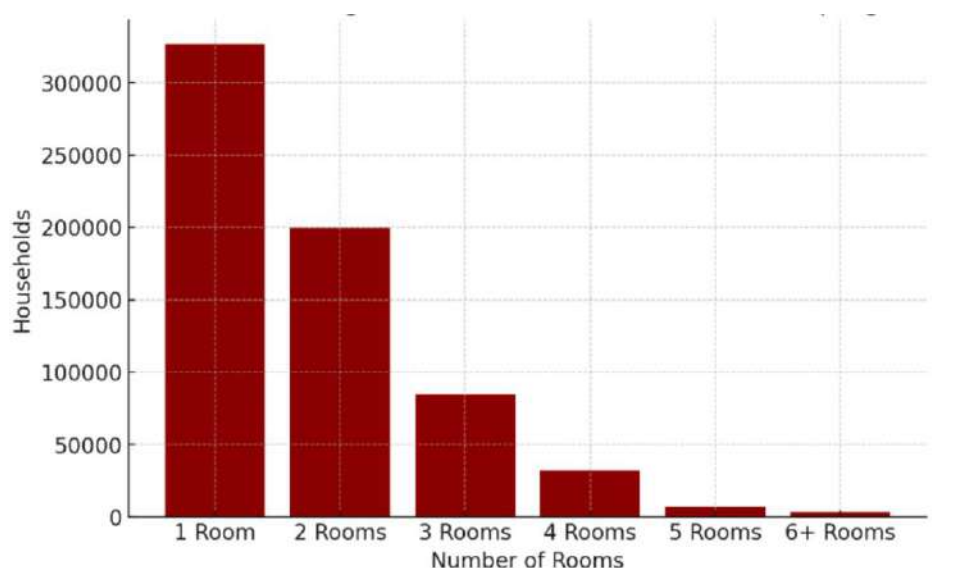


Figure 6.6: Number of rooms used for sleeping per household.

Source: Zimstats 2022

6.2. Housing market conditions

6.2.1. Average House Prices 2014 – 2024.

The prices for high density housing have grown 71% over the past ten years from \$35,000 in 2014 to \$60,000 in 2024. This represents a growth rate of 7% per annum. The medium density house has almost mimicked the movement in eth high density housing with average price moving from a \$100,000 in 2014 to \$150,000 in 2024 being a 50% increase over a 10-year period. This represents a 5% annual increase. Over the past 10 years the average price of low-density houses has fluctuated reflecting the macroeconomic fundamentals. The average price was at its lowest in 2017 -2018, started picking up in 2019 and became stable in 2020 to 2022 with arise occurring in 2023 followed by a decline in 2024 to around \$650,000. The average increase over the ten-year period was 8% being only 0.8% annually.

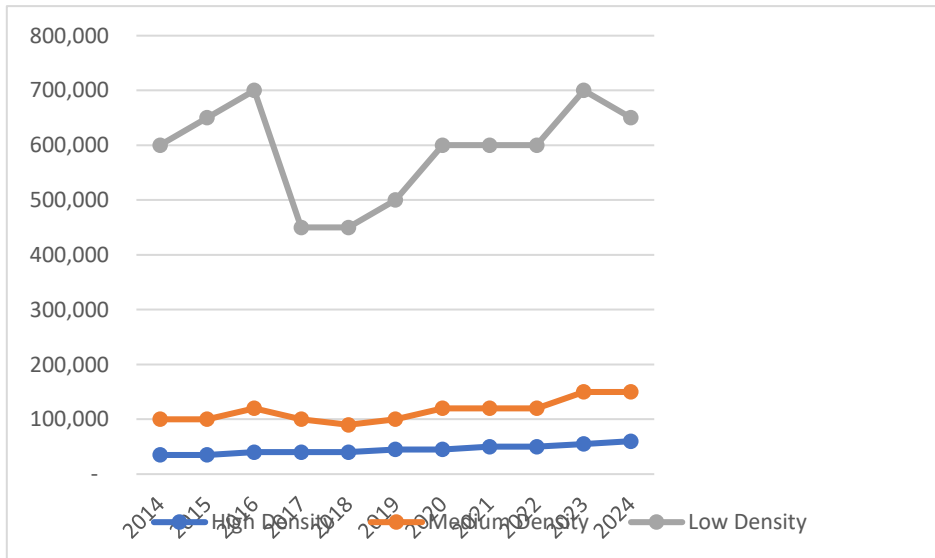


Figure 6.7: Average House Prices 2014 -2024
Source: Harare Master Plan Real Estate Survey 2024

6.2.2. Average House Rentals 2014 – 2024.

The average high density house monthly rentals have increased from \$200 to \$350. This represents a 75% increase over the ten-year period i.e. 7.5% annual increase in rentals. During the same period medium density rentals increased by 30% being a 3% annual increase. The average low-density rentals have remained stuck at \$2,000 for the past 10 years despite a spike to around \$2,500 in 2016.

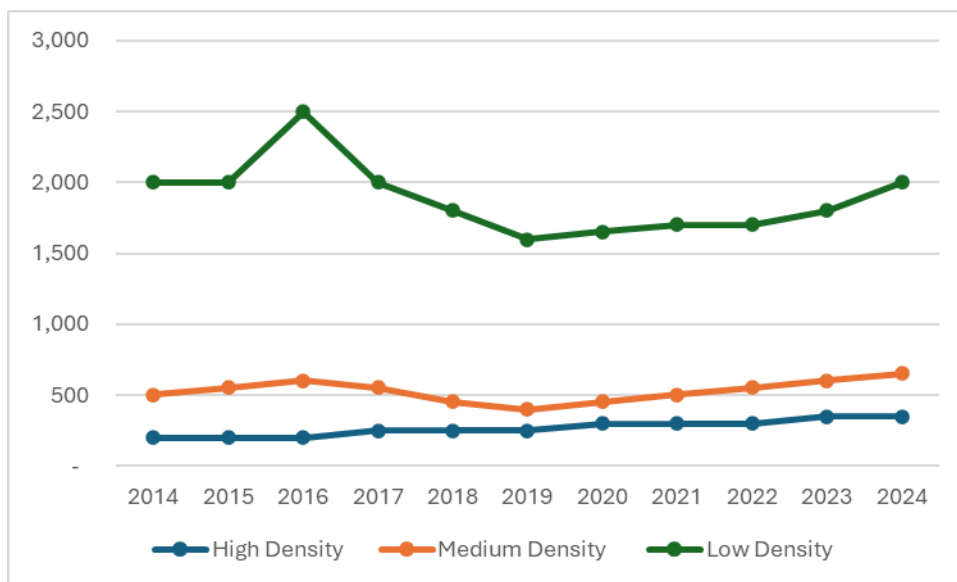


Figure 6.8: House Rentals 2014 – 2024
Source: Harare Master Plan Real Estate Survey 2024

6.2.3. Average Land Price 2014 – 2024.

6.2.3.1. Central Business District

The Harare Central Business District (CBD) is dominated by retail and office uses. In the past ten years the demand for small retail units has outweighed the supply because of the rapid informalisation of the economy. It is estimated that 64,7% of the economy is now informal (World Economics, 2024). In response to the informalisation of the economy, a number of properties in the CBD have been subdivided into small units to accommodate small and medium sized retailers and enterprises. Demand for large office space remains weak, resulting in relatively low rentals and high voids especially within the Central Business District. Several corporate occupiers have relocated to the suburban offices and some new office developments are currently underway.

Table 6.1: Major Relocations from the CBD

Institution	Year of relocation	New Location	Space (sq.m)
CBZ	2019	Borrowdale	
NMB Bank	2019	Borrowdale	3865
Stanbic	2016	Borrowdale	
First Capital Bank	2025	Borrowdale	
Nedbank	est. 2027	Highlands	

Source: Harare Master Plan Real Estate Survey 2024

6.2.3.2. Offices and Retail

Demand for small office space in the CBD has increased in the past 10 years, with average monthly rentals responding from a low of \$0.80 per square meter in 2019 to \$7.00 per square meter in 2023. However, a further decline to \$6.00 per square meter has been experienced in 2024 being a response to increased deterioration of amenities, parking and an increase in vacancies (see figure 75). Anecdotal evidence and the consensus view of market players is that approximately 60% of office space in the CBD has been vacant for the past five years pointing to a structural vacancy problem. The increase in rentals due to subdivision of space into smaller units seems to be reversing. By the end of 2026 approximately 10,000 square meters will be added to the CBD office vacancy as corporate head offices currently under construction in suburban locations are completed. Rentals in the CBD are quoted and paid in United States Dollars except for Government related entities that pay in local currency at the prevailing official exchange rate. The local currency rentals are volatile moving in line with the changes in the official exchange rate.

The area bound by Julius Nyerere Way, Samora Machel Avenue, Rotten Row and the Railway line is predominantly used for retail. Most of the buildings in this zone were built in the 1950s and 1960s. The buildings are mainly single and double storey with a few going up to four floors. Retail rentals have increased by about 160% in the past ten years from \$9.00 per square meter in 2014 to \$25.00 per square meter in 2024. The increase in retail rentals was driven mainly by the informalisation of the economy where retailing became the major economic activity in the CBD. From the physical survey of the CBD conducted in late 2024 about 69% of the buildings were in good condition with 31% in poor condition. The high percentage of buildings in good condition can be attributed to the city-wide abatement orders issued in 2017 by the city council to building owners. However, 31% of the buildings have been physically neglected resulting in a condition that is now expensive to repair. The repair bill may be large enough that it is cheaper to either gut, renovate or demolish the property and

build anew. This is also the case with most of the buildings that have been listed as historical buildings. However, this zone presence an opportunity for urban regeneration.

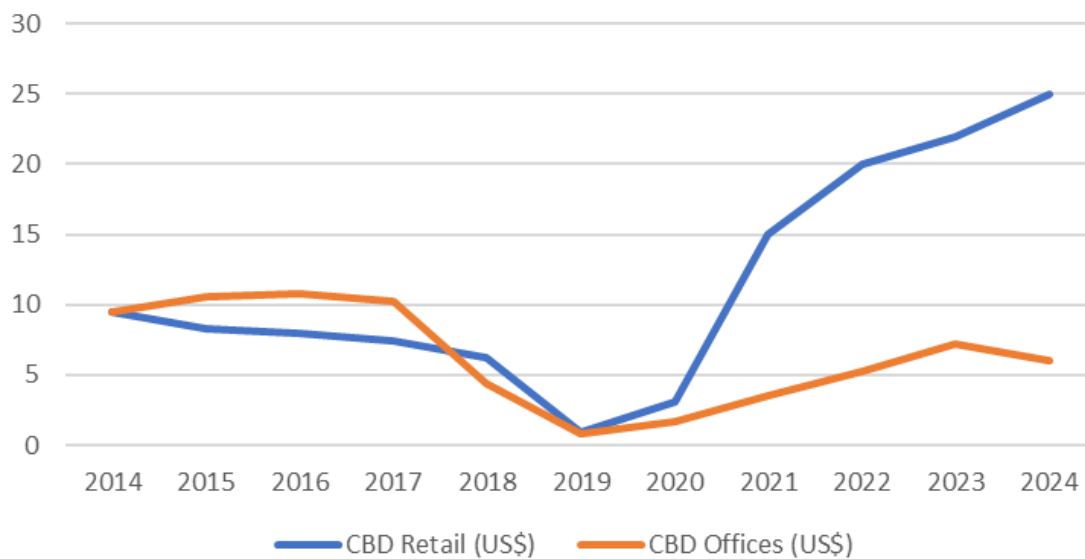


Figure 6.9: CBD Retail and Office Rentals 2014-2024

Source: Harare Master Plan Real Estate Survey 2024

6.2.3.3. *Industry*

The industrial sector has generally been affected, by competition from imported goods. However, the sector appears resilient especially in respect of warehousing and logistics. Storage, distribution, and logistics are becoming the predominant use of space in all the industrial areas as the manufacturing sector continues to be negatively affected by competition from imported goods. In industrial areas close to the CBD such a Workington and Graniteside a few industrial warehouses and factories have been subdivided into smaller units for retail and retail warehousing especially along major arteries e.g. former Lions Matches Factory along Lyton Road. The sector remains adversely affected by power outages, poor water supply and deteriorating infrastructure.

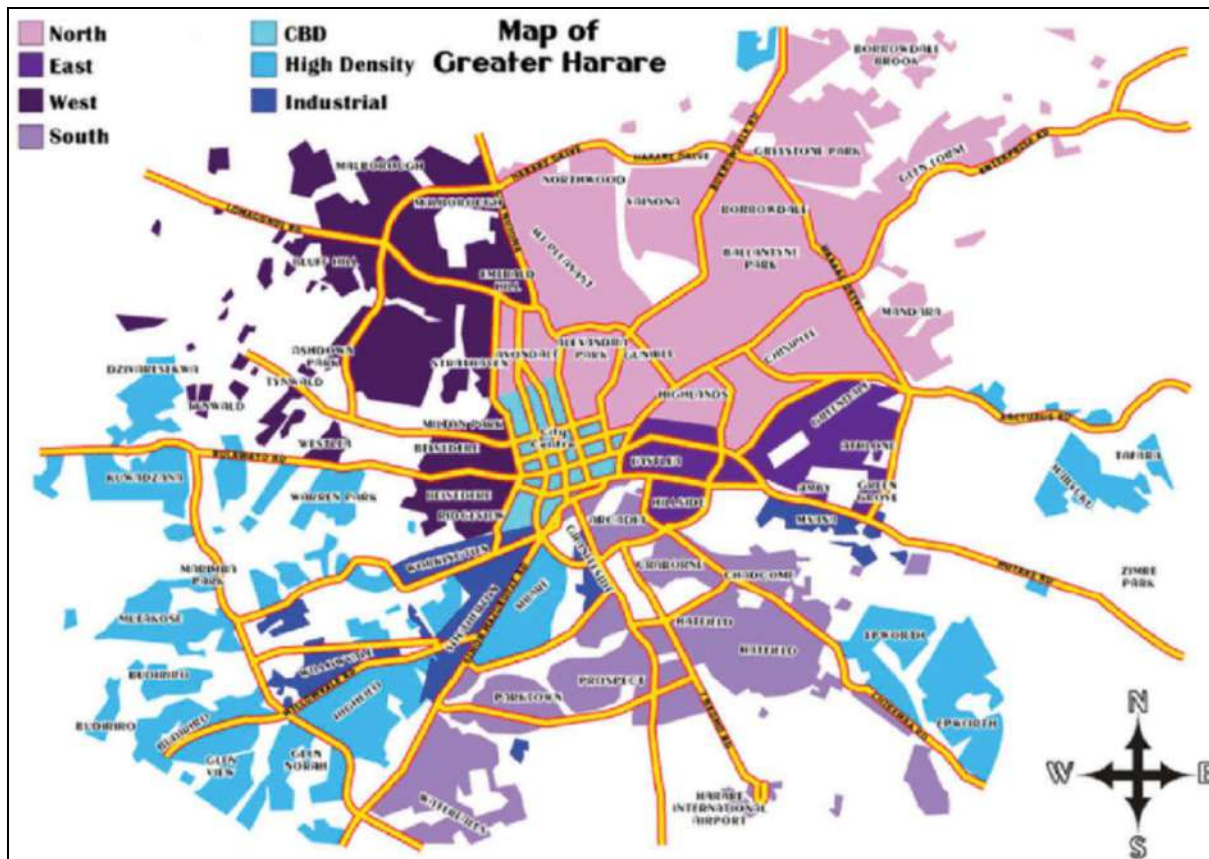


Figure 6.10: Location of Industrial Areas in Harare

The industrial land and space capacity is provided and maintained in three types of locations:
Historical Industrial Sites

The historical industrial sites include Workington, Southerton, Willowvale, Msasa, Ardbernie, Graniteside, and Prospect. The historical industrial sites are a major contributor to Harare's strategic industrial land and space for both heavy and light industrial uses. These are the main pool of industrial capacity for manufacturing, logistics and related uses that support the functioning of the local economy.

The core industrial uses, which comprise of general industry, light industry, and warehouses are predominantly found in these historical industrial sites. Within the historical industrial sites there is also vacant industrial land which comprises of stands which are cleared or with derelict buildings, or land with vacant buildings capable of occupation. The historical industrial site have a total of 2151 stands with a total land area of 2539 hectares.

Table 6.2: Historical Industrial Land Area

Historical Industrial Sites Land Area (ha)		
Workington	365	398
Southerton	378	472
Willowvale	450	703
Graniteside	375	226
Msasa	92	153
Ardbernnie	415	529
Prospect		
Bluff Hill	76	60
Total	2151	2539

New Industrial Sites

The new industrial sites include Pomona, Madokero, Sunway, Arlington/Seke Road, High Glen, First Ave/Waterfalls, Dzivarasekwa/Tynwald, Simon Mazorodze, Ceres/Caledon/Seke Road, and Arlington. The new industrial sites have local importance for mainly light industrial and related functions, which complement provision in the historical industrial areas. These sites need enhancing given the historical trends in supply and demand for industrial land. The new industrial sites are well connected to residential areas by public transport, walking and cycling.

Table 6.3: New Industrial Sites Land Area

New Industrial Sites Land Area (ha)		
Pomona	28	46
Madokero		
Ventersburg	103	61
Arlington/Seke Road		77
First Street Waterfalls		39
Dzivarasekwa/Tynwald		
Simon Mazorodze		
Ceres/Caledon/Seke Road		
Total	131	223

Source: Compiled from GVR of 2020

Home Industries

Home industries are located in the high-density suburbs. Examples include Glenview 8, Westlea, Tynwald, and Manresa. They were meant to cater for the small to medium enterprises but have been taken over by the informal sector.

Table 6.4: Home Industry Land Area

Home Industry Land Area (ha)		
Glenview 8	28	46
Gazaland		
Westlea	103	61
Tynwald		77
Manresa		39
Total	131	223

Source: Compiled from GVR of 2020

6.2.3.4. Industrial Development Land

Industrial development land constitutes stand, which are either vacant and cleared or have derelict industrial buildings. The stands have been extracted from the City's General Valuation Roll 2020. Where the land value is greater than the value of improvements the land is deemed ready for development or redevelopment and its considered available. Land that is specifically zoned for open storage has been excluded.

Table 6.5: Potential Industrial Development Sites in existing locations.

	Number of Stands	Area (ha)	Land Value > Improvements (land with potential for redevelopment) (ha)	Percentage
Harare	2282	2763	1101	40%
Historical Industrial Sites	2,151	2,539	1,040	41%
Workington	365	398	146	37%
Southerton	378	472	99	21%
Willowvale	450	703	292	42%
Graniteside	375	226	66	29%
Msasa	92	153	50	33%
Ardbernie	415	529	387	73%
Prospect				
Bluff Hill	76	60	42	70%
New Industrial Sites	131	223	61	27%
Pomona	28	46		
Madokero				
Sunway City (Ventersburg)	103	61	61	100%
Arlington/Seke Road		77		
First Ave/Waterfalls		39		
Dzivarasekwa/Tynwald				
Simon Mazorodze Road				
Ceres/Caledon/Seke Road				

Source: Compiled from GVR of 2020

As shown in Table 20, there is approximately 1101ha industrial land suitable for development or redevelopment in Harare in 2020 and equates to 40% of land when expressed in relation to land in industrial use. This is above the reasonable average rate of frictional vacancy of 5%.

6.2.3.5. Industrial Land and Property Values

Land Prices

The average price of industrial land has not significantly changed over the past ten years. The price has ranged from.....

Rentals

The average monthly rent in 2014 was around \$3.00 per square meter and this declined to \$2.00 per square meter. The major decline occurred in 2019 and 2020 driven by the change in currency and the covid 19 pandemic. Since 2021 industrial rentals have been on a recovery path and are still below the pre covid period. The relatively low rentals have failed to induce development for rental purposes. Most of the projects taking place relate to owner occupiers upgrading their properties to meet global standards such as removing asbestos to replace with chromadeck sheeting.

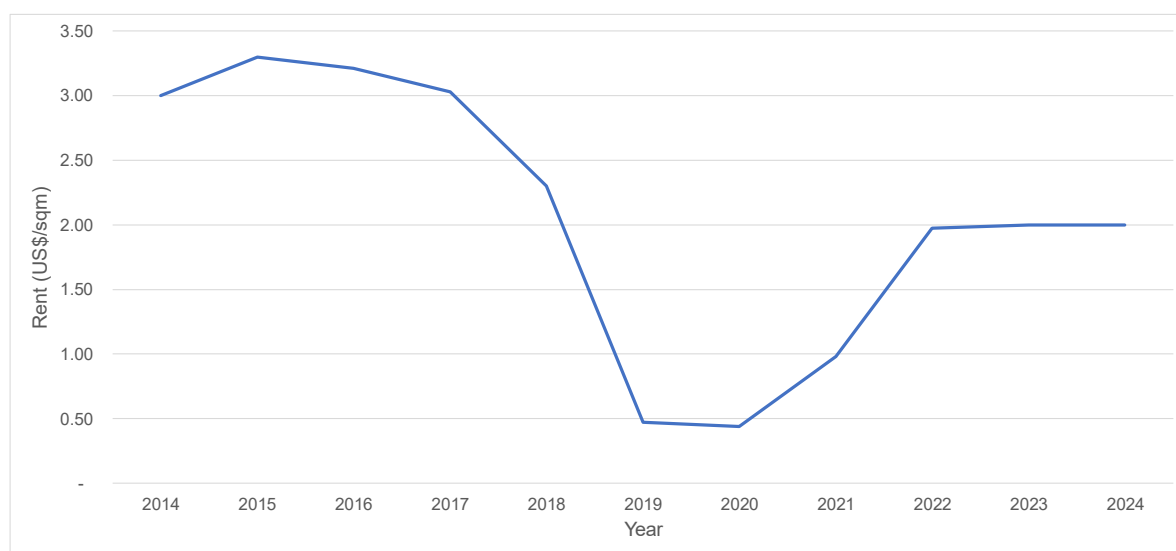


Figure 6.11: Average Rentals per Month Per Square Meter

6.2.3.6. Suburban Retail

In the past ten years the retail sector witnessed sustained positive performance despite the low consumer disposable incomes. This is supported by high occupancies including in newly constructed suburban shopping centres. A number of retail developments have taken place including Highland Park precinct, Madokero Shopping Mall, Paddington Square, Hatcliffe Shopping Mall and numerous fuel filling stations throughout the city. However, several suburban small retail/shopping centres especially in the southern and eastern suburbs have decayed e.g. Cheviot Shopping Centre, Parktown Shopping Centre, Zindoga, Machipisa, Uplands Shopping Centre, Calendon Shopping Centre etc. There is need for a regeneration of the old and tired shopping centers through consolidation of ownership.

6.2.3.6.1. Suburban Retail Space Demand

Like in the CBD there is a significant transformation taking place in the suburban retail space due to the growing presence of informal traders. Landlords are subdividing large retail space into micro units to accommodate small businesses. The traditional 60 square meter retail unit is now being utilised by up to 10 tenants in small cubicles.

6.2.3.6.2. Suburban Rental Rates

Rental rates for suburban retail space have been stable rental rates of between US\$15- 20 per square meter per month. However, there is a potential for gradual appreciation. Location has played a key role in the performance of shopping centres with prime malls like Sam Levy,

Village Walk, Highland Park showing a upward movement of rentals due to sustained demand from high income surrounding neighbourhoods.

6.2.3.6.3. *New Suburban Shopping Centres*

Retail centres in affluent suburbs like Borrowdale, Mount Pleasant, and Highlands continue to perform well, attracting premium retailers. Sam Levy's Village, Highland Park (phases 1 and 2), Madokero Mall, Westgate have attracted major retail anchors including regional brands from South Africa. In high density suburbs like Mbare, Glen View, Highfield, Kuwadzana etc., there is an influx of informal trade, leading to a thriving but unregulated market. Street vendors and market traders significantly out compete formal retailers, often benefiting from lower overhead costs. Formal retail outlets in these areas struggle with low foot traffic as most consumers prefer cheaper, informal alternatives. There are new and upcoming retail nodes in low and medium density residential areas. Some of the new retail developments includes the Big Poppers in Hogerty Hill, Cardinals Shopping Centre corner Harare Drive/Enterprise Road, Paddington Square Shopping Mall along Enterprise Road, and Madokero in Tynwald.

6.2.3.6.4. *Mbare Mixed Use Regeneration Zone*

The Mbare mixed use zone is approximately 150 hectares of land. The zone comprises of old and dilapidated residential hostels, retail shops & supermarkets, bus termini, old residential houses, stadium, green market, markets, industrial etc. The zone has been neglected and presence an opportunity for a major urban renewal project. The zone is within walking distance of the CBD in the southern direction.

Hostels

There are four hostel complexes namely, Nenyere, Shawasha, Matapi and Mbare. All the blocks are old and dilapidated having been built in the 1940s to house single unmarried African seeking work in Harare. Over the years the hostels have been taken over by families who live under squalid conditions with inadequate sanitary facilities which have not been improved given the changed circumstances of the new occupiers. The condition of the hostels is such that it is uneconomic to renovate given that the cost will be too expensive compared to demolishing and rebuilding modern structures.

Table 6.6: Mbare Hostels

Name of Hostel.	Number of blocks.	Total Number of Units	Estimated Residents
Nenyere (Magaba)	13		7,644
Shawasha	12		7,056
Matapi	14		9,120
Mbare	9		2,400
Matererini	10		2,500
Total	58	7,334	28,720

Source: Compiled from City of Harare press releases.

Residential “Joburg Lines”

This is the oldest suburb in Harare with dilapidated houses. The majority of the houses were mainly constructed of locally manufactured cement blocks. There is dumping of refuse around the suburb leading to epidemics like cholera and typhoid. Overpopulation is straining the infrastructure as witnesses by burst sewer and water pipes.

Bus Terminus

This is the transport hub for long distance travelling. There are two termini, one servicing the Mutare route and the other servicing the rest of the country.

Commercial/Industrial

Matapi/Siyaso/Magaba home industry complex was opened in the 1950s as a way of promoting self-help employment for those Africans who could not be absorbed into the formal employment system. The complex stretches from Mbare Township to the southern edge of the CBD. It is the home to a variety of entrepreneurs running informal businesses in trades such as welding, tinkering, motor mechanics, building materials sales, catering, sale of second-hand parts etc. The goods offered in this complex are generally more affordable than those found in the formal sector. The businesses that operate in the complex are mainly unregistered. The businesses operate from self-built structures mainly made from timber, steel poles and sheeting. There is multiple subletting and unauthorised electrical connections. Fire outbreaks are one of the major hazards.

In the Siyaso section users lease the various land spaces and structures from the City of Harare but the city seems to have lost control of the complex local political gangs. The Matapi and Magaba sections are privately owned and rentals vary from \$200 to \$600 per month depending on the size of structure and piece of land occupied.

6.3. Summary of Issues.

a) Housing Crisis and Shortage

- Severe housing backlog: 288,885 persons on the waiting list, with limited housing supply.
- High demand for affordable housing: 43% of households are lodgers.
- Overcrowding: Many households share one bedroom.
- Limited middle-income housing options: The majority of stock is high-density (67%).
- Poor housing conditions: Aging infrastructure and lack of repairs, especially in pre-independence suburbs.
- Unfinished housing projects: Many developments lack proper water, sewerage, and roads.
- Unregulated informal housing growth: Rapid expansion of informal settlements without services.
- Difficult approval processes: Slow, expensive, and bureaucratic housing development approval system.
- Corruption in land allocation: Council lists not being followed; land barons taking over.

b) Urban Decay and Infrastructure Collapse

- Deteriorating water and sewerage systems: Old, overburdened infrastructure leading to frequent breakdowns.
- Road network decline: Potholes, congestion, and lack of maintenance.
- Electricity shortages: Power outages affecting residential, commercial, and industrial areas.
- Sanitation and health risks: Poor waste management, uncollected refuse, and frequent outbreaks of diseases like cholera.

- c) Declining Central Business District (CBD)
 - Mass exodus of businesses: Major companies relocating to suburban areas due to high crime, poor parking, and deteriorating services.
 - High office vacancy rates: 60% of office space remains empty.
 - Retail sector transformation: Small-scale informal traders replacing large businesses.
 - Aging and neglected buildings: 31% of CBD buildings are in poor condition.
- d) Industrial Sector Decline
 - Reduced manufacturing activity: Industrial areas are now dominated by warehousing and logistics.
 - Deteriorating industrial infrastructure: Poor roads, unreliable water, and frequent power outages.
 - Weak demand for industrial land: Low rental prices fail to encourage new developments.
- e) Retail Sector Shifts
 - Growing suburban retail market: New malls (e.g., Highland Park, Madokero) thriving in affluent areas.
 - Decay of older shopping centres: Small suburban shopping centres (e.g., Machipisa, Cheviot) are neglected.
 - Expansion of informal trade: Street vendors outcompete formal retailers, leading to unregulated markets.
- f) Mbare Mixed-Use Regeneration Needed
 - Severely deteriorated hostels: Overcrowded, unsanitary living conditions in Shawasha, Matapi, and Nenyere hostels.
 - Decaying "Joburg Lines" housing: Unsafe, overcrowded buildings in need of renewal.
 - Unregulated home industries: Siyaso and Magaba home industries operate illegally, with poor infrastructure.
 - Transport congestion: The main bus terminus in Mbare is chaotic, lacking proper planning.
- g) Land Management and Governance Issues
 - Weak land administration: Corrupt allocation of stands, leading to unplanned developments.
 - Inadequate land-use planning: Poor enforcement of zoning laws.
 - Lack of city council capacity: Limited resources to implement real estate projects.
- h) Key Areas for Proposal Development
 - Mass affordable housing projects with infrastructure provision.
 - Incentivise private sector to undertake urban renewal initiatives in the CBD and Mbare.
 - Industrial revitalization programs to encourage modernisation of factory units.
 - Create a land development agency to operate along private sector lines.
 - Modernization of transport & infrastructure to support urban growth.

7. CHAPTER 8: PUBLIC UTILITIES, COMMUNICATIONS – BULK INFRASTRUCTURE SCOPING

7.1. Traffic and Transportation

7.1.1. Historical Overview of the Harare Transportation System

Harare's traffic and transportation system evolved around motorised traffic consequent to colonisation and abandonment of horse driven locomotives and the transition to road depended on car and rail locomotives. The road network system conformed to the grid iron system which later evolved through expansion and creation of outer ring roads. The city had a function public transport system then dependent on rail transport and public mass transit conventional buses.

7.1.2. Implementation of historical Traffic and Transportation Policy Proposals

Two (2) important policy documents underpin the city traffic and transportation heritage namely the 1993 Harare Combination Master Plan and the 1996 Harare Traffic Management Local Subject Plan. These two policy frameworks were revealed in terms of their implementation status of the traffic and transportation proposals.

7.1.2.1. The Harare Combination Master Plan Traffic and Transportation Proposals

Traffic and transportation proposals of the 1993 Harare Combination Master Plan were either not implemented or were partially implemented (see Table 7.1). Only one (1) out of the fourteen (14) key proposals was fully implemented, that is the Bulawayo-Mutare Road Reservations Development. The combined implication of the partial and non-implementation of the proposal against an exponential increase in car population in Harare over the past

decade has directly contributed to the ever-worsening traffic congestion and road traffic accidents in and around the Harare Metro.

Table 7.1: 1993 Harare Combination Master Plan Proposals Traffic and Transportation Proposals

Proposal	Fully Implemented	Partially Implemented	Not Implemented	Proposed Implementing Agent	Implementing Agent
Ring roads around CBD's			X	L.A and MoTID	
By-Passes Development		X		LA and MoTID	LA
Mutare and Bulawayo Road Reservations Development	X			LA	LA
Review/cancel freeway reservations over built areas			X	LA	
Staged Development of Freeway Reservations			X	LA and MoTID	
Chitungwiza-Harare Rail Transit system Development		X		LA and MoTID	G.LA
Heavy Goods Vehicle Parking Facility			X	LA and Private Sector	
Integrated coach bus terminus and carpark at Fourth Street		X		LA and Private Sector	LA. P
Mbare Long Distance Bus Terminus Development		X		LA and Private Sector	LA
Provision of direct bicycle routes properly grade separated			X	LA	
Traffic Management Techniques implementation		X		LA	LA
Control of Infrastructure by envisaged Metropolitan Traffic and Transportation Authority			X	LA. G	
Removal of unnecessary railway infrastructure and installations			X	LA. G & NRZ	
Servicing of Land			X	LA. G & Pvt	

7.1.2.2. The 1996 Harare Traffic Management Local Subject Plan Proposals

The 1996 Harare Traffic Management Local Subject Plan was developed with the object of detailing traffic management proposals for the city mainly focusing on the central city area. The plan made robust proposals some which were derived from the combination Master Plan, however most of these proposals were not implemented and partially implemented directly contributing to some of the present-day traffic and transportation problems.

Table 7.2: Evaluation of the 1996 Harare Traffic Management Local Subject Plan

Proposal	Fully Implemented	Partially Implemented	Not Implemented	Proposed Implementing Agent	Implementing Agent
Ring roads around CBD's			X	LA. G	
By-Passes Development		X		LA. G	LA
Mutare and Bulawayo Road Reservations Development	X			LA	LA
Review/cancel freeway reservations over built areas			X	LA	

Staged Development of Freeway Reservations			X	LA. G	
Chitungwiza-Harare Rail Transit System Development		X		G.LA	G.LA
Heavy Goods Vehicle Parking Facility			X	LA. Pvt	
Integrated coach bus terminus and car park at Fourth Street	X			LA. Pvt	LA. Pvt
Mbare Long Distance Bus Terminus Development		X		LA. Pvt	LA
Provision of direct bicycle routes properly grade separated			X	LA	
Traffic Management Techniques implementation		X		LA	LA
Control of Infrastructure by envisaged Metropolitan Traffic and Transportation Authority			X	LA. G	
Removal of unnecessary railway infrastructure and installations			X	LA. G & NRZ	
Servicing of Land			X	LA.G. Pvt	

Source: City of Harare - The 1996 Harare Traffic Management Local Subject Plan.

Table 7.2 indicate that most of the proposals spelt out in the 1993 Master Plan and Traffic Management Local Subject plan were not implemented. The non implementation of previous policy proposals aimed at minimising traffic and transportation is unfortunately happening at a same time Harare metro is experiencing rapid urbanisation over the years. Between 2023 and 2024 the population for the planning area increased by 1.58%.

7.1.3. Harare City Transportation System

7.1.3.1. Road Network and Classification

According to the road reclassification exercise of 2024 by the City of Harare, the city's roads can be classified into a 3-tier hierarchy comprising of Primary Level (Regional and National Roads), Secondary Level (Secondary Distributor) and Tertiary level (Local Distributor, Access Roads and Footpaths). The road hierarchy is also used to manage the type of vehicle permitted in certain roads as well as the time they are permitted. In terms of road layout, City of Harare's Road network follows a bike-spoke design, with roads converging in the CBD. This design has one major traffic flow disadvantage, that is channelling traffic towards the CBD posing serious traffic congestion levels and road traffic accidents. Figure 116 shows the road layout for Harare.

Cognisant of the problems of a bike spoke road design, early transport planners proposed freeways which would circumvent through traffic from gravitating through the CBD. Thus, Harare through the freeway reservations plan No. TE493/4 proposed six (6) freeway reservations and these were: -

1. The East-West Corridor (Samora Machel Avenue/Mutare Road/Bulawayo Road)
2. The North-South Corridor (Simon Mazorodze/Masvingo Road/ Sam Nujoma Street)
3. The North-West Corridor (Sam Nujoma / Nemakonde Way)
4. The North-East Corridor (ED Mnangagwa Road / Mutoko Road)
5. The Southern Corridor (Seke Road / Chitungwiza Corridor)
6. The Ring Road Corridor (Harare Drive)

Despite these noble proposals, these were largely not implemented due to a number of factors namely the astronomical costs associated with freeway and interchanges planning, construction and maintenance.

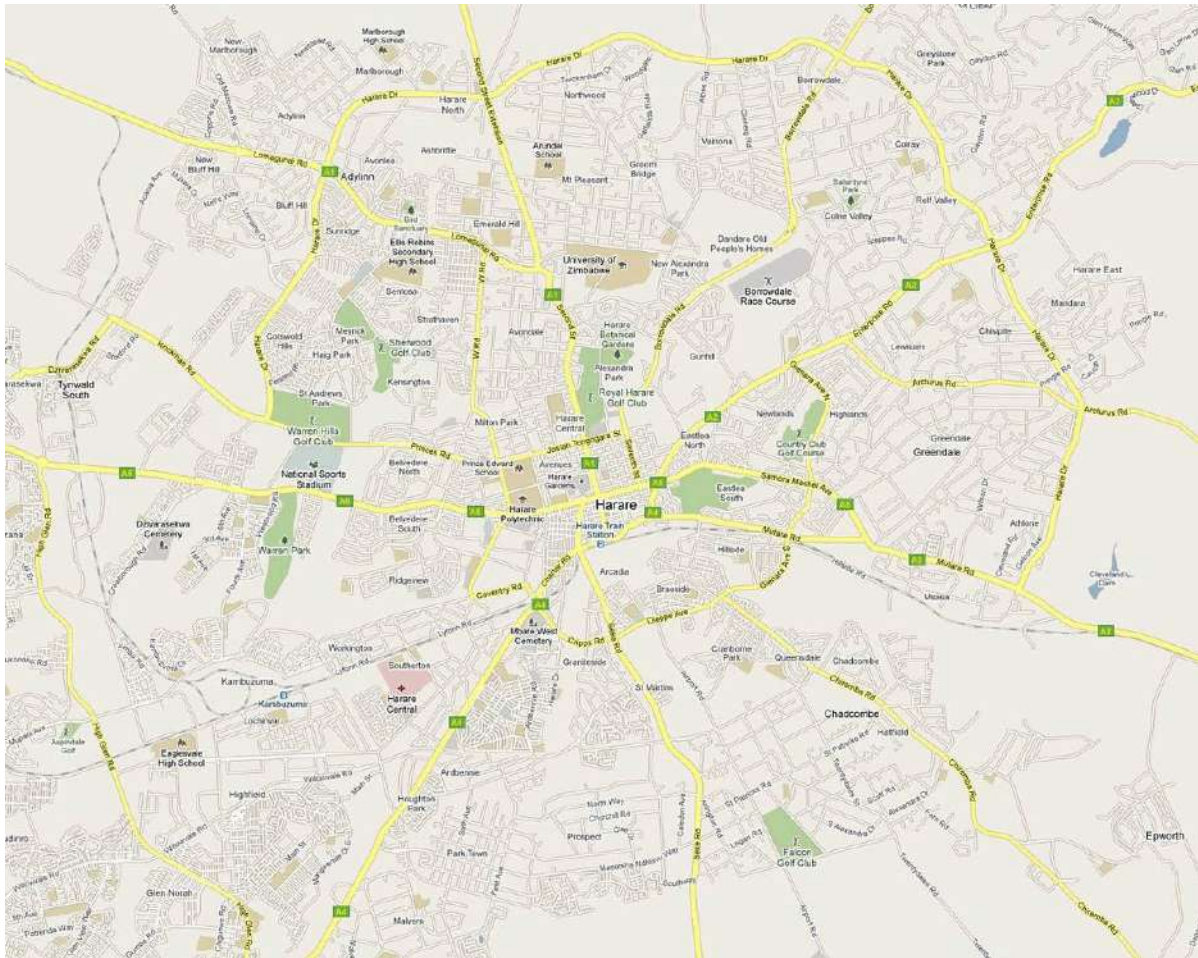


Figure 7.1: Harare City Road network design

7.1.3.2. Harare City Council Road Network Coverage by road type (km)

The total length of surfaced tarred roads within the Harare Municipality and the Harare Metro area is approximately 4900km. Table 30 provides a disaggregated road network coverage by road type as defined in the Harare Roads Inventory and Condition Survey (2017). As at 2017 an average of 75% of the City's Road network need a complete overhaul and extensive rehabilitation.

Table 7.3: Harare Road network length by road type in km

Province	Earth	Gravel	Gravel or Earth	Sealed	Not Sealed	Grand Total (km)
Harare Municipality	329	179		3233	289	4030
Harare Metro	215	79	13	533	35	875

Source: Roads Inventory and Condition Survey, 2017.

7.1.3.3. Road Network Condition

The 2017 National Road Condition Survey observed that Harare Metro has most of its roads (surfaced and gravel) being in poor condition as measured by the following indicators: -

- i. Riding Quality
- ii. Drainage Condition (by network length)

- iii. Potholes (by network length)
- iv. Road Markings
- v. Public Lighting and Traffic Lights

The following data is based on the results of the Visual Condition Index.

Table 7.4: Overview of Harare Metro and Harare Municipality Road Network Condition

Province	Very Poor	Poor	Fair	Good	Very Good	No Info	Grand Total
	0-15	15-30	30-55	55-80	81-100	No info	
Harare Metro	82	126	225	213	115	115	875
Percentage	9.3%	14.4%	25.7%	24.4%	13.1%	13.1%	100%
Harare Municipality	799	426	1118	796	532	357	4029
Percentage	19.8%	10.7%	27.7%	19.8%	13.2%	8.8%	100%

Source: Roads Inventory and Condition Survey, 2017.

23.7% of the total road network for the Harare Metro is in ‘very poor’ and ‘poor’ condition. 30.5% of the Harare Municipality Road network is in ‘very poor’ to ‘poor’ condition. Comparatively, a combined statistic of 37.5% and 33% for the Harare Metro and Harare Municipality roads were found to be in ‘good’ and ‘very good’ conditions respectively. These findings indicate that most roads in both Harare Metro and Harare Municipality are skewed towards not being good roads. With the current inadequacies in road maintenance funding, it may mean that the observations for the ‘poor’ to ‘very poor’ status is likely to increase in future.

7.1.3.4. Riding Quality

The Riding Quality of a pavement can be defined as the general extent to which the road users, through the medium of their vehicles, experience a ride that is smooth and comfortable, or bumpy and therefore unpleasant or perhaps unsafe. This is determined by the unevenness of the road profile, the loss of surface or base layer material and uneven patching. Table 7.6 shows the results of road network riding quality for Harare metro and Harare Municipality.

Table 7.5: Road Network Riding Quality for Harare Metro and Harare Municipality

Province	Riding Quality				Grand Total
	Poor	Fair	Good	Not stated	
Harare Metro	43	117	84	5	248
Percentage	17.3%	47.1%	33.7%	1.9%	100%
Harare Municipality	41	107	17	10	175
Percentage	23.4%	61.1%	9.7%	17.5%	100%

Source: Roads Inventory and Condition Survey, 2017.

Similar to the overall road network condition, the Harare Metro province and Harare Municipality roads are showing a low statistic of 33.7% and 9.7% of ‘good’ riding quality respectively, meaning longer stretch of road network (km) do not produce smooth riding for drivers.

7.1.3.5. Drainage Condition (by network length)

For a road to function properly, it has to be designed, constructed and maintained in such a way that any water that falls on the road is quickly and effectively drained away from it. This means it has to have a proper cross fall or camber, side drains, mitre drains and culverts designed, constructed and maintained in good working condition. Table 7.7 shows the results of drainage condition for the Harare Metro Province and the Harare Municipality roads.

Table 7.6: Road network drainage condition (by network length)

Province	Drainage Condition				Grand Total
	Poor	Fair	Good	Not stated	
Harare Metro	133	207	98	437	875
Percentage	15.2%	23.7%	11.2%	49.9	100%
Harare Municipality	2072	4752	590	619	8033
Percentage	25.9%	59.1%	7.3%	7.7%	100%

Source: Roads Inventory and Condition Survey, 2017.

The drainage indicator shows that a combined statistic of 38.9% and 85% of the road network for Harare Metro and Harare Municipality respectively have ‘poor’ and ‘fair’ drainage conditions (See Table 35). This is a hazard during rainy seasons which causes urban flooding and disrupts the smooth flow of traffic ultimately leading to severe traffic congestion and accidents.

Table 7.7: Potholes on sealed roads in the Harare Metro and Harare Municipality

Province	Pothole size by diameter					Grand Total
	Above 50cm ²	20cm ² - 50cm ²	20cm - - 10cm	None	(blank)	
Harare Metro	86	109	144	192	344	875
Percentage	9.8%	12.5%	16.5%	21.9%	39.3%	100%
Harare Municipality	1486	371	557	506	1190	4110
Percentage	36.2%	9%	13.6%	12.3%	28.9%	100%

Source: Roads Inventory and Condition Survey, 2017.

The proportion of potholes greater than 20cm² for Harare Municipality is estimated to be around 45.2%. This statistic is very high and a safety hazard to the driving public. Potholes damage vehicles through increased wear and tear and contribute to road traffic accidents.

7.1.3.6. Road Markings

60.3% of the total road network for the Harare Metro and the Harare Municipality does not have visible road markings. This statistic is very high and a safety hazard to the motoring public. Road traffic accidents are bound to occur when there are poor roadway markings.

Table 7.8: Condition of road markings for the Harare Metro and Harare Municipality

Province	Road Markings Availability			Grand Total
	No	Yes	Not stated	
Harare Metro	309	39	525	1585
Percentage	19.5%	2.4%	33.1%	100%
Harare Municipality	1386	597	1413	3396
Percentage	40.8%	17.6%	41.6%	100%

Source: Roads Inventory and Condition Survey, 2017.

7.1.3.7. Public Lighting and Traffic Lights

Public lighting infrastructure consists of installed streetlights and high mast tower lights meant to provide adequate, reliable lighting which is routinely maintained to continuously improve lighting coverage for public safety. There is a total of 85 000 streetlights and mast tower lights in the planning area. Currently, only 32 000 (**37.6%**) of these are functional while 53 000 (**62.4%**) are non-functional as shown in Table 37. Poor public lighting is hazard to both motorists and pedestrians and is a huge public safety and security concern. There is a positive correlation between poor public lighting and higher crime rates.

Table 7.9: Condition of street lighting in the Harare Metropolitan Province

Province	Functionality		Grand Total
	Functional	Non-functional	
Harare Metro	32 000	53 000	85 000
Percentage	48.3%	49.7%	100%

Source: Roads Inventory and Condition Survey, 2017.

As of May 2024, the City had a total of 215 controlled traffic lights junctions, 127 are working and 88 are not working. Of the 88 not working, it is because of various reason which includes no power, no controller, no CPU, being temporarily decommissioned, railway fault, faulty CPU and Invertor. Non-functioning traffic lights directly contribute to traffic congestion and road traffic accidents.

Table 7.10: Condition of traffic lights in the Harare Municipality

Province	Functionality		Grand Total
	Functional	Non-functional	
Harare Metro	127	88	215
Percentage	59%	41%	100%

Source: Harare City Council, 2024

7.1.3.8. Underlying factors contributing to Harare's poor Road Network and Street Furniture

The Roads Conditions and Inventory Report (2017) identified some underlying causes of the poor status of the country's road network inclusive of Harare Metro⁸. Most of the roads have outlived their design lives. Others have not been designed or constructed properly. Some of the roads and structures have not been maintained for many years due to several reasons including inadequate funding, human resource issues, lack of plant and equipment, among others.

Outlived Road Design Life

One of the key factors contributing to Harare's poor road network conditions is that most of the roads have outlived their design life, this is usually a 20-year period. The road bases have failed, potholes popped up everywhere, are severely cracked and in some cases, one cannot distinguish if the road was tarred or not.

⁸ In this document, Harare Metro refers to Chitungwiza Municipality, Ruwa Local Board and Epworth Local Board combined.

Poor Construction Standards

The majority of failures or rapid deterioration especially of infrastructure constructed in the last decade (1999 – 2009) could be attributed largely to lack of proper design and or lack of no proper quality control during construction. During this period, many qualified professionals including Engineers and Technicians left the country for greener pastures, creating a skills gap in some of both the public and private sector. Zimbabwe is lagging other countries in the updating of Roads Design & Construction Standards. Equally, there is no requirement on whether South African Standards must be adopted. This has created a knowledge gap that those joining the sector have no readily available standards to refer to. There is need for the updating and adoption of road design, construction maintenance standards which should become readily available to Road Authorities.

Financial Constraints

Financial constraint is a major contributor to the problems facing Road Authorities in the discharge of their function of properly maintaining roads and other public infrastructure. The Roads Fund From 2002, the main source of funding for road works is from the Roads Fund which is administered by the Zimbabwe National Roads Administration (ZINARA). Since 2009, ZINARA has collected \$1.14 Billion from road user charges, that is fuel levies, heavy vehicle surcharges, vehicle licenses and transit fees. Out of this amount, it has disbursed \$795 million to the Road Authorities over the same period for road works activities. Revenue On average, ZINARA collects between \$170m to \$200m as shown by the data below for the years 2015, 2016 and 2017.

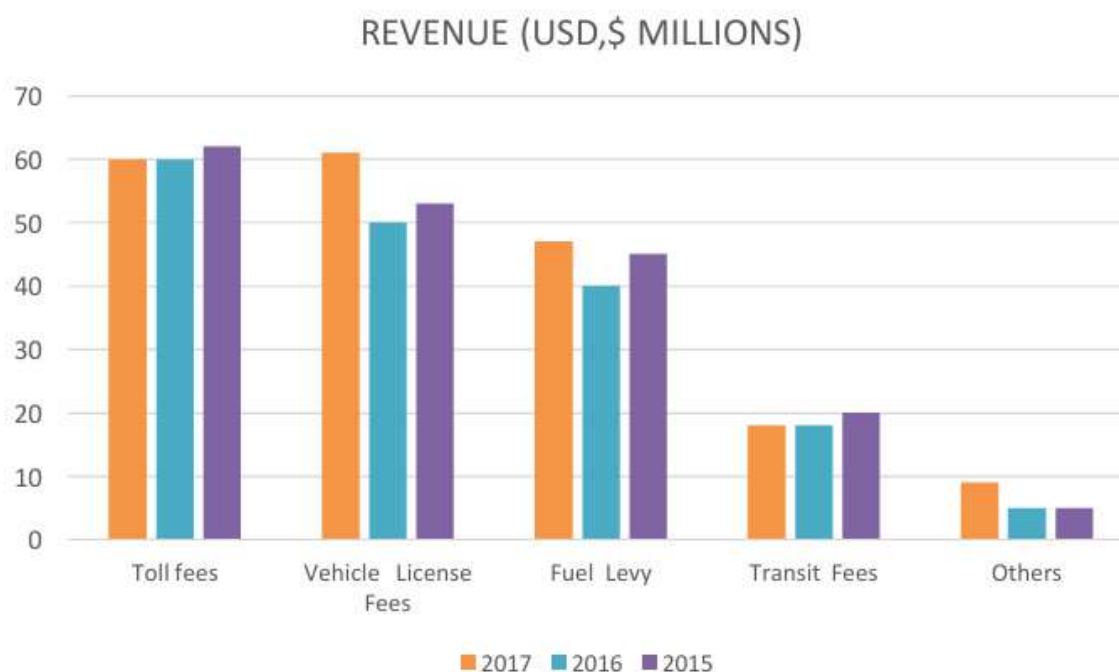


Figure 7.2: Sources of Revenue, ZINARA -2015-2017.

Source: Roads Conditions and Inventory Report (2017).

Lack of Experienced Technical Staff

There was a significant “brain drain” of experienced professionals from Zimbabwe especially during the period from 2000 to 2009. This has affected all road authorities and the private sector. Road authorities are now forced to engage under-qualified or inexperienced staff in key positions. In addition, the weak revenue base limits the Road Authorities’ ability to offer

attractive packages and better working conditions (motor vehicles, Tools & Equipment, money to implement projects, modern facilities) to lure and retain qualified technical staff. In some cases, the salary levels are so low that even the most basic needs for human survival cannot be met. Consequently, the low salary level is hardly a strong incentive for good performance. Employees are readily available to jump the ship if they find better pay elsewhere. This happens especially in the case of young professional staff who gain experience in road agencies and after some years receive attractive offers from private companies in and outside the country. Another common trend is that more qualified and experienced employees find it necessary to have a second job outside their normal job because public service salary does not meet the cost of supporting a family. Consequently, more attention is given to the better paying outside job than to their public service work.

7.1.4. Road Network Operational Performance

7.1.4.1. Prevailing Intersection Capacity Performance

Intersection capacity results are shown below for the six (6) major road corridors and the corresponding studied intersections. The study identified six major traffic and transportation corridors for the city namely (see Table 43): The East-West Corridor (Samora Machel Avenue / Mutare Road / Bulawayo Road), The North-South Corridor (Simon Mazorodze/Masvingo Road / Sam Nujoma Street), The North-West Corridor (Sam Nujoma / Nemakonde Way), The North-East Corridor (ED Mnangagwa Road / Mutoko Road), The Southern Corridor (Seke Road / Chitungwiza Corridor and The Ring Road Corridor (Harare Drive).

Table 7.11: Names of corridors and their corresponding number of intersections studied

Name of corridor	Number of intersections studied intersections along the corridor
The East-West Corridor (Samora Machel Avenue / Mutare Road / Bulawayo Road)	Seventeen (17)
The North-South Corridor (Simon Mazorodze/Masvingo Road / Sam Nujoma Street)	
The North-West Corridor (Sam Nujoma / Nemakonde Way)	Eight (7)
The North-East Corridor (ED Mnangagwa Road / Mutoko Road)	Eight (8)
The Southern Corridor (Seke Road / Chitungwiza Corridor)	
The Ring Road Corridor (Harare Drive)	Seven (7)

7.1.4.1.1. The East-West Corridor (Samora Machel Avenue/Mutare Road/Bulawayo Road)

Site 01: Bulawayo Road and Whitecliffe Road Intersection

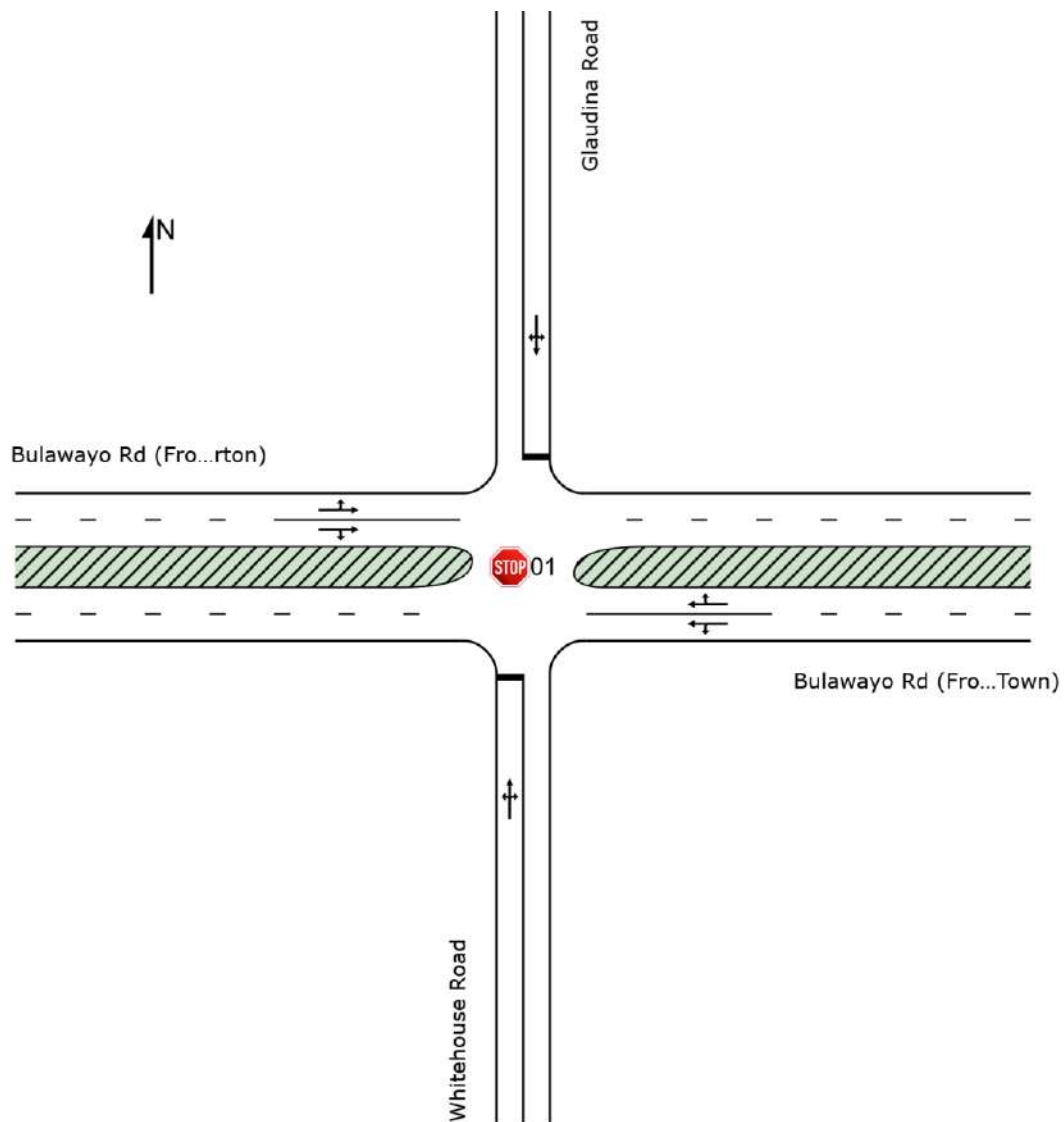


Figure 7.3: Bulawayo Road and Whitecliff Road Intersection

Table 7.12: Movement Summary Site: 01 [Bulawayo Road and Whitecliff Road: Samora Corridor]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Whitehouse Road															
1	L2	All MCs	29	7.4	29	7.4	2.173	1067.1	LOS F	50.9	389.1	1.00	5.07	15.20	3.2
2	T1	All MCs	13	9.0	13	9.0	2.173	1108.1	LOS F	50.9	389.1	1.00	5.07	15.20	3.2
3	R2	All MCs	104	3.6	104	3.6	2.173	1105.1	LOS F	50.9	389.1	1.00	5.07	15.20	3.2
Approach			146	4.8	146	4.8	2.173	1097.9	LOS F	50.9	389.1	1.00	5.07	15.20	3.2
East: Bulawayo Rd (From Town)															
4	L2	All MCs	200	4.3	200	4.3	0.255	5.7	LOS A	0.0	0.0	0.00	0.31	0.00	54.6
5	T1	All MCs	432	7.8	432	7.8	0.255	1.0	LOS A	0.9	7.3	0.14	0.28	0.14	57.5
6	R2	All MCs	35	98.4	35	98.4	0.255	12.7	LOS B	0.9	7.3	0.24	0.25	0.24	51.8
Approach			666	11.5	666	11.5	0.255	3.0	NA	0.9	7.3	0.11	0.29	0.11	56.3
North: Glaudina Road															
7	L2	All MCs	13	5.5	13	5.5	0.352	11.2	LOS B	0.4	3.5	0.85	0.96	0.94	41.1
8	T1	All MCs	10	9.8	10	9.8	0.352	46.5	LOS E	0.4	3.5	0.85	0.96	0.94	41.1

9	R2	All MCs	0	0.0	0	0.0	0.352	26.9	LOS D	0.4	3.5	0.85	0.96	0.94	33.3
Approach			23	7.4	23	7.4	0.352	26.8	LOS D	0.4	3.5	0.85	0.96	0.94	41.1
West: Bulawayo Rd (From Norton)															
10	L2	All MCs	3	4.7	3	4.7	0.188	5.6	LOS A	0.0	0.0	0.00	0.01	0.00	57.1
11	T1	All MCs	367	16.5	367	16.5	0.188	1.3	LOS A	0.8	6.8	0.13	0.17	0.13	57.9
12	R2	All MCs	57	10.5	57	10.5	0.188	12.4	LOS B	0.8	6.8	0.48	0.58	0.48	51.2
Approach			427	15.6	427	15.6	0.188	2.8	NA	0.8	6.8	0.18	0.22	0.18	56.9
All Vehicles			1261	12.0	1261	12.0	2.173	130.0	NA	50.9	389.1	0.25	0.83	1.89	19.0

Table 7.13 shows the Degree of Saturation based on the Ratio of Arrival Flow to Capacity, v/c ratio per lane.

Table 7.13: Degree of Saturation Site: 01 [Bulawayo Road and Whitcliffe Road (Site Folder: Samora Corridor)]

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	2.17	0.25	0.35	0.19	2.17

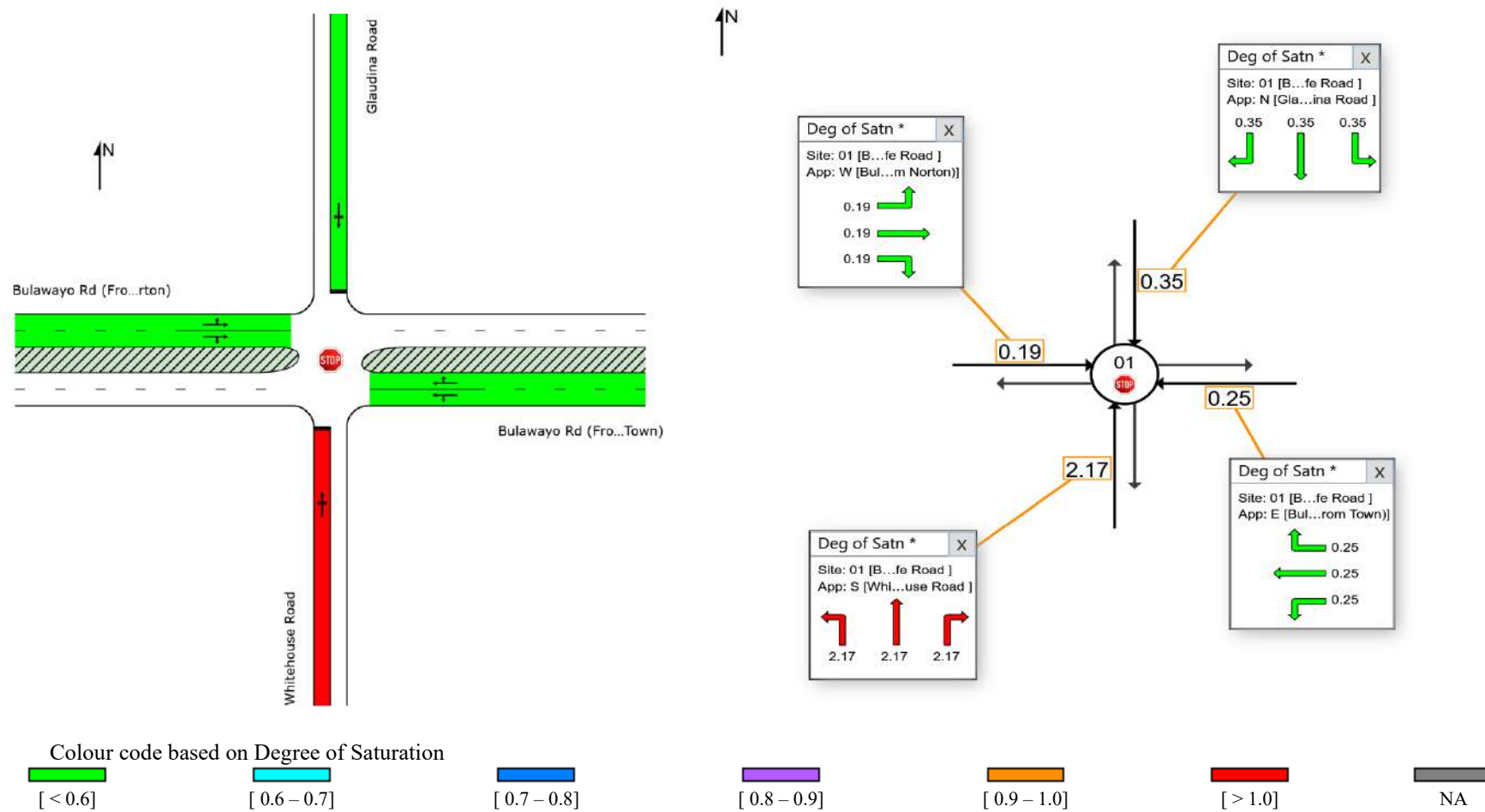


Figure 7.4: Lane Level of Service and Ratio of Arrival Flow to Capacity, v/c ratio per movement for Bulawayo Road and Whitecliff Road Intersection

Site 02: Bulawayo Road and First Avenue Intersection

Figure 7.5 shows the Average week day results Bulawayo Road and First Avenue Intersection.

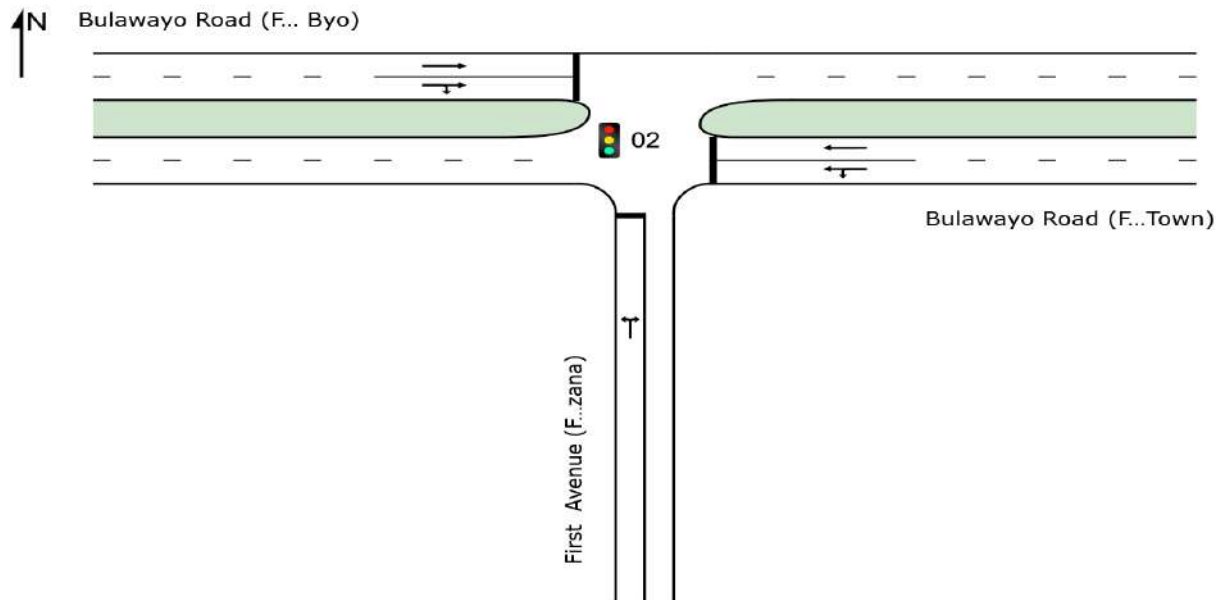


Figure 7.5: Bulawayo Road and First Avenue Intersection

Site: 02 [Bulawayo Rd and First (Kuwadzana Turn) (Site Folder: Samora Corridor)]

Table 7.14: Movement Summary - Site: 02 [Bulawayo Rd and First (Kuwadzana Turn) (Site Folder: Samora Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: First Avenue (From Kuwadzana)															
1	L2	All MCs	75	7.8	75	7.8	0.374	35.8	LOS D	6.2	48.3	0.83	0.79	0.83	36.7
2	R2	All MCs	84	6.3	84	6.3	* 0.374	35.8	LOS D	6.2	48.3	0.83	0.79	0.83	36.8
Approach			159	7.0	159	7.0	0.374	35.8	LOS D	6.2	48.3	0.83	0.79	0.83	36.7
East: Bulawayo Road (From Town)															
4	L2	All MCs	82	3.9	82	3.9	0.300	17.0	LOS B	6.2	50.4	0.54	0.57	0.54	46.9
5	T1	All MCs	469	9.8	469	9.8	0.300	11.5	LOS B	7.3	54.5	0.54	0.51	0.54	49.6
Approach			551	8.9	551	8.9	0.300	12.3	LOS B	7.3	54.5	0.54	0.52	0.54	49.2
West: Bulawayo Road (From Byo)															
11	T1	All MCs	614	7.5	614	7.5	0.384	12.3	LOS B	9.8	75.8	0.59	0.53	0.59	49.5
12	R2	All MCs	38	11.5	38	11.5	* 0.384	23.5	LOS C	7.6	59.7	0.60	0.55	0.60	46.8
Approach			652	7.7	652	7.7	0.384	12.9	LOS B	9.8	75.8	0.59	0.53	0.59	49.3
All Vehicles			1362	8.1	1362	8.1	0.384	15.3	LOS B	9.8	75.8	0.60	0.55	0.60	47.4

Table 7.15: Lane Level of Service Site: 02 [Bulawayo Rd and First (Kuwadzana Turn) (Site Folder: Samora Corridor)]

	Approaches			Intersection
	South	East	West	
LOS	D	B	B	B

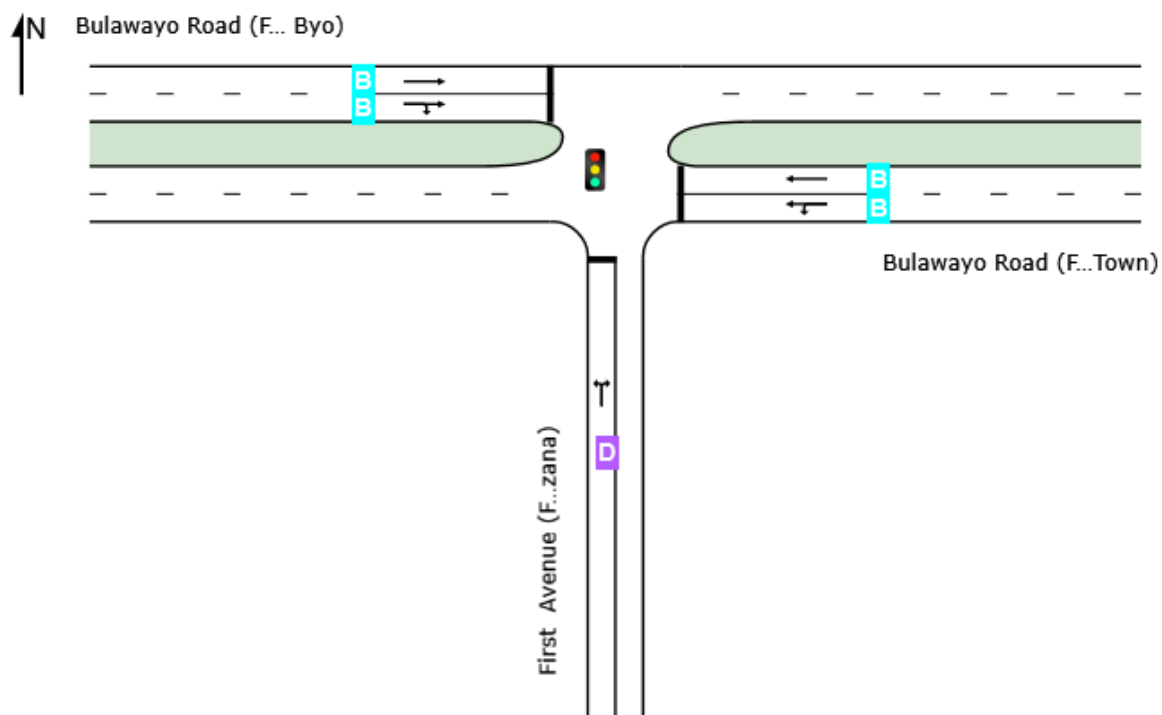


Figure 7.6: Lane Level of Service Site: 02 [Bulawayo Rd and First (Kuwadzana Turn) (Site Folder: Samora Corridor)]

Table 7.16: Degree of Saturation Site: 02 [Bulawayo Rd and First (Kuwadzana Turn) (Samora Corridor)]

	Approaches			Intersection
	South	East	West	
Degree of Saturation	0.37	0.30	0.38	0.38

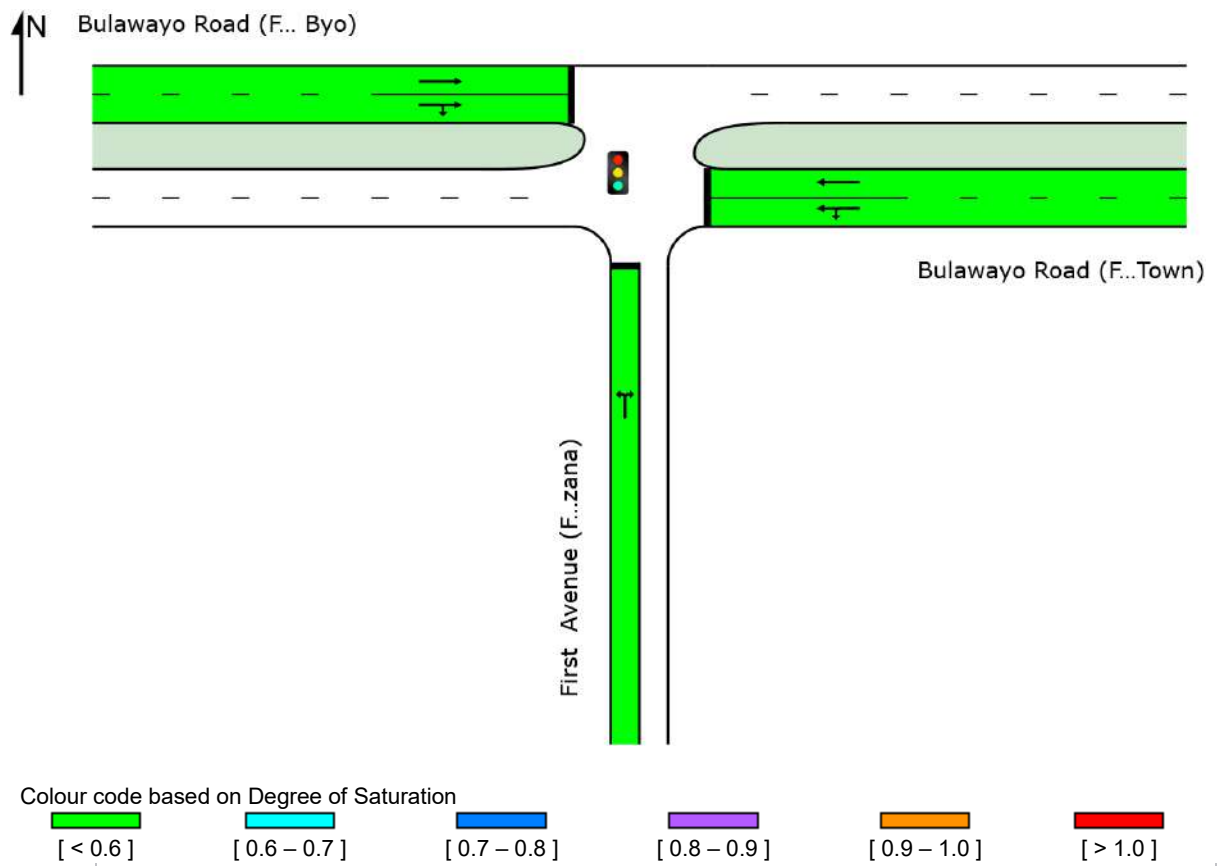


Figure 7.7: Site: 02 [Bulawayo Rd and First (Kuwadzana Turn) (Samora Corridor)]

Site 03: Bulawayo Road and Dzivarasekwa Road (15-hour Average Daily Traffic (ADT) Results)

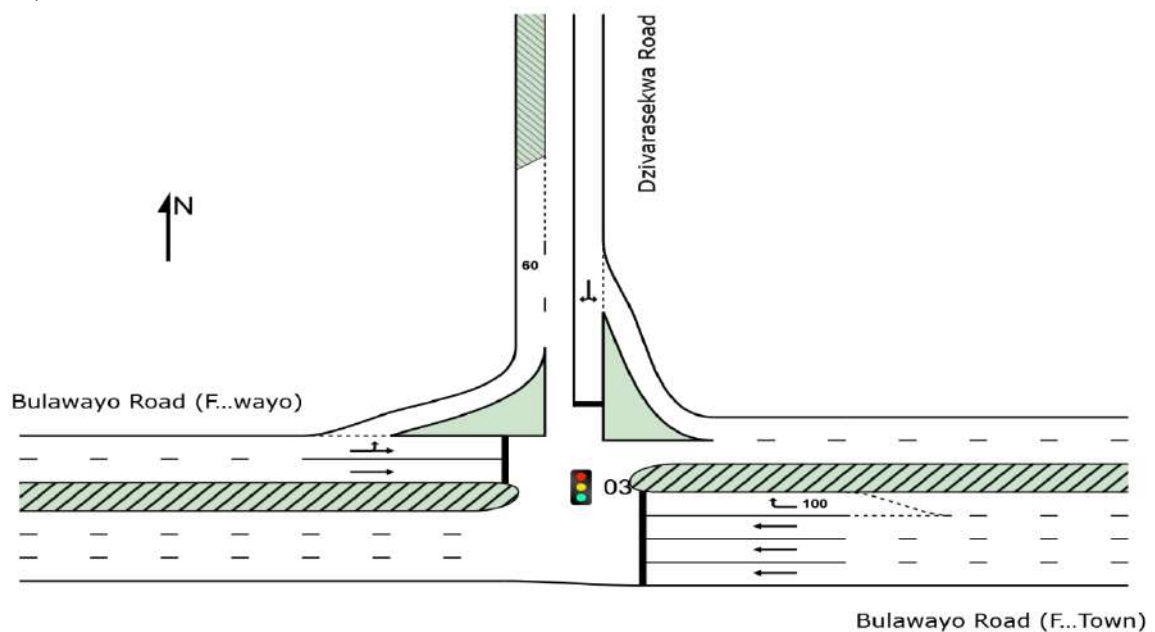


Figure 7.8: Site 03: Bulawayo Road and Dzivarasekwa Road

Table 7.17: Site 03 Movement Summary - [Bulawayo Road and Dzivarasekwa Road (Samora Corridor)]

Bulawayo Road and Dzivarasekwa Road

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Eff. No. of Cycles	Aver. Speed km/h
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				
East: Bulawayo Road (From Town)															
5	T1	All MCs	346	10.4	346	10.4	0.100	2.9	LOS A	1.2	9.2	0.35	0.28	0.35	57.2
6	R2	All MCs	121	4.1	121	4.1	* 0.194	7.7	LOS A	1.0	7.8	0.33	0.66	0.33	48.0
Approach			467	8.8	467	8.8	0.194	4.1	LOS A	1.2	9.2	0.35	0.37	0.35	55.1
North: Dzivarasekwa Road															
7	L2	All MCs	153	7.0	153	7.0	0.454	5.7	LOS A	8.0	61.0	0.73	0.78	0.73	38.8
9	R2	All MCs	144	8.3	144	8.3	0.454	38.5	LOS D	8.0	61.0	0.73	0.78	0.73	38.4
Approach			296	7.6	296	7.6	0.454	21.6	LOS C	8.0	61.0	0.73	0.78	0.73	38.6
West: Bulawayo Road (From Blwayo)															
10	L2	All MCs	73	5.8	73	5.8	0.344	5.9	LOS A	4.9	37.9	0.35	0.37	0.35	51.6
11	T1	All MCs	730	7.7	730	7.7	* 0.344	3.4	LOS A	4.9	37.9	0.38	0.35	0.38	56.6
Approach			803	7.6	803	7.6	0.344	3.6	LOS A	4.9	37.9	0.38	0.35	0.38	56.3
All Vehicles			1566	7.9	1566	7.9	0.454	7.2	LOS A	8.0	61.0	0.43	0.44	0.43	52.4

Table 7.18: Lane Level of Service for Site: 03 [Bulawayo Road and Dzivarasekwa Road (Samora Corridor)]

Bulawayo Road and Dzivarasekwa Road

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site User-Given Phase Times)

	Approaches			Intersection
	East	North	West	
LOS	A	C	A	A

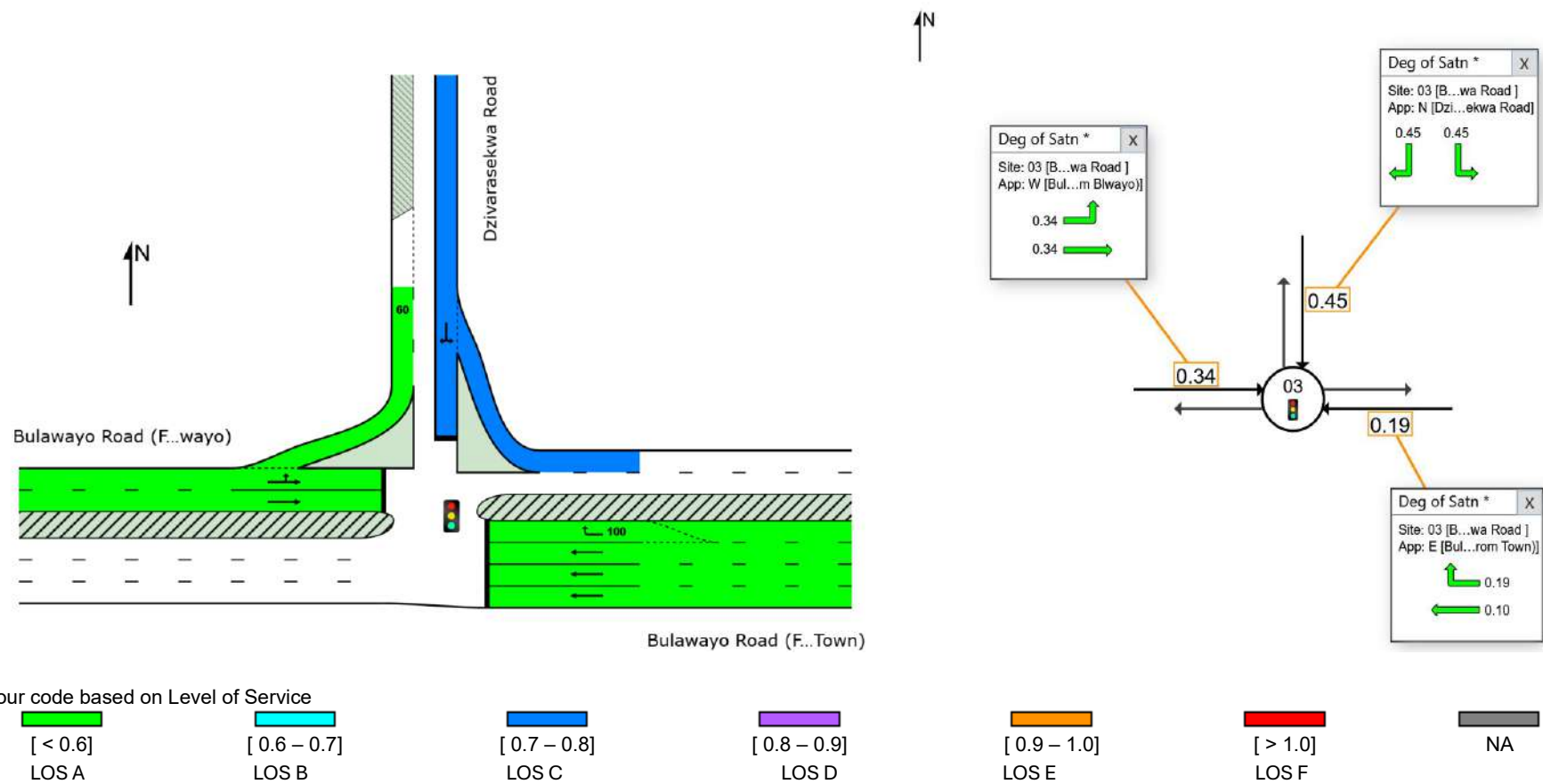


Figure 7.9: Lane Level of Service and Ratio of Arrival Flow to Capacity, v/c ratio per movement for Site: 03 [Bulawayo Road and Dzivarasekwa Road (Samora Corridor)]

**Site 04: Bulawayo Road and Highglen Road (Kuwadzana Roundabout) 15-hour
Average Daily Traffic (ADT) Results**

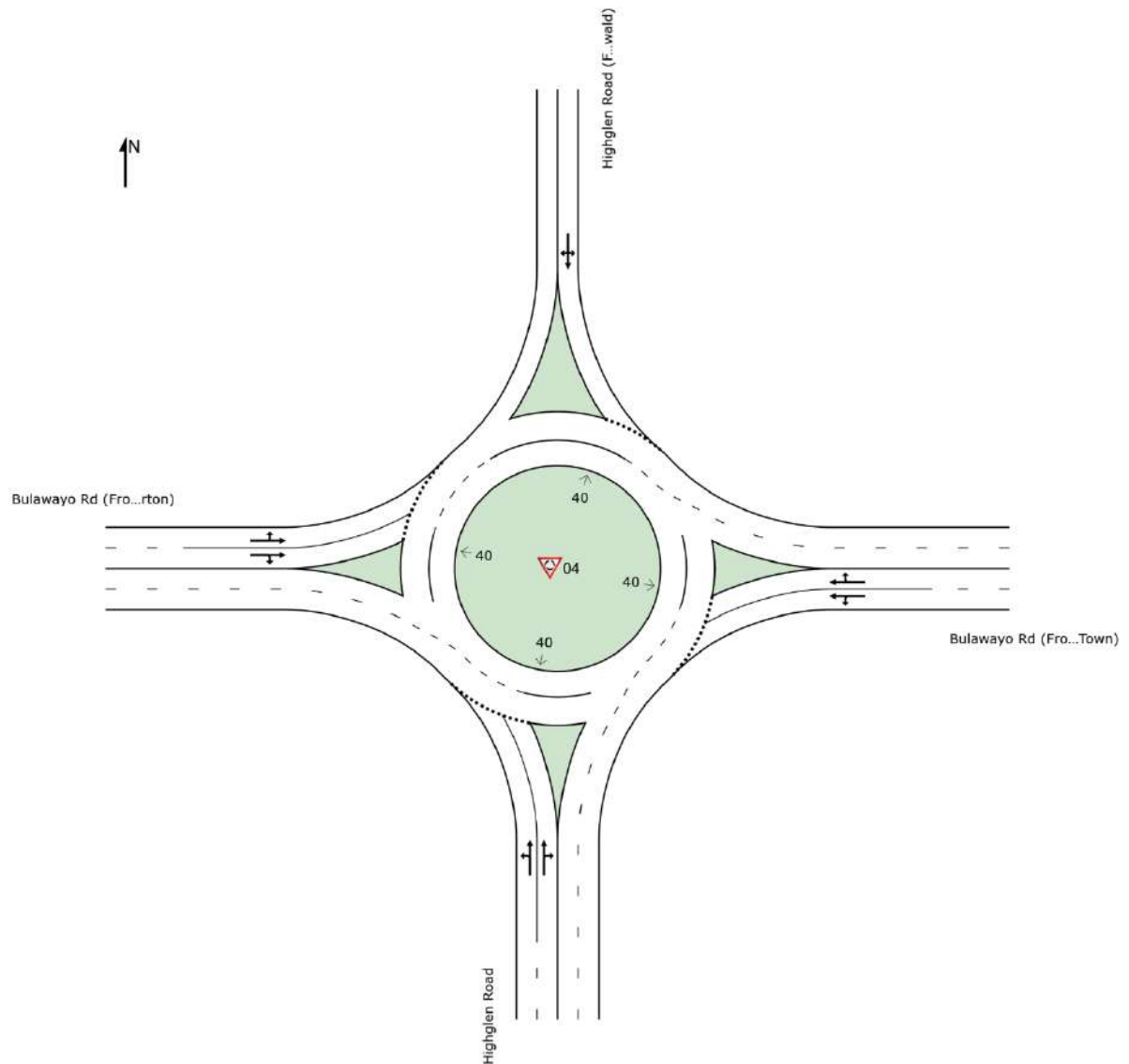


Figure 7.10: Site 04 [Bulawayo Road and Highglen Road (Site Folder: Samora Corridor)]

Table 7.19: Movement Summary Site: 04 [Bulawayo Road and Highglen Road (Samora Corridor)]

Bulawayo Road and Highglen Road
 Site Category: Existing Design
 Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Eff. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Highglen Road															
1	L2	All MCs	196	21.3	196	21.3	0.257	7.2	LOS A	1.1	9.9	0.65	0.71	0.65	52.6
2	T1	All MCs	24	12.1	24	12.1	0.281	7.8	LOS A	1.2	9.4	0.67	0.81	0.67	49.5
3	R2	All MCs	165	7.3	165	7.3	0.281	14.0	LOS B	1.2	9.4	0.67	0.81	0.67	48.6
Approach			385	14.7	385	14.7	0.281	10.2	LOS B	1.2	9.9	0.66	0.76	0.66	50.6
East: Bulawayo Rd (From Town)															
4	L2	All MCs	408	10.5	408	10.5	0.478	3.5	LOS A	3.5	29.5	0.20	0.34	0.20	55.1
5	T1	All MCs	958	14.6	958	14.6	0.478	3.2	LOS A	3.5	30.0	0.21	0.31	0.21	55.6
6	R2	All MCs	1	60.0	1	60.0	0.478	10.5	LOS B	3.5	30.0	0.21	0.29	0.21	52.9
Approach			1367	13.4	1367	13.4	0.478	3.3	LOS A	3.5	30.0	0.20	0.32	0.20	55.4
North: Highglen Road (From Tynwald)															
7	L2	All MCs	166	2.9	166	2.9	0.245	6.0	LOS A	1.1	7.7	0.62	0.68	0.62	53.6
8	T1	All MCs	27	4.8	27	4.8	0.245	5.9	LOS A	1.1	7.7	0.62	0.68	0.62	53.9
9	R2	All MCs	1	0.0	1	0.0	0.245	12.2	LOS B	1.1	7.7	0.62	0.68	0.62	53.0
Approach			194	3.1	194	3.1	0.245	6.0	LOS A	1.1	7.7	0.62	0.68	0.62	53.7
West: Bulawayo Rd (From Norton)															
10	L2	All MCs	1	60.0	1	60.0	0.289	5.0	LOS A	1.6	14.3	0.41	0.38	0.41	53.2
11	T1	All MCs	651	16.4	651	16.4	0.289	3.9	LOS A	1.6	14.3	0.42	0.39	0.42	54.4
12	R2	All MCs	7	75.2	7	75.2	0.289	11.8	LOS B	1.6	14.1	0.42	0.40	0.42	51.5
Approach			659	17.1	659	17.1	0.289	4.0	LOS A	1.6	14.3	0.42	0.39	0.42	54.3
All Vehicles			2604	13.8	2604	13.8	0.478	4.7	LOS A	3.5	30.0	0.36	0.43	0.36	54.2

Table 7.20: Lane Level of Service - Site: 04 [Bulawayo Road and Highglen Road (Samora Corridor)]

Bulawayo Road and Highglen Road
 Site Category: Existing Design
 Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	B	A	A	A	A

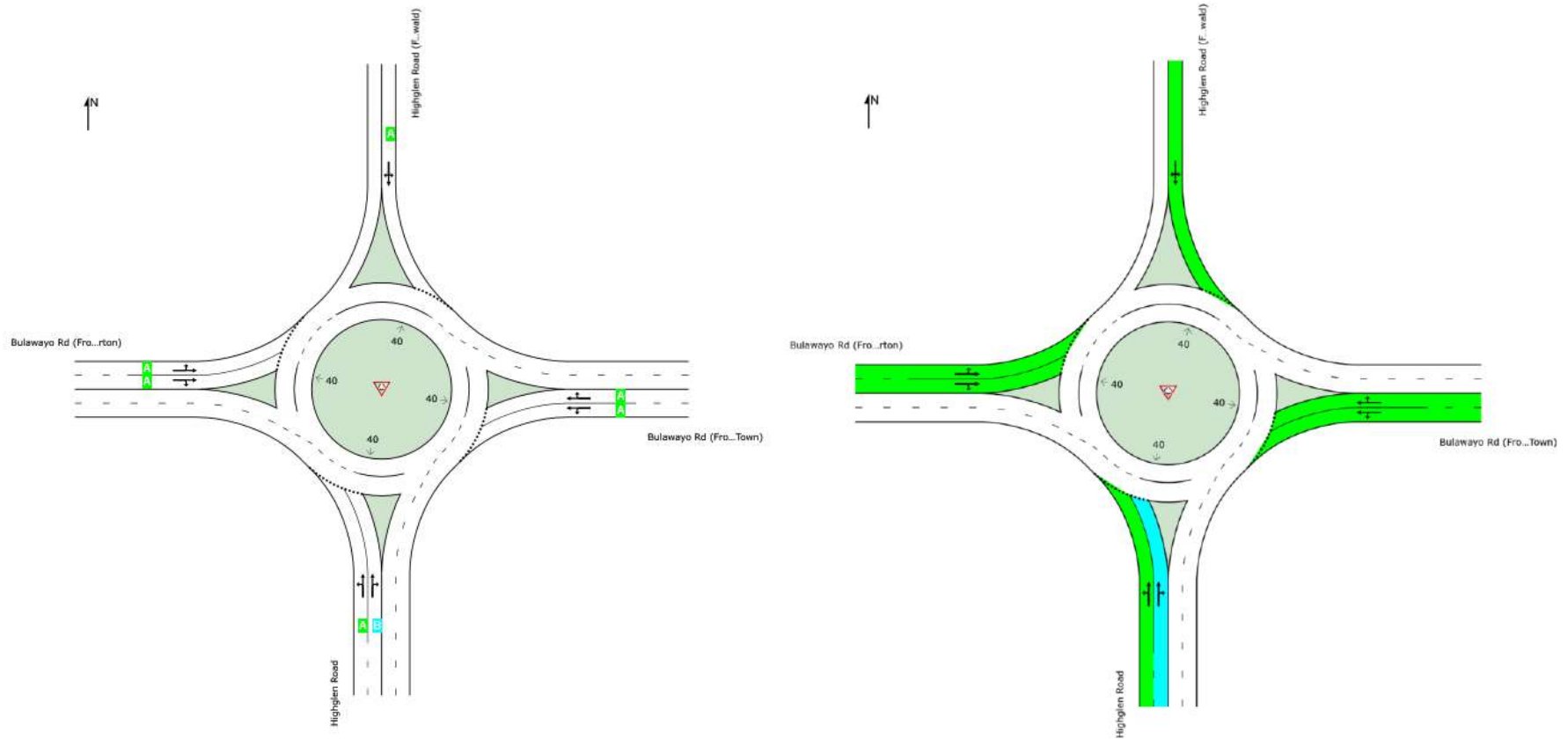


Figure 7.11: Site: 04 [Bulawayo Road and Highglen Road (Samora Corridor)]

Table 7.21: Lane Level of Service - Site: 04 [Bulawayo Road and Highglen Road (Site Folder: Samora Corridor)]

Bulawayo Road and Highglen Road
 Site Category: Existing Design
 Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	B	A	A	A	A

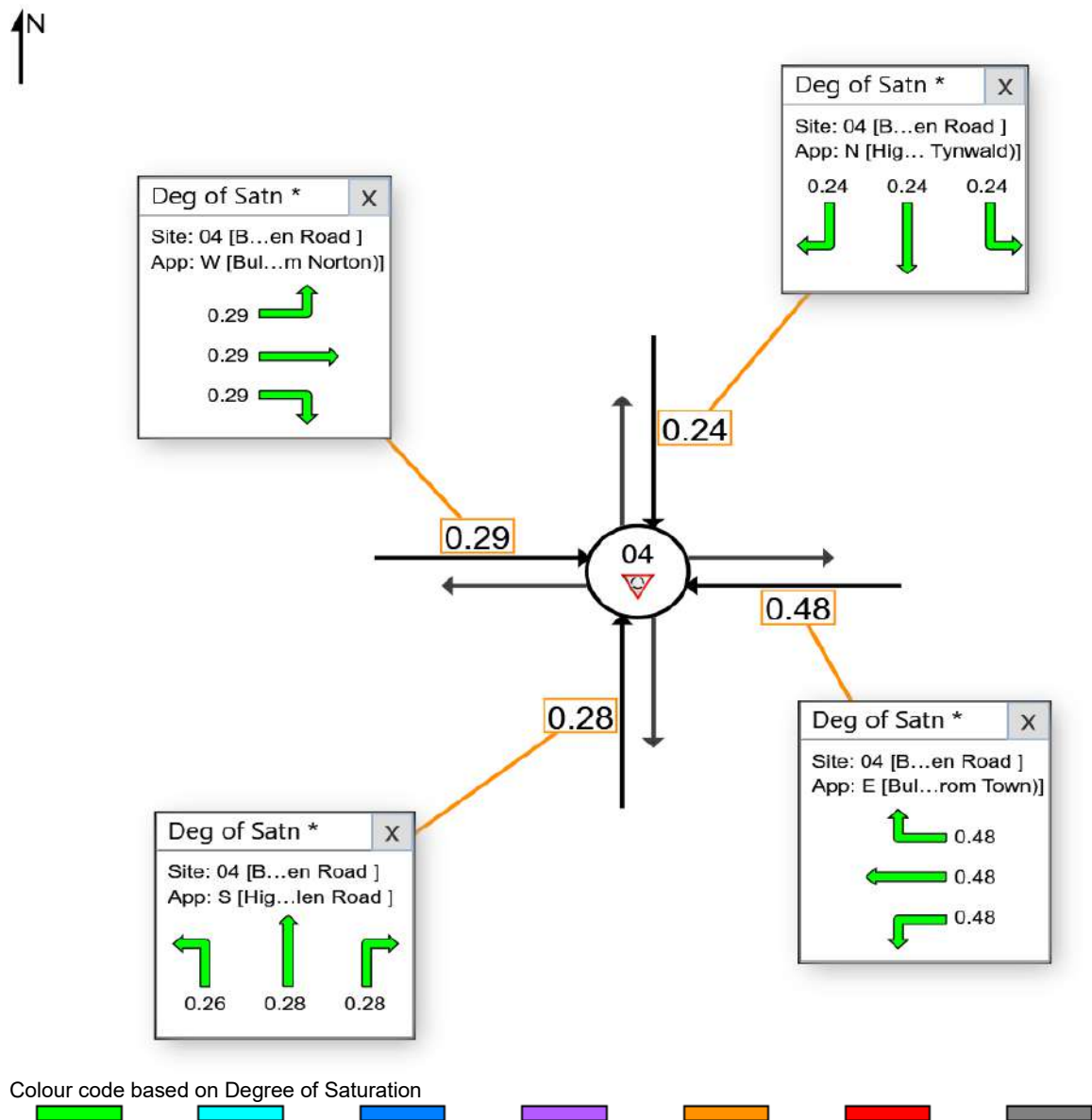


Figure 7.12: Ratio of Arrival Flow to Capacity, v/c ratio per movement - Site: 04 [Bulawayo Road and Highglen Road (Samora Corridor)]

Site 05: Bulawayo Road and Pleasant Valley Road 15-hour Average Daily Traffic (ADT) Results

Site Category: (None)

Stop (Two-Way)

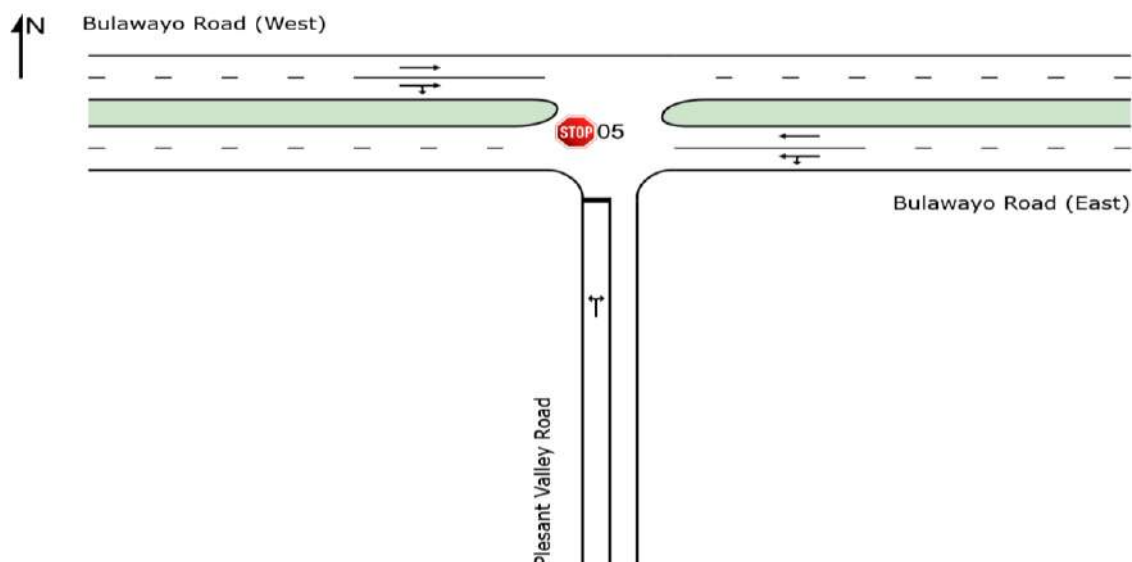


Figure 7.13: Site: 05 [Bulawayo Road and Pleasant Valley Road (Samora Corridor)]

Table 7.22: Site 05: MOVEMENT SUMMARY - [Bulawayo Road and Pleasant Valley Road (Samora Corridor)]

New Site

Site Category: (None)

Stop (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Pleasant Valley Road															
1	L2	All MCs	9	11.9	9	11.9	29.040	25259.9	LOS F	111.9	984.4	1.00	1.47	3.10	0.1
3	R2	All MCs	174	15.8	174	15.8	29.040	25461.1	LOS F	111.9	984.4	1.00	1.47	3.10	0.1
Approach			183	15.7	183	15.7	29.040	25451.4	LOS F	111.9	984.4	1.00	1.47	3.10	0.1
East: Bulawayo Road (East)															
4	L2	All MCs	105	3.0	105	3.0	0.437	5.7	LOS A	0.0	0.0	0.00	0.10	0.00	55.9
5	T1	All MCs	1241	10.4	1241	10.4	0.437	0.2	LOS A	0.0	0.0	0.00	0.04	0.00	59.0
Approach			1346	9.8	1346	9.8	0.437	0.6	NA	0.0	0.0	0.00	0.05	0.00	58.8
West: Bulawayo Road (West)															
11	T1	All MCs	916	10.3	916	10.3	0.567	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.3
12	R2	All MCs	88	3.0	88	3.0	1.120	156.4	LOS F	8.0	58.5	1.00	2.18	5.75	16.6
Approach			1005	9.7	1005	9.7	1.120	14.1	NA	8.0	58.5	0.09	0.19	0.51	48.3
All Vehicles			2534	10.2	2534	10.2	29.040	1843.7	NA	111.9	984.4	0.11	0.21	0.42	1.9

Table 7.23: Site 05 - Lane Level of Service [Bulawayo Road and Pleasant Valley Road (Samora Corridor)]

New Site
 Site Category: (None)
 Stop (Two-Way)

	Approaches			Intersection
	South	East	West	
LOS	F	NA (TWSC)	NA (TWSC)	NA (TWSC)

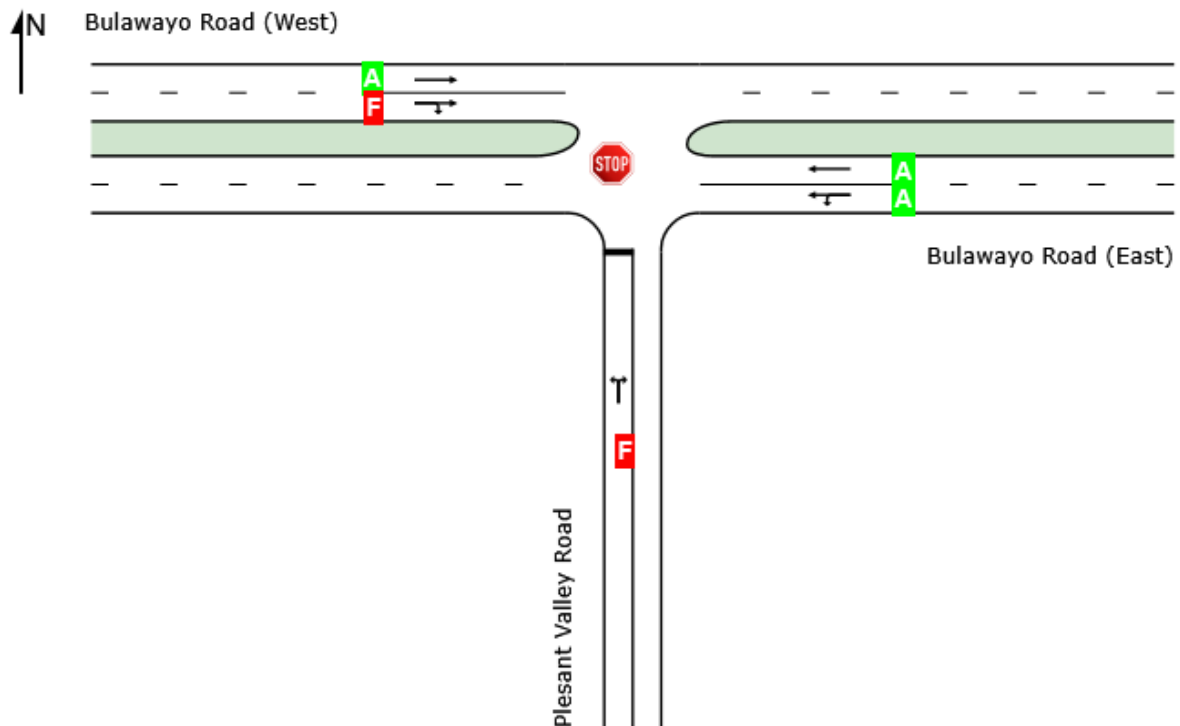


Figure 7.14: Lane Level of Service [Bulawayo Road and Pleasant Valley Road (Samora Corridor)]

Table 7.24: Site 05 Ratio of Arrival Flow to Capacity, v/c ratio per lane and degree of saturation [Bulawayo Road and Pleasant Valley Road (Samora Corridor)]

New Site
 Site Category: (None)
 Stop (Two-Way)

	Approaches			Intersection
	South	East	West	
Degree of Saturation	29.04	0.44	1.12	29.04

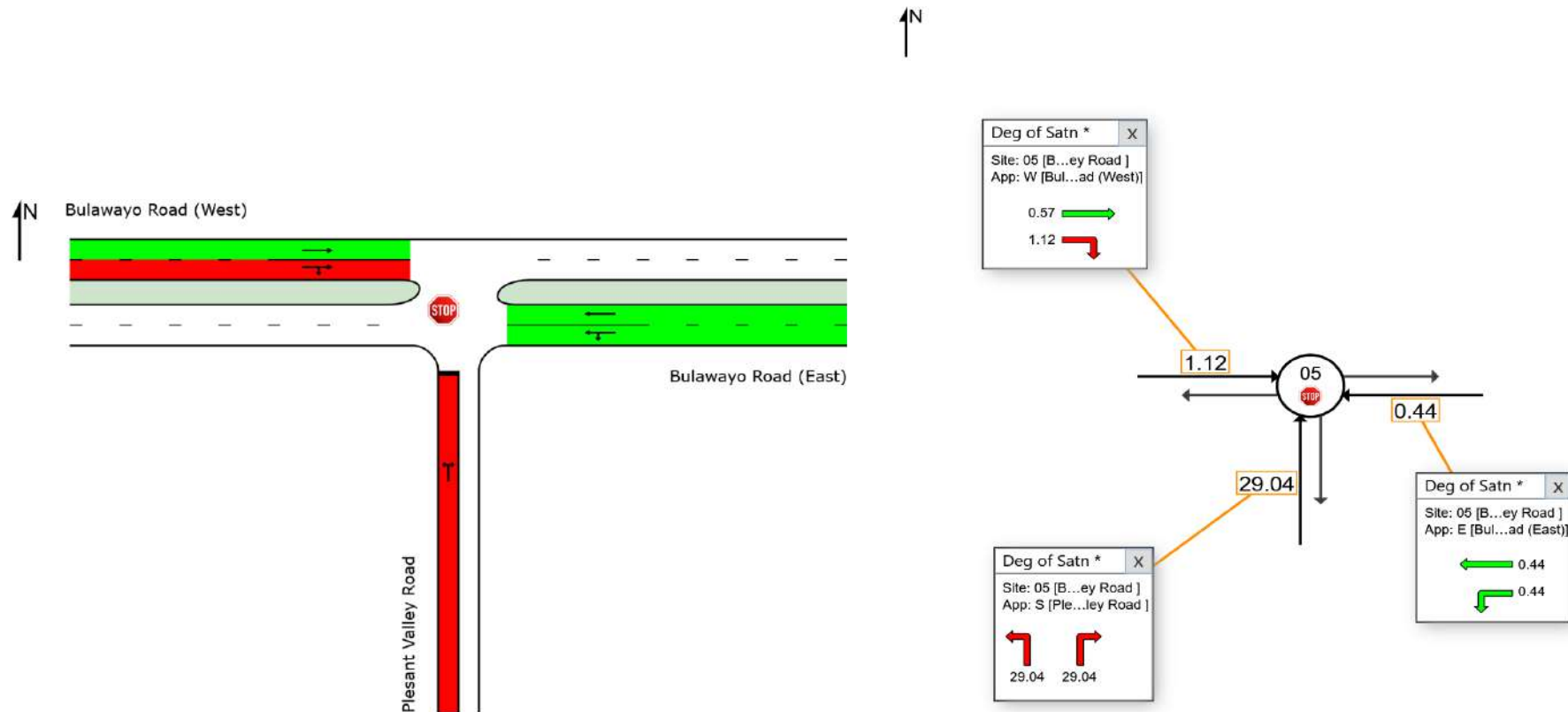


Figure 7.15: Site 05 Ratio of Arrival Flow to Capacity, v/c ratio per lane and degree of saturation [Bulawayo Road and Pleasant Valley Road (Samora Corridor)]

Site 06: Bulawayo Road and Crowborough Way (Warren Park Roundabout)
15-hour Average Daily Traffic (ADT) Results

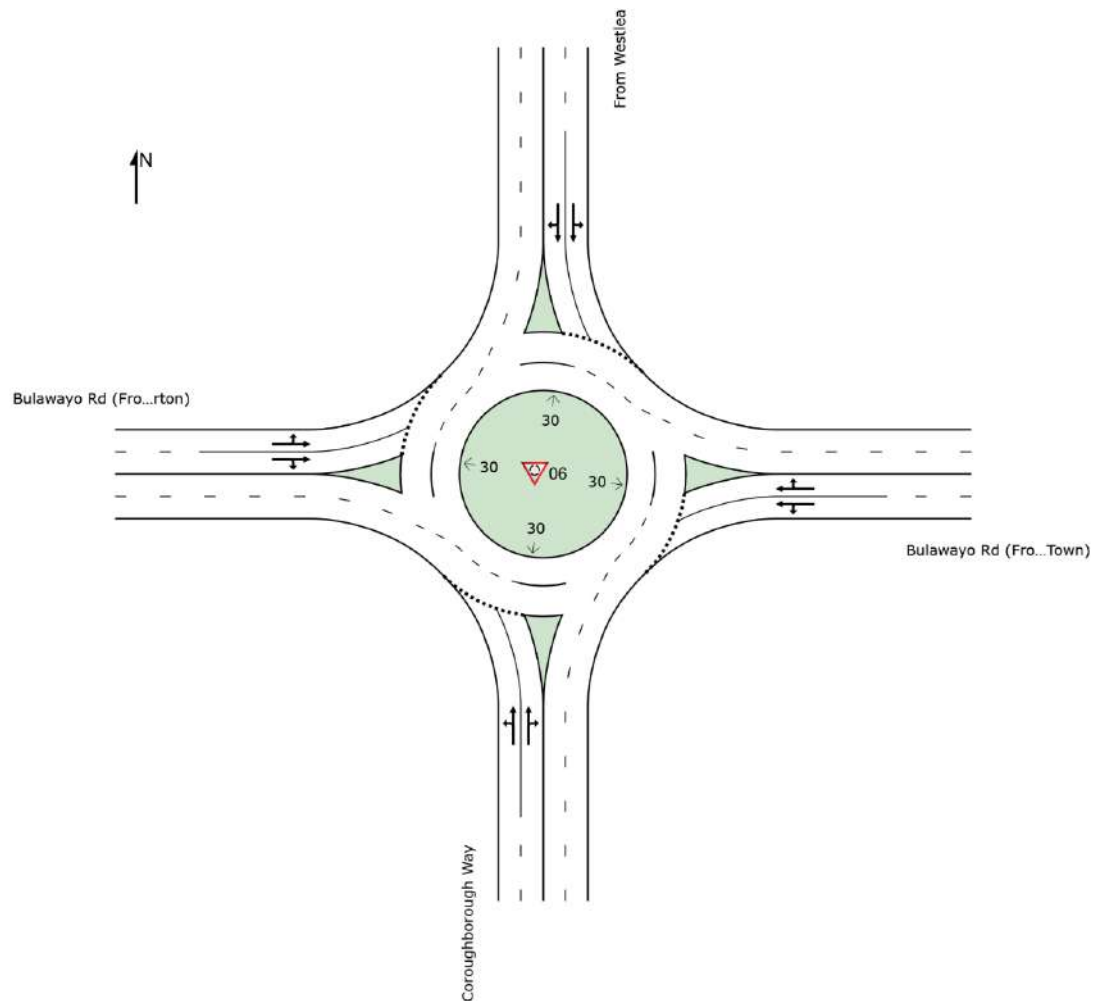


Figure 7.16: Site 06 Bulawayo Road and Crowborough Way (Warren Park Roundabout)

Table 7.25: Site 06 Movement Summary [Bulawayo Rd and Crowborough (Warren Park Roundabout) (Site Folder: Samora Corridor)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance																
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Eff. Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]					
			veh/h	%	veh/h	%	v/c	sec		veh	m					km/h
South: Coroughborough Way																
1	L2	All MCs	123	6.4	123	6.4	0.335	5.8	LOS A	1.9	14.3	0.55	0.56	0.55	52.7	
2	T1	All MCs	186	8.3	186	8.3	0.335	5.7	LOS A	1.9	14.3	0.55	0.56	0.55	53.2	
3	R2	All MCs	505	9.2	505	9.2	0.469	11.4	LOS B	3.0	24.2	0.60	0.67	0.60	48.8	
Approach			814	8.6	814	8.6	0.469	9.2	LOS A	3.0	24.2	0.58	0.63	0.58	50.3	
East: Bulawayo Rd (From Town)																
4	L2	All MCs	223	28.6	223	28.6	0.418	10.1	LOS B	2.1	22.1	0.77	0.85	0.89	50.0	
5	T1	All MCs	193	10.8	193	10.8	0.339	8.5	LOS A	1.7	13.7	0.75	0.77	0.78	52.0	
6	R2	All MCs	0	0.0	0	0.0	0.339	3.8	LOS A	1.7	13.7	0.75	0.77	0.78	47.6	
Approach			415	20.3	415	20.3	0.418	9.4	LOS A	2.1	22.1	0.76	0.81	0.84	50.9	
North: From Westlea																
7	L2	All MCs	222	11.0	222	11.0	0.740	15.9	LOS B	6.3	53.0	0.92	1.11	1.51	46.8	
8	T1	All MCs	439	12.1	439	12.1	0.740	17.2	LOS B	6.3	53.0	0.91	1.12	1.52	45.8	
9	R2	All MCs	145	11.3	145	11.3	0.740	24.6	LOS C	5.6	46.4	0.90	1.14	1.53	43.6	
Approach			806	11.7	806	11.7	0.740	18.2	LOS B	6.3	53.0	0.91	1.12	1.52	45.6	
West: Bulawayo Rd (From Norton)																
10	L2	All MCs	31	50.6	31	50.6	0.461	11.0	LOS B	2.7	22.9	0.71	0.74	0.80	50.6	
11	T1	All MCs	363	9.8	363	9.8	0.461	7.3	LOS A	2.7	22.9	0.71	0.74	0.81	52.0	
12	R2	All MCs	292	22.5	292	22.5	0.461	14.1	LOS B	2.6	22.4	0.72	0.84	0.82	48.1	
Approach			685	17.0	685	17.0	0.461	10.4	LOS B	2.7	22.9	0.72	0.79	0.81	50.2	
All Vehicles			2720	13.4	2720	13.4	0.740	12.2	LOS B	6.3	53.0	0.74	0.84	0.96	48.9	

Table 7.26: Site 06 - Lane Level of Service [Bulawayo Rd and Crowborough (Warren Park Roundabout) (Samora Corridor)]

New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	A	B	B	B

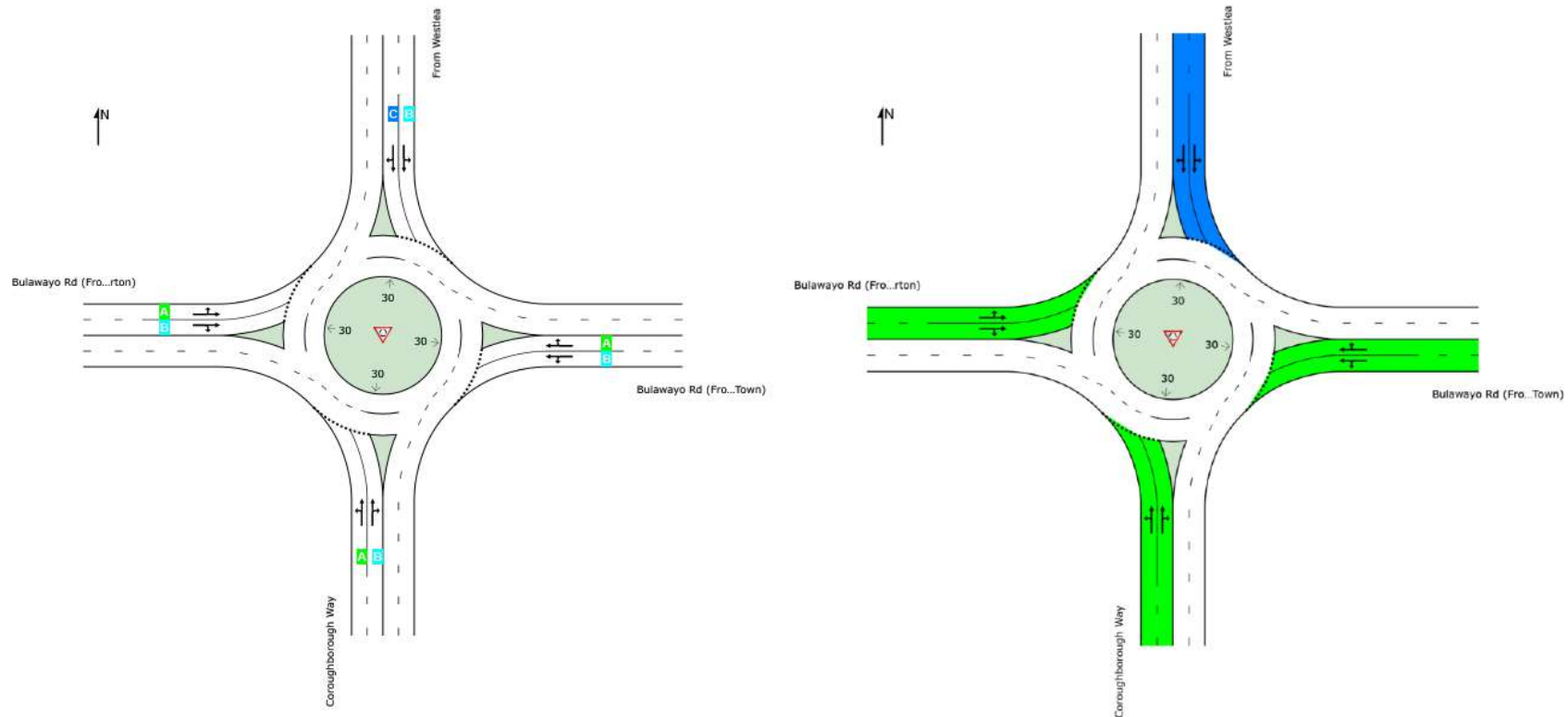


Figure 7.17: Degree of Saturation - Ratio of Arrival Flow to Capacity, v/c ratio per lane for Site 06 [Bulawayo Rd and Crowborough (Warren Park Roundabout) (Samora Corridor)]

Table 7.27: Degree of Saturation for Site 06 [Bulawayo Rd and Crowborough (Warren Park Roundabout) (Samora Corridor)]

New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.47	0.42	0.74	0.46	0.74

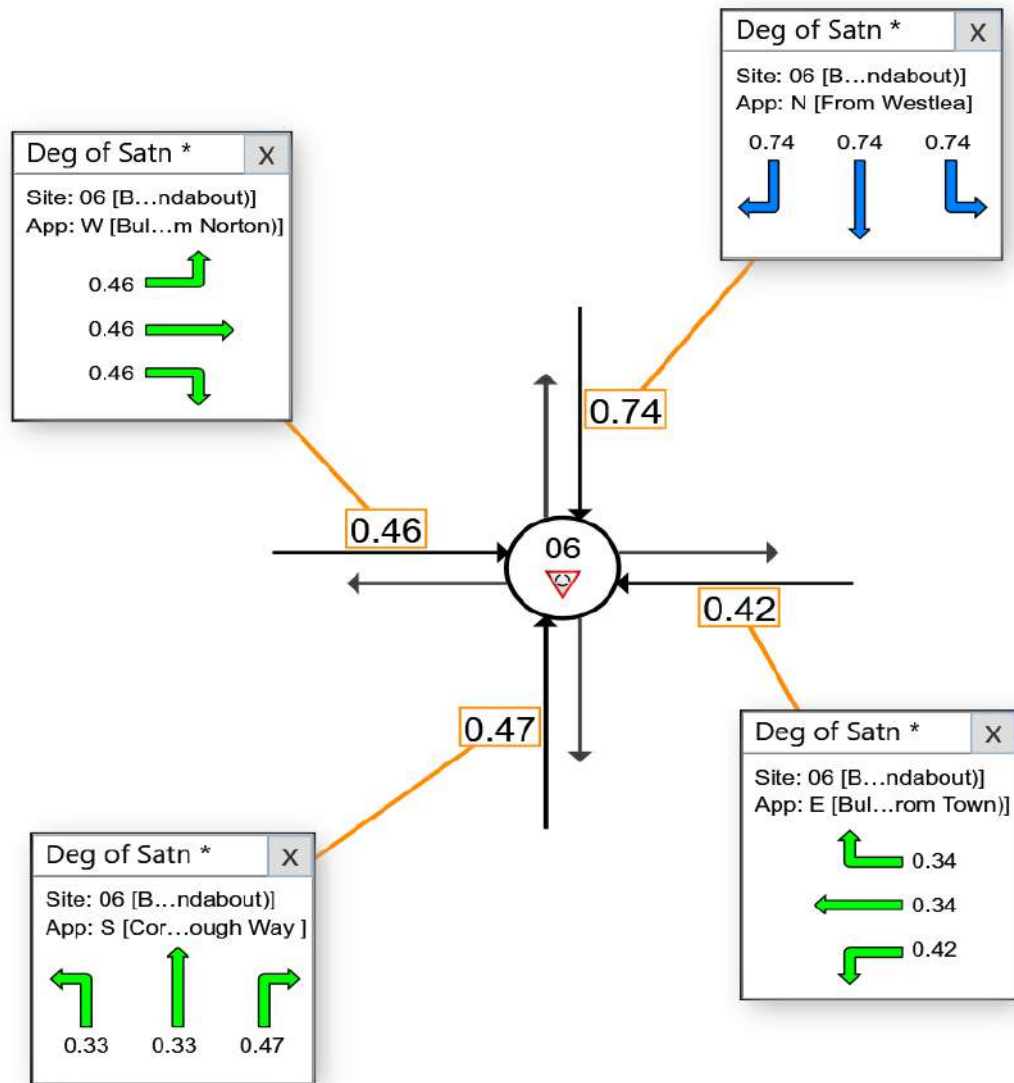


Figure 7.18: Degree of Saturation - Ratio of Arrival Flow to Capacity, v/c ratio per lane for Site 06 [Bulawayo Rd and Crowborough (Warren Park Roundabout) (Samora Corridor)] All Movement Classes (*)

Site 07: Bulawayo Road and Crowborough Way (Warren Park Roundabout)

15-hour Average Daily Traffic (ADT) Results

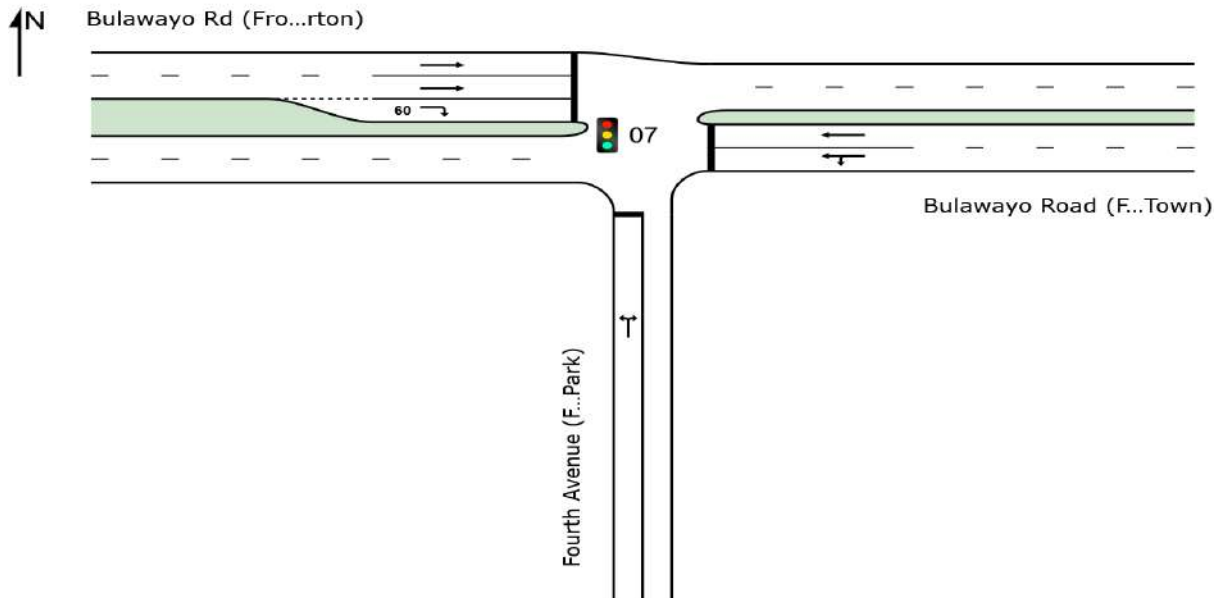


Figure 7.19: Site 07 Bulawayo Rd and Fourth (Warren Park 1 Intersection) (Samora Corridor)

Table 7.28: Site 07 - Movement Summary [Bulawayo Rd and Fourth (Warren Park 1 Intersection) (Samora Corridor)]

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 40 seconds (Site Practical Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Fourth Avenue (From Warren Park)															
1	L2	All MCs	91	10.2	91	10.2	0.341	7.7	LOS A	1.4	11.0	0.42	0.69	0.42	51.0
3	R2	All MCs	246	4.9	246	4.9	0.341	6.7	LOS A	1.4	11.0	0.42	0.69	0.42	51.3
Approach			337	6.3	337	6.3	0.341	7.0	LOS A	1.4	11.0	0.42	0.69	0.42	51.2
East: Bulawayo Road (From Town)															
4	L2	All MCs	266	10.3	266	10.3	* 0.752	10.2	LOS B	7.1	58.3	0.88	0.89	1.07	47.5
5	T1	All MCs	677	9.2	677	9.2	* 0.752	15.2	LOS B	9.3	73.7	0.91	0.90	1.09	48.7
Approach			943	9.5	943	9.5	0.752	13.8	LOS B	9.3	73.7	0.91	0.90	1.08	48.3
West: Bulawayo Rd (From Norton)															
11	T1	All MCs	541	7.4	541	7.4	0.426	10.5	LOS B	4.1	31.5	0.79	0.66	0.79	51.1
12	R2	All MCs	109	5.3	109	5.3	0.179	10.3	LOS B	0.9	6.8	0.68	0.72	0.68	49.3
Approach			650	7.0	650	7.0	0.426	10.4	LOS B	4.1	31.5	0.77	0.67	0.77	50.8
All Vehicles			1930	8.1	1930	8.1	0.752	11.5	LOS B	9.3	73.7	0.77	0.79	0.86	49.6

Table 7.29: Site 07 - Lane Level of Service [Bulawayo Rd and Fourth (Warren Park 1 Intersection) (Samora Corridor)]

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 40 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	South	East	West	
LOS	A	B	B	B

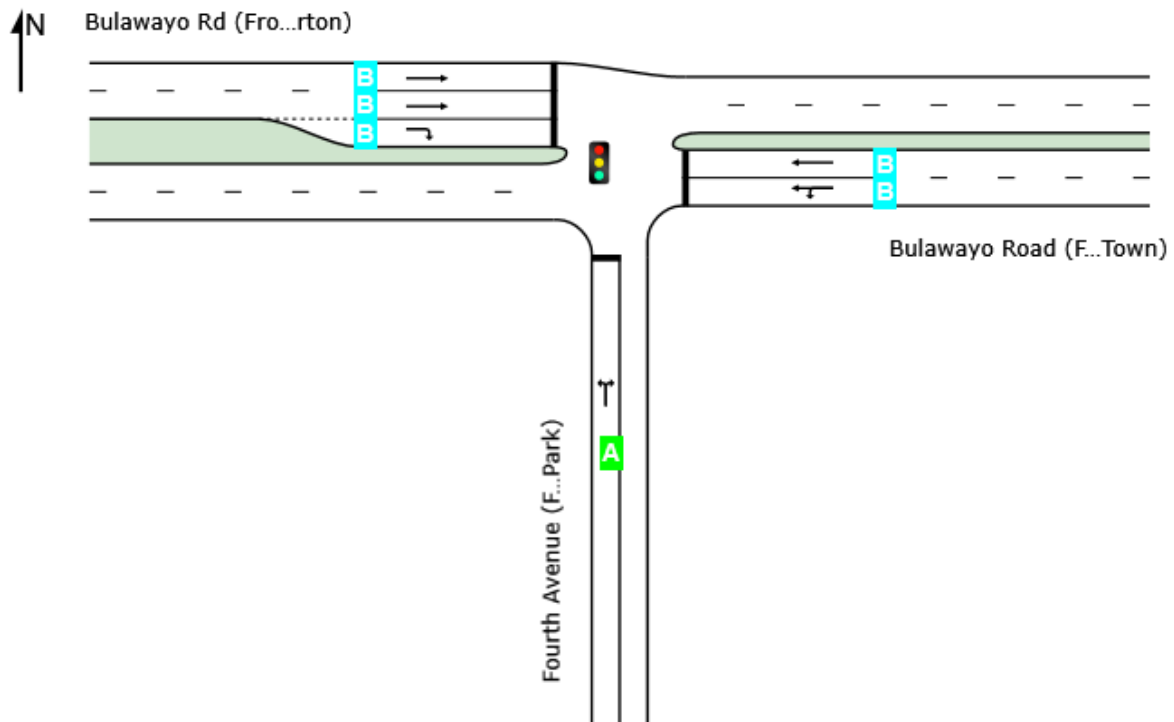


Figure 7.20: Site 07 - Lane Level of Service [Bulawayo Rd and Fourth (Warren Park 1 Intersection) (Samora Corridor)]

Table 7.30: Site: 07 Ratio of Arrival Flow to Capacity, v/c ratio per lane and Degree of Saturation [Bulawayo Rd and Fourth (Warren Park 1 Intersection) (Samora Corridor)]

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 40 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	South	East	West	
Degree of Saturation	0.34	0.75	0.43	0.75

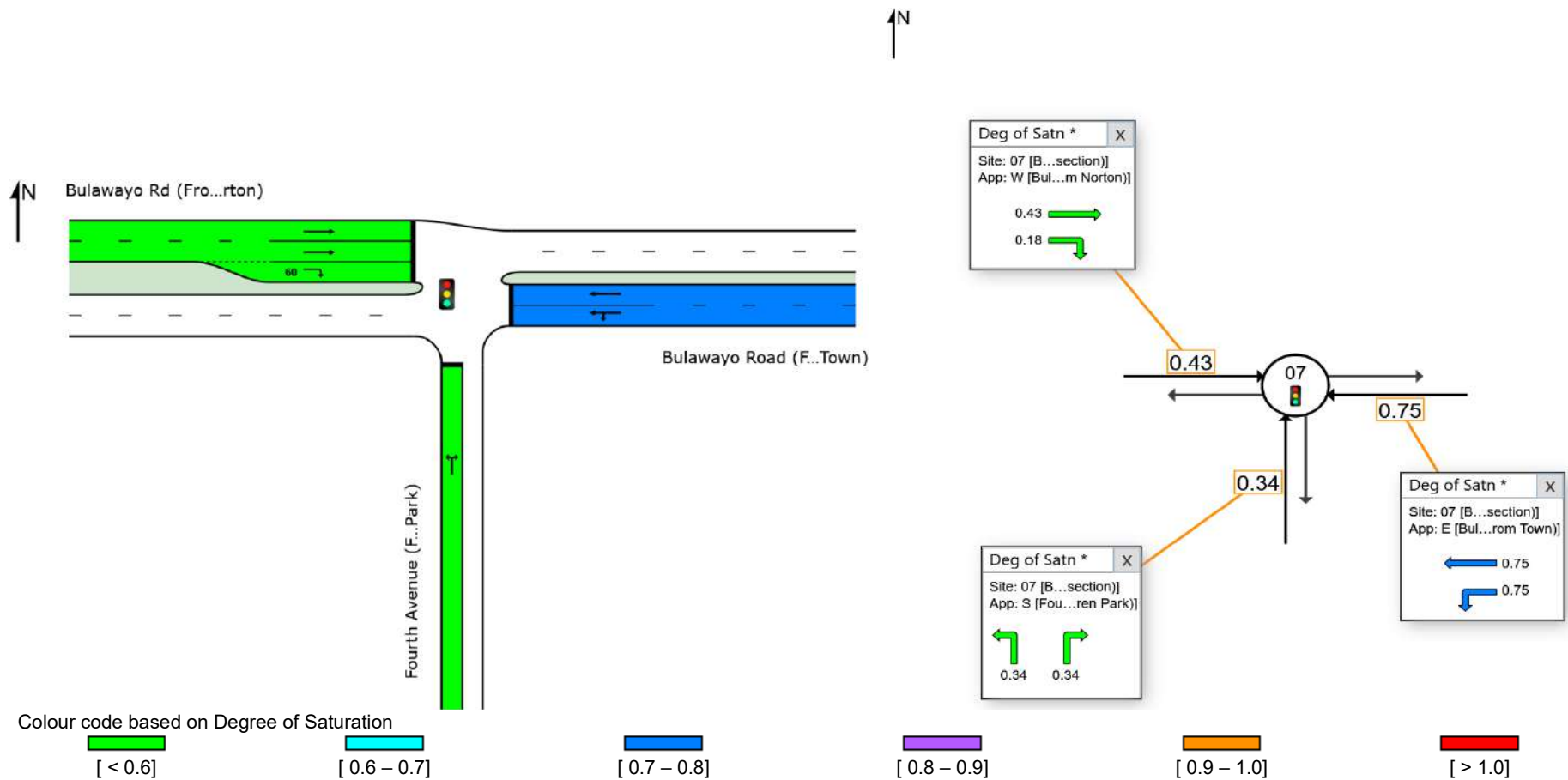


Figure 7.21: Site 07 - Ratio of Arrival Flow to Capacity, v/c ratio per movement [Bulawayo Rd and Fourth (Warren Park 1 Intersection) (Samora Corridor)]

Site 08: Samora Machel Avenue and Bishop Gaul Avenue

15-hour Average Daily Traffic (ADT) Results

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated

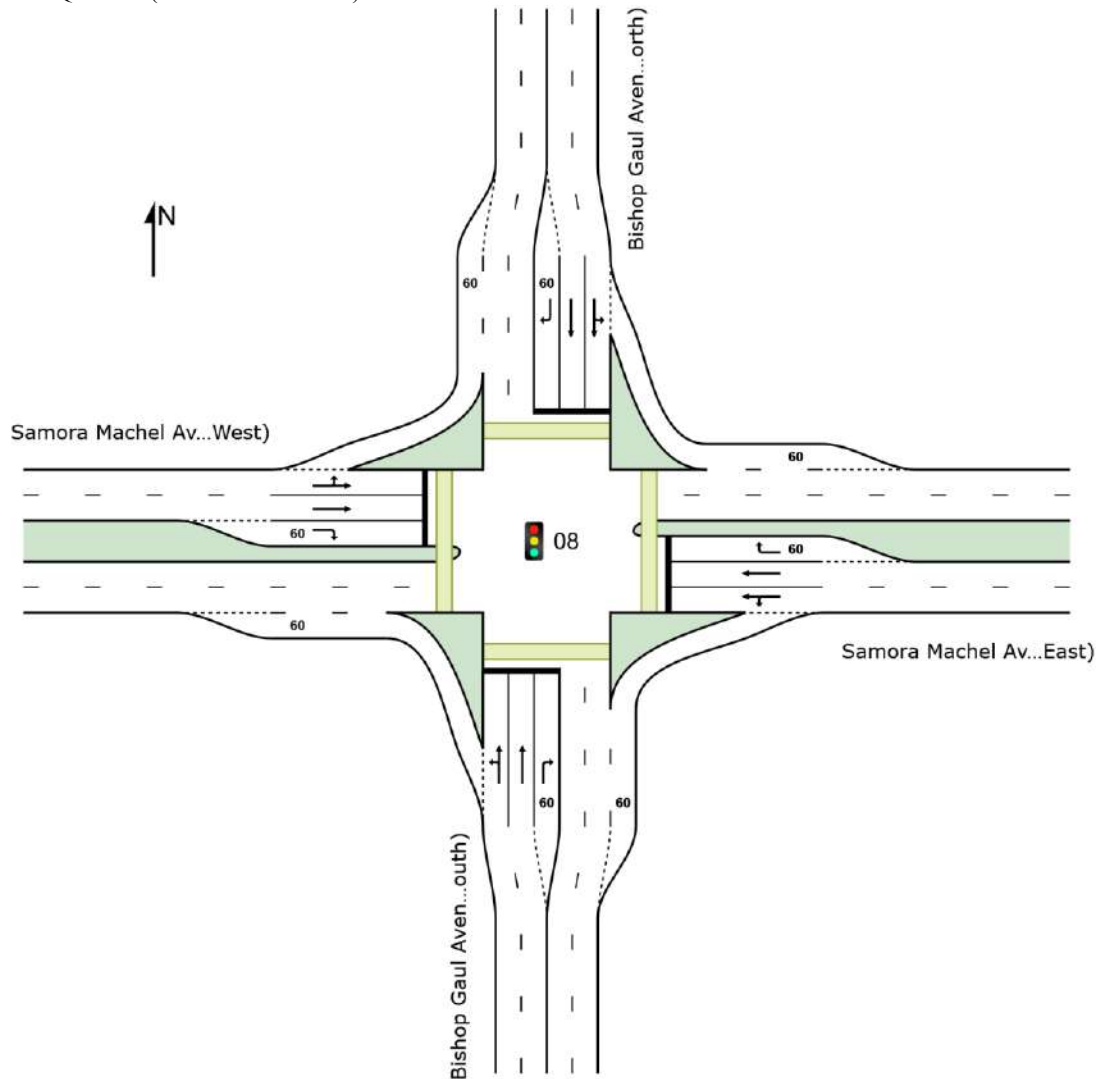


Figure 7.22: Site 08 Samora Machel and Bishop Gaul Avenue (Samora Corridor)

Table 7.31: Site 08 - Movement Summary [Samora Machel and Bishop Gaul Avenue (Site Folder: Samora Corridor)]

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site Practical Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Bishop Gaul Avenue (South)															
1	L2	All MCs	169	13.6	169	13.6	0.680	6.8	LOS A	13.2	115.8	0.97	0.84	0.98	30.2
2	T1	All MCs	205	4.6	205	4.6	0.680	105.8	LOS F	13.2	115.8	0.99	0.84	1.02	29.7
3	R2	All MCs	31	1.1	31	1.1	0.049	14.6	LOS B	0.6	4.1	0.50	0.65	0.50	47.0
Approach			405	8.1	405	8.1	0.680	57.5	LOS E	13.2	115.8	0.94	0.83	0.97	30.8
East: Samora Machel Ave (East)															
4	L2	All MCs	42	10.6	42	10.6	0.273	5.9	LOS A	8.0	59.7	0.57	0.54	0.57	44.4
5	T1	All MCs	399	3.1	399	3.1	0.273	23.8	LOS C	9.2	65.8	0.62	0.55	0.62	44.0
6	R2	All MCs	78	5.3	78	5.3	0.283	32.3	LOS C	3.2	24.5	0.83	0.76	0.83	38.3
Approach			519	4.1	519	4.1	0.283	23.6	LOS C	9.2	65.8	0.65	0.58	0.65	43.1
North: Bishop Gaul Avenue (North)															
7	L2	All MCs	240	5.0	240	5.0	0.869	18.5	LOS B	21.5	171.4	1.00	0.99	1.20	27.3
8	T1	All MCs	218	21.4	218	21.4	* 0.869	138.9	LOS F	21.5	171.4	1.00	1.03	1.26	27.0
9	R2	All MCs	191	2.4	191	2.4	* 0.329	21.5	LOS C	4.3	31.1	0.63	0.77	0.63	45.2
Approach			648	9.7	648	9.7	0.869	59.9	LOS E	21.5	171.4	0.89	0.94	1.05	30.2
West: Samora Machel Avenue (West)															
10	L2	All MCs	141	3.8	141	3.8	0.886	15.2	LOS B	48.5	361.4	0.96	0.95	1.05	35.2
11	T1	All MCs	1071	3.7	1071	3.7	* 0.886	51.3	LOS D	48.5	361.4	0.97	0.97	1.09	34.4
12	R2	All MCs	141	22.8	141	22.8	* 0.325	19.1	LOS B	2.8	29.4	0.55	0.71	0.55	46.3
Approach			1353	5.7	1353	5.7	0.886	44.2	LOS D	48.5	361.4	0.93	0.94	1.03	34.7
All Vehicles			2926	6.6	2926	6.6	0.886	45.8	LOS D	48.5	361.4	0.87	0.86	0.96	34.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Table 7.32: Site 08 - Lane Level of Service Movement Summary [Samora Machel and Bishop Gaul Avenue (Samora Corridor)]

	Approaches				Intersection
	South	East	North	West	
LOS	E	C	E	D	D

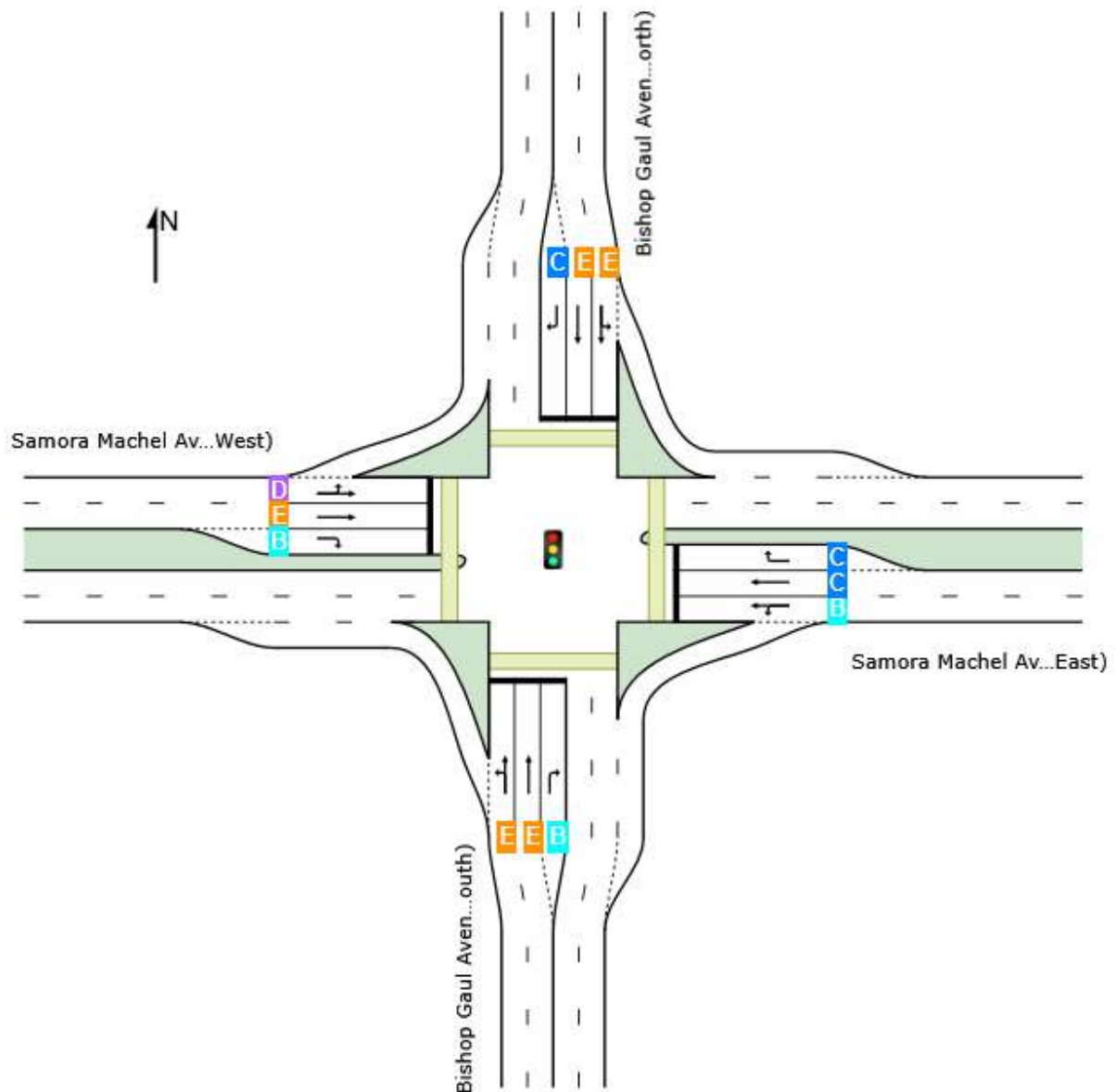


Figure 7.23: Site 08 - Lane Level of Service [Samora Machel and Bishop Gaul Avenue (Samora Corridor)]

Table 7.33: Site 08 - Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane [Samora Machel and Bishop Gaul Avenue (Samora Corridor)]

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site Practical Cycle Time)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.68	0.28	0.87	0.89	0.89

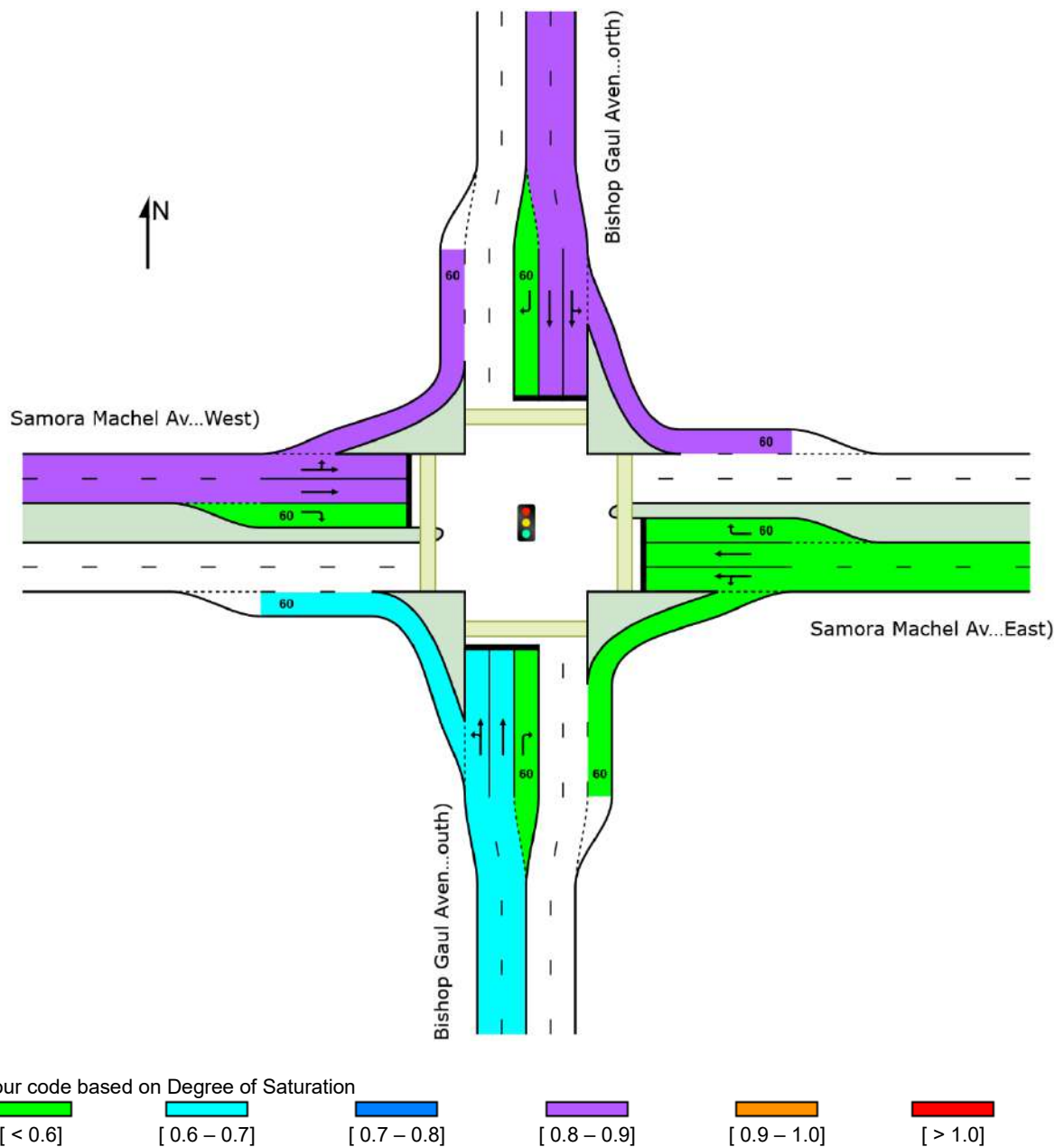


Figure 7.24: Site 08 - Lane Level of Service [Samora Machel and Bishop Gaul Avenue (Samora Corridor)]

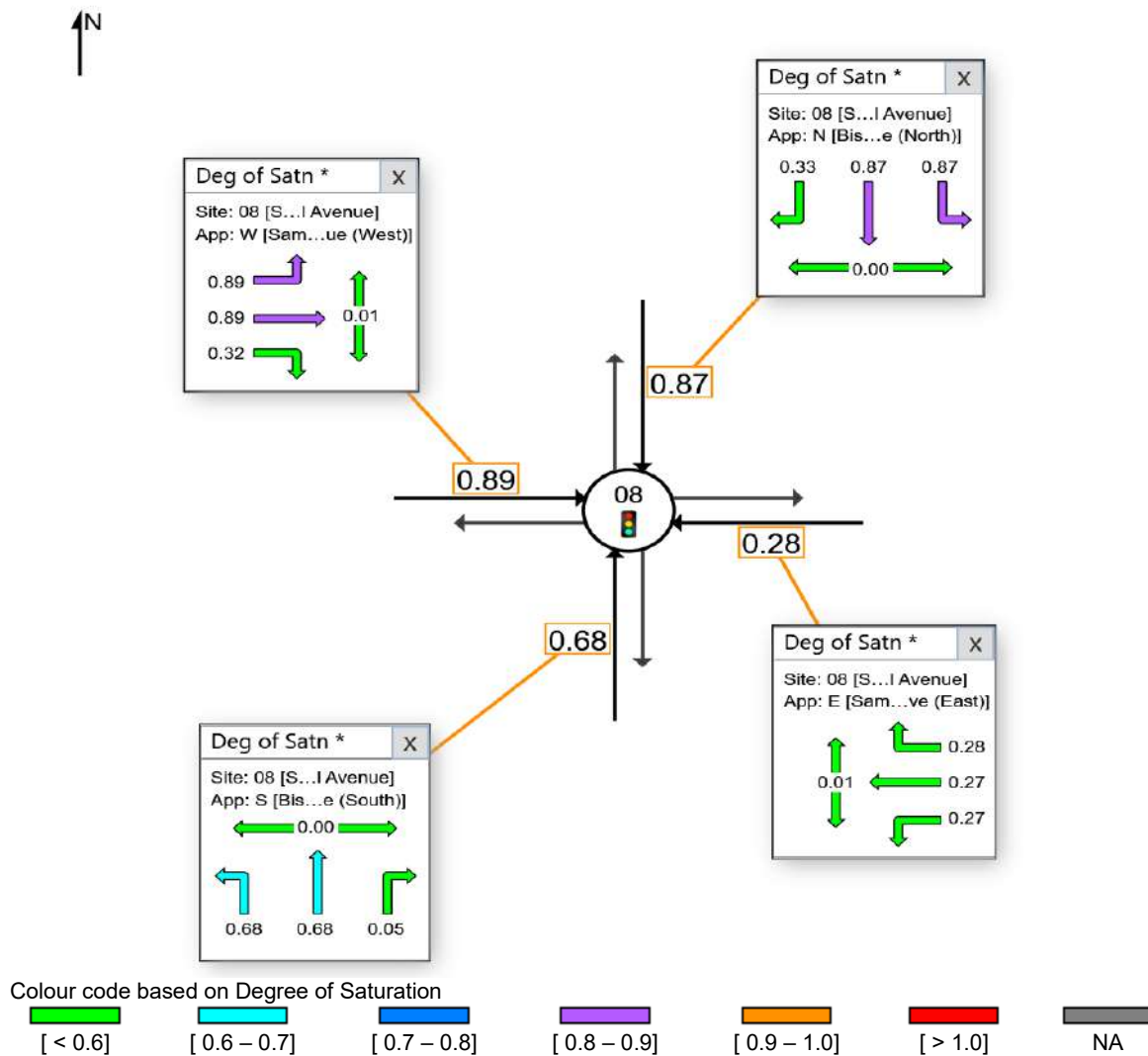


Figure 7.25: Site 08 - Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per movement [Samora Machel and Bishop Gaul Avenue (Samora Corridor)]

Site 09: Samora Machel Avenue and Rekayi Tangwena
15-hour Average Daily Traffic (ADT) Results

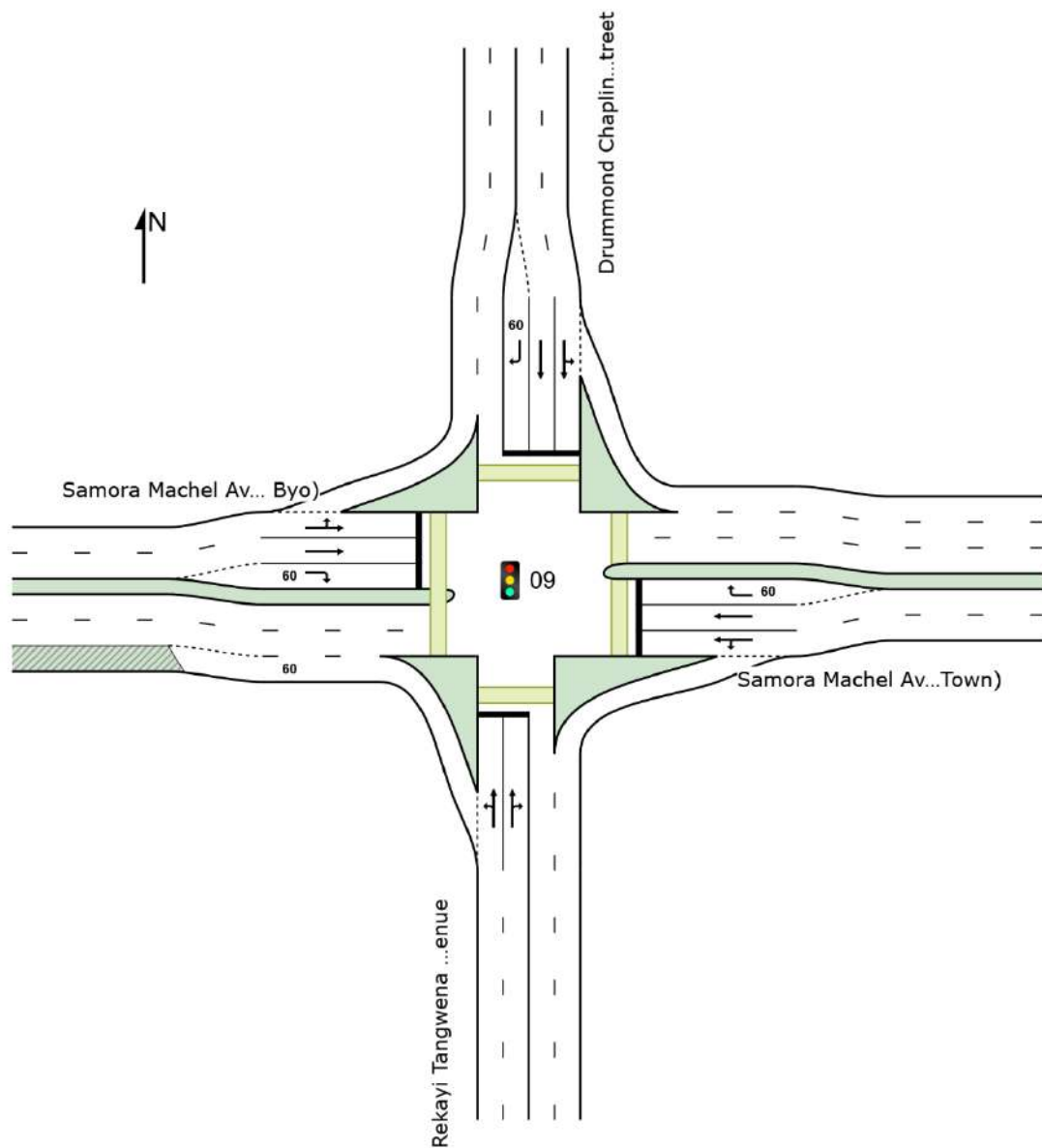


Figure 7.26: Site 09 Samora Machel and Rekayi Tangwena Avenue (Samora Corridor)

Table 7.34: Site 09 Movement Summary Samora Machel and Rekayi Tangwena Avenue (Samora Corridor)

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Rekayi Tangwena Avenue															
1	L2	All MCs	109	4.6	109	4.6	0.534	6.2	LOS A	39.4	287.3	0.74	0.69	0.74	40.3
2	T1	All MCs	724	2.9	724	2.9	0.534	33.2	LOS C	39.4	287.3	0.75	0.70	0.75	40.7
3	R2	All MCs	120	9.8	120	9.8 *	0.534	54.3	LOS D	9.9	76.5	0.99	0.86	0.99	30.1
Approach			954	4.0	954	4.0	0.534	32.8	LOS C	39.4	287.3	0.78	0.72	0.78	38.9
East: Samora Machel Avenue (East From Town)															
4	L2	All MCs	146	10.7	146	10.7	0.816	10.2	LOS B	28.8	227.6	0.98	0.92	1.04	31.1
5	T1	All MCs	526	6.8	526	6.8 *	0.816	75.3	LOS E	28.8	227.6	0.99	0.93	1.08	30.3
6	R2	All MCs	122	3.7	122	3.7 *	0.495	59.2	LOS E	6.2	46.4	0.92	0.87	0.92	31.5
Approach			793	7.0	793	7.0	0.816	60.9	LOS E	28.8	227.6	0.98	0.92	1.05	29.9
North: Drummond Chaplin Street															
7	L2	All MCs	265	4.1	265	4.1	0.826	7.8	LOS A	39.7	290.9	0.92	0.88	0.94	36.1
8	T1	All MCs	945	2.8	945	2.8 *	0.826	58.1	LOS E	39.7	290.9	0.92	0.87	0.95	37.1
9	R2	All MCs	98	1.1	98	1.1	0.196	40.7	LOS D	3.4	24.4	0.61	0.72	0.61	42.7
Approach			1308	2.9	1308	2.9	0.826	46.6	LOS D	39.7	290.9	0.90	0.86	0.92	34.0
West: Samora Machel Avenue (West From Byo)															
10	L2	All MCs	125	3.9	125	3.9	0.252	5.7	LOS A	13.1	98.5	0.77	0.70	0.77	35.5
11	T1	All MCs	327	5.2	327	5.2	0.252	59.3	LOS E	13.1	98.5	0.83	0.70	0.83	34.2
12	R2	All MCs	113	3.6	113	3.6	0.691	47.1	LOS D	5.4	39.7	1.00	0.81	1.07	33.1
Approach			564	4.6	564	4.6	0.691	45.0	LOS D	13.1	98.5	0.85	0.72	0.86	34.3
All Vehicles			3620	4.4	3620	4.4	0.826	45.8	LOS D	39.7	290.9	0.88	0.81	0.90	34.1

Table 7.35: Site 09 Lane Level of Service for Samora Machel and Rekayi Tangwena Avenue (Samora Corridor)

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

	Approaches				Intersection
	South	East	North	West	
LOS	C	E	D	D	D

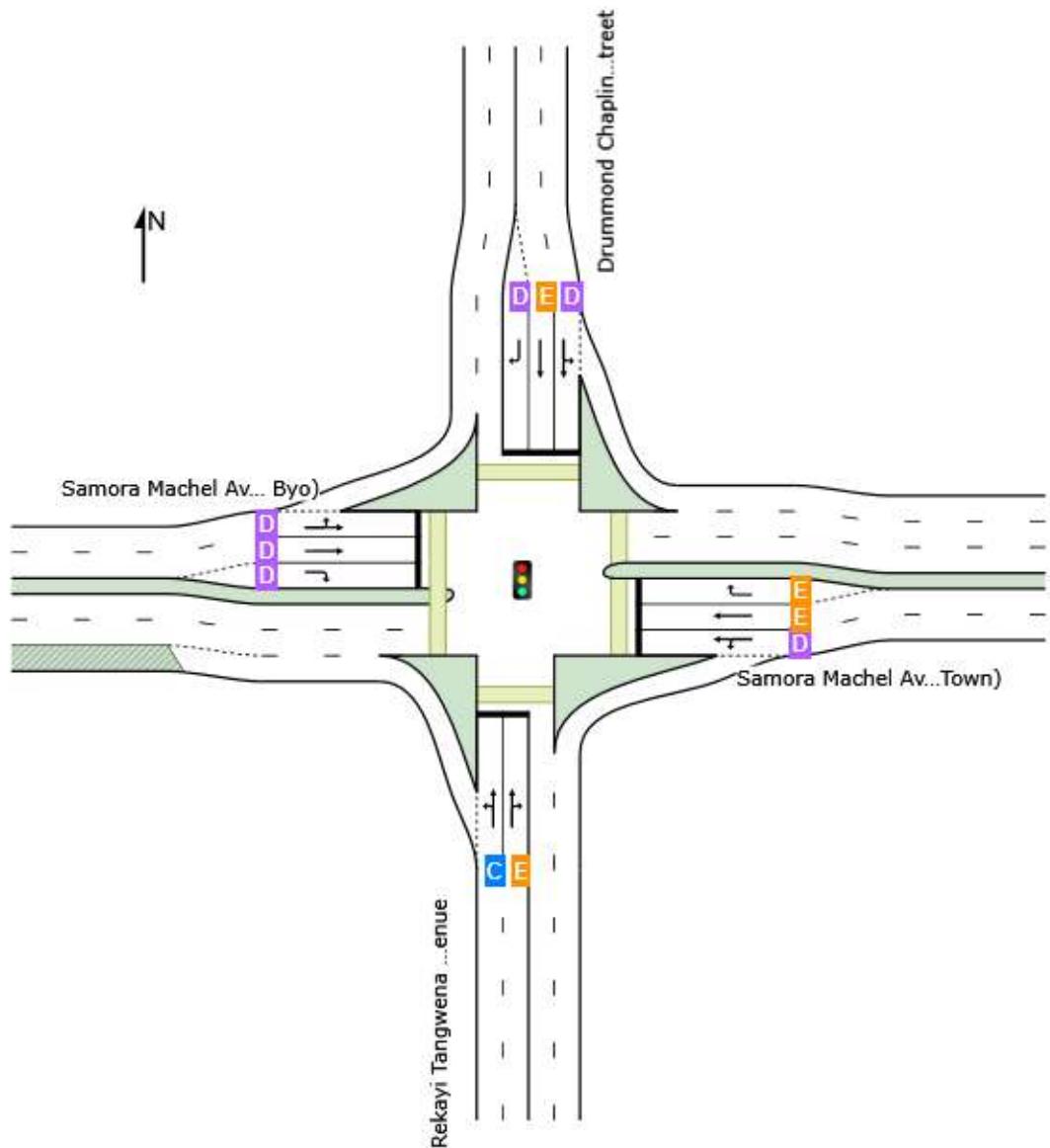


Figure 7.27: Site 09 Lane Level of Service for Samora Machel and Rekayi Tangwena Avenue (Samora Corridor)

Table 7.36: Site 09 Degree of Saturation for Samora Machel and Rekayi Tangwena Avenue (Samora Corridor)

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.53	0.82	0.83	0.69	0.83

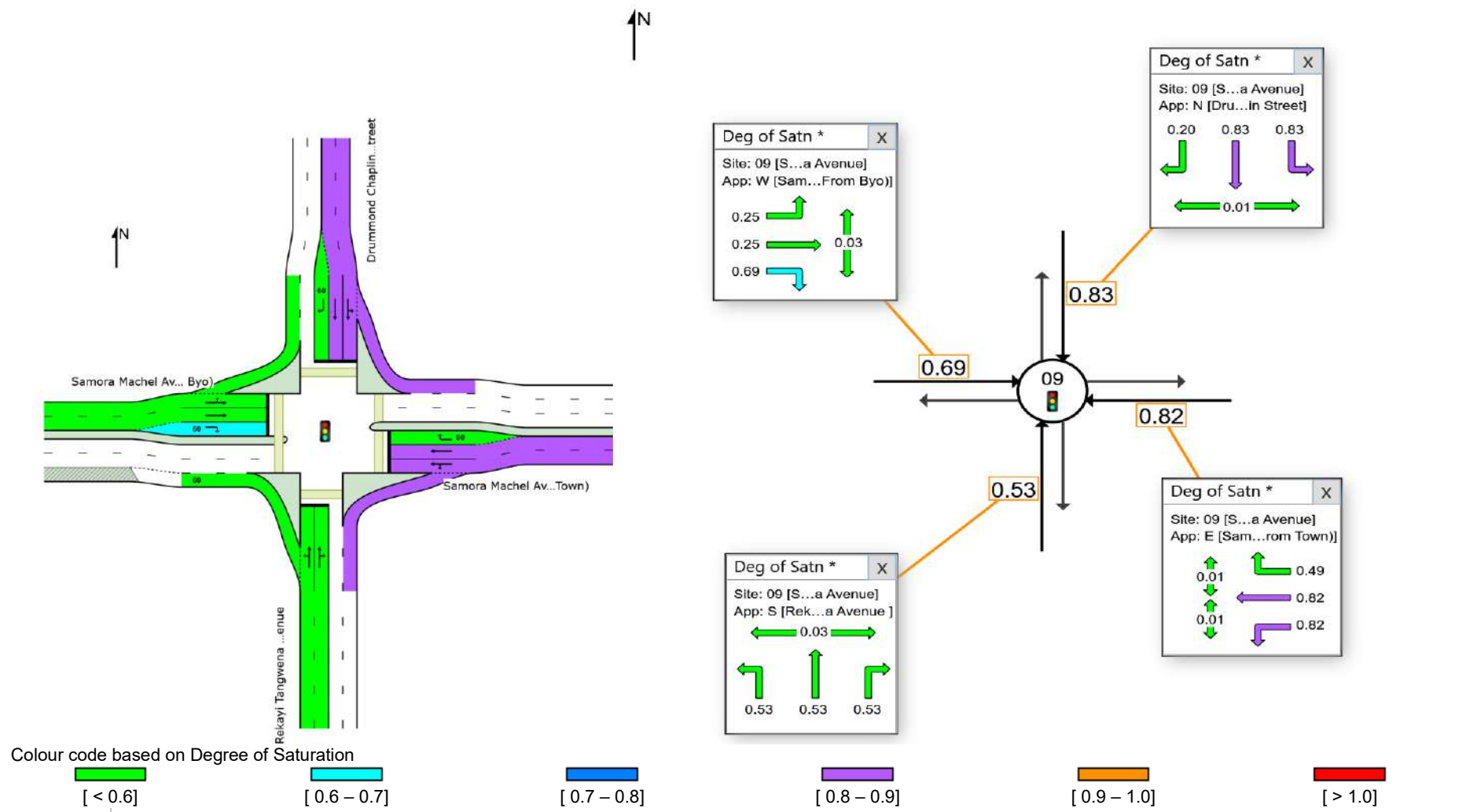


Figure 7.28: Site 09 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per movement [Samora Machel and Rekayi Tangwena Avenue (Site Folder: Samora Corridor)]

Site 10: Samora Machel Avenue and Prince Edward Road

15-hour Average Daily Traffic (ADT) Results

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated

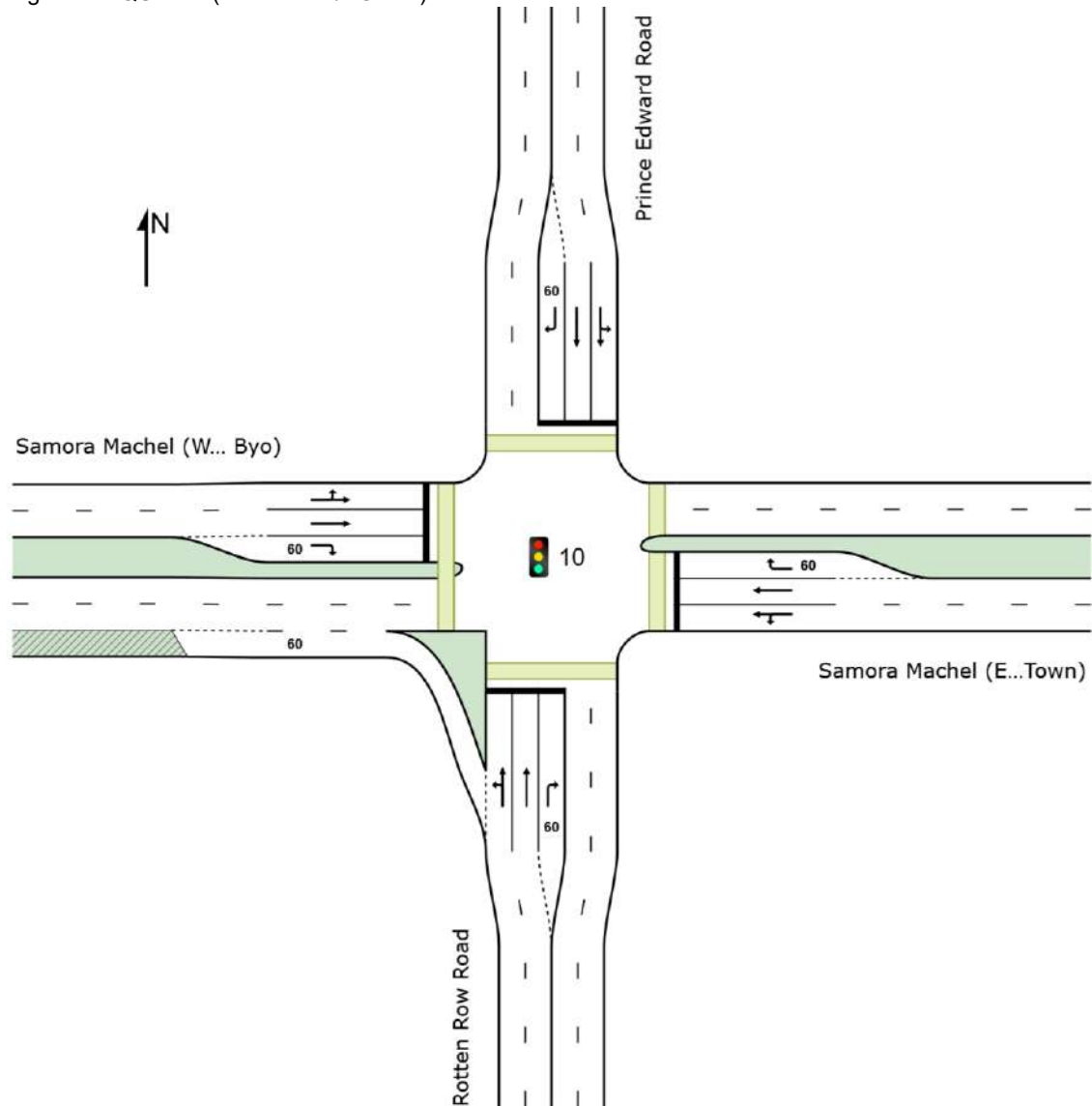


Figure 7.29: Site 10 Movement Summary [Samora Machel Av and Rotten Row (Samora Corridor)]

Table 7.37: Site 10 Movement Summary [Samora Machel Av and Rotten Row (Samora Corridor)]

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site Practical Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Eff. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Rotten Row Road															
1	L2	All MCs	230	4.4	230	4.4	0.454	5.8	LOS A	10.1	74.0	0.88	0.78	0.88	41.0
2	T1	All MCs	492	2.2	492	2.2	* 0.454	35.3	LOS D	10.8	77.8	0.90	0.76	0.90	42.4
3	R2	All MCs	56	7.2	56	7.2	0.136	16.5	LOS B	0.9	6.7	0.78	0.72	0.78	45.6
Approach			778	3.2	778	3.2	0.454	25.2	LOS C	10.8	77.8	0.89	0.76	0.89	42.2
East: Samora Machel (East From Town)															
4	L2	All MCs	66	25.9	66	25.9	0.297	27.1	LOS C	4.0	34.1	0.91	0.74	0.91	38.3
5	T1	All MCs	210	5.0	210	5.0	* 0.297	31.0	LOS C	4.5	34.1	0.93	0.73	0.93	40.4
6	R2	All MCs	262	3.6	262	3.6	* 0.434	17.4	LOS B	4.9	36.1	0.85	0.79	0.85	45.2
Approach			538	6.9	538	6.9	0.434	23.9	LOS C	4.9	36.1	0.89	0.76	0.89	42.3
North: Prince Edward Road															
7	L2	All MCs	102	11.3	102	11.3	0.190	12.9	LOS B	4.7	37.4	0.71	0.67	0.71	44.0
8	T1	All MCs	366	5.0	366	5.0	0.190	17.2	LOS B	5.7	43.9	0.69	0.59	0.69	47.8
9	R2	All MCs	335	3.9	335	3.9	* 0.390	17.3	LOS B	7.4	54.3	0.75	0.79	0.75	45.3
Approach			803	5.4	803	5.4	0.390	16.7	LOS B	7.4	54.3	0.72	0.68	0.72	46.2
West: Samora Machel (West From Byo)															
10	L2	All MCs	30	17.0	30	17.0	0.191	25.7	LOS C	2.5	20.4	0.91	0.71	0.91	38.5
11	T1	All MCs	147	5.8	147	5.8	0.191	30.2	LOS C	2.9	21.4	0.91	0.70	0.91	40.6
12	R2	All MCs	172	5.4	172	5.4	0.302	17.8	LOS B	3.2	23.8	0.83	0.76	0.83	45.0
Approach			349	6.5	349	6.5	0.302	23.7	LOS C	3.2	23.8	0.87	0.73	0.87	42.4
All Vehicles			2467	5.2	2467	5.2	0.454	21.9	LOS C	10.8	77.8	0.83	0.73	0.83	43.5

Table 7.38: Site 10 Lane Level of Service [Samora Machel Av and Rotten Row (Samora Corridor)]

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site Practical Cycle Time)

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	B	C	C

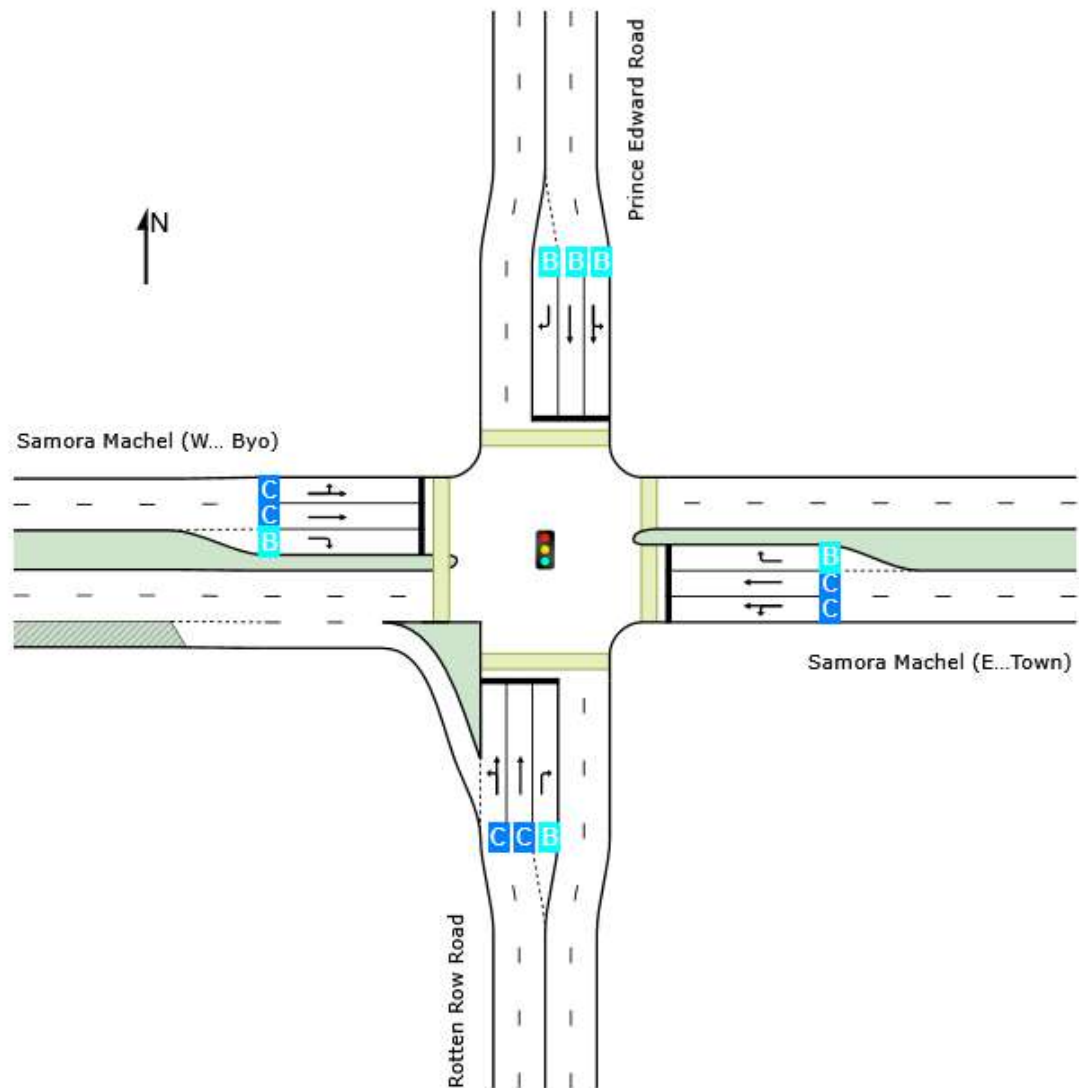


Figure 7.30: Site 10 Lane Level of Service [Samora Machel Av and Rotten Row (Samora Corridor)]

Table 7.39: Site 10 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane [Samora Machel Av and Rotten Row (Samora Corridor)]

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site Practical Cycle Time)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.45	0.43	0.39	0.30	0.45

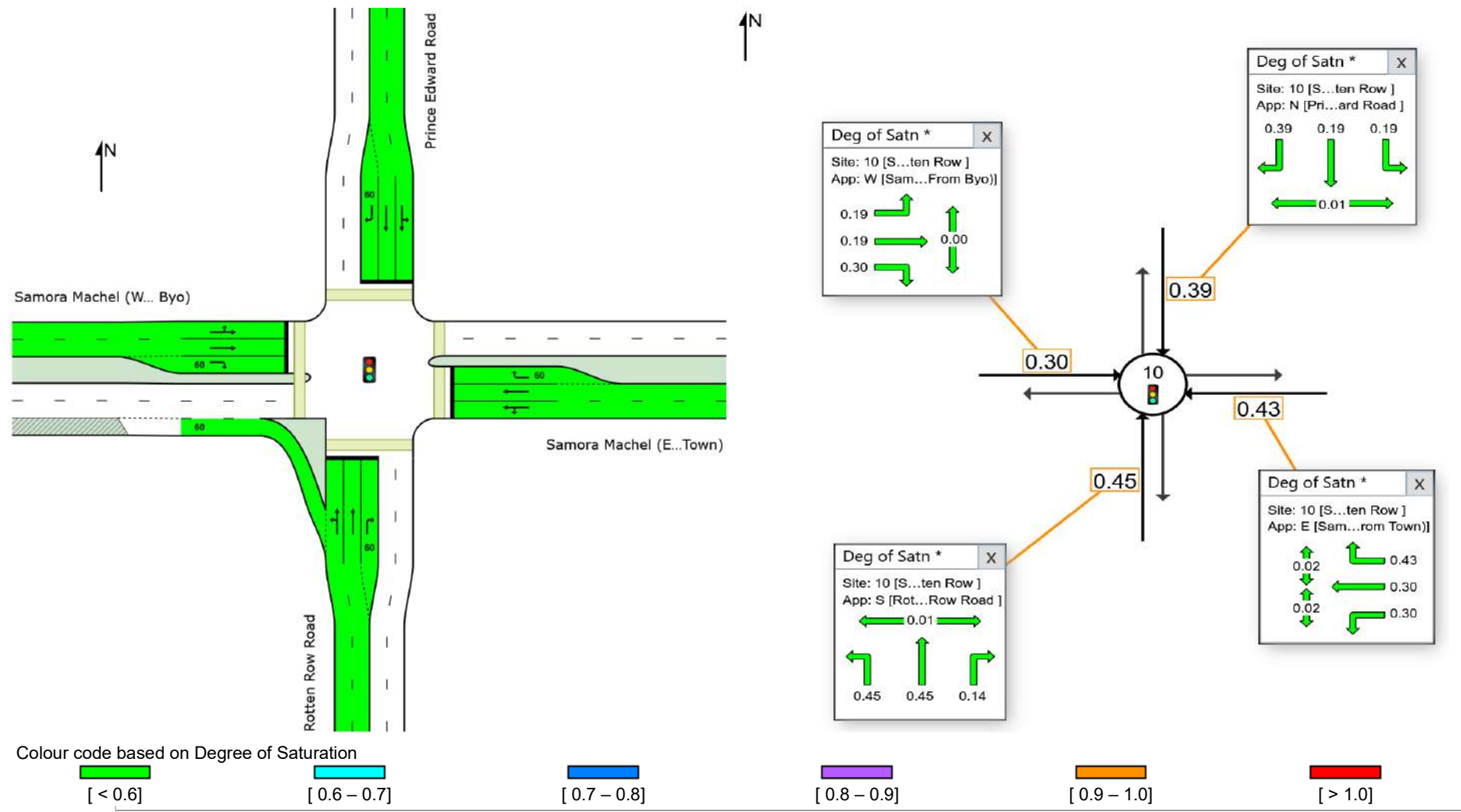


Figure 7.31: Site 10 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane [Samora Machel Av and Rotten Row (Samora Corridor)]

Site 11: Samora Machel Avenue and Leopold Takawira Street
15-hour Average Daily Traffic (ADT) Results

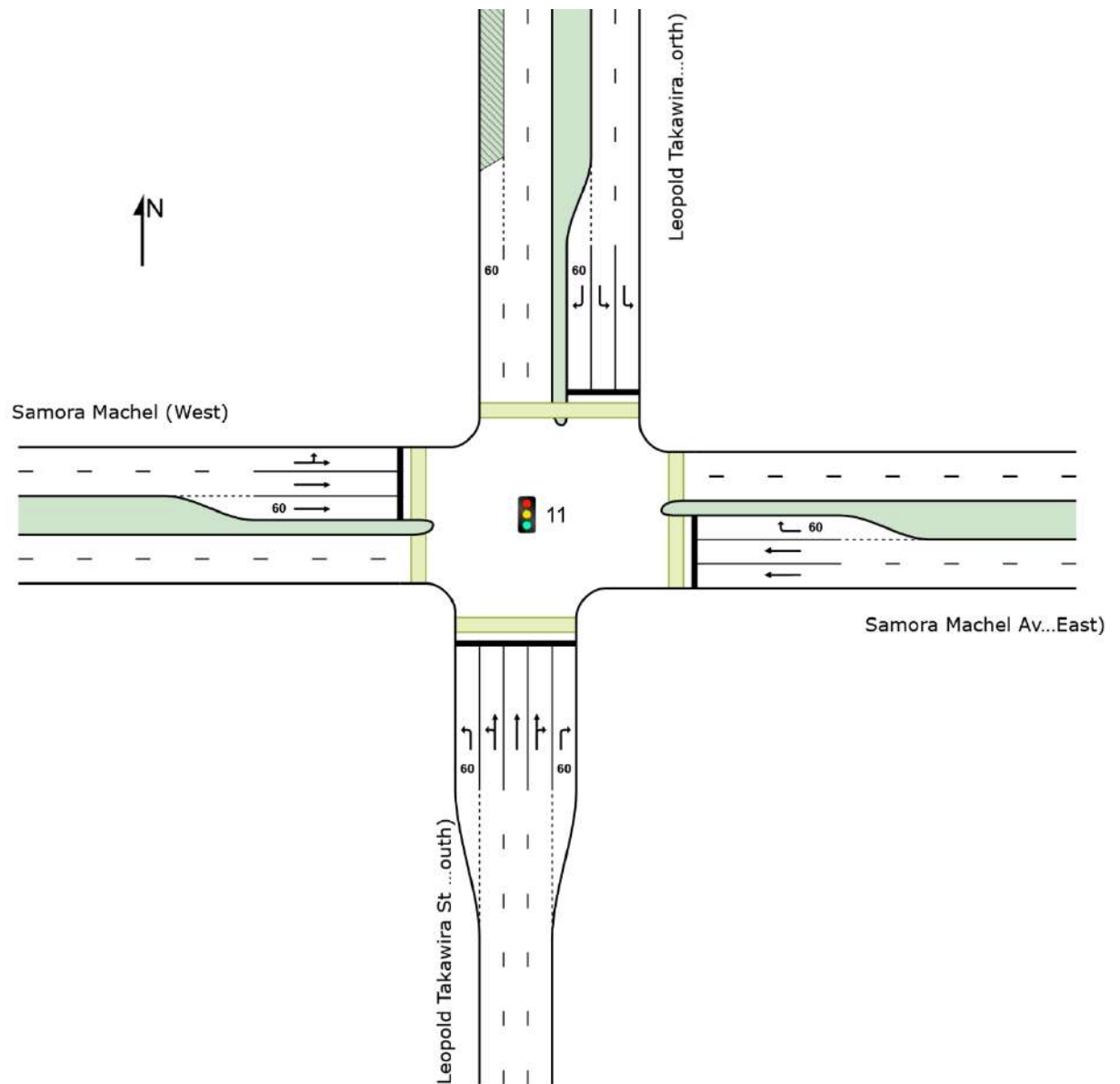


Figure 7.32: Site 11 Samora Machel Avenue and Leopold Takawira Street (Samora Corridor)

Site 12: Samora Machel Avenue and Sam Nujoma Street

15-hour Average Daily Traffic (ADT) Results

SITE LAYOUT

 Site: 12 [Samora Machel Av and Sam Nujoma Street (Site Folder: Samora Corridor)]

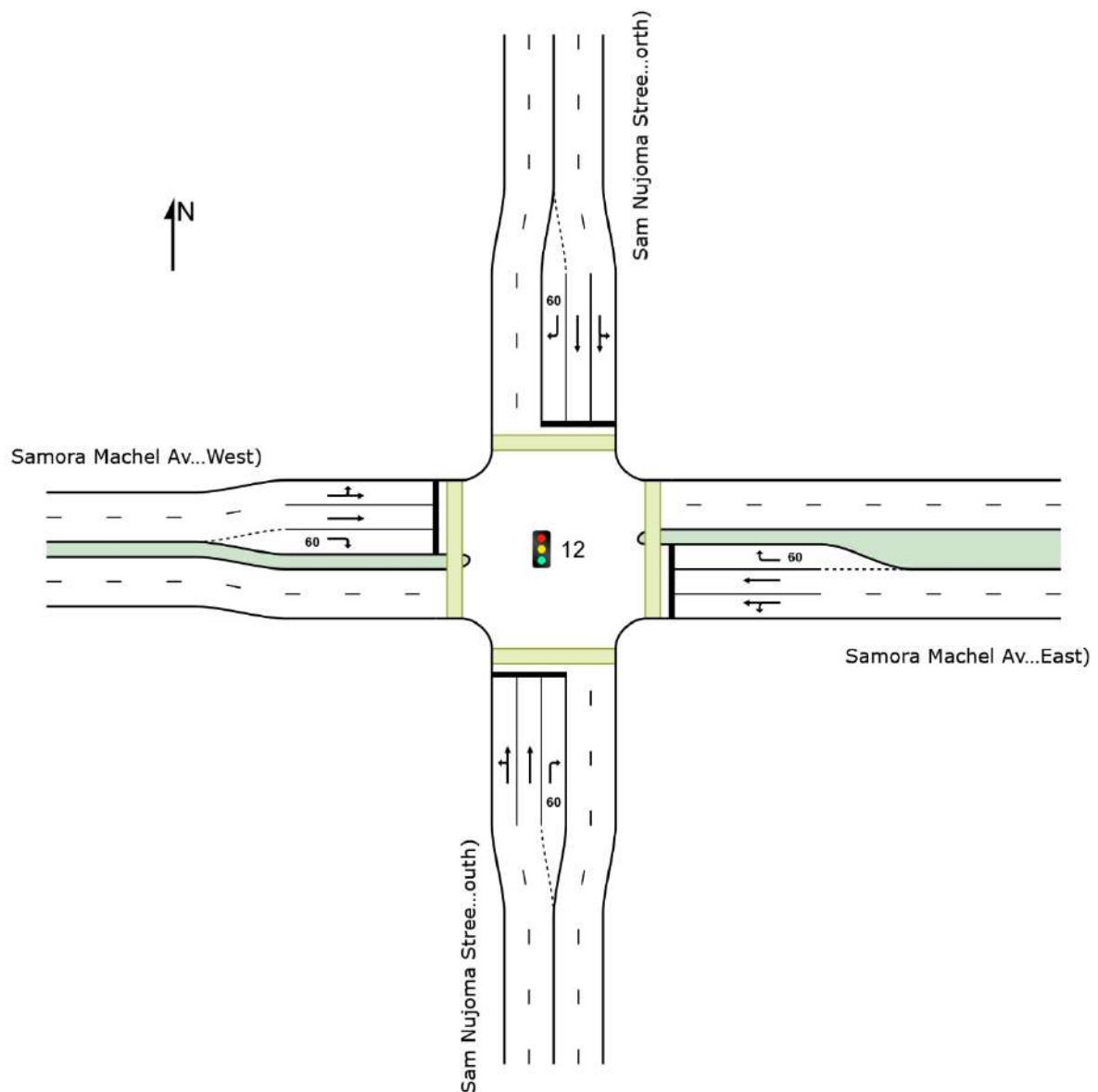


Figure 7.33: Site 12 Samora Machel Av and Sam Nujoma Street (Samora Corridor)]

Table 7.40: Site 12 Movement Summary Samora Machel Av and Sam Nujoma Street (Samora Corridor)]

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Eff. No. of Cycles	Aver. Speed km/h
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				
South: Sam Nujoma Street (South)															
1	L2	All MCs	129	2.1	129	2.1	0.237	31.1	LOS C	14.4	104.0	0.65	0.63	0.65	40.1
2	T1	All MCs	567	2.8	567	2.8	0.237	42.3	LOS D	15.4	110.9	0.64	0.58	0.64	42.0
3	R2	All MCs	246	4.5	246	4.5 *	1.824	848.2	LOS F	57.1	426.4	1.00	2.16	3.78	4.1
Approach			943	3.2	943	3.2	1.824	251.2	LOS F	57.1	426.4	0.74	1.00	1.46	11.7
East: Samora Machel Av (East)															
4	L2	All MCs	484	7.1	484	7.1	0.377	33.3	LOS C	22.5	179.7	0.70	0.79	0.70	37.6
5	T1	All MCs	353	3.4	353	3.4	0.355	57.5	LOS E	16.1	118.6	0.69	0.59	0.69	41.5
6	R2	All MCs	299	2.6	299	2.6 *	1.841	865.9	LOS F	69.5	511.2	1.00	2.15	3.80	4.1
Approach			1136	4.8	1136	4.8	1.841	260.0	LOS F	69.5	511.2	0.78	1.09	1.51	11.3
North: Sam Nujoma Street (North)															
7	L2	All MCs	186	7.6	186	7.6	0.462	34.7	LOS C	31.0	235.8	0.74	0.70	0.74	38.7
8	T1	All MCs	940	3.5	940	3.5	0.462	34.4	LOS C	31.0	235.8	0.74	0.67	0.74	40.4
9	R2	All MCs	119	3.2	119	3.2	0.433	52.4	LOS D	6.5	47.7	0.77	0.78	0.77	34.7
Approach			1245	4.1	1245	4.1	0.462	36.1	LOS D	31.0	235.8	0.74	0.69	0.74	37.4
West: Samora Machel Av (West)															
10	L2	All MCs	742	1.3	742	1.3	0.535	35.9	LOS D	37.8	268.7	0.77	0.82	0.77	36.7
11	T1	All MCs	131	19.5	131	19.5	0.097	23.8	LOS C	5.2	50.7	0.60	0.48	0.60	43.1
12	R2	All MCs	131	6.4	131	6.4	0.681	54.6	LOS D	8.8	68.6	0.91	0.86	0.97	31.0
Approach			1004	4.3	1004	4.3	0.681	36.8	LOS D	37.8	268.7	0.77	0.78	0.78	36.5
All Vehicles			4327	4.1	4327	4.1	1.841	141.9	LOS F	69.5	511.2	0.76	0.88	1.11	17.9

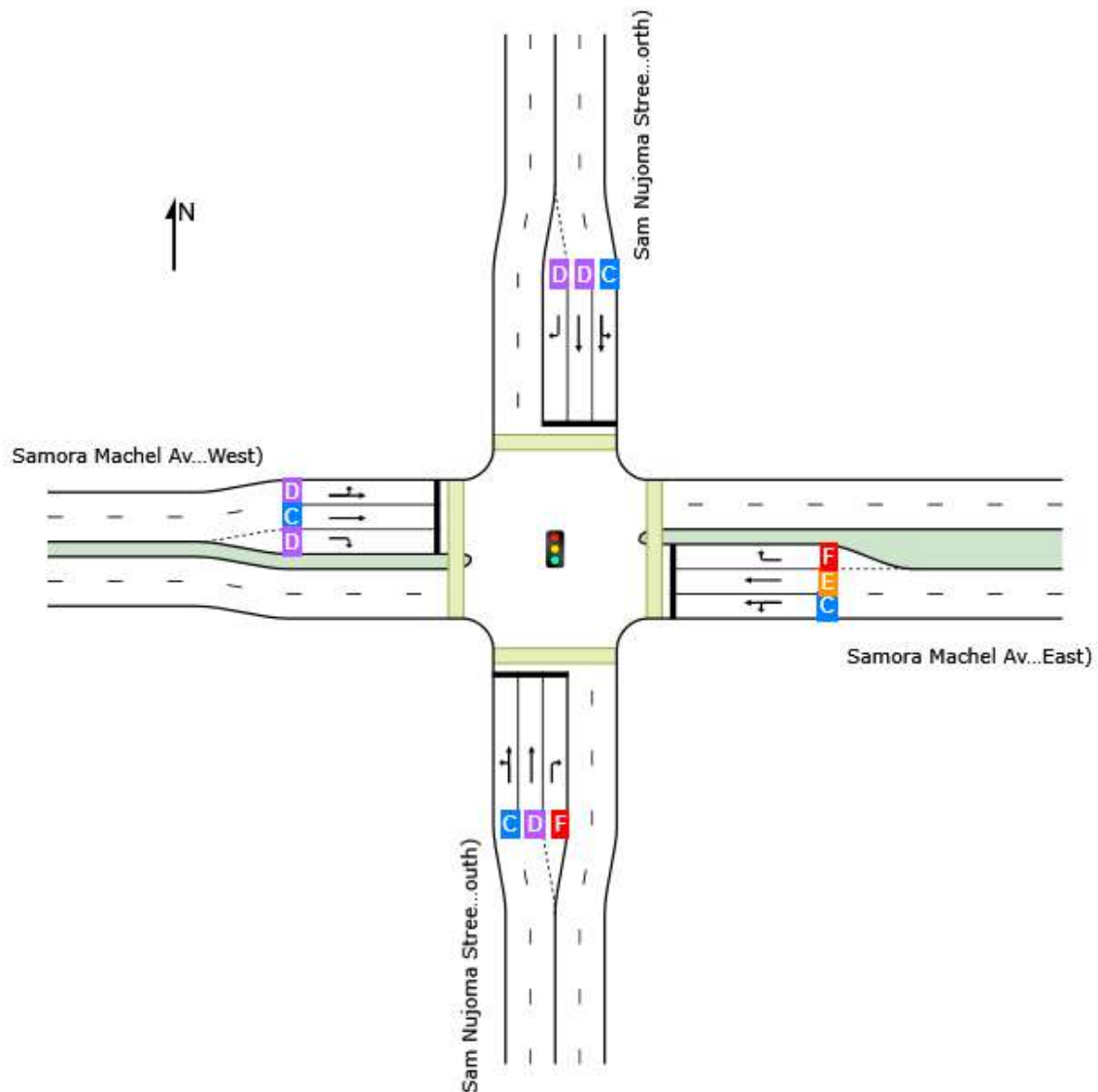


Figure 7.34: Site 12 Lane Level of Service Samora Machel Av and Sam Nujoma Street (Samora Corridor)

Table 7.41: Site 12 Lane Level of Service Samora Machel Av and Sam Nujoma Street (Samora Corridor)

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

	Approaches				Intersection
	South	East	North	West	
LOS	F	F	D	D	F

Table 7.42: Site 12 Degree of Saturation Samora Machel Av and Sam Nujoma Street (Samora Corridor)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	1.82	1.84	0.46	0.68	1.84

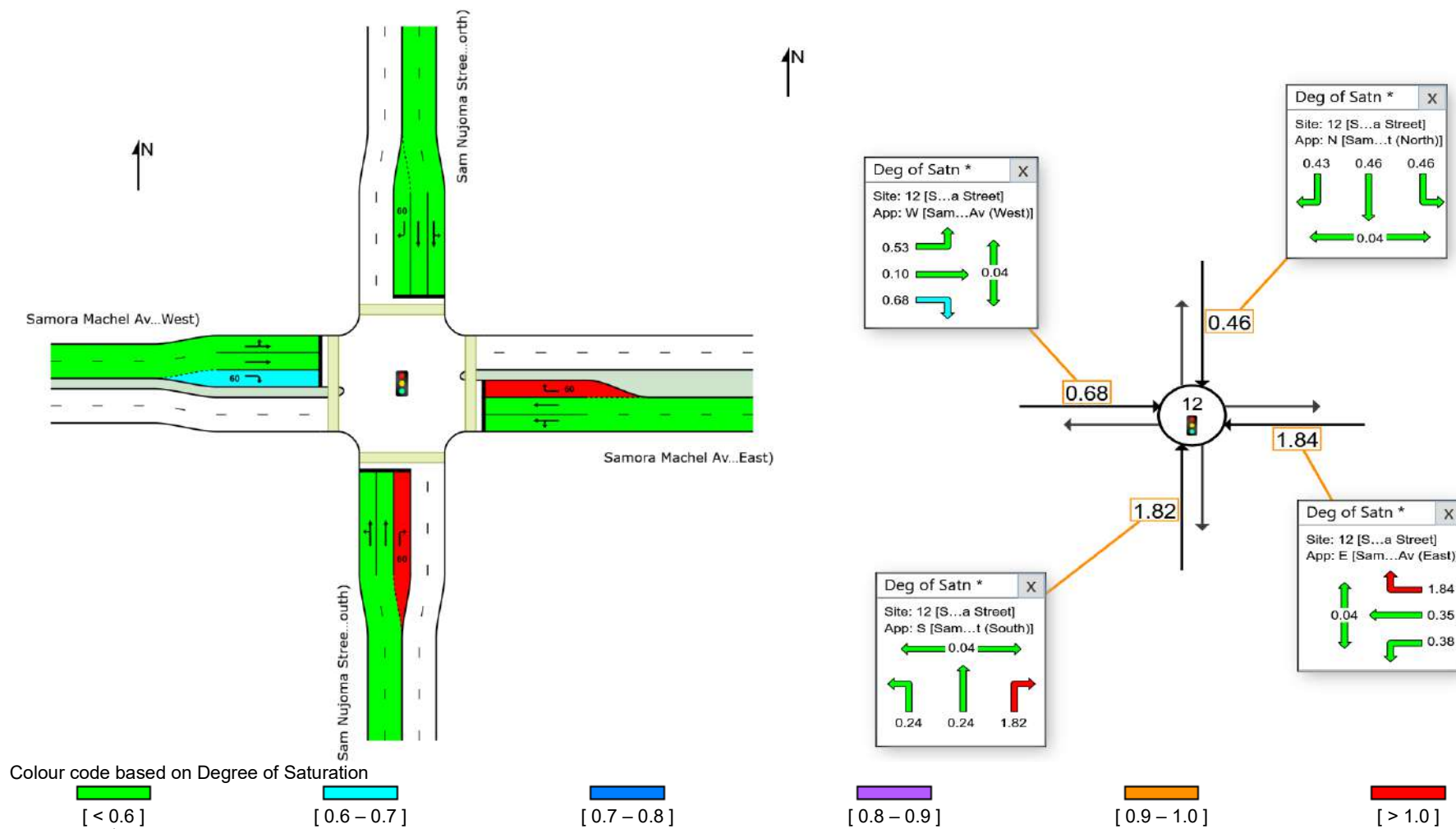


Figure 7.35: Ratio of Arrival Flow to Capacity, v/c ratio per movement - Site 12 Samora Machel Av and Sam Nujoma Street (Samora Corridor)

**Site 12: Samora Machel Avenue and Emmerson Dambudzo Mnangagwa Drive
Intersection
15-hour Average Daily Traffic (ADT) Results**

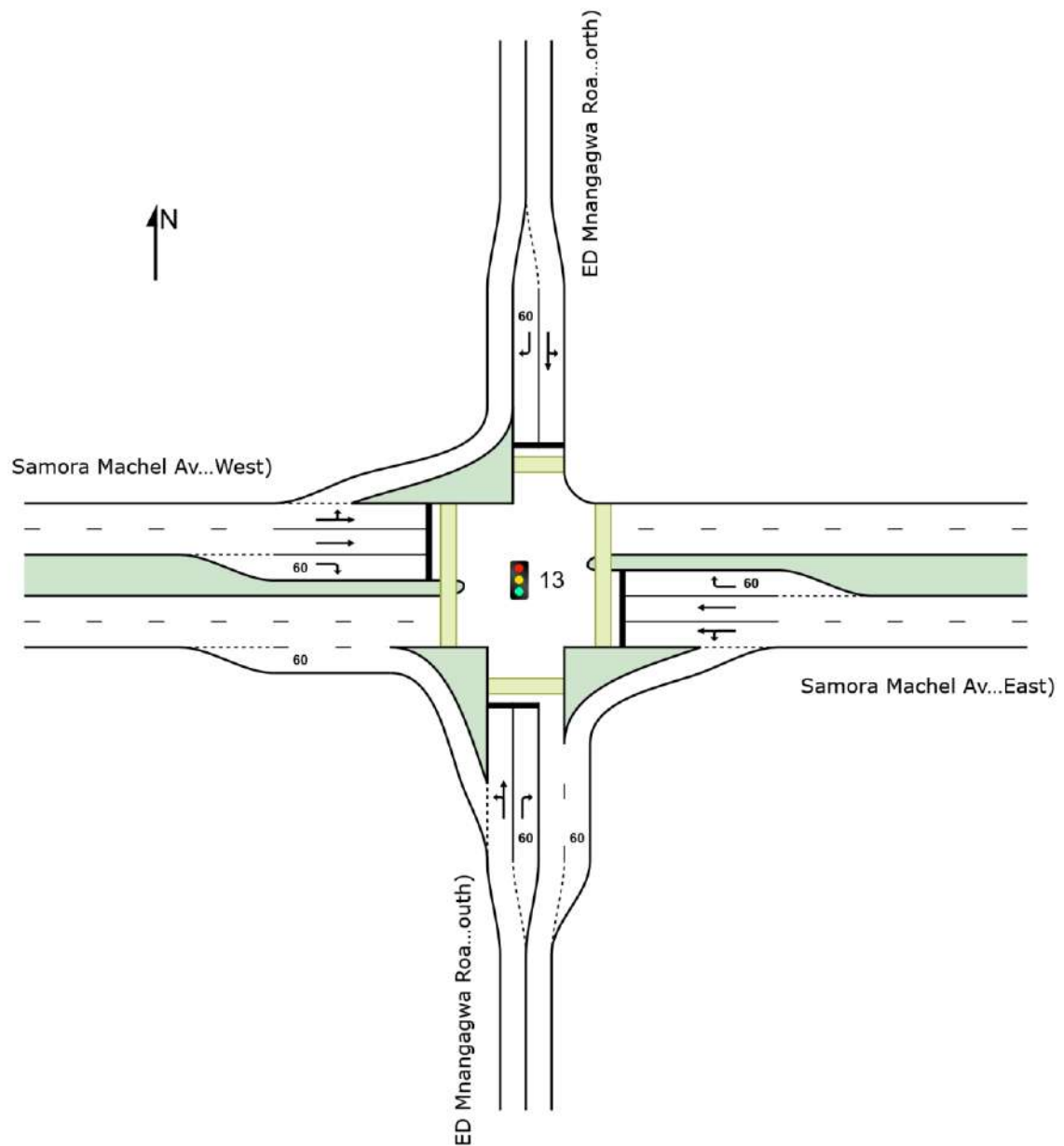


Figure 7.36: Site 13 Samora Machel Av and E.D Mnangagwa Road (Site Folder: Samora Corridor)

Table 7.43: Site 13 Movement Summary Samora Machel Av and E.D Mnangagwa Road (Samora Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: ED Mnangagwa Road (South)															
1	L2	All MCs	46	5.2	46	5.2	1.174	211.3	LOS F	67.3	498.8	1.00	1.81	2.06	12.6
2	T1	All MCs	447	3.5	447	3.5 *	1.174	255.6	LOS F	67.3	498.8	1.00	1.81	2.06	12.7
3	R2	All MCs	354	2.2	354	2.2 *	0.534	38.1	LOS D	10.1	73.3	0.60	0.76	0.60	46.3
Approach			848	3.0	848	3.0	1.174	162.3	LOS F	67.3	498.8	0.83	1.37	1.45	16.4
East: Samora Machel Av. (East)															
4	L2	All MCs	196	4.2	196	4.2	0.734	7.8	LOS A	17.7	132.8	0.98	0.87	1.02	29.2
5	T1	All MCs	281	5.6	281	5.6	0.734	107.9	LOS F	17.7	132.8	1.00	0.87	1.04	29.2
6	R2	All MCs	50	5.3	50	5.3	0.981	115.5	LOS F	4.5	34.3	1.00	0.96	1.66	21.1
Approach			527	5.0	527	5.0	0.981	71.5	LOS E	17.7	132.8	0.99	0.88	1.09	27.5
North: ED Mnangagwa Road (North)															
7	L2	All MCs	65	11.3	65	11.3	0.289	38.4	LOS D	15.0	117.9	0.70	0.63	0.70	38.7
8	T1	All MCs	259	5.8	259	5.8	0.289	32.7	LOS C	15.0	117.9	0.70	0.63	0.70	40.1
9	R2	All MCs	250	2.0	250	2.0	0.370	43.7	LOS D	9.5	69.0	0.83	0.86	0.83	35.2
Approach			574	4.8	574	4.8	0.370	38.2	LOS D	15.0	117.9	0.76	0.73	0.76	36.4
West: Samora Machel Avenue (West)															
10	L2	All MCs	19	19.2	19	19.2	1.151	160.4	LOS F	40.6	306.3	1.00	1.58	2.01	12.8
11	T1	All MCs	633	4.6	633	4.6 *	1.151	237.4	LOS F	42.8	319.9	1.00	1.59	2.01	13.0
12	R2	All MCs	54	2.3	54	2.3	0.616	112.1	LOS F	4.2	29.9	1.00	0.80	1.07	24.6
Approach			706	4.8	706	4.8	1.151	225.7	LOS F	42.8	319.9	1.00	1.53	1.94	12.8
All Vehicles			2655	4.3	2655	4.3	1.174	134.3	LOS F	67.3	498.8	0.89	1.18	1.36	18.7

Table 7.44: Site 13 Lane Level of Service Samora Machel Av and E.D Mnangagwa Road (Samora Corridor)

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

	Approaches				Intersection
	South	East	North	West	
LOS	F	E	D	F	F

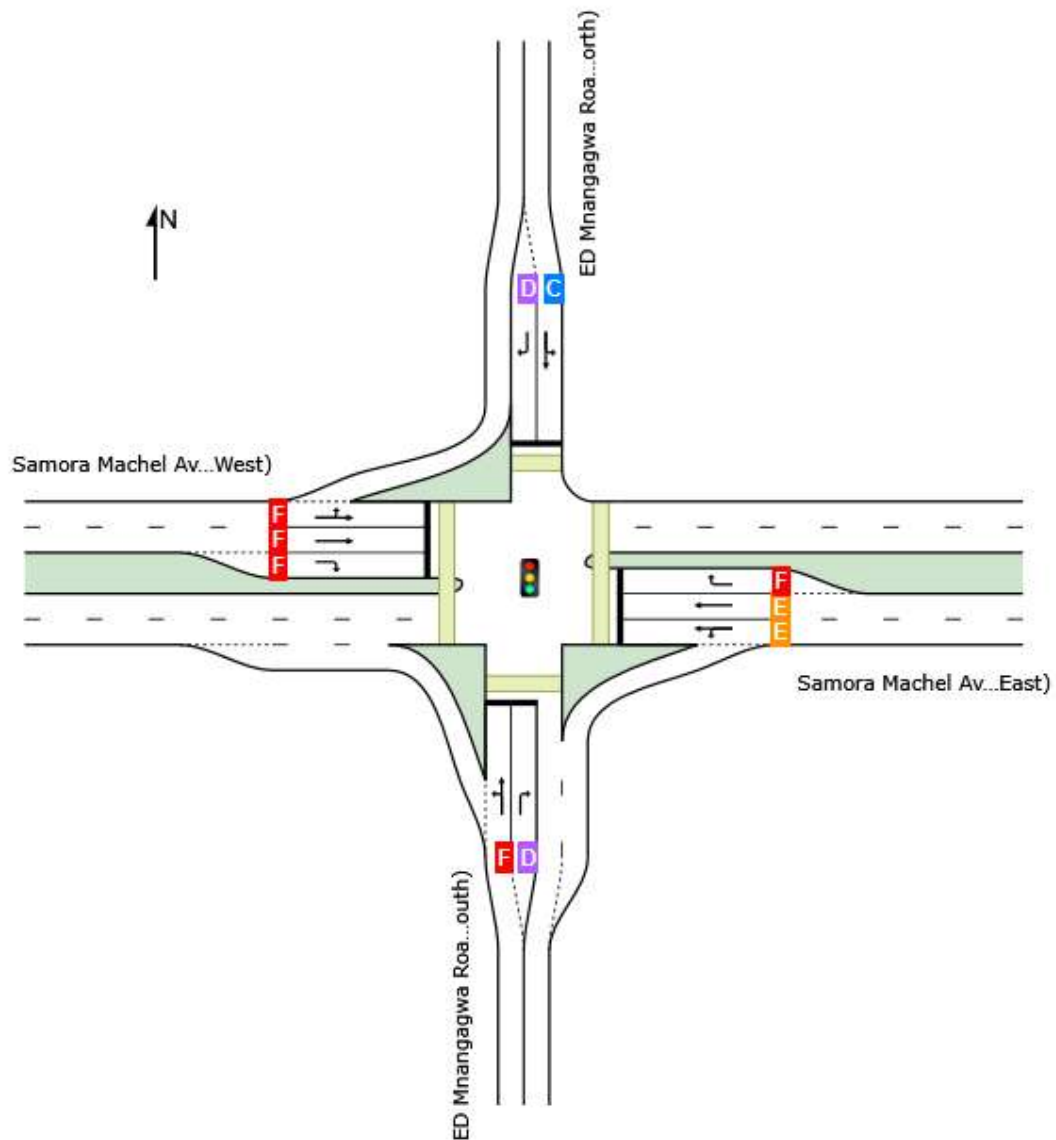


Figure 7.37: Site 13 Lane Level of Service Samora Machel Av and E.D Mnangagwa Road (Samora Corridor)

Table 7.45: Site 13 Degree of Saturation Samora Machel Av and E.D Mnangagwa Road (Samora Corridor)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	1.17	0.98	0.37	1.15	1.17

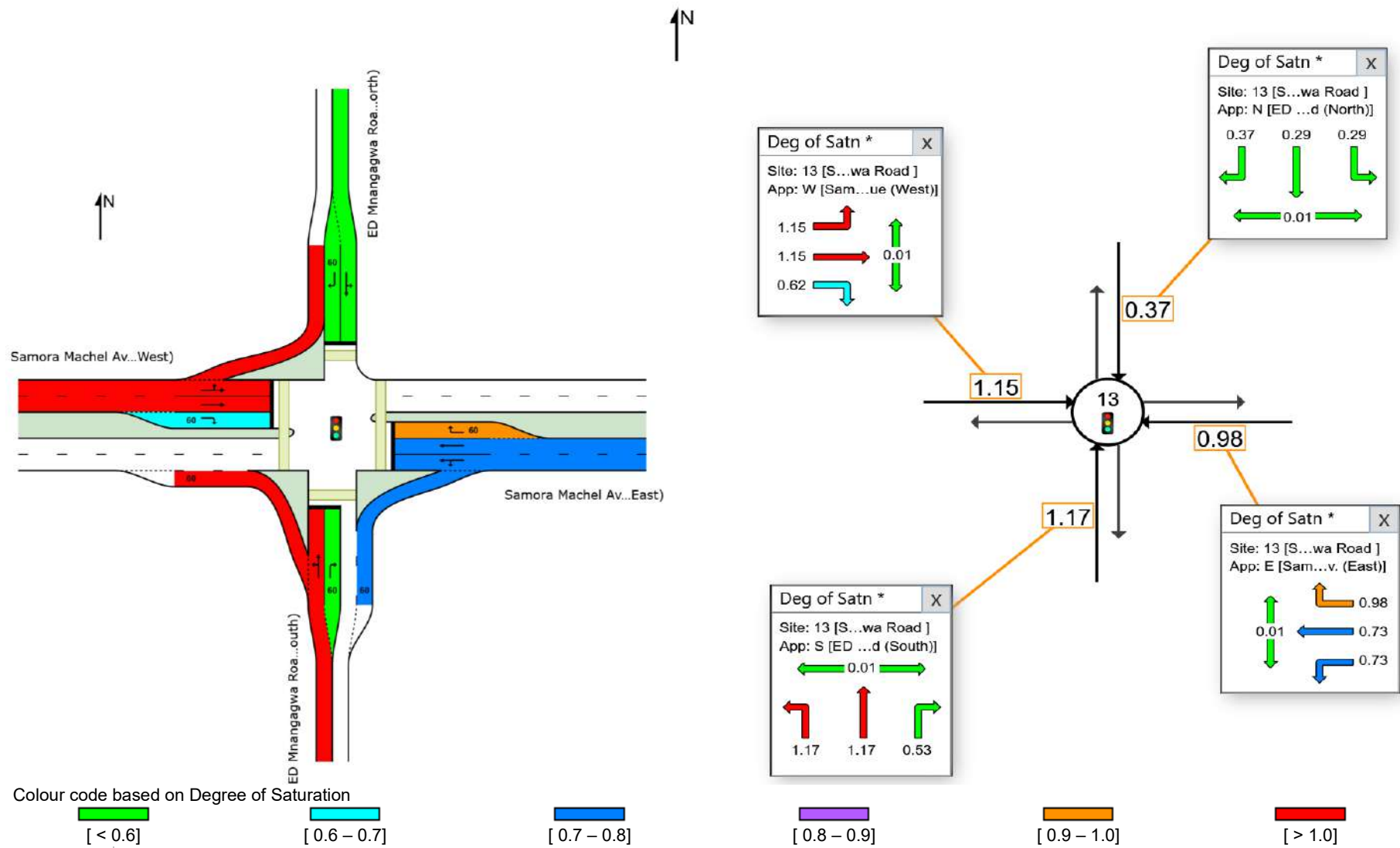


Figure 7.38: Site 13 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per movement Samora Machel Av and E.D Mnangagwa Road (Samora Corridor)

Site 14: Samora Machel Avenue and Glenara Intersection

15-hour Average Daily Traffic (ADT) Results

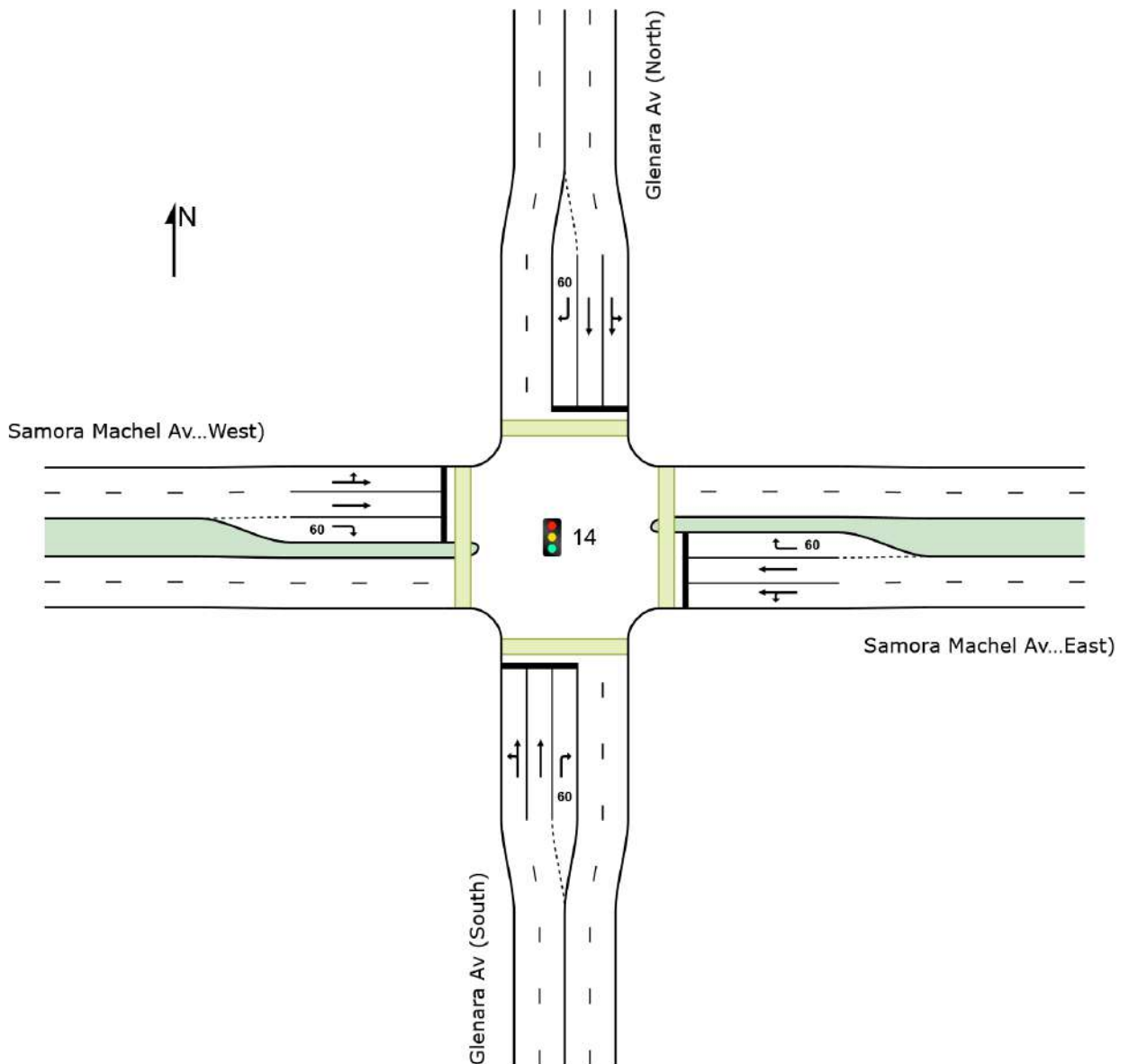


Figure 7.39: Site 14 Samora Machel Av and Glenara Road (Site Folder: Samora Corridor)

Table 7.46: Site 14 Samora Machel Av and Glenara Road (Site Folder: Samora Corridor)

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Eff. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Glenara Av (South)															
1	L2	All MCs	55	5.9	55	5.9	0.097	18.6	LOS B	3.1	25.3	0.57	0.56	0.57	46.1
2	T1	All MCs	232	11.9	232	11.9	0.097	12.9	LOS B	3.5	29.4	0.57	0.49	0.57	48.9
3	R2	All MCs	193	3.9	193	3.9	* 0.644	29.3	LOS C	7.2	53.8	0.84	0.83	0.88	39.5
Approach			480	8.0	480	8.0	0.644	20.2	LOS C	7.2	53.8	0.68	0.64	0.69	44.3
East: Samora Machel Av (East)															
4	L2	All MCs	372	8.1	372	8.1	0.557	29.2	LOS C	20.5	164.2	0.84	0.80	0.84	40.1
5	T1	All MCs	750	6.4	750	6.4	0.557	26.5	LOS C	20.5	164.2	0.84	0.75	0.84	42.8
6	R2	All MCs	177	3.1	177	3.1	0.720	44.9	LOS D	7.8	57.6	0.94	0.90	1.08	35.2
Approach			1300	6.5	1300	6.5	0.720	29.8	LOS C	20.5	164.2	0.86	0.78	0.88	39.8
North: Glenara Av (North)															
7	L2	All MCs	110	6.0	110	6.0	0.234	19.6	LOS B	8.6	64.1	0.61	0.59	0.61	45.8
8	T1	All MCs	632	3.5	632	3.5	0.234	13.9	LOS B	9.8	72.8	0.62	0.55	0.62	48.4
9	R2	All MCs	55	3.2	55	3.2	0.109	20.2	LOS C	1.4	10.1	0.59	0.70	0.59	43.7
Approach			797	3.8	797	3.8	0.234	15.2	LOS B	9.8	72.8	0.61	0.57	0.61	47.7
West: Samora Machel Av (West)															
10	L2	All MCs	111	2.3	111	2.3	0.287	26.3	LOS C	9.6	74.8	0.74	0.68	0.74	42.3
11	T1	All MCs	568	7.9	568	7.9	0.287	20.7	LOS C	10.8	86.1	0.74	0.64	0.74	44.4
12	R2	All MCs	98	2.6	98	2.6	* 0.712	47.6	LOS D	4.6	33.8	0.97	0.90	1.19	33.0
Approach			776	6.5	776	6.5	0.712	24.9	LOS C	10.8	86.1	0.77	0.68	0.80	42.3
All Vehicles			3353	6.0	3353	6.0	0.720	23.8	LOS C	20.5	164.2	0.75	0.69	0.77	42.7

Table 7.47: Site 14 Lane Level of Service Samora Machel Av and Glenara Road (Samora Corridor)

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	B	C	C

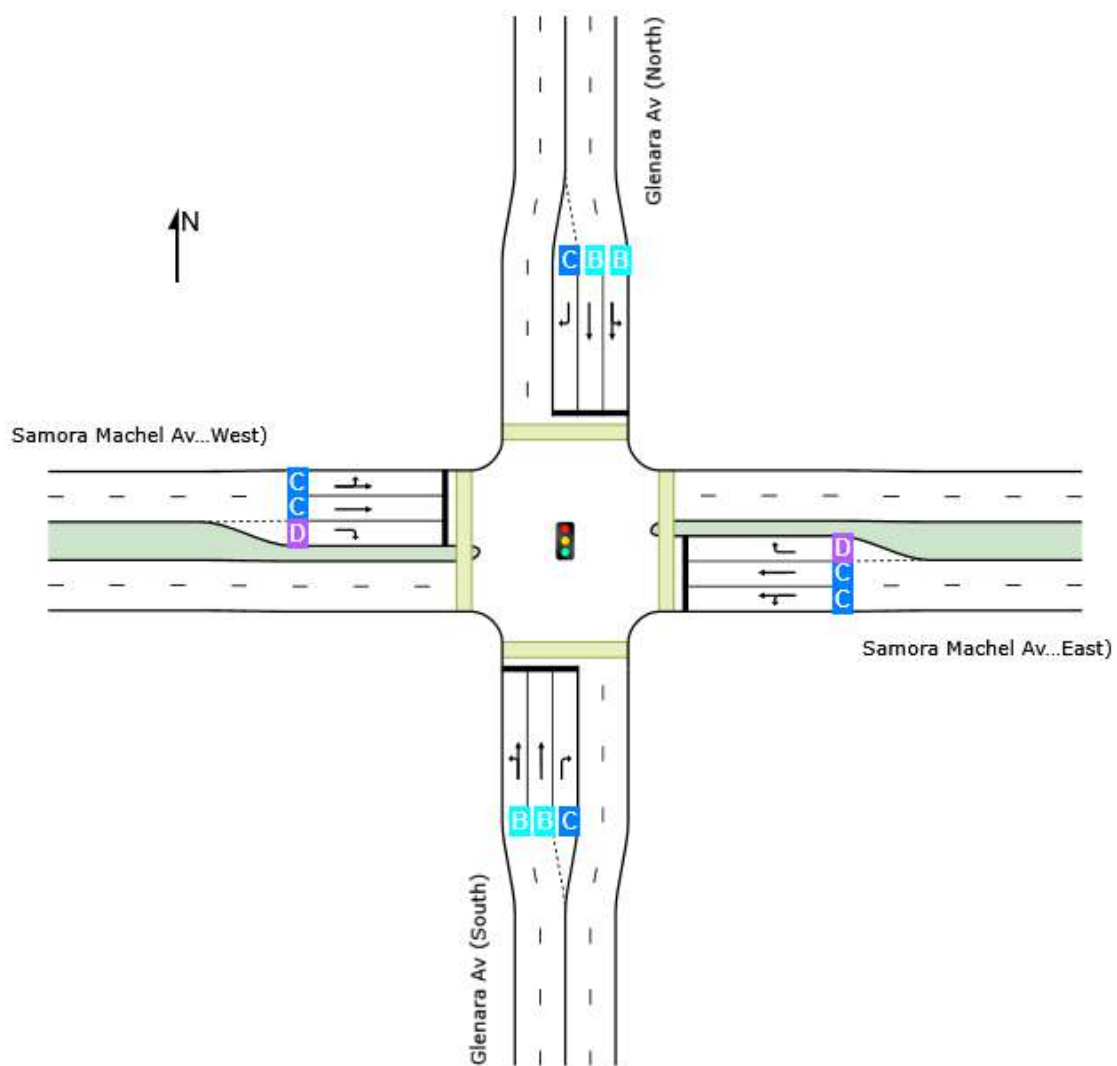


Figure 7.40: Site 14 Lane Level of Service Samora Machel Av and Glenara Road (Samora Corridor)

Table 7.48: Site 14 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Samora Machel Av and Glenara Road (Samora Corridor)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.64	0.72	0.23	0.71	0.72

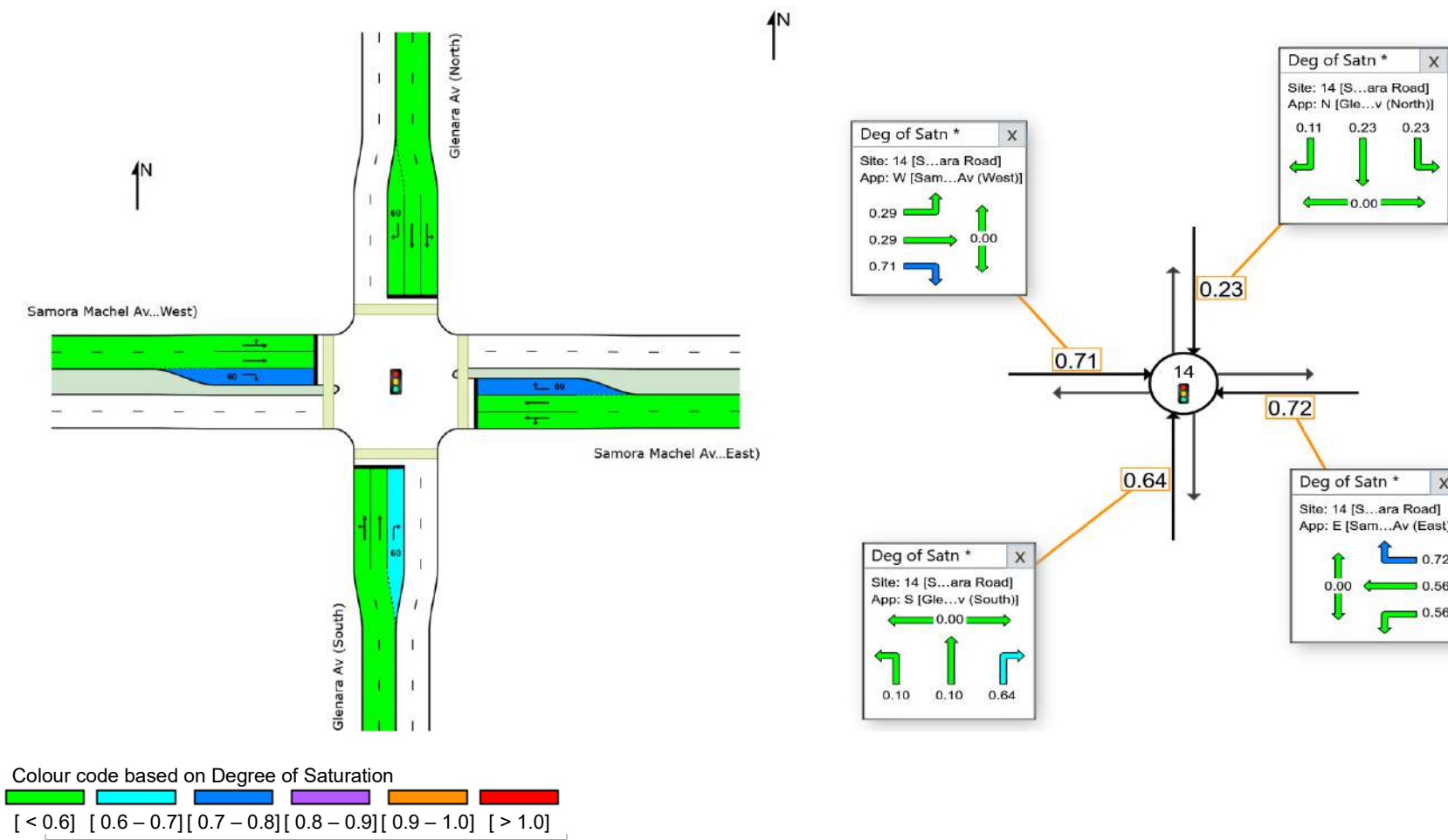


Figure 7.41: Site 14 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Samora Machel Av and Glenara Road (Samora Corridor)

Site 15: Samora Machel Avenue and Robert Mugabe Road Intersection **15-hour Average Daily Traffic (ADT) Results**

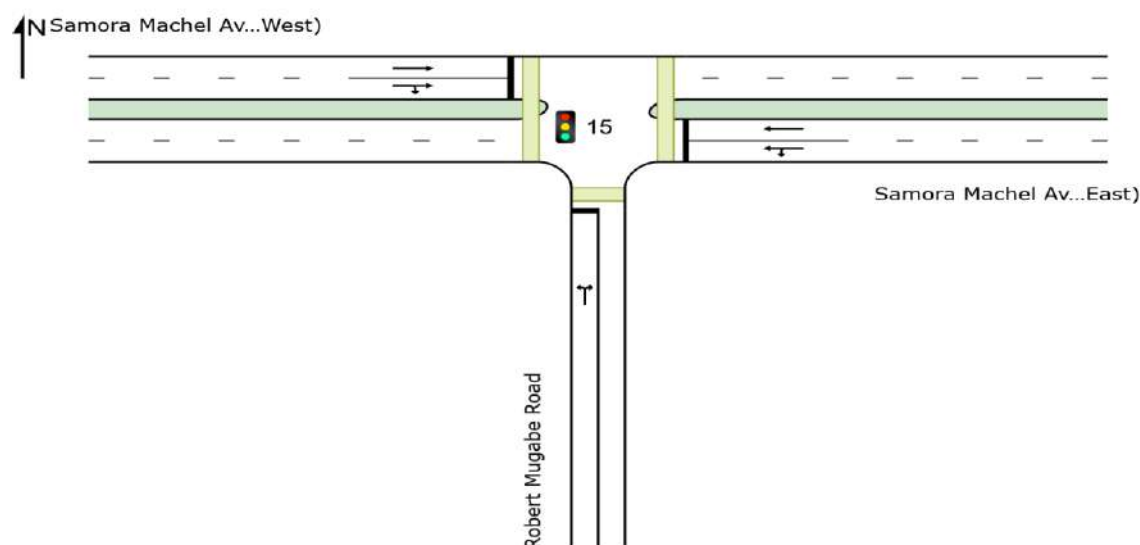


Figure 7.42: Site 15 Samora Machel Av and Robert Mugabe Road (Site Folder: Samora Corridor)

Table 7.49: Site 15 Movement Summary Samora Machel Av and Robert Mugabe Road (Samora Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec		veh	m				
South: Robert Mugabe Road															
1	L2	All MCs	24	9.4	24	9.4	4.277	3022.9	LOS F	429.8	3449.6	1.00	2.82	5.60	1.2
3	R2	All MCs	1276	10.7	1276	10.7	4.277	3022.9	LOS F	429.8	3449.6	1.00	2.82	5.60	1.2
Approach			1300	10.7	1300	10.7	4.277	3022.9	LOS F	429.8	3449.6	1.00	2.82	5.60	1.2
East: Samora Machel Av (East)															
4	L2	All MCs	616	10.7	616	10.7	0.661	17.1	LOS B	25.2	202.6	0.57	0.75	0.57	45.2
5	T1	All MCs	874	5.0	874	5.0	0.661	11.3	LOS B	31.0	234.7	0.57	0.54	0.57	50.2
Approach			1490	7.4	1490	7.4	0.661	13.7	LOS B	31.0	234.7	0.57	0.63	0.57	48.0
West: Samora Machel Av (West)															
11	T1	All MCs	826	6.5	826	6.5	0.668	11.5	LOS B	31.4	239.7	0.58	0.53	0.58	50.4
12	R2	All MCs	473	3.5	473	3.5	4.306	3042.1	LOS F	157.8	1155.8	1.00	2.85	5.62	1.2
Approach			1299	5.4	1299	5.4	4.306	1114.6	LOS F	157.8	1155.8	0.73	1.38	2.41	3.1
All Vehicles			4089	7.8	4089	7.8	4.306	1320.0	LOS F	429.8	3449.6	0.76	1.56	2.76	2.6

Table 7.50: Site 15 Lane Level of Service Samora Machel Av and Robert Mugabe Road (Samora Corridor)

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	South	East	West	
LOS	F	B	F	F

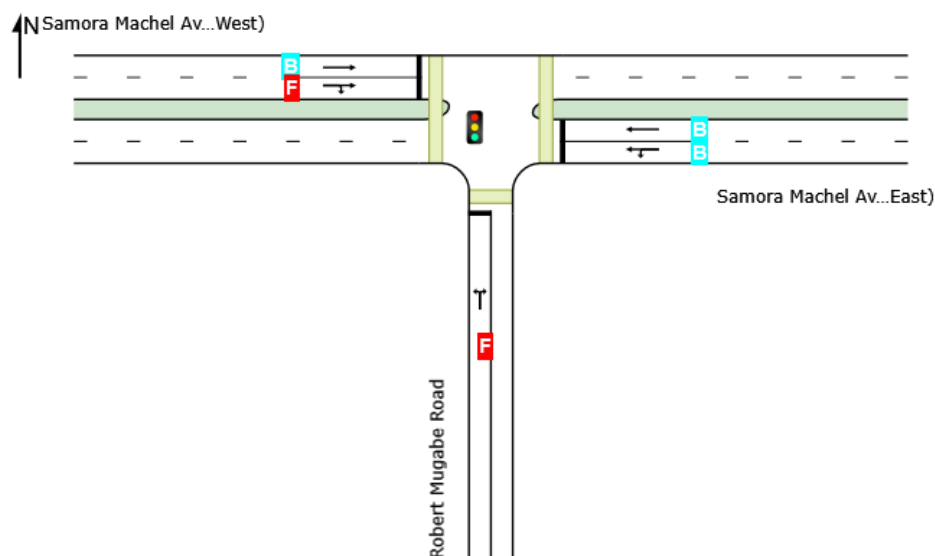


Figure 7.43: Site 15 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Samora Machel Av and Robert Mugabe Road (Samora Corridor)

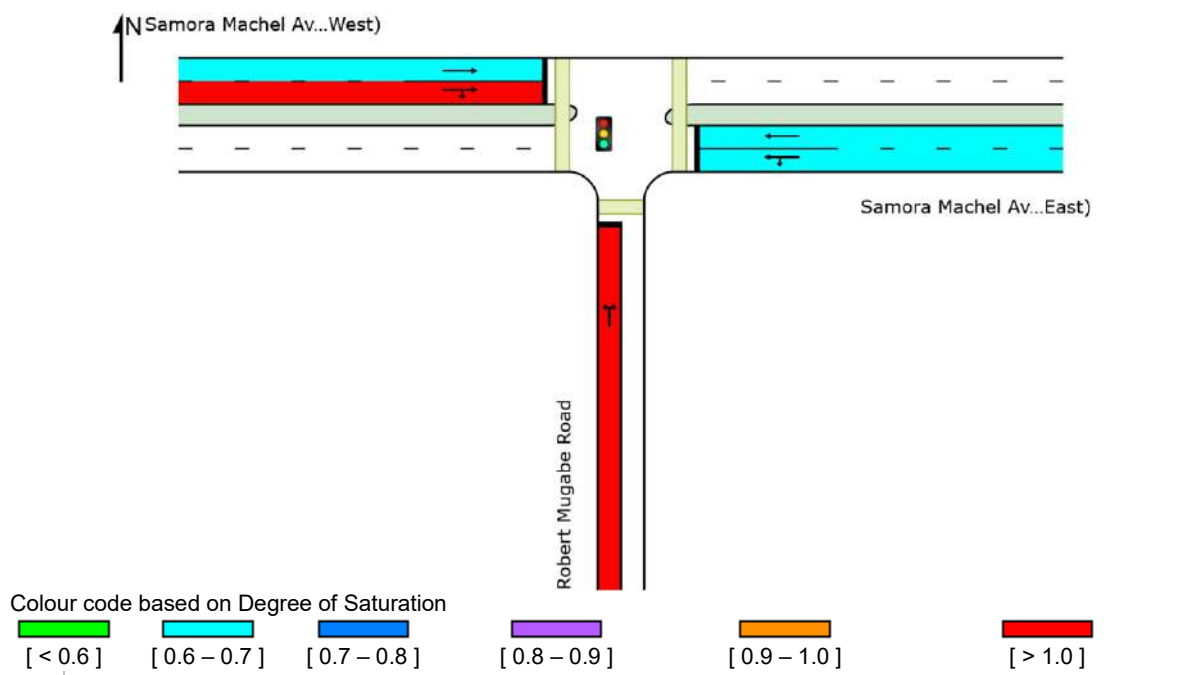


Figure 7.44: Site 15 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Samora Machel Av and Robert Mugabe Road (Samora Corridor)

Table 7.51: Site 15 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Samora Machel Av and Robert Mugabe Road (Samora Corridor)

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	South	East	West	
Degree of Saturation	4.28	0.66	4.31	4.31

Site 16: Samora Machel Avenue and Harare Drive Intersection
15-hour Average Daily Traffic (ADT) Results

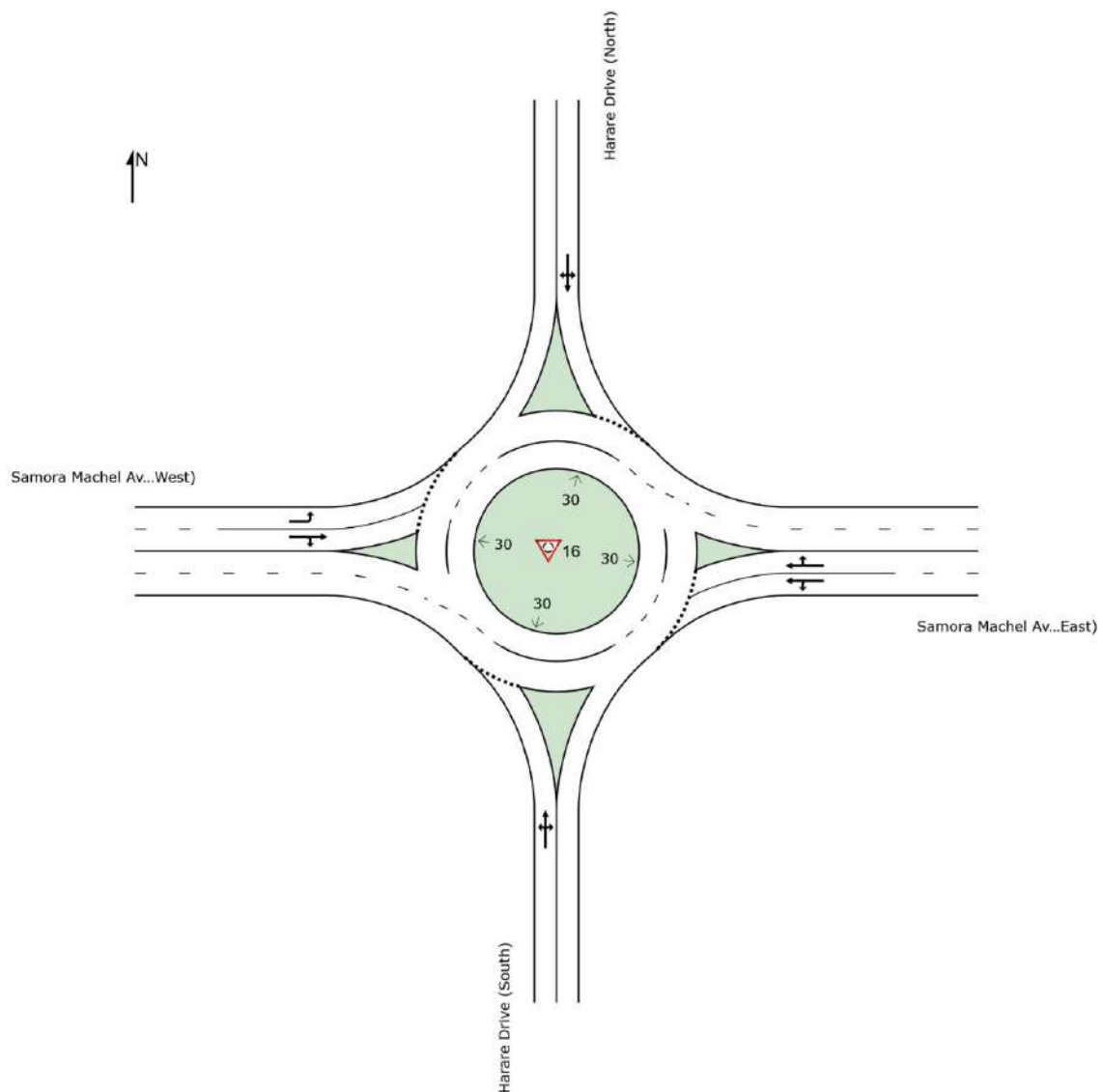


Figure 7.45: Site 16 Samora Machel Av and Harare Drive (Site Folder: Samora Corridor)

Table 7.52: Site 16 Movement Summary Samora Machel Av and Harare Drive (Samora Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
South: Harare Drive (South)															
1	L2	All MCs	63	16.6	63	16.6	0.394	14.3	LOS B	1.6	14.1	0.81	0.95	0.98	47.5
2	T1	All MCs	50	5.2	50	5.2	0.394	11.1	LOS B	1.6	14.1	0.81	0.95	0.98	48.0
3	R2	All MCs	23	25.2	23	25.2	0.394	22.3	LOS C	1.6	14.1	0.81	0.95	0.98	46.5
Approach			136	13.9	136	13.9	0.394	14.5	LOS B	1.6	14.1	0.81	0.95	0.98	47.5
East: Samora Machel Av (East)															
4	L2	All MCs	35	4.5	35	4.5	0.606	4.4	LOS A	5.7	46.8	0.49	0.43	0.49	52.9
5	T1	All MCs	1261	10.6	1261	10.6	0.606	4.5	LOS A	5.7	46.9	0.50	0.45	0.50	52.9
6	R2	All MCs	240	16.4	240	16.4	0.606	10.4	LOS B	5.6	46.9	0.51	0.50	0.51	51.1
Approach			1536	11.3	1536	11.3	0.606	5.4	LOS A	5.7	46.9	0.50	0.46	0.50	52.6
North: Harare Drive (North)															
7	L2	All MCs	184	24.1	184	24.1	1.700	665.7	LOS F	98.5	859.0	1.00	4.34	9.85	5.1
8	T1	All MCs	54	7.4	54	7.4	1.700	663.2	LOS F	98.5	859.0	1.00	4.34	9.85	5.1
9	R2	All MCs	114	7.0	114	7.0	1.700	668.5	LOS F	98.5	859.0	1.00	4.34	9.85	5.1
Approach			352	16.0	352	16.0	1.700	666.2	LOS F	98.5	859.0	1.00	4.34	9.85	5.1
West: Samora Machel Av (West)															
10	L2	All MCs	179	11.0	179	11.0	0.255	6.5	LOS A	1.3	10.8	0.54	0.61	0.54	52.8
11	T1	All MCs	1451	15.3	1451	15.3	1.358	333.0	LOS F	256.7	2197.8	1.00	7.70	13.81	9.5
12	R2	All MCs	11	76.8	11	76.8	1.358	346.6	LOS F	256.7	2197.8	1.00	7.70	13.81	9.4
Approach			1640	15.2	1640	15.2	1.358	297.6	LOS F	256.7	2197.8	0.95	6.93	12.37	10.4
All Vehicles			3663	13.6	3663	13.6	1.700	200.0	LOS F	256.7	2197.8	0.76	3.75	6.73	14.2

Table 7.53: Site 16 Lane Level of Service Samora Machel Av and Harare Drive (Samora Corridor)

New Site

Site Category: Existing Design

Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	B	A	F	F	F

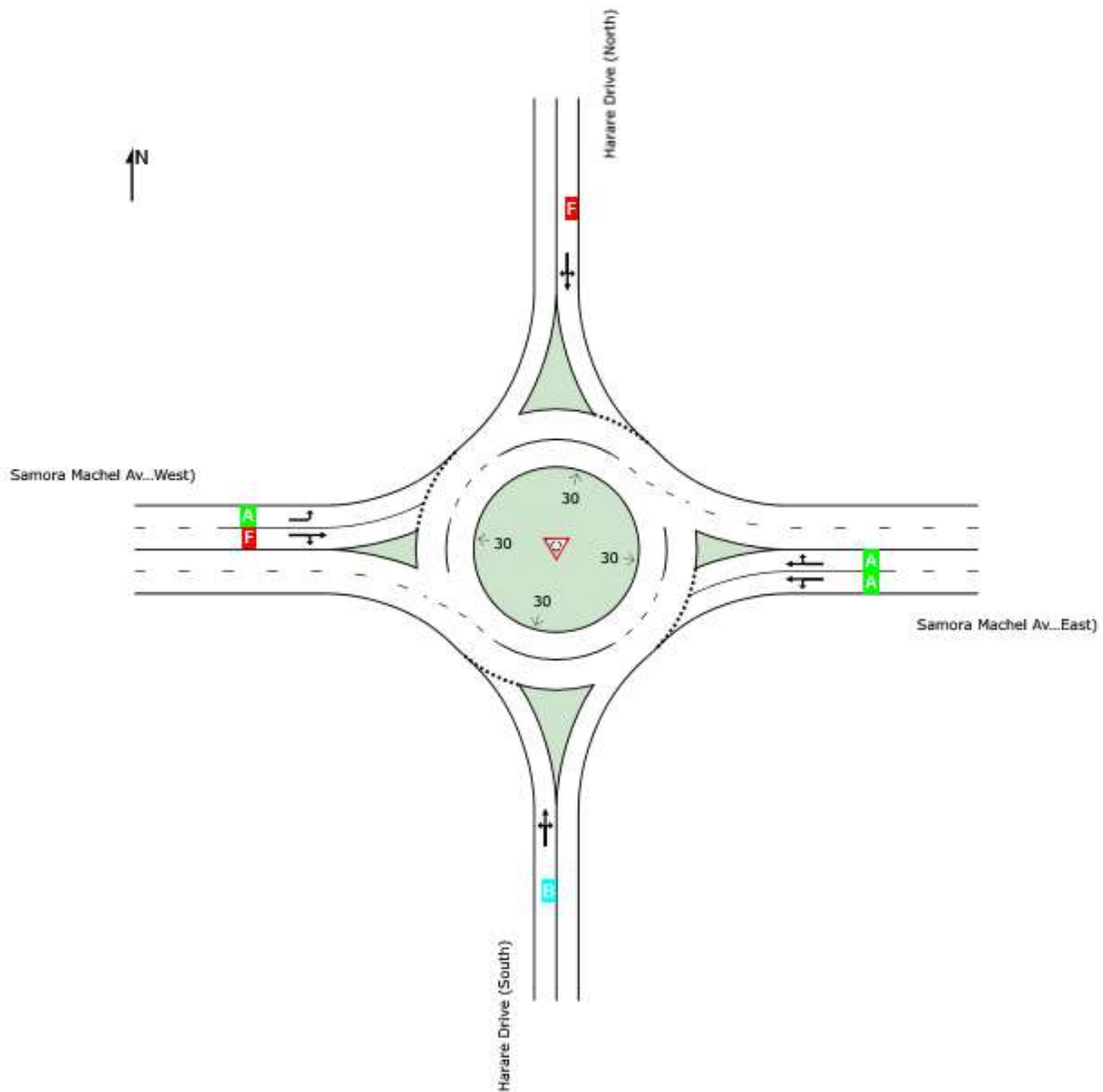


Figure 7.46: Site 16 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane [Samora Machel Av and Harare Drive (Samora Corridor)]

Table 7.54: Site 16 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane [Samora Machel Av and Harare Drive (Samora Corridor)]

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.39	0.61	1.70	1.36	1.70

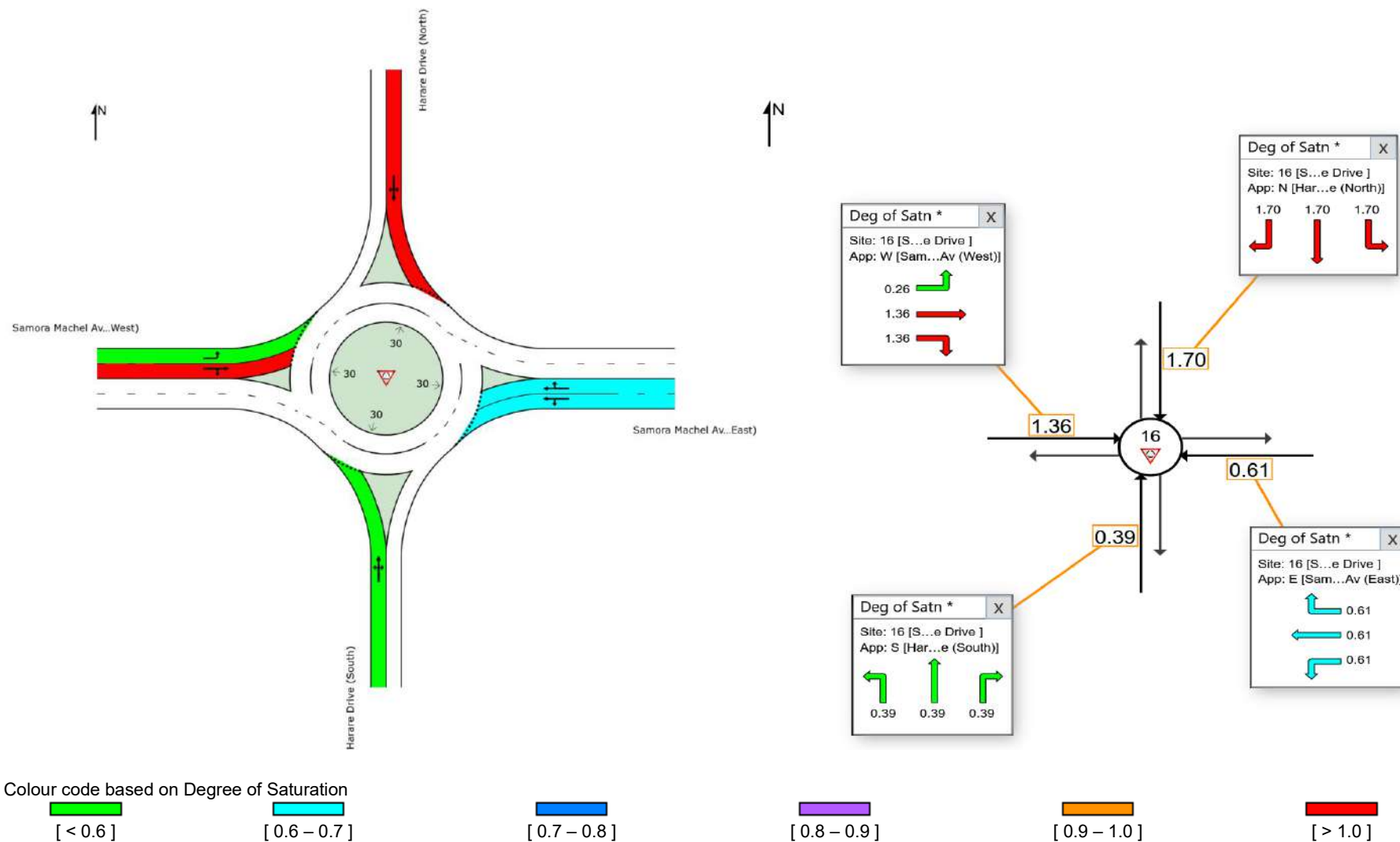


Figure 7.47: Site 16 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per movement Samora Machel Av and Harare Drive (Samora Corridor)

Site 17: Samora Machel Avenue and Donnybrook Road (Mabvuku Turnoff) Intersection 15-hour Average Daily Traffic (ADT) Results

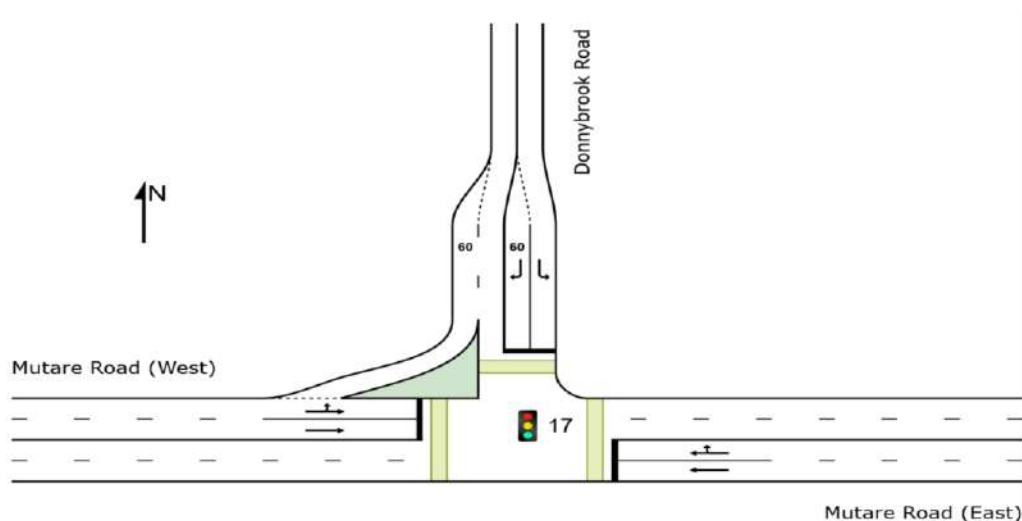


Figure 7.48: Site 17 Mutare Road and Donnybrook Road (Mabvuku Turnoff) (Samora Corridor)

Table 7.55: Site 17 Movement Summary Mutare Road and Donnybrook Road (Mabvuku Turnoff) (Samora Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]	v/c	sec		[Veh.	Dist]				km/h
			veh/h	%	veh/h	%				veh	m				
East: Mutare Road (East)															
5	T1	All MCs	546	9.4	546	9.4 *	0.525	4.5	LOS A	3.0	23.8	0.76	0.67	0.77	55.1
6	R2	All MCs	122	7.7	122	7.7	0.525	11.4	LOS B	2.2	17.5	0.76	0.72	0.79	51.2
Approach			668	9.1	668	9.1	0.525	5.8	LOS A	3.0	23.8	0.76	0.68	0.78	54.3
North: Donnybrook Road															
7	L2	All MCs	40	8.7	40	8.7	0.254	15.5	LOS B	0.4	3.3	0.92	0.72	0.92	45.9
9	R2	All MCs	85	7.5	85	7.5 *	0.537	16.4	LOS B	1.0	7.6	0.96	0.81	1.18	45.5
Approach			124	7.8	124	7.8	0.537	16.1	LOS B	1.0	7.6	0.95	0.79	1.10	45.6
West: Mutare Road (West)															
10	L2	All MCs	86	13.9	86	13.9	0.437	6.0	LOS A	1.9	16.2	0.63	0.59	0.63	53.4
11	T1	All MCs	533	13.1	533	13.1	0.437	4.4	LOS A	2.3	19.1	0.68	0.60	0.68	55.8
Approach			619	13.2	619	13.2	0.437	4.6	LOS A	2.3	19.1	0.68	0.60	0.68	55.4
All Vehicles			1412	10.8	1412	10.8	0.537	6.2	LOS A	3.0	23.8	0.74	0.65	0.76	53.9

Table 7.56: Site 17 Lane Level of Service Mutare Road and Donnybrook Road (Mabvuku Turnoff) (Samora Corridor)

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 20 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	East	North	West	
LOS	A	B	A	A

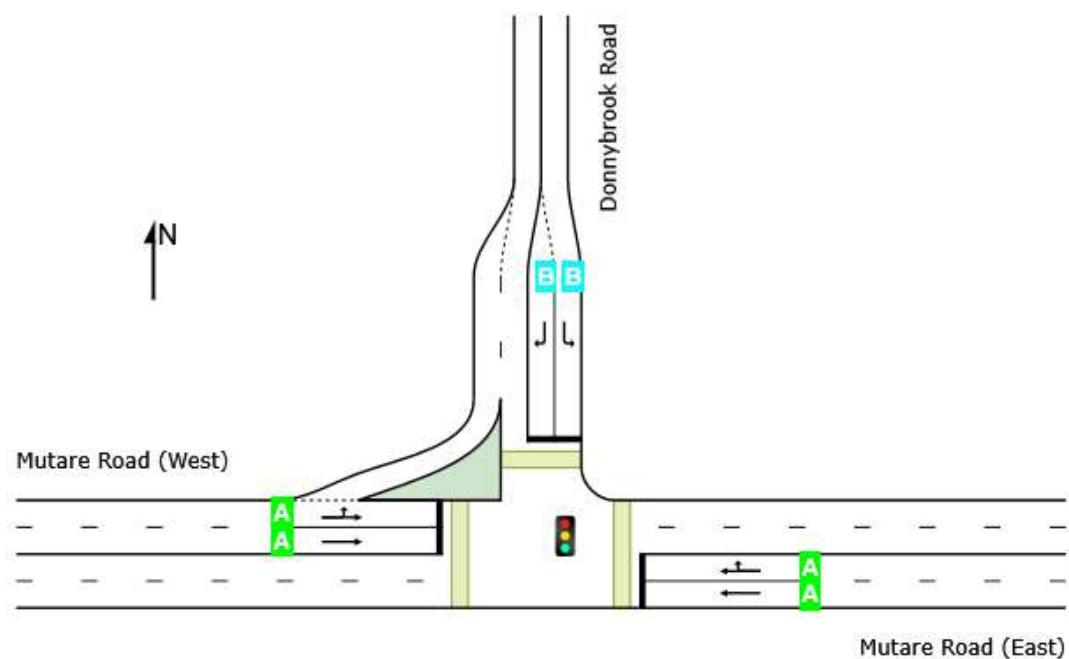


Figure 7.49: Site 17 Lane Level of Service Mutare Road and Donnybrook Road (Mabvuku Turnoff) (Samora Corridor)

Table 7.57: Site 17 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Mutare Road and Donnybrook Road (Mabvuku Turnoff) (Samora Corridor)

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 20 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	East	North	West	
Degree of Saturation	0.52	0.54	0.44	0.54

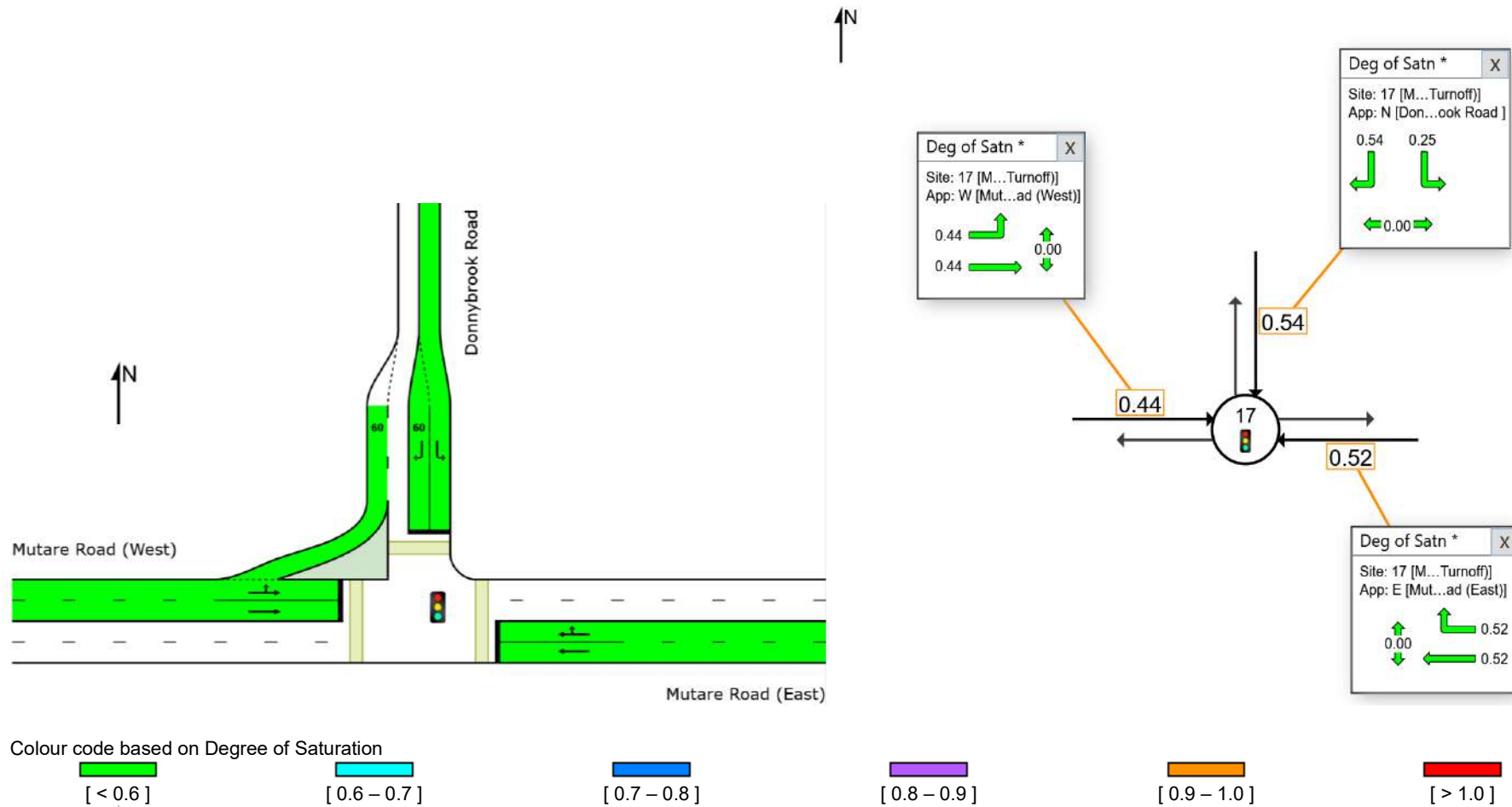


Figure 7.50: Site 17 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per movement [Mutare Road and Donnybrook Road (Mabvuku Turnoff) (Samora Corridor)]

7.1.4.1.1.1. *Corridor Nodal Capacity Results Interpretation and Analysis: The East-West Corridor (Samora Machel Avenue/Mutare Road/Bulawayo Road)*

The following gives a summary of the Level of Service (LOS) for the Samora Machel corridor based on nodal capacity results.

Site 01: Bulawayo Road and Whitecliffe Road Intersection

Site 01: Bulawayo Road and Whitecliffe Road Intersection	Approaches				Intersection
	South	East	North	West	
LOS	F	NA (TWSC)	D	NA (TWSC)	NA (TWSC)

Site 02: Bulawayo Road and First Avenue Intersection

	Approaches			Intersection
	South	East	West	
LOS	D	B	B	B

Site 03: Bulawayo Road and Dzivarasekwa Road

	Approaches				Intersection
	South	East	North	West	
LOS	B	A	A	A	A

Site 04: Bulawayo Road and High glen Road

	Approaches				Intersection
	South	East	North	West	
LOS	B	A	A	A	A

Site 05: Bulawayo Road and Pleasant Valley Road

	Approaches			Intersection
	South	East	West	
LOS	F	NA (TWSC)	NA (TWSC)	NA (TWSC)

Site 06: Bulawayo Road and Crowborough Way (Warren Park Roundabout)

	Approaches			Intersection
	South	East	West	
LOS	A	B	B	B

Site 06: Samora Machel Avenue and Bishop Gaul Avenue

	Approaches				Intersection
	South	East	North	West	
LOS	E	C	E	D	D

Site 07: Samora Machel Avenue and Rekayi Tangwena

	Approaches				Intersection
	South	East	North	West	
LOS	C	E	D	D	D

Site 8: Samora Machel Avenue and Bishop Gaul Avenue

	Approaches	Intersection

	South	East	North	West	
LOS	E	C	E	D	D

Site 09: Samora Mache Avenue and Rekayi Tangwena

	Approaches				Intersection
	South	East	North	West	
LOS	C	E	D	D	D

Site 10: Samora Machel Avenue and Rotten Row Avenue

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	B	C	C

Site 11: Samora Machel Avenue and Prince Edward Road

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	B	C	C

Site 12: Samora Machel Avenue and Sam Nujoma Street

	Approaches				Intersection
	South	East	North	West	
LOS	F	F	D	D	F

Site 13: Samora Machel Avenue and Emmerson Dambudzo Mnangagwa Drive Intersection

	Approaches				Intersection
	South	East	North	West	
LOS	F	E	D	F	F

Site 14: Samora Machel Avenue and Glenara Intersection

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	B	C	C

Site 15: Samora Machel Avenue and Robert Mugabe Road Intersection

	Approaches			Intersection
	South	East	West	
LOS	F	B	F	F

Site 16: Samora Machel Avenue and Harare Drive Intersection

	Approaches				Intersection
	South	East	North	West	
LOS	B	A	F	F	F

Site 17: Samora Machel Avenue and Donnybrook Road (Mabvuku Turnoff) Intersection

	Approaches			Intersection
	East	North	West	
LOS	A	B	A	A

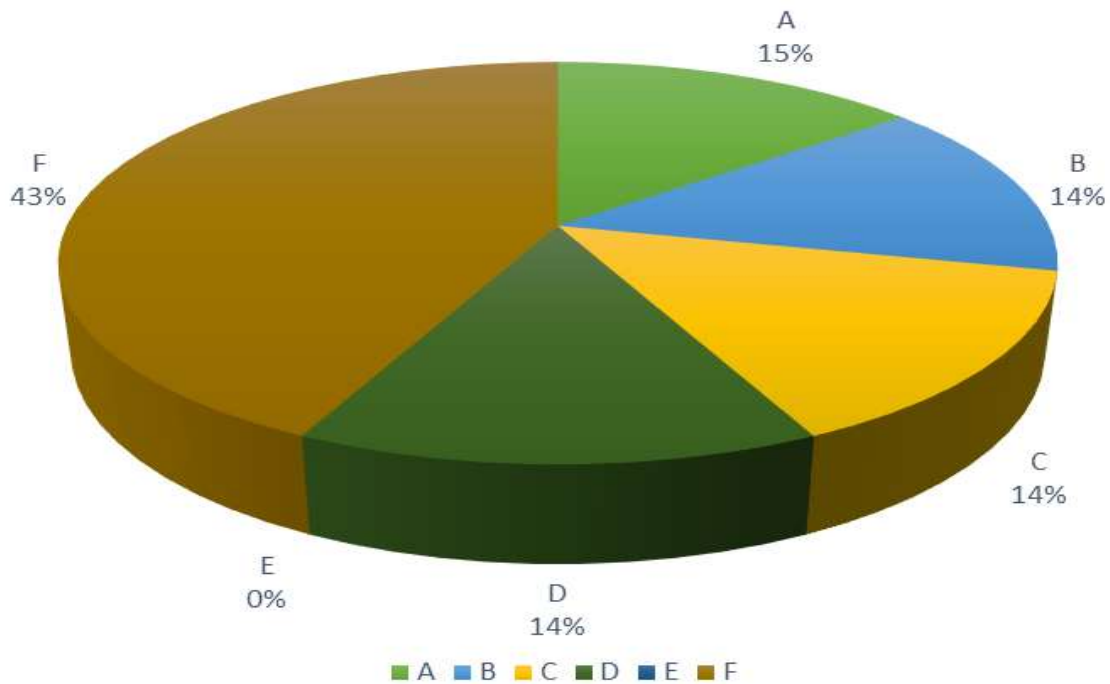


Figure 7.51: Samora Machel Corridor and their LOS

Study results indicate that The Samora Machel Avenue/Mutare Road/Bulawayo Road corridor has 43% of their intersections operation at the worst Level of Service, (LOS F) which means **Congested conditions** unstable speed with the formation of waiting lines at several intersections. Cycles of stop and departure with no apparent pattern because created by the behaviour of other drivers especially informal public transport operations. A high level of vigilance is required for the user with practically no comfort. At this level, the volume-to-capacity ratio exceeds 1, implying that the road segment is used above design capacity.

A further 14% and another 14% of the 17 studied intersections along this corridor are operating at a Level of Service of C and D respectively. A LOS of C indicate **Steady Traffic but Limited**. That is traffic flow is showing signs of slow space mean speeds and increasing traffic density. The presence of other vehicles affects drivers. The choice of the speed is affected and manoeuvring requires vigilance. The level of comfort decreases quickly at this level, because drivers have a growing impression of being caught between other vehicles. The Level of Service of D shows **Steady Traffic at High Density**. The speed and the manoeuvrability are severely reduced. Low level of comfort for drivers, as collisions with other vehicles, must constantly be avoided. A slight increase in the traffic risks causing some operational problems and saturating the network. A mere 29% of the intersections along the Samora Machel corridor are operating at an average LOS of A and B.

These results or s capacity and this is attributable to four (4) main factors.

- i. **The minor roads intersection the major road (Samora Machel) at grade.** This situation creates serious bottlenecks along the major road which according to principles of traffic engineering should have minimal direct entry and exit points. However, because the city has not upgraded the Samora Machel corridor into freeway as recommended in previous traffic and transportation studies, this corridor is experiencing high levels of congestion and the situation is likely to worsen in the near future.

- ii. **Unsuitable Give Way, Stop Controlled and Uncontrolled types of intersections.**
Most of the intersections operating at LOS F have not been upgraded to traffic light-controlled intersections amid high traffic flow conditions. This leads to poor driver behaviour of blocking traffic along main road as the motorists seek to joining the main traffic stream.
- iii. **Unsynchronised signal timing and phasing plans.** Most traffic signals timing and phasing plans lights along this corridor were not synchronised leading to an uncoordinated traffic control from one intersection to the next. This creates a problem of sub optimal traffic flow and spontaneous oversaturated conditions at one intersection and under saturation condition at some intersection approaches
- iv. **Non-functional traffic lights.** Despite the high volume, relatively high space mean speeds and multi modal traffic characterising the Samora Corridor, the poor LOS experienced at most intersection is not only as a result of high traffic volume, it is also due to a high incidence of non-functional traffic lights, where poor driver lane discipline cripples in leading to serious traffic weaving, traffic congestion and accidents.

7.1.4.1.2. *The North-South Corridor (Simon Mazorodze/Masvingo Road/ Sam Nujoma Street)*

**Site 01: Simon Mazorodze and Stoneridge Road
15-hour Average Daily Traffic (ADT) Results**

Site 02: Simon Mazorodze and Willowvale Road Intersection
15-hour Average Daily Traffic (ADT) Results

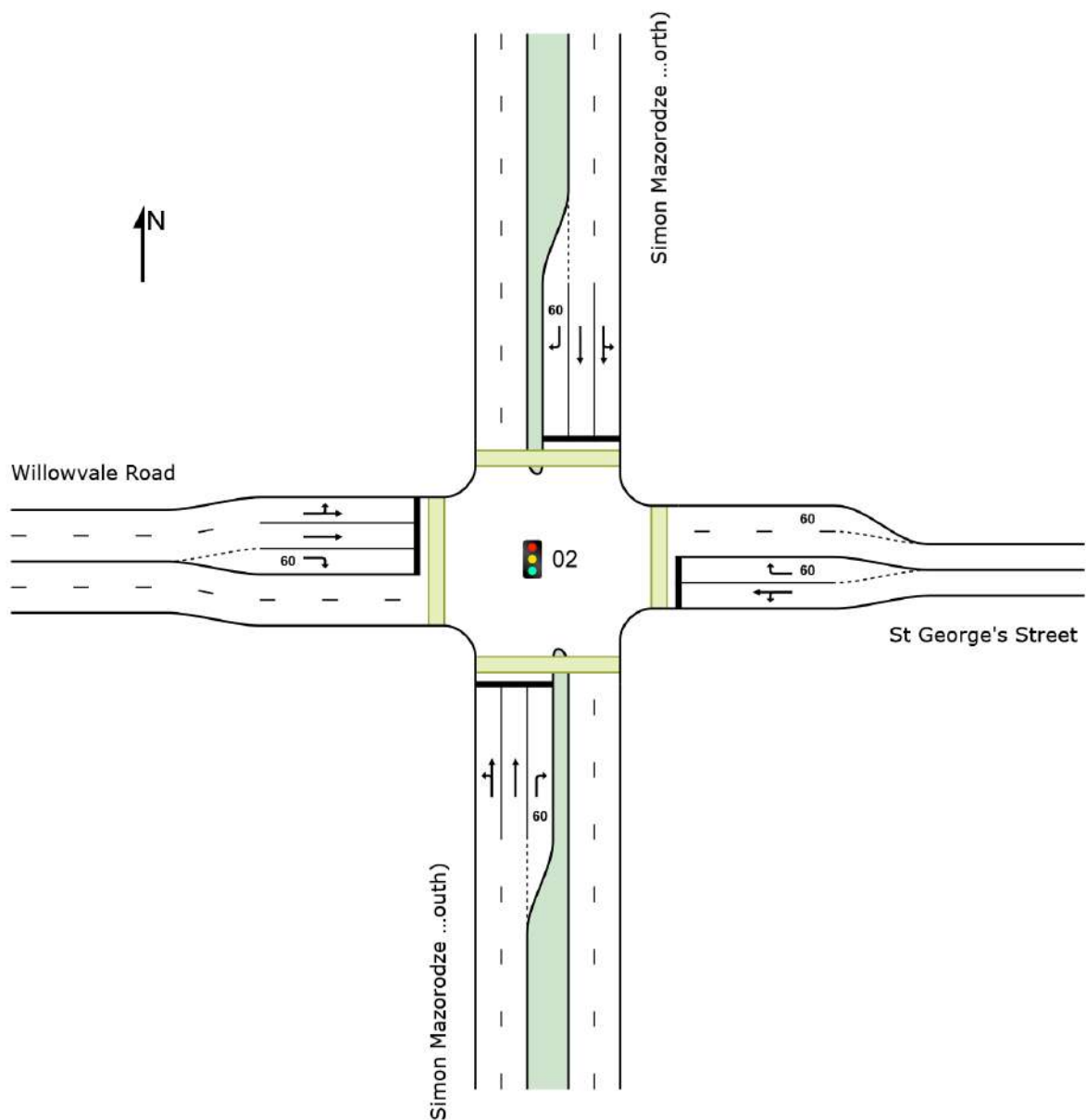


Figure 7.52: Site 02 Simon Mazorodze and Willowvale Road (Site Folder: Simon Mazorodze Corridor)

7.1.4.1.3. The North-West Corridor (Sam Nujoma / NemaKonde Way)

Site 01: NemaKonde Way and Sandton Road Intersection
15-hour Average Daily Traffic (ADT) Results

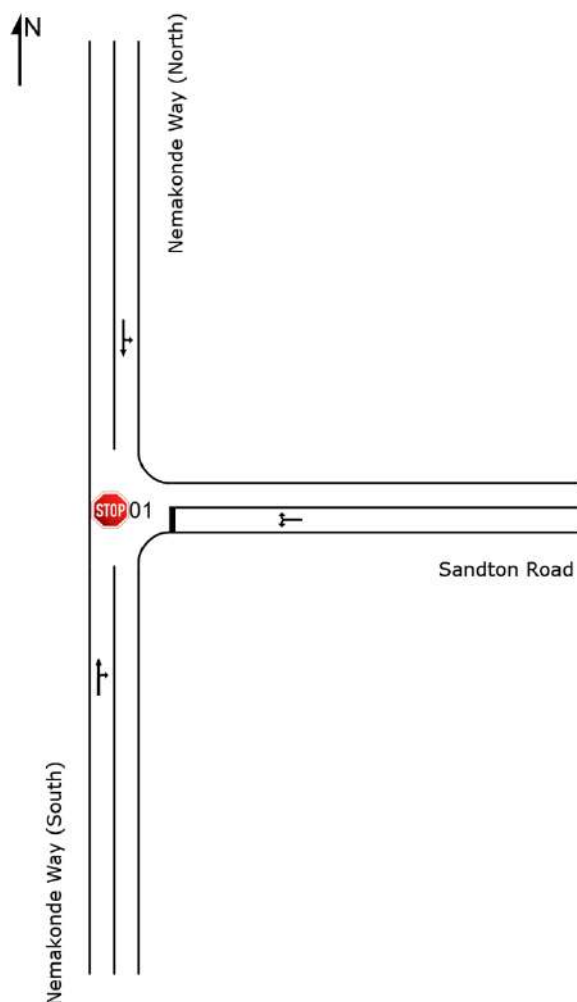


Figure 7.53: Site 01 NemaKonde Way and Sandton Road (Site Folder: Sam Nujoma NemaKonde Way Corridor)

Site 01 Summary movement for NemaKonde Way and Sandton Road (Sam Nujoma NemaKonde Way Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]	v/c	sec		[Veh.	Dist]				km/h
South: NemaKonde Way (South)															
2	T1	All MCs	279	16.6	279	16.6	0.206	0.5	LOS A	0.2	1.8	0.09	0.16	0.09	56.8
3	R2	All MCs	25	7.8	25	7.8	0.206	7.2	LOS A	0.2	1.8	0.09	0.16	0.09	54.6
Approach			304	15.9	304	15.9	0.206	1.0	NA	0.2	1.8	0.09	0.16	0.09	56.7
East: Sandton Road															
4	L2	All MCs	30	6.5	30	6.5	0.131	10.1	LOS B	0.4	3.1	0.52	0.96	0.52	48.0
6	R2	All MCs	51	3.2	51	3.2	0.131	12.4	LOS B	0.4	3.1	0.52	0.96	0.52	47.8
Approach			82	4.4	82	4.4	0.131	11.5	LOS B	0.4	3.1	0.52	0.96	0.52	47.9

North: Nemakonde Way (North)															
7	L2	All MCs	21	16.1	21	16.1	0.225	5.4	LOS A	0.0	0.0	0.00	0.04	0.00	53.1
8	T1	All MCs	305	20.7	305	20.7	0.225	0.1	LOS A	0.0	0.0	0.00	0.04	0.00	55.4
Approach			325	20.4	325	20.4	0.225	0.4	NA	0.0	0.0	0.00	0.04	0.00	55.3
All Vehicles			711	16.7	711	16.7	0.225	2.0	NA	0.4	3.1	0.10	0.20	0.10	54.9

Table 7.58: Site 01 Lane Level of Service [Nemakonde Way and Sandton Road (Sam Nujoma Nemakonde Way Corridor)]

LOS	Approaches			Intersection
	South	East	North	
LOS	NA (TWSC)	B	NA (TWSC)	NA (TWSC)

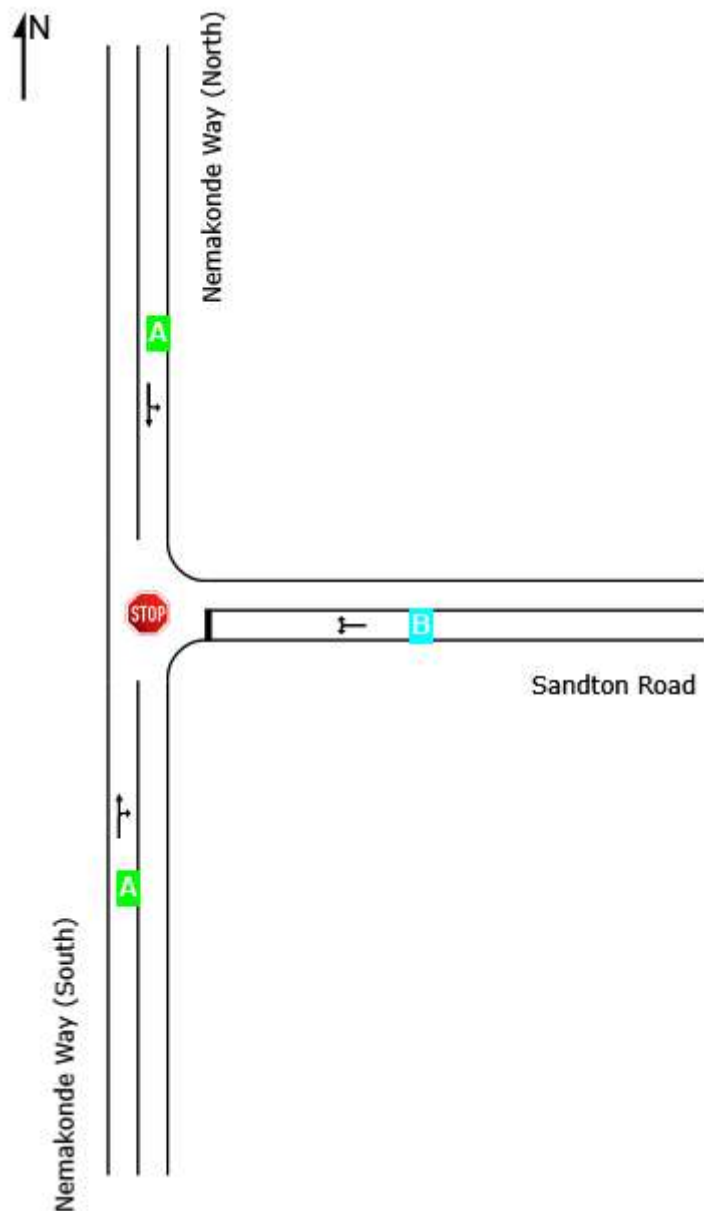


Figure 7.54: Site 01 Lane Level of Service [Nemakonde Way and Sandton Road (Sam Nujoma Nemakonde Way Corridor)]

**Table 7.59: Site 01 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane
[Nemakonde Way and Sandton Road (Sam Nujoma Nemakonde Way Corridor)]**

New Site

Site Category: Existing Design

Stop (Two-Way)

	Approaches			Intersection
	South	East	North	
Degree of Saturation	0.21	0.13	0.23	0.23

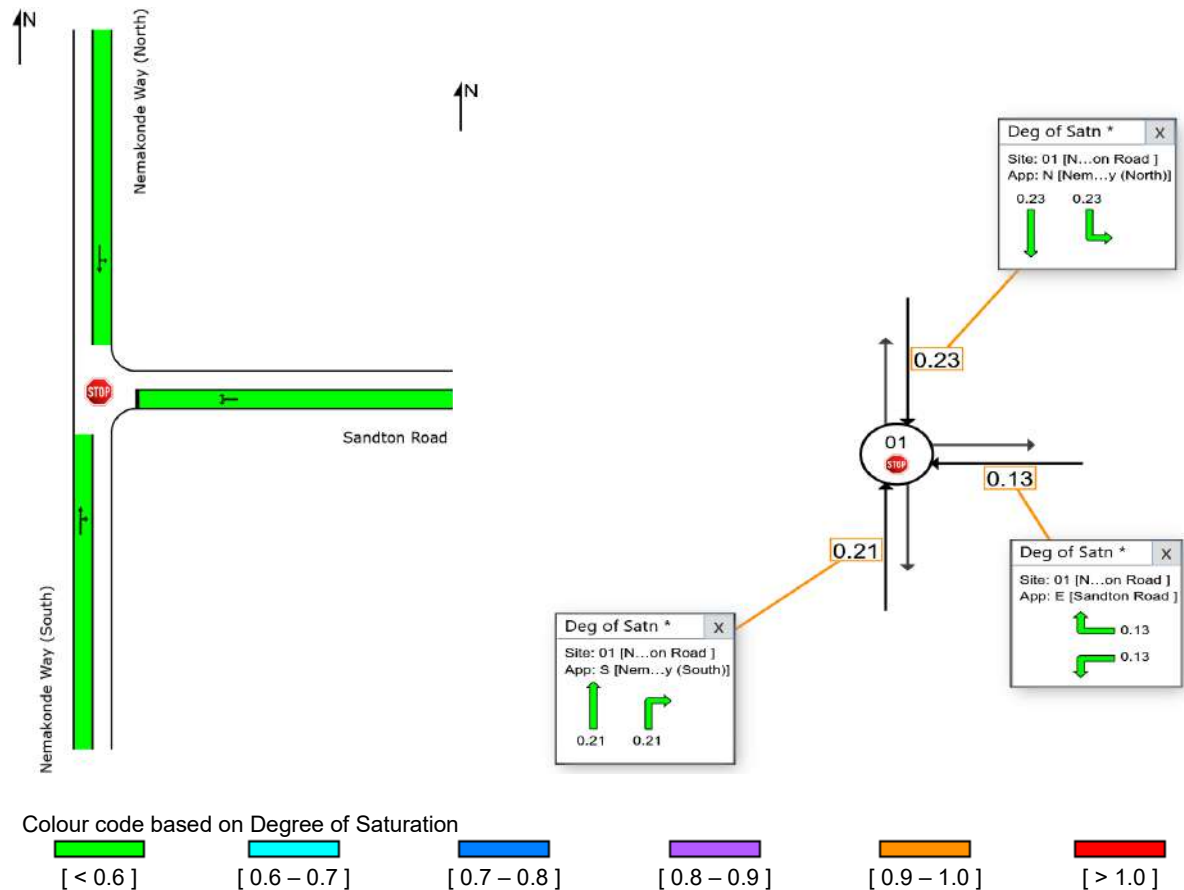


**Figure 7.55: Site 01 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane
[Nemakonde Way and Sandton Road (Sam Nujoma Nemakonde Way Corridor)]**

Site 02: Nermakonde Way and Old Mazowe Road Intersection
15-hour Average Daily Traffic (ADT) Results

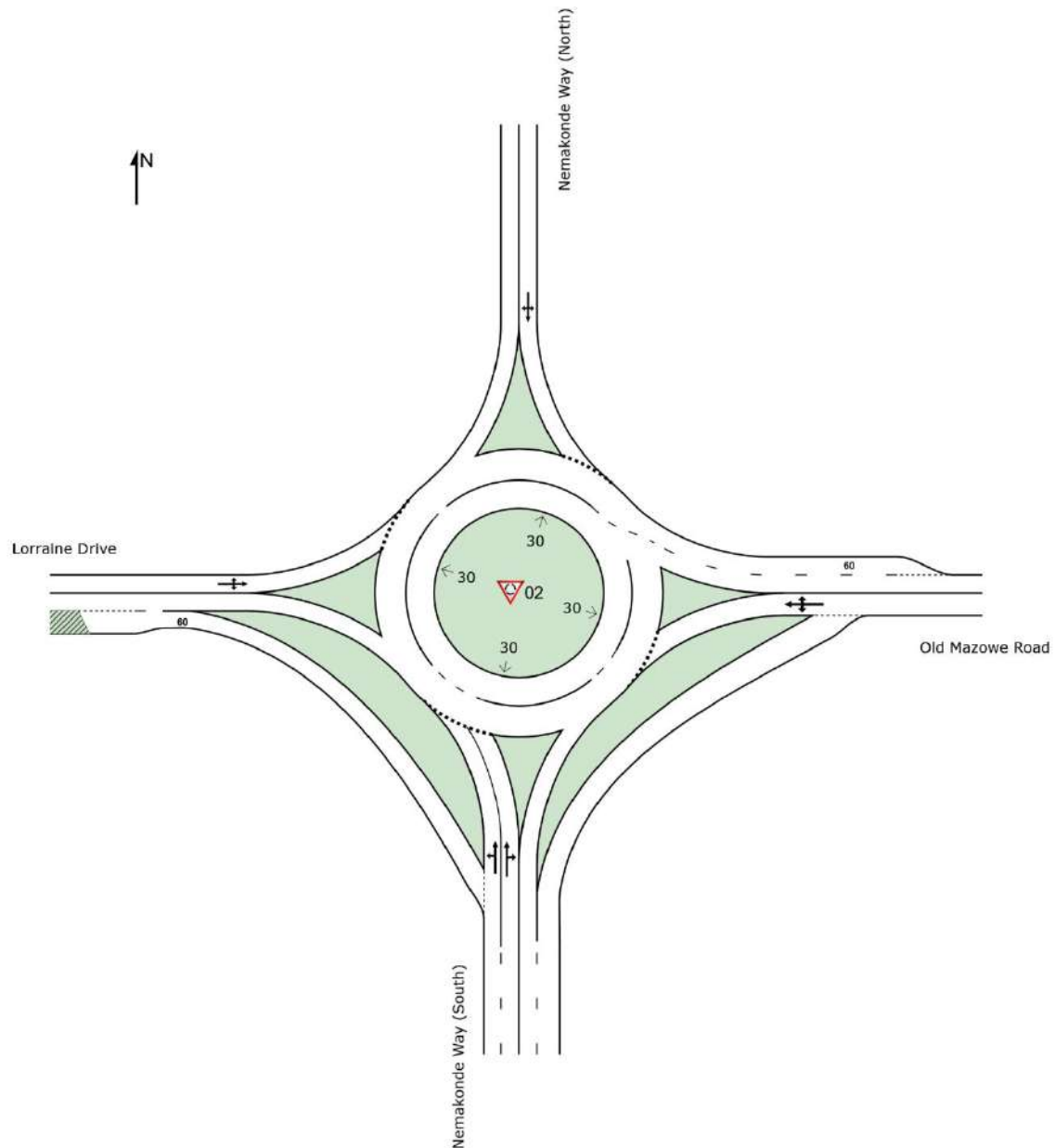


Figure 7.56: Site 02 Nermakonde Way and Old Mazowe Road (Sam Nujoma Nermakonde Way Corridor)

Table 7.60: Site 02 Movement Summary Nemakonde Way and Old Mazowe Road (Sam Nujoma Nemakonde Way Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Nemakonde Way (South)															
1	L2	All MCs	106	5.3	106	5.3	0.083	3.7	LOS A	0.2	1.2	0.11	0.41	0.11	55.1
2	T1	All MCs	325	12.2	325	12.2	0.332	4.9	LOS A	2.3	16.9	0.50	0.50	0.50	51.7
3	R2	All MCs	71	5.3	71	5.3	0.332	10.4	LOS B	2.3	16.9	0.51	0.50	0.51	51.2
Approach			502	9.7	502	9.7	0.332	5.4	LOS A	2.3	16.9	0.42	0.48	0.42	52.3
East: Old Mazowe Road															
4	L2	All MCs	613	5.9	613	5.9	0.531	5.0	LOS A	3.1	22.1	0.36	0.57	0.36	52.7
5	T1	All MCs	36	2.9	36	2.9	0.531	9.7	LOS A	3.1	22.1	0.36	0.57	0.36	53.1
6	R2	All MCs	54	3.0	54	3.0	0.531	15.3	LOS B	3.1	22.1	0.36	0.57	0.36	52.2
Approach			703	5.6	703	5.6	0.531	6.0	LOS A	3.1	22.1	0.36	0.57	0.36	52.7
North: Nemakonde Way (North)															
7	L2	All MCs	94	12.0	94	12.0	0.727	13.4	LOS B	8.7	67.4	0.94	0.93	1.30	47.2
8	T1	All MCs	299	15.5	299	15.5	0.727	13.7	LOS B	8.7	67.4	0.94	0.93	1.30	47.6
9	R2	All MCs	142	8.0	142	8.0	0.727	18.9	LOS B	8.7	67.4	0.94	0.93	1.30	46.8
Approach			535	12.9	535	12.9	0.727	15.0	LOS B	8.7	67.4	0.94	0.93	1.30	47.3
West: Lorraine Drive															
10	L2	All MCs	80	2.7	80	2.7	0.583	8.1	LOS A	4.8	34.4	0.77	0.79	0.90	49.2
11	T1	All MCs	71	2.8	71	2.8	0.583	8.4	LOS A	4.8	34.4	0.77	0.79	0.90	49.4
12	R2	All MCs	351	2.7	351	2.7	0.583	13.9	LOS B	4.8	34.4	0.77	0.79	0.90	48.6
Approach			502	2.7	502	2.7	0.583	12.2	LOS B	4.8	34.4	0.77	0.79	0.90	48.8
All Vehicles			2242	7.6	2242	7.6	0.727	9.4	LOS A	8.7	67.4	0.60	0.68	0.72	50.3

Table 7.61: Site 02 Lane Level of Service - Nemakonde Way and Old Mazowe Road (Site Folder: Sam Nujoma Nemakonde Way Corridor)

	Approaches				Intersection
	South	East	North	West	
LOS	A	A	B	B	A

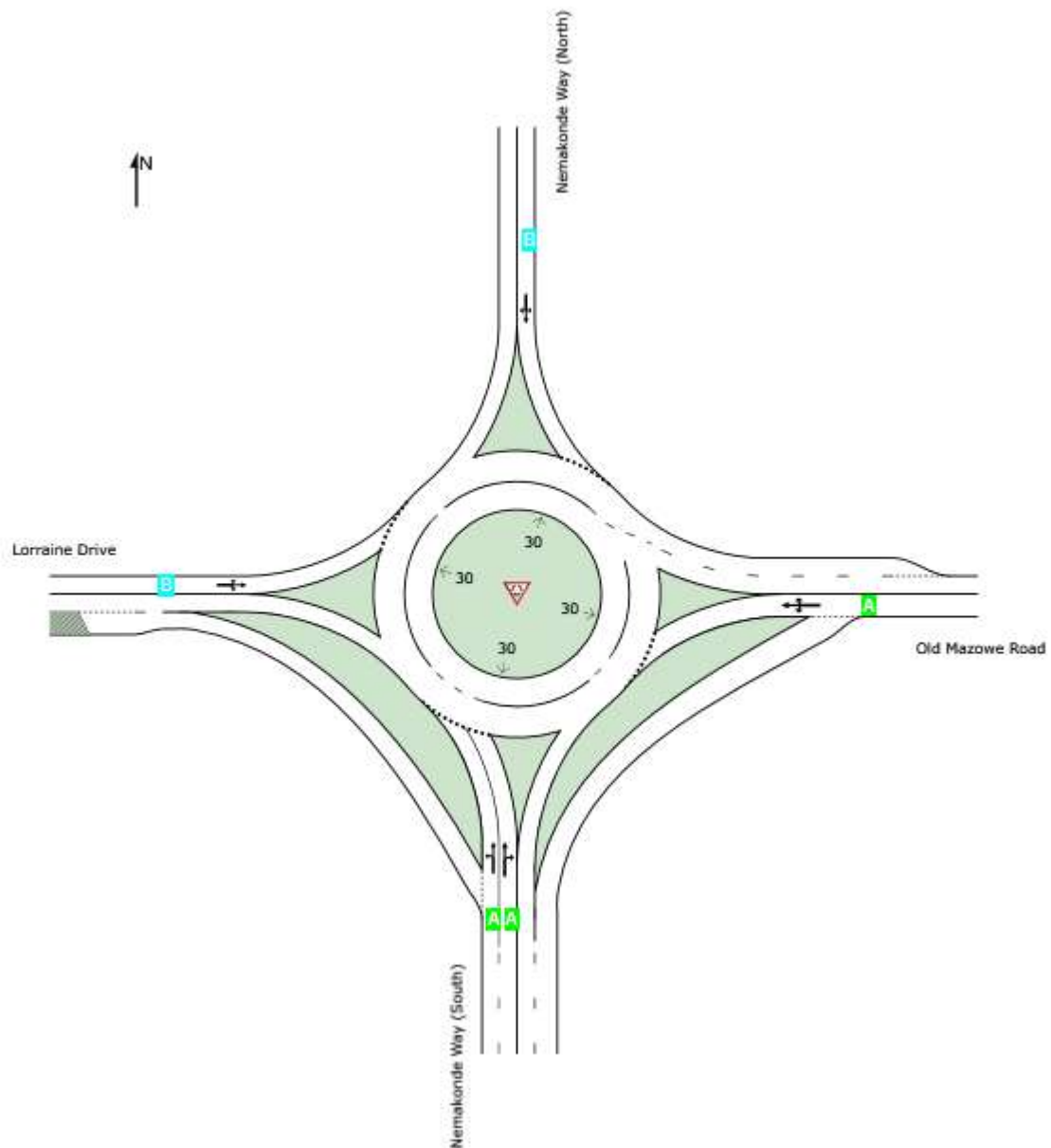


Figure 7.57: Site 02 Lane Level of Service - Nemakonde Way and Old Mazowe Road (Site Folder: Sam Nujoma Nemakonde Way Corridor)

Table 7.62: Site 02 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane - Nemakonde Way and Old Mazowe Road (Sam Nujoma Nemakonde Way Corridor)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.33	0.53	0.73	0.58	0.73

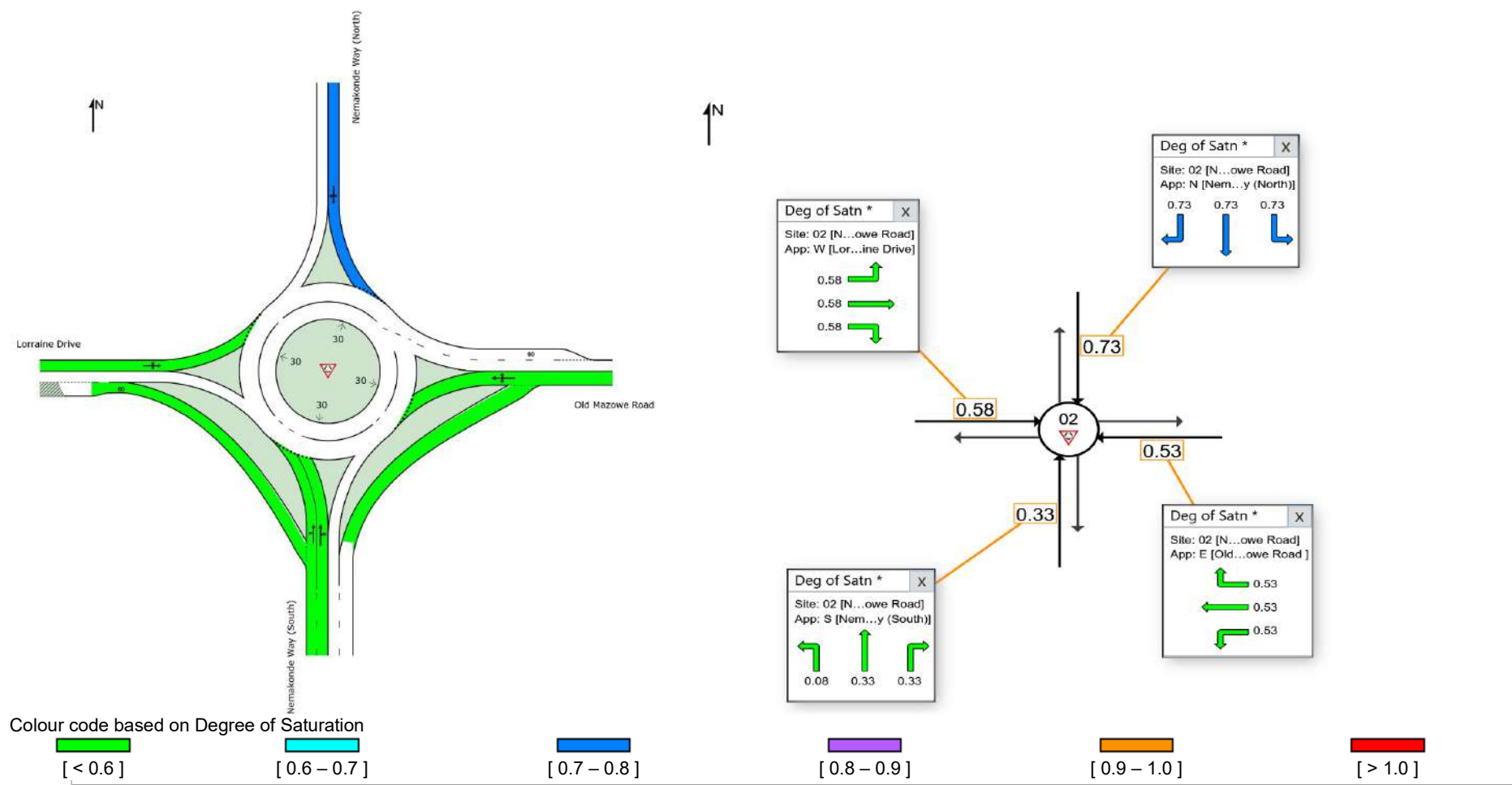


Figure 7.58: Site 02 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per movement Nemakonde Way and Old Mazowe Road (Sam Nujoma Nemakonde Way Corridor)]

Site 03: NemaKonde Way and West Road Intersection 15-hour Average Daily Traffic (ADT) Results

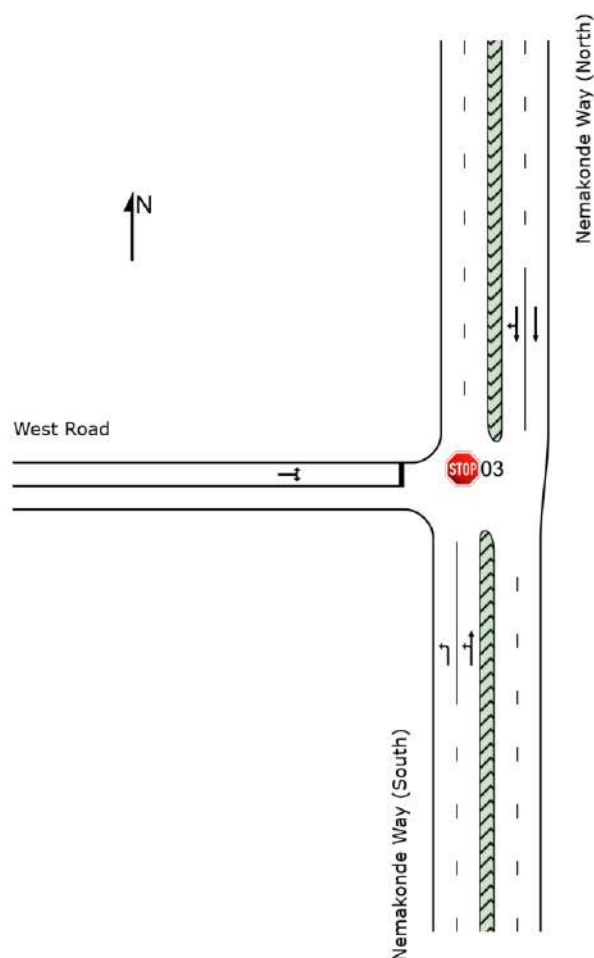


Figure 7.59: Site 03 NemaKonde Way and West Road (Sam Nujoma NemaKonde Way Corridor)

Table 7.63: Site 03 Movement Summary NemaKonde Way and West Road (Sam Nujoma NemaKonde Way Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: NemaKonde Way (South)															
1	L2	All MCs	98	5.2	98	5.2	0.239	5.6	LOS A	0.0	0.0	0.00	0.21	0.00	54.9
2	T1	All MCs	599	2.4	599	2.4	0.239	0.1	LOS A	0.0	0.0	0.00	0.06	0.00	58.8
Approach			697	2.8	697	2.8	0.239	0.9	NA	0.0	0.0	0.00	0.08	0.00	58.2
North: NemaKonde Way (North)															
8	T1	All MCs	643	1.8	643	1.8	0.290	1.0	LOS A	1.4	10.3	0.11	0.14	0.12	58.3
9	R2	All MCs	101	3.8	101	3.8	0.290	12.0	LOS B	1.4	10.3	0.54	0.67	0.61	51.0
Approach			743	2.0	743	2.0	0.290	2.5	NA	1.4	10.3	0.17	0.21	0.19	57.2
West: West Road															
10	L2	All MCs	118	4.0	118	4.0	1.869	795.5	LOS F	63.1	469.8	1.00	5.01	12.99	4.1
12	R2	All MCs	87	2.9	87	2.9	1.869	865.8	LOS F	63.1	469.8	1.00	5.01	12.99	4.1
Approach			205	3.6	205	3.6	1.869	825.3	LOS F	63.1	469.8	1.00	5.01	12.99	4.1
All Vehicles			1645	2.5	1645	2.5	1.869	104.5	NA	63.1	469.8	0.20	0.75	1.71	21.9

Table 7.64: Site 03 Lane Level of Service [Nemakonde Way and West Road (Sam Nujoma Nemakonde Way Corridor)]

	Approaches			Intersection
	South	North	West	
LOS	NA (TWSC)	NA (TWSC)	F	NA (TWSC)

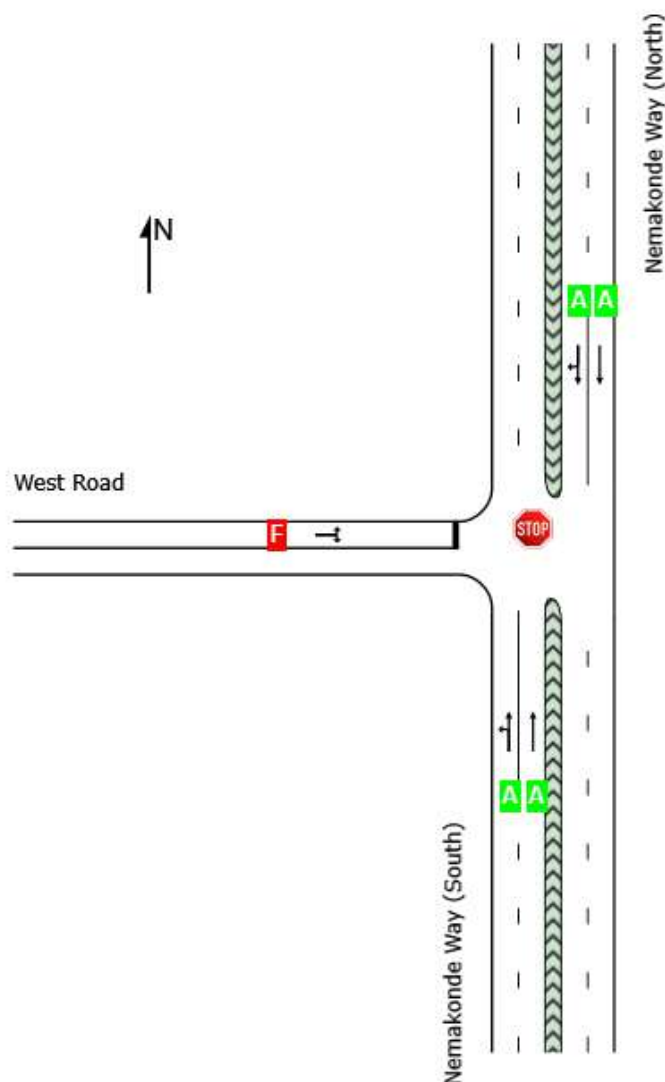


Figure 7.60: Site 03 Lane Level of Service [Nemakonde Way and West Road (Sam Nujoma Nemakonde Way Corridor)]

Table 7.65: Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane [Nemakonde Way and West Road (Sam Nujoma Nemakonde Way Corridor)]

	Approaches			Intersection
	South	North	West	
Degree of Saturation	0.24	0.29	1.87	1.87

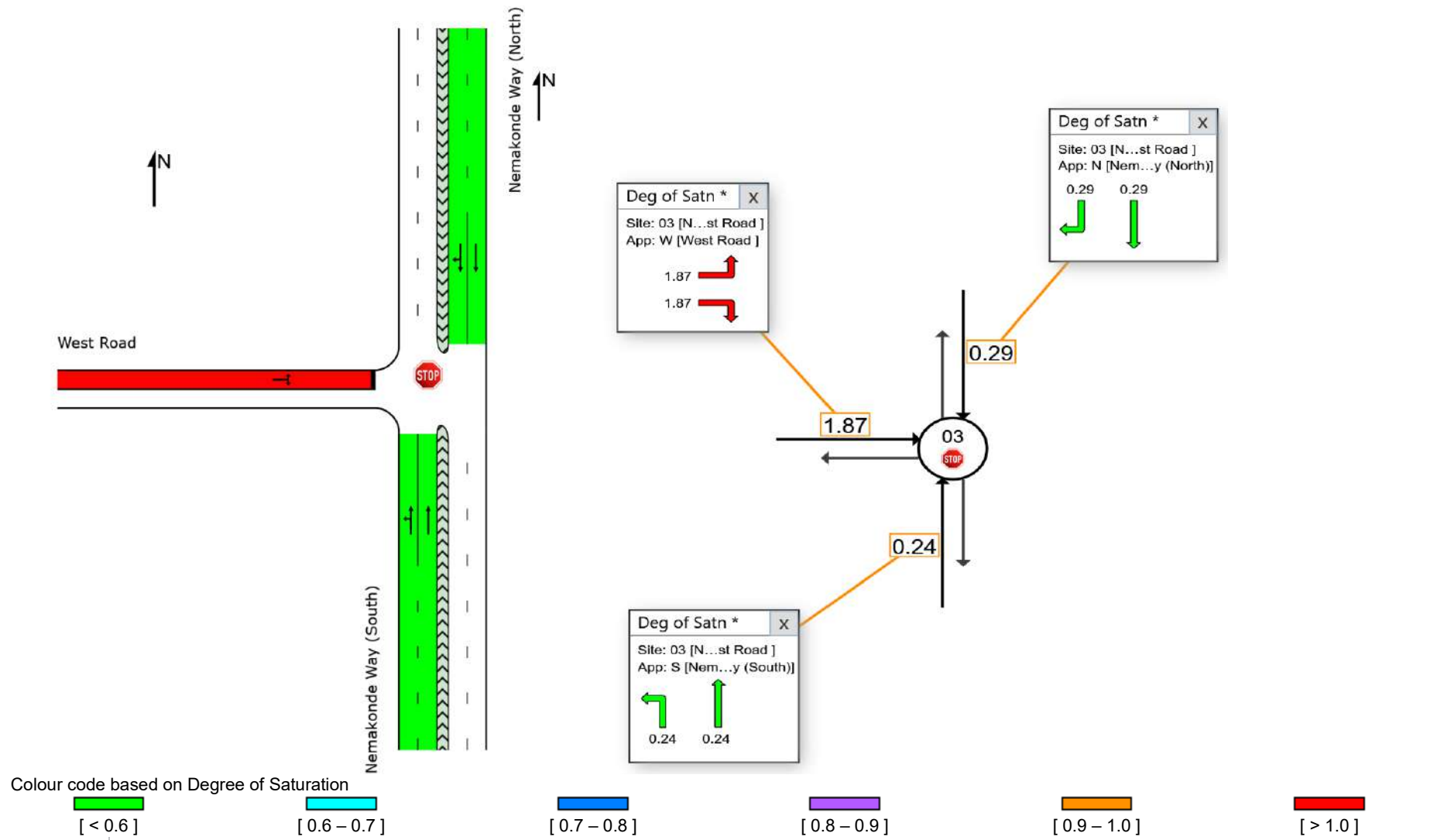


Figure 7.61: Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane [Nemakonde Way and West Road (Sam Nujoma Nemakonde Way Corridor)]

Site 04: Sam Nujoma and King George Road Intersection 15-hour Average Daily Traffic (ADT) Results

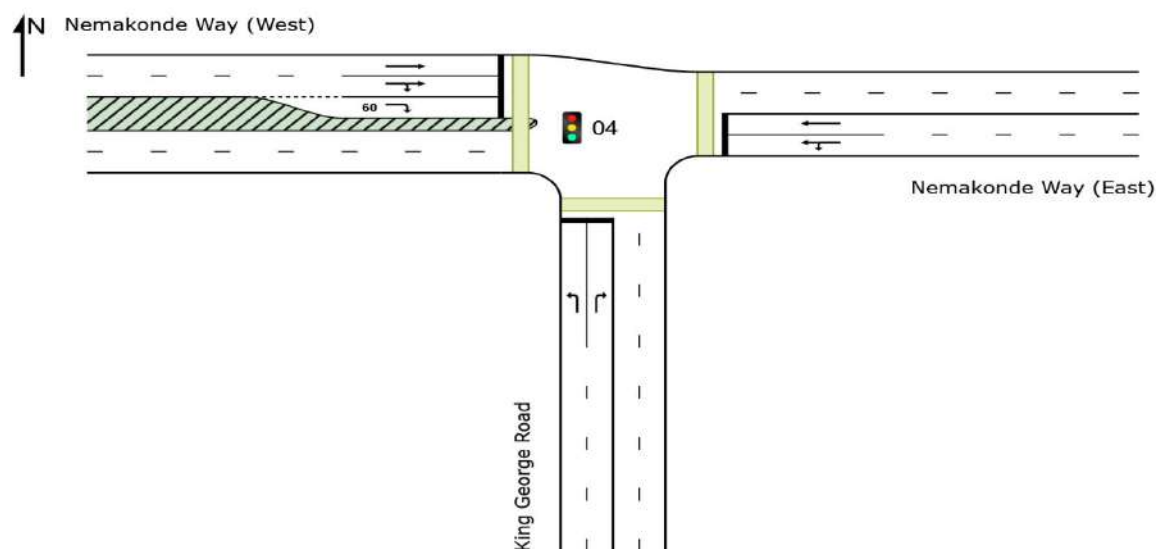


Figure 7.62: Site 04 Nemakonde Way and King George Road (Sam Nujoma Nemakonde Way Corridor)

Table 7.66: Site 04 Movement Summary Nemakonde Way and King George Road (Sam Nujoma Nemakonde Way Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec		veh	m				
South: King George Road															
1	L2	All MCs	380	2.6	380	2.6	0.450	6.8	LOS A	1.9	13.8	0.39	0.69	0.39	51.6
3	R2	All MCs	184	2.8	184	2.8	* 0.833	34.9	LOS C	5.5	40.8	1.00	1.03	1.52	37.1
Approach			564	2.6	564	2.6	0.833	16.0	LOS B	5.5	40.8	0.59	0.80	0.76	45.7
East: Nemakonde Way (East)															
4	L2	All MCs	182	2.9	182	2.9	0.850	31.7	LOS C	11.2	83.9	1.00	1.06	1.39	39.5
5	T1	All MCs	633	5.5	633	5.5	* 0.850	25.6	LOS C	12.5	95.7	1.00	1.06	1.37	41.8
Approach			816	4.9	816	4.9	0.850	27.0	LOS C	12.5	95.7	1.00	1.06	1.37	41.2
West: Nemakonde Way (West)															
11	T1	All MCs	472	4.9	472	4.9	0.600	19.2	LOS B	6.7	51.2	0.92	0.80	0.94	45.7
12	R2	All MCs	222	2.4	222	2.4	* 0.600	17.6	LOS B	4.3	32.5	0.95	0.82	1.01	44.8
Approach			694	4.1	694	4.1	0.600	18.7	LOS B	6.7	51.2	0.93	0.80	0.96	45.4
All Vehicles			2074	4.0	2074	4.0	0.850	21.2	LOS C	12.5	95.7	0.86	0.90	1.07	43.8

Table 7.67: Site 04 Lane Level of Service Nemakonde Way and King George Road (Sam Nujoma Nemakonde Way Corridor)

	Approaches			Intersection
	South	East	West	
LOS	B	C	B	C

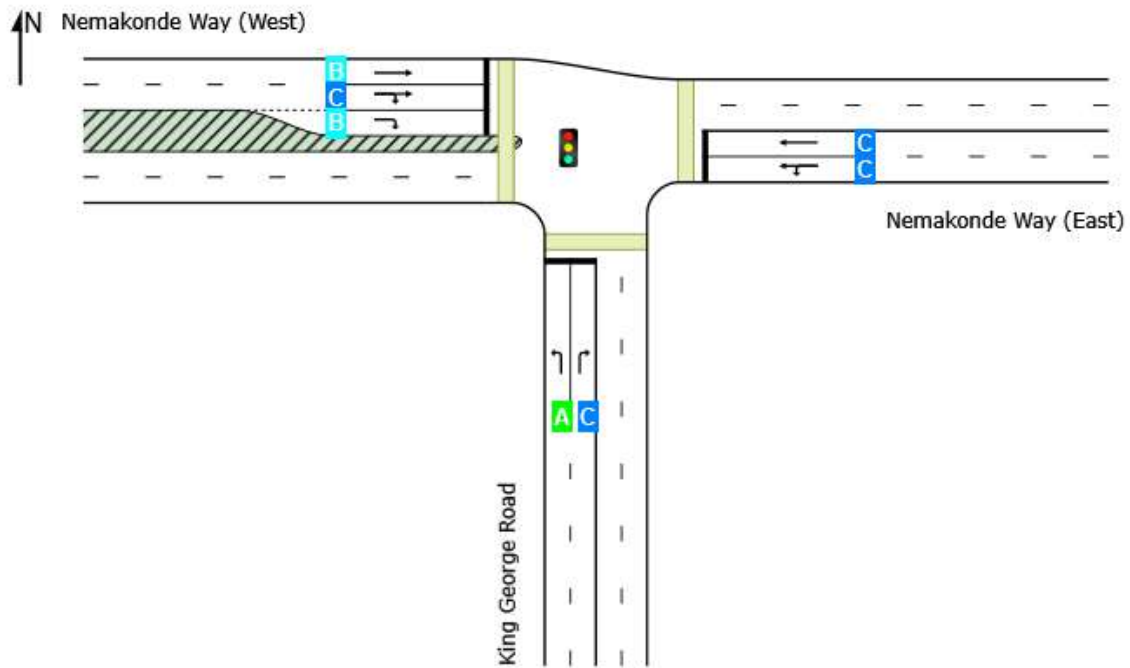


Figure 7.63: Site 04 Lane Level of Service Nemakonde Way and King George Road (Sam Nujoma Nemakonde Way Corridor)

Table 7.68: Site 04 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Nemakonde Way and King George Road (Sam Nujoma Nemakonde Way Corridor)

	Approaches			Intersection
	South	East	West	
Degree of Saturation	0.83	0.85	0.60	0.85

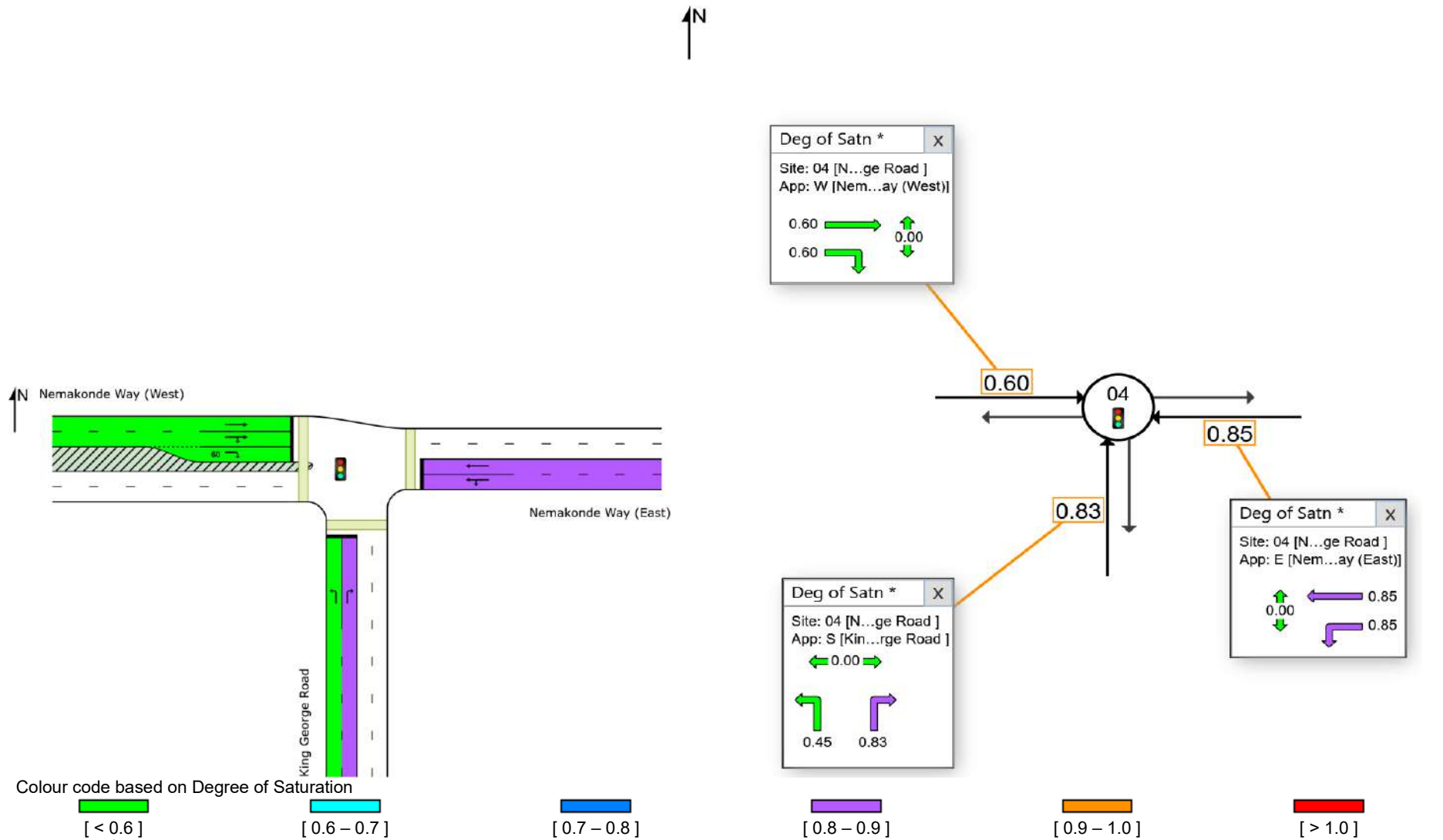


Figure 7.64: Site 04 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per movement [Nemakonde Way and King George Road (Sam Nujoma Nemakonde Way Corridor)]

Site 05: Sam Nujoma and Nemakonde Way Intersection
15-hour Average Daily Traffic (ADT) Results

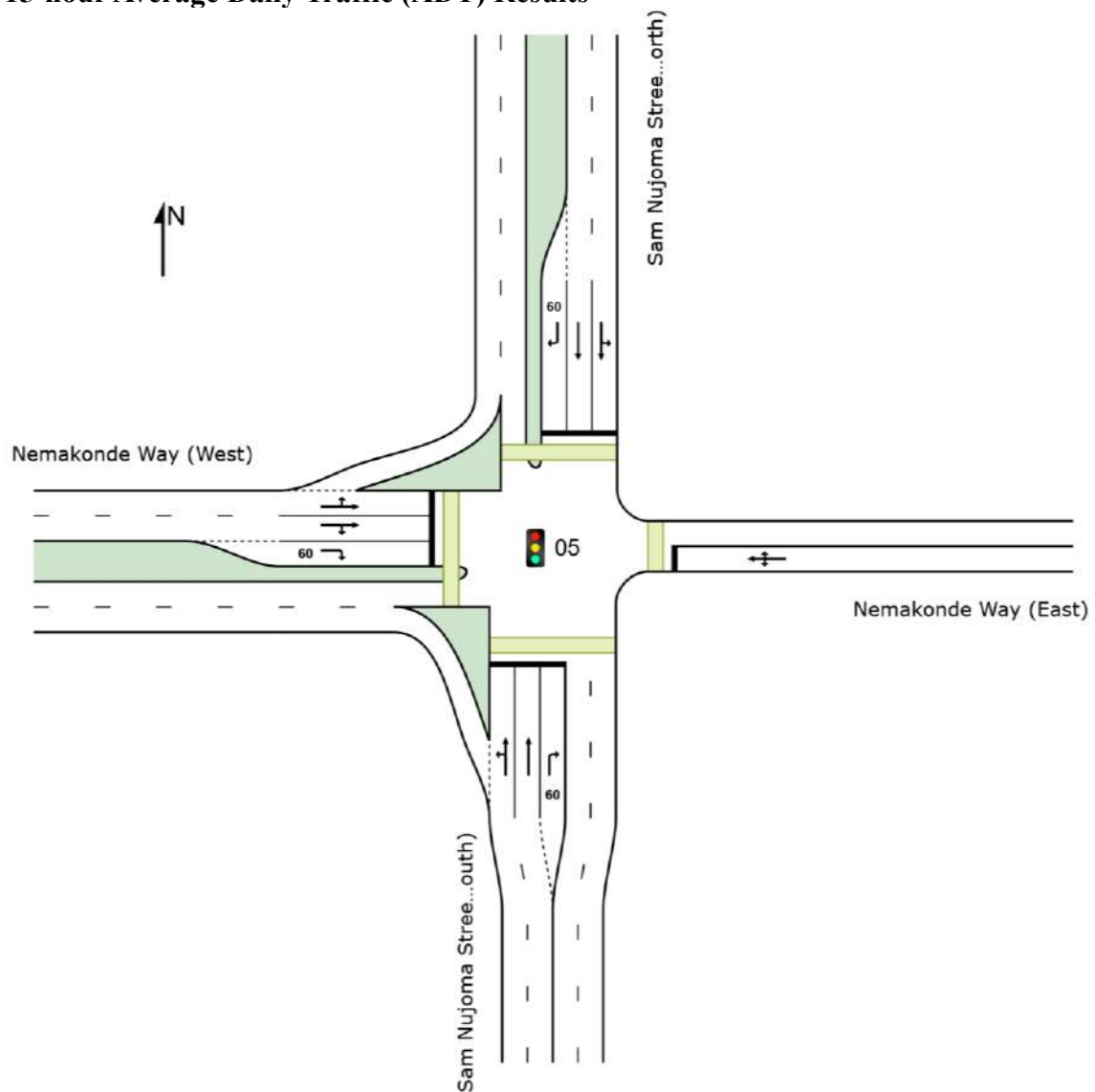


Figure 7.65: Site 04 MOVEMENT SUMMARY Sam, Nujoma and Nemakonde Way (Sam Nujoma Nemakonde Way Corridor)

Table 7.69: Site 04 Movement Summary Sam, Nujoma and NemaKonde Way (Sam Nujoma NemaKonde Way Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				
South: Sam Nujoma Street (South)															
1	L2	All MCs	257	6.1	257	6.1	0.800	10.5	LOS B	11.3	86.6	0.97	0.98	1.20	39.3
2	T1	All MCs	364	10.2	364	10.2	* 0.800	43.9	LOS D	11.3	86.6	0.99	0.98	1.25	40.2
3	R2	All MCs	18	7.9	18	7.9	0.042	13.9	LOS B	0.2	1.9	0.70	0.67	0.70	46.5
Approach			638	8.5	638	8.5	0.800	29.6	LOS C	11.3	86.6	0.98	0.97	1.22	40.0
East: NemaKonde Way (East)															
4	L2	All MCs	7	1.9	7	1.9	0.750	33.5	LOS C	6.2	47.4	0.98	0.93	1.22	39.6
5	T1	All MCs	187	5.0	187	5.0	0.750	28.0	LOS C	6.2	47.4	0.98	0.93	1.22	40.9
6	R2	All MCs	2	0.0	2	0.0	* 0.750	46.8	LOS D	6.2	47.4	0.98	0.93	1.22	39.8
Approach			196	4.9	196	4.9	0.750	28.4	LOS C	6.2	47.4	0.98	0.93	1.22	40.9
North: Sam Nujoma Street (North)															
7	L2	All MCs	165	6.8	165	6.8	0.716	33.2	LOS C	6.3	48.8	0.99	0.90	1.15	38.0
8	T1	All MCs	278	9.7	278	9.7	0.716	27.2	LOS C	7.2	57.1	0.99	0.89	1.13	41.1
9	R2	All MCs	13	6.3	13	6.3	0.106	37.3	LOS D	0.4	3.1	0.98	0.66	0.98	36.2
Approach			457	8.5	457	8.5	0.716	29.7	LOS C	7.2	57.1	0.99	0.89	1.14	39.8
West: NemaKonde Way (West)															
10	L2	All MCs	250	6.8	250	6.8	0.176	5.7	LOS A	0.0	0.0	0.00	0.52	0.00	53.0
11	T1	All MCs	297	3.8	297	3.8	0.831	30.8	LOS C	10.0	74.9	1.00	1.02	1.33	39.9
12	R2	All MCs	267	3.5	267	3.5	* 0.596	19.4	LOS B	5.5	40.8	0.83	0.80	0.83	44.1
Approach			814	4.6	814	4.6	0.831	19.4	LOS B	10.0	74.9	0.64	0.79	0.76	44.7
All Vehicles			2105	6.7	2105	6.7	0.831	25.6	LOS C	11.3	86.6	0.85	0.88	1.02	41.7

Table 7.70: Site 05 Lane Level of Service [Sam, Nujoma and NemaKonde Way (Sam Nujoma NemaKonde Way Corridor)]

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	C	B	C

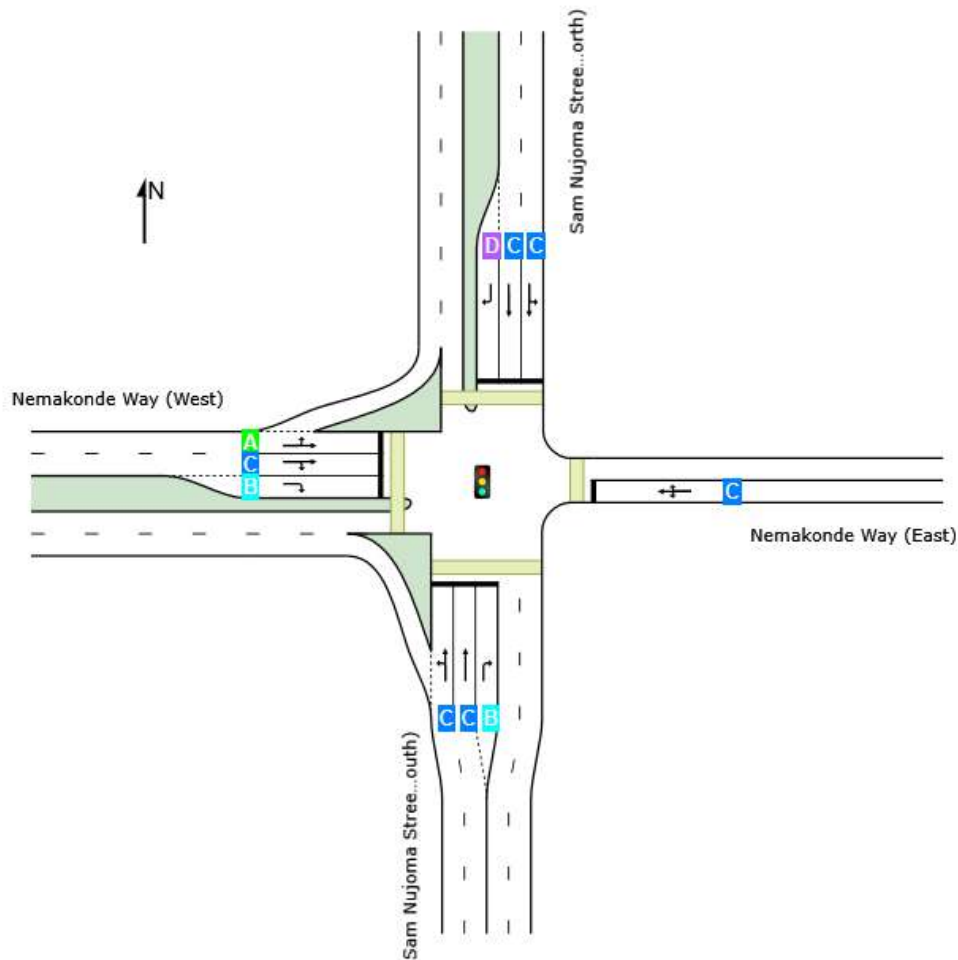


Figure 7.66: Site 05 Lane Level of Service [Sam, Nujoma and Nemakonde Way (Sam Nujoma Nemakonde Way Corridor)]

Table 7.71: Site 05 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane [Sam, Nujoma and Nemakonde Way (Sam Nujoma Nemakonde Way Corridor)]

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.80	0.75	0.72	0.83	0.83

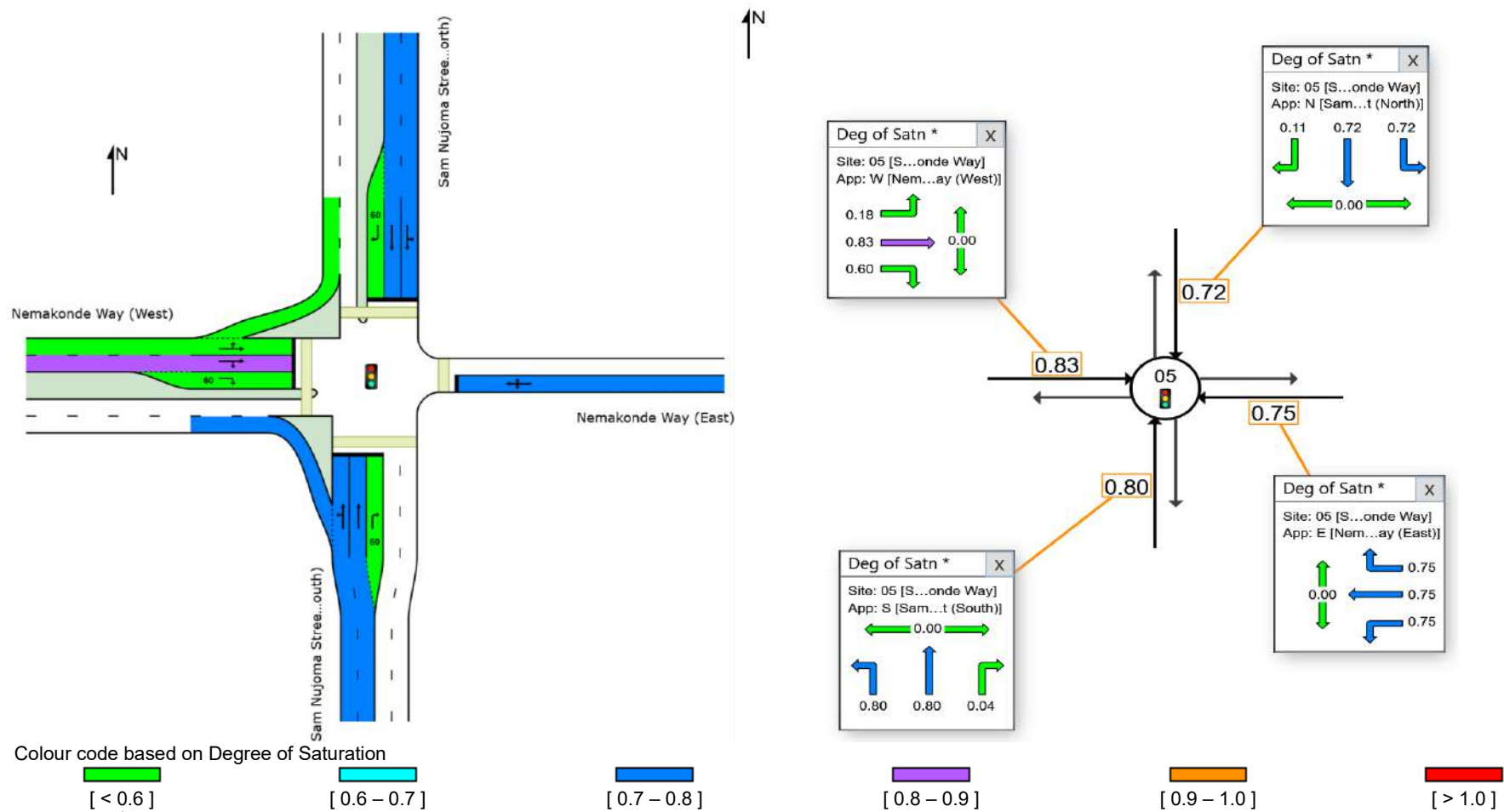


Figure 7.67: Site 05 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane [Sam, Nujoma and Nemakonde Way (Sam Nujoma Nemakonde Way Corridor)]

Site 06: Sam Nujoma and Churchill Road Intersection

15-hour Average Daily Traffic (ADT) Results

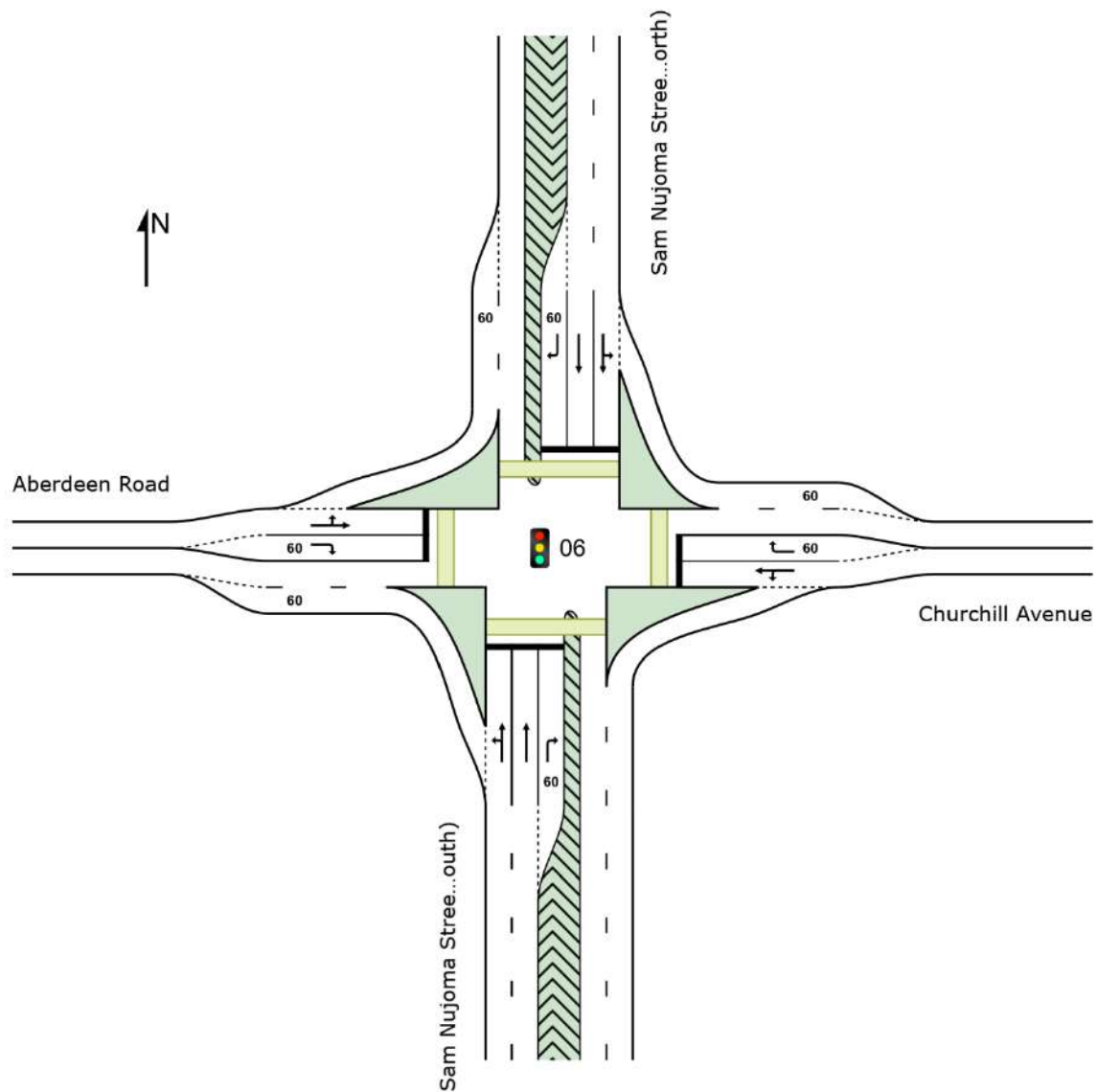


Figure 7.68: Site 06 Sam Nujoma Street and Churchill (Sam Nujoma Nemakonde Way Corridor)]

Table 7.72: Site 06 Movement Summary Sam Nujoma Street and Churchill (Sam Nujoma Nemakonde Way Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				
South: Sam Nujoma Street (South)															
1	L2	All MCs	119	3.2	119	3.2	0.942	31.6	LOS C	33.2	242.8	1.00	1.13	1.29	24.7
2	T1	All MCs	575	3.0	575	3.0	* 0.942	107.5	LOS F	33.2	242.8	1.00	1.13	1.31	24.9
3	R2	All MCs	124	3.2	124	3.2	0.401	57.9	LOS E	6.1	45.2	0.87	0.79	0.87	35.5
Approach			817	3.1	817	3.1	0.942	89.0	LOS F	33.2	242.8	0.98	1.08	1.24	24.3
East: Churchill Avenue															
4	L2	All MCs	269	2.6	269	2.6	0.955	61.9	LOS E	40.7	294.6	1.00	1.12	1.30	24.7
5	T1	All MCs	176	2.0	176	2.0	* 0.955	181.9	LOS F	40.7	294.6	1.00	1.12	1.30	25.1
6	R2	All MCs	126	4.4	126	4.4	* 0.275	59.1	LOS E	6.0	44.6	0.72	0.75	0.72	36.9
Approach			571	2.8	571	2.8	0.955	98.3	LOS F	40.7	294.6	0.94	1.04	1.18	22.9
North: Sam Nujoma Street (North)															
7	L2	All MCs	200	5.0	200	5.0	0.565	6.3	LOS A	15.7	119.0	0.89	0.81	0.89	32.3
8	T1	All MCs	276	4.3	276	4.3	0.565	85.0	LOS F	15.7	119.0	0.92	0.79	0.92	32.3
9	R2	All MCs	168	2.5	168	2.5	* 0.843	54.2	LOS D	9.8	71.4	1.00	0.90	1.22	31.1
Approach			645	4.1	645	4.1	0.843	52.5	LOS D	15.7	119.0	0.93	0.83	0.99	32.0
West: Aberdeen Road															
10	L2	All MCs	38	1.1	38	1.1	0.352	7.4	LOS A	10.2	73.3	0.79	0.69	0.79	35.6
11	T1	All MCs	152	1.4	152	1.4	0.352	48.7	LOS D	10.2	73.3	0.79	0.69	0.79	36.3
12	R2	All MCs	58	3.3	58	3.3	0.149	40.1	LOS D	2.8	21.3	0.74	0.73	0.74	35.3
Approach			247	1.8	247	1.8	0.352	40.4	LOS D	10.2	73.3	0.78	0.70	0.78	35.9
All Vehicles			2281	3.1	2281	3.1	0.955	75.7	LOS E	40.7	294.6	0.93	0.96	1.10	26.6

Table 7.73: Site 06 Lane Level of Service Sam Nujoma Street and Churchill (Sam Nujoma Nemakonde Way Corridor)

	Approaches				Intersection
	South	East	North	West	
LOS	F	F	D	D	E

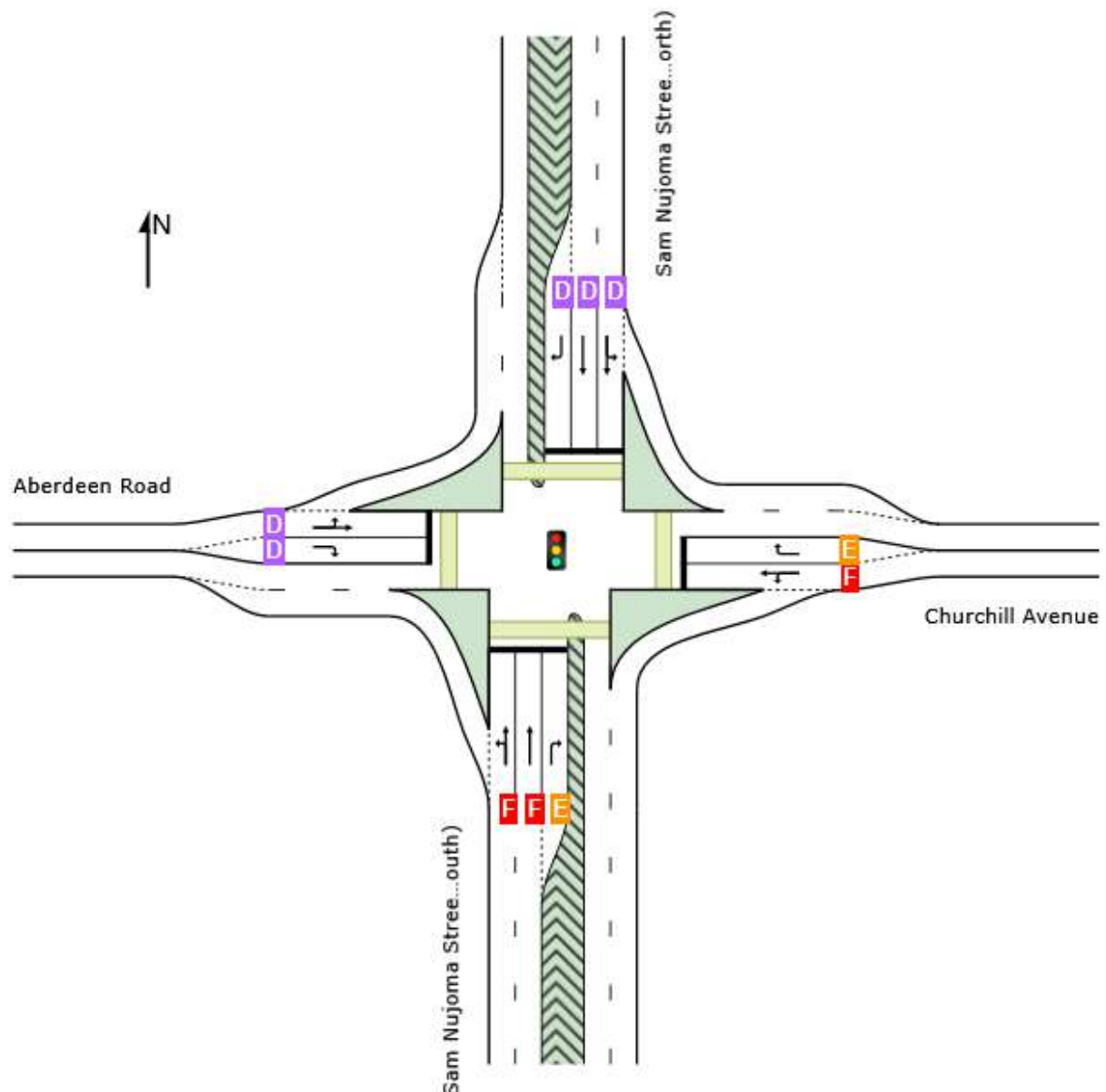


Figure 7.69: Site 06 Lane Level of Service Sam Nujoma Street and Churchill (Sam Nujoma Nemakonde Way Corridor)

Table 7.74: Site 06 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Sam Nujoma Street and Churchill (Sam Nujoma Nemakonde Way Corridor)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.94	0.95	0.84	0.35	0.95

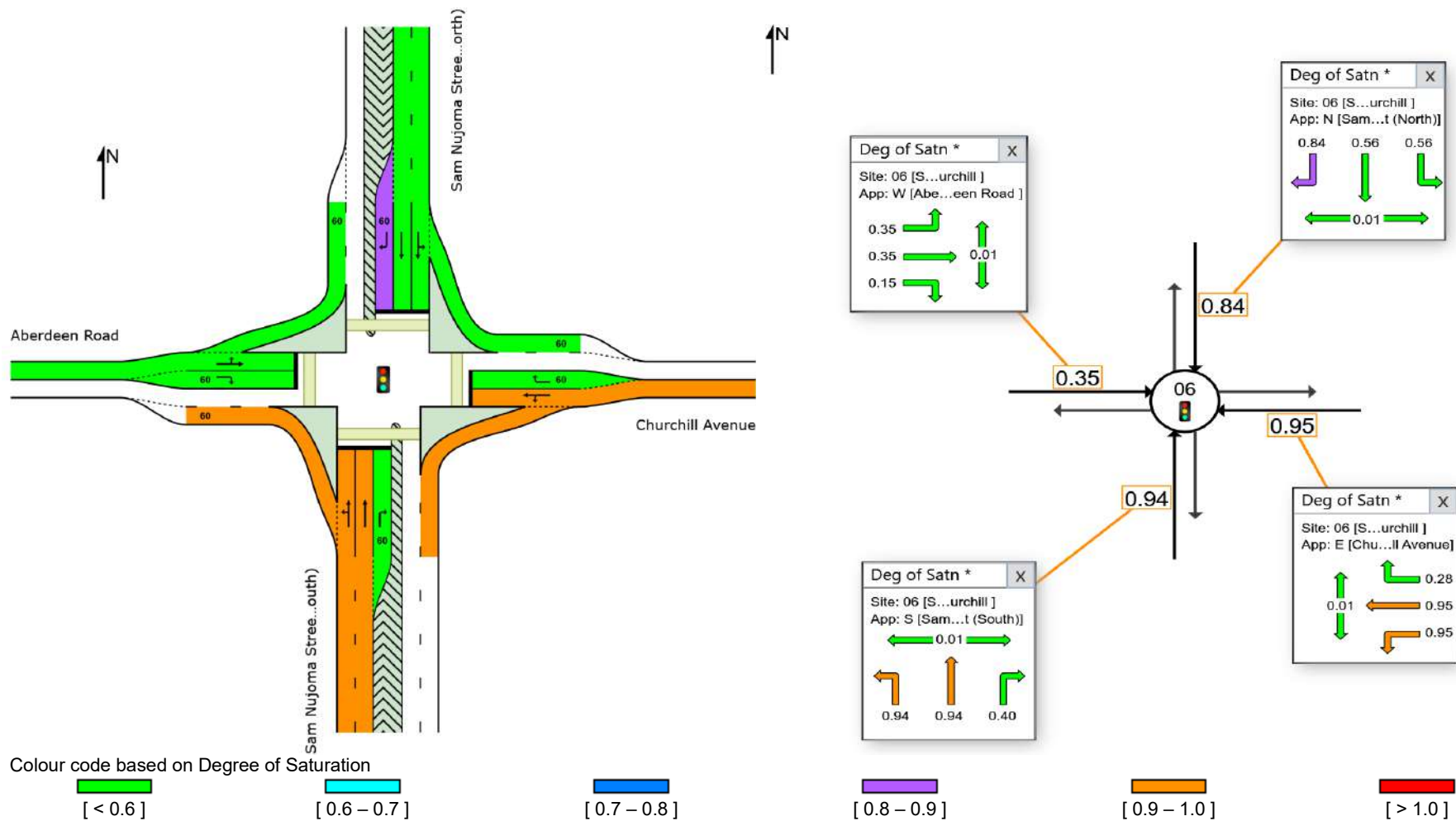


Figure 7.70: Site 06 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Sam Nujoma Street and Churchill (Sam Nujoma Nemakonde Way Corridor)

Site 07: Sam Nujoma and Josiah Tongogara Intersection
15-hour Average Daily Traffic (ADT) Results

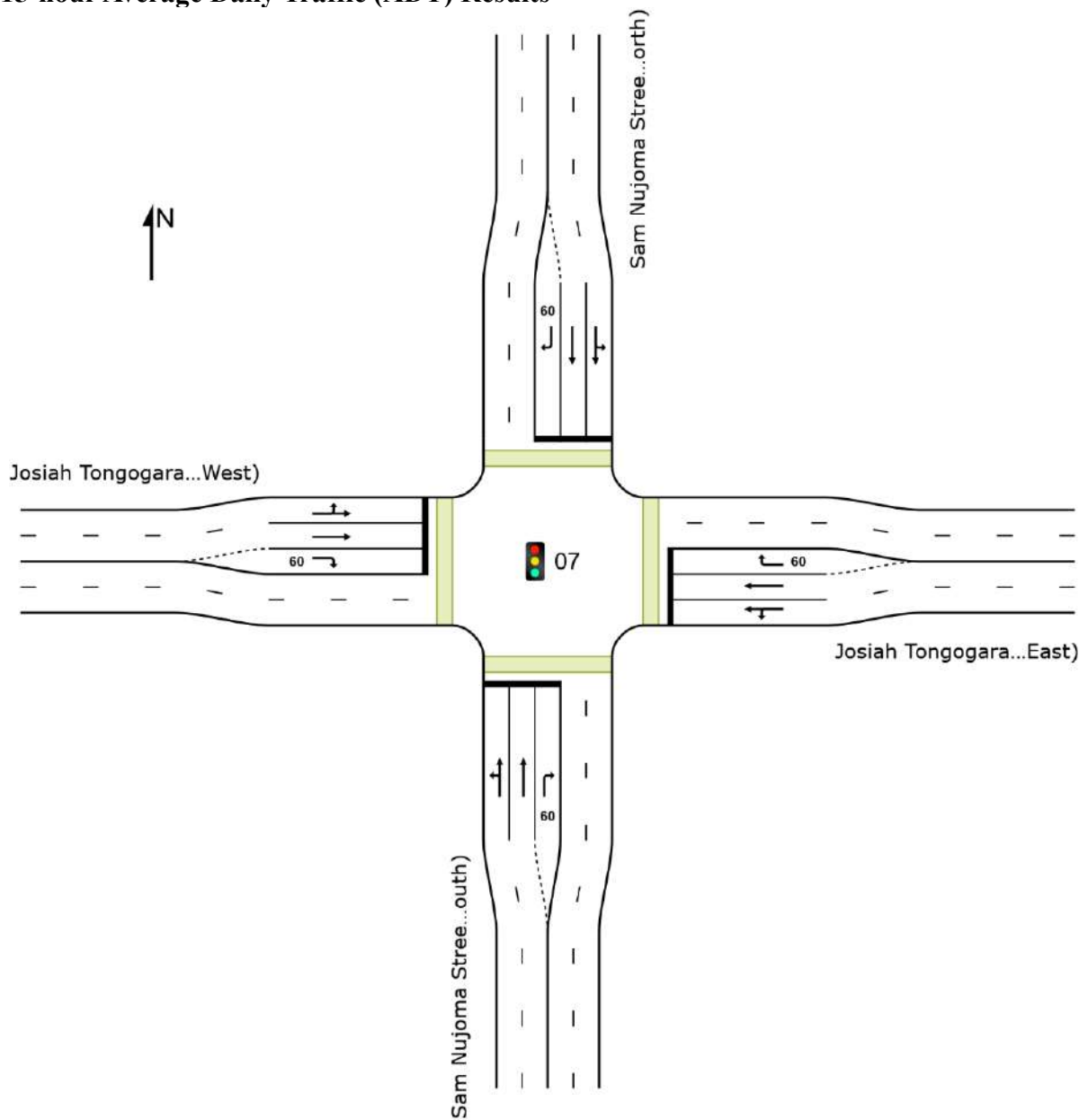


Figure 7.71: Site 07 Sam Nujoma Street and Josiah Tongogara Avenue (Sam Nujoma Nemakonde Way Corridor)

Table 7.75: Site 07 Movement Summary for Sam Nujoma Street and Josiah Tongogara Avenue (Sam Nujoma Nemakonde Way Corridor)

Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Eff. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Sam Nujoma Street (South)															
1	L2	All MCs	0	50.0	0	50.0	0.063	17.8	LOS B	0.7	5.1	0.82	0.59	0.82	38.6
2	T1	All MCs	95	2.6	95	2.6	0.063	13.3	LOS B	0.8	5.7	0.82	0.59	0.82	48.7
3	R2	All MCs	37	10.5	37	10.5	0.159	23.0	LOS C	0.7	5.7	0.90	0.72	0.90	41.9
Approach			132	4.8	132	4.8	0.159	16.0	LOS B	0.8	5.7	0.84	0.63	0.84	46.6
East: Josiah Tongogara Av (East)															
4	L2	All MCs	33	1.1	33	1.1	0.353	21.9	LOS C	3.4	25.1	0.92	0.74	0.92	45.2
5	T1	All MCs	372	3.8	372	3.8	0.353	16.2	LOS B	3.8	28.4	0.92	0.73	0.92	47.1
6	R2	All MCs	203	2.1	203	2.1 *	0.361	15.1	LOS B	2.9	20.7	0.85	0.77	0.85	46.4
Approach			607	3.1	607	3.1	0.361	16.2	LOS B	3.8	28.4	0.90	0.74	0.90	46.8
North: Sam Nujoma Street (North)															
7	L2	All MCs	264	2.9	264	2.9	0.396	20.3	LOS C	4.5	33.2	0.90	0.79	0.90	43.5
8	T1	All MCs	309	4.7	309	4.7 *	0.396	14.6	LOS B	5.3	39.3	0.90	0.73	0.90	48.3
9	R2	All MCs	94	10.1	94	10.1	0.272	20.5	LOS C	1.6	13.3	0.86	0.75	0.86	43.4
Approach			667	4.8	667	4.8	0.396	17.7	LOS B	5.3	39.3	0.89	0.75	0.89	45.6
West: Josiah Tongogara Av (West)															
10	L2	All MCs	70	4.5	70	4.5	0.404	22.1	LOS C	3.9	28.7	0.93	0.75	0.93	44.5
11	T1	All MCs	393	2.7	393	2.7 *	0.404	16.4	LOS B	4.4	32.6	0.93	0.75	0.93	46.9
12	R2	All MCs	78	0.5	78	0.5	0.134	14.2	LOS B	1.0	7.0	0.79	0.72	0.79	47.0
Approach			541	2.6	541	2.6	0.404	16.8	LOS B	4.4	32.6	0.91	0.74	0.91	46.6
All Vehicles			1947	3.6	1947	3.6	0.404	16.9	LOS B	5.3	39.3	0.90	0.74	0.90	46.3

Table 7.76: Site 07 Lane Level of Service Sam Nujoma Street and Josiah Tongogara Avenue (Site Folder: Sam Nujoma Nemakonde Way Corridor)

	Approaches				Intersection
	South	East	North	West	
LOS	B	B	B	B	B

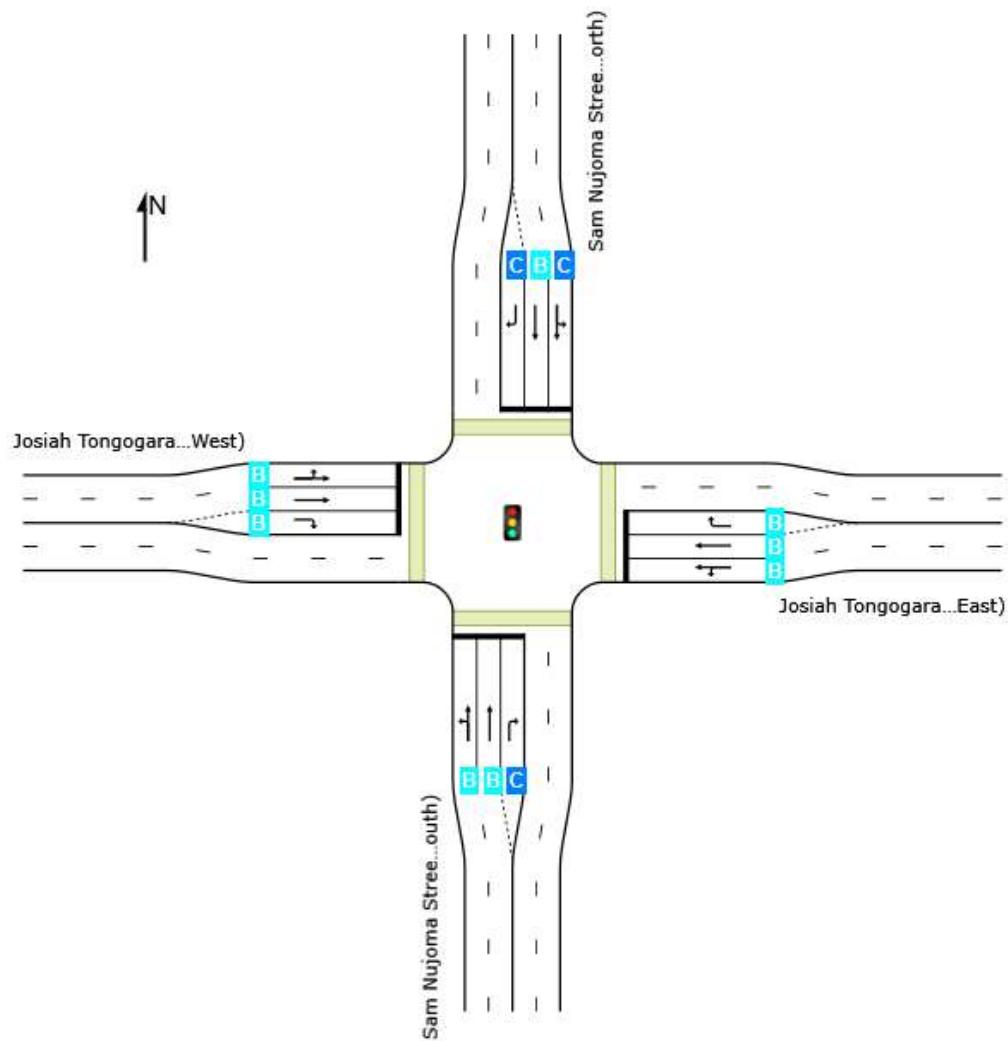


Figure 7.72: Site 07 Lane Level of Service Sam Nujoma Street and Josiah Tongogara Avenue (Site Folder: Sam Nujoma Nemakonde Way Corridor)

Table 7.77: Site 07 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Sam Nujoma Street and Josiah Tongogara Avenue (Site Folder: Sam Nujoma Nemakonde Way Corridor)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.16	0.36	0.40	0.40	0.40

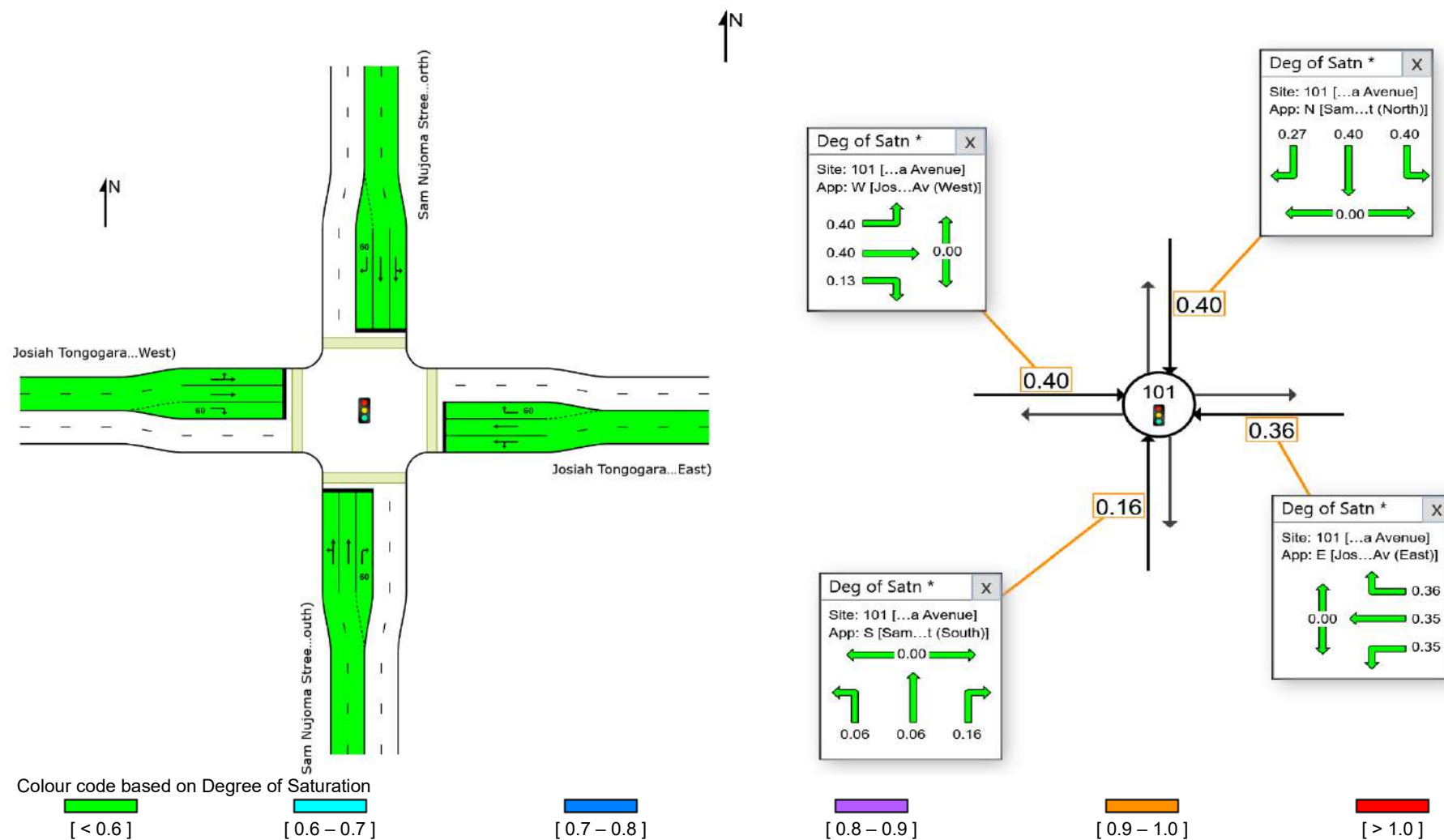


Figure 7.73: Site 07 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per movement (Sam Nujoma Street and Josiah Tongogara Avenue (Sam Nujoma Nemakonde Way Corridor))

Site 08: Sam Nujoma and Hebert Chitepo Avenue Intersection

15-hour Average Daily Traffic (ADT) Results

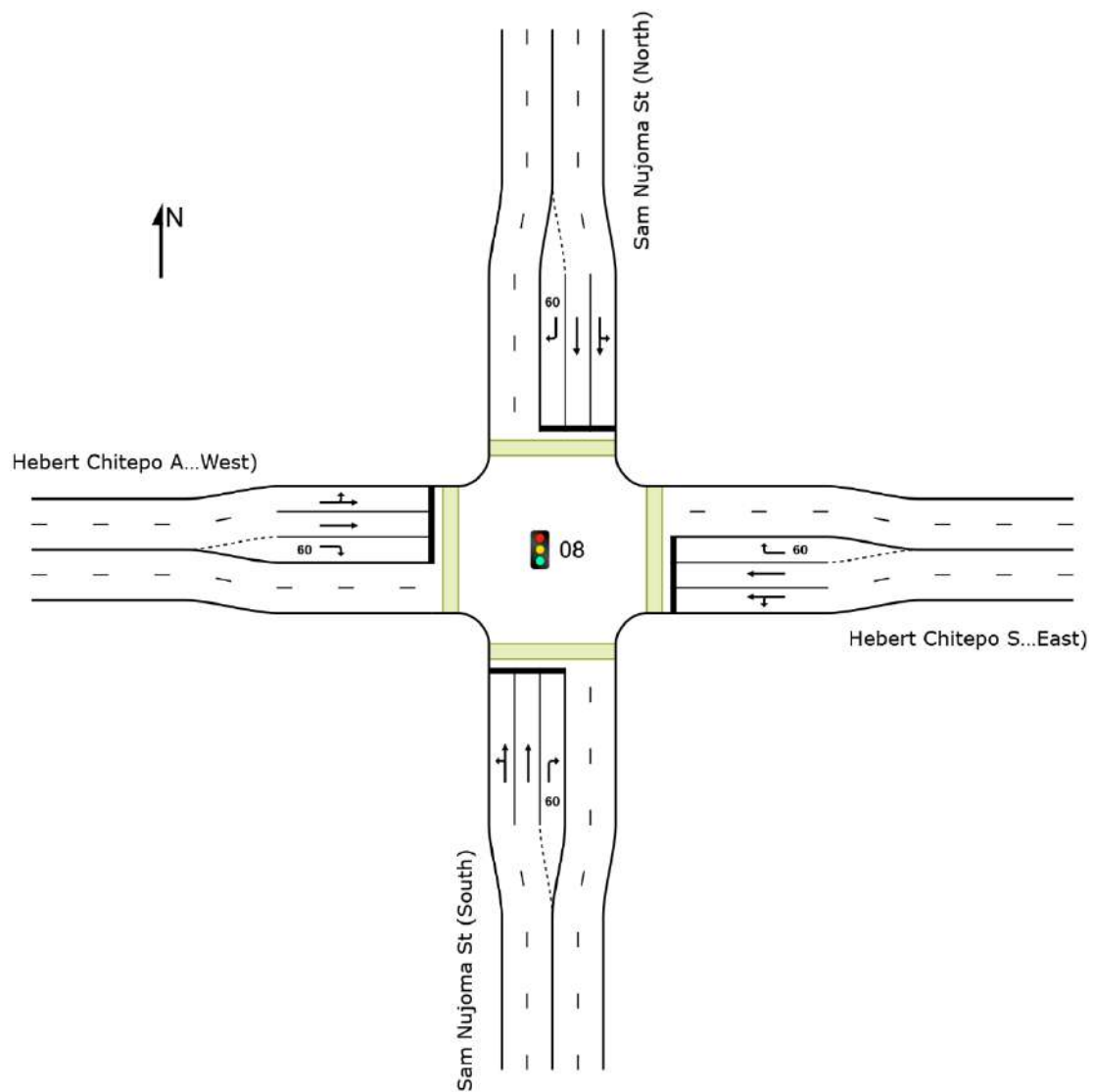


Figure 7.74: Site 08 Sam Nujoma Street and Hebert Chitepo Av. (Sam Nujoma Nemakonde Way Corridor)

Table 7.78: Site 08 Movement Summary for Sam Nujoma Street and Hebert Chitepo Av. (Sam Nujoma Nemakonde Way Corridor)

Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Eff. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Sam Nujoma St (South)															
1	L2	All MCs	40	7.3	40	7.3	0.325	13.9	LOS B	3.6	28.3	0.79	0.66	0.79	50.1
2	T1	All MCs	649	5.8	649	5.8	0.325	8.3	LOS A	4.1	31.8	0.79	0.66	0.79	52.6
3	R2	All MCs	137	1.6	137	1.6	0.401	16.3	LOS B	1.8	13.0	0.86	0.77	0.86	45.8
Approach			825	5.2	825	5.2	0.401	9.9	LOS A	4.1	31.8	0.80	0.68	0.80	51.2
East: Hebert Chitepo St (East)															
4	L2	All MCs	73	3.7	73	3.7	0.409	15.8	LOS B	4.1	31.7	0.87	0.73	0.87	48.5
5	T1	All MCs	612	7.4	612	7.4 *	0.409	10.1	LOS B	4.6	36.0	0.87	0.72	0.87	51.0
6	R2	All MCs	72	8.7	72	8.7	0.223	16.7	LOS B	0.9	7.6	0.84	0.74	0.84	45.4
Approach			758	7.2	758	7.2	0.409	11.3	LOS B	4.6	36.0	0.87	0.72	0.87	50.2
North: Sam Nujoma St (North)															
7	L2	All MCs	31	13.7	31	13.7	0.356	14.1	LOS B	4.2	30.8	0.80	0.67	0.80	50.0
8	T1	All MCs	752	2.4	752	2.4 *	0.356	8.4	LOS A	4.7	34.5	0.80	0.67	0.80	52.6
9	R2	All MCs	78	10.9	78	10.9	0.232	15.9	LOS B	1.0	7.7	0.82	0.74	0.82	46.0
Approach			860	3.5	860	3.5	0.356	9.3	LOS A	4.7	34.5	0.80	0.67	0.80	51.8
West: Hebert Chitepo Av (West)															
10	L2	All MCs	34	13.0	34	13.0	0.296	15.6	LOS B	2.8	22.5	0.84	0.69	0.84	48.8
11	T1	All MCs	452	8.6	452	8.6	0.296	9.8	LOS A	3.1	25.4	0.84	0.68	0.84	51.4
12	R2	All MCs	127	1.8	127	1.8	0.414	18.1	LOS B	1.8	13.0	0.91	0.77	0.91	44.8
Approach			613	7.5	613	7.5	0.414	11.8	LOS B	3.1	25.4	0.85	0.70	0.85	49.8
All Vehicles			3057	5.7	3057	5.7	0.414	10.5	LOS B	4.7	36.0	0.83	0.69	0.83	50.8

Table 7.79: Site 08 Lane Level of Service for Sam Nujoma Street and Hebert Chitepo Av. (Sam Nujoma Nemakonde Way Corridor)

	Approaches				Intersection
	South	East	North	West	
LOS	A	B	A	B	B

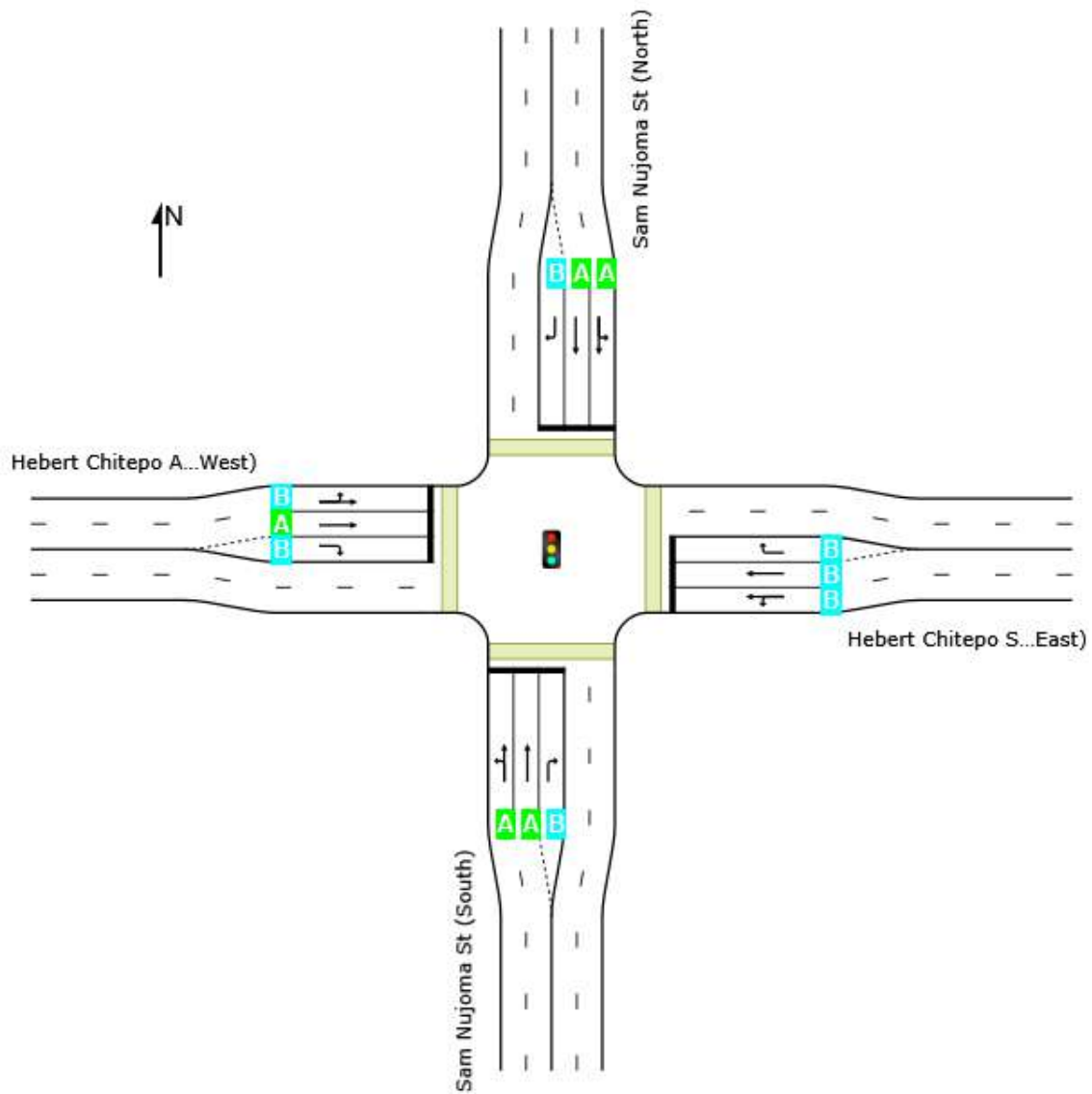


Figure 7.75: Site 08 Lane Level of Service for Sam Nujoma Street and Hebert Chitepo Av. (Sam Nujoma Nemakonde Way Corridor)

Table 7.80: Site 08 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane for Sam Nujoma Street and Hebert Chitepo Av. (Sam Nujoma Nemakonde Way Corridor)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.40	0.41	0.36	0.41	0.41

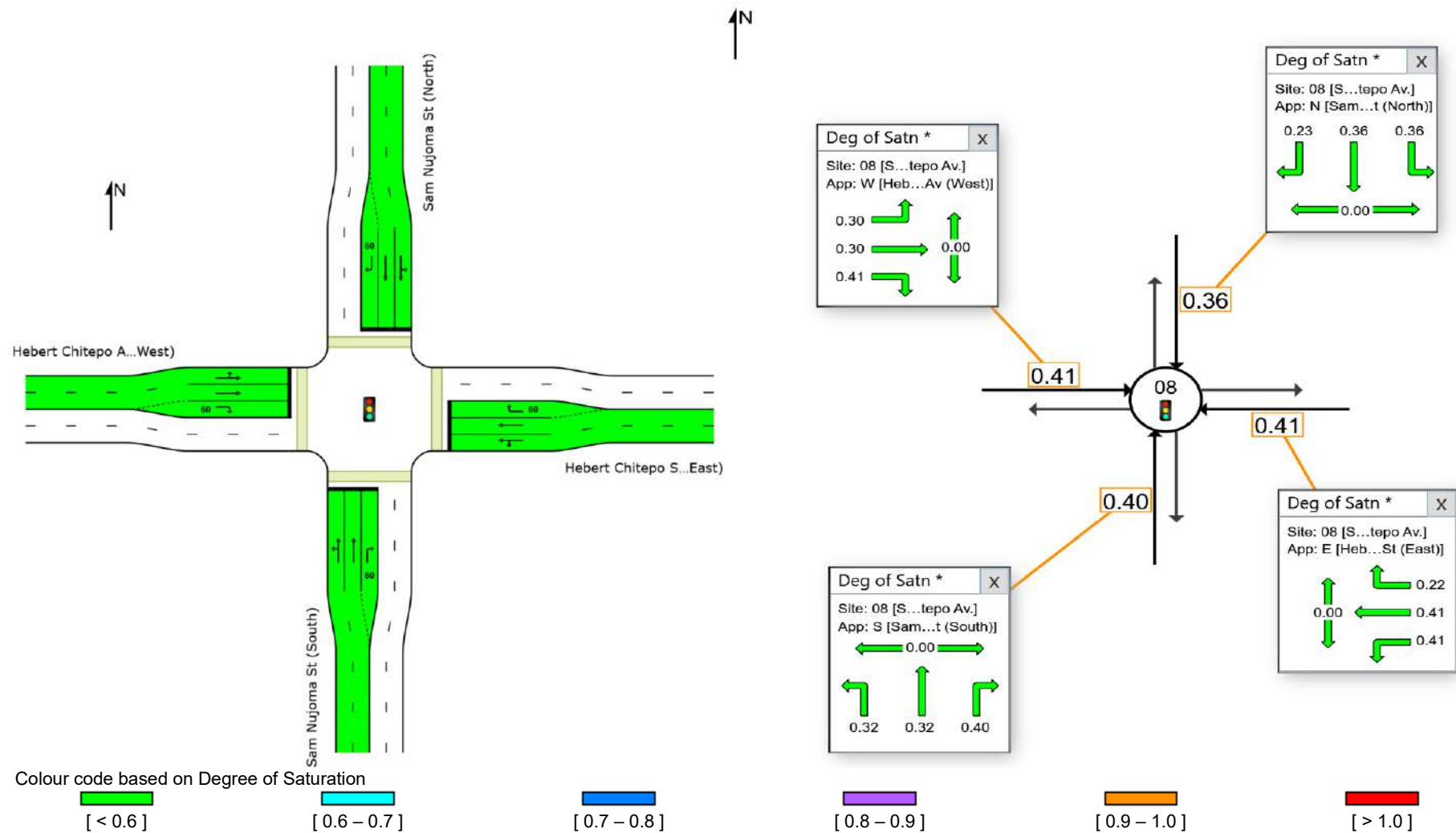


Figure 7.76: Site 08 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane for Sam Nujoma Street and Hebert Chitepo Av. (Sam Nujoma Nemakonde Way Corridor)

1.1.1.1.1. The North-East Corridor (ED Mnangagwa Road / Mutoko Road)

Site 01: ED Mnangagwa and Bindura-Shamva Road Intersection
15-hour Average Daily Traffic (ADT) Results

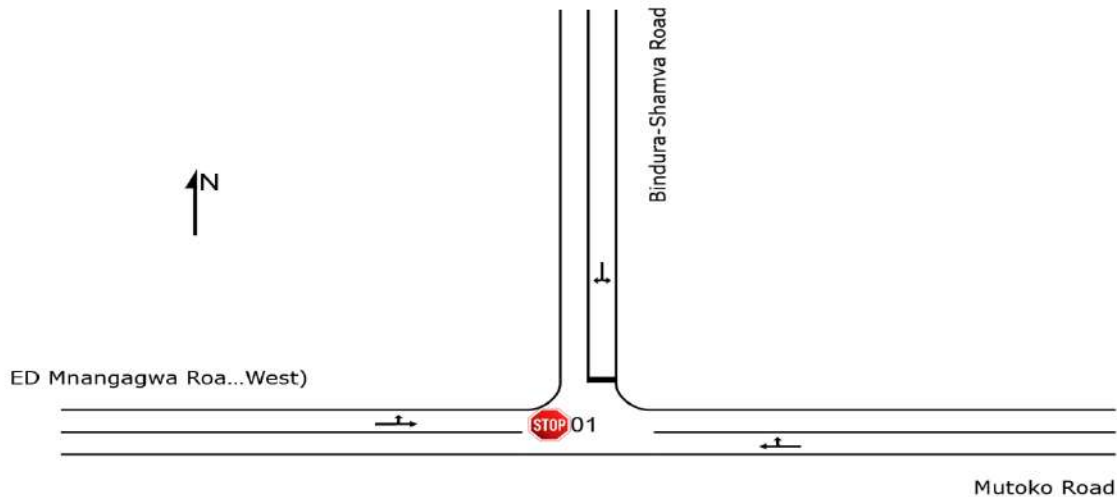


Figure 7.77: Site 01 ED Mnangagwa Rd and Bindura-Shamva Rd (Site Folder: ED Mnangagwa Corridor)

Table 7.81: Site 01 Movement Summary ED Mnangagwa Rd and Bindura-Shamva Rd (ED Mnangagwa Corridor)

Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]		sec		[Veh.	Dist]				km/h
			veh/h	%	veh/h	%	v/c			veh	m				
East: Mutoko Road															
5	T1	All MCs	139	13.4	139	13.4	0.097	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
6	R2	All MCs	0	0.0	0	0.0	0.097	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			139	13.4	139	13.4	0.097	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
North: Bindura-Shamva Road															
7	L2	All MCs	19	25.4	19	25.4	0.163	10.2	LOS B	0.6	4.7	0.41	0.93	0.41	47.8
9	R2	All MCs	93	12.8	93	12.8	0.163	11.0	LOS B	0.6	4.7	0.41	0.93	0.41	48.5
Approach			113	15.0	113	15.0	0.163	10.8	LOS B	0.6	4.7	0.41	0.93	0.41	48.4
West: ED Mnangagwa Road (West)															
10	L2	All MCs	93	11.1	93	11.1	0.160	5.7	LOS A	0.0	0.0	0.00	0.24	0.00	54.4
11	T1	All MCs	130	13.2	130	13.2	0.160	0.1	LOS A	0.0	0.0	0.00	0.24	0.00	57.2
Approach			223	12.3	223	12.3	0.160	2.4	NA	0.0	0.0	0.00	0.24	0.00	56.0
All Vehicles			475	13.3	475	13.3	0.163	3.7	NA	0.6	4.7	0.10	0.33	0.10	55.0

Table 7.82: Site 01 Lane Level of Service ED Mnangagwa Rd and Bindura-Shamva Rd (ED Mnangagwa Corridor)

	Approaches			Intersection
	East	North	West	
LOS	NA (TWSC)	B	NA (TWSC)	NA (TWSC)

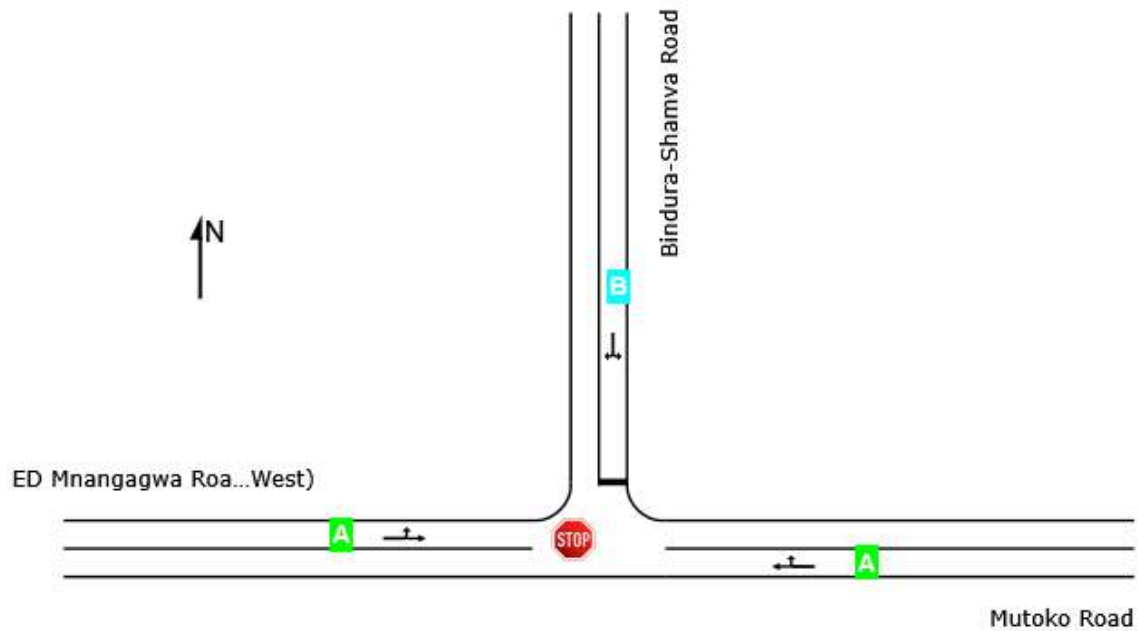


Figure 7.78: Site 01 Lane Level of Service ED Mnangagwa Rd and Bindura-Shamva Rd (ED Mnangagwa Corridor)

Table 7.83: Site 01 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane ED Mnangagwa Rd and Bindura-Shamva Rd (ED Mnangagwa Corridor)

New Site
 Site Category: Existing Design
 Stop (Two-Way)

	Approaches			Intersection
	East	North	West	
Degree of Saturation	0.10	0.16	0.16	0.16

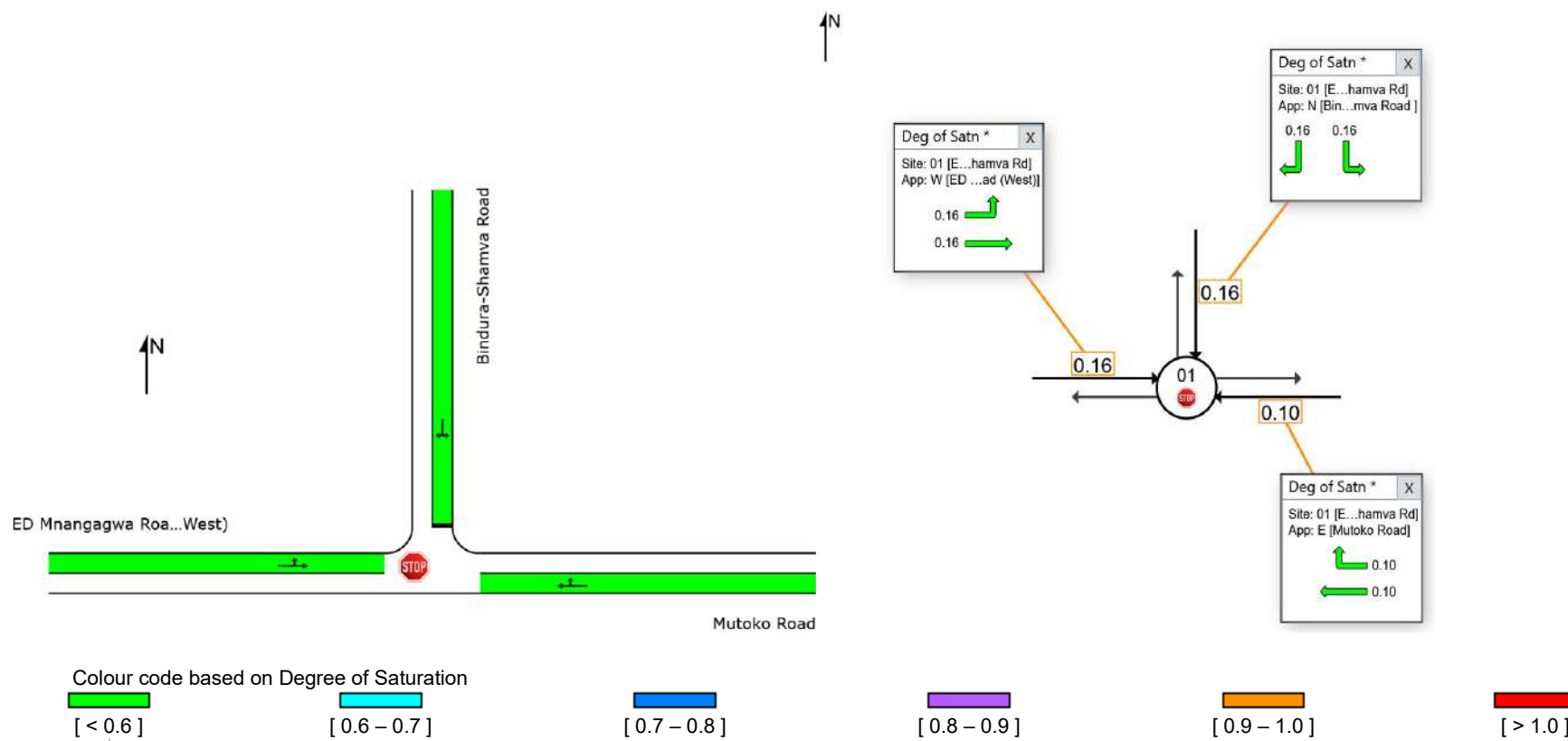


Figure 7.79: Site 01 ED Mwangagwa Rd and Bindura-Shamva Rd (ED Mwangagwa Corridor)

Site 02: ED Mnangagwa and Highland Glen Road Intersection

15-hour Average Daily Traffic (ADT) Results

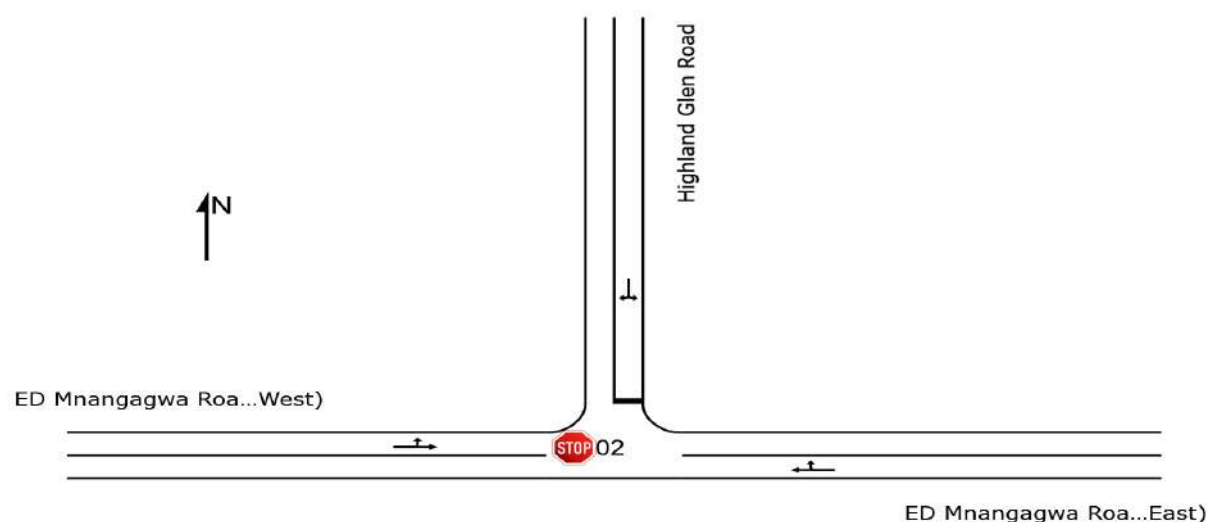


Figure 7.80: Site 02 ED Mnangagwa Rd and Highland Glen Rd (ED Mnangagwa Corridor)

Table 7.84: Site 02 Movement Summary ED Mnangagwa Rd and Highland Glen Rd (ED Mnangagwa Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
East: ED Mnangagwa Road (East)															
5	T1	All MCs	188	11.3	188	11.3	0.131	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
6	R2	All MCs	0	0.0	0	0.0	0.131	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach			188	11.3	188	11.3	0.131	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.7
North: Highland Glen Road															
7	L2	All MCs	17	7.2	17	7.2	0.109	9.7	LOS A	0.3	2.7	0.47	0.94	0.47	47.8
9	R2	All MCs	51	8.2	51	8.2	0.109	11.9	LOS B	0.3	2.7	0.47	0.94	0.47	48.2
Approach			67	7.9	67	7.9	0.109	11.4	LOS B	0.3	2.7	0.47	0.94	0.47	48.1
West: ED Mnangagwa Road (West)															
10	L2	All MCs	32	3.1	32	3.1	0.193	5.6	LOS A	0.0	0.0	0.00	0.07	0.00	56.2
11	T1	All MCs	255	8.9	255	8.9	0.193	0.1	LOS A	0.0	0.0	0.00	0.07	0.00	58.7
Approach			287	8.2	287	8.2	0.193	0.7	NA	0.0	0.0	0.00	0.07	0.00	58.4
All Vehicles			543	9.2	543	9.2	0.193	1.8	NA	0.3	2.7	0.06	0.15	0.06	57.3

Table 7.85: Site 02 Lane Level of Service ED Mnangagwa Rd and Highland Glen Rd (ED Mnangagwa Corridor)

New Site
Site Category: Existing Design
Stop (Two-Way)

	Approaches			Intersection
	East	North	West	
LOS	NA (TWSC)	B	NA (TWSC)	NA (TWSC)

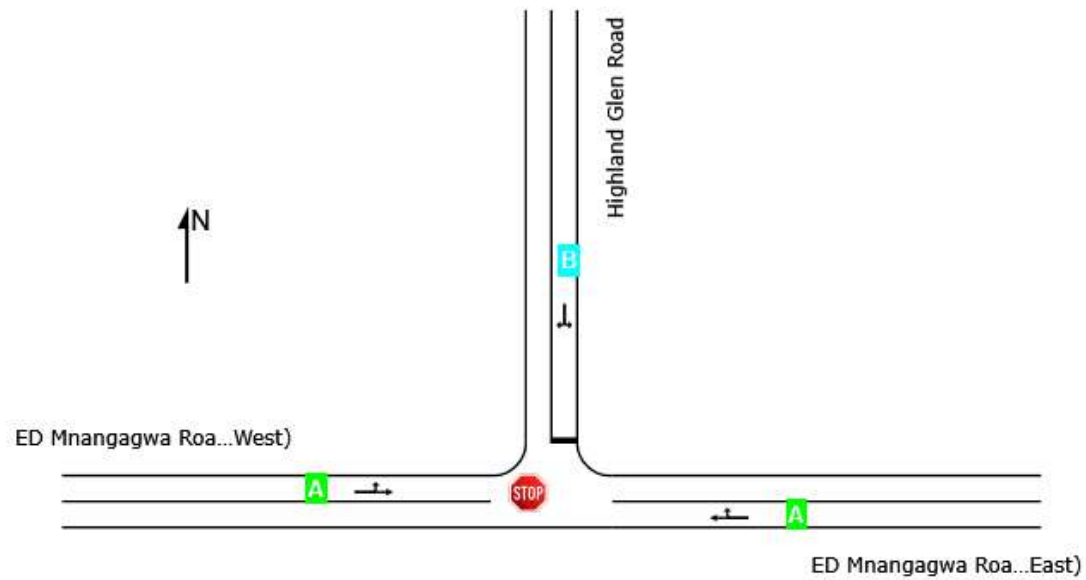


Figure 7.81: Site 02 Lane Level of Service ED Mnangagwa Rd and Highland Glen Rd (ED Mnangagwa Corridor)

Table 7.86: Site 02 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane ED Mnangagwa Rd and Highland Glen Rd (ED Mnangagwa Corridor)

	Approaches			Intersection
	East	North	West	
Degree of Saturation	0.13	0.11	0.19	0.19

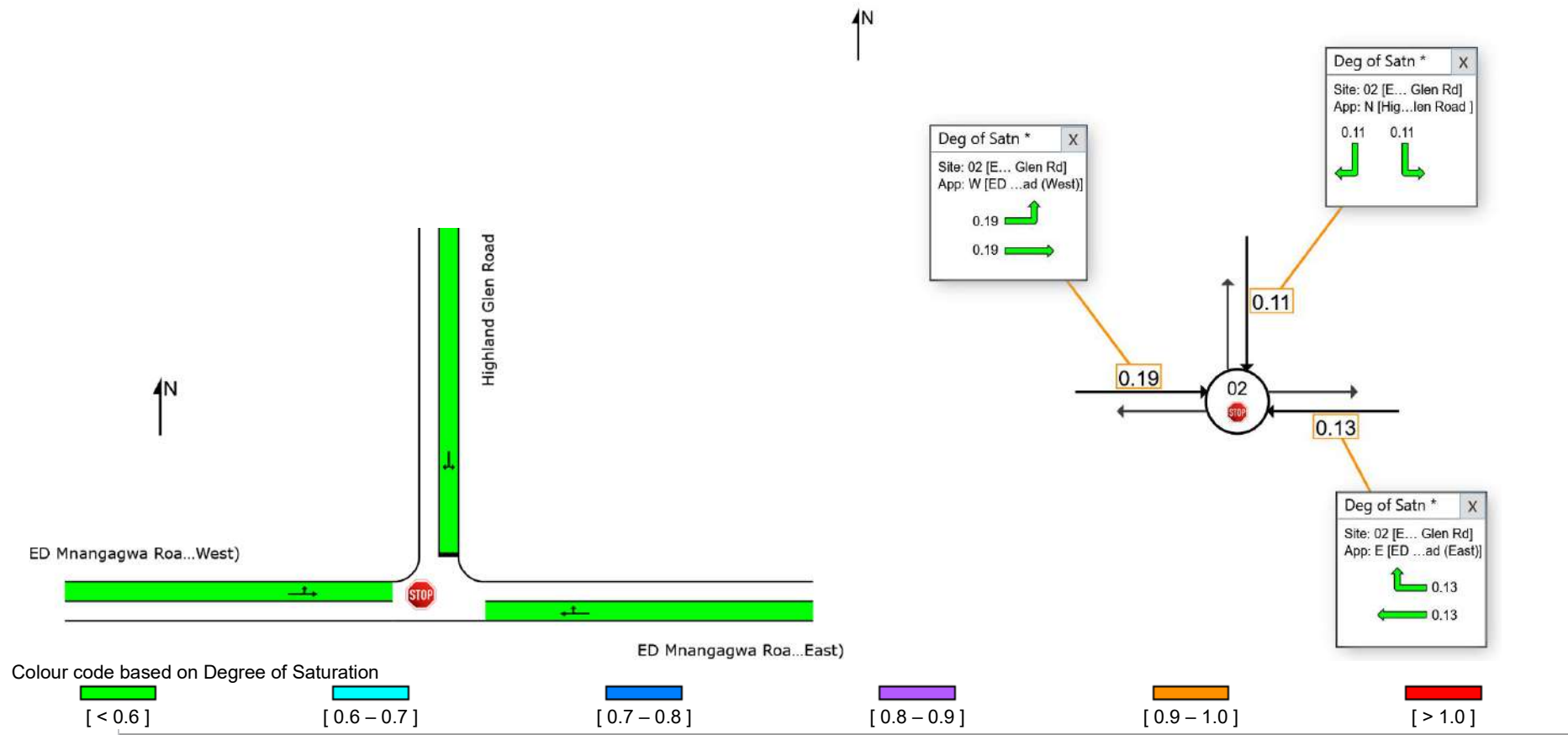


Figure 7.82: Site 02 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane ED Mwangagwa Rd and Highland Glen Rd (ED Mwangagwa Corridor)

Site 03: ED Mnangagwa and Drew Road Intersection 15-hour Average Daily Traffic (ADT) Results

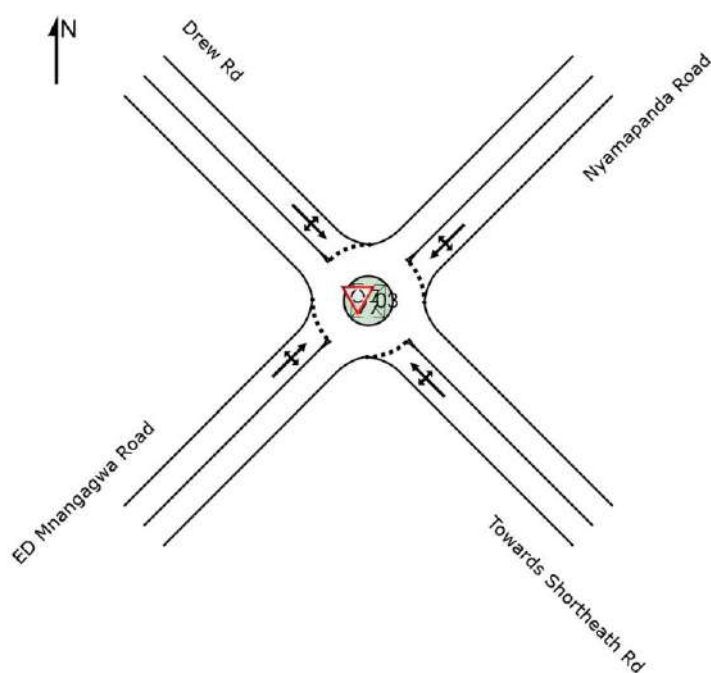


Figure 7.83: Site 03 ED Mnangagwa and Drew Road (ED Mnangagwa Corridor)

Table 7.87: Site 03 Movement Summary ED Mnangagwa and Drew Road (ED Mnangagwa Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Towards Shortheath Rd															
21	L2	All MCs	38	3.9	38	3.9	0.792	32.0	LOS C	8.9	66.4	1.00	1.15	1.74	37.4
22	T1	All MCs	0	0.0	0	0.0	0.792	25.8	LOS C	8.9	66.4	1.00	1.15	1.74	28.9
23	R2	All MCs	259	3.5	259	3.5	0.792	33.6	LOS C	8.9	66.4	1.00	1.15	1.74	37.4
Approach			297	3.6	297	3.6	0.792	33.4	LOS C	8.9	66.4	1.00	1.15	1.74	37.4
NorthEast: Nyamapanda Road															
24	L2	All MCs	30	12.2	30	12.2	0.775	9.9	LOS A	11.5	105.9	0.86	0.63	0.92	48.5
25	T1	All MCs	431	19.0	431	19.0	0.775	10.2	LOS B	11.5	105.9	0.86	0.63	0.92	48.2
26	R2	All MCs	236	24.3	236	24.3	0.775	12.0	LOS B	11.5	105.9	0.86	0.63	0.92	48.1
Approach			697	20.5	697	20.5	0.775	10.8	LOS B	11.5	105.9	0.86	0.63	0.92	48.2
NorthWest: Drew Rd															
27	L2	All MCs	58	7.1	58	7.1	0.326	10.5	LOS B	2.0	15.3	0.71	0.75	0.71	48.4
28	T1	All MCs	136	6.4	136	6.4	0.326	10.5	LOS B	2.0	15.3	0.71	0.75	0.71	48.5
29	R2	All MCs	0	0.0	0	0.0	0.326	4.4	LOS A	2.0	15.3	0.71	0.75	0.71	44.6
Approach			194	6.6	194	6.6	0.326	10.5	LOS B	2.0	15.3	0.71	0.75	0.71	48.5
SouthWest: ED Mnangagwa Road															
30	L2	All MCs	175	3.0	175	3.0	0.655	17.2	LOS B	6.2	48.1	0.89	0.93	1.23	44.6
31	T1	All MCs	184	9.5	184	9.5	0.655	17.8	LOS B	6.2	48.1	0.89	0.93	1.23	44.4
32	R2	All MCs	0	0.0	0	0.0	0.655	11.3	LOS B	6.2	48.1	0.89	0.93	1.23	38.2
Approach			359	6.3	359	6.3	0.655	17.5	LOS B	6.2	48.1	0.89	0.93	1.23	44.5
All Vehicles			1547	12.2	1547	12.2	0.792	16.6	LOS B	11.5	105.9	0.88	0.82	1.12	44.9

Table 7.88: Site 03 Lane Level of Service ED Mnangagwa and Drew Road (Site Folder: ED Mnangagwa Corridor)

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	C	B	B	B	B

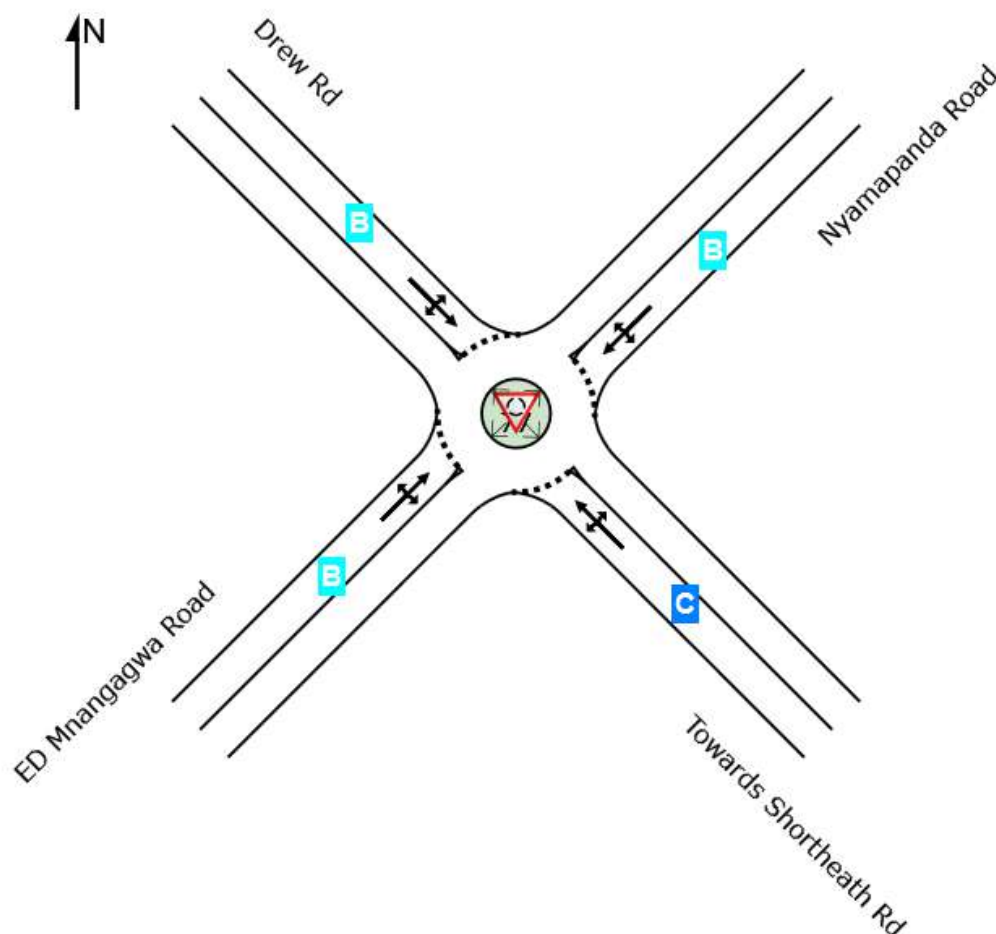


Figure 7.84: Site 03 Lane Level of Service ED Mnangagwa and Drew Road (ED Mnangagwa Corridor)

Table 7.89: Site 03 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane ED Mnangagwa and Drew Road (ED Mnangagwa Corridor)

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
Degree of Saturation	0.79	0.77	0.33	0.66	0.79

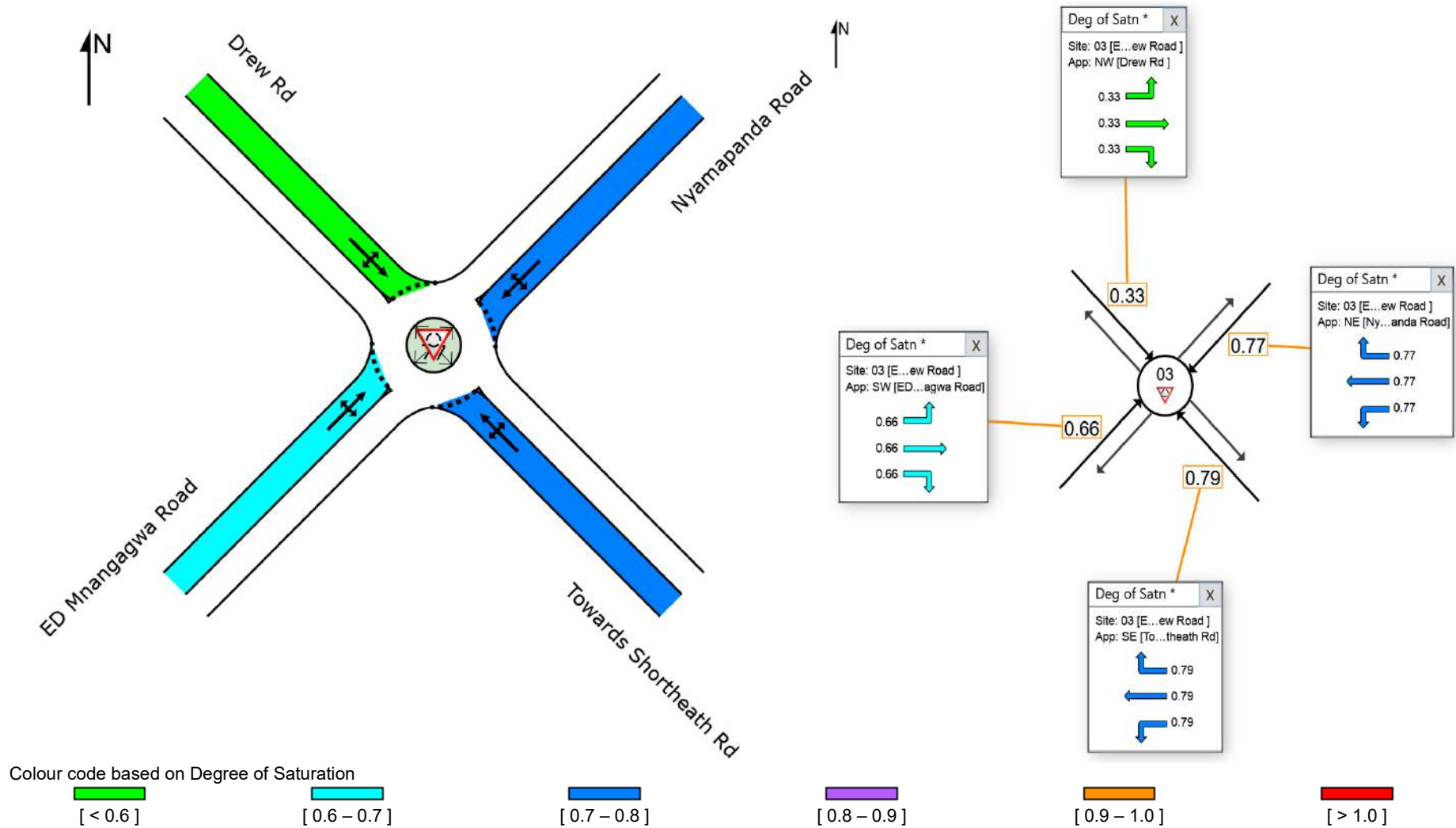


Figure 7.85: Site 03 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane ED Mnangagwa and Drew Road (ED Mnangagwa Corridor)

Site 04: ED Mnangagwa and Gletwyn Road Intersection

15-hour Average Daily Traffic (ADT) Results

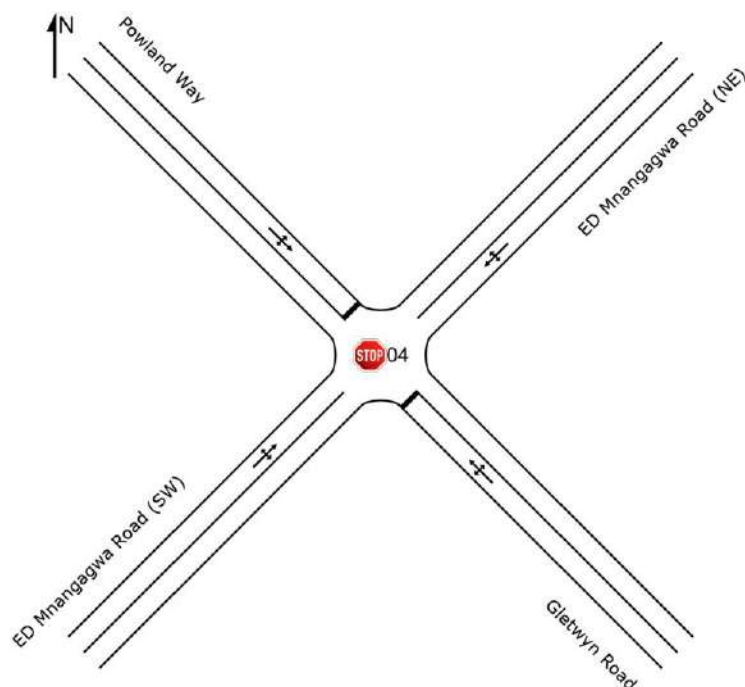


Figure 7.86: Site 04 ED Mnangagwa Rd and Gletwyn Rd (ED Mnangagwa Corridor)

Table 7.90: Site 04 Movement Summary ED Mnangagwa Rd and Gletwyn Rd (ED Mnangagwa Corridor)

Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]	v/c	sec		[Veh.	Dist]				km/h
			veh/h	%	veh/h	%				veh	m				
SouthEast: Gletwyn Road															
21	L2	All MCs	66	4.2	66	4.2	0.469	12.3	LOS B	2.6	20.0	0.64	1.10	0.96	47.3
22	T1	All MCs	187	7.4	187	7.4	0.469	16.0	LOS C	2.6	20.0	0.64	1.10	0.96	47.2
23	R2	All MCs	19	5.6	19	5.6	0.469	15.9	LOS C	2.6	20.0	0.64	1.10	0.96	47.0
Approach			271	6.5	271	6.5	0.469	15.1	LOS C	2.6	20.0	0.64	1.10	0.96	47.2
NorthEast: ED Mnangagwa Road (NE)															
24	L2	All MCs	38	4.3	38	4.3	0.279	5.9	LOS A	0.5	3.9	0.09	0.17	0.09	55.6
25	T1	All MCs	320	8.5	320	8.5	0.279	0.1	LOS A	0.5	3.9	0.09	0.17	0.09	58.3
26	R2	All MCs	56	5.4	56	5.4	0.279	6.1	LOS A	0.5	3.9	0.09	0.17	0.09	55.4
Approach			414	7.7	414	7.7	0.279	1.4	NA	0.5	3.9	0.09	0.17	0.09	57.7
NorthWest: Powland Way															
27	L2	All MCs	6	13.6	6	13.6	0.070	8.9	LOS A	0.2	1.7	0.45	0.85	0.45	47.8
28	T1	All MCs	10	9.0	10	9.0	0.070	12.6	LOS B	0.2	1.7	0.45	0.85	0.45	47.9
29	R2	All MCs	16	3.4	16	3.4	0.070	15.5	LOS C	0.2	1.7	0.45	0.85	0.45	47.7
Approach			33	7.1	33	7.1	0.070	13.4	LOS B	0.2	1.7	0.45	0.85	0.45	47.8
SouthWest: ED Mnangagwa Road (SW)															
30	L2	All MCs	61	12.3	61	12.3	0.076	5.7	LOS A	0.0	0.1	0.01	0.35	0.01	53.9
31	T1	All MCs	43	6.7	43	6.7	0.076	0.0	LOS A	0.0	0.1	0.01	0.35	0.01	56.9
32	R2	All MCs	0	100.0	0	100.0	0.076	8.7	LOS A	0.0	0.1	0.01	0.35	0.01	49.0
Approach			105	10.2	105	10.2	0.076	3.4	NA	0.0	0.1	0.01	0.35	0.01	55.1
All Vehicles			822	7.6	822	7.6	0.469	6.7	NA	2.6	20.0	0.28	0.52	0.38	53.0

Table 7.91: Site 04 Lane Level of Service ED Mnangagwa Rd and Gletwyn Rd (ED Mnangagwa Corridor)

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	C	NA (TWSC)	B	NA (TWSC)	NA (TWSC)

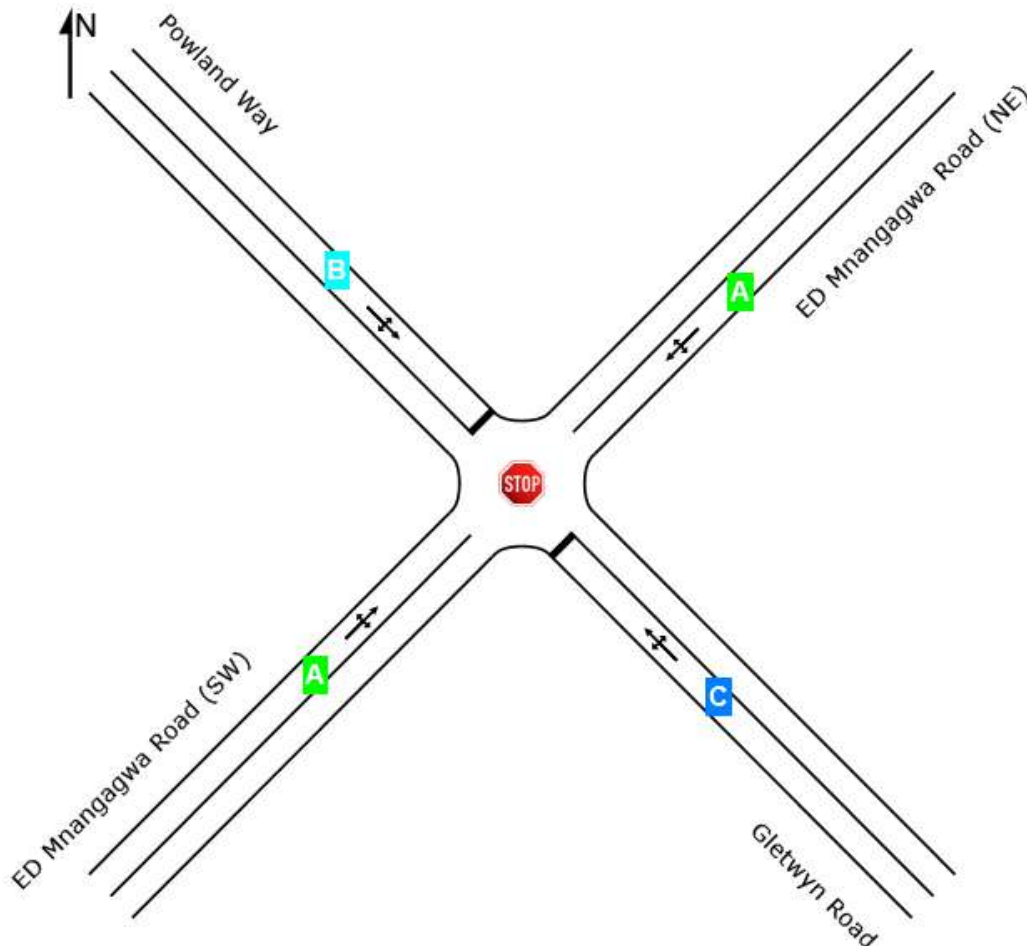


Figure 7.87: Site 04 Lane Level of Service ED Mnangagwa Rd and Gletwyn Rd (ED Mnangagwa Corridor)

Table 7.92: Site 04 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane ED Mnangagwa Rd and Gletwyn Rd (ED Mnangagwa Corridor)

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
Degree of Saturation	0.47	0.28	0.07	0.08	0.47

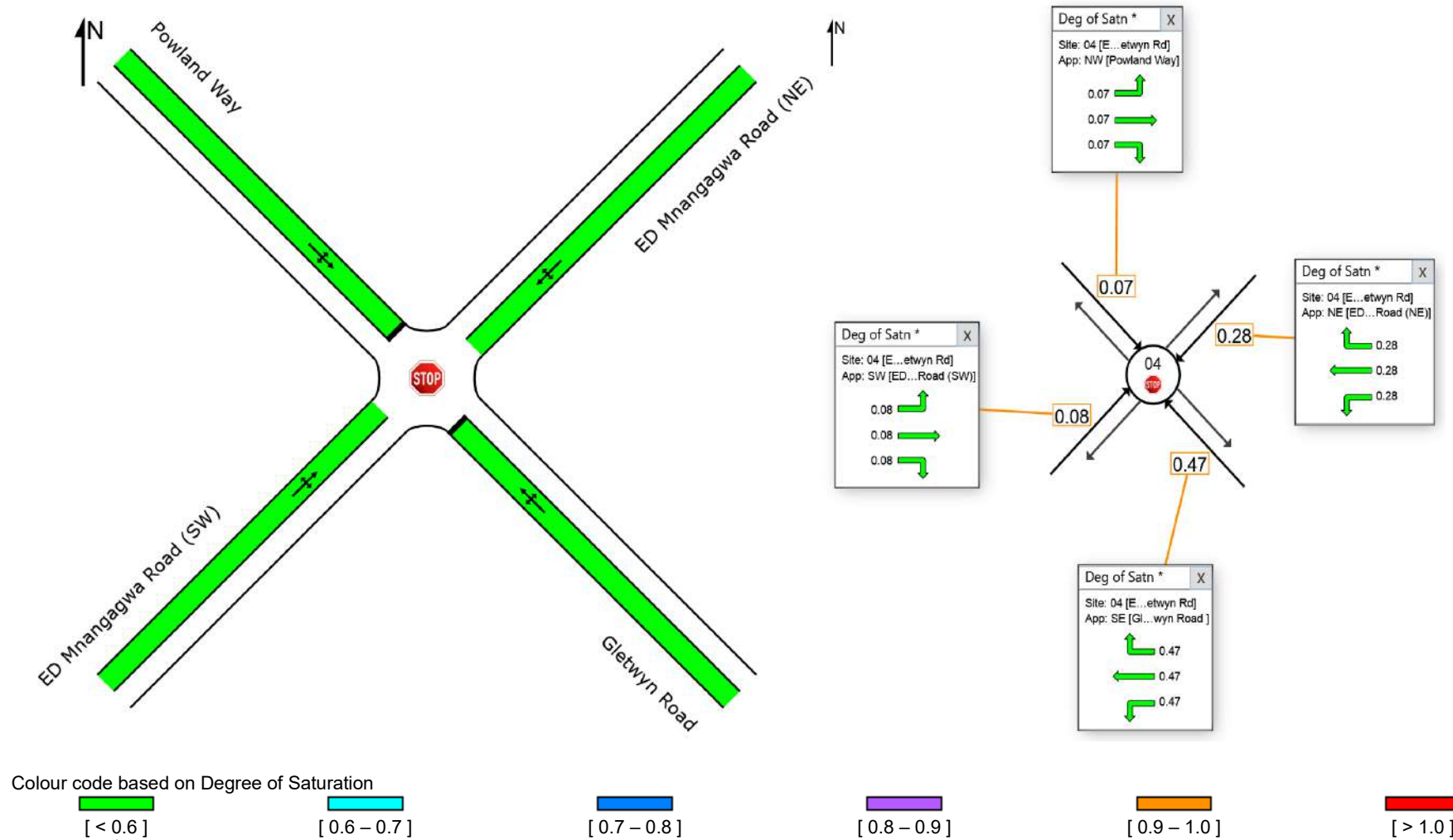


Figure 7.88: Site 04 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane ED Mnangagwa Rd and Gletwyn Rd (ED Mnangagwa Corridor)

Site 05: ED Mnangagwa and Acturus Road Intersection
15-hour Average Daily Traffic (ADT) Results

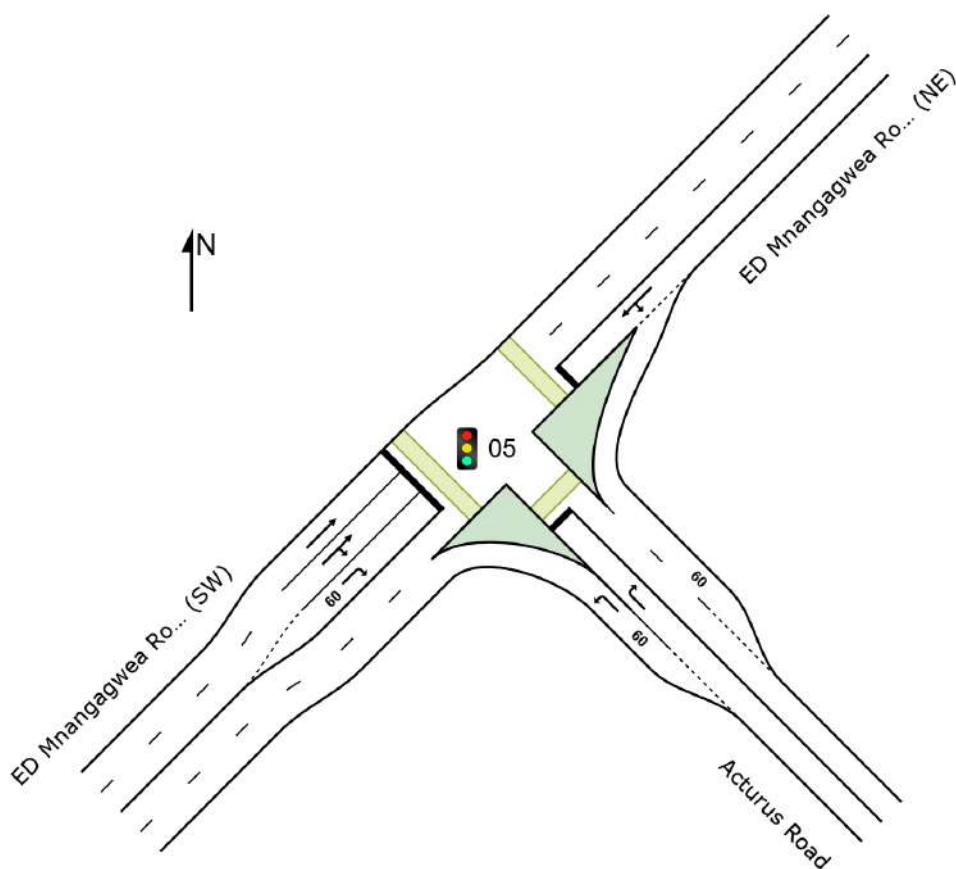


Figure 7.89: Site 05 ED Mnangagwa Rd and Acturus Rd (ED Mnangagwa Corridor)

Table 7.93: Site 05 Movement Summary ED Mnangagwa Rd and Acturus Rd (ED Mnangagwa Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
SouthEast: Acturus Road															
21	L2	All MCs	120	1.9	120	1.9	0.107	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	53.2
23	R2	All MCs	56	2.6	56	2.6	* 0.216	16.7	LOS B	0.7	5.4	0.84	0.74	0.84	45.2
Approach			177	2.1	177	2.1	0.216	9.2	LOS A	0.7	5.4	0.27	0.59	0.27	50.4
NorthEast: ED Mnangagwea Road (NE)															
24	L2	All MCs	170	2.4	170	2.4	0.627	6.4	LOS A	5.1	37.9	0.83	0.78	0.90	49.7
25	T1	All MCs	231	6.2	231	6.2	* 0.627	13.8	LOS B	5.1	37.9	0.83	0.78	0.90	51.1
Approach			401	4.6	401	4.6	0.627	10.6	LOS B	5.1	37.9	0.83	0.78	0.90	50.5
SouthWest: ED Mnangagwea Road (SW)															
31	T1	All MCs	524	4.2	524	4.2	0.464	8.4	LOS A	3.1	23.3	0.81	0.67	0.81	52.7
32	R2	All MCs	123	1.5	123	1.5	0.295	15.8	LOS B	1.6	11.1	0.83	0.76	0.83	46.0
Approach			648	3.7	648	3.7	0.464	9.8	LOS A	3.1	23.3	0.81	0.69	0.81	51.3
All Vehicles			1226	3.8	1226	3.8	0.627	10.0	LOS A	5.1	37.9	0.74	0.71	0.76	50.9

Table 7.94: Site 05 Lane Level of Service ED Mnangagwa Rd and Acturus Rd (ED Mnangagwa Corridor)

	Approaches			Intersection
	Southeast	Northeast	Southwest	
LOS	A	B	A	A

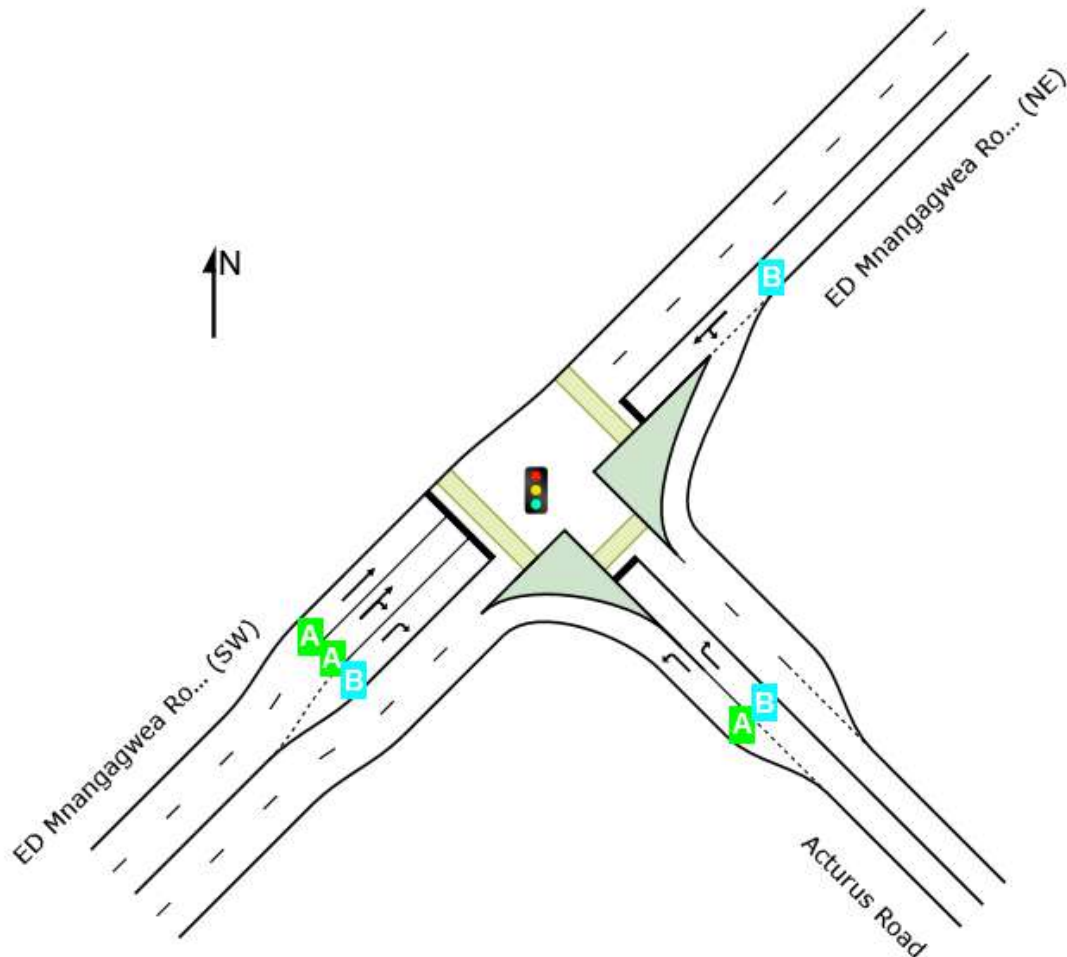


Figure 7.90: Site 05 Lane Level of Service ED Mnangagwa Rd and Acturus Rd (ED Mnangagwa Corridor)

Table 7.95: Site 05 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane ED Mnangagwa Rd and Acturus Rd (ED Mnangagwa Corridor)

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 30 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	Southeast	Northeast	Southwest	
Degree of Saturation	0.22	0.63	0.46	0.63

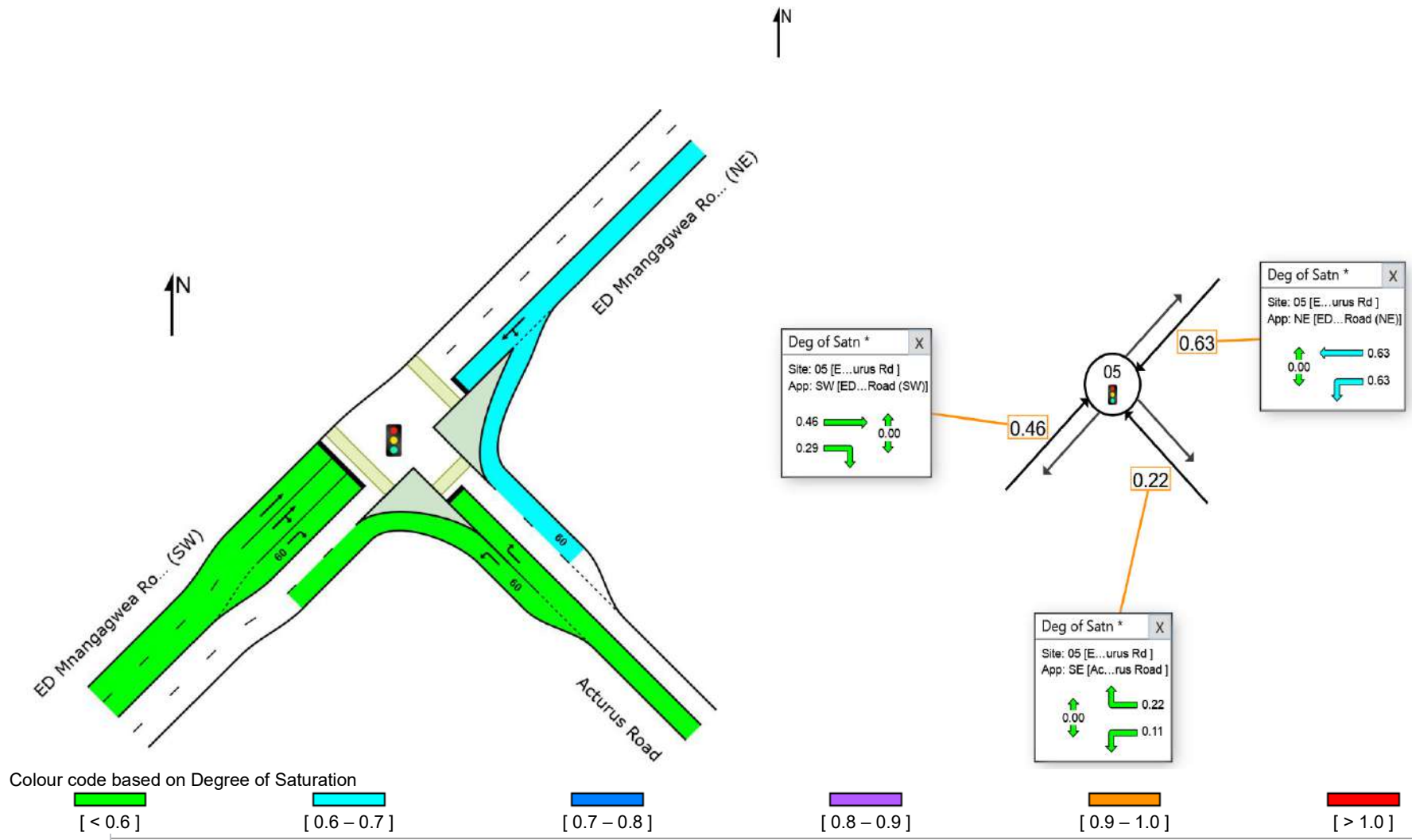


Figure 7.91: Site 05 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane ED Mhangagwa Rd and Acturus Rd (ED Mhangagwa Corridor)

Site 06: ED Mnangagwa and Glenara Road Intersection

15-hour Average Daily Traffic (ADT) Results

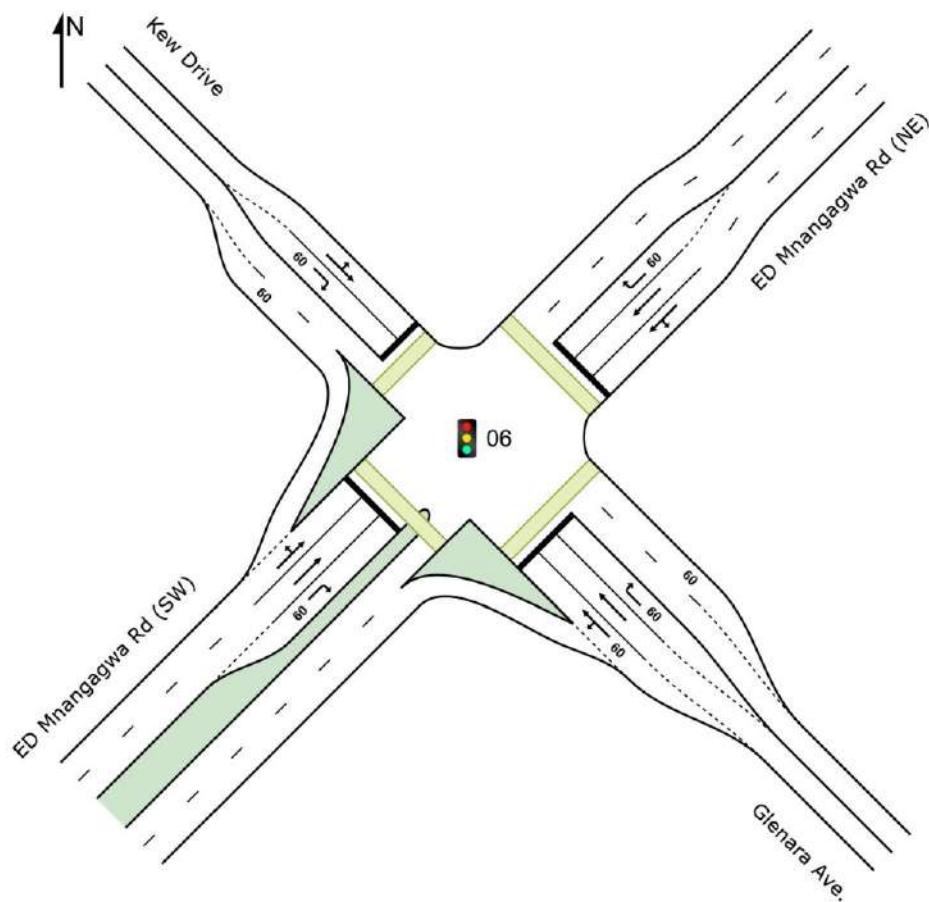


Figure 7.92: Site 06 ED Mnangagwa Rd and Glenara Rd (ED Mnangagwa Corridor)

Site 07: ED Mnangagwa and Churchill Road Intersection

15-hour Average Daily Traffic (ADT) Results

Site 08: ED Mnangagwa and Robert Mugabe Road Intersection

15-hour Average Daily Traffic (ADT) Results

7.1.4.1.4. The Ring Road Corridor (Harare Drive)

Site 01: Harare Drive and Acturus Road

15-hour Average Daily Traffic (ADT) Results

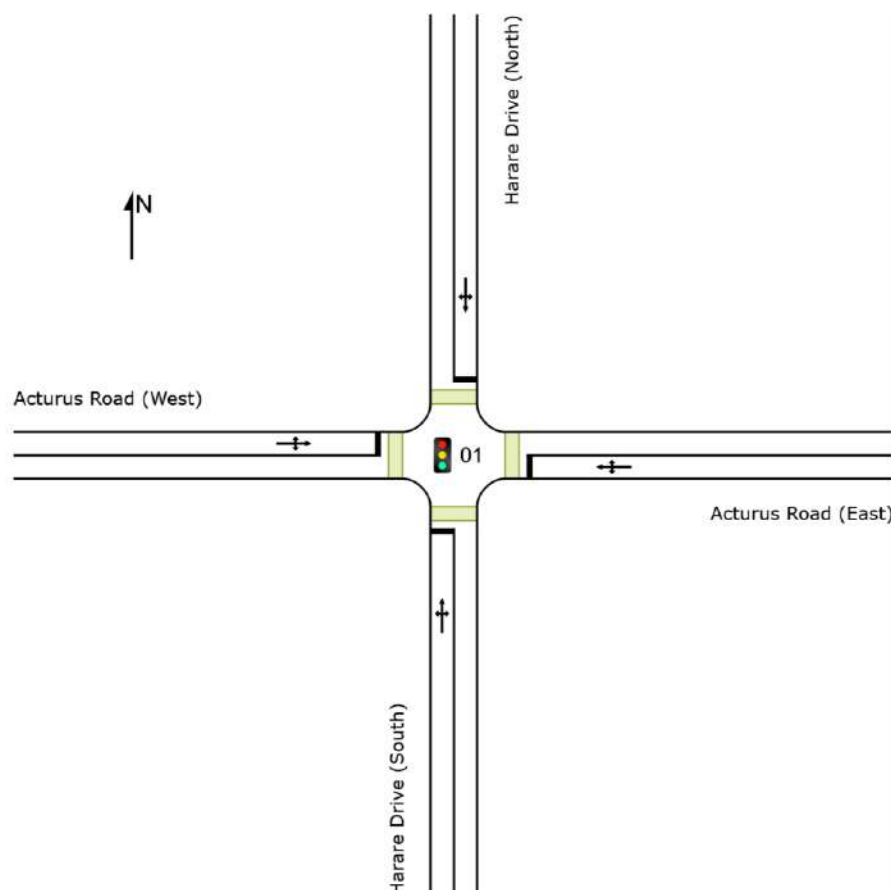


Figure 7.93: Site 01 Harare Drive and Acturus Road (Harare Drive Corridor)

Table 7.96: Site 01 Movement Summary Harare Drive and Acturus Road (Harare Drive Corridor)

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site Practical Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Eff. No. of Cycles	Aver. Speed km/h
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				
South: Harare Drive (South)															
1	L2	All MCs	35	2.2	35	2.2	0.607	34.3	LOS C	9.1	71.1	0.89	0.78	0.89	37.8
2	T1	All MCs	163	10.5	163	10.5	0.607	28.7	LOS C	9.1	71.1	0.89	0.78	0.89	38.9
3	R2	All MCs	17	4.5	17	4.5	0.607	64.4	LOS E	9.1	71.1	0.89	0.78	0.89	37.6

Approach		215	8.7	215	8.7	0.607	32.5	LOS C	9.1	71.1	0.89	0.78	0.89	38.6
East: Acturus Road (East)														
4	L2 All MCs	32	8.6	32	8.6	0.773	35.1	LOS D	16.8	125.5	0.93	0.89	1.02	37.1
5	T1 All MCs	303	4.2	303	4.2	0.773	29.7	LOS C	16.8	125.5	0.93	0.89	1.02	38.7
6	R2 All MCs	26	11.8	26	11.8	0.773	67.4	LOS E	16.8	125.5	0.93	0.89	1.02	37.2
Approach		361	5.1	361	5.1	0.773	32.9	LOS C	16.8	125.5	0.93	0.89	1.02	38.4
North: Harare Drive (North)														
7	L2 All MCs	4	4.8	4	4.8	1.015	98.9	LOS F	31.7	231.4	1.00	1.43	1.76	22.0
8	T1 All MCs	308	2.9	308	2.9 *	1.015	93.8	LOS F	31.7	231.4	1.00	1.43	1.76	22.8
9	R2 All MCs	79	3.6	79	3.6	1.015	117.8	LOS F	31.7	231.4	1.00	1.43	1.76	22.3
Approach		392	3.1	392	3.1	1.015	98.7	LOS F	31.7	231.4	1.00	1.43	1.76	22.7
West: Acturus Road (West)														
10	L2 All MCs	4	4.8	4	4.8	1.022	99.7	LOS F	32.2	235.2	1.00	1.45	1.79	21.5
11	T1 All MCs	308	2.9	308	2.9 *	1.022	94.7	LOS F	32.2	235.2	1.00	1.45	1.79	22.2
12	R2 All MCs	79	3.6	79	3.6	1.022	135.4	LOS F	32.2	235.2	1.00	1.45	1.79	21.8
Approach		392	3.1	392	3.1	1.022	103.0	LOS F	32.2	235.2	1.00	1.45	1.79	22.1
All Vehicles		1360	4.5	1360	4.5	1.022	72.0	LOS E	32.2	235.2	0.96	1.19	1.43	27.2

Table 7.97: Site 01 Lane Level of Service Harare Drive and Acturus Road (Harare Drive Corridor)

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	F	F	E

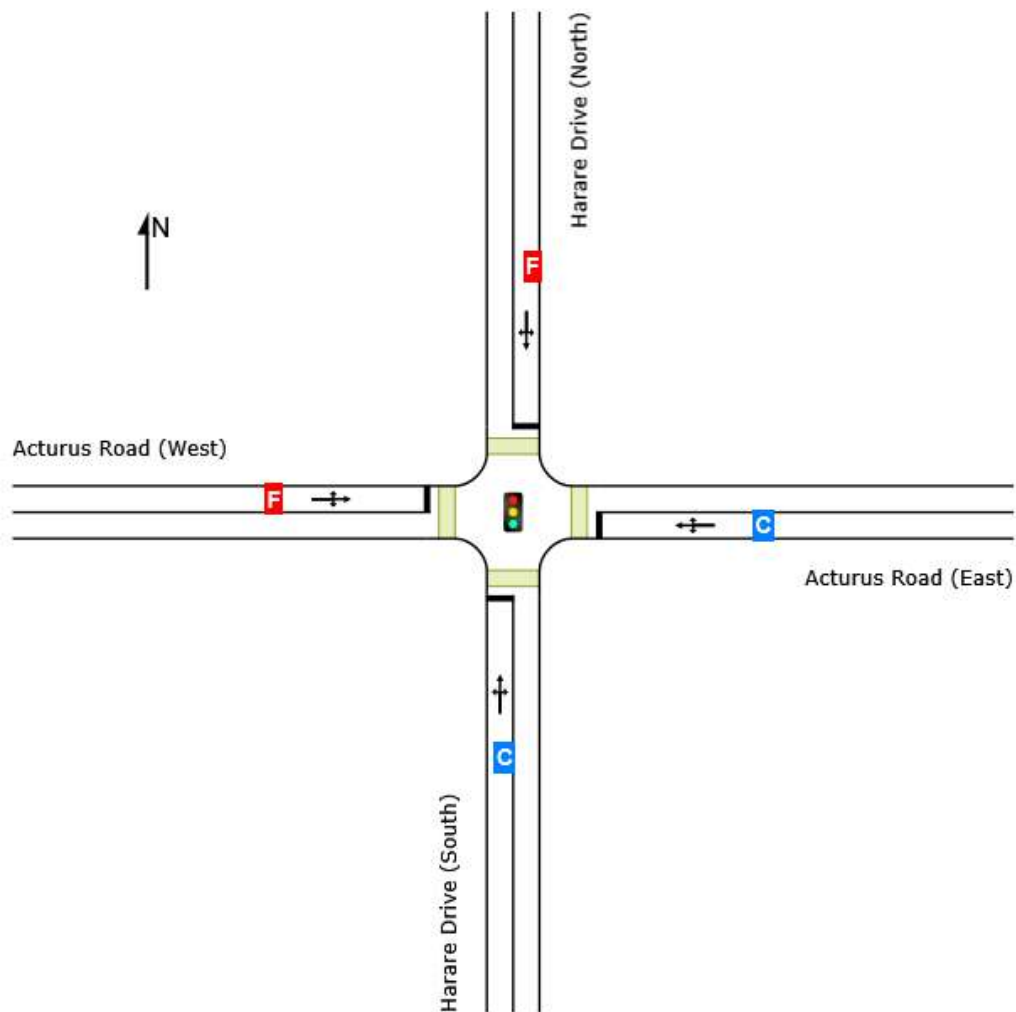


Figure 7.94: Site 01 Lane Level of Service Harare Drive and Acturus Road (Harare Drive Corridor)

Table 7.98: Site 01 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Harare Drive and Acturus Road (Harare Drive Corridor)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.61	0.77	1.02	1.02	1.02

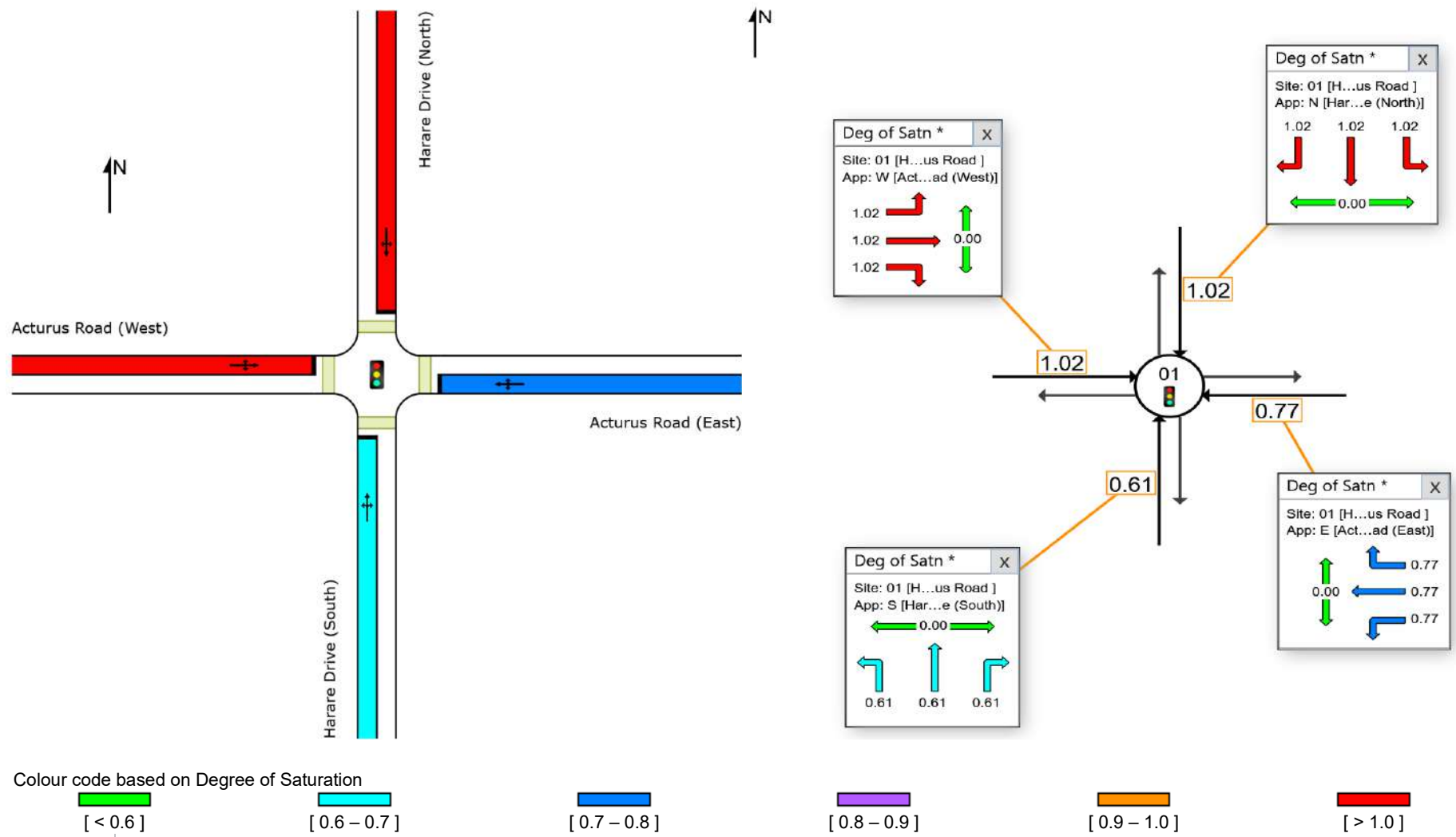


Figure 7.95: Site 01 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Harare Drive and Acturus Road (Harare Drive Corridor)

Site 02: Harare Drive and E.D Mnangagwa Road

15-hour Average Daily Traffic (ADT) Results

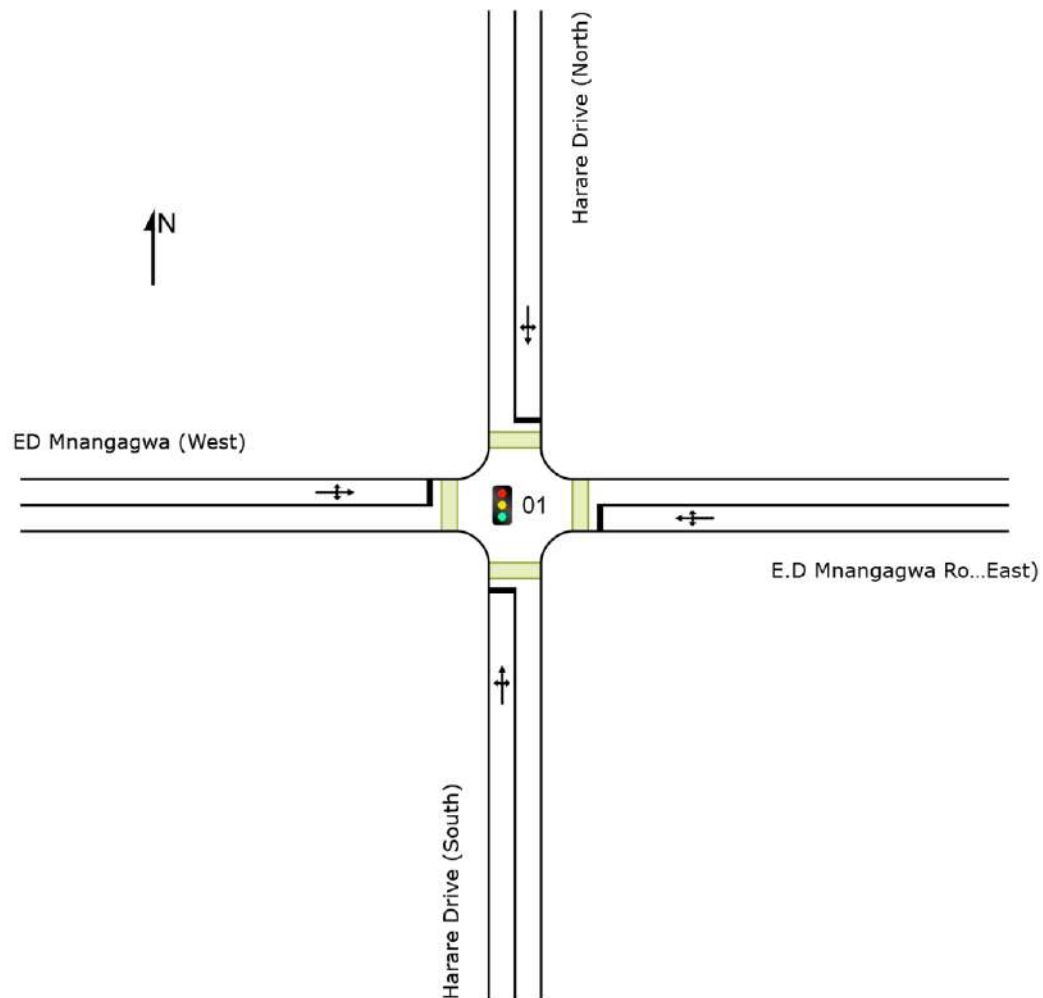


Figure 7.96: Site 01 Harare Drive and ED Mnangagwa Road (Harare Drive Corridor)

Table 7.99: Site 01 Movement Summary Harare Drive and ED Mnangagwa Road (Harare Drive Corridor)

Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Harare Drive (South)															
1	L2	All MCs	49	7.4	49	7.4	0.842	32.9	LOS C	7.6	66.3	0.99	1.08	1.48	38.6
2	T1	All MCs	170	18.1	170	18.1	0.842	27.3	LOS C	7.6	66.3	0.99	1.08	1.48	40.0
3	R2	All MCs	31	10.7	31	10.7 *	0.842	38.5	LOS D	7.6	66.3	0.99	1.08	1.48	38.4
Approach			250	15.1	250	15.1	0.842	29.8	LOS C	7.6	66.3	0.99	1.08	1.48	39.5
East: E.D Mnangagwa Road (East)															
4	L2	All MCs	89	12.6	89	12.6	0.800	25.3	LOS C	8.7	70.2	0.95	0.99	1.27	41.2
5	T1	All MCs	187	7.1	187	7.1	0.800	19.6	LOS B	8.7	70.2	0.95	0.99	1.27	42.8
6	R2	All MCs	37	15.1	37	15.1	0.800	45.9	LOS D	8.7	70.2	0.95	0.99	1.27	40.9
Approach			313	9.6	313	9.6	0.800	24.4	LOS C	8.7	70.2	0.95	0.99	1.27	42.1
North: Harare Drive (North)															
7	L2	All MCs	30	12.7	30	12.7	0.567	23.1	LOS C	3.5	28.6	0.92	0.79	0.96	42.5
8	T1	All MCs	95	12.2	95	12.2	0.567	17.4	LOS B	3.5	28.6	0.92	0.79	0.96	44.3
9	R2	All MCs	23	15.4	23	15.4	0.567	34.2	LOS C	3.5	28.6	0.92	0.79	0.96	42.2
Approach			148	12.8	148	12.8	0.567	21.2	LOS C	3.5	28.6	0.92	0.79	0.96	43.6
West: ED Mnangagwa (West)															
10	L2	All MCs	20	13.3	20	13.3	0.894	35.5	LOS D	14.1	113.6	0.99	1.17	1.55	38.0
11	T1	All MCs	360	9.2	360	9.2	0.894	29.8	LOS C	14.1	113.6	0.99	1.17	1.55	39.4
12	R2	All MCs	33	7.7	33	7.7 *	0.894	48.8	LOS D	14.1	113.6	0.99	1.17	1.55	37.9
Approach			413	9.3	413	9.3	0.894	31.6	LOS C	14.1	113.6	0.99	1.17	1.55	39.2
All Vehicles			1124	11.1	1124	11.1	0.894	27.8	LOS C	14.1	113.6	0.97	1.05	1.38	40.6

Table 7.100: Site 01 Lane Level of Service Harare Drive and ED Mnangagwa Road (Harare Drive Corridor)

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	C	C	C

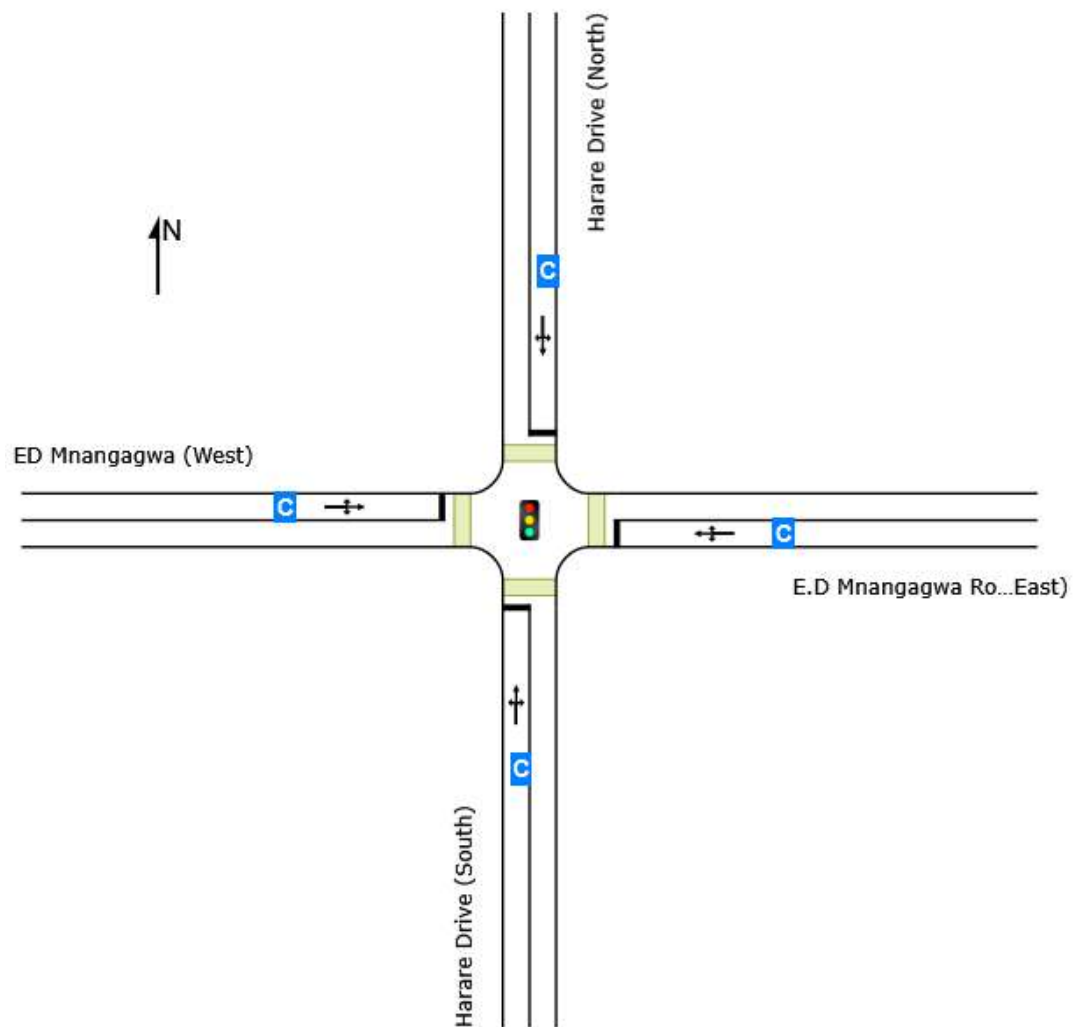


Figure 7.97: Site 01 Lane Level of Service Harare Drive and ED Mnangagwa Road (Harare Drive Corridor)

Table 7.101: Site 01 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Harare Drive and ED Mnangagwa Road (Harare Drive Corridor)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.84	0.80	0.57	0.89	0.89

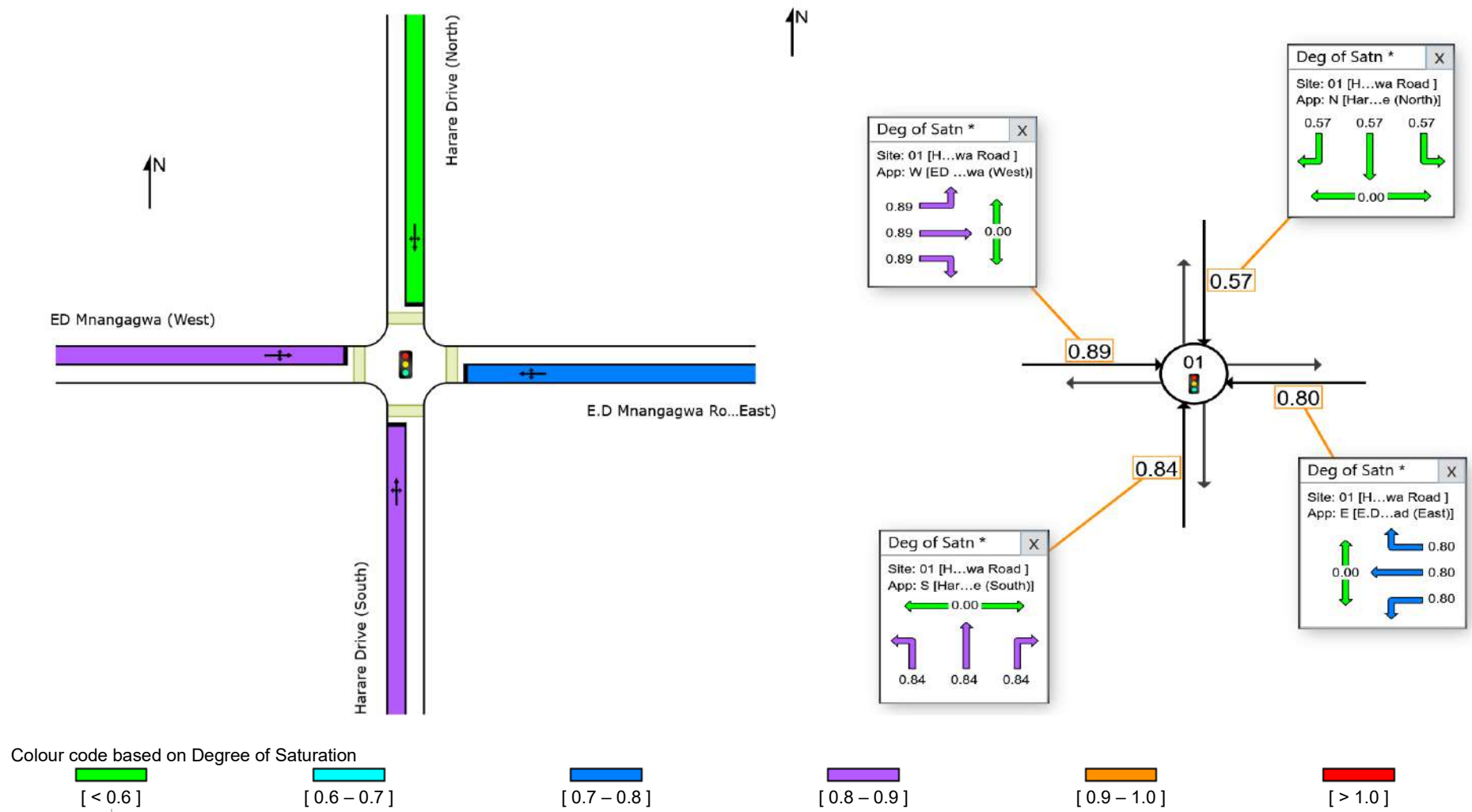


Figure 7.98: Site 01 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Harare Drive and ED Mnangagwa Road (Harare Drive Corridor)

Site 03: Harare Drive and Borrowdale Road

15-hour Average Daily Traffic (ADT) Results

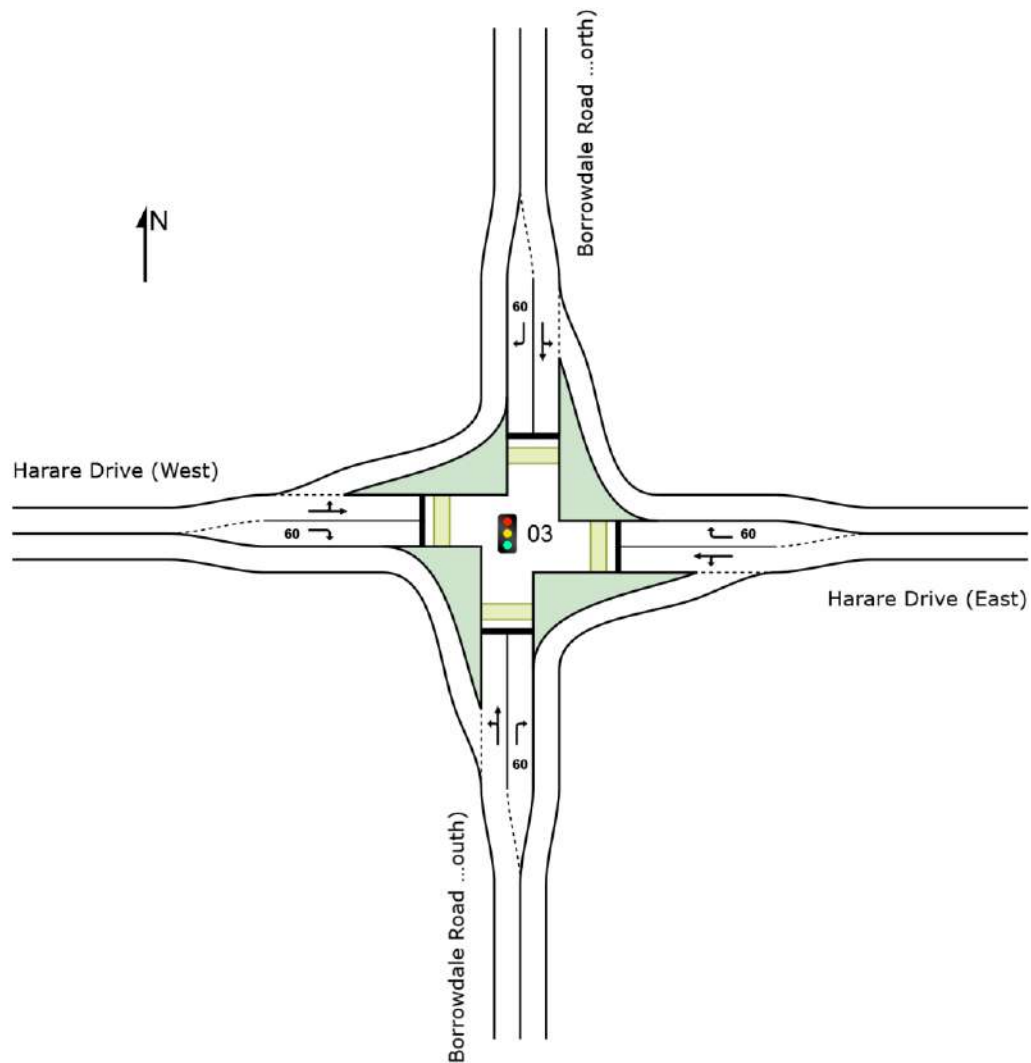


Figure 7.99: Site 03 Harare Drive and Borrowdale Road (Harare Drive Corridor)

Table 7.102: Site 03 Movement Summary Harare Drive and Borrowdale Road (Harare Drive Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Eff. No. of Cycles	Aver. Speed km/h
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				
South: Borrowdale Road (South)															
1	L2	All MCs	59	4.9	59	4.9	0.890	21.7	LOS C	14.1	124.3	0.98	1.18	1.53	38.8
2	T1	All MCs	356	13.8	356	13.8 *	0.890	32.5	LOS C	14.1	124.3	0.98	1.18	1.53	39.7
3	R2	All MCs	27	3.6	27	3.6	0.076	20.4	LOS C	0.5	3.8	0.76	0.70	0.76	43.3
Approach			442	12.0	442	12.0	0.890	30.4	LOS C	14.1	124.3	0.97	1.15	1.48	39.7
East: Harare Drive (East)															
4	L2	All MCs	80	13.0	80	13.0	0.846	15.3	LOS B	9.3	78.5	0.98	1.07	1.43	39.8
5	T1	All MCs	226	11.0	226	11.0 *	0.846	32.6	LOS C	9.3	78.5	0.98	1.07	1.43	41.1
6	R2	All MCs	104	9.2	104	9.2	0.271	22.3	LOS C	2.1	17.0	0.83	0.76	0.83	42.2
Approach			410	11.0	410	11.0	0.846	26.7	LOS C	9.3	78.5	0.94	0.99	1.28	41.1
North: Borrowdale Road (North)															
7	L2	All MCs	40	17.1	40	17.1	0.613	6.1	LOS A	6.1	46.7	0.80	0.72	0.82	47.8
8	T1	All MCs	270	3.7	270	3.7	0.613	13.5	LOS B	6.1	46.7	0.80	0.72	0.82	49.7
9	R2	All MCs	89	2.2	89	2.2	0.429	29.5	LOS C	2.2	15.9	0.97	0.76	0.97	39.1
Approach			399	4.7	399	4.7	0.613	16.3	LOS B	6.1	46.7	0.84	0.73	0.85	46.7
West: Harare Drive (West)															
10	L2	All MCs	210	9.8	210	9.8	0.611	6.0	LOS A	5.8	47.4	0.78	0.77	0.81	46.7
11	T1	All MCs	91	7.6	91	7.6	0.611	36.1	LOS D	5.8	47.4	0.78	0.77	0.81	48.2
12	R2	All MCs	25	6.6	25	6.6	0.116	28.2	LOS C	0.6	4.4	0.92	0.70	0.92	39.6
Approach			326	9.0	326	9.0	0.611	16.1	LOS B	5.8	47.4	0.80	0.77	0.81	46.4
All Vehicles			1576	9.3	1576	9.3	0.890	22.9	LOS C	14.1	124.3	0.89	0.92	1.13	43.0

Table 7.103: Site 03 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Harare Drive and Borrowdale Road (Harare Drive Corridor)

					Intersection
	South	East	North	West	
Degree of Saturation	0.89	0.85	0.61	0.61	0.89

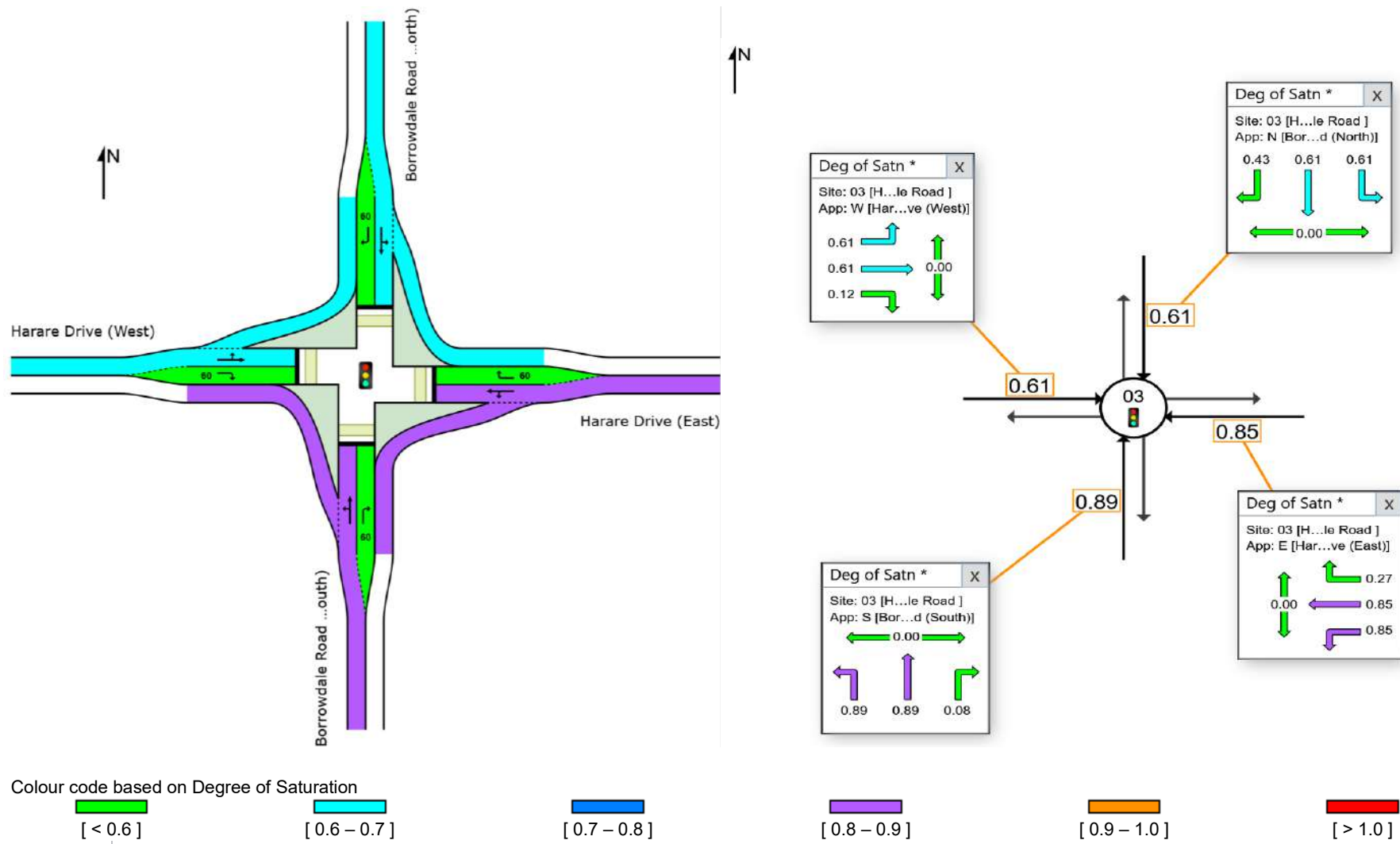


Figure 7.100: Site 03 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Harare Drive and Borrowdale Road (Harare Drive Corridor)

Site 04 Harare Drive and Alpes Road

15-hour Average Daily Traffic (ADT) Results

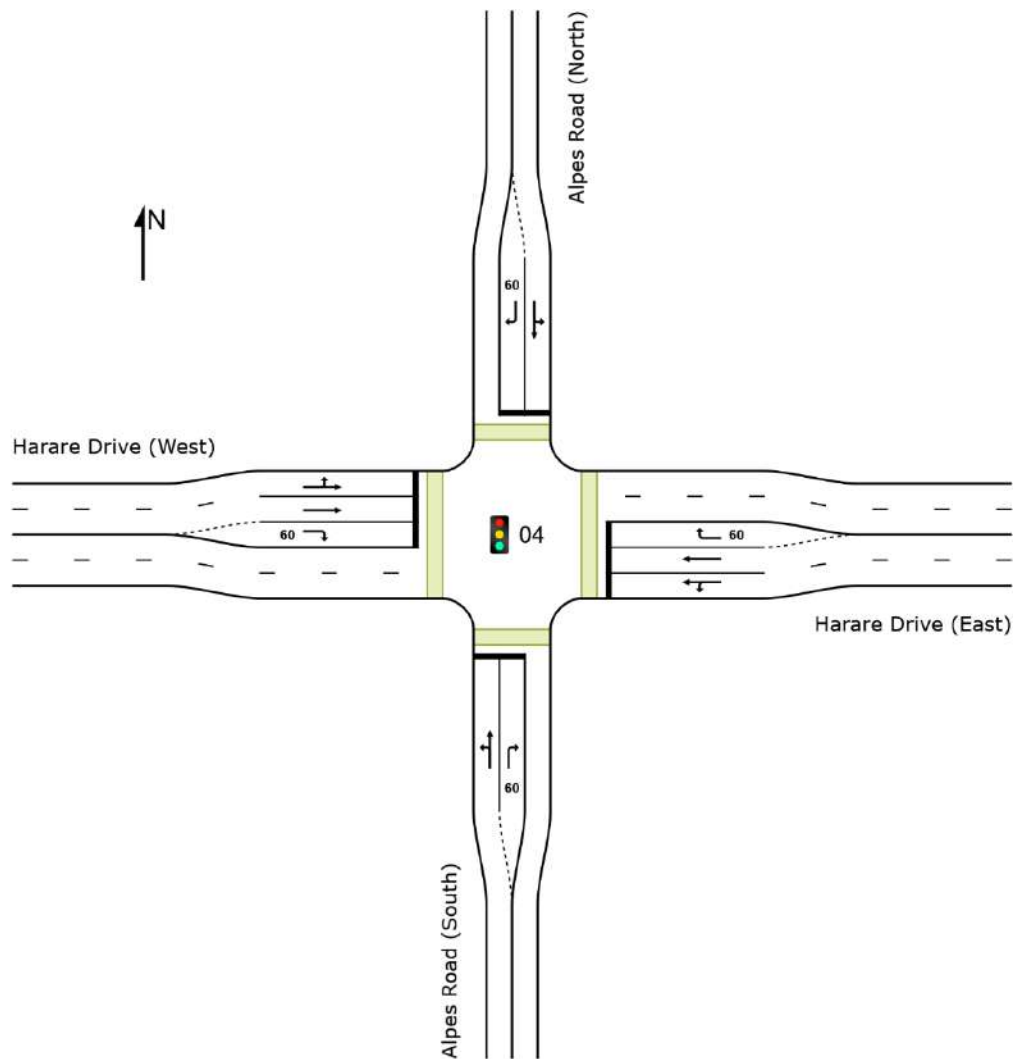


Figure 7.101: Site 04 Harare Drive and Alpes Road (Harare Drive Corridor)

Table 7.104: Site 04 Movement Summary Harare Drive and Alpes Road (Harare Drive Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que Stop	Eff. Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				veh
South: Alpes Road (South)															
1	L2	All MCs	154	13.7	154	13.7	0.776	19.4	LOS B	8.6	73.0	0.86	0.93	1.12	45.6
2	T1	All MCs	270	10.4	270	10.4	* 0.776	13.6	LOS B	8.6	73.0	0.86	0.93	1.12	47.7
3	R2	All MCs	50	13.1	50	13.1	0.173	19.4	LOS B	0.8	7.4	0.82	0.73	0.82	43.7
Approach			474	11.8	474	11.8	0.776	16.1	LOS B	8.6	73.0	0.85	0.91	1.09	46.6
East: Harare Drive (East)															
4	L2	All MCs	73	13.4	73	13.4	0.706	26.6	LOS C	2.9	23.4	0.99	0.91	1.31	41.3
5	T1	All MCs	262	11.3	262	11.3	* 0.706	20.0	LOS B	4.3	34.5	0.99	0.90	1.24	44.7
6	R2	All MCs	78	6.1	78	6.1	0.371	25.6	LOS C	1.6	12.0	0.97	0.75	0.97	40.9
Approach			412	10.7	412	10.7	0.706	22.2	LOS C	4.3	34.5	0.99	0.87	1.20	43.3
North: Alpes Road (North)															
7	L2	All MCs	171	11.3	171	11.3	0.729	17.3	LOS B	6.9	65.4	0.82	0.88	1.02	46.4
8	T1	All MCs	198	21.2	198	21.2	0.729	11.6	LOS B	6.9	65.4	0.82	0.88	1.02	48.4
9	R2	All MCs	102	13.4	102	13.4	0.377	22.0	LOS C	1.9	15.8	0.91	0.77	0.91	42.4
Approach			471	15.9	471	15.9	0.729	15.9	LOS B	6.9	65.4	0.84	0.85	0.99	46.3
West: Harare Drive (West)															
10	L2	All MCs	87	15.5	87	15.5	0.519	24.4	LOS C	1.8	16.3	0.95	0.80	1.02	40.9
11	T1	All MCs	139	10.6	139	10.6	0.500	17.6	LOS B	2.7	23.0	0.95	0.75	0.95	46.4
12	R2	All MCs	116	9.4	116	9.4	0.666	28.1	LOS C	2.5	20.4	1.00	0.84	1.22	39.6
Approach			343	11.4	343	11.4	0.666	22.9	LOS C	2.7	23.0	0.97	0.80	1.06	42.5
All Vehicles			1700	12.6	1700	12.6	0.776	18.9	LOS B	8.6	73.0	0.90	0.86	1.08	44.8

Table 7.105: Site 04 Lane Level of Service Harare Drive and Alpes Road (Harare Drive Corridor)

	Approaches				Intersection
	South	East	North	West	
LOS	B	C	B	C	B

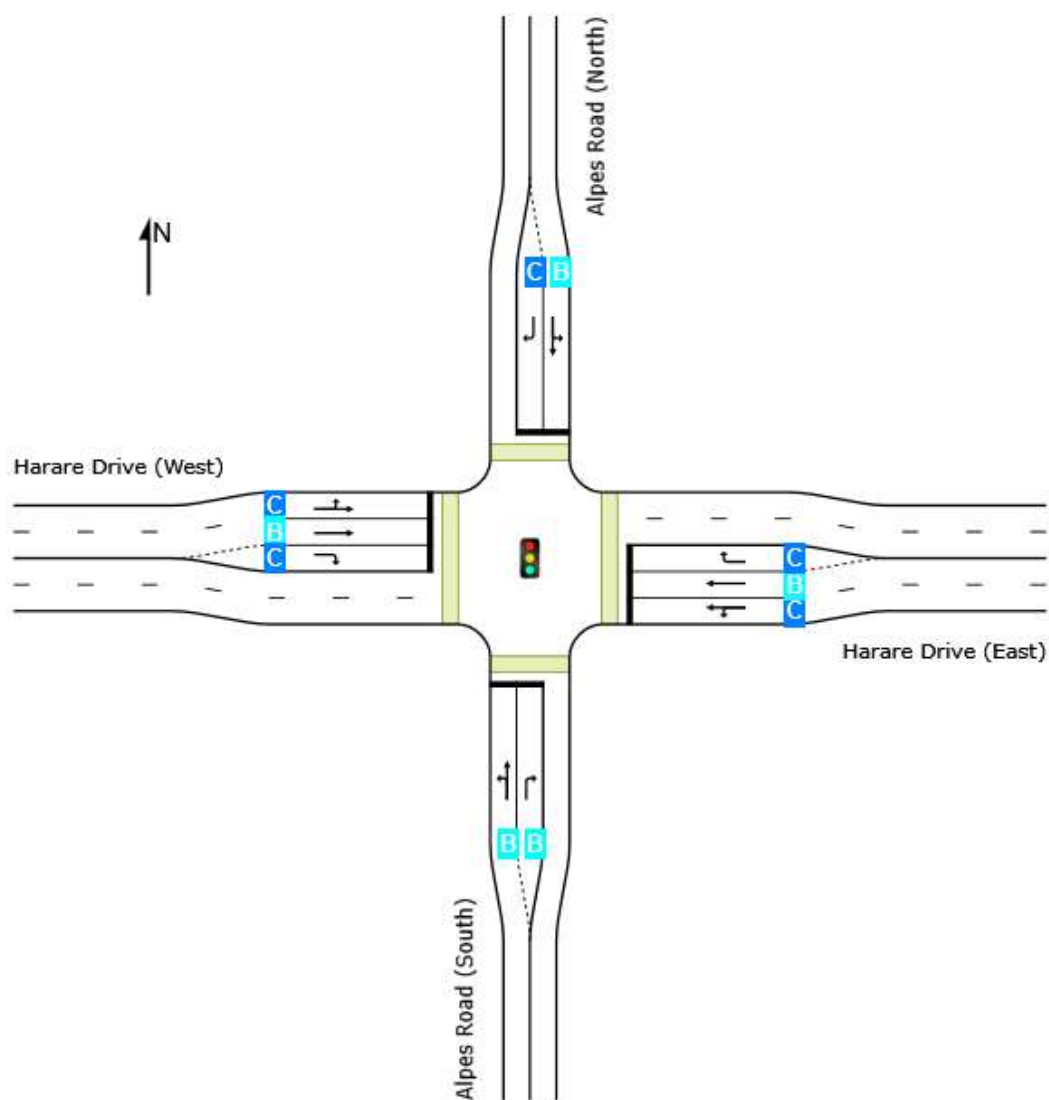
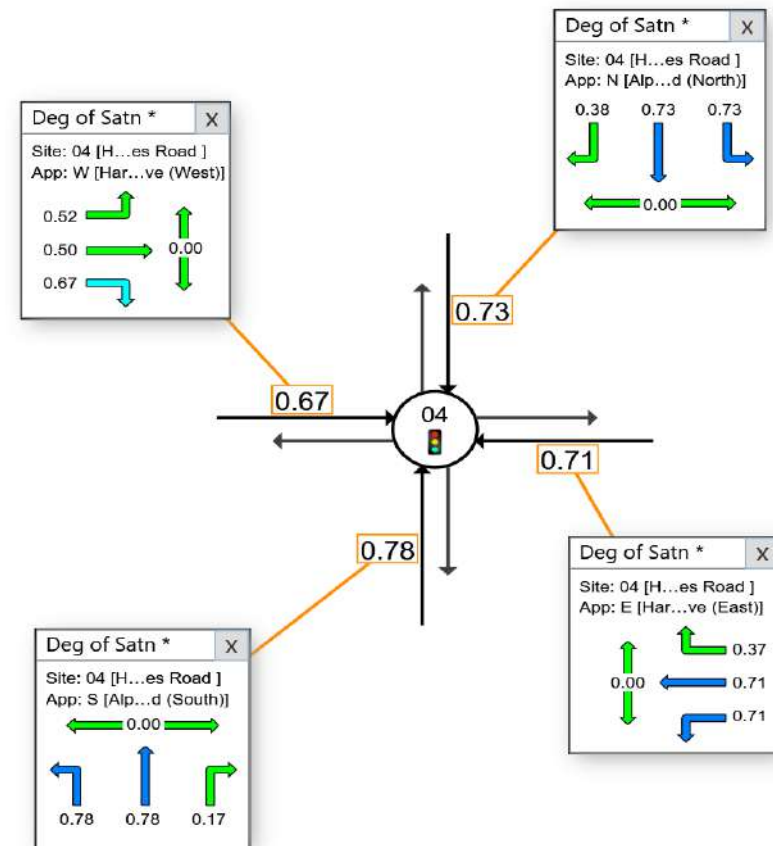
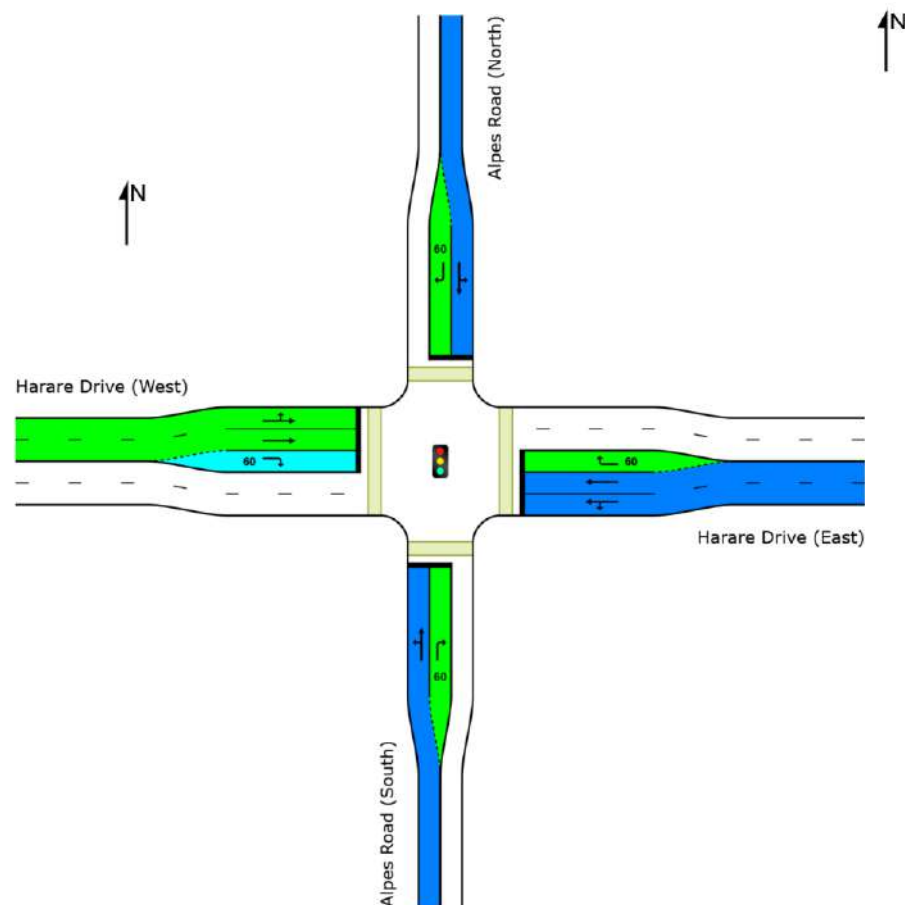


Figure 7.102: Site 04 Lane Level of Service Harare Drive and Alpes Road (Harare Drive Corridor)

Table 7.106: Site 04 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Harare Drive and Alpes Road (Harare Drive Corridor)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.78	0.71	0.73	0.67	0.78



Colour code based on Degree of Saturation



Figure 7.103: Site 04 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Harare Drive and Alpes Road (Harare Drive Corridor)

Site 05: Harare Drive and Sam Nujoma Street

15-hour Average Daily Traffic (ADT) Results

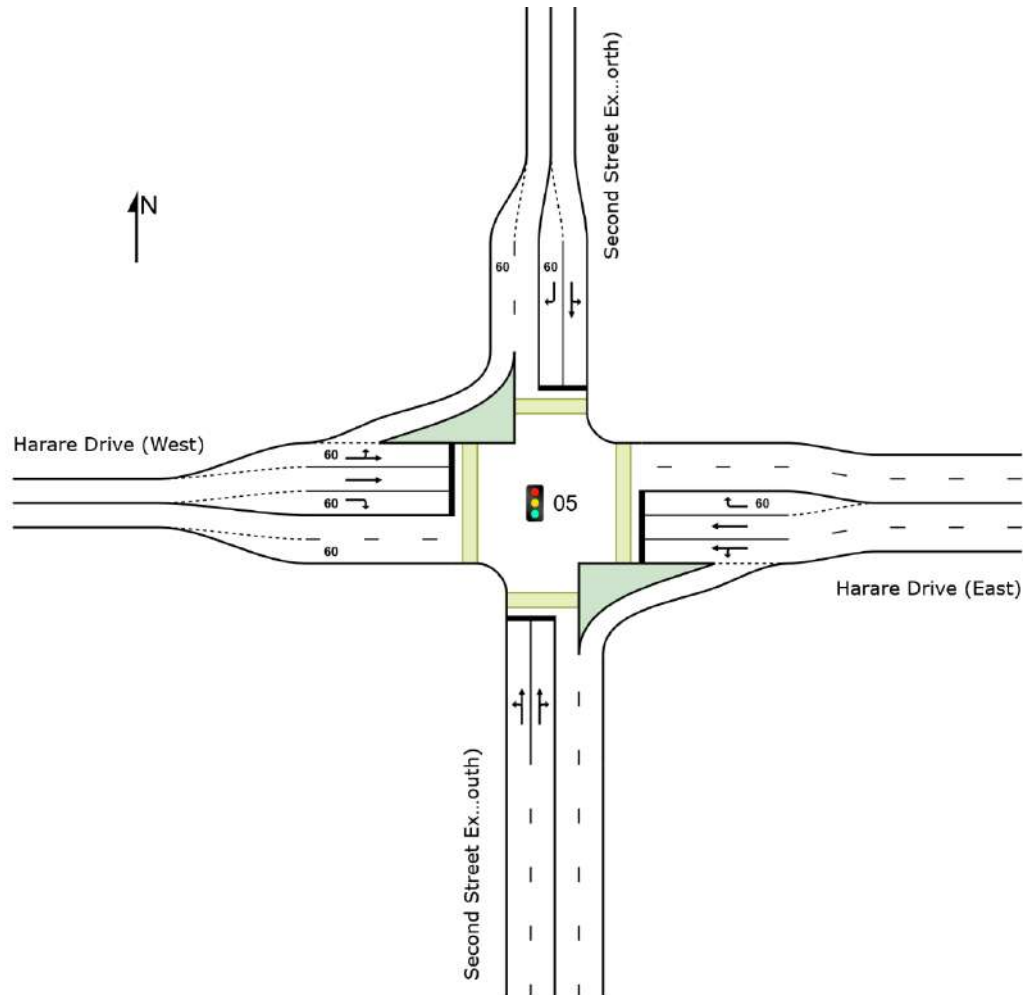


Figure 7.104: Site 05 Harare Drive and Second Street Extension (Harare Drive Corridor)

Table 7.107: Site 05 Movement Summary Harare Drive and Second Street Extension (Harare Drive Corridor)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Eff. No. of Cycles	Aver. Speed km/h
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				
South: Second Street Extension (South)															
1	L2	All MCs	188	3.4	188	3.4	0.715	18.4	LOS B	4.5	34.7	0.91	0.92	1.18	45.8
2	T1	All MCs	278	13.7	278	13.7	0.715	11.7	LOS B	4.5	34.7	0.92	0.91	1.21	48.2
3	R2	All MCs	72	6.6	72	6.6 *	0.715	21.5	LOS C	4.1	33.7	0.93	0.91	1.22	46.7
Approach			539	9.2	539	9.2	0.715	15.3	LOS B	4.5	34.7	0.92	0.91	1.20	47.1
East: Harare Drive (East)															
4	L2	All MCs	84	9.5	84	9.5	0.243	5.7	LOS A	1.1	9.0	0.60	0.64	0.60	50.6
5	T1	All MCs	281	11.9	281	11.9 *	0.658	13.8	LOS B	3.8	31.7	0.91	0.83	1.06	49.6
6	R2	All MCs	64	10.6	64	10.6	0.236	19.5	LOS B	0.9	7.5	0.93	0.73	0.93	43.6
Approach			429	11.3	429	11.3	0.658	13.1	LOS B	3.8	31.7	0.85	0.78	0.95	48.8
North: Second Street Extension (North)															
7	L2	All MCs	90	9.9	90	9.9	0.494	14.4	LOS B	2.4	19.4	0.82	0.73	0.82	48.3
8	T1	All MCs	104	10.1	104	10.1	0.494	8.7	LOS A	2.4	19.4	0.82	0.73	0.82	50.6
9	R2	All MCs	68	16.6	68	16.6	0.252	18.8	LOS B	1.0	8.6	0.90	0.74	0.90	44.0
Approach			262	11.7	262	11.7	0.494	13.3	LOS B	2.4	19.4	0.84	0.73	0.84	48.0
West: Harare Drive (West)															
10	L2	All MCs	69	10.4	69	10.4	0.539	6.9	LOS A	2.4	19.3	0.86	0.76	0.91	48.2
11	T1	All MCs	313	11.3	313	11.3	0.539	13.5	LOS B	2.9	23.7	0.90	0.76	0.94	50.0
12	R2	All MCs	122	4.9	122	4.9	0.487	21.0	LOS C	1.9	14.5	0.98	0.77	1.01	43.0
Approach			504	9.6	504	9.6	0.539	14.4	LOS B	2.9	23.7	0.91	0.76	0.95	47.9
All Vehicles			1733	10.2	1733	10.2	0.715	14.2	LOS B	4.5	34.7	0.89	0.81	1.01	47.9

Table 7.108: Site 05 Lane Level of Service Harare Drive and Second Street Extension (Harare Drive Corridor)

	Approaches				Intersection
	South	East	North	West	
LOS	B	B	B	B	B

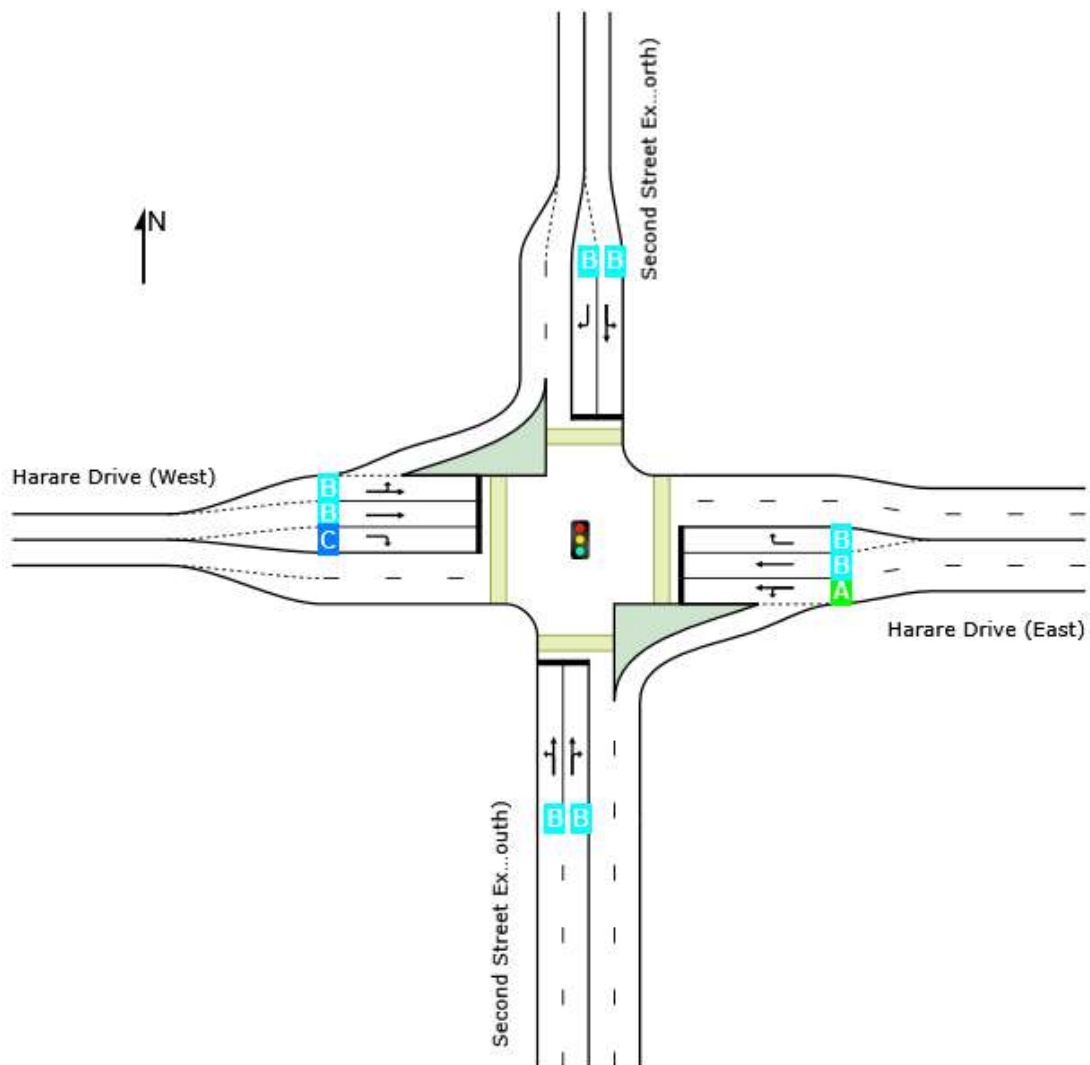


Figure 7.105: Site 05 Lane Level of Service Harare Drive and Second Street Extension (Harare Drive Corridor)

Table 7.109: Site 05 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Harare Drive and Second Street Extension (Harare Drive Corridor)

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.71	0.66	0.49	0.54	0.71

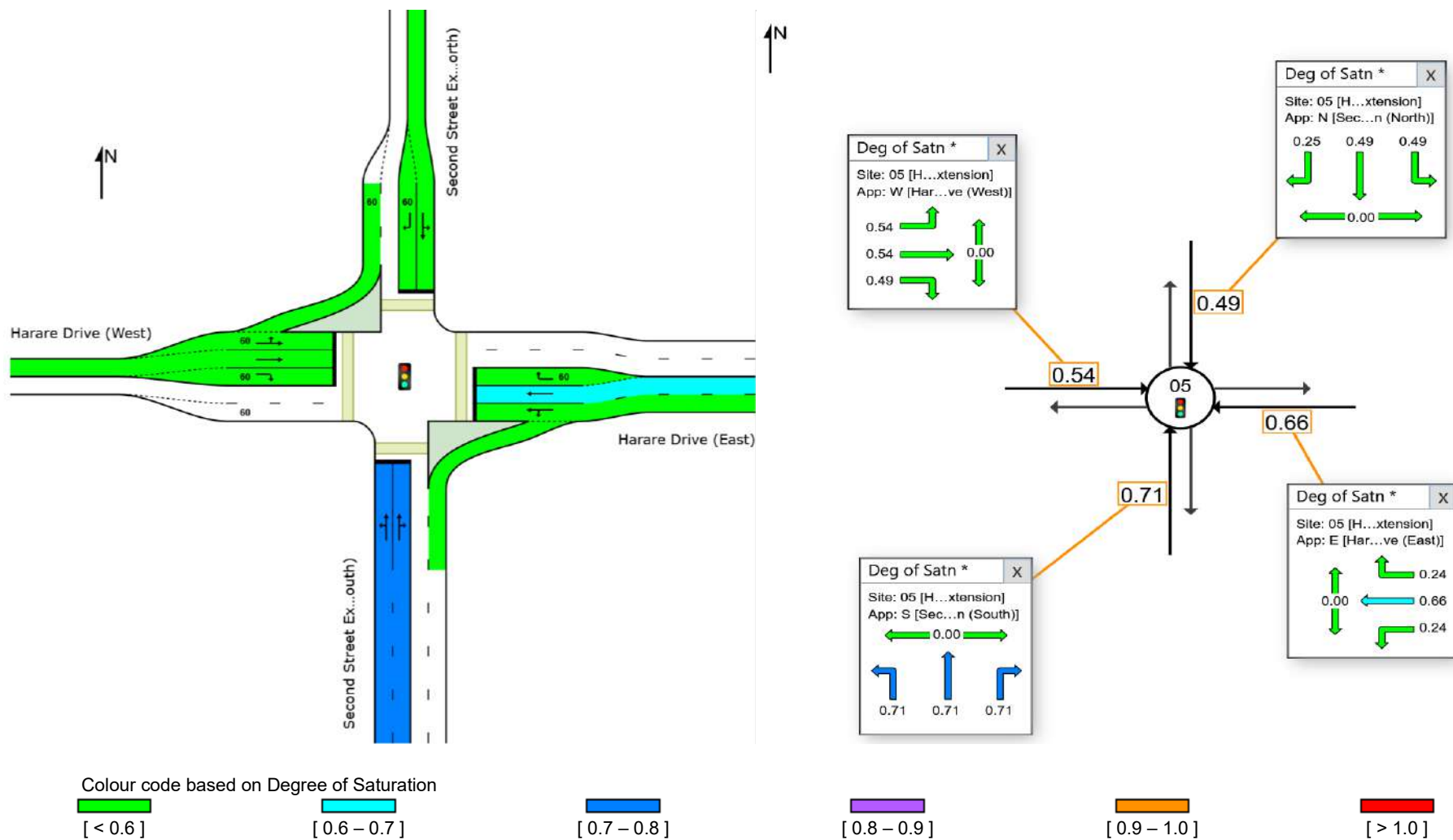


Figure 7.106: Site 05 Degree of Saturation and Ratio of Arrival Flow to Capacity, v/c ratio per lane Harare Drive and Second Street Extension (Harare Drive Corridor)

Site 06: Harare Drive and Nemakonde Way

15-hour Average Daily Traffic (ADT) Results

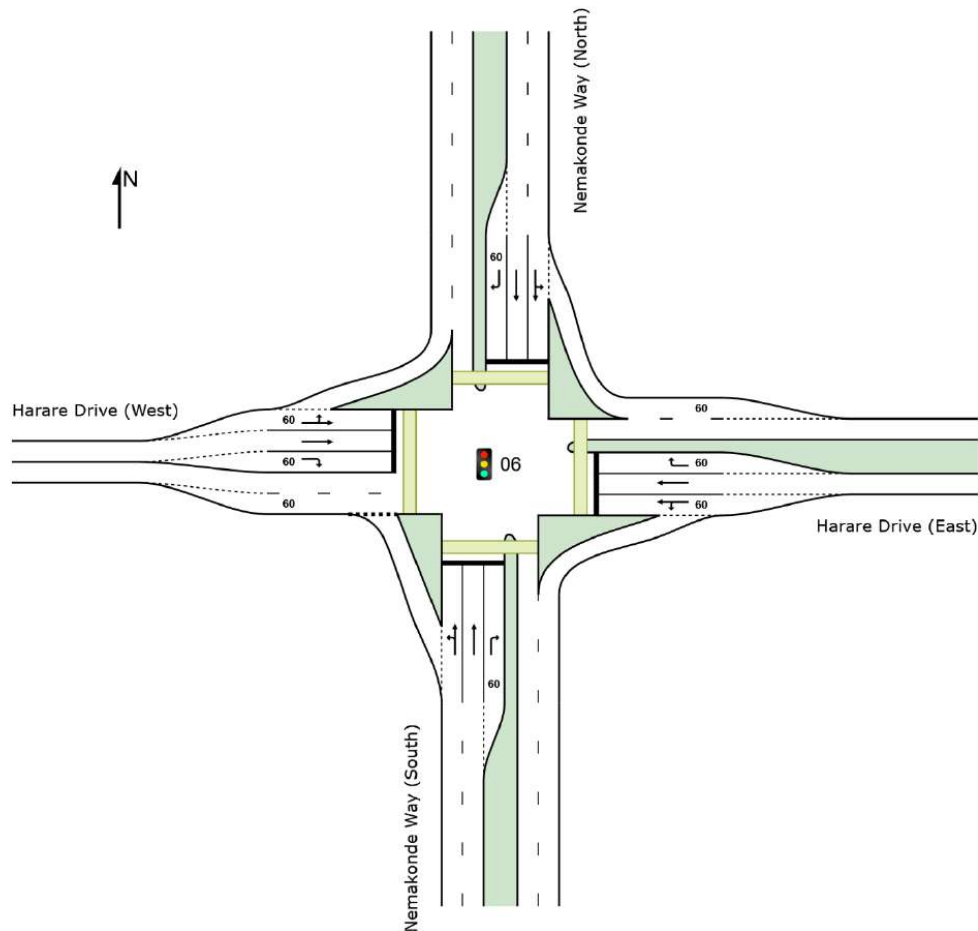


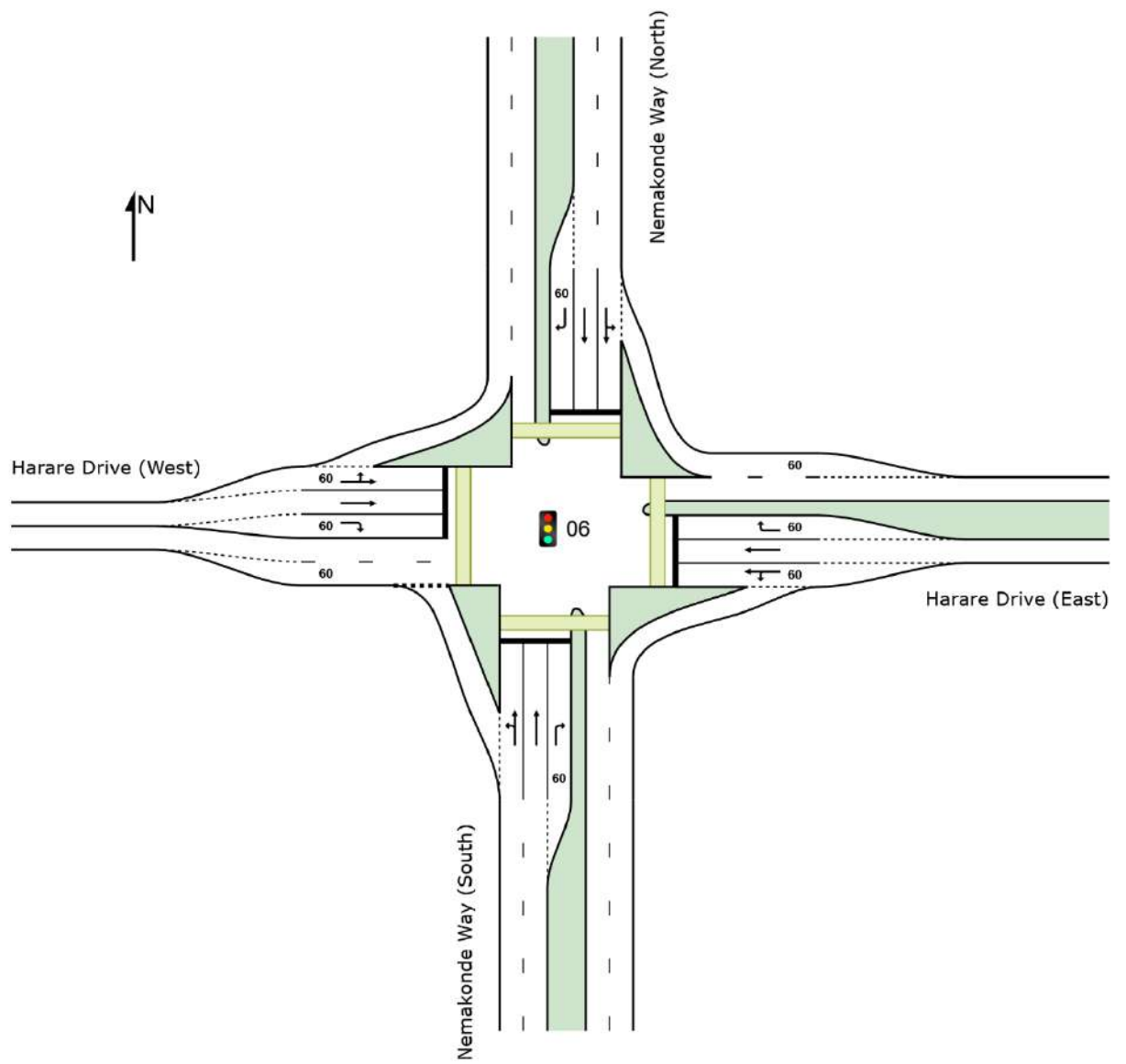
Figure 7.107: Site 06 Harare Drive and Nemakonde Way (Harare Drive Corridor)

Site 07: Harare Drive and Nemakonde Way

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 07 [Harare Drive and Nemakonde Way (Site Folder: Harare Drive Corridor)]



MOVEMENT SUMMARY

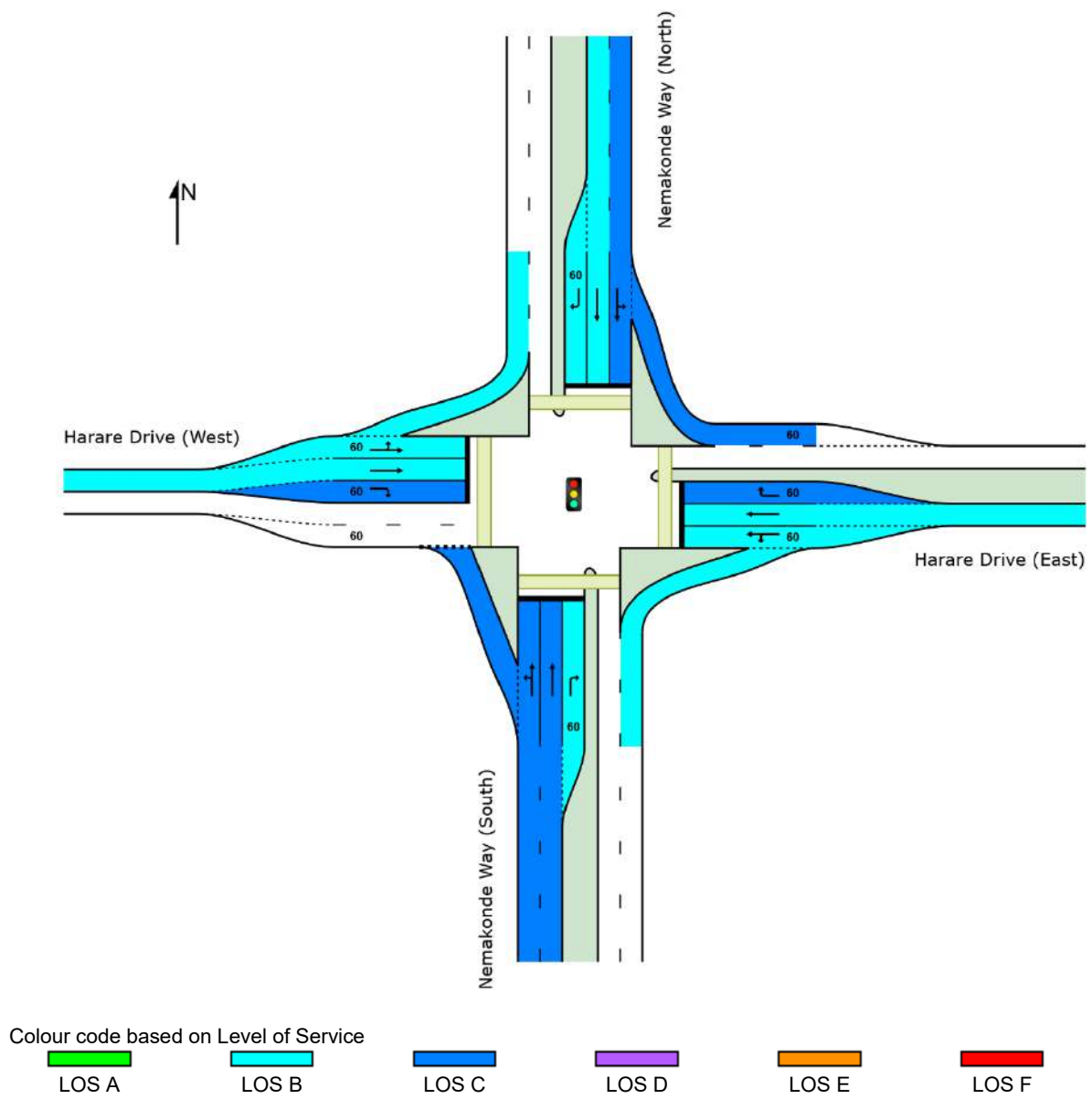
 Site: 07 [Harare Drive and Nemakonde Way (Site Folder: Harare Drive Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
South: Nemakonde Way (South)															
1	L2	All MCs	62	2.8	62	2.8	0.815	16.6	LOS B	6.2	52.0	1.00	1.04	1.41	42.2
2	T1	All MCs	505	15.9	505	15.9 *	0.815	23.4	LOS C	6.3	54.7	1.00	1.03	1.41	43.8
3	R2	All MCs	88	5.4	88	5.4	0.198	13.7	LOS B	1.0	7.8	0.85	0.73	0.85	47.3
Approach			655	13.3	655	13.3	0.815	21.5	LOS C	6.3	54.7	0.98	0.99	1.34	44.1
East: Harare Drive (East)															
4	L2	All MCs	118	3.1	118	3.1	0.175	5.6	LOS A	1.7	12.6	0.63	0.68	0.63	48.8
5	T1	All MCs	185	7.1	185	7.1	0.447	19.9	LOS B	3.0	23.3	0.89	0.73	0.89	47.7
6	R2	All MCs	171	12.4	171	12.4	0.815 *	29.6	LOS C	4.0	33.5	1.00	1.00	1.53	39.2
Approach			474	8.0	474	8.0	0.815	19.8	LOS B	4.0	33.5	0.86	0.81	1.05	44.5
North: Nemakonde Way (North)															
7	L2	All MCs	163	12.5	163	12.5	0.715	8.4	LOS A	6.4	50.4	0.96	0.90	1.13	44.1
8	T1	All MCs	414	8.3	414	8.3	0.715	24.0	LOS C	6.4	50.4	0.97	0.90	1.16	45.7
9	R2	All MCs	130	23.4	130	23.4	0.329 *	14.7	LOS B	1.5	13.6	0.90	0.75	0.90	46.3
Approach			707	12.0	707	12.0	0.715	18.7	LOS B	6.4	50.4	0.96	0.87	1.11	45.5
West: Harare Drive (West)															
10	L2	All MCs	192	23.9	192	23.9	0.549	5.9	LOS A	4.7	40.6	0.85	0.77	0.85	46.1
11	T1	All MCs	294	5.0	294	5.0	0.549	23.0	LOS C	4.7	40.6	0.92	0.77	0.93	47.3
12	R2	All MCs	68	9.0	68	9.0	0.287	24.4	LOS C	1.3	10.6	0.94	0.74	0.94	41.4
Approach			554	12.0	554	12.0	0.549	17.3	LOS B	4.7	40.6	0.90	0.77	0.90	46.1
All Vehicles			2391	11.6	2391	11.6	0.815	19.3	LOS B	6.4	54.7	0.93	0.87	1.11	45.0

LEVEL OF SERVICE

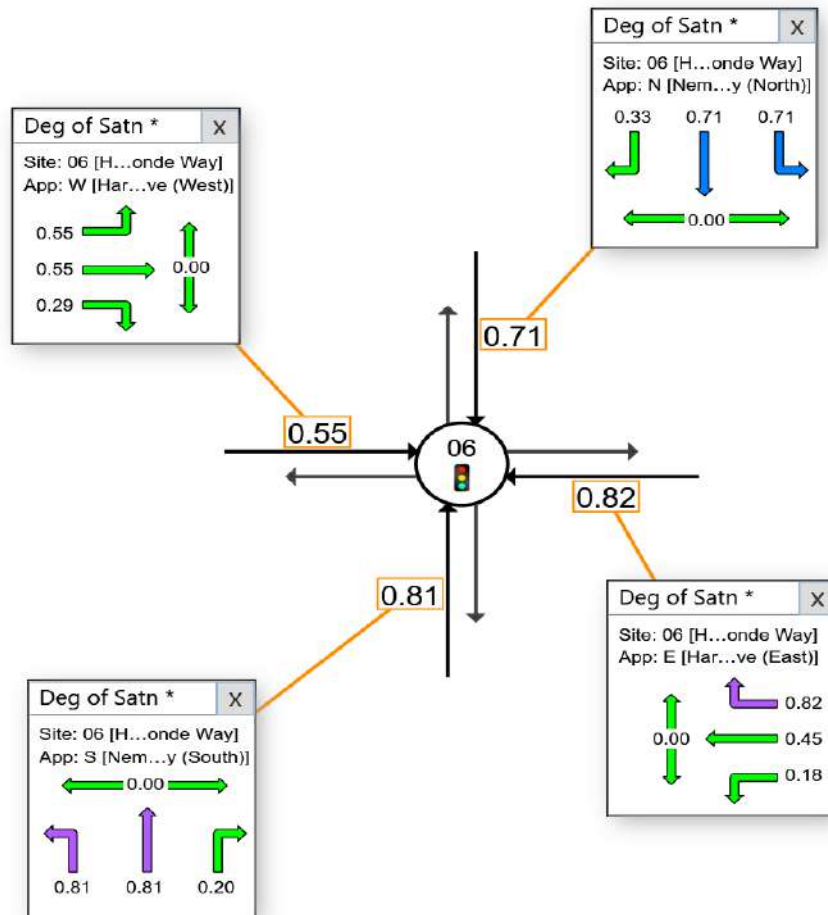
 Site: 07 [Harare Drive and Nemaconde Way (Site Folder: Harare Drive Corridor)]

	Approaches				Intersection
	South	East	North	West	
LOS	C	B	B	B	B

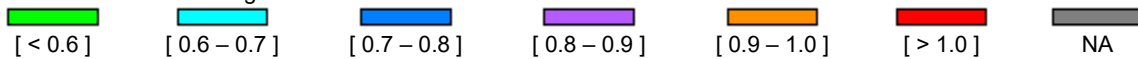


DEGREE OF SATURATION

Site: 07 [Harare Drive and Nemakonde Way (Site Folder: Harare Drive Corridor)]



Colour code based on Degree of Saturation

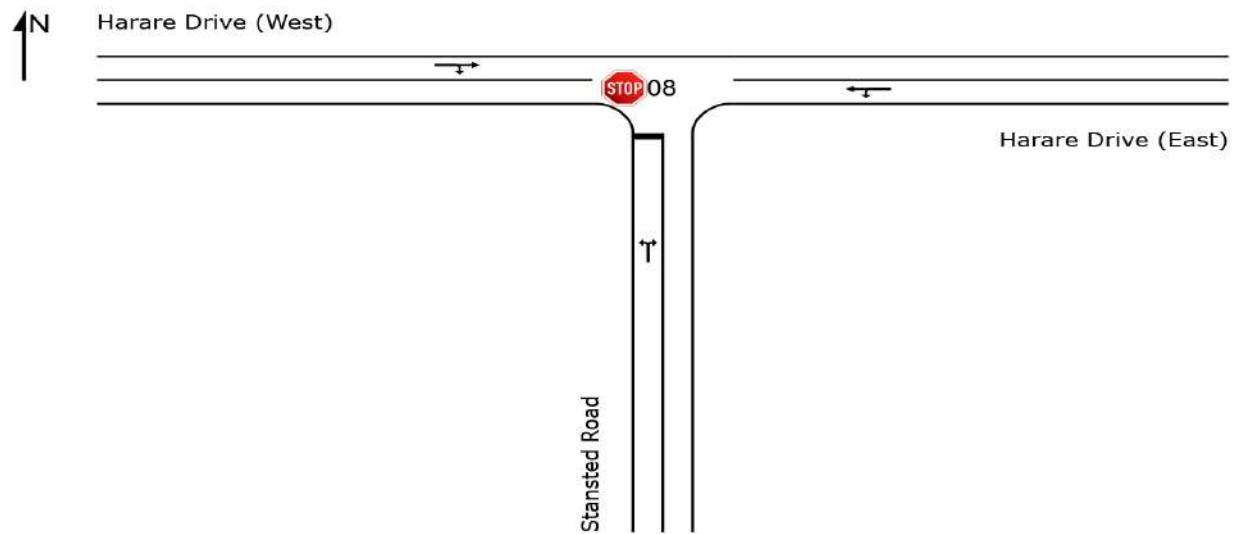


Site 08: Harare Drive and Stansted Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 08 [Harare Drive and Stansted Road (Site Folder: Harare Drive Corridor)]



MOVEMENT SUMMARY

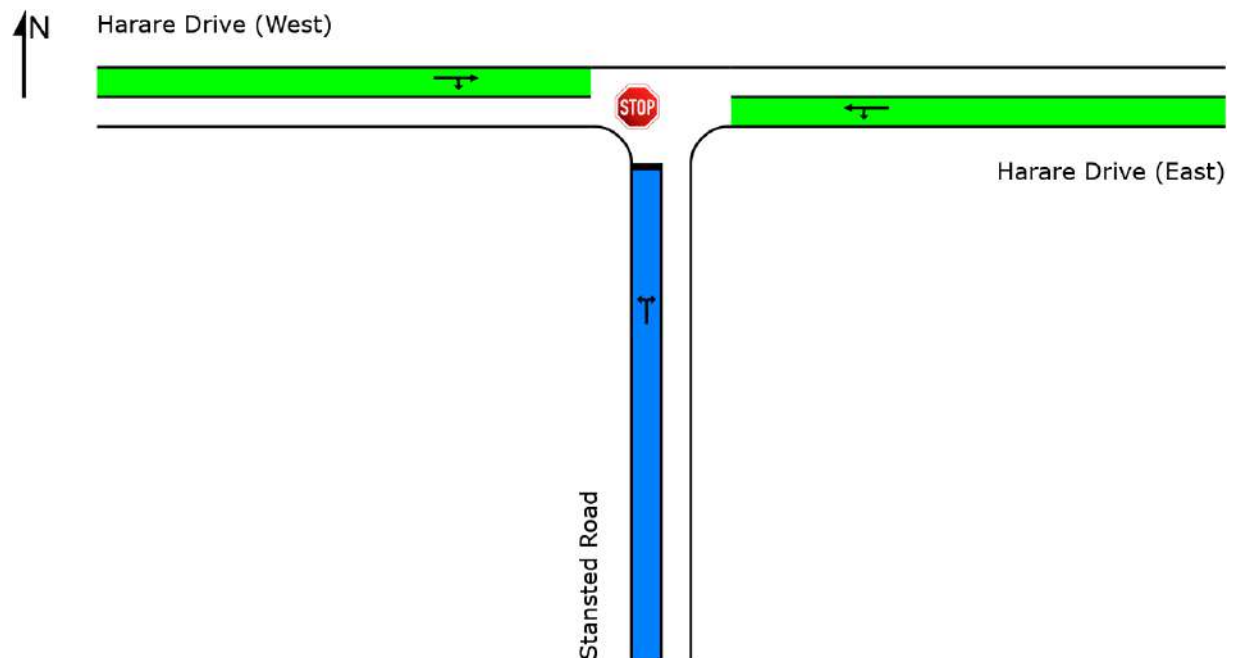
 Site: 08 [Harare Drive and Stansted Road (Site Folder: Harare Drive Corridor)]

Vehicle Movement Performance																
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total	HV]	[Total	HV]				[Veh.	Dist]					
			veh/h	%	veh/h	%				v/c	sec					veh
South: Stansted Road																
1	L2	All MCs	77	37.4	77	37.4	0.422	14.6	LOS B	1.7	15.2	0.75	1.07	1.08	42.4	
3	R2	All MCs	49	26.6	49	26.6	0.422	37.4	LOS E	1.7	15.2	0.75	1.07	1.08	42.4	
Approach			126	33.2	126	33.2	0.422	23.5	LOS C	1.7	15.2	0.75	1.07	1.08	42.4	
East: Harare Drive (East)																
4	L2	All MCs	84	6.8	84	6.8	0.275	5.7	LOS A	0.0	0.0	0.00	0.12	0.00	55.9	
5	T1	All MCs	320	10.1	320	10.1	0.275	0.1	LOS A	0.0	0.0	0.00	0.12	0.00	58.6	
Approach			405	9.4	405	9.4	0.275	1.3	NA	0.0	0.0	0.00	0.12	0.00	58.0	
West: Harare Drive (West)																
11	T1	All MCs	439	23.6	439	23.6	0.530	2.6	LOS A	3.8	31.2	0.41	0.52	0.63	55.4	
12	R2	All MCs	217	13.2	217	13.2	0.530	9.8	LOS A	3.8	31.2	0.41	0.52	0.63	52.4	
Approach			656	20.2	656	20.2	0.530	4.9	NA	3.8	31.2	0.41	0.52	0.63	54.4	
All Vehicles			1187	17.9	1187	17.9	0.530	5.7	NA	3.8	31.2	0.30	0.45	0.46	53.9	

LEVEL OF SERVICE

 Site: 08 [Harare Drive and Stansted Road (Site Folder: Harare Drive Corridor)]

	Approaches			Intersection
	South	East	West	
LOS	C	NA (TWSC)	NA (TWSC)	NA (TWSC)



Colour code based on Level of Service



LOS A



LOS B



LOS C



LOS D



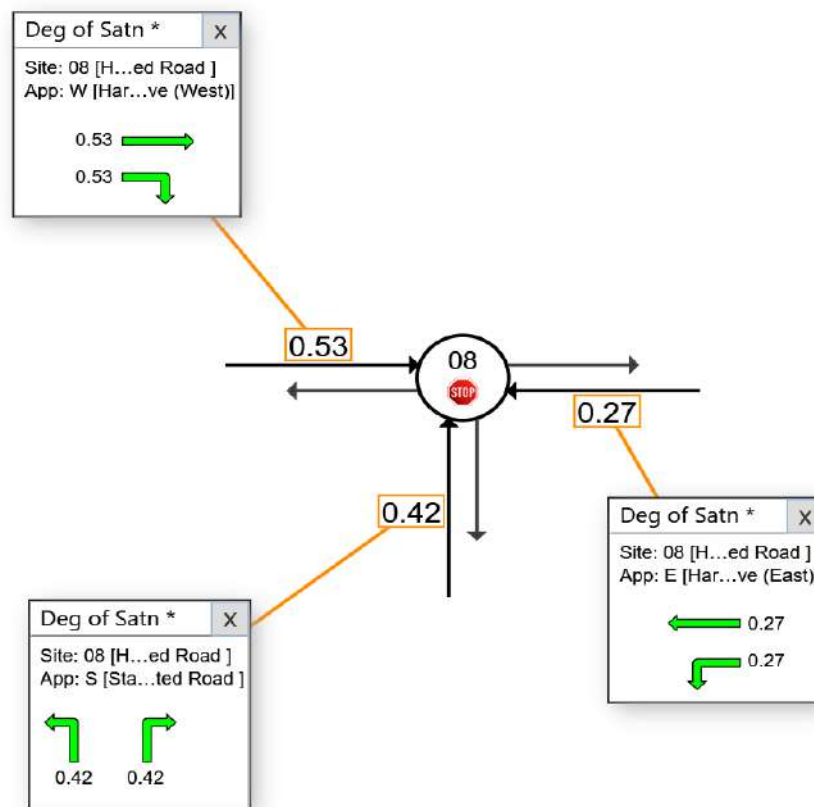
LOS E



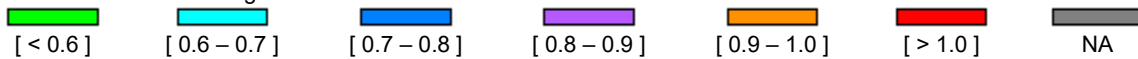
LOS F

DEGREE OF SATURATION

 Site: 08 [Harare Drive and Stansted Road (Site Folder: Harare Drive Corridor)]



Colour code based on Degree of Saturation

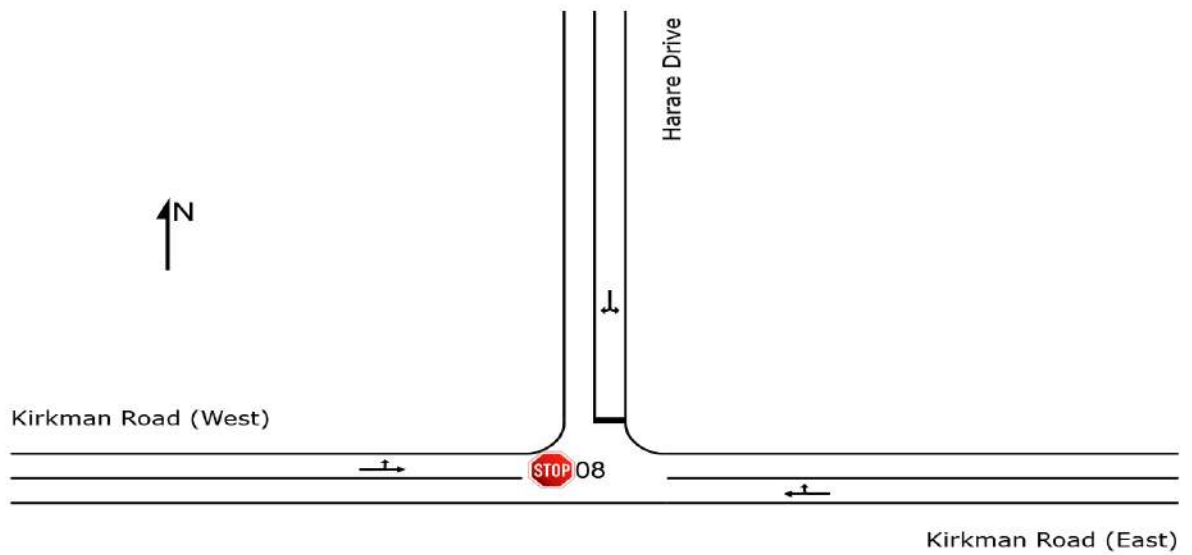


Site 09: Harare Drive and Kirkman Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 09[Harare Drive and Kirkman Road (Site Folder: Harare Drive Corridor)]



MOVEMENT SUMMARY

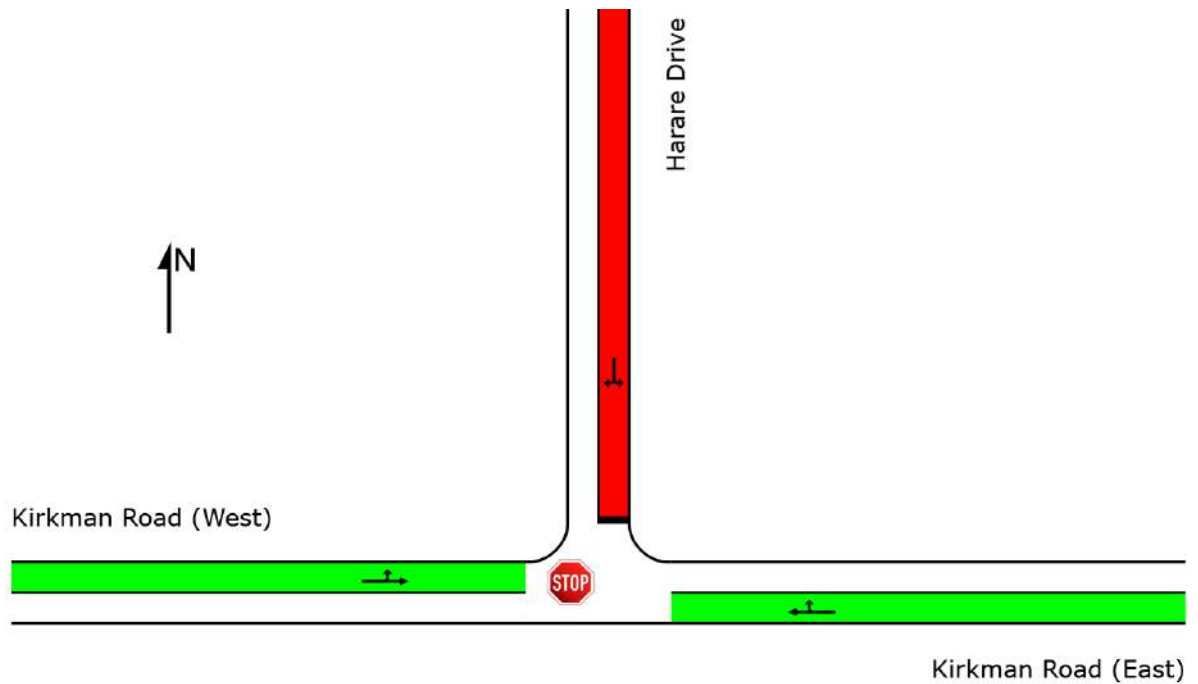
 Site: 09 [Harare Drive and Kirkman Road (Site Folder: Harare Drive Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
East: Kirkman Road (East)															
5	T1	All MCs	479	8.8	479	8.8	0.697	7.0	LOS A	9.5	80.5	0.55	0.73	1.30	51.7
6	R2	All MCs	282	19.5	282	19.5	0.697	14.8	LOS B	9.5	80.5	0.55	0.73	1.30	48.7
Approach			762	12.7	762	12.7	0.697	9.9	NA	9.5	80.5	0.55	0.73	1.30	50.5
North: Harare Drive															
7	L2	All MCs	110	19.8	110	19.8	1.709	652.0	LOS F	48.6	418.9	1.00	7.14	19.39	5.0
9	R2	All MCs	71	14.3	71	14.3	1.709	695.3	LOS F	48.6	418.9	1.00	7.14	19.39	5.0
Approach			181	17.7	181	17.7	1.709	669.0	LOS F	48.6	418.9	1.00	7.14	19.39	5.0
West: Kirkman Road (West)															
10	L2	All MCs	67	16.2	67	16.2	0.275	5.8	LOS A	0.0	0.0	0.00	0.10	0.00	55.7
11	T1	All MCs	333	7.5	333	7.5	0.275	0.1	LOS A	0.0	0.0	0.00	0.10	0.00	58.9
Approach			400	8.9	400	8.9	0.275	1.1	NA	0.0	0.0	0.00	0.10	0.00	58.3
All Vehicles			1343	12.3	1343	12.3	1.709	96.2	NA	48.6	418.9	0.45	1.41	3.35	23.0

LEVEL OF SERVICE

 Site: 09 [Harare Drive and Kirkman Road (Site Folder: Harare Drive Corridor)]

	Approaches			Intersection
	East	North	West	
LOS	NA (TWSC)	F	NA (TWSC)	NA (TWSC)



Colour code based on Level of Service

 LOS A

 LOS B

 LOS C

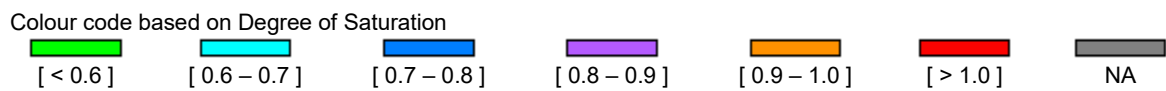
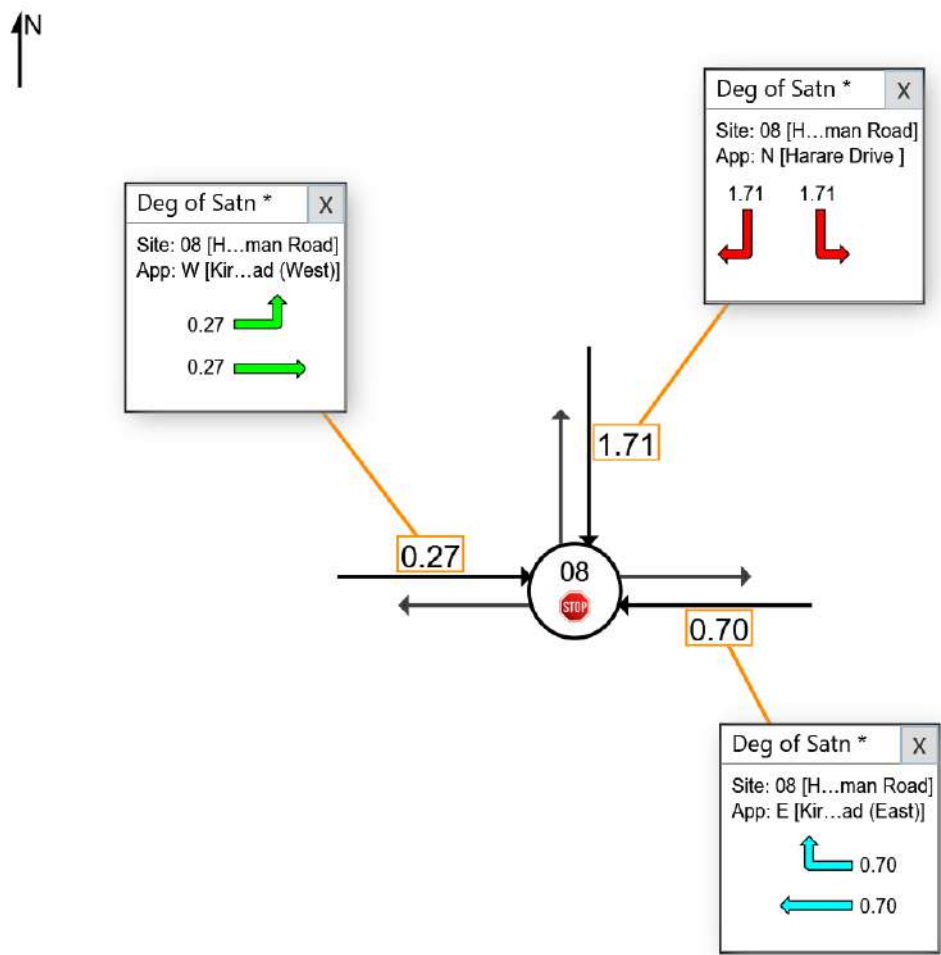
 LOS D

 LOS E

 LOS F

DEGREE OF SATURATION

 Site: 09 [Harare Drive and Kirkman Road (Site Folder: Harare Drive Corridor)]

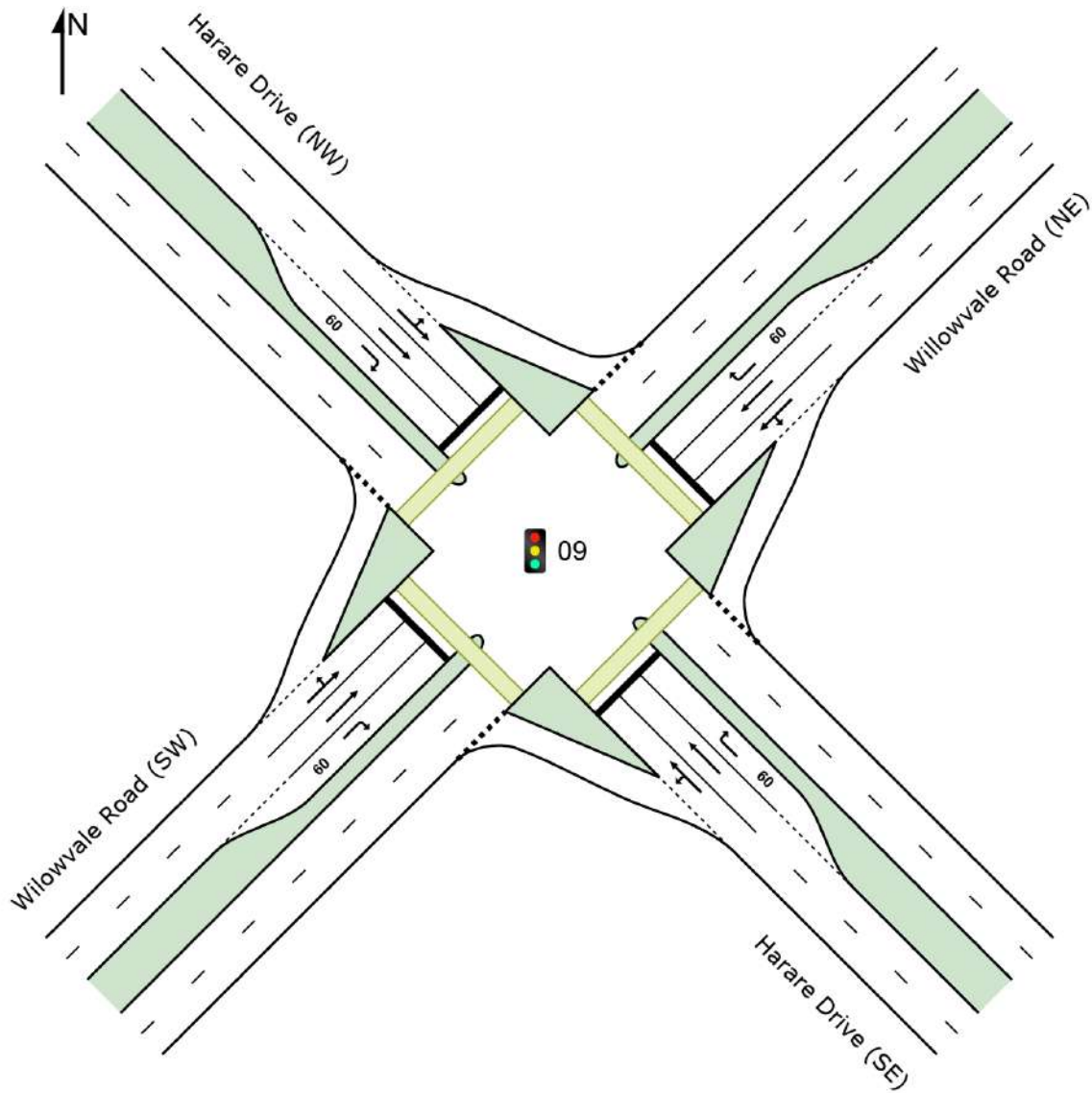


Site 10: Harare Drive and Willowvale Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

Site: 10 [Harare Drive and Willowvale Road (Site Folder: Harare Drive Corridor)]



MOVEMENT SUMMARY

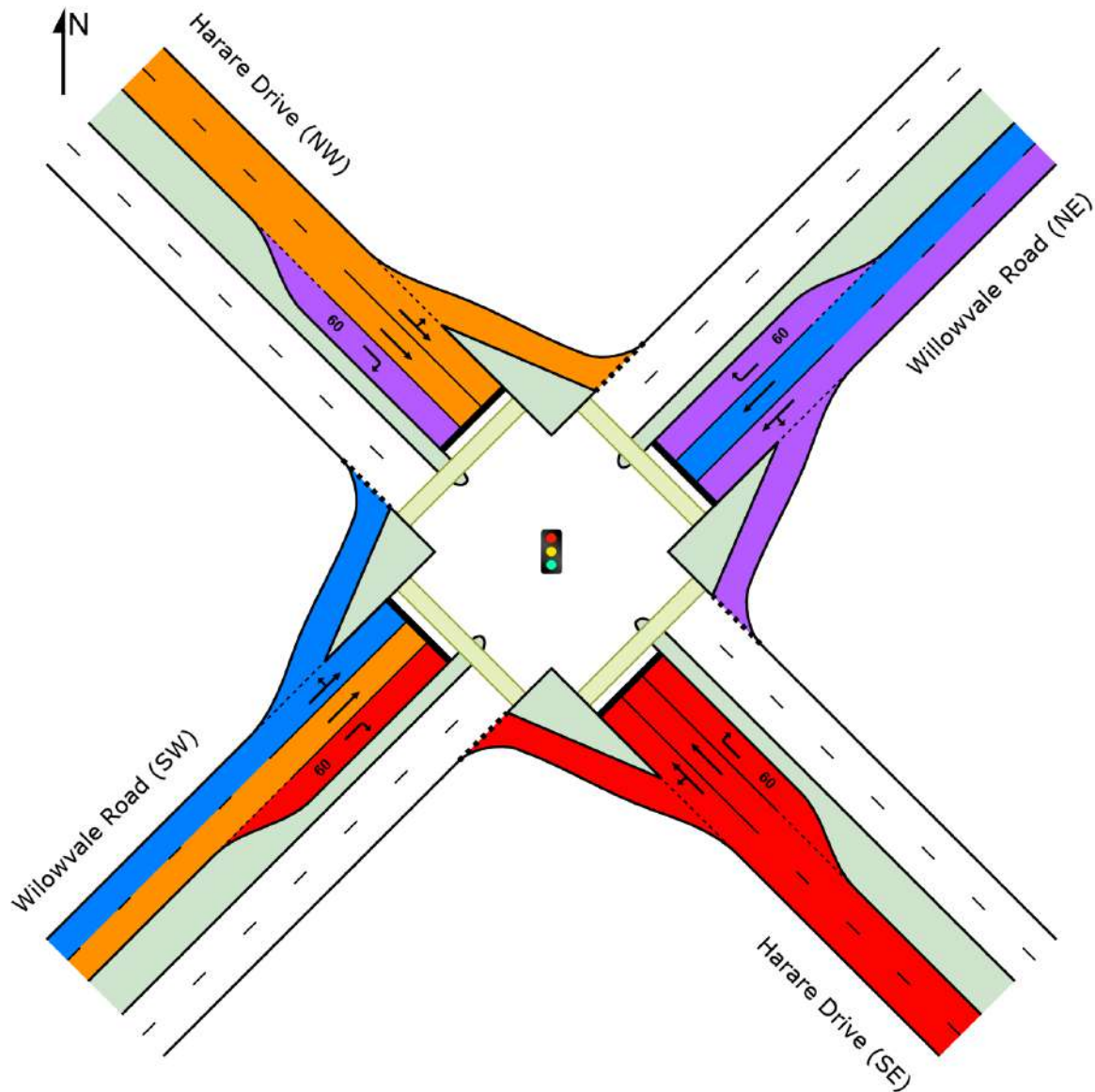
 Site: 10 [Harare Drive and Willowvale Road (Site Folder: Harare Drive Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
SouthEast: Harare Drive (SE)															
21	L2	All MCs	119	47.7	119	47.7	1.262	269.7	LOS F	33.8	332.2	1.00	1.62	2.43	9.4
22	T1	All MCs	316	46.7	316	46.7 *	1.262	332.0	LOS F	33.8	332.2	1.00	1.73	2.44	9.6
23	R2	All MCs	282	47.8	282	47.8	1.005 *	110.0	LOS F	24.3	239.5	1.00	1.25	1.55	19.1
Approach			716	47.3	716	47.3	1.262	234.3	LOS F	33.8	332.2	1.00	1.52	2.09	11.4
NorthEast: Willowvale Road (NE)															
24	L2	All MCs	39	18.6	39	18.6	0.389	22.8	LOS C	5.6	44.6	0.91	0.76	0.91	34.0
25	T1	All MCs	261	6.9	261	6.9	0.389	38.7	LOS D	10.1	76.7	0.79	0.67	0.79	37.9
26	R2	All MCs	24	21.9	24	21.9	0.094	49.2	LOS D	1.3	12.0	0.77	0.71	0.77	32.3
Approach			324	9.5	324	9.5	0.389	37.6	LOS D	10.1	76.7	0.80	0.68	0.80	36.9
NorthWest: Harare Drive (NW)															
27	L2	All MCs	36	21.9	36	21.9	0.621	34.6	LOS C	6.1	50.7	0.99	0.88	1.01	27.7
28	T1	All MCs	191	10.9	191	10.9	0.621	70.8	LOS E	9.0	71.5	0.98	0.83	0.99	29.1
29	R2	All MCs	141	6.2	141	6.2	0.489	49.4	LOS D	7.7	58.5	0.82	0.86	0.82	32.4
Approach			368	10.1	368	10.1	0.621	59.1	LOS E	9.0	71.5	0.92	0.85	0.93	30.1
SouthWest: Wilowvale Road (SW)															
30	L2	All MCs	119	16.3	119	16.3	0.452	12.2	LOS B	8.4	69.0	0.74	0.74	0.74	39.7
31	T1	All MCs	300	7.8	300	7.8	0.452	55.5	LOS E	11.0	86.5	0.76	0.69	0.76	39.2
32	R2	All MCs	296	5.5	296	5.5	1.361 *	432.1	LOS F	49.4	376.7	1.00	1.68	2.72	7.8
Approach			715	8.3	715	8.3	1.361	204.3	LOS F	49.4	376.7	0.86	1.11	1.57	13.7
All Vehicles			2123	22.0	2123	22.0	1.361	163.8	LOS F	49.4	376.7	0.91	1.14	1.52	15.6

LEVEL OF SERVICE

 Site: 10 [Harare Drive and Willowvale Road (Site Folder: Harare Drive Corridor)]

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	F	D	E	F	F



Colour code based on Level of Service

 LOS A

 LOS B

 LOS C

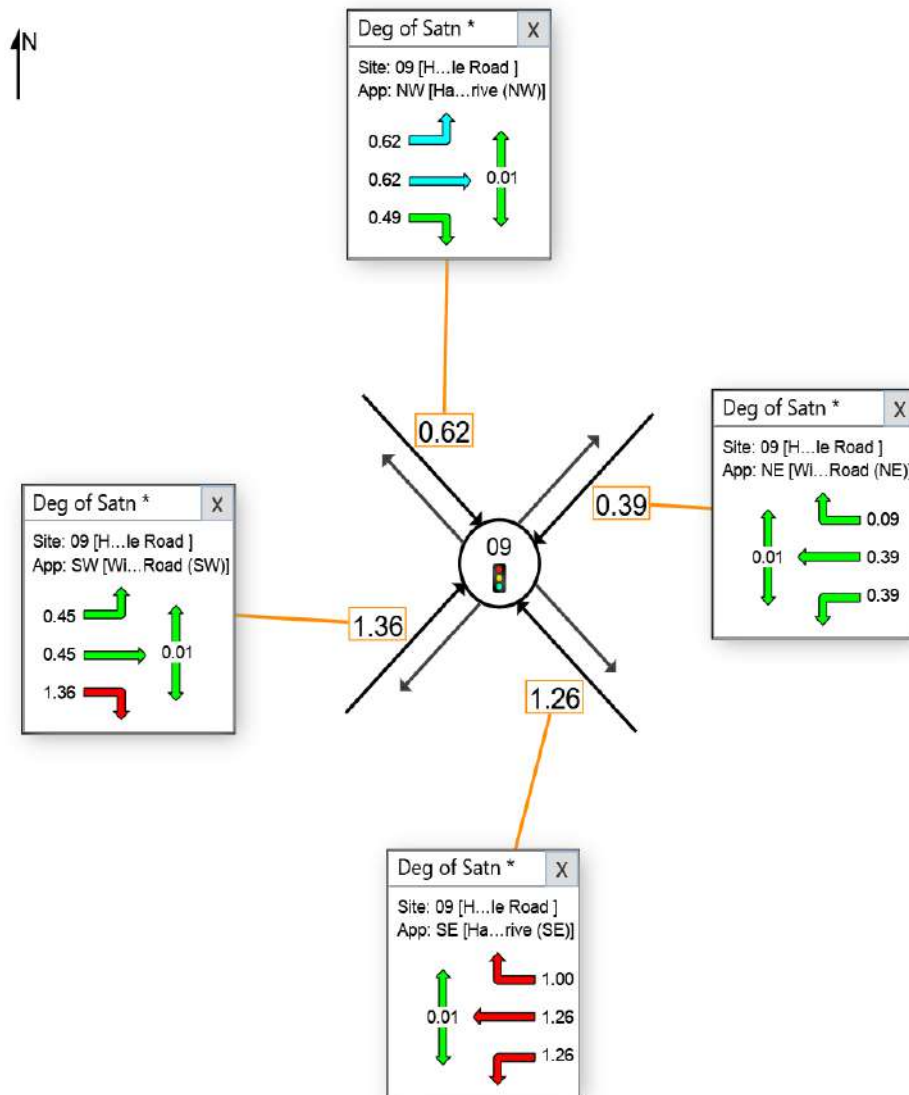
 LOS D

 LOS E

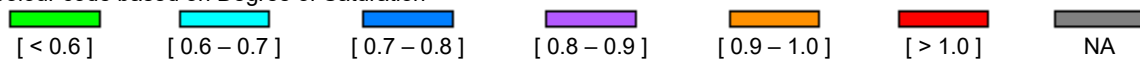
 LOS F

DEGREE OF SATURATION

 Site: 10 [Harare Drive and Willowvale Road (Site Folder: Harare Drive Corridor)]



Colour code based on Degree of Saturation

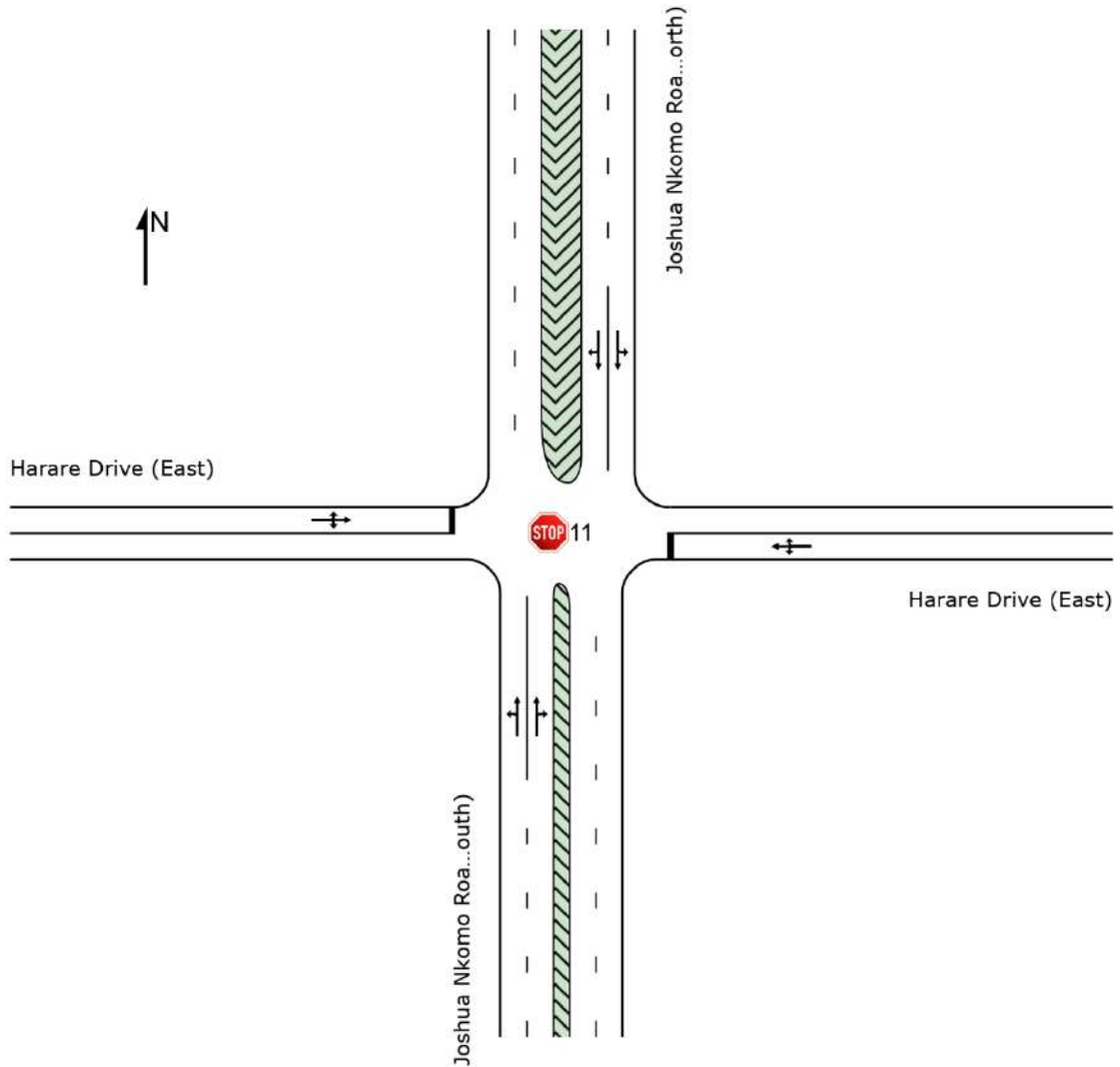


Site 11: Harare Drive and Joshua Nkomo Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 11 [Harare Drive and Joshua Nkomo Road (Site Folder: Harare Drive Corridor)]



MOVEMENT SUMMARY

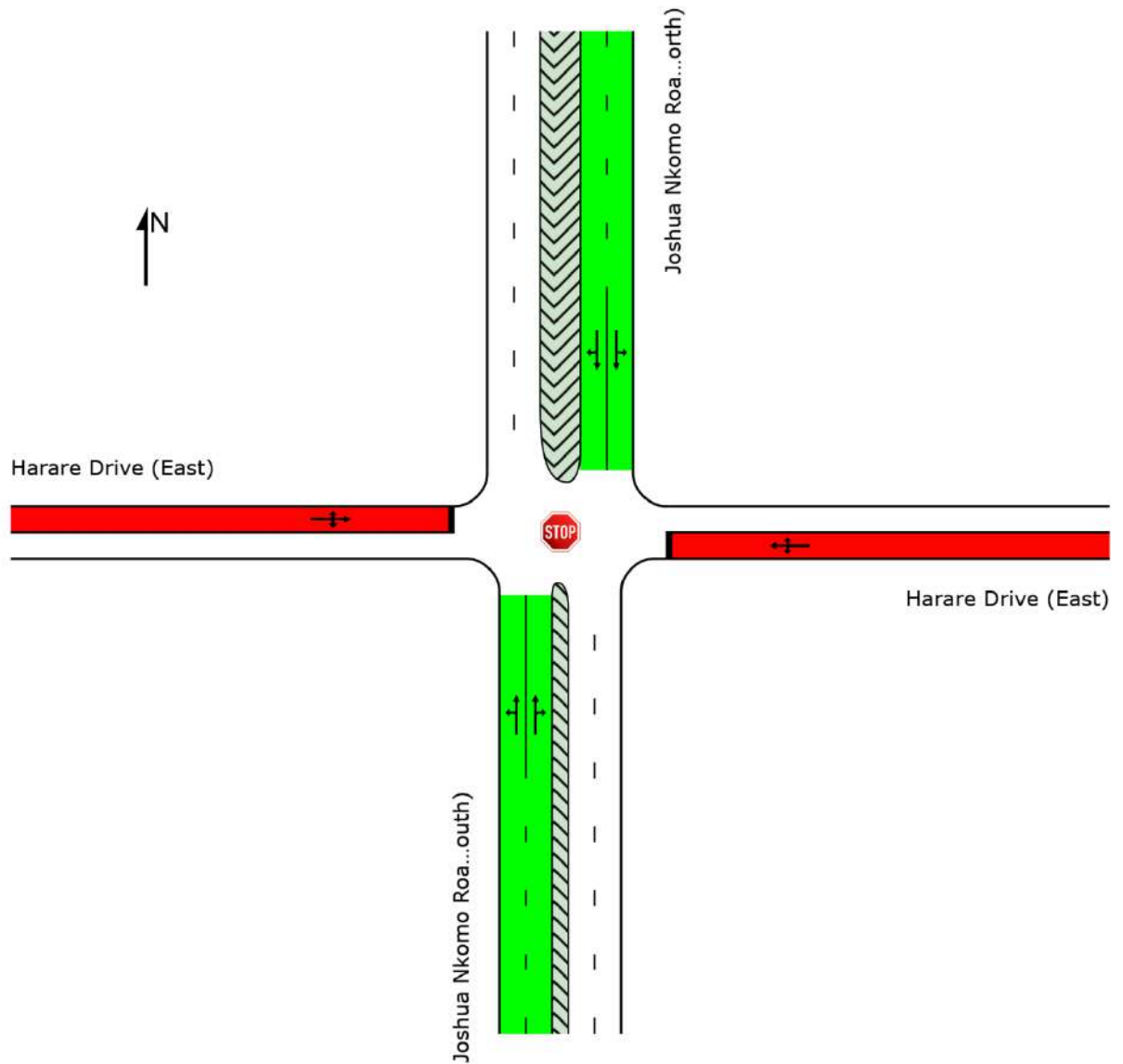
 **Site: 11 [Harare Drive and Joshua Nkomo Road (Site Folder: Harare Drive Corridor)]**

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Joshua Nkomo Road (South)															
1	L2	All MCs	6	70.8	6	70.8	0.124	6.4	LOS A	0.0	0.0	0.00	0.02	0.00	54.1
2	T1	All MCs	196	8.8	196	8.8	0.124	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	59.6
3	R2	All MCs	174	6.3	174	6.3	0.200	8.1	LOS A	0.8	6.3	0.49	0.70	0.49	50.8
Approach			377	8.7	377	8.7	0.200	3.9	NA	0.8	6.3	0.23	0.33	0.23	55.1
East: Harare Drive (East)															
4	L2	All MCs	67	3.8	67	3.8	1.168	194.4	LOS F	44.6	355.1	1.00	2.47	5.49	11.8
5	T1	All MCs	164	13.2	164	13.2	1.168	267.4	LOS F	44.6	355.1	1.00	2.47	5.49	11.8
6	R2	All MCs	31	4.3	31	4.3	1.168	265.4	LOS F	44.6	355.1	1.00	2.47	5.49	11.8
Approach			263	9.7	263	9.7	1.168	248.5	LOS F	44.6	355.1	1.00	2.47	5.49	11.8
North: Joshua Nkomo Road (North)															
7	L2	All MCs	171	5.8	171	5.8	0.122	5.5	LOS A	0.0	0.0	0.00	0.49	0.00	52.6
8	T1	All MCs	217	8.5	217	8.5	0.122	0.1	LOS A	0.1	0.9	0.05	0.13	0.05	58.4
9	R2	All MCs	13	3.2	13	3.2	0.122	5.8	LOS A	0.1	0.9	0.06	0.07	0.06	53.0
Approach			401	7.2	401	7.2	0.122	2.6	NA	0.1	0.9	0.03	0.28	0.03	55.6
West: Harare Drive (East)															
10	L2	All MCs	11	3.8	11	3.8	0.853	33.1	LOS D	3.2	27.5	0.95	1.50	2.57	27.2
11	T1	All MCs	53	20.7	53	20.7	0.853	72.2	LOS F	3.2	27.5	0.95	1.50	2.57	27.0
12	R2	All MCs	23	12.8	23	12.8	0.853	94.8	LOS F	3.2	27.5	0.95	1.50	2.57	27.1
Approach			87	16.5	87	16.5	0.853	73.3	LOS F	3.2	27.5	0.95	1.50	2.57	27.1
All Vehicles			1128	9.0	1128	9.0	1.168	65.8	NA	44.6	355.1	0.39	0.90	1.56	28.5

LEVEL OF SERVICE

 Site: 11 [Harare Drive and Joshua Nkomo Road (Site Folder: Harare Drive Corridor)]

	Approaches				Intersection
	South	East	North	West	
LOS	NA (TWSC)	F	NA (TWSC)	F	NA (TWSC)



Colour code based on Level of Service

 LOS A

 LOS B

 LOS C

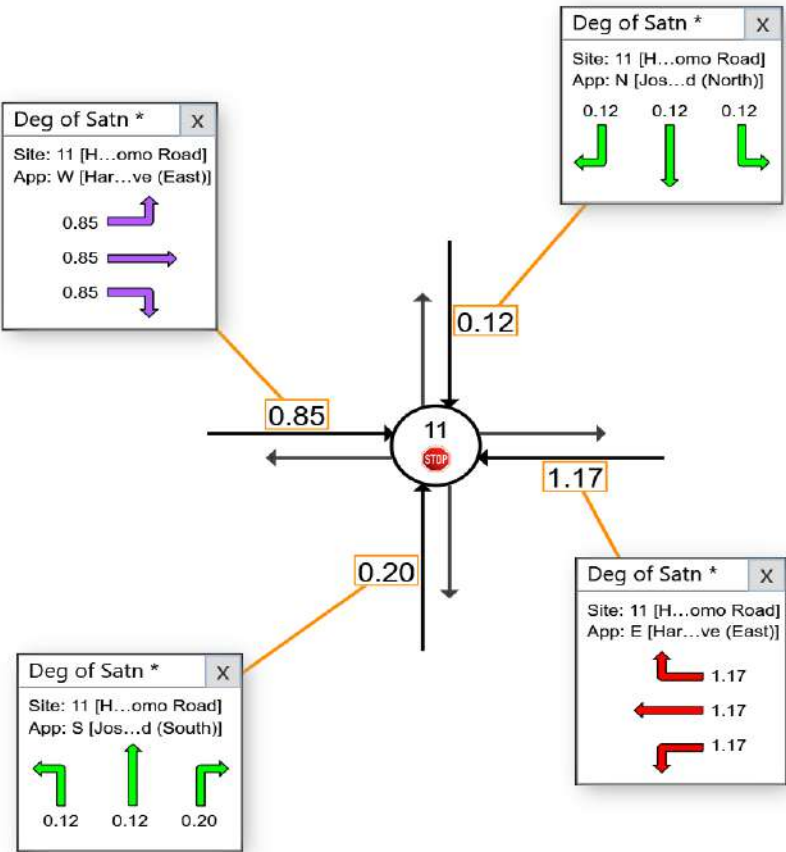
 LOS D

 LOS E

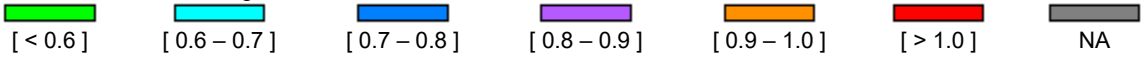
 LOS F

DEGREE OF SATURATION

 Site: 11 [Harare Drive and Joshua Nkomo Road (Site Folder: Harare Drive Corridor)]



Colour code based on Degree of Saturation



Corridor Nodal Capacity Results Interpretation and Analysis: The Harare Drive (Ring Road Corridor)

The following are summarised intersection LOS results and the result interpretation for the Harare Drive Corridor.

Site 01: Harare Drive and Acturus Road

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	F	F	E

Site 02: Harare Drive and ED Mnangagwa

	Approaches				Intersection
	South	East	North	West	
LOS	E	F	F	D	E

Site 03: Harare Drive and Gaydon Road

	Approaches				Intersection
	South	East	North	West	
LOS	A	A	A	A	A

Site 04: Harare Drive and Borrowdale Road

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	B	B	C

Site 05: Harare Drive and Alpes Road

	Approaches				Intersection
	South	East	North	West	
LOS	B	C	B	C	B

Site 06: Harare Drive and Second Street Extension

	Approaches				Intersection
	South	East	North	West	
LOS	B	B	B	B	B

Site 07: Harare Drive and Nemakonde Way Intersection

	Approaches				Intersection
	South	East	North	West	
LOS	C	B	B	B	B

Site 08: Harare Drive and Stansted Road

	Approaches			Intersection
	South	East	West	
LOS	C	NA (TWSC)	NA (TWSC)	NA (TWSC)

Site 09: Harare Drive and Kirkman Road

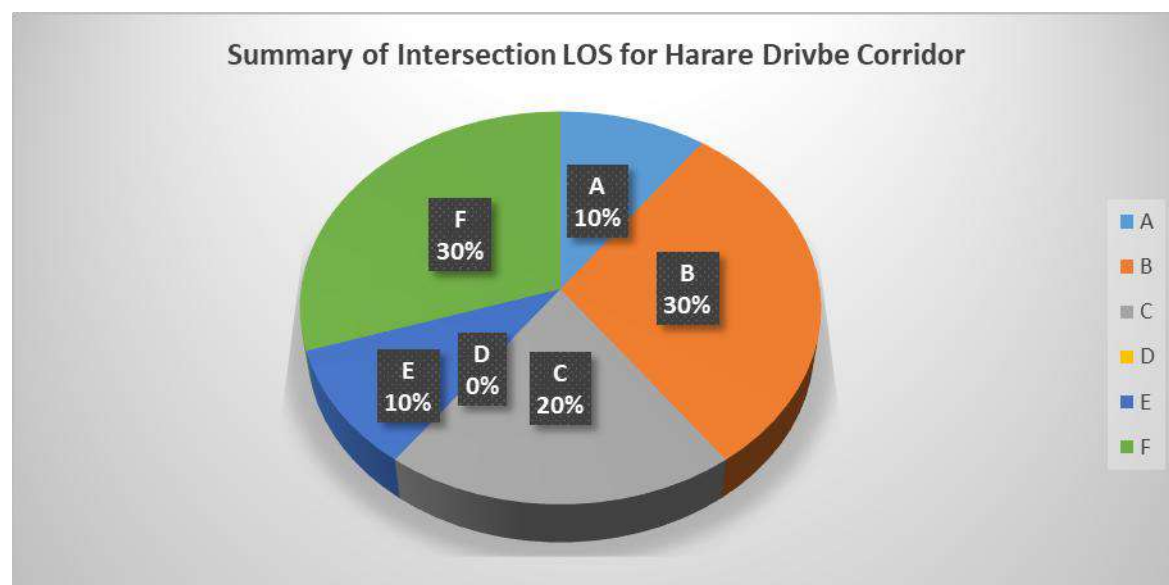
	Approaches			Intersection
	East	North	West	
LOS	NA (TWSC)	F	NA (TWSC)	NA (TWSC)

Site 10: Harare Drive and Willowvale Road

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	F	D	E	F	F

Site 11: Harare Drive and Joshua Nkomo

	Approaches				Intersection
	South	East	North	West	
LOS	NA (TWSC)	F	NA (TWSC)	F	NA (TWSC)



Results above show that the Harare Drive corridor has a combined statistic of 40% of the studied 11 intersections operation at Levels of Service E and F characterised by slow moving vehicles with multiple stop and go conditions as well as higher traffic queuing at such intersections. These worst LOS were observed to be along those **incomplete sections of the ring road** for example Harare Drive and Kirkman, Harare Drive and Joshua Nkomo as well as Harare Drive and Willowvale road.

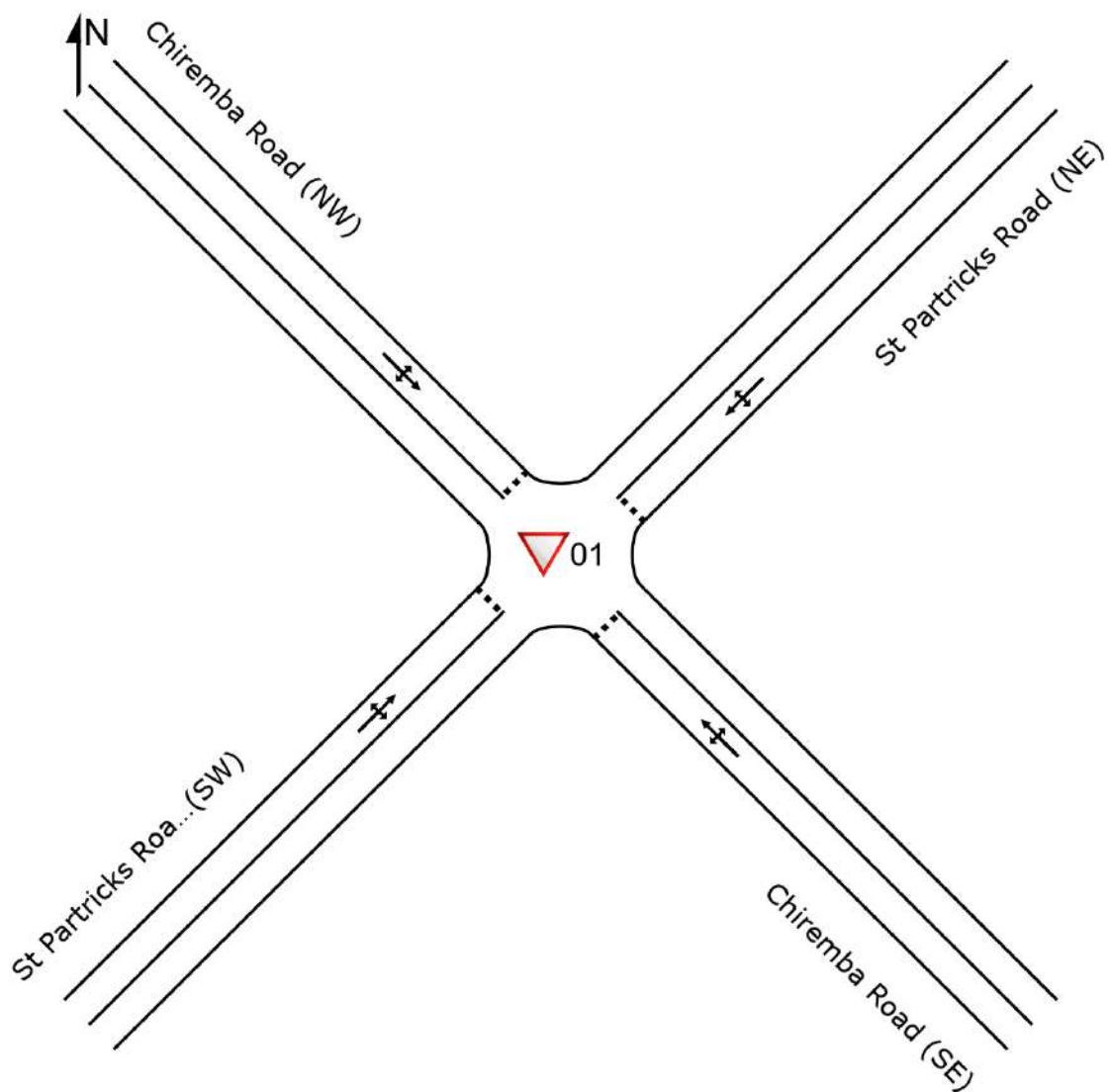
7.1.4.1.5. Chiremba Corridor

Site 01: Chiremba Road and St Patricks Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

▼ Site: 01 [Chiremba Road and St Patricks Road (Site Folder: Chiremba Corridor)]



MOVEMENT SUMMARY

Site: 01 [Chiremba Road and St Patricks Road (Site Folder: Chiremba Corridor)]

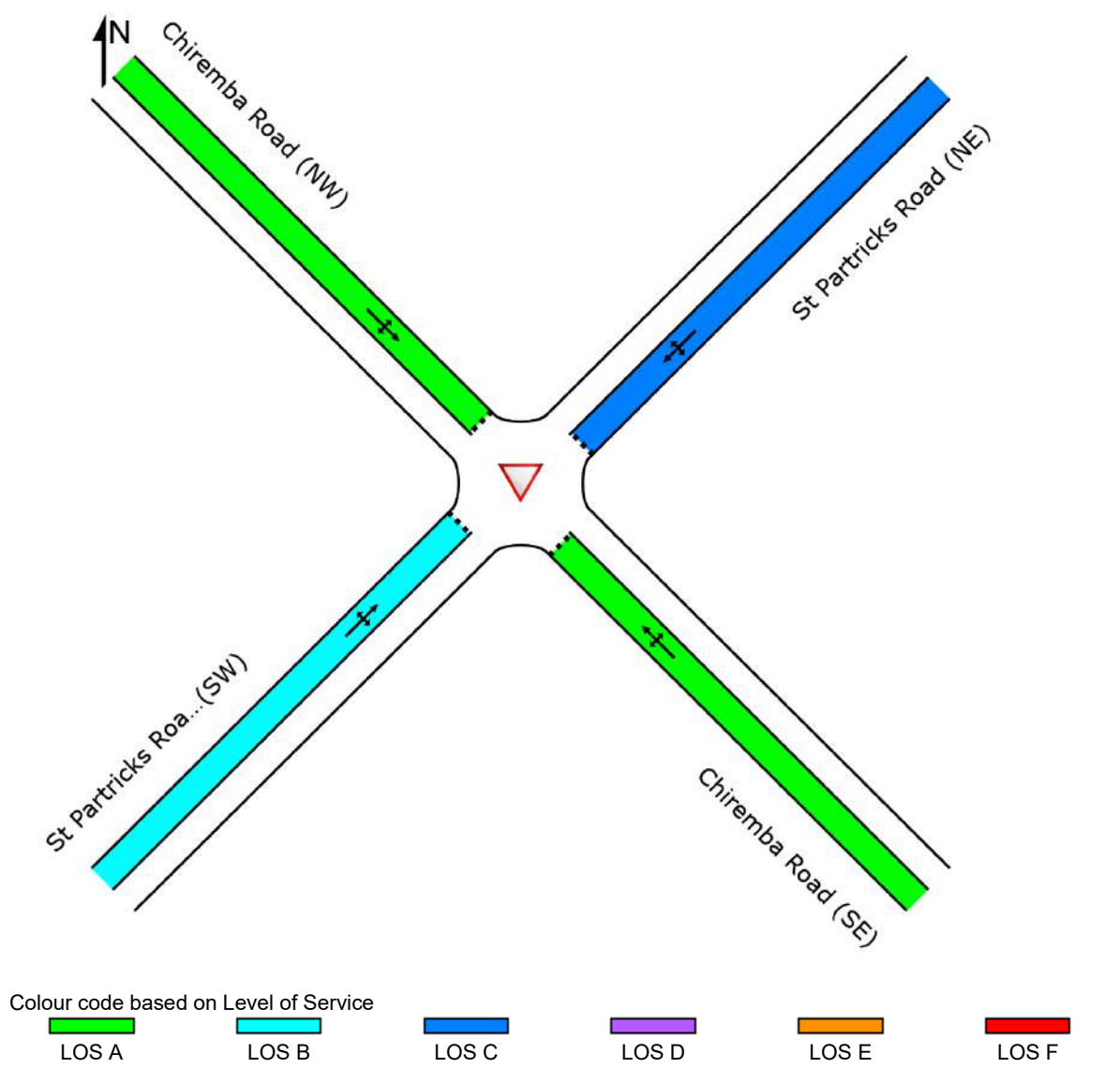
Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Chiremba Road (SE)															
21	L2	All MCs	45	6.3	45	6.3	0.409	5.7	LOS A	2.3	17.5	0.14	0.50	0.14	53.0
22	T1	All MCs	449	7.1	449	7.1	0.409	4.4	LOS A	2.3	17.5	0.14	0.50	0.14	53.4
23	R2	All MCs	4	3.9	4	3.9	0.409	14.6	LOS B	2.3	17.5	0.14	0.50	0.14	52.7
Approach			497	7.0	497	7.0	0.409	4.6	LOS A	2.3	17.5	0.14	0.50	0.14	53.3
NorthEast: St Partricks Road (NE)															
24	L2	All MCs	21	3.0	21	3.0	0.357	8.7	LOS A	1.2	9.1	0.72	0.96	0.96	44.7
25	T1	All MCs	19	3.0	19	3.0	0.357	8.3	LOS A	1.2	9.1	0.72	0.96	0.96	45.1
26	R2	All MCs	74	3.1	74	3.1	0.357	22.4	LOS C	1.2	9.1	0.72	0.96	0.96	44.7
Approach			114	3.1	114	3.1	0.357	17.5	LOS C	1.2	9.1	0.72	0.96	0.96	44.8
NorthWest: Chiremba Road (NW)															
27	L2	All MCs	96	4.7	96	4.7	0.538	5.7	LOS A	3.5	25.6	0.25	0.50	0.25	51.6
28	T1	All MCs	377	5.4	377	5.4	0.538	4.4	LOS A	3.5	25.6	0.25	0.50	0.25	51.5
29	R2	All MCs	74	5.8	74	5.8	0.538	18.0	LOS C	3.5	25.6	0.25	0.50	0.25	51.2
Approach			547	5.3	547	5.3	0.538	6.5	LOS A	3.5	25.6	0.25	0.50	0.25	51.5
SouthWest: St Partricks Road (SW)															
30	L2	All MCs	38	4.3	38	4.3	0.202	8.1	LOS A	0.6	4.6	0.60	0.82	0.62	48.3
31	T1	All MCs	22	3.2	22	3.2	0.202	7.7	LOS A	0.6	4.6	0.60	0.82	0.62	48.6
32	R2	All MCs	33	4.7	33	4.7	0.202	18.9	LOS C	0.6	4.6	0.60	0.82	0.62	48.0
Approach			93	4.2	93	4.2	0.202	11.8	LOS B	0.6	4.6	0.60	0.82	0.62	48.3
All Vehicles			1251	5.7	1251	5.7	0.538	7.1	NA	3.5	25.6	0.27	0.57	0.30	51.2

LEVEL OF SERVICE

▽ Site: 01 [Chiremba Road and St Patricks Road (Site Folder: Chiremba Corridor)]

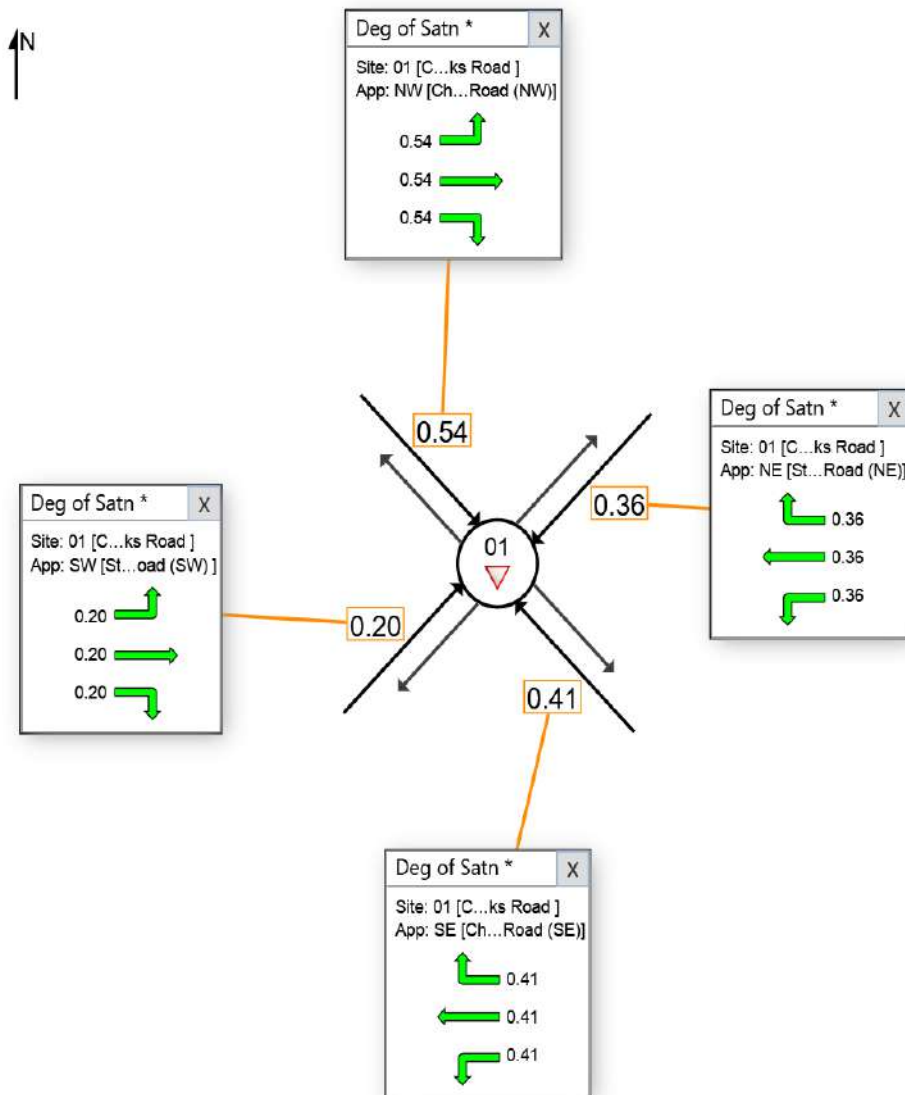
Output produced by SIDRA INTERSECTION Version: 9.1.6.228

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	A	C	A	B	NA (TWSC)

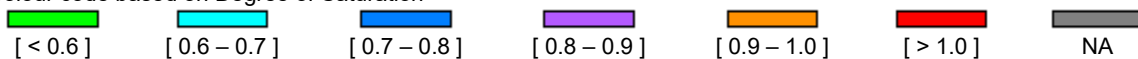


DEGREE OF SATURATION

▽ Site: 01 [Chiremba Road and St Patricks Road (Site Folder: Chiremba Corridor)]



Colour code based on Degree of Saturation

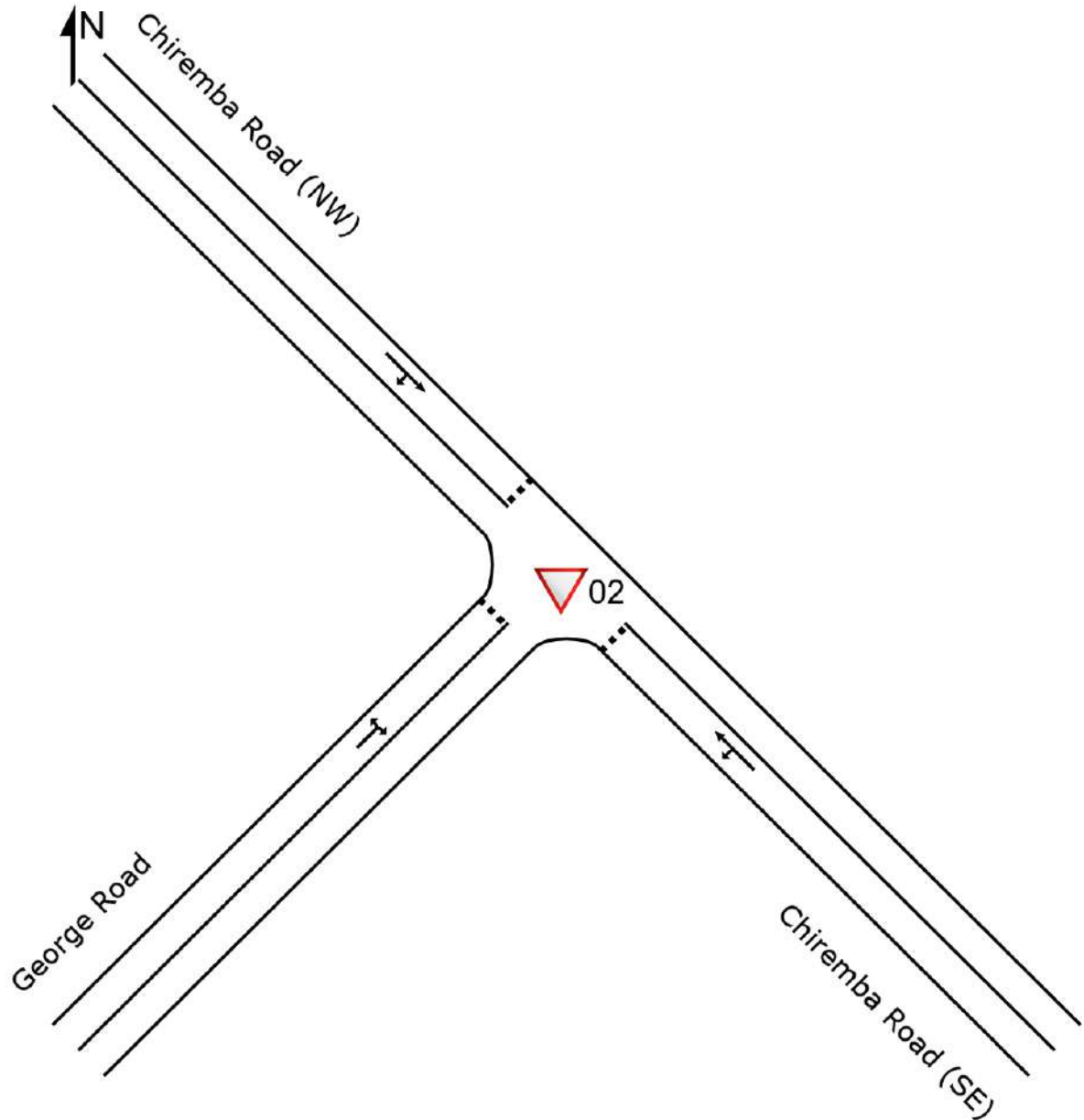


Site 02: Chiremba Road and George Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

▼ Site: 02 [Chiremba Road and George Road (Site Folder: Chiremba Corridor)]



MOVEMENT SUMMARY

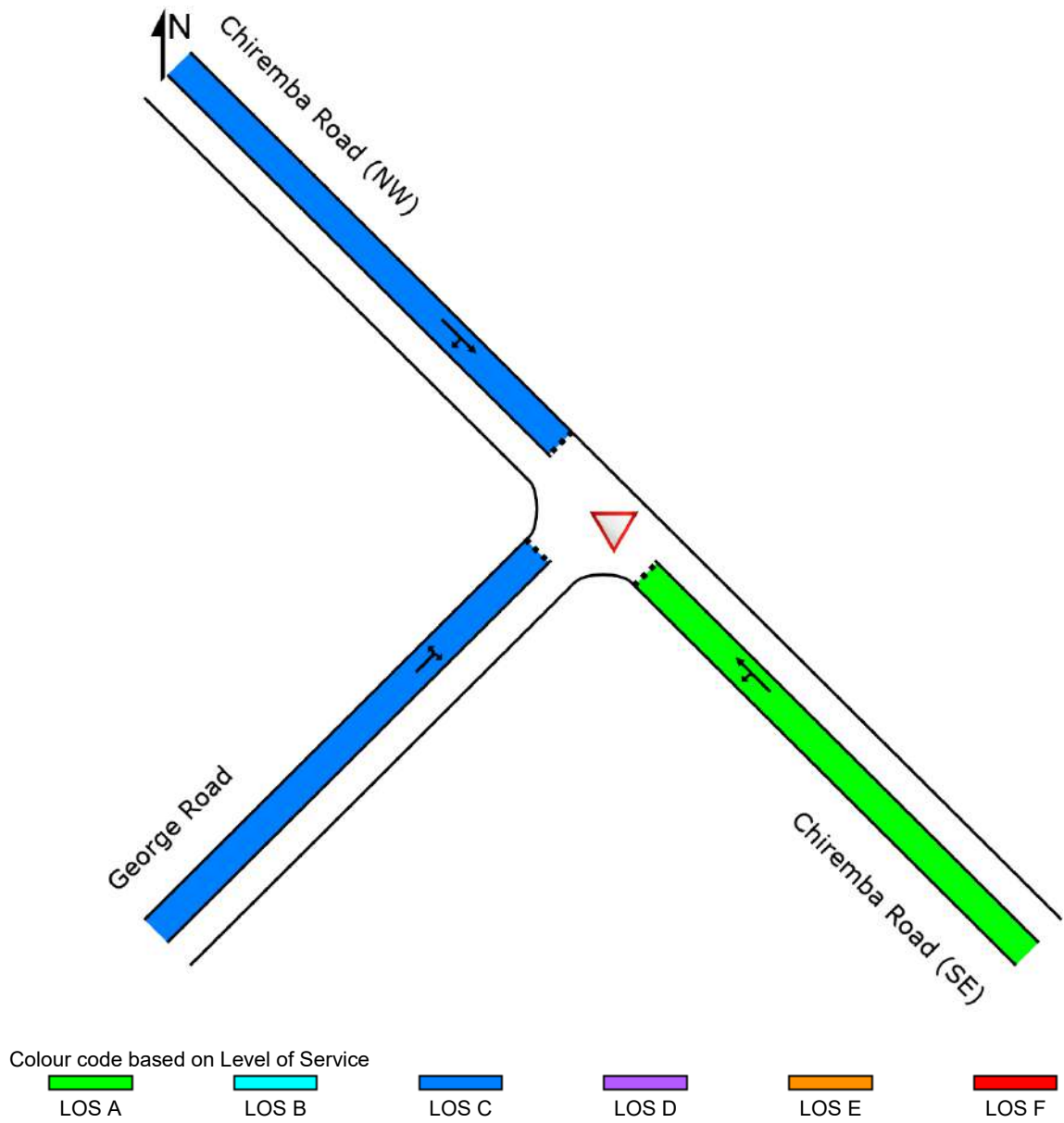
Site: 02 [Chiremba Road and George Road (Site Folder: Chiremba Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Chiremba Road (SE)															
21	L2	All MCs	132	8.3	132	8.3	0.154	5.6	LOS A	0.0	0.0	0.00	0.55	0.00	53.0
22	T1	All MCs	146	2.8	146	2.8	0.154	4.1	LOS A	0.0	0.0	0.00	0.55	0.00	53.6
Approach			279	5.4	279	5.4	0.154	4.8	LOS A	0.0	0.0	0.00	0.55	0.00	53.3
NorthWest: Chiremba Road (NW)															
28	T1	All MCs	317	3.2	317	3.2	0.540	8.3	LOS A	7.2	53.5	0.75	0.91	1.45	45.6
29	R2	All MCs	165	5.2	165	5.2	0.540	32.7	LOS D	7.2	53.5	0.75	0.91	1.45	45.1
Approach			483	3.9	483	3.9	0.540	16.6	LOS C	7.2	53.5	0.75	0.91	1.45	45.4
SouthWest: George Road															
30	L2	All MCs	81	36.7	81	36.7	0.642	11.7	LOS B	5.0	48.3	0.74	1.03	1.45	43.4
32	R2	All MCs	210	21.8	210	21.8	0.642	22.2	LOS C	5.0	48.3	0.74	1.03	1.45	43.5
Approach			291	26.0	291	26.0	0.642	19.3	LOS C	5.0	48.3	0.74	1.03	1.45	43.5
All Vehicles			1053	10.4	1053	10.4	0.642	14.2	NA	7.2	53.5	0.55	0.85	1.07	46.7

LEVEL OF SERVICE

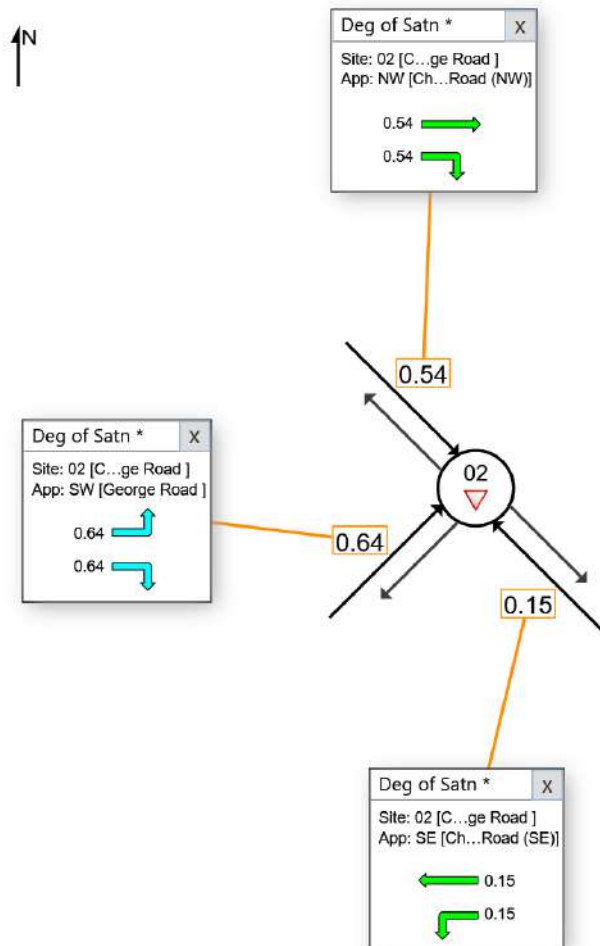
▼ Site: 02 [Chiremba Road and George Road (Site Folder: Chiremba Corridor)]

	Approaches			Intersection
	Southeast	Northwest	Southwest	
LOS	A	C	C	NA (TWSC)

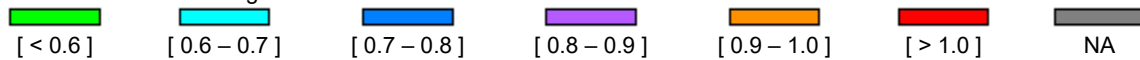


DEGREE OF SATURATION

▽ Site: 02 [Chiremba Road and George Road (Site Folder: Chiremba Corridor)]



Colour code based on Degree of Saturation

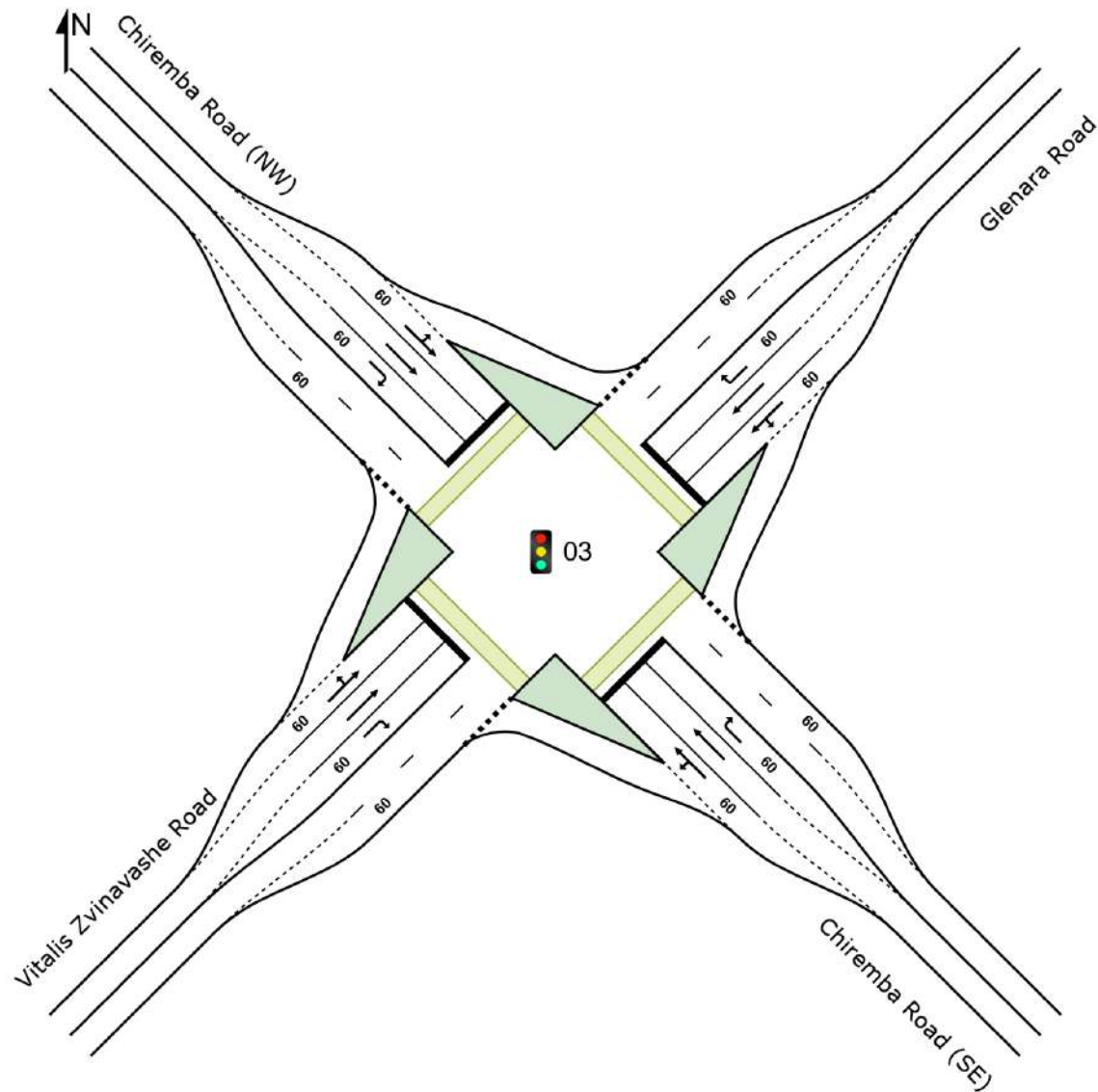


Site 03: Chiremba Road and Glenara Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 03 [Chiremba Road and Glenara Road (Site Folder: Chiremba Corridor)]



MOVEMENT SUMMARY

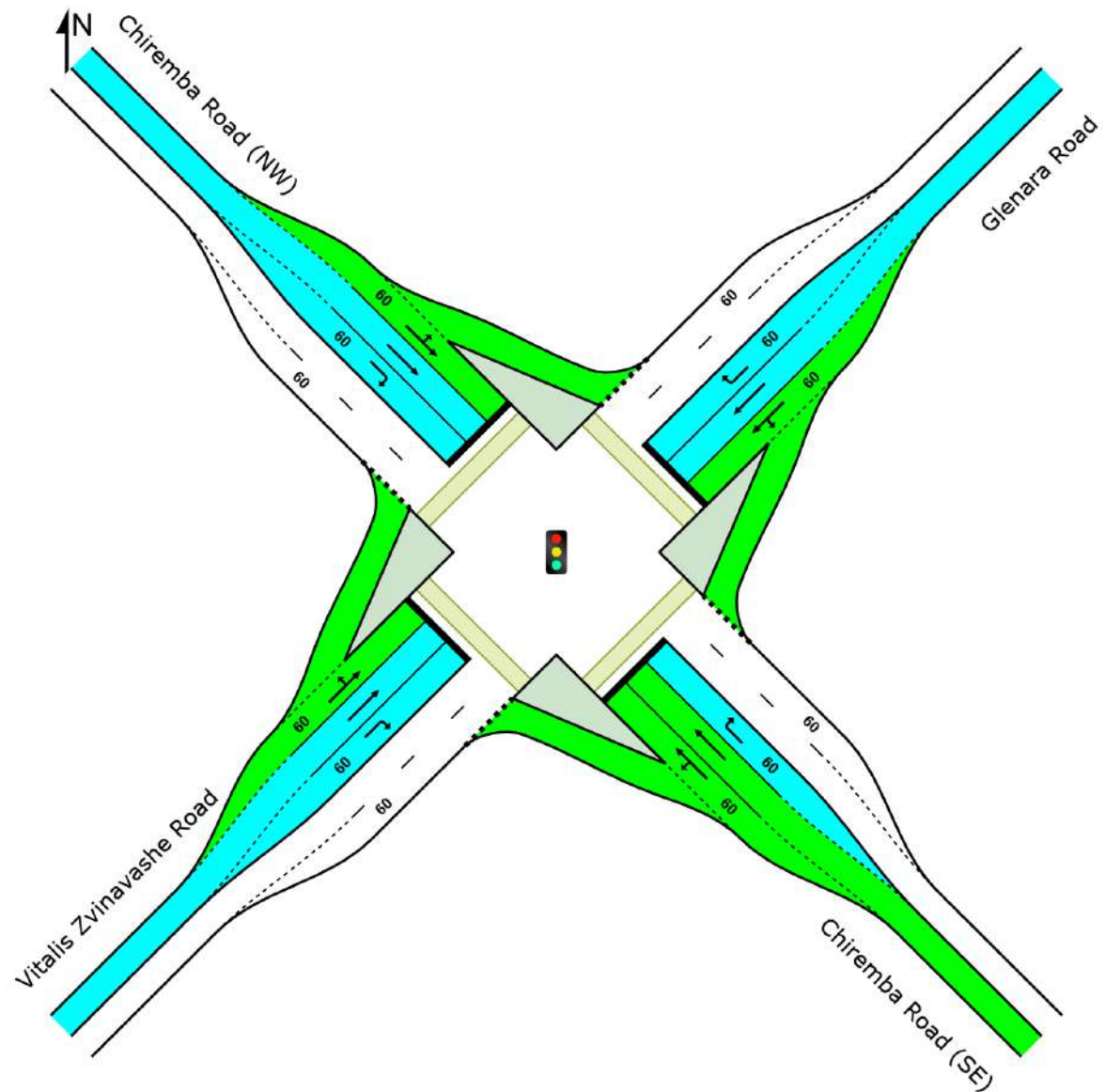
 Site: 03 [Chiremba Road and Glenara Road (Site Folder: Chiremba Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
SouthEast: Chiremba Road (SE)															
21	L2	All MCs	87	6.7	87	6.7	0.143	9.5	LOS A	0.6	4.7	0.63	0.66	0.63	50.9
22	T1	All MCs	222	6.6	222	6.6	0.374	9.4	LOS A	2.5	19.5	0.82	0.67	0.82	51.9
23	R2	All MCs	91	7.0	91	7.0	0.286	17.7	LOS B	1.2	9.9	0.89	0.75	0.89	44.9
Approach			400	6.7	400	6.7	0.374	11.3	LOS B	2.5	19.5	0.79	0.69	0.79	49.9
NorthEast: Glenara Road															
24	L2	All MCs	99	8.7	99	8.7	0.209	8.6	LOS A	0.8	6.6	0.66	0.66	0.66	51.5
25	T1	All MCs	326	13.4	326	13.4	0.545	9.9	LOS A	3.8	31.3	0.85	0.73	0.86	51.6
26	R2	All MCs	14	7.7	14	7.7	0.045	17.8	LOS B	0.2	1.4	0.86	0.67	0.86	44.8
Approach			439	12.2	439	12.2	0.545	9.8	LOS A	3.8	31.3	0.81	0.71	0.81	51.3
NorthWest: Chiremba Road (NW)															
27	L2	All MCs	93	5.6	93	5.6	0.196	9.3	LOS A	0.8	6.1	0.68	0.67	0.68	51.2
28	T1	All MCs	307	10.7	307	10.7	0.512*	9.8	LOS A	3.6	28.7	0.85	0.72	0.85	51.6
29	R2	All MCs	151	5.9	151	5.9	0.409	17.2	LOS B	2.1	15.9	0.89	0.77	0.89	45.2
Approach			551	8.6	551	8.6	0.512	11.7	LOS B	3.6	28.7	0.83	0.72	0.83	49.6
SouthWest: Vitalis Zvinavashe Road															
30	L2	All MCs	88	6.7	88	6.7	0.214	7.6	LOS A	0.8	6.4	0.66	0.64	0.66	51.9
31	T1	All MCs	329	19.4	329	19.4	0.558*	9.9	LOS A	3.7	33.6	0.85	0.73	0.87	51.6
32	R2	All MCs	89	2.5	89	2.5	0.280	18.5	LOS B	1.3	9.1	0.91	0.75	0.91	44.6
Approach			506	14.2	506	14.2	0.558	11.0	LOS B	3.7	33.6	0.83	0.72	0.84	50.2
All Vehicles			1896	10.5	1896	10.5	0.558	11.0	LOS B	3.8	33.6	0.82	0.71	0.82	50.2

LEVEL OF SERVICE

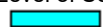
 Site: 03 [Chiremba Road and Glenara Road (Site Folder: Chiremba Corridor)]

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	B	A	B	B	B



Colour code based on Level of Service

 LOS A

 LOS B

 LOS C

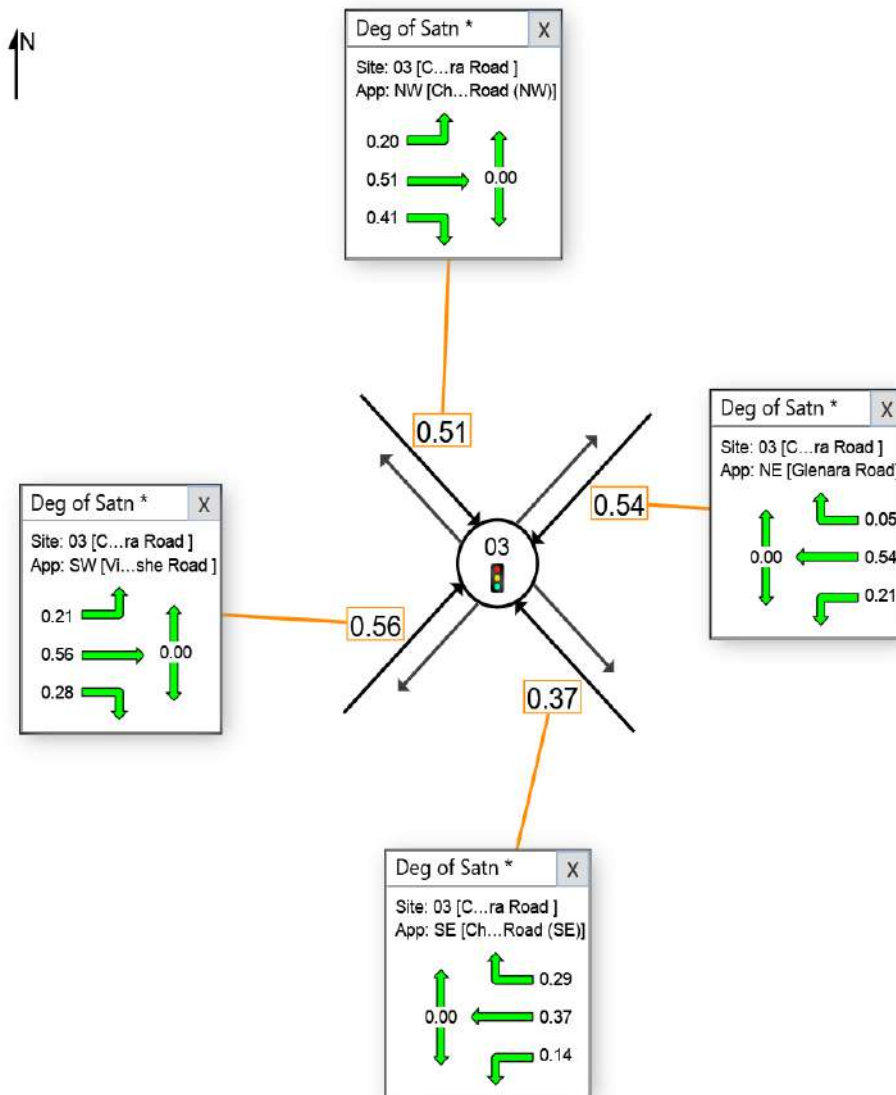
 LOS D

 LOS E

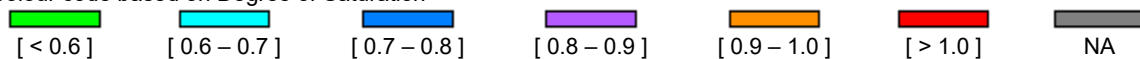
 LOS F

DEGREE OF SATURATION

 Site: 03 [Chiremba Road and Glenara Road (Site Folder: Chiremba Corridor)]



Colour code based on Degree of Saturation

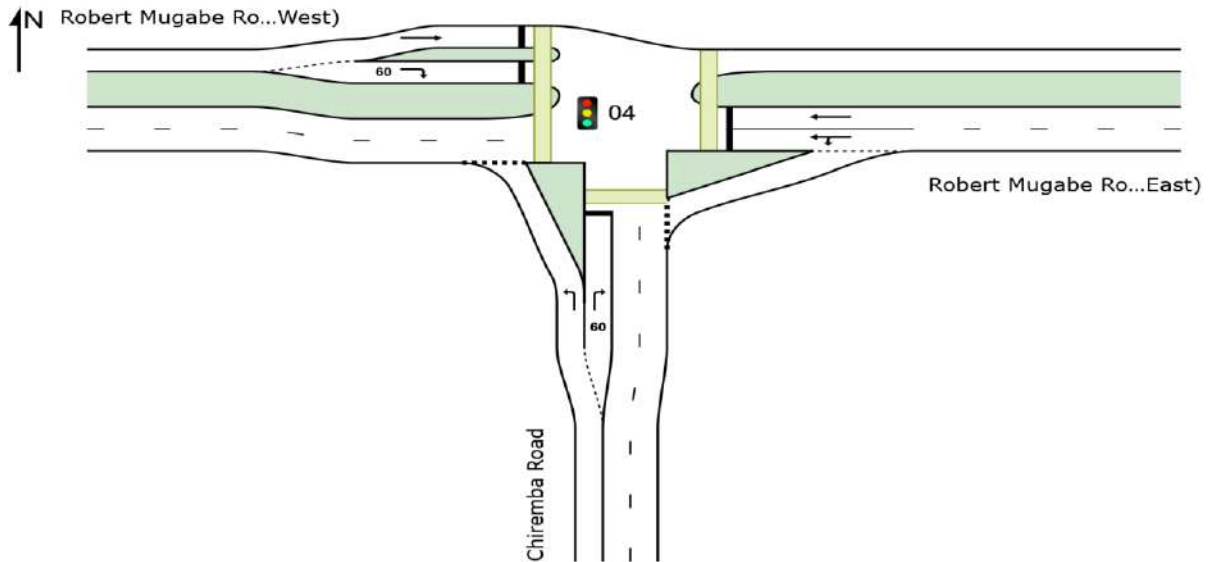


Site 04: Chiremba Road and Robert Mugabe

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

Site: 04 [Chiremba Road and Robert Mugabe Road (Site Folder: Chiremba Corridor)]



MOVEMENT SUMMARY

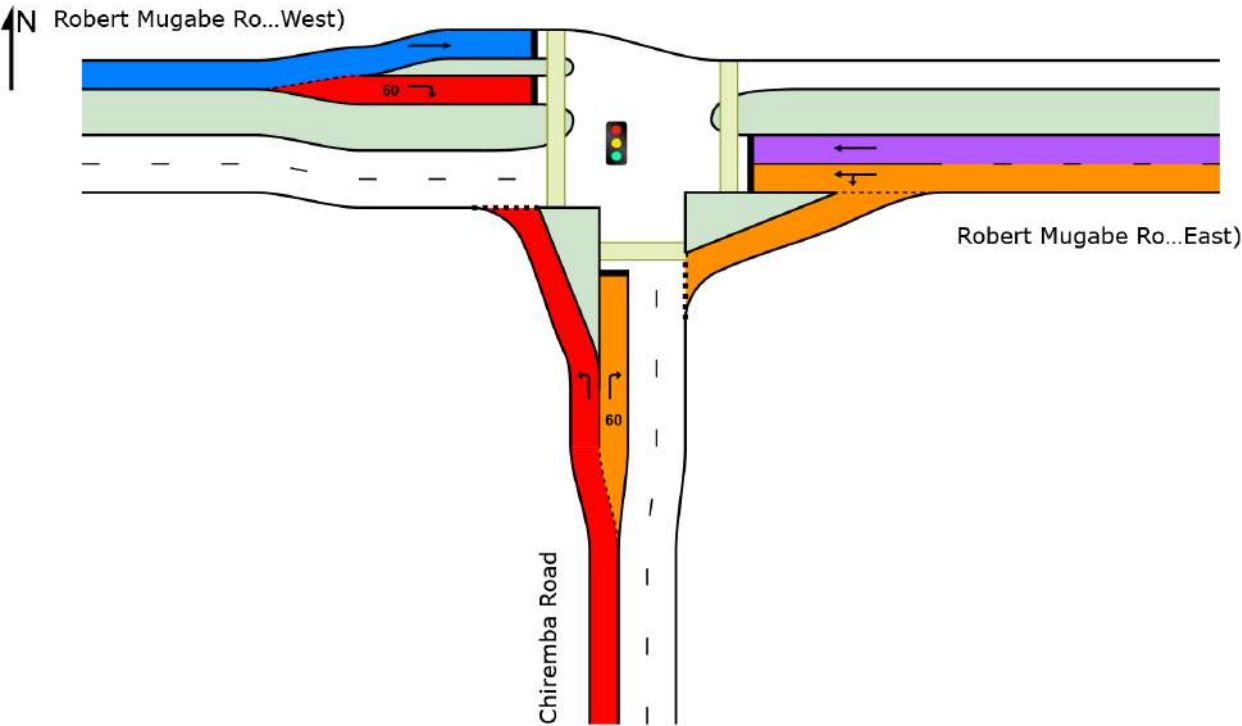
 Site: 04 [Chiremba Road and Robert Mugabe Road (Site Folder: Chiremba Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Chiremba Road															
1	L2	All MCs	823	3.0	823	3.0	1.050	116.7	LOS F	82.4	601.6	1.00	1.24	1.51	20.0
3	R2	All MCs	163	2.7	163	2.7	[*] 0.427	56.9	LOS E	8.2	59.5	0.72	0.78	0.72	36.9
Approach			986	3.0	986	3.0	1.050	106.8	LOS F	82.4	601.6	0.95	1.16	1.38	19.2
East: Robert Mugabe Road (East)															
4	L2	All MCs	153	6.2	153	6.2	0.822	51.8	LOS D	26.4	201.4	0.98	1.02	1.07	28.4
5	T1	All MCs	731	6.1	731	6.1	[*] 0.822	54.5	LOS D	34.3	263.0	0.97	0.94	1.02	32.4
Approach			884	6.1	884	6.1	0.822	54.0	LOS D	34.3	263.0	0.97	0.95	1.03	31.6
West: Robert Mugabe Road (West)															
11	T1	All MCs	503	4.3	503	4.3	0.356	25.0	LOS C	2.2	16.2	0.13	0.08	0.13	59.3
12	R2	All MCs	950	3.1	950	3.1	[*] 1.960	920.4	LOS F	221.6	1638.9	1.00	2.32	3.96	3.7
Approach			1453	3.5	1453	3.5	1.960	610.2	LOS F	221.6	1638.9	0.70	1.54	2.64	5.3
All Vehicles			3323	4.1	3323	4.1	1.960	312.9	LOS F	221.6	1638.9	0.85	1.27	1.84	9.4

LEVEL OF SERVICE

Site: 04 [Chiremba Road and Robert Mugabe Road (Site Folder: Chiremba Corridor)]

	Approaches			Intersection
	South	East	West	
LOS	F	D	F	F



Colour code based on Level of Service

LOS A

LOS B

LOS C

LOS D

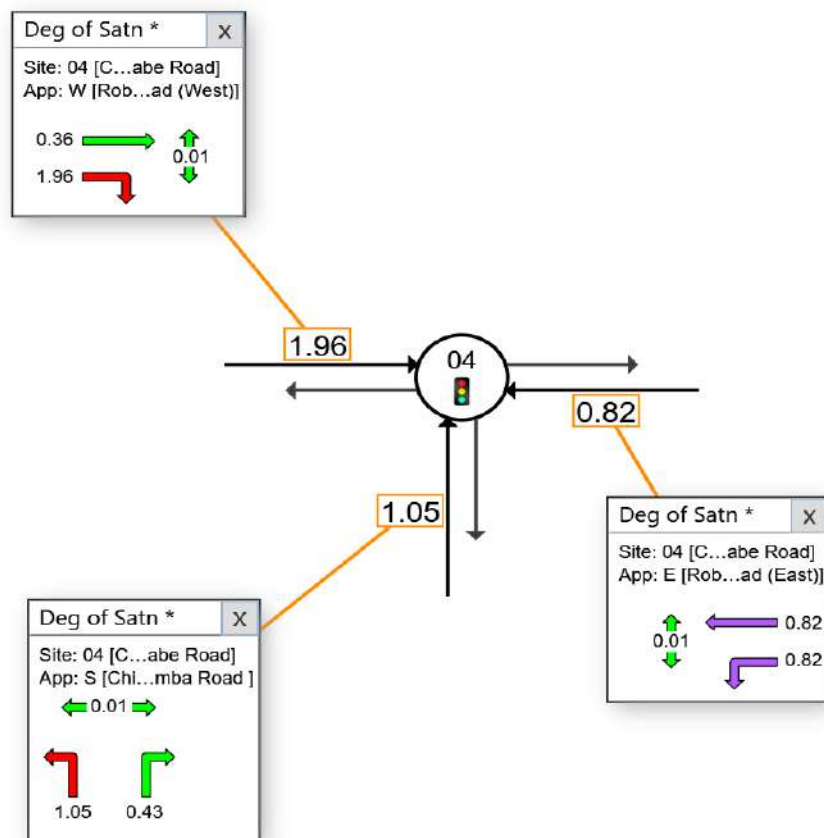
LOS E

LOS F

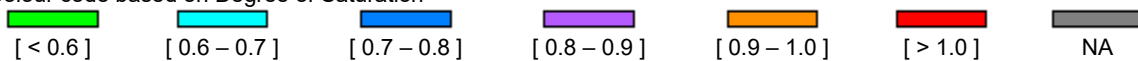
DEGREE OF SATURATION

 Site: 04 [Chiremba Road and Robert Mugabe Road (Site Folder: Chiremba Corridor)]

All Movement Classes (*)



Colour code based on Degree of Saturation



Corridor Nodal Capacity Results Interpretation and Analysis: The Chiremba Corridor

Site 01: Chiremba Road and St Patricks Road

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	A	C	A	B	NA (TWSC)

Site 02: Chiremba Road and George Road

	Approaches			Intersection
	Southeast	Northwest	Southwest	
LOS	A	C	C	NA (TWSC)

Site 03: Chiremba Road and Glenara Avenue

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	B	A	B	B	B

Site 04: Chiremba Road and Robert Mugabe Road

	Approaches			Intersection
	South	East	West	
LOS	F	D	F	F

While the other intersections along the Chiremba corridor, appear to be operating at reasonable LOS with relatively better traffic speeds and manoeuvrability. One (1) intersection requires immediate attention and that it thew Chiremba Road and Robert Mugabe Intersection, which is operating at an abnormally high levels of traffic jam largely due to the **at grade intersection design coupled with a high demand for right turning traffic onto Chiremba road from Robert Mugabe**. The at grade right turning traffic problem is the major contributing factor to poor intersection performance on this site.

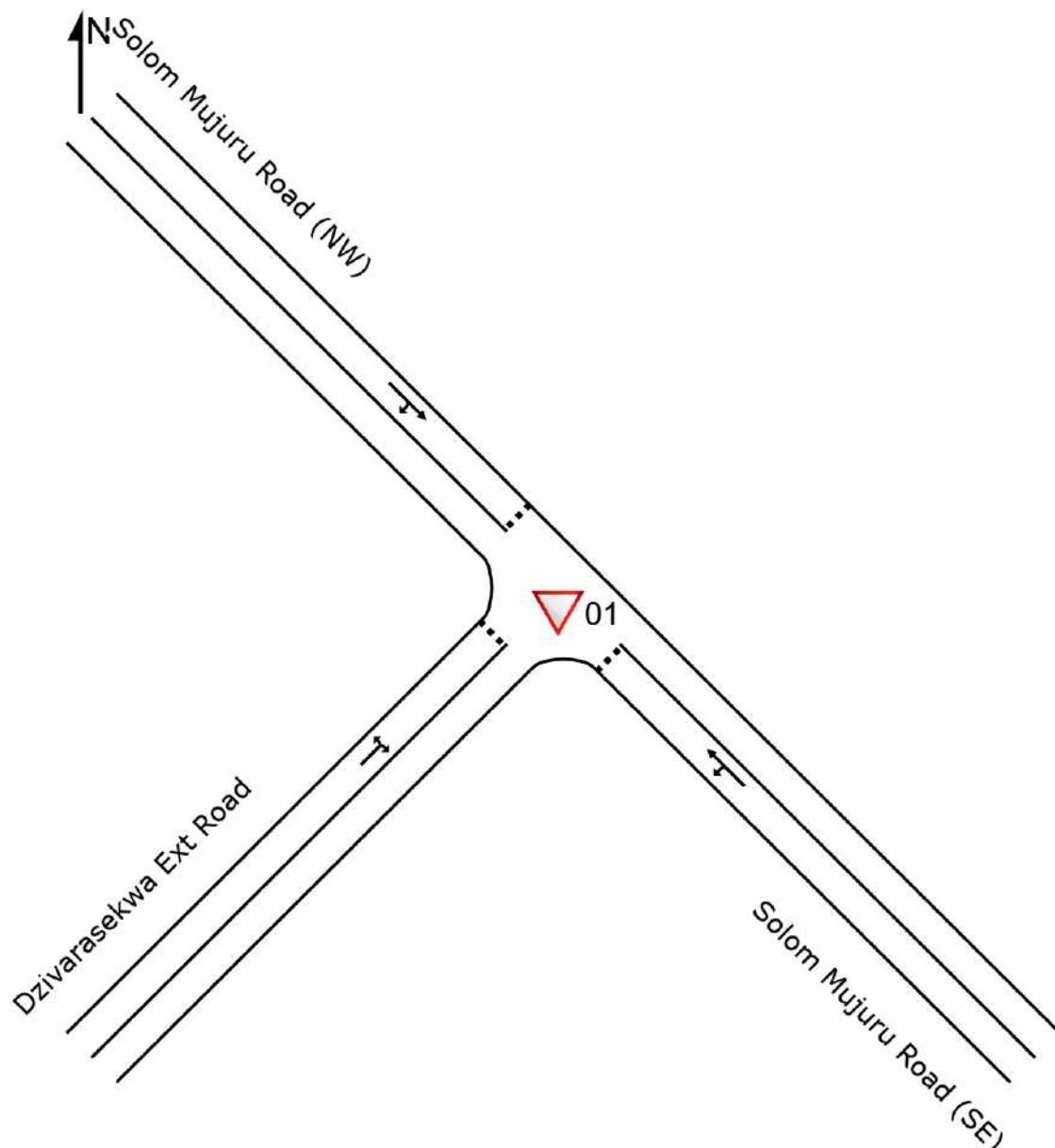
7.1.4.1.6. *Solomon Mujuru Drive Corridor*

Site 01: Solomon Mujuru Drive and Dzivarasekwa Extension Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

▽ Site: 01 [Solom Mujuru Road and Dzivarasekwa Ext Road (Site Folder: Solomon Mujuru Corridor)]



MOVEMENT SUMMARY

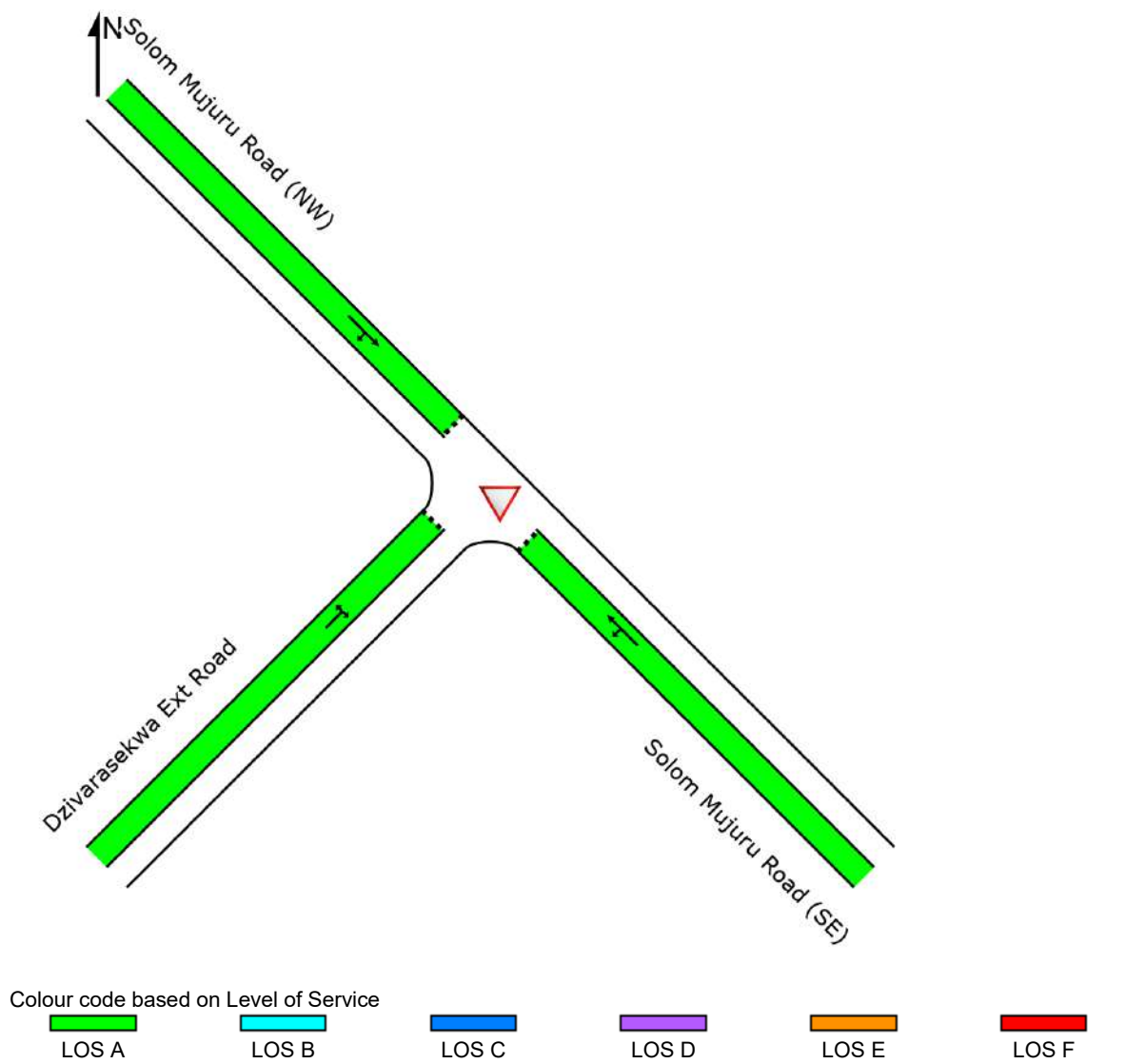
▼ Site: 01 [Solom Mujuru Road and Dzivarasekwa Ext Road (Site Folder: Solomon Mujuru Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				veh	m				
SouthEast: Solom Mujuru Road (SE)															
21	L2	All MCs	38	19.3	38	19.3	0.079	5.8	LOS A	0.0	0.0	0.00	0.54	0.00	52.5
22	T1	All MCs	87	19.8	87	19.8	0.079	4.3	LOS A	0.0	0.0	0.00	0.54	0.00	52.9
Approach			125	19.6	125	19.6	0.079	4.8	LOS A	0.0	0.0	0.00	0.54	0.00	52.8
NorthWest: Solom Mujuru Road (NW)															
28	T1	All MCs	57	27.8	57	27.8	0.079	4.5	LOS A	0.4	4.0	0.39	0.59	0.39	51.0
29	R2	All MCs	29	11.5	29	11.5	0.079	11.5	LOS B	0.4	4.0	0.39	0.59	0.39	50.8
Approach			86	22.3	86	22.3	0.079	6.9	LOS A	0.4	4.0	0.39	0.59	0.39	50.9
SouthWest: Dzivarasekwa Ext Road															
30	L2	All MCs	23	22.1	23	22.1	0.116	6.2	LOS A	0.4	3.2	0.29	0.60	0.29	50.4
32	R2	All MCs	85	3.2	85	3.2	0.116	6.7	LOS A	0.4	3.2	0.29	0.60	0.29	51.5
Approach			108	7.3	108	7.3	0.116	6.6	LOS A	0.4	3.2	0.29	0.60	0.29	51.3
All Vehicles			319	16.2	319	16.2	0.116	6.0	NA	0.4	4.0	0.20	0.58	0.20	51.8

LEVEL OF SERVICE

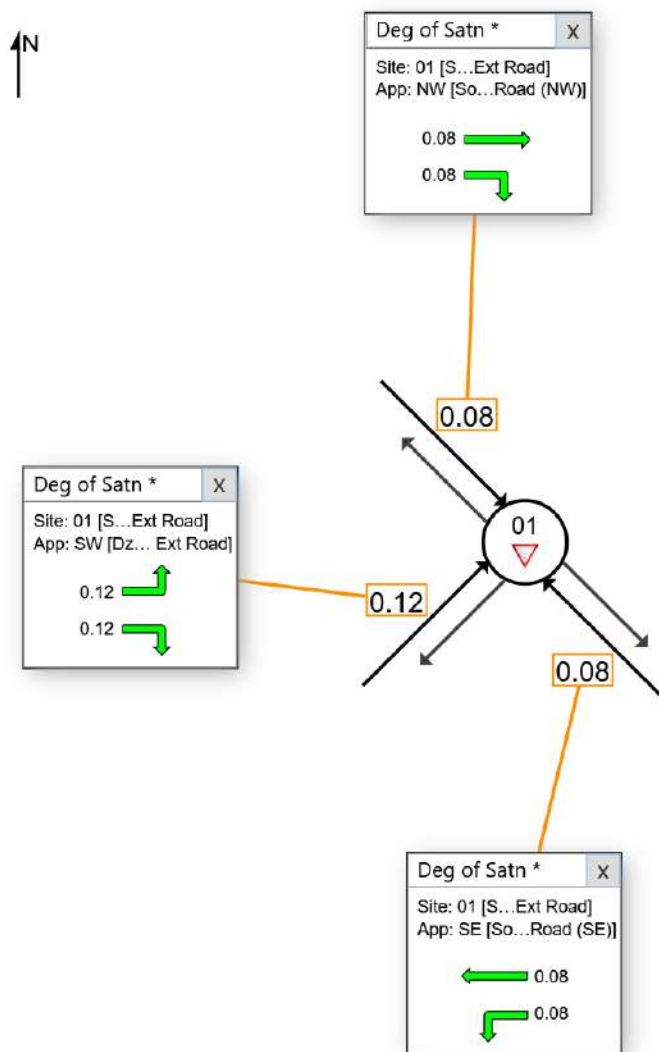
▽ Site: 01 [Solom Mujuru Road and Dzivarasekwa Ext Road (Site Folder: Solomon Mujuru Corridor)]

	Approaches			Intersection
	Southeast	Northwest	Southwest	
LOS	A	A	A	NA (TWSC)

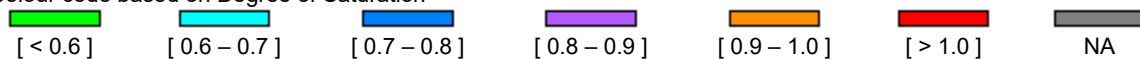


DEGREE OF SATURATION

▽ Site: 01 [Solom Mujuru Road and Dzivarasekwa Ext Road (Site Folder: Solomon Mujuru Corridor)]



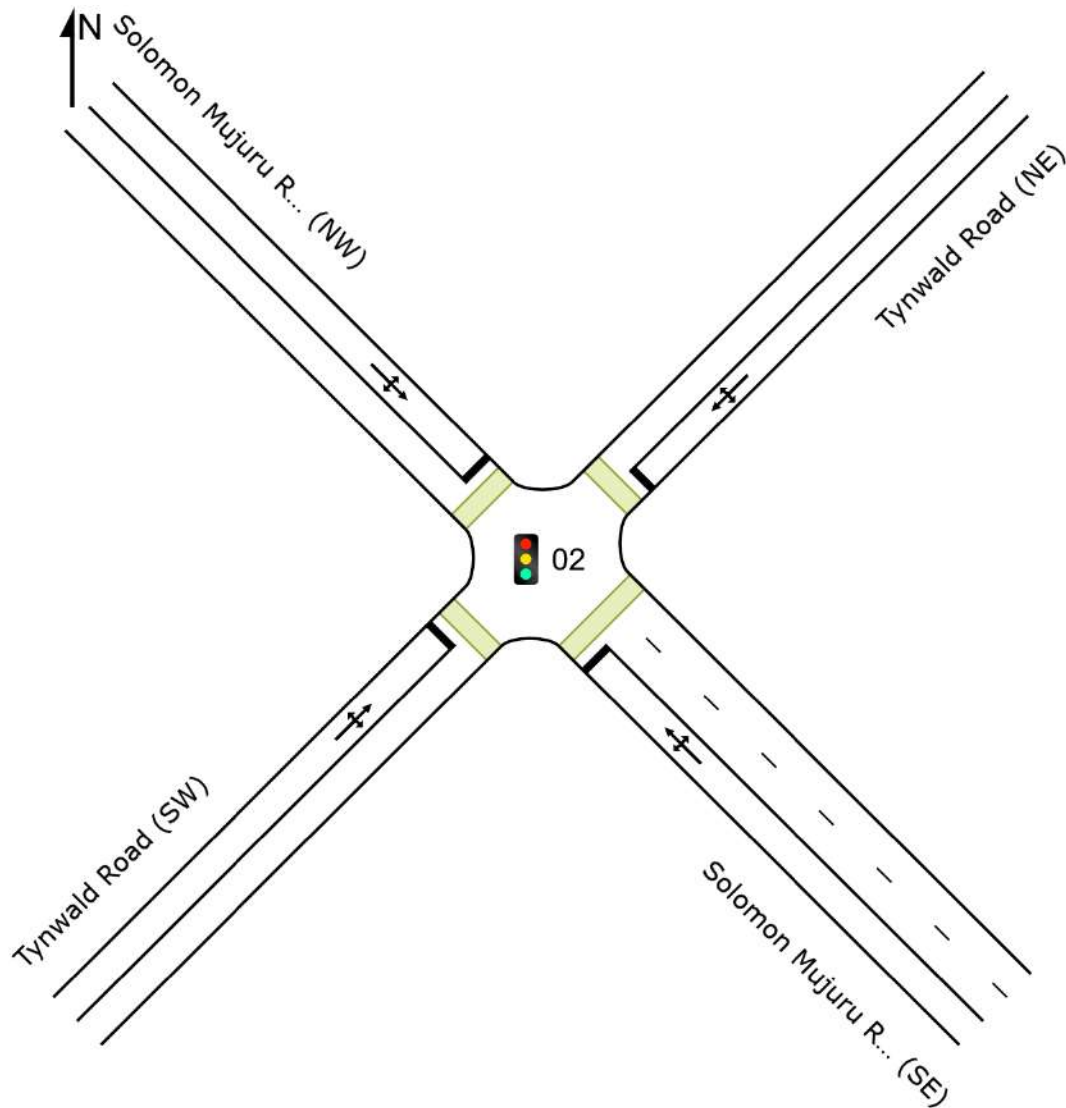
Colour code based on Degree of Saturation



Site 02: Solomon Mujuru Drive and Tynwald Road Intersection
15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 **Site: 02 [Solomon Mujuru Road and Tynwald Road (Site Folder: Solomon Mujuru Corridor)]**



MOVEMENT SUMMARY

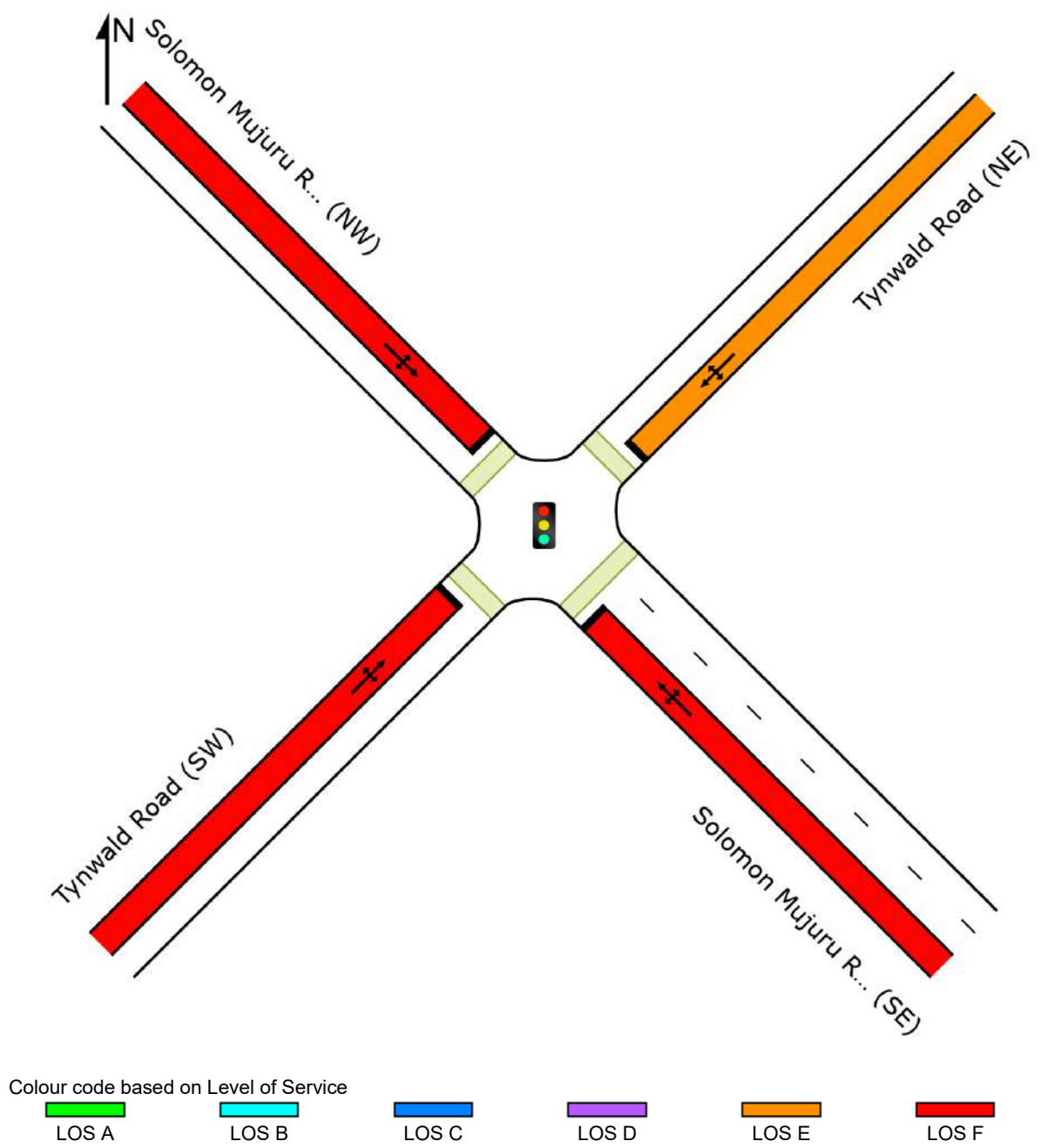
 Site: 02 [Solomon Mujuru Road and Tynwald Road (Site Folder: Solomon Mujuru Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
SouthEast: Solomon Mujuru Road (SE)															
21	L2	All MCs	99	16.3	99	16.3	1.372	380.6	LOS F	128.8	1030.4	1.00	2.15	2.70	7.9
22	T1	All MCs	536	5.9	536	5.9	1.372	374.8	LOS F	128.8	1030.4	1.00	2.15	2.70	8.0
23	R2	All MCs	120	23.5	120	23.5	* 1.372	496.7	LOS F	128.8	1030.4	1.00	2.15	2.70	7.9
Approach			754	10.1	754	10.1	1.372	394.9	LOS F	128.8	1030.4	1.00	2.15	2.70	8.0
NorthEast: Tynwald Road (NE)															
24	L2	All MCs	11	24.1	11	24.1	0.276	64.3	LOS E	2.7	22.9	0.93	0.74	0.93	27.1
25	T1	All MCs	12	12.9	12	12.9	0.276	58.6	LOS E	2.7	22.9	0.93	0.74	0.93	28.1
26	R2	All MCs	16	11.8	16	11.8	0.276	78.7	LOS E	2.7	22.9	0.93	0.74	0.93	27.3
Approach			39	15.6	39	15.6	0.276	68.5	LOS E	2.7	22.9	0.93	0.74	0.93	27.5
NorthWest: Solomon Mujuru Road (NW)															
27	L2	All MCs	8	43.1	8	43.1	1.076	136.6	LOS F	69.6	631.1	1.00	1.48	1.66	17.1
28	T1	All MCs	506	10.2	506	10.2	1.076	130.6	LOS F	69.6	631.1	1.00	1.48	1.66	17.6
29	R2	All MCs	81	74.0	81	74.0	1.076	247.8	LOS F	69.6	631.1	1.00	1.48	1.66	16.9
Approach			595	19.4	595	19.4	1.076	146.7	LOS F	69.6	631.1	1.00	1.48	1.66	17.5
SouthWest: Tynwald Road (SW)															
30	L2	All MCs	137	10.6	137	10.6	1.365	413.1	LOS F	45.8	439.0	1.00	1.60	2.74	7.6
31	T1	All MCs	10	27.6	10	27.6	* 1.365	407.4	LOS F	45.8	439.0	1.00	1.60	2.74	7.7
32	R2	All MCs	121	35.6	121	35.6	1.365	416.7	LOS F	45.8	439.0	1.00	1.60	2.74	7.6
Approach			268	22.5	268	22.5	1.365	414.5	LOS F	45.8	439.0	1.00	1.60	2.74	7.6
All Vehicles			1656	15.6	1656	15.6	1.372	301.2	LOS F	128.8	1030.4	1.00	1.79	2.29	10.0

LEVEL OF SERVICE

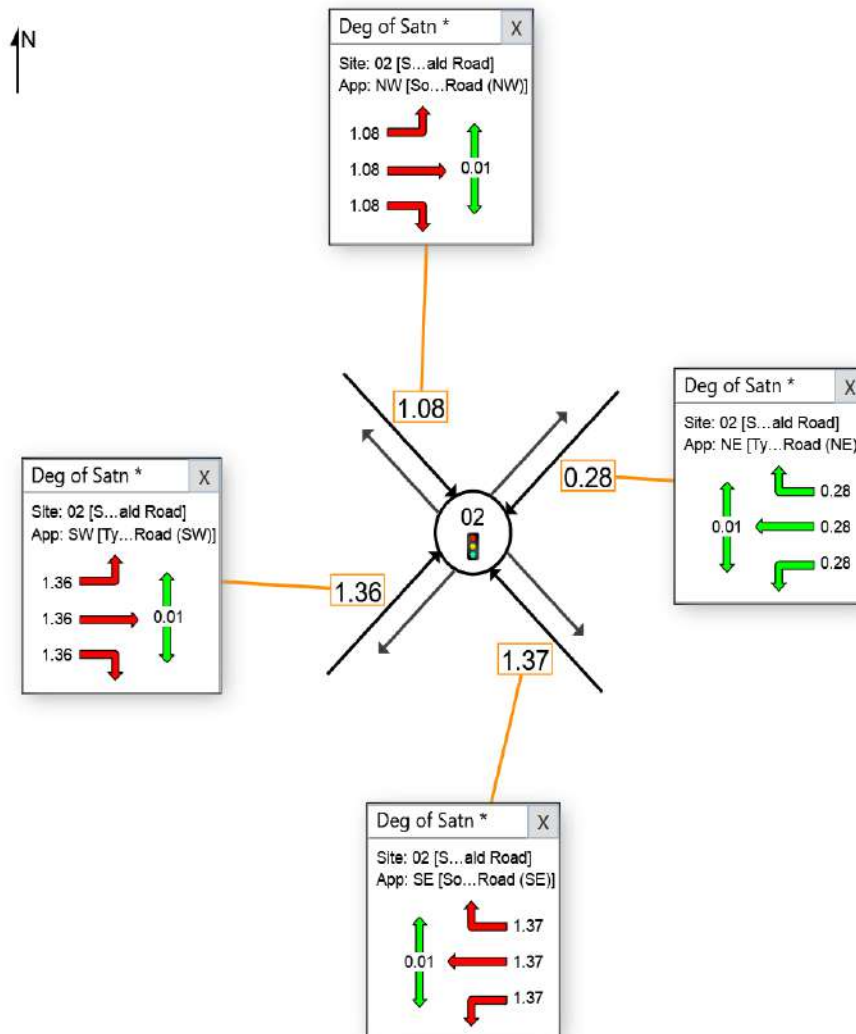
Site: 02 [Solomon Mujuru Road and Tynwald Road (Site Folder: Solomon Mujuru Corridor)]

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	F	E	F	F	F

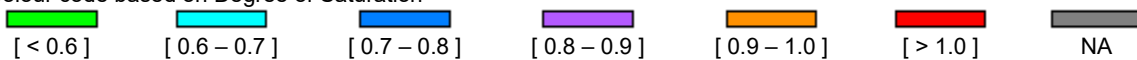


DEGREE OF SATURATION

 **Site: 02 [Solomon Mujuru Road and Tynwald Road (Site Folder: Solomon Mujuru Corridor)]**



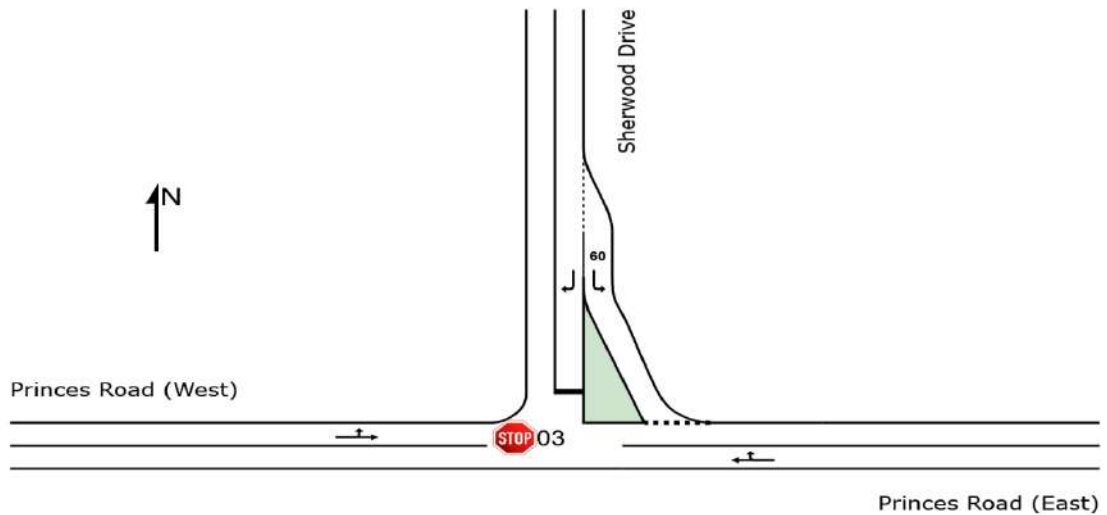
Colour code based on Degree of Saturation



Site 03: Princes Road and Sherwood Drive Intersection
15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 **Site: 03 [Princes Road and Sherwood Drive (Site Folder: Solomon Mujuru Corridor)]**



MOVEMENT SUMMARY

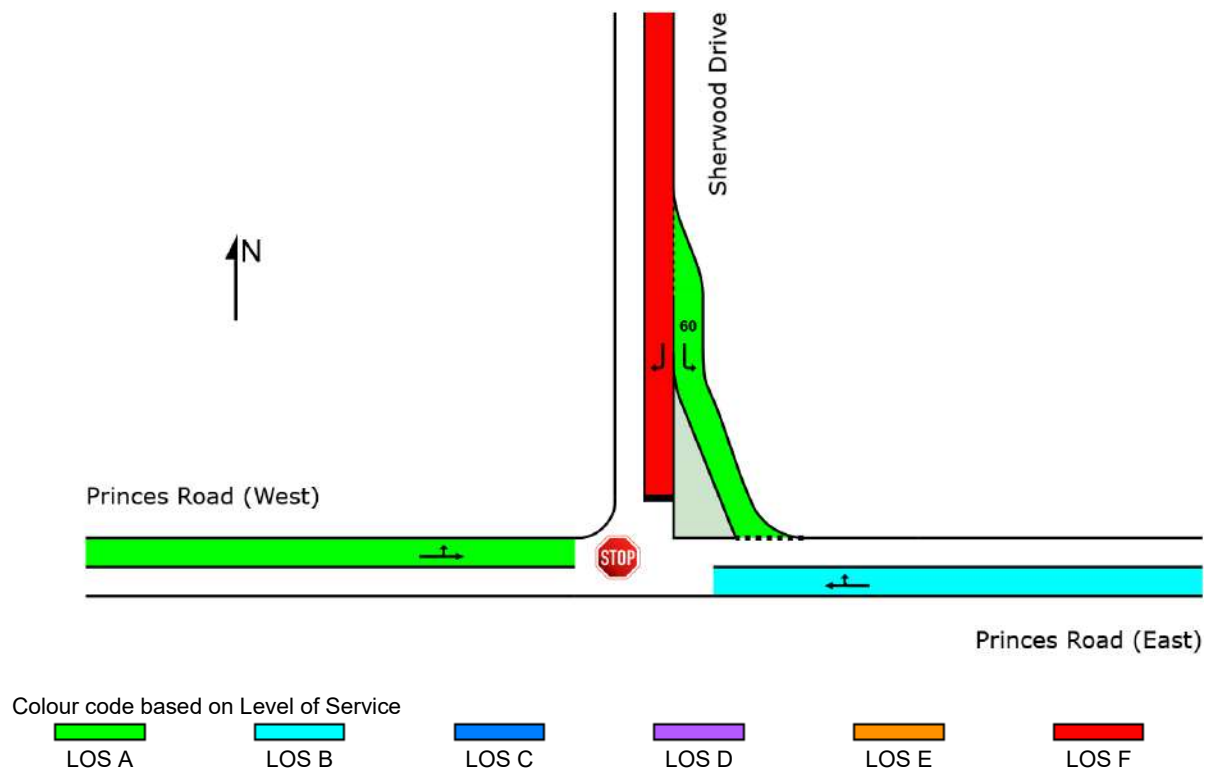
 Site: 03 [Princes Road and Sherwood Drive (Site Folder: Solomon Mujuru Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh.]	[Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Princes Road (East)															
5	T1	All MCs	504	8.3	504	8.3	0.689	7.4	LOS A	7.9	60.9	0.57	0.76	1.41	51.4
6	R2	All MCs	256	2.6	256	2.6	0.689	15.5	LOS C	7.9	60.9	0.57	0.76	1.41	49.3
Approach			759	6.4	759	6.4	0.689	10.1	NA	7.9	60.9	0.57	0.76	1.41	50.6
North: Sherwood Drive															
7	L2	All MCs	94	5.3	94	5.3	0.103	7.9	LOS A	0.4	3.0	0.46	0.66	0.46	51.2
9	R2	All MCs	86	8.1	86	8.1	1.557	542.6	LOS F	20.6	160.7	1.00	3.82	12.58	6.0
Approach			181	6.6	181	6.6	1.557	263.5	LOS F	20.6	160.7	0.72	2.17	6.25	11.2
West: Princes Road (West)															
10	L2	All MCs	260	2.5	260	2.5	0.439	5.7	LOS A	0.0	0.0	0.00	0.23	0.00	54.9
11	T1	All MCs	410	2.8	410	2.8	0.439	0.2	LOS A	0.0	0.0	0.00	0.23	0.00	57.3
Approach			670	2.7	670	2.7	0.439	2.3	NA	0.0	0.0	0.00	0.23	0.00	56.3
All Vehicles			1610	4.9	1610	4.9	1.557	35.3	NA	20.6	160.7	0.35	0.70	1.37	37.4

LEVEL OF SERVICE

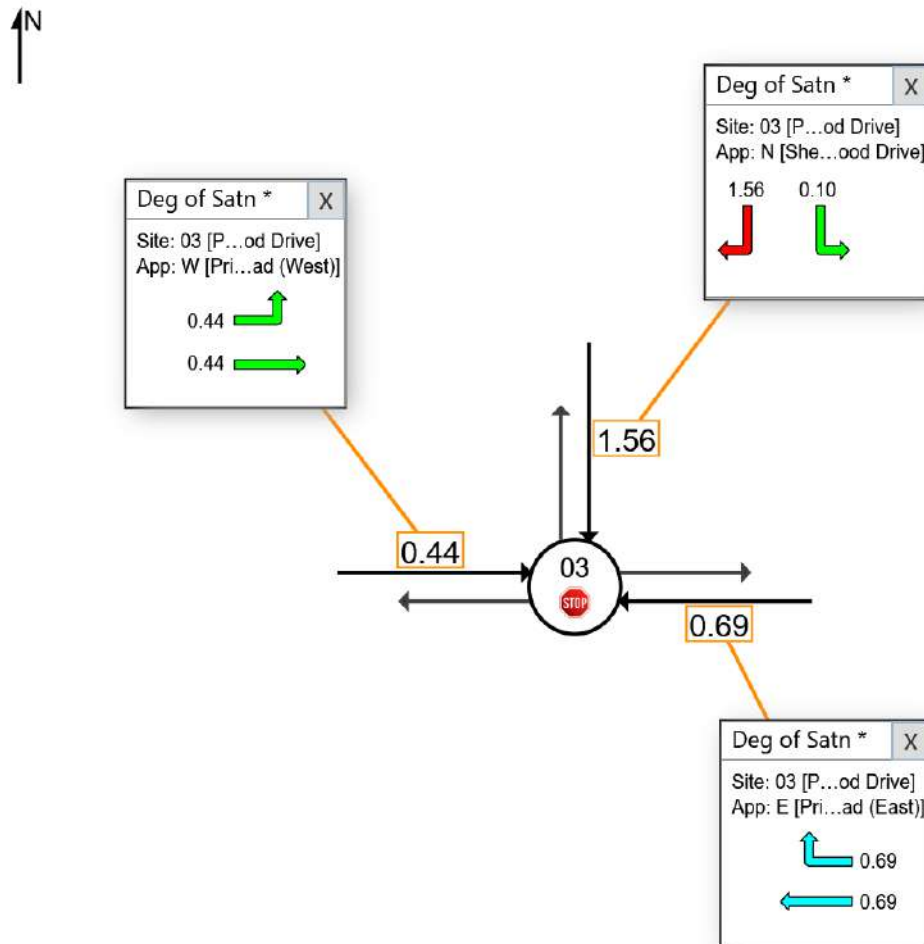
 Site: 03 [Princes Road and Sherwood Drive (Site Folder: Solomon Mujuru Corridor)]

	Approaches			Intersection
	East	North	West	
LOS	NA (TWSC)	F	NA (TWSC)	NA (TWSC)

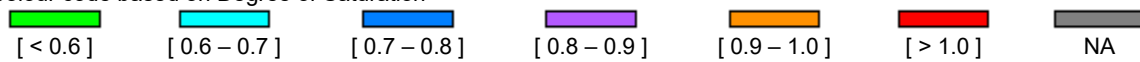


DEGREE OF SATURATION

 Site: 03 [Princes Road and Sherwood Drive (Site Folder: Solomon Mujuru Corridor)]



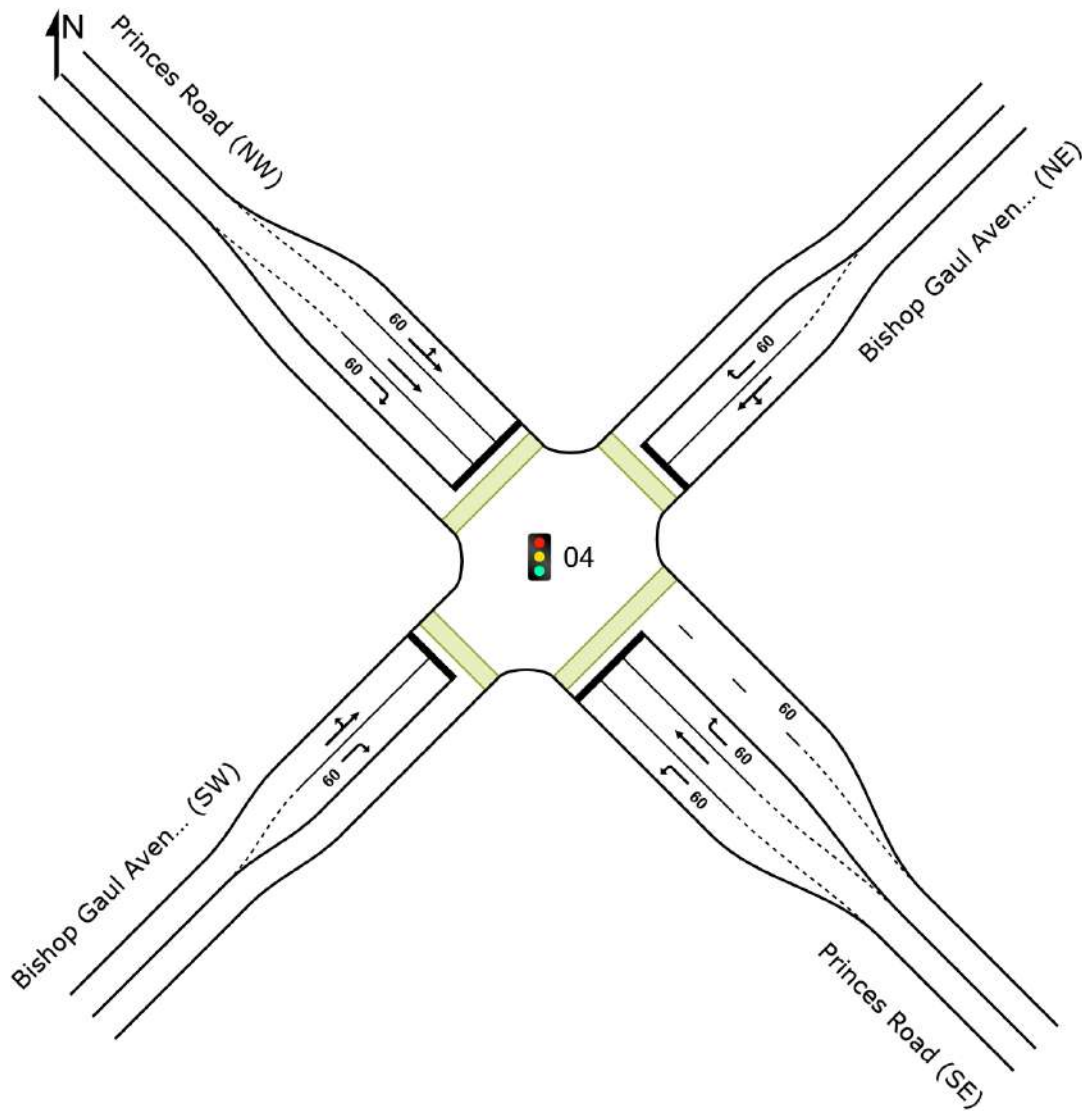
Colour code based on Degree of Saturation



Site 04: Princes Road and Bishop Gaul Road Intersection
15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 04 [Princes Road and Bishop Gaul Avenue (Site Folder: Solomon Mujuru Corridor)]



MOVEMENT SUMMARY

 Site: 04 [Princes Road and Bishop Gaul Avenue (Site Folder: Solomon Mujuru Corridor)]

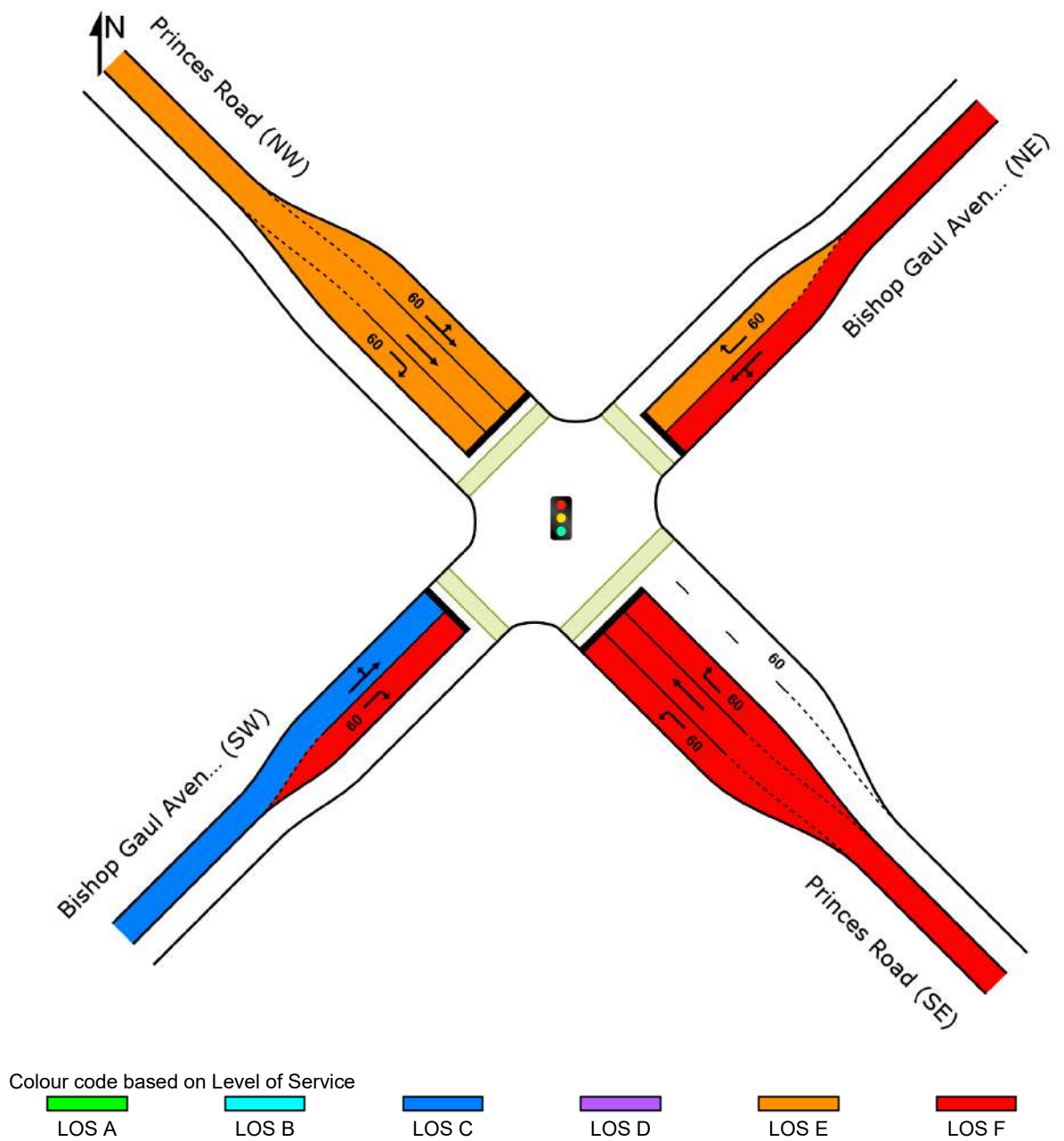
Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				veh	m				
SouthEast: Princes Road (SE)															
21	L2	All MCs	188	13.5	188	13.5	0.533	82.4	LOS F	11.6	96.6	0.89	0.82	0.89	31.1
22	T1	All MCs	440	3.7	440	3.7 *	1.207	291.6	LOS F	62.0	464.7	1.00	1.84	2.19	11.3
23	R2	All MCs	180	1.5	180	1.5	1.393	473.6	LOS F	31.4	224.7	1.00	1.60	2.84	7.2
Approach			808	5.5	808	5.5	1.393	283.5	LOS F	62.0	464.7	0.97	1.55	2.03	10.6
NorthEast: Bishop Gaul Avenue (NE)															
24	L2	All MCs	135	8.9	135	8.9	1.145	225.5	LOS F	86.8	664.5	1.00	1.66	1.92	14.1
25	T1	All MCs	530	4.8	530	4.8 *	1.145	219.0	LOS F	86.8	664.5	1.00	1.66	1.92	14.3
26	R2	All MCs	167	1.5	167	1.5	0.393	62.9	LOS E	8.6	61.5	0.75	0.78	0.75	35.7
Approach			832	4.8	832	4.8	1.145	188.7	LOS F	86.8	664.5	0.95	1.49	1.68	14.6
NorthWest: Princes Road (NW)															
27	L2	All MCs	78	1.1	78	1.1	0.256	60.3	LOS E	5.7	40.6	0.80	0.74	0.80	33.0
28	T1	All MCs	330	2.5	330	2.5	0.722	62.3	LOS E	20.1	145.9	0.94	0.83	0.95	32.7
29	R2	All MCs	65	1.6	65	1.6	0.666 *	65.0	LOS E	3.6	25.7	1.00	0.79	1.10	31.2
Approach			473	2.2	473	2.2	0.722	62.3	LOS E	20.1	145.9	0.93	0.81	0.95	29.4
SouthWest: Bishop Gaul Avenue (SW)															
30	L2	All MCs	30	3.5	30	3.5	0.404	27.6	LOS C	13.7	106.6	0.63	0.58	0.63	42.6
31	T1	All MCs	294	7.0	294	7.0	0.404	22.0	LOS C	13.7	106.6	0.63	0.58	0.63	44.1
32	R2	All MCs	71	13.4	71	13.4	1.415	469.8	LOS F	12.6	102.2	1.00	1.39	2.93	6.9
Approach			395	7.8	395	7.8	1.415	102.6	LOS F	13.7	106.6	0.70	0.72	1.04	22.3
All Vehicles			2508	5.0	2508	5.0	1.415	181.9	LOS F	86.8	664.5	0.91	1.26	1.56	15.0

LEVEL OF SERVICE

 Site: 04 [Princes Road and Bishop Gaul Avenue (Site Folder: Solomon Mujuru Corridor)]

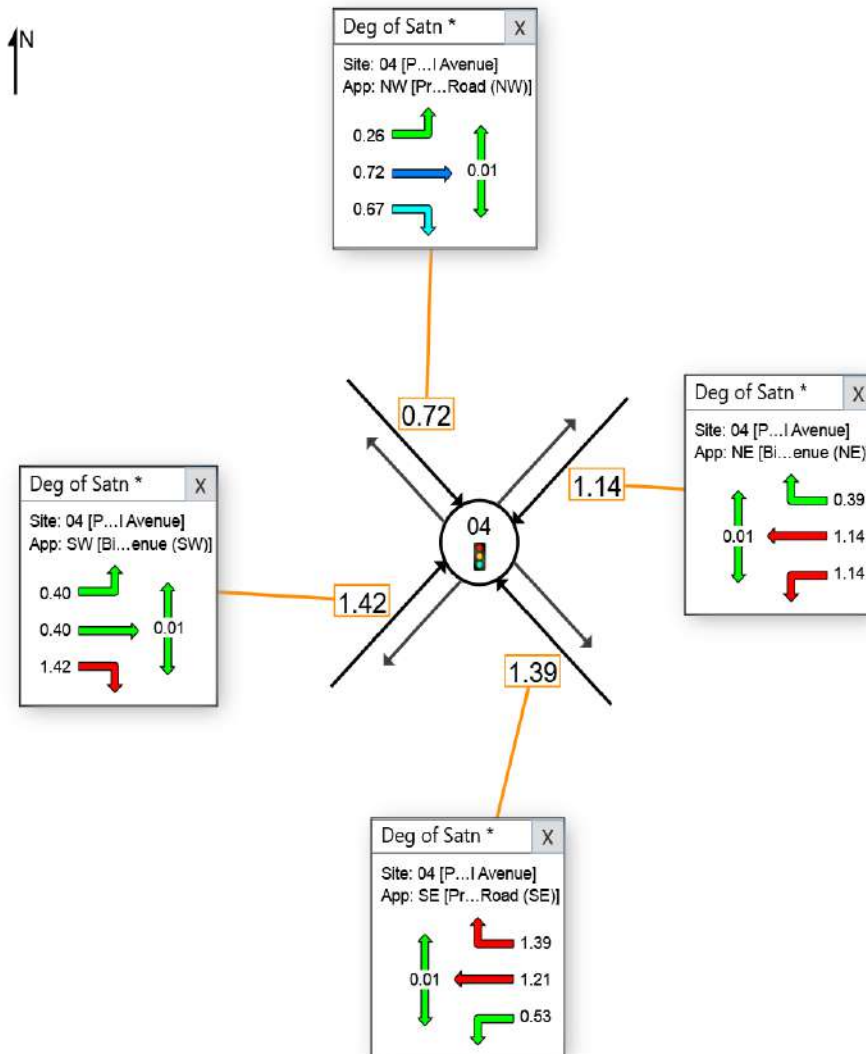
New Site
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	F	F	E	F	F

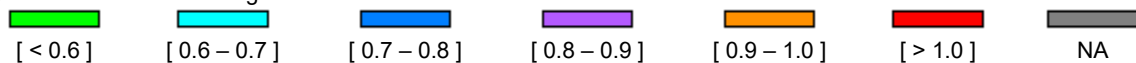


DEGREE OF SATURATION

 Site: 04 [Princes Road and Bishop Gaul Avenue (Site Folder: Solomon Mujuru Corridor)]



Colour code based on Degree of Saturation



Corridor Nodal Capacity Results Interpretation and Analysis: The Solomon Mujuru Drive Corridor

Site 01: Solomon Mujuru Drive and Dzivarasekwa Extension Road

	Approaches			Intersection
	Southeast	Northwest	Southwest	
LOS	A	A	A	NA (TWSC)

Site 02: Solom Mujuru Drive and Tynwald Road

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	F	E	F	F	F

Site 03: Princes Road and Sherwood Drive

	Approaches			Intersection
	East	North	West	
LOS	NA (TWSC)	F	NA (TWSC)	NA (TWSC)

Site 04: Princess Road and Bishop Gaul Road

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	F	F	E	F	F

The majority of studied intersections along the Solomon Mujuru corridor are operating at a LOS F characterised by high levels of traffic delays, high traffic densities and increased queue lengths emanating from two (2) factors: -

- i. **Recurrent nonfunctional traffic lights** especially at the intersection of Solomon Mujuru and Tynwald Roads as well as Solomon Mujuru Drive and Harare Drive, this then has a shockwave effect on traffic propagation from the intersection leading to serious quaking and ultimately increased travel time.
- ii. The increased traffic volume owing to new residential developments in areas such as Madokero, DZ extension and Reinham which have contributed to a higher traffic load against the 2 lane Solom Mujuru road. The Harare Combination Master Plan recommended the **upgrading of Solomon Mujuru highway to be a 2-lane bidirectional highway to cater for the increased traffic load, however this has not been implemented.**

Corridor Nodal Capacity Results Interpretation and Analysis: The Solomon Mujuru Drive Corridor

Site 01: Solomon Mujuru Drive and Dzivarasekwa Extension Road

	Approaches			Intersection
	Southeast	Northwest	Southwest	
LOS	A	A	A	NA (TWSC)

Site 02: Solom Mujuru Drive and Tynwald Road

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	F	E	F	F	F

Site 03: Princes Road and Sherwood Drive

	Approaches			Intersection
	East	North	West	
LOS	NA (TWSC)	F	NA (TWSC)	NA (TWSC)

Site 04: Princess Road and Bishop Gaul Road

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	F	F	E	F	F

The majority of studied intersections along the Solomon Mujuru corridor are operating at a LOS F characterised by high levels of traffic delays, high traffic densities and increased queue lengths emanating from two (2) factors: -

- iii. **Recurrent nonfunctional traffic lights** especially at the intersection of Solomon Mujuru and Tynwald Roads as well as Solomon Mujuru Drive and Harare Drive, this then has a shockwave effect on traffic propagation from the intersection leading to serious quaking and ultimately increased travel time.
- iv. The increased traffic volume owing to new residential developments in areas such as Madokero, DZ extension and Reinham which have contributed to a higher traffic load against the 2 lane Solom Mujuru road. The Harare Combination Master Plan recommended the **upgrading of Solomon Mujuru highway to be a 2-lane bidirectional highway to cater for the increased traffic load, however this has not been implemented.**

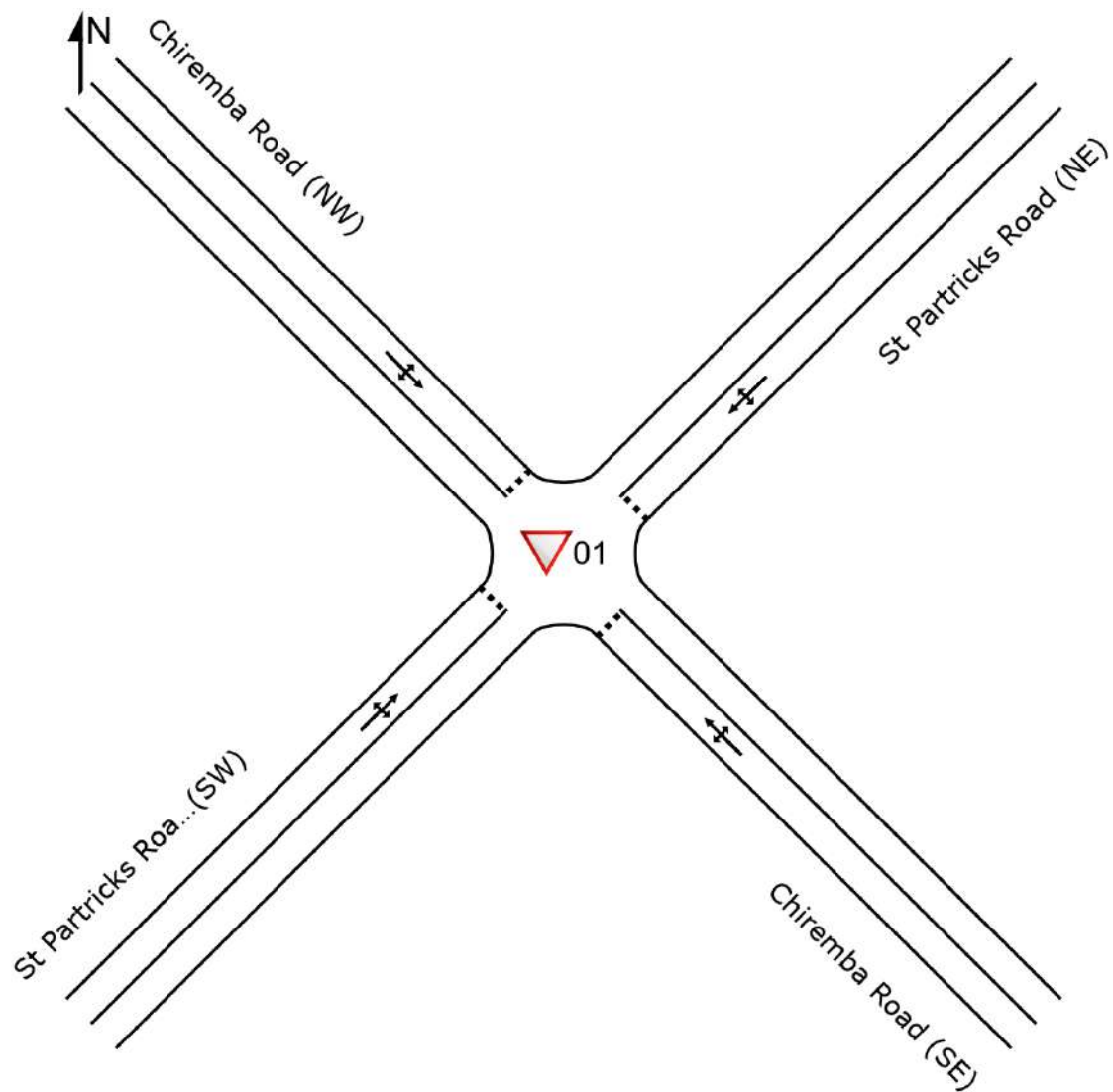
7.1.4.1.7. Chiremba Road Corridor

Site 01: Chiremba Road and St Patricks Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

▼ Site: 01 [Chiremba Road and St Patricks Road (Site Folder: Chiremba Corridor)]



MOVEMENT SUMMARY

Site: 01 [Chiremba Road and St Patricks Road (Site Folder: Chiremba Corridor)]

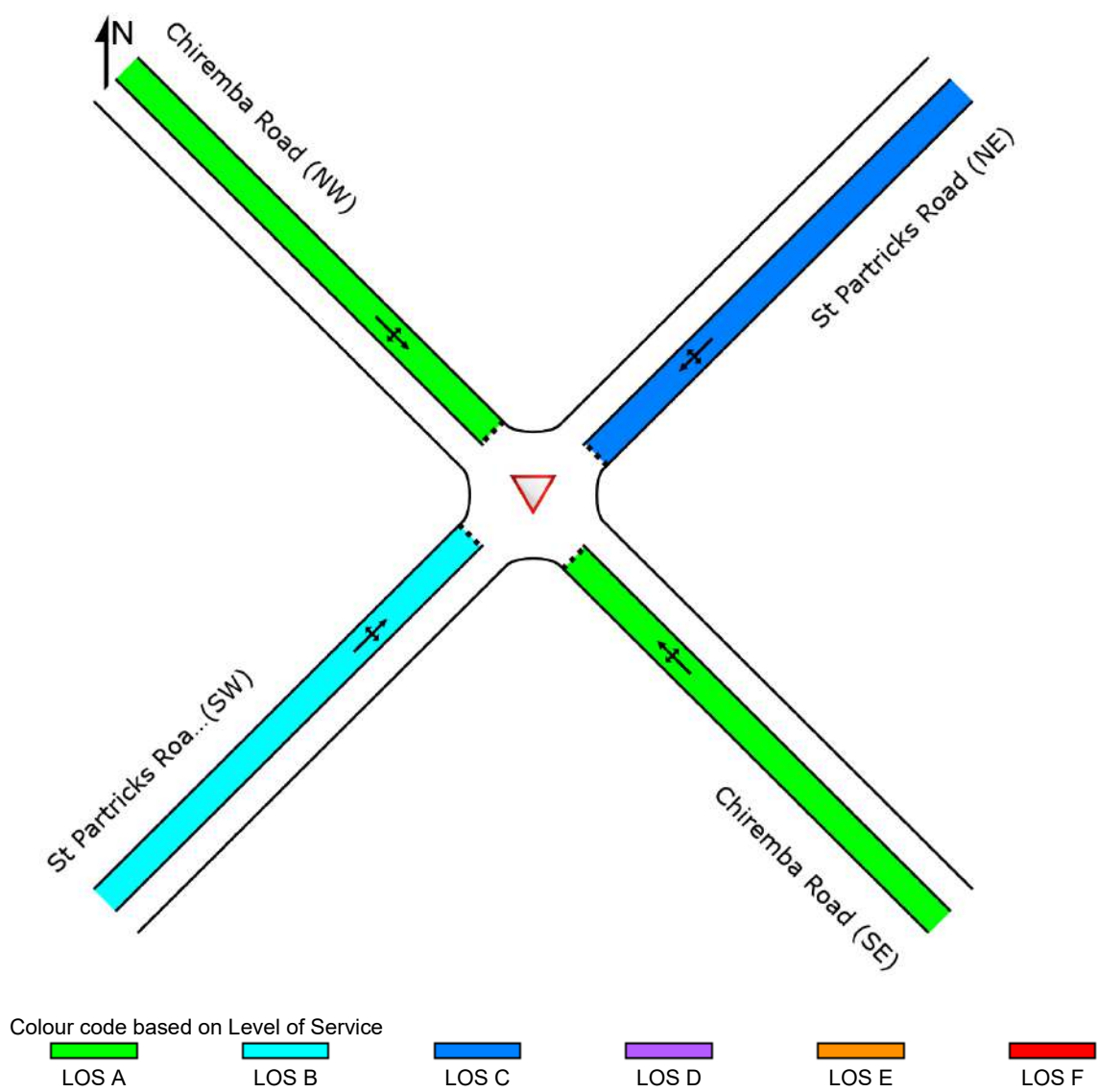
Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Chiremba Road (SE)															
21	L2	All MCs	45	6.3	45	6.3	0.409	5.7	LOS A	2.3	17.5	0.14	0.50	0.14	53.0
22	T1	All MCs	449	7.1	449	7.1	0.409	4.4	LOS A	2.3	17.5	0.14	0.50	0.14	53.4
23	R2	All MCs	4	3.9	4	3.9	0.409	14.6	LOS B	2.3	17.5	0.14	0.50	0.14	52.7
Approach			497	7.0	497	7.0	0.409	4.6	LOS A	2.3	17.5	0.14	0.50	0.14	53.3
NorthEast: St Partricks Road (NE)															
24	L2	All MCs	21	3.0	21	3.0	0.357	8.7	LOS A	1.2	9.1	0.72	0.96	0.96	44.7
25	T1	All MCs	19	3.0	19	3.0	0.357	8.3	LOS A	1.2	9.1	0.72	0.96	0.96	45.1
26	R2	All MCs	74	3.1	74	3.1	0.357	22.4	LOS C	1.2	9.1	0.72	0.96	0.96	44.7
Approach			114	3.1	114	3.1	0.357	17.5	LOS C	1.2	9.1	0.72	0.96	0.96	44.8
NorthWest: Chiremba Road (NW)															
27	L2	All MCs	96	4.7	96	4.7	0.538	5.7	LOS A	3.5	25.6	0.25	0.50	0.25	51.6
28	T1	All MCs	377	5.4	377	5.4	0.538	4.4	LOS A	3.5	25.6	0.25	0.50	0.25	51.5
29	R2	All MCs	74	5.8	74	5.8	0.538	18.0	LOS C	3.5	25.6	0.25	0.50	0.25	51.2
Approach			547	5.3	547	5.3	0.538	6.5	LOS A	3.5	25.6	0.25	0.50	0.25	51.5
SouthWest: St Partricks Road (SW)															
30	L2	All MCs	38	4.3	38	4.3	0.202	8.1	LOS A	0.6	4.6	0.60	0.82	0.62	48.3
31	T1	All MCs	22	3.2	22	3.2	0.202	7.7	LOS A	0.6	4.6	0.60	0.82	0.62	48.6
32	R2	All MCs	33	4.7	33	4.7	0.202	18.9	LOS C	0.6	4.6	0.60	0.82	0.62	48.0
Approach			93	4.2	93	4.2	0.202	11.8	LOS B	0.6	4.6	0.60	0.82	0.62	48.3
All Vehicles			1251	5.7	1251	5.7	0.538	7.1	NA	3.5	25.6	0.27	0.57	0.30	51.2

LEVEL OF SERVICE

▽ Site: 01 [Chiremba Road and St Patricks Road (Site Folder: Chiremba Corridor)]

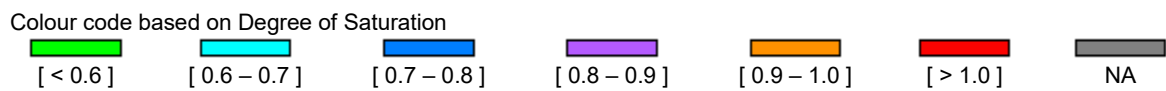
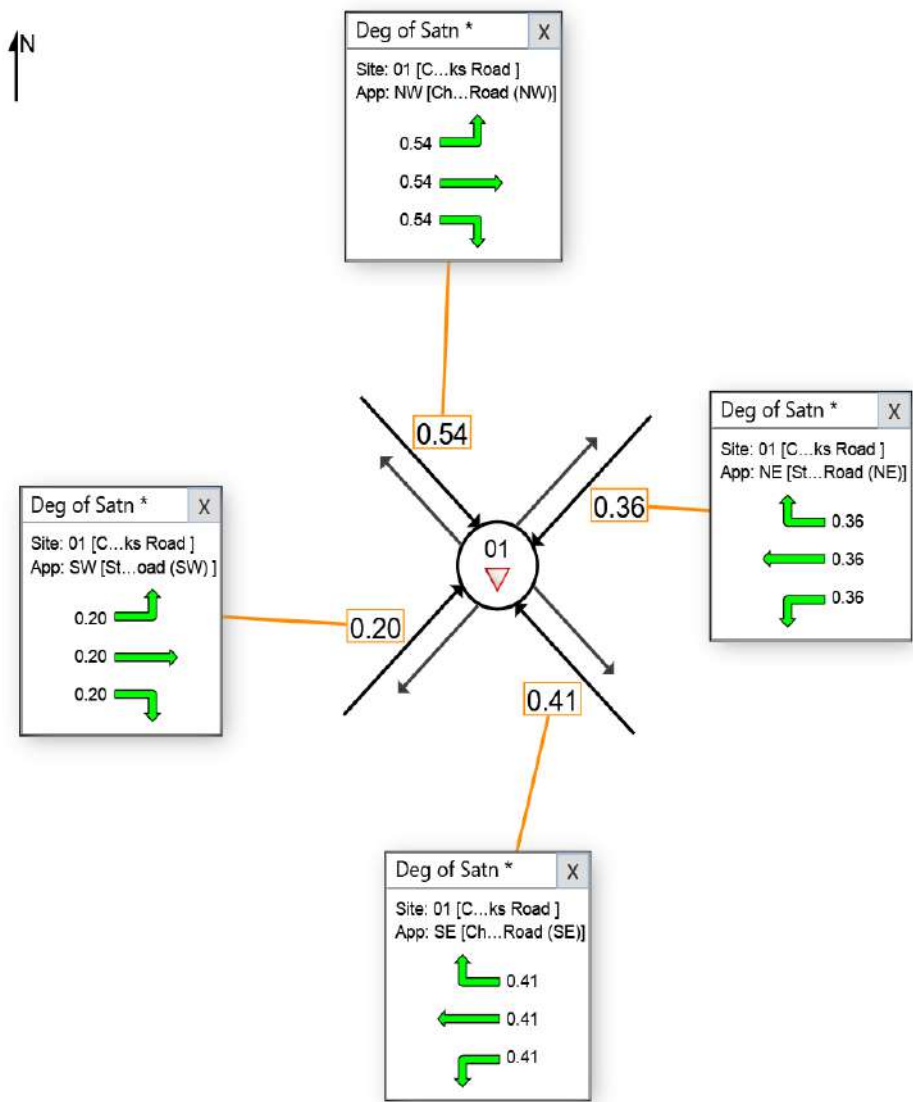
Output produced by SIDRA INTERSECTION Version: 9.1.6.228

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	A	C	A	B	NA (TWSC)



DEGREE OF SATURATION

▽ Site: 01 [Chiremba Road and St Patricks Road (Site Folder: Chiremba Corridor)]

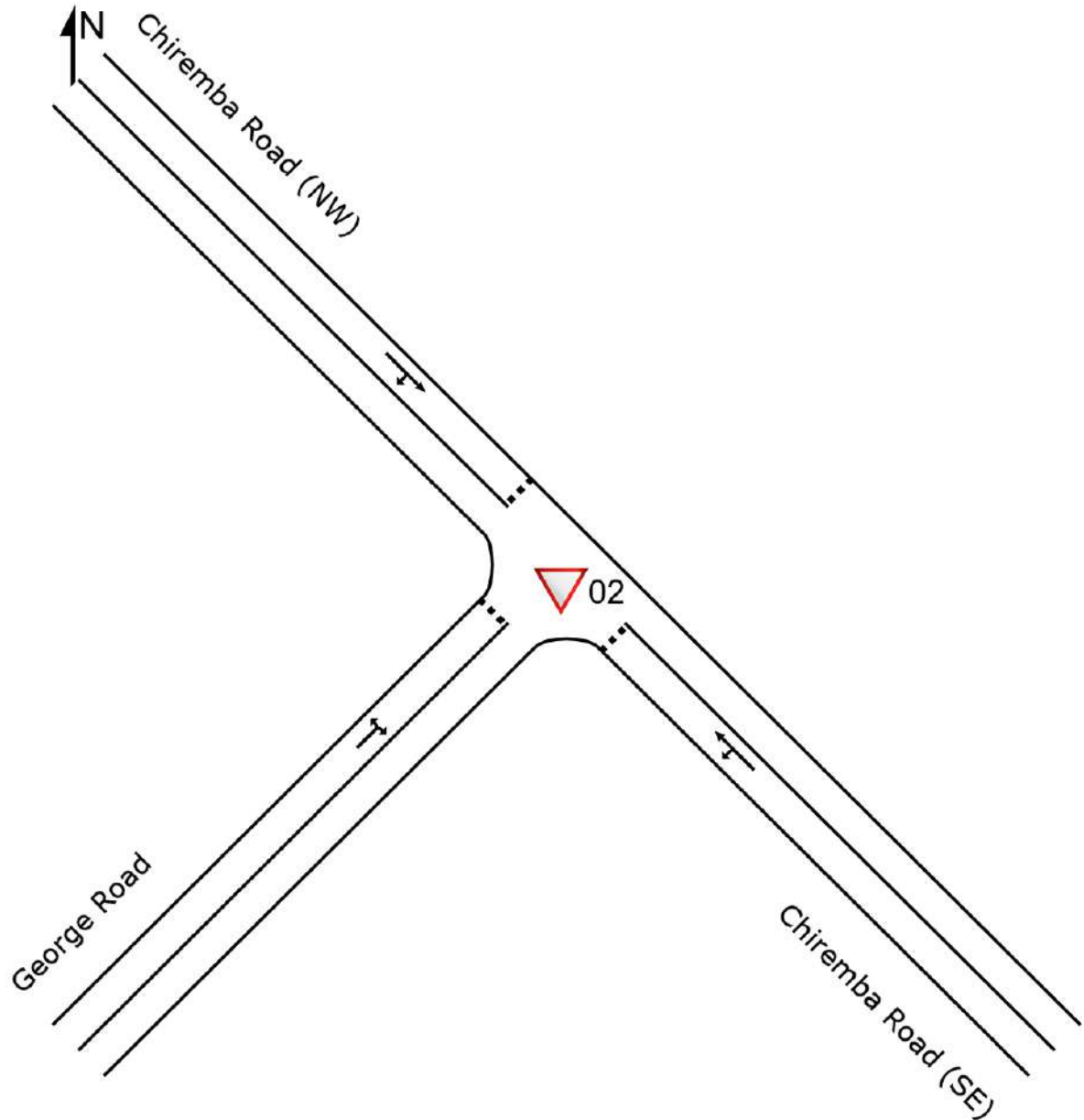


Site 02: Chiremba Road and George Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

▼ Site: 02 [Chiremba Road and George Road (Site Folder: Chiremba Corridor)]



MOVEMENT SUMMARY

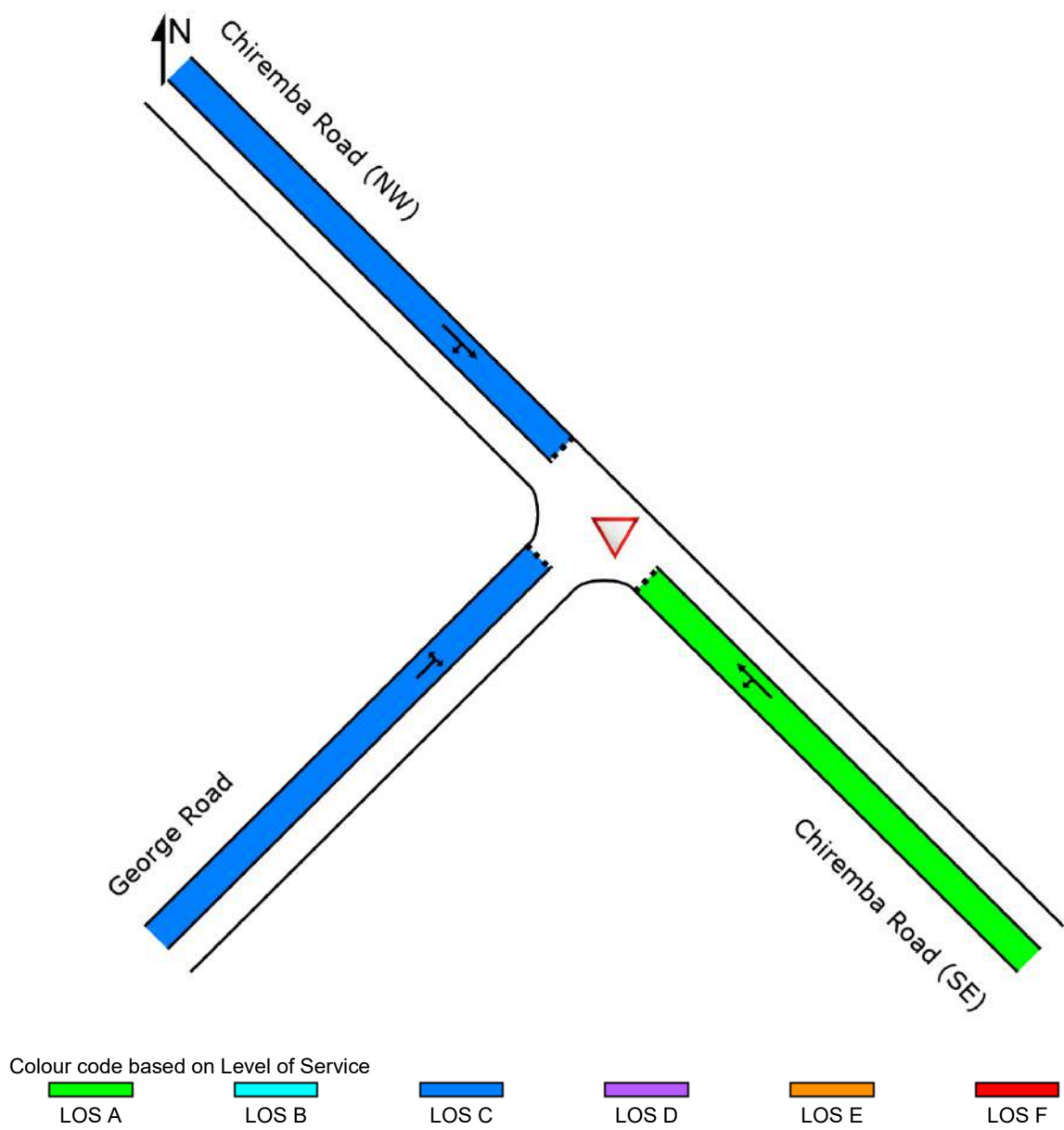
Site: 02 [Chiremba Road and George Road (Site Folder: Chiremba Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Chiremba Road (SE)															
21	L2	All MCs	132	8.3	132	8.3	0.154	5.6	LOS A	0.0	0.0	0.00	0.55	0.00	53.0
22	T1	All MCs	146	2.8	146	2.8	0.154	4.1	LOS A	0.0	0.0	0.00	0.55	0.00	53.6
Approach			279	5.4	279	5.4	0.154	4.8	LOS A	0.0	0.0	0.00	0.55	0.00	53.3
NorthWest: Chiremba Road (NW)															
28	T1	All MCs	317	3.2	317	3.2	0.540	8.3	LOS A	7.2	53.5	0.75	0.91	1.45	45.6
29	R2	All MCs	165	5.2	165	5.2	0.540	32.7	LOS D	7.2	53.5	0.75	0.91	1.45	45.1
Approach			483	3.9	483	3.9	0.540	16.6	LOS C	7.2	53.5	0.75	0.91	1.45	45.4
SouthWest: George Road															
30	L2	All MCs	81	36.7	81	36.7	0.642	11.7	LOS B	5.0	48.3	0.74	1.03	1.45	43.4
32	R2	All MCs	210	21.8	210	21.8	0.642	22.2	LOS C	5.0	48.3	0.74	1.03	1.45	43.5
Approach			291	26.0	291	26.0	0.642	19.3	LOS C	5.0	48.3	0.74	1.03	1.45	43.5
All Vehicles			1053	10.4	1053	10.4	0.642	14.2	NA	7.2	53.5	0.55	0.85	1.07	46.7

LEVEL OF SERVICE

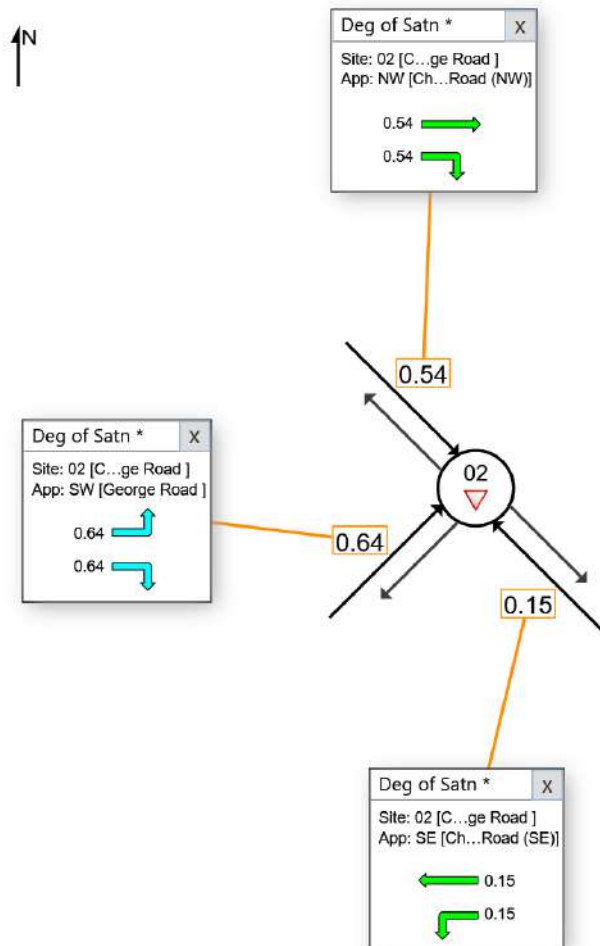
▼ Site: 02 [Chiremba Road and George Road (Site Folder: Chiremba Corridor)]

	Approaches			Intersection
	Southeast	Northwest	Southwest	
LOS	A	C	C	NA (TWSC)

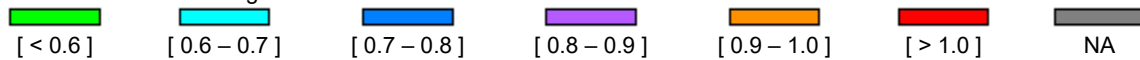


DEGREE OF SATURATION

▽ Site: 02 [Chiremba Road and George Road (Site Folder: Chiremba Corridor)]



Colour code based on Degree of Saturation

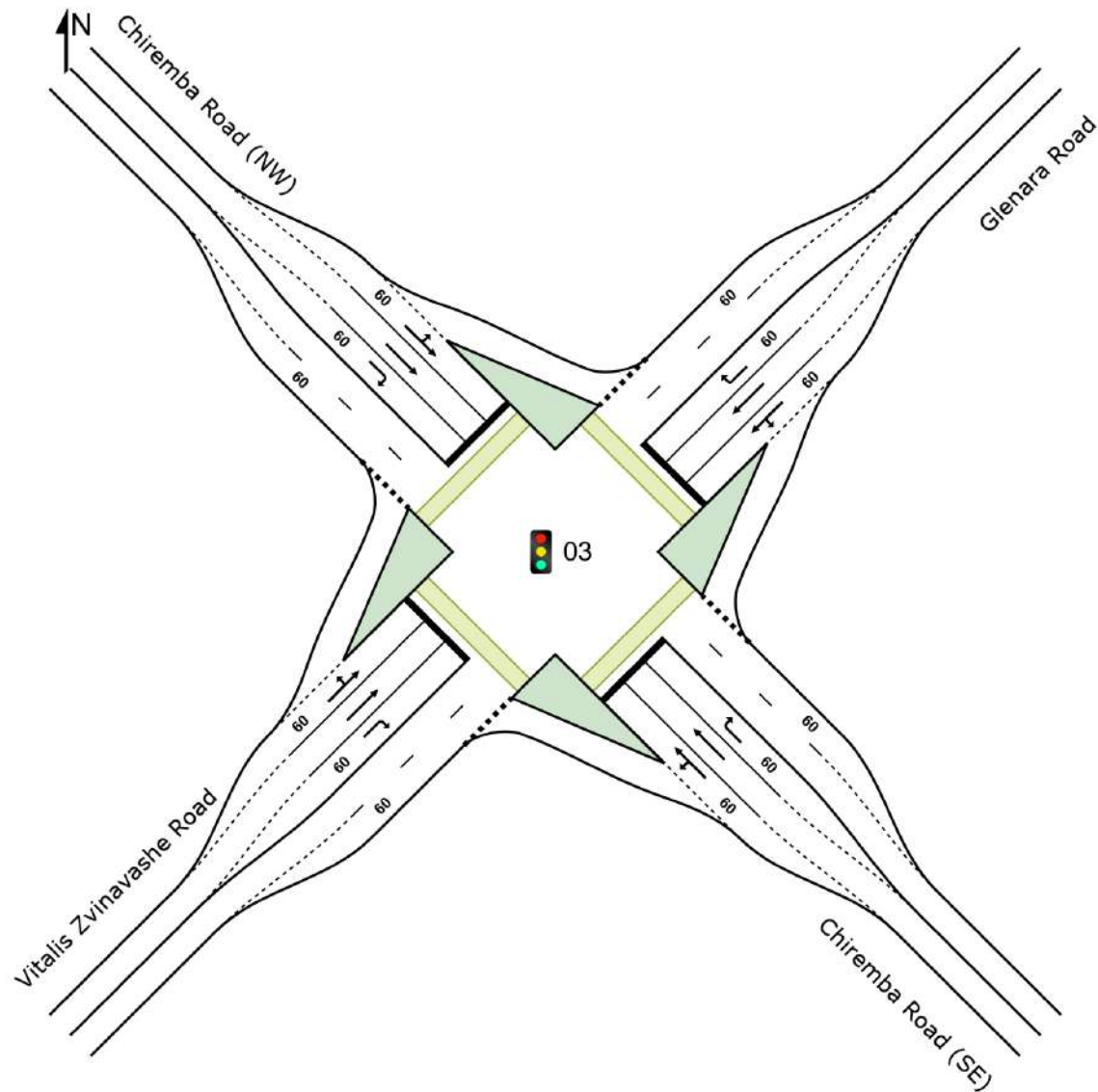


Site 03: Chiremba Road and Glenara Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 03 [Chiremba Road and Glenara Road (Site Folder: Chiremba Corridor)]



MOVEMENT SUMMARY

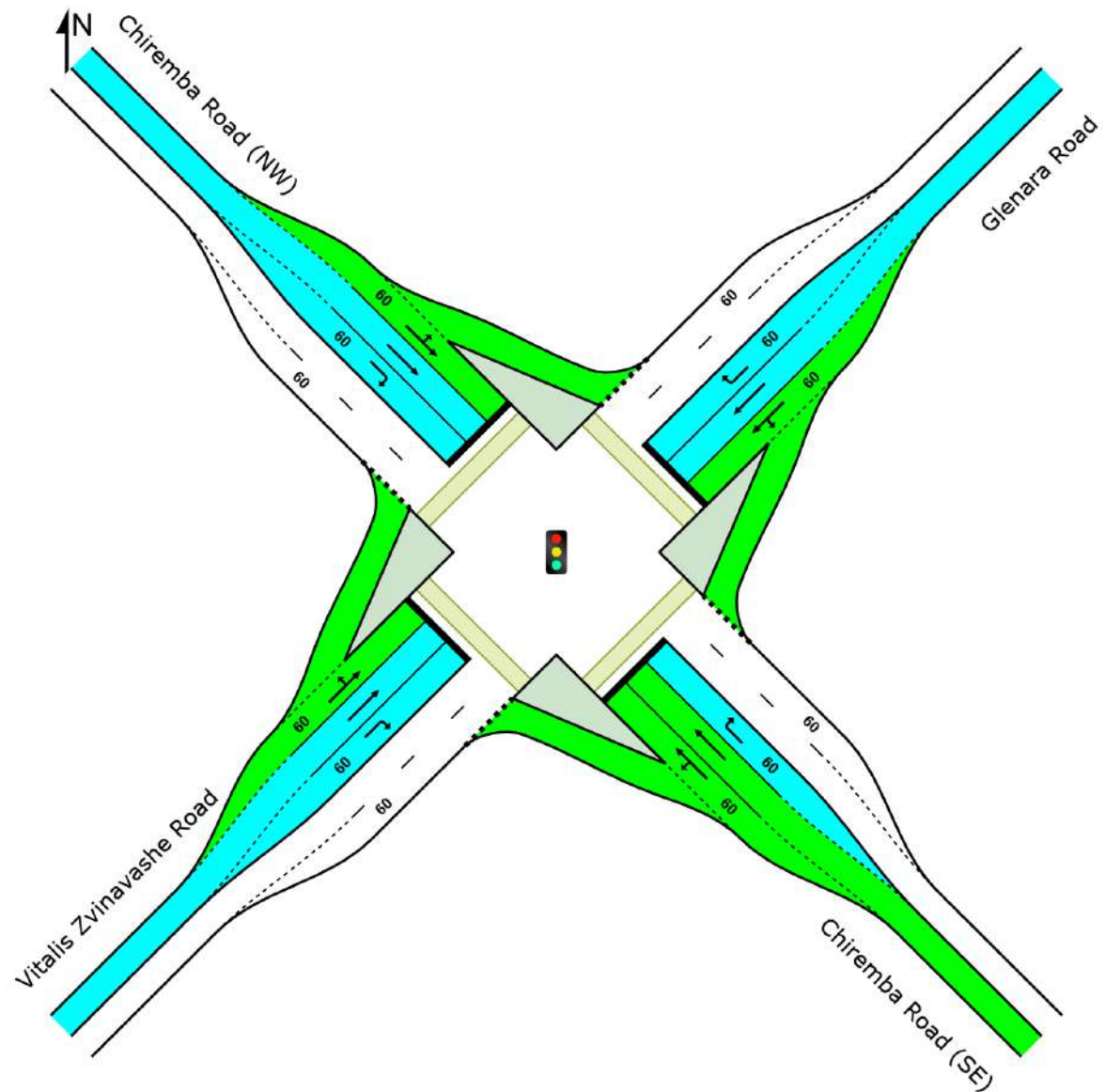
 Site: 03 [Chiremba Road and Glenara Road (Site Folder: Chiremba Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				veh	m				
SouthEast: Chiremba Road (SE)															
21	L2	All MCs	87	6.7	87	6.7	0.143	9.5	LOS A	0.6	4.7	0.63	0.66	0.63	50.9
22	T1	All MCs	222	6.6	222	6.6	0.374	9.4	LOS A	2.5	19.5	0.82	0.67	0.82	51.9
23	R2	All MCs	91	7.0	91	7.0	0.286	17.7	LOS B	1.2	9.9	0.89	0.75	0.89	44.9
Approach			400	6.7	400	6.7	0.374	11.3	LOS B	2.5	19.5	0.79	0.69	0.79	49.9
NorthEast: Glenara Road															
24	L2	All MCs	99	8.7	99	8.7	0.209	8.6	LOS A	0.8	6.6	0.66	0.66	0.66	51.5
25	T1	All MCs	326	13.4	326	13.4	0.545	9.9	LOS A	3.8	31.3	0.85	0.73	0.86	51.6
26	R2	All MCs	14	7.7	14	7.7	0.045	17.8	LOS B	0.2	1.4	0.86	0.67	0.86	44.8
Approach			439	12.2	439	12.2	0.545	9.8	LOS A	3.8	31.3	0.81	0.71	0.81	51.3
NorthWest: Chiremba Road (NW)															
27	L2	All MCs	93	5.6	93	5.6	0.196	9.3	LOS A	0.8	6.1	0.68	0.67	0.68	51.2
28	T1	All MCs	307	10.7	307	10.7	0.512*	9.8	LOS A	3.6	28.7	0.85	0.72	0.85	51.6
29	R2	All MCs	151	5.9	151	5.9	0.409	17.2	LOS B	2.1	15.9	0.89	0.77	0.89	45.2
Approach			551	8.6	551	8.6	0.512	11.7	LOS B	3.6	28.7	0.83	0.72	0.83	49.6
SouthWest: Vitalis Zvinavashe Road															
30	L2	All MCs	88	6.7	88	6.7	0.214	7.6	LOS A	0.8	6.4	0.66	0.64	0.66	51.9
31	T1	All MCs	329	19.4	329	19.4	0.558*	9.9	LOS A	3.7	33.6	0.85	0.73	0.87	51.6
32	R2	All MCs	89	2.5	89	2.5	0.280	18.5	LOS B	1.3	9.1	0.91	0.75	0.91	44.6
Approach			506	14.2	506	14.2	0.558	11.0	LOS B	3.7	33.6	0.83	0.72	0.84	50.2
All Vehicles			1896	10.5	1896	10.5	0.558	11.0	LOS B	3.8	33.6	0.82	0.71	0.82	50.2

LEVEL OF SERVICE

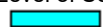
 Site: 03 [Chiremba Road and Glenara Road (Site Folder: Chiremba Corridor)]

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	B	A	B	B	B



Colour code based on Level of Service

 LOS A

 LOS B

 LOS C

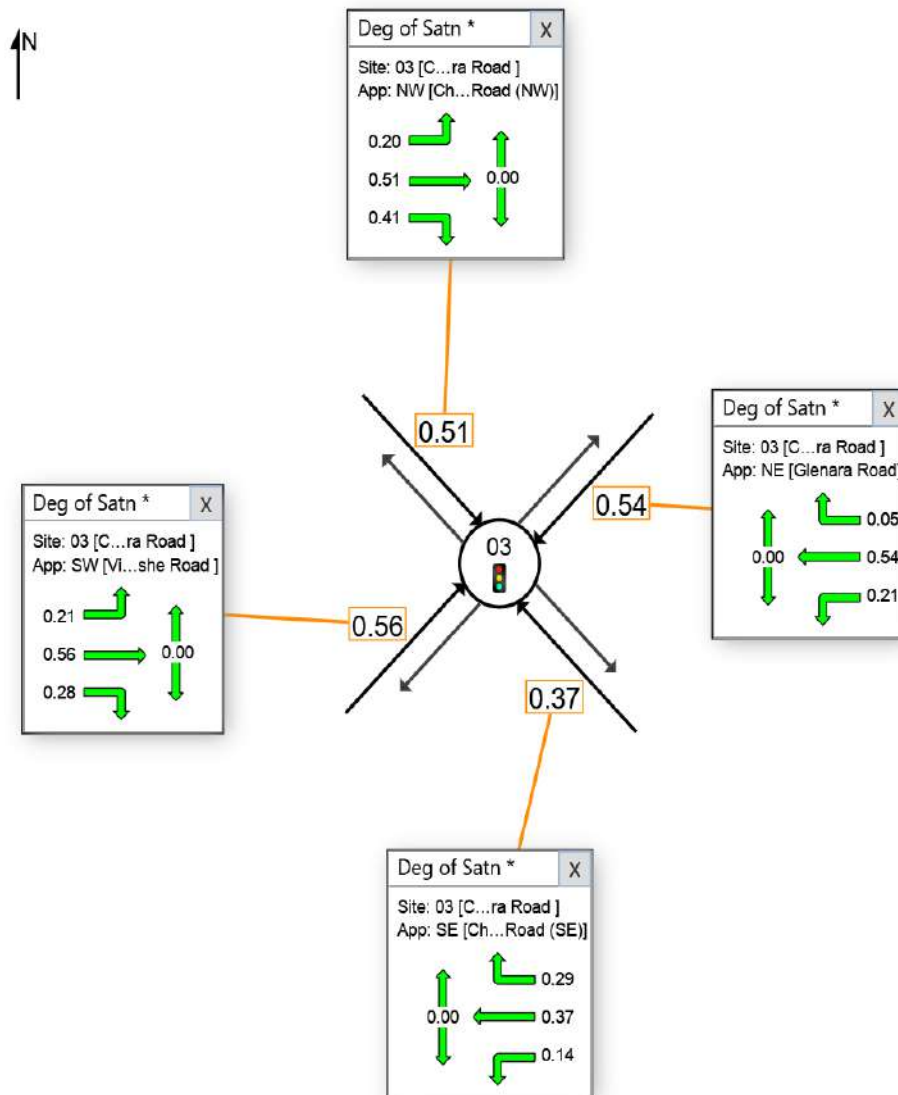
 LOS D

 LOS E

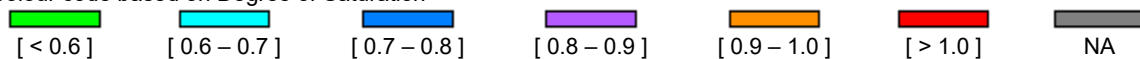
 LOS F

DEGREE OF SATURATION

 Site: 03 [Chiremba Road and Glenara Road (Site Folder: Chiremba Corridor)]



Colour code based on Degree of Saturation

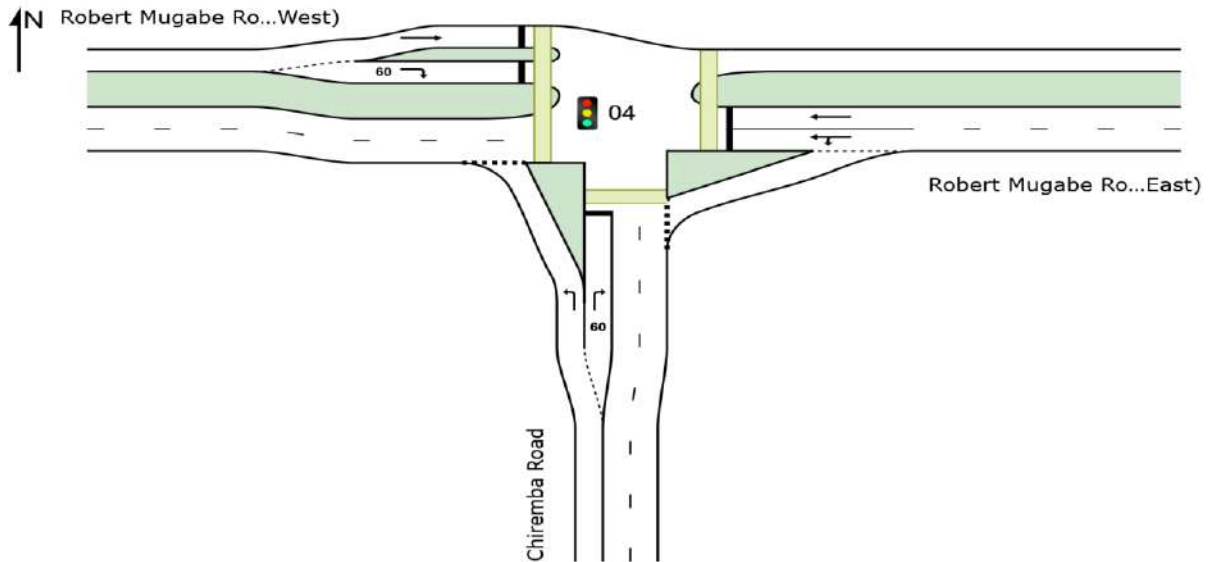


Site 04: Chiremba Road and Robert Mugabe

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 04 [Chiremba Road and Robert Mugabe Road (Site Folder: Chiremba Corridor)]



MOVEMENT SUMMARY

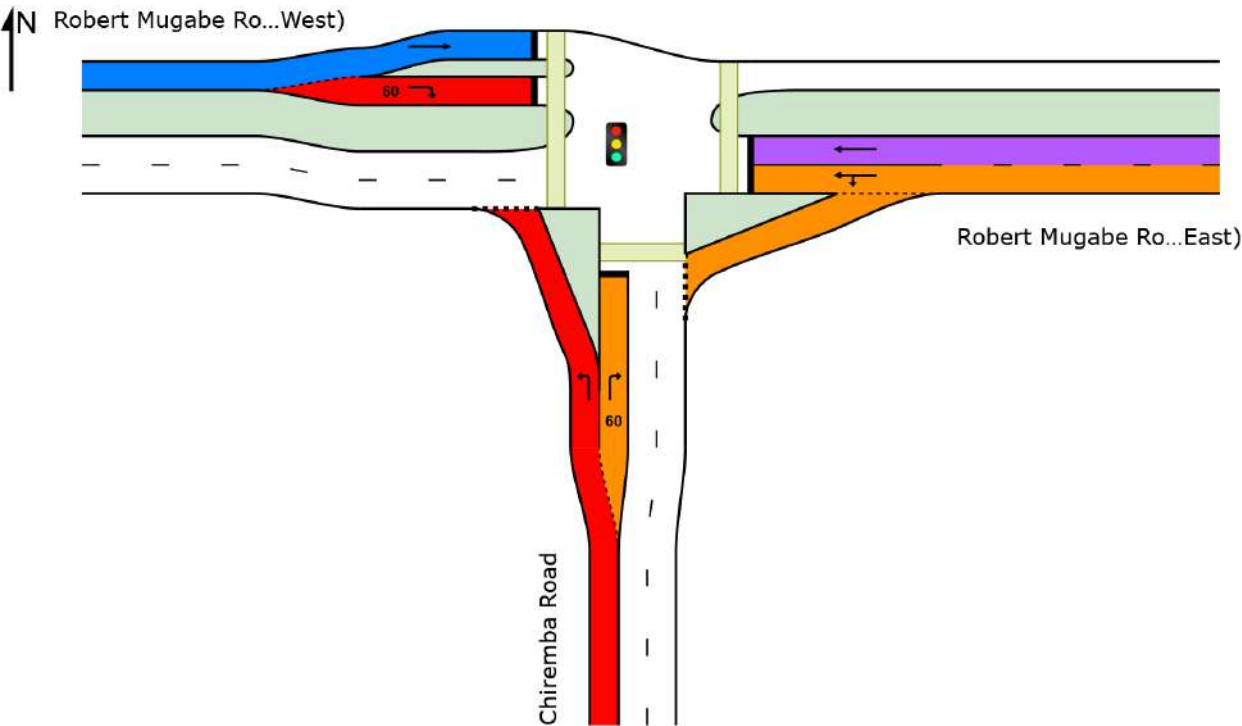
 Site: 04 [Chiremba Road and Robert Mugabe Road (Site Folder: Chiremba Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Chiremba Road															
1	L2	All MCs	823	3.0	823	3.0	1.050	116.7	LOS F	82.4	601.6	1.00	1.24	1.51	20.0
3	R2	All MCs	163	2.7	163	2.7	[*] 0.427	56.9	LOS E	8.2	59.5	0.72	0.78	0.72	36.9
Approach			986	3.0	986	3.0	1.050	106.8	LOS F	82.4	601.6	0.95	1.16	1.38	19.2
East: Robert Mugabe Road (East)															
4	L2	All MCs	153	6.2	153	6.2	0.822	51.8	LOS D	26.4	201.4	0.98	1.02	1.07	28.4
5	T1	All MCs	731	6.1	731	6.1	[*] 0.822	54.5	LOS D	34.3	263.0	0.97	0.94	1.02	32.4
Approach			884	6.1	884	6.1	0.822	54.0	LOS D	34.3	263.0	0.97	0.95	1.03	31.6
West: Robert Mugabe Road (West)															
11	T1	All MCs	503	4.3	503	4.3	0.356	25.0	LOS C	2.2	16.2	0.13	0.08	0.13	59.3
12	R2	All MCs	950	3.1	950	3.1	[*] 1.960	920.4	LOS F	221.6	1638.9	1.00	2.32	3.96	3.7
Approach			1453	3.5	1453	3.5	1.960	610.2	LOS F	221.6	1638.9	0.70	1.54	2.64	5.3
All Vehicles			3323	4.1	3323	4.1	1.960	312.9	LOS F	221.6	1638.9	0.85	1.27	1.84	9.4

LEVEL OF SERVICE

Site: 04 [Chiremba Road and Robert Mugabe Road (Site Folder: Chiremba Corridor)]

	Approaches			Intersection
	South	East	West	
LOS	F	D	F	F



Colour code based on Level of Service

LOS A

LOS B

LOS C

LOS D

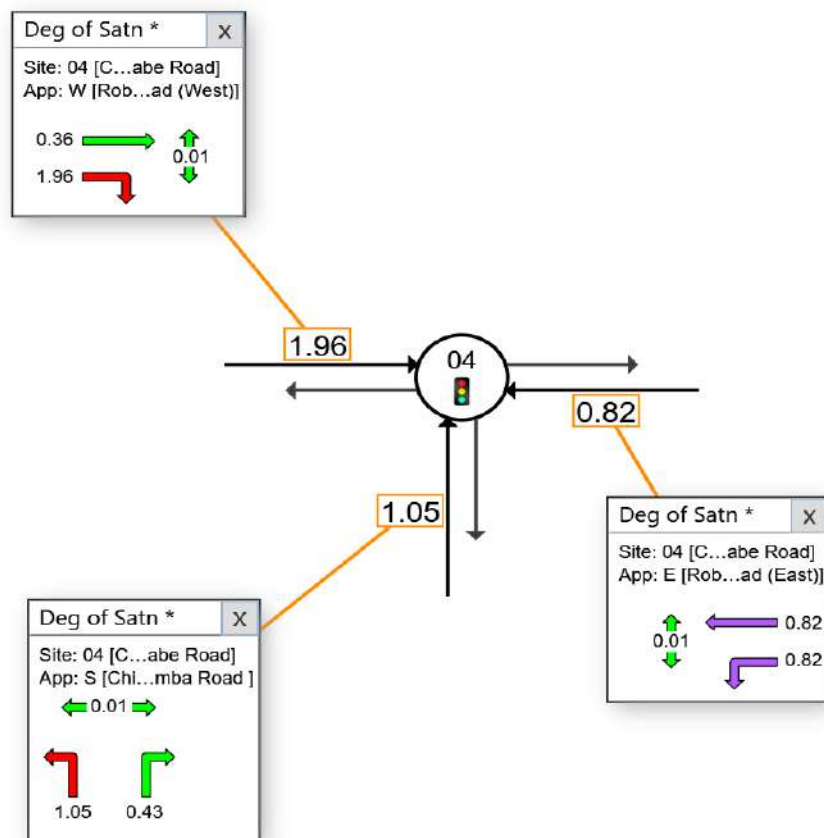
LOS E

LOS F

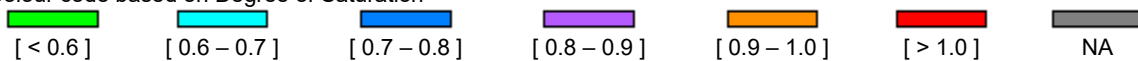
DEGREE OF SATURATION

 Site: 04 [Chiremba Road and Robert Mugabe Road (Site Folder: Chiremba Corridor)]

All Movement Classes (*)



Colour code based on Degree of Saturation



Corridor Nodal Capacity Results Interpretation and Analysis: The Chiremba Corridor

Site 01: Chiremba Road and St Patricks Road

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	A	C	A	B	NA (TWSC)

Site 02: Chiremba Road and George Road

	Approaches			Intersection
	Southeast	Northwest	Southwest	
LOS	A	C	C	NA (TWSC)

Site 03: Chiremba Road and Glenara Avenue

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	B	A	B	B	B

Site 04: Chiremba Road and Robert Mugabe Road

	Approaches			Intersection
	South	East	West	
LOS	F	D	F	F

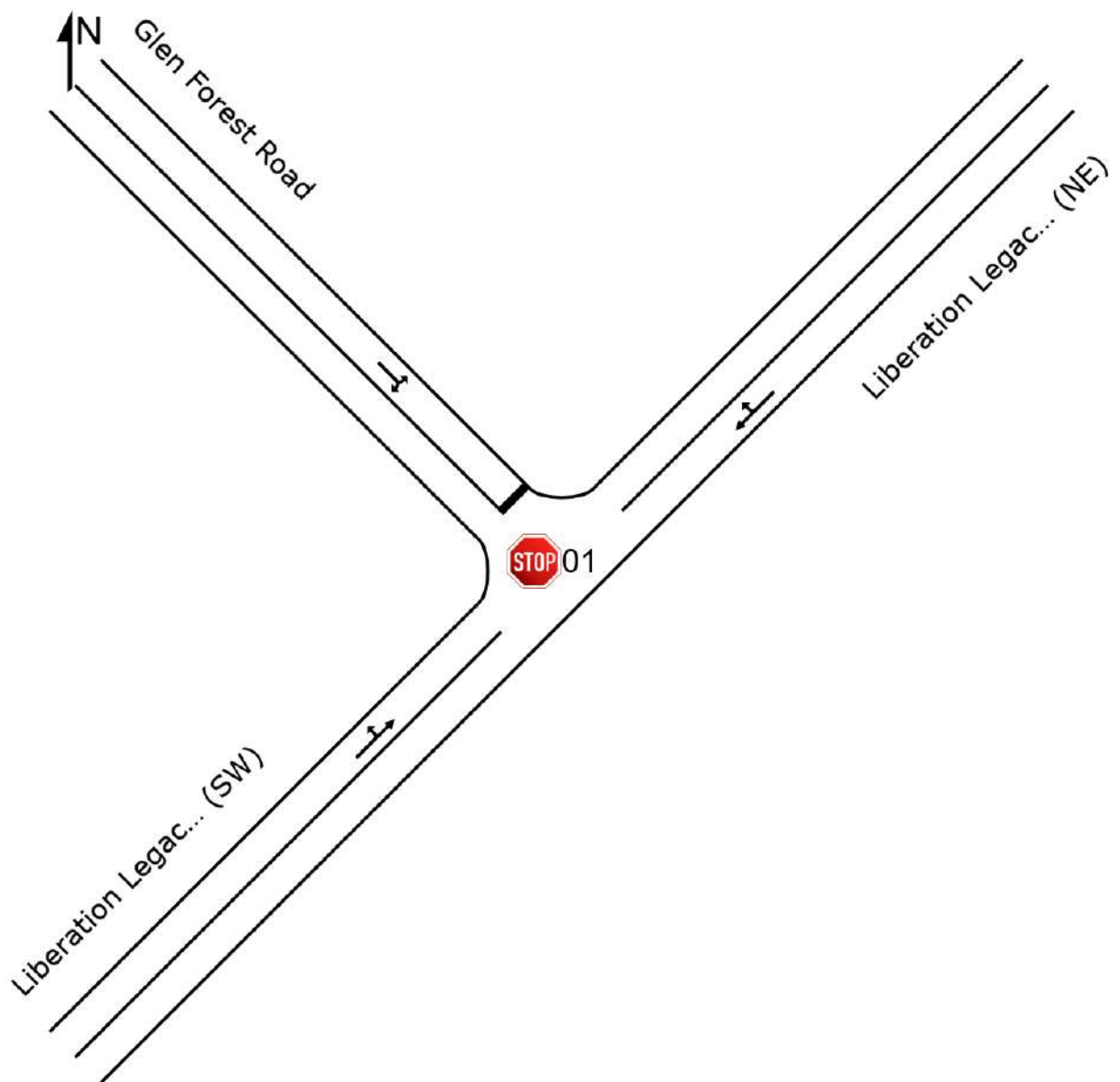
While the other intersections along the Chiremba corridor, appear to be operating at reasonable LOS with relatively better traffic speeds and manoeuvrability. One (1) intersection requires immediate attention and that it the Chiremba Road and Robert Mugabe Intersection, which is operating at an abnormally high levels of traffic jam largely due to the **at grade intersection design coupled with a high demand for right turning traffic onto Chiremba road from Robert Mugabe**. The at grade right turning traffic problem is the major contributing factor to poor intersection performance on this site.

Site 01: Domboshawa Road and Glen Forest Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 **Site: 01 [Liberation Legacy Way and Glen Forest Road (Site Folder: Borrowdale Road Corridor)]**



MOVEMENT SUMMARY

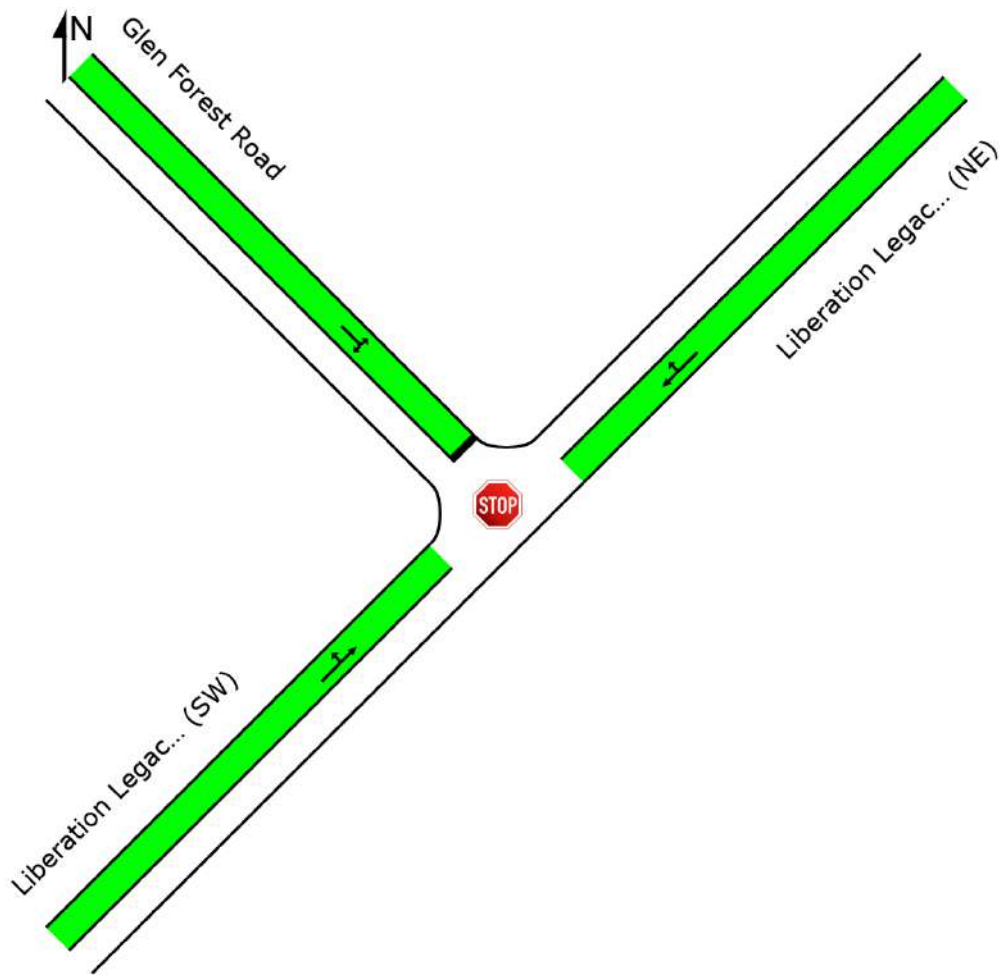
 **Site: 01 [Liberation Legacy Way and Glen Forest Road (Site Folder: Borrowdale Road Corridor)]**

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
NorthEast: Liberation Legacy Way (NE)															
25	T1	All MCs	98	9.1	98	9.1	0.071	0.0	LOS A	0.0	0.3	0.03	0.04	0.03	59.5
26	R2	All MCs	5	25.4	5	25.4	0.071	6.2	LOS A	0.0	0.3	0.03	0.04	0.03	54.5
Approach			102	9.8	102	9.8	0.071	0.3	NA	0.0	0.3	0.03	0.04	0.03	59.2
NorthWest: Glen Forest Road															
27	L2	All MCs	6	10.0	6	10.0	0.030	9.0	LOS A	0.1	0.8	0.29	0.89	0.29	49.9
29	R2	All MCs	20	12.2	20	12.2	0.030	9.4	LOS A	0.1	0.8	0.29	0.89	0.29	49.8
Approach			26	11.7	26	11.7	0.030	9.3	LOS A	0.1	0.8	0.29	0.89	0.29	49.9
SouthWest: Liberation Legacy Way (SW)															
30	L2	All MCs	20	6.4	20	6.4	0.086	5.6	LOS A	0.0	0.0	0.00	0.09	0.00	55.6
31	T1	All MCs	107	7.8	107	7.8	0.086	0.0	LOS A	0.0	0.0	0.00	0.09	0.00	58.2
Approach			127	7.6	127	7.6	0.086	0.9	NA	0.0	0.0	0.00	0.09	0.00	57.8
All Vehicles			255	8.9	255	8.9	0.086	1.5	NA	0.1	0.8	0.04	0.15	0.04	57.4

LEVEL OF SERVICE

 **Site: 01 [Liberation Legacy Way and Glen Forest Road (Site Folder: Borrowdale Road Corridor)]**

	Approaches			Intersection
	Northeast	Northwest	Southwest	
LOS	NA (TWSC)	A	NA (TWSC)	NA (TWSC)



Colour code based on Level of Service

LOS A

LOS B

LOS C

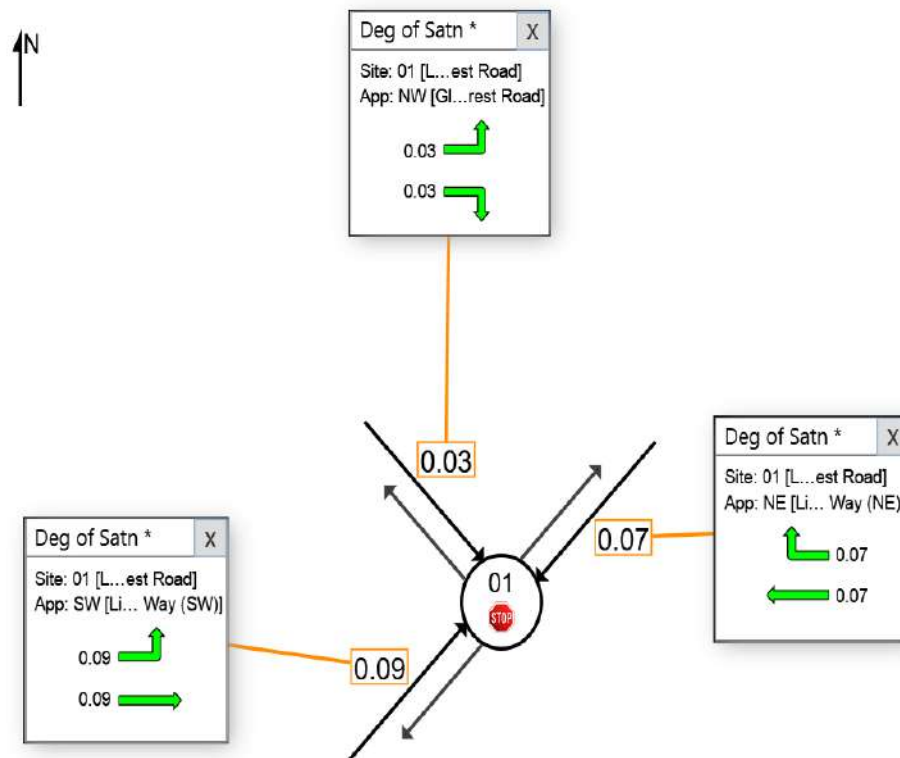
LOS D

LOS E

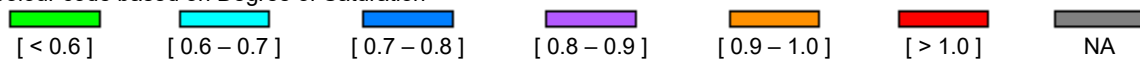
LOS F

DEGREE OF SATURATION

 **Site: 01 [Liberation Legacy Way and Glen Forest Road (Site Folder: Borrowdale Road Corridor)]**



Colour code based on Degree of Saturation

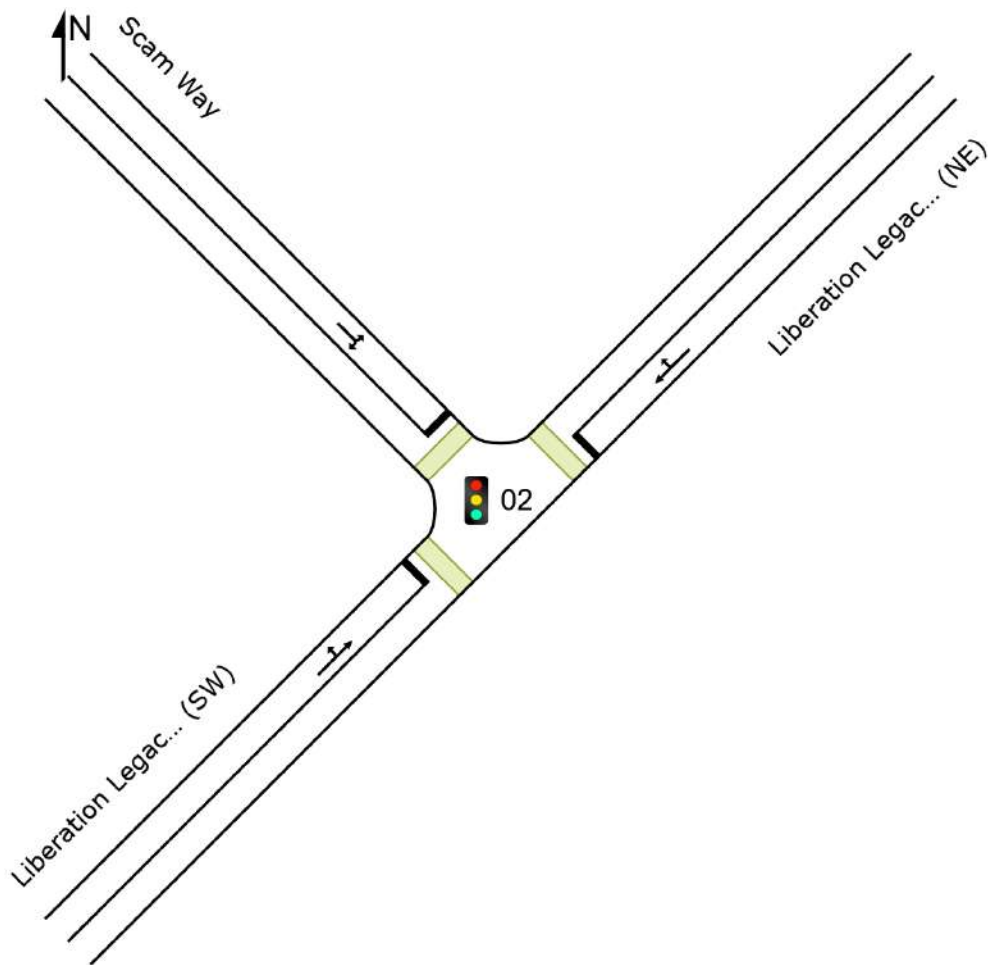


Site 02: Borrowdale Road and Scam Way

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 02 [Borrowdale Road and Scam Way (Site Folder: Borrowdale Road Corridor)]



MOVEMENT SUMMARY

 Site: 02 [Borrowdale Road and Scam Way (Site Folder: Borrowdale Road Corridor)]

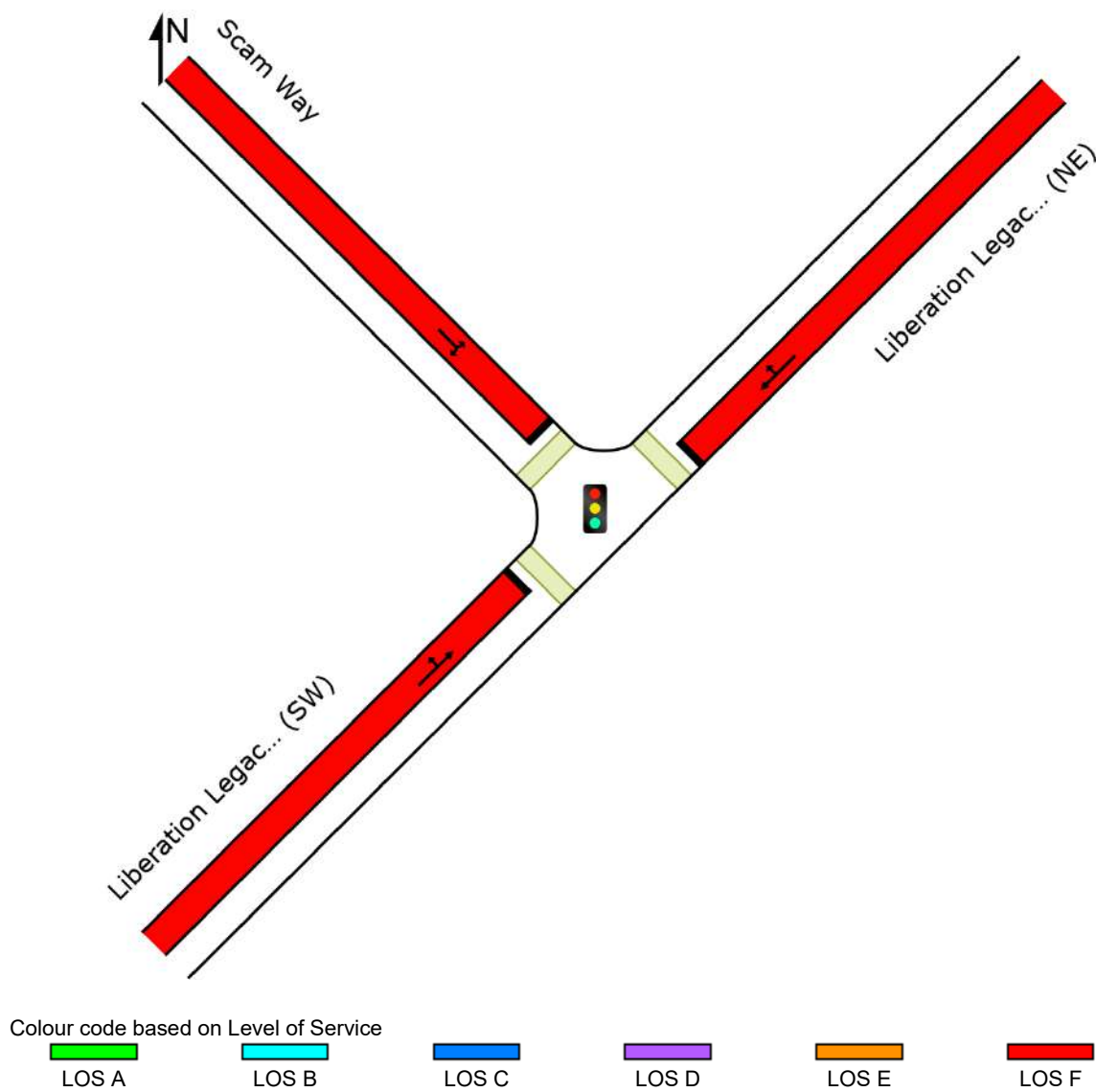
Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total veh/h]	[HV %]	[Total veh/h]	[HV %]				[Veh. veh]	[Dist m]				
NorthEast: Liberation Legacy Way (NE)															
25	T1	All MCs	3858	10.0	3858	10.0	12.607	10481.6	LOS F	1585.5	13036.0	1.00	5.02	6.52	0.3
26	R2	All MCs	296	14.9	296	14.9	12.607 *	10927.5	LOS F	1585.5	13036.0	1.00	5.02	6.52	0.3
Approach			4154	10.3	4154	10.3	12.607	10513.4	LOS F	1585.5	13036.0	1.00	5.02	6.52	0.3
NorthWest: Scam Way															
27	L2	All MCs	473	7.1	473	7.1	12.536	10461.3	LOS F	875.1	6935.1	1.00	2.93	6.52	0.3
29	R2	All MCs	1820	6.8	1820	6.8	12.536 *	10461.2	LOS F	875.1	6935.1	1.00	2.93	6.52	0.3
Approach			2293	6.9	2293	6.9	12.536	10461.2	LOS F	875.1	6935.1	1.00	2.93	6.52	0.3
SouthWest: Liberation Legacy Way (SW)															
30	L2	All MCs	2392	5.1	2392	5.1	6.811	5260.0	LOS F	2600.7	21377.9	1.00	4.45	6.12	0.7
31	T1	All MCs	4851	12.3	4851	12.3	6.811	5254.4	LOS F	2600.7	21377.9	1.00	4.45	6.12	0.7
Approach			7242	9.9	7242	9.9	6.811	5256.3	LOS F	2600.7	21377.9	1.00	4.45	6.12	0.7
All Vehicles			13688	9.5	13688	9.5	12.607	7723.3	LOS F	2600.7	21377.9	1.00	4.37	6.31	0.5

LEVEL OF SERVICE

 Site: 02 [Borrowdale Road and Scam Way (Site Folder: Borrowdale Road Corridor)]

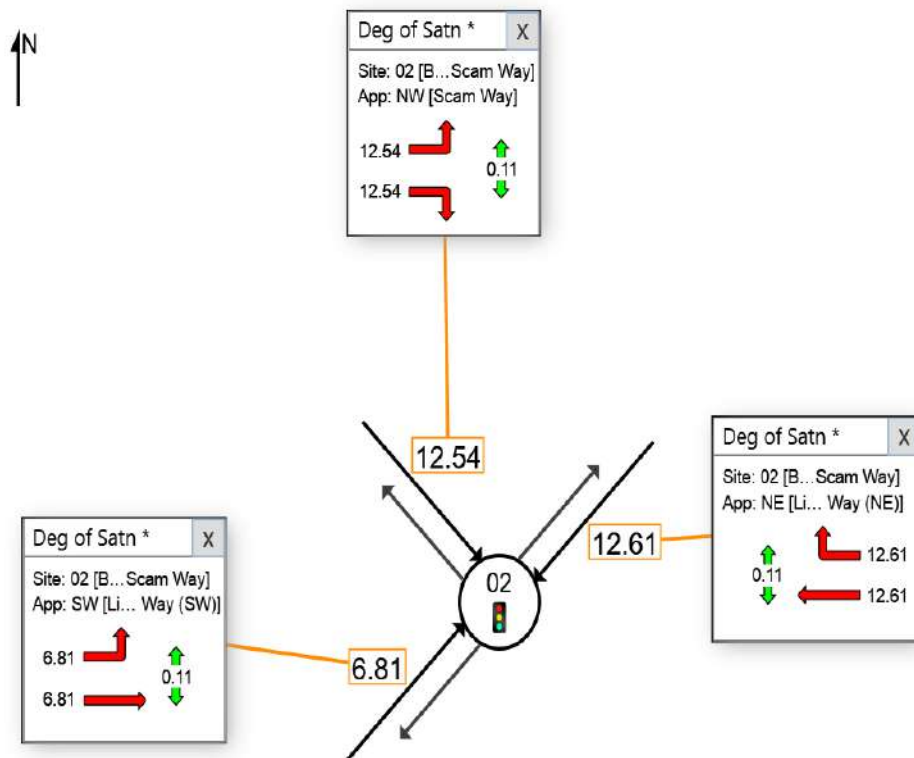
New Site
Site Category: Existing Design
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	Northeast	Northwest	Southwest	
LOS	F	F	F	F

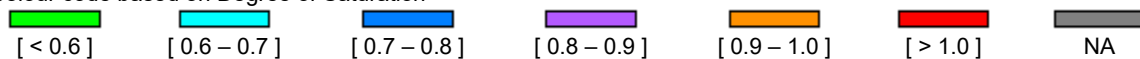


DEGREE OF SATURATION

 Site: 02 [Borrowdale Road and Scam Way (Site Folder: Borrowdale Road Corridor)]



Colour code based on Degree of Saturation

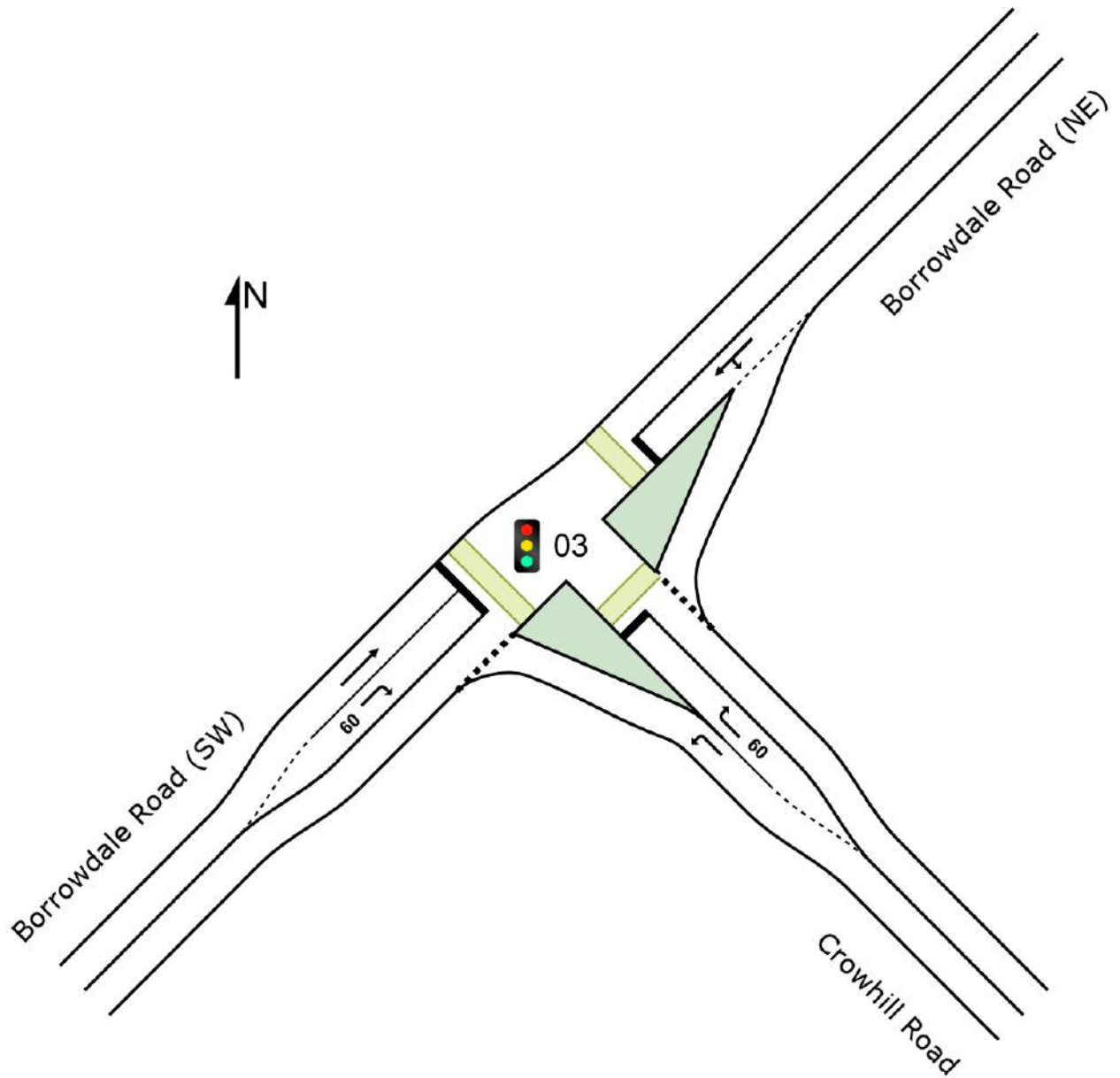


Site 03: Borrowdale Road and Crow hill Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 03 [Borrowdale Road and Crowhill Road (Site Folder: Borrowdale Road Corridor)]



MOVEMENT SUMMARY

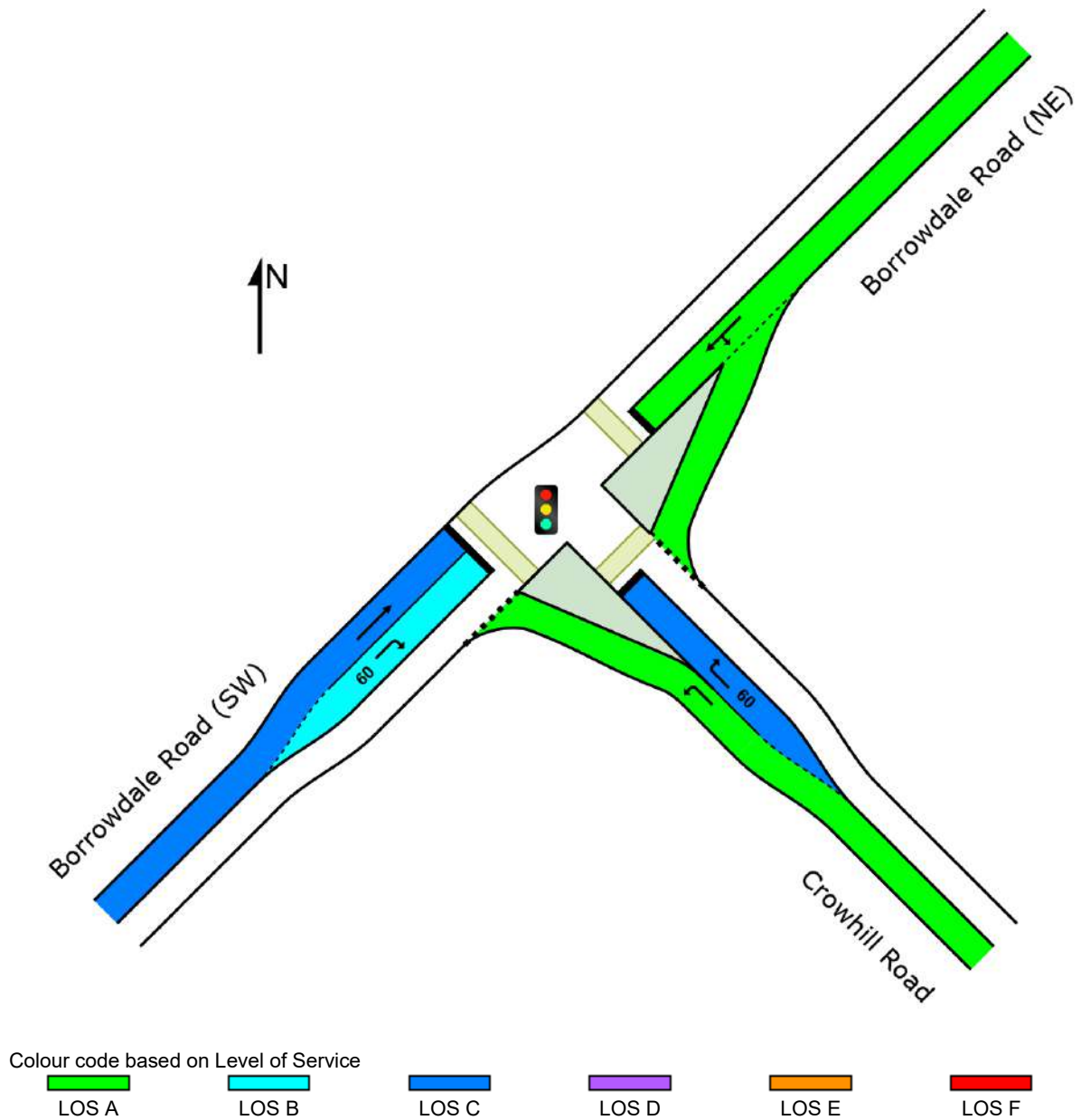
 Site: 03 [Borrowdale Road and Crowhill Road (Site Folder: Borrowdale Road Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
SouthEast: Crowhill Road															
21	L2	All MCs	227	5.8	227	5.8	0.324	8.8	LOS A	1.7	13.0	0.58	0.71	0.58	50.4
23	R2	All MCs	58	12.1	58	12.1	0.494 *	24.9	LOS C	1.2	10.3	0.94	0.80	1.03	40.8
Approach			285	7.1	285	7.1	0.494	12.1	LOS B	1.7	13.0	0.65	0.73	0.67	48.1
NorthEast: Borrowdale Road (NE)															
24	L2	All MCs	42	7.0	42	7.0	0.573	8.5	LOS A	4.3	34.8	0.71	0.65	0.71	51.0
25	T1	All MCs	289	10.0	289	10.0	0.573	7.5	LOS A	4.3	34.8	0.71	0.65	0.71	52.9
Approach			332	9.6	332	9.6	0.573	7.7	LOS A	4.3	34.8	0.71	0.65	0.71	52.6
SouthWest: Borrowdale Road (SW)															
31	T1	All MCs	567	5.3	567	5.3	0.885 *	22.9	LOS C	15.4	119.5	0.95	1.14	1.48	43.5
32	R2	All MCs	174	4.6	174	4.6	0.381	16.0	LOS B	2.6	20.1	0.77	0.77	0.77	45.6
Approach			742	5.1	742	5.1	0.885	21.3	LOS C	15.4	119.5	0.91	1.06	1.31	43.9
All Vehicles			1358	6.6	1358	6.6	0.885	16.0	LOS B	15.4	119.5	0.81	0.89	1.03	46.7

LEVEL OF SERVICE

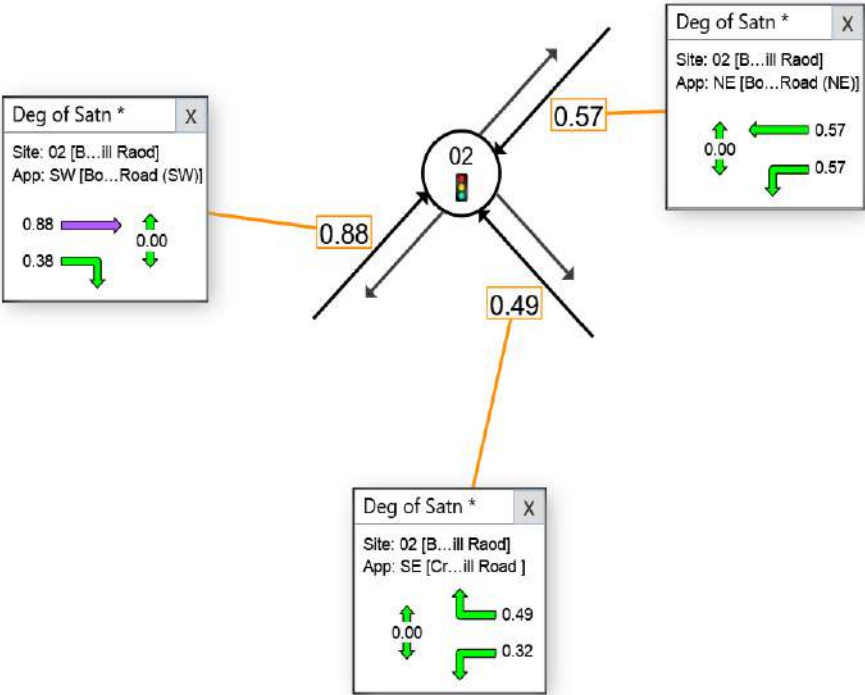
 Site: 03 [Borrowdale Road and Crowhill Road (Site Folder: Borrowdale Road Corridor)]

	Approaches			Intersection
	Southeast	Northeast	Southwest	
LOS	B	A	C	B

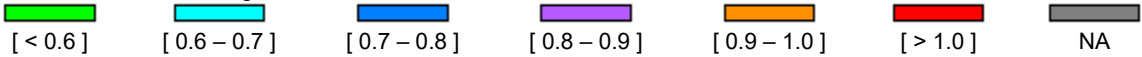


DEGREE OF SATURATION

Site: 03 [Borrowdale Road and Crowhill Road (Site Folder: Borrowdale Road Corridor)]



Colour code based on Degree of Saturation

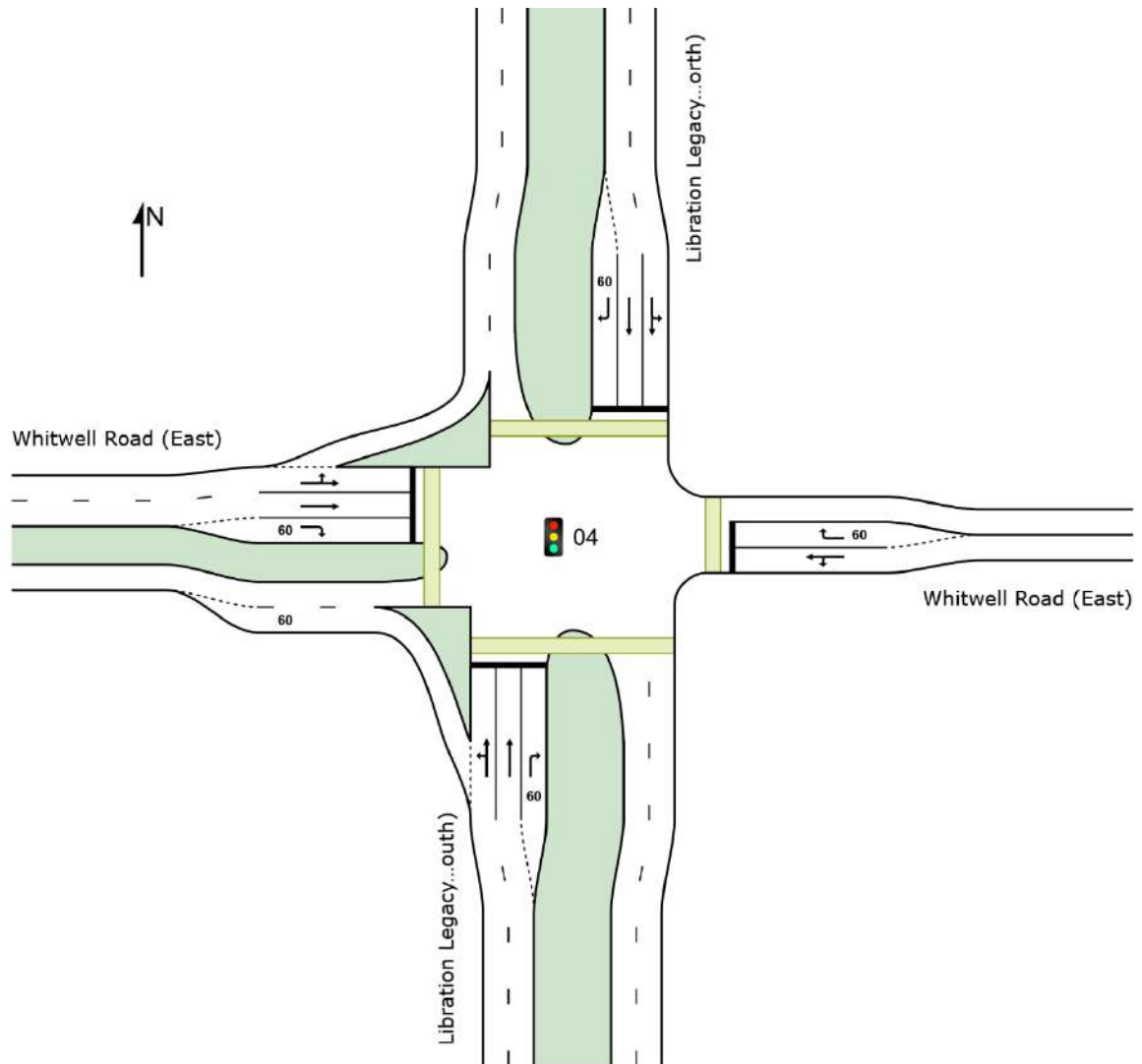


Site 04: Borrowdale Road and Whitwell Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

Site: 04 [Borrowdale Road and Whitwell Road (Site Folder: Borrowdale Road Corridor)]



MOVEMENT SUMMARY

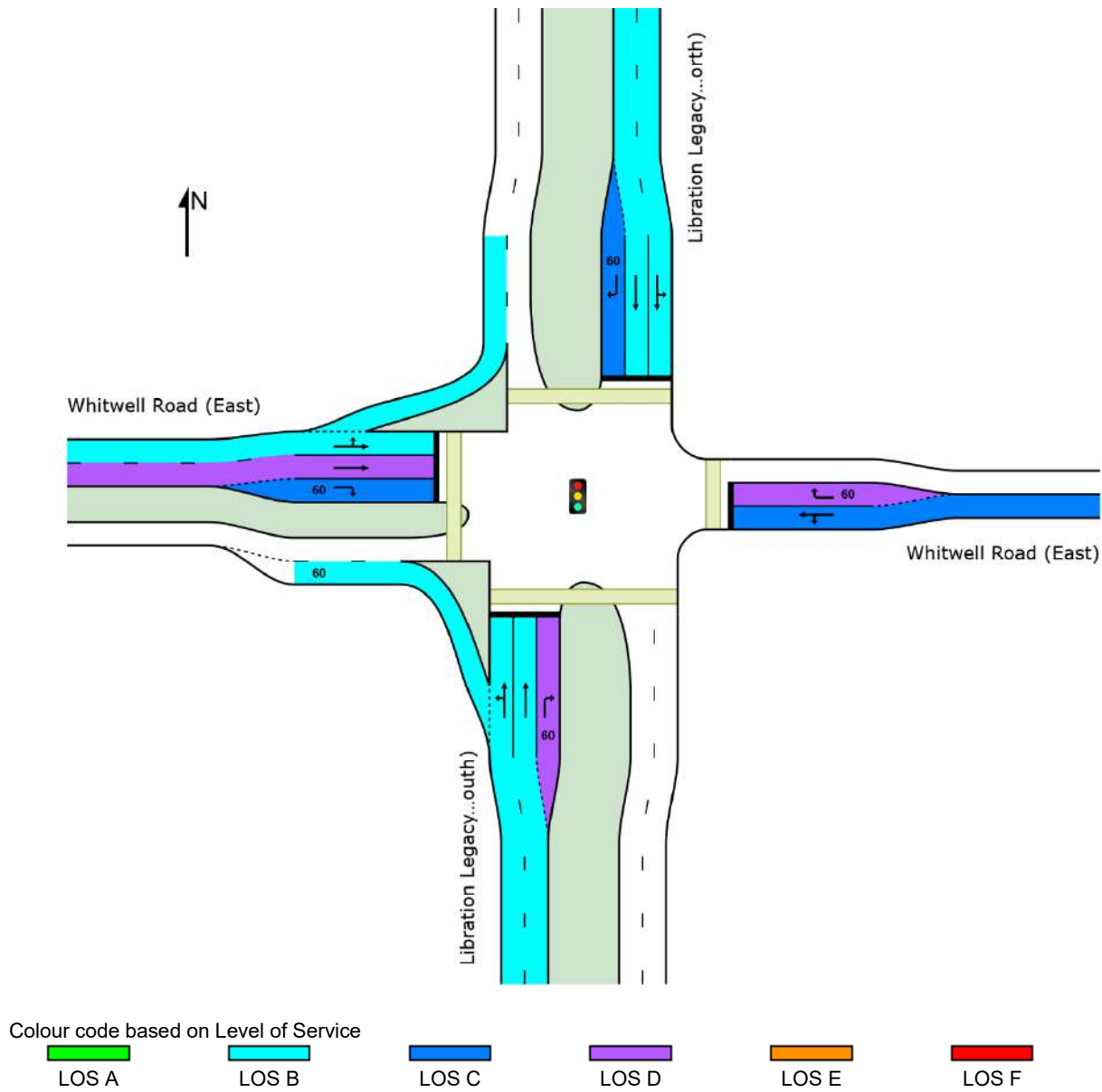
 Site: 04 [Borrowdale Road and Whitwell Road (Site Folder: Borrowdale Road Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
South: Libration Legacy Way (South)															
1	L2	All MCs	34	4.8	34	4.8	0.151	5.9	LOS A	2.2	18.1	0.60	0.56	0.60	46.9
2	T1	All MCs	165	12.1	165	12.1	0.151	16.2	LOS B	2.2	18.8	0.61	0.52	0.61	48.5
3	R2	All MCs	299	3.4	299	3.4	* 0.855	44.6	LOS D	13.8	102.1	0.99	1.02	1.32	34.0
Approach			497	6.4	497	6.4	0.855	32.5	LOS C	13.8	102.1	0.84	0.83	1.03	38.6
East: Whitwell Road (East)															
4	L2	All MCs	69	2.7	69	2.7	0.688	28.4	LOS C	8.1	58.7	0.95	0.86	1.03	38.0
5	T1	All MCs	145	1.8	145	1.8	0.688	34.7	LOS C	8.1	58.7	0.95	0.86	1.03	39.1
6	R2	All MCs	90	2.1	90	2.1	* 0.468	37.6	LOS D	3.2	23.6	0.95	0.75	0.95	36.4
Approach			304	2.1	304	2.1	0.688	34.1	LOS C	8.1	58.7	0.95	0.83	1.01	38.0
North: Libration Legacy Way (North)															
7	L2	All MCs	10	4.4	10	4.4	0.340	21.1	LOS C	6.1	44.3	0.69	0.59	0.69	46.0
8	T1	All MCs	469	2.3	469	2.3	0.340	15.5	LOS B	6.1	44.4	0.69	0.59	0.69	47.8
9	R2	All MCs	10	2.2	10	2.2	0.018	20.5	LOS C	0.2	1.6	0.61	0.64	0.61	43.8
Approach			488	2.3	488	2.3	0.340	15.7	LOS B	6.1	44.4	0.69	0.59	0.69	47.7
West: Whitwell Road (East)															
10	L2	All MCs	66	2.5	66	2.5	0.168	5.6	LOS A	2.0	14.4	0.64	0.67	0.64	44.4
11	T1	All MCs	341	2.8	341	2.8	* 0.842	40.9	LOS D	14.2	105.3	0.98	1.00	1.23	37.1
12	R2	All MCs	138	0.6	138	0.6	0.404	34.3	LOS C	4.7	33.2	0.89	0.78	0.89	37.8
Approach			544	2.2	544	2.2	0.842	34.9	LOS C	14.2	105.3	0.92	0.91	1.07	38.0
All Vehicles			1834	3.3	1834	3.3	0.855	29.0	LOS C	14.2	105.3	0.84	0.79	0.95	40.3

LEVEL OF SERVICE

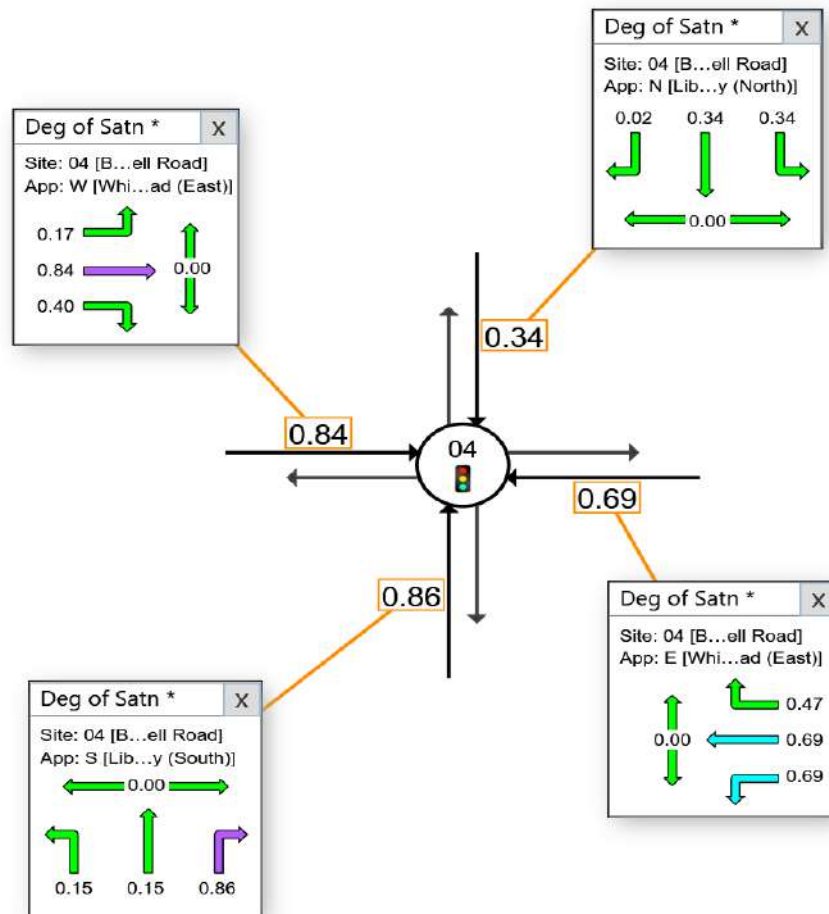
 Site: 04 [Borrowdale Road and Whitwell Road (Site Folder: Borrowdale Road Corridor)]

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	B	C	C

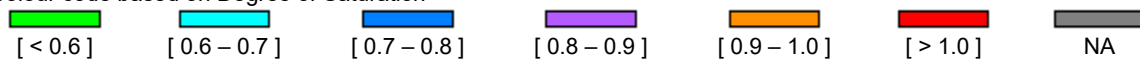


DEGREE OF SATURATION

 Site: 04 [Borrowdale Road and Whitwell Road (Site Folder: Borrowdale Road Corridor)]



Colour code based on Degree of Saturation

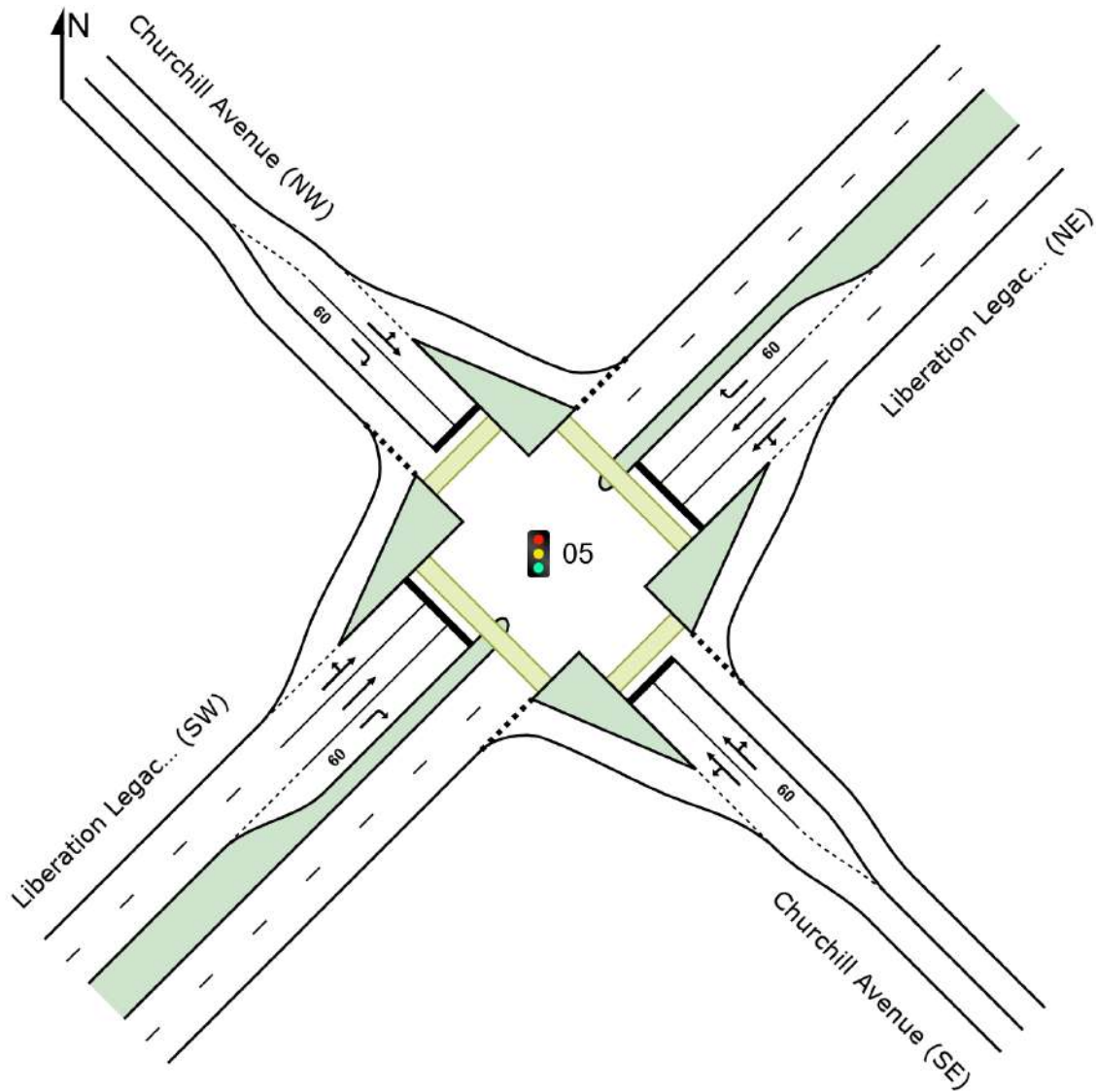


Site 05: Borrowdale Road and Churchill Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 05 [Liberation Legacy Way and Churchill Avenue (Site Folder: Borrowdale Road Corridor)]



MOVEMENT SUMMARY

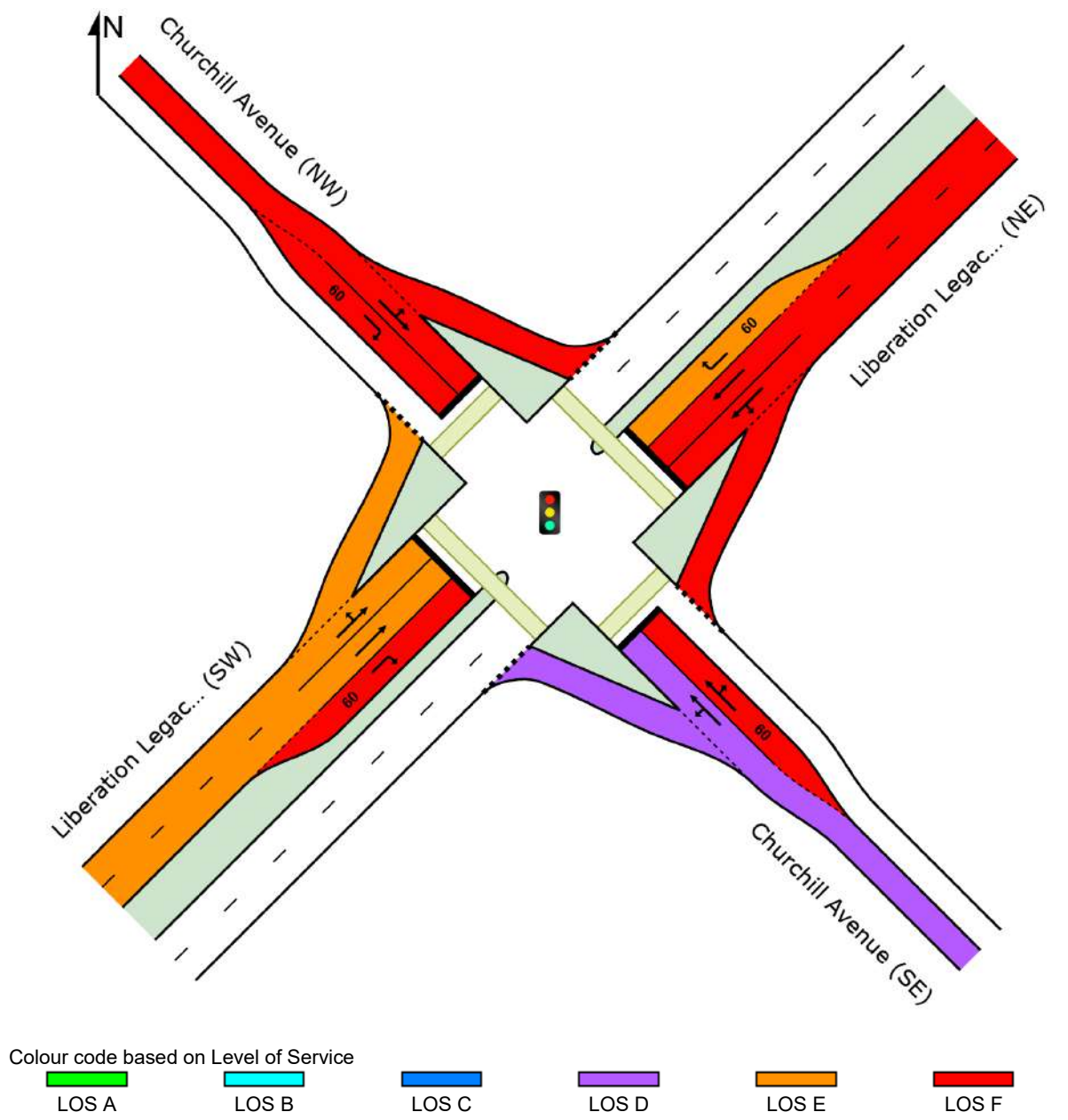
 Site: 05 [Liberation Legacy Way and Churchill Avenue (Site Folder: Borrowdale Road Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh.]	Dist]				
			veh/h	%	veh/h	%									
SouthEast: Churchill Avenue (SE)															
21	L2	All MCs	83	0.5	83	0.5	0.218	49.2	LOS D	4.7	34.3	0.72	0.73	0.72	37.9
22	T1	All MCs	280	5.6	280	5.6	1.089	173.0	LOS F	37.4	287.2	0.97	1.41	1.69	16.7
23	R2	All MCs	61	3.9	61	3.9	1.089	234.8	LOS F	37.4	287.2	1.00	1.49	1.80	15.5
Approach			424	4.4	424	4.4	1.089	157.9	LOS F	37.4	287.2	0.92	1.29	1.52	16.7
NorthEast: Liberation Legacy Way (NE)															
24	L2	All MCs	74	8.7	74	8.7	1.116	142.5	LOS F	62.1	467.0	1.00	1.36	1.84	14.2
25	T1	All MCs	895	3.3	895	3.3 *	1.116	191.1	LOS F	62.1	467.0	1.00	1.50	1.84	14.6
26	R2	All MCs	161	2.3	161	2.3	0.694 *	67.6	LOS E	7.4	53.5	0.97	0.84	1.02	35.2
Approach			1130	3.5	1130	3.5	1.116	170.4	LOS F	62.1	467.0	1.00	1.39	1.73	14.9
NorthWest: Churchill Avenue (NW)															
27	L2	All MCs	96	2.3	96	2.3	1.126	176.3	LOS F	48.3	350.0	1.00	1.39	1.91	13.4
28	T1	All MCs	294	2.0	294	2.0 *	1.126	185.1	LOS F	48.3	350.0	1.00	1.39	1.91	13.5
29	R2	All MCs	161	1.8	161	1.8	0.769	97.0	LOS F	12.1	87.9	1.00	0.89	1.12	26.3
Approach			551	2.0	551	2.0	1.126	157.8	LOS F	48.3	350.0	1.00	1.24	1.68	14.4
SouthWest: Liberation Legacy Way (SW)															
30	L2	All MCs	102	3.2	102	3.2	0.830	35.0	LOS D	25.0	187.5	1.00	1.00	1.10	28.7
31	T1	All MCs	655	3.7	655	3.7	0.830	76.3	LOS E	29.5	220.9	0.99	0.96	1.08	30.7
32	R2	All MCs	83	2.3	83	2.3	1.591	648.5	LOS F	16.8	122.9	1.00	1.51	3.34	5.3
Approach			840	3.5	840	3.5	1.591	127.7	LOS F	29.5	220.9	0.99	1.02	1.30	19.3
All Vehicles			2945	3.3	2945	3.3	1.591	154.0	LOS F	62.1	467.0	0.99	1.24	1.57	16.1

LEVEL OF SERVICE

Site: 05 [Liberation Legacy Way and Churchill Avenue (Site Folder: Borrowdale Road Corridor)]

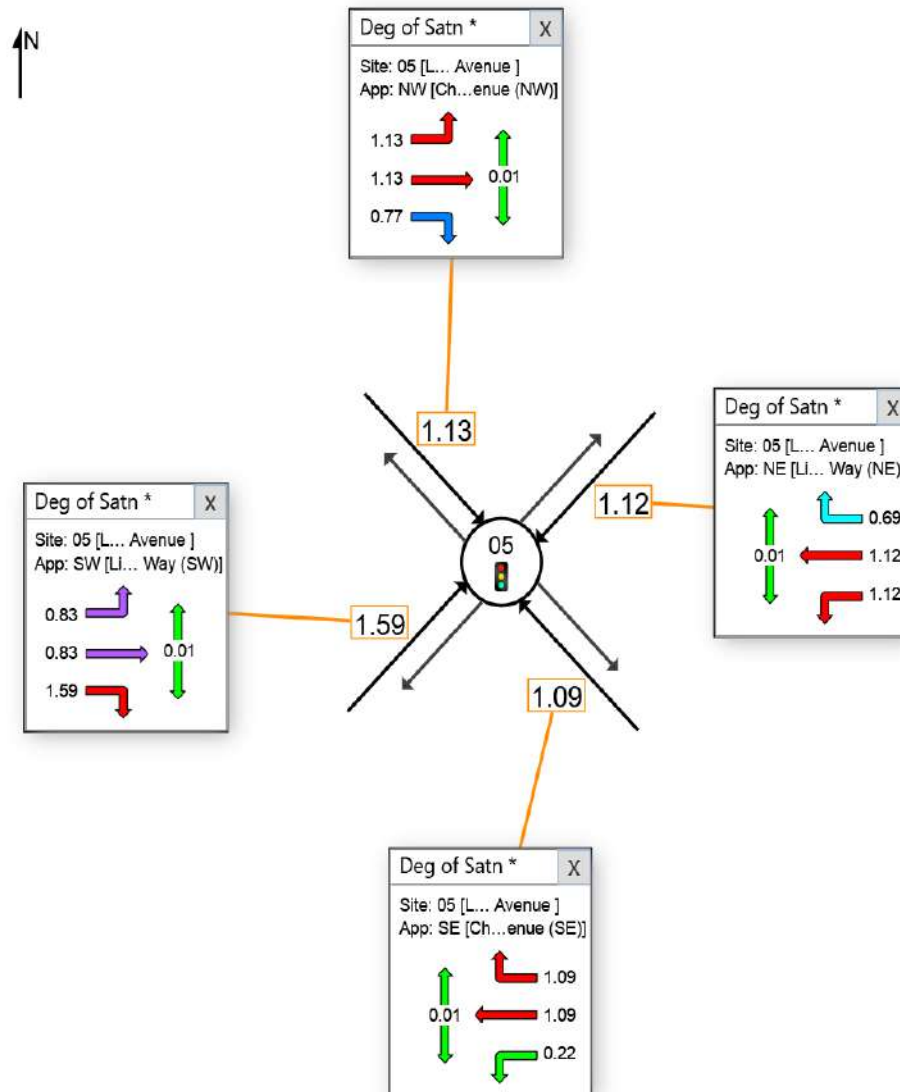
	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	F	F	F	F	F



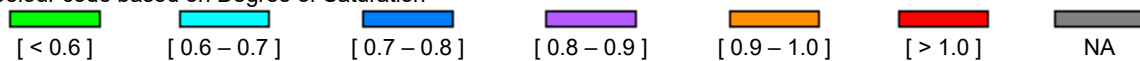
DEGREE OF SATURATION

 Site: 05 [Liberation Legacy Way and Churchill Avenue (Site Folder: Borrowdale Road Corridor)]

All Movement Classes (*)



Colour code based on Degree of Saturation



Corridor Nodal Capacity Results Interpretation and Analysis: The Liberation Legacy Way / Domboshawa Corridor

Site 01: Borrowdale Road and Scam Way

	Approaches			Intersection
	Northeast	Northwest	Southwest	
LOS	F	F	F	F

Site 02: Borrowdale Road and Crowhill Road

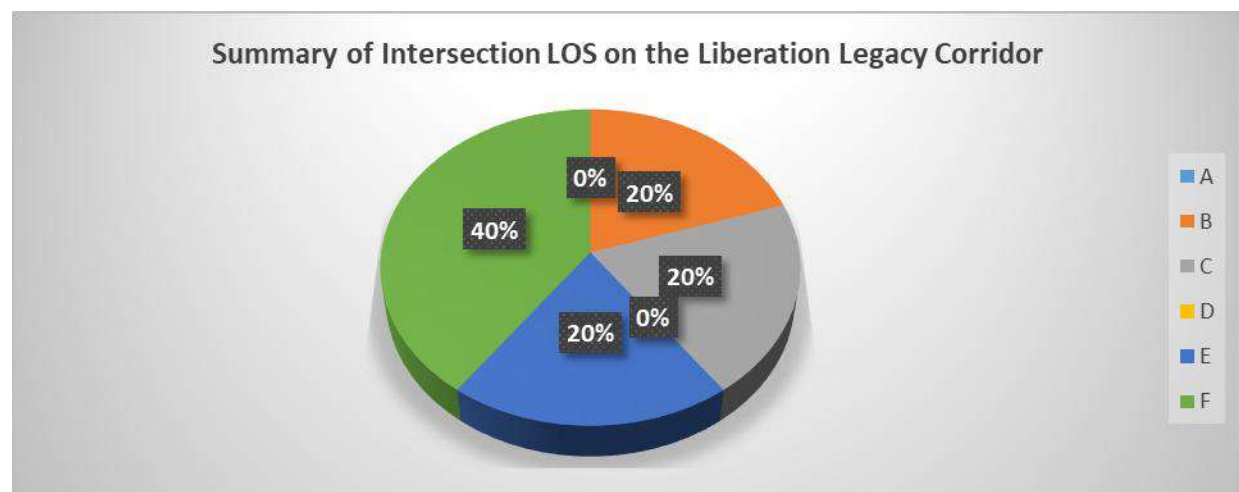
	Approaches			Intersection
	Southeast	Northeast	Southwest	
LOS	B	A	C	B

Site 03: Borrowdale Road and Whitwell Road

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	B	C	C

Site 04: Borrowdale Road and Churchill Road

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	F	F	F	F	F



The liberation legacy corridor is generally performing well when it comes to intersection capacity, however one (1) of this studied intersection requires a **signal warrant study** (Liberation Legacy Way and Scam Way, the current yield control traffic control mechanism appears to be failing to optimise on traffic flow on this intersection. The Liberation Legacy Way and Churchill Road intersection requires a further investigation **on the signal timing and phasing plan**, as the current plan seems not to optimise on traffic flow and hence the poor level of service.

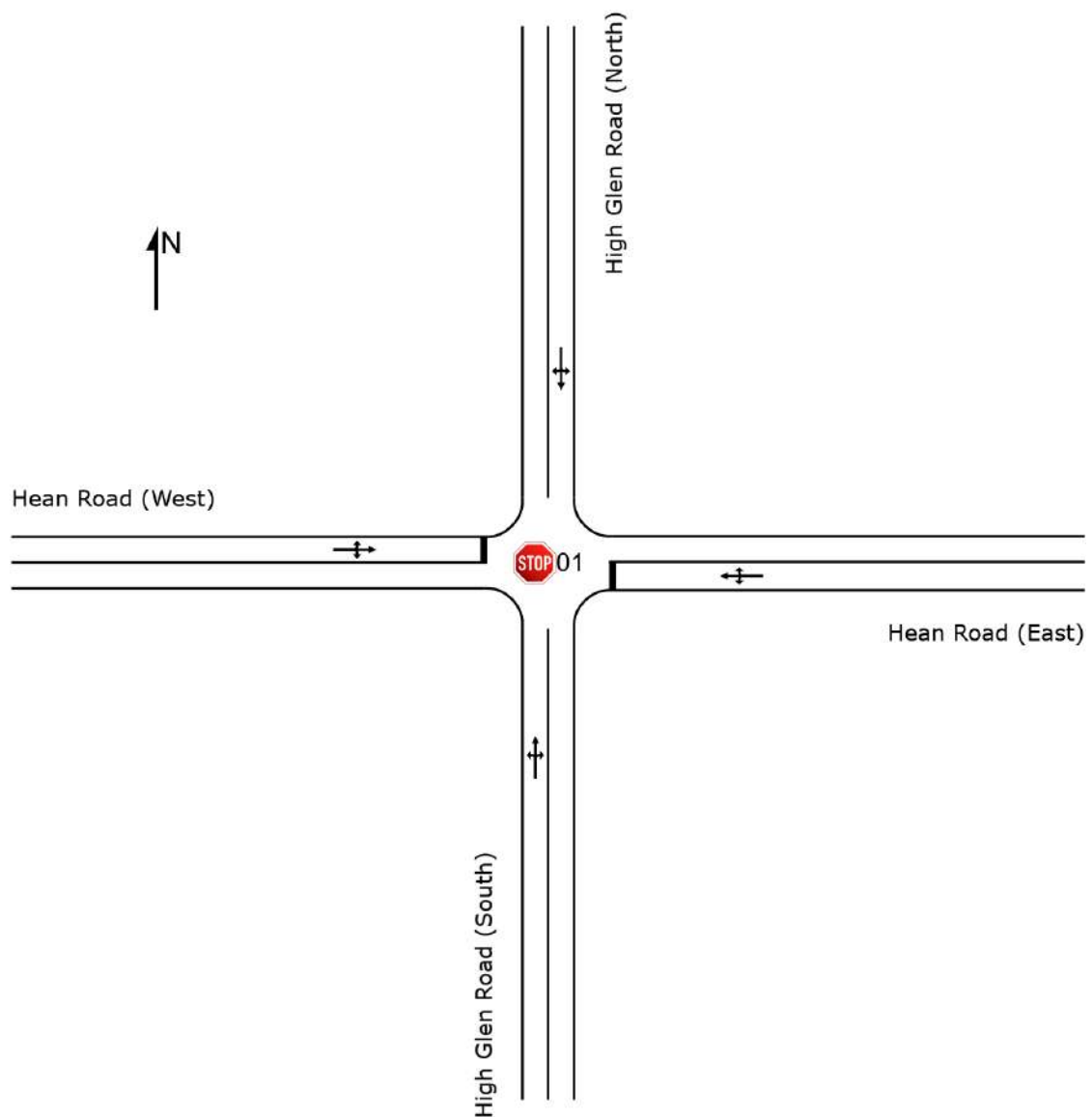
7.1.4.1.9. *Highglen Road Corridor*

Site 01: High glen Road and Heany Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 **Site: 01 [High Glen Road and Hean Road (Site Folder: High glen Road Corridor)]**



MOVEMENT SUMMARY

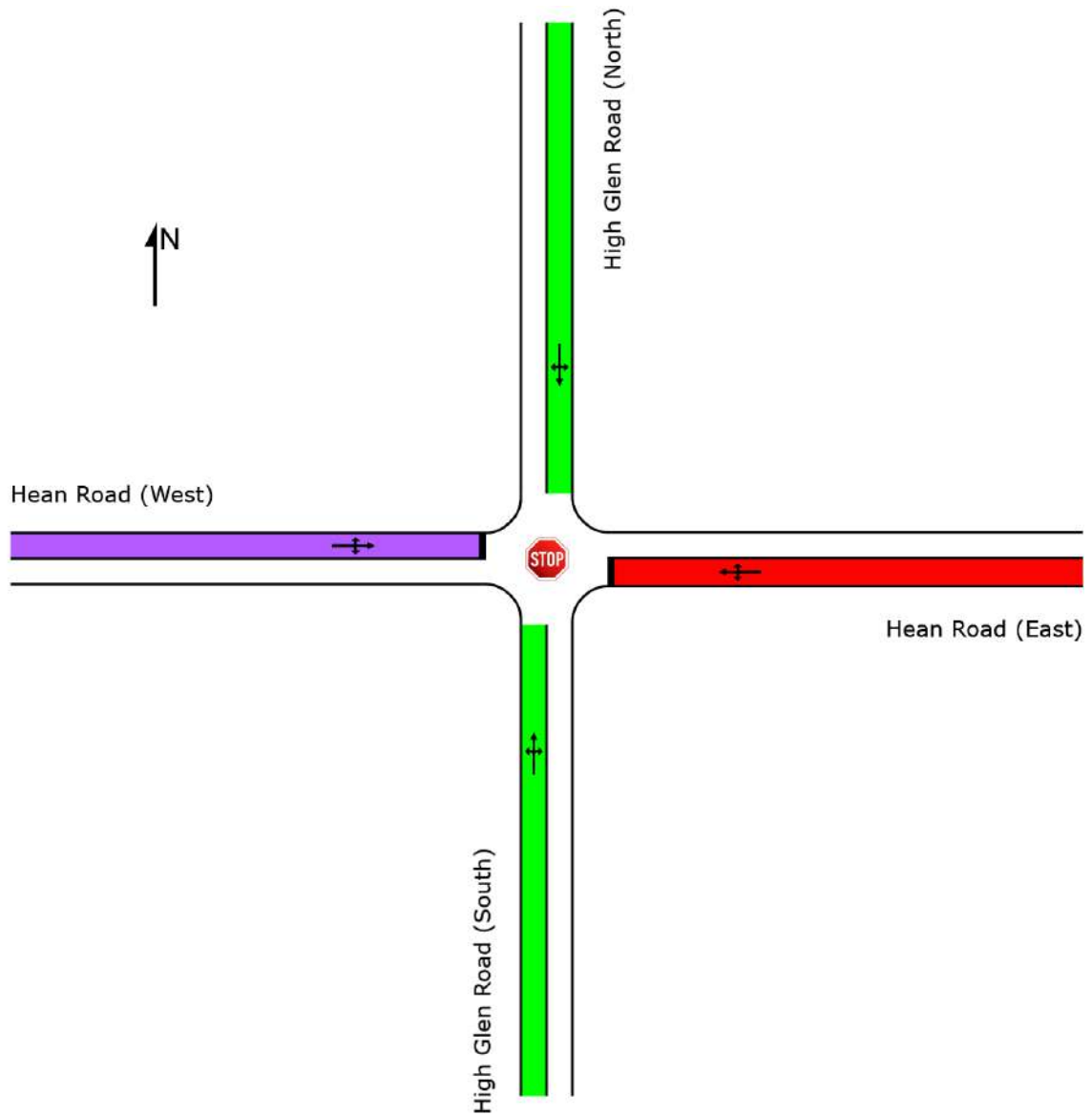
 Site: 01 [High Glen Road and Hean Road (Site Folder: Highglen Road Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: High Glen Road (South)															
1	L2	All MCs	69	3.5	69	3.5	0.214	6.9	LOS A	0.4	2.9	0.17	0.35	0.17	53.6
2	T1	All MCs	179	7.7	179	7.7	0.214	0.9	LOS A	0.4	2.9	0.17	0.35	0.17	55.2
3	R2	All MCs	22	6.6	22	6.6	0.214	9.8	LOS A	0.4	2.9	0.17	0.35	0.17	52.8
Approach			271	6.5	271	6.5	0.214	3.2	NA	0.4	2.9	0.17	0.35	0.17	54.6
East: Hean Road (East)															
4	L2	All MCs	36	4.9	36	4.9	0.988	58.0	LOS F	13.9	99.6	0.99	2.12	4.93	27.7
5	T1	All MCs	196	7.1	196	7.1	0.988	69.5	LOS F	13.9	99.6	0.99	2.12	4.93	27.6
6	R2	All MCs	64	3.3	64	3.3	0.988	75.0	LOS F	13.9	99.6	0.99	2.12	4.93	27.6
Approach			296	6.0	296	6.0	0.988	69.3	LOS F	13.9	99.6	0.99	2.12	4.93	27.6
North: High Glen Road (North)															
7	L2	All MCs	208	7.5	208	7.5	0.553	6.0	LOS A	1.0	7.6	0.10	0.27	0.12	54.3
8	T1	All MCs	469	7.8	469	7.8	0.553	0.3	LOS A	1.0	7.6	0.10	0.27	0.12	56.8
9	R2	All MCs	54	2.8	54	2.8	0.553	7.2	LOS A	1.0	7.6	0.10	0.27	0.12	54.1
Approach			732	7.3	732	7.3	0.553	2.4	NA	1.0	7.6	0.10	0.27	0.12	55.8
West: Hean Road (West)															
10	L2	All MCs	28	3.3	28	3.3	0.756	19.1	LOS C	5.0	35.4	0.89	1.35	2.09	37.8
11	T1	All MCs	166	3.9	166	3.9	0.756	34.8	LOS D	5.0	35.4	0.89	1.35	2.09	38.3
12	R2	All MCs	26	3.5	26	3.5	0.756	36.7	LOS E	5.0	35.4	0.89	1.35	2.09	38.0
Approach			220	3.8	220	3.8	0.756	33.0	LOS D	5.0	35.4	0.89	1.35	2.09	38.2
All Vehicles			1518	6.4	1518	6.4	0.988	20.0	NA	13.9	99.6	0.40	0.80	1.35	43.9

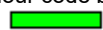
LEVEL OF SERVICE

 Site: 01 [High Glen Road and Hean Road (Site Folder: High glen Road Corridor)]

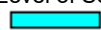
	Approaches				Intersection
	South	East	North	West	
LOS	NA (TWSC)	F	NA (TWSC)	D	NA (TWSC)



Colour code based on Level of Service



LOS A



LOS B



LOS C



LOS D



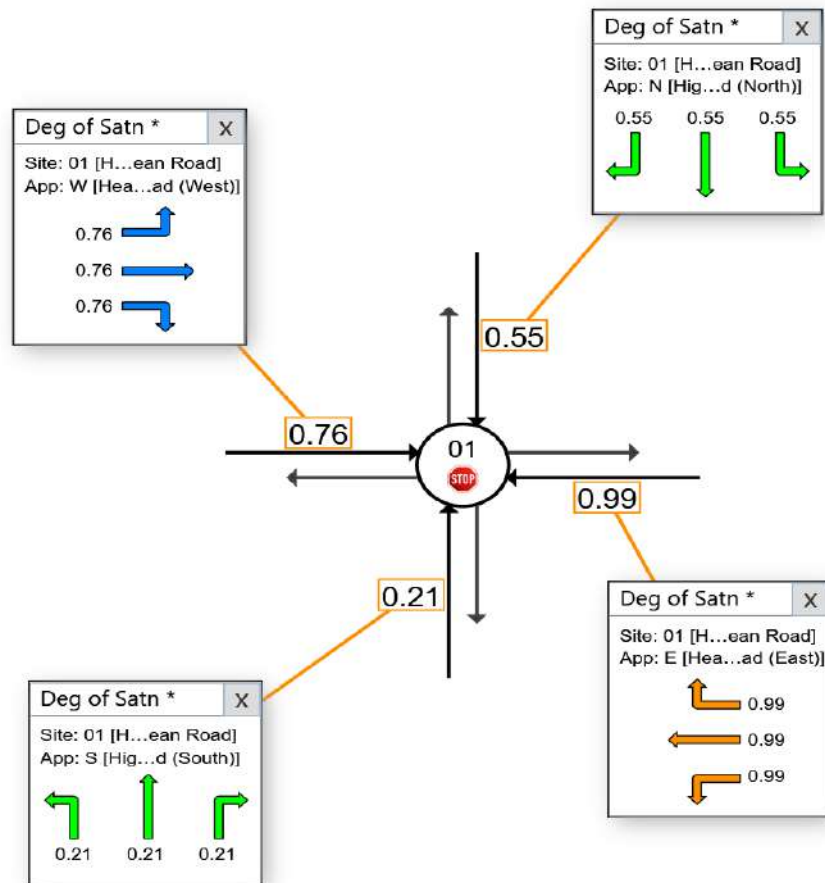
LOS E



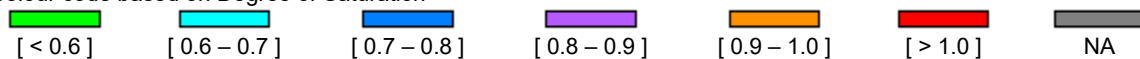
LOS F

DEGREE OF SATURATION

 Site: 01 [High Glen Road and Hean Road (Site Folder: High glen Road Corridor)]



Colour code based on Degree of Saturation

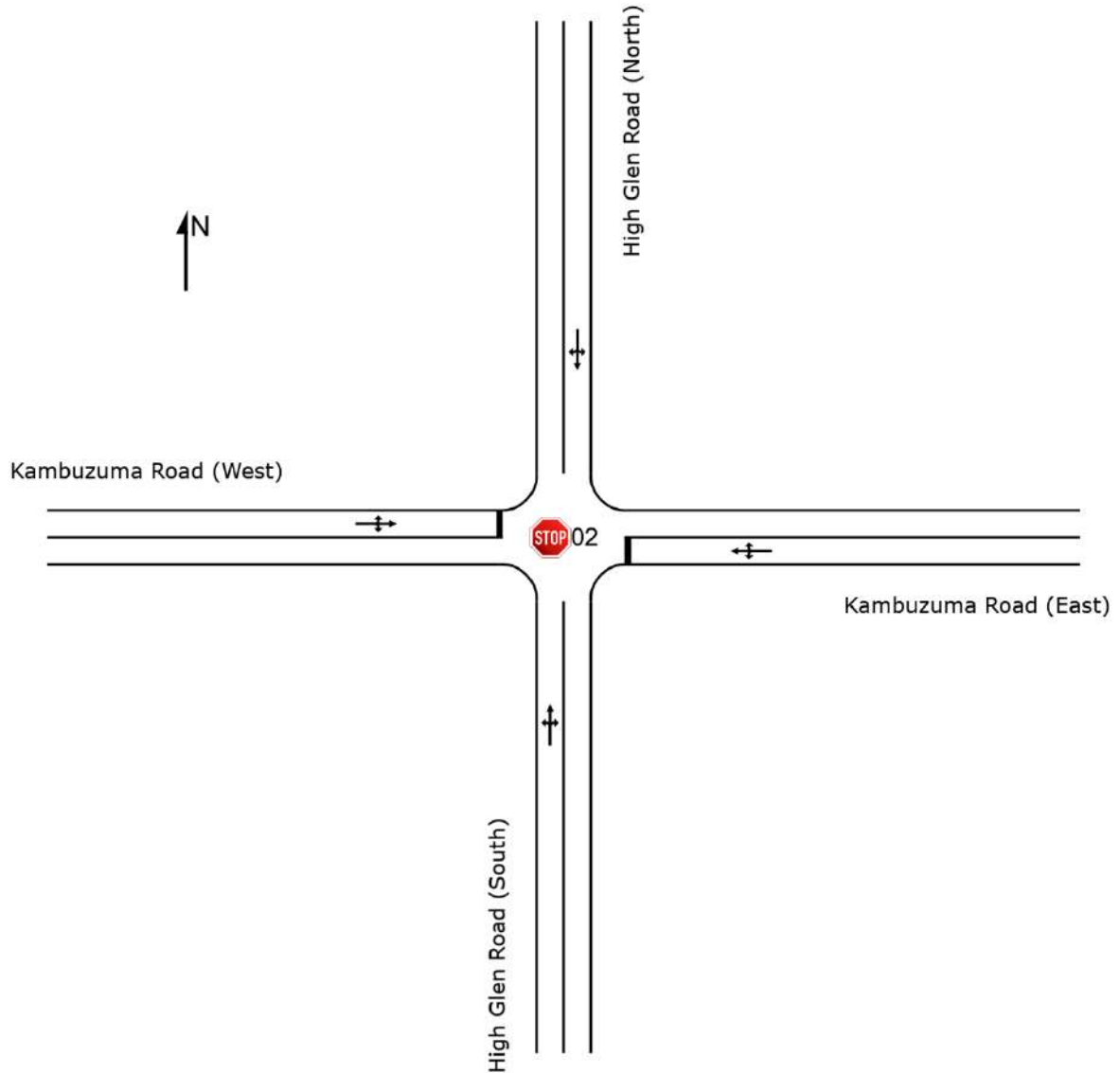


Site 02: High glen Road and Kambuzuma Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 02 [High Glen Road and Kambuzuma Road (Site Folder: Highglen Road Corridor)]



MOVEMENT SUMMARY

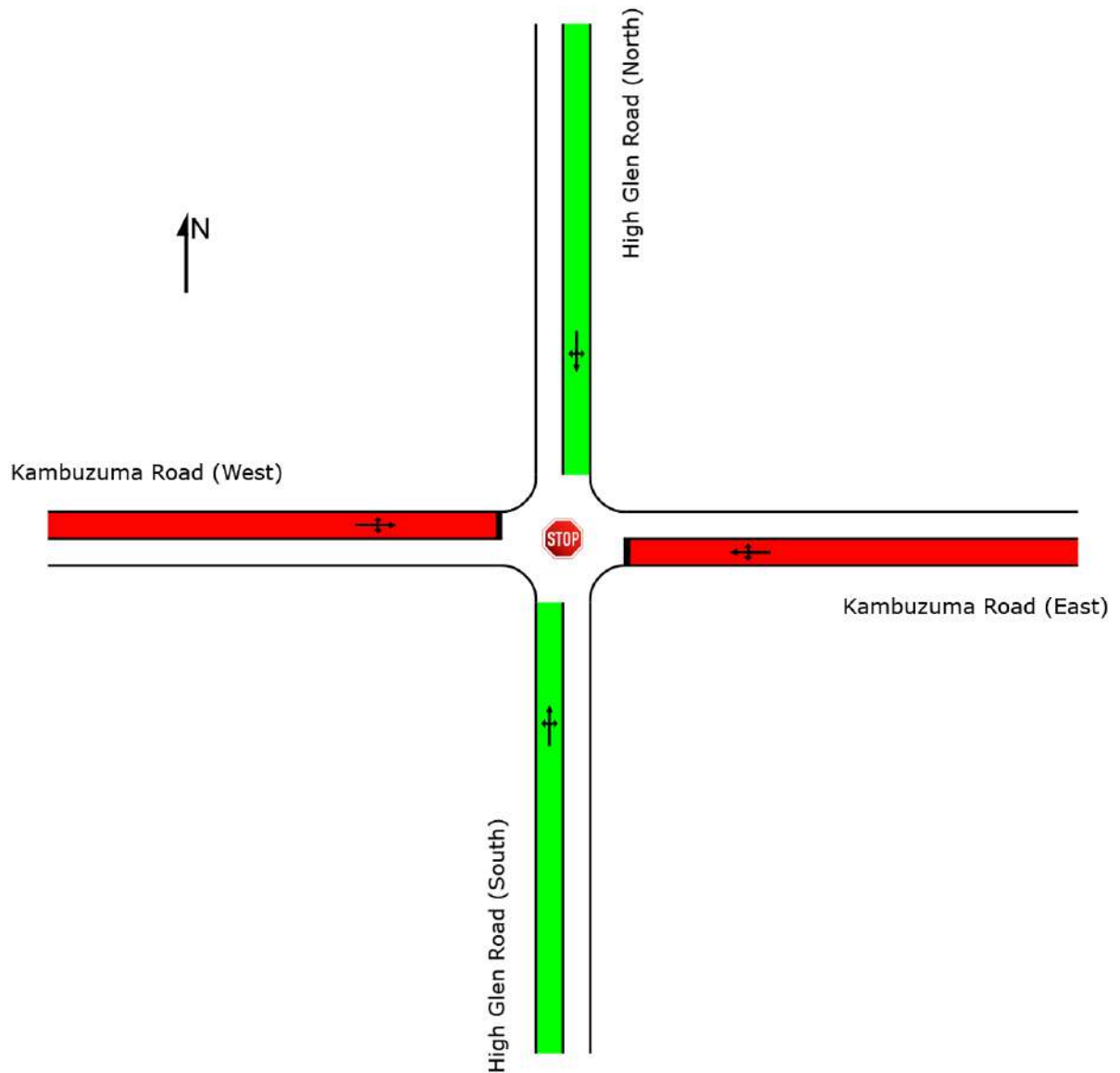
 Site: 02 [High Glen Road and Kambuzuma Road (Site Folder: High glen Road Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: High Glen Road (South)															
1	L2	All MCs	52	8.5	52	8.5	0.301	7.9	LOS A	1.4	11.5	0.36	0.42	0.36	53.5
2	T1	All MCs	259	14.3	259	14.3	0.301	1.3	LOS A	1.4	11.5	0.36	0.42	0.36	56.3
3	R2	All MCs	113	13.8	113	13.8	0.301	8.3	LOS A	1.4	11.5	0.36	0.42	0.36	53.0
Approach			423	13.4	423	13.4	0.301	4.0	NA	1.4	11.5	0.36	0.42	0.36	55.0
East: Kambuzuma Road (East)															
4	L2	All MCs	145	13.6	145	13.6	1.453	424.3	LOS F	105.0	848.7	1.00	6.67	18.32	7.3
5	T1	All MCs	298	5.7	298	5.7	1.453	438.5	LOS F	105.0	848.7	1.00	6.67	18.32	7.3
6	R2	All MCs	62	9.5	62	9.5	1.453	459.7	LOS F	105.0	848.7	1.00	6.67	18.32	7.3
Approach			505	8.4	505	8.4	1.453	437.0	LOS F	105.0	848.7	1.00	6.67	18.32	7.3
North: High Glen Road (North)															
7	L2	All MCs	96	9.2	96	9.2	0.189	5.7	LOS A	0.1	0.5	0.02	0.19	0.02	55.3
8	T1	All MCs	216	16.5	216	16.5	0.189	0.0	LOS A	0.1	0.5	0.02	0.19	0.02	58.1
9	R2	All MCs	4	6.9	4	6.9	0.189	6.6	LOS A	0.1	0.5	0.02	0.19	0.02	54.9
Approach			316	14.2	316	14.2	0.189	1.8	NA	0.1	0.5	0.02	0.19	0.02	57.2
West: Kambuzuma Road (West)															
10	L2	All MCs	31	55.2	31	55.2	2.079	989.1	LOS F	73.3	707.8	1.00	7.82	22.25	3.4
11	T1	All MCs	150	15.7	150	15.7	2.079	1002.4	LOS F	73.3	707.8	1.00	7.82	22.25	3.4
12	R2	All MCs	39	33.5	39	33.5	2.079	1064.9	LOS F	73.3	707.8	1.00	7.82	22.25	3.4
Approach			221	24.5	221	24.5	2.079	1011.6	LOS F	73.3	707.8	1.00	7.82	22.25	3.4
All Vehicles			1465	13.5	1465	13.5	2.079	304.5	NA	105.0	848.7	0.60	3.64	9.77	9.9

LEVEL OF SERVICE

 Site: 02 [High Glen Road and Kambuzuma Road (Site Folder: High glen Road Corridor)]

	Approaches				Intersection
	South	East	North	West	
LOS	NA (TWSC)	F	NA (TWSC)	F	NA (TWSC)



Colour code based on Level of Service

 LOS A

 LOS B

 LOS C

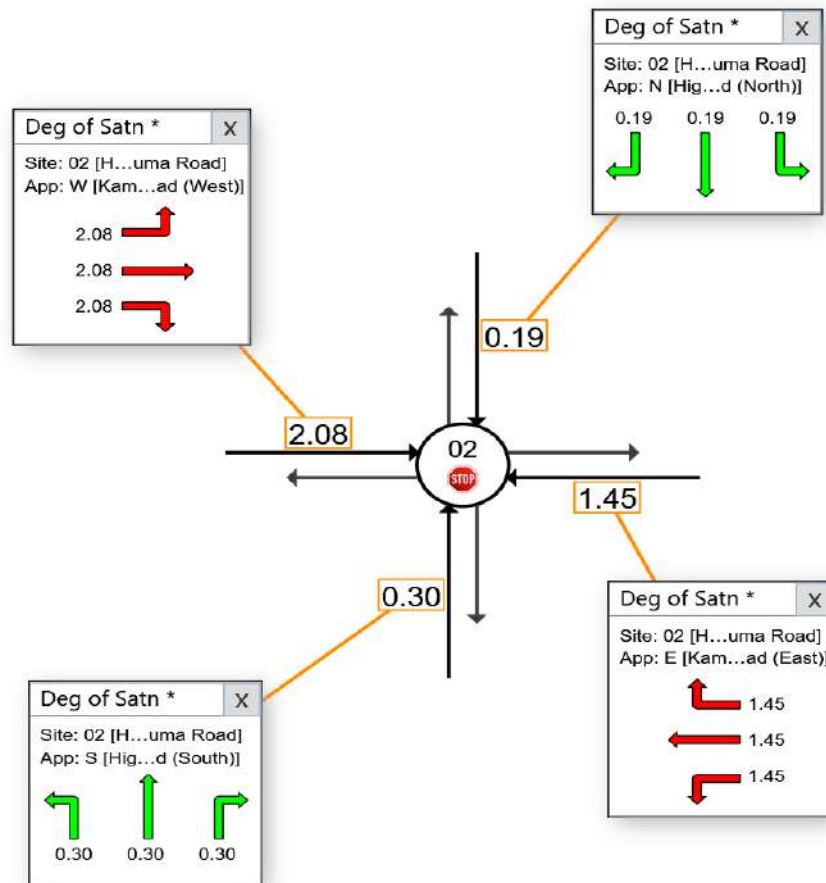
 LOS D

 LOS E

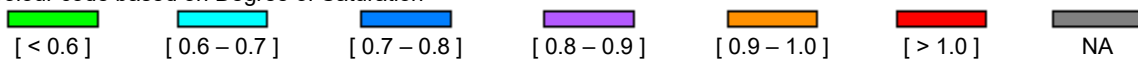
 LOS F

DEGREE OF SATURATION

 Site: 02 [High Glen Road and Kambuzuma Road (Site Folder: High glen Road Corridor)]



Colour code based on Degree of Saturation

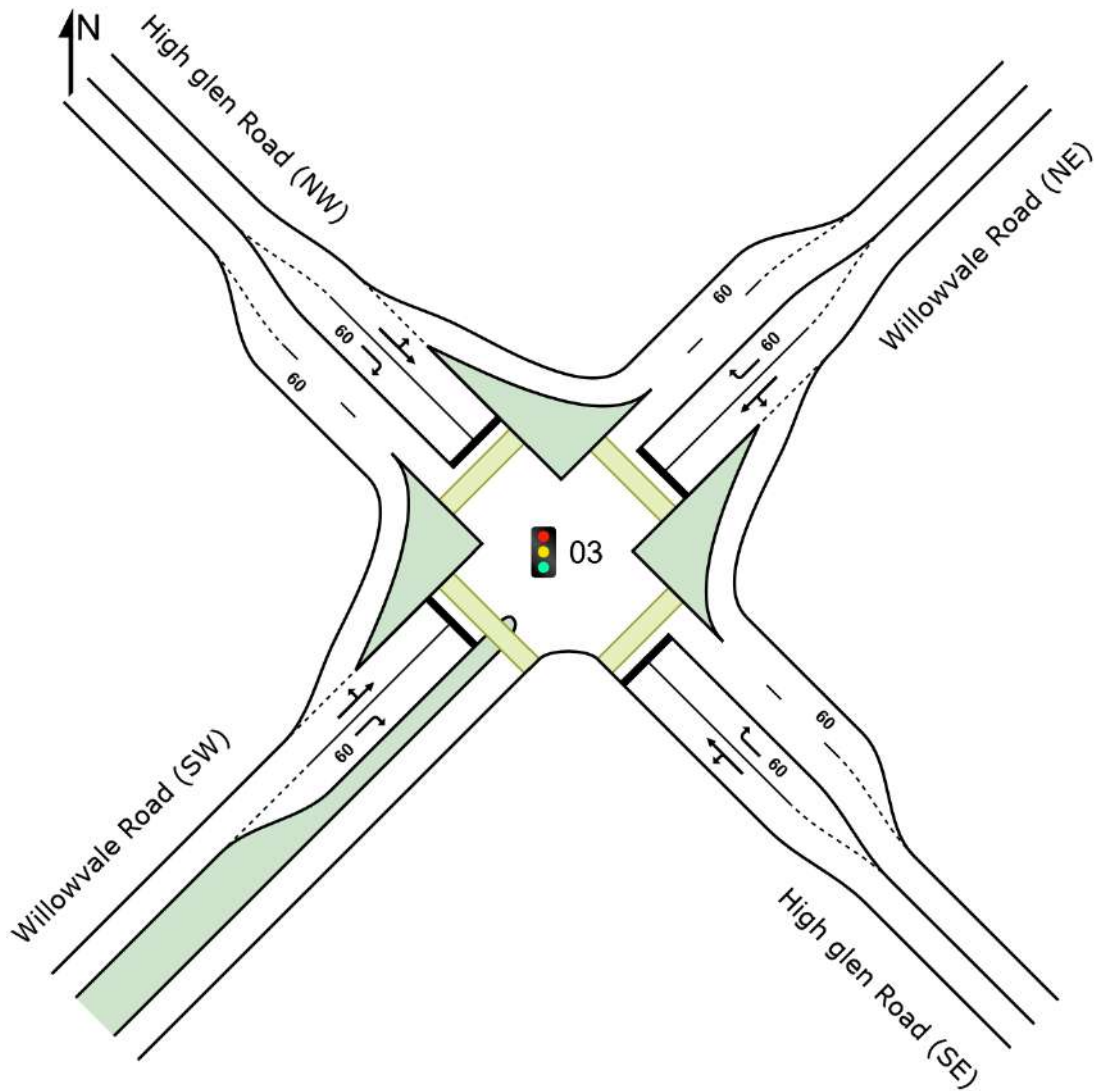


Site 03: High glen Road and Willowvale Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 03 [Highglen Road and Willowvale Road (Site Folder: Highglen Road Corridor)]



MOVEMENT SUMMARY

 Site: 03 [Highglen Road and Willowvale Road (Site Folder: Highglen Road Corridor)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site

Site Category: Existing Design

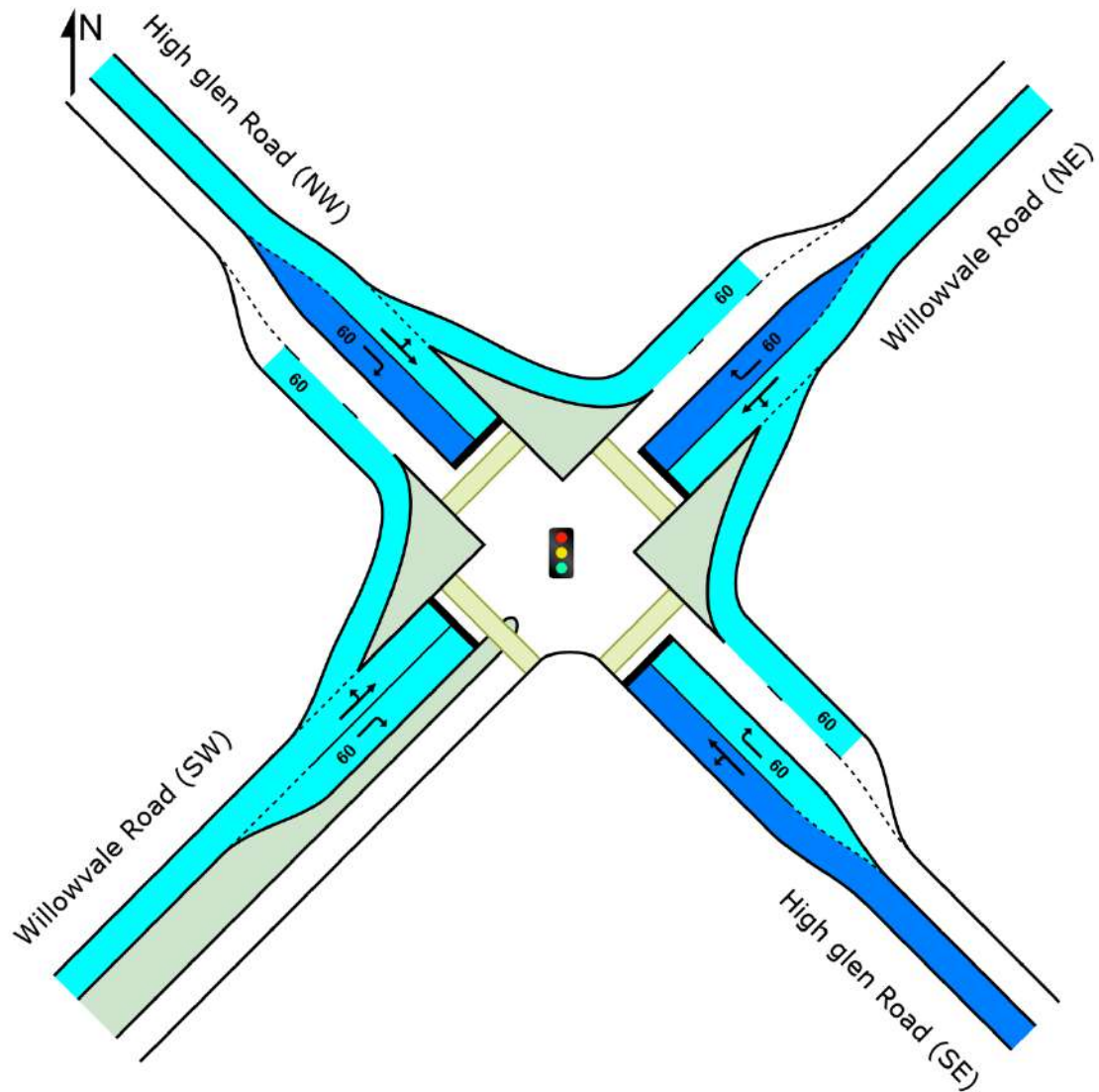
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 40 seconds (Site Practical Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
SouthEast: High glen Road (SE)															
21	L2	All MCs	82	10.6	82	10.6	0.833	27.8	LOS C	6.9	59.9	0.98	1.07	1.50	41.2
22	T1	All MCs	199	14.8	199	14.8	0.833 *	22.2	LOS C	6.9	59.9	0.98	1.07	1.50	42.9
23	R2	All MCs	83	13.6	83	13.6	0.215	18.5	LOS B	1.3	11.3	0.81	0.74	0.81	44.2
Approach			363	13.6	363	13.6	0.833	22.6	LOS C	6.9	59.9	0.94	1.00	1.34	42.8
NorthEast: Willowvale Road (NE)															
24	L2	All MCs	120	10.5	120	10.5	0.597	6.2	LOS A	5.6	45.0	0.82	0.75	0.83	48.2
25	T1	All MCs	231	8.9	231	8.9	0.597	15.4	LOS B	5.6	45.0	0.82	0.75	0.83	50.0
26	R2	All MCs	74	13.8	74	13.8	0.316	23.6	LOS C	1.4	12.0	0.93	0.75	0.93	41.4
Approach			424	10.2	424	10.2	0.597	14.3	LOS B	5.6	45.0	0.84	0.75	0.85	47.8
NorthWest: High glen Road (NW)															
27	L2	All MCs	93	6.5	93	6.5	0.417	6.8	LOS A	3.0	24.1	0.76	0.70	0.76	47.9
28	T1	All MCs	111	11.5	111	11.5	0.417	18.2	LOS B	3.0	24.1	0.76	0.70	0.76	49.5
29	R2	All MCs	10	16.5	10	16.5	0.054	25.8	LOS C	0.2	1.8	0.95	0.65	0.95	40.6
Approach			213	9.5	213	9.5	0.417	13.6	LOS B	3.0	24.1	0.77	0.69	0.77	48.3
SouthWest: Willowvale Road (SW)															
30	L2	All MCs	63	8.9	63	8.9	0.788	10.5	LOS B	9.5	74.9	0.93	0.96	1.20	45.4
31	T1	All MCs	383	9.0	383	9.0	0.788 *	18.2	LOS B	9.5	74.9	0.93	0.96	1.20	46.9
32	R2	All MCs	70	13.4	70	13.4	0.206	19.4	LOS B	1.2	10.2	0.83	0.74	0.83	43.5
Approach			516	9.6	516	9.6	0.788	17.4	LOS B	9.5	74.9	0.92	0.93	1.15	46.2
All Vehicles			1516	10.7	1516	10.7	0.833	17.2	LOS B	9.5	74.9	0.88	0.86	1.06	46.0

LEVEL OF SERVICE

 Site: 03 [High glen Road and Willowvale Road (Site Folder: High glen Road Corridor)]

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	C	B	B	B	B



Colour code based on Level of Service

 LOS A

 LOS B

 LOS C

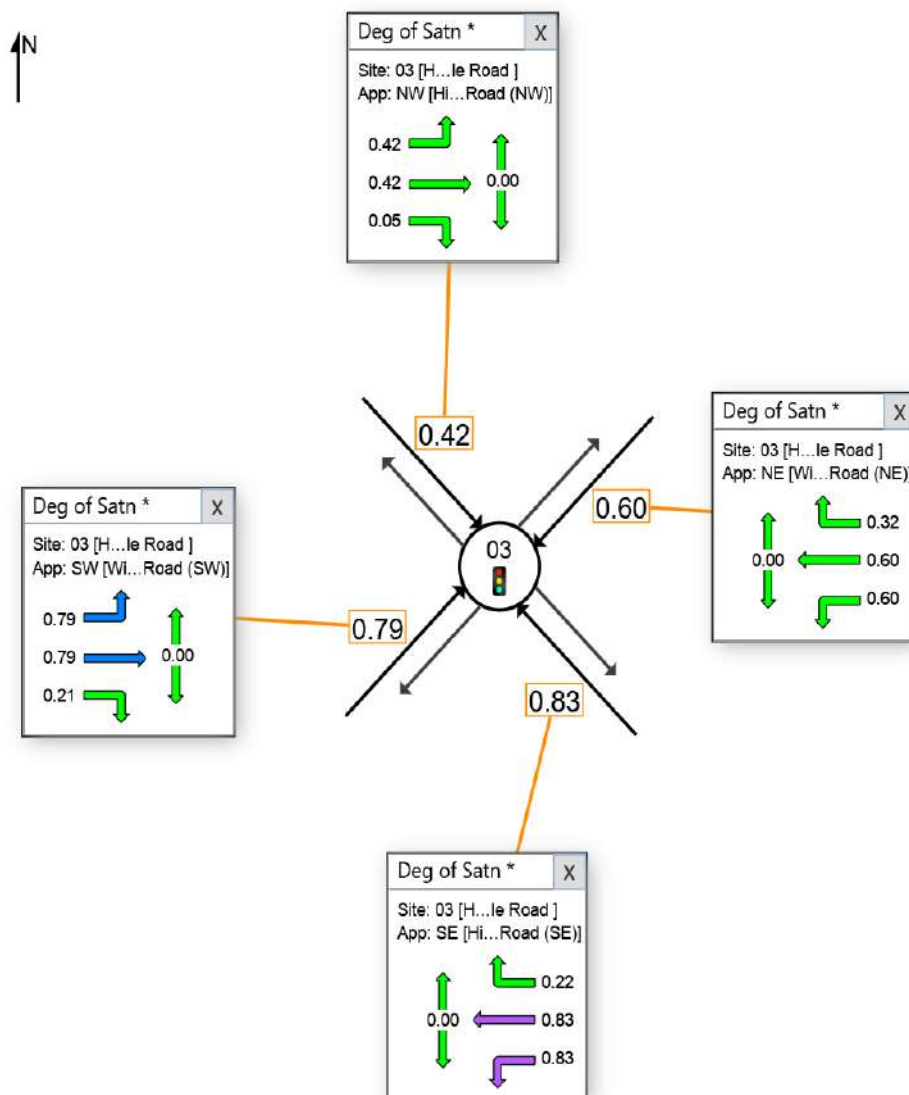
 LOS D

 LOS E

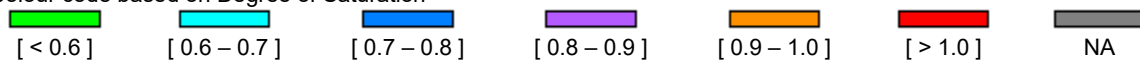
 LOS F

DEGREE OF SATURATION

 Site: 03 [High glen Road and Willowvale Road (Site Folder: High glen Road Corridor)]



Colour code based on Degree of Saturation

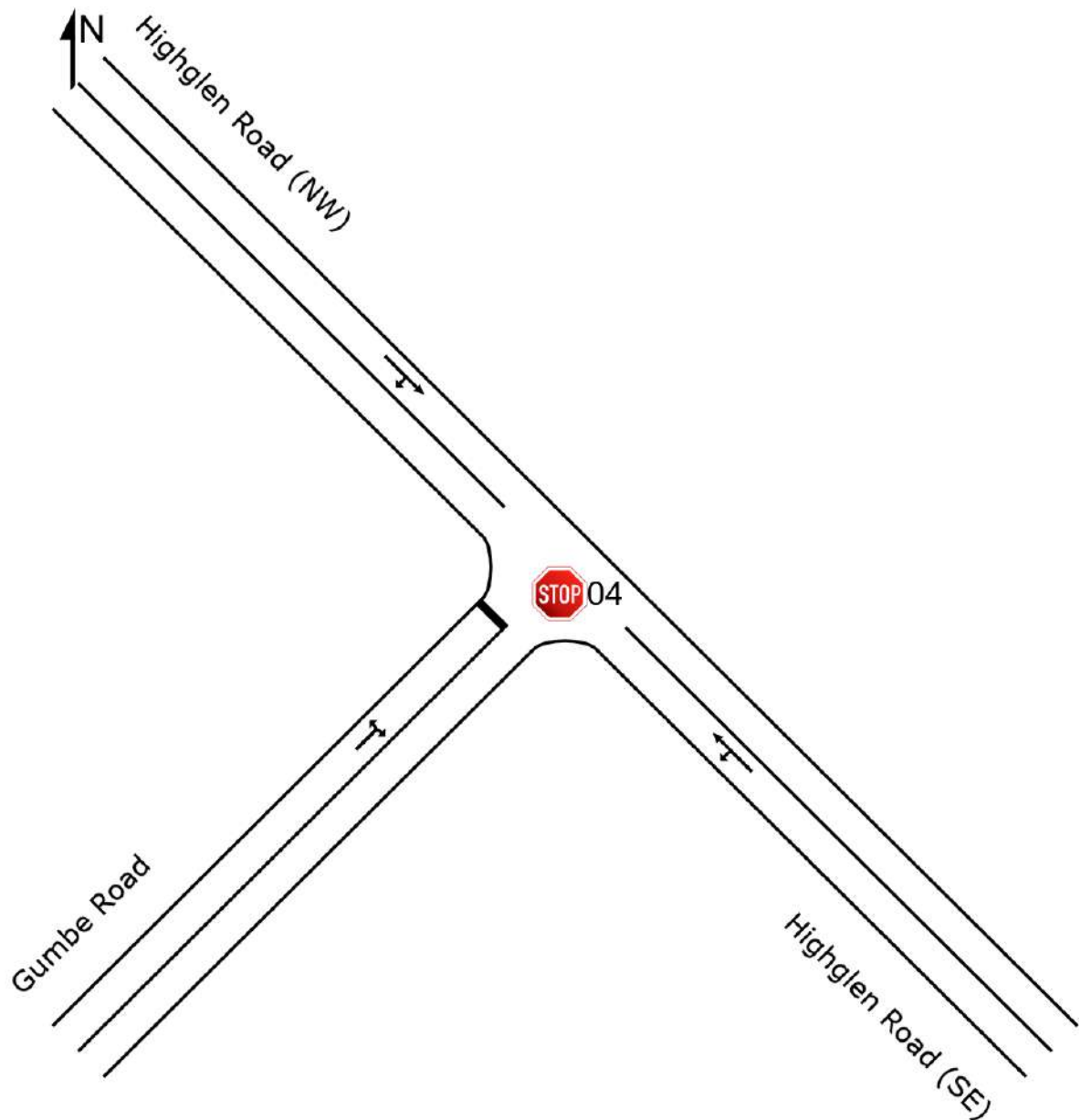


Site 04: High glen Road and Gumbe Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 04 [High glen Road and Gumbe Road (Site Folder: High glen Road Corridor)]



MOVEMENT SUMMARY

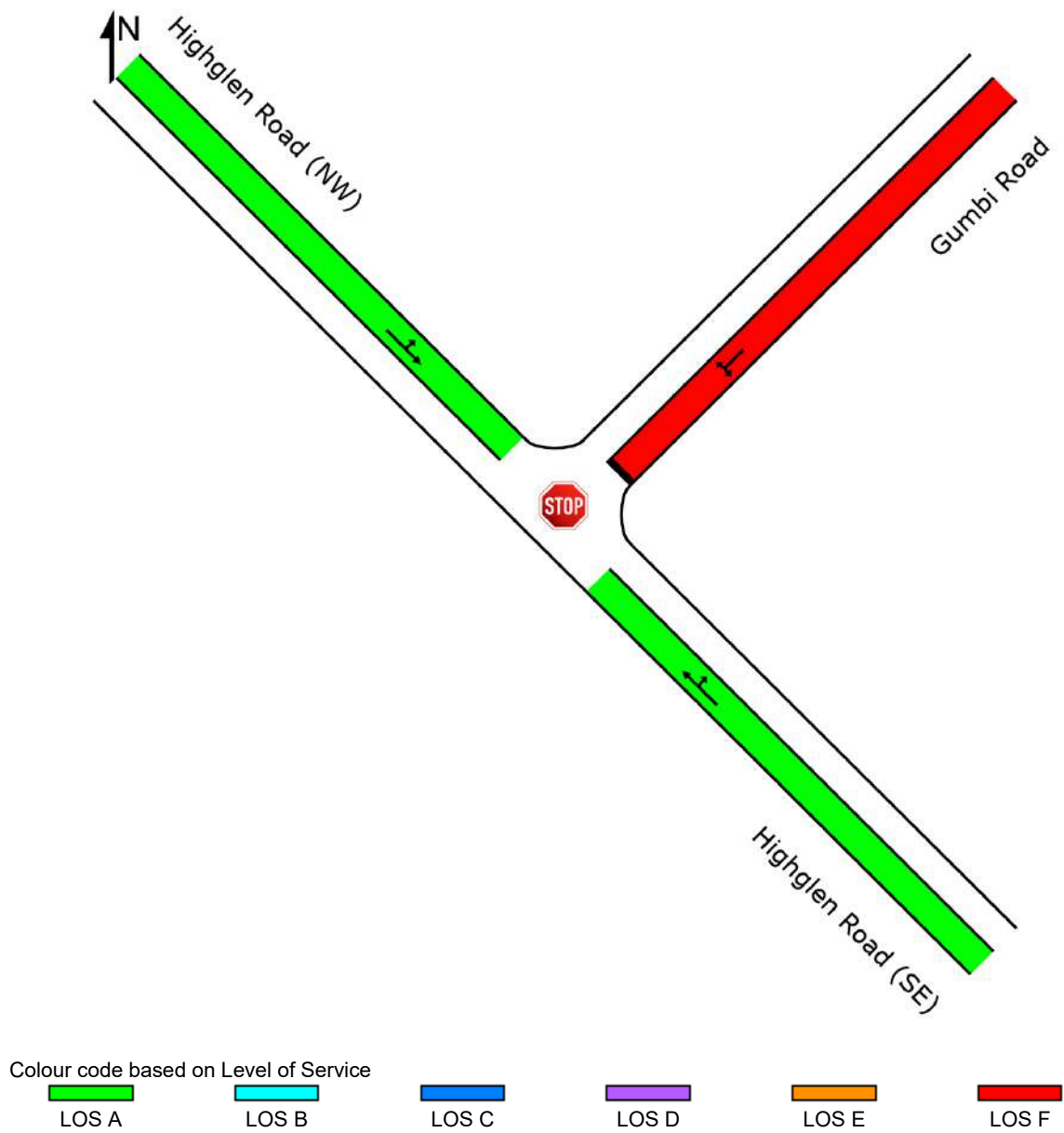
 Site: 04 [High glen Road and Gumbe Road (Site Folder: High glen Road Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Highglen Road (SE)															
22	T1	All MCs	395	6.8	395	6.8	0.313	1.0	LOS A	1.1	8.1	0.28	0.34	0.28	57.2
23	R2	All MCs	98	1.4	98	1.4	0.313	8.3	LOS A	1.1	8.1	0.28	0.34	0.28	54.7
Approach			492	5.7	492	5.7	0.313	2.4	NA	1.1	8.1	0.28	0.34	0.28	56.7
NorthEast: Gumbe Road															
24	L2	All MCs	416	16.4	416	16.4	2.989	1806.0	LOS F	294.6	2560.8	1.00	13.51	38.09	1.9
26	R2	All MCs	289	16.1	289	16.1	2.989	1842.4	LOS F	294.6	2560.8	1.00	13.51	38.09	1.9
Approach			704	16.3	704	16.3	2.989	1820.9	LOS F	294.6	2560.8	1.00	13.51	38.09	1.9
NorthWest: Highglen Road (NW)															
27	L2	All MCs	49	1.4	49	1.4	0.276	5.6	LOS A	0.0	0.0	0.00	0.06	0.00	56.4
28	T1	All MCs	454	8.1	454	8.1	0.276	0.1	LOS A	0.0	0.0	0.00	0.06	0.00	58.8
Approach			503	7.4	503	7.4	0.276	0.6	NA	0.0	0.0	0.00	0.06	0.00	58.6
All Vehicles			1700	10.6	1700	10.6	2.989	755.2	NA	294.6	2560.8	0.49	5.71	15.86	4.5

LEVEL OF SERVICE

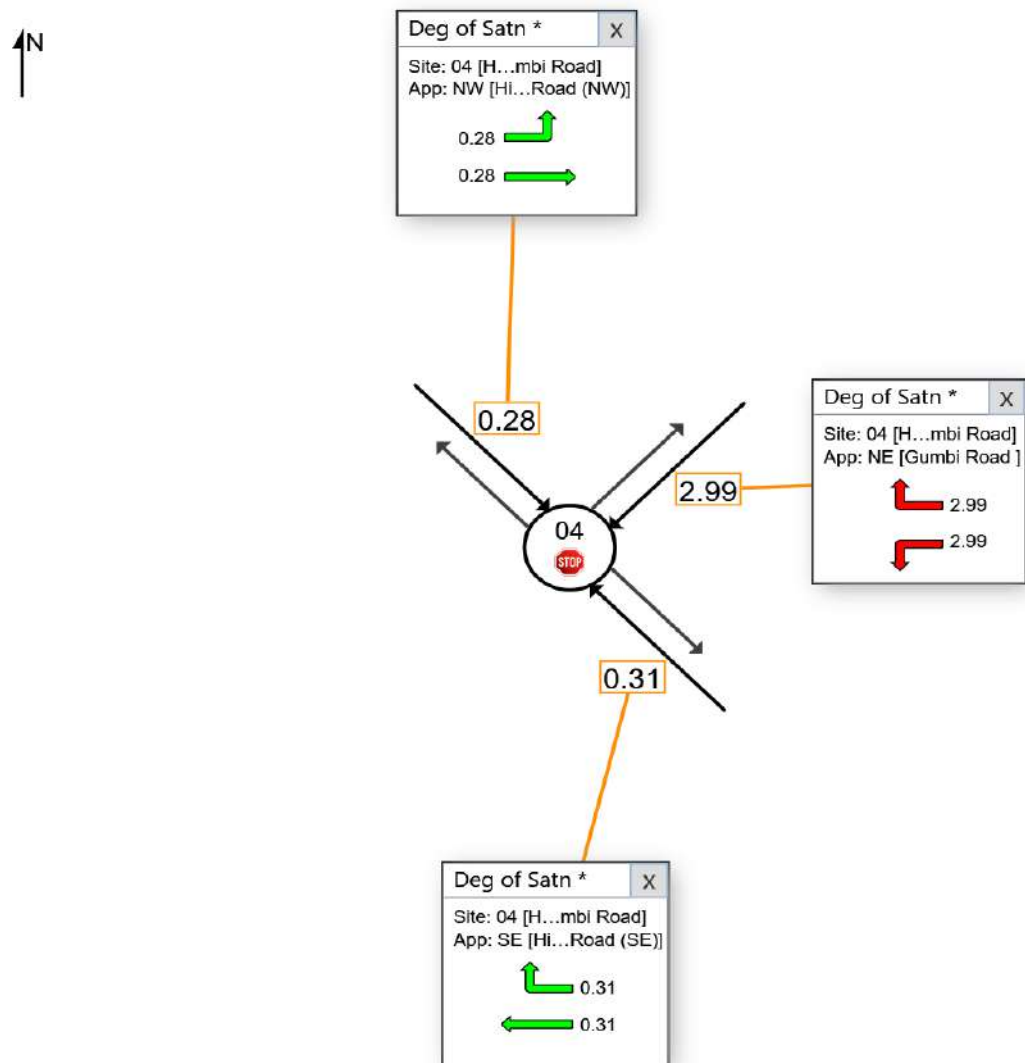
 Site: 04 [High glen Road and Gumbe Road (Site Folder: High glen Road Corridor)]

	Approaches			Intersection
	Southeast	Northeast	Northwest	
LOS	NA (TWSC)	F	NA (TWSC)	NA (TWSC)

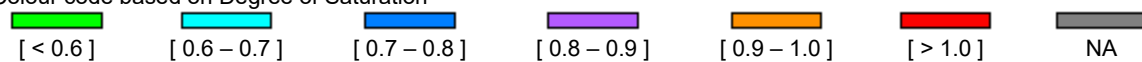


DEGREE OF SATURATION

 Site: 04 [High glen Road and Gumbe Road (Site Folder: High glen Road Corridor)]



Colour code based on Degree of Saturation

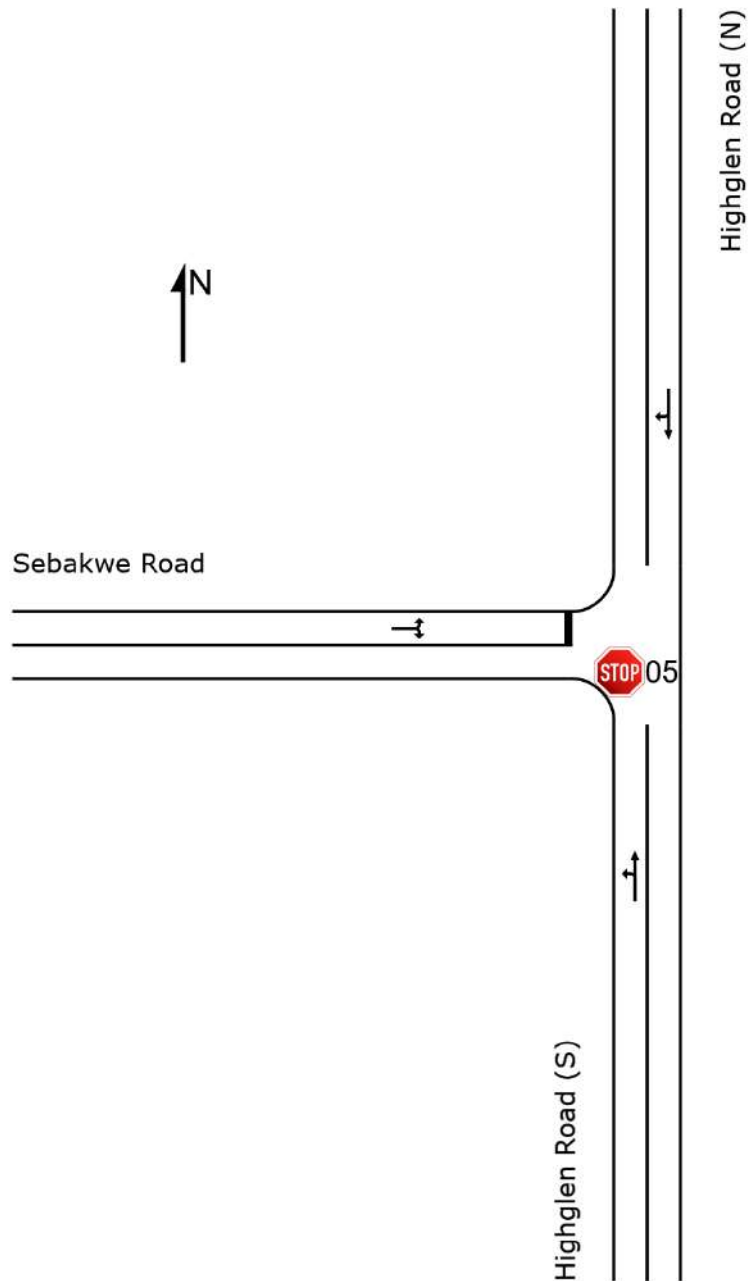


Site 05: High glen Road and Sebakwe Road

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 05 [High glen Road and Sebakwe Road (Site Folder: High glen Road Corridor)]



MOVEMENT SUMMARY

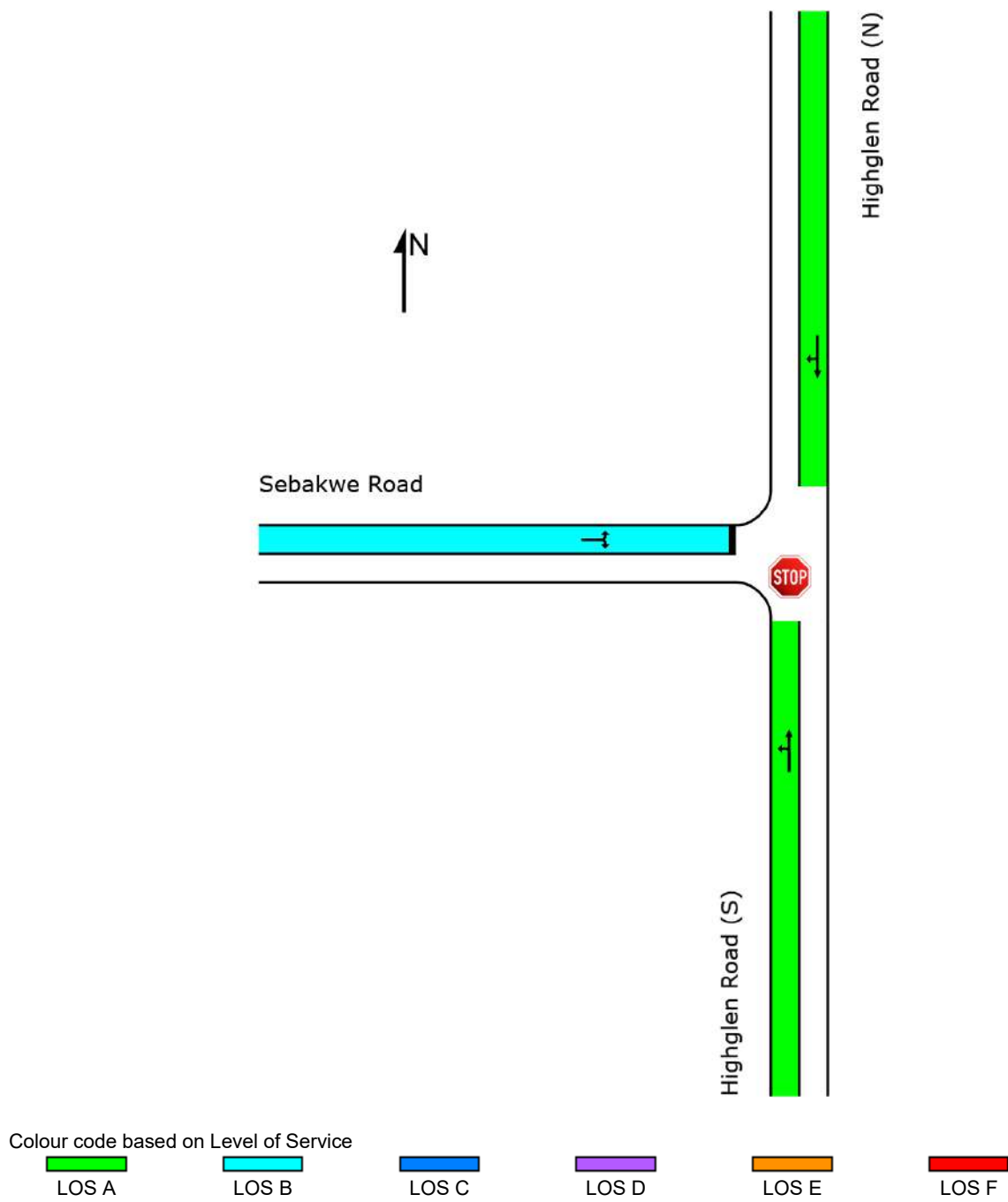
 Site: 05 [Highglen Road and Sebakwe Road (Site Folder: Highglen Road Corridor)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
South: Highglen Road (S)															
1	L2	All MCs	24	2.4	24	2.4	0.107	5.6	LOS A	0.0	0.0	0.00	0.09	0.00	56.3
2	T1	All MCs	133	9.6	133	9.6	0.107	0.0	LOS A	0.0	0.0	0.00	0.09	0.00	58.9
Approach			156	8.5	156	8.5	0.107	0.9	NA	0.0	0.0	0.00	0.09	0.00	58.5
North: Highglen Road (N)															
8	T1	All MCs	94	4.9	94	4.9	0.073	0.1	LOS A	0.1	0.8	0.08	0.12	0.08	58.6
9	R2	All MCs	15	6.4	15	6.4	0.073	6.2	LOS A	0.1	0.8	0.08	0.12	0.08	55.7
Approach			109	5.1	109	5.1	0.073	1.0	NA	0.1	0.8	0.08	0.12	0.08	58.2
West: Sebakwe Road															
10	L2	All MCs	38	28.4	38	28.4	0.122	10.2	LOS B	0.4	4.3	0.35	0.93	0.35	49.2
12	R2	All MCs	50	35.9	50	35.9	0.122	11.8	LOS B	0.4	4.3	0.35	0.93	0.35	48.7
Approach			88	32.7	88	32.7	0.122	11.1	LOS B	0.4	4.3	0.35	0.93	0.35	48.9
All Vehicles			353	13.5	353	13.5	0.122	3.5	NA	0.4	4.3	0.11	0.31	0.11	55.7

LEVEL OF SERVICE

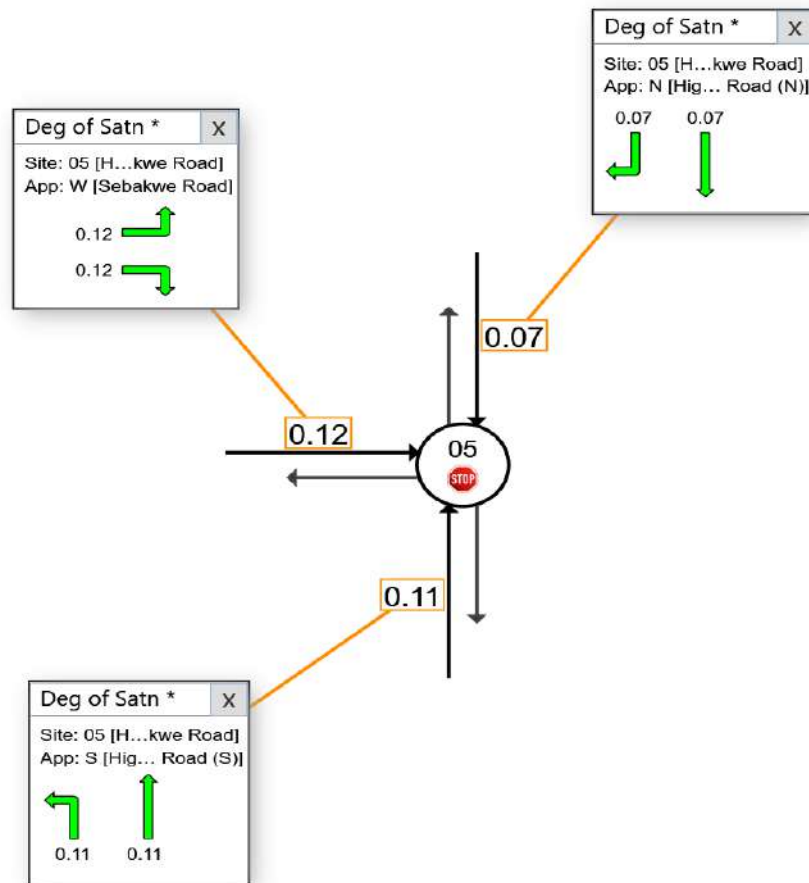
 Site: 05 [Highglen Road and Sebakwe Road (Site Folder: Highglen Road Corridor)]

	Approaches			Intersection
	South	North	West	
LOS	NA (TWSC)	NA (TWSC)	B	NA (TWSC)



DEGREE OF SATURATION

 Site: 05 [Highglen Road and Sebakwe Road (Site Folder: Highglen Road Corridor)]



Colour code based on Degree of Saturation

 [< 0.6]

 [$0.6 - 0.7$]

 [$0.7 - 0.8$]

 [$0.8 - 0.9$]

 [$0.9 - 1.0$]

 [> 1.0]

 NA

Corridor Nodal Capacity Results Interpretation and Analysis: The Highglen Corridor

Site 01: Highglen Road and Hean Road

	Approaches				Intersection
	South	East	North	West	
LOS	NA (TWSC)	F	NA (TWSC)	D	NA (TWSC)

Site 02: Highglen Road and Kambuzuma Road

	Approaches				Intersection
	South	East	North	West	
LOS	NA (TWSC)	F	NA (TWSC)	F	NA (TWSC)

Site 03: Highglen Road and Willowvale Road

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	C	B	B	B	B

Site 04: Highglen Road and Gumbi Road

	Approaches			Intersection
	Southeast	Northwest	Southwest	
LOS	NA (TWSC)	NA (TWSC)	A	NA (TWSC)

Site 05: Highglen Road and Sebakwe Road

	Approaches			Intersection
	South	North	West	
LOS	NA (TWSC)	NA (TWSC)	B	NA (TWSC)

While the studied intersections along Highglen road are generally performing reasonably well, it is important to note that the worst performing intersections with a high degree of traffic saturation are those with a lower order or low traffic volume traffic control devices such as yield and stop control; signs yet those intersections have long surpassed the level of traffic control by yielding. Such is a case with the Highglen and Kambuzuma road as well as Highglen and Hean Intersections. Hence **a signal warrant study** is required on these intersections to upgrade from stop controlled or yield controlled to traffic light or traffic circle-controlled intersections.

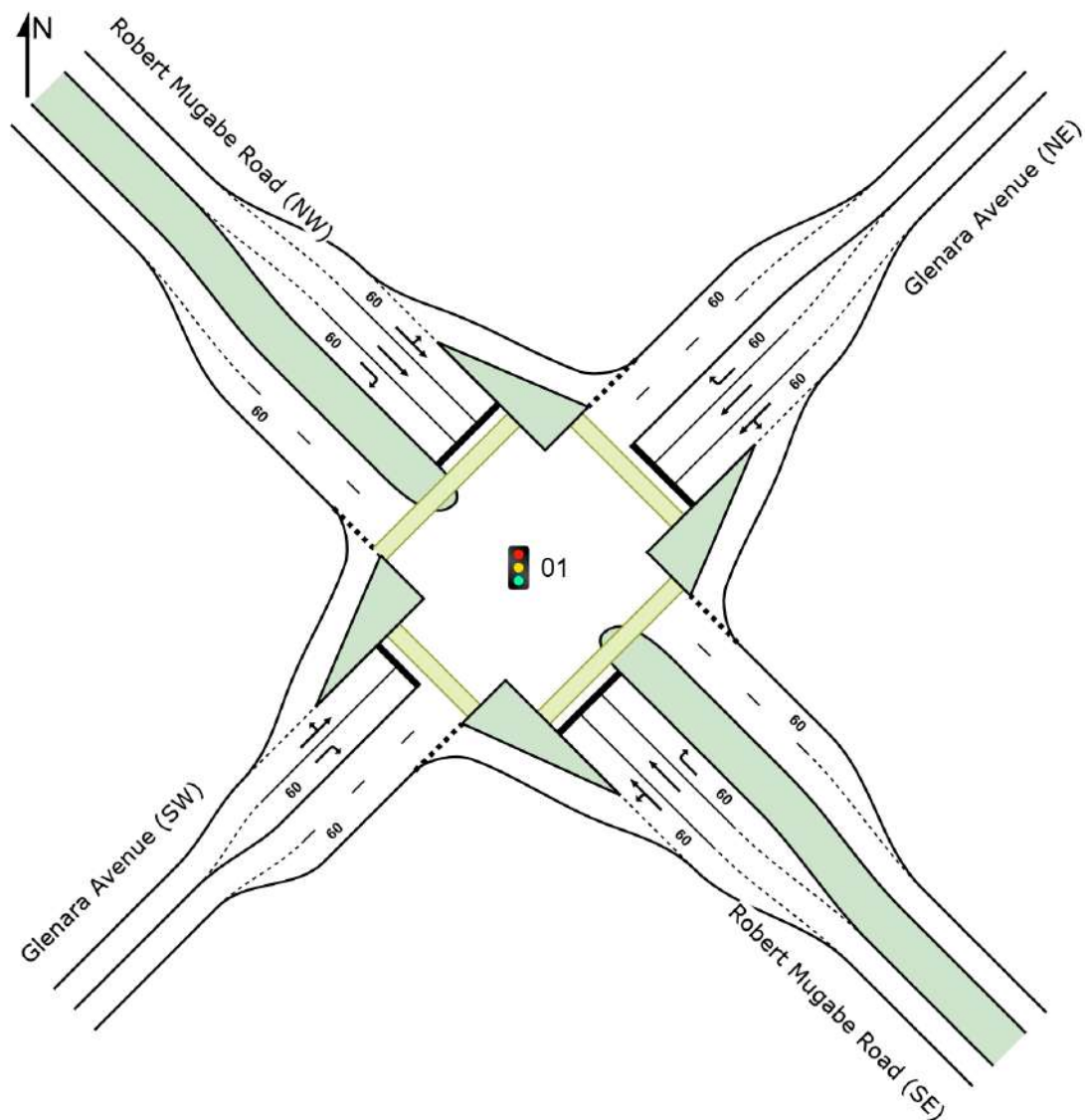
7.1.4.1.10. *Non-Corridor Critical Nodes*

Site 01: Robert Mugabe Road and Glenara Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 **Site: 01 [Robert Mugabe Road and Glenara Avenue (Site Folder: Non-Corridor Critical Nodes)]**



MOVEMENT SUMMARY

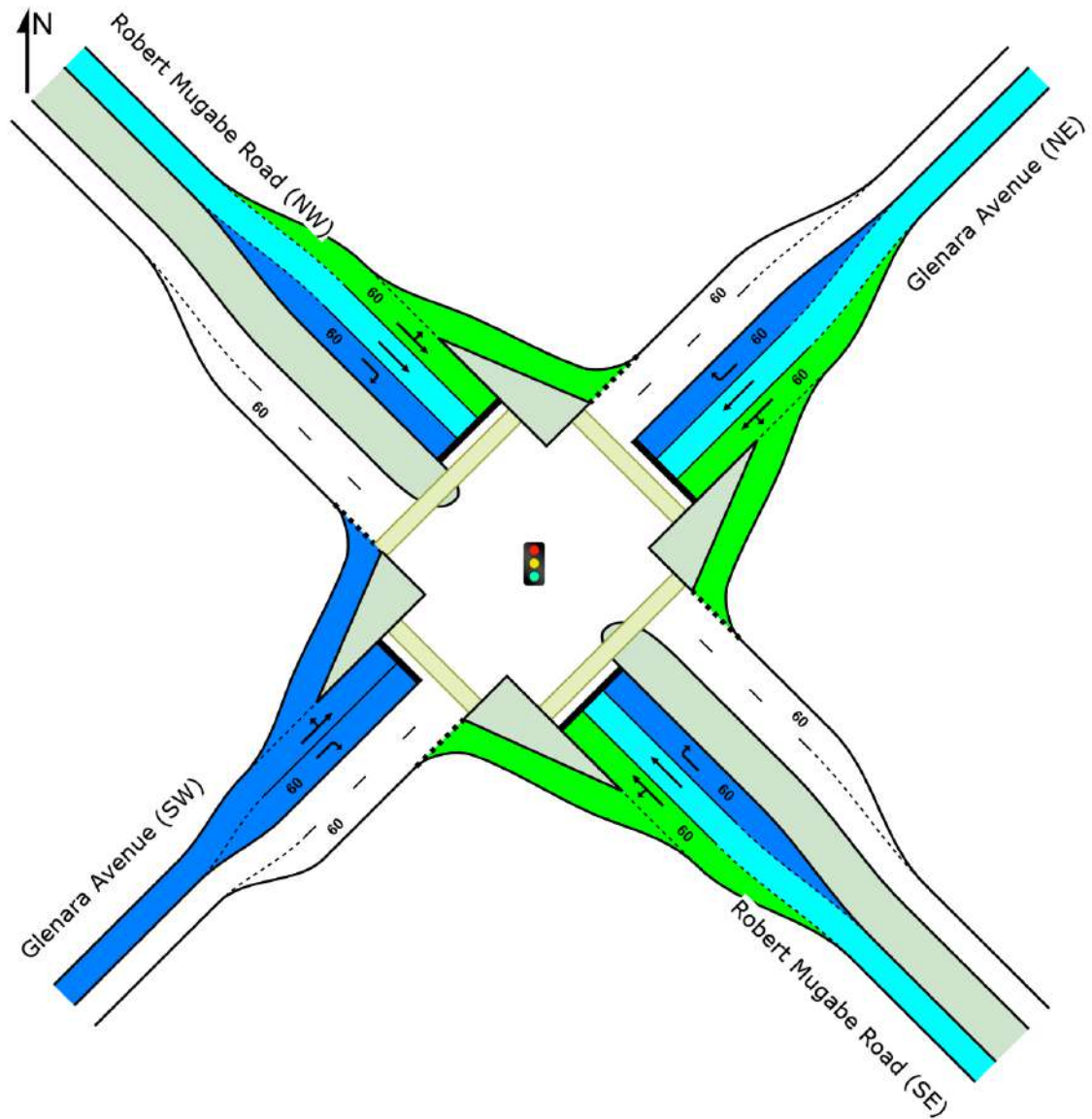
 Site: 01 [Robert Mugabe Road and Glenara Avenue (Site Folder: Non-Corridor Critical Nodes)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Robert Mugabe Road (SE)															
21	L2	All MCs	290	18.9	290	18.9	0.323	7.8	LOS A	1.6	14.2	0.47	0.67	0.47	50.9
22	T1	All MCs	478	9.0	478	9.0 *	0.842	19.7	LOS B	11.0	87.7	0.96	1.05	1.35	45.4
23	R2	All MCs	7	12.4	7	12.4	0.027	21.4	LOS C	0.1	1.0	0.85	0.65	0.85	43.0
Approach			775	12.7	775	12.7	0.842	15.3	LOS B	11.0	87.7	0.78	0.90	1.02	47.3
NorthEast: Glenara Avenue (NE)															
24	L2	All MCs	7	8.0	7	8.0	0.093	10.6	LOS B	0.4	3.1	0.73	0.57	0.73	51.2
25	T1	All MCs	143	5.5	143	5.5	0.228	10.4	LOS B	1.7	12.8	0.76	0.60	0.76	51.3
26	R2	All MCs	114	7.7	114	7.7	0.472	24.2	LOS C	2.2	18.3	0.96	0.77	0.96	41.8
Approach			264	6.5	264	6.5	0.472	16.4	LOS B	2.2	18.3	0.84	0.67	0.84	46.7
NorthWest: Robert Mugabe Road (NW)															
27	L2	All MCs	143	9.6	143	9.6	0.254	9.1	LOS A	1.4	11.3	0.65	0.69	0.65	50.4
28	T1	All MCs	401	6.7	401	6.7	0.662	12.5	LOS B	6.7	51.7	0.87	0.79	0.94	49.8
29	R2	All MCs	38	11.3	38	11.3	0.197	25.3	LOS C	0.7	6.3	0.95	0.71	0.95	41.0
Approach			583	7.7	583	7.7	0.662	12.5	LOS B	6.7	51.7	0.82	0.76	0.87	49.3
SouthWest: Glenara Avenue (SW)															
30	L2	All MCs	38	7.0	38	7.0	0.818	25.0	LOS C	7.0	58.2	0.98	1.07	1.42	41.8
31	T1	All MCs	268	11.4	268	11.4 *	0.818	24.2	LOS C	7.0	58.2	0.98	1.07	1.42	43.1
32	R2	All MCs	195	29.9	195	29.9	0.530	20.2	LOS C	3.5	32.8	0.90	0.79	0.90	43.2
Approach			501	18.3	501	18.3	0.818	22.7	LOS C	7.0	58.2	0.95	0.96	1.21	43.1
All Vehicles			2122	11.9	2122	11.9	0.842	16.4	LOS B	11.0	87.7	0.84	0.85	1.00	46.6

LEVEL OF SERVICE

 Site: 01 [Robert Mugabe Road and Glenara Avenue (Site Folder: Non-Corridor Critical Nodes)]

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	B	B	B	C	B



Colour code based on Level of Service

 LOS A

 LOS B

 LOS C

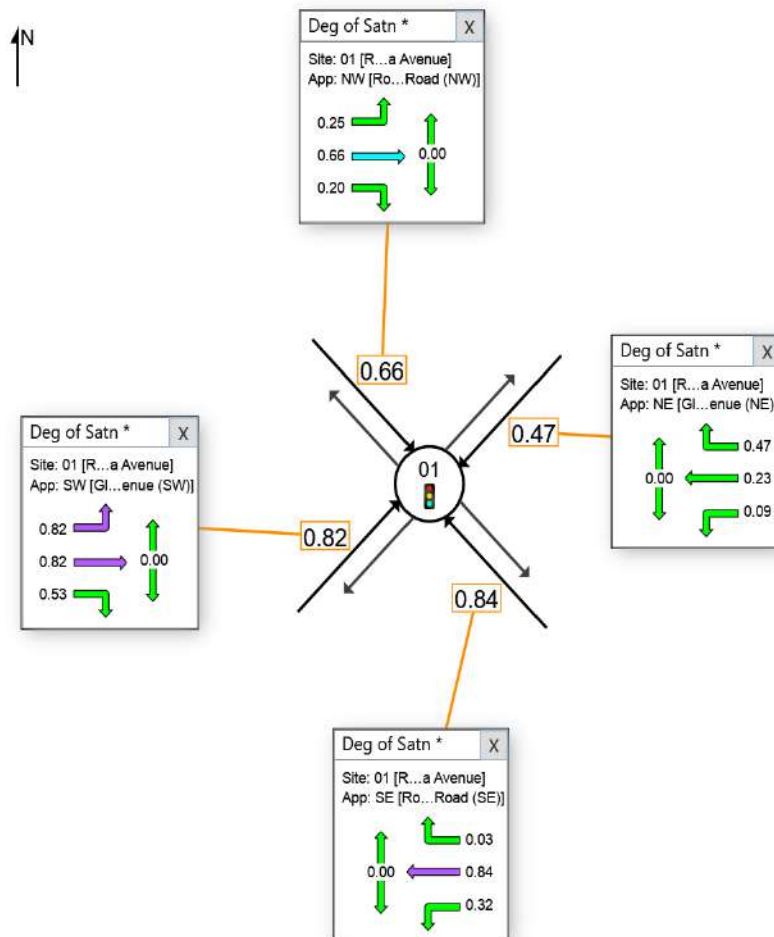
 LOS D

 LOS E

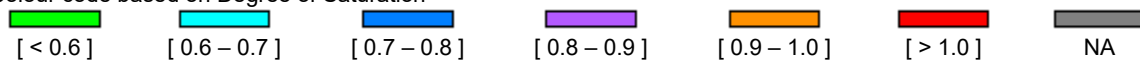
 LOS F

DEGREE OF SATURATION

 **Site: 01 [Robert Mugabe Road and Glenara Avenue (Site Folder: Non-Corridor Critical Nodes)]**



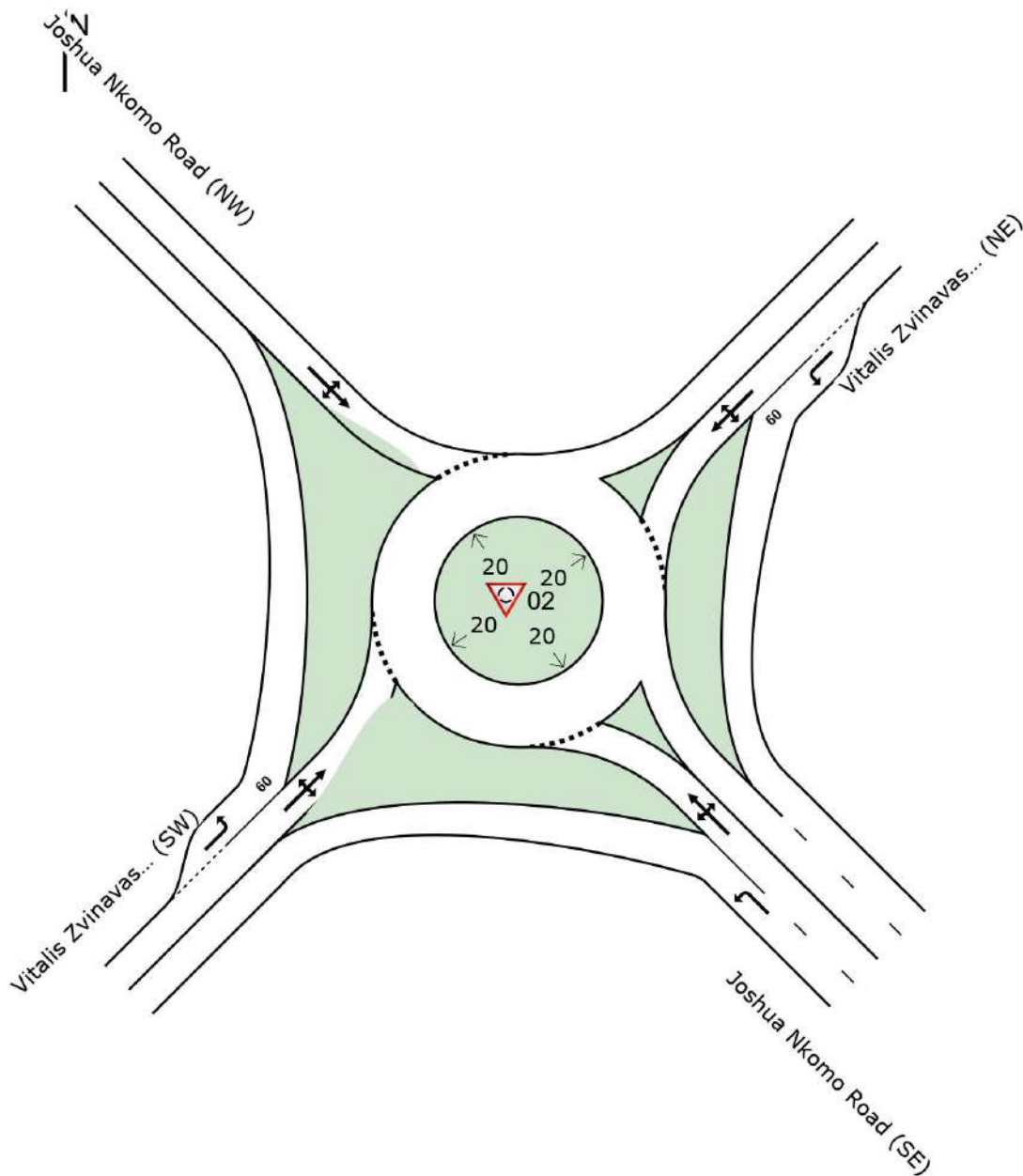
Colour code based on Degree of Saturation



Site 02: Vitalis Zvinavashe and Joshua Nkomo Intersection
15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 **Site: 02 [Vitalis Zvinavashe Road and Joshua Nkomo Road (Site Folder: Non-Corridor Critical Nodes)]**



MOVEMENT SUMMARY

 **Site: 02 [Vitalis Zvinashe Road and Joshua Nkomo Road (Site Folder: Non-Corridor Critical Nodes)]**

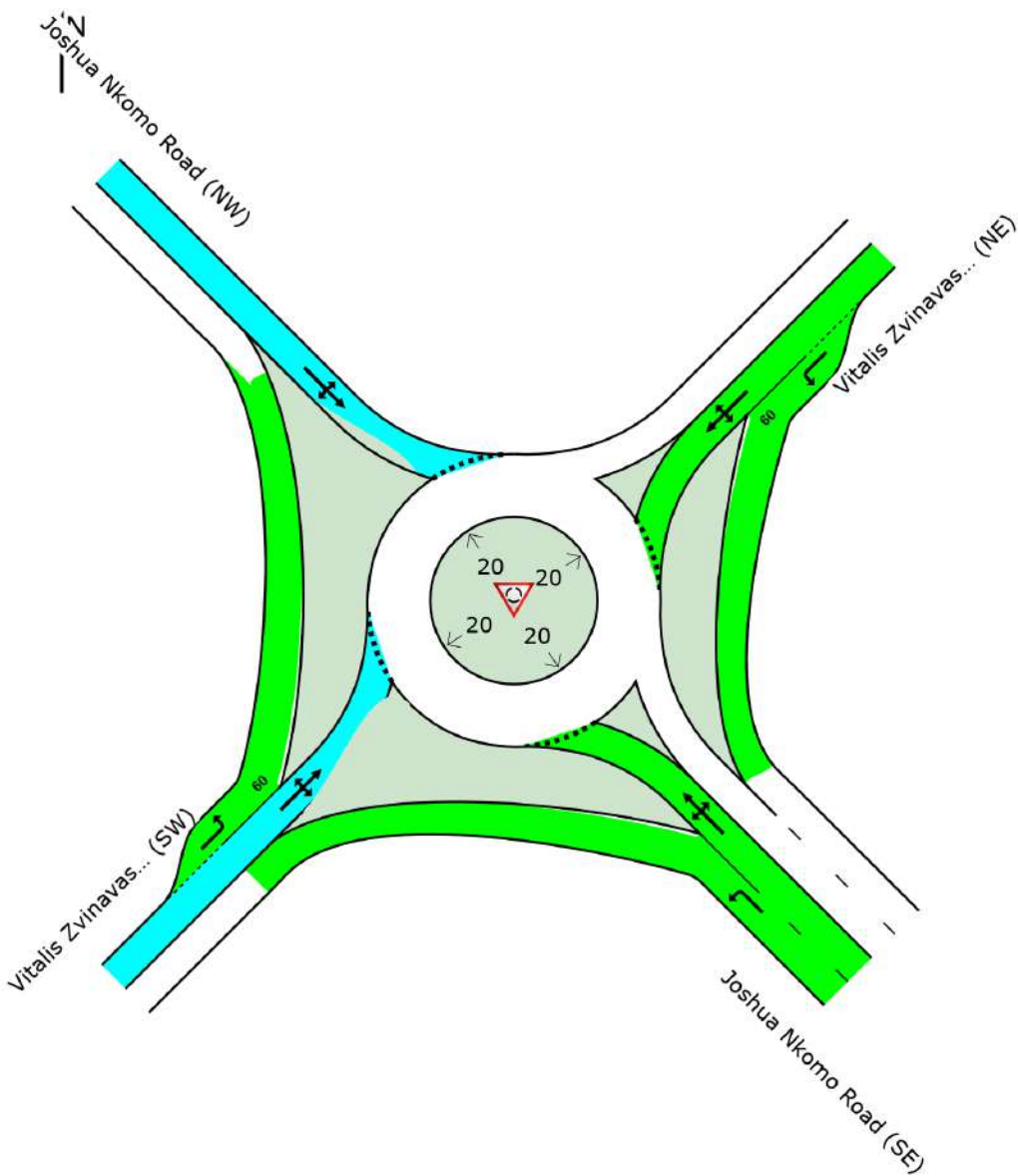
Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Joshua Nkomo Road (SE)															
21	L2	All MCs	225	4.1	225	4.1	0.469	4.8	LOS A	3.7	27.1	0.34	0.54	0.34	53.3
22	T1	All MCs	327	3.3	327	3.3	0.469	6.9	LOS A	3.7	27.1	0.76	0.65	0.76	51.6
23	R2	All MCs	60	4.8	60	4.8	0.469	11.7	LOS B	3.7	27.1	0.76	0.65	0.76	50.7
Approach			612	3.7	612	3.7	0.469	6.6	LOS A	3.7	27.1	0.61	0.61	0.61	52.1
NorthEast: Vitalis Zvinashe Road (NE)															
24	L2	All MCs	199	5.4	199	5.4	0.178	3.6	LOS A	0.0	0.0	0.00	0.46	0.00	54.7
25	T1	All MCs	345	16.1	345	16.1	0.419	7.7	LOS A	2.9	24.6	0.75	0.66	0.75	51.0
26	R2	All MCs	33	7.7	33	7.7	0.419	11.9	LOS B	2.9	24.6	0.75	0.66	0.75	50.1
Approach			576	11.9	576	11.9	0.419	6.5	LOS A	2.9	24.6	0.49	0.59	0.49	52.2
NorthWest: Joshua Nkomo Road (NW)															
27	L2	All MCs	59	9.5	59	9.5	0.411	9.4	LOS A	2.9	26.1	0.84	0.78	0.88	48.8
28	T1	All MCs	119	23.3	119	23.3	0.411	10.8	LOS B	2.9	26.1	0.84	0.78	0.88	49.0
29	R2	All MCs	61	16.1	61	16.1	0.411	14.8	LOS B	2.9	26.1	0.84	0.78	0.88	48.0
Approach			238	18.1	238	18.1	0.411	11.5	LOS B	2.9	26.1	0.84	0.78	0.88	48.7
SouthWest: Vitalis Zvinashe Road (SW)															
30	L2	All MCs	53	11.7	53	11.7	0.051	3.5	LOS A	0.0	0.0	0.00	0.45	0.00	54.1
31	T1	All MCs	223	25.2	223	25.2	0.559	8.7	LOS A	5.0	44.5	0.80	0.73	0.88	49.3
32	R2	All MCs	291	11.3	291	11.3	0.559	12.7	LOS B	5.0	44.5	0.80	0.73	0.88	48.7
Approach			567	16.8	567	16.8	0.559	10.3	LOS B	5.0	44.5	0.72	0.71	0.80	49.4
All Vehicles			1994	11.5	1994	11.5	0.559	8.2	LOS A	5.0	44.5	0.63	0.65	0.66	50.9

LEVEL OF SERVICE

Site: 02 [Vitalis Zvinavashe Road and Joshua Nkomo Road (Site Folder: Non-Corridor Critical Nodes)]

New Site
Site Category: Existing Design
Roundabout

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	A	A	B	B	A



Colour code based on Level of Service

LOS A

LOS B

LOS C

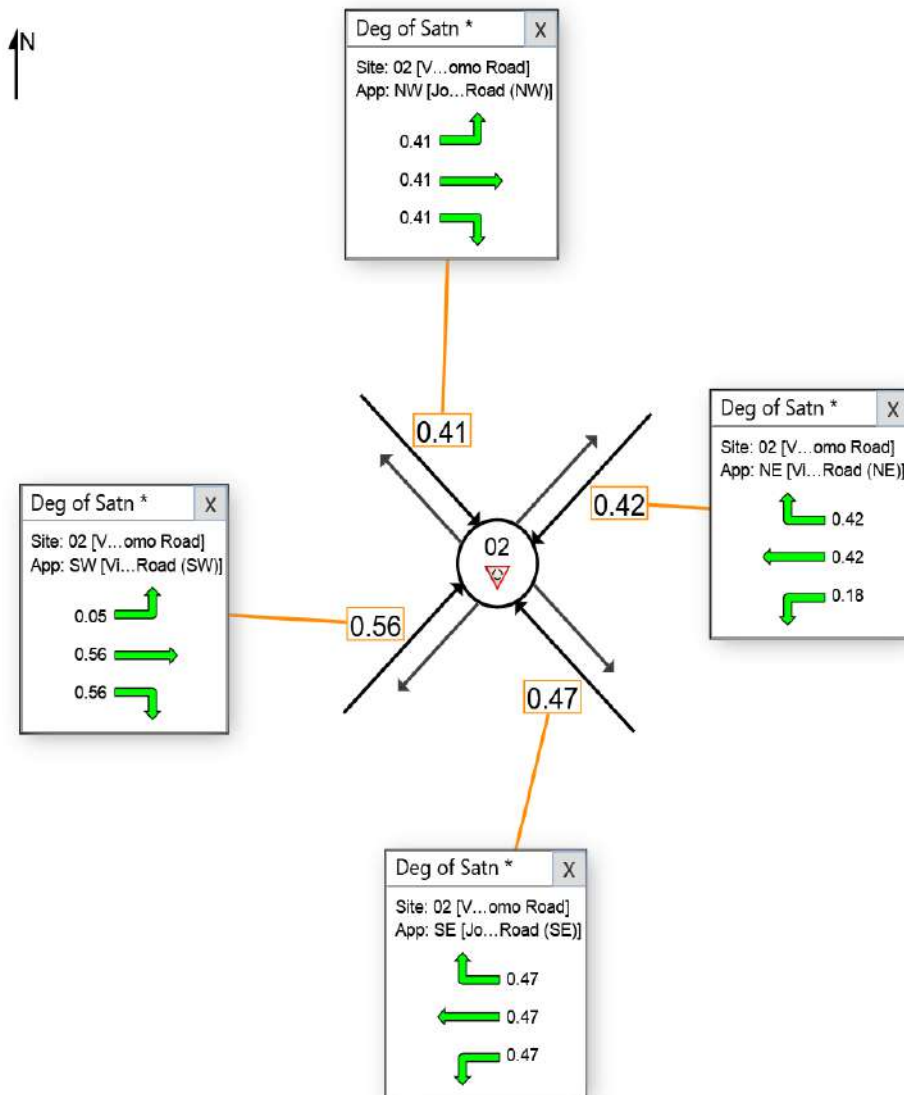
LOS D

LOS E

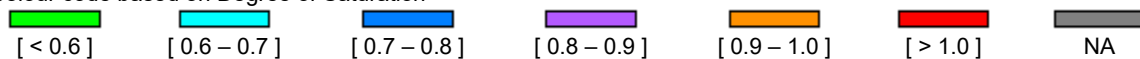
LOS F

DEGREE OF SATURATION

Site: 02 [Vitalis Zvinvashe Road and Joshua Nkomo Road (Site Folder: Non-Corridor Critical Nodes)]



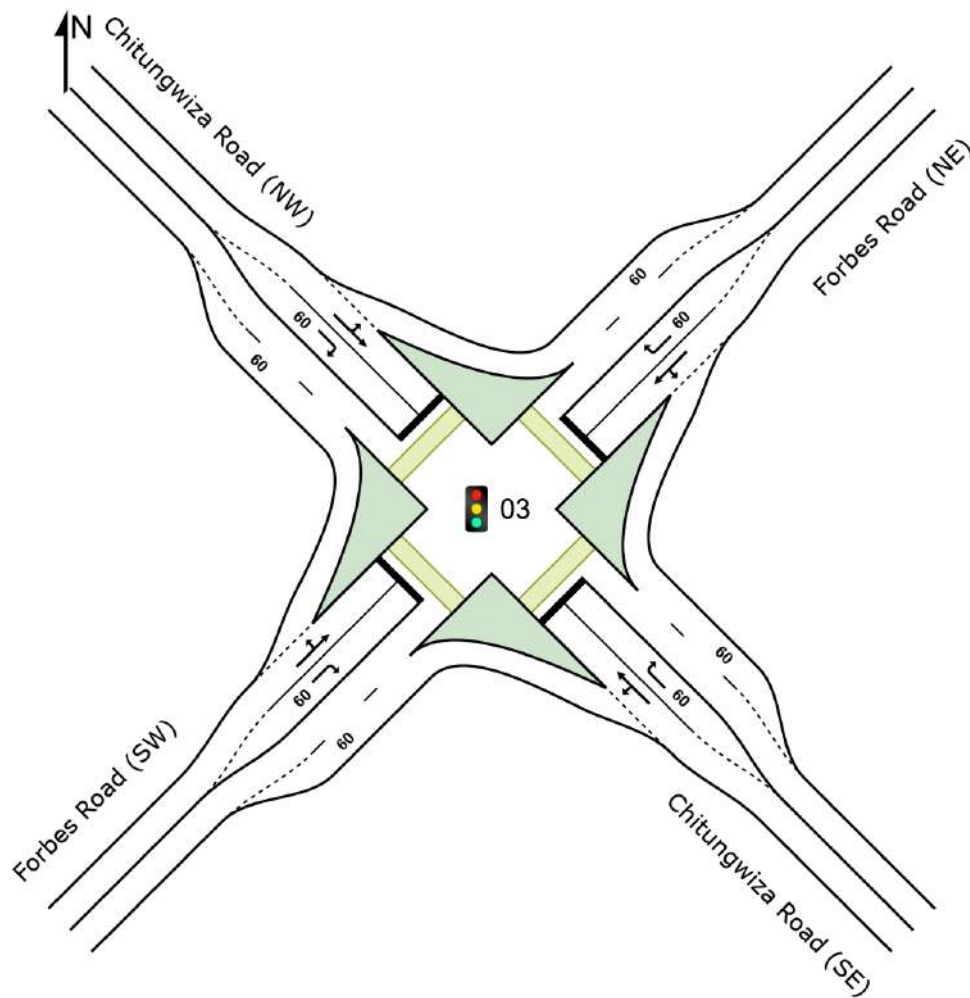
Colour code based on Degree of Saturation



Site 03: Forbes Road and Chitungwiza Road Intersection
15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 03 [Forbes Road and Chitungwiza Road (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

 Site: 03 [Forbes Road and Chitungwiza Road (Site Folder: Non Corridor Critical Nodes)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
SouthEast: Chitungwiza Road (SE)															
21	L2	All MCs	94	11.9	94	11.9	0.130	6.2	LOS A	0.5	4.4	0.35	0.64	0.35	51.4
22	T1	All MCs	12	38.7	12	38.7	0.130	18.8	LOS B	0.5	4.4	0.35	0.64	0.35	47.4
23	R2	All MCs	140	10.3	140	10.3	0.343 *	16.9	LOS B	1.9	15.8	0.87	0.77	0.87	45.1
Approach			247	12.3	247	12.3	0.343	12.9	LOS B	1.9	15.8	0.65	0.71	0.65	47.4
NorthEast: Forbes Road (NE)															
24	L2	All MCs	207	4.1	207	4.1	0.648	6.7	LOS A	4.8	38.7	0.79	0.80	0.89	49.5
25	T1	All MCs	179	15.2	179	15.2	0.648	14.9	LOS B	4.8	38.7	0.79	0.80	0.89	50.9
26	R2	All MCs	4	1.8	4	1.8	0.011	16.5	LOS B	0.1	0.3	0.85	0.62	0.85	41.1
Approach			390	9.2	390	9.2	0.648	10.6	LOS B	4.8	38.7	0.79	0.80	0.89	50.1
NorthWest: Chitungwiza Road (NW)															
27	L2	All MCs	3	0.0	3	0.0	0.009	3.2	LOS A	0.1	0.3	0.75	0.53	0.75	34.9
28	T1	All MCs	4	2.0	4	2.0	0.009	15.8	LOS B	0.1	0.3	0.75	0.53	0.75	37.4
29	R2	All MCs	12	5.1	12	5.1	0.029	15.5	LOS B	0.1	1.1	0.79	0.66	0.79	45.0
Approach			18	3.8	18	3.8	0.029	13.8	LOS B	0.1	1.1	0.78	0.62	0.78	41.7
SouthWest: Forbes Road (SW)															
30	L2	All MCs	63	2.4	63	2.4	0.735	8.3	LOS A	5.4	46.4	0.90	0.91	1.18	48.1
31	T1	All MCs	284	18.2	284	18.2	0.735 *	13.6	LOS B	5.4	46.4	0.90	0.91	1.18	49.5
32	R2	All MCs	50	10.5	50	10.5	0.126	15.3	LOS B	0.6	5.2	0.79	0.71	0.79	45.9
Approach			397	14.7	397	14.7	0.735	13.0	LOS B	5.4	46.4	0.89	0.88	1.13	48.8
All Vehicles			1052	11.9	1052	11.9	0.735	12.1	LOS B	5.4	46.4	0.79	0.81	0.92	48.8

LEVEL OF SERVICE

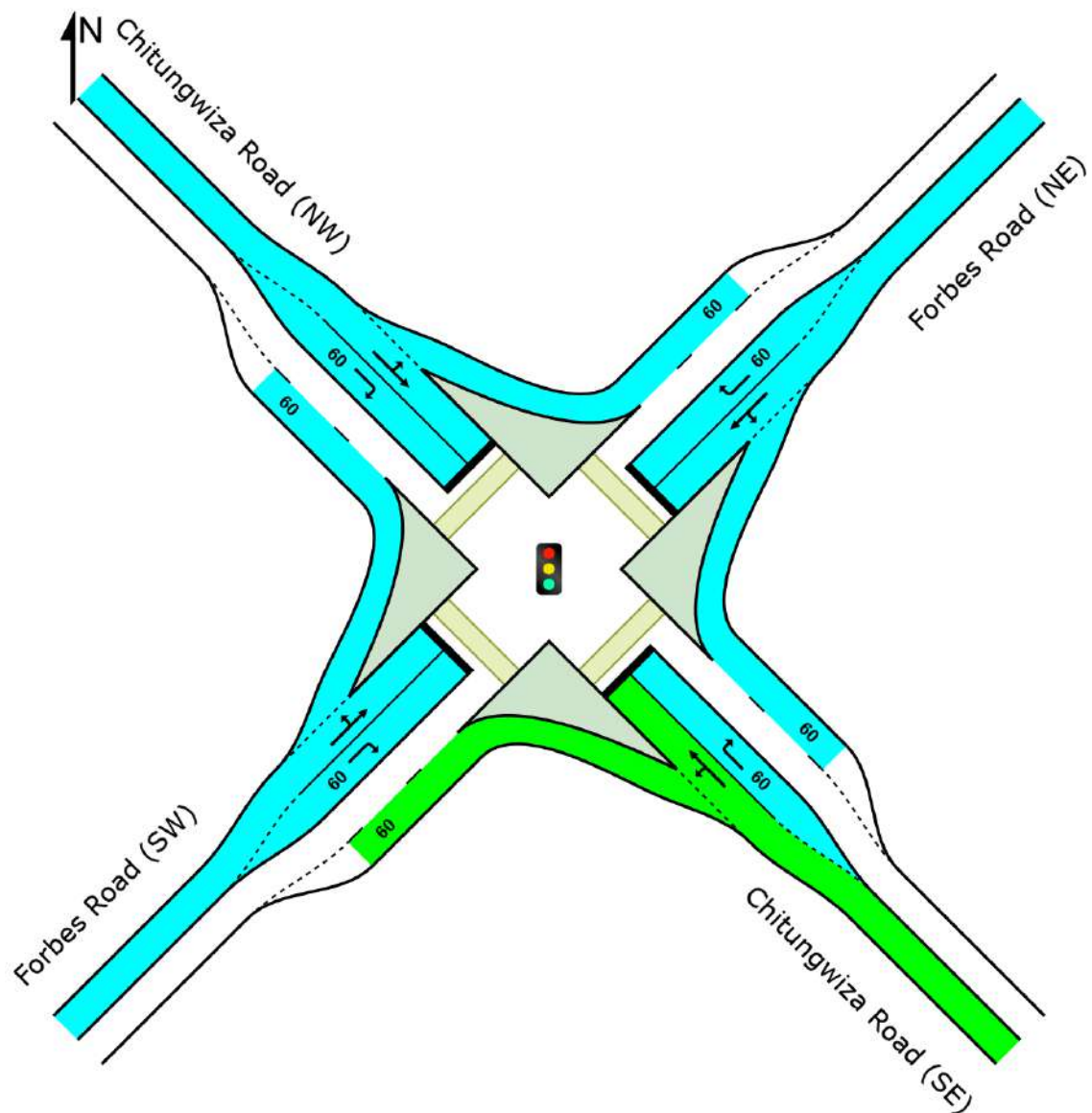
 **Site: 03 [Forbes Road and Chitungwiza Road (Site Folder: Non-Corridor Critical Nodes)]**

New Site

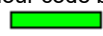
Site Category: Existing Design

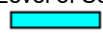
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 30 seconds (Site Practical Cycle Time)

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	B	B	B	B	B



Colour code based on Level of Service

 LOS A

 LOS B

 LOS C

 LOS D

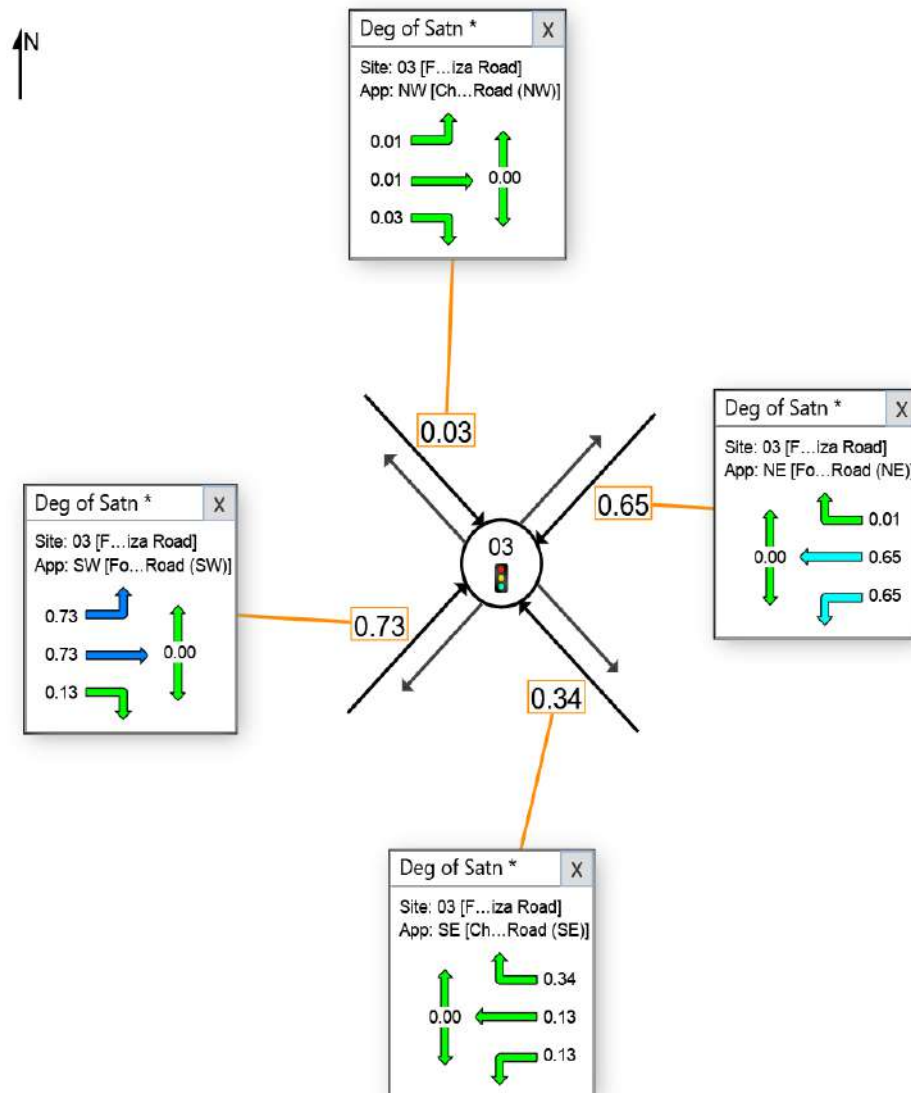
 LOS E

 LOS F

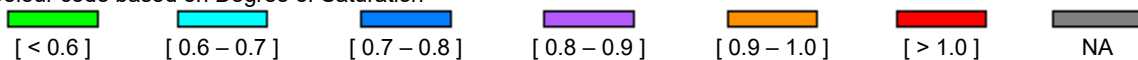
DEGREE OF SATURATION

 Site: 03 [Forbes Road and Chitungwiza Road (Site Folder: Non-Corridor Critical Nodes)]

All Movement Classes (*)



Colour code based on Degree of Saturation

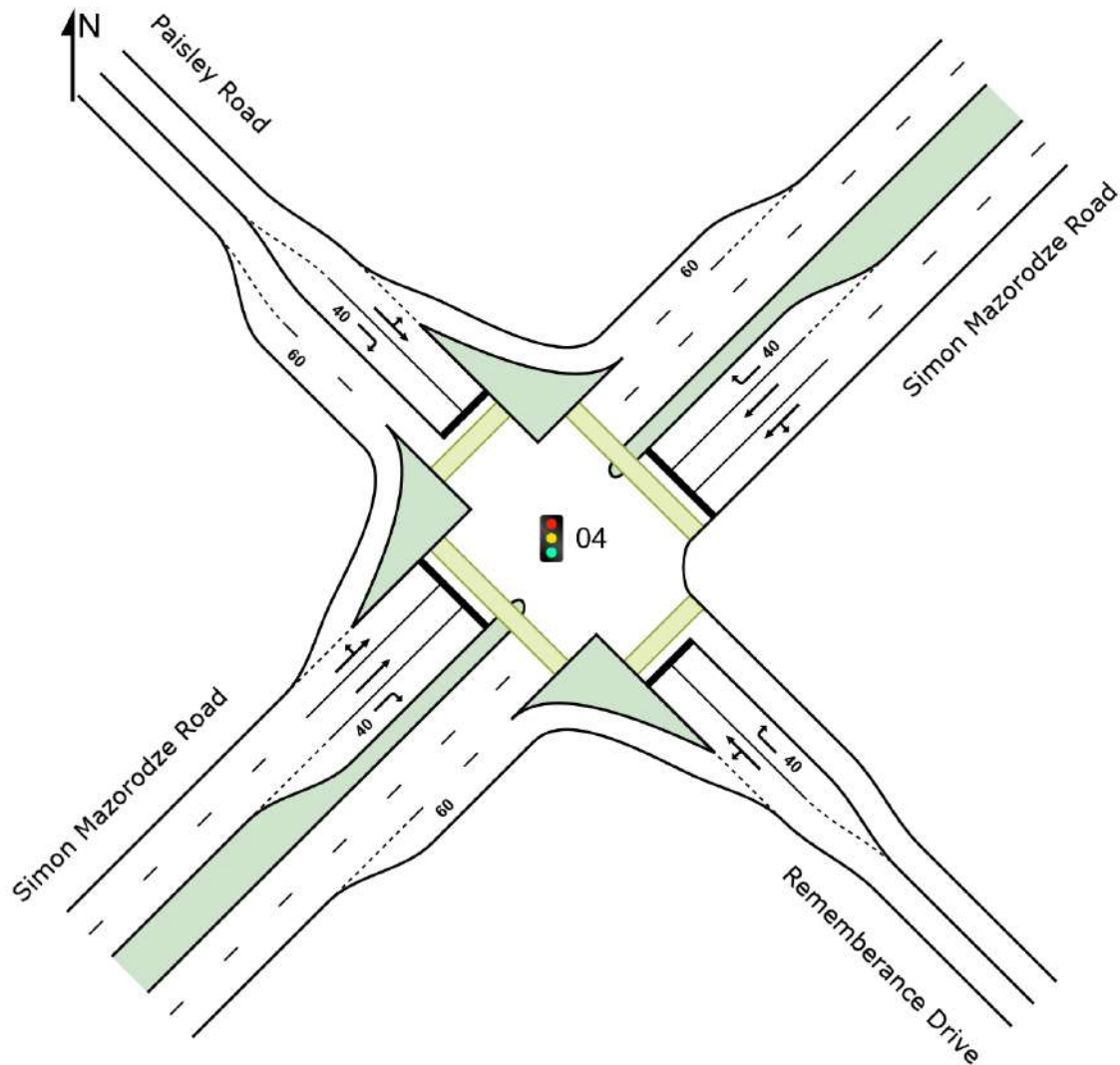


Site 04: Simon Mazorodze Road and Remembrance Drive Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 04 [Simon Mazorodze and Remembrance Drive (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

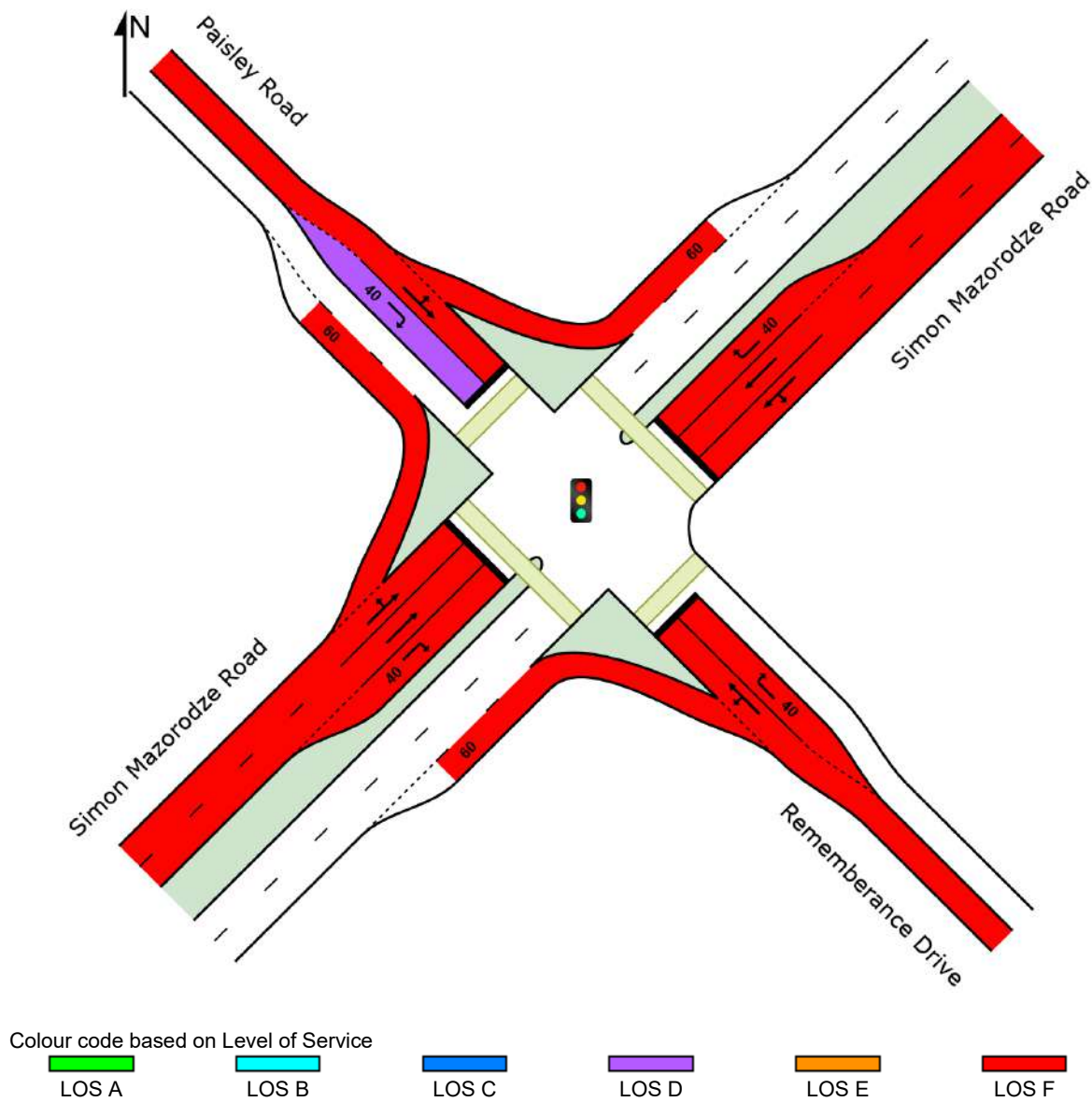
 Site: 04 [Simon Mazorodze and Remembrance Drive (Site Folder: Non-Corridor Critical Nodes)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
SouthEast: Remembrance Drive															
21	L2	All MCs	223	12.7	223	12.7	0.900	71.6	LOS E	33.1	295.0	0.83	0.93	1.02	33.8
22	T1	All MCs	226	17.4	226	17.4	0.900	94.9	LOS F	33.1	295.0	0.83	0.93	1.02	34.6
23	R2	All MCs	182	19.5	182	19.5	[*] 2.565	1535.0	LOS F	51.5	468.6	1.00	2.38	4.70	2.3
Approach			631	16.3	631	16.3	2.565	502.5	LOS F	51.5	468.6	0.88	1.35	2.08	6.5
NorthEast: Simon Mazorodze Road															
24	L2	All MCs	36	8.0	36	8.0	1.966	948.4	LOS F	119.7	922.1	1.00	2.84	3.98	3.6
25	T1	All MCs	998	7.1	998	7.1	[*] 1.966	968.8	LOS F	128.9	988.4	1.00	2.87	3.98	3.6
26	R2	All MCs	111	9.1	111	9.1	2.204	1226.6	LOS F	28.9	228.9	1.00	1.85	4.32	3.0
Approach			1145	7.3	1145	7.3	2.204	993.2	LOS F	128.9	988.4	1.00	2.77	4.02	3.5
NorthWest: Paisley Road															
27	L2	All MCs	296	3.8	296	3.8	1.506	494.0	LOS F	237.5	1992.8	1.00	2.50	3.05	6.7
28	T1	All MCs	946	15.0	946	15.0	1.506	516.1	LOS F	237.5	1992.8	1.00	2.50	3.05	6.7
29	R2	All MCs	75	13.4	75	13.4	0.160	49.7	LOS D	3.1	26.0	0.60	0.71	0.60	39.0
Approach			1317	12.4	1317	12.4	1.506	484.5	LOS F	237.5	1992.8	0.98	2.39	2.91	6.8
SouthWest: Simon Mazorodze Road															
30	L2	All MCs	293	16.8	293	16.8	1.838	768.8	LOS F	107.6	1003.8	1.00	2.65	3.78	4.1
31	T1	All MCs	564	29.1	564	29.1	1.838	893.2	LOS F	107.6	1003.8	1.00	2.72	3.78	4.1
32	R2	All MCs	208	21.9	208	21.9	4.372	3176.8	LOS F	69.5	650.5	1.00	2.36	5.64	1.1
Approach			1065	24.3	1065	24.3	4.372	1305.8	LOS F	107.6	1003.8	1.00	2.63	4.14	2.7
All Vehicles			4159	14.7	4159	14.7	4.372	837.7	LOS F	237.5	1992.8	0.97	2.40	3.41	4.1

LEVEL OF SERVICE

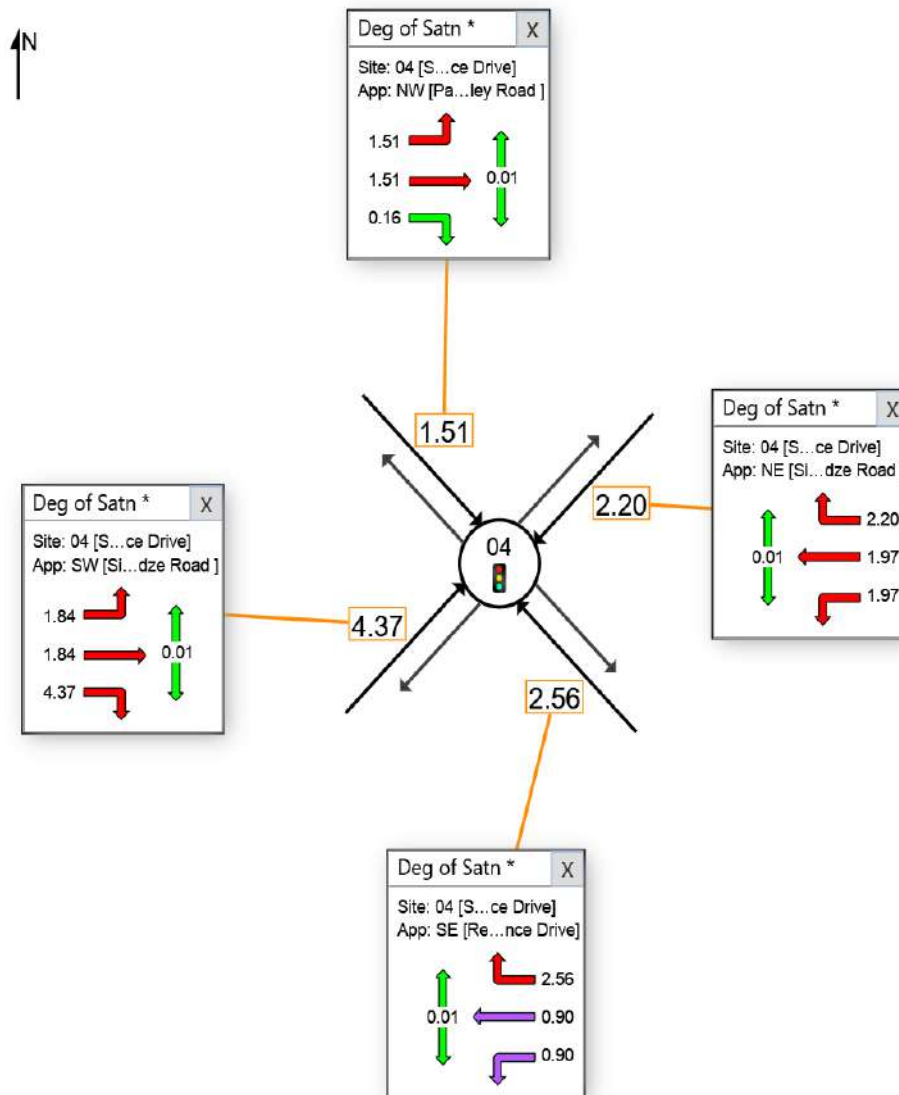
 Site: 04 [Simon Mazorodze and Remembrance Drive (Site Folder: Non-Corridor Critical Nodes)]

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	F	F	F	F	F

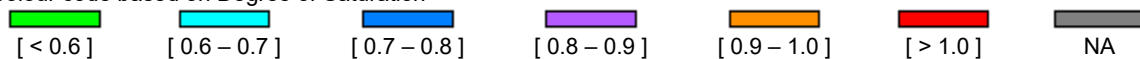


DEGREE OF SATURATION

 Site: 04 [Simon Mazorodze and Remembrance Drive (Site Folder: Non-Corridor Critical Nodes)]



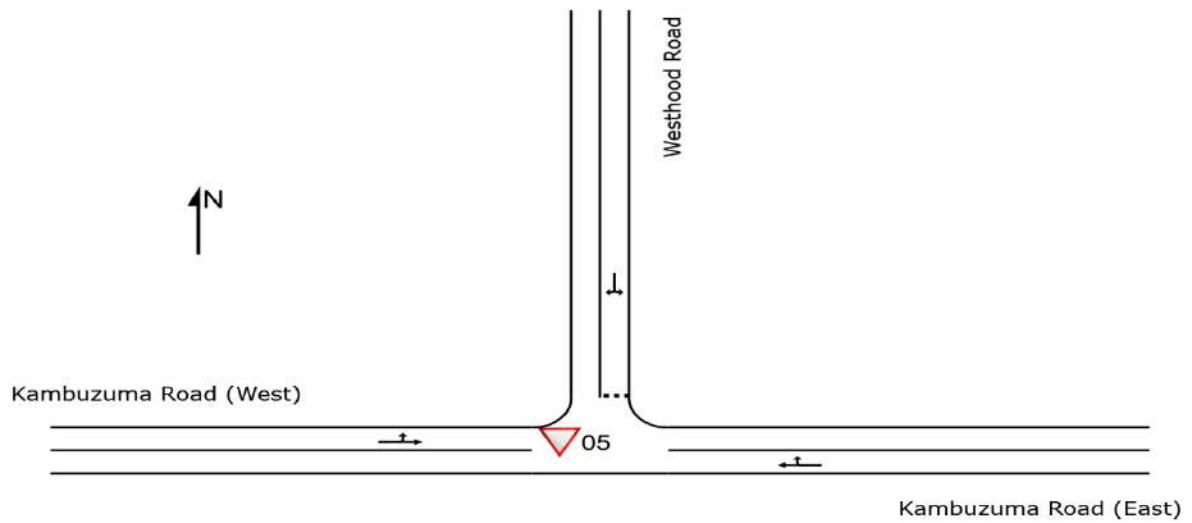
Colour code based on Degree of Saturation



Site 05: Westwood Road and Kambuzuma Road Intersection
15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

▼ Site: 05 [Westwood Road and Kambuzuma Road (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

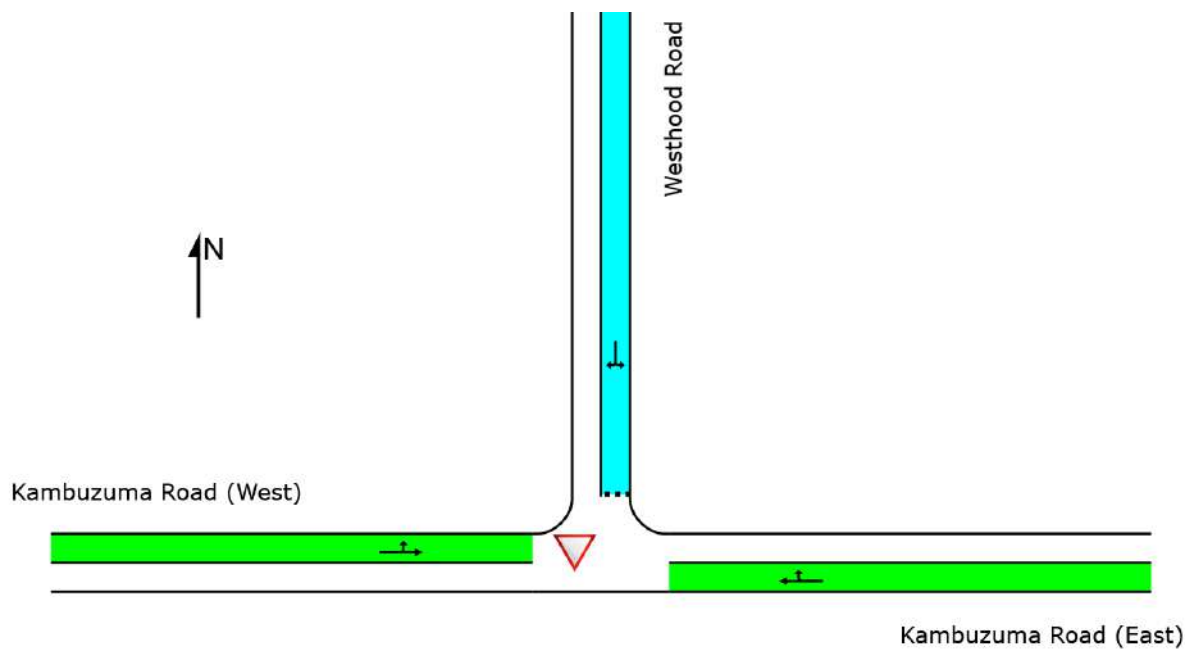
▼ Site: 05 [Westwood Road and Kambuzuma Road (Site Folder: Non-Corridor Critical Nodes)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Kambuzuma Road (East)															
5	T1	All MCs	267	7.5	267	7.5	0.227	0.8	LOS A	0.8	6.4	0.26	0.30	0.26	56.1
6	R2	All MCs	87	10.0	87	10.0	0.227	7.4	LOS A	0.8	6.4	0.26	0.30	0.26	49.5
Approach			354	8.1	354	8.1	0.227	2.4	NA	0.8	6.4	0.26	0.30	0.26	54.4
North: Westhood Road															
7	L2	All MCs	64	6.1	64	6.1	0.256	6.9	LOS A	0.9	7.3	0.53	0.73	0.55	43.6
9	R2	All MCs	95	13.0	95	13.0	0.256	12.2	LOS B	0.9	7.3	0.53	0.73	0.55	42.0
Approach			159	10.2	159	10.2	0.256	10.1	LOS B	0.9	7.3	0.53	0.73	0.55	42.6
West: Kambuzuma Road (West)															
10	L2	All MCs	78	10.7	78	10.7	0.173	5.7	LOS A	0.0	0.0	0.00	0.15	0.00	51.4
11	T1	All MCs	234	6.4	234	6.4	0.173	0.0	LOS A	0.0	0.0	0.00	0.15	0.00	57.6
Approach			313	7.5	313	7.5	0.173	1.4	NA	0.0	0.0	0.00	0.15	0.00	55.9
All Vehicles			826	8.3	826	8.3	0.256	3.5	NA	0.9	7.3	0.21	0.32	0.22	52.1

LEVEL OF SERVICE

▽ Site: 05 [Westhood Road and Kambuzuma Road (Site Folder: Non-Corridor Critical Nodes)]

	Approaches			Intersection
	East	North	West	
LOS	NA (TWSC)	B	NA (TWSC)	NA (TWSC)



Colour code based on Level of Service

LOS A

LOS B

LOS C

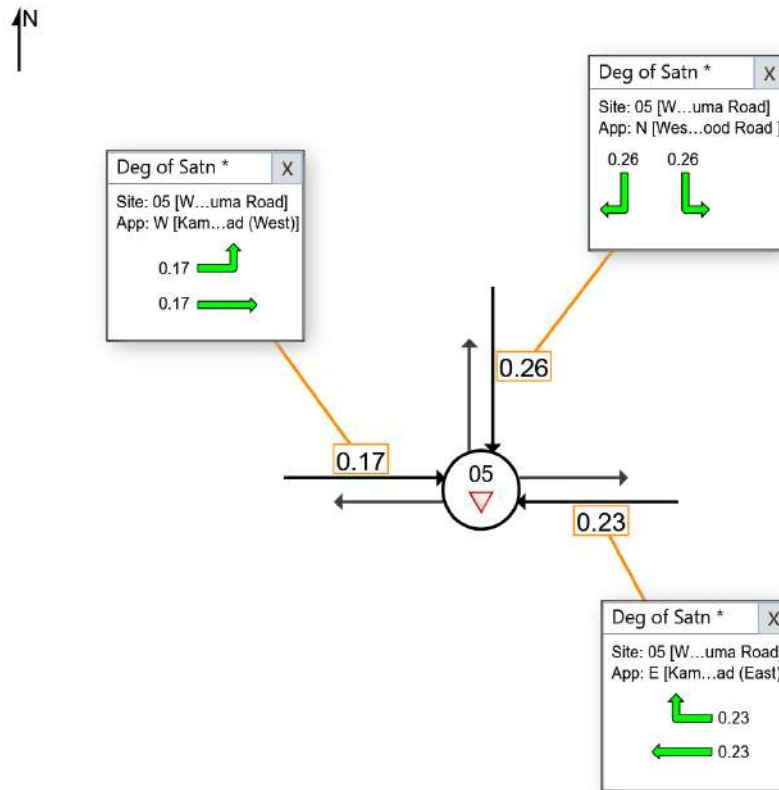
LOS D

LOS E

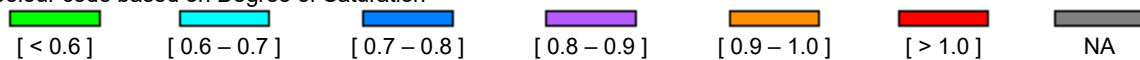
LOS F

DEGREE OF SATURATION

▽ Site: 05 [Westwood Road and Kambuzuma Road (Site Folder: Non-Corridor Critical Nodes)]



Colour code based on Degree of Saturation

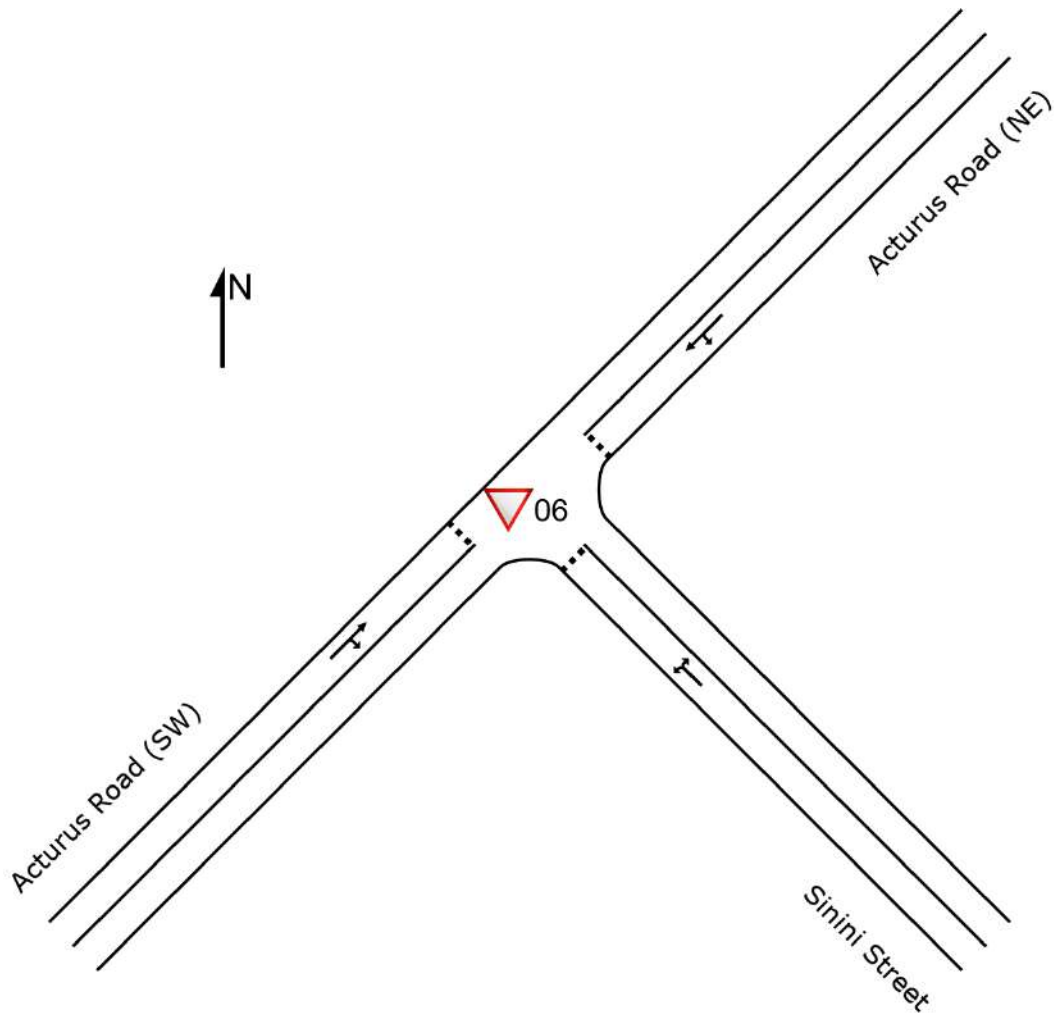


Site 06: Acturus Road and Sinini Street Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

▽ Site: 06 [Acturus Road and Sinini Street (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

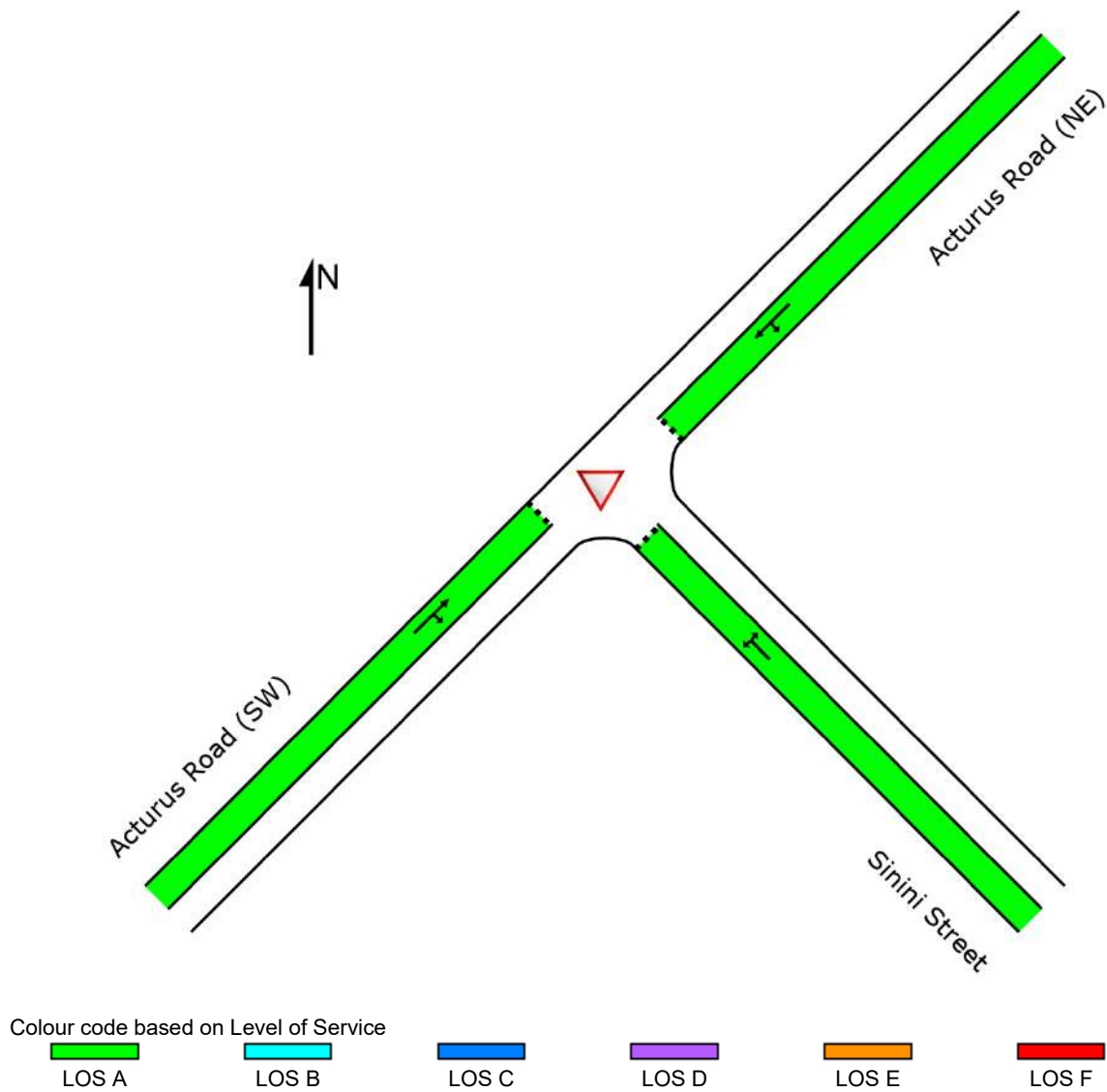
▼ Site: 06 [Acturus Road and Sinini Street (Site Folder: Non-Corridor Critical Nodes)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Sinini Street															
21	L2	All MCs	63	12.3	63	12.3	0.072	6.6	LOS A	0.3	2.2	0.34	0.59	0.34	50.4
23	R2	All MCs	7	7.5	7	7.5	0.072	11.4	LOS B	0.3	2.2	0.34	0.59	0.34	50.3
Approach			71	11.8	71	11.8	0.072	7.1	LOS A	0.3	2.2	0.34	0.59	0.34	50.4
NorthEast: Acturus Road (NE)															
24	L2	All MCs	142	7.0	142	7.0	0.189	5.6	LOS A	0.0	0.0	0.00	0.55	0.00	53.1
25	T1	All MCs	191	10.5	191	10.5	0.189	4.2	LOS A	0.0	0.0	0.00	0.55	0.00	53.5
Approach			334	9.0	334	9.0	0.189	4.8	LOS A	0.0	0.0	0.00	0.55	0.00	53.4
SouthWest: Acturus Road (SW)															
31	T1	All MCs	267	7.5	267	7.5	0.297	4.2	LOS A	2.1	16.5	0.59	0.69	0.59	50.6
32	R2	All MCs	87	10.0	87	10.0	0.297	22.5	LOS C	2.1	16.5	0.59	0.69	0.59	49.6
Approach			354	8.1	354	8.1	0.297	8.7	LOS A	2.1	16.5	0.59	0.69	0.59	50.4
All Vehicles			758	8.8	758	8.8	0.297	6.8	NA	2.1	16.5	0.31	0.62	0.31	51.6

LEVEL OF SERVICE

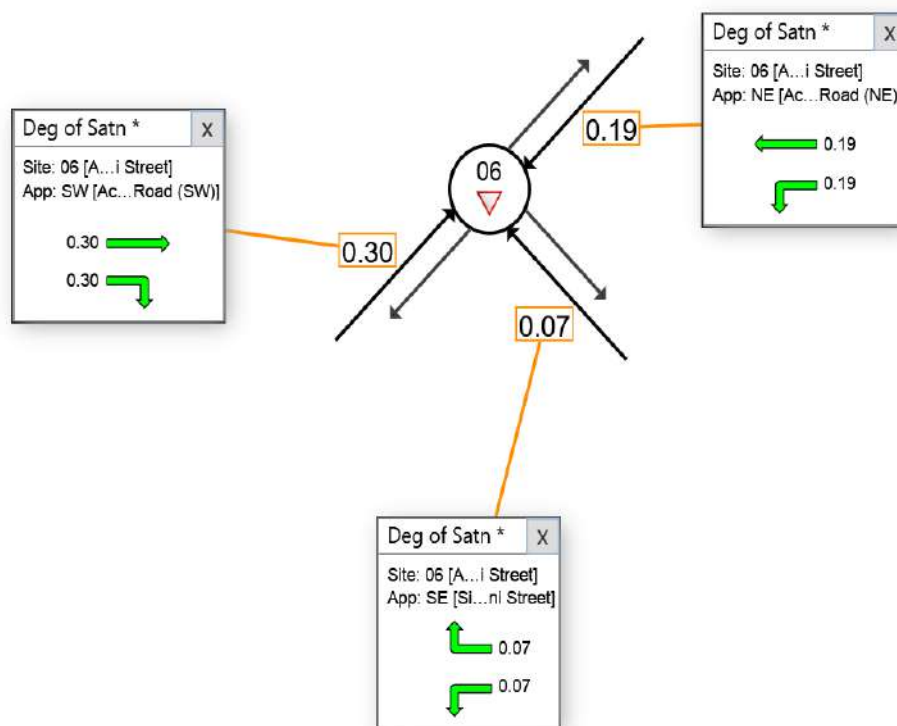
▽ Site: 06 [Acturus Road and Sinini Street (Site Folder: Non-Corridor Critical Nodes)]

	Approaches			Intersection
	Southeast	Northeast	Southwest	
LOS	A	A	A	NA (TWSC)

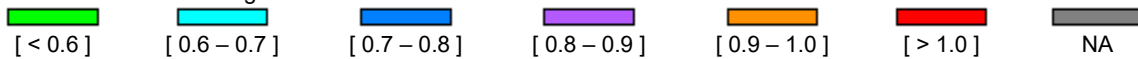


DEGREE OF SATURATION

▽ Site: 06 [Acturus Road and Sinini Street (Site Folder: Non Corridor Critical Nodes)]



Colour code based on Degree of Saturation

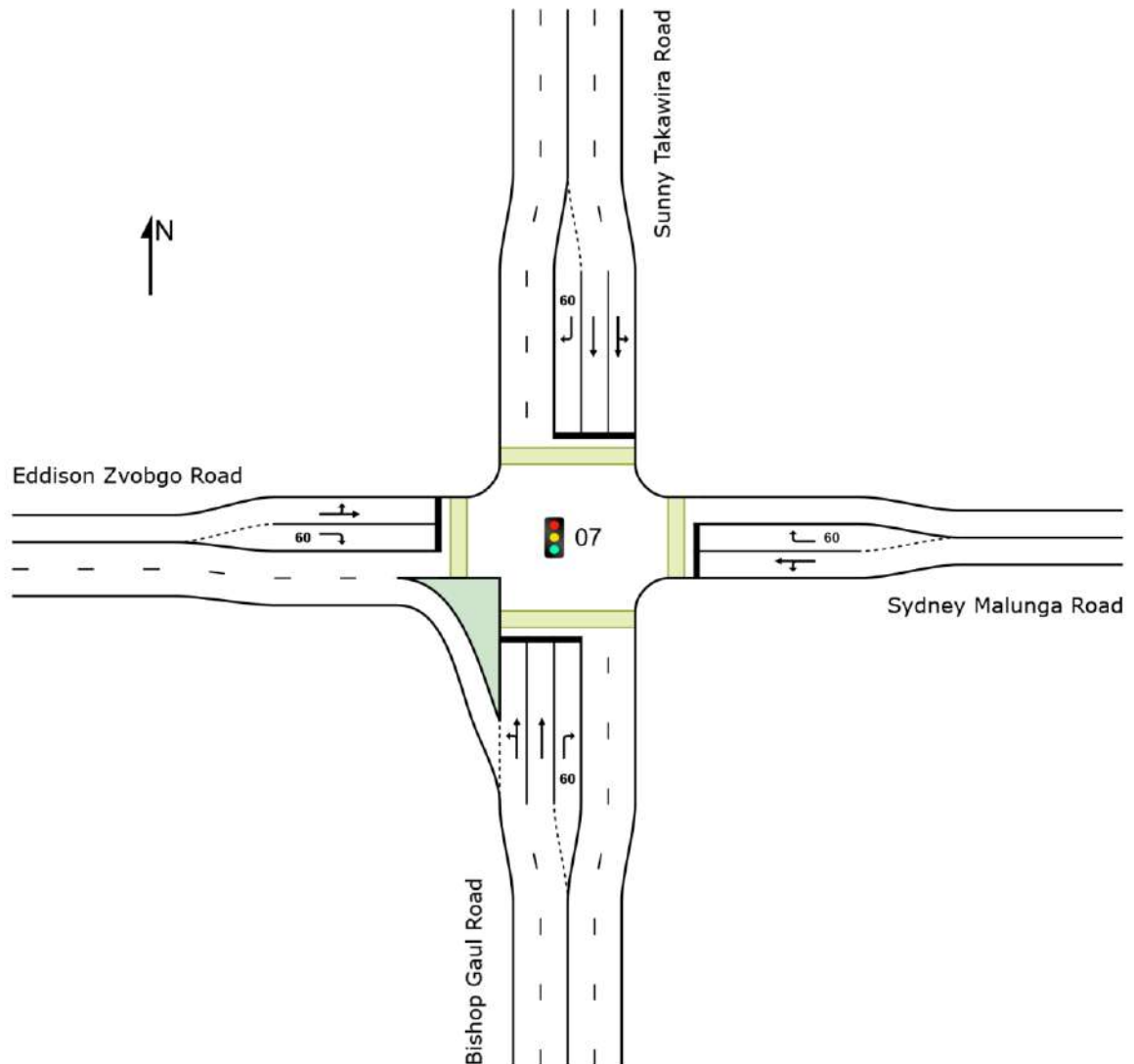


Site 07: Quindon Street and West Road Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

Site: 07 [Quindon Street and West Road (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

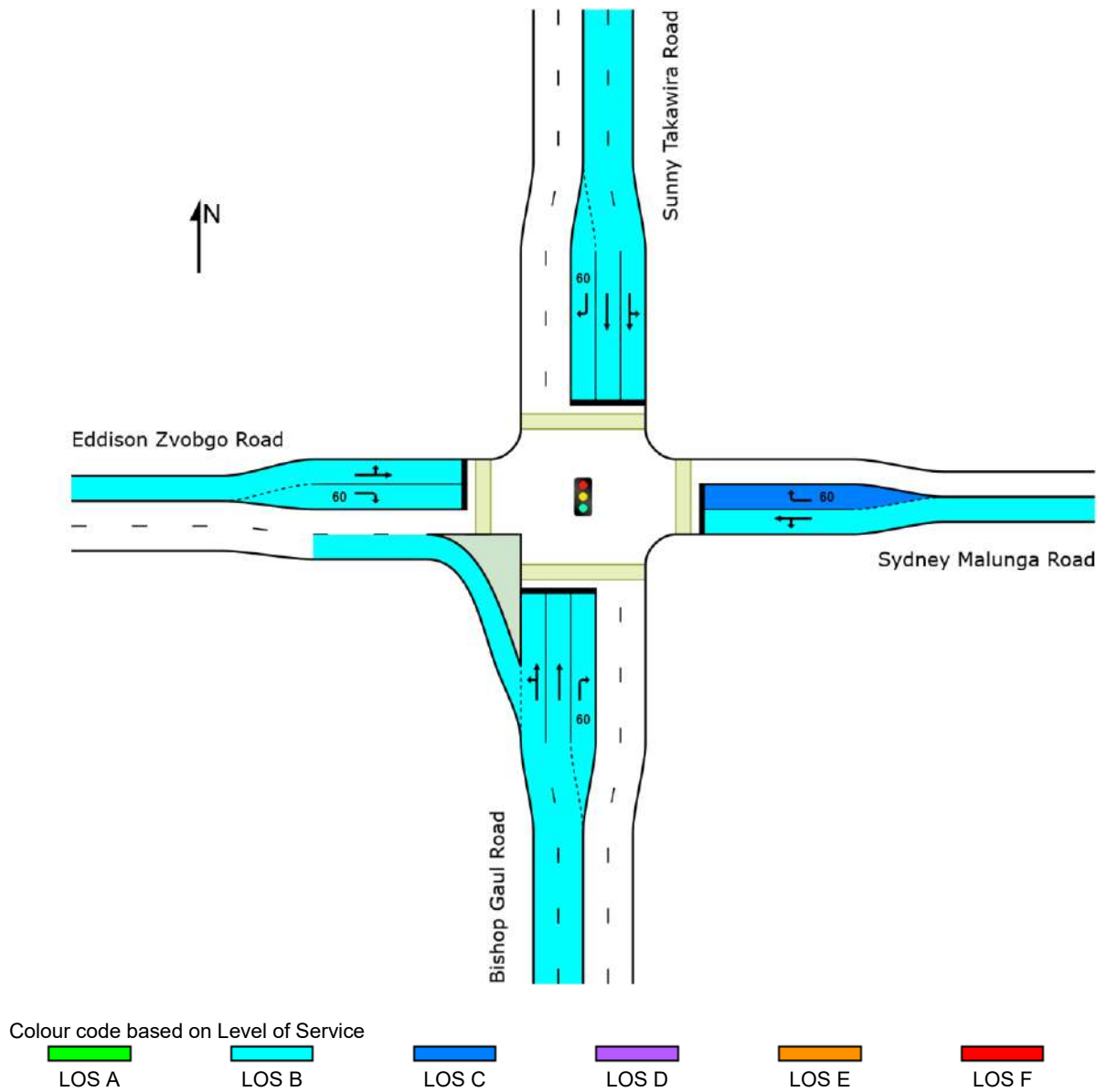
 Site: 07 [Quindon Street and West Road (Site Folder: Non-Corridor Critical Nodes)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
South: Bishop Gaul Road															
1	L2	All MCs	149	5.4	149	5.4	0.552	5.8	LOS A	3.3	25.5	0.84	0.77	0.87	48.5
2	T1	All MCs	293	10.6	293	10.6	0.552*	15.6	LOS B	3.3	25.5	0.89	0.77	0.95	49.9
3	R2	All MCs	9	2.3	9	2.3	0.031	18.6	LOS B	0.1	0.9	0.89	0.65	0.89	44.5
Approach			452	8.7	452	8.7	0.552	12.4	LOS B	3.3	25.5	0.88	0.77	0.92	49.3
East: Sydney Malunga Road															
4	L2	All MCs	89	3.8	89	3.8	0.697	16.8	LOS B	4.9	38.5	0.90	0.87	1.11	47.8
5	T1	All MCs	240	6.7	240	6.7	0.697	11.2	LOS B	4.9	38.5	0.90	0.87	1.11	49.7
6	R2	All MCs	122	3.3	122	3.3	0.455	20.0	LOS C	1.8	13.8	0.96	0.77	0.96	43.7
Approach			451	5.2	451	5.2	0.697	14.7	LOS B	4.9	38.5	0.92	0.84	1.07	47.5
North: Sunny Takawira Road															
7	L2	All MCs	107	2.6	107	2.6	0.518	17.8	LOS B	2.2	17.0	0.92	0.79	0.96	45.8
8	T1	All MCs	226	7.8	226	7.8	0.518	12.1	LOS B	2.5	20.3	0.92	0.76	0.94	49.5
9	R2	All MCs	120	3.0	120	3.0	0.430	19.9	LOS B	1.8	13.2	0.96	0.76	0.96	43.7
Approach			453	5.3	453	5.3	0.518	15.5	LOS B	2.5	20.3	0.93	0.77	0.95	47.0
West: Eddison Zvobgo Road															
10	L2	All MCs	11	7.6	11	7.6	0.782	19.7	LOS B	5.7	52.5	0.94	0.99	1.35	46.8
11	T1	All MCs	321	23.2	321	23.2	0.782*	14.1	LOS B	5.7	52.5	0.94	0.99	1.35	48.6
12	R2	All MCs	64	2.8	64	2.8	0.212	18.4	LOS B	0.9	6.6	0.90	0.73	0.90	44.6
Approach			397	19.5	397	19.5	0.782	14.9	LOS B	5.7	52.5	0.94	0.95	1.28	47.8
All Vehicles			1753	9.4	1753	9.4	0.782	14.4	LOS B	5.7	52.5	0.91	0.83	1.05	47.9

LEVEL OF SERVICE

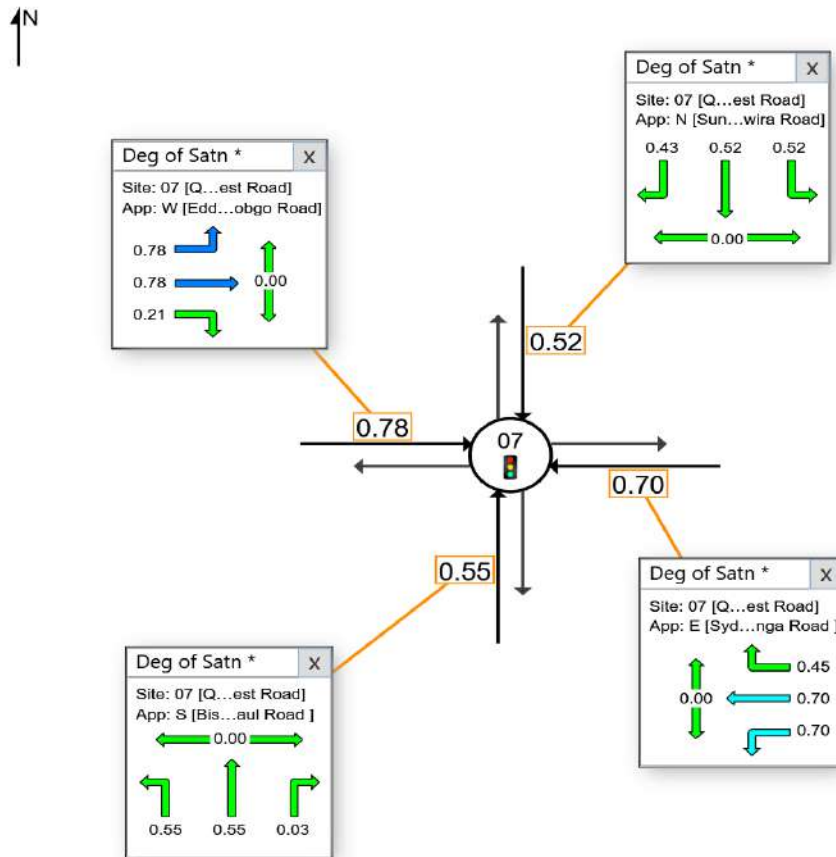
Site: 07 [Quindon Street and West Road (Site Folder: Non-Corridor Critical Nodes)]

	Approaches				Intersection
	South	East	North	West	
LOS	B	B	B	B	B

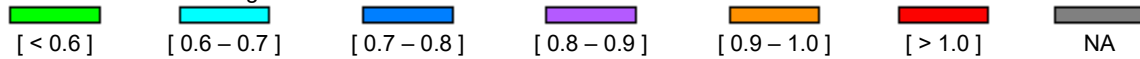


DEGREE OF SATURATION

 Site: 07 [Quindon Street and West Road (Site Folder: Non-Corridor Critical Nodes)]



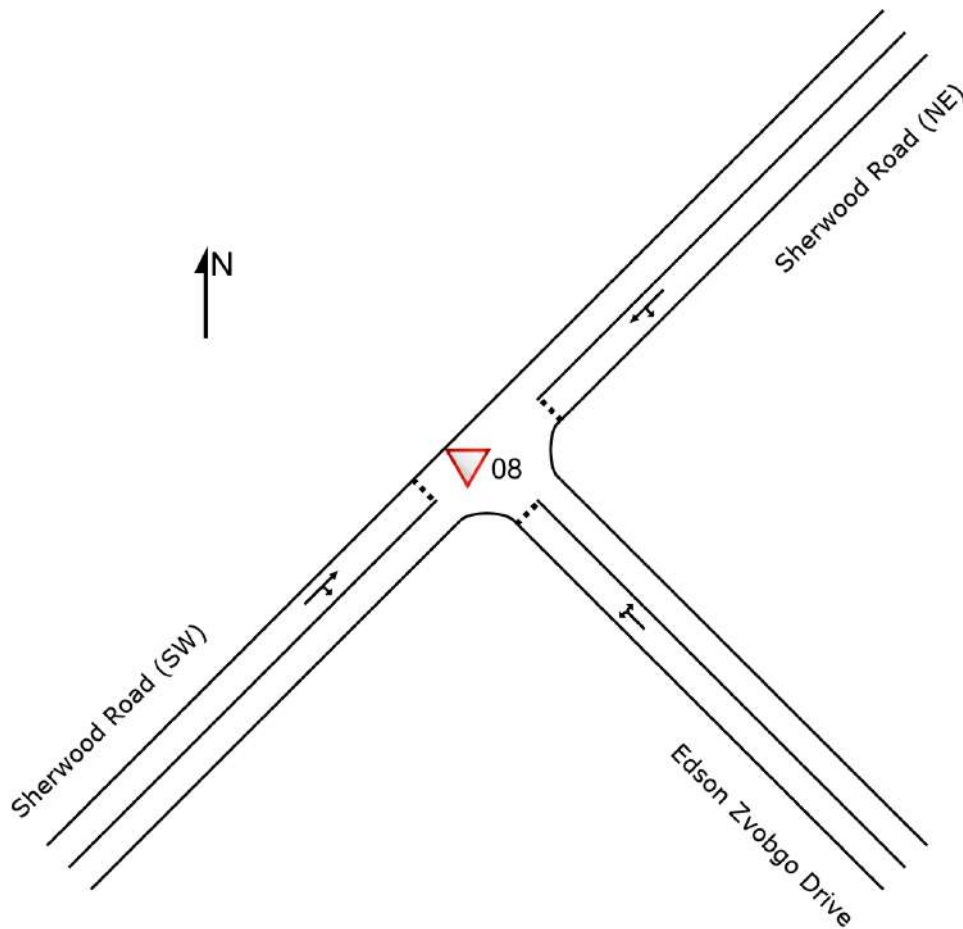
Colour code based on Degree of Saturation



Site 08: Sherwood Road and Edson Zvobgo Drive Intersection
15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

▼ Site: 08 [Sherwood Road and Edson Zvobgo Drive (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

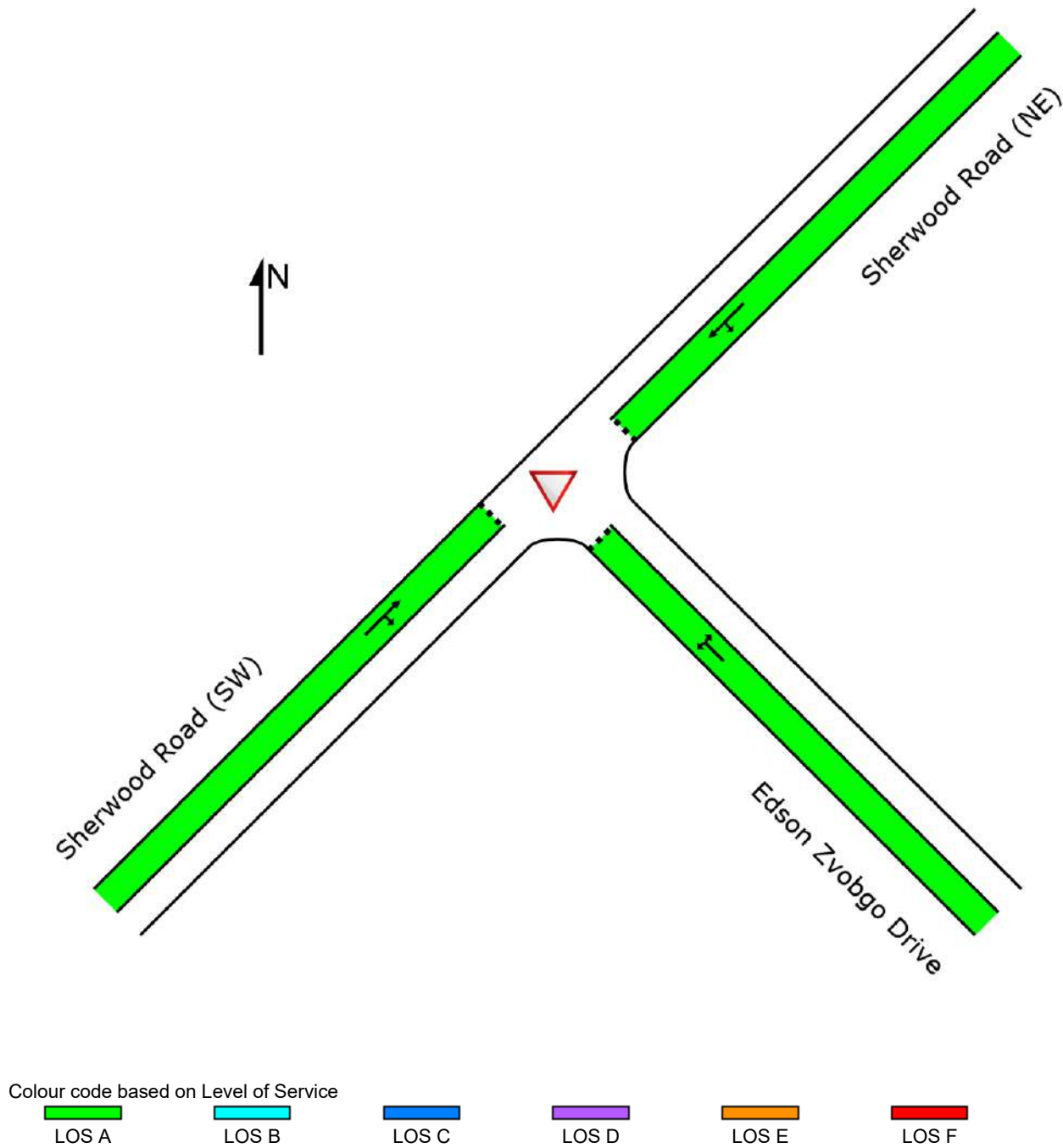
▼ Site: 08 [Sherwood Road and Edson Zvobgo Drive (Site Folder: Non-Corridor Critical Nodes)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh.	Dist]				
			veh/h	%	veh/h	%									
SouthEast: Edson Zvobgo Drive															
21	L2	All MCs	69	1.4	69	1.4	0.070	6.1	LOS A	0.3	1.9	0.27	0.57	0.27	52.0
23	R2	All MCs	18	0.8	18	0.8	0.070	6.6	LOS A	0.3	1.9	0.27	0.57	0.27	51.8
Approach			87	1.3	87	1.3	0.070	6.2	LOS A	0.3	1.9	0.27	0.57	0.27	51.9
NorthEast: Sherwood Road (NE)															
24	L2	All MCs	109	2.3	109	2.3	0.141	5.5	LOS A	0.0	0.0	0.00	0.55	0.00	53.2
25	T1	All MCs	154	1.5	154	1.5	0.141	4.1	LOS A	0.0	0.0	0.00	0.55	0.00	53.8
Approach			263	1.9	263	1.9	0.141	4.7	LOS A	0.0	0.0	0.00	0.55	0.00	53.5
SouthWest: Sherwood Road (SW)															
31	T1	All MCs	8	7.4	8	7.4	0.204	4.2	LOS A	0.7	5.6	0.43	0.69	0.43	51.0
32	R2	All MCs	143	4.0	143	4.0	0.204	8.1	LOS A	0.7	5.6	0.43	0.69	0.43	50.4
Approach			151	4.1	151	4.1	0.204	7.9	LOS A	0.7	5.6	0.43	0.69	0.43	50.4
All Vehicles			501	2.5	501	2.5	0.204	5.9	NA	0.7	5.6	0.18	0.60	0.18	52.3

LEVEL OF SERVICE

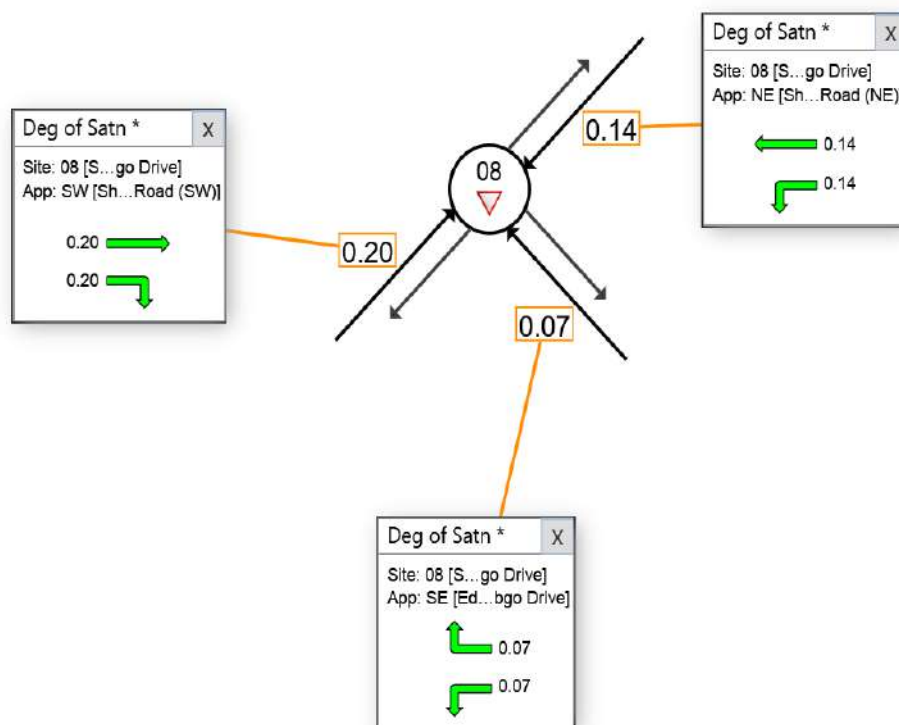
▼ Site: 08 [Sherwood Road and Edson Zvobgo Drive (Site Folder: Non-Corridor Critical Nodes)]

	Approaches			Intersection
	Southeast	Northeast	Southwest	
LOS	A	A	A	NA (TWSC)

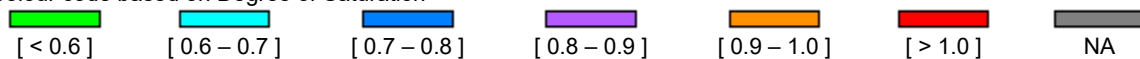


DEGREE OF SATURATION

▽ Site: 08 [Sherwood Road and Edson Zvobgo Drive (Site Folder: Non-Corridor Critical Nodes)]



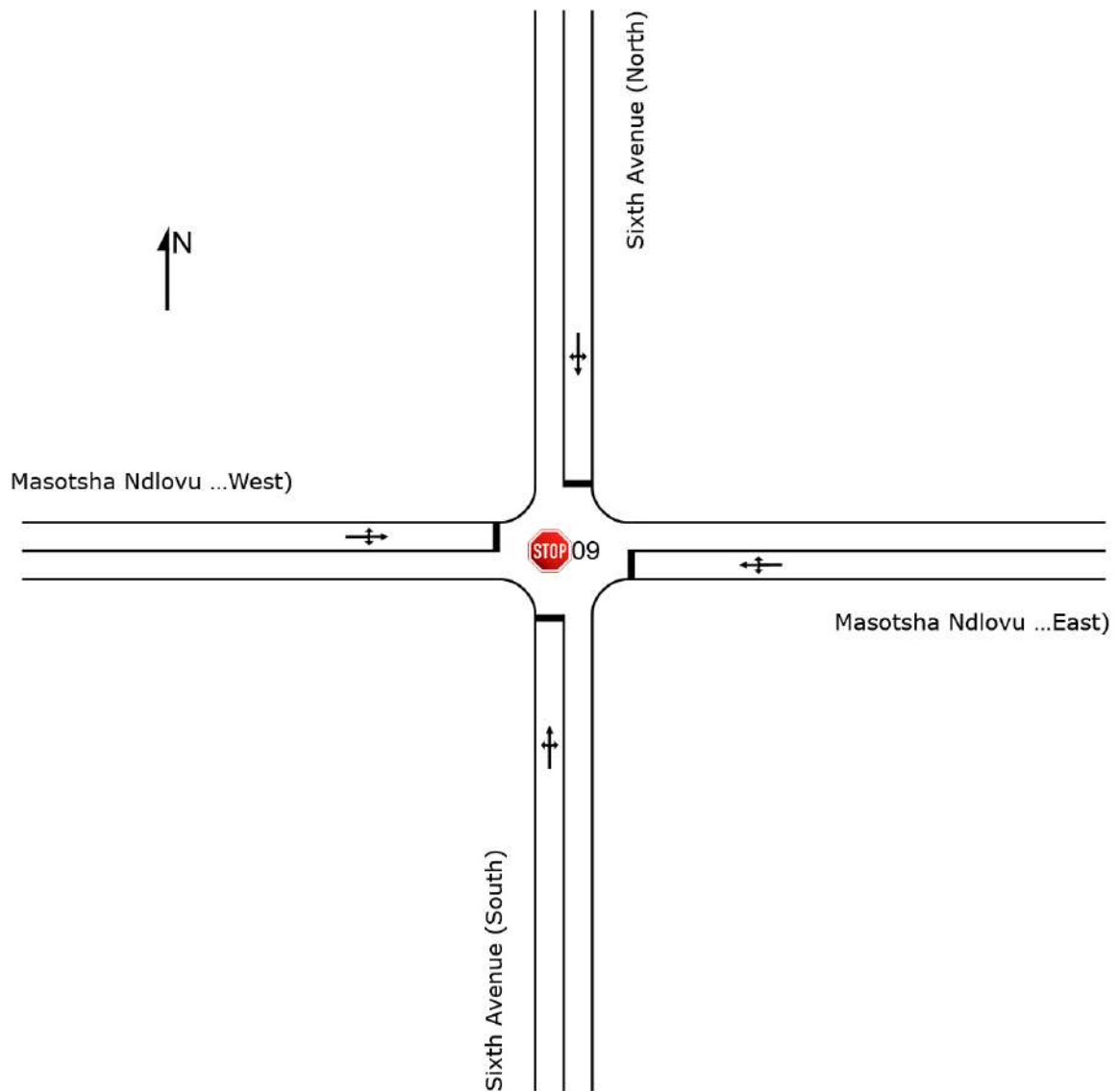
Colour code based on Degree of Saturation



Site 09: Masotsha Ndlovu Way and Sixth Avenue Intersection
15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 **Site: 09 [Masotsha Ndlovu Way and Sixth Avenue (Site Folder: Non-Corridor Critical Nodes)]**



MOVEMENT SUMMARY

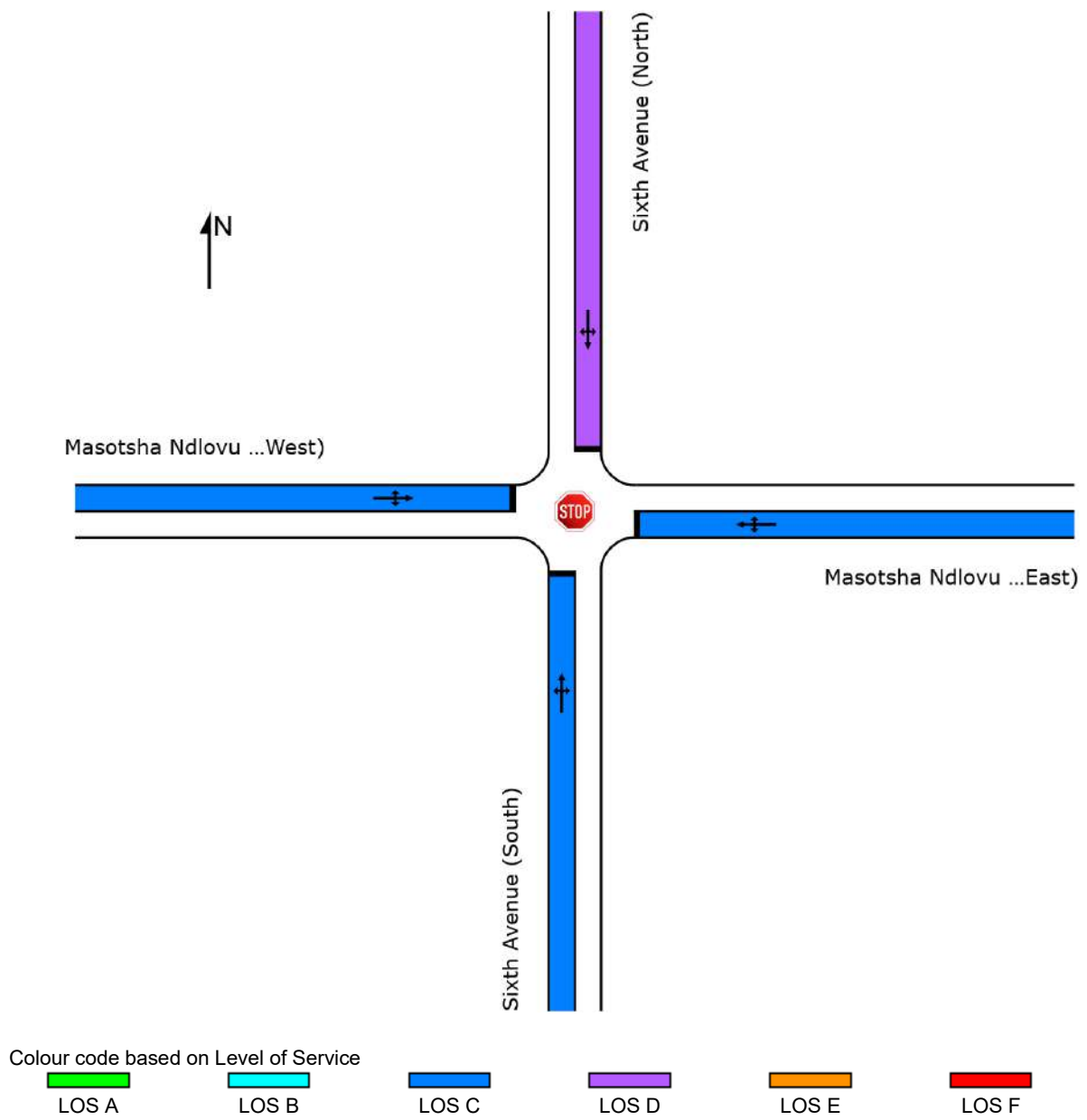
 Site: 09 [Masotsha Ndlovu Way and Sixth Avenue (Site Folder: Non Corridor Critical Nodes)]

Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Stop Rate	Eff. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Sixth Avenue (South)															
1	L2	All MCs	13	4.9	13	4.9	0.335	17.3	LOS C	1.3	9.4	0.88	1.27	2.35	46.6
2	T1	All MCs	118	1.9	118	1.9	0.335	16.6	LOS C	1.3	9.4	0.88	1.27	2.35	46.6
3	R2	All MCs	36	1.2	36	1.2	0.335	16.3	LOS C	1.3	9.4	0.88	1.27	2.35	46.5
Approach			166	2.0	166	2.0	0.335	16.6	LOS C	1.3	9.4	0.88	1.27	2.35	46.6
East: Masotsha Ndlovu Way (East)															
4	L2	All MCs	21	2.7	21	2.7	0.507	16.7	LOS C	2.4	18.3	0.85	1.40	2.83	46.7
5	T1	All MCs	198	5.2	198	5.2	0.507	16.6	LOS C	2.4	18.3	0.85	1.40	2.83	46.5
6	R2	All MCs	123	7.8	123	7.8	0.507	16.5	LOS C	2.4	18.3	0.85	1.40	2.83	46.2
Approach			342	6.0	342	6.0	0.507	16.6	LOS C	2.4	18.3	0.85	1.40	2.83	46.4
North: Sixth Avenue (North)															
7	L2	All MCs	151	8.6	151	8.6	0.681	35.3	LOS E	4.4	34.3	1.00	1.60	3.85	37.8
8	T1	All MCs	75	4.1	75	4.1	0.681	34.3	LOS D	4.4	34.3	1.00	1.60	3.85	37.9
9	R2	All MCs	26	3.7	26	3.7	0.681	34.2	LOS D	4.4	34.3	1.00	1.60	3.85	37.8
Approach			252	6.8	252	6.8	0.681	34.9	LOS D	4.4	34.3	1.00	1.60	3.85	37.8
West: Masotsha Ndlovu Way (West)															
10	L2	All MCs	42	3.2	42	3.2	0.400	17.5	LOS C	1.7	12.8	0.89	1.31	2.52	46.2
11	T1	All MCs	156	6.6	156	6.6	0.400	17.6	LOS C	1.7	12.8	0.89	1.31	2.52	46.1
12	R2	All MCs	8	2.6	8	2.6	0.400	16.8	LOS C	1.7	12.8	0.89	1.31	2.52	46.0
Approach			207	5.7	207	5.7	0.400	17.5	LOS C	1.7	12.8	0.89	1.31	2.52	46.1
All Vehicles			967	5.4	967	5.4	0.681	21.6	LOS C	4.4	34.3	0.90	1.41	2.95	43.8

LEVEL OF SERVICE

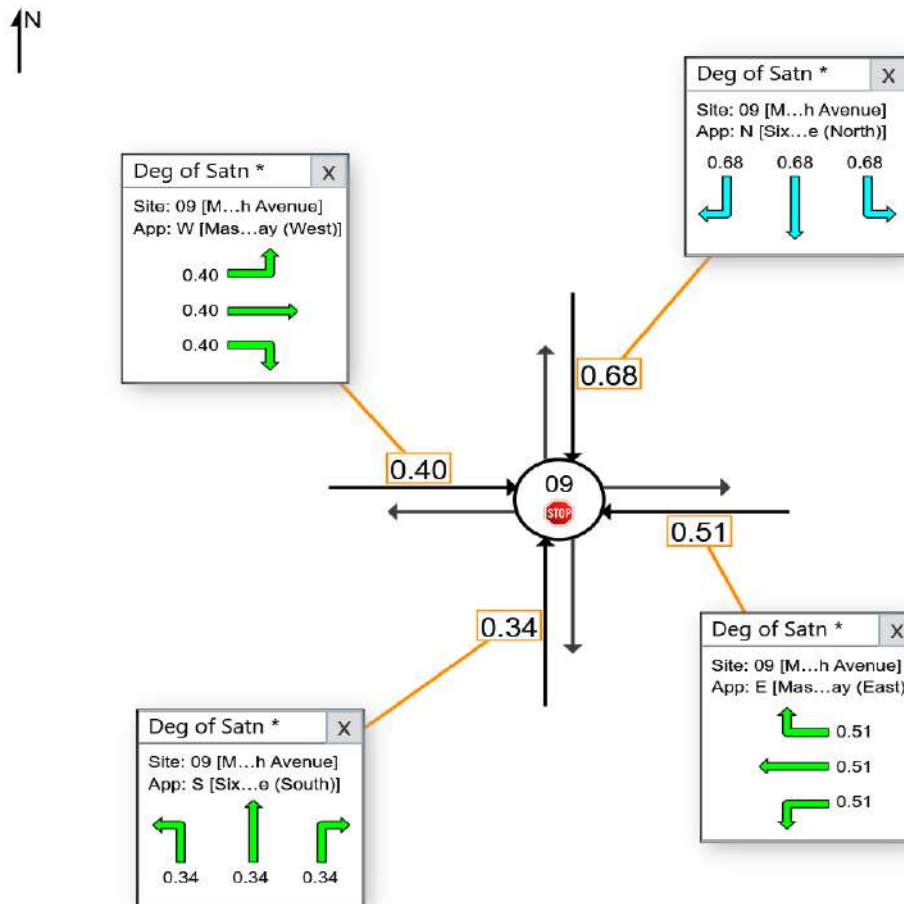
Site: 09 [Masotsha Ndlovu Way and Sixth Avenue (Site Folder: Non Corridor Critical Nodes)]

	Approaches				Intersection
	South	East	North	West	
LOS	C	C	D	C	C

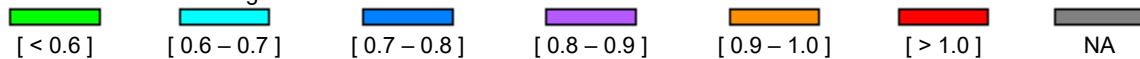


DEGREE OF SATURATION

 Site: 09 [Masotsha Ndlovu Way and Sixth Avenue (Site Folder: Non-Corridor Critical Nodes)]



Colour code based on Degree of Saturation

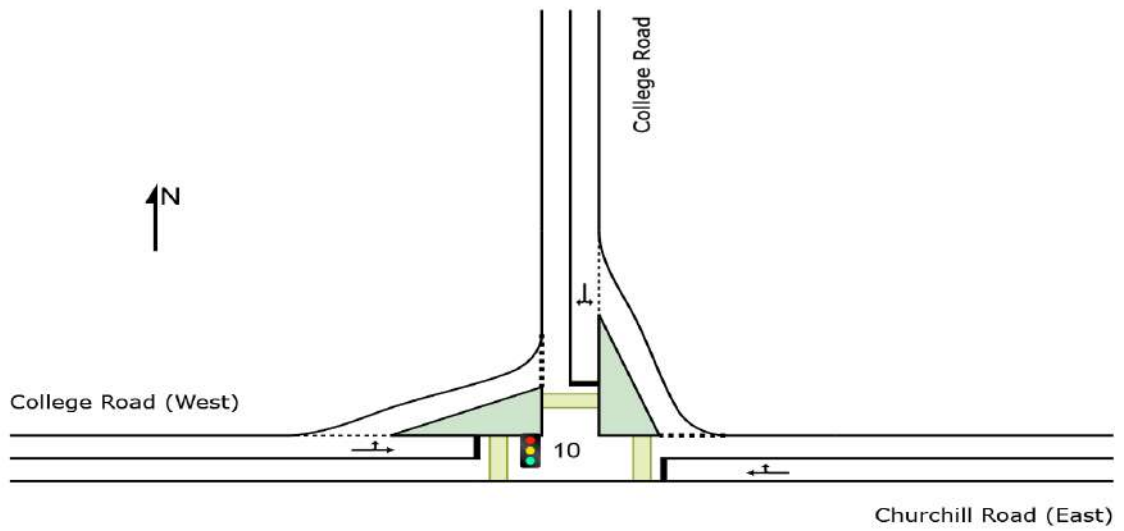


Site 10: College Road and Churchill Road Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 10 [College Road and Churchill Road (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

 Site: 10 [College Road and Churchill Road (Site Folder: Non Corridor Critical Nodes)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site

Site Category: Existing Design

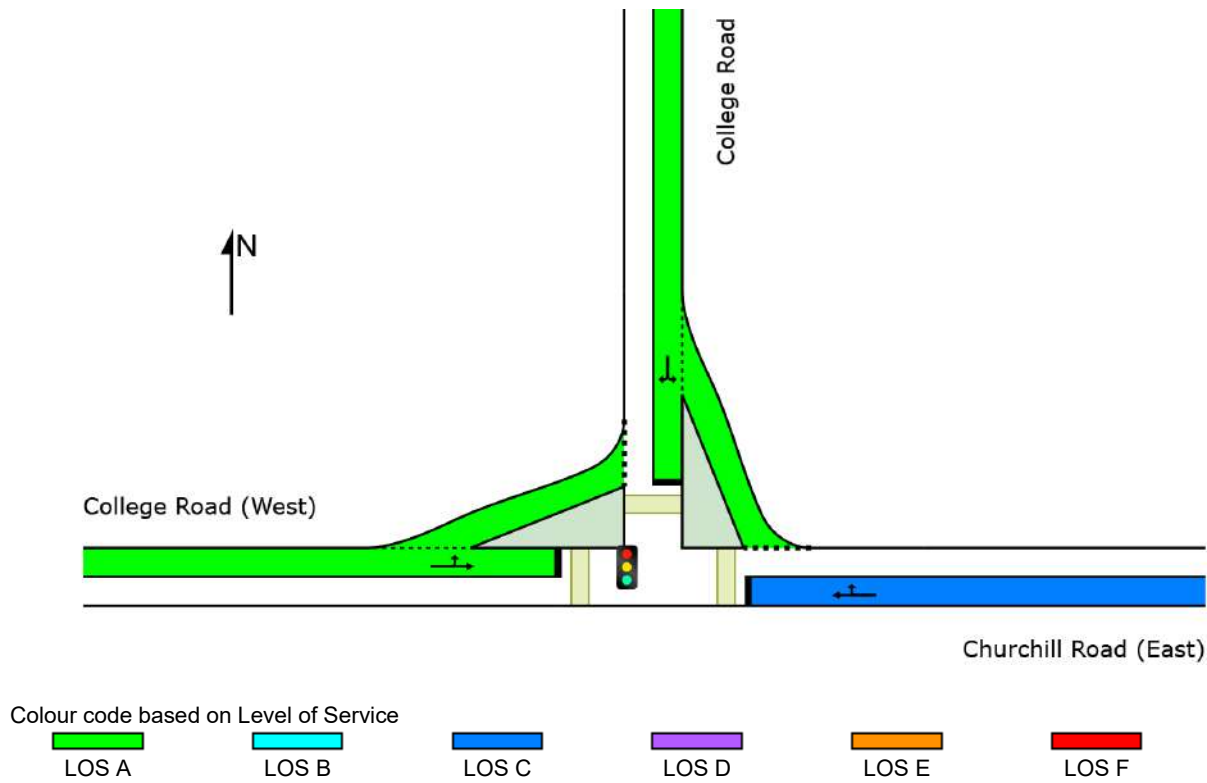
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site Practical Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
East: Churchill Road (East)															
5	T1	All MCs	401	4.2	401	4.2	0.879	24.2	LOS C	26.5	199.8	0.90	1.01	1.15	41.1
6	R2	All MCs	283	7.8	283	7.8	0.879*	33.3	LOS C	26.5	199.8	0.90	1.01	1.15	36.5
Approach			684	5.7	684	5.7	0.879	28.0	LOS C	26.5	199.8	0.90	1.01	1.15	39.3
North: College Road															
7	L2	All MCs	97	4.9	97	4.9	0.187	7.0	LOS A	1.2	8.7	0.27	0.63	0.27	50.2
9	R2	All MCs	71	2.7	71	2.7	0.187*	6.8	LOS A	1.2	8.7	0.27	0.63	0.27	49.6
Approach			168	4.0	168	4.0	0.187	6.9	LOS A	1.2	8.7	0.27	0.63	0.27	49.9
West: College Road (West)															
10	L2	All MCs	152	4.6	152	4.6	0.495	11.3	LOS B	5.7	43.4	0.66	0.66	0.66	47.3
11	T1	All MCs	181	5.2	181	5.2	0.495	8.8	LOS A	5.7	43.4	0.66	0.66	0.66	51.5
Approach			333	4.9	333	4.9	0.495	9.9	LOS A	5.7	43.4	0.66	0.66	0.66	49.7
All Vehicles			1185	5.2	1185	5.2	0.879	19.9	LOS B	26.5	199.8	0.74	0.86	0.89	43.0

LEVEL OF SERVICE

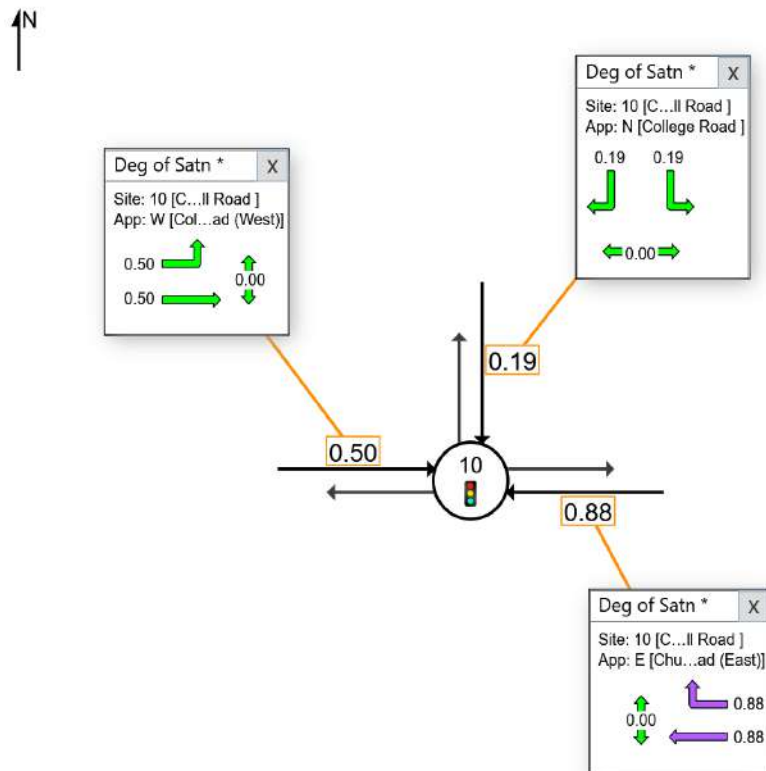
Site: 10 [College Road and Churchill Road (Site Folder: Non-Corridor Critical Nodes)]

LOS	Approaches			Intersection
	East	North	West	
LOS	C	A	A	B

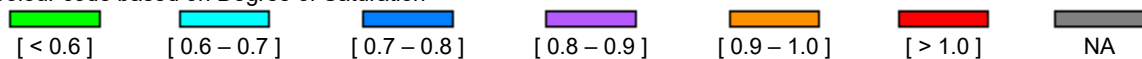


DEGREE OF SATURATION

 Site: 10 [College Road and Churchill Road (Site Folder: Non-Corridor Critical Nodes)]



Colour code based on Degree of Saturation

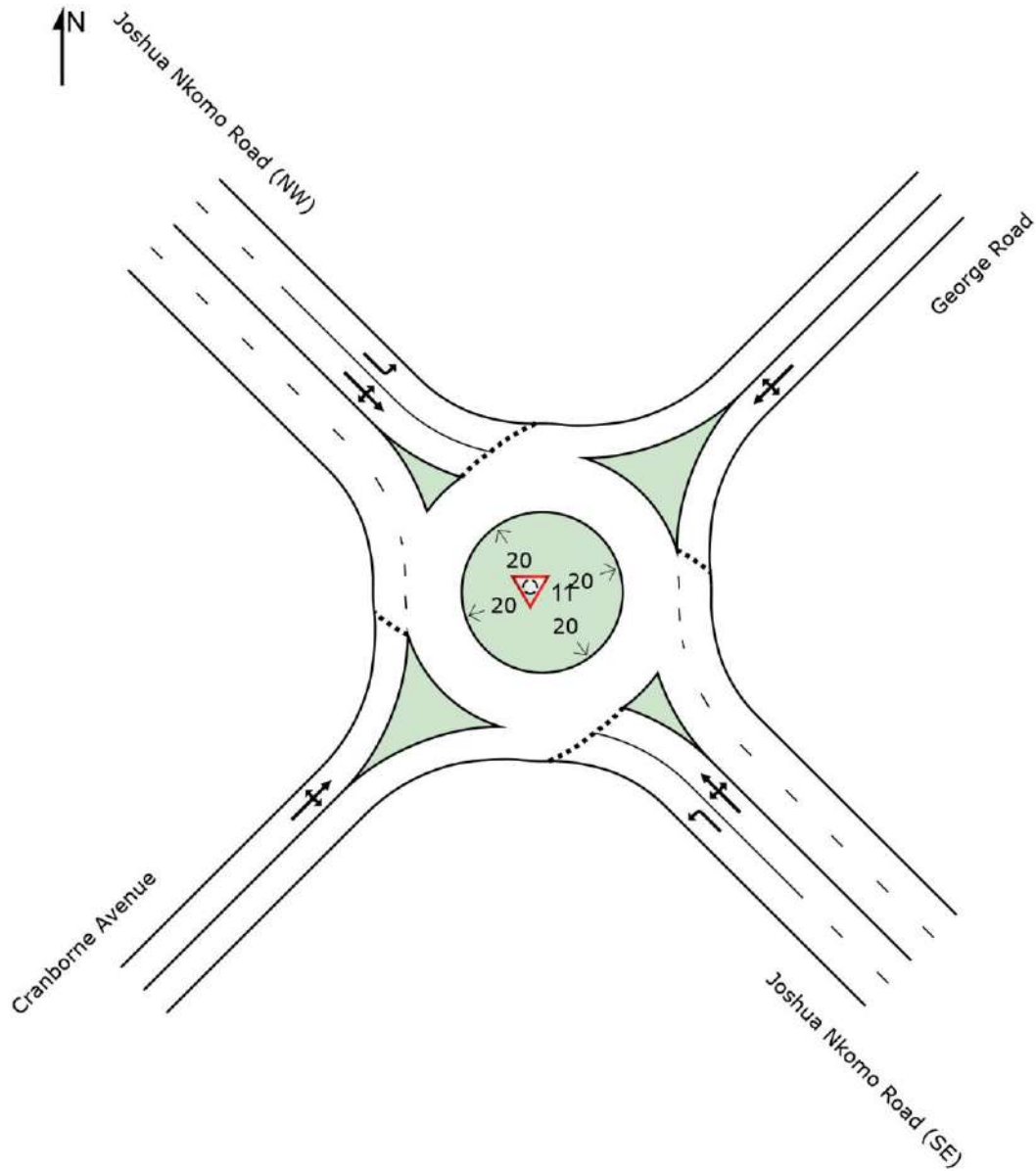


Site 11: Joshua Nkomo Road and George Road Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

▼ Site: 11 [Joshua Nkomo Road and George Road (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

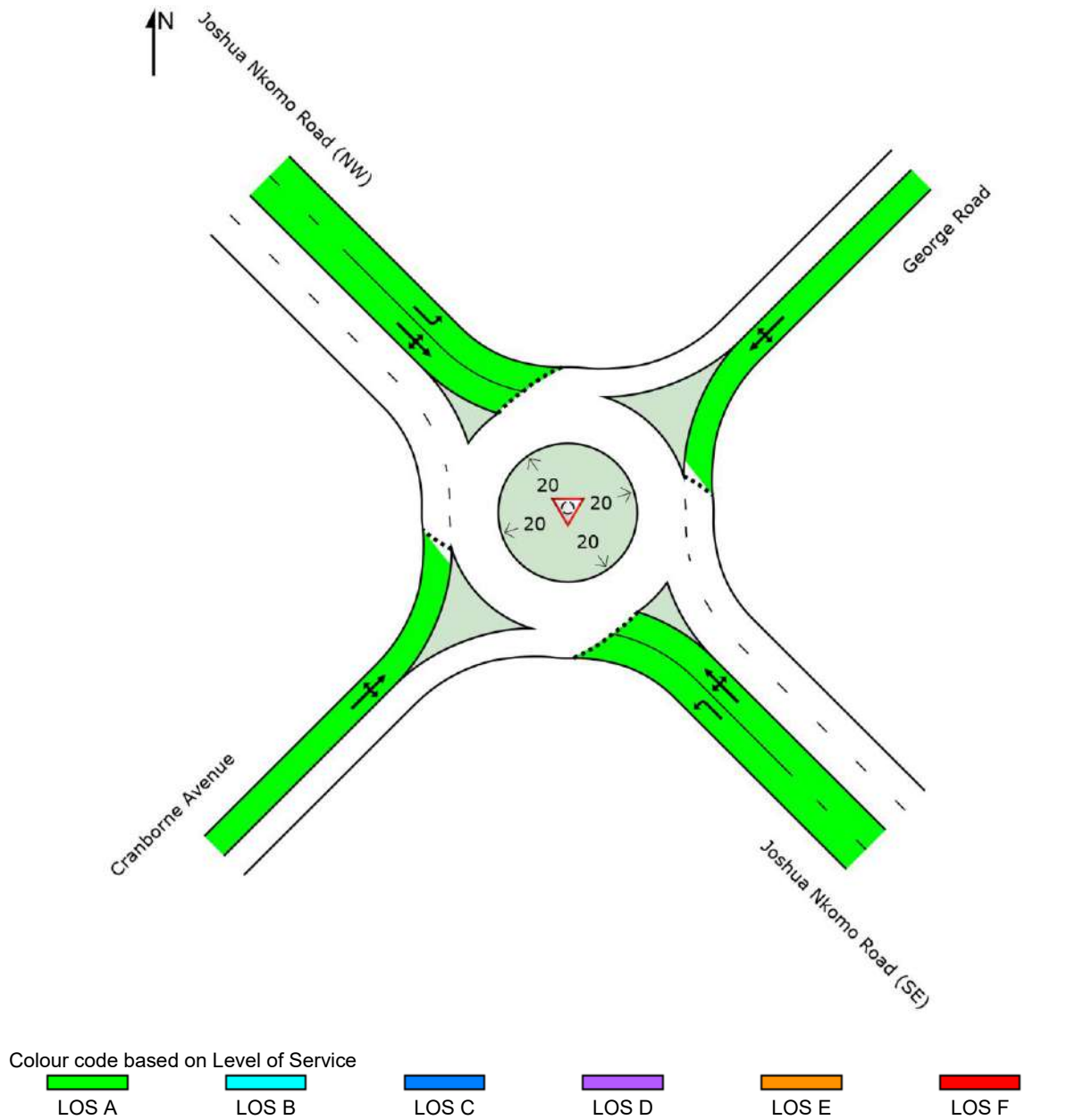
 **Site: 11 [Joshua Nkomo Road and George Road (Site Folder: Non-Corridor Critical Nodes)]**

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%				v/c	sec				
SouthEast: Joshua Nkomo Road (SE)															
21	L2	All MCs	21	2.7	21	2.7	0.026	6.2	LOS A	0.1	0.9	0.49	0.57	0.49	52.9
22	T1	All MCs	198	5.2	198	5.2	0.272	5.7	LOS A	1.7	13.3	0.54	0.58	0.54	51.8
23	R2	All MCs	123	7.8	123	7.8	0.272	10.4	LOS B	1.7	13.3	0.54	0.58	0.54	50.8
Approach			342	6.0	342	6.0	0.272	7.4	LOS A	1.7	13.3	0.53	0.58	0.53	51.5
NorthEast: George Road															
24	L2	All MCs	43	3.3	43	3.3	0.296	6.7	LOS A	1.9	14.1	0.65	0.67	0.65	50.6
25	T1	All MCs	84	7.0	84	7.0	0.296	7.0	LOS A	1.9	14.1	0.65	0.67	0.65	50.6
26	R2	All MCs	135	5.4	135	5.4	0.296	11.6	LOS B	1.9	14.1	0.65	0.67	0.65	49.9
Approach			263	5.6	263	5.6	0.296	9.3	LOS A	1.9	14.1	0.65	0.67	0.65	50.2
NorthWest: Joshua Nkomo Road (NW)															
27	L2	All MCs	276	7.2	276	7.2	0.453	5.6	LOS A	3.3	25.8	0.49	0.54	0.49	52.1
28	T1	All MCs	305	5.6	305	5.6	0.453	5.4	LOS A	3.3	25.8	0.52	0.54	0.52	52.6
29	R2	All MCs	91	7.2	91	7.2	0.453	10.1	LOS B	3.3	25.8	0.52	0.54	0.52	51.6
Approach			673	6.5	673	6.5	0.453	6.1	LOS A	3.3	25.8	0.51	0.54	0.51	52.2
SouthWest: Cranborne Avenue															
30	L2	All MCs	129	9.0	129	9.0	0.258	7.1	LOS A	1.6	12.4	0.64	0.65	0.64	51.5
31	T1	All MCs	64	9.4	64	9.4	0.258	7.2	LOS A	1.6	12.4	0.64	0.65	0.64	51.5
32	R2	All MCs	24	6.8	24	6.8	0.258	11.8	LOS B	1.6	12.4	0.64	0.65	0.64	50.9
Approach			216	8.9	216	8.9	0.258	7.7	LOS A	1.6	12.4	0.64	0.65	0.64	51.5
All Vehicles			1494	6.5	1494	6.5	0.453	7.2	LOS A	3.3	25.8	0.56	0.59	0.56	51.6

LEVEL OF SERVICE

Site: 11 [Joshua Nkomo Road and George Road (Site Folder: Non-Corridor Critical Nodes)]

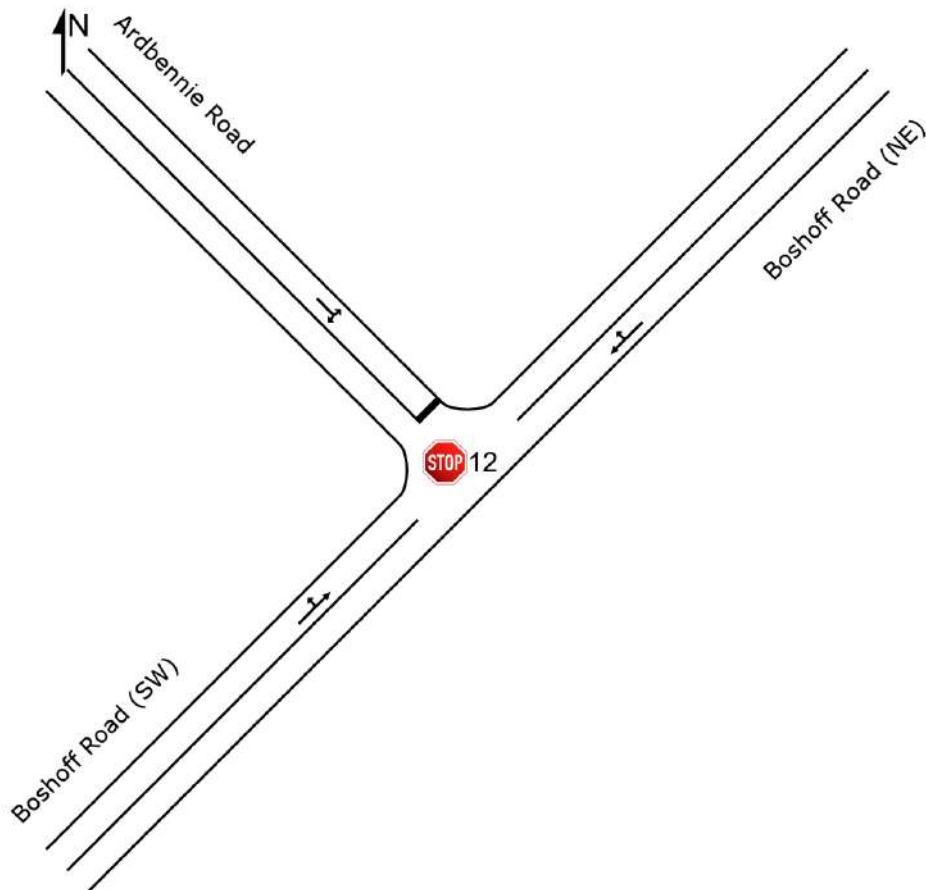
	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	A	A	A	A	A



Site 12: Ardbennie and Boshoff Road Intersection
15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 **Site: 12 [Ardbennie Road and Boshoff Road (Site Folder: Non-Corridor Critical Nodes)]**



MOVEMENT SUMMARY

 **Site: 12 [Ardbennie Road and Boshoff Road (Site Folder: Non-Corridor Critical Nodes)]**

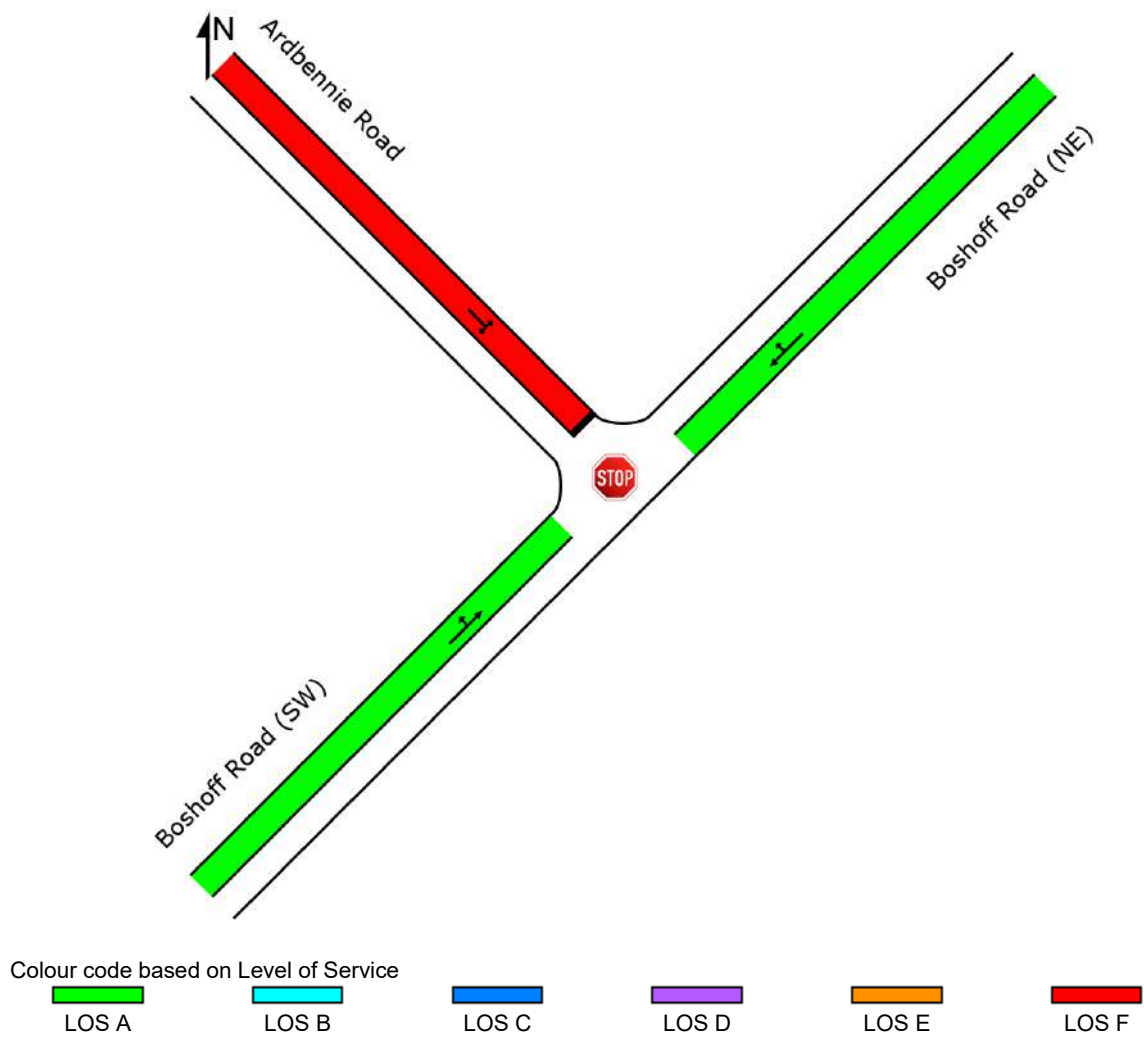
Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh. Dist]					
			veh/h	%	veh/h	%				v/c	sec				
NorthEast: Boshoff Road (NE)															
25	T1	All MCs	340	5.4	340	5.4	0.451	2.7	LOS A	3.1	23.4	0.46	0.58	0.64	55.0
26	R2	All MCs	220	5.6	220	5.6	0.451	9.4	LOS A	3.1	23.4	0.46	0.58	0.64	52.4
Approach			561	5.5	561	5.5	0.451	5.4	NA	3.1	23.4	0.46	0.58	0.64	53.9
NorthWest: Ardbennie Road															
27	L2	All MCs	205	3.6	205	3.6	2.532	1390.8	LOS F	221.9	1727.6	1.00	11.08	33.71	2.5
29	R2	All MCs	375	7.0	375	7.0	2.532	1422.0	LOS F	221.9	1727.6	1.00	11.08	33.71	2.5
Approach			581	5.8	581	5.8	2.532	1411.0	LOS F	221.9	1727.6	1.00	11.08	33.71	2.5
SouthWest: Boshoff Road (SW)															
30	L2	All MCs	150	5.8	150	5.8	0.306	5.7	LOS A	0.0	0.0	0.00	0.20	0.00	55.2
31	T1	All MCs	300	6.5	300	6.5	0.306	0.1	LOS A	0.0	0.0	0.00	0.20	0.00	57.8
Approach			450	6.3	450	6.3	0.306	2.0	NA	0.0	0.0	0.00	0.20	0.00	57.0
All Vehicles			1592	5.8	1592	5.8	2.532	517.2	NA	221.9	1727.6	0.53	4.30	12.52	6.3

LEVEL OF SERVICE

 **Site: 12 [Ardbennie Road and Boshoff Road (Site Folder: Non Corridor Critical Nodes)]**

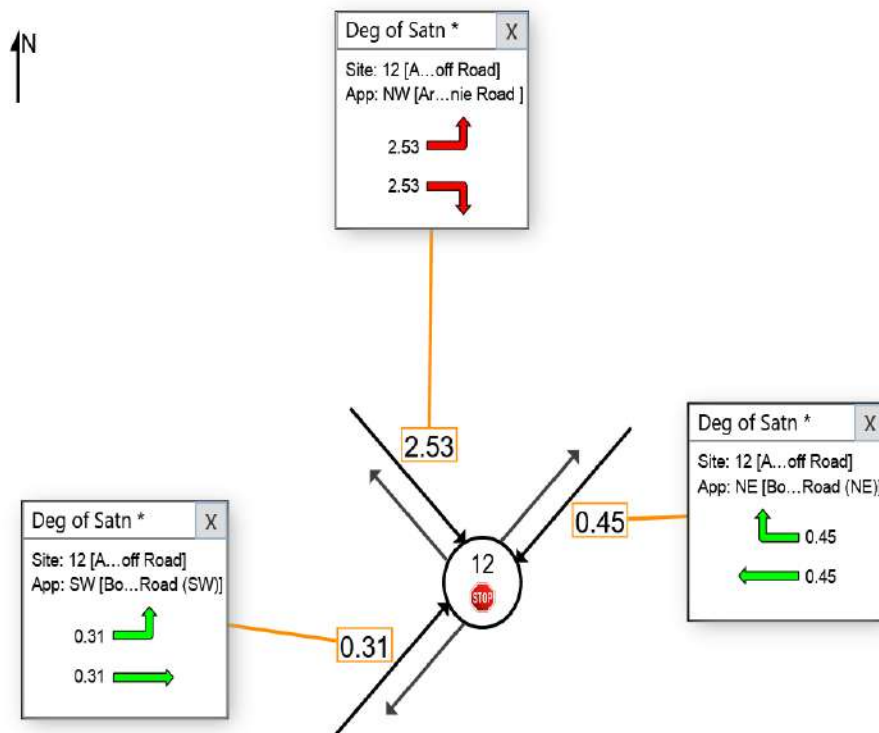
New Site
Site Category: Existing Design
Stop (Two-Way)

	Approaches			Intersection
	Northeast	Northwest	Southwest	
LOS	NA (TWSC)	F	NA (TWSC)	NA (TWSC)

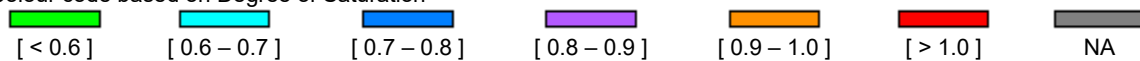


DEGREE OF SATURATION

 Site: 12 [Ardbennie Road and Boshoff Road (Site Folder: Non-Corridor Critical Nodes)]



Colour code based on Degree of Saturation

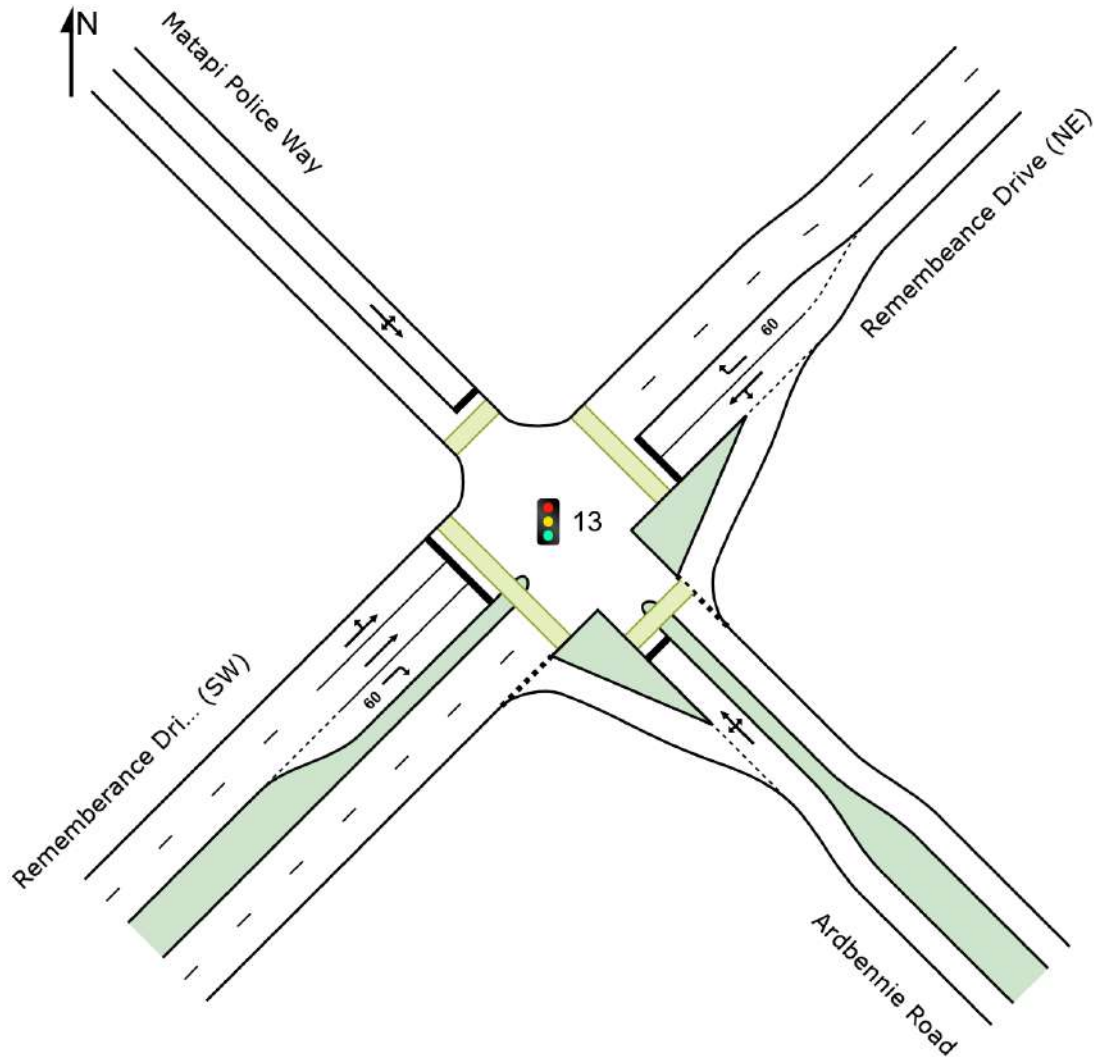


Site 13: Ardbennie Road and Remembrance Road Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 13 [Ardbennie Road and Remembrance Drive (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

 **Site: 13 [Ardbennie Road and Remembrance Drive (Site Folder: Non Corridor Critical Nodes)]**

New Site

Site Category: Existing Design

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 40 seconds (Site Practical Cycle Time)

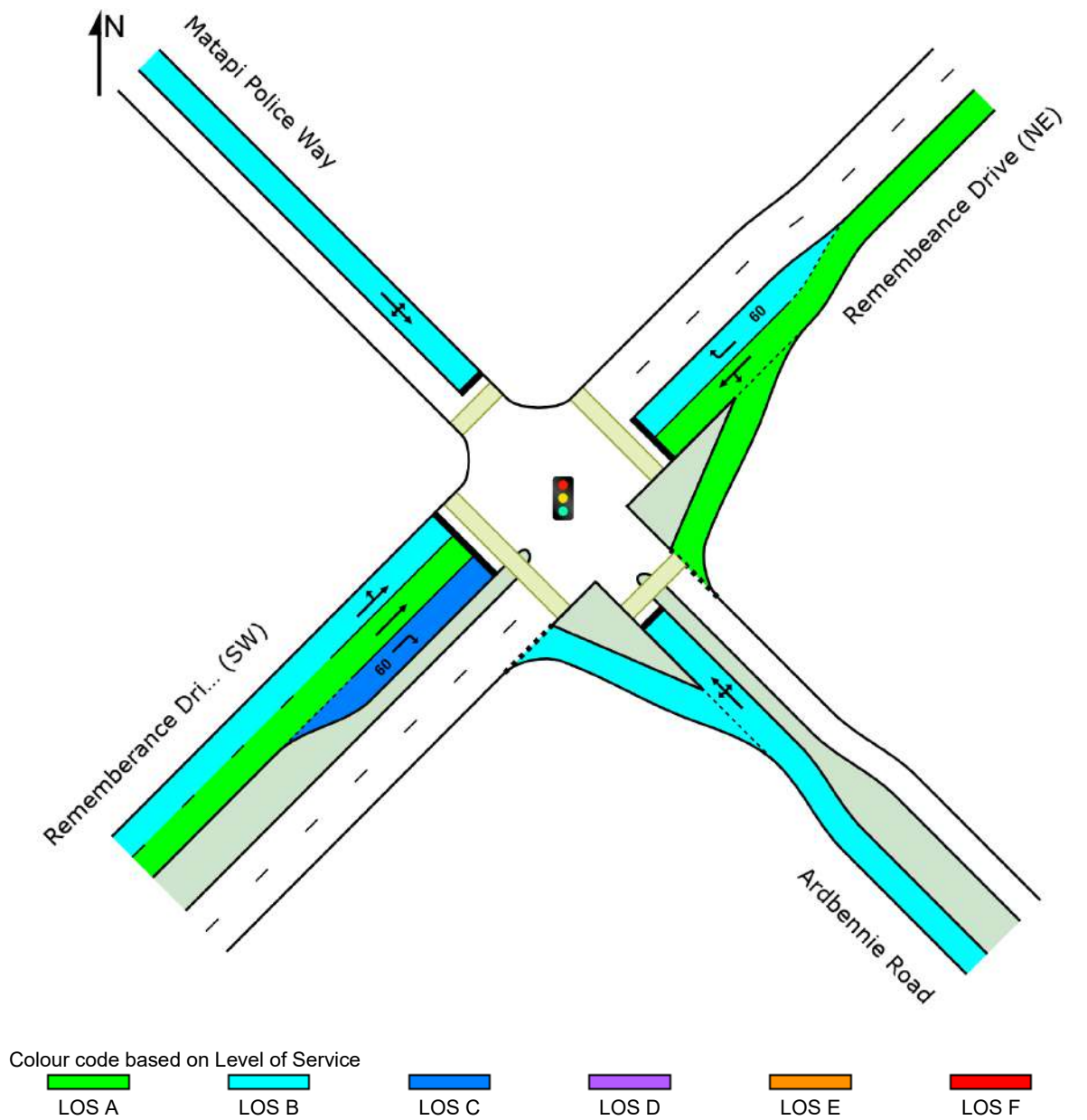
Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Ardbennie Road															
21	L2	All MCs	95	22.6	95	22.6	0.681	9.3	LOS A	5.0	41.7	0.94	0.90	1.08	41.2
22	T1	All MCs	0	0.0	0	0.0 *	0.681	18.2	LOS B	5.0	41.7	0.94	0.90	1.08	37.2
23	R2	All MCs	202	6.9	202	6.9	0.681	23.9	LOS C	5.0	41.7	0.94	0.90	1.08	41.3
Approach			297	11.9	297	11.9	0.681	19.2	LOS B	5.0	41.7	0.94	0.90	1.08	41.3
NorthEast: Remembrance Drive (NE)															
24	L2	All MCs	200	16.4	200	16.4	0.650	8.8	LOS A	4.4	41.9	0.78	0.77	0.85	47.8
25	T1	All MCs	172	25.9	172	25.9 *	0.650	9.5	LOS A	4.4	41.9	0.78	0.77	0.85	48.1
26	R2	All MCs	19	9.0	19	9.0	0.041	13.8	LOS B	0.2	2.0	0.63	0.68	0.63	34.3
Approach			391	20.2	391	20.2	0.650	9.3	LOS A	4.4	41.9	0.77	0.76	0.84	47.4
NorthWest: Matapi Police Way															
27	L2	All MCs	8	25.0	8	25.0	0.158	18.1	LOS B	0.5	3.9	0.81	0.68	0.81	28.5
28	T1	All MCs	8	1.8	8	1.8	0.158	14.2	LOS B	0.5	3.9	0.81	0.68	0.81	40.0
29	R2	All MCs	11	7.9	11	7.9	0.158	18.2	LOS B	0.5	3.9	0.81	0.68	0.81	30.8
Approach			26	11.2	26	11.2	0.158	17.0	LOS B	0.5	3.9	0.81	0.68	0.81	33.1
SouthWest: Remembrance Drive (SW)															
30	L2	All MCs	60	15.0	60	15.0	0.260	13.8	LOS B	1.1	10.2	0.66	0.67	0.66	24.1
31	T1	All MCs	188	16.3	188	16.3	0.260	7.7	LOS A	2.0	17.9	0.66	0.56	0.66	49.0
32	R2	All MCs	108	12.0	168	12.0	0.355	34.7	LOS C	6.5	53.9	0.76	0.76	0.76	43.2
Approach			356	14.8	416	14.4	0.355	19.5	LOS B	6.5	53.9	0.70	0.66	0.70	42.5
All Vehicles			1070	15.9	1130	15.0	0.681	14.6	LOS B	6.5	53.9	0.79	0.76	0.85	43.6

LEVEL OF SERVICE

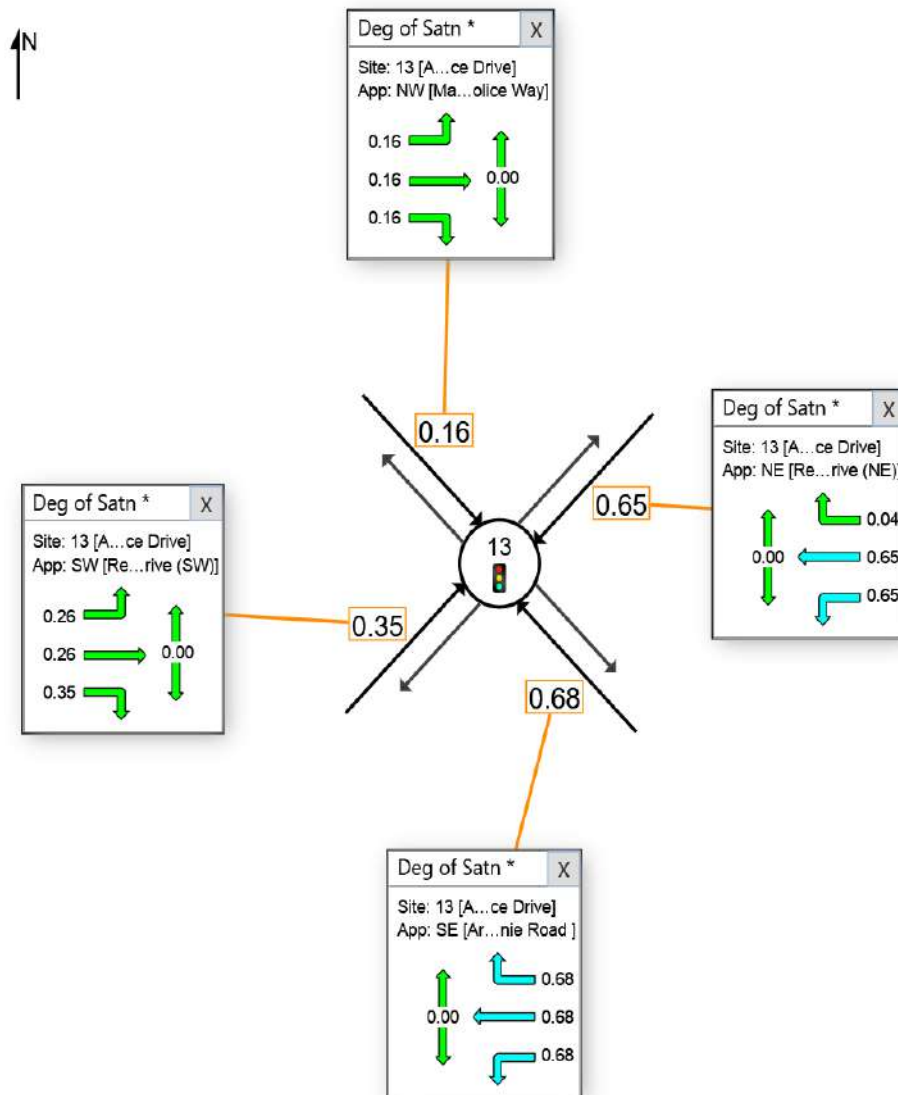
Site: 13 [Ardbennie Road and Remembrance Drive (Site Folder: Non-Corridor Critical Nodes)]

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	B	A	B	B	B

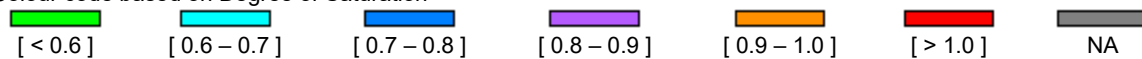


DEGREE OF SATURATION

 Site: 13 [Ardbennie Road and Remembrance Drive (Site Folder: Non-Corridor Critical Nodes)]



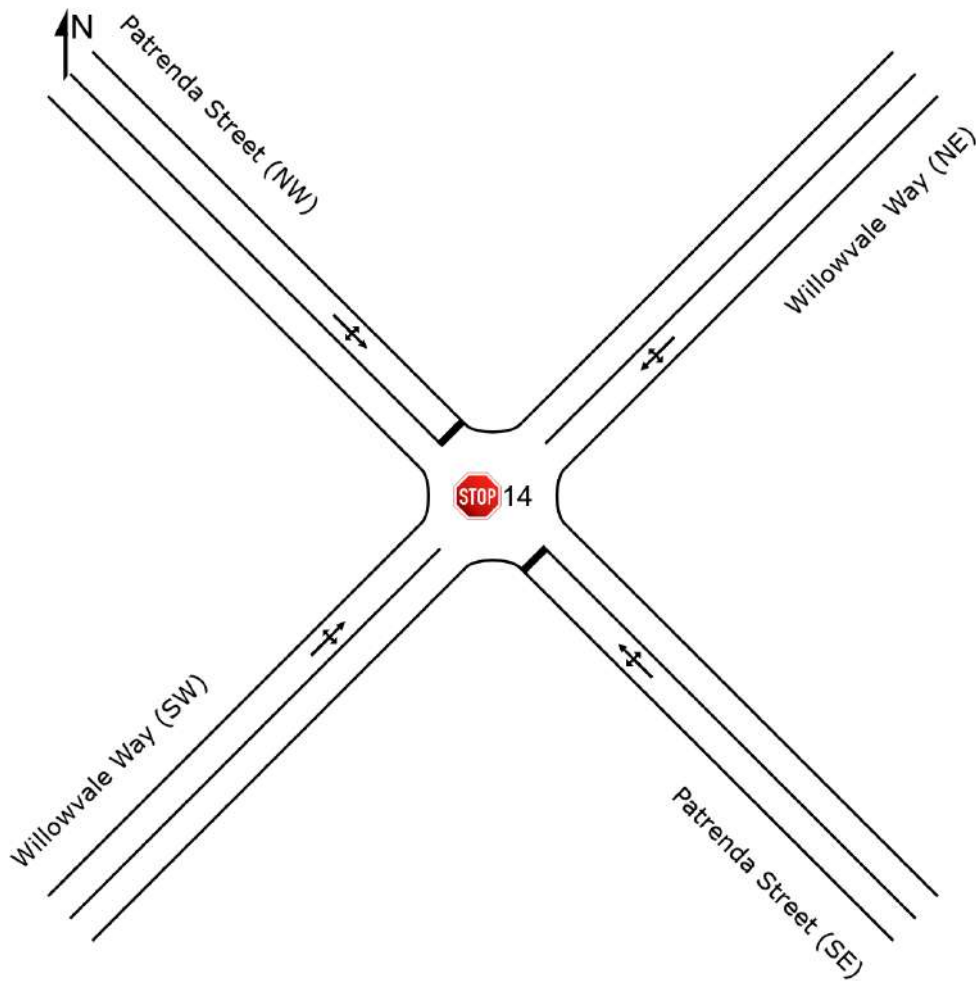
Colour code based on Degree of Saturation



Site 14: Willowvale Road and Patrenda Street Intersection
15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 **Site: 14 [Willowvale Road and Patrenda Street (Site Folder: Non-Corridor Critical Nodes)]**



MOVEMENT SUMMARY

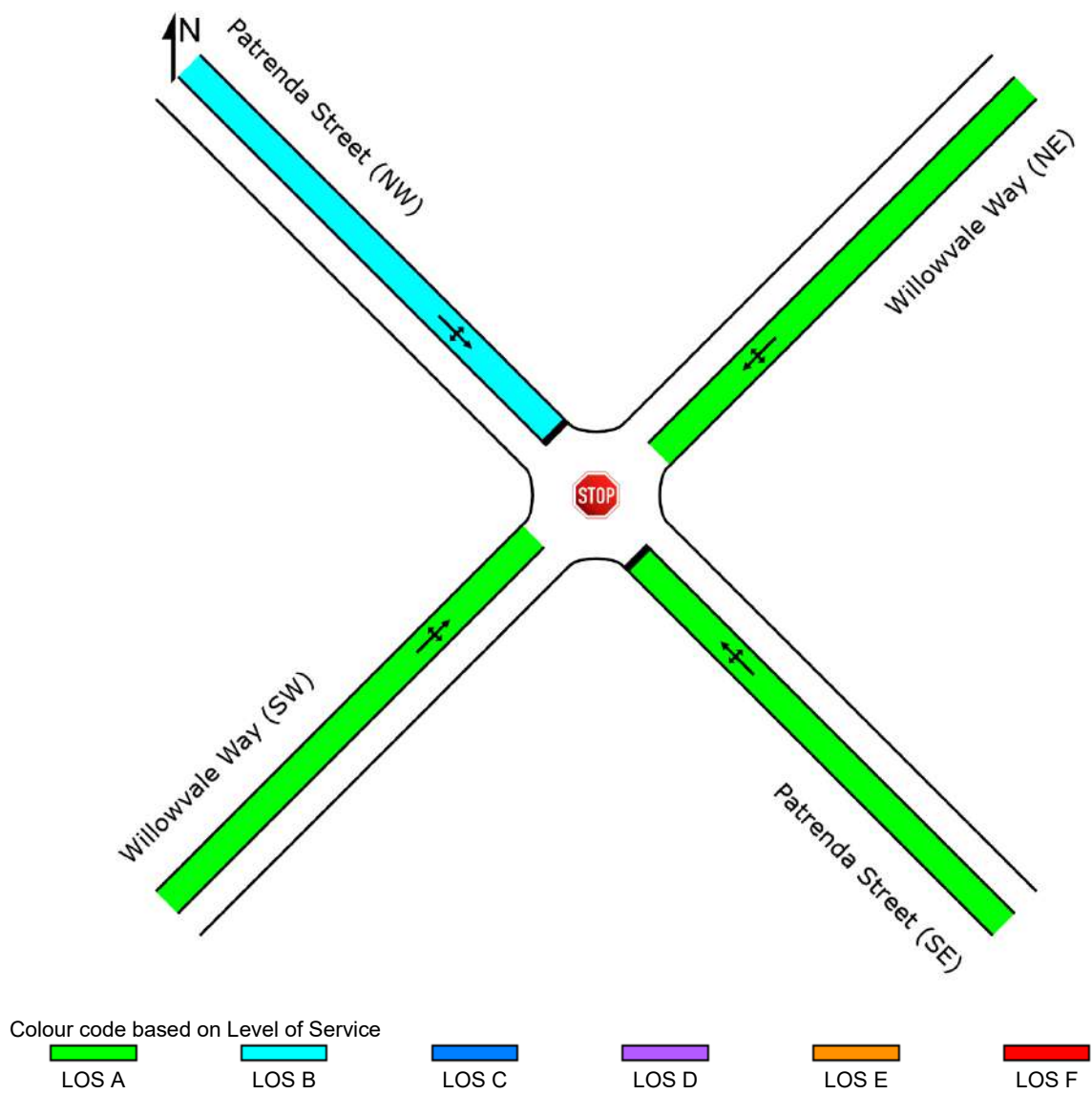
 **Site: 14 [Willowvale Road and Patrenda Street (Site Folder: Non-Corridor Critical Nodes)]**

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Patrenda Street (SE)															
21	L2	All MCs	13	8.9	13	8.9	0.089	8.4	LOS A	0.3	2.4	0.24	0.94	0.24	49.2
22	T1	All MCs	53	5.1	53	5.1	0.089	9.0	LOS A	0.3	2.4	0.24	0.94	0.24	50.3
23	R2	All MCs	17	4.6	17	4.6	0.089	8.9	LOS A	0.3	2.4	0.24	0.94	0.24	48.9
Approach			83	5.6	83	5.6	0.089	8.9	LOS A	0.3	2.4	0.24	0.94	0.24	49.8
NorthEast: Willowvale Way (NE)															
24	L2	All MCs	12	12.4	12	12.4	0.054	5.5	LOS A	0.2	1.5	0.16	0.38	0.16	51.6
25	T1	All MCs	28	11.4	28	11.4	0.054	0.2	LOS A	0.2	1.5	0.16	0.38	0.16	55.8
26	R2	All MCs	36	6.1	36	6.1	0.054	5.8	LOS A	0.2	1.5	0.16	0.38	0.16	53.0
Approach			75	9.1	75	9.1	0.054	3.7	NA	0.2	1.5	0.16	0.38	0.16	53.8
NorthWest: Patrenda Street (NW)															
27	L2	All MCs	16	20.8	16	20.8	0.075	9.2	LOS A	0.3	2.4	0.28	0.94	0.28	49.0
28	T1	All MCs	24	20.9	24	20.9	0.075	10.2	LOS B	0.3	2.4	0.28	0.94	0.28	49.3
29	R2	All MCs	20	22.4	20	22.4	0.075	10.5	LOS B	0.3	2.4	0.28	0.94	0.28	48.9
Approach			59	21.4	59	21.4	0.075	10.0	LOS B	0.3	2.4	0.28	0.94	0.28	49.1
SouthWest: Willowvale Way (SW)															
30	L2	All MCs	20	4.0	20	4.0	0.074	5.6	LOS A	0.1	0.9	0.05	0.22	0.05	55.0
31	T1	All MCs	65	5.8	65	5.8	0.074	0.0	LOS A	0.1	0.9	0.05	0.22	0.05	57.2
32	R2	All MCs	18	3.2	18	3.2	0.074	5.5	LOS A	0.1	0.9	0.05	0.22	0.05	54.3
Approach			102	5.0	102	5.0	0.074	2.0	NA	0.1	0.9	0.05	0.22	0.05	56.3
All Vehicles			319	9.2	319	9.2	0.089	5.7	NA	0.3	2.4	0.17	0.58	0.17	52.5

LEVEL OF SERVICE

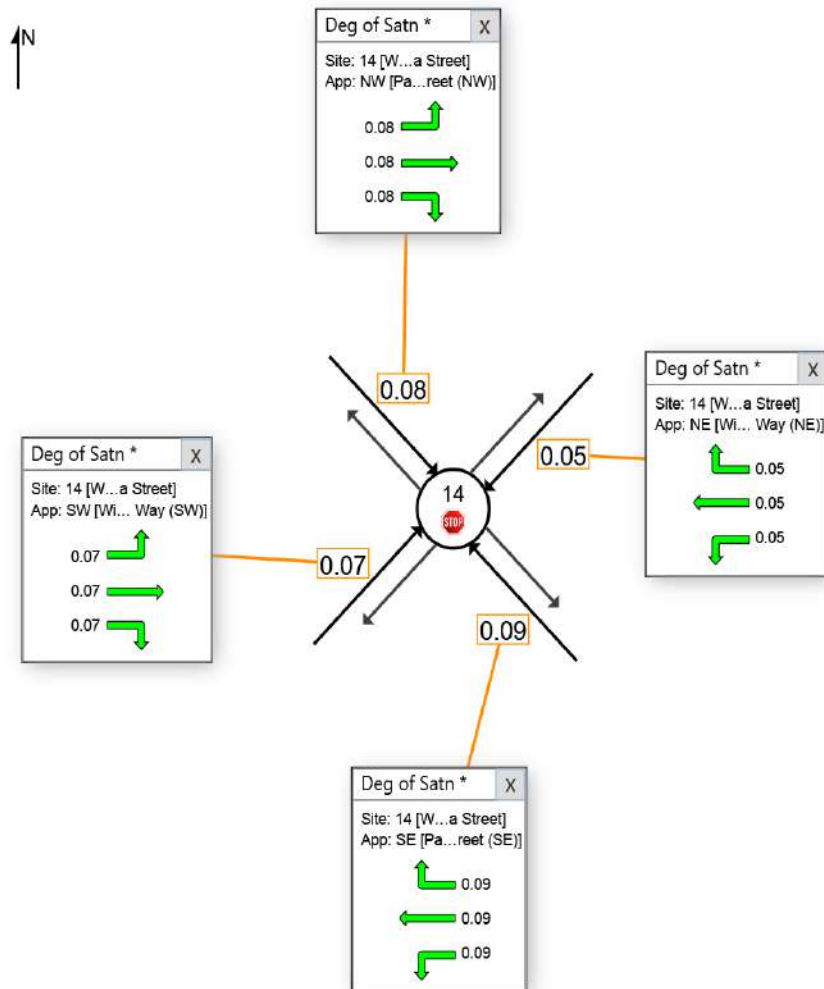
 Site: 14 [Willowvale Road and Patrenda Street (Site Folder: Non-Corridor Critical Nodes)]

	Approaches				Intersection
	Southeast	Northeast	Northwest	Southwest	
LOS	A	NA (TWSC)	B	NA (TWSC)	NA (TWSC)

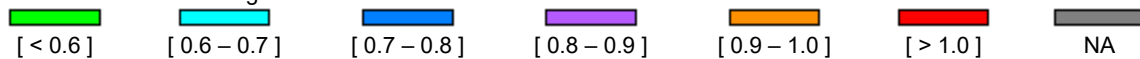


DEGREE OF SATURATION

 Site: 14 [Willowvale Road and Patrenda Street (Site Folder: Non-Corridor Critical Nodes)]



Colour code based on Degree of Saturation



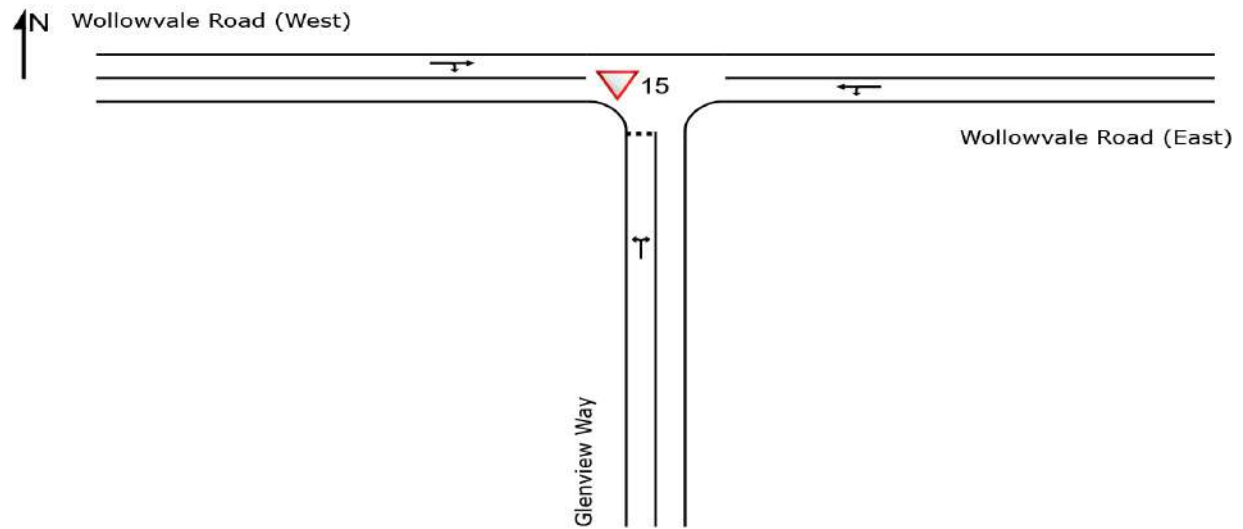
NA: The movement only runs in short lanes and these are not included in determining Queue Storage Ratio, or the movement has zero volume for the selected Movement Class.

Site 15: Willowvale Road and Glenview Way Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

▽ Site: 15 [Willowvale Road and Glenview Way (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

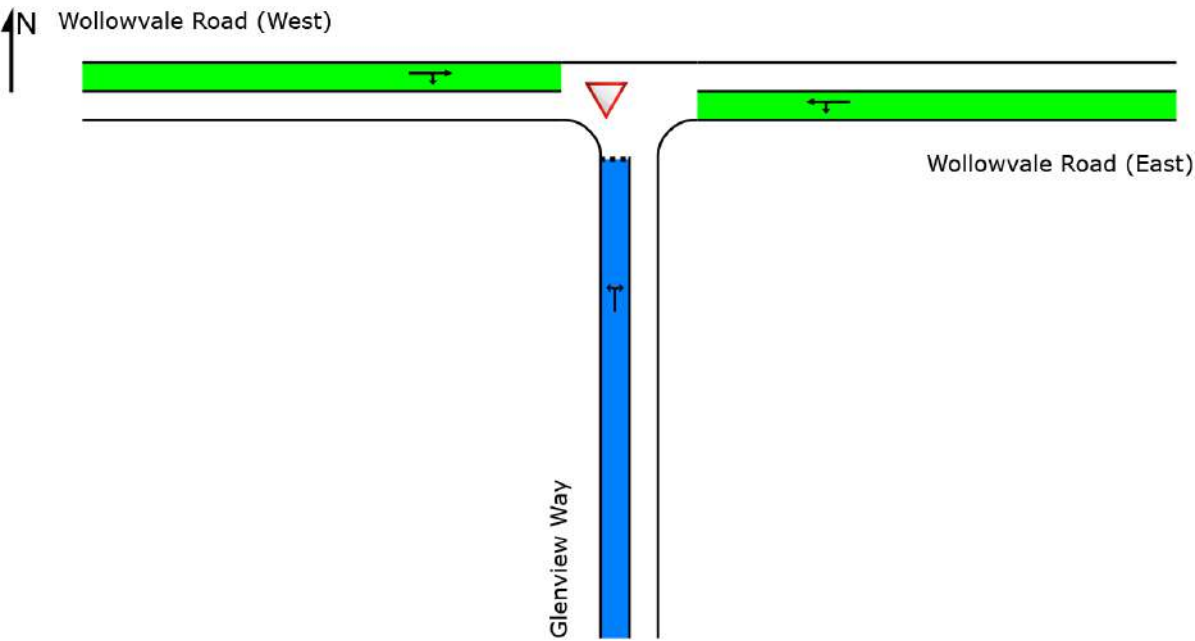
▼ Site: 15 [Wollowvale Road and Glenview Way (Site Folder: Non-Corridor Critical Nodes)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Glenview Way															
1	L2	All MCs	44	7.9	44	7.9	0.506	9.1	LOS A	2.4	21.6	0.66	0.98	1.09	46.0
3	R2	All MCs	193	15.1	193	15.1	0.506	16.5	LOS C	2.4	21.6	0.66	0.98	1.09	45.5
Approach			237	13.7	237	13.7	0.506	15.2	LOS C	2.4	21.6	0.66	0.98	1.09	45.6
East: Wollowvale Road (East)															
4	L2	All MCs	115	4.9	115	4.9	0.283	5.6	LOS A	0.0	0.0	0.00	0.18	0.00	55.3
5	T1	All MCs	261	5.1	261	5.1	0.283	0.1	LOS A	0.0	0.0	0.00	0.18	0.00	57.7
Approach			377	5.0	377	5.0	0.283	1.8	NA	0.0	0.0	0.00	0.18	0.00	56.9
West: Wollowvale Road (West)															
11	T1	All MCs	239	4.4	239	4.4	0.227	0.5	LOS A	0.5	3.5	0.18	0.25	0.18	58.0
12	R2	All MCs	55	2.9	55	2.9	0.227	7.4	LOS A	0.5	3.5	0.18	0.25	0.18	55.3
Approach			293	4.1	293	4.1	0.227	1.8	NA	0.5	3.5	0.18	0.25	0.18	57.5
All Vehicles			907	7.0	907	7.0	0.506	5.3	NA	2.4	21.6	0.23	0.41	0.34	53.6

LEVEL OF SERVICE

▽ Site: 15 [Willowvale Road and Glenview Way (Site Folder: Non-Corridor Critical Nodes)]

	Approaches			Intersection
	South	East	West	
LOS	C	NA (TWSC)	NA (TWSC)	NA (TWSC)



Colour code based on Level of Service

LOS A

LOS B

LOS C

LOS D

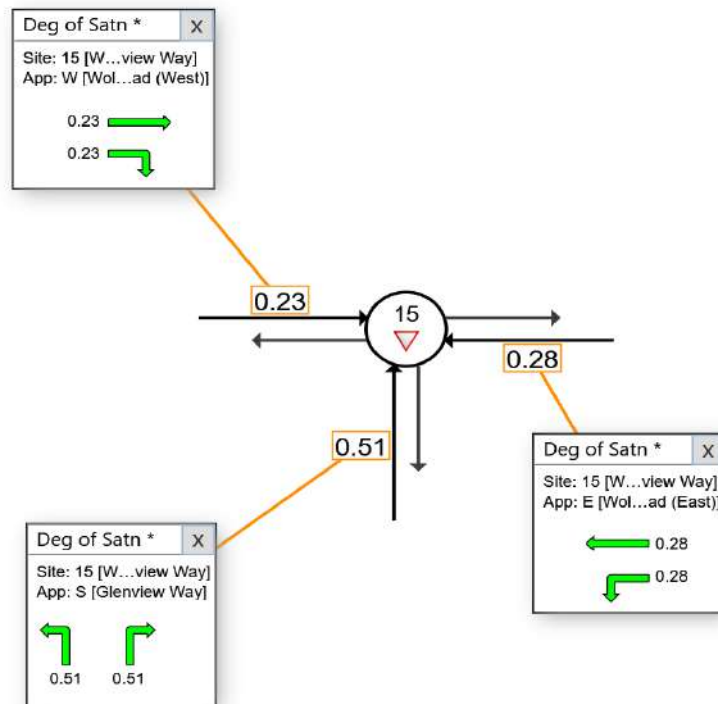
LOS E

LOS F

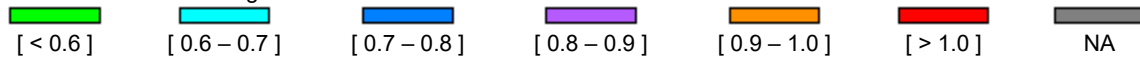
DEGREE OF SATURATION

▽ Site: 15 [Willowvale Road and Glenview Way (Site Folder: Non-Corridor Critical Nodes)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228



Colour code based on Degree of Saturation

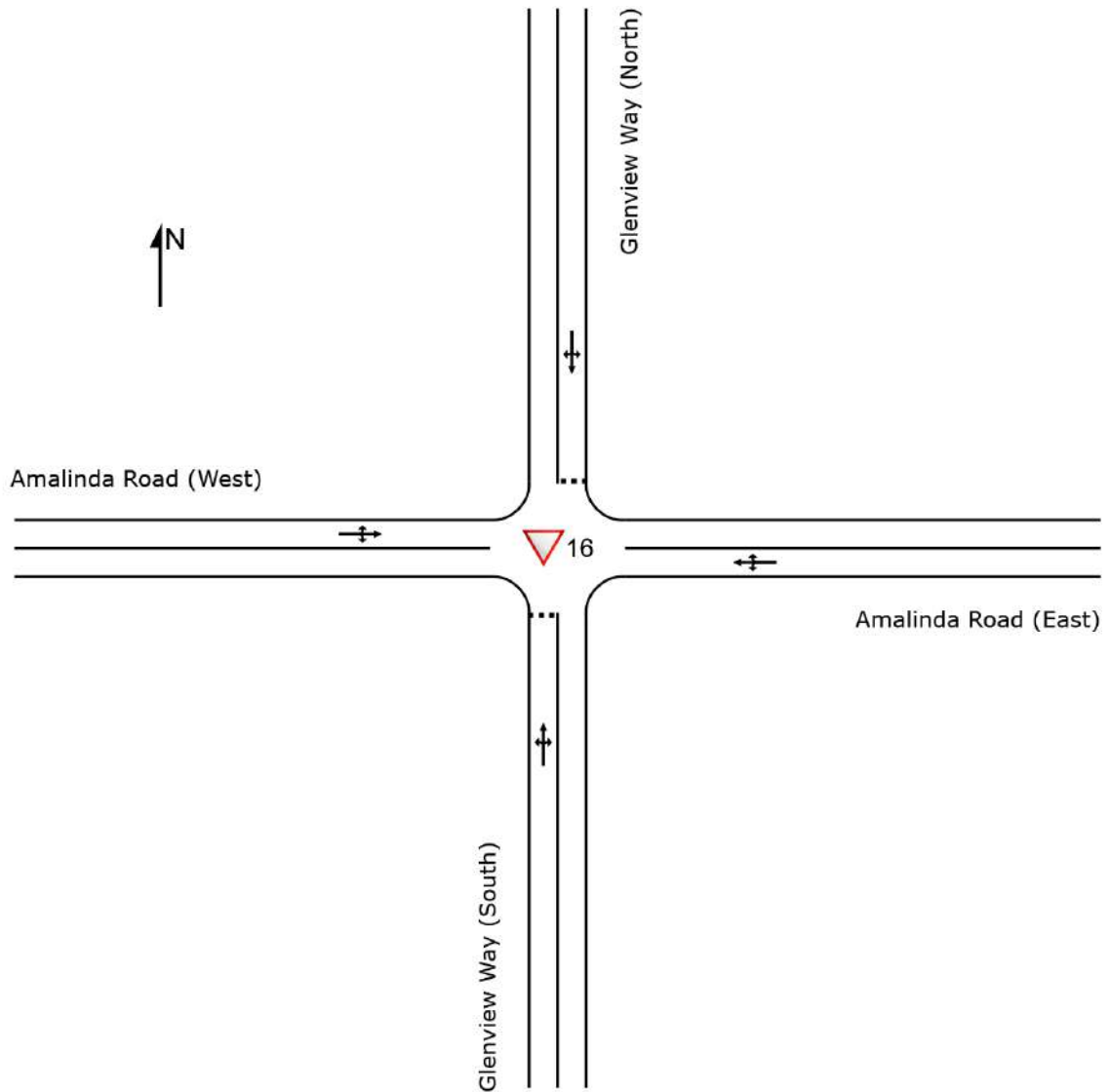


Site 16: Glenview Way and Amalinda Road Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

▽ Site: 16 [Glenview Way and Amalinda Road (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

▼ Site: 16 [Glenview Way and Amalinda Road (Site Folder: Non-Corridor Critical Nodes)]

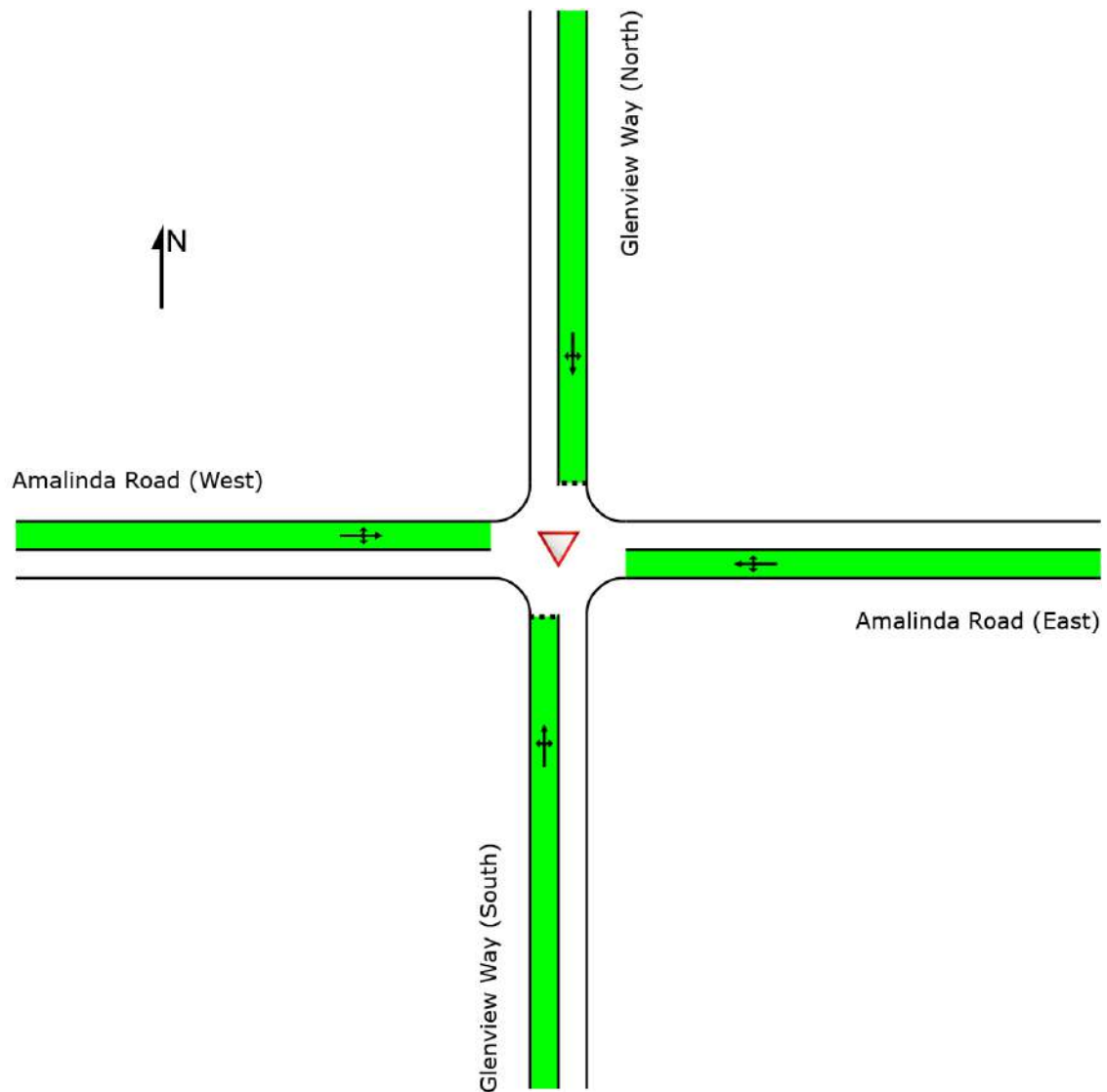
Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Glenview Way (South)															
1	L2	All MCs	4	11.5	4	11.5	0.023	5.7	LOS A	0.1	0.6	0.04	0.54	0.04	52.0
2	T1	All MCs	12	6.8	12	6.8	0.023	4.2	LOS A	0.1	0.6	0.04	0.54	0.04	52.6
3	R2	All MCs	8	18.2	8	18.2	0.023	5.5	LOS A	0.1	0.6	0.04	0.54	0.04	50.3
Approach			25	11.4	25	11.4	0.023	4.8	LOS A	0.1	0.6	0.04	0.54	0.04	51.7
East: Amalinda Road (East)															
4	L2	All MCs	2	0.0	2	0.0	0.006	5.3	LOS A	0.0	0.2	0.08	0.48	0.08	50.2
5	T1	All MCs	1	0.0	1	0.0	0.006	0.0	LOS A	0.0	0.2	0.08	0.48	0.08	48.5
6	R2	All MCs	7	0.0	7	0.0	0.006	5.1	LOS A	0.0	0.2	0.08	0.48	0.08	49.6
Approach			10	0.0	10	0.0	0.006	4.5	NA	0.0	0.2	0.08	0.48	0.08	49.6
North: Glenview Way (North)															
7	L2	All MCs	2	2.9	2	2.9	0.044	5.6	LOS A	0.2	1.1	0.09	0.54	0.09	52.1
8	T1	All MCs	17	5.2	17	5.2	0.044	3.8	LOS A	0.2	1.1	0.09	0.54	0.09	50.6
9	R2	All MCs	29	6.9	29	6.9	0.044	5.7	LOS A	0.2	1.1	0.09	0.54	0.09	51.4
Approach			49	6.1	49	6.1	0.044	5.0	LOS A	0.2	1.1	0.09	0.54	0.09	51.2
West: Amalinda Road (West)															
10	L2	All MCs	17	3.7	17	3.7	0.016	5.6	LOS A	0.0	0.2	0.01	0.48	0.01	52.1
11	T1	All MCs	5	2.9	5	2.9	0.016	0.2	LOS A	0.0	0.2	0.01	0.48	0.01	51.2
12	R2	All MCs	4	3.4	4	3.4	0.016	4.7	LOS A	0.0	0.2	0.01	0.48	0.01	48.9
Approach			26	3.5	26	3.5	0.016	4.4	NA	0.0	0.2	0.01	0.48	0.01	51.4
All Vehicles			109	6.1	109	6.1	0.044	4.8	NA	0.2	1.1	0.06	0.52	0.06	51.2

LEVEL OF SERVICE

▽ Site: 16 [Glenview Way and Amalinda Road (Site Folder: Non-Corridor Critical Nodes)]

New Site
Site Category: E

	Approaches				Intersection
	South	East	North	West	
LOS	A	NA (TWSC)	A	NA (TWSC)	NA (TWSC)



Colour code based on Level of Service

LOS A

LOS B

LOS C

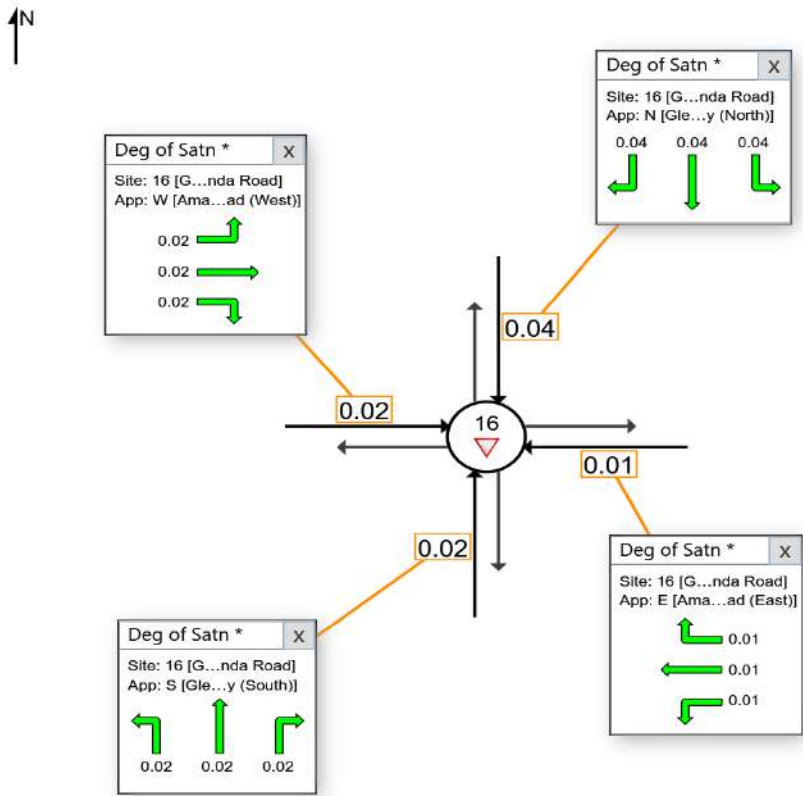
LOS D

LOS E

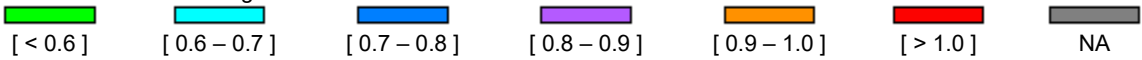
LOS F

DEGREE OF SATURATION

▽ Site: 16 [Glenview Way and Amalinda Road (Site Folder: Non-Corridor Critical Nodes)]



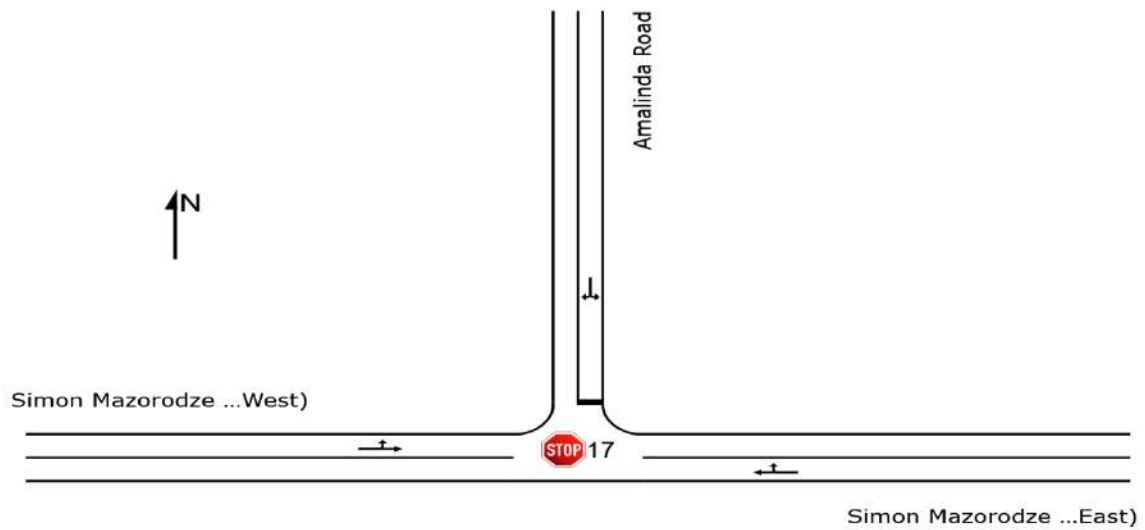
Colour code based on Degree of Saturation



Site 17: Amalinda Road and Simon Mazorodze Intersection
15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 17 [Amalinda Road and Simon Mazorodze Road (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

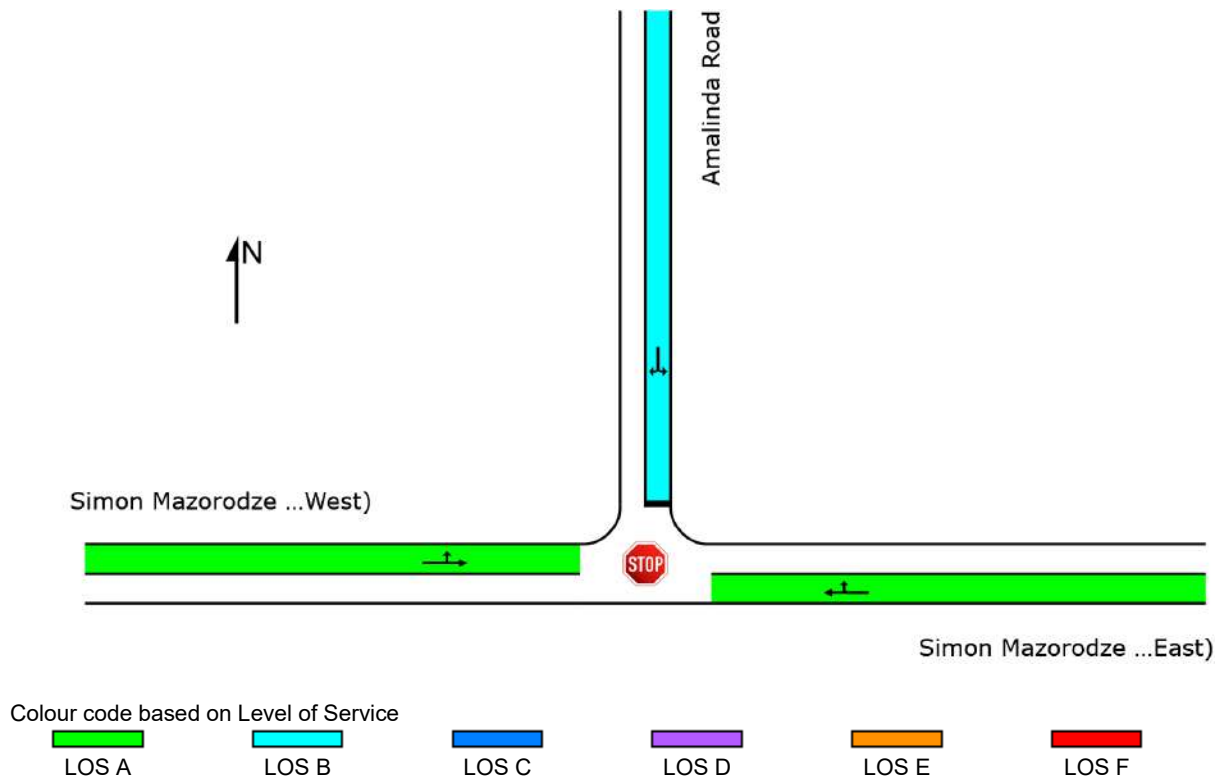
 **Site: 17 [Amalinda Road and Simon Mazorodze Road (Site Folder: Non-Corridor Critical Nodes)]**

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total	HV]	[Total	HV]				[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
East: Simon Mazorodze Road (East)															
5	T1	All MCs	260	5.9	260	5.9	0.204	0.3	LOS A	0.3	2.5	0.13	0.18	0.13	58.4
6	R2	All MCs	38	1.9	38	1.9	0.204	7.4	LOS A	0.3	2.5	0.13	0.18	0.13	55.7
Approach			297	5.4	297	5.4	0.204	1.2	NA	0.3	2.5	0.13	0.18	0.13	58.0
North: Amalinda Road															
7	L2	All MCs	61	2.5	61	2.5	0.256	9.9	LOS A	0.9	7.0	0.55	0.95	0.59	48.5
9	R2	All MCs	89	6.5	89	6.5	0.256	14.4	LOS B	0.9	7.0	0.55	0.95	0.59	48.1
Approach			150	4.9	150	4.9	0.256	12.6	LOS B	0.9	7.0	0.55	0.95	0.59	48.3
West: Simon Mazorodze Road (West)															
10	L2	All MCs	95	3.6	95	3.6	0.253	5.6	LOS A	0.0	0.0	0.00	0.15	0.00	55.5
11	T1	All MCs	277	10.9	277	10.9	0.253	0.1	LOS A	0.0	0.0	0.00	0.15	0.00	58.0
Approach			372	9.0	372	9.0	0.253	1.5	NA	0.0	0.0	0.00	0.15	0.00	57.3
All Vehicles			819	6.9	819	6.9	0.256	3.4	NA	0.9	7.0	0.15	0.31	0.16	55.6

LEVEL OF SERVICE

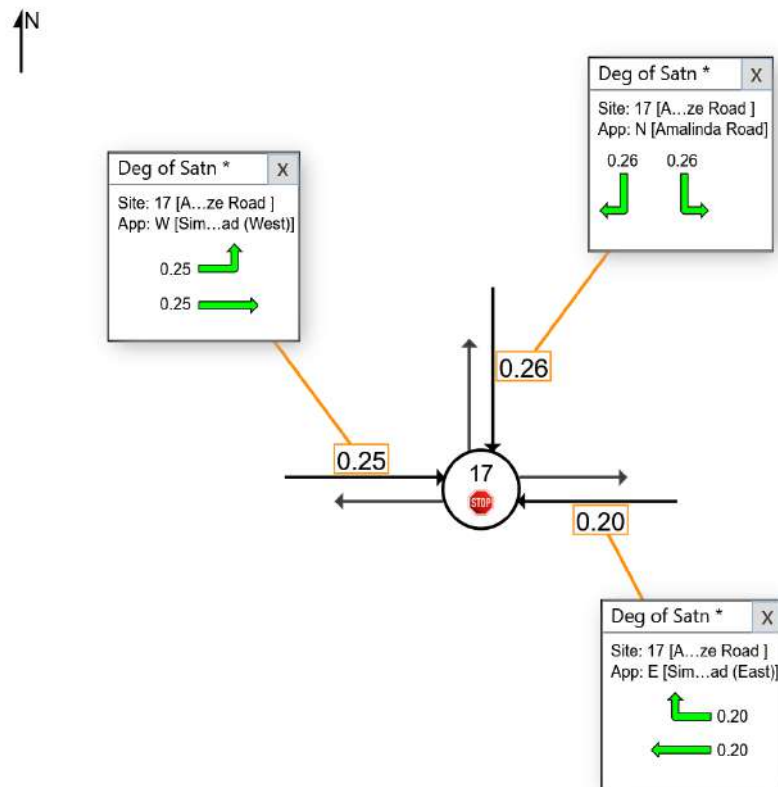
 Site: 17 [Amalinda Road and Simon Mazorodze Road (Site Folder: Non-Corridor Critical Nodes)]

	Approaches			Intersection
	East	North	West	
LOS	NA (TWSC)	B	NA (TWSC)	NA (TWSC)

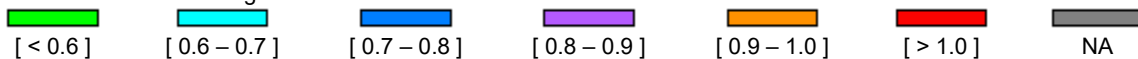


DEGREE OF SATURATION

 Site: 17 [Amalinda Road and Simon Mazorodze Road (Site Folder: Non-Corridor Critical Nodes)]



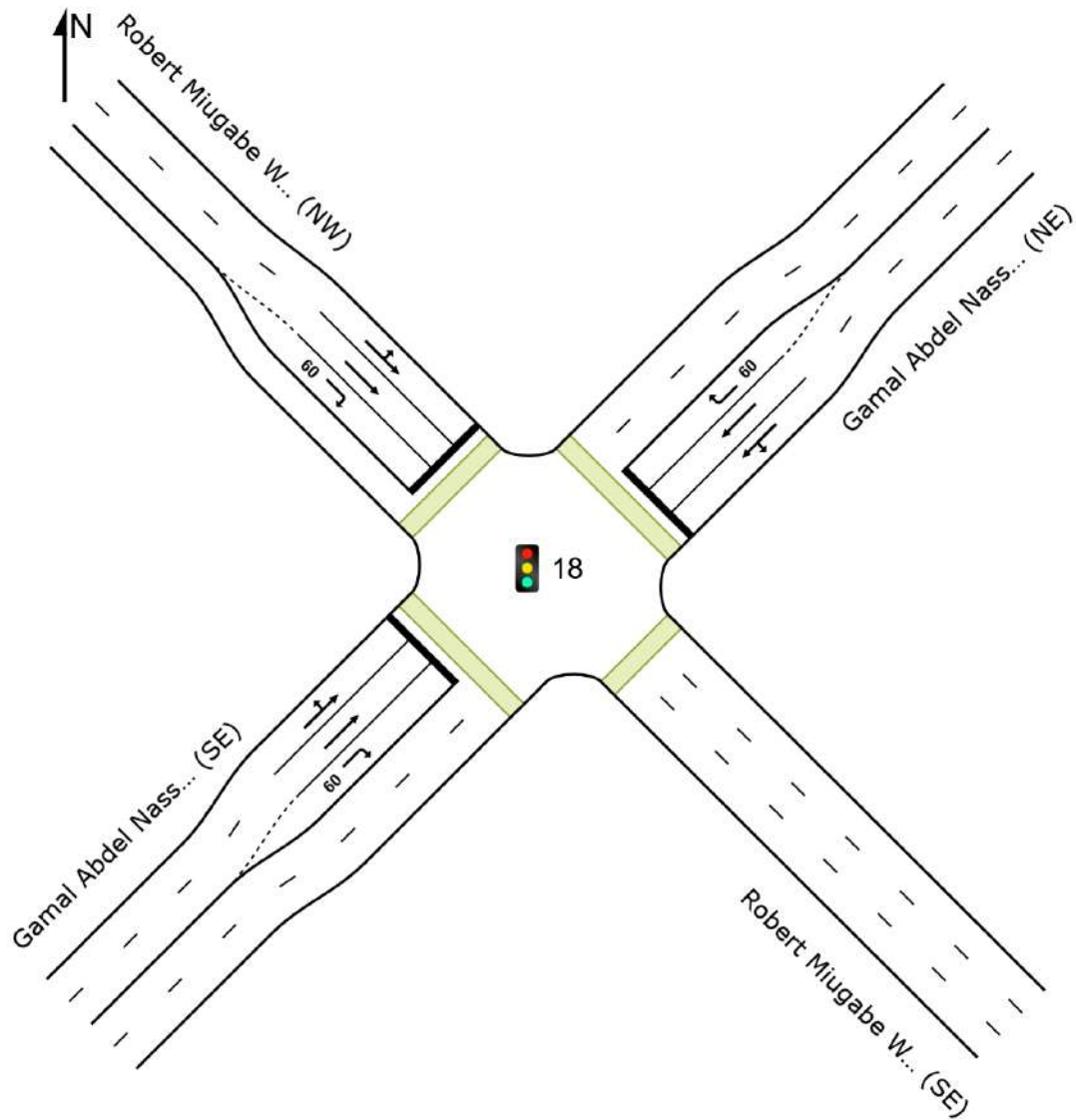
Colour code based on Degree of Saturation



Site 18: Robert Mugabe Way and Gamal Abdel Nassier Intersection
15-hour Average Daily Traffic (ADT) Intersection Capacity Results

SITE LAYOUT

 Site: 18 [Robert Mugabe Way and Gamal Abdel Nasser Road (Site Folder: Non-Corridor Critical Nodes)]



MOVEMENT SUMMARY

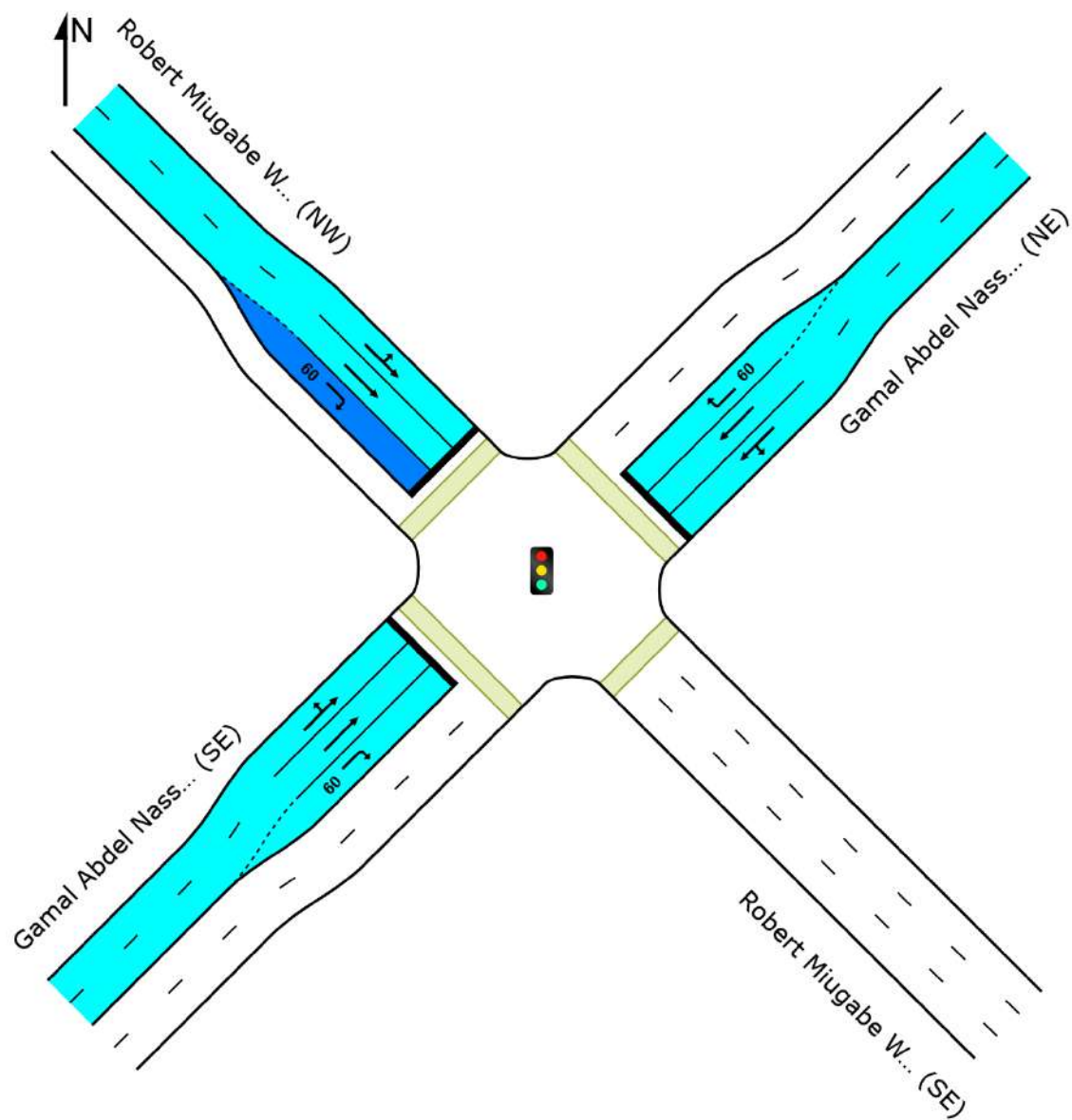
 Site: 18 [Robert Mugabe Way and Gamal Abdel Nasser Road (Site Folder: Non Corridor Critical Nodes)]

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh.	Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
NorthEast: Gamal Abdel Nasser Road (NE)															
24	L2	All MCs	102	1.9	102	1.9	0.600	23.1	LOS C	5.3	40.0	0.97	0.81	1.01	43.8
25	T1	All MCs	483	8.2	483	8.2 *	0.600	17.4	LOS B	5.9	46.6	0.97	0.81	1.00	46.2
26	R2	All MCs	190	4.1	190	4.1	0.272	12.1	LOS B	2.0	15.2	0.75	0.74	0.75	48.3
Approach			775	6.4	775	6.4	0.600	16.9	LOS B	5.9	46.6	0.92	0.79	0.94	46.4
NorthWest: Robert Miugabe Way (NW)															
27	L2	All MCs	34	2.9	34	2.9	0.195	21.4	LOS C	1.6	11.6	0.89	0.70	0.89	44.8
28	T1	All MCs	165	2.4	165	2.4 *	0.195	15.8	LOS B	1.9	13.4	0.89	0.69	0.89	47.2
29	R2	All MCs	64	1.6	64	1.6	0.162	21.5	LOS C	1.1	8.0	0.88	0.73	0.88	43.0
Approach			263	2.3	263	2.3	0.195	17.9	LOS B	1.9	13.4	0.89	0.70	0.89	45.8
SouthWest: Gamal Abdel Nasser Road (SE)															
30	L2	All MCs	35	10.7	35	10.7	0.239	21.7	LOS C	1.9	14.9	0.90	0.71	0.90	44.5
31	T1	All MCs	195	7.3	195	7.3	0.239	16.0	LOS B	2.2	17.0	0.90	0.70	0.90	47.1
32	R2	All MCs	418	3.9	418	3.9	0.657 *	14.0	LOS B	5.3	39.5	0.92	0.84	0.98	46.7
Approach			648	5.3	648	5.3	0.657	15.0	LOS B	5.3	39.5	0.91	0.79	0.95	46.7
All Vehicles			1686	5.3	1686	5.3	0.657	16.3	LOS B	5.9	46.6	0.91	0.78	0.94	46.4

LEVEL OF SERVICE

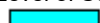
 Site: 18 [Robert Mugabe Way and Gamal Abdel Nasser Road (Site Folder: Non-Corridor Critical Nodes)]

	Approaches			Intersection
	Northeast	Northwest	Southwest	
LOS	B	B	B	B



Colour code based on Level of Service

 LOS A

 LOS B

 LOS C

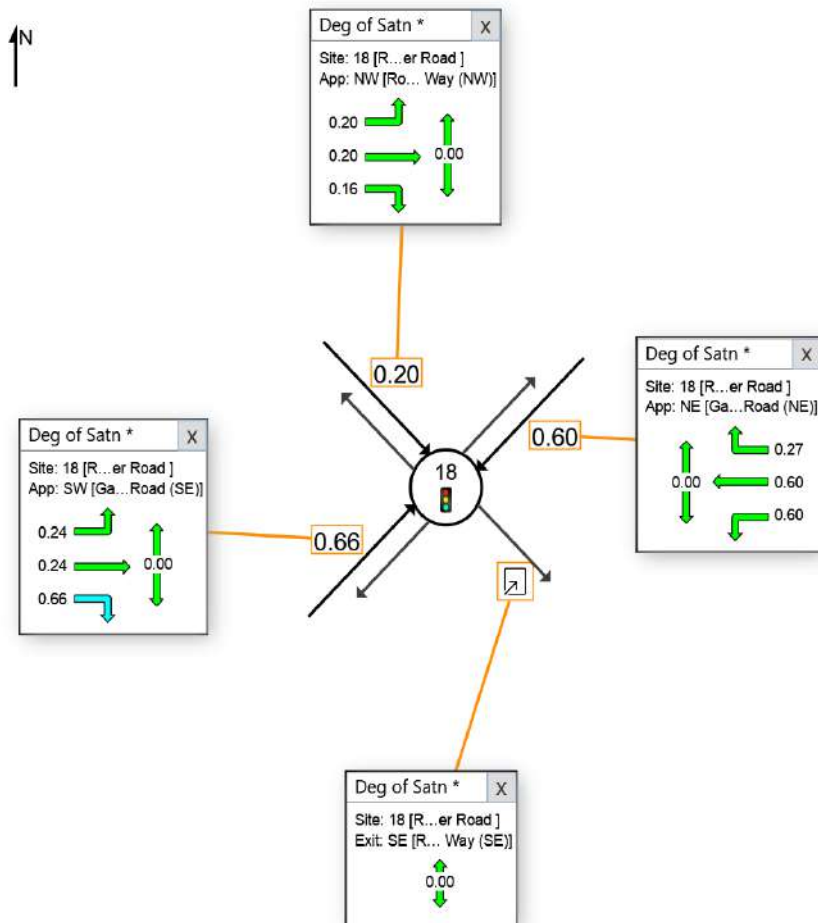
 LOS D

 LOS E

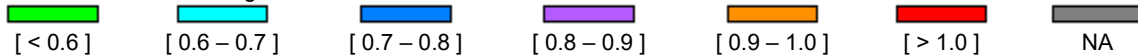
 LOS F

DEGREE OF SATURATION

 **Site: 18 [Robert Miugabe Way and Gamal Abdel Nasser Road (Site Folder: Non Corridor Critical Nodes)]**



Colour code based on Degree of Saturation



NA: The movement only runs in short lanes and these are not included in determining Queue Storage Ratio, or the movement has zero volume for the selected Movement Class.

Site 19: Josiah Tongogara and Prince Edward Street

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

Site 20: The Chase and Alpes Road Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

Site 21: Quorn Road and the Chase Road Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

Site 21: Quorn Road and the Chase Road Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

Site 22: Whitwell Road and Alpes Road Intersection

15-hour Average Daily Traffic (ADT) Intersection Capacity Results

7.1.5. Harare Road Safety Performance (Road Traffic Accident Analysis)

This section presents information on the Harare Road network safety performance, commonly known as Road Traffic Accidents (RTA) analysis. Five critical questions are answered in this section, namely:

1. What is the annual accidents statistics recorded in the study area from 2020-2024?
2. Where do these RTA occur?
3. What time of day, day of week and month of the year do they occur most?
4. What type of accidents are witnessed in the study area?
5. What are the major contributing factors of RTA in the study area?
6. What is the outcome of the accidents (minor injury, major injury, fatality)?

7.1.5.1. Annual Road Traffic Accidents Frequency Rate, 2020-2024

Figure 3 shows that the annual number of RTA increased exponentially by 87.5% from 12089 in 2021 to 22670 in 2022 and maintained a high statistic above 21000.

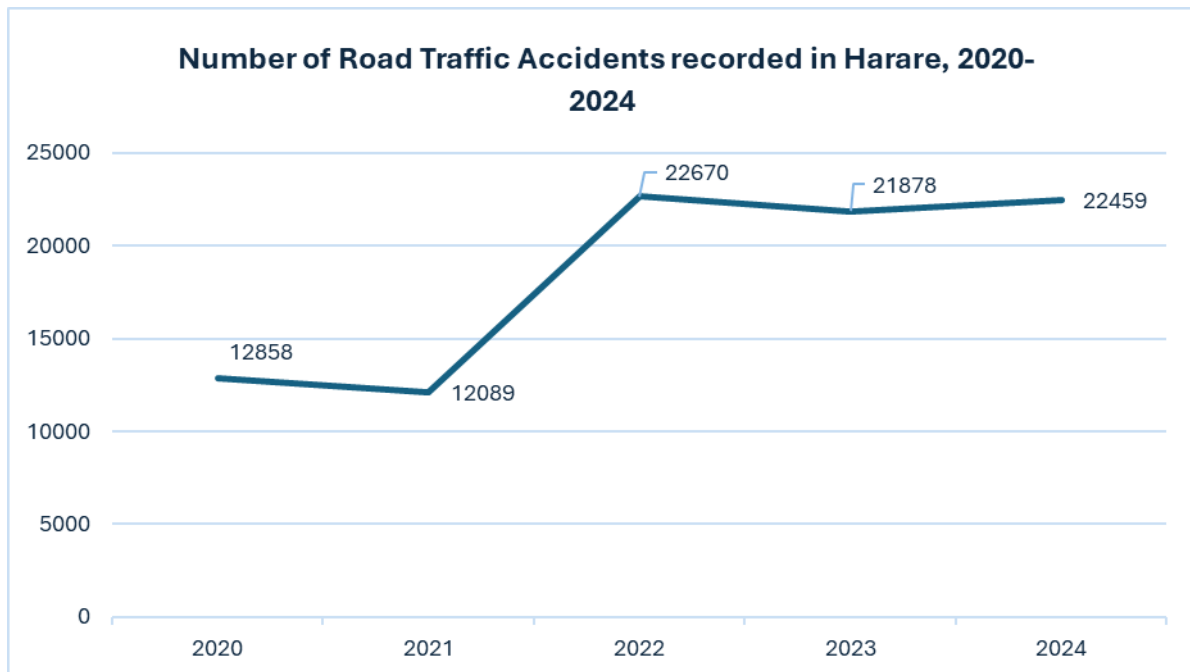


Figure 7.108: Annual Number of Road Traffic Accidents recorded in Harare, (2020-2024)

Source: The Zimbabwe Republic Police, 2024.

This figure is very high considering the population of Harare which is estimated to be 1.6 million as of 2024. Based on the above statistics, Traffic Accident Rate per 1000 people for the period 2022-2024 was determined based on the average of 2022, 2023 and 2024 statistics and was calculated as follows: -

$$\text{Accident Rate per 1,000 People} = \left(\frac{\text{Total Number of Traffic Accidents}}{\text{Total Population}} \right) \times 1,000$$

$$\text{Accident Rate per 1000 people} = (22335 / 1\,600\,000) \times 1000$$

Therefore, the Accident Rate per 1000 people per year for Harare is = **13.9 per 100 000** people which represents a significantly high statistic.

7.1.5.2. Spatial distribution of Road Traffic Accidents in Harare

Because of the poor levels of service being experienced at most studied intersections, there appears to be a positive correlation with the number of accidents witnessed for a 5-year period (2020-2024). Figure 7.109 shows the spatial distribution of accidents within the study area.

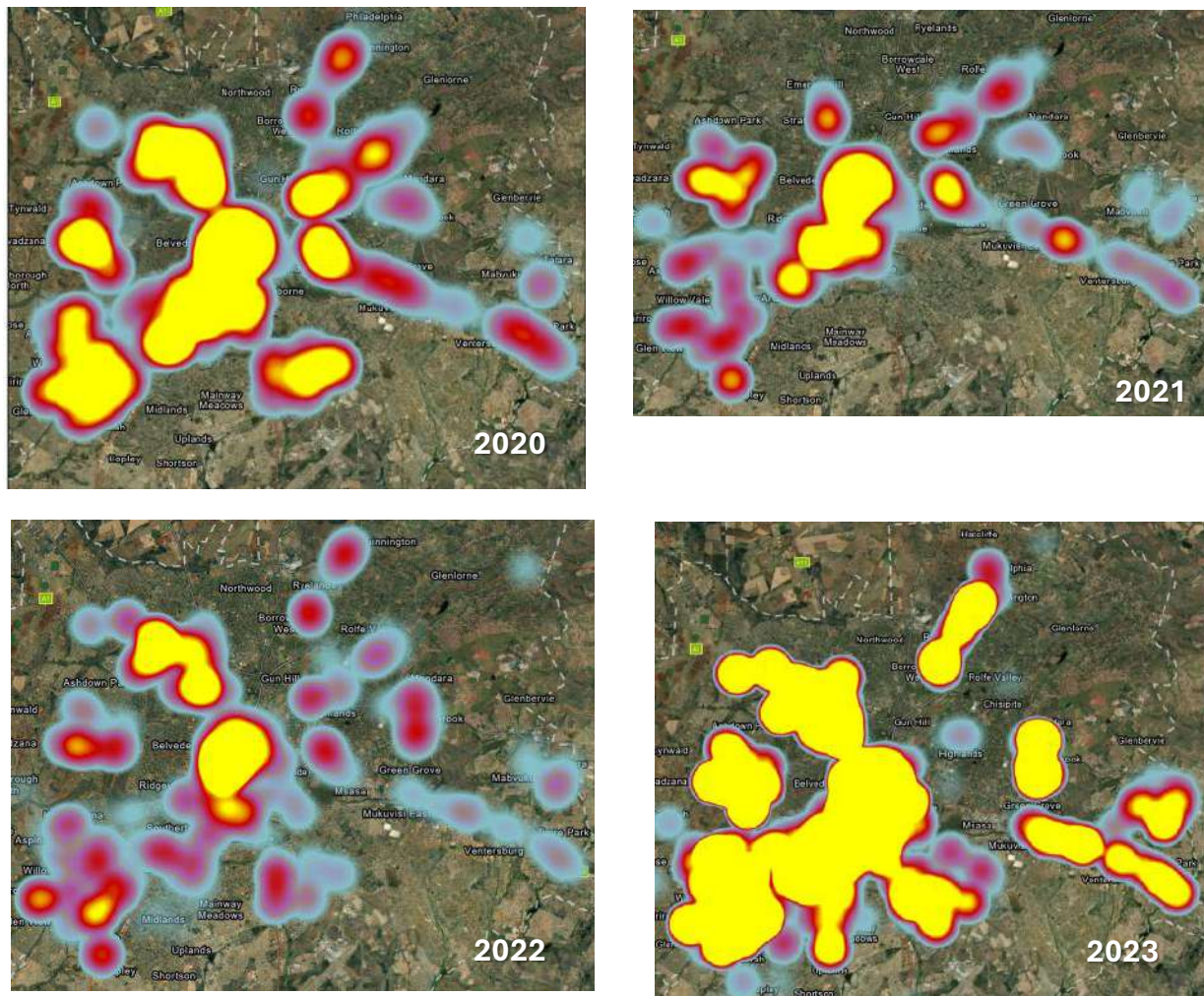


Figure 7.109: The Spatial distribution of Road Traffic Accidents in the Study area
Source: The Zimbabwe Republic Police

As is shown above, across the 5-year period, the majority of accidents were observed to be occurring in the Harare CBD, along Kirkman Road, Bulawayo Road, Borrowdale Road, Seke Road, Mutare Road, Simon Mazorodze Road, Willowdale Road and in the high-density suburbs of Kuwadzana, Budiriro, Highfields and Glen view.

7.1.5.3. Temporal distribution of Road Traffic Accidents in Harare

In addition to the spatial distribution of accidents in Harare, this study further sought to determine the time of day during which accidents occur most as well as day of the week and lastly month of the year. First, an analysis of time of day shows that most accident incidences occurred from 7am to 8am and evening peak periods, 4pm to 7pm. Second, Mondays and

Fridays were observed to be also witnessing highest number of accidents. Third, data shows that there is no well-defined pattern on accidents occurrence during the month of the year.

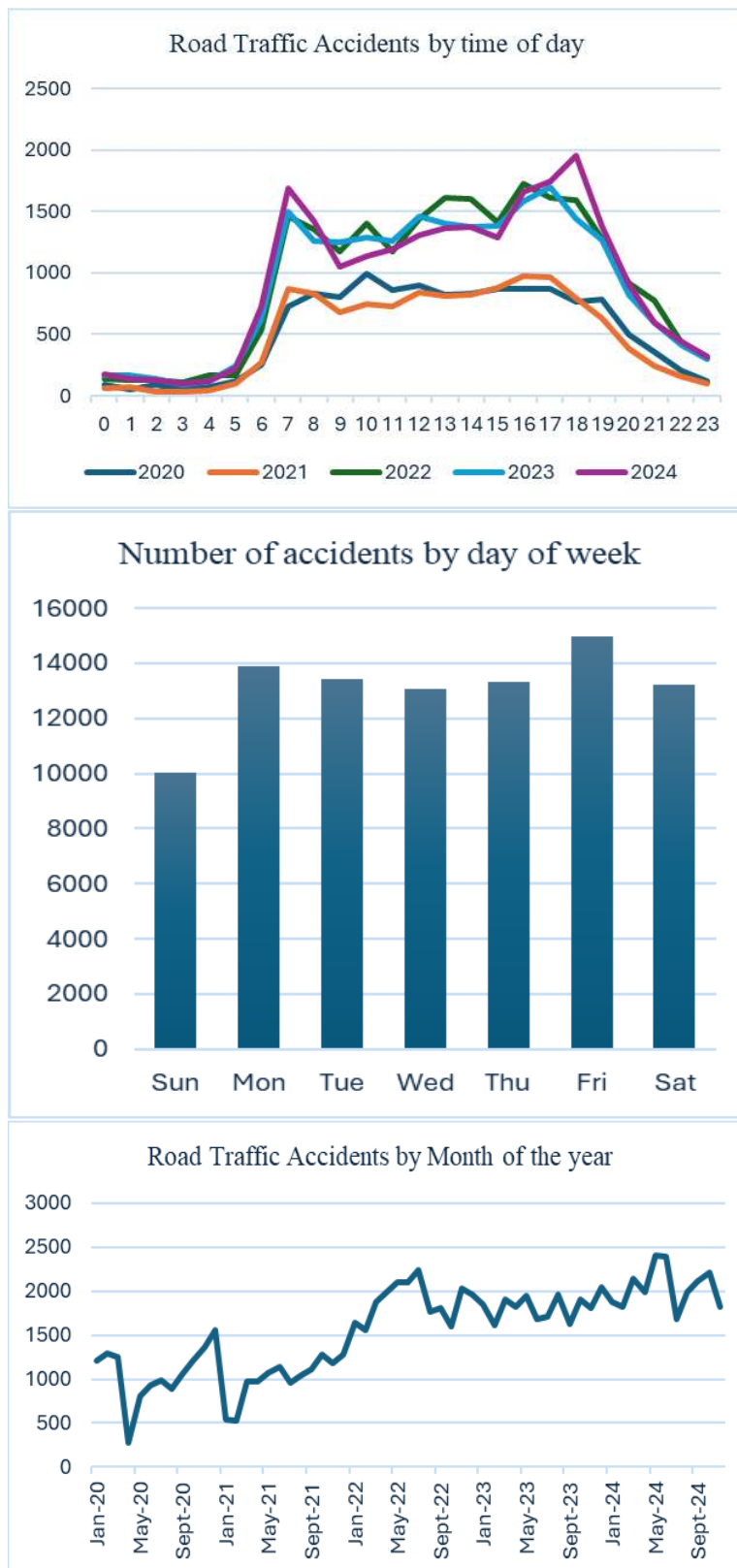


Figure 7.110: Road Traffic Accident temporal patterns.
Source: The Zimbabwe Republic Police, 2024.

7.1.5.4. Causes of Road Traffic Accidents in Harare

Between 2020-2024, the leading seven (7) causes of RTA in Harare revolved around the DRIVER. Out of a total of 91 133 RTA recorded incidences, driver related factors including tailgating, misjudgement, turning errors, parking errors and over speeding contributed to a combined statistic of 99.2%. While Harare is experiencing poor road network conditions and poor traffic control systems, ironically these were found to be contributing insignificantly, (0.1%) to the RTA problem in Harare.

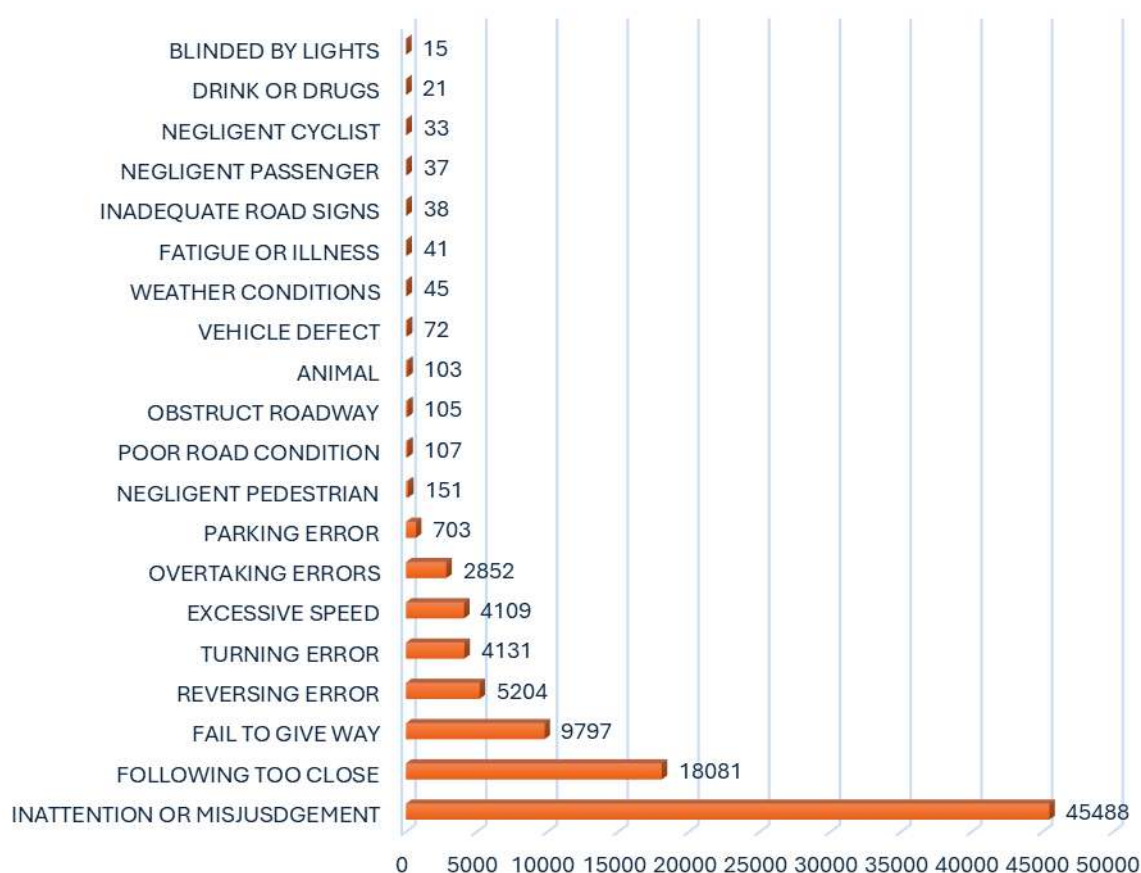


Figure 7.111: Causes of Road Traffic Accidents in Harare

Source: The Zimbabwe Republic Police, 2024.

7.1.5.5. Types of Road Traffic Accidents experienced in Harare

The types of accidents occurring in Harare include vehicle-to-vehicle collisions (front to front, front to rear or side swipe) and vehicle to object and vehicle. The majority of accidents are vehicle to vehicle type of accidents rooted in the driver behavioural problem. Driver misjudgement and inattentiveness has been shown to lead to nose to tail bumping with 22999 cases followed by side swipe (same direction) with 21 492 cases and side swipe (opposite direction) with 13 528 cases recorded over a period of five (5) years.

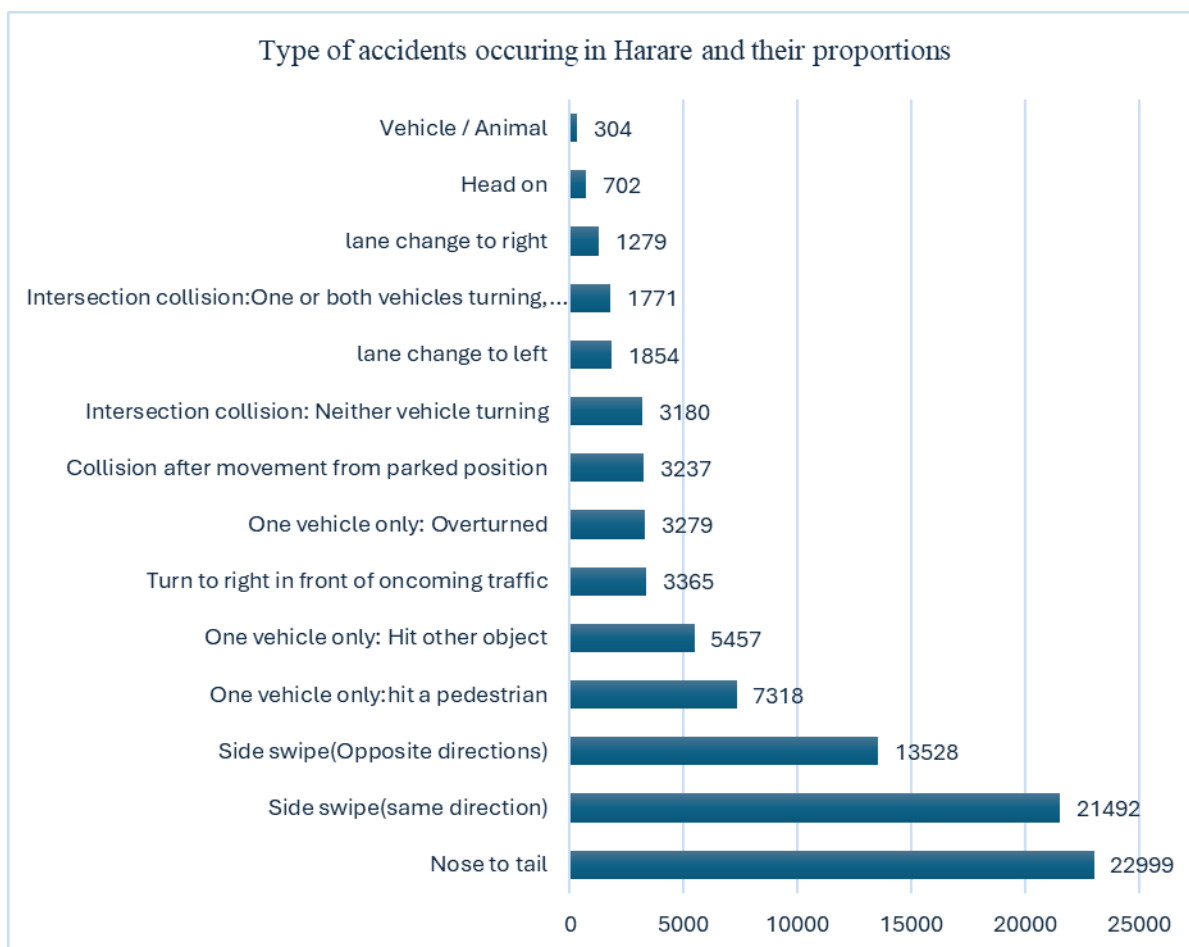


Figure 7.112: The types of Road Traffic Accidents occurring in Harare and their proportions
Source: The Zimbabwe Republic Police, 2024.

7.1.5.6. Outcome of Road Traffic Accidents in Harare

Although the city is experiencing a high number of accidents, the majority of these resulted in no injuries. Fatality rates were also observed to be low (See table 140).

Table 7.110: Outcome of Road Traffic Accidents in Harare

Outcome of Accident	‘Hit and Run’ cases				
	2020	2021	2022	2023	2024
Fatal	14	7	53	40	63
Injury	132	79	354	402	467
No Injury	1728	251	3605	3787	4219
	Other				
	2020	2021	2022	2023	2024
Fatal	148	136	234	208	244
Injury	823	1228	1962	1412	2154
No Injury	10008	10388	16432	15242	15308

7.1.5.7. Correlation of Road Traffic Accidents to the Transportation System for Harare

7.1.5.8. Correlation of Road Traffic Accidents to Land Use

7.1.5.9. Discussion and implications of Road Traffic Accidents

7.1.6. Harare Urban Rail Transportation

7.1.6.1. Rail infrastructure and its network coverage

The National Railways of Zimbabwe, (NRZ) operates both freight and passenger services into the planning area. The total length of railway tracks in Harare currently spans around 71km, stretching from Ruwa at 256.72km to Harare at 278km, Harare to Whitehouse at 305km, and Lochinvar to Mt Hampden covering 21km. The major station is situated south of the Central Business District (CBD) along Kenneth Kaunda bounded on the south by the Mukuvisi public open space belt. This is where all the railway operations facilities are located, and this includes the present railway station buildings and tracks related to it. Just the south of the avenue, shunting lines and goods sheds further to the south, some railways staff houses and lines leading East to Masa and West to Lochinvar. The international container terminal at Rugare handles 80 containers a day (500 a week) and this is expected to increase. Access to the container depot would be enhanced by the completion of Harare drive between Bulawayo Road and Highfield Road. A few private sidings serve the industrial areas of greater Harare. The 300 existing siding are in the Willowvale area 29, Mabvuku area 14 and generally in Harare 216. The Intercity commuter lines now are only transporting goods due to the lack intercity passengers, but plans are in the works to reintroduce the commuter lines, whilst freight services are operating as normal.

7.1.6.2. Railway Infrastructure Condition

Rail infrastructure, that is rail tracks, locomotives and signalling systems have deteriorated over the years due to poor maintenance and most of these have outlived their economic and design lives. This poses a challenge in efficiently transporting bulk commodities as well as passengers within and outside the planning area.

7.1.6.3. Railway Infrastructure Maintenance

7.1.6.4. Railway Transport Classification

7.1.6.5. Rail Transport Operational Performance

7.1.6.6. Rail Safety Performance (Accidents Analysis)

7.1.7. Future urban rail passenger services

7.1.7.1. *Chitungwiza railway line project*

A detailed design of the Chitungwiza railway line project was carried out by the Government of Zimbabwe through the Ministry of Local Government. The detailed engineering design was completed in 1991, and the project was however not implemented due to lack of finance, because of the sheer size of the scope of the design. The Harare -Chitungwiza railway line project aims to provide an efficient, safe and reliable means of transport for passengers from Seke, Chitungwiza Manyame, Sunningdale Prospect, Mbare and Graniteside commuting to and from Harare CBD. The corridor is currently served by buses and private minibuses, and the proposed commuter train service is expected to provide a lasting solution to problems of traffic congestion other safety issues along Seke road. Also in the long term, the NRZ plans to establish a fully-fledged metro rail to service all surrounding Harare settlements such as Ruwa, Norton, Domboshava, Nyabira and Cyber City.

In 2004 the Government reconvened the project committee for the Chitungwiza railway project with the aim of minimising the scope to the essentials to reduce cost whilst maintaining high standards of safety. One of the major recommendations from this committee was a deviation from the SOFRETU adopted route after Manyame River going towards Chitungwiza. The SOFRETU route alignment after Manyame River ran a Southeast direction towards Seke road up to Makoni Shopping centre. The 2004 committee recommended that the commuter rail line should run in a Southwest direction after Manyame River and then westwards as it passes through St Mary's Zengeza 3&4, Units C, D, J, K and finally to Makoni. Also, in the long term the NRZ plans to establish a fully-fledged metro rail to service all surrounding Harare settlements such as Ruwa, Norton, Domboshava, Nyabira and Cyber City. The short-term plans for development on NRZ owned land country wide that is the servitude along the mainline (90m) on all corridors which increases on sidings and stations currently served for railway development be zoned for mixed land use which entails commercial, residential, agricultural and institutional on lease basis. The NRZ Board may grant authority to lease out on temporary basis the land that may be excess to requirements and the leases will be managed through Real Estate Portfolio. NRZ is committed to comply with local authority regulations.

7.1.7.2. *Metro rail system*

The NRZ has plans to introduce metro rail system around the CBD and the residential areas. Metro Rail Transportation also known as Mass Rapid Transit (MRT) is a type of high-capacity public transport that is generally built in urban areas. It is a fully segregated rail-based mass transit system which could be at grade, elevated or underground. Due to its physical segregation and system technology, metro rail can have a very high capacity of 40 000 to 80 000 passengers per hour per direction.

7.1.7.3. *Challenges with the Rail Transport System in the planning area*

- i. Funding constraint Government not availing adequate financial support for maintenance new proposed development.
- ii. Rail links leading to industrial properties have been closed or vandalised.
- iii. Vandalism of infrastructure components- ballast steel, components etc, electrified section and signalling system decommissioned owing to theft of copper.
- iv. Illegal mining activities on the railway servitude.
- v. Obsolete and aged equipment.

- vi. Encroachments into NRZ servitude affects implementation of projects.

7.1.8. Urban Public Transportation System

7.1.8.1. *Historical Overview of Public Transport in Harare*

Public Transport in Harare can be traced back to the development of Zimbabwe's urban public transport system due to its prominence as the capital city. This overview is crucial from two stand points. First, present public transport challenges facing Harare to a lesser extent other cities and towns in Zimbabwe are largely due to previous policies and Government decisions and hence they need to be understood from that historical context. Second, it is very important to learn from the failures and or successes of previous public transport policy and regulatory regimes so that this present master plan is guided accordingly. Public transport in Zimbabwe is better understood in four (4) distinct phases.

- i. Before the attainment of independence in 1980,
- ii. After independence, but before the public transport deregulation (1980 and 1993)
- iii. Post the deregulation 1993-2022.
- iv. Present, 2023 to date.

7.1.8.1.1. *Before 1980*

Zimbabwe (then Rhodesia) before independence operated **a franchised system of its urban public transport**. The exclusive franchise agreement was between the United Transport Group, (UTG) from Britain which had its subsidiary referred to by the name Salisbury United Passenger Company, (SUOC) operating in Harare. This franchised public transport service had operational standards set by the Government including scheduling of routes, fares and other important key areas such as safety, comfort and convenience. During this period, conventional 75-seater buses operated a scheduled service within a 26km radius from the city centre in all major centres (Harare Combination Master Plan, 1993). Back then, there were insignificant para-transit modes. The emergence of informal transport by operators was to supplement their low incomes and daily fuel expenses to and from work. This form of carpooling was illegal and operators faced arrest by the 14 police. The illegality was because the Municipal Traffic Laws Enforcement Act (Chapter 29:10) of 1961 recognised no Passenger Service Vehicle (PSV) other than metered taxis and SUOC services. No significant traffic flow problems or bad behaviour by drivers were witnessed because of the tightly regulated system by both local and central government.

7.1.8.1.2. *Between 1980 and 1993*

Upon the attainment of independence in 1980, the Government of Zimbabwe (GoZ) adopted a **new political ideology altogether gradually replacing the capitalist ideology with socialism**. Socialism meant state control. It also meant the GoZ's pronounced direct participation into the various economic activities. **In 1982 the GoZ took a policy decision to fix fares, removing this responsibility from the local authority level** (Harare Traffic Local Subject Plan, 1997). Furthermore, because of the socialist drive and the impetus to empower the local indigenous entrepreneurs, the GoZ through a Presidential Decree in December 1983 took a **decision to license the operation of a paratransit public transport system locally known as Emergency Taxis (ETs)**. These were legalised to serve two main purposes. Firstly, to act as temporary mode of transport supplementing public transport services, secondly to allow local indigenous players to take part in the urban public transport market.

Because of this, ETs were established as a new public transport mode and were required to obtain permits from the Ministry of Transport that specified routes, passenger capacity of the vehicle and fares. The LAs were mandated to provide ETs ranks and monitor and enforce their proper use. By 1987 there were 14 ET ranks in the Harare CBD. The legalisation of ET led to defined and legally tolerated informal transport and this did not cause traffic congestion problems. Neither were serious poor driver behavioural issues observed.

The socialism political ideology persisted as shown by the **GoZ's interest in participating in the provision and management of urban public transport**. Accordingly, the 12-year SUOC bus franchise agreement which became operative in 1975 expired on the 30th of June 1987 was renewed for a further year until 30th June 1988. One way or another, expiry of this contract provided a perfect opportunity for the GoZ to revise the franchise agreement to cater for the new political dispensation. During this period, questions were raised on whether SUOC (name changed to Harare United Omnibus Company, HUOC) should continue to be the sole provider of public transport, or whether free competition should prevail. As such in 1988, the GoZ expressed its intention to participate as a major shareholder by **acquiring 51% of the Zimbabwe United Passenger Company (a parent company to HUOC)**. Following this acquisition of ZUPCO by the GoZ, its Harare Division witnessed a **significant decline in operational performance**. Evidence from archival data suggest that the decline in ZUPCO's Harare division operational performance was partly a result of stiff competition from pirate taxis which were gaining popularity and dominance.

Parallel to ZUPCO's continued operational losses, was an increase in the number of ETs and area coverage. **These however, became difficult to control and that was when Harare began to experience serious traffic congestion problems owing to poor driver behaviour.**

7.1.8.1.3. Post 1993-2022

In 1991, the GoZ proposed a policy agenda that led to the **Economic Structural Adjustment Programme, ESAP**. The World Bank and IMF provided support to ESAP whose aim was to change Zimbabwe's controlled economic to a market-driven economy. The changes were meant to promote economic growth and cushion the poor by:

- i. Reducing fiscal and parastatal deficit and instituting prudent monetary policies
- ii. Liberalising trade policies and foreign exchange system
- iii. Carrying out domestic deregulation and
- iv. Establishing social safety net and training programmes for vulnerable groups

It is against these broader ESAP policy goals that the public transport sector in urban areas was in principle **partially deregulated in August 1993** allowing privately operated 'commuter omnibuses' (also known as kombis) to compete with ZUPCO. The reason why the GoZ settled for partial deregulation had to do with merits and demerits of deregulation based on experiences from Chile, India and Kenya which had done it before. Such demerits included cut throat competition, increased negative environmental externalities, congestion and pollution resulting from traffic. Despite the partial deregulation rhetoric, Mbara and Maunder (1996) have argued that the Zimbabwe's urban transport **was fully deregulated right from the beginning because the local and central authorities lost their regulatory power and the informal transport proved difficult to regulate**. The deregulation policy opened up the urban transport market and led to competition of three major modes of transport operating in urban centres that is ZUPCO's conventional buses, kombis and ETs.

As years progressed from 1993 up to around 1996, the competition became even more intense with kombis dominating the market. Kombis offered a flexible schedule as opposed to a relatively rigid scheduled service offered by ZUPCO gave them a competitive advantage. Furthermore, kombis' smaller carrying capacity meant a quick passenger fill up time, quick departure and such performance indicators gave kombis much popularity. ETs became more and more unpopular and were eventually phased out in 1997.

7.1.8.1.4. 2023 to date, from deregulation to self-regulation?

Currently the urban public transport market in Harare is dominated by kombis and a small proportion of pirate taxis locally known as *mshikashikas*. Minibuses mainly operate from the seven (7) main bus termini within the Harare CBD whilst *mshikashikas* operate along arterials throughout the city centre within the vicinity of intersections. There is no direct competition between these two modes because *mshikashikas* are offering intra city (shuttle) service to passengers, for example connecting one terminal point to another within a 2km to 3km radius. Kombis are catering for suburban travel demand. *Mshikashikas* are both illegal and informal as they are not licensed to serve as Public Service Vehicles.

After 30 years of a deregulated public transport regime, 1993-2023, the GoZ realised the many negative environmental externalities emanating from such a free market including but not limited to air, noise and land pollution, traffic congestion and accidents. Hence by the beginning of March 2023, the GoZ through Statutory Instrument 213a of 2022 issued out a directive instructing all local authorities to take over the management of public transport allowing some form of self-regulation through kombi and bus operators' associations. This directive resulted in kombi and bus operators forming various operators' associations and these were registered with their respective LAs.

Table 7.111: Bus and Kombi operators' associations registered with the City of Harare

Name of Association	Number of Members	Number of Commuter Omnibuses	Number of buses
GHACO (Greater Harare Association of Commuter Operators)	350	1000	-
ZUDAC (Zimbabwe Union of Drivers and Conductors)	315	680	-
ITRA	129	486	12
PAMUSHANA	28	89	-
HYTA (Harare Youth Transporters Association)	537	568	23
Lifestyle Motors Association	200	387	22
ZICOTO (Zimbabwe Commuter Omnibus Transport Organisation)	35	96	-
ZUDUCO (Zimbabwe United Deregulated Commuter Omnibus)	500	460	40
Black Giants Transport Drivers Association	90	100	-
ZIPTA (Zimbabwe Public Transport Drivers Association)	64	101	-
HCCA (Harare-Chitungwiza Commuter Association)	-	-	-
UCOZ (Urban Commuters Operators of Zimbabwe)	35	120	-
TOTAL	2283	4087	97

7.1.8.2. Present Harare Residents Travel Patterns and Trip Characteristics

7.1.8.2.1. Trip Generation

7.1.8.2.2. Trip Distribution

7.1.8.2.3. Modal Split

Approximately 46% of the Harare residents use kombis, buses and *mshikashikas* as their modes of public transport. Furthermore, approximately 16.9% walk and 28.5% use their private vehicles. Thus, in any transport planning endeavour, public transport including non-motorized transport such as walking should be prioritised as these are the major modes of transport meeting the ever-growing travel demand.

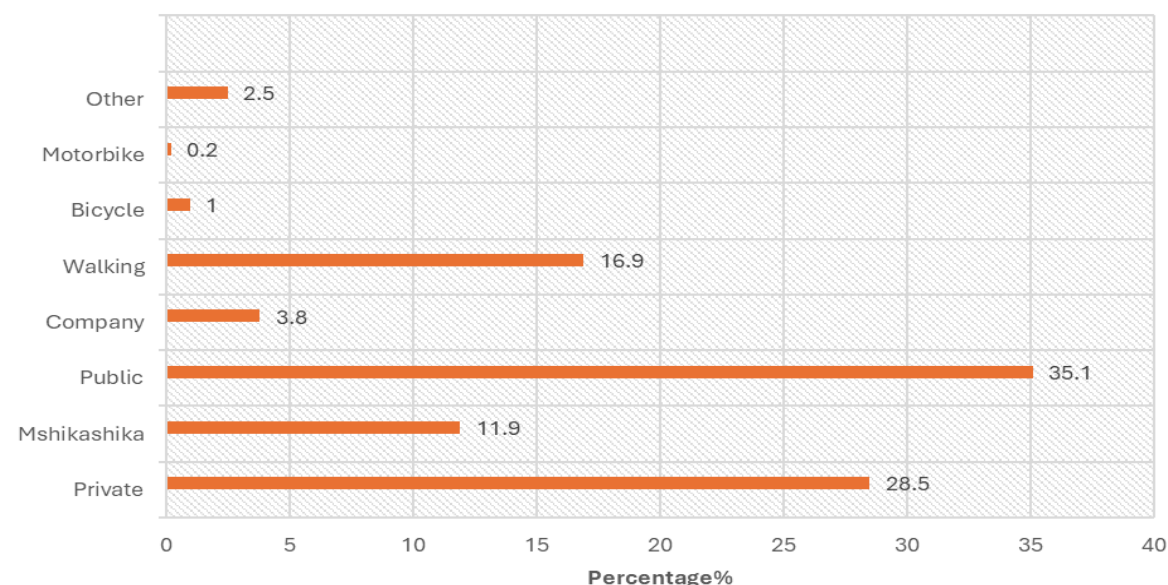


Figure 7.113: Harare residents' transport mode use

Source: Study, 2024.

7.1.8.2.4. Traffic Assignment

7.1.8.3. Public Transportation

7.1.8.3.1. Public Transportation Infrastructure

Public transport infrastructure such as bus termini, bus shelters, bus stops and public toilets at bus termini has deteriorated over the years due to non-maintenance.

7.1.8.3.2. Bus termini and their condition in the Harare CBD

Currently there are six (6) major bus termini in the Central City area as presented in Table 18. While the condition of ablution facilities has been improved over the years, passenger shelter remains a challenge with more than 80% of the termini having vandalised passenger shelters. This subjects passengers to harsh weather conditions such as rain and sun as they wait for the bus.

Table 7.112: Major bus termini in the Harare Central City area

Terminus Name	Location	Bays	Passenger Shelter	Amenities Toilets
Market Square	Harare	13	1	Yes
Charge Office	Inez Terrace/R Manyika	7&3	No	Yes
Copacabana	Chinhoyi St/Agostinho Neto (Speke)Avenue	6	No	Yes

Rezende South	Rezende South	Curbside	No	Yes
Fourth Street	Simon. V.Muzenda/R. Mugabe	48	Yes	Yes
Rezende North	Rezende North	Terminus	No	Yes

Source: Harare City Council, 2024.

Table 7.113: Bus Termini in Harare Suburbs

1. Machipisa	17. Highfield (Lusaka)	33. Warren Park 2
2. Mbare Musika	18. Highfield (Cannan Western)	34. Budiriro 1
3. High Glen	19. Road Port	35. Budiriro 3
4. Warren Park D	20. Kuwadzana 1	36. Glen View 3
5. Plymouth and Beatrice	21. Kuwadzana 2	37. Glen View 1
6. Mufakose Area (Rutendo Hall)	22. Kuwadzana 3	38. Glen View (Makomva)
7. Mufakose Samuriwo	23. Kuwadzana 4	39. Dzivarasekwa (Mawadze)
8. Mufakose OK	24. Kuwadzana 5	40. Chisipiti
9. Mufakose Mhishi	25. Kuwadzana 6	41. Glen View 4
10. Beverly East (Msasa)	26. Kuwadzana Extension	42. Hatcliffe 1
11. Dzivarasekwa 1	27. Kambuzuma 1	43. University Zimbabwe
12. Glen View 8	28. Kambuzuma 3	44. Sunningdale
13. Mabvuku 2	29. Kambuzuma 5	45. Budiriro (CABS)
14. Glen Norah (Chitubu)	30. Dzivarasekwa 4	46. Budiriro (Current)
15. Glen Norah (Specimen)	31. Hatfield	47. Budiriro 4
16. Glen Norah B	32. Warren Park 1	48. Stodart Shops (Mbare)

Source: Study Findings 2024

Early plans had provided for adequate bus termini in most suburbs in Harare, the termini infrastructure (bus shelters and ablution facilities) have not been maintained and some have been vandalised. Some of the ablutions facilities in these areas are no longer working and those that are working are overwhelmed. Bus termini in the Central Business District are no longer able to cope with the volume of buses and commuter omnibuses. The operators are now parking their buses and Kombis around the ranks, blocking passing traffic and causing congestion. There are no clearly marked dropping off zones in the CBD bus termini. On some ranks there are multiple entry and exit points and this makes it difficult to control traffic in the termini.

7.1.8.3.3. Public Transportation Modal Split in Harare

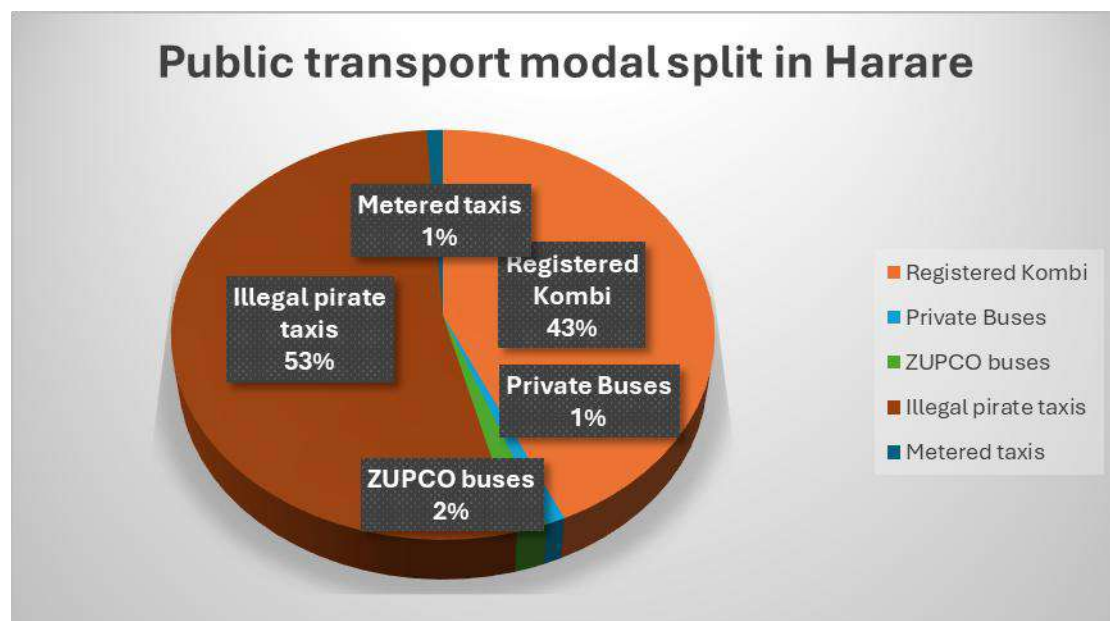


Figure 7.114: Public Transport Modal Split in Harare.

Source: Study, 2024.

7.1.8.4. City Parking Management

7.1.8.4.1. Parking Management Policy Framework

City parking management for the Harare City Council is executed under the Harare Traffic By-Laws 1983 and more specifically the Harare Parking By-Laws 1983. In terms of the executing arm, Harare City Council (HCC) has mandated City Parking to enforce parking and traffic by-laws within the capital with effect from the 16th of February 2023. City Parking is a private company that is mandated by local authorities to manage parking and provide parking technologies.

7.1.8.4.2. Parking Status quo 2024 in Central City Area

Based on data gathered from the 1992 Harare Car Parking Study report, the 2024 Harare Traffic and Transportation Local Subject Plan Findings report and recent observations. The reports are a comprehensive set of data which provides an excellent base for any updating studies. The statistics have been updated to include recent additions to the parking inventory. The area for which data is provided is for the Harare CBD as bounded by Park Lane and Samora Machel Avenue Central in the north, Fourth Street in the east, Kenneth Kaunda Avenue, the railway line and Abercorn Street in the south and Chinhoyi Street in the west. This area contains the main business and shopping areas of Harare as well as many government ministries and municipal departments.

The City Council provides controls and administrates most of the parking facilities for the general public and also allows for the provision of private parking under certain conditions. Parking facilities in the city centre are of three main categories: on-street parking utilising part of the road reserve and off-street parking on surface lots and multi-storey parkades. The total number of public parking spaces provided in the CBD is approximately 7070 of which 35% are off-street and 65% are on-street. The private parking complement is estimated at 5 440 bays both on and off street.

In general, the off-street parking used to cater more for the needs of the long-term parker while the on-street for that of the short-term parker. However, time restrictions on the on-street parking were removed recently and one could park for up to 8 hours. This is however against the spirit and purpose of parking within the city centre which is aimed at rationalising space use, by encouraging short term parking.

7.1.8.4.3. Public Parking

7.1.8.4.3.1. On-street parking

Public on-street parking is provided in parallel, angled and 90° (head-on) bays all of which are non-metered parking. There is currently no control over parking duration on all parking bays. The inventory and details of the on-street parking is given in Table 7.114.

Table 7.114: On-street parking provision in the Harare Central City area

Type of parking	No of bays	%
Angled and 90° bays		
- Metered	0	
- Non-metered	3210	
Subtotal	3210	70
Parallel bays		
- Metered	0	
- Non-metered	1360	
Subtotal	1360	30
TOTAL	4570	100

Source: Parking study, 2025.

7.1.8.4.3.2. Off-street parking

Public off-street parking is provided in both parkades and at open air parking lots. The total number of off-street parking space provided within the central City areas is approximately 2500 of which 64% are in parkades and 36% are open air parking lots. The details of the parkades /parking lot locations and their related number of bays is given in Table 7.115. The parkades provide general public parking, reserved parking and preferential parking (mainly) for overnight parking.

Table 7.115: Off-street parking provision in the Harare Central City area

Parkade/parking lot	Location	No of bays
Municipal Parkades:	North-west of Jason Moyo junction	452
Julius Nyerere Way	South-west of Second Street junction	923
Union/Samora Machel Avenue		
Private Parkades:	West of Third Street off Speke Avenue	215
Meikles	North-east of Julius Nyerere Way	400
Joina City		
	Subtotal	1 990
Parking Lots:	North-west of Leopold Takawira Street	433
Park Lane	South-east of George Silundika Avenue junction	340
Fourth Street		
	Subtotal	773
	TOTAL	2763

Source: Parking study, 2025.

It is presently required that provision be made for the off-street parking on all erven with zoning other than *special residential*. These parking requirement standards (parking indices) are given in Table 7.116.

Table 7.116: Off-street parking provision standards

LAND USE	MINIMUM NO OF PARKING SPACES
• Shops	6.0 per 100 sq.m of g.f.s
• Offices	2.0 per 100 sq.m of g.f.s
• Offices (if not located with shopping centre)	2.5 per 100 sq.m of g.f.s
• Medical Rooms	6.0 per 100 sq.m of g.f.s
• Funeral Chapels	0.5 per seat
• Hospitals, Nursing Homes	0.7 per bed
• Cinemas and Halls	0.1 per seat
• Cinemas and Halls (if not located with a shopping centre)	0.25 per seat
• Churches	0.15 per seat
• Schools	1.1 per classroom plus 2.0 per 100 sq.m of office floor space
• Sports Stadiums	0.2 per seat
• Auditoriums	10.0 per 100 sq.m floor space
• Halls (without fixed seats)	1.0 per bedroom plus 10.0 per 100 sq.m floor space of public rooms
• Hotels and Motels	a) 1.0 per bedroom flat not exceeding 100 sq.m floor space of public rooms
	b) 1.25 per two-bedroom flat not exceeding 125 sq.m floor area
• Flats	c) 1.5 per flat with three or more bedrooms

Source: Parking Study, 2025.

7.1.8.4.3.3. Private parking (both on-street and of-street)

Private parking is allocated under four categories, namely:

- a) Diplomatic missions.
- b) International agencies.
- c) National Government Ministries and Departments.
- d) Integral bays in private or public buildings for specific corporate or governmental bodies

There are approximately 5 040 such parking bays in the central City area.

7.1.8.4.3.4. Parking and loading requirements as recommended in City Centre Local Plan No 22

Item 13: Provision of Facilities for Loading, Unloading and Fuelling of Vehicles

- a) Subject to the provisions of this clause no person shall erect or permit to be erected on any stand any building intended to be used for purposes of business or industry unless a loading area shall have been set aside for the purpose of any loading, unloading or fuelling of vehicles which are likely to be involved in connection with the use of such stand or building.

- b) Where any loading area is set aside in terms of the preceding subclause, access thereto shall be from a sanitary or service lane, or, in the case of any stand not served by a sanitary or service lane from a thoroughfare approved by the Authority in such a manner and or such width and in such position as the Authority may determine.
- c) Where any loading area is contained within a building or is built over or covered at a higher level a minimum clearance of 4 meters shall be provided between the level of the loading area the underside of any higher portion of such building or covering, and no column, pier or other similar structural device to support such higher portion of a building shall be permitted within such loading area.
- d) For the purposes of this clause *purpose of business or industry* shall include any building any portion or which is used for purposes of shops or offices or as storage or wholesale warehouses.
- e) If application is made to the Authority for approval to an alternation in the character of the use of portion of a building which together with previously approved applications of a similar nature, involves an alteration in the character of the use of not more than 300 square meters of total floor area contained within a building which has no loading area or which has a loading area which does not conform to the provisions of this local plan, the Authority may grant approval and, in its discretion, may stipulate that the provision of a loading area shall not be required or that the existing loading area, if any, shall not be required to conform to some or all of the provisions of this Scheme.
- f) If application is made to the Authority for approval to an alternation in the character of the use of portion of a building which together with previously approved applications of a similar nature, involves an alteration in the character of the use of more than 300 square meters of total floor area contained within a building exceeding two storeys in height which has no loading area or which has a loading area which does not conform to the provisions of this local plan, the Authority having regard to the cost involved in providing a loading area in conformance with the requirements of this Scheme, may grant approval subject to the provisions of a loading area in conformance with this local plan within such period, not being more than ten (10) years from the date of its giving such approval, as it may deem fit.

Item 14: Provision of Accommodation for the Parking of Vehicles

- a) No building shall be erected in specified zones unless a total area in accordance with the requirements of Appendix II shall have been set aside within the stand to the satisfaction of the Authority for the purpose of providing accommodation for the parking of vehicles and for loading and off-loading purposes.

Item 15: Space for Parking of Vehicles in Zone 1

- a) Except with prior consent of the Authority and subject to any conditions it deems fit, space for the parking of motor vehicles shall be required to be provided on individual properties in sub-zones 1A(i), 1A, 1B(i), 1B as indicated in Table B5.4, that is to say twenty-five percentum (25%) of all developed floor space in every building in these zones shall be set aside for the provision of parking for motor vehicles. Developers shall be free to provide more parking on larger stands where such a higher provision

is feasible and justified by demand. In addition, adequate space shall also be set aside, to the satisfaction of the Authority, for loading and off-loading of service vehicles.

- b) The land set aside for parking and for loading and off-loading shall be excluded from calculations of floor area factor purposes.
- c) Where the land set aside for parking and for loading and off-loading is in the basement or ground floor of the buildings, the coverage of such floors may, with the prior approval of the Authority, be permitted to achieve one hundred percentum (100%) of the standing question.
- d) In special circumstances and with the consent of the Authority, such areas may be permitted to encroach under adjacent streets and/or sanitary lane.
- e) The provisions of 15(b), (c) and (d) above shall be applied also in all other zones where applicable.

Item 16: Surfacing of Car Parking Lots or Bays

- a) Where any car parking bay is required to be provided in terms of this local plan, the land comprising such car parking bay together with the means of access thereto shall be surfaced with bituminous, concrete or other materials to the satisfactions of the Authority.

Table 7.117: Local Plan Number 22 recommended parking provision standards

Zone No	Designated use	Provision for parking of motor vehicles
1A(i)	Special Shops	25% of total developed floor space plus, in addition, adequate space for loading and off-loading of service vehicles, all to be excluded from calculations of floor area factors
1A	Shops	As above
1B(i)	Special offices	As above
1B	Offices	As above
1D	General Commercial	As required by the Authority but not less than 4 bays per stand
1F	Suburban Commercial	One bay for every 70m ² of floor area contained in the building(s)
2A(i)	Detached dwelling homes	At least one bay for each family dwelling unit on the property
2A(v)	Flats	At least one bay for each family residential unit on the premises
3A	Surgeries	One for every 30m ² of floor area contained in the building(s)
4B	Public buildings	Not less than one bay for every 70 m ² of floor area contained in the building(s) on the property
5C	Light industry	As required by the Authority
5D	Service industry	Not less than 4 bays per stand

Source: Local Plan No 22

7.1.8.5. Traffic Enforcement

7.1.8.5.1. Challenges with Harare City Parking Management and Traffic Management

7.1.8.6. Aviation

7.1.8.6.1. Aviation infrastructure (Airports, Aerodromes and Airstrips in Harare)

In terms of airports and air infrastructure, the study area (Harare and its surroundings) by the Government of Zimbabwe in 1999 through the Civil Aviation Act of 1998. The CAAZ is the main provider of civil aviation services, serving as the regulator of the industry managing the civil aviation infrastructure, including the main airports, and providing airspace management services. The study area is served by two airports, the Charles Prince Airport (Mount Hampden) and the Robert Gabriel Mugabe (RGM) International Airport formerly known as Harare International Airport and Salisbury Airport.

7.1.8.6.2. Robert Gabriel Mugabe International Airport size and Capacity

The planning area is served by one airport, the RGM International Airport which is the largest airport in the study area as well as the largest in the country. It is located 15 kilometres south of the city and serves as a primary gateway into Zimbabwe and a natural gateway into Southern Africa. The airport has 4.725m long and 46m wide runway, capable of handling wide bodied aircrafts such as the Boeing 777/B747. It has a design capacity of up to 3.8 million passengers a year. The RGM international airport is fully compliant with international standards and has the capacity to handle regional traffic should it be required. The volume could be increased if the African Open Skies (Yamasukro Agreement) policy could be used effectively as currently a number of bilateral agreements are in the works to allow fellow African nations and Zimbabwe to utilize the facilities in each other's' countries.

It is also important to note that the International Airport is currently under expansion with the construction of a new terminal and related facilities to increase its passenger handling capacity. The expansion of the airport is part of the efforts by the Zimbabwean governments drive to improve aviation infrastructure in line with international standards which is also aimed at driving economic growth.

7.1.8.6.3. Use of unmanned aerial vehicles in Harare

7.1.8.6.4. Challenges in aviation infrastructure

The study established that Civil Aviation infrastructure in Zimbabwe needs rehabilitation and regular maintenance. A particular concern is air traffic control and safety, as equipment is old and in need of replacement. Closely related to traffic surveillance is the capability for aircraft communication to and from the ground. The entire airspace of Zimbabwe has not been covered by existing facilities, and what does exist is deficient. The airspace surveillance equipment is not well maintained, and shortcomings in surveillance also raised concerns about search and rescue operations. Weather installations are inadequate, and broadband infrastructure is not available at most airports. An ongoing program of CAAZ is making progress in addressing deficiencies in the ground to air communication system, but much remains to be done in this area.

7.1.8.6.5. Future plans for the Aviation sub sector

7.1.9. Urban Logistics and Freight Transportation

7.1.9.1. *Characteristics of urban logistics in Harare*

Urban Logistics in Harare is characterised by the delivery and consumption of mainly agricultural products such as tomatoes, cabbages, potatoes and other perishables from surrounding peri urban farms and as far as Mutoko (tomatoes), Nyanga and Beatrice (potatoes) to mention but a few. Recently, downtown Harare has also witnessed the growth of small-scale retail shops which generate and attract a significant proportion of freight traffic, yet this phenomenon is not well provided for in the existing urban development frameworks. The lack of a clear framework guiding urban logistics for Harare has caused serious spatial-traffic flow challenges socially in the market areas of Mbare Musika and downtown Harare which currently are serving urban logistical hubs. However, because of a lack of the inclusion of urban logistics activities within the broader urban development framework of Harare has seen the delivery vehicles clogging the road network in and around the distribution centres of Mbare and other markets in the high-density residential areas, raising a transport safety and health concerns.

7.1.9.2. *Challenges and opportunities for urban logistics in Harare*

Lack of inclusion of urban logistics in Spatial Development Frameworks. Current Spatial Development Framework or urban development frameworks do not address the issue of urban logistics as this is relatively new phenomena, however which is growing exponentially with the growth in informal urban economies. The emerging intense small-scale retailers have not been addressed from an urban logistics perspective. This presents a policy void which impacts directly on land use-transportation relationship.

7.1.10. Non-Motorised Transport in Harare

7.1.10.1. *Need for NMTs in Harare*

Approximately 18% of Harare's households use walking (16.9%) and cycling (1%) as their modes of transport. Based on this, roads alone are therefore not enough to secure social sustainability and only worsens already existing income inequality. Low-income households in the Harare Metropolitan Area spend more than (25%) of their monthly income on transport expenditure. Hence the need is acknowledged by the City of Harare for a new planning approach, which provides sustainable transport options for all citizens, especially the low-income earners, children, elderly and the physically challenged. The importance of NMT as an integral part of the transport system in providing more sustainable transport options is acknowledged. NMT forms a significant part of the daily activity of people as they commute to and from public transport stops and stations, places of work, places of education and walking to water collection points and means of creating a living. NMT has an important role to play in greening the economy in the context of providing and promoting more sustainable transport options, forming part of more cost-effective solutions in establishing a sustainable transport system to improve economic progression for the residents of Harare.

7.1.10.2. *NMT Infrastructure conditions in Harare*

Harare is one of the cities in the world characterized by the nonexistence of a NMT Policy to guide the planning, designing and management of NMT infrastructure in the city. This policy vacuum has led to the neglect of NMT in the city and further propelling the increased use of Motorised Transport, which is socially, economically and environmentally unsustainable. A diagnostic study for NMT environment has revealed the following: -

Neglected cycling lanes and invaded pedestrian sidewalks in Harare

Currently Harare does have relics of cycling lanes and pedestrian which were in existence in the 80s and early 90s. Over the years these have not been maintained and have faded away into oblivion. Pedestrian sidewalks especially in the CBD have been occupied by street traders forcing the pedestrians to use the motorway and in turn compromising on pedestrian safety. Figure 7.115 is a pictorial impression of the invaded sidewalks in Harare.



Figure 7.115: Invaded pedestrian sidewalks in Harare.

Lack of NMT network continuity

Where cycling lanes are available, these lack continuity or have not been developed further to provide for a complete circuit to promote cycling. Historically, the planning for NMTs were primarily done for medium to low density residential areas in Harare, in areas such as Mount Pleasant, Marlborough, Highlands, Newlands to mention but a few. Ironically, the majority of NMT users are found in high density areas such as Mufakose, Kuwadzana, Highfields, Budiriro and Dzivarasekwa among others. The lack of continuity is further expressed by barriers experienced at intersections where there are no dropped kerbs or lack of pedestrian crossing lines at left turn slip lanes. Road safety for pedestrians and cyclists is an ongoing concern.

Road safety is a major issue

Hazardous locations include the CBD area. A lack of law enforcement and partially ignorant travel behaviour of motorists especially informal public transport operators (*Mshikashika*) leave NMT users even more vulnerable. Conflicts between motorists and pedestrians are a challenge, especially at some signalised intersections with left-turn slip lanes.

Urban sprawl discourages the use of NMTs

Harare is witnessing an unprecedented growth pattern characterised by sprawl as opposed to densification. This growth model encourages the use of motorised means of travel and discourages walking and cycling. Facilitating this mobility are highways which encourage high-speed traffic and have created an urban fabric that is explicitly hostile to NMT users.

7.1.10.3. Challenges and prospects for improving NMT Conditions in Harare

The following factors were singled out as key barriers to the development and promotion of NMT in Harare

Lack of institutional support for NMT

The Harare City Council have weak traffic demand policies, therefore, showing that institutional support for NMT is generally weak, as policies and government spending clearly do not promote the usage of NMT. There is a stigma around NMT, especially among Harare residents and that associates it with poverty. If Harare City Council could make adequate provisions in terms of infrastructure investments and policies, this mind-set could be changed, and people will tend to keep using NMT even though their income levels allow for the usage of motorised transportation.

Lack of NMT Budgeting and Funding

Because NMT support is generally not support by the Local Authority as evidenced by the absence of a robust NMT policy it follows that budgetary allocations done are largely earmarked at Motorised Transport infrastructure construction and maintenance, leaving out NMT infrastructure such as the upgrading, maintenance and construction of new cycling and pedestrian walkways.

Poor traffic enforcement on disregard of NMT users by motorists

The poor driver behaviour exhibited by motorists in Harare characterised by red light running, the creation of artificial lanes, abrupt lanes switching and poor lane discipline endangers pedestrians and cyclists. Yet, the Harare Traffic enforcement unit has demonstrated weak capacity to deal with such behaviour and or use unsafe approaches to deal with such behaviour, such as the use of spikes and chasing after errant drivers who then engage in dangerous driver behaviour and in some cases running over pedestrians.

7.1.11. Cross Cutting Issues in Transportation in Harare

7.1.11.1. Urban informality and transportation in Harare

The growth of street trading has direct and indirect impacts on the City's Transportation system. First, street trading negatively impacts the road network capacity by reducing the effective road width. The pedestrian sidewalks particularly in the Harare CBD are occupied by intense vending activities, forcing the pedestrians to use the roadways for motorists creating mixed traffic conditions which contribute to very high levels of traffic congestion and accidents.

Secondly, intense street trading has negatively impacted on the road network drainage system due to poor waste management practices practiced by the street traders. The refuse left by street traders finds its way onto the drainage system which then clogs and then during rainy season, urban flooding occurs severely disrupting traffic flow and to some extent damaging the vehicles.

7.1.11.2. Gender and transport in Harare

Many women in Harare depend on public transport to meet their mobility needs, and yet, accessing public transport and public spaces comes at great risk of gender-based violence. The violence stemming from informal public transport (*kombis and Mshikashika*) ranges from leering looks and offensive gestures, to unwanted touching, sexual assault and theft by stealth especially at crowded bus termini such as Copacabana, Fourth Street, Market Square and Charge Office. Touts at kombi ranks have been known to harass women and girls during boarding and disembarking kombis and Mshikashikas in and around the CDB incidental terminal areas. This situation creates unfavourable conditions for women and girls to use public transport especially during late hours.

7.1.11.3. Safety and Security in Harare's Transportation system

Like the gender dimension of transport in Harare, the safety and security of persons using public transport in Harare is compromised. This stems primarily from an infrastructural deficiency point of view wherein the streetlights and traffic lights are dysfunctional, providing fertile grounds for transport related crimes. In a transport corridor where streets lights are non-existent or not working, crime prevails. Incidence of mugging, cell phone grabbing and hit and run cases have been reported in Harare in areas with poor transportation facilities.

7.1.11.4. Transport and climate change for Harare

According to Zimbabwe's Nationally Determined Contribution, (NDCS), the transport sector contributes to approximately 33% of the Greenhouse Gas emissions (GHGs) which is a high statistic detriment to the environment. While the impacts of climate change are real and are being witnessed in different dimensions. The Zimbabwe Transport Policy and other developmental frameworks in Harare do not directly address climate change issues from a transportation perspective. The types of vehicles operating in Harare and Zimbabwe in general are largely Internal Combustion type of vehicles powered by petrol and diesel, which is regarded an environmentally unfriendly, contributing directly to Greenhouse Gas Emissions, (GHG) which in turn lead to global warming and climate change. Second hand vehicle imports from countries such as Japan, Singapore and to some extent South Africa are usually towards the end of their economic life and contribute more to GHG, yet the transport policy is silent on specific strategies and mitigation measures to reduce the impact of transport on the environment.

Sustainability should be at the core of any transport policy or urban development framework such as this master plan, reflecting on Zimbabwe's commitment to transitioning to a low-carbon economy and aligning the sector with the country's climate change mitigation and adaptation goals. Transport strategies should focus on reducing emissions by encouraging the adoption of electric vehicles (EVs), promoting non-motorized transport (NMT), enhancing public transport systems, and shifting freight movement from road to rail, which has a lower environmental impact. These measures are integral to Zimbabwe's commitment to international climate agreements, including the Paris Agreement, and to achieving the targets outlined in Zimbabwe's Nationally Determined Contributions (NDCs).

7.1.11.5. *Energy and Transport*

The transport sector is largely powered by fossil fuels which are regarded as environmentally unfriendly. Petrol and diesel combustion is directly related to GHG emissions which contribute to global warming. Harare alone with an estimated 800 000 private motor vehicles is arguably contributing to GHGs in greater proportions. This is further worsened by the fact that most of the vehicles in Harare have outlived their economic life spans and are therefore polluting significantly. A key strategy for promoting sustainable transport is investing in electric vehicles (EVs), public transport systems, and non-motorized transport infrastructure.

7.1.12. Summary of Issues

1. Condition of traffic lights in the Harare Municipality indicated that 59% of the traffic lights are functional and 41% are not functional.
2. Condition of street lighting established there is a total of 85 000 streetlights and most tower lights in the planning area. Currently, only 32 000 (37.6%) of these are functional while 53 000 (62.4%) are dysfunctional
3. the drainage indicator shows that 38.9% of roads have 'poor' conditions while 85% of the road network 'fair' drainage conditions,
4. 23.7% of the total road network for the Harare Metro is in 'very poor' and 'poor' condition and for Harare Municipality Roads, a combined statistic of 30.5% of the road network is in 'very poor' to 'poor' condition. Comparatively, a combined statistic of 37.5% and 33% for the Harare Metro and Harare Municipality roads were found to be in 'good' and 'very good' conditions respectively,
5. a low statistic of 33.7% and 9.7% of 'good' riding quality was established, **meaning longer stretch of road network (km) do not produce smooth riding for drivers.**
6. 60.3% of the total road network for the Harare Metro and the Harare Municipality did not have visible road markings,
7. Level of service for primary intersections (major roads) and secondary intersections (neighbourhood nodes) ranges from fair to poor based on 15hrs of average daily data. During the morning and evening peak period the level of service is beyond poor what is called a gridlock situation (it's a total chaos) serve for corridors recently upgraded under the SADC Program.
8. Most intersections and mid-block sections were observed to be congested especially during the morning and evening peak periods. The **causes of congestion** were found to be:
 - (a) Minor roads, joining major roads at the same level (at-grade), case of Samora Machel Road Corridor
 - (b) High private car ownership
 - (c) High level of motor-vehicle and pedestrian mix, pedestrians using roadways due to occupied pavements by informal traders
 - (d) Malfunctioning traffic lights
 - (e) Traffic lights that are not synchronised to optimise on traffic flow
 - (f) Poor driver behaviour from *mshikashikas* and kombi drivers
 - (g) Imbalanced public transport modal split, with a lot of illegal pirate taxis, kombis and less of conventional buses which ferry a lot of passengers at the same time and are an efficient user of road space.
9. Public transport system in Harare is dysfunctional with the modal split as follows 53% pirate taxes, 43% registered commuter omnibuses, 2% ZUPCO buses, 1% metered taxis, 1% private buses.

10. Annual number of RTA increased exponentially by 87.5% from 12089 in 2021 to 22670 in 2022 and maintained a high statistic above 21000 till 2024.
11. the majority of accidents were observed to be occurring in the Harare CBD, along Kirkman Road, Bulawayo Road, Borrowdale Road, Seke Road, Mutare Road, Simon Mazorodze Road, Willowdale Road and in the high-density suburbs of Kuwadzana, Budiro, Highfields and Glen view.
12. Most accidents occur during the morning peak and evening peak and are constant throughout the week and the dominant types are nose to tail, side swipe same direction, vehicle pedestrian collision and right turning Infront on oncoming traffic,
13. Dominant causes of accidents are misjudgement/inattention, following too close, fail to give way, reversing error, turning error, excessive speed, overtaking error, parking error, negligent pedestrian, obstructed roadway, vehicle defects etc.
14. Dilapidated and vandalised rail infrastructure (poor tracks and signalling systems) to support passenger rail

7.2. Existing Bulk Infrastructure Assessment

7.2.1. Water Supply Services and Infrastructure

This section unpacks the Bulk Water Supply and Infrastructure Scoping for Harare Metropolitan. Key issues of focus include the existing water sources, treatment and supply services and the current state of the existing infrastructure and estimated service requirements.

7.2.1.1. History of the City's Water Supply

The earliest residents of Harare drew their water from streams and wells. Since then, the City's water supply scheme has developed over the years from the commissioning of the Cleveland Dam and associated treatment plant close to Msasa, in 1915. Today raw water for potable water production is drawn from Harava dam, Seke dam, Lake Chivero together with Lake Manyame on the upper Manyame sub catchment on Manyame River. Seke Dam, previously Prince Edward Dam, was constructed in the early 1930s along the Manyame River to the South of the City. Raw water was pumped to a treatment plant built on The Kopje hill. In 1974, the Prince Edward Water Treatment Works (WTW) were built at Seke Dam. Harava Dam was completed on the Manyame River upstream of Seke Dam in 1974. Prince Edward WTW, of 90 million litres per day, is supplied by Harava and Seke dams. Its intended area of supply was the whole of the Southern parts of Harare, including Chitungwiza. At that time the only development in Chitungwiza was St Mary's; Zengeza 1 was still being built. The massive development to the East of Zengeza was prearranged just before Independence and built after 1980. The current Prince Edward Water Treatment Works (WTW) was intended as a peak load plant, to supply the difference between average demand and peak demand during the driest months between the end of winter and the start of the rainy season. The Prince Edward WTW can empty the two upstream dams (Seke and Harava) in 3 months. It has not been used as a peak load plant for some years now. The Prince Edward WTW can deliver treated water to Chitungwiza, the southern suburbs and to the Letombo reservoirs in Msasa. When Prince Edward WTW is not running, the southern suburbs and Chitungwiza may be fed with water from Morton Jaffray, either pumped directly from Warren Control Pump Station or back-fed by gravity from the Letombo reservoirs.

The McIlwaine Dam, now Chivero Dam, downstream of Seke was built in the early 1950s. The Morton Jaffray waterworks were built in stages till the 1980s with a design capacity summing up to 614 million litres per day. The Manyame Dam was completed in 1976 downstream of Lake Chivero just before Independence in 1980, After Independence, the tunnel that brings water from the dam to a deep pump station at Morton Jaffray was completed.

7.2.1.2. Existing Water Supply Overview

The City of Harare is mandated to provide water supply services to the residents, industries and commercial entities, as well as neighbouring towns as proposed by the Harare Metropolitan Combined Masterplan. Inclusive of these locations or service areas are Chitungwiza, Norton, Ruwa and Epworth, Rydale Ridge and Whitecliffe in Zvimba, Inkomo Barracks in Darwendale and Domboshava. In this regard, infrastructure for the defined purpose is inclusive of raw water abstraction and treatment facilities for potable water. As well as transmission through mains, pumping to storage reservoirs, distribution network to consumer points and metering equipment for cost recovery of the resource thus provided.

The city has faced significant challenges in water supply during recent years. The city's water distribution network is outdated. Most of the pipework and treatment plants need repair or replacement, resulting in water loss from frequent bursts, leaks and faulty pipe fittings. The city council has embarked on rehabilitation and expansion works on the water treatment plants and distribution network. Efforts were also made with the support of the government to improve supply efficiency and water conservation through public awareness campaigns. Also, installation of water meters in properties without the devices and replacing faulty meters. In 2024, Harare City documented 68.3% water supply coverage over the properties registered in the cadastral records. According to the City of Harare survey, sources of water used in Harare were found to be rationed as presented in the graph below.

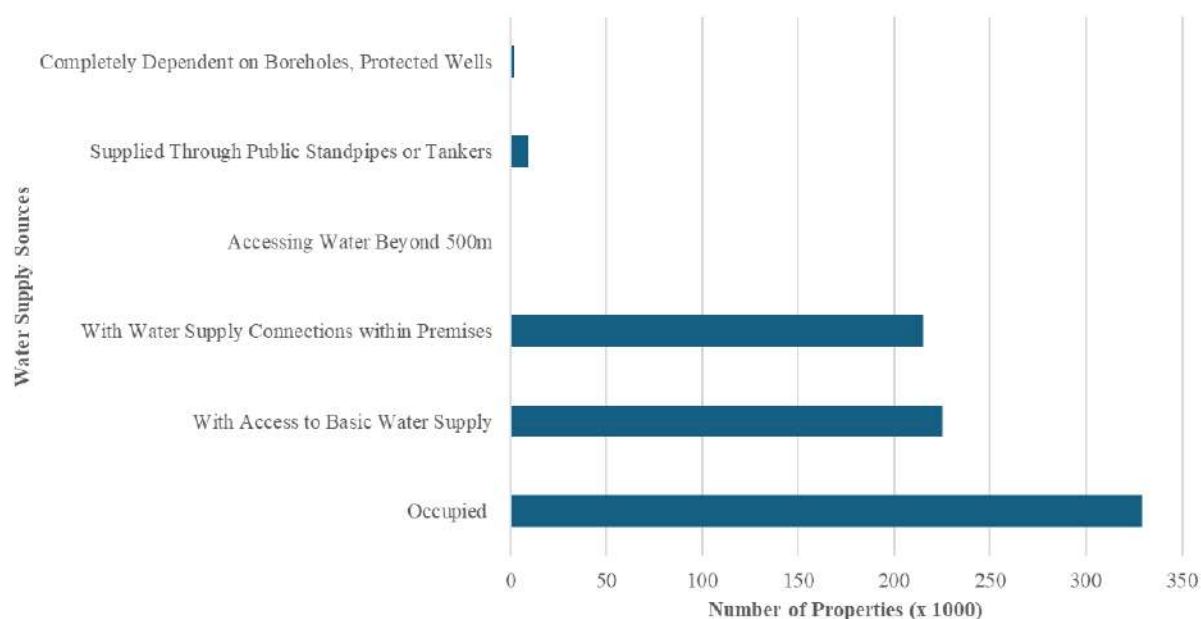


Figure 7.116: Harare City Water Supply Sources

Studies were carried out on Harare water supply by the World Bank and African Development Bank in consultation with ZimSTAT, GKW, BCHOD, Lamont/Nicholas O'Dwyer including Gauff Ingenieure as consultants from 2010 to 2014. The report provided in-depth analyses of existing infrastructure, projected demand and future facilities to the anticipated demands with a horizon up to 2030. The information thus generated still subsists as most of the recommendations from these studies have not been fully implemented owing to funding challenges.

Compounding the infrastructure issues, the region has experienced droughts. Dwindling water levels have been observed in the main reservoirs, Lake Chivero and Lake Manyame. This reduction in available raw water has coincided with a steadily growing population demand, outpacing the municipal infrastructure. Hence, leading to water shortages and rationing. Harare, Chitungwiza, Ruwa and Norton sit upstream of the water sources and contribute to the pollution of the lakes. High treatment costs are incurred in operating the plant and providing better water quality to the city. Presently, the residents have resorted to groundwater as the main alternative water source. ZINWA took action to capture and regulate groundwater abstractions. Some practice rainwater harvesting and re-use of effluent from sewer treatment plants mainly for irrigation.

7.2.1.3. Raw Water Sources

The City's water supply scheme has developed over the years from the commissioning of the Cleveland Dam, in 1915, to the current status where raw water is abstracted for potable water production from Harava and Seke Dams through treatment at Prince Edward Treatment while Lakes Chivero and Manyame feed into Morton Jaffray Water treatment plant. The raw water supply sources are on the Upper Manyame Subcatchment of the Manyame River. Within this Sub-catchment, the main rivers are Ruwa, Nyatsime, Hunyani, Mukuvisi, Marimba, Little Marimba Gwebi and Manyame. The city thus sits on the watershed of its source of raw water for potable water supply.

Chivero Dam is 85% owned by the City of Harare and the 15% is owned by ZINWA. Darwendale is wholly owned by ZINWA and Prince Edward is wholly owned by the City of Harare. Prince Edward Dam usually reduces its water levels in the dry season especially in September and October.

Bathymetric surveys carried out on both Chivero and Manyame at full supply level showed that the reservoirs had silted up by 6% and 9% respectively thereby incurring a reduction of their annual 4% yield level from 560 000m³ to 480 000m³. Further to this effect of siltation, the raw water sources are heavily polluted and eutrophicated owing to anthropogenic activities upstream of the surface water reservoirs as evidenced by algal and water hyacinth blooms in the aquatic ecological system within the Sub catchment area. The major pollutants influent at the raw water sources are either raw sewage spillages from corroded stream crossings or partially treated wastewater discharged from wastewater treatment plants within the catchment.

There being about nine treatment plants in the catchment, the major wastewater treatment plants include Zengeza, Firle, Crowborough and Norton. Since the raw water supply system indicatively shows that is a singular entity, any level of discharge or pollution from any of the towns upstream affects the whole ecosystem downstream thus meaning an integrated system of the water in the catchment is required. Given the environmental degradation thus observed and the depleting dam yields, new alternative raw water sources and accompanying treatment facilities are required as an urgent intervention in line with climate change dictates.

7.2.1.4. Raw Water Supply Sources

The accompanying table shows indicative status of existing raw water supply sources including their sustenance of abstraction based on design capacities of the respective treatment plants the reservoirs relate to.

Table 7.118: Raw Water Sources

Source	Year	Design Capacity (ML)	Current Capacity (ML)	Current Capacity (%)	Estimated Supply Time (months)	10% Yield Capacity (ML)
Seke Dam	1929	3 380	2 287	68	3	1920
Harava Dam	1973	9 026	6 367	70	3	3380
Lake Chivero	1952	215 328	206 266	95	36	89300
Lake Manyame	1976	477 603	426 618	89	36	107220

The studies mentioned earlier recommended the investment in incremental development of the Kunzwi/ Musami water supply schemes and investigation of the viability of the Muda and

Mazowe dams to augment supplies to the current raw water sources that supply Harare and its environs. The proposed Kunzvi Dam to the East of Harare will yield about 250 ML/day.

Lake Chivero is heavily polluted due to the overspilling of raw sewage from Chitungwiza and the malfunction wastewater infrastructure in Harare. Parts of Chitungwiza are downstream of the treatment works and require pumping to reach the plant intake. Due to the power outages, faulty equipment and clogged pipework, wastewater from the sumps overflow into Hunyani/Manyame River system through to Lake Chivero. Lyndhurst wastewater treatment plant is planned to receive sewage generated from Mabvuku/Tafara after decommissioning of Donnybrook set of ponds. However, effluent from the waste stabilization ponds cannot be disposed by land application as land for that purpose has since been occupied by informal settlers and electrical/ mechanical equipment stolen or vandalized.

7.2.1.5. Subsurface Water Sources

Geographically located around satellite towns of Ruwa, Epworth, Chitungwiza and Norton, within the Upper Manyame sub catchment, the City of Harare's geology provides a low underground water potential according to the Gauff Report of 2014. Hydrogeological conditions provide a wide variety of water table depths, subsequent borehole depths and yields per second depending on geology. The most prolific boreholes are located in the Mukuvisi and Marimba corridors with the greater number found in the low to ultra-low-density areas in the North/ Eastern parts of the city. However, some shallow wells and boreholes have been found to be contaminated in the South/Western parts of the city. Wetland ecosystems are part of the natural water recharge cycle that also support the ground water recharge.

7.2.1.6. Raw Water Quality

Figures 230 and 231 present the of the average water quality values for the water received from the raw water sources from 2015 to 2024. Lake Chivero and Lake Manyame have increased in turbidity and total solids. These parameters affect the filtration treatment. The filter media clog more hence a greater loss in water for backwashing. The increase in temperature, and reduction in dissolved oxygen is evidence for the increase in aquatic organisms. The raw water source is heavily polluted by faecal matter evidenced by the increase in faecal coliforms and increased Biological Oxygen Demand (BOD). Cases of sewer pipe bursts and poor sewer effluent discharged into the rivers have been reported on several occasions.

Seke Dam and Harava Dam source water for Prince Edward WTW when there is adequate water. The raw water has better quality compared to Lake Chivero and Lake Manyame. There are signs of pollution in the water body. An increase in BOD and faecal coliforms indicates raw sewage entering the water channels. The reduction in dissolved oxygen shows increase in aquatic life. There is also an average decrease in total hardness and total solids in the waters.

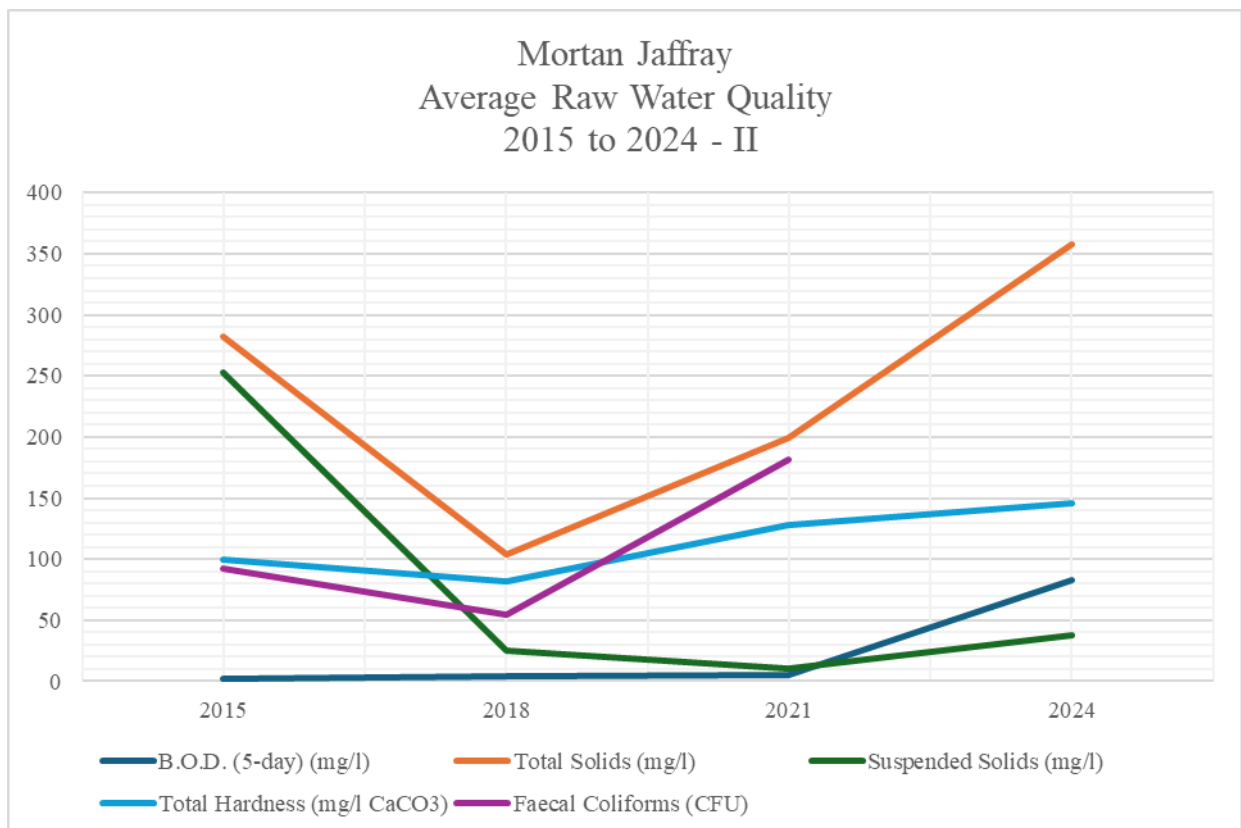
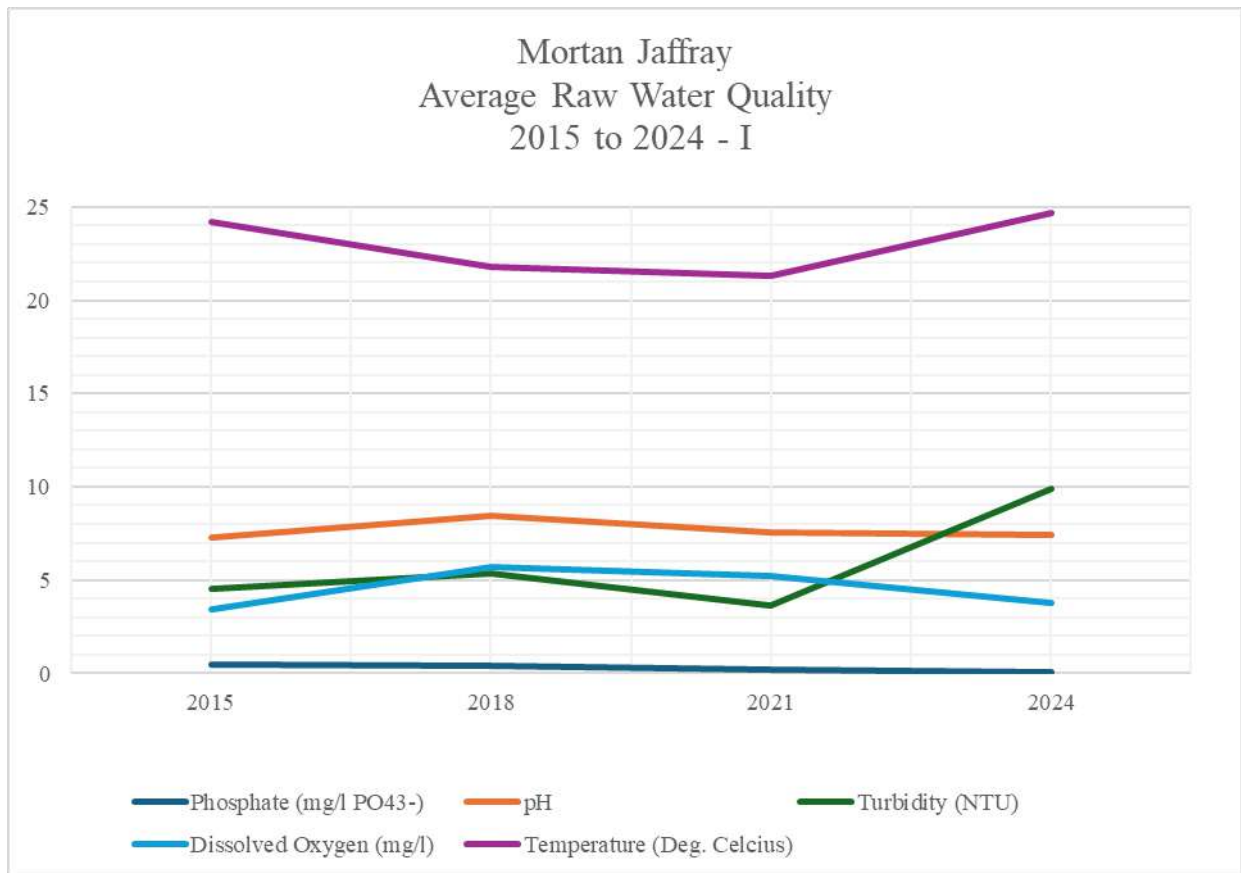


Figure 7.117 : Mortan Jaffray (Chivero / Manyame) Raw Water Averages 2015 to 2024

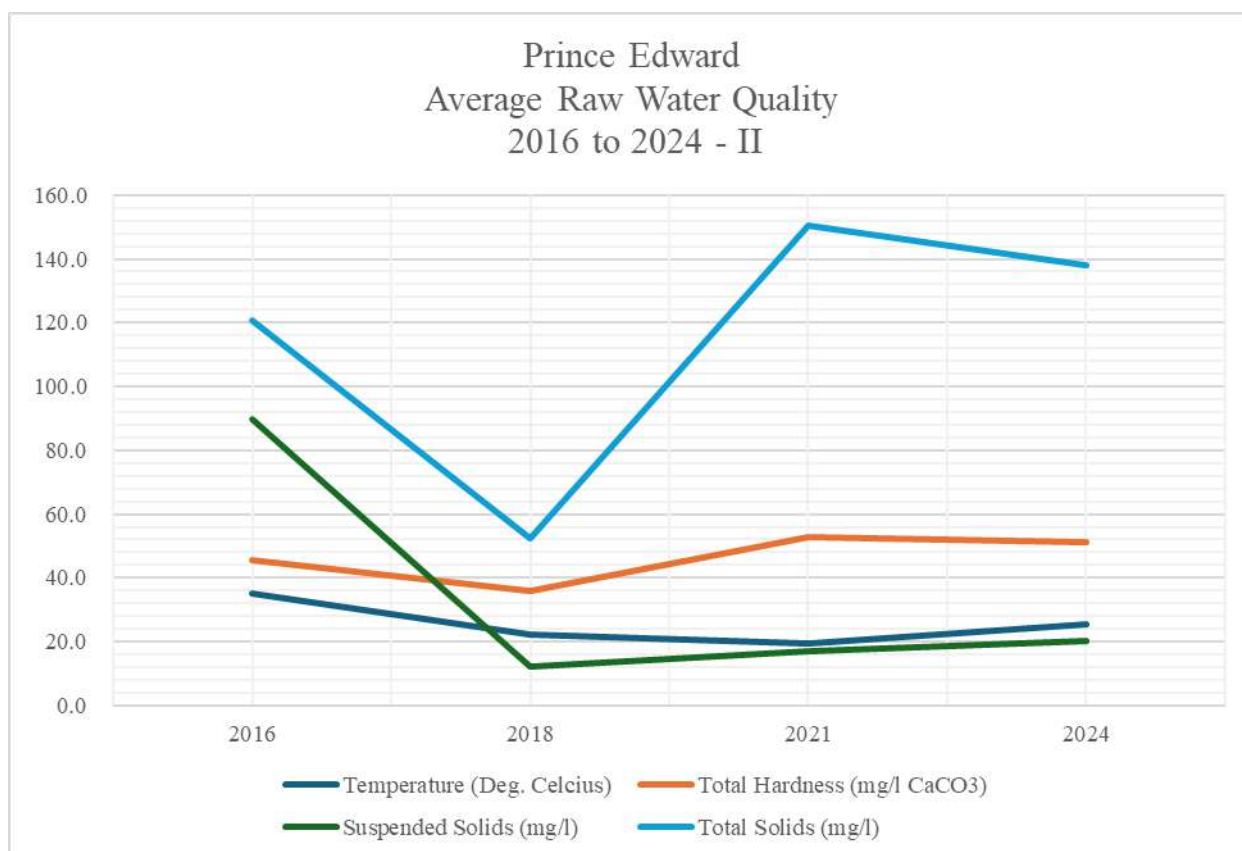
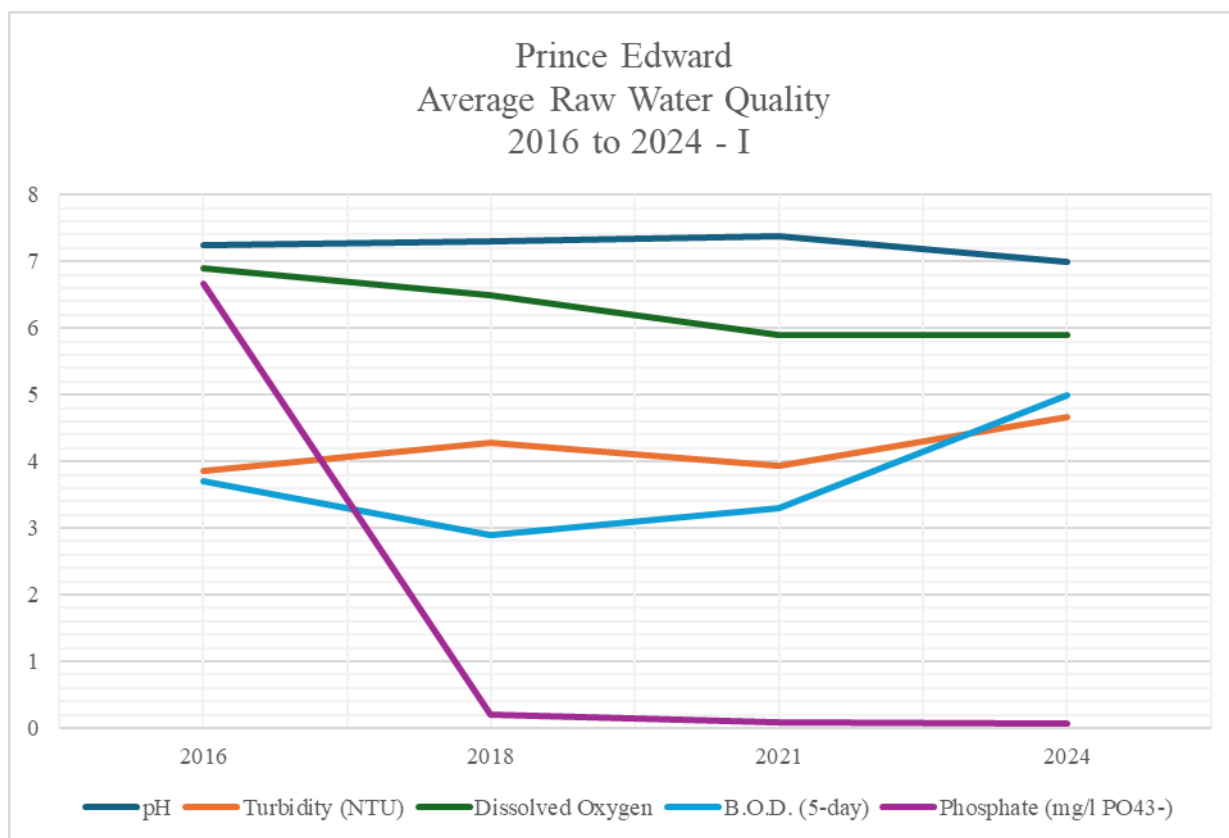


Figure 7.118: Prince Edward Average Raw Water Quality 2016 to 2024

7.2.1.7. Water Treatment Infrastructure Condition and Capacity Assessment

7.2.1.7.1. Raw Water Pump Station and Intakes

Prince Edward WTW has a low lift pump station consisting of 4 pumps and abstracts raw water from Seke Dam. The pumps have been in operation for the past 50 years and require replacement. Maintenance work has been done on the pump sets to improve efficiency in the time being.

Table 7.119: Prince Edward WTW Low Lift Pump Station

Pump	Capacity (ML/day)	Head (m)	Status
1	50,4	22	Functional but requires upgrade
2	50.4	22	Functional but requires upgrade
3	50.4	22	Functional but requires upgrade
4	50.4	22	Functional but requires upgrade

Raw water for Morton Jaffray Water Treatment Works is abstracted from three number intake works. The oldest intake tower constructed in 1952 draws water at five water levels. Three of these feed into a common 1100 mm diameter water main which transports raw water to the distribution chamber at the head of the water treatment works. The remaining being an irrigation intake and the river outlet pipe respectively. A new intake tower was constructed in 1976 to resolve the issue of abstraction levels in the old intake tower. Raw water is discharged into a mixing chamber through a 3 m × 3 m tunnel before it is fed into the treatment works. The last intake is a 3m x 3m rectangular tunnel running for 15.4 km at Lake Manyame. Upon reaching the works, this tunnel is approximately 45m into the ground and raw water is pumped to a riser shaft. The pumpstation comprises of 5 Weir pumps; three were installed in 1985 and two pumps installed in 1993. Raw water is pumped up a water tower, approximately 40m above ground, and then falls by gravity into the 1800 mm diameter main leading to the raw water chamber where it is mixed with water from Lake Chivero. The falling height of the water from Lake Manyame supersaturates with dissolved oxygen, which later is released in the Pulsator type clarifiers, thus reducing the floc formation process due to flotation effects.

7.2.1.7.2. Existing Treatment Capacity

Harare City has two water treatment facilities, Morton Jaffray and Prince Edward. The abstracted raw water is treated for distribution to residents of Harare, its satellite towns and Government institutions beyond its regulatory geospatial boundaries. As highlighted earlier, the treatment plants were constructed in phases over the years. The following table summarizes the size of water treatment plants and the current operating capacities for these systems.

Table 7.120: Existing Water Treatment Plant Capacities

Unit	Year Built	Design Capacity (ML/day)	Available Capacity (ML/day)	Current Treatment (ML/day)
Prince Edward	1974	90	65	65
Morton Jaffray 1A	1954	75	400	270
Morton Jaffray 1B	1966	85		
Morton Jaffray 2	1976	227		
Morton Jaffray 3	1994	227		
Total		704	465	335

7.2.1.7.3. Water Treatment Works

Morton Jaffray and Prince Edward water treatment plants were designed according to the raw water quality at the time. Over the years, the raw water sources have become heavily polluted through industrial discharges, poor effluent from sewer plants, contaminated storm water drains and farming operations. Consequently, the treatment technologies used at the water treatment plants have been continually reviewed so that quality of potable water produced is not compromised in terms of meeting WHO and SAZ parameters for human consumption. The plants generally require rehabilitation and consistent repairs. These water treatment plants utilise the conventional surface water treatment process depicted in figure 7.120. There are additional stages necessitated by the quality of the raw water source. These include pre-chlorinating to remove algae and activated carbon treatment to remove odours.



Figure 7.119: Water Treatment Process

7.2.1.7.3.1. Prince Edwards WTW

Prince Edward WTW was constructed in 1950 and renovated in 1974 with the design capacity of 90,000 m³/day. Volumes of water treated varies with season; approximately 65,000 m³/day during the wet season and 40,000 m³/day in the dry season. The plant is operated when the dam has filled up to the required capacity. During some time in the year the plant is not functional owing to depleted raw water levels in Seke and Harava Dams. The treatment works utilize the conventional surface water treatment technology.

7.2.1.7.3.2. Morton Jaffray WTW

Morton Jaffray Water Treatment Works (WTW) consists of three units which were constructed in phases of four (refer to Table 7.121). The Units 1A and 1B are fed from Lake Chivero by Gravity. The remaining two are fed from the Lakes Chivero and Manyame by gravity as well. Lake Chivero is hypertrophic and being used though treatment is expensive due chemicals. The water undergoes pre-chlorinating with High Test Hypochlorite (HTH) to kill weed, harmful algal bloom (HAB). There is regeneration of algae observed in the rapid sand filters. More water is lost in backwashing the filter material. The media binds itself and requires changing over a shorter period. The estimated water loss from backwash is nearly 10% of production. Backwashing exercises are done more frequently. Currently, there are no pumps available in Lake Manyame to draw water from the tunnel.

Table 7.121: Water Treatment Components for Prince Edwards WTW

Stage	Description
Chemical preparation and dosing	i. Lime dosing for pH correction takes place downstream of the rapid sand filters after being prepared in two octagonal tanks with mixers. ii. Aluminium Sulphate dosing is done at the inlet point of the distribution channel. Three alum make-up tanks prepare the coagulant solution which gravitates to three mixing tanks before being pumped to the dosing point. On average the dosage rate is approximately 27.5 to 35 mg/l. iii. Sodium Silicate is dosed as a flocculation aid between September and December at a rate of 0.5 mg/l. iv. Powdered Activated Carbon (PAC) is manually dosed into the raw water at a rate of one 25 kg bag every 2 hrs. This treatment reduces the organic matter content during dry periods and the first rains.
Coagulation and Flocculation	The channel is 28.6 m long by 2.4 m wide and 2 m deep. There are asbestos deflectors that facilitate mixing, ensuring the homogeneity of the coagulant, and to promote flocculation.
Clarification	There are twenty-eight vertical flow clarifiers with approximate dimensions of 18m x 9m x 9m and a surface loading rate of 1.5m/hr. Coagulated water is distributed from a central circular chamber. Clarified water spills over into asbestos cement troughs fixed at the top of the tanks and flows to the rapid sand filters. Sludge from the clarifiers is transferred to lagoons using two sludge pumps, installed in the old 1929 low-lift pump station. The clarification plant is in good condition except for the sludge pumps, one is operational and the other is old.
Rapid Sand Filtration	There are sixteen Degremont Aquazur-type rapid gravity sand filters constructed in banks of eight on either side of the filter gallery. The observation deck was constructed with the dimensions 11.8m x 4.25m. Under normal circumstances, filtration rate is around 5m/hr. The water depth on the sand filter surface was designed to be controlled by siphons which are no longer operational. When the filter resistance reaches 1.5m, washing of the filter layer using pumped water and pressurized air takes place. Backwashing is starts with air only followed by air and water and finally water only until the water is clear. The filter floors were constructed with partial cracked precast concrete slabs fitted with Degremont D20-type filter nozzles. Each filter is operated via three valves which are filtered water outlet, backwash water inlet, and air inlet valves. The valves were installed with pneumatic actuators which need replacement.
Disinfection	Gaseous chlorine is dosed to kill pathogens and to kill algae, due to algal bloom in the supplying dams. The dosage allows for residual chlorine to preserve the treated water in transmission.

Table 7.122: Water Treatment Components for Morton Jaffray Units 1A and 1B

Stage	Description
Chemical preparation and dosing	i. Organic matter in the raw water is treated by Powdered Activated Carbon (PAC). The PAC is prepared in two concrete tanks with stirrers. ii. Gaseous chlorine is dosed for perchlorinating raw water to remove algal blooms which aggressively bind to the rapid sand filter media. Raw water is also dosed with aluminium sulphate which is prepared in four concrete tanks equipped with a stirrer. These tanks are badly corroded and must be refurbished. iii. Sodium silicate, a flocculation aid, is prepared from two concrete tanks with new stirrers. iv. pH is adjusted by adding lime slurry prepared in two circular steel tanks. The corresponding stirrers and dosing pumps need replacement. v. Pre-chlorinating is done to kill algae, due to algal bloom in the supplying dams.
Flocculation and Clarification	Clarifiers 1 and 2 are circular with bottom scrapers for sludge removal. Upstream are flocculation chambers fitted with mechanical flocculators. Both clarifiers and flocculators are not operational. The mechanical components need replacement. Desludging can only be achieved by emptying the tanks and removing sludge manually. Clarifier 3 is a circular Accelerator type of clarifier with an integrated flocculator. This clarifier is out of operation as the electromechanical equipment (motor, stirrer, valves, and pipework) needs replacement. Clarifiers 4, 5, and 6 are Patterson Candy type of vertical flow clarifiers with an overall depth of 12m and 8 sludge pockets each. Clarifier No. 7 is a Degremont Pulsator type clarifier, which receives raw water from a separate gravity main from Lake Chivero. The vacuum system that creates the pulsations for sludge blanket formation is not functional. Several raw water diversion plates at the bottom of the rectangular clarifier are broken. Operating valves will need to be assessed.
Rapid Gravity Sand Filters	There twenty-six rapid gravity sand filters, 12 Patterson filters installed from 1952 to 1954 and 14 Degremont filters installed in 1966. The baffle gates and float-type filter outflow regulation system of the Patterson type filters require new installation. All valves (filtered water outlet, backwash water inlet, and air inlet) need to be replaced with pneumatic actuators complete with corresponding air compressors. The two existing backwash air blowers are very old but still operational. The inlet plates of the Degremont filters are heavily corroded. Several of the asbestos cement filter floor slabs are cracked and need repairing. The siphon-type outflow control system is not working. All valves (filtered water outlet, backwash water inlet, and air inlet) will also need to be replaced with pneumatic actuators. Only one air blower is operational for filter backwashing. Two old backwash water pumps, installed in 1954, are serving both filters. Several valves and pump starters will need to be replaced as well as the electrical control board.
Disinfection	Gaseous chlorine is dosed for disinfection and killing algae. The dosage allows for residual chlorine to preserve the treated water in transmission. Two new chlorinators were installed when the chlorination system for treated water disinfection was rehabilitated under the “UNICEF “project in 2009/2010.

Table 7.123: Water Treatment Components for Morton Jaffray Units 2 and 3

Stage	Description
Chemical Preparation and Dosing	- To reduce the organic matter content of the raw water, Powdered Activated Carbon (PAC) is added into the raw water mixing chamber. A dosing pump provides 25 % of the required amount and the rest is added manually. - Sulphuric Acid (H_2SO_4, 98%) is mechanically dosed for pH correction into the same mixing chamber reduce the pH down to 6.8 to 7.0 which is optimum for subsequent coagulation with aluminium sulphate. Sulphuric acid is stored in a 60-ton storage capacity tank, which lasts on average 4 days only. - Aluminium Sulphate is dosed at the inlet point of the six distribution channels leading to the clarifiers. High dosing rates of 60 to 80 mg/l are added to the water which is approximately 40 tons/day. There are three aluminium sulphate solution tanks approximately 600 m³ each. Two concrete tanks, originally for sodium silicate preparation are used for the solution preparation. Alum is pumped to the dosing tanks by two centrifugal pumps (GRUNDFOS). A reserve volume for the prepared alum is stored in the above non-functional tanks. - Sodium Silicate is dosed as a flocculation aid using two separate dosing plants for each treatment plant unit, Units 2 and 3. Each plant comprises of two preparation and dosing concrete tanks fitted with a corresponding stirrer. - Lime dosing for final pH adjustment is through a lime dosing station, comprising 4 No. lime slurry hoppers and 4 No. lime dosing pumps. - Pre-chlorinating is done to kill algae, due to algal bloom in the supplying dams.
Pulsator Type Sludge Blanket Clarifiers	Units 2 and 3 each comprises of three Pulsator type Clarifiers commissioned in 1976 and 1994, respectfully. These are of the same type and size. A distribution chamber with weirs discharges partially treated water to individual channels, where coagulation and some kind of pre-flocculation take place. Each clarifier inlet channel has a “Venturi” flume for flow measurement purposes. This type of clarification process is not ideal for raw water containing algae. The sludge blanket forming over the surface area easily breaks down under operational circumstances such as inaccurately monitored chemical dosing rates and frequent power failures. Sludge accumulates at the bottom of the clarifiers necessitating frequent emptying and cleaning of the clarifiers, almost every 3 to 4 months. Thus, a significant loss of water. The removal rate in these is less than the observed rates in the vertical clarifiers for Unit 1. One of the six channels has a missing flume resulting in overloading of this channel and the corresponding downstream clarifier.
Rapid Gravity Sand Filters	Units 2 and 3 were both constructed with 18 Degremont V-type rapid gravity sand filters regulated by siphon type outflow. This regulation system is no longer operational. New pneumatically actuated solenoid valves were installed in 2009/2010 in all four mains for each filter (i.e. in $\Phi 400$ mm filtered water outlet, $\Phi 600$ mm backwash water outlet, $\Phi 500$ mm backwash water inlet and $\Phi 300$ mm air inlet). However, Unit 3, compressed airlines are inadequate to meet the pressure required to operate the valve actuators. There are two backwash water pumps dedicated to Units 2 & 3 and one stand-by air blower serving both units.
Disinfection	Gaseous chlorine is dosed to kill pathogens and to kill algae, due to algal bloom in the supplying dams. The dosage allows for residual chlorine to preserve the treated water in transmission.



Pulsator Clarifiers



Rapid Gravity Sand Filters

Figure 7.120: Pulsator Clarifiers and Rapid Gravity Sand Filters

7.2.1.7.3.3. *Morton Jaffray's Backwash Water Treatment and Recycling Plant*

About 20 years ago, a backwash water treatment plant was installed allowing for recycling of backwash water which would be conveyed to the head of the works. This would allow for water savings of around 12,000 to 15,000 m³/d. Nonetheless, the plant which was being installed by ODIS Filtering Ltd., of Israel could not be completed and was never commissioned. The plant was designed to follow the treatment process chain below.

- i. Water flows into the SOLIQUATOR for polymer supported solid-liquid separation.
- ii. Pressure filtration of the liquid phase of the SOLIQUATOR with the filtered water to Unit 3.
- iii. High rate settling for the solid phase of the SOLIQUATOR with the settled water returned to the SOLIQUATOR.
- iv. Polymer supported belt press thickening of the settled solids of the high-rate settlers with the supernatant returned to the SOLIQUATOR.
- v. Polymer supported filter press dewatering of the sludge from the belt press with the supernatant returned to the SOLIQUATOR.

7.2.1.8. *Water Distribution Infrastructure Condition and Capacity Assessment*

Potable water produced at the water treatment plants is distributed to Harare and satellite towns. These include Chitungwiza, Norton, Ruwa and Epworth, Rydale Ridge and Whitecliffe in Zvimba, Inkomo Barracks in Darwendale and Domboshava. Other areas with significant demands include government facilities within the city boundaries such as, Chikurubi Complex and Cranborne Barracks. The water distribution infrastructure is composed of transmission mains, storage reservoirs, booster pump stations, distribution reticulated network and metered consumer connection points. The water distribution infrastructure has been operated for a long period resulting in wear and tear of pipework. Overtime in-situ materials build up within the distribution network increasing friction factors and the weakened pipes are very prone to bursts/ leaks. City of Harare reported to have pressurised supply amounting on an average of 14 hours a day.

Table 7.124: Water Distribution Infrastructure Summary

Item	Description	Unit	Quantity	Item
1	Water reservoir sites	No.	32	1
2	Transmission mains and distribution network	meters	6 521 000	2
3	Booster pump stations	No.	16	3
4	Metered connections	No.	215 225	4
5	Metered communal/public standposts	No.	446	5

Reparative works have been done to the system over the past years. Fourteen pumps have been replaced at Warren control and the Darwendale pumps procured for Morton Jaffray with use of Devolution Funds. Pumps 11 to 14 were replaced and a Government-to-Government loan agreement. Plans are underway to rehabilitate Letombo Pump Station and pumps 4 to 10 at Morton Jaffray to improve transmission and reduce recurrent losses in the system.

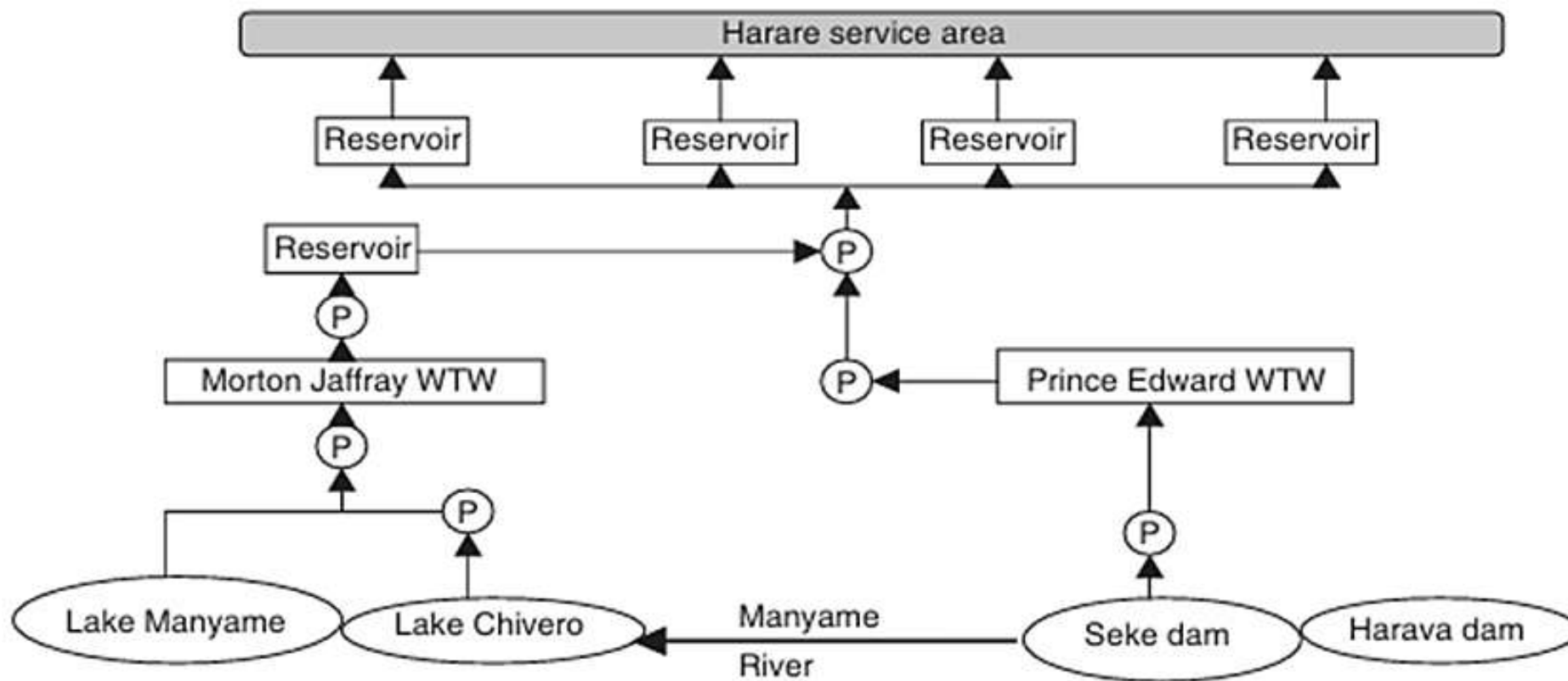


Figure 7.121: Schematic Layout of Water Supply System for the Harare Metropolitan Area

7.2.1.8.1. Treated Water High Lift Pump Stations

7.2.1.8.1.1. Morton Jaffray WTW High Lift Pump Stations

This treatment plant has a high lift pump station comprising of 14 pump sets. An ND 800 mm suction pipe with a positive suction feeds Pump Sets 1 to 3. The rest draw treated water from a concrete water duct built to a capacity of 455 ML/d using positive suction.

Table 7.125: Morton Jaffray High Lift Pump Properties

Pump	Year of Commission	Make and Operational Properties	Comments
1-3	2016 (original 1954)	12 UZDL 25 Worthington Flow rate, Q = 19.0 m ³ /min, 172 m head Speed is 1450 rpm, efficiency of 85%. 1 Nos. Operational, 2Nos. Standby	• ND 750 mm transmission main to Lochinvar Reservoir • Mainly services Unit 1
4-6	1960	12 LNC 29"A Pleuger Worthington Parallel Q = 75 m ³ /min, 154.3 m head Speed is 1480 rpm, efficiency of 85%	• Operates as two pumps in parallel • ND 975mm main to Warren Control Pump station
7-10	1976	20" SDS METS Pump A 600 kW in series with a Pump B 1,300 kW	• ND 1300 mm transmission main to Warren Control Pump Station
11-14	2016 (original 1994)	16-LN-35E Duty point of 53 m ³ /min against a of 90 m head Speed is 1482 rpm and the efficiency 88%.	• Operates as two identical pumps connected in series • ND 1300 transmission main to Warren Control Pump station

7.2.1.8.1.2. Prince Edward WTW High Lift Pump Stations

Three pump sets were installed in the high lift pump station. These approximately 50 years old except for some whose motors were replaced by the European Union (EU) project. Presently, one pump is operational. The newly installed pump motors do not fit adequately for the corresponding pump. New pumps were be installed under the UWSSRP Phase 1. There is also a very old drainage pump at the station. The pumps feed into a ND 975mm pipeline to Harare City. Chitungwiza receives water from this plant through ND 600mm pipe. The water supply from this plant is seasonal.

7.2.1.8.1.3. Booster Pump Stations

The city's potable water supply network is supported by sixteen booster stations with operational pumping capacity ranging from 720 m³/day to 362,880 m³/day. Four of these are lift stations were constructed with water towers at Donnybrook, Highlands, Greendale and Waterfalls. The other two lift stations coupled with reservoirs in Kuwadzana and Dzivaresekwa. There are also private pump stations. One in Donnybrook for Lafarge Cement Factory and another at Philadelphia for a military camp. The proposed Kunzwi WTP and Kunzwi Booster Station will discontinue the use of a number of these pump stations. Table 156 summarizes the properties of the booster pump stations.

Table 7.126: Booster Stations Properties

	Pumping Station	Function of Pump Stations	Capacity (m ³ /day)	Head (m)	Year of installation	Status
(a)	Old Alexandra Park	transmission	50,000	45	1971	<i>n.a.</i>
	New Alexandra Park	transmission	21600	100	<i>n.a.</i>	Functional
(b)	Avondale	transmission	42480	70	2018	Functional
(c)	Bluff Hill	transmission	12000	45	<i>n.a.</i>	Not operational
(d)	Crow hill	transmission	9,160	40	<i>n.a.</i>	Operational
(e)	Emerald Hill	lift station	1680	35	2018	Operational
(f)	Greendale	lift station	2,671.2	22.5	2018	Operational
(g)	Hatfield	removed	-	-	-	<i>n.a.</i>
(h)	Hogerty Hill	transmission	3,260	30	1978-79	<i>n.a.</i>
(j)	Kuwadzana	transmission	3,600	80	<i>n.a.</i>	2018
(k)	Letombo	transmission	86,400	97	<i>n.a.</i>	40% operational. Needs Rehabilitation
(l)	Mabvuku	lift station	3,360	30	2018	Operational
(m)	Marimba Park	lift station	<i>n.a.</i>	<i>n.a.</i>	<i>n.a.</i>	<i>n.a.</i>
(n)	Orange Grove	transmission	13132.8	96	2018	Operational
(o)	Pockets Hill	lift station	1,200	54	2018	50% operational
(p)	Warren Control	transmission	362,880	120		Operational
(q)	Waterfalls	lift station	<i>n.a.</i>	<i>n.a.</i>	<i>n.a.</i>	<i>n.a.</i>

7.2.1.8.1.4. Transmission Mains

Morton Jaffray transmits water through four pumping mains ranging in size from 750mm to 1300mm. These mains reach Lochinvar Reservoirs and Warren Control Distribution Pump Station. Warren Control Pump station feeds into 800mm, 975mm, 1000mm and 1500mm mains to Bluff Hill, Alexandra Park Reservoirs, Highfield and Letombo, respectively. Harare City's reticulation system is made up of pipework with varying materials from PVC, HDPE, steel, asbestos cement and GRP. Figure 7.123 shows the configuration of the Main Water Transmission Network.

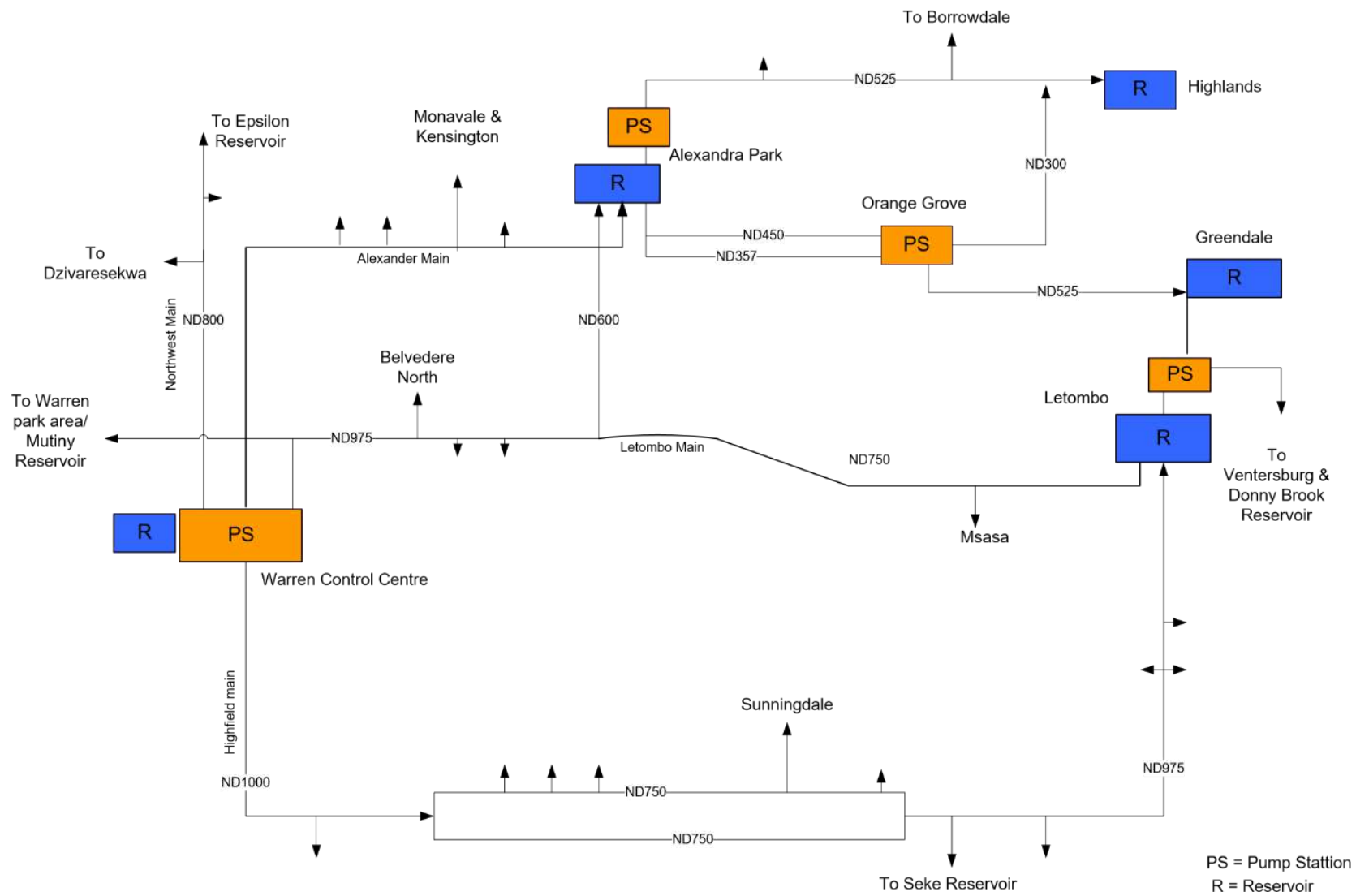


Figure 7.122: Configuration of the Main Water Transmission Network

7.2.1.8.1.5. Reservoirs

The water supply system in Harare has 32 treated water reservoir sites. The reservoirs are spread all over the city with top of water levels ranging from 1,460 m and 1,600 m above sea level. Letombo, Alexandra Park, Lochinvar, Greendale and Highlands are the main reservoirs which feed other sites. These make up to a storage capacity of approximately 553,740 m³ altogether. That is 70% of the total storage capacity of the water supply system. The table 7.127 shows the main characteristics of the reservoirs and their operational status.

Table 7.127: Reservoir Characteristics

	Reservoir Site	Volume(m ³)	Status	T.W.L(m)
1	Adylinn	1,140	Not in use	1519.02
2	Alexandra Park	111,950	In use	1538.37
3	Arundel	7,680	Not in use	1531.82
4	Bluff Hill	5,680	In use	1506.06
5	Cold Comfort	5,200	Not in use	n.a.
6	Donnybrook	13,860	In use	1602.02
7	Dzivaresekwa High Level	11,400	Not in use	1481.50
8	Dzivaresekwa Low Level	5,680	In use	n.a.
9	Emerald Hill	25,980	In use	1552.19
10	Epsilon	4,090	In use	1518.86
11	Greendale	70,900	In use	1583.76
12	Hatfield	13,630	In use	1521.30
13	Hatcliffe	11,400	In use	n.a.
14	Highlands	61,240	In use	1568.55
15	Hogerty Hill	1,140	In use	1600.07
16	Kambanji	5,680	Not in use	1538.75
17	Kopje	7,960	In use	1525.27
18	Kuwadzana	18,000	In use	1476.00
19	Kuwadzana Ext	12,900	In use	n.a.
20	Letombo	236,400	In use	1539.51
21	Lochinvar	70,880	In use	1478.05/ 1475.58
22	Marimba Park	11,700	In use	1463.00
23	Marimba Park High	11,400	In use	1490.84
24	Meyrick Park	2,280	In use	1517.65
25	Mt Pleasant Heights	5,000	Not in use	n.a.
26	Mutiny	11,400	In use	1520.45
27	Philadelphia	7,580	In use	1574.70
28	Ridge Road	3,410	In use	1531.31
29	Ventersburg	22,800	In use	1559.50
30	Viking	27,260	In use	1516.73
31	Waterfalls	5,680	In use	1467.13
32	Southview Park Fidelity	10,000	In use	n.a.
33	Sunway City	55,700	In use	n.a.
	Total	877,000		

7.2.1.8.1.6. Distribution Network

The distribution system is supplied by both pumping and gravity. Some areas are supplied exclusively by pumping or gravity whilst others are supplied by a combination of both. Most of the areas are supplied by pumping as the treated water comes from the lowest part of the city. Connection points along transmission mains are equipped with pressure reducing valves (PRVs) to reduce excessive pressure levels in the primary and secondary distribution network. There are 33 PRVS in the network.

The primary and secondary distribution network is made up of AC, steel and PVC pipes which sum up to 5,200 km. Steel pipes are the oldest. PVC pipes were installed after 1980 and make up for 22% of the network. Corroded steel pipes are a major source of leakage.

Efforts have been made to replace a much of the old steel pipes with PVC pipes over the last few years.

Currently, 215 225 properties and 446 standposts are metered in the system. Table 7.128 shows the breakdown of the pipe work lengths according to materials as reported in 2016. A greater fraction of the pipework and installed meters are old resulting in underestimation due to age. Within the supply zones, the AC pipes in some areas suburbs appear to be fairly good conditions despite having a lifespan of 60-80 years. However, there are leaking valves, hydrants and pipes running across roads. The fittings' chambers no longer have covers. They are damaged, silted and filled with litter or stones. The increase in heavy vehicles in residential access roads exert extreme pressures on old pipe work resulting in bursts. The cyclic loading of the pipes because of the inconsistent supply is also a potential cause of bursts. Some house connections are leaking after the fitted meters implying metered wastage. Harare water charges flat rate billing which limits to an average amount of water usage. This results in high margin of Non-Revenue water. There is no arrangement for fixing household leaks at the expense of the council or the consumer.

Table 7.128: Primary and Secondary Network Pipe Lengths

Diameter	Material			Total
	AC	STEEL	PVC	
ND 50	450,000	7,970		457,970
ND 63			190,780	190,780
ND 75	686,100	30,000		716,100
ND 90			270,000	270,000
ND 100	1,107,080	29,000		1,136,080
ND 110			300,000	300,000
ND 125	750			750
ND 150	890,000	48,000		938,000
ND 160			150,000	150,000
ND 225	312,900	12,485		325,385
ND 250	30,900	8,650	98,700	138,250
ND 300	140,455	20,840	140,000	301,295
ND 350	1,500	14,830		16,330
ND 375	30,000	21,380		51,380
ND 400	8,000	9,800		17,800
ND 450	60,620	18,970		79,590
ND 500	8,000	16,900		24,900
ND 525	5,000	18,000		23,000
ND 575		3,000		3,000
ND 600		16,400		16,400
Total	3,731,305	276,225	1,149,480	5,157,010

7.2.1.8.1.7. District Metering System

The City's distribution system was constructed with bulk water meters and flow meters for measuring weekly flows through outlets and inlets of reservoirs and pumping stations (see figure 7.124). Flows in main supply pipes were also metered. The system is no longer functional. Most of the meters are faulty and several interconnections among district metering areas are not metered. There were 145 district meters installed in the water supply system. Chitungwiza Council used to record readings from 11 meters and rest were monitored by the City of Harare Water Workshop. The lack of a functional metering system makes it difficult to identify areas of high-water losses.

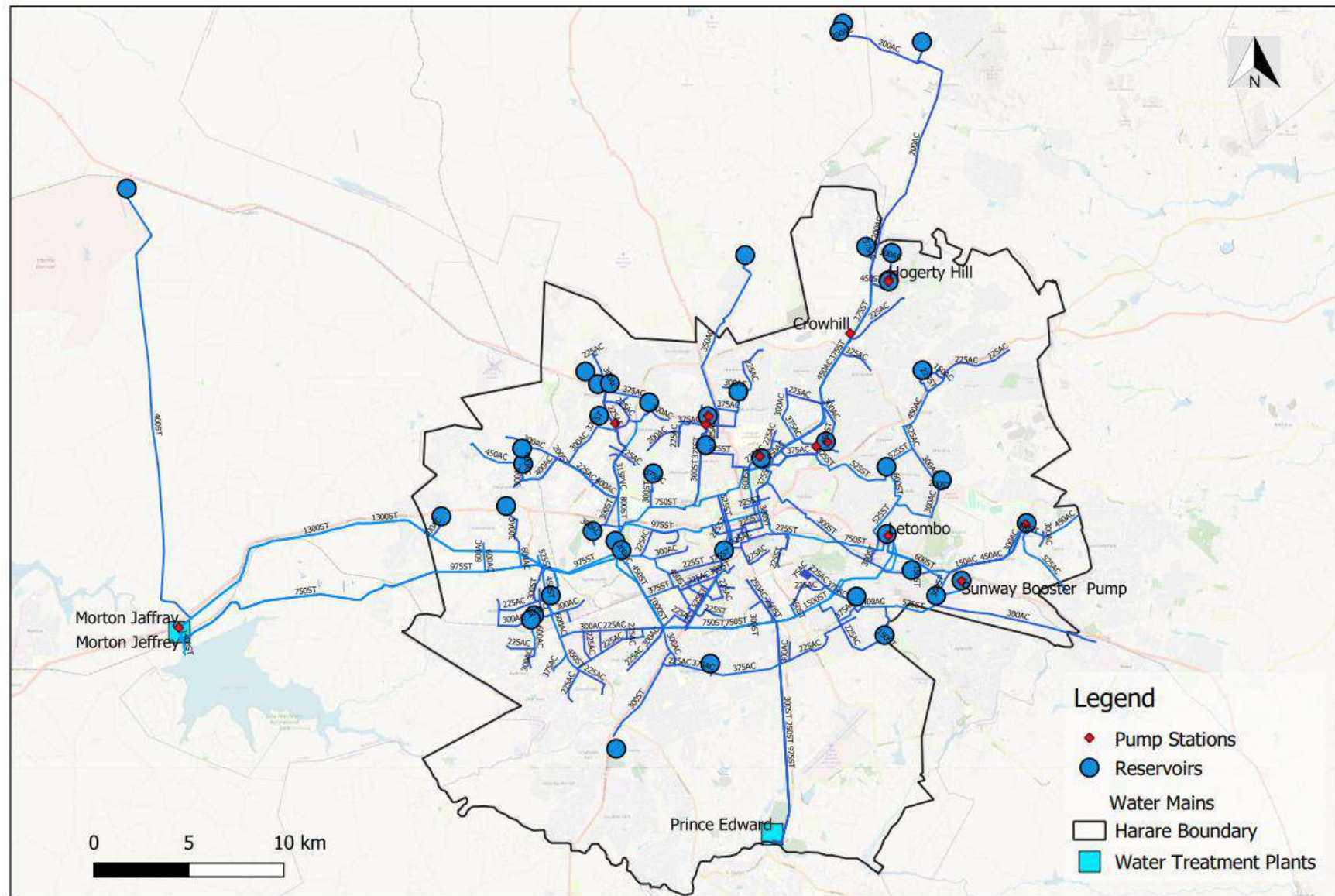


Figure 7.123: Harare Water Reticulation System

7.2.1.8.1.8. Distribution Zones within Harare City

Harare City was divided into supply zones based on the knowledge that each area has a dedicated service reservoir (see Table 7.129). These reservoirs are supplied by transmissions mains, normally of larger diameter fitted with bulk water meters. Water then flows from the reservoirs into the supply zone stands through an outlet bulk meter. However, the bulk water meters are currently not operational.

Table 7.129: Water Supply Zones

	Water Supply Zone	Reservoir Volume (m ³)	Areas Covered
1	Adylinn	1,140	New Marlborough and Adylinn areas
2	Alexandra Park	111,950	Alexandra Park, Avondale, Kensington, Milton Park, Belvedere Park, Strathaven and Avenue areas
3	Arundel	7,680	Mount Pleasant, Little Norfolk and Northwood areas
4	Bluff Hill	5,680	New Bluff Hill, Bluff Hill Park, Ashdown Park and Sanganayi Park areas
5	Donnybrook	13,860	Mabvuku, Tafara, Chikurubi, Manresa and Chizhanje areas
6	Dzivaresekwa	17,080	Dzivaresekwa area
7	Emerald Hill	25,980	Sherwood Park, Sentosa and Mayfield Park areas
8	Epsilon	4,090	Marlborough, Avonlea, Emerald Hill and Ashbrittle areas
9	Greendale	70,900	Lewisam, Chisipite, The Grange, Athlone, Mandara, Wormshill, Lichendale, Oval Park, Runnivale and Rhodesvale areas
10	Hatfield	13,630	Hatfield area
11	Hatcliffe	11,400	Hatcliff, Sally Mugabe, part of Sunningdale and Graniteside.
12	Highlands	61,240	Borrowdale, Vainona, Pomona, Colray, Borrowdale West, Rietfontein, Colne Valley and Ballantyne Park areas
13	Kambanji	5,680	Greystone Park Quinington, Chiltern Hills, Glenwood, Kambanji, Glen Lorne, Grey Lichen and Carrick Creagh
14	Kopje	7,960	City Centre area
15	Kuwadzana	30,900	Tynwald, Nkwisi Park, Cold Comfort Westlea, Kuwadzana, Kuwadzana Phase 3, Kuwadzana Phase 4 Extension, Crowborough and Crowborough North areas
16	Letombo	236,400	Sunningdale, Graniteside, Highfield, Ardbennie, Mbare, Prospect, Logan Park, Sunningdale, St Martins, Cranborne Park, Queensdale, Arcadia, Graniteside, Braeside, Hillside, Beverly West, Msasa, Mukuvisi Park, Amby, Bingley, Beverly, Greengrove and Lorelei areas
17	Lochinvar	70,880	Kambuzuma, Rugare, Marimba Park, Aspindale Park, Lochinvar and Willowvale areas.
18	Marimba Park	23,100	Marimba Park
19	Meyrick Park	2,280	St Andrews, Haig Park, Cotswold Hills, Mabelreign, Sunridge, Ridgeway and Sunrise areas
20	Mt Pleasant Heights	5,000	Mount Pleasant Heights
21	Mutiny	11,400	Warren Park and Warren Park D
22	Philadelphia	7,580	Winchendon, Helensvale, Borrowdale Brook, Philadelphia and Eland Park.
23	Ridge Road	3,410	Avondale West areas
24	Ventersburg	22,800	Epworth, Chadcombe, Masasa Park, Mukuvisi and Park Meadowland areas
25	Viking	27,260	Workingston, Southerton, Ridgeview, Belvedere South and Lincoln Green areas
26	Waterfalls	5,680	Houghton Park, Park Town, Malvern, Midlands, Waterfalls, Induna and Grobee Park areas.
27	Southview Park Fidelity	10,000	Southview Park
28	Sunway City	55,700	Sunway City

7.2.1.8.1.9. Proposed Water Supply Interventions

The current water supply sources of Harare and its neighbouring towns are polluted. The Lake Chivero is polluted by raw sewage and poor effluent discharges from Chitungwiza and Harare. Also, stormwater drains and waste disposal into streams is another cause of the polluted water sources. Lake Manyame sits downstream of Norton. The city pollutes the lake similar to Harare. The extent of the pollution is not as extreme as Lakes Chivero, Harava and Seke Dam.

The Kunzvi-Musami project is expected to solve the issue of cleaner raw water supply. Water from the dam will be treated at a plant proposed near Donnybrook reservoirs to the northern parts of the city in Mabvuku. Water from the proposed reservoir will be pumped to Caledonia and the proposed pressurized ring main along the Harare Drive. City Harare will take up about 87% of the raw water, to be treated and shared with the local authorities according to the demands. The remaining 13% will be distributed amongst farms.

There is a proposal under feasibility studies which will allow for 200ML/day to be withdrawn from Lake Manyame. It will provide for a treatment plant in Norton producing 40ML/day and construction of a 160ML treatment unit 5 at Mortan Jaffray. The water from MJ WTW will be supplied to the new city in Mount Hampden and the northwest suburbs. City of Harare will also supply the New Cybercity from the Warren Control. The Bluffhill Pump Station will be used to provide additional head for the water to reach the city through an ND800mm mains.

7.2.1.9. Summary of Rehabilitation Works on Water Supply Infrastructure

The Urgent Water Supply and Sanitation Rehabilitation Programme (UWSSRP) Phase 1, completed in 2015, targeted to improve water and sanitation services in six cities in Zimbabwe. Harare and Chitungwiza were part of this project and received funding for reparative works on the water and sanitation infrastructure. Zimbabwe Government also funded additional works since then. These were executed by City of Harare with additional funds from their revenue.

7.2.1.9.1. Mortan Jaffray UWSSRP Phase 1 Works

In, Unit 1, better flow meters were fitted into the raw water main from Lake Chivero to the raw water inlet chamber raw water main from Lake Chivero to Clarifier No. 7. There was replacement of pumps for Aluminium Sulphate solution transfer and dosing, as well as the lime slurry equipment. The chlorine dosing system was rehabilitated and fitted with an electric powered chlorine cylinder lifting system. Extensive works were executed in the replacement of high lift pump sets No. 1 to 3 which included changing motors, starters, pipework, valves and fittings and electrical control boards.

Reparative works for Units 2 and 3 included replacement of flow meters in raw water ND 2200 and ND 1390 mains from Lake Manyame to the raw water mixing chamber. New Aluminium Sulphate solution transfer pumps and sodium silicate dosing pumps were installed. Lime slurry preparation and dosing facilities were refurbished. The sand in the 16 rapid gravity sand filters was replaced by new filter media (sand). Additional works on these filters were replacement of the filter under-drainage system, broken nozzles, all gallery pipework and valves. Another air compressor for the operation of pneumatically actuated valves was fitted. The Pulsator system of three Clarifiers, including air pump, motor, starters and vacuum release devices were refurbished. Furthermore, lateral pipes to one Clarifier and

baffles in both Clarifiers were replaced. New parts for Pump sets No. 4 to 10 were fitted, including all related motors, starters, pipework, valves and fittings and electrical control boards. Pump sets No. 11 to 14 had spare parts supplied for future servicing works. Lastly, the Unit 2 and 3 treatment plant buildings were revamped.

7.2.1.9.2. Prince Edward UWSSRP Phase 1 Works

Less reparative works were done on this plant when compared to Morton Jaffray. The changes made were mostly rehabilitation of the raw water pump-station, flash mixing and flocculation tank, clarifiers, rapid gravity sand filters and high lift clear water pump station. The chemical building was refurbished, and basic site works were carried out.

7.2.1.9.3. In-house Maintenance – Zimbabwe Government Devolution Funds

City of Harare had in-house maintenance works funded by the Government's Devolution funds and the council's revenues. The Morton Jaffray Darwendale pumps are in the process of being installed. The filters and clarifiers for both treatment works were rehabilitated. Reparative works were carried out on the Warren Control centre. The Kuwadzana reservoir restored for operation. General desludging of reservoirs was done as part of maintenance.

7.2.1.10. Summary of Outstanding Rehabilitation Works on Water Supply Infrastructure

In addition to the Urgent Water Supply and Sanitation Rehabilitation Programme (UWSSRP) Phase 1, these are some of the works identified that require attention. Morton Jaffray WTW Unit 1 requires supply of materials and works to improve the intakes at Lake Chivero, mixing chambers, clarifiers and filters. The same applies for the equipment utilized in the Units 2 and 3, that were not replaced in the UWSSRP Phase 1. The Units 2 and 3 also require dosing systems, valves, wash pumps, and clean water pumps. The plants also require new fire hoses, chemical storage tanks, clean water meters, standby backup power generators, dewatering pumps, motors, turbine pumps and pipes. The Darwendale intake is also due for repair. Other miscellaneous works include redecoration of the central control room and lighting of workshop and roads in plant.

The clear water plant Laboratory was to be supplied with equipment for better investigations and profiling of water samples. These being the heat magnetic stir, Ultraviolet spectrometer, Biochemistry incubator, Stationery turbidimeter, Ion chromatograph, Replace Accelerator Clarifier equipment, electronic balance, BOD incubator, Viscosity meter, Gas chromatograph, Chlorine detector, Colorimeter, PH meter, Atom spectrometer, Muffle furnace, Conductivity meter, Bottom sampler, 3-way taps, E-Collilert Complete, Autoclave, Binocular microscope, Electric centrifugal machine, Distillation unit, Liquid chromatograph and Dry oven.

The reticulation system pumps stations, Alex Park, New Alex, Letombo and Warren Control are need of new pump, fittings, pipework, lighting systems, and electrical materials. A upgrade of the water delivery system in the form of information technology equipment is to be supplied and installed for the city.

7.2.1.11. Existing Water Supply Level of Service

Harare City water supply has been erratic in the past years resulting from fault equipment at both treatment and supply stages. The raw water sources are also not in the best state such that the result is expensive chemical use to bring the water to potable drinking standard.

Residents and neighbouring local authorities have not fully honoured the service bills due to them. As a result, the City Council barely manages to procure the requisite water treatment chemicals, to repair or replace the pumps that are broken down, and curb significant losses due to leakage in the aged and now under-capacity reticulation system. City of Harare has not been able to upgrade and rehabilitate the water supply system commensurate with the increased population served by the system. Most of the system rehabilitation works have been funded by external parties.

In 1980, Harare had an estimated 400 000 residents. By the time of the 2012 census the population of greater Harare (Harare, Chitungwiza, Epworth, Norton and Ruwa) was 2,100,000. With all the new developments in and around Harare, the population is now over 4 million. This population size would make Greater Harare similar in size to Dar es Salaam, the historical capital of Tanzania. Considering the population of 4 million, Morton Jaffray's design capacity of 614 million litres per day would produce 153 litres per person per day, which would be more than ample.

Non-revenue water accounted for in 2024 amounted to 68% primarily due to leakages and unmetered connections, while recovery on billing was about 48%. This means that Harare is only getting revenue from less than 20% of the water that it produces. This model is not viable for a utility service provider if 80% of its product is lost, stolen or simply not paid for. The cost of treating the water is also increased by pollution of Lake Chivero from the sewerage systems and surface runoff of Harare and Chitungwiza. The sewage treatment plants at Crowborough and at Firle were designed to treat the effluent to a standard that could be discharged safely into Lake Chivero, so allowing for increased yield of the lake due to indirect recycling. However, there is wholesale discharge of untreated sewage from blocked sewers and broken-down pump stations. Sewage treatment plants have deteriorated due to lack of appropriate maintenance. They are now dysfunctional and discharge untreated or partially treated sewage into the lake.

7.2.1.12. Water Demand Historical Analysis

An overview of the water demand was analysed from 1989 to the present-day demand. Harare Metropolitan water demand was estimated based on land use and population. For the metropolitan, the population figures from censal data were used. Population figures account for multiple households residing on a property registered as single dwelling. Also, the informal settlements unaccounted for but have access to municipal standpipes and boreholes in the city. The population was categorised as into four groups namely, Low Density, Medium Density, High Density and Informal Settlements. The ward populations were used to estimate the population in different areas for the years 2012 and 2022. For the years 1969 and 1982, population for the groups were obtained from the CSO data recorded in the Harare Combined Masterplan Report of Study. Values for the remaining years, 1992 and 2002, were obtained from interpolation of the population findings for the other years. Estimations of the water demand from institutions, commercial and industrial areas were calculated as a percentage of the domestic consumption.

Water estimations volumes based on populations for the years 1969, 1982 and 2002 were calculated using figures published in the Design Approach to Water and Sewerage Problems Relative to Urban and Rural Communities in Zimbabwe (Ministry of Local Government and Housing, 1989). The same manual was used to estimate the land-use demand.

The estimations were presented in the tables that follow.

Table 7.130: Water Demand Flow Projections

City of Harare Master Plan - Water Demand Flow Projections

Estimated Population Demand

References	Land Use schedule	2012			2022			2024		
		Population	l/cap/dy	l/dy	Population	l/cap/dy	l/dy	Population	l/cap/dy	l/dy
	Harare									
WRTSM pg 17, Table3.2	Low Density	412,842	300	123,852,714	498,132	300	149,439,450	511,167	300	153,350,131
WRTSM pg 17, Table3.2	Medium Density	43,764	200	8,752,842	117,975	200	23,595,000	121,062	200	24,212,458
WRTSM pg 17, Table3.2	High Density	865,073	85	73,531,167	1,054,579	85	89,639,215	1,082,176	85	91,984,984
	Informal Settlers	137,128	40	5,485,114	178,932	40	7,157,260	183,614	40	7,344,558
	Institutional (15% of domestic volume)			31,743,276			40,474,639			41,533,820
	Industrial			28,446,000			39,754,259			51,062,519
	Commercial			9,130,000			10,150,285			11,170,570
	Total	1,458,807			1,849,617			1,898,020		
WRTSM pg 10	Total ADWD			280,941,113			360,210,108			380,659,039
	Distribution Losses		42%	117,995,267		55%	198,115,559		68%	258,848,146
WRTSM pg 13	Total ADWD + Losses			398,936,381			558,325,668			639,507,185
	Peak Day Factor			1.47			1.47			1.47
	Peak Daily water Demand			586,436,479			820,738,731			940,075,562
	Required Reservoir Storage (Two Day Storage)			1,173,000,000			1,641,000,000			1,880,000,000
	Chitungwiza									
WRTSM pg 17, Table3.2	Low Density	4,489	300	1,346,700	4,826	300	1,447,859	4,952	300	1,485,748
WRTSM pg 17, Table3.2	Medium Density	5,600	200	1,120,000	5,940	200	1,187,987	6,095	200	1,219,076
WRTSM pg 17, Table3.2	High Density	330,017	85	28,051,445	342,289	85	29,094,549	351,246	85	29,855,924
	Informal Settlers	16,734	40	669,360	18,191	40	727,642	18,667	40	746,684
	Institutional (15% of domestic volume)			4,678,126			4,868,706			4,996,115
	Industrial			1,811,000			2,587,000			2,759,444
	Commercial			1,681,000			2,018,000			2,092,889
	Total	356,840			371,246			380,961		
WRTSM pg 10	Total ADWD			39,357,631			41,931,743			43,155,880
	Distribution Losses		31%	12,200,866		47%	19,498,261		62%	26,756,646
WRTSM pg 13	Total ADWD + Losses			51,558,496			61,430,004			69,912,526
	Peak Day Factor			1.47			1.47			1.47
	Peak Daily water Demand			75,790,990			90,302,106			102,771,413
	Required Reservoir Storage (Two Day Storage)			152,000,000			181,000,000			206,000,000

City of Harare Master Plan Review - Water Demand Flow Projections
Estimated Population Demand

References	Landuse schedule	2012			2022			2024		
		Population	l/cap/dy	l/dy	Population	l/cap/dy	l/dy	Population	l/cap/dy	l/dy
WRTSM pg 17, Table3.2 WRTSM pg 17, Table3.2 WRTSM pg 17, Table3.2 WRTSM pg 10 WRTSM pg 13	Norton									
	Low Density	16,112	300	4,833,600	20,715	300	6,214,513	21,257	300	6,377,141
	Medium Density	-	200	-	-	200	-	-	200	-
	High Density	51,749	85	4,398,665	66,323	85	5,637,451	68,059	85	5,784,978
	Informal Settlers	-	40	-	-	40	-	-	40	-
	Institutional (15% of domestic volume)			1,384,840			1,777,795			1,824,318
	Industrial			2,320,000			3,712,000			4,021,333
	Commercial			110,000			175,000			189,444
	Total	67,861			87,038			89,316		
	Total ADWD			12,937,105			17,516,759			18,197,214
	Distribution Losses		35%	4,527,987		40%	7,006,704		45%	8,188,746
	Total ADWD + Losses			17,465,091			24,523,463			26,385,960
	Peak Day Factor			1.47			1.47			1.47
	Peak Daily water Demand			25,673,684			36,049,490			38,787,362
WRTSM pg 17, Table3.2 WRTSM pg 17, Table3.2 WRTSM pg 17, Table3.2 WRTSM pg 10 WRTSM pg 13	Ruwa									
	Low Density	14,950	300	4,485,000	21,638	300	6,491,382	22,204	300	6,661,255
	Medium Density	7,718	200	1,543,600	11,289	200	2,257,872	11,585	200	2,316,958
	High Density	33,665	85	2,861,525	61,151	85	5,197,810	62,751	85	5,333,831
	Informal Settlers	-	40	-	-	40	-	-	40	-
	Institutional (15% of domestic volume)			1,333,519			2,092,060			2,146,807
	Industrial			1,079,000			587,000			477,667
	Commercial			340,000			3,965,000			4,770,556
	Total	56,333			94,078			96,540		
	Total ADWD			11,642,644			20,591,123			21,707,073
	Distribution Losses (25%)			2,910,661			5,147,781			5,426,768
	Total ADWD + Losses			14,553,305			25,738,904			27,133,841
	Peak Day Factor			1.47			1.47			1.47
	Peak Daily water Demand			21,393,358			37,836,189			39,886,747
WRTSM pg 10 WRTSM pg 13	Required Reservoir Storage (Two Day Storage)			51,000,000			72,000,000			78,000,000
WRTSM pg 17, Table3.2 WRTSM pg 17, Table3.2 WRTSM pg 17, Table3.2 WRTSM pg 10 WRTSM pg 13	Ruwa									
	Low Density	14,950	300	4,485,000	21,638	300	6,491,382	22,204	300	6,661,255
	Medium Density	7,718	200	1,543,600	11,289	200	2,257,872	11,585	200	2,316,958
	High Density	33,665	85	2,861,525	61,151	85	5,197,810	62,751	85	5,333,831
	Informal Settlers	-	40	-	-	40	-	-	40	-
	Institutional (15% of domestic volume)			1,333,519			2,092,060			2,146,807
	Industrial			1,079,000			587,000			477,667
	Commercial			340,000			3,965,000			4,770,556
	Total	56,333			94,078			96,540		
	Total ADWD			11,642,644			20,591,123			21,707,073
	Distribution Losses (25%)			2,910,661			5,147,781			5,426,768
	Total ADWD + Losses			14,553,305			25,738,904			27,133,841
	Peak Day Factor			1.47			1.47			1.47
	Peak Daily water Demand			21,393,358			37,836,189			39,886,747
WRTSM pg 10 WRTSM pg 13	Required Reservoir Storage (Two Day Storage)			43,000,000			76,000,000			80,000,000

City of Harare Master Plan - Water Demand Flow Projections
Estimated Population Demand

References	Landuse schedule Description	2012			2022			2024		
		Population	l/cap/dy	l/dy	Population	l/cap/dy	l/dy	Population	l/cap/dy	l/dy
WRTSM pg 17, Table3.2 WRTSM pg 17, Table3.2 WRTSM pg 17, Table3.2 WRTSM pg 10 WRTSM pg 13	Epworth									
	Low Density	14,880	300	4,464,000	20,640	300	6,191,850	21,180	300	6,353,885
	Medium Density	42,100	200	8,420,000	42,511	200	8,502,238	43,624	200	8,724,733
	High Density	9,612	85	817,020	13,826	85	1,175,249	14,188	85	1,206,004
	Informal Settlers	100,870	40	4,034,800	129,391	40	5,175,634	132,777	40	5,311,075
	Institutional (15% of domestic volume)			2,660,373			3,156,746			3,239,355
	Industrial			-			-			-
	Commercial			47,000			128,000			146,000
	Total	167,462			206,368			211,768		
	Total ADWD			20,396,193			24,201,717			24,835,051
	Distribution Losses		31%	6,322,820		36%	8,591,609		40%	9,934,020
	Total ADWD + Losses			26,719,013			32,793,326			34,769,072
	Peak Day Factor			1.47			1.47			1.47
	Peak Daily water Demand			39,276,949			48,206,189			51,110,535
	Required Reservoir Storage (Two Day Storage)			79,000,000			96,000,000			102,000,000
WRTSM pg 10 WRTSM pg 13	Harare Metropolitan Supply									
	Total ADWD			365,274,685			464,451,450			488,554,258
	Distribution Losses			91,318,671			116,112,863			122,138,564
	Total ADWD + Losses			456,593,357			580,564,313			610,692,822
	Peak Day Factor			1.47			1.47			1.47
	Peak Daily water Demand			671,192,234			853,429,540			897,718,448
	Required Reservoir Storage (Two Day Storage)			1,342,000,000			1,707,000,000			1,795,000,000

Assumptions

Note: WRTSM stands for Water Reticulation Treatment Storage Manual

City of Harare Master Plan Review - Water Demand and Wastewater Flow Projections
Estimated Population Demand

Referencess	Landuse schedule	ADWD				DWF
	Description	Area (Ha)	Estimated Number of Units	l/dy	l/dy	l/dy
	Residential					
WRTSM pg 17, Table3.3	Residential Agricultural	4,609	137	3,000	411,000	
WRTSM pg 17, Table3.2	Low Density	1,982	43,548	1,500	65,322,000	32,661,000
WRTSM pg 17, Table3.2	Medium Density	7,018	31,890	900	28,701,000	20,090,700
WRTSM pg 17, Table3.2	High Density	18,455	175,702	850	149,346,700	119,477,360
WRTSM pg 17, Table3.2	Flats/Clusters	1,220.3	91,525	900	82,372,309	65,897,847
	Total		175,702			
	Industrial	Area (Ha)	Estimated Developable Area (Ha)	l/ha/dy	l/dy	l/dy
WRTSM pg 17, Table3.2	Industrial	4,863.1	3,647.3	20,000	72,946,455	51,062,519
	Commercial					
WRTSM pg 17, Table3.2	Central Business District	75.7	60.6	32,000	1,938,629	1,453,972
WRTSM pg 17, Table3.2	Suburban Commercial	1,040.2	676.2	16,000	10,818,586	8,113,940
WRTSM pg 17, Table3.2	Offices	328.8	213.7	10,000	2,136,879	1,602,659
	Institutional	Area (Ha)	Estimated Number of Pupils (2022 Census)	l/ha/dy	l/dy	l/dy
WRTSM pg 17, Table3.2	Institutional	4,480.4	2,688.2	16,000	43,011,954	27,957,770
	Open Spaces	Area (Ha)	Estimated Developable Area (Ha)	l/ha/dy	l/dy	l/dy
WRTSM pg 17, Table3.2	Cemetery	432.7	43.3	10,000	432,698	-
WRTSM pg 17, Table3.2	Active Open Spaces	2,126.7	2,126.7	10,000	21,266,601	
WRTSM pg 17, Table3.2	Recreational	870.6	870.6	10,000	8,706,421	
WRTSM pg 17, Table3.2	Passive Open Spaces	3,387.1			-	
	Total	6,607				
WRTSM pg 10	Total ADWD				288,510,339	
	Distribution Losses				196,187,030	
	Total ADWD + Losses				484,697,369	
WRTSM pg 13	Peak Day Factor				1.47	
	Peak Daily water Demand				712,505,133	
	Required Reservoir Storage (Two Day Storage)				1,425,000,000	
	Total DWF					275,566,066
SALA Manual, pg 27	Peak Factor to Treatment Plant					3.00
	Peak DWF					826,698,199

Assumptions

- (i). 50% of flats/clusters was accounted as net developable area, with an average of 3 storeys and average floor area of 200sqm/unit
- (ii). 80% of commercial was accounted as net developable area with an average 4 storeys in the CBD. 65% of suburban commercial land was accounted as net developable area with average of 2 storeys.
- (iii). 60% of institutional area was accounted as net developable area.

Note: WRTSM stands for Water Reticulation Treatment Storage Manual

7.2.1.13. Water Supply in Harare Metropolitan

The table 7.131 summarizes the water supplied on average to Harare City and its surrounding towns. It also shows the demands projected by Gauff Ingenieure (2014) in the Greater Harare Water and Sanitation Investment Plan Report.

Table 7.131: Water Supply for Harare Metropolitan

Item	Water Supply Area	Average Supplied (ML/Day as Produced)	Estimated Demand as at 2020 (ML/Day)	Projected Demand as at 2030 (ML/Day)
1	Harare	311.5	744	926
2	Chitungwiza	15	102	128
3	Norton	5	42	54
4	Ruwa	2.5	51	67
5	Epworth	1	54	57
Total		335	993	1 232

In the past five years, water production was at its peak in 2021 and has gradually reduced over the years (see figure 7.121). The water produced has seasonal variations. Production is higher in winter and low in summer.

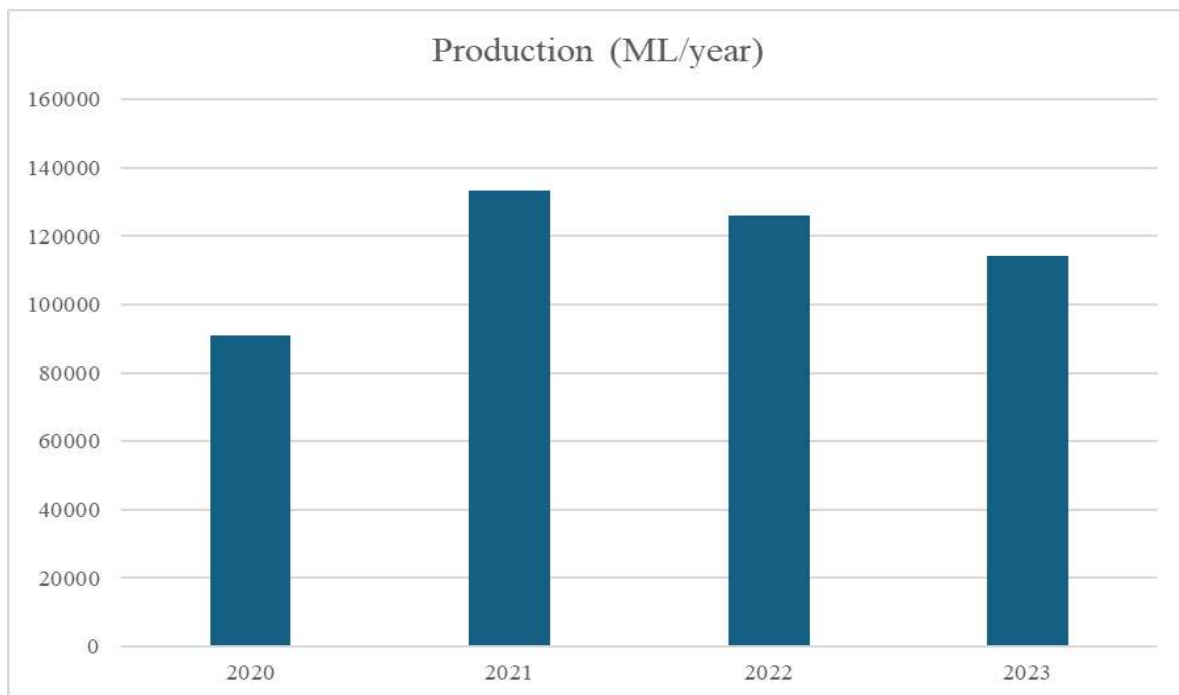
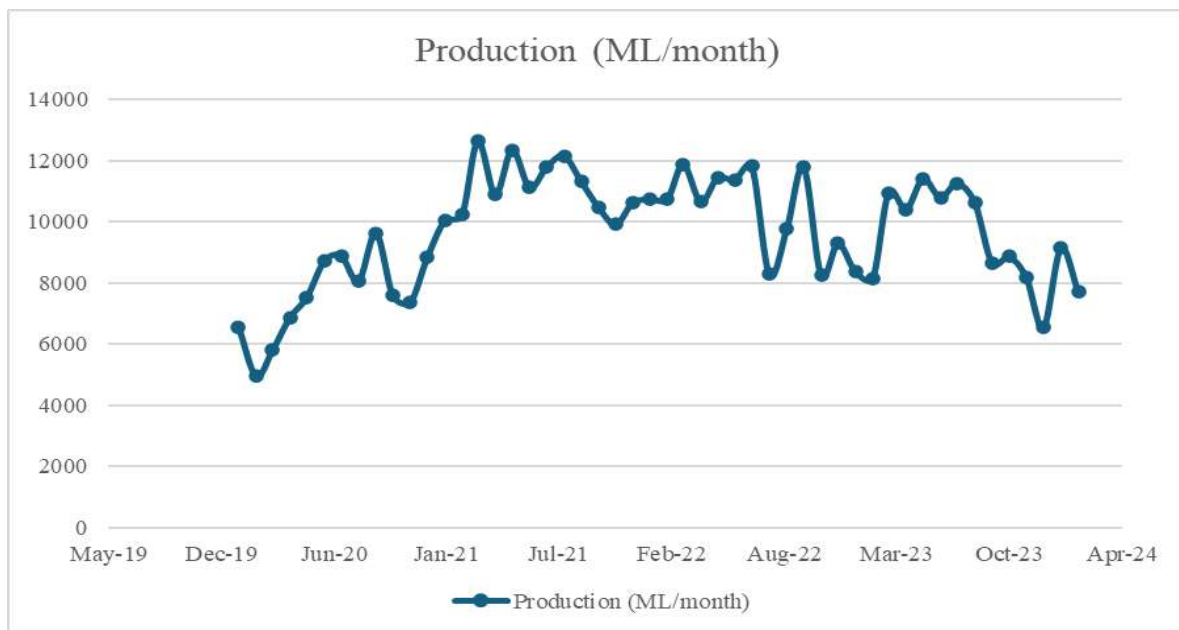


Figure 7.124: Water Production Rates 2020 to 2024

7.2.1.14. Consumer Study

7.2.1.14.1. Frequency of portable water access

The study observed that more than 50% of city's population does not receive water daily (see Figure 7.125). Water supply is intermittent with the majority of the population receiving water once a week, twice a week or thrice a week. There are some parts of the city particularly in the peri-urban and north-eastern parts of the city which never receives water.

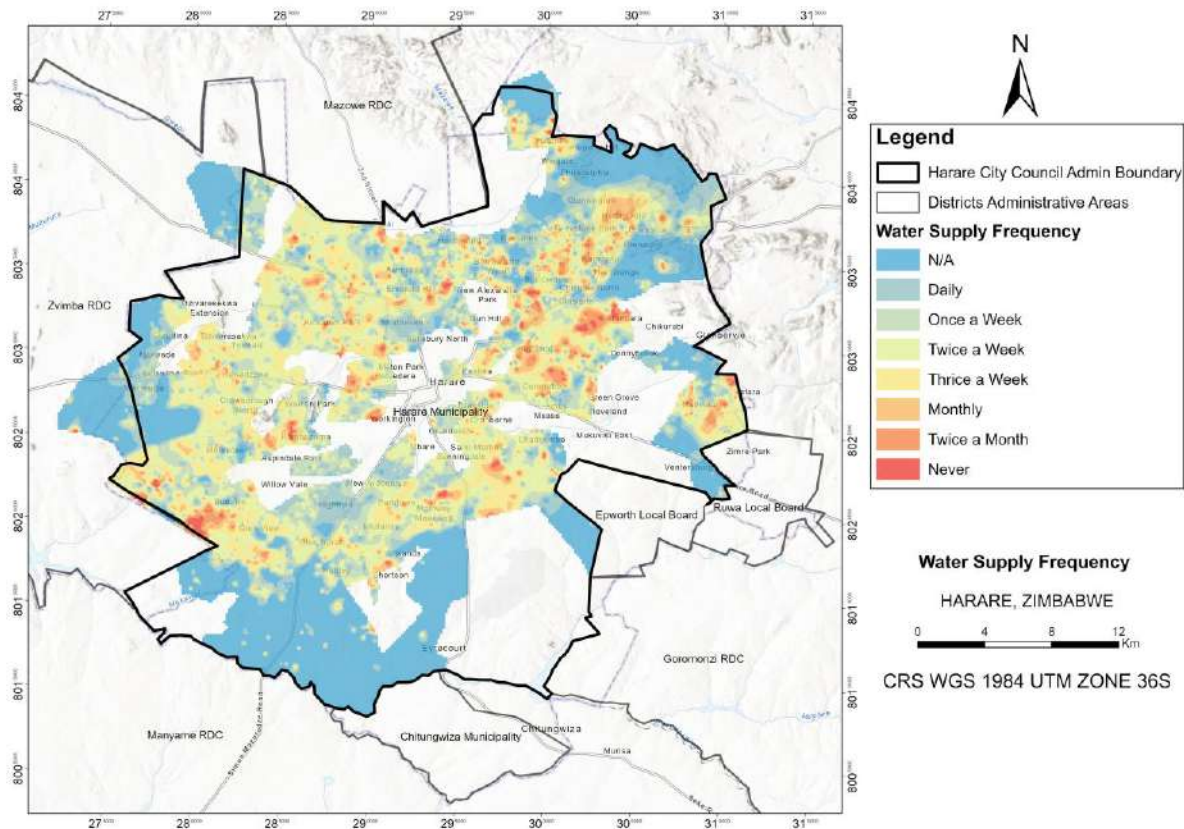


Figure 7.125: Spatial characterisation of water supply frequency

7.2.1.14.2. Household Water Storage

The study observed that households use water storage containers as a coping mechanism to erratic municipal water supply. The size of water storage containers is high in low density suburbs where storage containers range from 500L to over 10000L. Whereas in high density areas use water storage containers below 500L with isolated incidences of above the same (see figure 7.126).

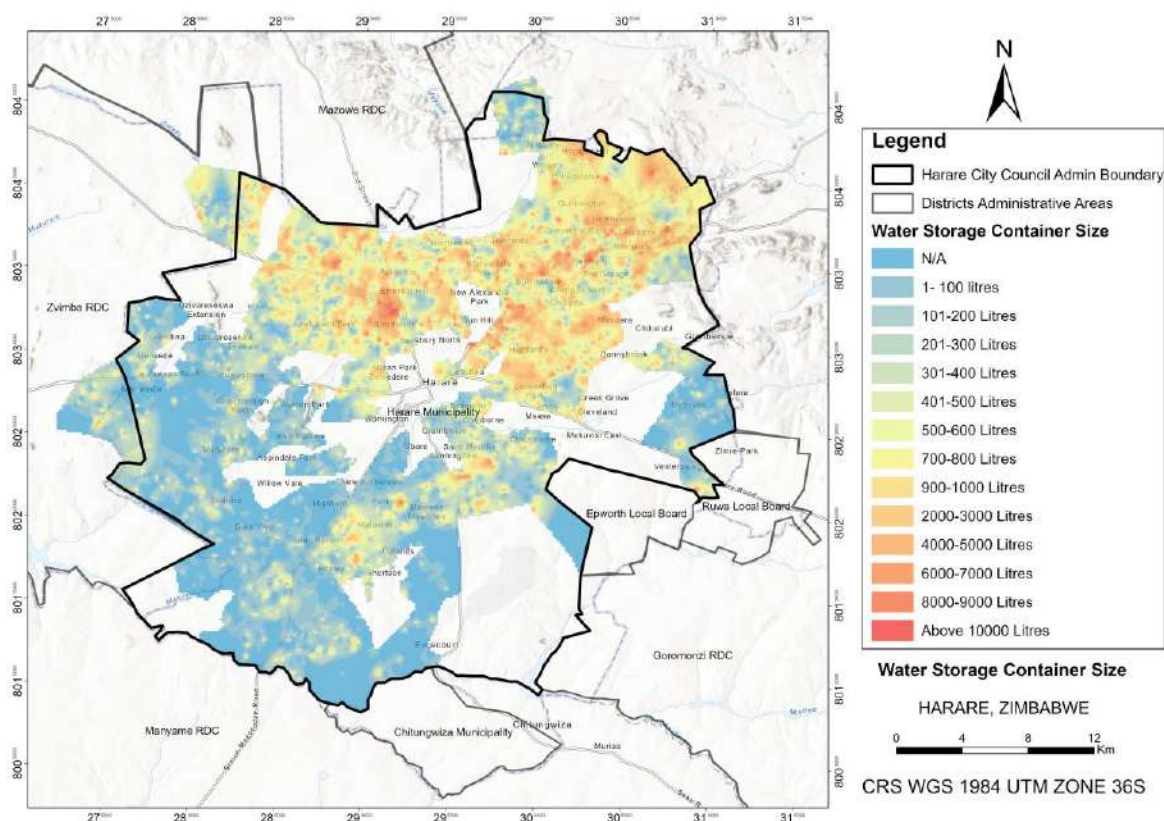


Figure 7.126: Household Water storage containers

7.2.1.14.3. Non-Revenue Water (NRW) Assessment

Non-revenue water is the difference between water produced and water billed to consumers. In 2024 it was estimated at 68% compared with standard of between 15 and 25%. About 60% of the loss is commercial and the rest is physical. Financial recovery on billing is less than 50%. Some of the causes of such losses are due to an old system constructed about 40 to 50 years with minor replacements within the network. The system capacity is less compared to the increased service demand. Hence, the distribution network is the main source of water loss. Also, water supply is not consistent in the pipework. The pressure variations in the pipes result in material fatigue which contribute to pipe bursts. The transmission mains and distribution pipework, as well as fittings, are overdue replacement. Some of the automated systems in the control stations and pump stations are being operated manually.

A few rehabilitation projects have been executed but only solved part of the network. The effects of the upgrades are not significant when compared to the years prior. Large capital is required to fully implement new equipment and replace old pipework. Cases of vandalism have been noted in areas with exposed water points causing leakages. Some of the residents and developers are illegally connecting their properties to the water network. The City of Harare maintenance team has been targeting to fix reported leaks within 24 hours. However, there has been poor response in some areas. Cases of network disruption has occurred during construction activities resulting in massive losses of water. There are individuals drawing water from fire hydrants for bulk water collection and activities such as car washes.

There are properties with faulty meters whilst others have multiple dwellings without proper metering. Residents have not honoured their accrued bills regardless of the continual supply.

Property connection meters are manually read, and it becomes a tedious task for the City of Harare Staff. Bills charged are based on average consumptions in areas. These do not account for leakages in housing properties. A few areas in the city have prepaid and smart meters. These are mostly commercial properties.

Water treatment works are not well metered. Some of the areas of potential water loss are aged pipework, faulty valves and pumps, frequent backwashing of filter beds due to polluted water sources. Also, the equipment is due for replacement and makes monitoring difficult. Some automated systems within the works are currently operated manually. This results in more treated water being used for maintenance.

7.2.1.14.4. Alternative Water Sources

Property owners in Harare City and the Metropolitan have resorted to subsurface water as an alternative source. Properties varying in size, including 250 square metre stands, have either drilled boreholes or dug wells. The regulatory authorities ZINWA and City of Harare have not permitted drilling boreholes within properties of sizes less than 450 square metres. Contrary to this, citizens have wells and boreholes within building lines and close to structural features property. Some residents use communal boreholes which were either sponsored by an external party or the residents themselves. Most fetch water in containers from a standpipe. The limitation is when there is no electricity from the national grid or solar power, residents cannot receive water. Most shared boreholes allow for reticulation within the targeted properties.

ZINWA has an ongoing exercise to register as many extraction points of subsurface water as possible in each catchment area. Unfortunately, the data collected only represents the boreholes and wells in permitted areas. These extraction points are not metered or monitored for drinking standards. A number of people have a biased view of subsurface water being clean regardless of the activities within the proximity. A few areas have been strongly advised against borehole drilling. Westlea suburb, being one of them, due to the previously operated Golden Quarry Dumpsite which has received industrial waste in the past years.

There are also commercial bulk water delivery trucks that deliver water to residential and commercial properties from boreholes. This best serves properties or buildings without space to drill boreholes and areas without subsurface water. Such an approach is expensive, and the quality of water delivered is not guaranteed. There are cases where water is drawn from the council's fire hydrants and delivered as borehole water. Harare City and most of its satellite cities lie within the Upper Manyame Sub-Catchment Council (ZINWA). The following only represent the registered communal boreholes in the City.

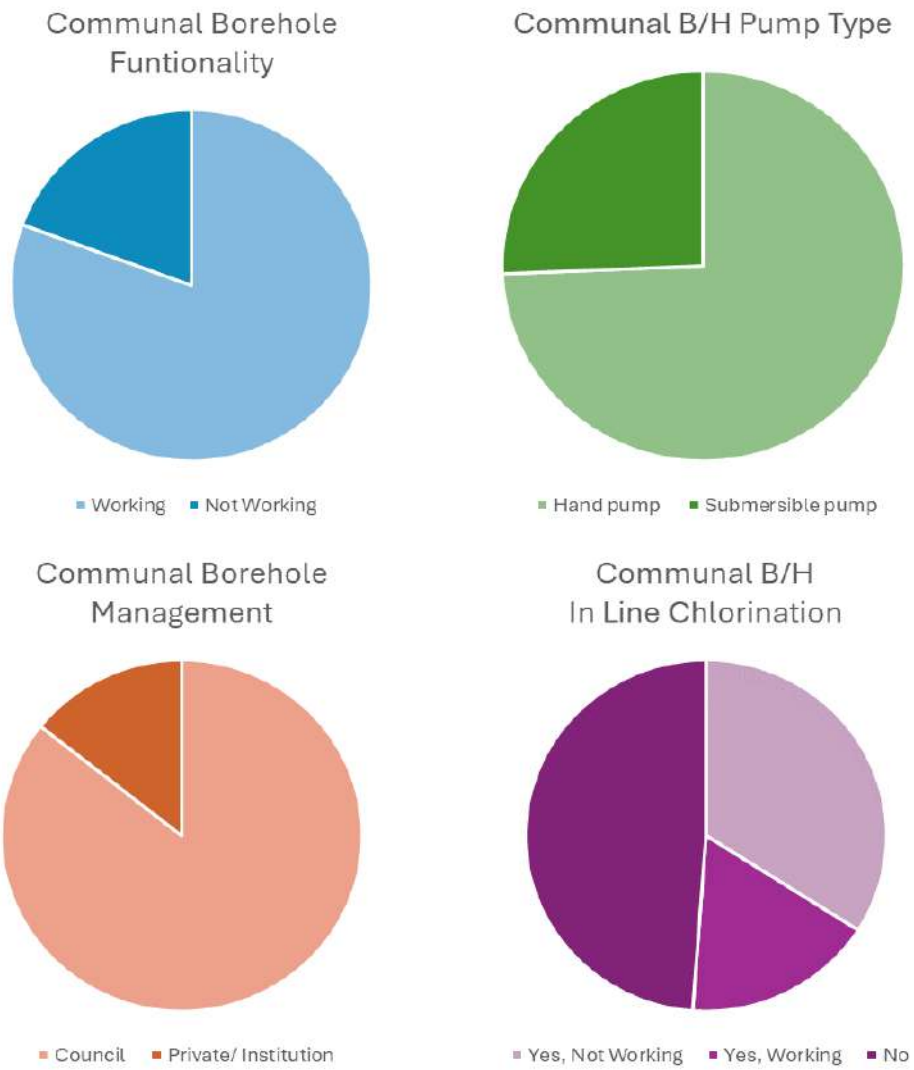


Figure 7.127: Communal Boreholes in Harare

7.2.1.15. Summary of Issues

1. Cleaner raw water resources are needed for better water quality in the city and the growing population demand.
2. There is poor reclamation of water after sewage treatment into the raw water sources.
3. Terrain of the planning area, Harare is built upstream, and results in runoff and pollution meaning more chemicals are required to treat the water.
4. The rapid increase in population in the Chivero catchment (43%/annum) is putting increased pressure on available urban water infrastructure (water supply, wastewater treatment plants and disposal, rivers and Lake Chivero), causing failures and overloading.
5. Rehabilitation of treatment and supply infrastructure is required to meet the current and projected demand.
6. Supply of chemicals – purchased in foreign currency whilst bills are paid in local currency.
7. Water losses from frequent water bursts from aged pipes.
8. The municipality is failing to operate existing infrastructure at optimum capacity due to power shortages, faulty treatment plant components, low pump capacity, battered pipework, old pipe fittings, and non-functioning reservoirs.
9. Mismatch between population growth and water supply which are still the same in terms of capacity –resulting in water rationing and shortages.
10. The water demand per residential property has increased due to some families sharing a single dwelling unit.
11. Densification of large sized residential properties has also increased water demand.
12. Cases of vandalism and illegal water connections have resulted in non-revenue water.
13. City residents have resorted to wells and boreholes to relieve water stresses in households. These water abstraction points are not well monitored for water quality and strain supply of surface water reservoirs.
14. Accumulated debts from residents and some institutions.

7.2.2. Existing Bulk Wastewater Infrastructure Assessment

The section outlines the existing wastewater collection, treatment and disposal services. The current state of the existing infrastructure and estimated service requirements.

7.2.2.1. *Wastewater Infrastructure Overview*

City of Harare utilizes many forms of treatment for the wastewater generated. Each land use produces characteristic waste. Low density residential homes use onsite treatment, whilst medium-density and high-density properties have offsite treatment site. Commercial and industrial areas make use of both onsite and offsite treatment depending on location and volumes of waste produced. Municipal treatment plants mostly receive domestic waste. Special liquid wastes from industries or commercial areas goes through pre-treatment. Thereafter, if the effluent that meets the municipal requirements, it can be disposed into municipal lines. Otherwise, the waste should be treated further before disposal at designated sites that meet the Environmental Management Agency (EMA) stipulations.

The city has a reticulated sewerage system for offsite treatment making up more than 5500 km. The sewerage reticulation infrastructure is made up of mainly gravity flow lines which, due to the nature of the terrain, is divided into five major catchments. These lead to corresponding sewage treatment works namely Firle Works, Crowborough, Donnybrook ponds, Marlborough Borrowdale Brooke and Hatcliffe works. Firle Works is the biggest treatment site. These plants have a total design capacity of treating 219,5 megalitres/day. Harare Water recorded a sum of nearly 215 520 ML/year of wastewater generated in the city's reticulated system. Some of the effluent is pumped to farms after treatment. The rest flows into the water bodies for recycling.

Sadly, cases of pipe bursts have been reported and confirmed by water quality tests recorded at monitored river points. Most of the pipework has been worn down due to the corrosive nature of the conveyed sewage. Furthermore, there is increase in loading of the pipework due to densification of properties without any upgrades in the pipe sizes. In-line pump stations convey sewage to transition chambers from areas where gravity flow to the nearest plant is not feasible.

Currently, the treatment plants are not able to treat water to the required standards for disposal into the environment. Raw sewage overflows into water bodies in addition to the burst pipes and overflowing sumps at non-functional pump stations. This has contributed to pollution of the Lake Chivero which has been condemned for water supply intake due to the aggressive growth in algal blooms and other pollutants. Hence, the poor treatment of the wastewater has caused strain in water supply provisions.

The City is need of investment projects to fund rehabilitation works of the conveyance system and treatment plant. Many of these areas have been identified in the previous Master Plan and rehabilitation reports.

7.2.2.2. *Sanitation Methods Used*

According to Harare Water records, 68.5% of properties have access to individual or communal toilets within working distances. Harare has two major sanitation methods which are onsite and offsite treatment. Septic tanks paired with a soak away and Pit Latrines denote technologies used for non-sewered sanitation systems implying on-site containment of faecal sludge. Offsite treatment consists of sewer reticulated systems leading to central wastewater

treatment works (WTW). Harare Water considers decentralised wastewater treatment systems (DEWATS), popularly termed “bio-digesters”, as onsite treatment as the system is mostly located within the development.

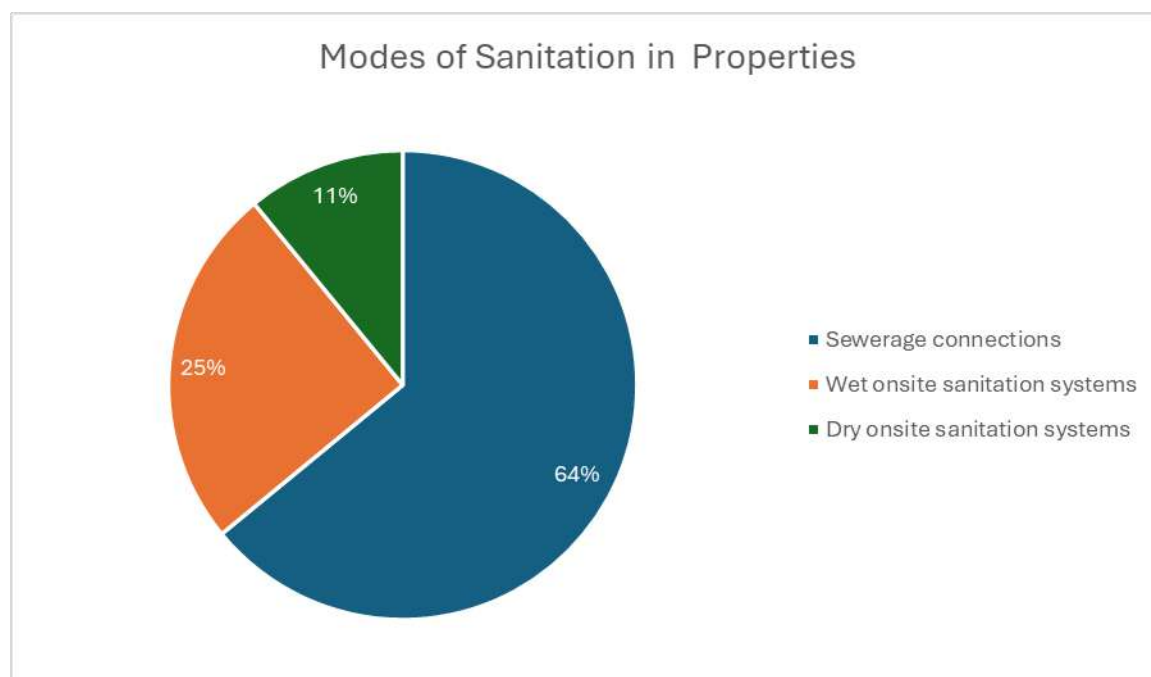


Figure 7.128: Modes of Sanitation Systems in Properties in 2024

Onsite treatment is suitable for low density suburbs and rural areas. Most areas in low-density suburbs use the septic tank and soak away system or bio-digester system and these areas include Borrowdale, Philadelphia, Helensvale, Greystone, Rietfontein, Glen Lorne, Shawasha, Chisipite, Mandara, Greendale and Mt Pleasant. The National Housing policy allows for this treatment on stands greater than 1000m². There is enough land available for containment of the faecal sludge and wastewater to breakdown biologically. Minimal influence is involved in this treatment hence it takes a longer. Stercus waste from these areas is discharged into the city reticulation system at designated manholes for a fee.

Pit latrines and septic tanks are being used by new residential areas that have been developed around Harare with no sewer reticulated system. Pit Latrines store faecal matter with minimal treatment. The solids at the bottom undergo anaerobic digestion, however due to the weight of incoming sludge it cakes. These are suburbs like Retreat, Hopley- Tariro, Ushewekunze, Southly Park in the Southern part of Harare and Caledonia in the East. The areas are close to water bodies making it a prolific site for shallow wells. Unfortunately, the suburbs being high-density and most properties each have onsite treatment and wells in the confinement of their properties. The distances between the dug wells and sanitation systems are way to close resulting high risk of water pollution.

Most decentralized wastewater management facilities were constructed in densified stands. The bio – digester sewer system has been introduced in low-density areas that are subdivided by constructing cluster housing developments and commercial centres. The usual septic tank sewer system will be no longer coping with the volume of the sewage and inadequacies of land for the traditional soakaways. Harare Water only permits developments of this nature with a minimum land share of 500 m² in densified housing stands.

Commercial and industrial properties, where adequate land is available, also do onsite treatment of domestic wastewater. Liquid waste from the activities can also be treated at the premises using appropriate technology. The effluent can be recycled or disposed in designated areas approved by the municipality and EMA.

Medium-density and high-density suburbs dispose into buried sewer reticulated systems. Commercial and industrial properties in densified areas such as the CBD utilize the municipal lines for domestic waste and suitable pretreated waste. Pre-treatment of this wastewater include oil-grease traps, silt traps and septic tanks for high waste with high BOD content.

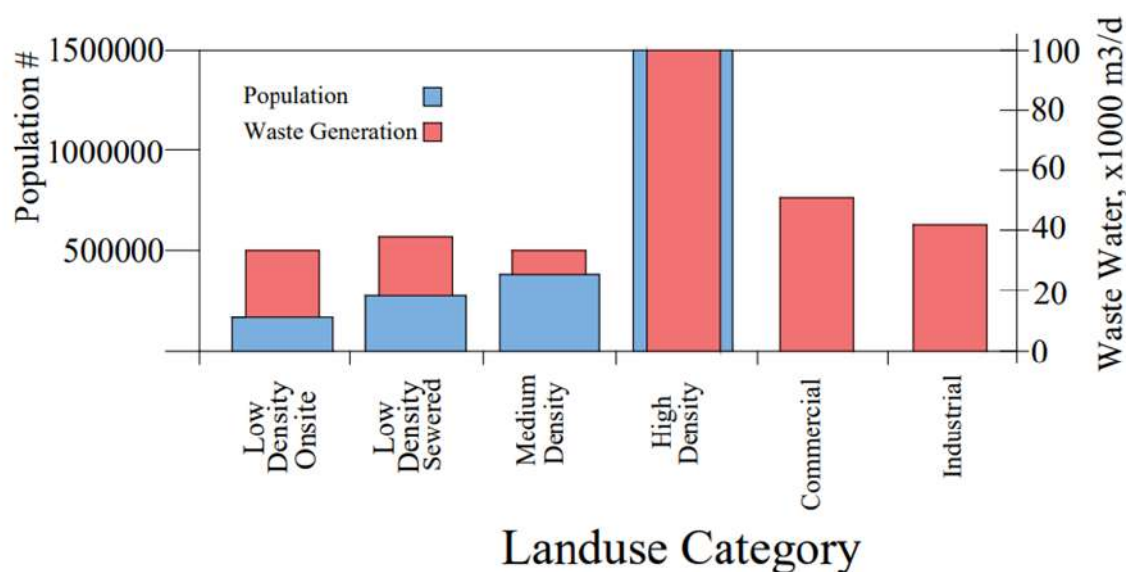


Figure 7.129: Population distribution and Wastewater generation in Harare

7.2.2.3. *Stercus Waste Disposals into Municipal Reticulation Systems*

Septic tanks and “bio-digestors” contain faecal for a few years, during which the sludge stabilizes. It roughly takes 2 to 5 years for desludging. Some developments have inadequate sizing of this technology resulting in high rate of solid matter built up. A 5 cubic metre load of desludge waste is equivalent to faecal waste of 5000 individuals. Disappointingly, most faecal sludge finds its way into the environment as irresponsible collectors try to evade payment to Council. Faecal Sludge Management policy is thus required for management of the facilities to ISO standards of treatment and subsequent disposal.

The designated municipal manholes for sludge disposal are open and manned during the day. After hours, notorious collectors dump loads without paying. There are also cases whereby industrial waste is being emptied into the manholes after operating hours. This increases pH in the sewage which corrodes pipework. The chemical pollutants and the increased pH cause



Figure 7.130: Open Outfall Manhole Newlands

Table 7.132: Open Manhole Locations and Pipe Sizes

	Open Manhole Location	Pipe Size
1	Newlands Shopping Centre	ND450
2	Simon Mazorodze near roundabout	ND1200
3	Marlborough Manchester (<i>closed</i>)	ND300
4	Sherwood Drive, Meyrick Park	ND450

7.2.2.4. *Municipal Public Restrooms*

City of Harare has numerous municipal restrooms available to the public, some for a fee whilst others are free. The restrooms service the CBD and the commercial centres in municipal districts. Some of the housing facilities have municipal restrooms utilized in their areas. Table 163 outlines the inventory of these district municipal restrooms. The municipal hostels make up 318 of toilets and the rest, 64, are located at commercial centres, district offices, markets and bus termini.

Table 7.133: Municipal District Restrooms

No.	District	No. of Toilets	Location
1	Glen Norah	4	Chitubu, Mushayabande, Spaceman, Glen Norah 'B'
2	Dzivaresekwa	2	Dzivarasekwa 3 Shops, Home Industry
3	Mbare	8	District Office, Mupedzanhamo, Carter House, Paget House, Stodart, Retail Market x 2, Car Park
4	Mabvuku	2	Chizhanje, Matongo
5	Budiriro	3	Budiriro 1,2,4 Shops
6	Warren Park	7	Warren Park 1, Home Industry, District Office, Terminus Warren Park 2, Pfukwa, Meriki, Tavern
7	Kambuzuma	9	Kambuzuma 2 (2Nos), Kambuzuma 3,4 & 6, Rugare Shops (2Nos), District Office (2Nos)
8	Hostels	318	For all blocks of flats
9	Glen View	7	District Office, Glen View 3 Shops x 2, Makomva, Tichagarika, Glen View 1 & 4
10	Kuwadzana	2	District Office, Porta Farm
11	Tafara	5	District Office, Old Tafara Shops, Home Industry, Markets (2Nos)
12	Mabvuku	8	District Office, Chizhanje Shops, Red Bull, Matongo, Hunters, Kamunhu Shops, Chiawasha, Matoko
13	Mufakose	2	District Office, Library
14	Hatcliffe	Nil	

There are 112 toilet locations in the CBD, 88 are free, 8 are paid for and the rest are not operational. There additional paid restrooms in district centres.

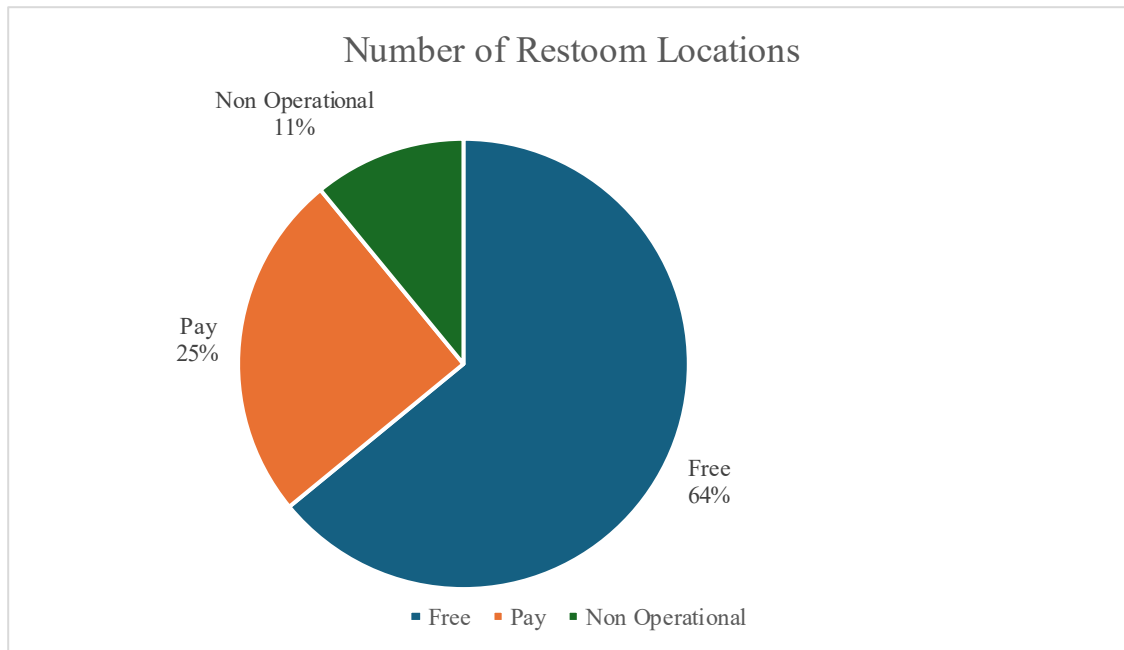


Figure 7.131: Municipal Toilets in the CBD

Table 7.134: Paid Public Restrooms in the CBD

Area	Name of Toilet	Status
City	Rezende Parkade	Operated by COH
	Samora Machel Parkade	Operated by COH
	Africa Unity Square	Operated by COH
	Jason Moyo & First Street	Operated by COH
	Joina City Footbridge	Operated by Joina City
	Market Square	Operated by Disruptive Innovation
Mbare	Mbare Terminus (Zupco)	Operated by Disruptive Innovation
Highfield	Lusaka Terminus	Operated by COH
Budiriro	Budiriro 5B shops	Operated by COH

7.2.2.5. Sewerage Catchment Areas

Harare lies in the Upper Manyame Sub Catchment. Within the city boundary are further subdivisions which influence the sewer network which relies on gravity. Pumping head is provided in some sections of the city. There are five main catchments and treatments sites. Additional catchments such as Chisipite and Budiriro collect wastewater at the lowest point and pump into transition chamber located in another catchment. The catchments have been summarized below:

7.2.2.5.1. Marlborough

Areas Covered

The network collects wastewater from 3 groups of suburbs. Wastewater from Adylinn and Marlborough flows in a Ø 450 mm RC main into the Marlborough WWTW. New Marlborough area utilizes a Ø 300mm AC main which discharges into the Marlborough WWTW.

The last group covers Avonlea, Ashbrittle and Emerald Hill suburbs draining towards the Marlborough Pump Station where it is pumped via 375 mm Ø RC main into the Firle

wastewater pipe network. During power outages, wastewater gravitates to the Marlborough WWTW.

Estimated Wastewater Volumes

On record, the average inflow at the treatment plant is about 12 million litres a day. From estimations based on land use and population, about 20 million litres a day is expected.

7.2.2.5.2. *Hatcliffe*

Areas Covered

This catchment has two groups, one lies in another sub catchment. The old design allowed for pumping for wastewater collected from Hogert Hill, Borrowdale Brook, Philadelphia and part of Carrick Creagh. A series of three booster pump stations conveyed the sewage against gradient into a transition chamber in Hatcliff. The wastewater would gravitate towards the Ø 450 mm AC main to the Hatcliffe WWTW via a Ø 300 mm AC main. This arrangement required reliable power to service the area. Power outages overflowed the sumps. These pump stations have been decommissioned. Borrowdale Brooke community constructed and now maintains a treatment plant downhill the development which makes use of aerated chambers. The disinfected effluent irrigates the golf course within the gated community. Hatcliffe properties drain into the Ø 300 mm AC main that sizes up to a Ø 450 mm AC main as it enters the WWTW. This main is the same as the one previously fed by the transmission chamber receiving pumped sewage.

Estimated Wastewater Volumes

At full supply 15 megalitres of water are collected per day from the catchment.

7.2.2.5.3. *Crowborough*

Areas Covered

Crowborough Catchment is the second largest catchment in the city lying in the western part of Harare City. The suburbs in the areas as well as the University of Zimbabwe, Dzivaresekwa, Heavy industry and Parirenyatwa Hospital are drained by this network. There are two major ND 900mm RC pipes that run parallel and drain into the Crowborough WWTW. Table 7.135 presents the suburb groups and respective outfall channels.

Table 7.135: Crowborough Catchment Area

Group Number	Suburbs	Outfall System
1	Sunrise, Sunridge, Avondale West, Sherwood Park, Sentosa, Mayfield, Park, Gotsword Hills, Meyrick Park, Strathaven, St Andrews Park, Mablereign and Monavale	There are two mains, Ø 315 mm PVC and Ø 525 mm RC. These join downstream into a Ø 900 mm RC main leading to Crowborough WWTW.
2	Avondale, Kensington and Alexandra Park	Wastewater discharges into two Ø 315 mm PVC mains that join downstream into a Ø 450 mm RC main. This main eventually discharges into one of the Ø 900 mm twin collector main headed to the Crowborough WWTW.
3	Belvedere North, Milton Park and Lincoln Green	The Ø 450 mm RC main discharges into a Ø 900 mm RC twin main.
4	Belvedere South, Ridge View and Workington	These areas discharge into a Ø 315 mm PVC main which in turn discharge into a 450 mm Ø RC main followed by the Ø 900 mm RC twin main.
5	Rugare	A Ø 450 mm RC main discharge into a Ø 900 mm RC twin main.
6	Lochinvar and Kambuzuma	Wastewater from these areas discharge into a Ø 300 mm

		PVC main branching into a 900 mm Ø RC twin main.
7	New Marimba and Marimba	A Ø 300 mm AC main collecting from the suburbs empties into a Ø 900 mm RC twin main.
8	Mufakose	A Ø 315 mm PVC and Ø 600 mm RC mains service the area. The Ø 315 mm main discharges directly into Crowborough WWTW. The Ø 600 mm RC discharges into the 900 mm Ø RC twin main.
9	Crowborough and Crowborough North	A Ø 300 mm AC main drains the area and discharges into a Ø 900 mm RC twin main.
10	Kwadzana, Kwadzana Phase 3, Kwadzana Phase 4 Ext, Glaufina, Dzivaresekwa, Dzivaresekwa Ext, Madokero Estate, Tynwald North and Sanganayi Park, Bluff Hill, Bluff Park and New Bluff Hill Park	A Ø 600 mm AC main services the areas and discharges into the Crowborough WWTW.
11	Tynwald, Tynwald South, Nkwisi Park, Westlea, Ashdown Park and Warren Park D	The Ø 450 mm RC main from these suburbs discharges into a Ø 900 mm RC twin main.
12	Warren Park	Wastewater is discharged into a Ø 900 mm RC twin main.
13	Mufakose	Part of the area drains into a Ø 900 mm RC twin main through a Ø 600 mm AC. The rest of the area discharges into Ø 375 mm RC which enters Crowborough WWTW at a low level and is pumped to the head of the works.

Estimated Wastewater Volumes

The Crowborough WWTW receives 120 megalitres/day of sewage when there is full water supply in the catchment.

7.2.2.5.4. *Firle/Mukuvisi*

Areas Covered

Firle or Mukuvisi Catchment Area is a large drainage area which encompasses suburbs from the eastern parts, central areas and southern parts of the city. The catchment also covers the CBD Harare & Nazareth hospitals, Chikurubi and light industries. The largest collector main from this catchment area is a Ø 1400 mm RC conveyor pipe. This size makes up the twin mains which empties into the treatment plant. A summary of the collector mains is shown in table 7.136.

Table 7.136: Firle Catchment Area

Group Number	Suburbs	Outfall System
1	Chisipite and Lewisam	Wastewater from these areas is pumped through an Ø 200 mm AC to a Transition Chamber in Highlands. Thereafter, the wastewater gravitates Ø 375mm RC main into a Ø 450 mm RC pipe which subsequently discharges into the Ø 750 RC main. The sequence follows to a Ø900 mm AC main then the Ø1400 mm RC twin collector main.
2	Highland, part of Newlands, Oval Park and Runnivale	A Ø 450 mm RC pipe collects from these areas and subsequently discharges into the Ø 750 mm RC main which empties into a Ø 900 mm AC main leading to one of the Ø 1400 twin collector main.
3	Borrowdale West, Pomona, Vainona, Groombridge, Little Norfolk, Mount Pleasant and North Wood	Wastewater from these areas is pumped via a Ø 300 AC to a Transition Chamber in Gunhill. From this chamber its gravitates in a Ø 450mm RC main connecting to a Ø 675mm RC main which discharges into a Ø 1400 twin collector main.
4	Gunhill and part of Newlands	The sewage from these areas gravitates from the Ø 450 mm RC main into the Ø 675 mm RC main and finally discharges into one of the 1400 mm Ø twin collector main.
5	Worms Hill, Greendale, Dawn Hill, Oval Park and Rhodesville	Areas served by a Ø 315 mm PVC main which subsequently discharge into the Ø 450 mm RC main. The Ø 450 mm RC main discharges into the Ø 675 mm RC main. The Ø 675 mm main discharge into one of the Ø 1400 mm twin collector main. The Ø 1400 mm collector main discharges into the Firle WWTW.
6	Masasa, Mukuvisi Park, Beverly, Mukuvisi, Mukuvisi Park, Greenglove, Beverly	Wastewater from these areas discharge a 375 mm Ø RC main which subsequently discharge into the 525 mm Ø RC main and then into a 600 mm Ø RC main. The 600 mm Ø RC main discharges into the 750 mm Ø RC main. The 750 mm Ø main discharge into one of the 1400

	West, Amby, Bingley and Athlone	mm Ø twin collector main. The 1400 mm Ø collector main discharges into the Firle WWTW.
7	Cranborne Park, Queensdale, Arcadia and Braeside	Wastewater from these areas discharge a 675 mm Ø RC main. The 675 mm Ø main discharge into one of the 1400 mm Ø twin collector main. The 1400 mm Ø collector main discharges into the Firle WWTW.
8	Chadcombe, Masasa Park, Park Meadows and Hatfield	Wastewater from these areas discharge a 375 mm Ø RC main which subsequently discharge into the 525 mm Ø RC main. The 525 mm Ø main discharge into one of the 1400 mm Ø twin collector main. The 1400 mm Ø collector main discharges into the Firle WWTW.
9	Graniteside, St Martins, Sunningdale and New Prospect Park	Wastewater from these areas discharge into two directions. Graniteside drains directly into the 1400 mm Ø collector main discharges into the Firle WWTW 1400 mm while Sunningdale, St Martins and New Prospects area drains into the 675 mm Ø main, which also discharges into one of the 1400 mm Ø twin collector main. The 1400 mm Ø collector main discharges into the Firle WWTW.
10	City Centre and the Avenues	Wastewater from these areas discharge into two mains. The 525 mm Ø RC main collecting wastewater from the town centre and the 750 mm Ø RC main collecting the wastewater from the avenues. The 525 mm Ø RC main discharges into a 750 mm Ø RC main which in turn discharges into the 1400 mm Ø RC collector main to Firle WWTW. The 750 mm also discharges into another twin 1400 mm Ø RC collector main to the Firle WWTW.
11	Mbare	Wastewater from this area discharges into the 1400 mm Ø RC collector main to the Firle WWTW.
12	Part of Southerton	Wastewater from this area is discharges a 375 mm Ø RC main which subsequently discharge into the 600 mm Ø RC main. The 600 mm Ø main discharge into one of the 1400 mm Ø twin collector main which in turn discharges into the Firle WWTW.
13	Ardbennie	Wastewater from this area discharges into two mains directions, the North Eastern part discharges into a 375 mm Ø RC main which in turn discharge into the 1400 mm Ø RC collector main. The other parts other parts of the suburb discharges into the 1400 mm Ø RC collector main to the Firle WWTW.
14	Prospect and Park Town	Wastewater from these areas discharge into a 300 mm Ø RC main which in turn discharge into the 1400 mm Ø RC collector main to the Firle WWTW.
15	Malvern, Midlands, Waterfalls, Induna, Grobbie Park and Mbare West	Wastewater from these areas discharge into the 1400 mm Ø RC collector main to the Firle WWTW
16	Glen View	Wastewater from this area discharges into a 300 mm Ø AC main which in turn discharge into a 375 mm Ø AC main. The 375 mm Ø AC main in turn discharges into the 450 mm Ø AC collector main. The influent from the 450 mm Ø AC main discharges into the 675 mm Ø AC collector main to the Firle WWTW.
17	Glen Norah	Wastewater from this area discharges into two mains directions, the North part discharges into a 300 mm Ø AC. The Southern part discharges into 450 mm Ø RC main. Both mains discharges into the 1400 mm Ø RC collector main to the Firle WWTW.
18	Highfield	Wastewater from this area discharges into two 375 mm Ø RC mains. Both mains merge downstream a 375 mm Ø RC before joining the 1400 mm Ø RC collector main to the Firle WWTW.
19	Willowvale	Wastewater from this area discharges into a 450 mm Ø RC main which in turn discharge into a 525 mm Ø RC main. The 525 mm Ø RC main in turn discharges into the 675 mm Ø RC collector main which discharges into the Firle WWTW.

Estimated Wastewater Volumes

At full water supply, the WWTW receive 150 megalitres in a per day.

7.2.2.5.5. Budiro Catchment

Budiro Catchment Area comprises of the high-density areas of Budiro 1, 2, 3, 4 and 5. Budiro 1, 2 and 3 discharge into two Ø 375 mm RC mains which in turn discharges into a Ø 450 mm RC main. The 450 mm Ø RC main discharges into a 675 mm Ø collector main emptying into the Firle WWTW.

The pumping station cannot be relied on due to power outages. Proposals were made by Harare Water to bypass the pump station and construct a treatment plant in a council's farm that is 400m away. The collected sludge from the plant will be used for energy generation.

7.2.2.5.6. Donnybrook

Areas Covered

Parts of Mabvuku and units in Chizhanje are each drained by two Ø 225 mm RC mains towards Donnybrook Ponds 1. The two join into a Ø 450 mm RC mains which continues

downstream to join a Ø 750 mm RC mains. On the other side of the development lies a Ø 150 mm RC draining areas North East of Mabvuku towards the Donnybrook Ponds 4 and joins a Ø 450 mm RC mains. The Ø 450 mm RC mains tapers into a Ø 525 mm RC mains. A Ø 225 mm RC mains drains some parts of Mabvuku towards Donnybrook Ponds 3 and continues into a Ø 450 mm RC mains. Another Ø 225 mm RC mains drains some parts of Tafara towards Donnybrook Ponds 2. This main connects into a Ø 600 mm RC main along with the Ø 525 mm RC mains. The Ø 600 mm RC mains joins the a Ø 750 mm RC mains which tapers into a 900mm RC mains followed by sizes 1000mm RC and finally a 1200mm RC. There are no outfall treatment works.

Estimated Wastewater Volumes

The Donnybrook Catchment receives 20 megalitres/day of sewage when there is full water supply in the catchment.

7.2.2.6. Sewer Reticulation Infrastructure Condition and Capacity Assessment

7.2.2.6.1. Sewer Mains

The sewerage reticulation infrastructure, made up of mainly gravity flow lines, comprises pipework ranging in diameter from 150mm to 1400mm with materials varying from PVC, HDPE, CCGRP, earthenware, asbestos cement, reinforced concrete and steel on stream crossings. In total the network is more than 5500 km in length.

Presently, more than 30 of the pipe mains crossing water streams have been rehabilitated by the City of Harare. There were spillages into water bodies resulting from dilapidated pipework. As standard maintenance, City of Harare scours lines to remove siltation or built-up sludge by use of manual tools and water jetting.

Cases of body dumping within the Ø 1400 mm RC have been reported several times. The bodies caused restricted flows and were retrieved at the treatment plants. Vandalism of manholes has also been observed downstream catchments. Peri-urban agriculture found value in raw sewage. Some individuals close the outlets of the manholes in attempt to have the raw sewage overflow into their farms for irrigation. The settleable solids build up in the pipework and restricts flow. Also, spills upstream of the catchment will affect the neighbouring areas and wetlands.

During rainy seasons, the peak wet weather flow is higher. There is already a general increase in flow of water in pipework during dry weather. Cases of pipe bursts and overspilling in the manholes will be higher. The characteristic smell of the sewage can be detected in residential areas. The poor conveyance of stormwater drains which trickles into manholes is also another factor to the increase flow of water in the sewerage systems.

7.2.2.6.2. Sewer Pumps

The following table is a summary of the sewerage pump stations in Harare. Though the network is predominantly by gravity, some areas drain other watersheds and require pumping head to a transition chamber where water then gravitates into the other network.

Table 7.137: Sewerage Pump Stations in Harare

Pump Stations	Status	Capacity (ML/day)	Ownership
Arundel	Down	1.5	private

Avonlea	Pumps functional, down due to collapsed gravity and burst pumping main.	5	CoH
Bradfield	Functional and pumping	2.5	CoH
Budiriro	Pumps function, down due to intake incapacitation to cope with grit arising from collapsed gravity main.	10	CoH
CABS	Down, yet to be commissioned and handed over.	0.2	private
CABS	Down, yet to be commissioned and handed over.	0.2	private
Chisipite	Functional and pumping	5	CoH
North Eastern	Pumps functional, down owing to collapsed gravity main.	5	CoH

7.2.2.7. Wastewater Treatment Works Infrastructure Condition and Capacity

7.2.2.7.1. Assessment

Firle Works, Crowborough Works, Donnybrook Ponds, Marlborough Ponds and Hatcliffe Works are the constructed treatment plants for offsite sanitation systems. The Firle Works is situated near Glenview and is the biggest treatment site. It receives raw sewage from residential homes, the city centre and the Workington Industrial Sites. Crowborough Works is in Crowborough Farm, southwest of the city and nearly 28 km from the city. It is the second biggest treatment plant.

Marlborough Ponds services the waste from Marlborough medium-density suburbs and parts of Avondale when there is no power to pump into the Firle catchment. The effluent is discharged into Gwebi River. Donnybrook Ponds used to service the waste from Mabvuku and Tafara, the eastern high-density suburbs. Hatcliffe Ponds treats the waste from the northern high-density suburb of Hatcliffe. The effluent from the plant discharges into Chinyika River, a tributary of Mazowe River. The table 7.138 summarizes the mean performance of the treatment plants to date.

Table 7.138: Sewage Treatment Infrastructure and Catchment

Plant	Design capacity (ML/day)	Inflows at full water supply	Available capacity (ML/day)	Pumped to farms (ML/day)	Spillage to environment (ML/day)
Firle	144	150	54	54	111
Crowborough	54	120	13	36	78
Marlborough	7	20	7	0	13
Hatcliffe	2.5	15	2.5	0	12.5

Donnybrook	12	20	5	0	4
TOTAL	219.5	335	81.5	90	231.5

In addition to the municipal plants there decentralises treatment systems which are used by emerging developments in areas originally set for low density properties and farms. Different technologies are used which are first approved by the City of Harare, Water Department.

7.2.2.7.2. *Firle WWTW*

Firle sewage treatment works has a total of 5 individual wastewater treatment streams constructed to with a nominal overall design treatment capacity of 144,000 m³/day. The Units 1 and 2 each have a design treatment capacity of 18,000 m³/d and were commissioned in 1970. These two treatment streams are identical in design. They are made up of common intakes, grit chambers, sedimentation tanks and trickling filters. The common intake works were constructed with two parallel screen channels equipped with two sets of manually raked coarse and medium screens and corresponding Venturi Flumes. Downstream are six parallel baffled type vertical flow grit chambers with corresponding air-lift type grit removal system including compressor and air-lift pipework. These chambers are followed by six circular sedimentation tanks of the Dortmund tank design, without any sludge scraping device. Each unit has four trickling filters 38m in diameter and 4m high, filled with granite rocks as the filter media. The units have four circular humus tanks, final sedimentations tanks.

The third unit is a modified activated sludge process biological reactor (BNR) operating with a 5-stage configuration for biological nutrient removal of nitrogen and phosphorous. It has a design treatment capacity of 18,000 m³/d. The plant was commissioned in 1982. Unit 3 stream follows a 5-stage biological reactor which enable denitrification and phosphorous removal as well as treatment of carbonaceous load. Downstream are three humus tanks for the sludge removal.

Unit 4 is also a modified activated sludge process biological reactor. The treatment follows three stages configuration for the biological nutrient removal of nitrogen and phosphorous. Firle WWTW has three ponds in series serving all units as additional effluent treatment to meet the standards for land and crop irrigation. The exposure to sunlight on the surfaces allow for disinfection of pathogens by UV radiation. Presently, the treated effluent from units 3, 4 and 5 is directly spills into Mukuvisi River. Treated effluent from Unit 1 and 2 is discharged into adjacent farms owned by the City of Harare for further purification. The effluent from this treatment does not meet EMA standards for effluent disposal into rivers or water courses. Star and kikuyu grass in the farms take up the nutrients. The water also percolates into the soil and replenishes underground water. The grass is fed to the cattle stock owned by the City Council.

There are two separate effluent pump stations. The first effluent pump station with a total of six pumps. Another is a new effluent pump station with a total of four pumps, two of which were operational.

7.2.2.7.3. *Crowborough WWTW*

This treatment site has a total of 3 individual wastewater treatment streams with an overall design treatment capacity of 54,000 m³/day. Units 1 and 2 were commissioned in 1959 and

1972 respectively, each with a nominal design capacity of 18,000 m³/day. The two units each have common intake works comprising two parallel screen channels equipped with two sets of manually raked coarse and medium screens and corresponding Venturi Flumes. This is followed by six parallel baffled type vertical flow grit chambers with corresponding air-lift type grit removal system including compressor and air-lift pipework. Downstream are six corresponding circular sedimentation tanks of the Dortmund tank design without any sludge scraping device. The units also have a set of four trickling filters, 38m in diameter and 4m high, filled with granite rocks as the immobilized media. Effluent from the filters feed into the subsequent circular humus tanks.

Unit 3 is a modified activated sludge process biological reactor commonly known as a BNR with a 5 stage configuration for biological nutrient removal of nitrogen and phosphorous, and was commissioned in 1982 and has a nominal design treatment capacity of 18,000 m³/d. Unit 3 comprises of a 5 stage biological reactor enabling denitrification and phosphorous removal as well as treatment of carbonaceous load. There are three humus tanks for sludge removal.

Crowborough WWTW also has three ponds operating in series to serve unit 1 and 2 as additional effluent treatment to meet the standards for land and crop irrigation. The exposure to sunlight on the surfaces allow for disinfection of pathogens by UV radiation. Treated effluent from Unit 1 & 2 is discharged on to the adjacent Crowborough and Ingwe farms owned by the City of Harare for further purification. There is also star and kikuyu grass plantation for nutrient removal. The grasslands are grazed by the municipal cattle stock. Treated effluent from Unit 3 is overflowing into Marimba River.

There is one effluent pump station with a total of six pumps, all of which are not working. Work is in progress to provide for aerated lagoons at the WWTW. The pipework and compressors for the ponds have been purchased. There is outstanding plant which are aerators and the corresponding pipework for the project to be completed.

7.2.2.7.4. Hatcliffe

Hatcliffe sewage treatment works has single treatment process train with a nominal overall design treatment capacity of 5,000 m³/day. The treatment process includes preliminary pre-treatment and biological treatment using a BNR technology.

7.2.2.7.5. Marlborough

The sewage treatment works comprise of a pond system with an overall design treatment capacity of 2,000 m³/day. The treatment process comprises of three primary stabilisation ponds and two secondary stabilisation ponds.

7.2.2.7.6. Donnybrook

Mabvuku Tafara is a high-density suburb is to be serviced by Donnybrook Ponds 1 to 3 which emptied the effluent into Caledonia Farms. Caledonia was developed into residential stands. City of Harare constructed a pipeline to the proposed treatment plant in Lyndhurst farm. The WWTW will serve the Mabvuku Tafara, Caledonia and Epworth stands. The plant has not yet been constructed. Waste from the upstream areas of the pipework gravitates to the proposed site. A pump station was constructed to transfer the wastewater to the farms. However, due power problems and vandalism by surrounding informal settlers, the raw sewage overflows into streams.

7.2.2.7.7. *Decentralised Wastewater Treatment Systems (DEWATS)*

New developments in the city are being permitted to densify large properties of residential units. Some are converted into cluster homes of 500 m² minimum land share, high rise apartments and commercial centres. Waste is drained away from their properties to the treatment sites normally located at the lowest point of the development. The general treatment train incorporates settling chambers similar to septic tanks, anaerobic baffle reactors and/or aerated chambers followed by constructed wetlands. Many at times these, require large influence of mechanical, hydraulic and chemical processes to enable treatment on smaller areas. Hence, electrical power and high maintenance work is required to keep the systems running smoothly. Some suburbs such as Borrowdale Brooke with such a system uses the disinfected effluent for irrigation of green areas. This system has been in operation since 2017. Other areas are Stoneridge, Carrick Creagh, Nyeredzi Ridge, Pomona City and clusters in the northern suburbs. These are being managed by the developers and communities.

One of the challenges faced with the systems is the outfall of the effluent into the environment. Most properties are locked within suburbs, no access is available to a stream or river. Some have inadequate green areas for irrigation. The Environmental Management Agency discourages disposal into open municipal stormwater drains and has restrictions for effluent disposal into the environment (*Wastewater and Effluent Disposal Regulations Statutory Instrument (S. I.) 274 of 2000*). Policies are required for better design and management of such plants. There is need to constantly monitor the operations as well as outfall into water bodies for less contamination. The reclaimed water should be safe for the exposed individuals in these environments.



Figure 7.132: Constructed Treatment Plant in Stoneridge

7.2.2.8. *Proposed Sewage Treatment Plants and Capacity*

In line with the increasing spatial expansion of Harare and commensurate population growth, the city has proposals to augment its sewage treatment infrastructure to meet anticipated service demands in the horizon 2030 and beyond. The city proposes to construct a sewage treatment plant receiving waste from the Southern Incorporated Areas and part of Chitungwiza with estimated. In Chitungwiza, one of the catchments has a pump station which should pump water to upstream to existing treatment works. The pump station is not operating hence raw sewage spills into the streams and pollutes Lake Chivero. Other proposals include expansion of Crowborough, optimizing of Firle, upgrade of Hatcliffe and construct new Lyndhurst treatment plant including the Gwebi plant to relieve Marlborough ponds.

A sludge digestion plant was being constructed which was estimated to retain up to 40ML of water. Feasibility studies are required to continue the works. Plans are underway to design and construct a biofilter for Crowborough WWTW and Firle WWTW. These will improve effluent quality before disposal into the water bodies. Sludge harvested can be used for energy production. Table 7.139 presents the plants that underwent feasibility studies.

Table 7.139: Proposed Wastewater Treatment Plants

Treatment Plant	Proposal	Design Capacity (ML/day)	Estimated Cost (USD)
Southern Incorporated Areas (SIA)	Construct new plant and outfall sewers	120	210 000000
Lyndhurst	Construct new plant	60	60 000 000
Gwebi	Construct new plant and outfall sewers	40	60 000 000
Hatcliffe	Construct new plant and outfall sewers	20	30 000 000
Firle	Plant optimization	144	1 000 000
Crowborough	Upgrade existing plant	60	60 000 000

During the years 1996 to 2003, the Harare Sewerage Master Plan sponsored by the French and Government of Zimbabwe provided plans of rehabilitating the treatment plants to full functionality. This study and recommendations were carried out by SAFEGE in conjunction with City of Harare. They recommended the following:

- i. The upgrading of existing infrastructure inclusive of house connections.
- ii. Investment in expansion of the sewerage infrastructure to the southern incorporated areas of Harare.
- iii. Construction of new sewage treatment plants in areas under development.
- iv. Consideration of sources of infrastructure investment funding including completing rehabilitation works to ensure full functionality.
- v. Investment in mechanised sewer mains cleaning equipment.

7.2.2.9. *Summary of Rehabilitation Works on Wastewater Infrastructure*

During the Urban Water Supply and Sanitation Rehabilitation Project (UWSSRP) Phase 1 the following works were executed to reinstate existing wastewater treatment plants (see table 170). In addition to these works, the City of Harare had in house maintenance works funded

by the Government's Devolution funds and the council's revenues. The Firle Units 5 C and D were repaired.

Table 7.140: Wastewater Treatment Plants Rehabilitation Works - UWSSRP Phase 1

Item	WWTW	Scope of Rehabilitation Works
1	Firle Sewage Treatment Works	Rehabilitation works we done on biological trickling filters, including, pond system for Firle Units 1&2, effluent pumping station and effluent pumping main.
2	Crowborough Sewage Treatment Works	Biological Trickling Filters and the Pond System were rehabilitated.
3	Donnybrook Stabilisation Ponds	The pond system was rehabilitated. Reparative works were done on inlet, outlet structures, including installation of aluminium gates, valves and other metal fittings to distribution and collection chambers.
4	Little Marimba Trunk Sewer	Damaged sections along the trunk sewer mains were repaired.

7.2.2.10. Summary of Outstanding Rehabilitation Works on Wastewater Infrastructure

There is adequate land to establish and expand existing sewerage treatment plants. The existing plants have adequate design capacity to treat a significant portion of the collected wastewater. Components of these plants need repair to restore full capacity. Obtaining funds for the outstanding work is the major drawback especially with the high expenses incurred at the moment and low retention on charged bills. There is need of repair of machines and digesters at the existing sewerage treatment plants. There is need to resuscitate existing plants to be able to recycle water.

7.2.2.10.1. Firle WWTW

The existing effluent pump station is overdue for replacement of sewage pumps, dewater pump set and motor, accelerator clarifier equipment, flow meter recorder, screen board, transformer, electrical system for the station and valves. The new effluent pump station requires new flow meters, sewage pump and motor starters, valves, transformer, fans, pipes, steel grating and guard rails and all electrical systems. The plant needs a generator, transformers, breakers for transformers and portable sub pump for dewatering effluent pump station.

7.2.2.10.2. Crowborough WWTW

The biological (trickling) filters need screw conveying machine and electrical wiring. The plant is need of new ACSR conductors, raw sewage pump, transformers, and portable submersible pump, dewatering pump station, pipes, fittings and electricals. The Mufakose sump needs mechanical screens, new accelerator, clarifier equipment and new flow meters. Also, raw sewage pumps, vertical pump, pipes, fittings and electrical cables are needed for the Mufakose sump.

7.2.2.11. Valuation of Sanitation Level of Service

7.2.2.11.1. Wastewater Outfall Volumes

7.2.2.12. Summary of Issues

- i. Delivering potable water is one of the most basic of the City of Harare's responsibilities. Over the years, water supply has depreciated.
- ii. The City of Harare relies on four dams within the Manyame Catchment for its raw water supply namely Seke, Harava, Chivero and Manyame Dams.
- iii. The major raw water storage areas are Prince Edward, Lake Chivero and Dawendale, all of these are supplying water to the City of Harare and surrounding areas Norton, Epworth, Chitungwiza and Ruwa.
- iv. The Local Authority is facing water quantity and quality problems which results in most of the suburbs experiencing water cuts.
- v. Harare and its dormitory towns have a demand of 800 mega litres a day but the Local Authority has a capacity to produce only 295 mega- litres of water per day.
- vi. Water shortages in the planning area are mostly attributed to rapid population growth, inadequate maintenance of wastewater treatment plants,
- vii. Suburbs affected by water supply shortages include most of Harare's high density suburbs (Glen View, Chitungwiza, Tafara, Mabvuku) Zimre Park, Greendale, Chadcombe, Mainway Meadows, Greencroft, Mabelreign and Waterfalls amongst other suburbs.
- viii. City of Harare has five Sewage Treatment Works namely Firle works, Crowborough, Donnybrook ponds, Marlborough and Hatcliff works with Firle works being the biggest.
- ix. There is a mismatch between the current sewerage demand and sewerage infrastructure, where supply is way less than the current sewerage infrastructure provision.
- x. Causes of inadequate sewerage infrastructure provision is mainly attributed to dilapidated sewerage system network that was laid out over 50 years ago.

7.2.3. Roads and Storm Water Drainage and Flood Management Assessment

This section outlines the existing roads infrastructure, stormwater and flood management particularly current state of the existing infrastructure and estimated service requirements.

7.2.3.1. Roads and Storm Water Drainage Overview

Harare City, being a national capital, hubs a lot of economic activities. Transportation becomes essential in enabling them. The city links several provinces in the country. The transportation infrastructure involves massive works to construct and maintain due to the operating volumes of traffic. The roads in the city are managed by both Harare City and the Ministry of Transport – Department of Roads. Ministry of Transport – Department of Roads mainly deals with the roads connecting cities and towns and regional trunk roads. City of Harare manages most of the arterial, distributor and local access roads. The Civil Aviation Authority of Zimbabwe (CAAZ) manages the airports and air infrastructure. Railways and rail infrastructure in the city are owned, managed and operated by the National Railways of Zimbabwe (NRZ).

During the Emergency Recovery and Reconstruction Project (ERRP) roads under the Ministry of Transport and some under City of Harare were rehabilitated. With the help of funding from the SADC, additional roads have been dualized to accommodate the increased road traffic.

Harare also lies in the Upper Manyame Catchment and in a goon rainfall region. The roads in Harare are susceptible to damage in regions with wetlands. Since most of the land within the administrative boundary is constructed, there is less space for water to percolate into the ground. The stormwater conveyance systems have been failing to accommodate rainfall leading to flooding in the city streets.

Cases of flash floods have been also found in areas outside the CBD. New developments, especially Southern Incorporated Areas, were constructed with inadequate roads infrastructure. During rainy seasons, water builds up and in the carriage ways and into some homes. Residents in areas nearby Harare and these Southern Incorporated Areas have experienced flooding due to poor positioning of the properties. Other homes are informal settlements in wetlands which experience flooding.

7.2.3.2. Existing Infrastructure Condition and Capacity Assessment

7.2.3.2.1. Existing Road Network Infrastructure

Harare City has a dense network of roads with a total length of about 4000 kilometres. The several major highway roads converge into the CBD. Some have been linked by the Harare Drive ring road to allow access of the industrial areas without entering the city centre. The road widths of the carriageways range from 3.0 m to 3.5 m. Roads outside the business districts have wider road shoulders. Most of the roadworks are surfaced in the business district, industrial areas and northern suburbs. The primary and secondary roads are surfaced by asphalt and pavers at some intersections and roundabouts. Chip and spray surfacing is used in most local access roads but easily wears down. The roads in the high-density residential areas are greatly damaged due to poor earthworks and maintenance of roads. Roads and paved surfaces in parts of the city have inadequate crossfalls. Water tends to pond in areas where the surface gradient does not enable flow. Overtime the roads develop potholes.

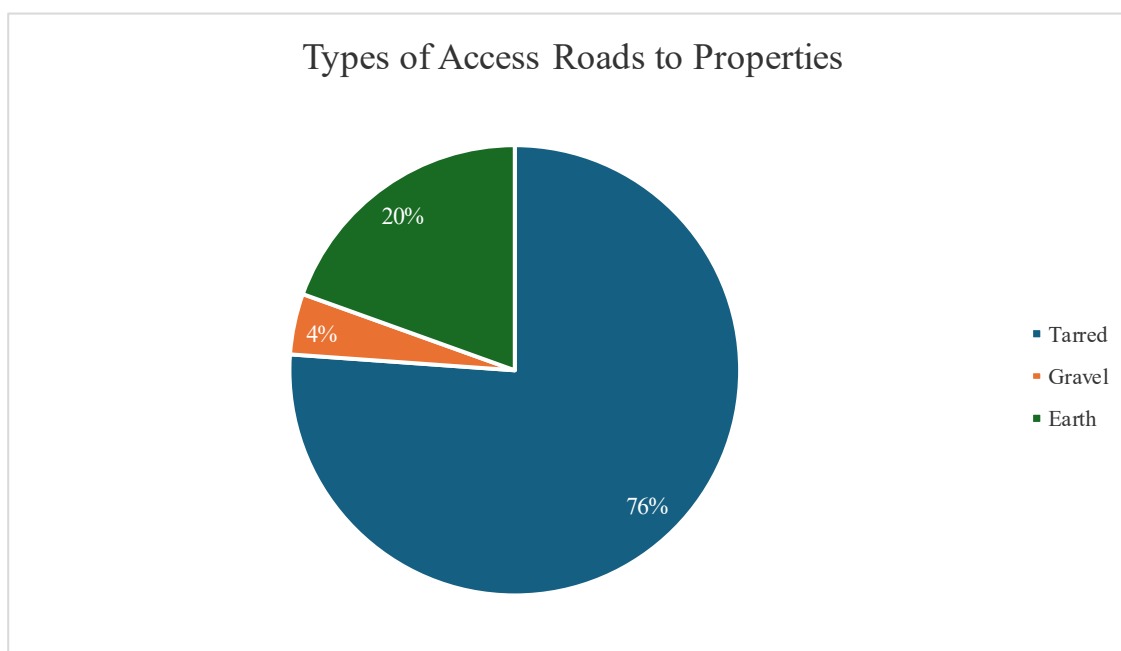


Figure 7.133: Types of Access Roads to Properties

About thirty bridges were constructed along the roads to allow for road crossings at water streams and rivers. There are more than eight flyovers constructed for grade separation of the roads and railways. The city's largest interchange, popularly known as Mbudzi Round about is still under construction. The interchange allows for grade separated roads.

7.2.3.2.2. Major Road Classification

The planning area is well served with different roads in terms of hierarchy, size, as well as the necessary road infrastructure. According to the recently completed road reclassification exercise of 2024 by the City of Harare the road hierarchy is made up of Primary level roads, Secondary Level Roads (Secondary Distributors) and Tertiary Level Roads.

7.2.3.2.2.1. Primary level roads

Primary level roads have a road servitude of $\pm 140\text{m}$, however they have been reduced $\pm 31.49\text{m}$ due to encroachments of land uses and other developments being established in the servitudes. The primary level road comprises of:

i. Principal Arterial System (Regional Roads)

These were previously named using the A1, A2, A3 up to A7 nomenclature for the roads that link with Harare Central Business District. They are seven in the planning area and they include Nemakonde Road/Lomagundi Road, Bulawayo Road/Samora Machel Avenue West, Mutare Road/Samora Machel Avenue East, Simon Mazorodze Road, Sam Nujoma/Golden Stairs Road, ED Munangagwa Way and Seke Road.

ii. Minor Arterial System (National Roads).

These roads are within the planning area and act as district links with big servitudes, they include proposed Marimba Freeway, proposed Makabusi Freeway and proposed Northwest Freeway.

7.2.3.2.2.2. Secondary Level Roads (Secondary Distributors)

These have a collector-distributor function, linking local distributors to the Primary level roads. They have a road servitude of $\pm 25.00\text{m}$. Examples include Crowhill Road, Churchill Road and Alpes Road. Tertiary Level Roads are intended to provide access to properties, they also link properties to the higher-level roads in the hierarchy. It follows that traffic volumes and speeds on these roads tend to be low. Tertiary Level Roads with their servitude include Local Distributor Roads ($\pm 18.89\text{m}$), Stand Access ($\pm 12.00\text{m}$, $\pm 10.00\text{m}$) and Foot Paths ($\pm 2.50\text{m}$).

7.2.4. Aviation Infrastructure

In terms of airports and air infrastructure, the study area (Harare and its surroundings) is managed by the Civil Aviation Authority of Zimbabwe (CAAZ), established by the Government of Zimbabwe in 1999 through the Civil Aviation Act of 1998. The CAAZ is the main provider of civil aviation services, serving as the regulator of the industry, managing the civil aviation infrastructure, including the main airports, and providing airspace management services. The study area is served by two airports, the Charles Prince Airport (Mount Hamden) and the Robert Gabriel Mugabe (RGM) International Airport formerly known as Harare International Airport and Salisbury Airport.

7.2.4.1. Robert Gabriel Mugabe International Airport

The planning area is served by one airport, the RGM International Airport which is the largest airport in the study area as well as the largest in the country. It is located 15 kilometres south

of the city and serves as a primary gateway into Zimbabwe and a natural gateway into Southern Africa. The airport has 4.725m long and 46m wide runway, capable of handling wide-bodied aircrafts such as the Boeing 777/B747. It has a design capacity of up to 3.8 million passengers a year. The RGM international airport is fully compliant with international standards and has the capacity to handle regional traffic should it be required. The volume could be increased if the African Open Skies (Yamasaki Agreement) policy could be used effectively as currently a number of bi-lateral agreements are in the works to allow fellow African nations and Zimbabwe to utilize the facilities in each other's countries.

It is also important to note that the International airport is currently under expansion with the construction of a new terminal and related facilities to increase its passenger handling capacity. The expansion of the airport is part of the efforts by the Zimbabwean government's drive to improve aviation infrastructure in line with international standards which is also aimed at driving economic growth.

The study established that Civil Aviation infrastructure in Zimbabwe is in need of rehabilitation and regular maintenance. A particular concern is air traffic control and safety, as equipment is old and in need of replacement. Closely related to traffic surveillance is the capability for aircraft communication to and from the ground. The entire airspace of Zimbabwe has not been covered by existing facilities, and what does exist is deficient. The airspace surveillance equipment is not well maintained, and shortcomings in surveillance also raise concerns about search and rescue operations. Weather installations are inadequate, and broadband infrastructure is not available at most airports. An ongoing program of CAAZ is making progress in addressing deficiencies in the ground to air communication system, but much remains to be done in this area.

7.2.5. Railways and Rail Infrastructure

Railways and rail infrastructure in the planning area is owned, managed and operated by the National Railways of Zimbabwe (NRZ). The total length of railway tracks in Harare currently spans around 71km, stretching from Ruwa at 256.72km to Harare at 278km, Harare to Whitehouse at 305km, and Lochinvar to Mt. Hampden covering 21km. The main depot for Harare is located at the south of the City along Kenneth Kaunda Avenue. The NRZ operates both Intercity and Commuter locomotives within and around the planning area which transport both passengers and freight. The Intercity commuter lines at the moment are only transporting goods due the lack of intercity passengers but plans are in the works to reintroduce the commuter lines, whilst freight services are operating as normal.

A detailed design of the Chitungwiza railway line project was carried out by the Government of Zimbabwe through the Ministry of Local Government. The detailed engineering design was completed in 1991 and the project was however not implemented due to lack of finance because of the sheer size of the scope of the design. The Harare – Chitungwiza railway line project aims to provide an efficient, safe and reliable means of transport for passengers from Seke, Chitungwiza, Manyame, Sunningdale, Prospect, Mbare and Graniteside commuting to and from Harare CBD. The corridor is currently served by buses and private minibuses and the proposed commuter train service is expected to provide a lasting solution to problems of traffic congestion and other safety issues along Seke road. Also in the long term, the NRZ plans to establish a fully-fledged metro rail to service all surrounding Harare settlements such as Ruwa, Norton, Domboshava, Nyabira and Cyber City.

7.2.6. Stormwater Conveyance

Harare is situated in predominant wetlands. During the rainy seasons, water fails to flow pools on road carriageway affecting visibility on roads at night. Potholes easily form on the roads. In the CBD and southern areas, terrible flash floods occur. Harare City recorded functionality of less than 50% for stormwater drainage systems. This portion of drains is constantly maintained throughout the year.

The CBD has underground drains which convey water to the nearest streams. These drains have silted up and some are filled with litter. The catchpit covers and grating have been vandalized. Areas out of the CBD mostly use open channel drains to convey water. There are some suburbs such as Avondale, Belvedere, Belgravia, Eastlea and Mabelreign that make use of underground drains. Where adequate road servitude is available, open channel drains are used. Nearly 50 km of mitre drains have been constructed in the city to relieve the roadside stormwater channels. There is low maintenance work administered to the stormwater drains. Both underground and open channel drains have silted up. Residents and vendors have developed bad habits of dumping waste in stormwater channels. Vendors have set up structures along the roadways. Their waste piles up in the drains and restricts flow of water. Some have set up brick structures near drains which fill up during rainy days.

In Southern Incorporated Areas, some of the roads in the were unsurfaced. Due to the areas being mostly sandy, the drains quickly silted. During the rainy season, roads are not accessible. Residents must walk to the nearest accessible road. The vehicle operators use detours which over time have also become prone to wearing out in rainy seasons.



Figure 7.134: Stormwater Challenges in the City

7.2.7. Assessment of the City Ranks and Bus Termini

There are municipal and private ranks in the city. Public transportation vehicles in the city have been assigned ranks in which they operate. There are some commuters carrying passengers to areas outside the city's administrative boundaries. These have no permission to access local municipal ranks. By design, the ranks were located outside the CBD. This implies that residents from developments outside the city boundaries would have to travel from the CBD to the intercity ranks then proceed to the desired destination. Unfortunately, the commuters and passengers line up along the streets in near areas such as Harare Girls High, Agricultural Show Grounds, Bus Port and the flyover above Seke Road.

Table 7.141: Ranks and Bus Termini

	Name	Operation
1	Rezende North	COH
2	Speke Avenue (Copa Cabana)	COH
3	Simon Muzenda Bus Terminus (Fourth Street)	COH
4	Market Square	COH
5	Charge Office	COH
6	Coventry Holding Bay	COH
7	Mbare Musika Old Bus Terminus	COH
8	Mbare Musika New Bus Terminus	COH
9	Machipisa Bus Terminus	COH
10	High Glen	Private
11	Road Port	Private
12	Western Triangle Collection Bus Terminus	COH

The study focused mostly on municipal rank. A survey of the city's ranks was conducted to determine the state of the infrastructure.

7.2.7.1. *National Sports Stadium Holding Bay*

The road surfacing of the bays is 90% complete, the entrance road is a gravel road. An underground storm water drainage system was constructed. The catch pits are open as the covers were vandalized and some were stolen. The curbing is still in good condition, but some parts have been uplifted due to tree roots developing. There is no signage provided as yet since the terminus is not yet complete. The toilets structures are complete but not working.



Figure 7.135: National Sports Stadium Holding Bay

7.2.7.2. *Western Triangle Bus Collection Terminus*

The Western Triangle Bus Terminus serves various routes and connects different parts of the city. This terminus is essential for daily commuters, providing access to buses that travel to different neighborhoods and regions. The road surface area is now severely degraded. The bus stop shelters on the terminus are worn out all of them they need to be replaced. It is not in use has since become a parking space for broken down vehicles.



Figure 7.136: Western Triangle Bus Collection Terminus

7.2.7.3. *Machipisa Bus Terminus*

Machipisa Bus Terminus is located in Highfields. This terminus serves numerous routes that connect various parts of Harare and its surrounding regions. The terminus is named after the Machipisa Shopping Center, which is a prominent landmark in the Highfields area. The terminus has an underground storm water drainage system with catch pits that are 50% functional. Canopies are in fairly good condition with need of few touch ups. A few potholes were observed. Portions that aren't in use have been turned into trading areas.



Figure 7.137: Machipisa Bus Terminus

7.2.7.4. Mbare Bus Terminus Old Rank

The Mbare Bus Terminus, often referred to as the "old rank," is located in the Mbare suburb. It serves as a central point for buses and commuter omnibuses (kombis) traveling to various parts of Harare and beyond. Historically, Mbare Bus Terminus has been one of the busiest and most important transport centers in the city, facilitating the movement of thousands of passengers daily. It is well-known for its vibrant and bustling atmosphere, with vendors, travelers, and transport operators creating a lively scene. However, it has also faced challenges such as congestion, infrastructure wear and tear, and issues related to hygiene and safety. Over the years, there have been efforts to upgrade and modernize the terminus to improve its functionality and the overall experience for users. The road surface is severely degraded with numerous potholes. The road to the entrance has completely degraded. There are no visible stormwater drains or catch pits. There is missing signage and bus stop shelters provided.

7.2.7.5. Mbare Musika Bus Terminus New Rank

This terminus serves as a major departure and arrival point for both local and long-distance travel. Buses and kombis operate from Mbare Musika to various parts of the city and the country, making it a critical node in the public transportation network. There are potholes developing at the terminus. Signage and bus stop shelters are missing in most parts. The terminus is highly polluted due to people who are using it as a marketplace. The curbing is in a fair state. Storm water collecting gulleys were constructed in the area.

7.2.7.6. 4th Street Bus Terminus

The 4th Street Bus Terminus, also known as Simon Muzenda Street Bus Terminus, is a local rank for areas in the north and eastern suburbs as well as Ruwa, Epworth and Damafalls. It is situated at the intersection of Simon Vengai Muzenda Street (formerly 4th Street) and Jason Moyo Avenue. This terminus plays a crucial role in the city's public transportation network, facilitating the movement of passengers to various destinations within Harare and to other parts of Zimbabwe. The terminus uses an underground storm water drainage system and most of the catch pits are blocked. A few potholes have been developing. Most of the bus stop shelters are worn out and the signage is battered. The curbing has been destroyed by notorious commuter omnibuses driving over the infrastructure. The terminus is paved all around and is fairly good condition.

7.2.7.7. Market Square Bus Terminus

Market Square Bus Terminus in the CBD serves areas in the south of Harare . Located in the heart of the city, this terminus serves as a key point for buses and commuter omnibuses (kombis) that travel to various suburbs and outlying areas. It is especially known for services to high-density suburbs. The top surface area is flat and has a flexible pavement that is severely damaged. There is uneven surfacing. Signage and shelters are worn-out. Most of the stormwater catch pits are filled up with mud and solid waste.

7.2.7.8. Speke Avenue (Copa-Cabana) Bus Terminus

Situated in the heart of Harare's CBD, Copa Cabana is easily accessible and conveniently located near major commercial and retail establishments. The terminus serves as a departure and arrival point for suburbs or areas in the western parts of Harare. These vehicles connect passengers to various suburbs of Harare and other towns and cities across Zimbabwe. The

pavement is severely degraded. Bus stop shelters are worn out. Stormwater catchpits have been vandalized by traders who are using the terminus as their marketplace. The terminus has missing signage.

7.2.7.9. Rezende North Bus Terminus

It is a fairly small bus terminus mainly for areas northwest of Harare. Most of the stormwater catch pits are blocked due to solid waste that is being duped by vendors and overfilled skip bins. The pavement is in fairly good condition.

7.2.7.10. Charge Office Bus Terminus

The Charge Office bus terminus serves locals as drop off and pick point to their destinations within the city. The terminus used by many buses and commuter omnibuses. There is severely degraded pavement in parts of the rank. There were no catchpits identified; kerb gutters are serving the bus terminus. There is inadequate signage and waiting area for the passengers.

7.2.8. Stormwater Capacity Assessment

7.2.8.1. Flood prone area

7.2.8.2. Existing drainage system

7.2.9. Summary of Rehabilitation and Maintenance Works

7.2.9.1. Ministry of Transport – Department of Roads

The roads managed by the Ministry of Transport – Department of Roads are regional trunk roads and national highways. There are some state roads classified as secondary distributors that are overseen by the department. The government launched the Emergency Recovery and Reconstruction Project (ERRP) targeting about 50 000 kilometres of roads nationwide. The Ministry of Transport, Department of Roads rehabilitated nearly 150 kilometres of roads in Harare during the ERRP II. In 2024, a maintenance plan targeted about 320 kilometres of roads. In preparation for the SADC Summit 200 kilometres of road length was rehabilitated. Harare Drive, Nemakonde Road (previously Lomagundi) and Liberation Legacy Way (previously Second Street Extension) were dualized.

Other works done by the Ministry of Transport, Department of Roads are periodic maintenance divided into quarters. In the first and last quarter of the year reparative works include pothole patching, grass cutting, stormwater clearance, vegetation clearance, signage repairs and road marking. The maintenance team surveys main roads every week in search of faulty areas. Low levels of roads are surveyed biweekly and others monthly.

7.2.9.2. City of Harare Department of Works

In 2024, City of Harare maintained about 30km of roads. The extent of works included resurfacing of chip and spray for 9km, overlay resurfacing of 6km and other periodic maintenance on 14km in the forms of reconstruction, rehabilitation and roadside furniture replacement.

7.2.10. Summary of Issues

- i. The city has a total surfaced road length over 3900 km and stormwater drains spanning over 4000km.
- ii. The planning area is served by one airport, the RGM International, located 15 kilometres south of the city and serves as a primary gateway into Zimbabwe and a natural gateway into Southern Africa.
- iii. There are poorly constructed roads with inadequate crossfalls and poorly constructed drains.
- iv. Harare City sits in the Upper Manyame catchment which has moderately high rainfalls
- v. Southern Incorporated Areas were built in flood prone areas.
- vi. There is low maintenance work administered to rehabilitation of stormwater drains. Silt and litter has filled up the drains.
- vii. There is need to improve aviation infrastructure in line with international standards which will also drive economic growth.
- viii. Vandalism of transportation infrastructure components – ballast steel, components etc, electrified section and signalling system decommissioned owing to theft of copper.
- ix. Illegal mining activities on the railway servitude.
- x. Obsolete and aged equipment.
- xi. Encroachments into NRZ servitude affects implementation of projects.

7.2.11. Solid Waste Management Facilities

This section outlines the existing solid waste collection and management services particularly the current state of the existing plant, disposal facilities and estimated service requirements.

7.2.11.1. Solid Waste Management Overview

Harare City must operate in a healthy manner and coexist with its natural environment. Hence, it must legally comply with the legislations namely, the Urban Councils Act, Environment Management Act, Waste Management by law of 1979, Harare Anti-Litter By Law S. I 30 of 2016, S.I 6, S.I 7 and S.I 10. This enables preservation of natural environment and the health of the citizens. To achieve the necessary balance, waste must be stored and treated appropriately. Waste is generated and collected from 3 major land use classifications which are domestic, commercial and institutional. The waste undergoes a chain process including storage, collection, transportation, and finally disposal. In a survey by United Nations in 2021, Harare population generates about 0.56 kg per capita per day of solid waste. City of Harare estimated waste generation of 0.54 kg per capita per day in 2024. The city as whole produces a total of 798 tonnes/day. Only 26% of the municipal solid waste is collected per day and 2% is treated at the controlled facilities daily.

There is one operational solid waste facility, Pomona Dump Site. The facility is run by a partnership created between City of Harare and Geogenics BV (Netherlands). Another large dumpsite used for hazardous liquid and industrial waste was decommissioned for the Liberation City in Westlea. Currently, City of Harare is operating Chenesa 2. This clean-up

program targets to clear the city of waste in illegal spots and areas. The Pomona dumpsite will be used for the disposal.

7.2.11.2. Solid Waste Generation and Storage

Each property from the different land use classifications has some level of storage capacity. The storage facilities are emptied during collection. Public places in the city have litter bins along the streets to cater for the pedestrians and car users. Domestic properties mostly make use of refuse bags which may be contained in steel or plastic bins. It has become a common practice for the residents to leave the waste refuse bags in front of their housing units prior to or on the day of collection. Residents in flats or cluster units must take their trash to communal bins which maybe lidded bins or skip bins. However, only a few have such areas.

The commercial units use lidded bins, steel or plastic, of approximately 75 litres for storage. Farmer and local markets make use of skip bins. A portion of the properties is designated to allow for storage and access for the trucks. Industrial waste is stored in either lidded bins or skip bins.

City of Harare also manages street cleaning. The main area of focus has been the CBD due to the high traffic of people. There are many business activities that take place in the heart of the city, both legal and illegal. Street sweeping is being done manually by the municipal staff. The staff is equipped with personal protective gear, brooms, trash pans and bin trollies. Municipal street cleaners offload their gathered waste into the skip bins strategically located in the city. These bins are inadequate compared to the rate of waste generated and widely spaced.

Currently, the city centre has been cluttered with vendors in walkways, parking bays, street corners, ranks and open areas that are secured. Some businesses are housed in buildings that do not provide adequate sanitation for the practice. These vendors and business operators stuff their waste in stormwater catchpits. Others offload into the litterbins with inadequate capacity for their trash volumes. The litterbins are not well distributed in the city.

7.2.11.3. Solid Waste Characteristics

The solid waste is collected from different land uses and transported to the dumpsites. Medical waste, industrial waste and household waste are collected, treated and stored differently. This section covers mostly what was found in household and dumpsites. The United Nations Habitat 2021 Survey estimated about 559 tons/day of household waste and 240 tons/day of non-household. Most of the household waste is organic matter generation (see figure 7.137). The waste reaching the dumpsite is inclusive of more land uses.

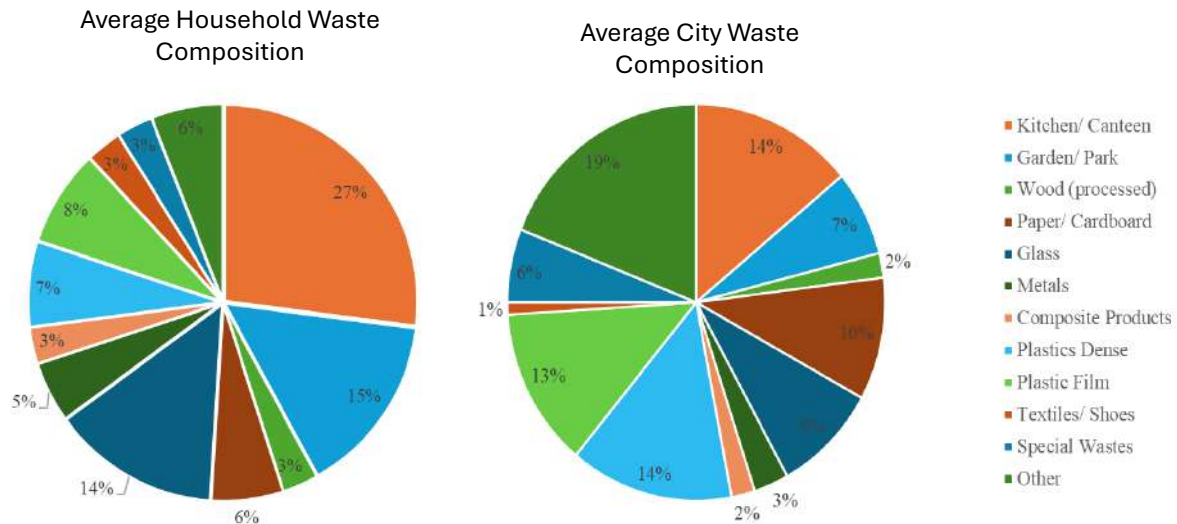


Figure 7.138: Solid Waste Profile for Harare City

7.2.11.4. Solid Waste Collection and Transportation

Waste is collected from different land use properties and delivered to the appropriate dumpsite for treatment. Waste is collected weekly from domestic and industrial properties. The Central Business District and hotels are serviced daily. Shopping centres have their waste collected three times a week. Medical waste removal from hospitals and clinics is not currently being done by the municipality. Collection and transportation of agricultural and garden waste are not currently within the waste management scope. However, the municipality hopes to provide this service in the future.



Figure 7.139: Waste Collection Services in the City

City of Harare has estimated efficiency of 32.4% of waste collection. The average waste collected is nearly 8 900 tonnes/month. The proportions of the waste collected from different sources is shown in the graph. Harare City makes use of refuse compactors, skip trucks, tractors, hook loaders, front end loaders and tipper trucks for collection and transportation. Authorized commercial waste collectors also operate within the city. The collected waste from domestic, commercial and institutional waste is discarded at the Pomona Dumpsite. The commercial waste collectors are permitted to use the municipal dumpsites if the necessary fees are paid.

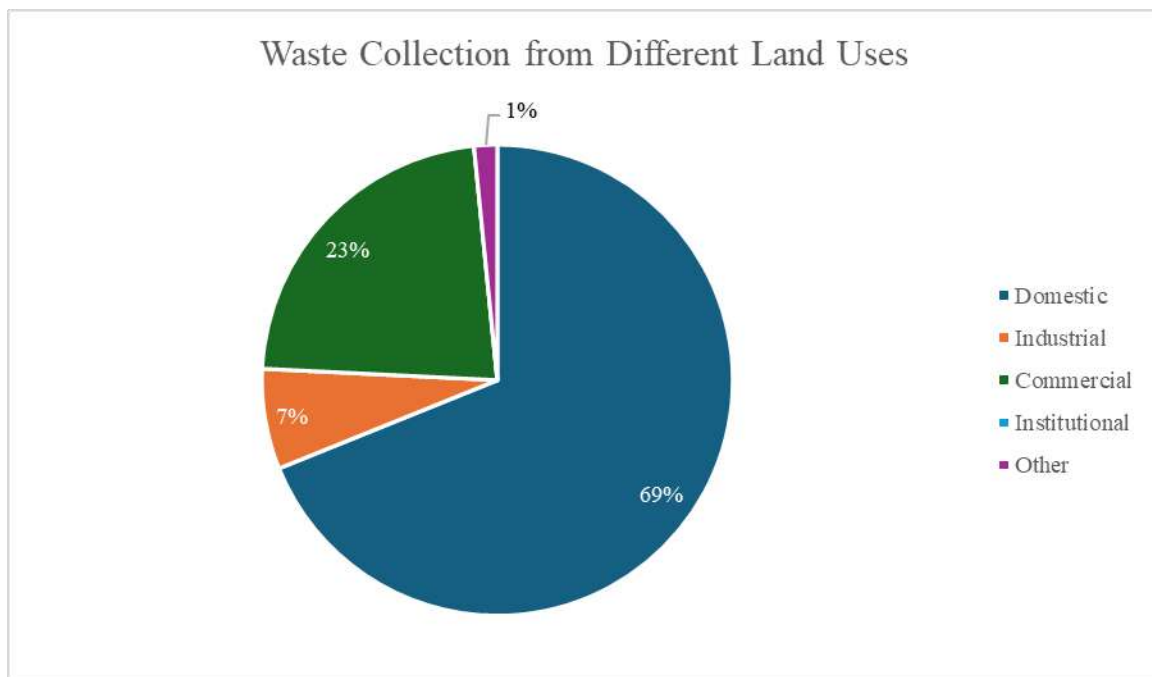


Figure 7.140: Waste Collection from Different Land Uses

Some dubious commercial providers of this service illegally dump waste in open spaces or city outskirts. Harare residents are also guilty of this within their neighbour hoods. Cases of illegal dumping along the perimeter of the dumpsites has been observed at the Golden Quarry Dumpsite. Harare City Council, at its expense, must clean up these areas and transport the waste to the official dumpsite. Upon collection the waste is taken up as combined masses without waste. A significant number of commercial areas have no sanitary lanes hence refuse trucks compete for space with delivery trucks. Also, the service lanes are not luminated hence, night collection becomes difficult. Property owners set up service lane gates. However, half of them are not manned. The refuse management team faces challenges with no defined routes for transportation in both the CBD and residential areas to the disposal site. There are no waste transfer stations where waste can be offloaded from certain suburbs and then transported to the disposal site using a large truck, preferably a 30-ton. An ideal placement of such would be a station in Highfield to cater for Highfield, Glen Norah, Glen View and Budiriro. The study established that household solid waste collection frequency is high in the low-density areas than high density areas. The majority of households solid waste is never collected across the city, the same is for industrial properties (Figure 7.141 and Figure 7.142).

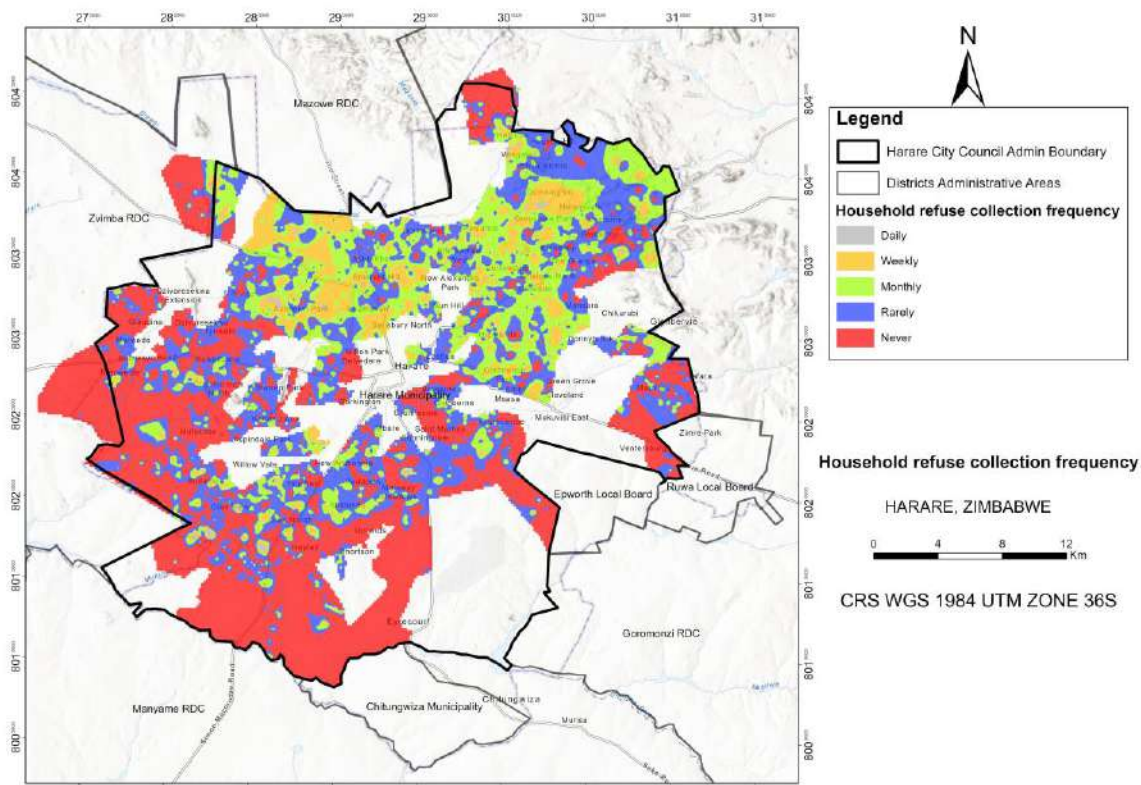


Figure 7.141: Household solid waste collection frequency

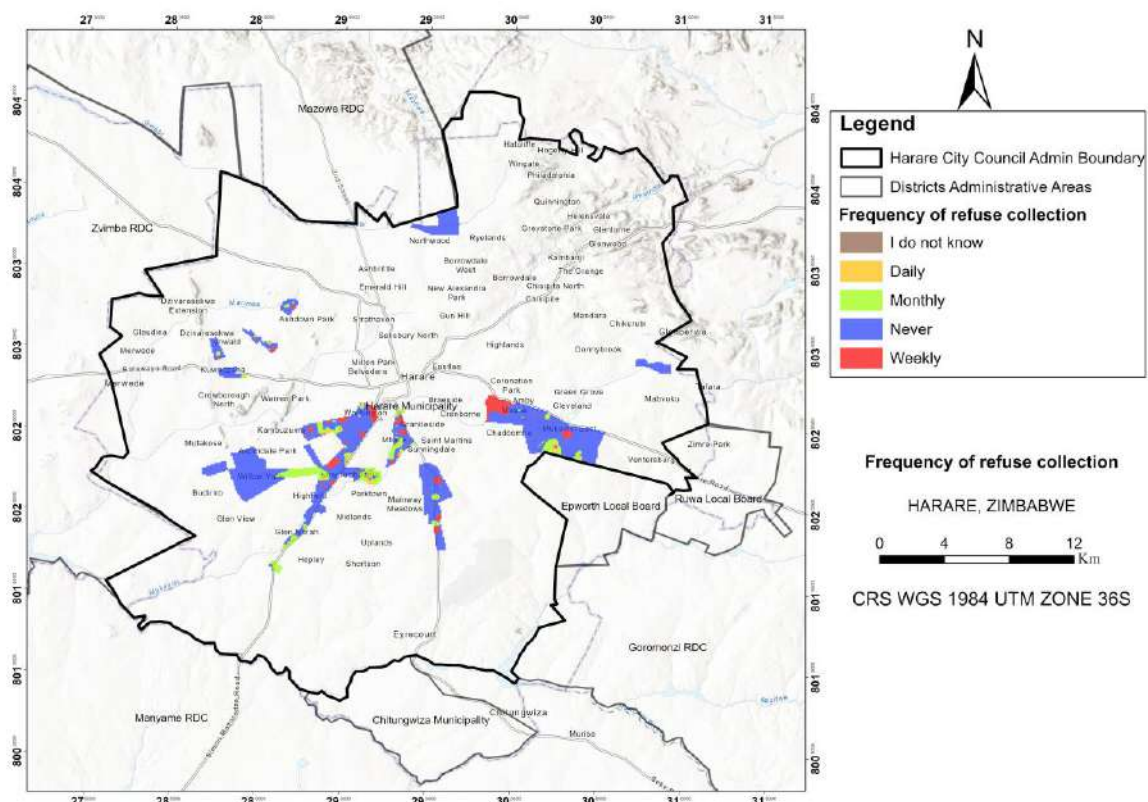


Figure 7.142: Industrial solid waste collection frequency

7.2.11.5. Solid Waste Treatment and Disposal Facilities

There were two dumpsites used to service the city. The Pomona Dumpsite was rehabilitated and commissioned in 2022. However, the Golden Quarry dumpsite in Westlea was decommissioned and rezoned for the Liberation City. The City of Harare still waits for land to be allocated in replacement of this dumpsite by the Ministry of Local Government, Public Works and National Housing. In 2024, less than 20% of the waste collected was recycled.

7.2.11.5.1. Solid Waste Treatment

Medical waste undergoes treatment before disposal. The waste is burnt to ashes or a certain extent in the incinerators to disinfect it before disposal at the dump site. The municipal incinerator located in Graniteside broke down. Incineration has been localised to most general clinics and hospitals. Pomona Dumpsite has a sorting facility to separate bulky objects and recyclable material from the rest of the mass. This sorting process will also sort the remanent waste into classes of combustible and incombustible matter. The unrecyclable and incombustible waste will be transported to the landfills. Previously, industrial and liquid waste was dumped at the Golden Quarry. There was no treatment of the waste. The waste would collect in a deep pool.

7.2.11.5.2. Geo Pomona Waste Management Facility

Geo Pomona Dumpsite is approximately 100Ha in size. The dumpsite was established in 1985 as a landfill. The area was previously used as a brick moulding site leaving massively excavated land. The dumpsite is mainly used for household waste. In the previous years, the dumpsite was mismanaged by various stakeholders and there was no oversight. This resulted in recurring fire outbreaks from methane gas build-up in the landfill. Air in the area was heavily polluted affecting residents.

The waste management facility was rehabilitated and commissioned in 2022. This facility is now run by a partnership created between City of Harare and Geogenics BV (Netherlands). These restorative works included land clearing, land zoning for ongoing waste disposal, construction of access roads, electrification, lighting, fencing, guard rooms and access gates. Waste accumulated over the 20 years of mismanagement is being encapsulated with layers of geomembrane and geotextile. A protective layer of soil is to be added on top and finished off with vegetative cover such as lawns and bushes. An area of 15 hectares was allocated for this approach.

Management of the waste brought to the site starts with weighing the vehicles on entry and on exit. A digital data capturing system is used to monitor the vehicles. The waste disposed undergoes sorting manually and mechanically. Waste is separated into sets of bulky objects, recyclable matter and materials with enough calorific power for the Waste to Energy Plant. Reusable material is sourced to the recycling companies. The remanent waste is confined into landfills.

The Geo Pomona Waste Management is constructing 3 dumping cells, engineered landfills, complying with local legislation enforced by EMA, the City of Harare and the Ministry of Health. These three cells were allocated for different purposes namely, municipal solid waste, ash from the Waste to Energy Plant and hazardous waste. The municipal waste filled into the cells will be mainly organic matter.

The cell for deposition of hazardous waste was lined with clay, geomembrane and geotextile. A drainage system, monitored by piezometers, was installed for conveying the leachate to a water treatment plant. This protects the river tributaries flowing near the properties. The rest of the cells are still under construction.

The landfills are filled by spreading and compacting a layer of solid waste over the space. Compaction reduces air pockets within the matter and prevents storage of methane gas which causes continuous fires. A confining layer of soil is compacted on top to cover the consolidated solid waste. Hence, the landfills are filled with these alternating layers.

7.2.11.5.3. Golden Quarry Waste Management Facility

This facility was in Westlea and covered 30 hectares of land. It was previously a gold mine trenched up to 30 meters. The gold quarry transformed into an industrial and hazardous waste dumpsite. Waste was disposed in the pool and left uncovered. Unfortunately, the facility was poorly managed during its 40 years of operation. Aquifers in the surrounding areas become contaminated. Hence properties in Westlea, Meyrick Park and Ashdown Park have tainted water in boreholes and wells. Local authorities have outlawed drilling of boreholes and excavation of wells in these areas.

Recently the facility was repurposed for construction of Liberation City, which will have an African museum, a hotel and other recreational features. Geo Pomona Management was appointed to reclaim land. This relieved the residents as they were heavily affected by the dumpsite especially during rainy seasons. Sadly, some residents illegally dump waste at the foot of the hill along Golden Quarry Road. City of Harare noted cases illegal dumping liquid waste within the sewer lines. Some of the previous users of the dumpsite are suspected to be responsible.

7.2.11.5.4. Proposed Disposal Facilities

The City of Harare waits for land allocation in replacement of the Golden Quarry Dumpsite from Ministry of Local Government, Public Works and National Housing. The location of the dumpsite is crucial since it must meet the Environmental Management Agency (EMA) requirements. Also, the site must not be near any airport, aerodrome and airbases. There were no sites found within the Harare City borders that could be used a dumpsite. A suitable piece of land was identified in Whitecliff, Zvimba. The proposal was submitted and is pending for approval.

7.2.11.5.5. Level of Service Assessment

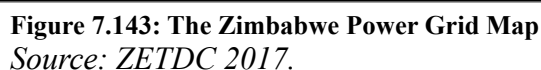
The rate of waste generated by the city is higher than the rate of waste collected by the municipality services. This is evidenced by the overfilled bins at vegetable markets, municipal shopping centres and the bus termini. Citizens of the city notoriously dump waste in open lands and open channel drains. This contributes to the city's problematic stormwater conveyance and polluted rivers. There are cases whereby industrial waste is disposed of in the manholes of existing sewer reticulation system during late hours of the day. These liquids have a high pH which in turn affects the existing technology at the treatment plants. Such liquids require pretreatment to reduce pH, removal of toxic compounds and high organic compounds before being disposed into such systems.

7.2.11.6. Summary of Issues

1. There is no separation of waste from source. Residents and companies need to participate in separating waste for better waste disposal.
2. Distribution of litter bins is low in the city centre and not emptied frequently.
3. Waste collection within residential properties is man handled by staff who empty refuse bags in the truck and return them to residents.
4. Waste collection equipment has been burdened by the current densification drive in areas such as Greendale, Waterfalls and Mt Pleasant.
5. Street cleaning entirely manual in the CBD and takes more time.
6. There is no provision for collecting and incinerating or disposing of dead animals.
7. Most commercial and industrial properties have poorly or no designated bin areas with a sanitary lane for an 8-tonne refuse collection vehicle. The sprouting malls in the CBD have become a major challenge.
8. Additional offloading bins and better bin placements are required for convenience of city street sweepers with the CBD, Mbare and outlying shopping centres. The current locations were in open spaces found in bus termini.
9. Flats and cluster home communities rarely have bin areas. This area should be critical on the site layouts and accessible to the refuse collection vehicles.
10. Farmers and trading markets have low storage capacity of bins allocated and aren't frequently emptied.
11. There are no waste transfer stations for waste to be emptied from smaller vehicle to larger vehicles. These stations would improve regularity, collection routes and coverage of waste collection services.
12. A large portion of the waste is organic. There are no treatment facilities such as biogas plants or composting centres which can source compost or fertilizers to agricultural farms, landscapers and gardeners.
13. Additional landfill is required for industrial waste and treatment plants for the liquid waste.
14. There is no functional municipal incinerator for the City of Harare. It needs to be rehabilitated.
15. Industrial waste is being notoriously emptied into the sewer reticulation lines.

7.2.12.1. Current Energy Landscape and Challenges

As depicted in the NDS1-2 and Vision 2030, the quality of infrastructure in an economy is a measure of the quality of life of the citizens in a country and has an important bearing on sustainable long-term economic growth. Electricity is a key pillar and central to such issues as economic growth, food production, climate change and preservation of ecosystems. The deterioration of the electricity infrastructure incapacitated ZESA Holdings from delivering on its mandate of providing electricity to the nation.



The Harare Metropolitan Area is mainly supplied via National Grid of Zimbabwe. The old thermal power station is now not reliable or viable due to ageing, environmental issues and bloated costs of production. Zimbabwe's electricity access rate stands at 62%, with Harare Metropolitan facing acute power shortages, frequent load shedding, and aging infrastructure. The energy mix is dominated by coal (57%) and hydropower (40%), leaving renewables at just 3%. Key challenges include facing the National Grid, hence impacting on Harare's Energy Supply are:

- Aging Infrastructure: Outdated transmission networks and substations, particularly in Harare, lack redundancy, causing instability.
- Climate Vulnerability: Droughts reduce hydropower output (e.g., Kariba Dam), exacerbating energy deficits.
- Financial Constraints: Non-cost-reflective tariffs, limited green financing, and ZESA Holdings' operational inefficiencies hinder investment.
- Supply-Demand Gap: Installed capacity (2,220 MW) lags demand (1,800 MW), with dependable capacity at 1,200 MW. Peak demand is projected to reach 5,410 MW by 2035.

7.2.12.2. Harare Metropolitan 132kV Primary Network

The Harare Metropolitan 132kV Primary Network enters the region from a westerly direction. Figure 7.141 shows a schematic distribution of the network.

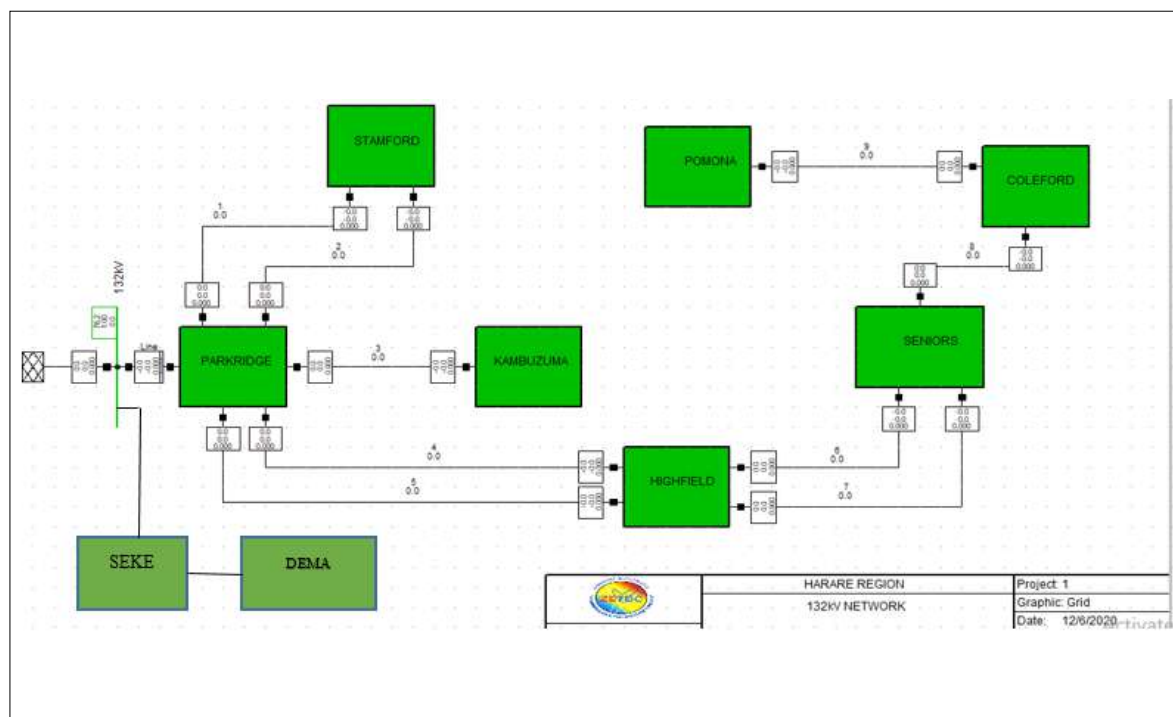


Figure 7.144: Harare region 132kv network

7.2.12.3. Harare Electricity Region Metrics

The Harare region network metrics are summarised below:

- The Region Maximum Demand-is 540MW.
- NUMBER OF 132/33kV SUBSTATIONS – 8
- INSTALLED CAPACITY – 836MVA

- **132kV SUBSTATION MDS, MVA**
- COLEFORD – 80
- POMONA – 62
- SENIORS - 74
- HIGHFIELD – 110
- PARKRIDGE – 70
- STAMFORD - 52
- KAMBUZUMA - 42
- SEKE - 53
- **CITY INTAKE 330/33kV BULK, MD-166MVA**

Figure 7.142 illustrates the Harare Region 132 and 33kV Network, representing the electrical grid for the region with a total load of 377 MW.

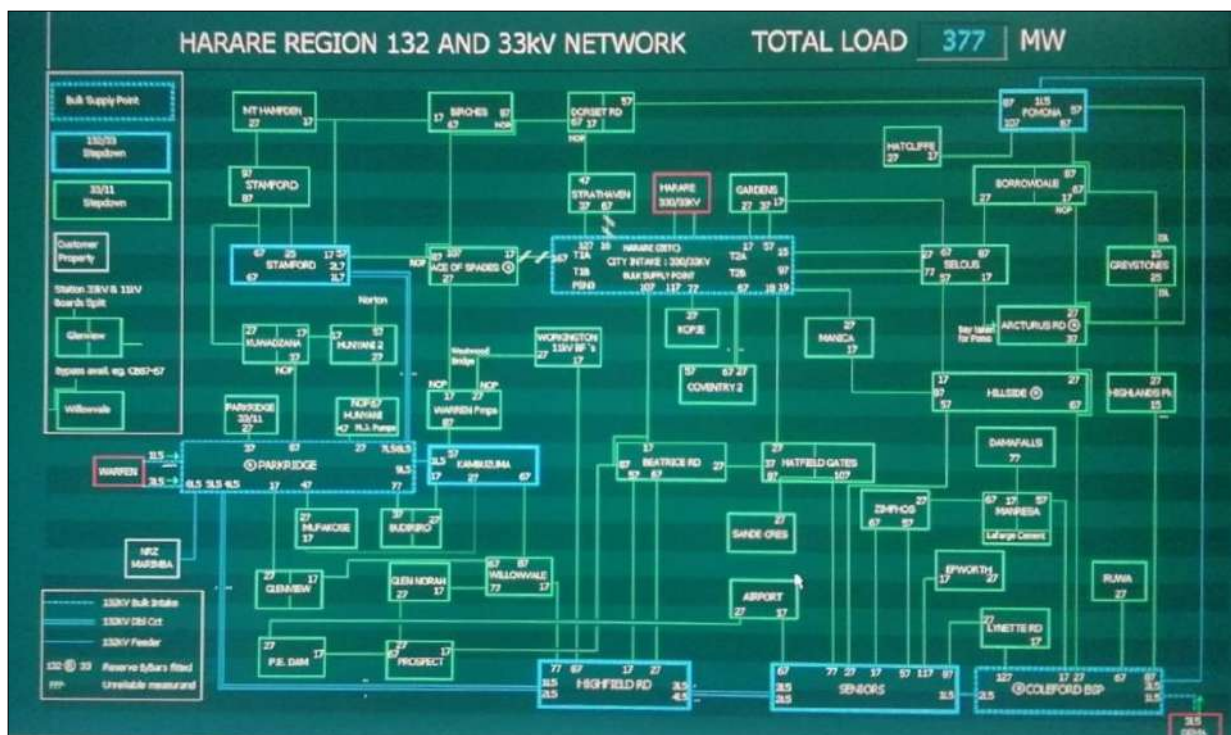


Figure 7.145: Harare region 132kv and 33kv network

The key components and their interrelations within the network:

- Bulk Supply Points 132/33 Stepdown: These transformers reduce the voltage from 132kV to 33kV to make it more manageable for distribution. These are the primary entry points for high-voltage power into the network.
- The Harare Region electrical network is a complex system designed to distribute power efficiently from high-voltage entry points down to local distribution levels. Each component, from bulk supply points to local substations, plays a critical role in stepping down voltage and ensuring stable power delivery. The network is designed with redundancy and monitoring to handle load variations and maintain reliability.

Multiple distribution points that supply power to critical urban, industrial, and residential

zones anchor Harare's electrical grid. These distribution points are supported by substations with varying capacities and configurations, ensuring redundancy and reliability.

Table 7.142: Substations supplying Harare City

Distribution Point	Substation	Installed Capacity (MVA)		Y	X
City Intake 330/33	Aces	30	2x15	17.817	30.99967
	Beatrice	50	2x25	17.8736	31.01775
	Borrowdale	32	2x16	31.0881	31.0881
	Coventry	50	2x25	17.8465	31.03312
	Gardens	41	1x25x,1x16	17.826	31.0464
	Kopje	20	1x20	17.8389	31.0395
	Manica	32	2x16	17.8287	31.05596
	Selous	30	2x15	17.8207	31.06272
	Strathaven	30	2x15	17.7947	31.02102
City Intake 330/33	Total	300		17.8434	31.0301
Coleford 132/33	Arcturus	16	2x8	17.7976	31.09874
	Coleford	32	2x16	17.8076	31.14215
	Highlands Park	24	1x16+1x8	17.7518	31.14913
	Lynette	32	2x15/25	17.8408	31.11304
	Manresa	32	2x9.6/16	17.82	31.19595
	Ruwa	32	2x16	17.896	31.23683
	Damo falls	40	2x20	17.8561	31.2427
	Total	90	2x35/45	17.8076	31.14215
Highfield 132/33	Glen Norah	40	2x20	17.9149	30.97061
	Highfield	32	2x16	17.8735	31.00936
	Pe Dam	20	1x20	17.9764	31.06035
	Prospect	32	2x9.6/16	17.903	31.03008
	Willowvale	63	2x25/31.5	17.8903	30.96702
	Workington	32	2x16	17.8547	30.99722
	Total	180	2x60/90	17.8735	31.00936
Kambuzuma 132/33	Glen Norah	32	2x20	17.9149	30.97061
	Kambuzuma	20	1x20	17.8533	30.95652
	Mufakose	40	2x20	17.8691	30.91449
	Warren Pumps 33/11kV	12	1x4+1x8	17.8382	30.98522
Kambuzuma 132/33	Total	90	2x45	17.8533	30.95652
Pomona 132/33	Birches	32	2x16	17.7701	31.00199
	Dorset	30	2x15	17.7794	31.03847
	New Greystone	20	1x20	17.7478	31.11391
	Hatcliff	20	1x20	17.8711	31.0645
	Pomona	32	2x16	17.7485	31.08511
	Total	90	2x45	17.7485	31.08511
Seniors 132/33	Airport	32	2x16	17.8576	31.09294
	Epworth	20	1x20	17.9003	31.14205
	Sande Crescent	16	1x16	17.8638	31.04623
	Hatgates	32	2x16	17.8711	31.0645
	Hillside	25	1x15+1x10	17.8256	31.09684
	Seniors	32	2x16	17.8576	31.09294
Seniors 132/33	Total	135	1x90+1x31.5/45	17.8576	31.09294
Stamford 132/33	Birches	32	2x16	17.7826	30.94069
	Kuwadzana	32	2x16	17.8188	30.91708
	Mabelreign	16		17.7913	30.99842
	Mount Hampden	16	1x16	17.7491	30.93745
	Stamford	16	1x16	17.7826	30.94069
Stamford 132/33	Total	135	1x90+1x45	17.7826	30.94069
Parkridge 132/33	Budiriro	32	2x16	17.8917	30.92519
	Glenview	32	2x16	17.9164	30.94204
	Hunyani Port 33/11kv	5	1x5	17.8771	30.76893
	Parkridge	40	2x20	17.8539	30.897

Source: ZESA Holdings

7.2.12.4. Key Distribution Points and Substations

ZESA has constrained local generation due to aged infrastructure. While ZESA has installed capacity of 2220MW, the dependable capacity is 1200MW against a demand of 1800MW.

Some of the reasons for this energy deficit are due to:

- (i) Undercapitalization due to a non-cost reflective tariff
 - ZESA is incapacitated to undertake network expansion projects.
 - Furthermore, the Utility is sitting on a huge backlog in new connections and citizens must wait for long periods before being connected. 320 thousand Housing units have been built but are not connected to the grid because of absence of backbone infrastructure.
 - The Utility has dilapidated infrastructure resulting in incessant faults. Power Stations are behaving erratically because of the undercapitalization.
- (ii) Poor working capital leading to inability to maintain existing aging and dilapidated infrastructure. There are shortages in operational vehicles, materials, tools and equipment and strategic spares. The shortages lead to operational inefficiencies exhibiting themselves as faults and unreliable power supply.

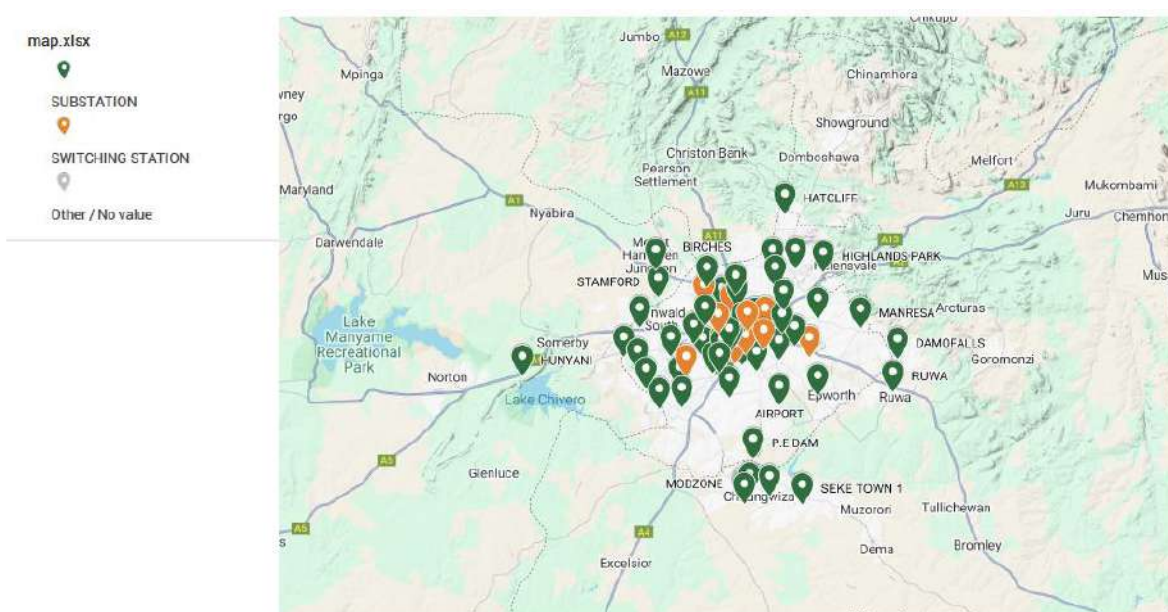


Figure 7.146: Harare Region Substation and Switching Stations

Specific details are presented hereunder:

i. City Intake 330/33 kV (Total Capacity: 300 MVA)

Substations:

- Beatrice (50 MVA, 2x25 MVA) and Coventry (50 MVA, 2x25 MVA): Highest capacity substations, critical for industrial and high-density zones.
- Gardens (41 MVA, 1x25+1x16 MVA): Unique hybrid configuration, balancing flexibility and capacity.
- Kopje (20 MVA, 1x20 MVA): Single transformer substation; a potential reliability risk.

Geographical Spread: Clustered in central Harare (latitudes 17.7947–17.8736, longitudes 30.99967–31.06272), indicating dense urban coverage.

ii. Highfield 132/33 (Total Capacity: 180 MVA)

Substations:

- Willowvale (63 MVA, 2x25/31.5 MVA): Largest capacity in the 132/33 category, serving mixed-use zones.
- Glen Norah (40 MVA, 2x20 MVA) and Prospect (32 MVA, 2x9.6/16 MVA): Support expanding residential areas.

Geographical Spread: Covers southern and western regions (latitudes 17.7518–17.9764), critical for suburban growth.

iii. Coleford 132/33 (Total Capacity: 90 MVA)

Substations:

- Damo Falls (40 MVA, 2x20 MVA): High-capacity node for northern industrial corridors.
- Arcturus (16 MVA, 2x8 MVA): Smaller substation serving localized demand.

Geographical Spread: Northern and north-eastern zones (latitudes 17.7518–17.896).

iv. Kambuzuma 132/33 (Total Capacity: 90 MVA)

Substations

- Mufakose (40 MVA, 2x20 MVA): Supports residential expansion in northwest Harare.
- Warren Pumps (12 MVA, 1x4+1x8 MVA): Critical for water infrastructure but undersized.

Geographical Spread: North-western clusters (latitudes 17.8382–17.9149).

v. Pomona 132/33

Substations:

- Birches (32 MVA, 2x16 MVA): Primary substation for eastern suburbs.
- New Greystone (20 MVA, 1x20 MVA): Single transformer configuration; requires redundancy.

There is a general shortage of power in the country mainly driven by the following factors:

- Constrained local generation due to aged infrastructure
- Undercapitalization due to a non-cost reflective tariff
- Poor working capital
- Insufficient foreign currency leading to incapacitation to import power

ZESA has constrained local generation due to aged infrastructure. While ZESA has installed capacity of 2220MW, the dependable capacity is 1200MW against a demand of 1800MW.

Some of the reasons for this energy deficit are due to:

(iii) Undercapitalization due to a non-cost reflective tariff

- ZESA is incapacitated to undertake network expansion projects.
- Furthermore, the Utility is sitting on a huge backlog in new connections and citizens must wait for long periods before being connected. 320 thousand Housing units have been built but are not connected to the grid because of absence of backbone infrastructure.
- The Utility has dilapidated infrastructure resulting in incessant faults. Power Stations are behaving erratically because of the undercapitalization.

(iv) Poor working capital leading to inability to maintain existing aging and dilapidated infrastructure. There are shortages in operational vehicles, materials, tools and equipment and strategic spares. The shortages lead to operational inefficiencies exhibiting themselves as faults and unreliable power supply.

7.2.12.5. Infrastructure Strengths and Challenges

7.2.12.5.1. Strengths

- Redundant configurations (e.g., 2x25 MVA transformers) ensure reliability in high demand zones.
- Strategic geographical distribution covers urban cores and emerging suburbs.
- Total installed capacity aligns with current demand projections.

7.2.12.5.2. Challenges

- Single Transformer Substations: Kopje (20 MVA), New Greystone (20 MVA), and Pe Dam (20 MVA) lack redundancy, posing outage risks.
- Capacity Imbalances: Highfield (180 MVA) and City Intake (300 MVA) dominate capacity, while Coleford and Kambuzuma (90 MVA each) may lag future growth.
- Aging Infrastructure: Hybrid configurations (e.g., 1x25+1x16 MVA) complicate maintenance and scalability.

7.2.12.6. Future Projections

By 2030, Harare's demand is projected to grow by 40%. The master plan must:

- Phase out hybrid configurations in favour of modular, scalable designs.
- Align infrastructure upgrades with urban expansion corridors (e.g., northwest Mufakose, eastern Pomona).

7.2.12.7. Adequacy of Power Supply

The study established that the dominant users are Residential Users (77%), Business/Industrial Users (12%), Government Entities (4%), NGOs/Civil Society (4%) respectively.

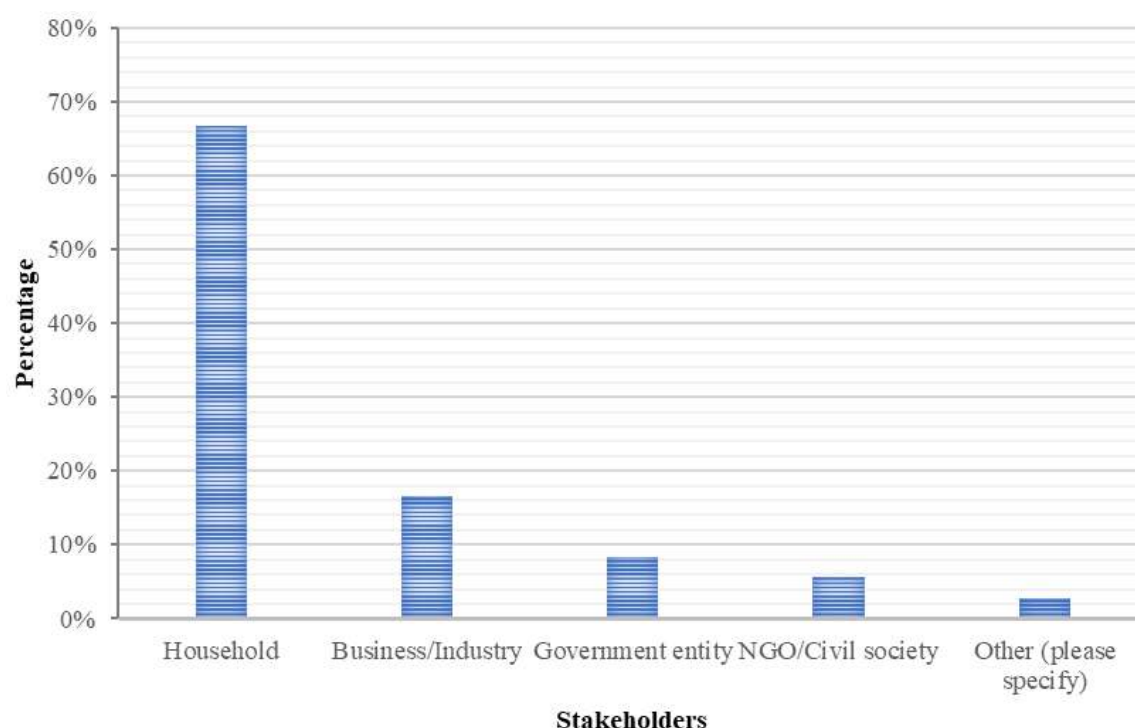


Figure 7.147: Power consumers in Harare

The study established that power supply is inadequate for all users i.e. Residential Use, Business/Industrial Use, Government Entities, NGOs/Civil Society in the city. 54,2% report that their power supply is very inadequate, whereas only 2.6% report that their power supply is very adequate. The main causes of power supply gaps include Load shedding (80.65%)

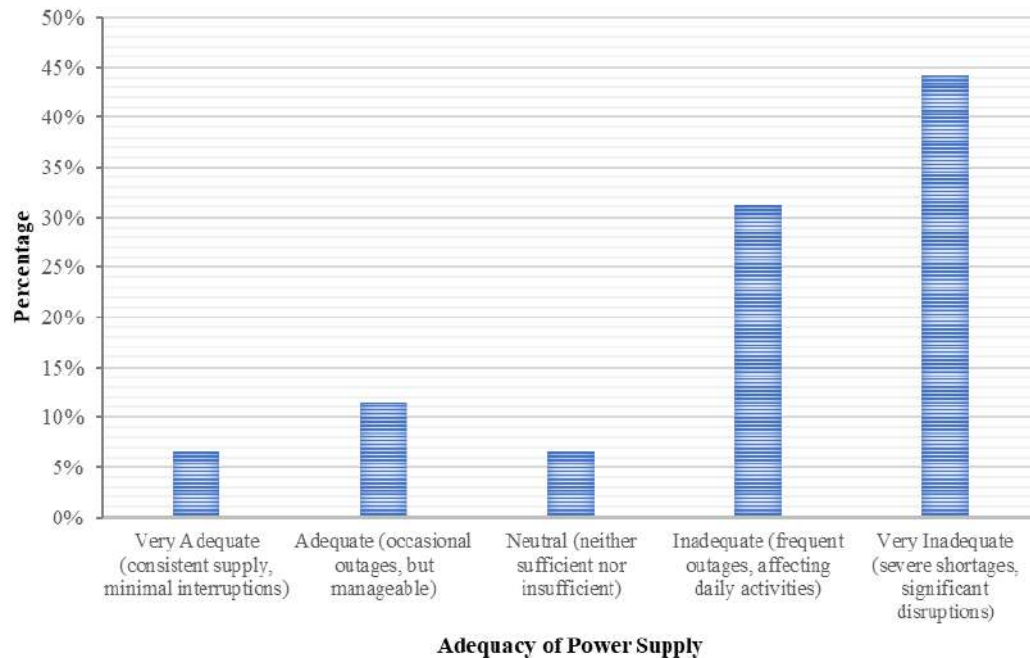


Figure 7.148: Adequacy of Power Supply in Harare

77.8% of the respondents noted that they received more than 6 hours of power outages per day which is alarming.

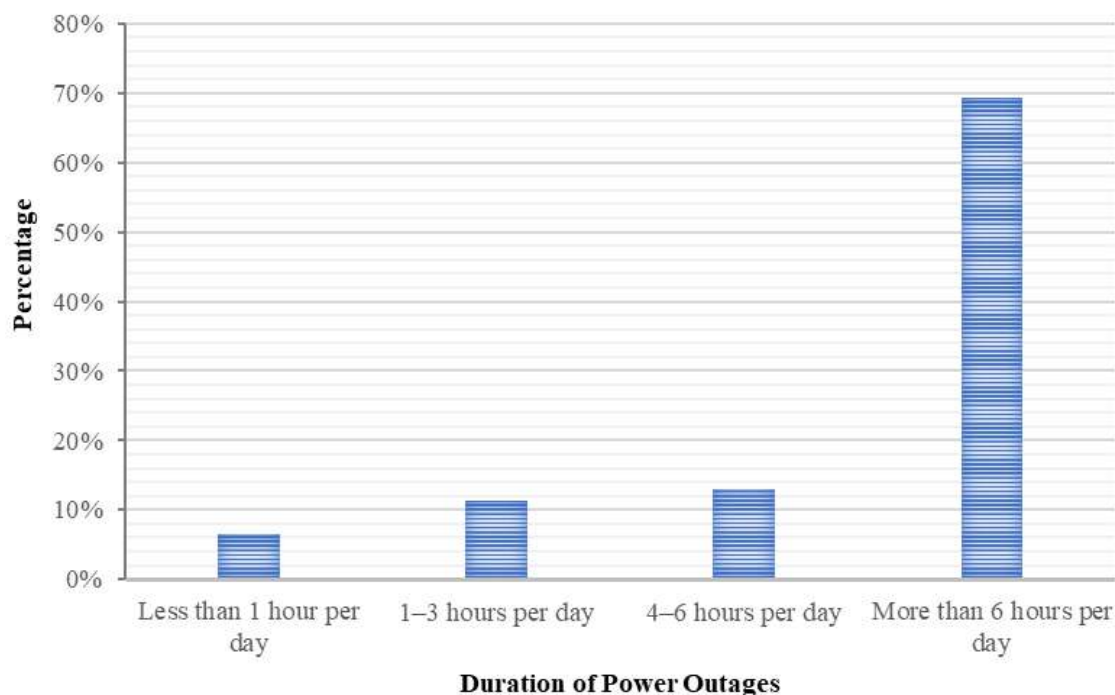


Figure 7.149: The average duration of power outages in their area

80.6% of the respondents noted that power outages affected their daily activities and business operations severely and minimal disruption and no disruption was noted by 0% of the respondents.

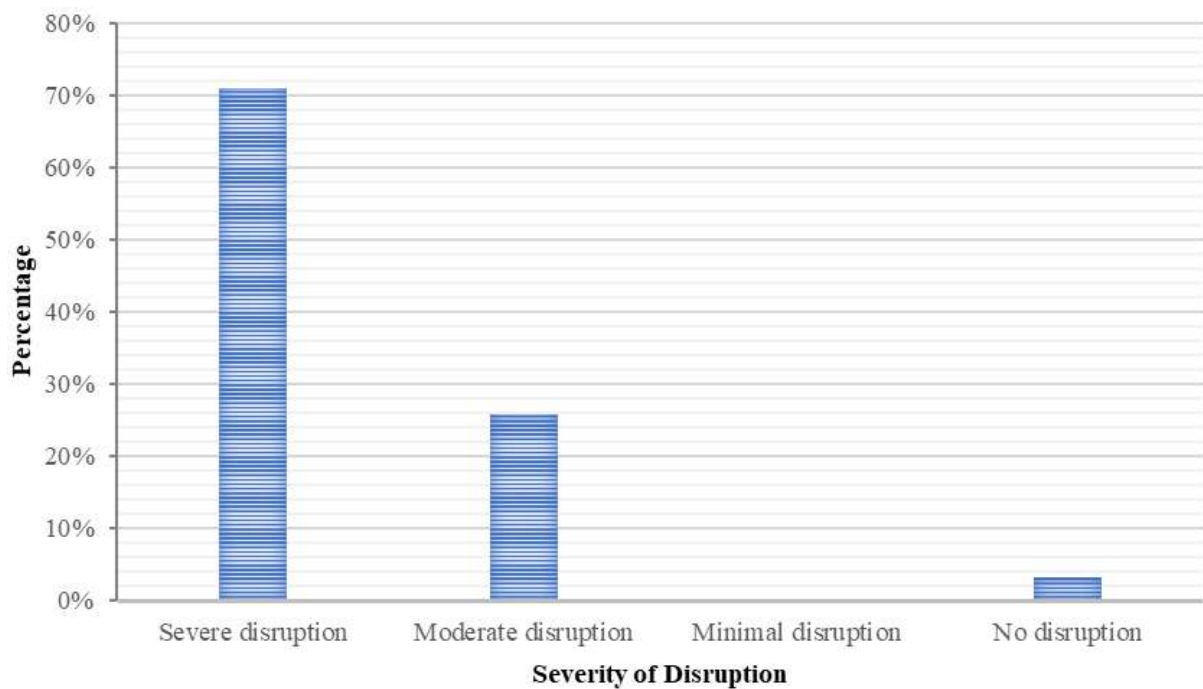


Figure 7.150: Impact of power outages on daily activities and business operations

Hydro and solar sources of energy are primary sources of energy used in Harare.

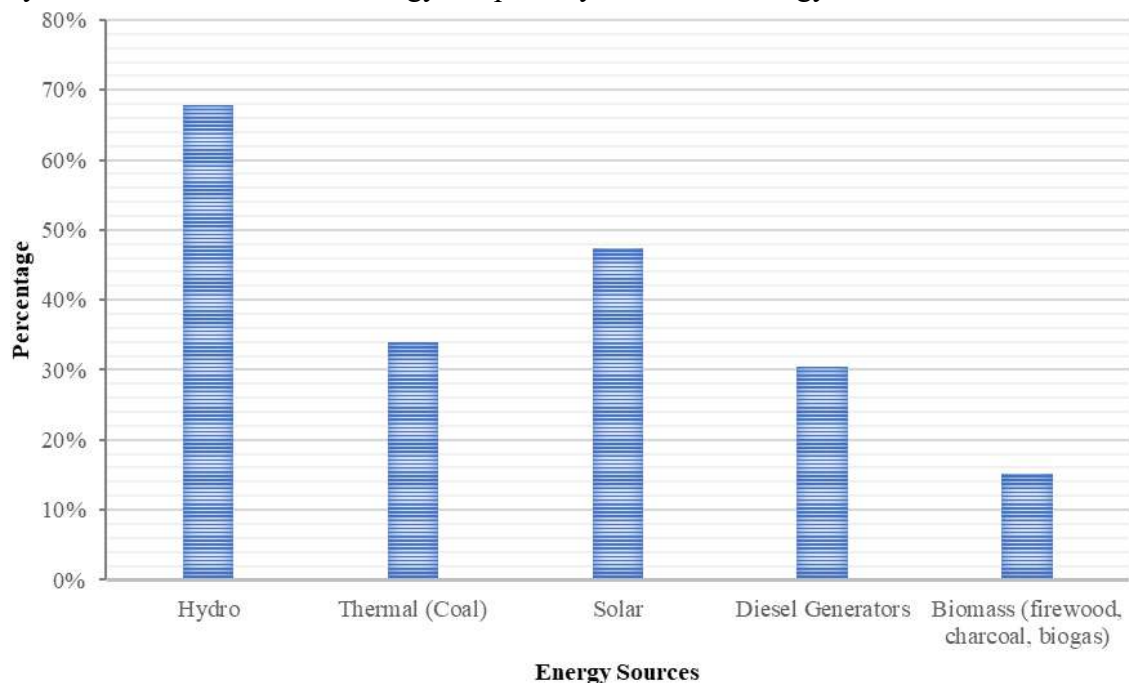


Figure 7.151: Primary Sources of energy used in their area

82% of the respondents experience fluctuations in power quality (e.g., voltage instability, surges, and frequent blackouts) which indicates that the power and distribution system is not

performing well. 97% of the respondents noted that they are willing to transition to cleaner and more sustainable energy sources. 84% of respondents noted that there is a high initial cost of solar and renewable energy systems, 25% inadequate infrastructure support, 21% limited knowledge and awareness and 9% lack of government incentives which acts as a barrier to adoption of green energy sources.

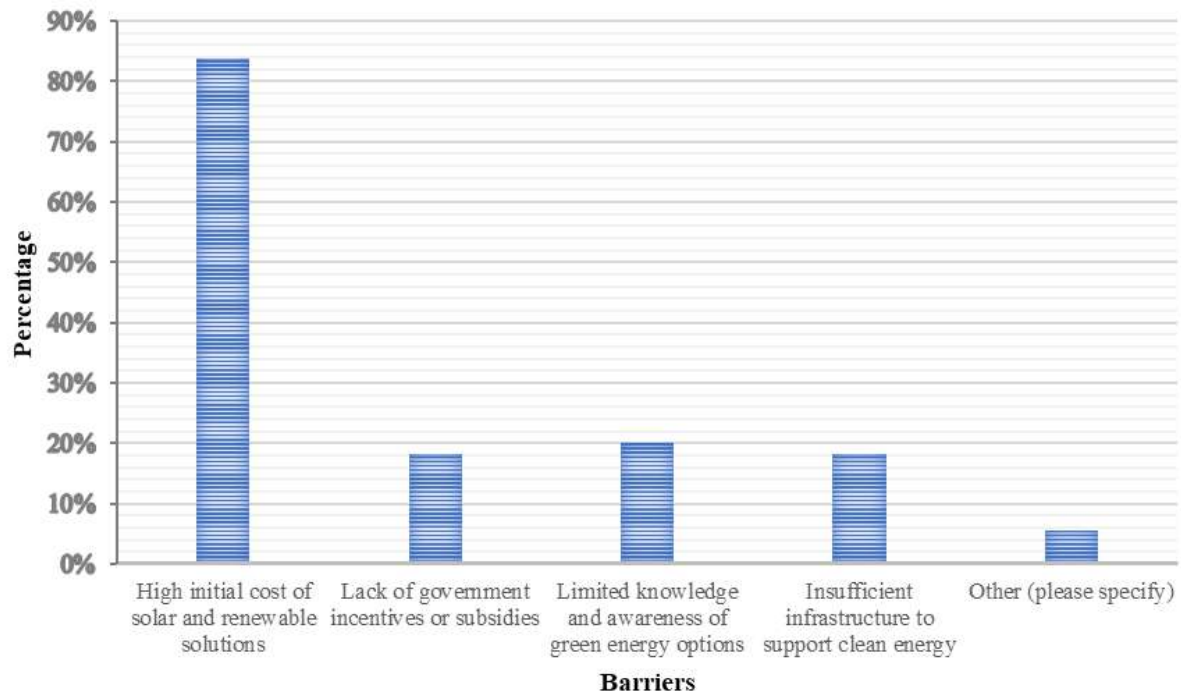


Figure 7.152: Barriers that prevent the adoption of green energy

81% of respondents suggests subsidies for solar and other renewable energy technologies as key policy enablers to transition to cleaner energy.

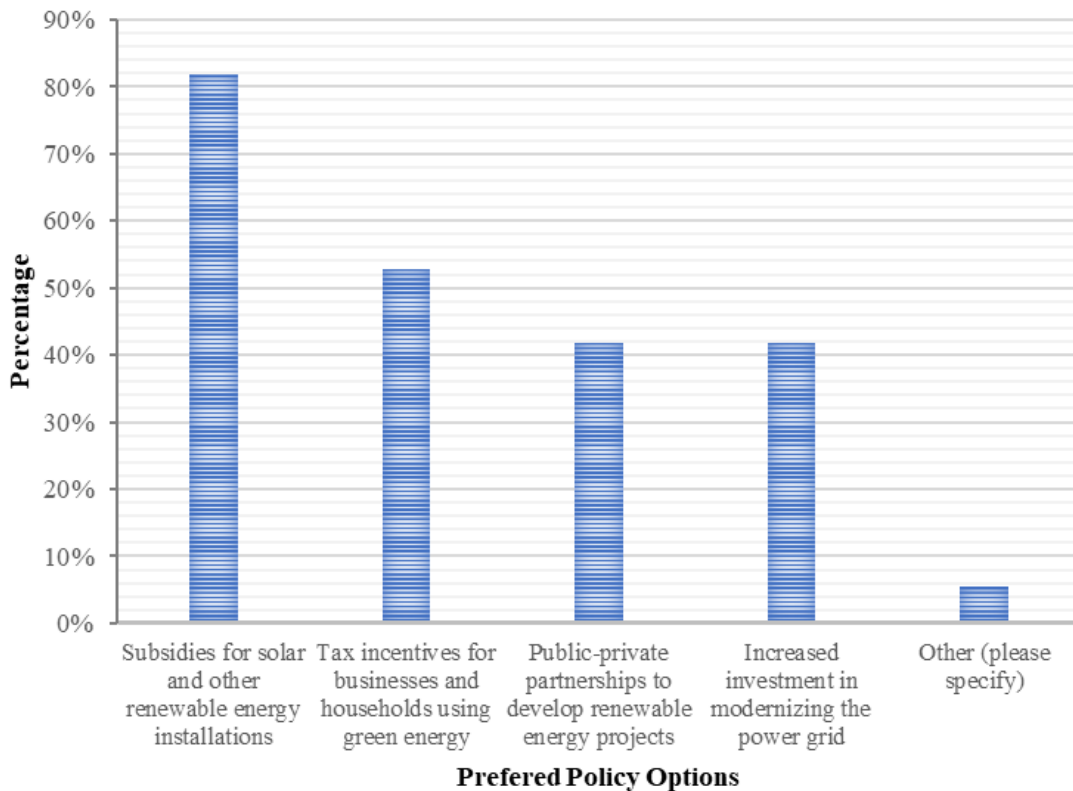


Figure 7.153: Policy solutions to improve energy supply and distribution

75% of the respondents report that there is a need to invest in renewable energy 50% of the respondents also report that there is a need to upgrade existing infrastructure and create decentralized energy systems. 67% (majority) of the respondents feel that the Private Sector has as major role to play in energy supply and distribution.

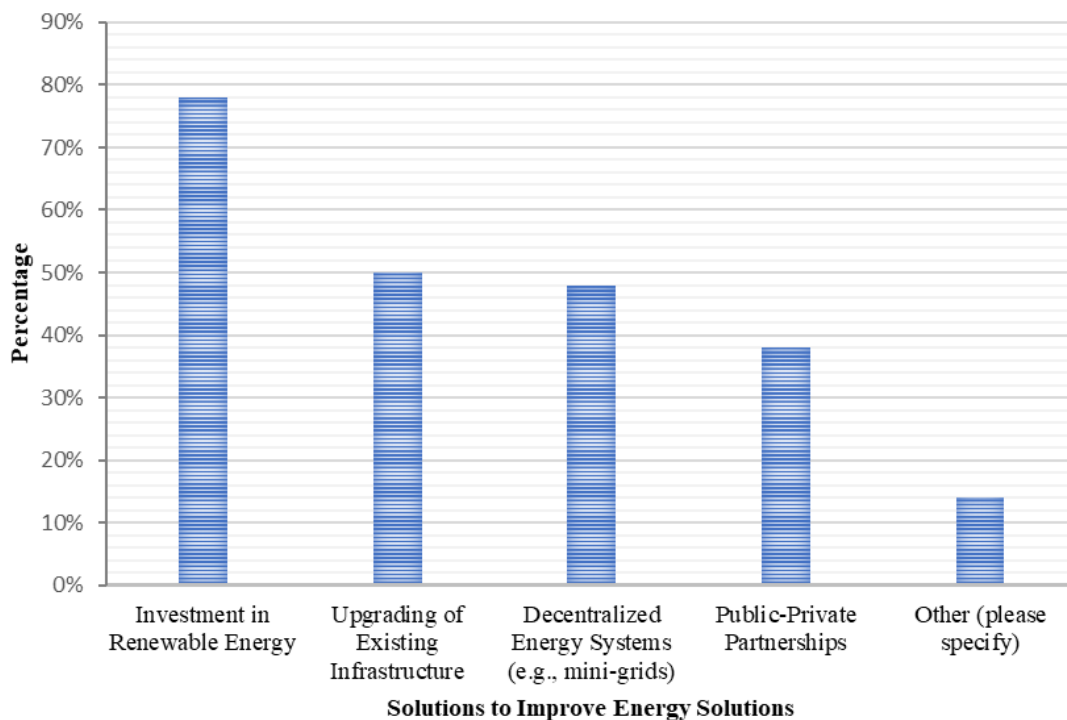


Figure 7.154: Solutions to improve energy supply and distribution

7.2.12.8. *Summary*

- Most of the Stakeholders of the Harare Masterplan-Power Supply and Distribution are household residents
- The state of the power supply in Zimbabwe is very alarming as noted from the survey results
- Load shedding is the major cause of power supply gaps in Harare and their needs to be measures to mitigate this lack in power. This therefore backs the initiatives of the master plan
- The high cost of implementing renewable energy systems and green technologies is the main barrier to implementing renewable energy in Harare
- Most of the people in Harare are willing to transition to cleaner and more sustainable energy and would be in support of the masterplan
- The masterplan can aim at introducing subsidies for the Solar and other renewable energy sources instead of having taxes and tariffs – as reported through the survey.

7.2.13. *Information Communication Technologies*

Information and Communication Technologies (ICTs) include various technologies that enable communication, information processing, and data storage. ICTs encompass both hardware (e.g., computers, smartphones, sensors, and networking devices) and software (e.g. enterprise resource planning system, databases, cloud platforms, and applications). Other ICTs include network nodes, network services, telecom services and satellite systems. Their importance lies in their ability to streamline processes, improve efficiency, and provide scalable solutions to urban challenges. This is especially true in the context of Smart Cities, where ICTs enable integrating various systems and services for better urban management.

7.2.13.1. *Review of the Harare Combination Master Plan ICTs Overview*

The master plan of 1993 did not mention or take into consideration the existence of Information Communication Technologies, hence no provisions were made for development of systems and policies to harness them in the growth of the city. While this oversight could be attributed to the fact that the ICTs sector in the country was still in its infancy with the only ICT player then being the state owned PTC which was still under the purview of the Ministry of Transport and Infrastructure. It is worth that the new Master Plan appreciates the overview of the ICT landscape in Zimbabwe and Harare, existing capabilities and inventory of service providers, applications and solutions and specific strategies for leveraging ICT to address urban challenges effectively and how council departments leverage the ICTs as a driver and enabler of progress to achieve smart city status. The Africa Smart Cities Blue Print and NDS 1 policy documents recognise ICTs as drivers of improved operational efficiency and governance.

7.2.13.2. *Telecommunications Infrastructure in Harare*

The telecommunications sector in Harare is served by three major mobile network operators (MNOs): Econet Wireless, NetOne Private Limited, and Telecel Zimbabwe. All operators are regulated by the Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ). The city also has several Internet Service Providers (ISPs), including PowerTel,

TelOne, Utande, and ZOL Zimbabwe. The public mobile internet subscriber base at that time stood at 1.5 million.

There are three Mobile Network Operators

- **Econet Wireless:** The largest provider, offering extensive coverage and high reliability. With over 80% population coverage in Harare, Econet focused on 4G/LTE services and was deploying optic-fibre broadband to support its mobile network.
- **NetOne:** The second-largest provider, with over 70% population coverage. NetOne was expanding its infrastructure and actively upgrading to 3G, 4G/LTE, and exploring 5G technologies.
- **Telecel Zimbabwe:** The smallest provider among the three, with 60-65% coverage in Harare. Telecel was working on network upgrades to improve service quality.

Operators were increasing the number of cell sites and base stations and upgrading to 4G/LTE while exploring 5G technologies. Regular maintenance and upgrades ensure network reliability and service quality are common. TelOne, PowerTel and other ISPs were deploying optic-fibre broadband, providing high-speed internet access to residential and business customers and enabling backhaul connectivity for cell sites.

In terms of Policy and Regulation POTRAZ governs the telecommunications sector, ensuring compliance and development. Whereas Land Use Policies are critical in allocating land for telecommunications infrastructure in new developments to support sector growth.

The telecommunications sector faces several obstacles in achieving comprehensive service provision:

- **Foreign Currency Shortages:** Limited resources to upgrade, expand, and maintain networks.
- **Power Outages:** Increased costs and operational disruptions.
- **Affordability Issues:** Low disposable incomes constrain service affordability and uptake.
- **High Population Density:** Deploying sufficient infrastructure in densely populated suburbs remains challenging.
- **Urban Landscape:** Dense buildings, skyscrapers, and hilly terrain create signal interference and dead zones, affecting consistent coverage.

In terms of preliminary Observations in Harare on:

- **Traffic Management:**
 - There is no synchronization of traffic signals, leading to congestion. Traffic signals are not interlinked, and the lack of a functional traffic control room exacerbates the issue. Smart solutions for traffic management, such as centralized controllers and intelligent signal phasing systems, are needed.
- **Urban Planning and Utilities Management:**
 - Lack of provisions for smart technologies in land use, water management, and power management. Tools like Geographic Information Systems (GIS) for city planning and smart meters for water and electricity management should be integrated.
- **Policy frameworks:**
 - The Statutory Instrument on the Right of Way for Electronics Communications is an essential legislative instrument that governs infrastructure development and deployment of all Telecommunication devices

in the City. This forms the backbone of all information communication services that area to be established in the city. This also becomes the only city by law that governs the operations of ISPs and MNOs which are essential stakeholders in the establishment of Smart City systems as their network infrastructure is that one that will support all IoTs.

TelOne, Dandemutande and Liquid Intelligence Services these Internet Service Providers play a critical role in shaping the digital landscape of Harare. TelOne is the primary service provider for most government departments and has the largest fibre optic coverage in the city. It is then followed by Liquid Intelligence Services and lastly Dandemutande which are both private ISPs and carter to many sectors and businesses in the city by providing Internet service and cloud computing and support services. In terms of internet accessibility there are several public Wi-Fi hotspots that are provided by restaurants and ISPs. Figure 7.151 shows the distribution of TelOne's Wi-Fi hotspots.

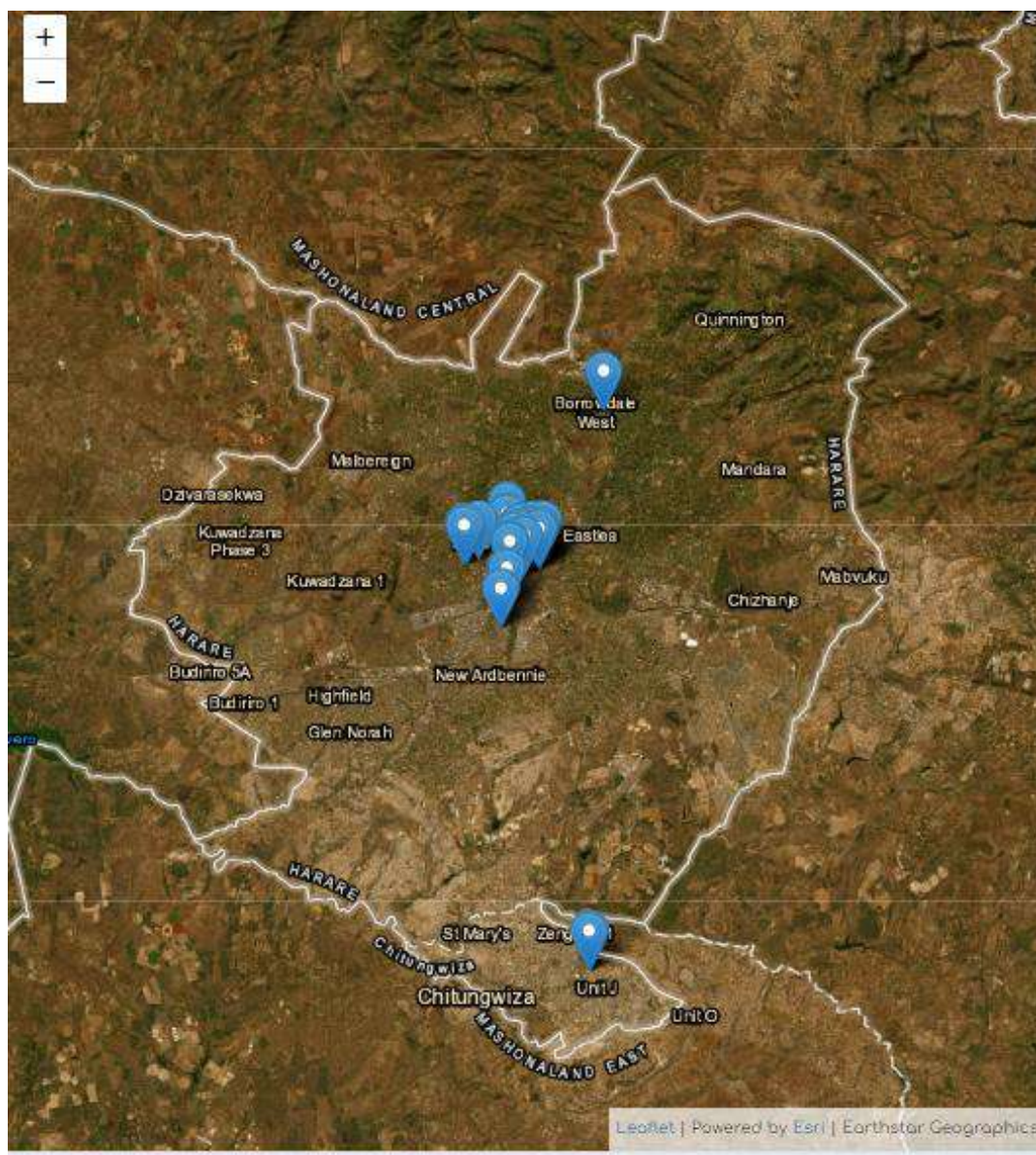


Figure 7.155: Map Showing the TelOne Wi-Fi Hotspots in the Harare Province

Source: accessed from <https://www.TelOne.co.zw>

Apart from the TelOne Wi-Fi public Hotspots, there are also various other public Wi-Fi hotspots, such as cafes and food court facilities. Liquid Intelligent Services also provides free Wi-Fi hotspots for all the tertiary institutions in the city under the Liquid Eduzone brand. Other players like Econet also provide public Wi-Fi connectivity under the SaSai Wi-Fi finder hotspots dotted around the city. These provide internet coverage to the public.

The Telecommunications landscape in the city is also comprised of the Mobile network operators and the regulatory board POTRAZ. The current operational operators are Econet with the largest infrastructure investment in the province followed by NetOne and lastly Telecel. These operators provide full network coverage for the city under different technologies from 2G, 3G, LTE and 5G. In terms of 5G coverage currently only two operators have begun deployment of the technology, these are Econet and NetOne. Telecel is still lagging in LTE and 5G technologies.

7.2.13.2.1. Network Coverage and Capacity

Currently the optic fibre network coverage for the city sits at more than 1,600km² this is information provided by the three major ISPs TelOne, Dandemutande and Liquid Intelligent Services. The fibre optic coverage extends beyond this figure due to other small players that have yet to register their input like Africom, Telco and PowerTel, all these operators have installed optic fibre network. Apart from optic fibre connectivity there are various other internet network infrastructure that are offered by ISPs in the city and these include ADSL which is mainly offered by TelOne, VSAT and the recently licenced Starlink that utilises Low earth Orbital satellites that are more cost effective and provide for improved connectivity increased network speeds and lower latency causing overall improved internet services.

Table 7.143: Internet Access at home per Province and type of Service

	Fixed Narrowband Network	Mobile Narrowband Network	Fixed broadband Network	Terrestrial Fixed Broadband Network	Mobile Cellular broadband Network (via handset)	Mobile Cellular broadband Network via a card	Households with access to internet home
Province	Percent	Percent	Percent	Percent	Percent	Percent	Number
Bulawayo	1.2	97.8	7.9	12.1	94.7	5.1	209 650
Manicaland	0.0	97.3	1.8	0.1	86.5	5.7	224 955
Mash Central	0.0	97.8	2.9	3.2	90.9	7.2	71 774
Mash East	0.5	94.8	1.5	0.3	95.1	9.5	123 849
Mash West	0.4	98.1	2.6	0.3	82.7	2.3	232 163
Mat North	0.0	98.6	0.5	0.5	92.1	2.4	76 107
Mat South	0.0	97.6	0.0	0.0	97.9	1.4	123 783
Midlands	0.3	97.6	1.5	0.2	96.5	4.8	216 248
Masvingo	0.6	98.3	1.3	0.0	98.6	2.2	140 306
Harare	1.2	97.3	2.7	0.7	96.4	16.5	451 482
Area							
Urban	1.0	97.9	4.4	2.9	96.1	9.6	1 043 757
Rural	0.0	97.0	0.3	0.3	89.4	4.5	8 26 599
National	0.6	97.5	2.6	1.80	93.1	7.3	1 870 316

Source: ZIMSTAT 2020

Table 7.144: The number of households that did not have access to the Internet in Harare but with cellular data services

	Do not need Internet (not useful, not interesting)	Have access to internet elsewhere	Cost of the equipment is too high	Cost of the service is too high	Privacy and security concerns	Insert service is not available in area	Internet services is available but does not correspond to household (e.g quality, speed)	Cultural/ religious reasons (e.g exposure to harmful content)	Lack of local content	Households without access to internet home
Province	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Number
Bulawayo	54.1	2.2	59.8	48.2	2.2	2.1	0	0	1.6	37 867
Manicaland	39.2	2.3	62.6	38.9	0.5	7.4	2.1	2.2	2.1	296 981
Mash Central	30.3	1.8	74.8	54.2	0.1	7.4	0.3	0.3	11.5	161 232
Mash East	40.1	1.6	67.6	52.9	0.9	17.7	1.8	4.5	1.3	259 232
Mash West	43.7	1.1	64.1	35.7	0.2	9.1	1.7	2.9	4.5	211 052
Mat North	27.9	0.5	76.1	37.2	0.0	9.1	1.1	0.6	0.0	127 123
Mat South	52.9	4.0	51.3	32.1	3.3	8.6	10.7	0.4	0.6	84 021
Midlands	28.0	1.5	78.2	47.1	1.3	10.1	0.3	0.8	1.3	233 560
Masvingo	41.7	6.8	70.4	39.9	0.8	12.5	7.1	5.1	3.6	291 042
Harare	24.7	1.3	78.2	53.5	0.9	1.8	0.1	1.0	0.9	161 370
Area										
Urban	31.4	4.9	74.6	51.5	0.8	1.5	0	1.1	0	
Rural	38.3	1.9	67.8	42.2	0.8	11.8	2.1	2.7	2.1	8 26 599
National	36.9	2.5	69.1	44.0	0.8	9.7	1.7	2.4	1.7	1 870 316

Source: ZIMSTAT 2020

Harare Province has 97.3% of its households with access to network coverage and 96.4% with access to mobile broadband coverage signifying a high percentage of coverage in the city. Given the growth in network coverage and internet penetration per year at an average of 2.5 % (according to POTRAZ for the past 4 years), most of the gaps may have been addressed since the growth of the sector in Harare Metropolitan growth has been Harare Centric. According to the ZIMSTAT 2020 census report only 1.8% about 2% of the population respondents mentioned that their area did not have network coverage. Much of the Metropolitan Province had network coverage as of the year 2020 and given the growth of the sector in the past four years the issue of coverage for the Harare Province has increased with more than 1000 mobile base stations being deployed by all MNOs combined to address the issue of connectivity and coverage to underserved areas nationwide.

Table 7.145: Status of international connectivity infrastructure in Zimbabwe

Operator	Entry/Exit Point	Connected Capacity	Upstream Carrier	Under Sea Cable System
TelOne	Beitbridge	32 x STM1 (5Gbps)	Liquid Telecom	EASSY
	Beitbridge via Bulawayo	32 x STM1 (5Gbps)	Broadband InfraCo SA	EASSY
	Plumtree	32 x STM1 (5Gbps)	Botswana Fibre Networks (BoFiNet) Ltd	EASSY
	Forbes Border – Mutare	16 x STM1 (2.488Gbps)	TDM Mozambique	EASSY
Liquid Telecom	Beitbridge – Liquid	4 x 10Gbps	Liquid Telecom	SEACOM / EASSY / WACS / SAT3
	Beitbridge – Broadband Infraco	4 x 10Gbps	Broadband InfraCo – SA	SEACOM / EASSY / WACS / SAT3
	Routes to Zambia	4 x 10Gbps	Liquid Telecom	n/a – to Zambia
PowerTel	Plumtree Border Post	STM16	Botswana Fibre Networks (BoFiNet) Ltd	EASSY
	Mutare/Forbes Border Post	STM16	TDM Mozambique	EASSY

Source: Ministry of ICT 2020

Being a landlocked country, Zimbabwe faces several complex difficulties on global connectivity, characterised by high transit costs, limited international internet connectivity and limited competition in the number of cross border carriers. The country has an aggregate international connectivity capacity of 140Gbps shared between TelOne, PowerTel Communications and Liquid Telecom Zimbabwe. The figure 7.152 shows the optic fibre network backbone of the country and the proposed expansion.

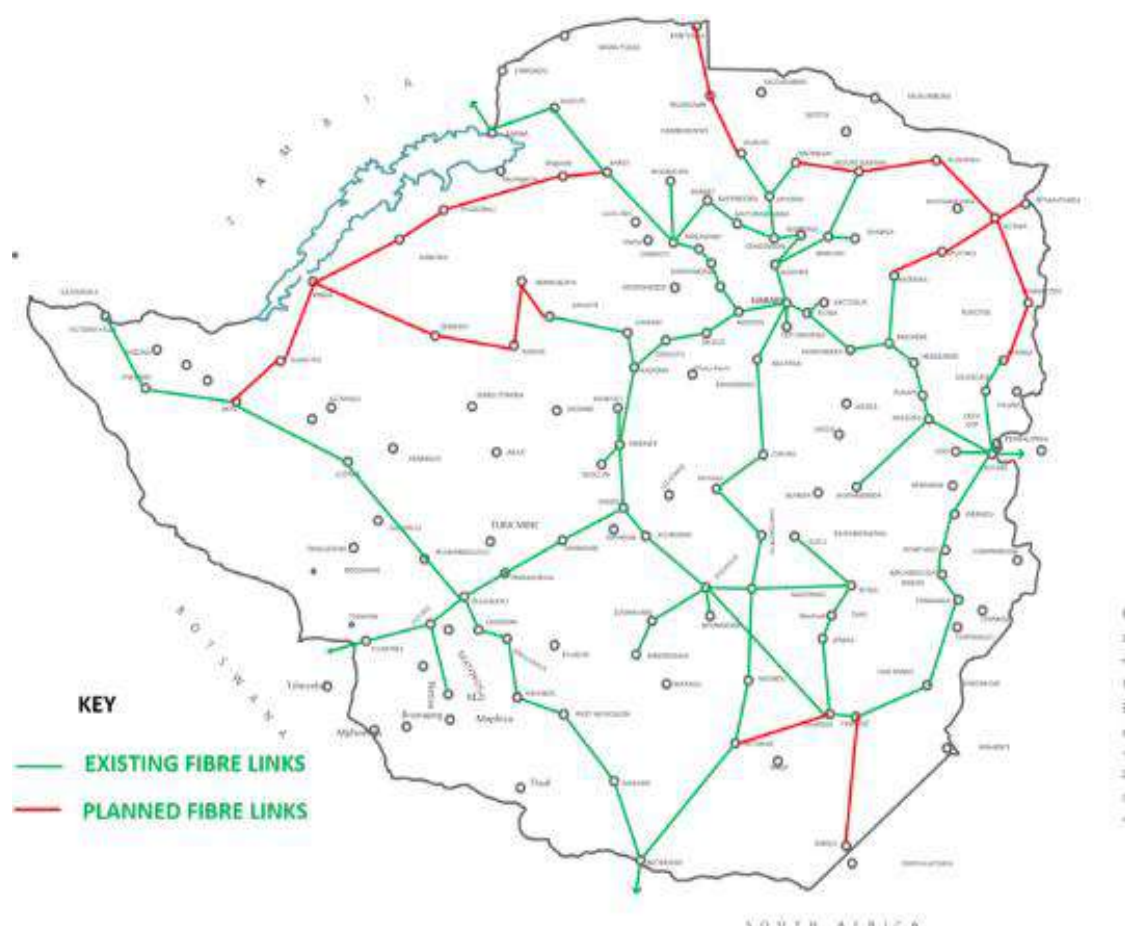


Figure 7.156: Existing 10,152km Optic Fibre network backbone and planned expansion.

Source: Ministry of ICT 2021

Apart from coverage provided by ISPs, MNOs also provide cellular internet connectivity. Table 7.146 shows the distribution of the mobile base stations deployed by the different MNOs in Harare for 2G, 3G and 4G networks representing the level of coverage that the city has in terms of cellular network.

Table 7.146: The number of base stations and type of technology provided

Service Provider	Number of 5G Base Stations	Number of 4G-LTE Base Stations	Number of 3G Base Stations	Number of 2G Base Stations
NetOne	10	333	185	223
Telecel	0	11	253	175
Econet	23	584	601	547

Whereas figures 7.153-55 shows the distribution of base stations by operator in Harare.

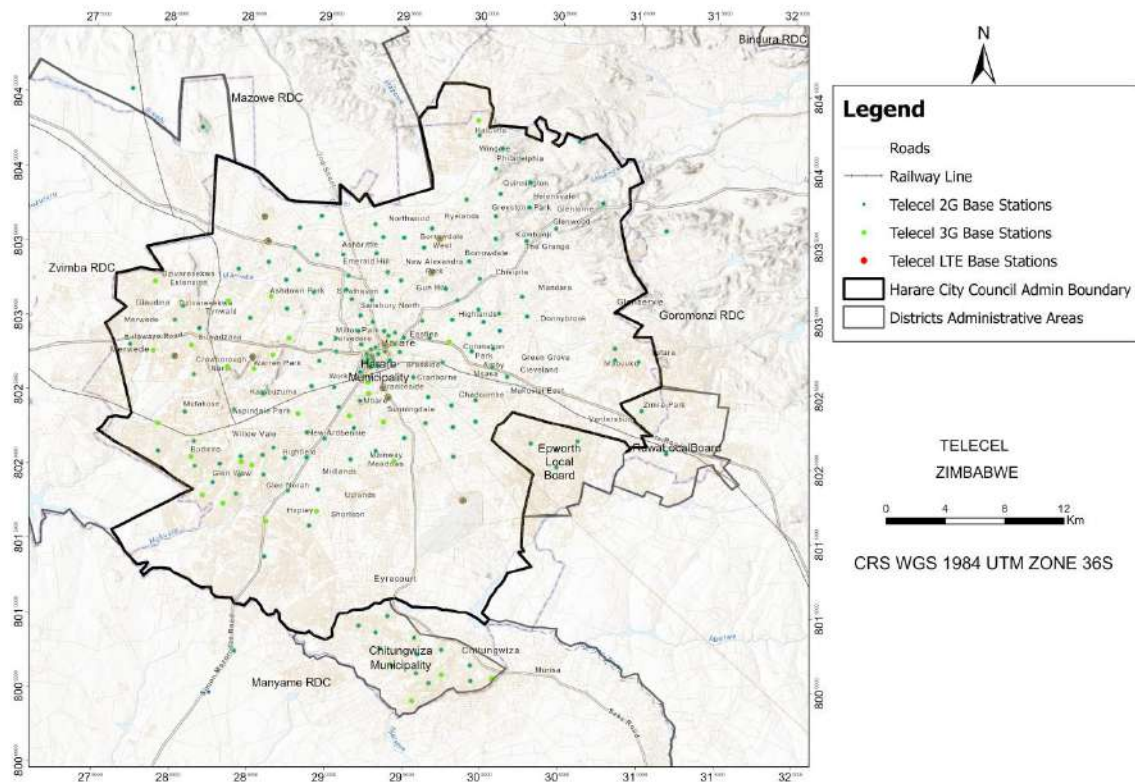


Figure 7.157: The distribution of Telecel 2G, 3G and LTE Base Station Towers in Harare

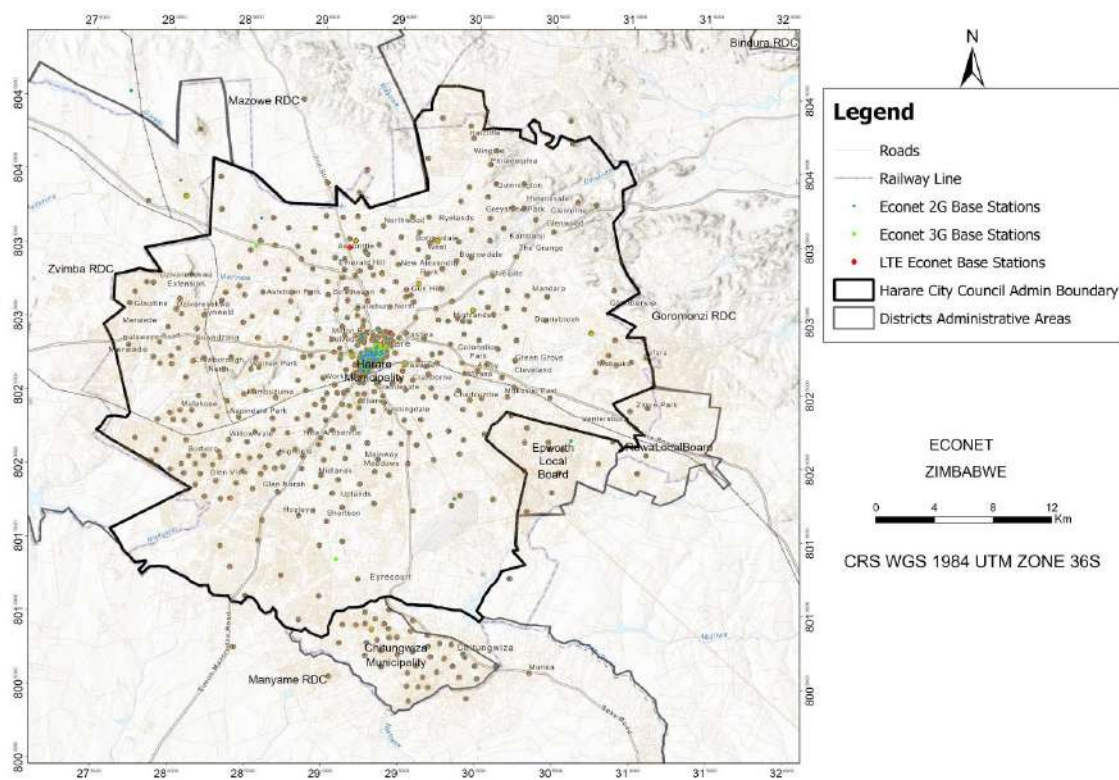


Figure 7.158: The distribution of Econet 2G, 3G and LTE Base Station in Harare

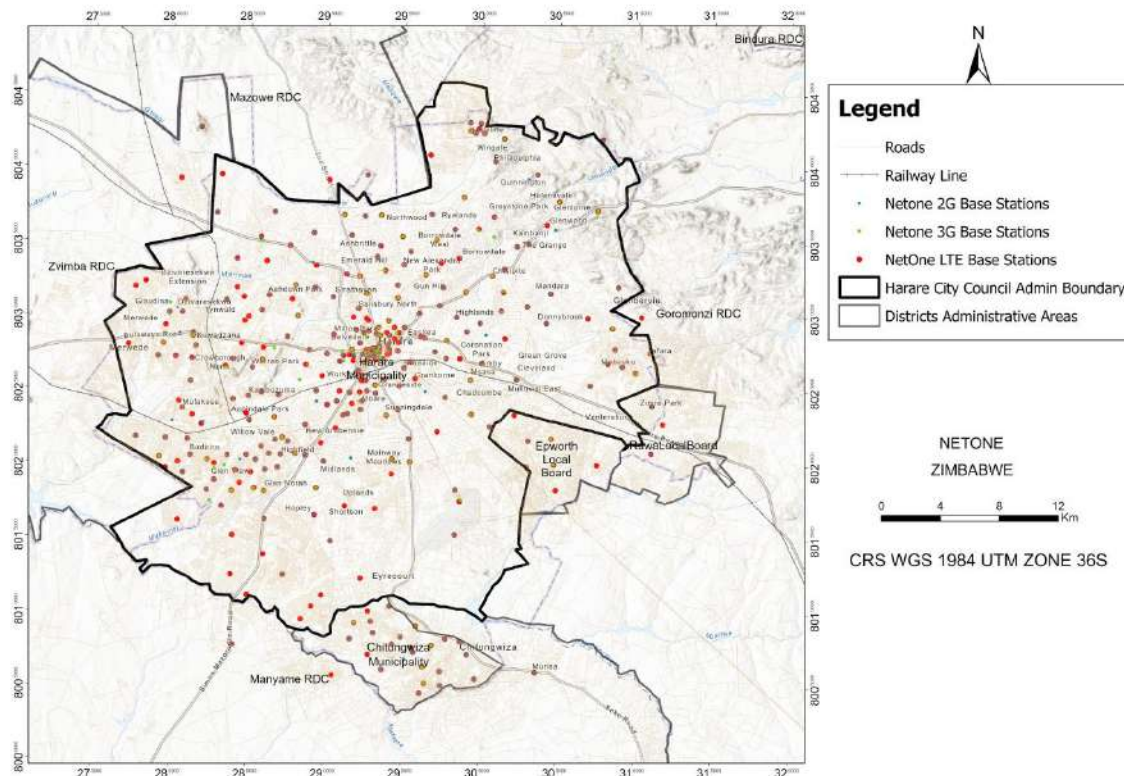


Figure 7.159: The distribution of 2G, 3G and LTE Base Station of NetOne in Harare

The historical practice has been that each operator to construct, which resulted in multiple masts on the same site. The Ministry of ICT and POTRAZ developed a policy on shared infrastructure, which enabled construction of one tower where operators would set up their communications active devices. The operators are allocated tower sites to manage and maintain. Since then, the issue of connectivity has improved as mobile networks share infrastructure.

7.2.13.2.2. *Technological Inventory*

TelOne has a diverse technological ecosystem featuring optic fibre, mobile towers, data centres, and advanced networking capabilities. It is dotted around the City and these can be utilised in the implementation of Smart City solutions. The same can also be said for the other mobile network operators particularly Econet Wireless as the company has already started development of Smart City solutions as seen in its smart homes' solutions. Other innovations include smart energy management smart transport systems like the Vaya ride share and smart security and surveillance options. Econet Digital lifestyle network is an integrative approach to smart solutions and it can be supported using the 5G network infrastructure that the organisation is already spearheading as it was the first MNO to deploy 5G mobile network infrastructure. As of October 2024, NetOne has launched its first 5G network infrastructure marking the growth of the network infrastructure.

7.2.13.2.3. *Broadband and High-Speed Internet Expansion*

TelOne has approximately 177,000 active broadband subscribers in Harare whose speed tier distribution is as follows:

- 40% below 10 Mbps
- 30% between 10-50 Mbps

- 20% between 51-100 Mbps
- 10% above 100 Mbps

Thus, based on these findings, majority of the subscribers fall below 10Mbps and this can be attributed to several reasons. Dandemutande another provider (ISP) has currently deployed 430km² worth of optic fibre network in the Harare Metropolitan Province mainly servicing the following areas Westgate, Emerald, Hill, Mount Pleasant, Borrowdale, Gunhill, Alexandra Park, Belgravia, Avondale, Workington, Ardbennie, Willovale, Graniteside, Msasa Newlands, highlands and the CBD. Liquid Intelligent Services is an ISP that also currently has installed 337 km². It has 3930 buildings connected and 37458 home subscriptions in Harare covering 38% of the Metropolitan Province. It also currently has 296 VSAT stations deployed in the country with a bandwidth of 140Mbps. The statistics for the optic fibre network infrastructure for Liquid Intelligent Services are:

- International bandwidth capacity is 850 Gbps
- Maximum available speed is 1000 Mbps
- Peak International bandwidth utilisation at 28.95%
- Average International bandwidth utilisation at 28.65%

Table 7.147: Showing Optic Fibre Deployment in Harare by different ISPs

Internet Service Provider	Optic Fibre Deployment in Harare (km ²)
TelOne	846
Dandemutande	430
Liquid Intelligent Services	337

7.2.13.2.4. Internet Penetration Rates

The 2020 ZIMSTAT data reveals Harare's leading position in digital connectivity. The city demonstrated the highest number of households with internet access and mobile device ownership. POTRAZ reports a significant internet penetration increase from 59.1% to 70.1%, representing an 11% growth rate substantially higher than the sector's average growth of 2.75%.

Table 7.148: Distribution of households with Internet Access

	Fixed Narrowband Network	Mobile Narrowband Network	Fixed broadband Network	Terrestrial Fixed Broadband Network	Mobile Cellular broadband Network (via handset)	Mobile Cellular broadband Network via a card	Households with access to internet home
Province	Percent	Percent	Percent	Percent	Percent	Percent	Number
Buluwayo	1.2	97.8	7.9	12.1	94.7	5.1	209 650
Manicaland	0.0	97.3	1.8	0.1	86.5	5.7	224 955
Mash Central	0.0	97.8	2.9	3.2	90.9	7.2	71 774
Mash East	0.5	94.8	1.5	0.3	95.1	9.5	123 849
Mash West	0.4	98.1	2.6	0.3	82.7	2.3	232 163
Mat North	0.0	98.6	0.5	0.5	92.1	2.4	76 107
Mat South	0.0	97.6	0.0	0.0	97.9	1.4	123 783
Midlands	0.3	97.6	1.5	0.2	96.5	4.8	216 248
Masvingo	0.6	98.3	1.3	0.0	98.6	2.2	140 306
Harare	1.2	97.3	2.7	0.7	96.4	16.5	451 482
Area							
Urban	1.0	97.9	4.4	2.9	96.1	9.6	1 043 757
Rural	0.0	97.0	0.3	0.3	89.4	4.5	8 26 599
National	0.6	97.5	2.6	1.8	93.1	7.3	1 870 316

The data also indicated that individuals primarily use mobile devices for communication, banking, and financial services. These statistics suggest Harare has a strong potential to leverage ICT integration and develop innovative digital solutions that capitalise on the existing technological infrastructure and user behaviours.

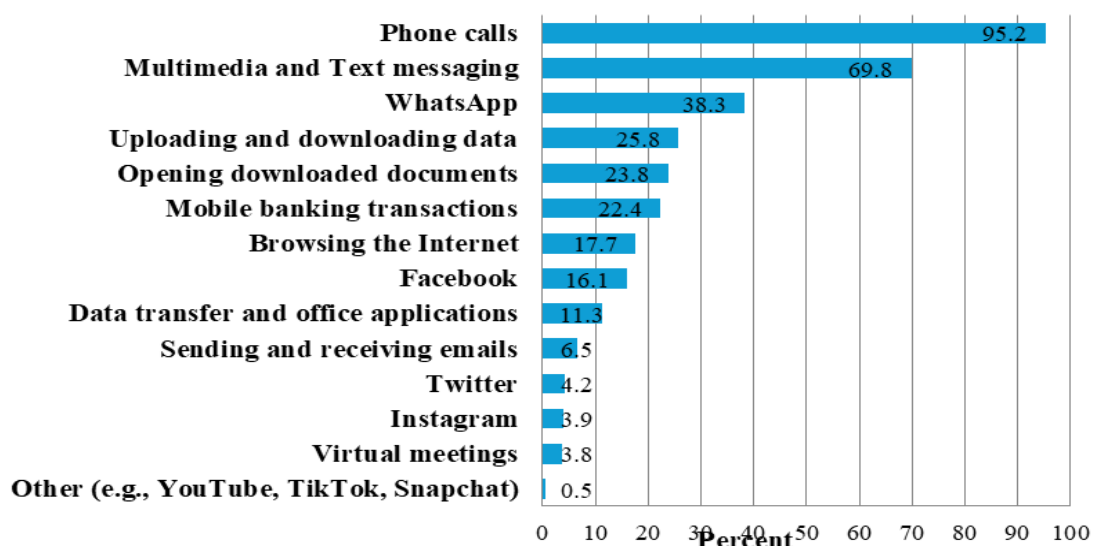


Figure 7.160: Private internet usage according,

Source: ZIMSTAT census 2020

The min and max speeds are as follows:

- Maximum available speed for residential customers is 100 Mbps
- Maximum available speed for business customers: 10000 Mbps
- Average actual speeds delivered: 20 Mbps

The Zimbabwe Statistical Authority (ZIMSTAT) Harare Province had the highest number of people and households with internet access in 2020. The same study showed that the region also had the highest number of people with mobile devices by sheer numbers.

Table 7.149: National Distribution of Households with Internet access for each Province

	Households with Internet Access	Households with Internet Access	Households without Internet Access	Households without Internet Access	All Households	All Households
Province	Number	Percent	Number	Percent	Number	Percent
Bulawayo	209,650	84.7	37,867	15.3	247,517	100
Manicaland	224,955	43.1	296,981	56.9	521,936	100
MashCentral	71,774	30.7	161,899	69.3	233,673	100
Mash East	123,849	32.3	259,232	67.7	383,081	100
Mash West	232,163	52.4	211,052	47.6	443,216	100
Mat North	76,107	37.4	127,123	62.6	203,230	100
Mat South	123,783	59.6	84,021	40.4	207,804	100
Midlands	216,248	48.1	233,560	51.9	449,808	100
Masvingo	140,306	32.5	291,042	67.5	431,348	100
Harare	451,482	73.7	161,370	26.3	612,852	100
Area						
Urban	1,043,757	74.0	367,082	26.0	1,410,839	100
Rural	826,559	35.6	1,497,066	64.4	2,323,625	100
National	1,870,316	50.1	1,864,148	49.9	3,734,464	100

Source: ZIMSTAT 2020

There has been an increase in Data subscription for the 2nd Quarter of 2024 alone according to POTRAZ signifying an increased connectivity in the country. This increase creates many opportunities for the integration of smart solutions in the city and country by improving the ease of doing business.

Table 7.150: Active Internet and Data Subscriptions

Technology	Q1 2024	Q2 2024	Change (%)
Mobile Internet Subscriptions	11,275,921	11,758,515	4.28%
Fixed LTE	77,865	84,277	8.23%
Leased Lines	2,805	2,805	0.00%
DSL	102,892	100,689	-2.14%
WiMAX	9,975	11,262	12.90%
CDMA	107	113	5.61%
VSAT	5,600	4,651	-16.95%
Active Fibre Subscriptions	77,763	80,552	3.59%
Total	11,552,928	12,042,864	4.24%

Source: POTRAZ 2nd Quarter report 2024.

Table 7.151 indicates the growing rate of international incoming bandwidth suggesting an increased capacity to support more internet users and usage. This increase in capacity is noted by increase in bandwidth, thus improving access to the internet for Harare residents.

Table 7.151: Equipped International Incoming Internet Bandwidth Capacity (Mbps)

Operator	Q1 2024	Q2 2024	Change (%)
Liquid	850,000	850,000	0.00%
TelOne	165,000	165,000	0.00%
Powertel	5,000	27,100	442.00%
Dandemutande	17,385	17,385	0.00%
Telecontract	1,700	2,000	17.65%
Africom	620	620	0.00%
Total	1,039,705	1,062,105	2.15%

Source: POTRAZ Second Quarter Report 2024

7.2.13.3. Smart City Infrastructure and IoT Integration

TelOne has both the capabilities and infrastructure to support Smart Cities deployment and operationalisation as evidenced by the deployment of the Smart Traffic monitoring pilot in capital. Currently, it offers the following solutions towards Smart Cities within the Harare Metropolitan Province.

- Smart traffic management
- Smart lighting
- Smart waste management
- Smart water metering
- Smart agriculture

Besides TelOne, Econet can also support any Smart City solutions through its 5G network infrastructure. The company also entered a partnership with the Harare Municipal Council in November 2018 to turn First Street in the CBD into a smart street by providing digital screens, smart lighting and other smart services. This project has not started to date.

7.2.13.3.1. Current IoT Deployments

Internet of Things is one of the key modern technology forces towards the development and transformation of the Smart Cities. As such, within the Harare Metropolitan Province, TelOne has over 2000 connected devices with vehicle tracking being their key offering and primary focus in this regard. Econet wireless also provides connectivity options for small businesses, farmers, schools and churches through the SmartBiz options. The company also offers asset tracking options and water and energy management services.

There is also the issue of the most widely adopted financial technologies in the country where the MNOs are the major pioneering force. The availability of mobile money payment platforms enhances the ease of transacting and doing business. Mobile platforms like Ecocash from Econet which has a commanding stake in the market according to a financial review by Mauna *et al.*, 2022. The company's had 93% market share followed by NetOne's OneMoney platform that had 6 percent market share and lastly Telecel's, Telecash had 0.8 % of the market share.

Apart from the MNO the country also has a platform for interoperability of bank transactions between different banks which was established in 1994 by the banking sectors known as Zimswitch. The Zimswitch platforms handles all domestic money transactions between banks and allows for connectivity between the banks and the Point-of-Sale machines and ATMs. The Zimswitch platform handles transactions of more than 95% of all banking institutions including some mobile money platforms according to the Maune *et al.*, 2022 report of financial inclusion and mobile money interoperability. This platform enhances the ease of transactions for both business and the normal citizens. It is an example of how the Internet of Things has been integrated and adopted in the national and local economy. This service serves a foundational framework for the integration of other IoTs in E-Commerce for adoption into the Smart City.

7.2.13.3.2. Smart City Readiness Assessment

TelOne Zimbabwe, with its existing telecommunications infrastructure and expertise, possesses the potential to play a crucial role in the development of a Smart City ecosystem within the Harare Metropolitan Province. The company's current offerings include key Smart City solutions such as smart traffic management, smart lighting, smart waste management, and smart water metering. These solutions leverage TelOne's network infrastructure to enable real-time data collection, analysis, and control, enhancing efficiency and improving city services. However, to maximize its contribution, TelOne needs to further enhance its capabilities in areas such as data analytics, artificial intelligence, and machine learning. Robust cybersecurity measures are also crucial to protect critical infrastructure and data from potential threats. Furthermore, fostering strong collaborations with other stakeholders, including city planners, government agencies, and technology providers, is essential for the successful implementation and integration of Smart City solutions. Liquid Telecoms and Dandemutande operate data centres that provide cloud computing services to private sector organisations.

By investing in data analytics, strengthening cybersecurity, and actively engaging in collaborative efforts, TelOne can leverage its existing strengths and contribute significantly to the creation of a more sustainable, efficient, and liveable city for the residents of Harare. This includes exploring and embracing emerging technologies such as 5G, IoT, and edge computing to enhance the capabilities of Smart City solutions and improve the overall quality of life within the Metropolitan area.

Apart from the network providers the existence of smart technologies in the way of life already exists in the local economy. Assessing the existing smart technologies and harnessing their already existing appeal and acceptance will help catalyse the transformation of Harare into a Smart City. The city already has an existing framework, especially in the financial internet and information technologies, other platforms such as the USSD platforms that facilitate transactions for mobile money and internet banking shows that in terms of e-commerce and financial integration, the city is already ready in terms of smart technology integration. The existing e-government platforms that allow for application of liquor licenses, tax clearance, procurement, and business registrations for example, are also an integral pre-existing smart technology framework that all solutions can be built upon to achieve the desired Smart City status.

7.2.13.3.3. Potential IoT Use Cases

TelOne Zimbabwe, with its established telecommunications infrastructure and expertise, is well-positioned to capitalize on the burgeoning IoT market. By leveraging its existing network capabilities, TelOne can expand its service offerings to encompass a wide range of IoT applications. This includes solutions for vehicle tracking and fleet management, enabling real-time monitoring, route optimization, and predictive maintenance for businesses and public transportation systems.

In urban management, TelOne can leverage IoT to address critical challenges such as traffic congestion, environmental pollution, and energy consumption. Solutions such as smart parking systems, air and water quality monitoring, and smart grid management can be implemented using TelOne's network infrastructure. These IoT-powered solutions can significantly improve the quality of life for urban residents, enhance resource management, and contribute to the development of a more sustainable and liveable city.

The use of online payment systems is widely used in the country and city and these e-payment platforms are hosted on services provided by MNOs. They help enhance the ease of doing business in the city as they are a form of IoT deployment that is widely used and accepted in the city. Apart from the use of mobile money systems, there is also the hosting of the National Payment System and Zimswitch platforms for use in cashless transactions thereby expediting payment options available to both the public and businesses alike thus helping in improving the ease of doing business. This is one of the indicators that are assessed in the ease of doing business index scoring. This will be crucial in accelerating the transition of the city into a Smart City. Econet has not only been restricted to the mobile money market its also entered the Banking Sector and opened Steward Bank enabling seamless integration between mobile money and the bank as well as allowing for small scale loans without the need for going to the Bank. SMEs can utilise the Kashagi loan to get an emergency short term loan and help in business operations. This also address one of the key indicators of the ease of doing business index which is the availability and length of time waiting for application approval. These mobile money applications improve and speed up the process of loan applications, resulting in an efficient banking sector.

Other innovations linked to the IoTs are the provision of Healthcare Cover on mobile platforms not only by the traditional Insurers but also by MNOs. They have entered the fold and are providing insurance services like Maisha Healthcare from Econet and recently launched One health NetOne medical insurance cover as of November 2024. This provides integration of a lot of systems into the network which is essential for the creation of a Smart Healthcare Services.

Other potential use cases are the deployment of the e-governance platforms that improve the ease of doing business and reduce congestion in the CBD thus acting as a form of decentralisation of crucial government systems into the virtual system.

7.2.13.3.4. Integration Challenges

MNOs and ISPs face several significant challenges in deploying Smart City solutions within the City.

- **Infrastructure Vandalism:** Cable theft (copper and aluminium) and vandalism of equipment, such as streetlights and surveillance cameras, are prevalent issues. This disrupts connectivity, impacting service delivery and increasing operational costs.
- **Power Instability:** Frequent power outages and unreliable power supply pose significant challenges. This impacts the operation of devices and systems, damages equipment, and disrupts data reliability.
- **High Implementation Costs:** High upfront investment costs, ongoing maintenance expenses, and limited access to funding hinder the scale and pace of Smart City deployments.
- **Regulatory and Policy Challenges:** The absence of clear regulations and bureaucratic hurdles can delay project implementation and create uncertainty for stakeholders.
- **Skills Gap:** A shortage of skilled personnel with expertise in areas such as data science, cybersecurity, and IoT technologies can hinder the effective development and management of Smart City solutions.

These challenges require careful consideration and proactive mitigation strategies to ensure the successful deployment and operation of Smart City solutions within the Harare.

7.2.13.3.5. Digital Public Services and E-Government

Digital Public Services and E-Government are crucial for a city's digital transformation. They enhance citizen engagement by providing convenient online access to government services, reducing bureaucratic delays, and increasing transparency and accountability. This fosters trust between citizens and the government, improves service delivery efficiency, and ultimately leads to a more responsive and citizen-centric administration, thereby driving economic growth and improving the overall quality of life within the city.

TelOne's support for Digital Public Services and E-Government Services should not be underestimated. Through their internet services and the network, they have been supporting the following government portals:

- E-government portals
- Online tax services
- Digital ID services
- Public service applications

7.2.13.3.5.1. Existing E-Government Platforms

The Government of Zimbabwe has made several remarkable strides in the ICT sector. The E-Government Framework and Implementation Strategy 2011 – 2015, has been the key reference and guide for the implementation of e-Government programs. The following are examples of e-government systems:

- Online Passport Application System
- E-Taxation – Zimbabwe Revenue Authority
- E-health at Chitungwiza Hospital
- Online Liquor Application System
- Public Finance Management System
- E-Visa – Department of Immigration and
- High Performance Computing System (HPCS)
- e-GP system for government tenders

According to the World Bank group ease of doing business study done in 2020, most of these platforms have seen the country move up the ranks in the ease of doing business rankings from 155 to 140 in 2020.

7.2.13.3.5.2. Service Accessibility

This adoption of an e-government thrust lead to the establishment of the e-government portal and websites. These are to ensure convenient access to government interactive information, timely delivery of public services and efficient methods of conducting business transactions. In the same vein, the need to have efficient, up-to-date online systems, including websites and emails, is highly critical. It also offers transparency and improves governance issues. The establishment and implementation of the Community Information Centres (CICs) and school's computerization programmes has provided platforms for citizens to access government content. The City of Harare has several post offices that have been converted to CICs in their workspaces.

ISPs support the Digital Public Services and E-Government Services which is crucial for Zimbabwe's digital transformation. TelOne offers a 99.9% uptime on its infrastructure indicating reliable service delivery, which is a key factor for user satisfaction. However, enhancing the user experience requires a focus on user-centric design and regular

maintenance of these platforms to ensure that they are always accessible. This includes creating intuitive interfaces with clear instructions and ensuring accessibility for all users and ensuring regular maintenance as well as providing the availability of feedback channels to help improvement of the user experience and deal with issues and challenges that the users experience when using the platforms. Furthermore, improving interoperability between platforms and integrating citizen feedback mechanisms are essential.

The Zimbabwe Revenue Authority (ZIMRA) portal has an uptime of more than 85% this is also like that of the e-GP portal for the Procurement Regulatory Authority of Zimbabwe (PRAZ) that are always active. This has the effect of improving transparency and governance of the tender processes which are some of the indicators that are measured to come up with the Ease of Doing Business index score for a country.

7.2.13.3.5.3. Data Centre and Cloud Computing Infrastructure

Harare generates a significant volume of data from various sources:

- Data from sensors, cameras, and other devices deployed in smart traffic management, smart lighting, smart waste management, and smart water metering systems.
- Data from various government departments, such as health, education, and social services,
- Data generated through citizen engagement platforms, such as social media, feedback portals, and mobile applications

All this data must be stored and analysed annotated for easier management and access to both the public and private sectors. Currently existing data centres are operated by both the government and private sectors. The government data centres store information from all government ministries and these are accessible to the public. The private data centres are leased to other private sector players for cloud computing and other data storage capabilities. Access to the data centres and services in the city is exclusively catered for via the optic fibre network infrastructure.

a) TelOne Data Centre

A relatively small data centre, typically suitable for hosting a moderate number of servers and supporting basic computing needs. Specifications are as follows:

- Total data centre capacity: 1 MW
- Current utilization: 60 percent
- Number of rack spaces: 57
- Redundancy level: Tier III

b) Zimbabwe National Data Centre

According to available information, the Zimbabwe National Data Centre, primarily operated by the Government, has a capacity that is considered significant within the country, though precise details regarding its storage and processing power are not widely publicized.

c) Zimbabwe Centre for High Performance Computing (ZCHPC) Data Centre

ZCHPC boasts a theoretical computing capacity of up to 595 Tflops, with a storage capacity of up to 2.3 petabytes, utilizing 100Gbps Infiniband network infrastructure for high performance computing needs.

d) Africa Datacentre

Africa Data Centres is part of the Cassava Technologies group of companies who is a leading communications solutions provider across 13 countries primarily in Eastern and Southern Africa. The data centre serves mobile operators, carriers, enterprise, media and content companies and retail customers with high-speed, reliable connectivity, hosting, co-location and digital services. It is a state-of-the-art facility designed to meet high standards of reliability and efficiency. It features a total power capacity of 1.2 MW, ensuring that it can support a wide range of IT equipment and services. The power infrastructure includes redundant UPS systems and backup generators, providing a reliable power supply to minimize downtime.

e) Dandemutande Data Centre

Dandemutande also has three data centres operational in the Harare Metropolitan Province. They also provide private cloud computing services to different companies and citizens. The actual details of the structure of their data centres are not available.

f) Other Data Centres

These include:

- ZESA which operates its own data centre used for storing and management of data from its services such as smart electricity metres as well as customer information. The actual specifics of the data centre, such as power output, storage capacity as well as utilisation rates are not available in the public domain.
- The government departments also have data centres of their own and their capacity and capabilities are not well established in the public domain.

It is however important to note the existence of such infrastructures to help in formulation of solutions that are necessary for the adoption of a Smart City.

7.2.13.3.5.3.1. Cloud Computing Adoption

In Harare, Zimbabwe, cloud computing adoption is steadily growing, with companies increasingly utilising cloud services to access computing resources remotely, particularly through providers like Liquid Intelligent Technologies, allowing them to reduce costs and gain flexibility in their IT infrastructure without large upfront investments in hardware. However, some challenges remain for smaller businesses due to potential infrastructure limitations and lack of awareness about cloud benefits.

Key points about cloud computing adoption in Harare:

- *Positive trend:* Harare is considered one of the faster adopters of cloud services compared to other African cities, with businesses seeing the value in utilizing cloud platforms to cut operational costs.
 - *Benefits for businesses:* Cloud computing allows companies to access computing power, storage, and applications on demand, reducing the need for large on-premises servers and enabling scalability based on business needs.
 - *Major providers:* Liquid Intelligent Technologies is a prominent cloud service provider in Zimbabwe, offering various cloud solutions to businesses in Harare. TelOne is also amongst them, they provide the below-mentioned services:
 - IaaS: Infrastructure as a Service
 - SaaS: Software as a Service
 - PaaS: Platform as a Service
 - Storage

- *Challenges for SMEs:* Smaller businesses might face hurdles in adopting cloud technology due to potential limitations in internet access, lack of technical expertise, and concerns about data security.

Major players in the Zimbabwe market are actively seeking to expand their regional presence through operational expansion, acquisitions, mergers, and strategic partnerships. For instance, in October 2022, Liquid Cloud entered a strategic partnership with Microsoft, to offer robust cloud solutions, leveraging Liquid Cloud's advanced co-location and connectivity features in tandem with Microsoft Azure Stack HCI and Azure Arc technology. This collaboration empowers customers across diverse markets, including Zimbabwe, Rwanda, Tanzania, and others, to effectively navigate regulatory and data residency stipulations, tackle low latency workloads, fortify resilience, and ensure seamless business continuity.

In January 2023, Zimbabwe's Tano Digital Solutions Group completed the acquisition of Altron Botswana and Altron Mozambique. This strategic manoeuvre positions the company within a trajectory aimed at emerging as a formidable player among the leading technology companies in the region. As a Gold SAP Partner, they are pushing the cloud computing initiative by offering SMEs access to Partner Managed Cloud services. They have also entered a strategic partnership with AWS.

Dandemutande also offers cloud computing solutions as well as IT services to business and citizens, apart from that they also offer cybersecurity and internet services to their customers. Other companies located in the Metropolitan Province are Axis and Bakertilly Digital Solutions amongst others offer cybersecurity solutions to businesses across the country.

7.2.13.3.5.3.2. Data Storage and Management.

Harare like any other City in Zimbabwe is affected by the regulations and policies that are passed at National Level. Zimbabwe's Statutory Instrument (SI) 155 of 2024, the Cyber and Data Protection Licensing Regulations, established a comprehensive framework for data protection and cybersecurity. It mandates licensing for entities providing data protection services (like data processing or cybersecurity solutions) and for data controllers (those who determine the purpose and means of processing personal data, collecting it, or gaining commercially from it). The SI also requires the appointment of qualified and independent Data Protection Officers (DPOs) responsible for overseeing data protection practices and ensuring compliance.

Key aspects include:

- implementing data management protocols,
- robust security measures,
- breach notification requirements (within 24 hours to the Data Protection Authority and 72 hours to affected individuals for high-risk breaches), and
- adherence to compliance standards.

Non-compliance can result in significant penalties, including fines and imprisonment. This regulation aims to strengthen data protection, ensure compliance with existing laws, and safeguard personal data in Zimbabwe's increasingly digital landscape.

7.2.13.3.5.4. Public Safety and Surveillance Systems

Currently Harare Metropolitan has no established set of Public Safety and Surveillance Systems. Several projects have been proposed with the most recent strides having been undertaken by TelOne who prepared a solution and flighted it as a Tender on behalf of the Government of Zimbabwe intending to partner with private service providers on a Build Operate Transfer (BOT) arrangement. To show its commitment to the project, TelOne ran a pilot project along Simon V. Muzenda (formally Fourth Street) and Jason Moyo Avenue where they installed suspended CCTVs meant to perform traffic monitoring and public surveillance.

Econet at one point had partnered with the Harare City Council to ensure the upgrading of First Street into a smart street through the installation of info booths, digital screens and smart street lighting in 2018 as reported by the Business Times on November the 7th of that year. This represented the willingness and the capability of Econet to deploy Smart City solutions. However, the progress and the extent of the implementation of the proposed plan is not available. Nevertheless, these public sector partnerships are key to achieve the desired goals.

Public Safety and surveillance system also covers the health sector where the city of Harare and the government Civil Protection Unit (CPU) collaborate during local epidemic outbreaks, for example, during the COVID 19 pandemic where they made use of GIS data technologies for contact tracing. This allows the development of epidemiological strategies to combat the Public Health and Safety risks that these diseases and disasters pose. With the help of MNOs, the issue of public health safety has been managed as they provide hotlines and infrastructure to assist in contact tracing and contain spread of the epidemics. This collaboration is also utilised in times of natural disaster responses such as cyclones and floods.

The TelOne pilot utilised dome cameras which offered a wide field of view suitable for general traffic observation. They offer at least 720p resolution, but higher resolutions (1080p or even 4K) are becoming increasingly common in modern traffic monitoring systems. The installed cameras likely utilize Power over Ethernet (PoE) for both power and data transmission, minimizing the need for separate power lines.

While TelOne's pilot traffic monitoring cameras likely provide a basic level of surveillance with features such as wide-angle viewing and infrared illumination, they were limited compared to newer technologies in terms of resolution (likely 720p or lower). It also lacked advanced analytics, and potentially higher power consumption, necessitating an evaluation of its performance and a consideration of upgrading to more sophisticated systems with higher resolutions, AI-powered analytics, and edge computing capabilities for enhanced traffic management.

The installed dome cameras with infrared illumination, possess inherent integration capabilities that can enhance their effectiveness in a broader traffic management system. These cameras, when properly deployed and integrated, can become valuable assets in collecting real-time data and contributing to informed decision-making.

The implementation of traffic monitoring cameras raised important privacy and ethical considerations. It was crucial to ensure that the collection and use of video data are conducted transparently and in accordance with relevant laws and regulations. Clear guidelines on data retention, access control, and data sharing protocols should have been established prior to

pilot rollout. Public awareness and engagement proved are essential to address concerns and build trust amongst the Harare Citizens. Moreso, steps should be taken to minimize the potential for misuse of the data, such as implementing robust security measures to prevent unauthorized access and ensuring that data is only used for legitimate purposes related to traffic management and public safety. Right from the beginning, there is need for close collaboration with other stakeholders such as national security arms and Ministry of Home Affairs so that all interests and concerns are taken on board.

7.2.13.4. Digital Divide Analysis

According to the latest data from the Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ), as of the first quarter of 2024, there are approximately 11,552,928 internet subscribers in Zimbabwe, reflecting a 2.78% increase from the previous quarter. While the actual breakdown for Harare is not available. The greater part of this percentage represents Harare since it is the capital city. In Harare, the digital divide is primarily characterized by a significant gap in internet access between urban areas like Harare itself, where connectivity is relatively better, and peri urban regions which struggle with poor infrastructure as one moves further away from the CBD. Limited affordability, and lack of access to devices, leads to a large portion of the population being digitally excluded, particularly in education and economic opportunities. This is further exacerbated by high data costs, which limit internet usage even among those with access.

7.2.13.4.1. Community ICT Skills Assessment.

In Harare, community access to Information and Communication Technology (ICT) skills is growing through initiatives like the establishment of Community Information Centres (CICs) with many located in Harare, offering basic computer literacy and internet access to the public. Additionally, organizations like the Computer Society of Zimbabwe provide ICDL (International Computer Driving Licence) training at various test centres within the city, allowing individuals to gain recognised digital skills. Most universities and polytechnics provide ICT as part of their programmes.

Educational institutions:

Schools and colleges in Harare often offer ICT courses as part of their curriculum and the number of schools with access to the internet and that without internet access is illustrated on Figure 7.157 and 58 respectively.

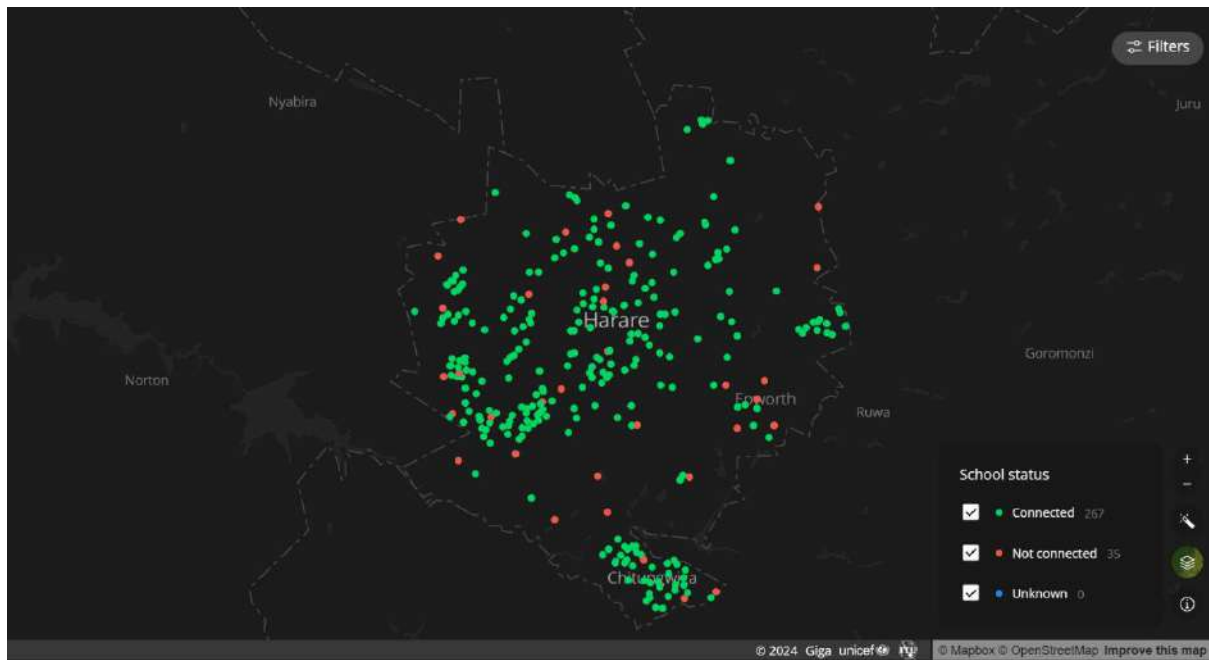


Figure 7.161: Mapped schools with Internet connection (In Green) and those without (In Red).

Source: Giga UNICEF 2024

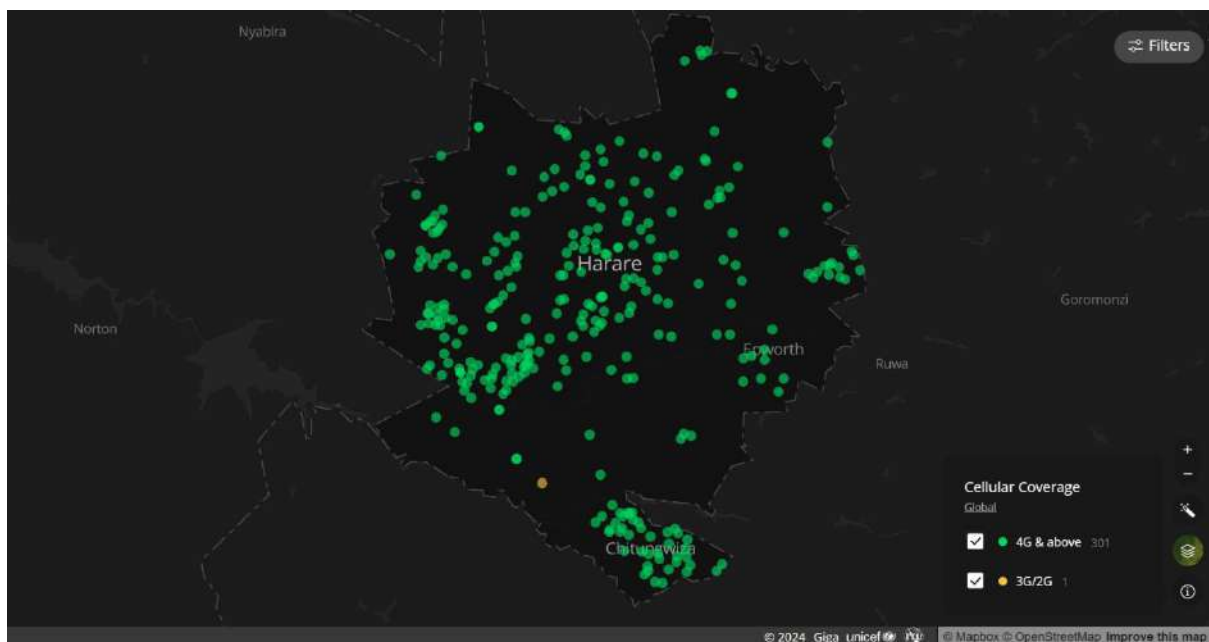


Figure 7.162: Harare mapped schools with access to cellular network coverage for 4G and above

Source: Giga UNICEF 2024

7.2.13.4.2. 5G and Next-Generation Connectivity

5G connectivity refers to the fifth-generation technology standard for wireless broadband networks. It is the latest mobile network technology, succeeding 4G (LTE), and is designed to significantly improve the speed, capacity, and latency of wireless communications.

Next-generation connectivity refers to the evolution of wireless and wired network technologies that enable faster, more reliable, and more efficient communication for emerging applications. This term encompasses advanced network innovations beyond current

capabilities, such as **5G**, **6G**, and future wireless technologies, as well as improved optic-fibre and satellite communications.

Currently, Econet is the leading mobile network operator with 5G infrastructure, occupying a large part of the 5G infrastructure market share with 23 base stations deployed in the Metropolitan province. NetOne is also moving to claim its market share in the 5G technologies as the company has launched 10 base stations for 5G telecommunication systems. Telecel is lagging in the deployment of Next Generation Networks, with only 1% market share of LTE deployments based on the POTRAZ abridged postal & telecommunications sector performance report second Quarter 2023.

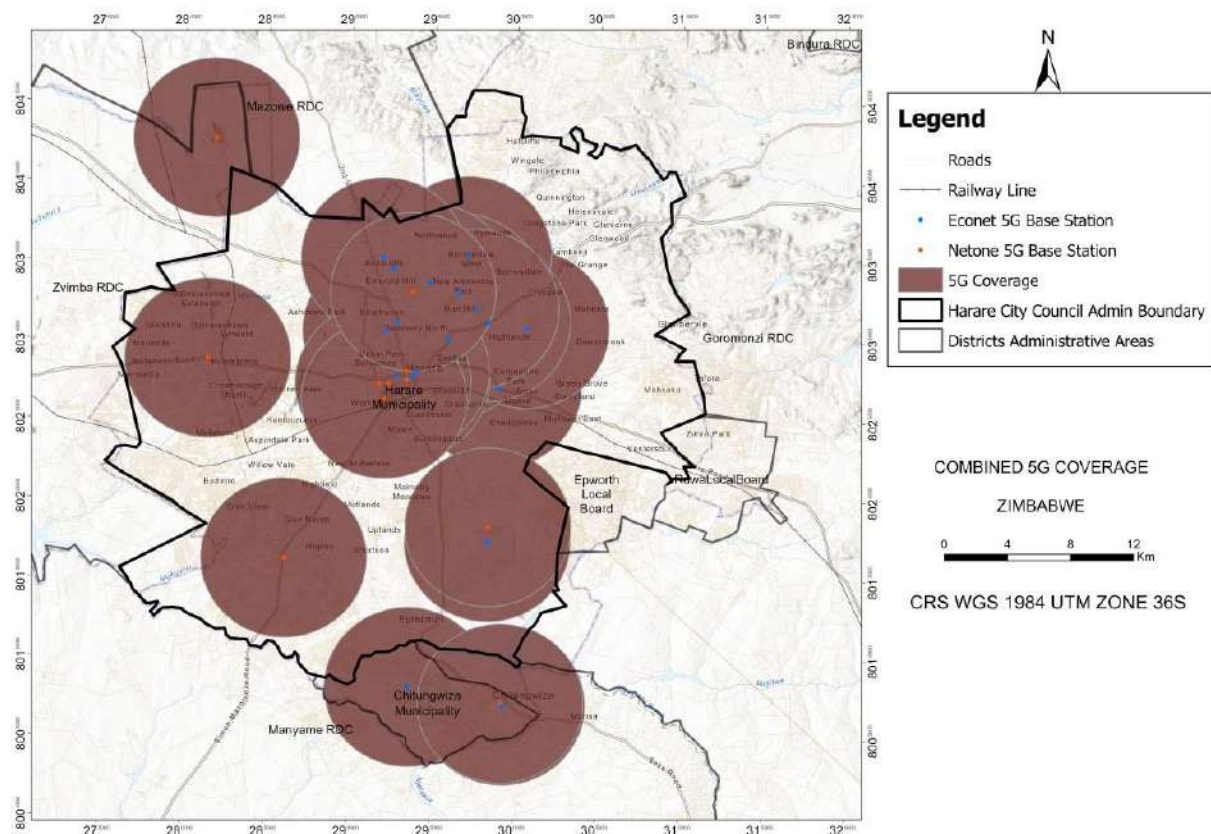


Figure 7.163: 5G connectivity distribution in the Harare Metropolitan area

7.2.13.4.3. GIS and Spatial Data Integration

The integration of Geographic Information Systems (GIS) and spatial data management within the context of Zimbabwean Mobile Network Operators (MNOs) and optic fibre service providers presents a significant opportunity for enhancing urban development, particularly in the framework of Smart City initiatives. The primary MNOs in Zimbabwe Econet Wireless, NetOne, and Telecel alongside optical fibre service providers such as Liquid Telecom and ZOL, play pivotal roles in this integration. This analysis will delve into their contributions to current GIS capabilities, spatial data management, integration strategies, and potential applications, particularly in the context of Smart City development. It also presents a lot of opportunities at land survey and town planning level, as it can be used in the waste management, land use management, epidemiological response and tracing as well as traffic and industrial development.

7.2.13.5. *Summary of Issues*

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8. CHAPTER 9: GOVERNANCE AND INSTITUTIONAL APPRAISAL

8.1. National to local governance framework for Harare

8.1.1. National and provincial government

Harare City does not operate in a vacuum. Its affairs are influenced (and influences) the functions of various sectors⁹ at national level. The Ministry of Local Government and Public Works coordinate the activities of the local government system in Zimbabwe, Harare is included. Further, there are other government ministries and agencies that impact on Harare's affairs (See Policy and Legislative Context section). The statutory functions performed by government agencies are sometimes not coordinated, resulting in delays in decision making. Institutional reforms in key sectors, notably roads and water have had a bearing on Council's performance (Chatiza, et al, 2023¹⁰). Respectively, management of vehicle licenses and responsibility for water services went through significant changes in the last 20 years (Muchadenyika, 2015¹¹). The consistently destabilizing brawls that have gone on for more than two decades have rendered the government of Harare practically unrecognizable. Provincial tier of government has influence on overall development management within the city. The provincial level programs impact Harare city e.g. the regularization program coordinated by the provincial DSPD. The presence of sector institutions and their mandates impacting on Harare is critical for integrated national development. Additionally, the sector agencies strengthen accountability systems (checks and balances) for the city. For instance, town planning applications within the city are circulated to different government agencies for technical input for purposes of coordinating and integrating development. However, it is the bureaucracy and administrative delays in the process of circulations that need to be attended to.

8.1.2. The Harare's Policy Structures

The City has experienced an increase in the number of committees since 2013 as a way of trying to address topical issues the city faced (See Table below). The committees have undergone significant changes, with some being removed and others added. The core committees, such as Finance and Development, Business, Environmental Management, Education, Health, Housing, Community Services and Licensing, Audit, Information and Publicity, and Human Resources and General Purposes, have remained relatively consistent since 2013 and are outlined as prerequisites by the Urban Council's Act. However, in 2018, the Informal Sector committee was added, acknowledging the importance of informal trade in the city's economy. In 2023, new committees emerged, focusing on Small, Medium Enterprises, Works and Town Planning, Disaster Risk Management and Public Safety, and Sports and Arts. These additions reflect the city's growing emphasis on entrepreneurship, infrastructure development, disaster preparedness, and community engagement.

Harare's Councillors, standing Committees and staff, undergo capacity building exercises. These sessions are often organized by the Council, national Government and other external development partners. The capacity building exercises are designed to enhance the skills and knowledge of its councillors and staff. Thematic areas covered in these sessions include local

⁹ Ministries responsible for land, local government, housing, justice, water, finance, and environment, National Departments of Surveyor General, Spatial Planning, Deeds, & Authorities for environment (EMA), water (ZINWA), taxes (ZIMRA), ICT (POTRAZ)

¹⁰ Chatiza et al. 2023. Land and Connectivity Domain Research Report. African Cities Research Consortium.

¹¹ Muchadenyika, D. (2015). Land for Housing: A Political Resource – Reflections from Zimbabwe's Urban Areas. *Journal of Southern African Studies*, 41(6), 1219-1238.

governance familiarization, code of conduct and protocols. The induction on local governance session is concerned with in-house government specialists and consultants providing an overview of the council's operations, meetings procedures, and relevant laws and policies.

Table 8.1: Council committees, 2013 - 2023

2013 (7 committees)	2018 (8 committees)	2023 (11 committees)
1. Finance and Development	1. Finance and Development	1. Finance and Development
2. Business	2. Business	2. Business
3. Environmental Management	3. Environmental Management	3. Environmental Management
4. Education, Health, Housing and Community Services and Licensing	4. Education, Health, Housing and Community Services and Licensing	4. Education, Health, Housing and Community Services and Licensing
5. Audit	5. Audit	5. Audit
6. Information and Publicity	6. Information and Publicity	6. Information and Publicity
7. Human Resources and General Purposes	7. Human Resources and General Purposes	7. Human Resources and General Purposes
	8. Informal sector	8. Small, Medium Enterprises
		9. Works and Town Planning
		10. Disaster Risk Management and Public Safety
		11. Sports and Arts

Familiarization tours are when Councillors visit various departments to gain a deeper understanding of their operations. Additionally, the City of Harare participates in stakeholder professional development summits, where councillors and staff can share experiences and learn from best practices. Exchange visits and sister-city relationships also provide opportunities for information sharing and peer reviews. The standing council committees participate in specialized capacity-building exercises designed to equip them with the necessary skills to effectively execute their mandate. These programs, often hosted by the Council, feature expert stakeholders from key sectors such as engineering, health, education, and town planning. Furthermore, committee representatives engage with national forums relevant to their areas of operation, including the National Auditors Forum, Zimbabwe Institute of Engineers Forum, and the Employers' Confederation of Zimbabwe Workshops, to ensure they remain informed and up to date on best practices and industry developments.

The Council faces significant challenges in policy development and by-law formulation, hindering effective governance. Key issues include limited in-house expertise, inadequate financial resources, and poor stakeholder engagement. The lack of cooperation from internal stakeholders and non-publication of by-laws further exacerbates the problem. These challenges are deeply rooted in institutional and systemic issues, such as limited financial autonomy, inadequate training, and governance instability as evidenced by Councillor recalls. Addressing these challenges will require a comprehensive approach that includes capacity building, stakeholder engagement, and institutional reforms.

8.1.3. Human Capital Structure

Regarding the technical staff, the city is disjointed as it lacks substantive heads of some departments. Harare's vacancy rate averages at 24% over the past 10 years. The Figure below

shows the vacancy rate per year between 2010 and 2024. Critical to note is that the City's executive is the most affected by the vacancies. For instance, Chamber Secretary position has been vacant since 2020, Finance Director position has been vacant since 2022, Human Capital Director position has been vacant since 2023, and the new position of the Director of Planning Services has not been filled since August 2023. With senior council officials in acting capacities, this undermines decision-making performance.

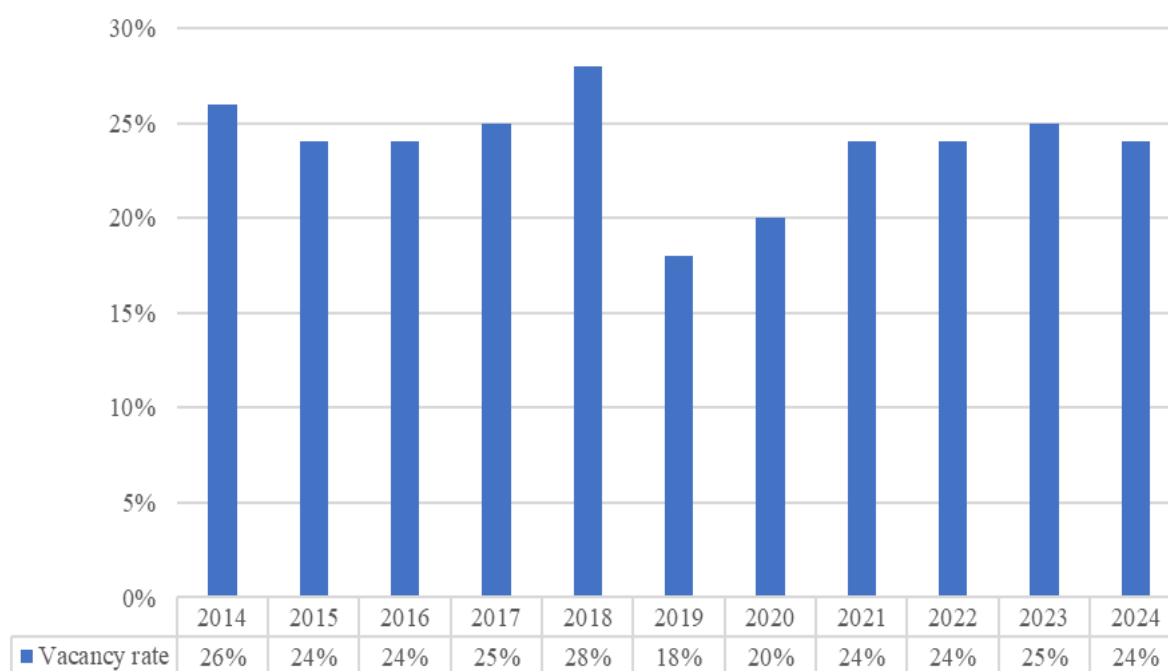


Figure 8.1: Vacancy Rate, City of Harare

Source: CoH Human Capital Development department (2024)

The table 8.2 shows that the total vacancy rate has fluctuated over the years, with a lower rate between 2017 to 2019, followed by an increase from 2020 to 2021. The Works department appears to be the most affected, consistently having highest vacancies throughout the five-year period, with a peak of 1,032 in 2021. The City Health department also showed a significant increase in vacancies from 2017 to 2021. The Human Capital Development department had the lowest vacancy rate throughout the period, with an average of around 30 vacancies per year.

Table 8.2: Vacancies by departments in City of Harare

Department	2017	2018	2019	2020	2021
City Health	349	305	347	445	512
Harare Water	431	439	337	454	500
Human Capital Development	35	26	28	34	30
Finance	80	91	98	109	117
Housing and Community Services	257	311	343	389	375
Works	772	864	803	903	1032
Town Clerk	44	43	47	71	69
Chamber Secretary	461	897	226	252	310
Total	2429	2976	2229	2657	2945

Source: CoH Human Capital Development department annual reports (2017-2021)

Regarding staff turnover, a review of the Harare city's Human Capital departments' annual reports (2017-2021) shows fluctuations in staff turnovers resulting from retirements, resignations, dismissals and deaths. Harare city experienced significant staff turnover between 2017 and 2021, with a shift from retirements to resignations as the primary reason for staff separation. Of importance to note is the increase in the number of staff resignations between 2017 and 2021.

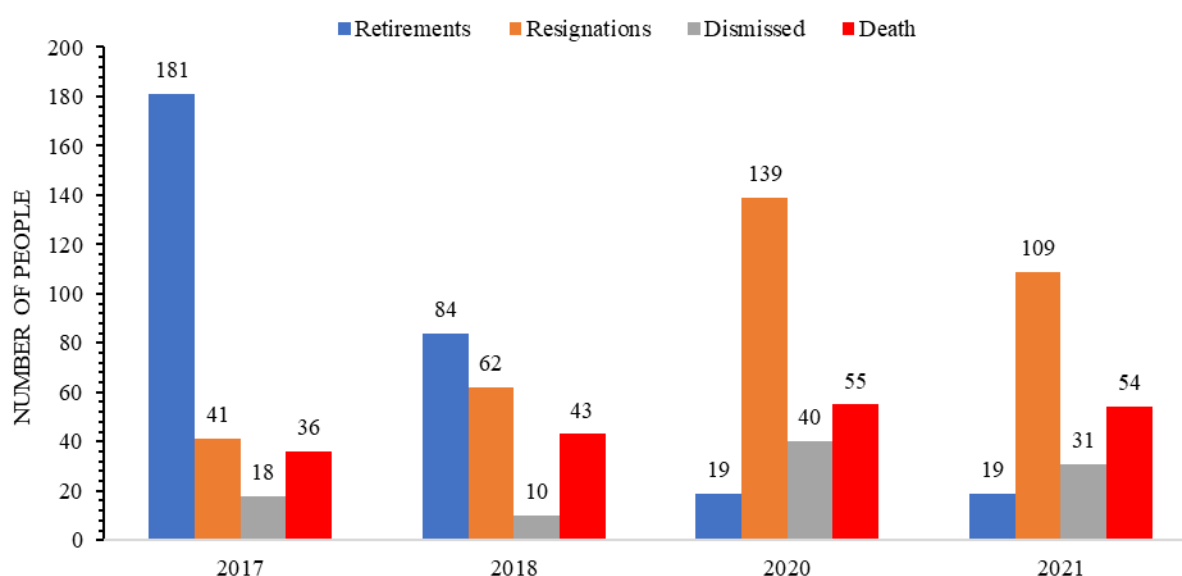


Figure 8.2: Staff turnover in the City of Harare

Source: CoH Human Capital Development department annual reports (2017-2021)

8.1.4. City Finance and Budget Performance

Harare city's finances are generated mainly from eight internal sources and four external sources. The internal sources include property tax, water, sewerage, refuse charges, estate funds, rentals, license and permits, and administration fees. The external sources are loans, ZINARA disbursements, devolution funds, and public sector investment programs. Comparisons between internal and external sources show that much of the City's revenue comes from internal sources. For instance, in 2023 internal sources contributed 64% of the total revenue in City of Harare.

The City of Harare has been experiencing low revenue collection efficiencies against the potential billing capacities. The figure below shows differences between collection and billing efficiencies between 2019 and 2024. Collection efficiencies are way below what is being billed. Where the billing efficiency exceeds 100%, it is mainly due to use of rates of previous budgets whilst waiting for budget approvals. A previous budget may have higher rates compared to the actual rates on the approved budget. Overall, the City has been able to bill 75% and above for its revenue sources. On the other hand, it has experienced a collection efficacy of around 40%. Narrowing down to the actual revenue heads, there has been a significant decrease in property tax collections in the City of Harare between 2019 and 2024. In 2024, property tax had the lowest collection efficiencies of 28.3 %. Based on the 2024 budget, property tax was anticipated to contribute of 37.7% of the city's total revenue, the highest compared to other revenue heads. Other revenue heads have fluctuated over the same period.

8.1.5. Urban resilience, responses to shocks and stresses

Harare faces several urban risks that largely emanate from limited provision of basic infrastructure and services. Those living or working in areas that lack basic services are disproportionately exposed to urban risks that include flooding, fire outbreaks, environmental pollution, road accidents, and collapse of buildings (Government of Zimbabwe, UNICEF and 2019¹²). Preliminary findings of disasters at urban markets show that risks to traders are largely a result of urban management gaps (DGI and DoS, 2024¹³). As has been observed in literature (African Union, 2018¹⁴, Faye et al, 2019¹⁵), constrained urban management coupled with urbanisation pressure makes urban settlements more vulnerable to disasters and risks. Harare is facing urban resilience resulting from the above factors (Government of Zimbabwe, UNICEF and 2019). Where city service provision is constrained mainly because of urbanisation pressure and financial constraints to maintain and expand infrastructure and services, residents are self-providing (DGI, 2023)¹⁶. Examples of self-provision methods include informal land access and housing developments, digging of boreholes and wells, and use of unimproved sanitation facilities. The City is facing development control gaps in attending to all the unregulated and informal activities partly because of the complexities of the interplay of legal, social, economic and political factors. Residents are organised around sector groups to access services e.g. housing social movements mainly cooperatives, transport associations, electricity development committees, urban market access committees etc. In such residents groups, council or state agencies may not be fully involved. This results in settlement level fragmentation and low equity on outcomes. Whilst the residents groups and associations are key in enhancing access to services, there are gaps in their regulation. Additionally, they groups are not fully capacitated to address the public interests.

Fire outbreaks have been experienced in the city's home and workspaces. For instance, over the last 9 years (29th July 2015 to 29th September 2024) 19 fires have occurred at 3 markets/home industries namely Glenview Area 8 Furniture Complex (GV8FC), Mbare main market, and Mbare Siyaso market (DGI, 2024). The fires are occurring as a result of limited fire services regulation, incompatible land uses, fire access blocked by informal uses, absence of fire hydrants or in some instance the fire hydrants are present but they location not known, inadequate education and awareness on fire prevention and control.

Road traffic accidents are high in Harare province, expected to account for half of the total accidents countrywide (UNECA, 2021¹⁷). In 2018, a study by Traffic Safety Council of Zimbabwe showed that approximately 94% of crashes in Harare were due to human error, and the remainder due to vehicle condition (5%) and road environment (1%). Other causes of risks from accidents include poor road conditions, inadequate rescue services, inefficient emergency communication system, lack of adequate enforcement and poor signals.

¹² Govt of Zim, UNICEF and UNDP (2019) Roadmap for building urban resilience in Zimbabwe

¹³ Development Governance Institute (2024). Analysing policies, processes, and practices impacting Glen View Area 8 Furniture Complex. Draft Paper for the Pundutso Urban Market Project, ACRC.

¹⁴ African Union, 2018. Raising the Agenda for Urban Disaster Risk Reduction in Africa.

¹⁵ Faye, P., Ribot, J. and Turner, M.D., 2019. Climate change is not the cause, migration is not the problem: Local representation and precarious young farmers leaving Senegal. Research Report No.14: Swedish International Centre for Local Development

¹⁶ Development Governance Institute and Dialogue on Shelter Trust (2023). Inclusive Urban Infrastructure: Country Working Paper.

¹⁷ UNECA, 2021. Road Safety Performance Review, Zimbabwe. United Nations Economic Commission for Africa.

8.1.5.1. Summary of urban risks by sector

Sector	Risks
Health	- Unsafe self-provided water sources - Disease outbreaks - Heat related illness - Inadequate sanitation facilities
Infrastructure	- Road accidents - Collapse of buildings
Commercial and industrial	- Unregulated Informal activity - Fire outbreaks - Pollution (industrial waste)
Environmental	- Unregulated sand and general resource extraction - Flooding - Cyclones - Pollution - Other adverse weather conditions - Degradation and encroachment of wetlands - Forest loss
Economy	- Fiscal and currency shocks - General policy changes/ policy predictability gaps - Inflation - Economic growth with joblessness
Housing	- Informal land access and development - Unsupervised superstructure construction - Informal service connections (e.g. water, sewer etc.) - Absence of adequate social amenities

8.1.6. Residents' Five Top Priorities for City Development

Figure 8.3 outlines Residents of Harare's five top priorities for the city's development namely:

1. Improved Service Delivery (Water, Sewer, Refuse Collection etc) (45.43%).
2. Economic Growth (31.85%),
3. Environmental Sustainability (7.45%),
4. Public Safety (7.36%),
5. Improved public transportation (4.71%) and
6. Other (3.2%) namely housing, health, education facilities etc.

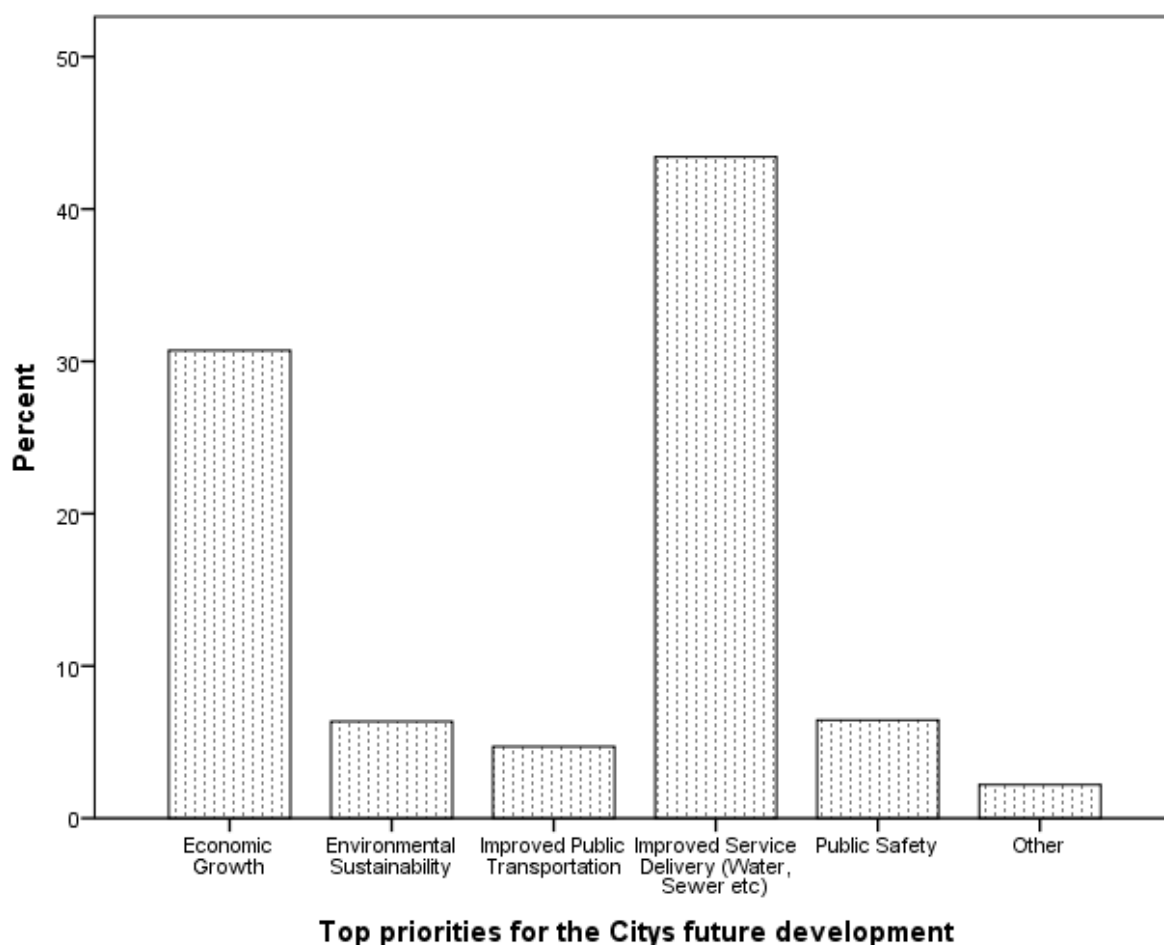


Figure 8.3: Residents' five top priorities for the city's development

8.1.7. Summary of Issues

7. City Governance (and Master Plan) Context

- The policy and legislative context guiding Harare city's operations is clear. Current national policies and international frameworks (at SADC, AU and globally) emphasise equity and sustainability. Gaps in the localisation of these policies exist at the city owing to resource and structural inadequacies.
- Harare city is not adequately cooperating with national government Ministries, Departments and Agencies. Attempts by the provincial tier to strengthen intergovernmental relations experience some stress arising from constrained devolution implementation, delayed alignment of local government laws to the constitution and general fiscal challenges.
- Harare City Council has 59 councilors (45 elected and 14 women's quota) led by a non-executive Mayor. They perform their policy development and evaluation functions through a committee system expanded from 7 in 2013 to 11 in 2023. However, committee performance has been politically and technically degraded. The 2018 and 2023 Councils faced turbulence due to recalls resulting in instability. Internally, Council-Executive interactions have been weak affecting both policy making and implementation at the Council.

- Council by-law or local legislation quality and enforcement are under strain. Some by-laws need review to align with contemporary challenges and opportunities. The highly contested enforcement environment requires robust administrative arrangements that the city has been able to establish.

8. Harare's Importance

- Harare's socio-economic significance in the province and the country at large is receding. While dominating Zimbabwean society, economy and politics the city is losing the capacity to competently drive industry and commerce, provide strategic infrastructure, and basic urban services to its residents.
- 76.2% of the provincial population is Harare residents. The city has a daytime population that almost doubles its regular population as inhabitants of nearby towns and surrounding rural areas spend most of each working day in the city. The daytime population demands education, health, security, water, employment, sanitation and transport services. Urban management failures have resulted in lack of delivery of quality and adequate services to city residents.

9. Citizen Participation

- Harare residents mistrust their Council. Their associations, cooperatives, lobby groups, committees do not effectively cooperate with the city and amongst themselves. City governance performance is not sufficiently inclusive. In some spaces like bus termini and main markets the city has been strategically dislodged by informal actors. Perception surveys show that residents are not satisfied with the City of Harare. A 2022 survey by CHRA and City of Harare showed that 55% of city residents were extremely dissatisfied with services, 23% dissatisfied, 14% neutral, 6% satisfied and only 2% extremely satisfied.

10. Human Capital

- The city has vertical and horizontal structural gaps in its human capital. Additionally, the city has had an 18 to 26% vacancy rate over the last 10 years. The most affected is the senior executive tier (Deputy Directors to Town Clerk), which is now unstable and characterised by discontinuous tenures due to suspensions for extended periods. Further, unattractive conditions of service result in high resignations and potential city employees not taking up employment offers. City departments are bureaucratic with many reporting layers and do not effectively coordinate horizontally. Because of city fiscal strain most departments lack financial and technical resources seriously constraining implementation of strategic city programs and projects elevating the corruption risk at the city.

11. Fiscal Performance

- City's finances are unhealthy. Much of the City's revenue comes from internal sources, with external sources (grants including intergovernmental fiscal transfers) contributing 30 to 40%. Regarding fiscal transfers, budgeted and actual disbursements often vary. In 2022 and 2023, 59% and 103% of the budgeted transfers were disbursed. The city has a billing efficiency of between 75 and 80% while collection efficiency is between 40 and 50%. Some of the city's revenue sources like urban markets and bus termini have been affected by informalisation as the city no longer has control of some of its assets. Though property tax remains the biggest contributor to the city's revenue collection efficiency declined from 75.06% in 2019 to 28.3% in 2024. This can be attributed to the city's inability to

periodically update its valuation roll and residents' unwillingness to pay bills because of corruption perceptions to the for a variety of reasons.

12. Public Safety

- On public safety, the Zimbabwe Republic Police (ZRP) and Harare Municipal Police (HMP) are the main agencies. Their distinct functions relate to national law and by-law enforcement respectively. They collaborate on various public safety assignments including development control functions of the city where violent actors make it difficult for the city to act alone. However, the reliability of ZRP's support to the city is dependent on the availability of resources, which are not always available and alignment of priorities. On the other hand, HMP visibility is low due to staff shortage, inadequate operational resources, and low overall acceptability. City standards of 1 officer to 450 residents suggest a staffing level of above 5000 using the 2022 population suggesting a 26% (1287 in post) manning level.

13. Previous Master Plan Performance

- Implementation of the Harare Combination Master Plan faced challenges. Though 65% of the proposals were implemented, those not implemented were strategic and pertain mainly to bulk infrastructure necessary for sustainable urban growth. Strategic traffic and transportation, water, sanitation, and energy policies and proposals were not implemented. While scope exists to integrate some of the policies and proposals (adapted to current and projected realities) critical governance improvements will be needed.

14. Urban Resilience

- Disaster risks in the city are mainly associated with infrastructure and service gaps compounded by stressed urban management practices. Common disasters are fire, floods, pollution (water, land and air), disease outbreaks, and traffic as well as other accidents. For instance, between July 2015 and September 2024, 19 fires occurred at 3 markets/home industries namely Glenview Area 8 Furniture Complex (GV8FC), Mbare Main, and Mbare Siyaso markets. Fires at GV8FC are largely a result of poor urban management. Residents and businesses of poorly served areas are most at risk to disasters. This is because enforced self-provision of land, housing, water, sanitation, workspace, and solid waste management services exacerbates disaster risks. At least 60% of the city's spatial extent is affected by this make-do self-provision where local authority presence is limited.

9. SUMMARY OF ISSUES

The study established the following issues across principal Environmental Characteristics, Socio-economic Characteristics, Real Estate and Land Markets Characteristics, Spatial Land Use Characteristics and Public Utilities and Communications (Traffic and Transportation, Water, Sewer, Roads, Energy and Telecommunications) in the study area:

1. Environmental Characteristics

- a) Accute levels of pollution: Water, Air, Land.
- b) Biodiversity Intactness Index is at 0.53 indicating biodiversity is severely stressed,
- c) Biomass is at 297 t/km² which is very low, but expected for an urban area
- d) Built up or impervious surface area is at ~69% indicating large expanse of impermeable surface/susceptible to flooding,
- e) Soil pH is at 7.6 indicating that the city's soils are acidic
- f) Nitrogen Oxide (N₂O) 1.0 µg/m³ is moderate
- g) Carbon Monoxide (CO) is at 126 µg/m³ (cubic meter of air contains a unit grame of CO), which is way above WHO limits on CO of 10 mg/m³
- h) Sulfur Dioxide (SO₂) is 33.32µg/m³ is moderate. The WHO upper limit is 125 µg/m³
- i) Methane (CH₄) is at 30.16×109µg/m³ indicating high levels of methan emmission into the atmosphere.
- j) Aerosol Concentration (Particulate Matter) PM_{2.5}: = 3.0 µg/m³ is at PM₁₀: = 4.0µg/m³ observations between 3 - 5 indicate a significant aerosol event, wildfire smoke, dust storms.
- k) The city is located in the watershed and a wetland city and urban development is occuring in wetlands.
- l) Significant loss of public open spaces

2. Social and Demographic Characteristics

- a) The city is population growth is plummeting (despite being the most populous urban settlement in Zimbabwe with a resident population of 1,849,617 people and an estimated 2,487,209 people in its metropolitan area) but remains the most populous urban settlement in the province and nationally, household sizes are declining and lower than the national average of 6. The city's population structure is youthful and has a declining aging population. The Harare Metropolitan area has over time grown to be the most densely populated urban conurbation in Zimbabwe.
- b) Ther city has a youthful population. In terms of population structure the 0-19 age group constitute 42.74%, 20-74 age group constitute 56.57% while 0.68% constitute 75+ age group.
- c) The city has a total of 500,651 Households.
- d) The city has a daytime population that almost doubles its regular population as inhabitants of nearby towns and surrounding rural areas spend their working days in the city. The highest population densities are in Chitungwiza, Epworth and Norton. Selected sections of Harare also exhibit high population densities. Important to note is the spread of population along major road networks radiating from Harare.
- e) 72.8% of the respondents were married, 15.2% were single, 6.6% were widowed, 2.8% were single parents and 2.7% were Divorced in the city.

- f) 72.8% of the respondents were married, 15.2% were single, 6.6% were widowed, 2.8% were single parents and 2.7% were Divorced in the city.
- g) 55.3% of the respondents had attained Secondary Educational level, 21.9% University, 16.6% College, 4.3% Primary education and 1.82% had never been to School.
- h) The dominant occupations are Self-employed (Entrepreneur/small business owners) which constitutes 31%, General Workers (23.1%), Pensioners (7.65%), Informal traders/Vendors (6.45%), Farmer (2.34%), Accountant (2.24%), Gardener (2.09%), (Students (1.84%) respectively. Figure 3.4 illustrates the diversity of occupations of Household Heads in the city.
- i) 6.2% are in Agriculture Sector, 7.3% Commerce and Banking, 7.9% Education, 32.1% Informal Sector, 8.7% Manufacturing, 2% Mining, 15.2% Public Service, 2.9% Security and 17.7% are Small Medium Enterprises. 20.7% work 7 days a week, 24.8% 6 days a week, 29.8% 5 days a week, 4.4% 4 days a week, 3.1% 3 days a week, 1.45 2 days a week, 0.8% 1 day a week, whereas 14.8% do not work at all.
- j) 80.3% of the respondents noted that there are no sufficient job opportunities in the city, whereas 19.7% of respondents noted availability of job opportunities.
- k) The city has 104 secondary schools and 128 Primary schools. In terms of proportions 35% of secondary schools are public schools and 64% are private schools, whereas for primary schools 70% are public and 29% are private schools. The schools are not evenly distributed across all districts based on number of schools per district. There are fewer public schools in the northern, eastern and southern districts of the city. Central Business District, Waterfalls District and Hopley District have the highest number of private schools for both primary and secondary education. Most districts have more public primary schools than secondary schools, fitting within the ratio of 1 secondary school for 3 primary school except for Highlands, Hatcliffe and Borrowdale districts. Pupils in these areas either travel to other nearby districts for education or are enrolled in private schools. Peripheral districts such as Hopley and Waterfalls with high records of private schools reveal stress on education are a result of rapid population growth.
- l) 51.7% consider educational facilities as adequate in their area, whereas 35.2% cite inadequacy and 13.1% do not know. The reasons for inadequacy include 3.4% distance travelled to school, 6.3% fewer schools, 5.6% fewer government schools, 4.8% no schools at all, 3.6% overcrowding, 1.3% no secondary schools, 0.2% no primary schools, 1.3% limited space for schools, 0.5% hot seating, 0.2% fewer blocks, 1.9% poor standard and 2.9% are unaffordable.
- m) The study observed that 58.8% of the households had school going children, 41.2% did not have any school going children. 24.7% of the households had at least one child attending school, 8.7% had 3 children, 2.8% had 4 children, 0.8% had 5 children, 0.3% had 6 children, 0.1 had 6 school going children and 0.1% had none respectively.
- n) The city has health facilities evenly distributed across (although they are in deplorable state and do not have adequate materials) the city despite poor coverage in the peri-

urban areas leaving them without accessible council healthcare services. Over the years the number of visits to council health facilities significantly decreased between 2014 and 2024 owing to their deplorable state and lack of adequate materials.

Whereas the outpatient department has been fluctuating across districts

- o) Council run recreational facilities are in a poor state. Stadiums in the city are functional but in need of repairs. All basic soccer fields are in poor but useable condition. Of the 45 community halls, 43 are functional and 2 are closed due to dilapidated condition.
- p) The housing waiting list in the city has been growing, against an erratic and limited council housing supply. There is a huge variance between housing delivery and the number of people in the waiting list.
- q) In Harare Province public safety and security is in dire state in Harare Central, Harare East, Harare South and Chitungwiza as they are the major hotspots of crime occurrence. The dominant types of crimes include Theft (35.3%), Assault (22.5%) Domestic Violence (9.31%), Material Damage of Property (3.82%), Fraud (1.68%).

3. Spatial Land Use Characteristics

- a) The proposals of the Harare Combination Master Plan were not fully implemented. There is scope for this current Master Plan to consider some of the proposals that were not implemented.
- b) The study observed an overall conformance of 42.3%. The Cohen's Kappa Coefficient of determination was 0.4705. This implies that there was weak agreement between plan intentions and plan implementation outcomes for the area spanning City of Harare and adjacent local authorities. It is apparent that adjacent local authorities disregarded the 1993 Harare Combination Master Plan and established developments at the urban fringe exacerbating urban sprawl as opposed to containment and densification strategies prescribed by the 1993 Harare Combination Master Plan.
- c) The Harare Metropolitan Province faces complex interdependencies between Harare City Council (HCC) and its dormitory towns (Chitungwiza, Ruwa, Epworth, Norton) and rural neighbors (Mazowe, Zvimba, Goromonzi RDCs). These relationships are strained by unplanned urban expansion, competing resource demands, and fragmented governance.
- d) The study established that the city's forward planning prepared Local Development Plans for 77.27% of its land area since 1993, only 22.73% still under schemes pre-1980 statutes. However, 88% of the Local Development Plans require review and all areas under schemes require urgent preparation of Local Development Plans,
- e) The proportion of Low-Density Residential coverage and the Flats/Clusters indicate the low levels of densification in the city. The study established that Low Density Residential is the dominant land use in the city constituting 22.71% (19475.75 hectares) followed by High Density Residential constitutes 21.57% (18501.2 hectares) of the city. Industrial area constitutes 9.81% (8413.88 hectares), while Institutional constitutes 9.21% (7899.16 hectares), Medium Density Residential constitutes 8.69% (7455.41 hectares) followed by Open Space Reservations which constitutes 7.45% (6392.41 hectares) respectively. Another land use category to note is the area covered by Flats/Clusters which constitutes 3.93% (3368.7 hectares) in extent.
- f) The study observed highly variable secondary land use typologies or non-residential uses operating on residential properties. 94.33% of residential properties had residential use only, while 0.573% were residential and office, 1.992% were

residential and retail commercial, 0.463% were residential and horticulture, 0.916% had residential and poultry, 0.020% had other uses such as lodge, 0.070% were residential and church and 0.010% were residential and grinding mill. Despite the predominance of residential use only

- g) There is limited use of vertical space in the city. Single detached dwelling houses constitute 65.18% (dominant housing model), flats (apartments high-rise) 0.795%, Attached Dwelling House 11.49%, clusters 0.573%, cottage and main house under construction 6.248%, cottage 11.31%, cabin and main house under construction 1.177%, cabin 2.173% and other types of structures (main house offices, main house church etc) 1.056%.
- h) Spiralling or unprecedented spatial growth of the city between 2013 and 2024,
- i) Projections up to 2040 indicate exponential growth over time and continued loss in historically non-built up area,
- j) Directionality of growth biased towards the urban fringe,
- k) 47% development conformance to the 1993 Master Plan (the master plan hardly followed at metropolitan level),
- l) 77.27% of the City's land area had statutory plans prepared , whereas 22.73% is still under pre 1980 town planning schemes,
- m) Land Development Indicator Trends indicate that:
 - special consent change of use applications have been constant over the last 10 years with a peak period between 2017 and 2018,
 - Land Subdivision applications have been growing exponentially since 2014 indicating a growth in private land supply into the market,
 - Land Consolidations have been growing exponentially since 2014,
 - Cluster housing applications have been on a steady decline from 174 permit in 2014 to 54 permits in 2024.
 - Building plan submissions have been growing exponentially from 159 in 2014 to 1949 in 2024,
- n) The dominant land use land cover types are bare ground, urban built-up (concrete) and forested cover type.
- o) 65.18% of building types in Harare are single dwelling houses, 17.35% are cottage, 11, 49% are attached dwelling houses, 5.8% are cabins or other temporary structure and 0.8% are flats and apartments.

4. Economic Characteristics

- a) National Economy
 - The economy has shown resilience post-Covid-19, recording high growth of over 5% (ZimStat, 2024).
 - Between the years 2020 and 2022, the country experienced GDP growth rates of 8.5%, 6.5% and 5.4%, respectively (ZimStat, 2024).
 - In absolute terms, GDP increased from ZW\$212.17 billion in 2019 to ZW\$237.19 billion in 2023Q1 (ZimStat, 2024).
 - The Ministry of Finance and Economic Development of Zimbabwe suggested a modest growth forecast of 2.5% (ZimStat, 2024).
- b) Harare's Economic State
 - At the end of 2022, Harare's economy was estimated to be worth ZW\$52.12 billion and its share of the national GDP was approximately 24.2% (ZimStat, 2024).

- The inflation rate for Harare was 1.2% and 14.5% higher than the overall annual inflation rates for the 2021 – 2022 fiscal years (ZimStat, Quarterly Digest of Statistics Q4 2022).
 - The city of Harare is ranked 3rd in 2023 on the cost-of-living index (Numeo, 2024), showing that the economy is relatively cheaper with average-income households being able to access essential services, compared to regional cities like Johannesburg which is ranked number 1 (Numeo, 2024).
 - Over the past four years, between 2019 and 2022, the sectorial contribution to GDP has not changed significantly. The tertiary sector accounts for most of the city's economic activities, contributing on average 68.8% to GDP, whilst secondary and primary activities share 28.9% and 2.5%, respectively (ZimStat, 2024).
 - The top five industries that have dominated the economy of Harare are (i) Wholesale and Retail; (ii) Manufacturing; (iii) Finance and Insurance Activities; iv) Information and Communication; and (v) Construction, with four-year average percentage contributions of 25.3%, 19%, 10.4%, 7.3% and 4.34%, respectively (ZimStat, 2024).
- c) Disposable Income and Consumption
- The average growth rate of GDP per capita in Harare between the years 2020 and 2022 was 4.26%, together with 7.4% for disposable income, which implies rising buying power with time (ZimStat, 2024).
- d) Socio-Economic Indicators
- In 2021, data from the Zimbabwe Poverty Atlas revealed high income disparity and poverty prevalence. The residents of Harare are 15.6% more likely to fall into poverty. In addition, a Gini coefficient indicates that the income gap between rich and poor households is 43.5% wider, which reveals an expanding gap between the rich and poor. According to the World Bank, the income gap is projected to reach 50.3% at the end of 2024 (Zimbabwe Poverty Atlas, 2021).
- e) Household Income Distribution
- The Household survey data for Harare shows that more than 80% of households earn less than US\$400.00 per month and approximately 1.2% earn more than US\$5,000.00 (Harare municipality 2024 Masterplan industrial survey conducted in 2024).
- f) Harare Municipal Finance: Budgets and Expenditures
- City's Budget Performance
- The budgeting environment for Harare between the years 2019 and 2023 was unfavourable. High inflation and rising informality in the economy made the goal of revenue mobilization very difficult, resulting in expenditure growth exceeding revenue growth. The size of the budget expanded slightly from 2% of GDP in 2019, to 3% as at 30 September 2024 (Harare Municipality Consolidated Budgets, 2024).
- Revenue Mobilization
- The revenue as percentage of the city's GDP (revenue-GDP ratio) is less than 5% (this increased from 1% (2020) to 4 % (2023) and in 2024 it decreased to 3%), which highlights that city revenue is less aligned to the size of economy (Harare Municipality Consolidated Budgets, 2024).
- Composition of Revenue Streams
- Property tax is the main contributor to own revenue and its dominance increased after the introduction of the new currency in 2024. During the period under review, property tax obtained the highest growth rate of 40.1% or 12.8 basis points, in comparison to other sources (Harare Municipality Consolidated Budgets, 2024).
- Expenditure Composition

- Current expenditure share to total expenditure is three times capital expenditure. The average share increased from 74.5% to 77.4% between the 2019-2021 and 2022-2024 fiscal years (Harare Municipality Consolidated Budgets, 2024).
- The city spent a higher percentage of the capital budget on Water, Sanitation, and Hygiene (WASH) programmes. For 2019 the share of allocation was 44%, and for the period 2022-2024, the allocation for WASH decreased to 24.2% (Harare Municipality Consolidated Budgets, 2024).
- The per capita capital expenditure for the city is growing. It increased by 2,219% to \$16,830.61 in 2023, from \$725.69 in 2020, which implies that the city was spending on average \$16,830.61 per person on capital expenditure (Harare Municipality Consolidated Budgets, 2024).
- g) Economic Future Forecast
 - The economy of Harare is projected to reach USD1.916 billion by 2040, at a 2023 exchange rate with a Compounded Average Growth Rate (CAGR) of 4.47%. Household and firm surveys show most people prefer a USD50 billion economy by 2040 (ZimStat, 2024).
- h) Economic Baseline Assessment Report
 - The growth momentum of Harare surpasses several cities in Southern Africa. Between the years 2020 and 2023 the economy achieved an average growth of 6% (ZimStat, 2024).
- i) Economic Sector Analysis
 - Like most Emerging Market and Developing Economy (EMDE) cities, the service sector accounts for over 65% of the city's GDP (ZimStat, 2024).
 - Between the years 2019 and 2022, the sector recorded a 3.1% average growth (-10.87% in 2020 to 4.9% in 2022), with food and accommodation, finance and insurance, wholesale and retail trade industries driving the growth. Job creation in the sector is higher than in the manufacturing sector. In contrast, the industry which constitutes 26% to 31% of economic activities is on a downward trend. The sectorial growth was -9.9 % in 2020 and -0.7% in 2022. (ZimStat, 2024).
 - Agricultural activities (urban agriculture), account for between 1% and 1.6% of GDP. The sector has been expanding slowly since 2019 (from -30.6% in 2020 to 0.43% in 2022) and is the source of livelihood for urban low-income households (ZimStat, 2024).
- j) Employment and Wages
 - World Bank Development indicators (2024) revealed that the share of employment in service and manufacturing for Zimbabwe has gone up, from an average of 26% (between the years 2014 and 2018) to 30.5% (between the years 2019 and 2022). Whilst for the manufacturing sector it has risen from 8.7% to 12.7%. Most urban employees are in the service sector and employment in agriculture for the period recorded a decline from 65.5% to 56.9%.
 - Between 2014 and 2018, employment creation was highest in Printing and Publishing; Paper and Paper Products; Textiles and Food and Beverages with the following employment rates 258.4%, 219.4%, 67.8%, and 15.7%, respectively. The top 5 subsectors with job contraction (negative employment rates) were (i) Coke, Refined Petroleum Products, Nuclear Fuel (-97.8%); (ii) Leather, Leather Products and Footwear (-77.5%); (iii) Tobacco Products (-70%); (iv) Office, Accounting and Computing Machinery (-71.4%); and (v) Electrical Machinery and Apparatus (-66.6%). The finding is consistent with claims that share of employment in highly productive and automated sectors is usually low (UNIDO, 2024).
- k) Employment Data for Harare

- The number of employees for Harare decreased from 315,200 in 2018 to 307,200 in June 2023, whilst earnings significantly shifted to USD1,894,594.12 in June 2023 from USD2,488,300.45 in 2018. The decrease in number of employees is in line with the shrinking industry. On the other hand, rising earnings have implications on market demand, social welfare and economic well-being for the working class (Harare municipality 2024 Masterplan industrial survey conducted in 2024).
- l) Industrial employment at a Glance greater Harare
 - The economy has been having challenges with unemployment for more than two decades now. The unemployment rate increased significantly from 10.7% in 2011 to 24% by 2021. The rate marginally decreased to 18.3% in 2023 but remains among the highest in the region. Female unemployment is almost double the unemployment rate for males, revealing the structural differences and gender norms prevailing in the economy (ZimStat, 2021).
- m) Manufacturing Trade
 - Manufacturing Survey reveals a low appetite for export in the manufacturing sector, with an average export quantity of 7% of gross output, illustrating wood and wood product sub sector as the lead exporter with a share of 18%. The manufacturing sector is regarded as a high-cost producer in the region, creating opportunities for imports from low-cost producers like South Africa (CZI, 2023).
- n) Fruit & Vegetable Value Chain Greater Harare
 - Average gross income for traders is almost twice the average income for producers. Results show that marketers/traders realise more income than producers due to higher mark-ups in the fruit & vegetable value chain (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
 - Average employees at trader level is higher than at producer level. This shows that employment creation increases along the fruit & vegetable value chain (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
 - 50% of producers and 60% of traders do pay council fees (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
 - 70% of traders are unregistered (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
 - 52% of farmers store their produce on open space (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
 - 92% of farmers said their storage facilities are not refrigerated and 47% of the storage facilities are council owned, 39% said they are not fumigated against 35% who reported constant fumigation daily or once per week (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
 - Findings from surveys show that most traders raised concerns over water supply, infrastructure and health standards. 61% of these traders raised the problem of clean tapped water and toilet facilities. 50% reported that water was never delivered. The industry uses water for cleaning fruits and vegetables. Evidence shows that 1kg of fruit or vegetables requires at least 5 litres of water for cleaning (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).

- 19% of traders ranked poor infrastructure whilst 14% reported space (warehouse or marketing space) as major constraints. The markets are overcrowded to the extent that traders use open spaces (Harare Municipality Master Plan 2024-2044, survey on city market value chains conducted on the 24th & 27th December 2024).
- o) Iron, Steel and Metal Industry
 - 74% of metal processors and metal & steel suppliers rank shortage of electricity as a major constraint and 20% listed poor roads (Harare Municipality Master Plan 2024-2044, survey on city Home Industry value chains conducted on the 24th & 27th of December 2024).
- p) Meat Industry
 - 63% of butcheries & supermarkets receive running water either once per week, once per month or never which created demand for bulk water deliveries and boreholes (Harare Municipality Master Plan 2024-2044, survey on city Meat Industry value chains conducted on the 24th & 27th of December 2024).
 - 58% use bins for waste disposal & 21% dump waste. 43% report refuse collection once per week and 24% never collected. The problem is leading to accumulation of refuse in business premises (Harare Municipality Master Plan 2024-2044, survey on city Meat Industry value chains conducted on the 24th & 27th of December 2024).
 - 53% ranked electricity as a major constraint. Energy crisis caused higher operating costs and reduced margins in the industry (Harare Municipality Master Plan 2024-2044, survey on city Meat Industry value chains conducted on the 24th & 27th of December 2024).
- q) Key Economic Sectors and Performance
 - In 2019, Whole and Retail Trade; Manufacturing; Financial and Insurance activities; Information and Communication Technology (ICT); and Education dominated with 25.1%; 21.1%; 8.6%; 5.9%; and 5% contributions to GDP, respectively. The Construction sector was in the top 5 with a 4.5% percentage contribution to GDP and registered an average growth of 4.2%, compared to -5.4% for manufacturing and 2.8% for wholesale and retail trade. ICT, together with the Financial and Insurance activities had the highest growth rates of 14.7% and 12.4%, respectively. These sectors are on a positive growth trajectory except for manufacturing, even though the sector is key to the city's economic development (ZimStat, 2024).
- r) Technology
 - Over the past three years between 2019 and 2023, an average of 45.8% of manufacturing firms upgraded their technology, with the upgrading being the highest in foodstuff subsector, chemical and petroleum products and pharmaceutical industries (CZI, 2023).
- s) Job Creation and Workforce Development

Status of Job Creation and Workforce Development in Harare

 - Persistent economic shocks have made the goal of job creation difficult. The unemployment rate for Harare increased from 9.2% to 20.5% between the years 2019 and 2023. The rate is higher amongst female and youth unemployment, which was 44.7% in 2023, a significant increase from 12.3% in 2019. Permanent job creation in the manufacturing sector decreased in 2023 to 11%, from 23% in 2022. Higher employment opportunities were created in small scale firms, which sat at 18% (CZI, manufacturing survey, 2023).

5. Real Estate and Land Markets

Housing Crisis & Shortage

- Severe housing backlog: 288,885 persons on the waiting list, with limited housing supply.
- High demand for affordable housing: 43% of households are lodgers.
- Overcrowding: Many households share one bedroom.
- Limited middle-income housing options: The majority of stock is high-density (67%).
- Poor housing conditions: Aging infrastructure and lack of repairs, especially in pre-independence suburbs.
- Unfinished housing projects: Many developments lack proper water, sewerage, and roads.
- Unregulated informal housing growth: Rapid expansion of informal settlements without services.
- Difficult approval processes: Slow, expensive, and bureaucratic housing development approval system.
- Corruption in land allocation: Council lists not being followed; land barons taking over.

Urban Decay & Infrastructure Collapse

- Deteriorating water & sewerage systems: Old, overburdened infrastructure leading to frequent breakdowns.
- Road network decline: Potholes, congestion, and lack of maintenance.
- Electricity shortages: Power outages affecting residential, commercial, and industrial areas.
- Sanitation & health risks: Poor waste management, uncollected refuse, and frequent outbreaks of diseases like cholera.

Declining Central Business District (CBD)

- Mass exodus of businesses: Major companies relocating to suburban areas due to high crime, poor parking, and deteriorating services.
- High office vacancy rates: 60% of office space remains empty.
- Retail sector transformation: Small-scale informal traders replacing large businesses.
- Aging & neglected buildings: 31% of CBD buildings are in poor condition.

Industrial Sector Decline

- Reduced manufacturing activity: Industrial areas are now dominated by warehousing & logistics.
- Deteriorating industrial infrastructure: Poor roads, unreliable water, and frequent power outages.
- Weak demand for industrial land: Low rental prices fail to encourage new developments.

Retail Sector Shifts

- Growing suburban retail market: New malls (e.g., Highland Park, Madokero) thriving in affluent areas.
- Decay of older shopping centres: Small suburban shopping centres (e.g., Machipisa, Cheviot) are neglected.
- Expansion of informal trade: Street vendors outcompete formal retailers, leading to unregulated markets.

Mbare Mixed-Use Regeneration Needed

- Severely deteriorated hostels: Overcrowded, unsanitary living conditions in Shawasha, Matapi, and Nenyere hostels.
- Decaying "Joburg Lines" housing: Unsafe, overcrowded buildings in need of renewal.

- Unregulated home industries: Siyaso & Magaba home industries operate illegally, with poor infrastructure.
- Transport congestion: The main bus terminus in Mbare is chaotic, lacking proper planning.

Land Management & Governance Issues

- Weak land administration: Corrupt allocation of stands, leading to unplanned developments.
- Inadequate land-use planning: Poor enforcement of zoning laws.
- Lack of city council capacity: Limited resources to implement real estate projects.

6. Public Utilities, Communications – Bulk Infrastructure Scoping

Traffic and Transportation

- Condition of traffic lights in the Harare Municipality indicated that 59% of the traffic lights are functional and 41% are not functional.
- Condition of street lighting established there is a total of 85 000 streetlights and most tower lights in the planning area. Currently, only 32 000 (37.6%) of these are functional while 53 000 (62.4%) are dysfunctional
- the drainage indicator shows that 38.9% of roads have ‘poor’ conditions while 85% of the road network ‘fair’ drainage conditions,
- 23.7% of the total road network for the Harare Metro is in ‘very poor’ and ‘poor’ condition and for Harare Municipality Roads, a combined statistic of 30.5% of the road network is in ‘very poor’ to ‘poor’ condition. Comparatively, a combined statistic of 37.5% and 33% for the Harare Metro and Harare Municipality roads were found to be in ‘good’ and ‘very good’ conditions respectively,
- a low statistic of 33.7% and 9.7% of ‘good’ riding quality was established, meaning longer stretch of road network (km) do not produce smooth riding for drivers.
- 60.3% of the total road network for the Harare Metro and the Harare Municipality did not have visible road markings,
- Level of service for primary intersections (major roads) and secondary intersections (neighbourhood nodes) ranges from fair to poor based on 15hrs of average daily data. During the morning and evening peak period the level of service is beyond poor what is called a gridlock situation (it’s a total chaos) serve for corridors recently upgraded under the SADC Program.
- Most intersections and mid-block sections were observed to be congested especially during the morning and evening peak periods. The causes of congestion were found to be:
 - (a) Minor roads, joining major roads at the same level (at-grade), case of Samora Machel Road Corridor
 - (b) High private car ownership
 - (c) High level of motor-vehicle and pedestrian mix, pedestrians using roadways due to occupied pavements by informal traders
 - (d) Malfunctioning traffic lights
 - (e) Traffic lights that are not synchronised to optimise on traffic flow
 - (f) Poor driver behaviour from *mshikashikas* and kombi drivers
 - (g) Imbalanced public transport modal split, with a lot of illegal pirate taxis, kombis and less of conventional buses which ferry a lot of passengers at the same time and are an efficient user of road space.
- Public transport system in Harare is dysfunctional with the modal split as follows 53% pirate taxis, 43% registered commuter omnibuses, 2% ZUPCO buses, 1% metered taxis, 1% private buses.

- Annual number of RTA increased exponentially by 87.5% from 12089 in 2021 to 22670 in 2022 and maintained a high statistic above 21000 till 2024.
- the majority of accidents were observed to be occurring in the Harare CBD, along Kirkman Road, Bulawayo Road, Borrowdale Road, Seke Road, Mutare Road, Simon Mazorodze Road, Willowdale Road and in the high-density suburbs of Kuwadzana, Budiro, Highfields and Glen view.
- Most accidents occur during the morning peak and evening peak and are constant throughout the week and the dominant types are nose to tail, side swipe same direction, vehicle pedestrian collision and right turning Infront on oncoming traffic,
- Dominant causes of accidents are misjudgement/inattention, following too close, fail to give way, reversing error, turning error, excessive speed, overtaking error, parking error, negligent pedestrian, obstructed roadway, vehicle defects etc.
- Dilapidated and vandalised rail infrastructure (poor tracks and signalling systems) to support passenger rail

Existing Bulk Infrastructure Assessment: Water Supply Services and Infrastructure, Bulk Wastewater Infrastructure, Roads and Storm Water Drainage and Flood Management Assessment and Solid Waste Management Facilities

- Harare's main raw water source is heavily polluted by raw sewage and polluted river streams from upstream cities, Harare and Chitungwiza. Seke and Harava Dams are seasonal supplies. Lake Manyame intakes are not in use due to old and non-operational intake infrastructure.
- The two water treatment plants are operating at less than 50% due to infrastructural issues and expensive running costs after the completed Urgent Water Supply and Sanitation Rehabilitation Programme (UWSSRP) Phase 1.
- The potable water supply system, predominantly of works aged 50 years, comprises of 33 service reservoirs, 16 booster pump stations, and nearly 6500 km of transmission and distribution pipework feeding into approximately 300 000 metered domestic consumer connections.
- Harare water supply is thinly spread over the city's administrative boundaries and satellite towns (Chitungwiza, Norton, Ruwa and Epworth, Rydale Ridge and Whitecliffe in Zvimba, Inkomo Barracks in Darwendale and Domboshava).
- Non-revenue water amounted to 68% primarily due to leakages and unmetered connections, while recovery on billing is at 48%.
- Water supply has been augmented at the consumer level by digging waste and drilling boreholes. Others pay for bulk water deliveries marketed as borehole water. Some of the service providers draw water from the COH fire hydrants stationed in the supply system.
- The city uses both onsite and offsite sanitation systems. Southern Incorporated Areas mostly use dry sanitation methods such as pit latrines on small stand sizes.
- The reticulated sewerage system, mostly over 50 years old, makes up to 5500 km of pipework over the 5 main catchments and flow from minor catchments is conveyed by sewer pump stations.
- COH has rehabilitated more than 30 of the pipe mains crossing water streams to reduce pollution from pipe bursts close to streams.
- 70% of the raw sewage received in treatment plants spills into the environment as there is less than 40% available treatment capacity. The inadequate capacity is due to old infrastructure.
- Sewerage systems are overwhelmed by the densification of properties and numerous households illegally residing in single-dwelling units. The system needs upgrading.

- Several proposals for water supply and sanitation systems are on record at the COH. These include rehabilitation works, system upgrades, Kunzvi-Musami water supply and the proposed wastewater treatment works of 445 megalitres/day. Most have not started due to lack of funding.
- The city roads have deteriorated leaving gravel bases exposed and numerous potholes. Regional and statutory roads are in a relatively excellent state. SIA developments do not have roads and stormwater infrastructure and are flood-prone areas.
- The CBD is also a flood-prone area due to the overburdened underground drainage system requiring dredging and rehabilitation of the covers and litter traps.
- Most of the city's ranks are in a dilapidated state. Some have since become marketplaces.
- The city produces 798 tonnes/day in solid waste. 26% is collected daily and 2% is treated at the controlled facilities. There is a need for additional plants to facilitate waste collection and disposal.
- Residents illegally dump waste in wetlands and open channel stormwater drains.
- There is one operational solid waste management site, Pomona Dump Site.
- Industrial waste disposal site is no longer available; some notoriously dispose into the sewerage system through the open manhole, after operating hours.
- Geo Pomona Waste Management is in the process of constructing a waste recycling plant.

Power Supply and Distribution

- Electricity access in Zimbabwe is currently at 62% (2022 Census) and is primarily from coal at 57% followed by hydropower at 40% with renewable sources of energy still behind at 3%. The main sources of energy are fuel wood at 61%, coal 8%, liquid fuels 18% and electricity 13%.
- The Harare Metropolitan Area is mainly supplied via National Grid of Zimbabwe. The old thermal power station is now not reliable or viable due to ageing, environmental issues and bloated costs of production. Zimbabwe's electricity access rate stands at 62%, with Harare Metropolitan facing acute power shortages, frequent load shedding, and aging infrastructure. The energy mix is dominated by coal (57%) and hydropower (40%), leaving renewables at just 3%.
- The Harare Metropolitan 132kV Primary Network enters the region from a westerly direction.
- The study established that the dominant users are Residential Users (77%), Business/Industrial Users (12%), Government Entities (4%), NGOs/Civil Society (4%) respectively
- The study established that power supply is inadequate for all users i.e. Residential Use, Business/Industrial Use, Government Entities, NGOs/Civil Society in the city. 54,2% report that their power supply is very inadequate, whereas only 2.6% report that their power supply is very adequate. The main causes of power supply gaps include Load shedding (80.65%)
- 77.8% of the respondents noted that they received more than 6 hours of power outages per day which is alarming.
- 80.6% of the respondents noted that power outages affected their daily activities and business operations severely and minimal disruption and no disruption was noted by 0% of the respondents.
- 82% of the respondents experience fluctuations in power quality (e.g., voltage instability, surges, and frequent blackouts) which indicates that the power and distribution system is not performing well. 97% of the respondents noted that they are

willing to transition to cleaner and more sustainable energy sources. 84% of respondents noted that there is a high initial cost of solar and renewable energy systems, 25% inadequate infrastructure support, 21% limited knowledge and awareness and 9% lack of government incentives which acts as a barrier to adoption of green energy sources.

- 81% of respondents suggests subsidies for solar and other renewable energy technologies as key policy enablers to transition to cleaner energy.
- 75% of the respondents report that there is need to invest in renewable energy 50% of the respondents also report that there is a need to upgrade existing infrastructure and create decentralized energy systems. 67% (majority) of the respondents feel that the Private Sector has as major role to play in energy supply and distribution.
- Most of the Stakeholders of the Harare Masterplan-Power Supply and Distribution are household residents
- The state of the power supply in Zimbabwe is very alarming as noted from the survey results
- Load shedding is the major cause of power supply gaps in Harare and their needs to be measures to mitigate this lack in power. This therefore backs the initiatives of the master plan
- The high cost of implementing renewable energy systems and green technologies is the main barrier to implementing renewable energy in Harare
- Most of the people in Harare are willing to transition to cleaner and more sustainable energy and would be in support of the masterplan
- The masterplan can aim at introducing subsidies for the Solar and other renewable energy sources instead of having taxes and tariffs – as reported through the survey.

Information Communication Technologies

- The master plan of 1993 did not mention or take into consideration the existence of Information Communication Technologies, hence no provisions were made for development of systems and policies to harness them in the growth of the city.
- The telecommunications sector in Harare is served by three major mobile network operators (MNOs): Econet Wireless, NetOne Private Limited, and Telecel Zimbabwe.
- the optic fibre network coverage for the city is more than 1,600km²
- Harare Province has 97.3% of its households with access to network coverage and 96.4% with access to mobile broadband coverage signifying a high percentage of coverage in the city. Given the growth in network coverage and internet penetration per year at an average of 2.5 % (according to POTRAZ for the past 4 years), most of the gaps may have been addressed since the growth of the sector in Harare Metropolitan growth has been Harare Centric.
- Trends shifting to shared infrastructure, which enable construction of one tower where operators would set up their communications active devices,
- Applications of ICTs in smart city, cloud computing, traffic management, e-governance, GIS, city surveillance and security.