

Road Asset Management System

Dalikhaya Mdunge

NTG

 **esri** South Africa

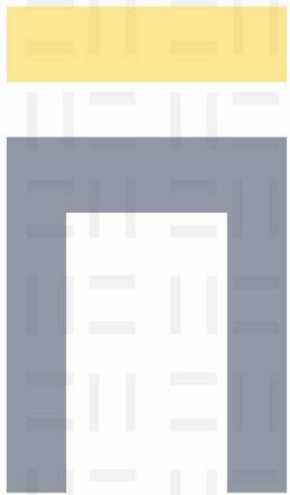
THE SOUTHERN AFRICA ESRI USER CONFERENCE 2023

26 October 2023



CONTENTS

1. Project Journey
2. Objectives
3. Status Quo
4. Minimum Requirements
5. System Components Developed
6. Products Used in the System Solution



COMPANY PROFILE

Level 1 BBBEE built environment organisation

It has been operating since 2005, and has a footprint in all nine provinces

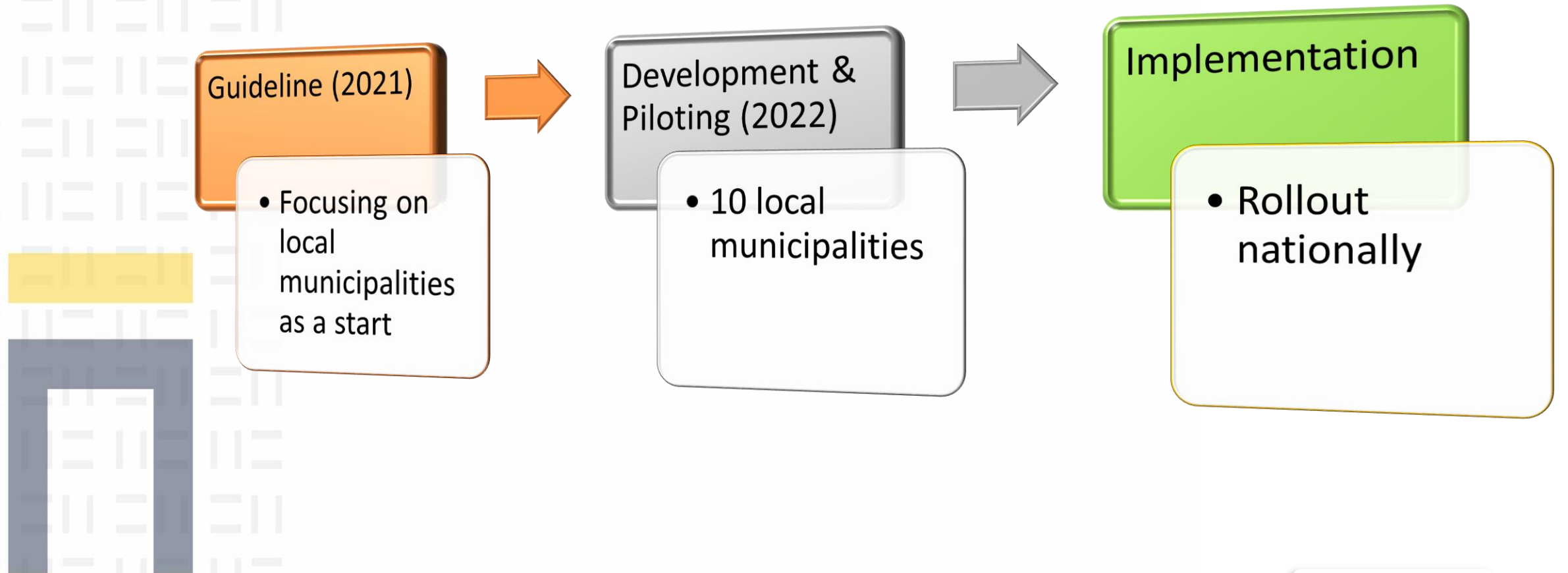
Focusing on:

- **Geospatial Intelligence Solutions**
- Geomatics
- Development Planning
- Skills Training
- Research & Innovation

Partners: Esri Inc, Esri SA, Microsoft



RAMS PROJECT JOURNEY



Challenge:

Management of roads and transport asset management has increasingly become a challenge in municipalities. With regards to roads asset management, municipalities are challenged in various areas such as organizational capacity, skills and competencies, planning, operational management and maintenance and to maintain standards of the municipal owned assets.

Project Objectives:

1. To enable improved road asset management in municipalities
2. To develop a roads asset management system for use by municipalities
3. To pilot the system at selected municipalities

How and where does government prioritize roads maintenance and upgrade if the quantity and status information is not readily accessible and accurate?

Table A-1: Road Asset Management System – Levels of Asset Management

Section	Level I	Level II	Level III	Level IV
Policy	Expectations set in vision and mission statements	Defined Policy Statements for service levels and minimum conditions	Regular review of achievements and adjustment of policy statements to reflect intent together with short term objectives and related action plans	Policy statements and strategies integrated into all business processes and regular review.
Inventory	Detailed listing of all roads	Integrated GIS and road and bridge inventory together with engineering details of each link	All road assets divided into components with different expected useful lives together with construction details	Inventory seamlessly integrated with planned roads, asset register, all acquisition data and related information material to performance
Valuation	Valuations per km or sq m of each road type	Valuations per sq m of road type adjusted for expected useful life	Valuation per component adjusted with estimates of remaining useful life and estimates of unit costs.	Valuation per component reliably adjusted for remaining useful life and unit costs based on detailed statistics of current construction costs.
Condition and Usage	Visual evaluations of condition of each road. Traffic counts at selected positions	Detailed, objective visual evaluations of each road and bridge with some instrument measurements. Traffic counts cover entire road network on a regular basis	Integrated visual and instrument evaluations taken at the minimum frequencies defined in Section D.5.3. Traffic count histories to reliably project future volumes	Reliable and credible condition and usage data that is used to accurately determine excess user costs and predict future excess user costs and related risks
Decision Support	Judgement of future condition and departmental priorities	Decisions based on reliable strategies and rankings based on condition and importance	Optimisation used to adapt strategies and improve returns on rehabilitation expenditure	Optimisation based on reliable performance predictions and linked to confirmation of performance based on past history

(i) **Initiative** – At this stage the people in the organisation are aware of potential asset management benefits and the need for consistent and good quality data. Certain individuals will take initiative to start applying the RAMS and start to make improvements to RAMS to see how it can be adapted to meet the developing needs of the organisation. The RAMS sustainability will often rely on heroic efforts of individuals.

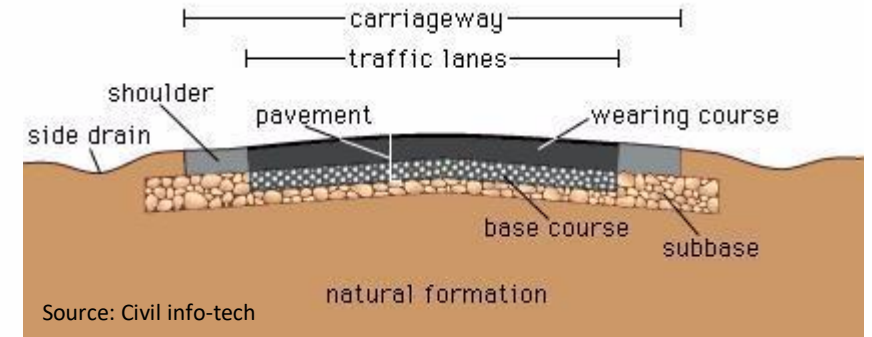
(ii) **Proficient** – in this stage the RAMS can be described as being embedded within the organisation and is a competent System with everyone having faith in the quality of the data and the related processes and outputs. The system will be able to be used to respond to most questions in respect of road asset inventory, condition, value and the probable quantum of funding required to maintain the assets to required conditions.

(iii) **Advanced** – in this stage the RAMS will be used and improved on a regular basis and all data collection and analysis systems will be regarded as routine within the organisation and all staff. The RAMS is used to directly influence the road authority's programme and work methods and to provide guidelines for maintenance standards, designs and procurement and specifications.

(iv) **Excellence** – at this stage all RAMS policies, process and procedures will routinely be improved to respond to ever more challenging questions at increasing levels of detail and to improve the outputs wherever these are shown not to reflect reality and to ensure a high level of successful and cost-effective performance for all money that is invested in the assets .

KEY DEVELOPMENT REQUIREMENTS

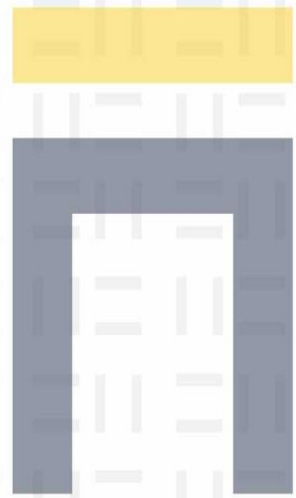
1. Asset Registration
2. Asset breakdown into components
 - Roads
 - Freeways
 - Dual Carriageway
 - Paved Road
 - Unpaved roads
 - Tracks
 - Roads Furniture
 - Bridges (General, Arch, Cable, Cellular)
 - Tunnels
3. Asset condition status
 - Condition Indices – Paved Roads
 - Condition Indices – Unpaved Roads
 - Condition Indices - Roadway
 - Condition Indices - Structures
 - Condition Indices – Ancillary Components
4. Asset costing and depreciation
5. Query reporting



$$VCI = (a \times VCI_p + b \times VCI_p^2)^2$$

$$VGI = (a \times VCI_p + b \times VCI_p^2)^2$$

IMPLEMENTATION AND SUSTAINABILITY REQUIREMENTS



- Strategy (outsourced vs insourced, 3rd party data, collection cycles, etc)
- Tools



- System Integration (Planning Department, Budgeting Department, Project Management Department, etc)
- IDP source of information

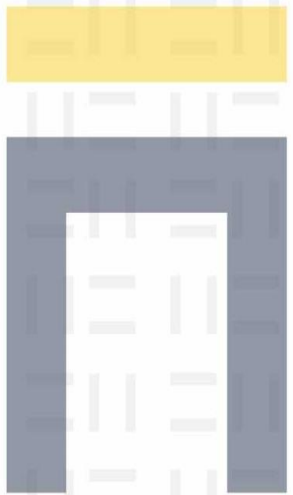


- Training
- Adequate number
- KPI's

- Opex (licence, data collection, training, etc)
- Capex

CONSIDERATION POINTS FOR CHOICE OF SOLUTION

1. GIS capabilities are a key factor
2. Assessment of existing or readily available software
3. Familiarity of the software to end-users
4. Integration and use by various departments
5. Sustainability through Partnerships



RAMS COMPONENTS



- Presentation

Web Mapping Application
Updated: Jun 10, 2022



00. Add/Edit Road Asset

Web Mapping Application
Updated: Jun 10, 2022



01. Combined RAMS Dashboard

Dashboard
Updated: Oct 16, 2023



02. RAMS Unpaved Roads Management System (URMS)

Dashboard
Updated: Feb 2, 2023



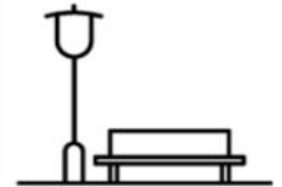
03. RAMS Pavement Management System (PMS)

Dashboard
Updated: Feb 2, 2023



04. RAMS Bridge Management System (BMS)

Dashboard
Updated: Apr 22, 2022



05. Road Furniture Management Systems

Dashboard
Updated: Feb 2, 2023
Road Furniture Management Systems



06. RAMS Traffic Link System

Dashboard
Updated: Apr 1, 2022

REAL_RAMs Traffic Link System Dashboard (copy)



07. RAMS Situational Analysis

Web Mapping Application
Updated: Jun 29, 2022



08. SDBIP Dashboard

Dashboard
Updated: Apr 4, 2022
SDBIP Dashboard



09. RAMS Document Repository

Dashboard
Updated: Mar 31, 2022



10. Online Traffic Flow

Instant App
Updated: Mar 31, 2022



11. Online Live Traffic Incidents

Dashboard
Updated: Feb 1, 2023



ADM Roads

Feature Layer
Updated: Jan 31, 2023
2019-2021



RAMS COMBINED COMPONENTS (DASHBOARD)

Number of Roads (Assessed) **3,233**

AAAT Total **3,685,581**

18,268.9
Road Length (km)

6.1
Road Width (m)(avg)

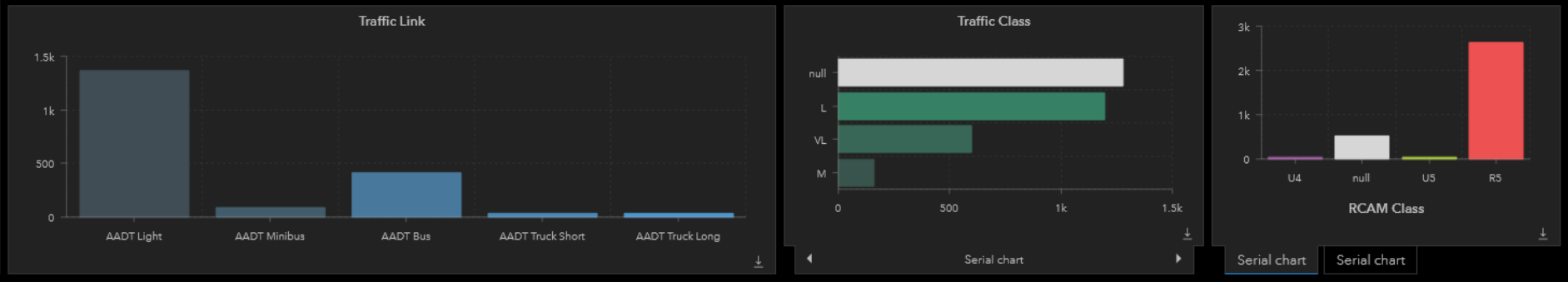
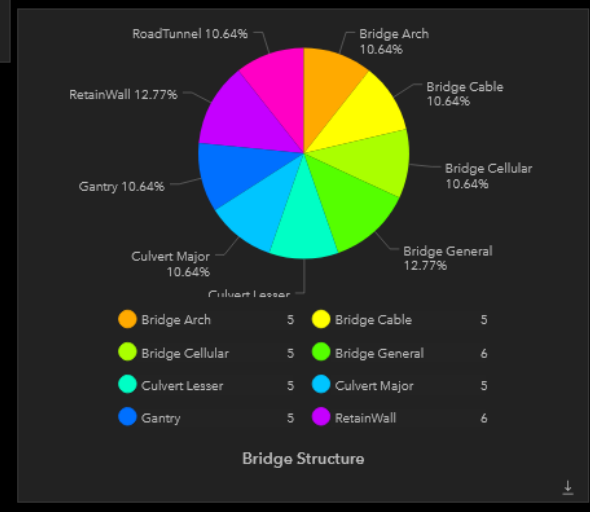
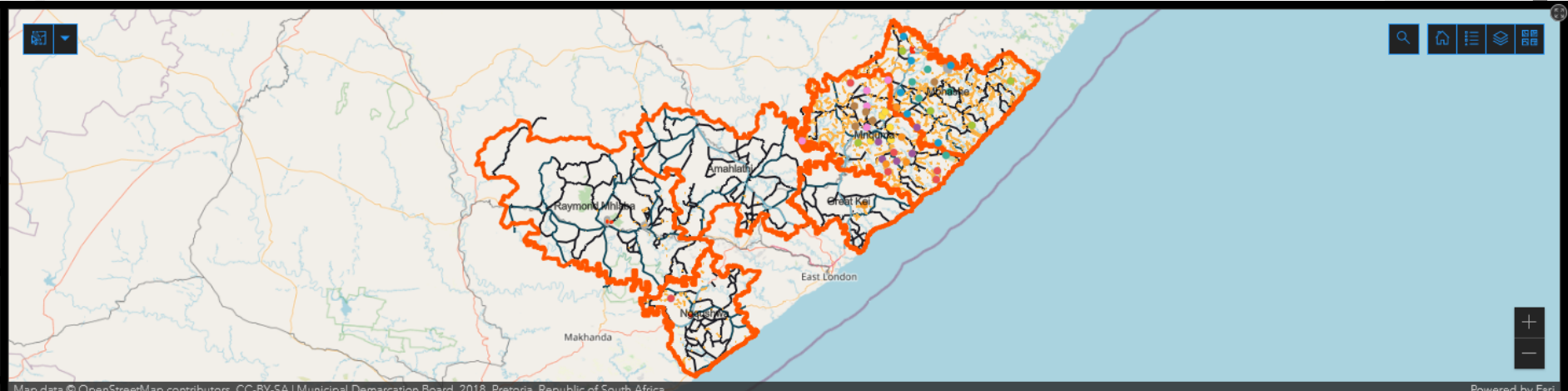
47
No of Bridges

2
No of Lane (avg)

1
No of Shoulders (avg)

R9,194,202,608
Maintenance Cost (Assessed)

R72,897,474,384.8
Estimated Upgrading Cost (Assessed)



ADD NEW ROAD ASSET WEBAPP

NTG solutions RAMS: Add New Feature with ArcGIS Web AppBuilder

Find address or place

Add New Feature

Select a template to create features

Amathole Roads

- BLOC
- CJP
- FLEX
- GRAV

Furniture

- New Feature
- Tourism Signs
- Warning Signs
- Guidance Signs
- Information Signs
- Regulatory Signs
- Route Markers
- Symbolic Signs

Bridges

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PAVEMENT MANAGEMENT SYSTEM DASHBOARD

Number of Roads

3,236

3,997.16

Road Length (km)

R9,194,202,608

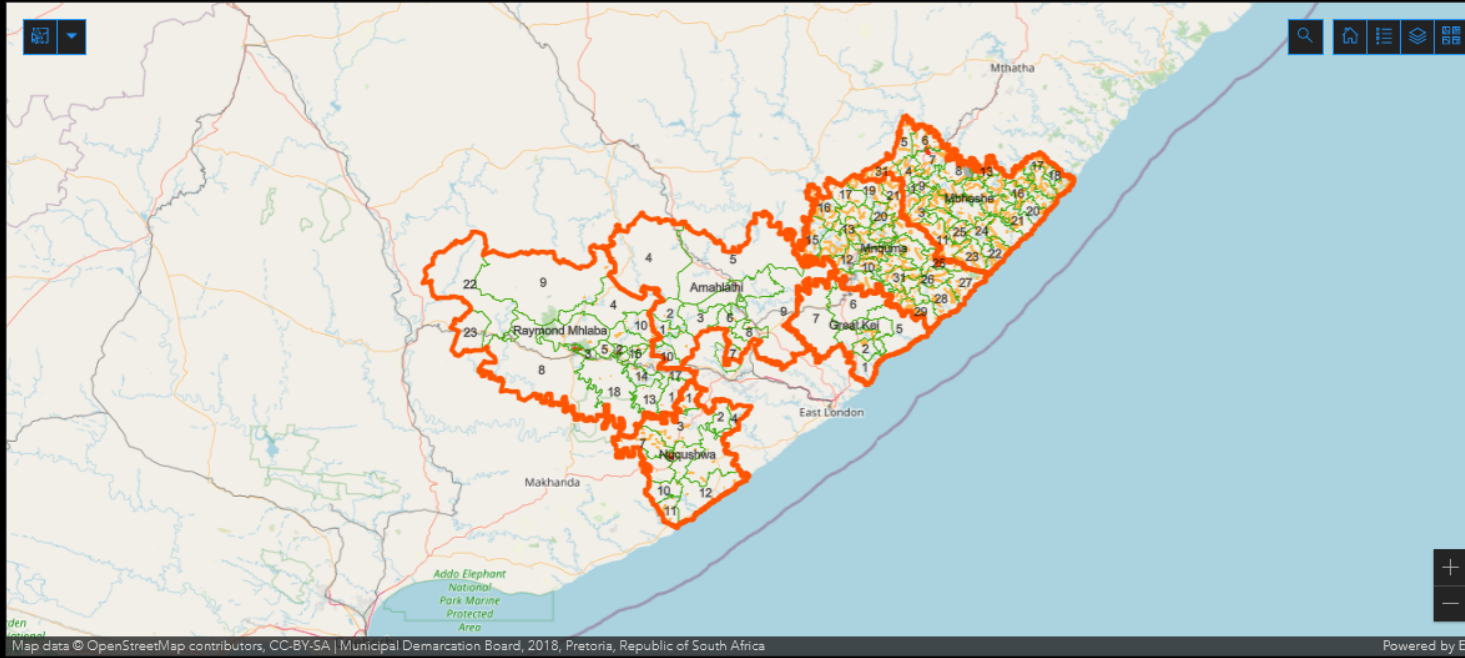
Maintenance Cost (M)

19.2k

Road Width(km) (avg)

Surface Type

No data



VCI (avg)

49.1

MNI(avg)

67

SCI (avg)

30.9

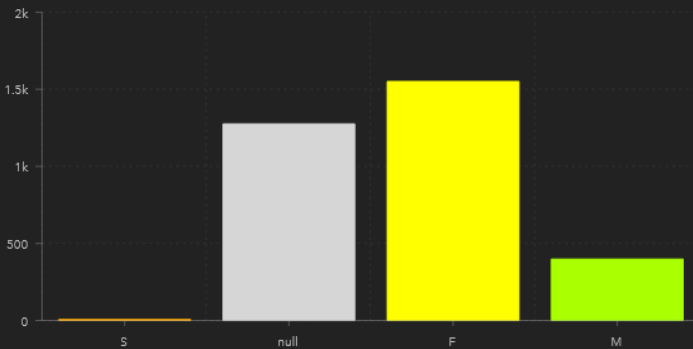
STCI (avg)

41.2

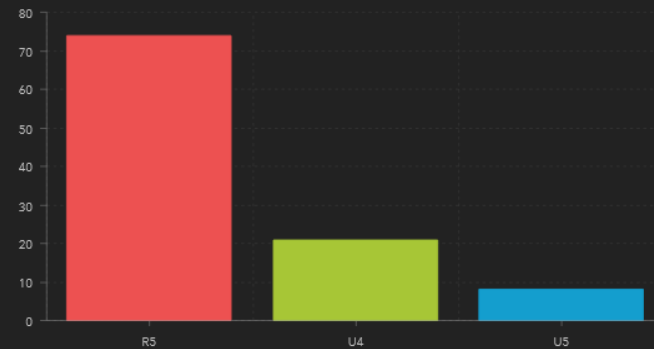
RCI (avg)

51.4

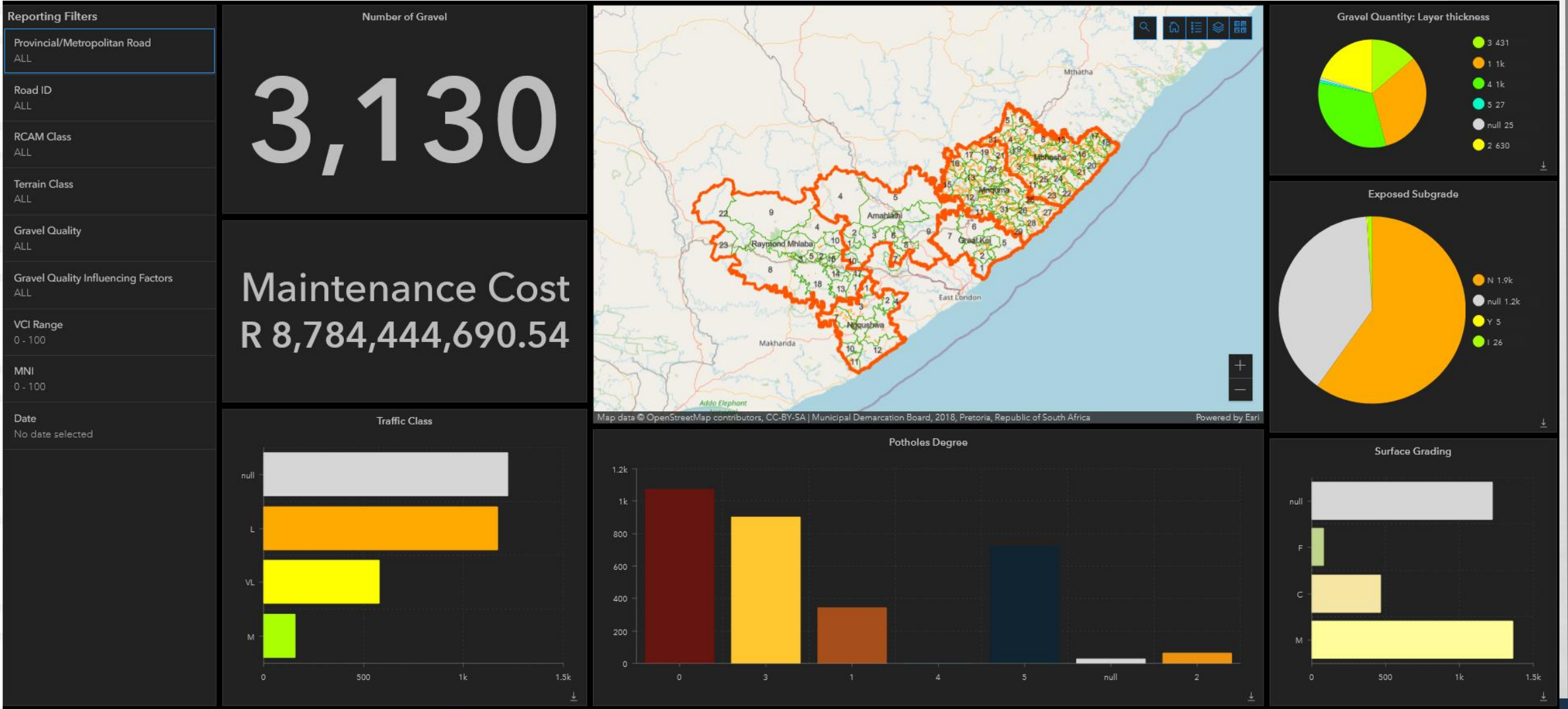
Gradient



RCAM Classification



UNPAVED MANAGEMENT SYSTEM DASHBOARD



PAVED & UNPAVED MANAGEMENT SYSTEM FORMS (APPS)

Pavement Management System

ROAD ID

Road

▼ Road Information

START KM	END KM
START DATE	END DATE
<input type="text"/>	<input type="text"/>
AUTH RD ID	SACD ROUTE
AUTH RD DIR	RCAM CLASS
START DESC	END DESC
GIS LINK	SEG ID
STATUS	SURF TYPE

Unpaved Road Management System

ROAD ID

Road

▶ Road Information

▶ Visual Condition

▼ Material Properties

GRAVEL QUALITY	GQUAL-OVERSIZE
GQUAL CLAY	GQUAL LOOSE
MAX SIZE	GRADING
PLASTICITY	GRAVEL QUANTITY
EXPOSURED SUBGRADE	SUBGRADE QUALITY

Image

BRIDGE MANAGEMENT SYSTEM DASHBOARD

Bridge Management System Dashboard

Filters

District Municipality
ALL

Local Municipality
ALL

Ward Number
ALL

Structure Type
ALL

Inspection Type
ALL

Road Authority
ALL

Inspector Name
ALL

Total Number of Structures

47

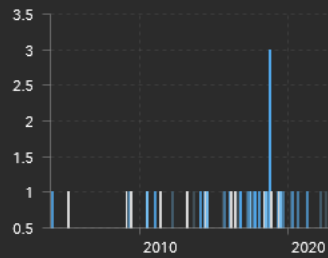
Ava Structure Height (m)

5.6

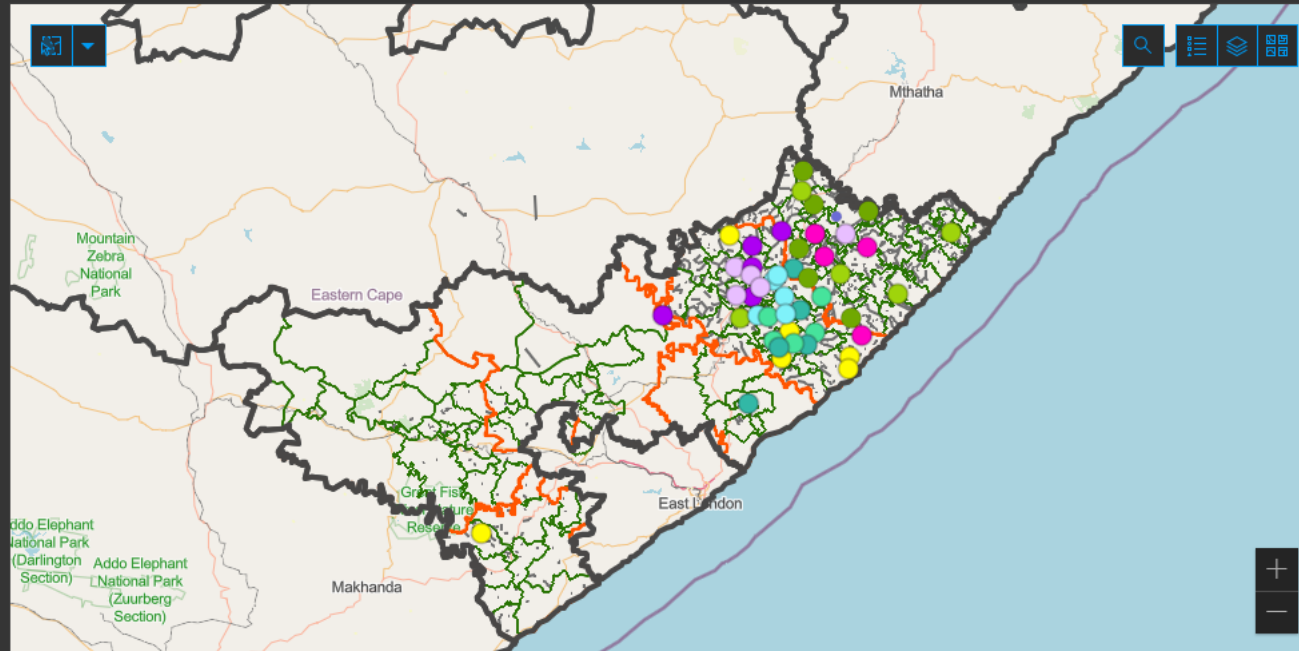
Ava Overall Length (m)

20.6

Number of structures constructed per year



- Culvert Lesser
- Road Tunnel
- Bridge Cable
- Bridge General
- Retain Wall
- Gantry
- Bridge Arch
- Bridge Cellular



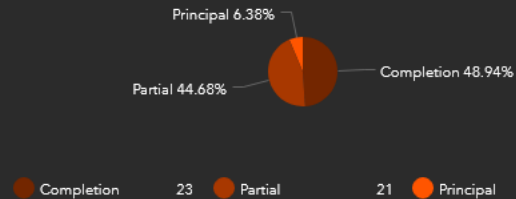
Map data © OpenStreetMap contributors, Microsoft, Esri Community Maps contributors, Map layer by Esri | Municipal Demarcation Board, 2018, Pretoria, Repu... Powered by Esri

Structures requiring further inspection:

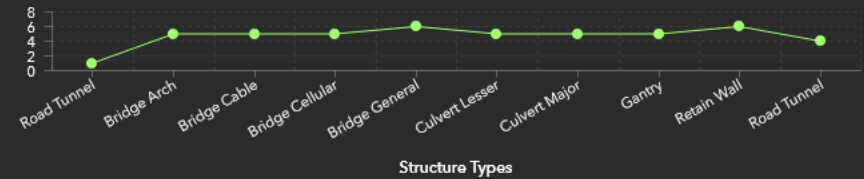
inspection:

- Bridge Cable : Storms , 21 inspection items
- Bridge Cable : Van Tou , 14 inspection items
- Bridge Cable : Niwey , 21 inspection items
- Bridge Cable : Taliép , 21 inspection items
- Bridge Cellular : Mkitso , 14 inspection items
- Bridge Cellular : Atter , 5 inspection items
- Bridge Cellular : Daniel , 21 inspection items
- Bridge Cellular : Hoesep , 14 inspection items
- Bridge General : Krymaan , 21 inspection items

Inspection Type



Number of each structure type



Structure Type | Inspection Items | Minimum height

TRAFFIC LINK SYSTEM DASHBOARD

- Filters
- Year of Assessed Roads
None
 - Local Municipality
None
 - Road ID
None
 - Ward Number
None
 - RCAM Classification
None
 - Road Type
None
 - Tererain Classification
None
 - Road Width
None
 - Date
No date selected
 - Total Number of Vehicles
0 - 5,000,000
 - Number of Light Vehicles
0 - 20,000
 - Number of Minibus Vehicles
0 - 2,000
 - Number of Buses
0 - 10,000
 - Number of Truck Short
0 - 1,000

Number of Roads

3,236

AADT Truck Short

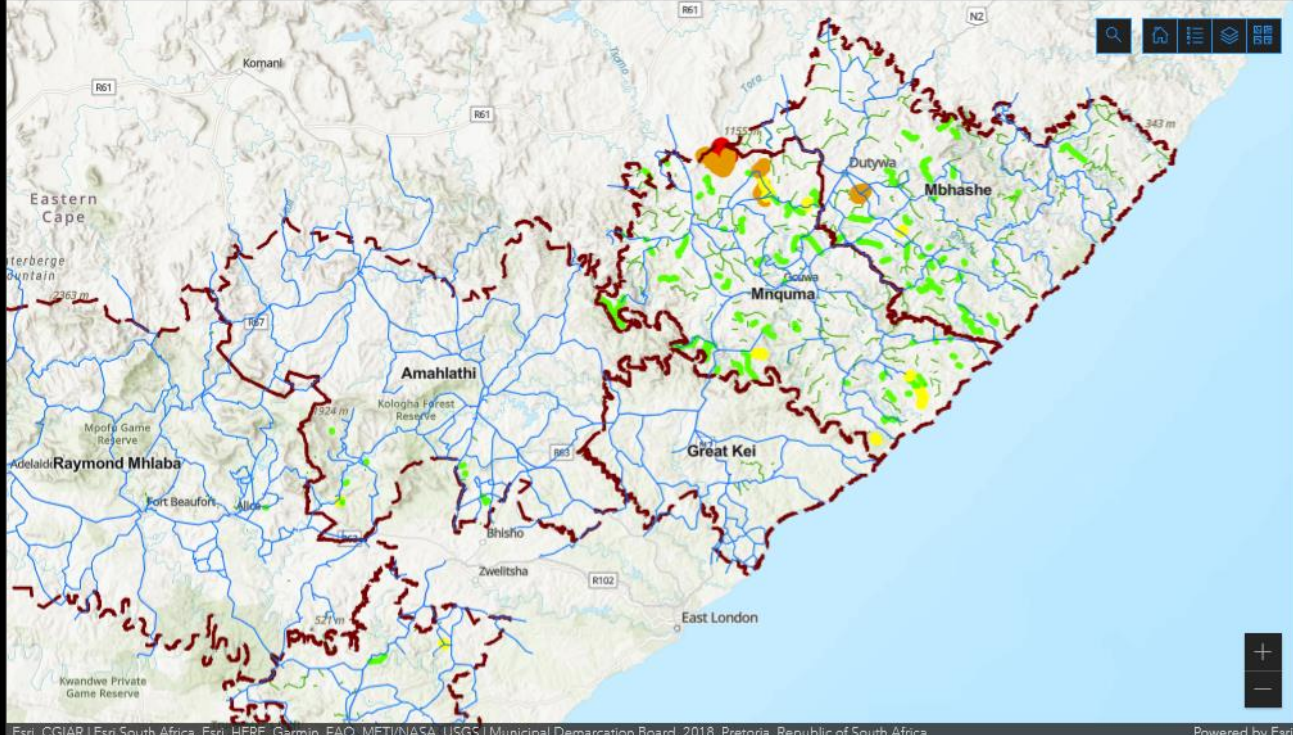
36,023

AADT Minibus
153,742

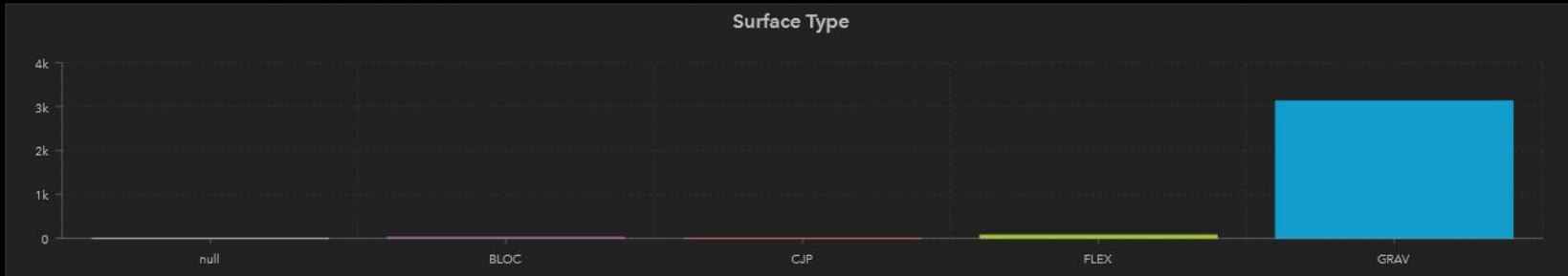
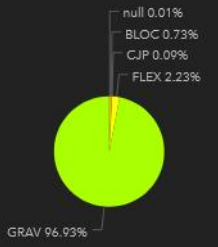
AADT Light
2,565,236

AADT Bus
784,498

AADT Truck Long
52,161



AADT Total
3,685,581



TRAFFIC LINK SYSTEM DASHBOARD

- Filters
- Year of Assessed Roads
None
 - Local Municipality
None
 - Road ID
None
 - Ward Number
None
 - RCAM Classification
None
 - Road Type
None
 - Tererain Classification
None
 - Road Width
None
 - Date
No date selected
 - Total Number of Vehicles
0 - 5,000,000
 - Number of Light Vehicles
0 - 20,000
 - Number of Minibus Vehicles
0 - 2,000
 - Number of Buses
0 - 10,000
 - Number of Truck Short
0 - 1,000

Number of Roads

3,236

AADT Truck Short

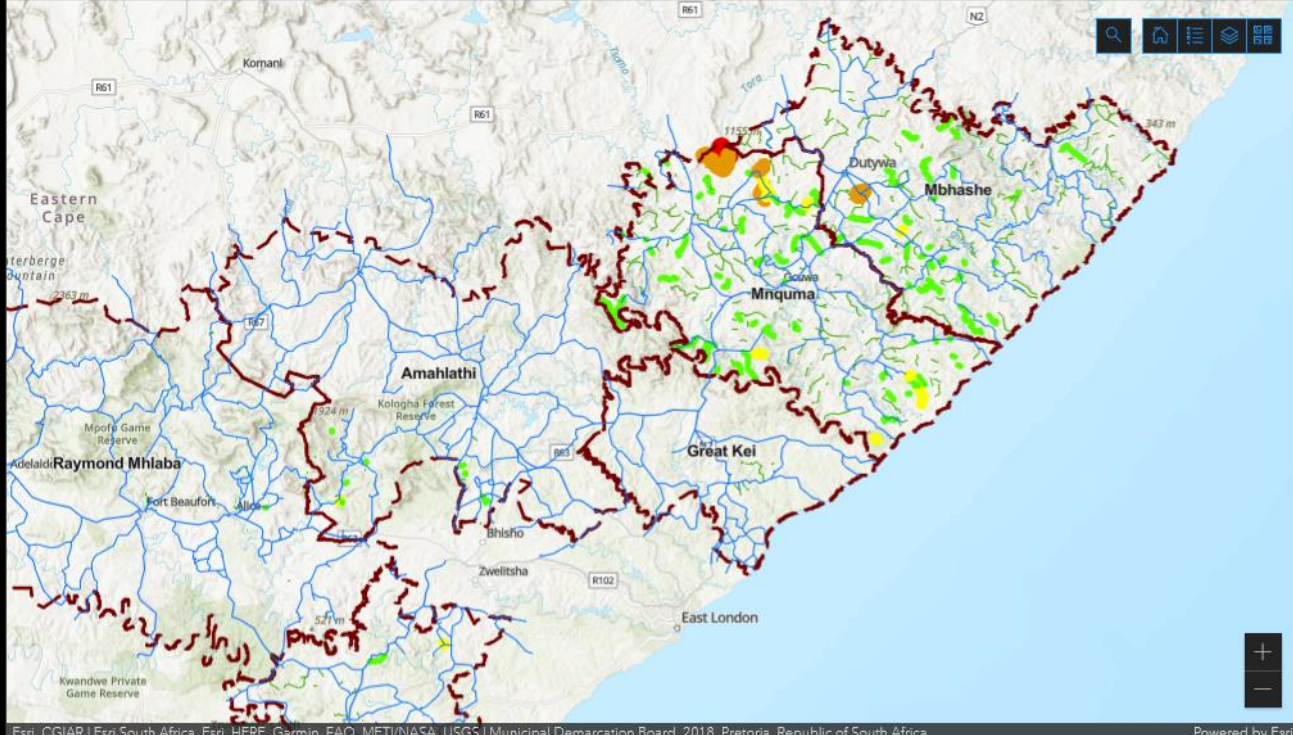
36,023

AADT Minibus
153,742

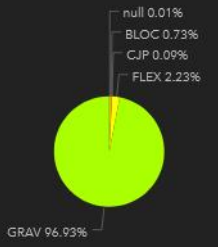
AADT Light
2,565,236

AADT Bus
784,498

AADT Truck Long
52,161



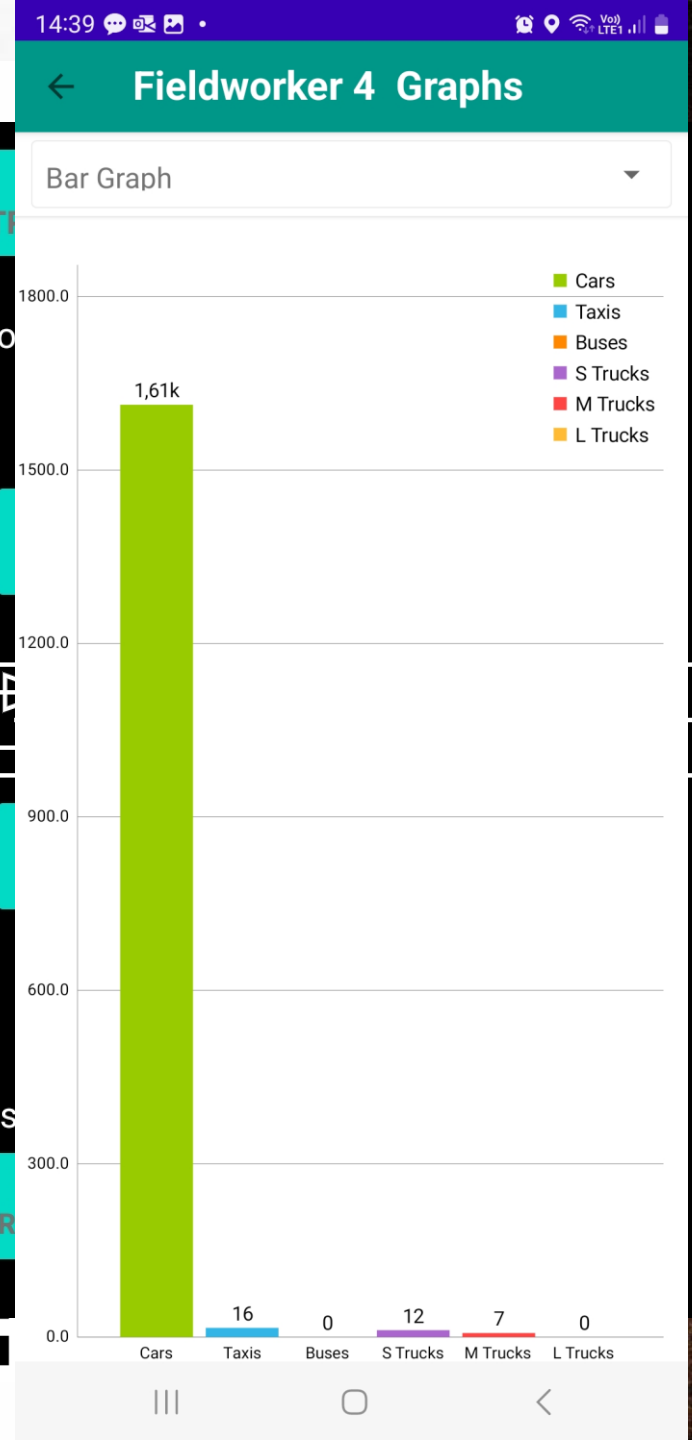
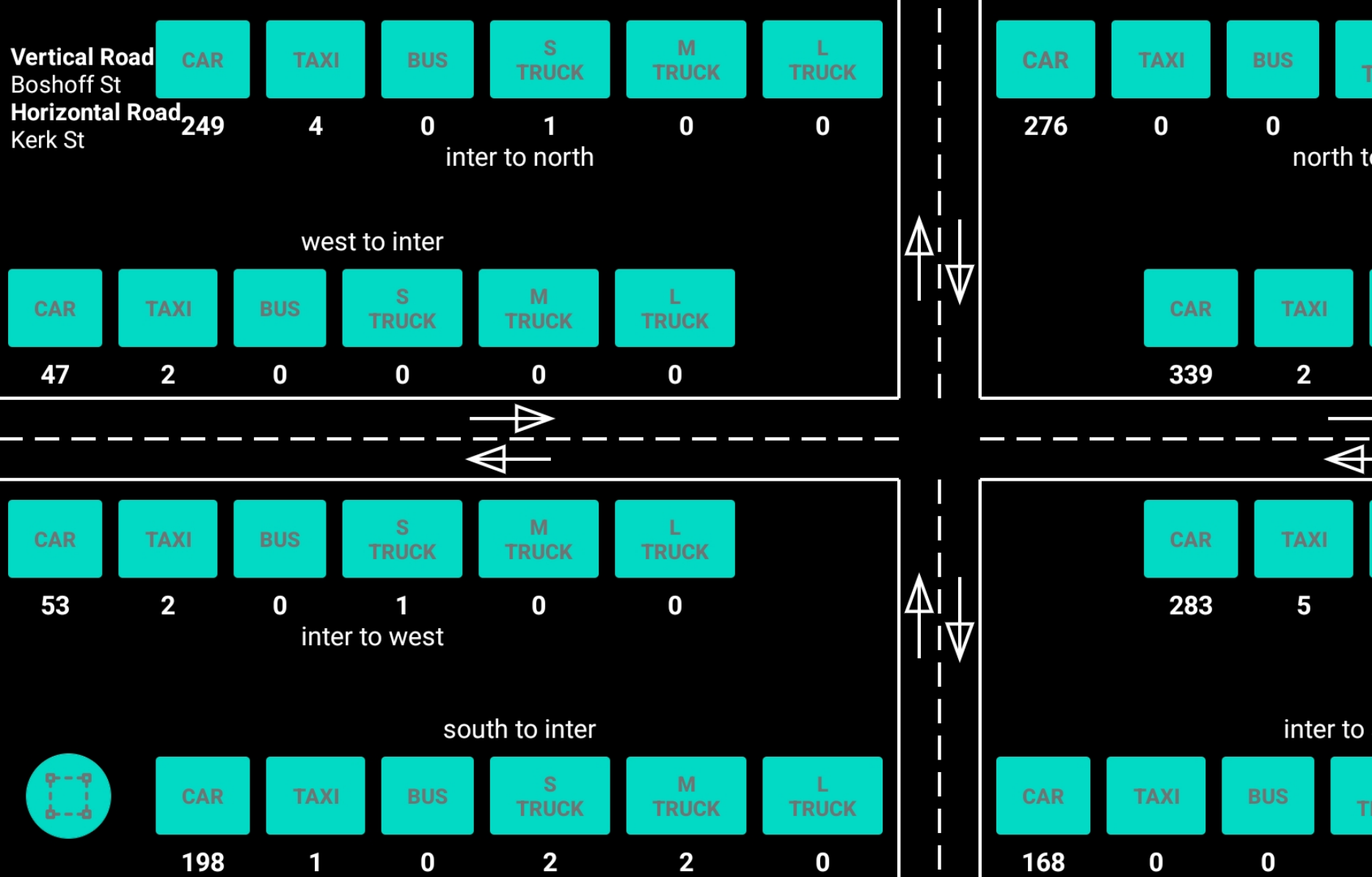
AADT Total
3,685,581



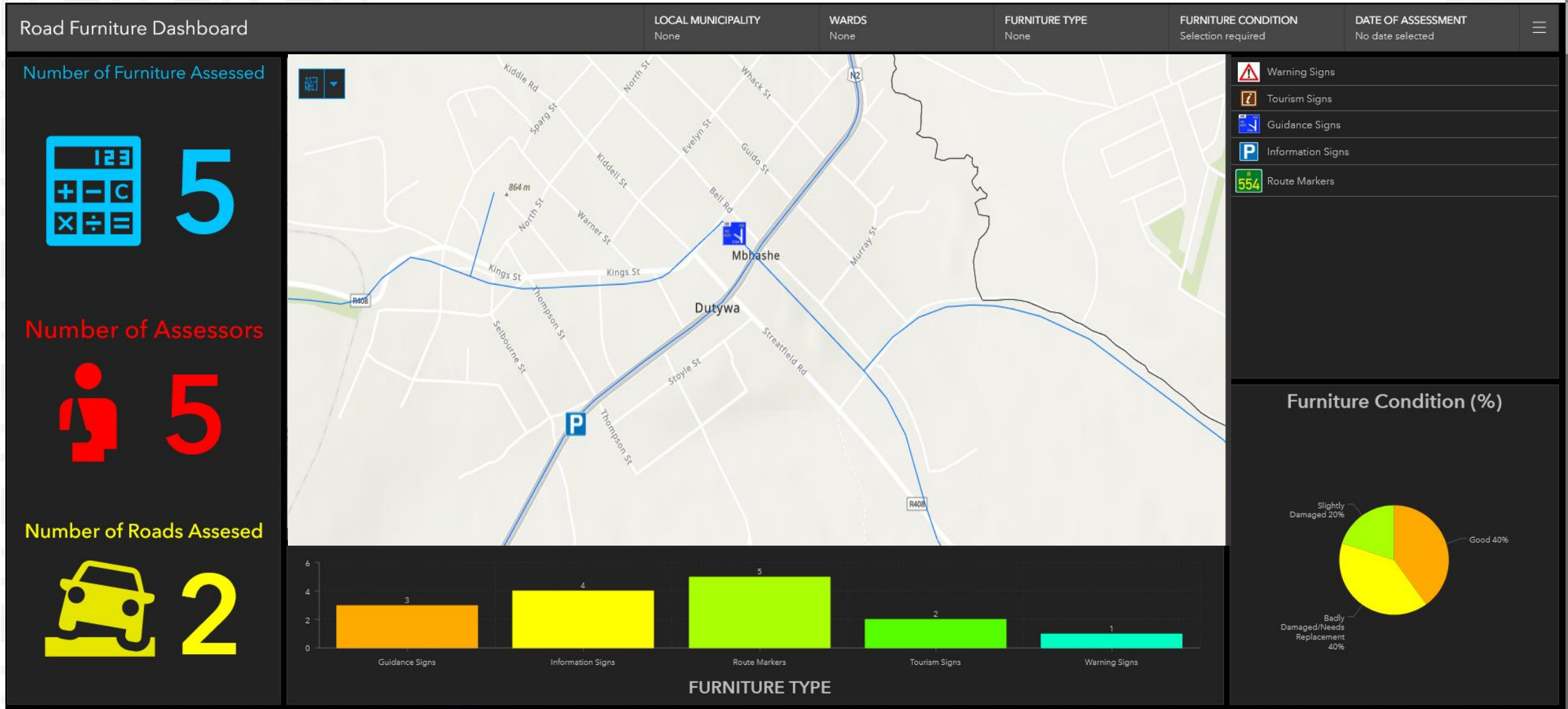
Surface Type



TRAFFIC LINK SYSTEM - TRAFFIC COUNT APP



FURNITURE MANAGEMENT SYSTEMS DASHBOARD



SITUATIONAL ANALYSIS

NTG solutions RAMS Situational Analysis with ArcGIS Web AppBuilder

Find address or place

Query

Tasks Results

Amathole_Road_Only

Gravel Quality
- empty -

Grading
- empty -

Pothole Degree
- empty -

Apply

Project Area

Map data © OpenStreetMap contributors, CC-BY-SA | Municipal Demarcation Board, 2018, Pretoria, Republic of South Africa

Hotspot Spatial_layers - PopLSM_Pov_Growth Soil type Traditional Authorities Poverty Index Land Capability Geology Economically Activity Commercial Land Road Furniture Management System (PMS) STATS_2011_2016 - MN_2011_STATS_SUMMARY STATS_2011_2016 - MN_2016_STATS_SUMMARY STATS_2011_2016 - MN_2011_2016_STATS_SUM

Options Filter by map extent Zoom to Clear selection Refresh

MUNICIPALITY	DISTRICT	PROVINCE	TOTAL POPULATION	Total_Population
Mbhashe	Amathole	Eastern Cape	254,908	254,908.00
Minquma	Amathole	Eastern Cape	252,390	252,390.00
Great Kei	Amathole	Eastern Cape	38,991	38,991.00
Amahlathi	Amathole	Eastern Cape	122,778	122,778.00
Ngqushwa	Amathole	Eastern Cape	72,190	72,190.00
Nkonkobe	Amathole	Eastern Cape	127,114	127,114.00
Nxuba	Amathole	Eastern Cape	24,264	24,264.00

7 features 0 selected

SITUATIONAL ANALYSIS REPORT

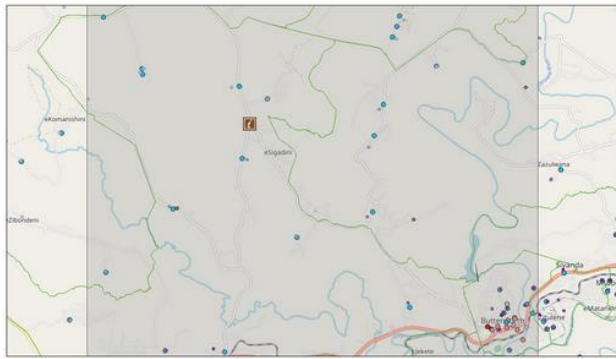


Report

Area of Interest Information

Area : 124,446,695.67 m²

Apr 6 2022 14:23:52 South Africa Standard Time



- 0-10 Bridges
- 0-10 Police Stations
- 0-10 Libraries
- 0-10 Schools
- 0-10 Road Furniture Management System (PMS)
- 0-10 Hospitals
- 0-10 Higher Education
- 0-10 Police Stations
- 0-10 Government Office
- 0-10 Tourist Signs
- 0-10 Government Office
- 0-10 Tourist Signs

Enter comments here

Summary

Name	Count	Area(m ²)	Length(km)
Bridges	3	N/A	N/A
Road Furniture Management System (PMS)	1	N/A	N/A
Wards	9	124,446,689.54	N/A
Police Stations	1	N/A	N/A
Schools	26	N/A	N/A

Road Furniture Management System (PMS)

#	patu	ASSESSOR	measured	furnitureType	FurnitureDescription	FurnitureCondition	returnCoordinates1	returnCoordinates2
1	No Data	No Data	No Data	Tourism Signs	ad	Good	No Data	No Data

#	coordinates	Replacement_costs	Count
1	No Data	No Data	1

Wards

#	WardNo	CAT_B	WardID	Province	MunicName	MapCode	Area(m ²)
1	2	EC122	21,202,002	EC	Mnquma	EC122_2	107,693.87
2	18	EC122	21,202,018	EC	Mnquma	EC122_18	1,684,860.30
3	9	EC122	21,202,009	EC	Mnquma	EC122_9	2,202,366.27
4	6	EC122	21,202,006	EC	Mnquma	EC122_6	2,275,661.28
5	1	EC122	21,202,001	EC	Mnquma	EC122_1	4,373,202.22
6	20	EC122	21,202,020	EC	Mnquma	EC122_20	7,334,338.88
7	13	EC122	21,202,013	EC	Mnquma	EC122_13	7,962,790.46
8	7	EC122	21,202,007	EC	Mnquma	EC122_7	34,820,492.33
9	8	EC122	21,202,008	EC	Mnquma	EC122_8	63,685,283.93

Police Stations

#	COMPNT_NM	LOCATION_X	LOCATION_Y	Count
1	BUTTERWORTH	28.14	-32.33	1

Schools

#	Name	Distance	Dist_Cat	NAME_1	Edu_Cat	Fund_Cat	No_of_Boys	No_of_Girl
1	WB Nxusani Senior Primary School	8.02	5 - 20	Eastern Cape	No Data	No Data	0	0
2	Thembelihle Junior Secondary School	3.38	2 - 5	Eastern Cape	No Data	No Data	0	0

CENTRALIZED DATA REPOSITORY

Central Data Repository

Click on the Local Municipality Boundary to view the documents in the Repository



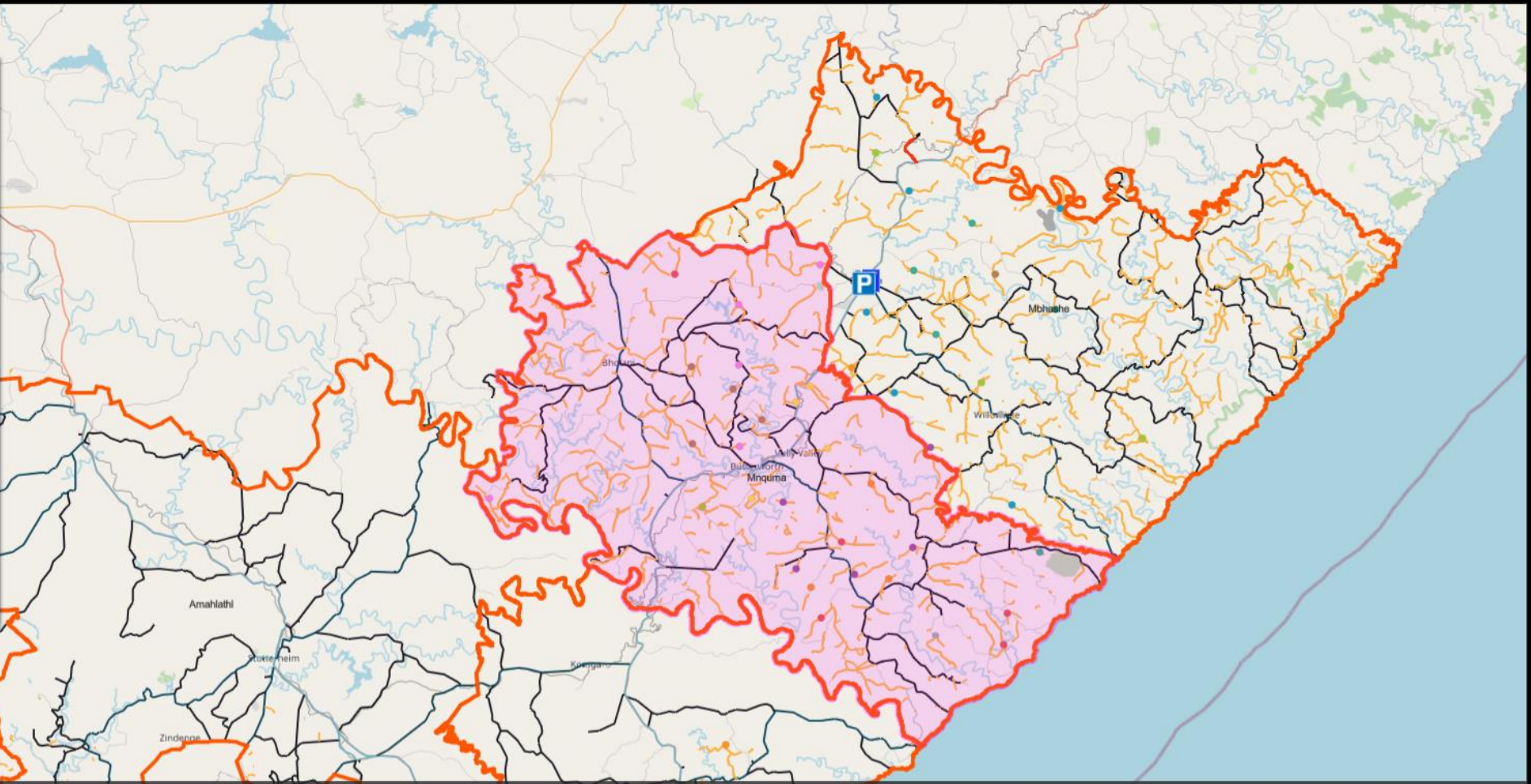
Zoom to + Pan 1 of 14

Mnquma

PROVINCE	EC
Municipality Name	Mnquma
District Municipality	Amathole

TMH9_Manual_Visual_RoadPavements_PartA_General (1).pdf

TMH_13_AutomatedRoadAssessments_PartG.pdf



Map data © OpenStreetMap contributors, CC-BY-SA | Municipal Demarcation Board, 2018, Pretoria, Republic of South Africa

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SDBIP DASHBOARD

08. SDBIP Dashboard

LOCAL MUNICIPALITY
None

WARDS
None

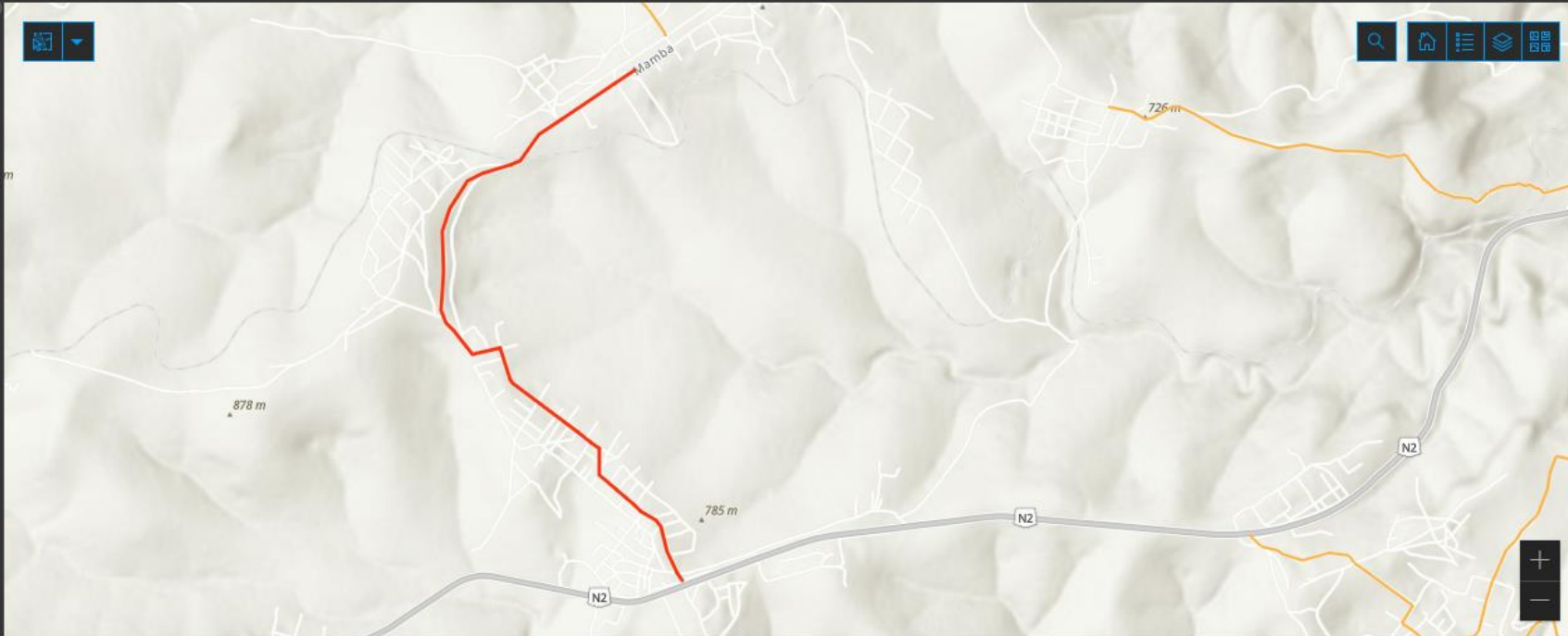
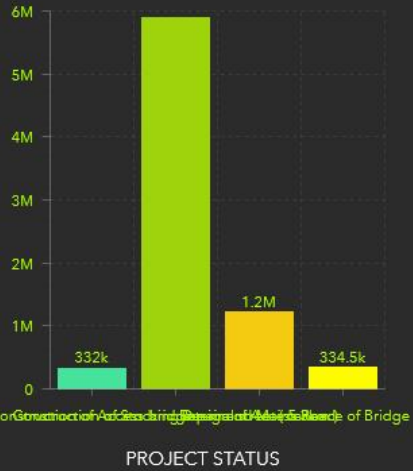
PROJECT DESCRIPTION
None

ROAD ID
Selection required

PROJECT STATUS
None

FINANCIAL YEAR
No date selected

PROJECT STATUS



Esri, NASA, NGA, USGS | Esri South Africa, Esri, HERE, Garmin, METI/NASA, USGS | Municipal Demarcation Board, 2018, Pretoria, Republic of South Africa

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Annual Target per Project

- Planned
- Under construction

FINANCIAL YEAR



Last update: a few seconds ago



1. ArcGIS Online Standard package

- a) Asset registration and visualization
- b) Indices calculations
- c) Dashboard
- d) Query reports

2. Survey 123

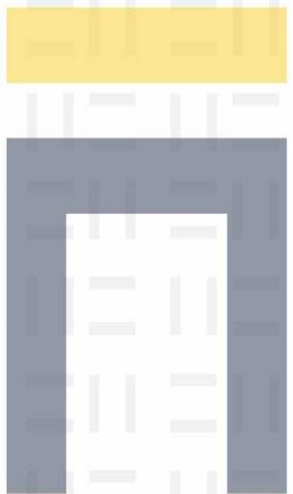
- a) Asset condition assessment

3. Java Applications

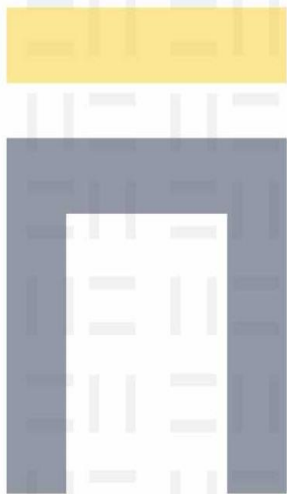
- a) 3rd party data import application
- b) Upgrade and Maintenance costs inputs and update
- c) Indices calculation

4. Android/IOS Applications

- a) Traffic counting
- b) Monitoring



ENKOSI!



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w: www.ntgsolutions.co.za

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Office No.2. Cnr of 5th & Harry Galaun
Roads, Midrand | 1685