FUNCTIONAL CLASSIFICATION OF ROADS IN THE ETHEKWINI MUNICIPAL AREA

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ABSTRACT

The need for a newly classified road network for the eThekwini Municipality was driven by the latest Road Infrastructure Strategic Framework for South Africa (RISFSA) and the benefits that the framework brings to authorities and road users. An up-to-date road network classified in accordance with the latest RISFSA and Committee of Transport Officials – Road Classification and Access Management (COTO RCAM) guidelines provides improved functionality to the road network, as well as a host of benefits to both the eThekwini Transport Authority (ETA) and road users within the Municipality.

A classified road database provides a sound basis for decision making when planning new routes and handling access approvals. A further key benefit of the RISFSA classified network is the intention to address the imbalances of the past, particularly in the eThekwini Municipality, by providing equality of access and mobility to all areas within the eThekwini Municipal boundary.

This paper discusses the methodology used for the road classification process, and highlights key outcomes. Due to the nature of this project, and its effect on a wide range of service authorities, extensive stakeholder engagement was a necessity in the final classification process. These notably included the ETA, KwaZulu-Natal Department of Transport and eThekwini Roads Provision.

1. INTRODUCTION

SMEC South Africa (Pty) Ltd was appointed in February 2012 by the eThekwini Transport Authority (ETA) to carry out the Functional Classification of Roads in the eThekwini Municipal area. The need for a newly classified road network for the eThekwini Municipality was driven by the latest Road Infrastructure Strategic Framework for South Africa (RISFSA) and the benefits that the framework brings to authorities and road users. A current road network, classified in accordance with the latest RISFSA and Committee of Transport Officials – Road Classification and Access Management (COTO RCAM) guidelines provides improved functionality to the road network, as well as a host of benefits to both the ETA and road users within the Municipality.

According to RISFSA (DOT, 2006), the classification and management of the road network is a fundamental component for the planning and development of road infrastructure in the country in order to optimise efficiency and effectiveness in the delivery of roads. The network is considered to be the heartbeat of development, because it performs the basic yet critical function of providing the lifeblood of access and mobility for the execution of economic and social activities.

2. KEY BENEFITS OF RISFSA

The primary benefit of an appropriately classified road network is for the governing authority that manages it together with the road users. Road users will benefit from the newly classified road network, with shorter travel times on higher mobility routes. Economically this benefits the community surrounding the immediate road network by improving travel times, improving road safety and potentially opening access to small businesses, as well as developers looking to gain access approvals in different areas of the Municipality. Lower order classification of busy routes where a higher number of accesses are present, also attempts to improve safety by reducing permissible speed limits and enabling the introduction of traffic calming measures and required pedestrian or Non-Motorised Transport (NMT) facilities. The RISFSA prescribed road classes for rural and urban roads are illustrated in Figure 1 and Figure 2 respectively.

Function			Description		Mobility				
Basic Function	Alternate functional descriptions	Determining function	Class No (R_)	Class name	Origin / destination	Through traffic component	Reach of connectivity	% of built km	AADT (average annual daily traffic)
Mobility	Vehicle priority, vehicle only, long distance, through, high order, high speed, numbered, commercial, economic, strategic; route, arterial road or highway.	Movement is dominant, through traffic is dominant, the majority of traffic does not originate or terminate in the immediate vicinity, the function of the road is to carry high volumes of traffic between urban areas	1	Principal arterial*	Metro areas, large cities, large border posts, join national routes	Exclusively	> 50 km	2 - 4% Classes 1 and 2	1000 – 100 000+
			2	Major arterial*	Cities and large towns, transport nodes (harbours and international airports), smaller border posts, join major routes	Exclusively	>25 km		500 – 25 000+
			3	Minor arterial*	Towns, villages and rural settlements, tourist destinations, transport nodes (railway sidings, seaports, landing strips), small border posts, other routes	Predominant	> 10 km	6 - 12% Classes 1, 2 and 3	100 – 2 000+
Access / Activity	Access, mixed pedestrian and vehicle traffic, short distance, low order, lower speed, community / farm, road or street.	Access, turning and crossing movements are allowed, the majority of traffic has an origin or destination in the district, the function of the road is to provide a safe environment for vehicles and pedestrians using access points	4	Collector road	Connect farming districts, rural settlements, tourist areas, national and private parks and mines to mobility routes	Minimal	< 10 km	20 - 25%	< 1 000
			5	Local road	Farm or property access, connection to other routes	Nil Discontinuous	< 5 km	65 - 75%	< 500
			6	Walkway (path or track)	Settlements, farms, transport nodes, water points	n/a			

Figure 1: Rural Functional Road Classification

Function			Description		Mobility				Traffic	
Basic Function	Alternate functional descriptions	Determining function	Class No (U_)	Class name	Through traffic component	Distance between parallel roads (km)	% of built km	Reach of Connectivity	Expected range of ADT (average daily traffic)	% of travel veh-km
Mobility	vehicle priority, vehicle only, long distance, through, high order, high speed, numbered, commercial, economic, strategic; route, arterial road or highway.	Movement is dominant, through traffic is dominant, the majority of traffic does not originate or terminate in the immediate vicinity, the function of the road is to carry high volumes of traffic between urban districts	1	Principal arterial (free-way)	Exclusively	5 - 10 km	5 - 10% Classes U1 and U2	> 20 km	40 000 - 120 000+	40 – 65% Classes U1 and U2
			2	Major arterial	Predominant	1.5 - 5.0 km		> 10 km	20 000 - 60 000	
			3	Minor arterial	Major	0.8 - 2.0 km	15 - 25% Classes U1, U2 and U3	> 2 km	10 000 - 40 000	65 – 80% Classes U1, U2 and U3
Access / Activity	Access, mixed pedestrian and vehicle traffic, short distance, low order, low speed, community, street.	Access, turning and crossing movements are allowed, the majority of traffic has an origin or destination in the immediate area, the function of the road is to provide a safe environment for vehicles and pedestrians using access points	4a	Collector street, commercial	Discourage		5 – 10%	< 2 to 3 km	< 25 000	5 – 10%
			4b	Collector street, residential	Discourage			< 2 km	< 10 000	
			5a	Local street, commercial	Prevent		65 – 80%	< 1 km	< 5 000	10 – 30%
			5b	Local street, residential	Prevent			< 0.5 km (1 km Max)	< 1 000	
			6a	Walkway, pedestrian priority	Ban					
			6b	Walkway, pedestrian only	Ban					

Figure 2: Urban Functional Road Classification

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The eThekwini Municipality is to benefit from the RISFSA project in the following ways:

- Improved functionality of the road network through correct road classification. Mobility is improved on major routes through higher order classification, preventing access provision on such routes where mobility is key;
- Similarly, routes where access is the key function of the road have been classified as a lower order road to ensure that the road functions as intended, as an access route with reduced mobility; and
- A classified road database provides a sound basis for decision making when planning new routes and handling access approvals. It provides a legally sound source of evidence for decision making and planning, as it was developed using the latest national road framework guidelines.

A further key benefit of the RISFSA classified network is the intention to address the imbalances of the past, particularly in the eThekwini Municipality, by providing equality of access and mobility to all areas within the eThekwini Municipal boundary. This enables high level and detailed transportation planning to take place in areas where minimal transportation planning has been provided for previously.

3. METHODOLOGY FOR CLASSIFICATION

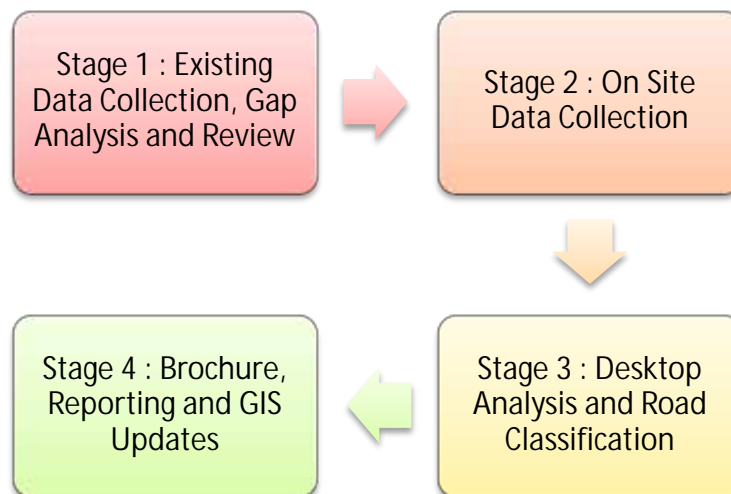The project methodology comprised of four main stages, as shown in Figure 3

Stage 1 : Existing Data Collection, Gap Analysis and Review

Stage 2 : On Site Data Collection

Stage 4 : Brochure, Reporting and GIS Updates

Stage 3 : Desktop Analysis and Road Classification

Figure 3: RISFSA Methodology Process

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3.1. Stage 1

The first stage of the project consisted of existing data review. Sources of the existing information included eThekwini Road Classification Database (2009), KZN DoT Provincial Road Classification Database (2012), ETA Traffic Count Database (2011), the latest eThekwini Planning and Development Data (2012) and the latest Mr SID imagery for eThekwini (2011). Once existing information regarding the existing road network was received, an assessment was required in order to determine its quality and accuracy of the data before the commencement of on-site and desktop data collection. The method used for this assessment was:

· Group road data in the database according to existing classification (Class 1 to Class 6);
· List the surface type of each class according to number of lanes;
· Transpose surface type and number of lanes against the specified road width; and
· Group the total length of road per class according to road widths and evaluate the accuracy in relation to reasonable standards.

Thereafter the latest intersection, cordon and screen-line counts were assessed and analysed in terms of the location and year conducted. Only traffic counts post 2008 were considered for analysis in this project. Existing traffic counts were transferred to a GIS database grouped according to traffic count type (intersection or cordon count) and dated (2008 to 2011). The following numbers of traffic counts were identified:

· 950 Intersection counts (ETA supplied); and
· 225 screen line counts (ETA supplied).

The RISFSA 2009 database indicated that the the total length of the road network within the eThekwini Municipal area is 12 330 km.

3.2. Stage 2

The second stage of this project included on-site data collection in terms of desktop level information, screen-line traffic counts and on-site visual inspection.

A team of data analysts used various sources of information obtained in Stage 1 to obtain data on all roads throughout the municipal area. This information was populated into road classification check lists and measured against criteria specified in the COTO RCAM document. From this point an initial road classification was made, and later verified by the traffic count data collected on site.
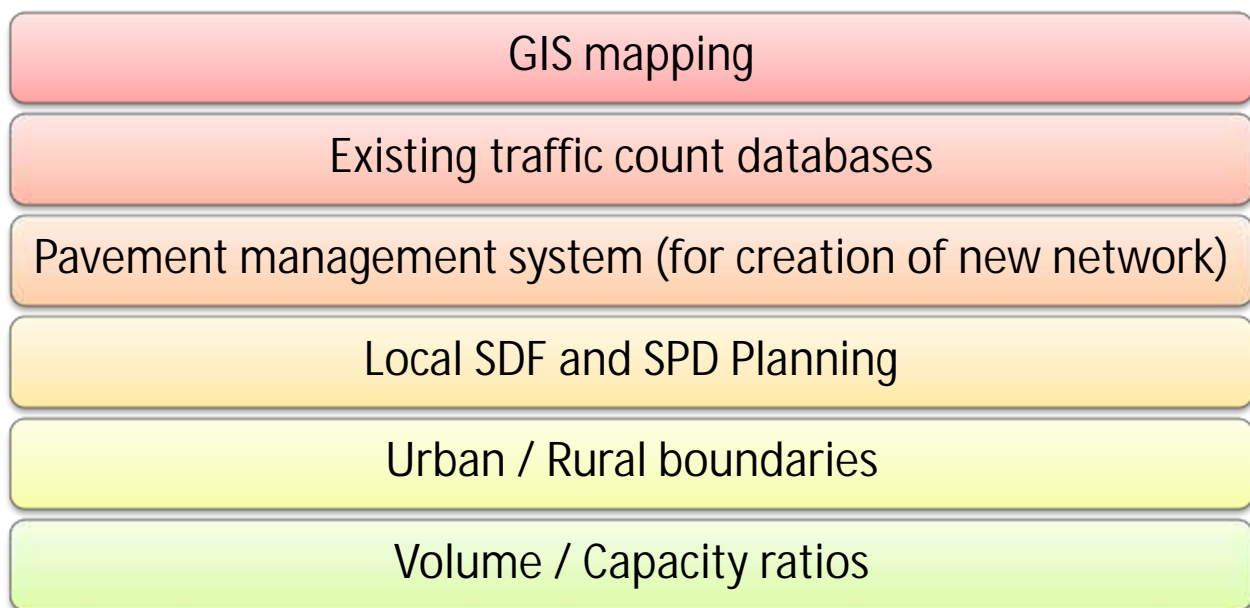
Traffic counts were undertaken as classified 24 hour, 3 day weekday counts. Weeks with public or school holidays were excluded due to irregular 'non-peak' traffic patterns unless agreed in advance with the Client. Major routes within the Municipality from class 1, 2 and 3 were identified and given 5km buffers to represent proximity of access to surrounding areas. Where large areas existed that were not serviced by major routes, existing roads classed from 4 to 6 were identified to determine suitable count locations. Traffic counts were also identified on roads which may be upgraded to higher order roads in future, providing mobility to poorly serviced areas.

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It was determined that approximately 600 electronic traffic counts were required. In addition to this, a specific request was made to classify Public Transport vehicles along primary routes. These were undertaken using an estimated 70 manual traffic counts, with their specific locations determined in close consultation with ETA representatives. A list of known bottle necks within the Municipality was also assessed to assist with the selection of manual counts.

Visual verifications were carried out by a team of technicians, who drove all roads within the eThekwini Municipality. This phase was conducted in a unique manner by incorporating innovative technology with visual verifications. Smarty HDD recorders and a GPS enabled cameras were used to video roads travelled and a significant number of photos of notable road features were taken to verify interim classifications in accordance with the COTO RCAM and RISFSA document principles. The data collected in this stage was also used to verify information gathered at desktop level such as road widths and surface type.

3.3. Stage 3

The existing data collected and analysed in Stage 1 and 2 was used to determine a data collection strategy in Stage 3. The following data was deemed essential for analysis and review in order to classify roads within the eThekwini Municipality:

GIS mapping

Existing traffic count databases

Pavement management system (for creation of new network)

Local SDF and SPD Planning

Urban / Rural boundaries

Volume / Capacity ratios

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The methodology used for road classification within eThekwini is in accordance with RISFSA and COTO RCAM principles, as illustrated in Figure 4.
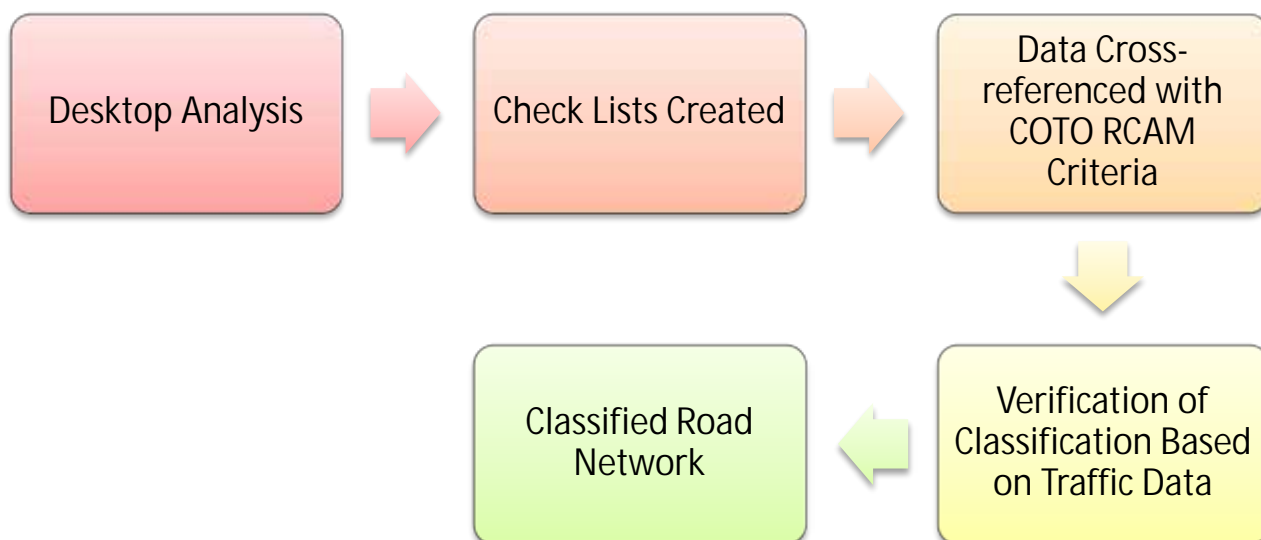

Figure 4: Road Classification Process

A breakdown of the classified road network within each region of eThekwini was provided, together with corresponding technical data indicating length of roads per owner and class. Stakeholder workshops formed an integral part of the project and provided a forum for relevant roads authorities to provide input for road classifications within the Municipality. These notably included the ETA, KwaZulu-Natal Department of Transport and eThekwini Roads Provision. Future road alignments were assessed, classified and added to the road network during these workshops in order to provide a comprehensive overview of the future eThekwini road network.

3.4.   Stage 4

The final stage of the project consisted of publishing the outcomes of the RISFSA project. Information regarding the classification process and the newly classified roads was made available in brochure format to the public from the offices of the ETA.

4. CHALLENGES FACED

The reclassification process experienced some challenges in terms of identification and verification of road ownership, urban and rural boundaries and property access. This information formed part of the decision making process, thus it was key to obtain the most recent, relevant and accurate data available. These challenges were overcome through extensive stakeholder engagement workshops with the relevant authorities and affected parties.

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5. LESSONS LEARNT

The SMEC project team has learn valuable lessons throughout the duration of the project which could benefit other authorities who may embark on the same process. It was identified that a data collection methodology is critical, both in terms of time and cost efficiency. It was also found that a top down and bottom up approach is useful when establishing a first draft classification – for example start with Class 1 and 2 roads then set the rest as class 5 and work through to identify the class 3's and 4's. It is important for all stakeholders to be reminded that the RISFSA network is how the road network should operate, not necessarily how it currently operates. Finally is was realised that the team should not be afraid to make bold decisions in terms of the classification – it can be easier to downgrade (from class 3 to 4) than upgrade (from class 3 to 2).

The strengths and weaknesses of the RISFSA system has been broken down as illustrated in Figure 5.

Strengths	Weaknesses
• High level planning that focusses on the future and how a transportation network can improve mobility and accessibility; • Useful as a guide for future development, provided that it is done in advance; • Useful template or checklist (user friendly) to assist with classifying road network; • Information collected can be used to assist in road condition assessments; and • Encourages integration between service authorities so that the user see a seamless transition on the road network.	• Difficult to retrofit planning with current network; • Can be data intensive in terms of information required to make a decision (but see point four above); • Only as strong as the buy-in from the various departments; • Traffic counts conducted over an extended period were often targeted in terms of theft; and • Defining the urban / rural boundary is often not linked to other standard planning guidelines – ie: it becomes a boundary specific for RISFSA classification.

Figure 5: RISFSA Strengths and Weaknesses

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6. PROJECT OUTCOMES

The SMEC project team introduced latest technology to capture these road features which were utilised for the classification of approximately 12 000km of road network. The functional classification of roads in the eThekwini Municipal area was completed on 28 March 2013.

The project successfully achieved the following objectives, in line with requirements set out in the original tender document and inception meeting:

- A wealth of existing municipal data necessary for road classification was collected and assessed;
- 600 electronic traffic counts were completed, assessed, used for road classification and added to the new road classification database;
- 100 manual traffic counts were completed, assessed, used for road classification and added to the new road classification database;
- Approximately 100 000 photos showing visual assessments were taken, assessed and added to the new road classification database;
- Completed the road classification of approximately 12 000 km of road network in accordance with the principles set out in the latest COTO RCAM and RISFSA documentation;
- Produced a brochure on the project for the public to access and learn about the project;
- Produced this final report detailing all aspects of the project and classification process; and
- Produced final road classification in GIS format as well as key NMT characteristics in the form of geo-referenced photos. Other key traffic information included are v/c ratios, public transport routes and future roads for planning purposes.

7. CONCLUSION

The RISFSA project successfully achieved its objectives through the classification of 12 000 km of road network, in accordance with the principles set out in the latest COTO RCAM and RISFSA documentation. This information has been stored and provided to the eThekwini Municipality to be used for reference on future transport projects. RISFSA has created a platform for transport to lead eThekwini into the future.