CITY OF CAPE TOWN'S TRANSPORTATION REPORTING SYSTEM (TRS)
A TOOL FOR ITP REPORTING AND OPERATING LICENCE MANAGEMENT

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ABSTRACT

In March 2010, the City of Cape Town put out a tender seeking assistance with the collection, capture, analysis and presentation of transport data for the update of the 2007 Integrated Transport Plan (ITP). The essential aim of the project is to equip the City with an integrated and consolidated system for storing and managing all information required to compile their ITP and to provide additional management reporting. Historically, the City had many separate sub-systems which housed its transportation data. In brief, the City had problems in handling and managing their data due to differing levels of technology and database platforms. Furthermore, other difficulties experienced included extending these existing systems to accommodate new functionality and reporting ability as well as these systems not being able to easily integrate, report or consolidate any information for management review.

Within one year of development, the Transportation Reporting System (TRS) has given City officials the ability to improve the management of their data and the ability to respond quicker and more efficiently to various enquiries. TRS is able to make survey data and reports available within a week of field surveys being completed, in addition to the data being protected and controlled in a transparent and auditable manner. Data is now easily accessed via the internet and automatic reports are generated to assist with the compilation of the CPTR.

1. INTRODUCTION

1.1. Background

Section 36 (1) of the National Land Transport Act (NLTA), Act 5 of 2009, states that, *"All planning authorities must prepare and submit to the MEC, by the date determined by the Minister, integrated transport plans for their respective areas for the five year period commencing on the first day of the financial year determined by*

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the MEC, and must update them in the prescribed manner and as frequently as prescribed."

The NLTA requires that all Type 1 planning authorities (Major Metropolitan Cities) produce a Comprehensive Integrated Transport Plan (CITP) that includes all other statutory transport plans, viz. Public Transport Plan, Rationalisation Plan, Operating Licence Strategy and Current Public Transport Record in one chapter, entitled, "Transport Register".

In order to be best positioned to produce data for inclusion into the Transport Register, the City's Transport Department developed a Transport Reporting System (TRS), which saw all its transport information that was previously housed in separate systems combined into a single database. Section 11 of the NLTA gives the national sphere of government the responsibility of assigning the operating license function to the most appropriate sphere of government. The City of Cape Town has done a feasibility study on the possible assignment of the operating license function. The Regulations section of the City has been proactive in developing the TRS to position itself if the function is devolved from the Provincial Government. Currently the City is only responsible for keeping a record of the demand for public transport services and to maintain a balance between this demand and the supply, which is currently regulated by the Provincial Regulatory Entity. TRS has been developed to integrate with all provincial licensing information systems.

1.2. Aim of the Paper

The aim of this paper is to share the approach and methodology of amalgamating the City's various data collection, capturing, reporting and storage methods into one comprehensive system, the TRS.

2. DATA COLLECTION BRIEF

In March 2010, the City put out the tender *"PROVISION OF PROFESSIONAL SERVICES TO ASSIST THE TRANSPORT DEPARTMENT WITH THE COLLECTION, CAPTURE, ANALYSIS AND PRESENTATION OF TRANSPORT DATA FOR THE UPDATE OF THE INTEGRATED TRANSPORT PLAN"* in an attempt to appropriately resource the various tasks to collect and validate public transport data.

Although the City had a good history of collecting and reporting on public transport data, it understood that, in order to meet their legislative commitments, it needed assistance in addressing the following concerns.

- The City had differing levels of technology and database platforms.
- Potential difficulties existed in extending the systems to include new functionality and reporting due to the age of these systems.
- There was no integrated reporting or consolidation of information for management review.

After a public tendering process, Vela VKE Consulting Engineers were appointed, along with their specialist geographical information system (GIS) subcontractor, Aspire Solutions, to commence with the work from 1 July 2010. The length of the

Contract is three years and ends 30 June 2013. After an initial assessment, the above concerns were deemed to stem directly from the following setbacks:

- **Vintage of Data** – Collected data were not being processed fast enough for analysis and reporting purposes.
- **Availability of Data** – Various reports were only available in hardcopy format and not always readily available.
- **Storage of Data** – Existing data were stored on various disparate databases, with MS Access and Excel being the most common. The City of Cape Town has an organisational policy in place that required the phasing out of Microsoft Access databases.
- **Integrity of Data** – In its then current form, the system was susceptible to subjectivity and required a data trail that could stand up to the scrutiny of an audit.

At the time of the tender, the City's data revision date of existing Public Transport data is tabulated below.

Table 1 – 2010 City of Cape Town Public Transport Data

Public Transport Mode	Revision Date	Data Storage
Minibus-taxis	November 2007	Microsoft Excel/Access
Metered-taxis	January 2008	Microsoft Excel
Bus	November 2006	Microsoft Excel/Access
Rail data is collected, analysed and stored independently by the PRASA.		

Furthermore the tasks required in the tender and frequency of the surveys over the 3 year tender period is tabulated below.

Table 2 – City of Cape Town Public Transport Data Tender Deliverables

No.	Description	Frequency from 1 July 2010 to 30 June 2013
1	Completed metropolitan minibus-taxi surveys	6
2	Completed metropolitan onboard bus survey	1
3	Completed metropolitan minibus-taxi passenger waiting time/queue length surveys	1
4	Completed metropolitan bus passenger waiting time/queue length survey	1
5	Completed metropolitan minibus-taxi holding and loading area surveys	6
6	Completed metropolitan bus loading and holding area survey	1
7	Completed metropolitan non-motorised transport surveys	3
8	Production and regular update of public transport supply and demand analysis	Continuous
9	Completed vehicle and occupancy surveys for selected employment CBD's	3
10	Completed metropolitan long distance minibus-taxi surveys	3
11	Completed metropolitan long distance bus surveys	3
12	Freight surveys	3
13	Metropolitan station parking surveys.	2
14	Completed parking inventories in selected CBD's	2
15	Database development and software support for the 3 year period as well as preparing a separate report on more innovate ways to collect data as well as the financial implications.	Continuous

3. FIELDWORK AND CAPTURING

3.1 Survey Methodologies

The following is a brief description of the typical work involved in recording the data for the various public transport modes.

- ***Minibus-Taxi Rank and Roadside Surveys*** – Surveyors are located at all Minibus-Taxi ranks and at strategic main approach roads short distances from the ranks in order to identify vehicles not reaching it. At the ranks, the staff record the time, number plates of vehicles arriving and departing to various destinations including the capacity and the utilisation of each vehicle and the fare to the various destinations. At the roadside points, the number plates, utilisation and direction in which the vehicle travels are recorded.
- ***Onboard Bus Surveys*** - The surveyors travel on each bus which operates on a Monday to Friday, recording the origin and destination. Along the route, the number of passengers is recorded, including their method of payment and the particular stop where the passenger boards or alights.
- ***Metered Taxi Surveys*** - Surveys are undertaken at all major ranks. The surveyor records the time the vehicle arrives or departs at the rank, the capacity, number of passengers carried, roof number (if any), vehicle make and model, company name and the tariff charged.
- ***Bus & Minibus-Taxi Passenger Waiting Times and Queue Length Surveys -*** There are 3 steps to the Passenger Waiting Times survey:
    - Step 1 - At the start of the peak period the surveyor identifies a person (marker) who enters the back of the queue of the specific route he/she has to survey. The time of the marker is recorded as well as times of the next 9 people who enter the queue. In the case of a bus, it is recommended that the surveyor identifies 19 people entering the queue. It is important that the surveyor stops recording passengers entering the queue once the marker is ready to board the vehicle.
    - Step 2 - The next step is to record the time the marker boards the vehicle as well as the times of the people recorded in Step1.
    - Step 3 – The last step involves recording the time the vehicle departs

  Once the cycle is complete, the surveyor repeats the whole process. However, should there be no queue, the process starts at Step 2.
  Queue Length Surveys are done at 15 minute intervals for the entire survey period.
- ***Bus & Minibus-Taxi Loading and Holding Area Utilisation Surveys*** - For this survey, the surveyor who is assigned to record the departures for a particular route will record the number of vehicles parked in the loading lane in 15 minute intervals. Another surveyor will count the holding area separately also in 15 minute intervals. This survey is carried out during maximum utilisation of a rank, be it morning peak (06h00-09h00) or evening peak (16h00 – 19h00) periods.
- ***Non-Motorised Transport Surveys*** - These surveys are located in areas where walking or cycling is the main means of transport in getting to the place of employment, school or home. The number of pedestrians and cyclists are counted either at a specific location or an intersection.
- ***Long Distance Bus & Minibus-Taxi Surveys*** - Survey staff are located at all long distance facilities. The staff record the time, number plates of vehicles arriving and departing to various destinations, including the capacity and the utilization of each vehicle and the fare to the various destinations.

- ***Freight Surveys*** - Surveyors are located at all major arterials roads entering the City of Cape Town area. They collect information regarding the different types of freight carriers entering the City of Cape Town area. An intercept interview survey is also conducted in conjunction with the survey at the weigh bridges where the vehicles are stationary in order to interview the drivers of the carriers.
- ***Station Parking Surveys*** - The surveyor records the number of parking bays at all rail stations and the utilisation thereof during the morning peak period. In addition the surveyor records the number of passengers being dropped off at the station by private vehicles and the number of vehicle trips being undertaken.
- ***Parking Inventory Surveys*** – the central business district (CBD) is divided into pre-determined zones with each city block having a unique number. A manual count is then undertaken and assigned to various blocks and broken down per parking type.
- ***CBD Vehicle and Occupancy Surveys*** - This survey is the only indicator of the modal split between private vehicles and public transport. The surveyors are placed at strategic points at the major roads into the CBD. The surveyor records the number of vehicles entering and exiting the CBD, the split between private vehicles and private transport, including the vehicle classification and the occupancy thereof. This survey is recorded at several of the City's major CBD's to better determine and monitor the trends in modal splits.

3.2 Capturing Methodologies

One of the setbacks that the City experienced previously was that the data it recorded in the field was often only captured after some time had lapsed. Consequently, the vintage or relevance of the data came into question. There were many reasons for this, but the main reason for the inefficiencies was that the survey and capturing was often carried out by the same staff. Further, capturing was carried out on various spreadsheets that needed to be combined, cleaned and managed. This often led to files being lost, overwritten, double captured, etc. The development of the TRS sought to mitigate these inefficiencies by allowing on-line capturing onto a web-based database. The following is a brief summary of the differences between the City's previous capturing methodology and the new TRS method.

Table 3 – Comparison between previous and TRS data capturing methodology

Public Transport Mode	Data Capturing	
	Previous Method	TRS Method
Bus Surveys	Excel	Direct data transfer from electronic GPS recording device onto TRS with instant reporting
Vehicle Occupancy Surveys	Excel	On-Line capturing onto TRS with instant spatial (GIS) and tabular reporting
Minibus-Taxi Surveys	Excel and Access	On-Line capturing onto TRS with instant reporting
Metered Taxi Surveys	Excel and Access	On-Line capturing onto TRS with instant reporting
Long Distance Taxi Surveys	Excel and Access	On-Line capturing onto TRS with instant reporting

Public Transport Mode	Data Capturing	
	Previous Method	TRS Method
Long Distance Bus Surveys	Excel and Access	On-Line capturing onto TRS with instant reporting
Station Parking Surveys	Excel	Excel and stored on TRS in a data repository.
On and Off-Street Parking Surveys	Excel	Excel and stored spatially in GIS output of TRS.
Freight Surveys	Excel	Excel and stored on TRS in a data repository.
Non-Motorized Transport Surveys	Excel	Excel and stored on TRS in a data repository.

4. DATABASE AND SYSTEM DEVELOPMENT

The field surveys discussed in the previous sections generate a vast amount of data and information in various forms. This information is very valuable for both fulfilling statutory requirements and for assisting transport officials within the City of Cape Town with planning, traffic modelling and more.

However this information is only valuable if it is properly stored, is well protected, is easily accessible and is available within a reasonable time frame. At the start of the project the City of Cape Town's Transport Department was battling to manage this, due mainly to the existence of many disparate sub-systems that were used to store, analyse and report on transport data. These sub-systems were mainly in the form of Microsoft Access databases or spreadsheets.

In order to correct this, a key feature of the project was the development of the City of Cape Town's web-based Transport Reporting System (TRS). The system was developed to integrate and consolidate transport survey data into a central database and to make the data and reports easily accessible to people within the department. Typical views of the system can be seen in the figures below.

Figure 1 – Login page and main navigation

Figure 2 – Capture screen for various survey types

- There was no lead time for system development as both the field surveys and the system development commenced immediately after the awarding of the contract
- The system development team had to develop and implement applicable capture forms in an accelerated fashion and thus stay ahead of the survey results coming in from the various survey types to ensure that online capturing could commence early in the project.
- As the system was live from early on, all new modules, functionality and changes had to be implemented in a fashion that did not undermine existing live functionality.
- User requirements, system design, system development, testing and implementation happened in parallel.

In order to overcome these challenges it was vital that the entire team collaborated closely and that there was frequent communication and feedback loops. From a development perspective, the principles of continuous development and the employment of Agile and Scrum software development methodologies were keys in ensuring the successful implementation of TRS. These methodologies are a group of software development methods based on iterative and incremental development principles. They encourage the following values:

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

5. REPORTING

The major benefit of implementing TRS was the creation of automatic reports and the quick access to information.

The main types of reporting widely available from TRS include:

- Raw survey data extractions for ad-hoc use such as modelling.
- Custom text and graph reports for various metrics such as supply and demand, modal usages, and vehicle occupancies.
- Spatial or GIS based reports that distil vast amounts of data into easy to interpret map-based views.

The figures below show typical examples of these reports.

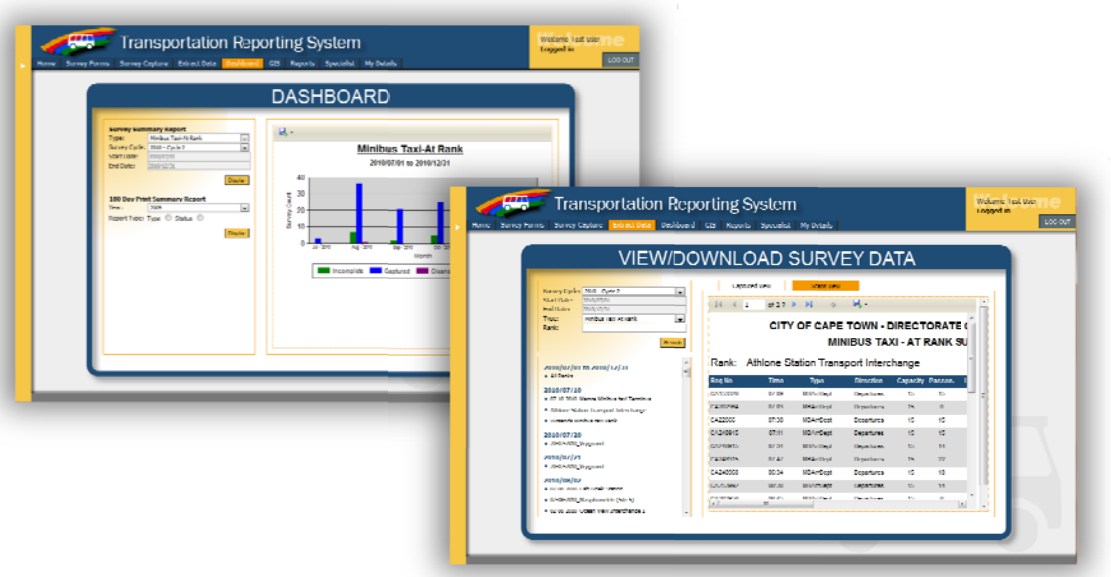

Figure 3 – Access to raw survey data and data dashboard view

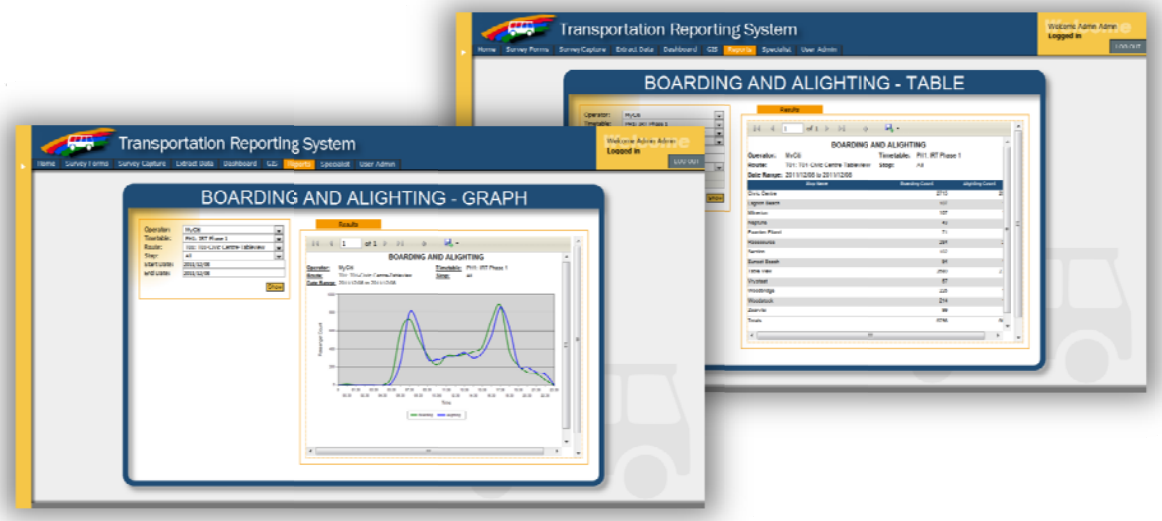

Figure 4 – Typical graph and table based reports

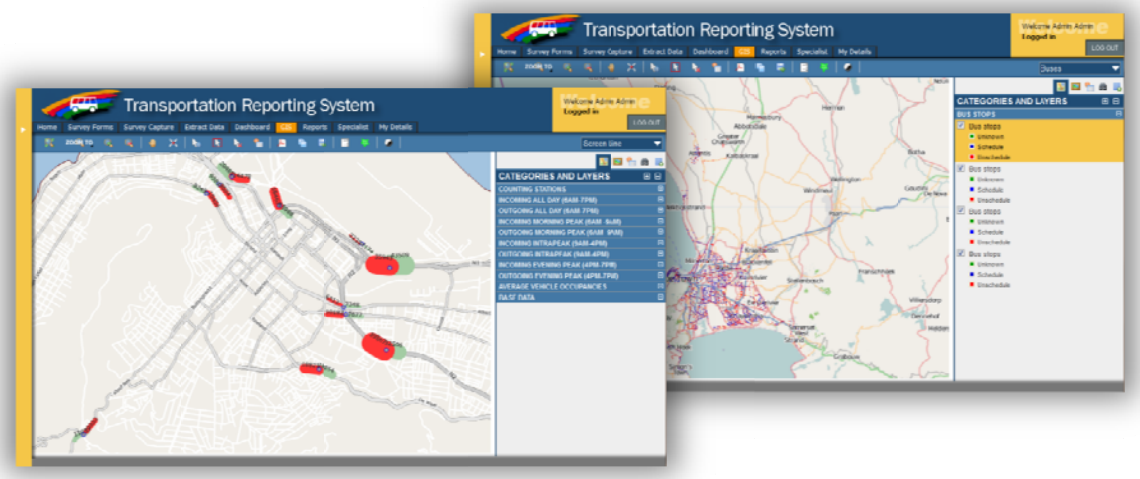

Figure 5 – Spatial or map based reports

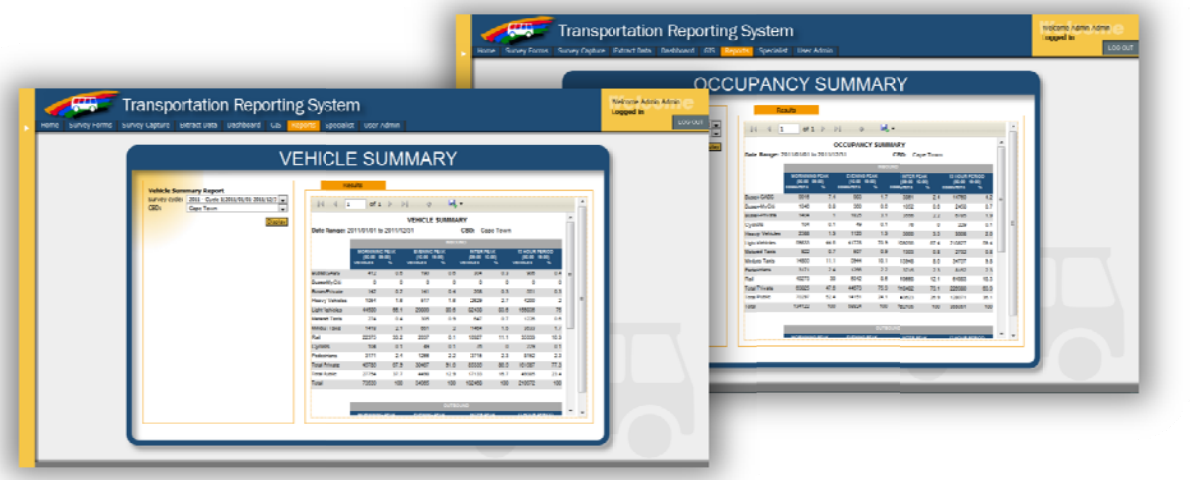

Figure 6 – More table based reports

6. DISCUSSION AND SUMMARY

The City of Cape Town's TRS is still a work in progress that needs to be adjusted to suit certain user needs. Notwithstanding this, to date, after one year in development, the TRS has gone to some length to address and manage some of the concerns as described in the Data Collection Brief (Section 2 of this Report). Below is a summary of how some of the concerns were addressed.

Table 4 – Summary of system improvements

Concerns	Advancement	Shortcomings
Vintage of Data	Data are recorded and uploaded on a web-based database which is immediately available for extraction and analysis by users. Certain modes are available instantly, such as the Bus Module, which makes use of portable electronic GPS enabled storage devices	Not all recorded data are captured at the same rate. However, a possible future improvement is to automate data collection and capturing as much as possible.
Availability of Data	Once captured, data are immediately available to various users. Depending on public transport mode, the data output is made available in at least one of the following formats. • Automatic report • PDF • MS Word • MS Excel	The availability of captured raw data is excellent. However, certain public transport modes require an internal (City of Cape Town) validation, such as the cleaning and matching process of the minibus-taxi module. This process has been automated to a large extent when compared to the way it was previously done. Notwithstanding this, in order to fulfil the legislative requirements, this process has to be undertaken by a City official and cannot be

Concerns	Advancement	Shortcomings
		outsourced.
Storage of Data	Data is stored on a central server running Microsoft SQL as a database platform.	Access to the data is only available via an internet connection. Connectivity and internet speed are continually improving within the City's IT infrastructure.
Integrity of Data	Electronic data trails are available for all inserts, extractions, printing of permits, etc. All modifications or alterations can be detected and isolated for auditing purposes. Also, the raw data capture sheets are uploaded to the TRS and scans can be downloaded for reference purposes.	Checks and balances will never ensure 100% integrity for a system like the TRS. However, when compared to what was previously done to ensure data integrity, this issue was addressed to a large extent.

TRS has also given City officials the ability to improve the management of their data and responding quicker and more efficiently to various enquiries. Within one year of development, TRS is able to demonstrate the following key successes:

- Survey data and reports are available within about a week of surveys being completed.
- The data is protected, controlled and there is transparency on the source thereof.
- There is wide-spread and easy access to this data.
- Automatic reports are being generated to assist with the compilation of the CPTR.
- Easy activity searches on registration or permit numbers are being performed daily to assist with operating licensing.