SMART SPATIAL DATA: PERFORMING PUBLIC TRANSPORT-RELATED TASKS USING THE ETHEKWINI TRANSPORT AUTHORITY'S SMART PORTAL

R PILLAY

Senior Civil Engineer (Pr. Eng): Public Transport Planning Branch
eThekwini Transport Authority
PO Box 680, Durban, 4000
Tel: 031 3117636, Email: ronald.pillay@durban.gov.za

ABSTRACT

The eThekwini Municipality's (EM) vision is to be Africa's most caring and liveable city by 2030. In support of this vision from a transport perspective, considering that the majority of commuters within EM depend on public transport (PT) for their livelihoods, the eThekwini Transport Authority (ETA) is taking great strides to better understand, plan and provide PT. This in turn means that relevant data is required. The Public Transport Planning (PTP) branch of the ETA has identified that whilst sufficient relevant PT-related data exists, innovative methods for better integrating and representing this data is required so that certain important PT-related tasks can be undertaken easier and quicker yet to a high level of confidence. To this end, the PTP branch has begun using spatial representation of PT data. Spatial mapping and representation of data is in itself an activity requiring specialised tools and skills, and is quite complicated for professionals who are not proficient with Geographic Information System (GIS) software. The PTP branch therefore resorted to using the ETA's *Smart Portal*, a GIS-based tool developed by the ETA, to display PT datasets simultaneously with datasets of other departments of the ETA and/or other service units of EM, thus facilitating the undertaking of PT-related tasks in a more informative and efficient manner.

1. INTRODUCTION

The PTP branch (hereafter referred to as PTP) of the ETA is responsible for planning PT services and infrastructure for the EM. This responsibility is multi-faceted, and includes conducting a number of PT-related tasks using spatial representation of data.

Spatial representation of PT data by means of desktop GIS software has proved to be a huge step forward in terms of capturing PT information and performing PT tasks. However challenges with conventional GIS spatial mapping techniques such as specialised skill and software requirements, amongst others, served as the opportunity for PTP to explore smarter spatial mapping techniques for conducting PT tasks.

The ETA's Smart Portal, a web-based GIS platform, was identified as a readily available option that PTP could use. PTP introduced PT datasets into the portal and conducted a series of PT tasks. A number of significant benefits were derived from the use of the Smart Portal.
This paper will therefore:

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- describe conventional techniques/methods of performing particular PT tasks and highlight some shortcomings of these techniques
- describe the ETA's GIS portal as a smarter form of spatial mapping and representation
- describe PT tasks undertaken using the Smart Portal as well as the benefits derived
- discuss how the Smart Portal will be used to perform further PT tasks in future

2. CONVENTIONAL METHODS OF PERFORMING CERTAIN PT TASKS AND ASSOCIATED SHORTCOMINGS

The activities for which PTP is responsible include but are not limited to:

- conducting site investigations to respond to requests from the public for provision of PT services and/or infrastructure
- provide direction to developers regarding the accommodation of PT services and infrastructure requirements in the preparation of their development applications
- reviewing and commenting on PT operating licence (OL) applications
- assess characteristics of particular geographical locations where PT interventions are required and/or are causing challenges

The conventional way in which the ETA has been performing these tasks is as follows:

- use *Current Public Transport Records* (CPTR) information to identify parameters such as origins, destinations and PT routes, and to assess PT supply
- request PT Supply information from the Provincial Regulatory Entity (PRE)
- conduct regular site visits and inspections
- appoint service providers to undertake certain PT tasks
- in absence of relevant data, use past data and studies to make sound assumptions for performing PT tasks

While the use of the above data sources and methods for undertaking these PT tasks are acceptable, there are a number of shortcomings with these approaches/methods such as, but not limited to, the following:

- Current conventional approach is predominantly a manual process and is therefore time consuming
- CPTR information is contained on a stand-alone information management tool. Many reports need to be printed and aligned to provide meaningful information
- Information from the PRE is incomplete and not in alignment with the format of information that PTP has. Therefore very difficult to use this information meaningfully
- Site visits are meaningful activities, but the drawback is that one would need to spend considerably long hours on site, and in many cases go to site over a number of different days, to get a real sense of what is actually occurring on site. Safety is also a major concern as a large proportion of routes and facilities are located in very dangerous areas.
- Appointment of service providers to conduct tasks such as feasibility assessments and PT surveys is very time consuming as it can take up to 6 months before an acceptable scope of work and tender document can be prepared, and a further 3 to 6 months before an appointment can be made owing to Supply Chain Management (SCM) processes.

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3. USING THE SMART PORTAL TO PERFORM PT TASKS

3.1 Introduction

Over the past two years, PTP has been working on a number of approaches for performing the tasks described in *Section 2* in a smarter way. In assessing the characteristics of PT it was found that the provision of PT services and infrastructure are influenced by factors such as:

- Land use
- Safety and environmental characteristics
- Geographical location
- Topography
- Geometric characteristics

It was also found that data relating to the above factors are available, but were either individual GIS shapefiles or captured on many stand-alone information management systems within ETA and across other service units of EM. PTP identified that there is a need for smarter innovations to allow these shapefiles and datasets to be integrated so that the large variety of data could be made readily available on a single platform.

Furthermore, considering that spatial representation of data provides the greatest opportunity for assessing PT in relation to factors as listed above, PTP began exploring smarter spatial data representation techniques. This exploratory work led to the investigation of the ETA's Smart Portal.

3.2. The Smart Portal

The ETA's Smart Portal is a GIS-based tool that was developed by the ETA to allow large numbers of differing datasets of the ETA and other service units to be spatially represented simultaneously so that projects and interventions of the ETA could be monitored and evaluated, as well as to assess the relationship(s) that exist between projects and initiatives of the ETA and those of other service units.

The types of layers that were available on the tool before PT information was introduced included, amongst other types of information, the following:

- Traffic signal locations
- Accident locations
- Location of schools
- CCTV camera locations
- Integrated Public Transport Corridor (IPTN) routes and stations

In developing the tool, the ETA contracted a professional service provider to develop the specialised GIS portal, as well as to facilitate the uploading of data onto the portal. All back-end work including maintenance of the tool is facilitated by the service provider. On the front-end of the tool, a user simply uses click boxes on a data layer display window to either activate or deactivate various layers of information. This setup renders the portal very easy to use, and while it is a GS-based tool, no formal GIS experience is required to perform tasks using the tool.

3.3. Public Transport Information in the Smart Portal

Considering the opportunities that the tool offers, PTP therefore introduced PT data into the tool to perform certain PT tasks. PTP brought in its 2012 CPTR datasets which contains a wide variety of PT information including PT facility names and locations, operator information, route information and amenities information.

3.4. PT tasks performed using the Smart Portal

a) Assessment of existing PT facilities and routes

The PT Facilities and Routes information from the CPTR data was displayed as individual layers on the portal. When each of these layers is selected, all facilities and routes contained in the respective layers are displayed. The tool allows the user to search for particular facilities and/or layers and allows the user to:

- Click on a facility/route to display information pertaining to the facility/route
- Zooming in and out of the facility/route and switch between basemap views to conduct qualitative assessments such as assessing site terrain conditions, checking availability and condition of non-motorised transport infrastructure, etc.

Figure 1 demonstrates how the portal displays the PT Facilities layer. Figure 2 demonstrates how the portal displays the PT routes layer.
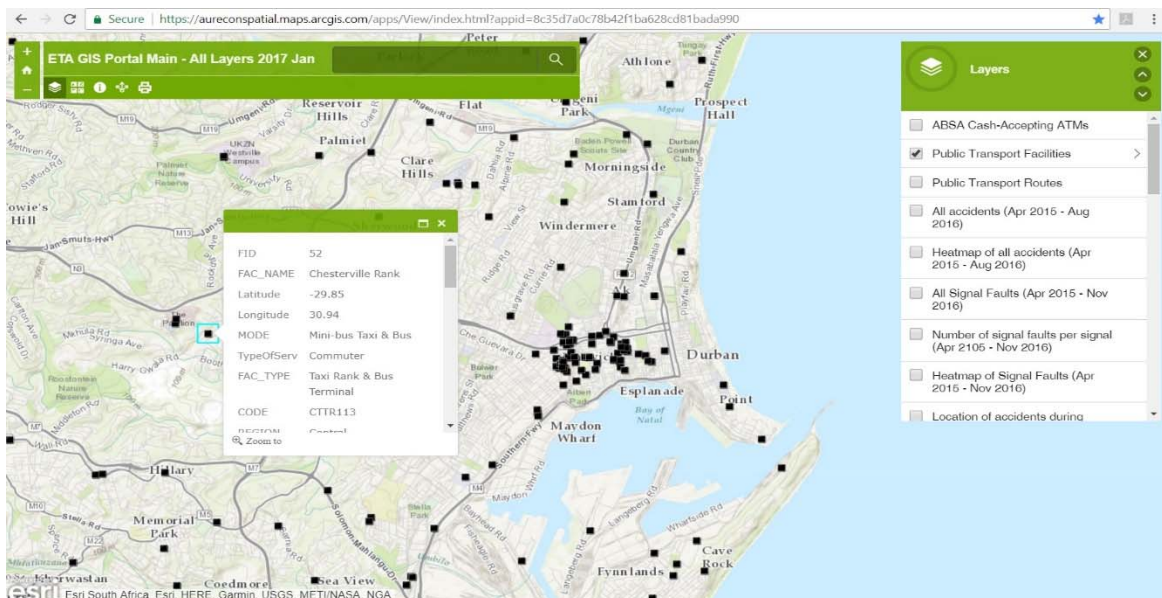

Figure 1: PT Facilities layer.

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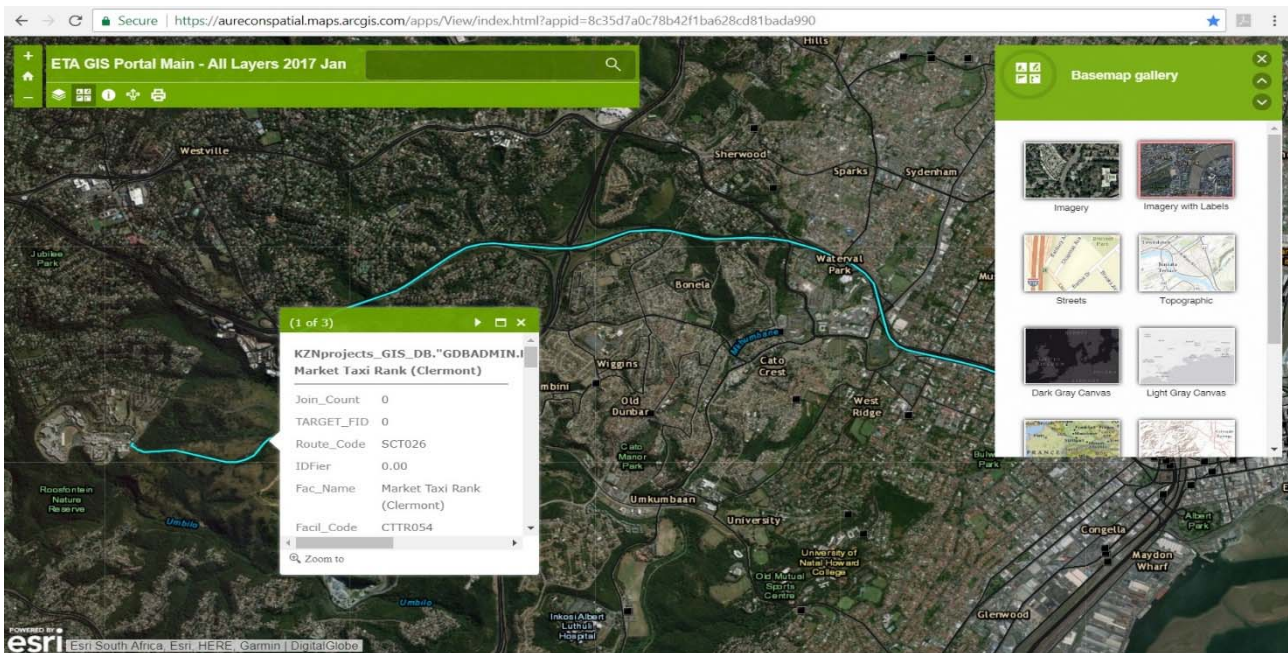784

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Figure 2: the PT Routes layer.

b) Assessment of impact of proposed IPTN feeder routes on existing PT routes

The ETA is currently rolling out Phase 1 of its IPTN network. An activity as part of the operational planning and stakeholder engagements for the rolling out of the first corridor of Phase 1 is to determine which existing PT routes will be affected by the rolling out of the feeder network of the new IPTN trunk-and-feeder service.

The portal was used to simultaneously display the existing PT routes with the proposed feeder network, and assessments could be done to identify which of the existing routes were affected. The portal is still being used to conduct these type of assessments, and this information will be used to inform decisions such as rationalising of services, identification of affected operators, compensation to the industry, etc.

c) Assessing relationship between accidents and PT

Pedestrian accidents are a common occurrence within EM. Considering that the majority of commuters within EM use PT, PTP pursued the assessment of the occurrence of pedestrian accidents at significant PT nodes. The Pinetown CBD was assessed, as it is a major PT hub and also the southern end point of the first IPTN corridor. The existing PT routes and facilities were selected, and the pedestrian accidents overlaid to relate PT to the pedestrian accidents. This is shown in Figure 3. The portal allowed PTP to verify that the main PT nodes within the Pinetown PT precinct were also the locations for the highest occurrence of pedestrian accidents. This information will now be used to firm up the roll out plan of this first corridor to ensure that the necessary mitigation measures are in place at these points to ensure that pedestrian safety is improved.
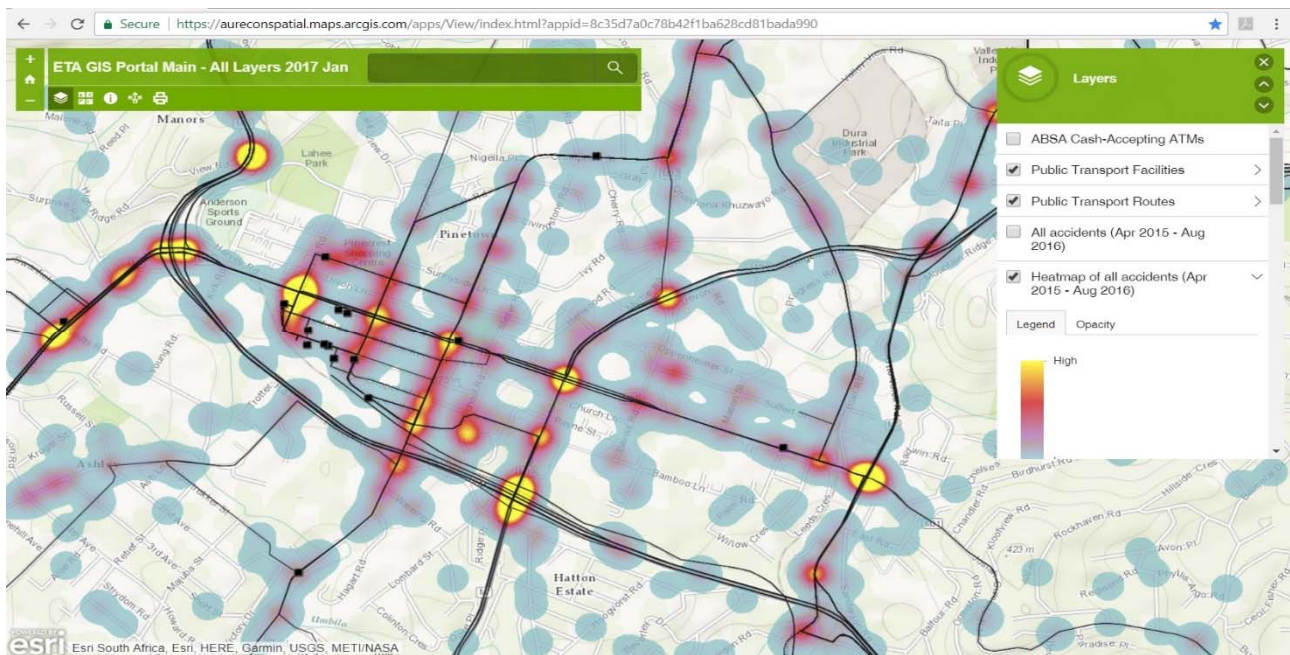
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Figure 3: Pedestrian accidents at PT nodes in Pinetown

PTP has also used the portal to perform the following activities:

- assessment of number of PT routes utilising the same road link
- assessment of different modes of PT using a common road link
- qualitative assessments in the process of evaluating PT plans and development applications
- assessment of pedestrian accidents at various locations, e.g. at PT nodes, at locations without non-motorised transport (NMT) infrastructure, at particular land uses such as school, etc.
- assessing requests for PT infrastructure such as laybyes, etc.
- assessing site requests spatially before going out to site

4. BENEFITS OF CONDUCTING PT ASSESSMENTS USING THE SMART PORTAL

The following benefits have been derived to date from performing PT tasks using the tool:

- a variety of datasets are able to be quickly and easily displayed simultaneously
- user-friendly and quick response. No formal GIS experience required
- spatial mapping with associated attribute information available at a click.
- do not need to consult several department or use several different datasets and platforms as all information now available on one platform
- allows for more comprehensive qualitative assessments to be done
- reduces the need for appointing external service providers to conduct particular investigations and surveys. This also reduces the delays and costs associated with conducting certain assessments
- web-based functionality makes the tool available to anyone requiring to us it without the need for specialised software
- allows a user to share particular data overlays with other users
- reduces time and cost associated with conducting site investigations

5. FURTHER PT TASKS THAT CAN BE PERFORMED

The use of the Smart Portal has allowed PTP to perform PT tasks in a simpler and quicker way. PTP has identified that a great number of PT-related activities can now be done using this portal, such as:

- identification of major PT nodes
- performing TOD related assessments
- identification of sites for installing PT survey and monitoring infrastructure for collecting information on an on-going basis
- assess PT routes where traffic congestion is a major problem to determine mitigating measures and measures to prioritise PT
- introduce PT infrastructure data layers to facilitate asset monitoring activities
- use the tool to match CPTR information with information received from the PRE
- introduce a static layer of PT link volumes from existing macro-models to serve as basis for qualitatively assessing PT demand against PT supply
- identify corridors for pursuing integrated corridor development initiatives
- Identifying operators affected by roll-out of IPTN
- Assess NMT requirements across EM

6. OPPORTUNITIES FOR FURTHER DEVELOPMENT OF THE TOOL

Many opportunities exist with a tool such as the Smart Portal to develop it to become a smart technology for PT. An opportunity that can readily be pursued is as follows:

- The portal can be made available to the public as a smart mobile application for getting PT information for basic public transport services within EM

7. CONCLUSION

In its endeavour to better plan PT using innovative technologies, the ETA has begun using its Smart Portal to perform PT tasks. By introducing PT information into a platform that allows for differing and wide-ranging datasets to be displayed simultaneously, the ETA has been able to perform PT tasks more in a more informative and efficient manner.

Whilst the portal is a GIS-based platform, it is extremely user-friendly and requires little or no real GIS-related skills. The portal also is readily available to be used by an unlimited number of users and is not constrained by specialised software requirements by virtue of it being web-based.

Using such an approach to performing PT assessments eliminates the need for consulting a host of individual datasets, models and studies. PT assessments and tasks can now be done considerably and comparatively quicker than conventional means.

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