RECOMMENDATIONS IN UPDATING BEST PRACTICE IN TRANSPORT DEMAND DATA COLLECTION PRACTICES FOR RURAL INTEGRATED TRANSPORT PLANS: EVIDENCE FROM NORTH-WEST PROVINCE

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ABSTRACT

The Integrated Transport Plan (ITP) guidelines and minimum requirements as gazetted in 2016, state that transport plans must be developed to enhance the effective functioning of cities, towns and rural areas through the integrated planning of transport infrastructure and facilities. These specific requirements have an emphasis on travel demand management and development in rural areas. However, the status quo chapter of the ITP guidelines only provides data collection requirements centred around the current supply of transport. The guidelines for data collection and analysis for ITP and precisely their application to rural transport development, are incorrectly calibrated to an urban commuter paradigm, with an expectation that trips to and from locations should balance on the same day. This appears to be an assumption worth further investigation and study.

Observations in this paper are largely based on two projects conducted in Dr Kenneth Kaunda and Bojanala Platinum District Municipality during the preparation for their Integrated Public Transport Network Plans in the period of 2018-2019. Observations were made on the passenger volume directional split in specific modes and travel patterns in rural areas. The directional split of passenger volume averaged a 50/30 split between return trips with as much as 20% of passengers not completing their return journey with the same mode of transport used for the forward trip or not completing the return trip that day. This observation was purely based on passenger volumes and not on individual passenger journey surveys. The on-site observations of trip-taking on rural roads in these two district municipalities further showed that hitchhiking (which consists of soliciting free rides on the side of the road from passing vehicles) and walking are extensively used for return journeys in rural areas, especially by school children in areas where scholar transport is not structured and organized. Approaching the data from the paradigm of the standard urban transport planning perspective may lead to the mistaken conclusion that the cordon count survey of passenger volumes in rural areas was erroneously carried out, and would require an entirely new collection – which then might yield the same “lost passenger” phenomenon. This research aimed to assess the current state of practice in the data collection guidelines set for rural areas and to conduct a gap analysis on why the phenomenon of an imbalance of passenger volume flows between the forward and return directions on rural roads is a likely outcome for a survey. Furthermore, the research provides input into updating the current guidelines on rural transport plans and data collection by providing recommendations on the data collection methodology for rural areas and providing an alternative approach that takes into consideration walking, cycling and private vehicle usage as additional data points to the travel demand and volume.

1. INTRODUCTION

The Integrated Transport Plans (ITP) guidelines and minimum requirements as gazetted in 2006 state that transport plans must be developed to enhance the effective functioning of cities, towns and rural areas through the integrated planning of transport infrastructure and facilities (DoT, 2006). The ITP guidelines requirements emphasise travel demand management and development in rural areas; however, the status quo chapter of the ITP only provides data collection requirements centred around the current supply of transport by means of the development of a register of current public transport operations. It has been observed and identified through practical experience that the information provided in the status quo records for rural areas is often incomplete, outdated or non-existent. This can be considered as a serious issue in the preparation of plans for a district or local area, as the completeness of the data can be disputed. Where data has been previously collected, such data are usually not useful for the preparation of any plan. This is most likely caused by a direct application of the data collection methodology provided in the guidelines, or through a lack of quality control and oversight in the preparation of the Current Public Transport Record (CPTR) for the Integrated Transport Plans for a district or local area.

In 2016, the Department of Transport published the Minimum Requirements for the Preparation of Integrated Transport Plans (DoT, 2016) which is the most relevant guideline for data collection in rural areas for the design of a public transport plan. This document includes a number of detailed requirements and objectives such as directing employment opportunities and activities to mixed-land uses and transforming high-density residential developments into high utilisation public transport corridors which are interconnected through development nodes within the corridors (DoT, 2016). Furthermore, these guidelines discourage urban sprawl where public transport services are inadequate; and give higher priority to public transport rather than private transport by ensuring the provision of adequate public transport services and applying travel demand management measures to discourage private transport plans (DoT, 2016).

There seems to be a disconnect between the data collection requirements and directives to determine a transport status quo; and the actual transport status quo. One must bear in mind that the data collected is used for modelling and prediction of future growth in transport demand. Based on a detailed analysis of these regulations, against evidence of the data collection conducted in Bojanala and Dr Kenneth Kaunda District Municipalities, the authors came to the realisation that there is a disconnect between the guidelines and practical methods to determine demand for transport services in an area. It was also observed that the data collection methodologies have been centred around the supply of vehicles and the availability of public transport within the rural areas without necessarily addressing the needs-assessment and demand for transport. This lack of direction on demand data collection is the most significant barrier to the preparation of effective and meaningful public transport plans. In addition, provisions have not been made to cater for the variability of travel patterns in rural areas, taking into consideration the time of the year, day of the week and period during the day as factors that need to be linked with the economic conditions of the rural area being surveyed. Furthermore, affordability and fare setting tolerance by rural users is simply not commented on in the Guidelines – with fare-setting and fare policies likely to be determined by over-the-top operational plan requirements that do not consider the ability of users to pay for transport services. Lastly, passenger satisfaction as a measurement is overlooked as a key source of data for designing any new services, but also evaluating the effectiveness of a service.

1.1 Aim of the Paper

The aim of this paper is to report on the research done by the authors on best practices in South Africa regarding transport demand data collection guidelines and practices. The research comprised of a review of the current data collection methodology for rural areas integrated transport plans and a gap analysis of the collected data based on the methodology in order to provide recommendations on rural areas data collection methodologies. The recommendations attempt to aid in developing a much better picture of demand in a rural area. The main focus is placed on assessing the methodology for cordon counts, rank counts and on-board surveys in minibus taxis and buses using data collected in Bojanala and Dr Kenneth Kaunda District Municipalities in 2018. The assessment seeks to explain specific phenomena observed during these surveys. The paper will also present the challenges encountered during data collection exercises as well as the impact these challenges might have on the quality and accuracy of collected data. The study shows that the current guidelines for data collection in rural areas do not take into consideration the total volume of passengers because of travel patterns specific to rural areas. This paper also aims to recommend a different approach for data collection and guidelines for interpreting the collected data for the purpose of uniformity.

1.2 Status Quo of Transport Planning in South Africa

Research on transport planning in South Africa shows that this field has evolved over the past few decades involving relevant stakeholders from all modes of travel comprising of policy makers, planners to implementing agents as well as various communities (Walters, 2012). The ITP guidelines emphasises how the paradigm has changed from the early days of transport planning where the approaches were simplistic and only consisted of accommodating the demands for increased mobility to a more sustainable approach preoccupied by estimating traffic increases and providing capacity to meet the expected growth (DoT, 2016). The latter approach is designed to take into consideration changes in behaviour and travel patterns. Furthermore, this approach endeavours to plan for disruptions that could be caused by economic changes.

The National Land Transport Act (NLTA) (DoT, 2009) as Gazetted, Act No. 5, 2009 strives to provide coordination between the land transport modes and requires metropolitan and service councils to prepare a record of public transport operations in their area of jurisdiction. This data aims at quantifying the trilogy of movements by taking into consideration the existing public transport services, people's existing origin and destination (OD) patterns as well as long term desired OD patterns within a municipality (DoT, 2009). This data can also serve as a primary source of information for the preparation of an Operating Licenses Strategy (OLS). The purpose of preparing Current Public Transport Records (CPTR) is to provide a record of public transport services, facilities and infrastructure, which will constitute the basis for the development of operating licence strategies and integrated transport plans (DoT, 2016). The CPTR merely serve as a record of captured data which classifies and presents all the public transport infrastructure and services that are present within an area of study. This information is used as part of the formulation of the Public Transportation Plan. Researchers over the past decade have identified key challenges and shortfalls in the CPTR data collection and capturing processes. Moodley (2005) highlighted the experiences encountered while preparing the CPTR and OLS for eThekwini Transport Authority where he discussed the limitations of the CPTR information in preparing the OLS. Cameron (2005) carried out a critical evaluation of the CPTR methodology with reference to the problems experienced in the preparation of the 2003 Bojanala Platinum District Municipality CPTR. These challenges

seem to still be persistent despite the fact that over 15 years have passed since they were raised; and technology and techniques have advanced in recent years to incorporate geospatial technology, mapping, mobile devices and automated back-office processes. New methodologies like onboard surveys using a mobile application have helped improve the accuracy of collected data and reduced some of these challenges.

The planning authority in a specific area is meant to use its CPTR and transport needs assessment to identify routes, capacity and demand along each route. However, the demand on a specific route is affected by the socio-economic conditions in the area because of the affordability of public transport in some rural areas. Only catering for the commuters that can afford public transport in rural areas does not show a true reflection of the demand on a specific route (Vanderschuren, 2010). The guidelines for IPTN Plans for District Municipalities (DoT, 2016) defines passenger demand analysis as the process of collecting and analysing data to determine current, latent and future passenger demand. This data requirement includes, but is not limited to: passenger numbers, passenger origin-destination data, public transport route information, major and minor stops, and road network information. This data is used in demand models in order to run demand analysis which attempt to replicate current levels of demand, travel patterns and system capacity.

As described in the consolidated IPTN guidance (DoT, 2018), South African cities are characterised by land-use arrangements where dormitory and apartheid planned suburbs are often situated long distances away from work opportunities. This spatial form contributes to high transportation costs for both citizens and authorities, i.e., citizens spend on average more than 20% of household income on transport (National Household Travel Survey, 2013). These land-use arrangements characterize the difficulties of rural areas to access public transport. The need for travel created room for the minibus taxi industry to serve this specific demand. However, the current economic circumstances do not allow all the members of poor communities to afford taxi fares and this automatically pushes them to revert to other means of transportation, i.e., hiking, cycling, carpooling and walking (National Household Travel Survey, 2013). According to the National Household Travel Survey of 2013, approximately 27% of the population in Bojanala and Dr Kenneth Kaunda District Municipalities indicated walking as their primary mode of travel. Adding to that, the following characteristic was observed in these areas which could impact public transport utilisation and affordability, that is, close to 80% of people living within the study area do not own a motor vehicle and are therefore reliant on public transport. The low-income nature of the area makes the use of public transport vehicles quite low given that only a small number of trips are made for non-essential purposes. Most trips are long travel distances to urban centres and commuters travel on average more than 40 km to reach their work destinations (National Household Travel Survey, 2013).

Ribbonnaar et al. (2015) state that the majority of people in the Western Cape province rely on public and non-motorised transport for their mobility and many of them do not have alternative choices even when they might be experiencing difficulties using public transport. The data from their research showed that in rural areas, walking is the main mode of transport, accounting for 62% of the modal split with a significant role for private vehicles (33%), which indicates that public transport is playing a less significant role in the province compared to urban areas. This behaviour is also observed in other provinces like North West (National Household Travel Survey, 2013); focusing mainly on scholar transport and commuters walking more than 60 minutes to their destinations in rural areas. Although these numbers might have changed recently, the observation remains the same when it comes to the percentage of commuters that do not use public transport as their main mode of transport in rural areas (Starkey et al., 2002).

The authors during the data collection process in 2018-2019 made observations on the passenger volume directional split in specific modes and travel patterns in rural areas. The directional split of passenger volume tended to be 50/30 with as much as 20% of passengers not completing their return journey with the same mode of transport used for the forward trip. This was purely based on passenger volumes and not individual passenger journey surveys. The physical observations further showed that hitchhiking (hailing a private vehicle for transport on a side of a road usually by holding out the thumb or money to indicate the ability to pay for the ride) and walking are used extensively for the return journey in rural areas, especially by school children in areas where scholar transport is not structured and organized. In addition, there is a possibility that travellers do not return back to their origin on the same day, but may stay overnight at their destination. All these different commuter trips and behaviours form part of a specific travel demand in the area that needs to be taken into consideration when planning for future developments.

2. STATUS QUO OF ITP DATA COLLECTION IN SOUTH AFRICA

A general overview of the transportation system is required in order to indicate the modal split between private, public transport and non-motorised transport, assessing the viability of the transport service with regards to the travel times, costs, availability, and accessibility, safety and reliability (DoT, 2016). The IPTN Guidelines require the following different types of surveys to be undertaken for the purposes of ITPs as shown in Table 1.

Table 1: Different types of surveys

Onboard Surveys	**Rank Surveys**	**Cordon Counts**	**Legality Surveys and Extent of Illegal Operations**
Non-motorised Transport Route Surveys	Capacity and Utilization of Facilities Surveys	Public Transport Facilities Surveys	Travel Demand Surveys and Supply Surveys
Latent Demand Surveys	User Preference Surveys and Meter Taxi Surveys	Private vehicle and occupancy surveys	Passenger Waiting Time Surveys and Passenger Satisfaction Surveys

Table 2 summarises, for some of the survey types mentioned, the type of data collected and the outputs.

Table 2: Type of data collected and outputs

Survey Type	**Data Collected**	**Output**
Household Travel Survey	Schedule 1 municipalities	Household travel survey
Route Survey	Detailed description must be provided of each route on which public transport services are operated, including a description of the route starting points and destination and all the street names along the route. Furthermore, all points where passengers are picked up and set down must also be captured. The description must be in sufficient detail so that it can be captured on a Geographic Information System (GIS), and be used in operating licenses and on the Operating Licence Administration System (OLAS). Routes and networks used for services operating without operating licenses or permits must also be included.	Origin, destination, route name, mode, route, distance, trip time (one-way), turnaround time (cycle time)

Table 2: Cont'd.

Survey Type	Data Collected	Output
Household Travel Survey	Schedule 1 municipalities	Household travel survey
Rank Survey	Origin-Destination, Vehicle Occupancy Vehicle make, model, registration number, Time of Arrival and Departure, Association	Route Information, Route Profile, Route Utilization, Ridership and Passenger Volume
Ingress/Egress Survey	Time in/Time out, Number of vehicles in/out, Mode utilized, Vehicle occupancy (Full, ¾, ½, ¼, Empty)	Duration of stay, Number of vehicles, Indicative Demand
Public Transport Mode Utilisation Survey	Vehicle arrival/departure time, Vehicle registration number, Destination, Passengers (arriving, boarding, remaining, left on aisle), Mode utilised	Duration of stay per destination, Number of vehicles per destination, Demand per destination, Passengers (arriving, boarding, remaining, left on aisle) per destination
Public Transport Facility Amenities survey	Markings, Number of aisles/berths, Roof shelters, Water/Electricity, Office block	Public Transport Facility inventory
Public Transport Interview survey	Markings, Number of aisles/berths, Roof shelters, Water/Electricity, Office block	Fares, O-D patterns, Trip purpose, Shift modes, Transfers, Level of Service (LOS), Frequency of vehicles, Travel Time, Waiting time

3. ISSUES WITH CURRENT TRANSPORT DATA COLLECTION PRACTICES IN A RURAL SETTING

The assessment by the authors of the impact of the ITP guidelines on the data collection exercises in Bojanala and Dr Kenneth Kaunda District Municipalities in 2018 led to the following observations:

1. There is a lack of uniformity and standardization on the data collection methodology, forms designed and interpretation of the results.

2. The choice of locations for cordon counts in rural areas becomes difficult due to main roads passing through the areas. The chances of accounting for vehicles more than once were high and also allocating traffic to a specific node could be inaccurate due to vehicles that are passing through.

3. Long distance travels created an imbalance in the passenger volume calculation, especially for trips that only returned at the end of the week. They could not be accounted for as round trips.

4. Due to the fact that many trips do not originate at the rank facilities during early morning and off-peak times, there was a leakage in passenger volumes when only conducting rank counts. The concept called "spin off" in which taxi drivers move around in order to get as many passengers as possible before going to a specific destination resulted in a specific vehicle passing through a few cordon counts with the same passengers before heading to the urban centres, hence being counted more than once as it freely moved through the area.

5. Only conducting cordon counts would allocate volume to a specific urban centre being the next logical destination, while an undetermined percentage of those passengers usually do not travel to the specified centre, hence resulting in errors in the base data that will be used for projection and modelling.

6. There is a disconnect between the instructions and expectations of transportation planners and the reality in the field which also makes it difficult for the results to be interpreted in the right context.

7. Travel patterns vary significantly in rural areas and a preliminary assessment or area reconnaissance is necessary in order to properly design the data collection methodology as well as the choice of locations.

8. The different types of surveys are used in silos during the data collection exercise and are meant to be interpreted and analysed as integrated or linked data which gives an erroneous picture of the travel patterns and passenger volumes.

9. The budgets currently allocated to surveys in IPTN and ITP projects are usually very small, making it difficult for the data collection team to collect all necessary data. This has been observed in many instances and is believed to happen because of the importance ascribed to surveys. Emphasising the importance of data will be a step in the right direction in order to scale this challenge.

The purpose of these surveys is to ensure that all public transport trips are surveyed, in particular those that do not originate from identified public transport ranks as they can provide control totals for vehicles originating in a total area. They can supplement the route-based surveys, but cannot replace them.

4. PROPOSED DATA COLLECTION METHODOLOGY FOR RURAL AREAS

The data collection process proposed by the authors is summarised in Figure 1.

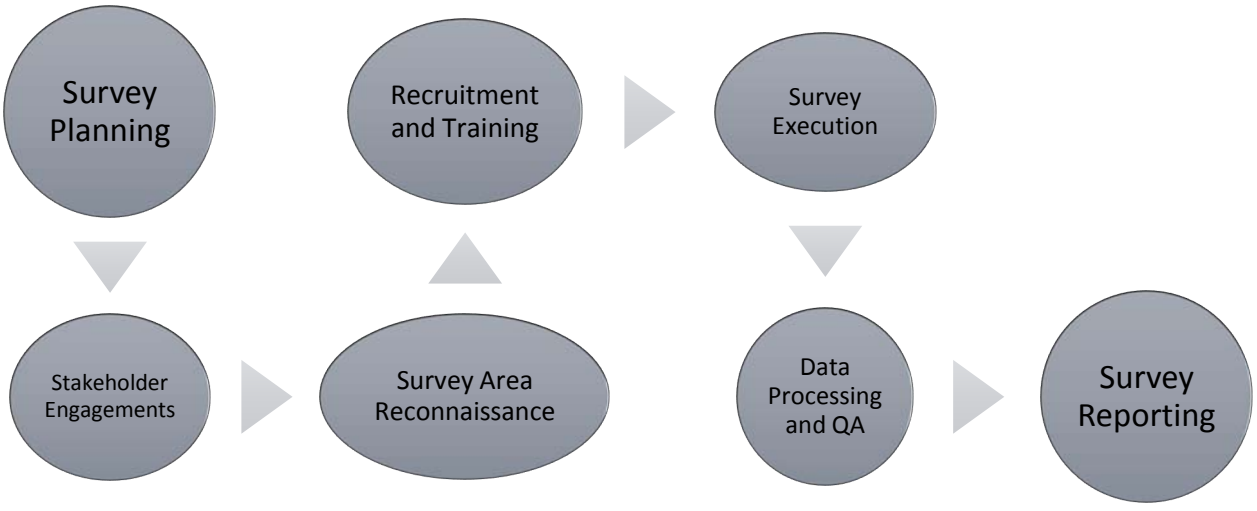

Figure 1: Proposed data collection process flow

The authors have completed data collection for various integrated transport plans in South Africa in the period of 2018-2019. The experience in the implementation of the data collection methodology that informed this approach is suited for urban and rural

environment. The observations in the field during these recent data collection projects led to the formulation of the following steps for data collection.

1. A very detailed and explanatory inception meeting where the project, timelines, budgets and local conditions are explained and discussed with the relevant stakeholders, including the project funders and local beneficiaries. Oftentimes, the beneficiaries (district municipality) and the funders (national or provincial government) interests and focus are not aligned leading to expectation gaps once the project is implemented. Expectations of the project stakeholders need to be clearly documented and understood at the beginning of a project.

2. An adequate budget is planned for and provided for accurate data collection to ensure that quality data is available for planning. It is tempting to a consultant to price a planning project competitively by cutting costs for data collection, or to try to reduce the survey budgets while a project is being executed. However, this places the entire process at risk, and is something clients should not allow. Providing a provisional sum that tenderers cannot change allows a client or planning authority to ensure that adequate resources are allocated for data collection and associated activities.

3. A two-level stakeholder engagement process needs to be followed, involving the relevant structure and hierarchy of the minibus taxi industry and contracted public transport operators. This will make them feel part of the process from the start and will develop a sense of ownership in the process and results thereafter. Based on the stakeholder engagement, an assessment should be done on whether there is a need to recruit enumerators from the stakeholders' proposed list. This approach builds trust between parties and can be managed in terms of quality assurance and performance management and shows willingness to work together, especially where change management is needed.

4. The analysis of the objectives of the survey and the data that will be required as outputs in order to determine which survey methodology to use. Based on the above analysis, choose the type of surveys and proceed with the choice of locations that maximize the collection of data or give the best picture of what is happening on the ground. The aim will be to make use of the same resources in order to collect more than one deliverable which helps when there is a budgetary constraint due to inadequate allowances.

5. The design of the survey forms will take into consideration the ease of the collection of the data and the complexity that comes with increasing the information to be collected. This is the step where local travel patterns and social economic conditions need to be taken into consideration to allow for a true reflection of passenger volumes. Some innovation in collection practice will be required. Once the choice of location is confirmed, the next step is resource allocation. This requires maximisation and optimisation in order to control and protect the budget, time and quality of the data. The more detailed the resource plan and inclusion of contingencies, the better the chances of success. The total staffing numbers will come from the resource planning, and is often overlooked as a discreet step.

6. The recruitment and training of staff is the next step. This is where enumerators are informed and trained on the methodology, followed with a compulsory dry-run in order to assess the practicality of the design and methodology.

7. The execution of the actual fieldwork depending on the scope and the intent of the study then follows.

8. The post-survey processing of the data is an important discrete step in order to standardize the outputs and make them useful for planning purposes, and

9. Reporting takes the form of mapping, databases, reports and raw datasets. Specifying the data outputs should be done with all relevant stakeholders that would like to make use of this data.

Observations in the field have shown that a combination of rank counts with on-board surveys within a local municipality increases the accuracy of the passenger volume and route utilization figures. Combining these two methods with properly selected cordon counts allows for the capture of vehicles that do not operate from rank facilities. This is usually the case for numerous rural areas and it also allows for the capturing of passenger volume originating from sub ranks without having to double count them. The full picture is only attained once the geospatial representation is matched with the ground conditions. Transportation planners should aim to understand the impact of the choice of methods despite the budgetary constraints due to the importance of collecting good data.

It is worth noting that the term “data” is seldom used in the Guidelines for data collection in public transport systems. There is no room in the guidelines on data collection other than for a static survey to be carried out. Technology has improved and has rapidly continued to move forward in the last few years. As such, datasets and information are becoming streams that are unprecedented neither at their depth, scale of collection, or their degree of continuous operation. Information such as payment systems, mobile networks, satellite imagery or weigh-in-motion stations are not considered in the guidelines. This should be an active area of research and development in the field of transport planning, especially in the rural environment – where datasets are rare or out of date, and the impact of new technology can have a very big influence in producing high-quality data for rural transport planning.

5. CONCLUSIONS AND RECOMMENDATIONS

This research paper aimed to present the gaps observed in data collection for rural areas. It is important to note that the success of a data collection exercise depends on a good survey design, an understanding of the local travel patterns and a more hands-on approach from transportation planners. The interpretation of the data becomes clearer when the geospatial representation is linked with the collected data and the chosen points take into consideration alternative modes of travel such as walking and the use of private vehicles during off-peak hours which affects the directional split of passenger volume.

Due to the imbalance of passenger numbers that occur with pedestrian movement and private vehicles, a recommendation would be to have separate cordon counts for pedestrians in rural areas, by allocating those passengers to specific urban centres and origin-destination pairs and finally incorporating them into the passenger volume used for projection and modelling.

Understanding a system requires intensive field observation. To this end, it is recommended that transportation planners and modellers spend time in the field with the data collectors in order to assess the impact of the survey design method and also to have more flexibility in the methodology and interpretation of the data.

Finally, more budgets should be allocated for data collection in ITPs projects in order to design the most suitable survey methodology that will paint a more realistic picture of the condition of rural areas and their travel patterns.

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