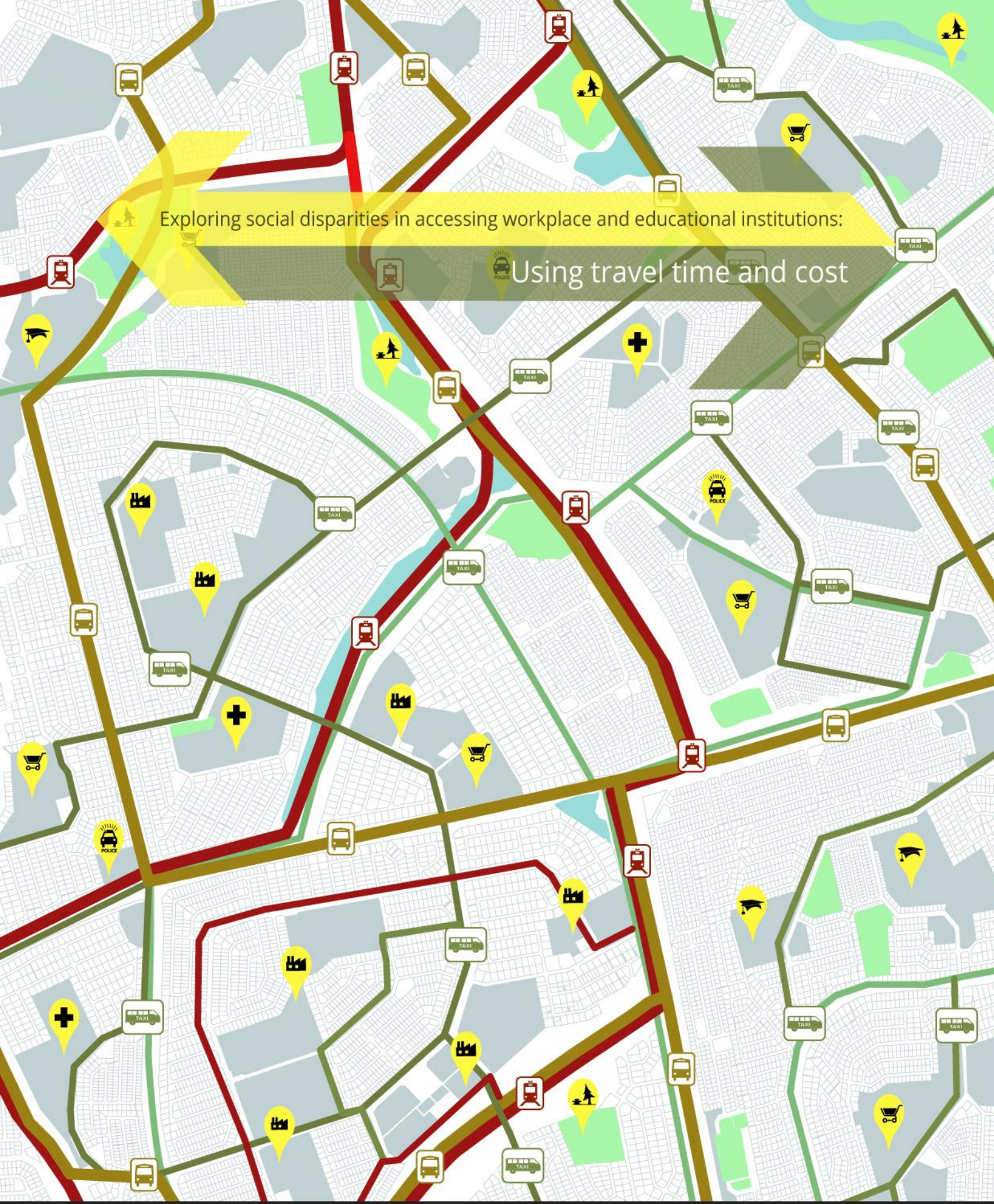

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Transport Series Volume II

Exploring social disparities in accessing workplace and educational institutions: Using travel time and travel cost

In-depth analysis of the National Household Travel Survey data 2013

Statistics South Africa, 2018

Risenga Maluleke, Statistician-General

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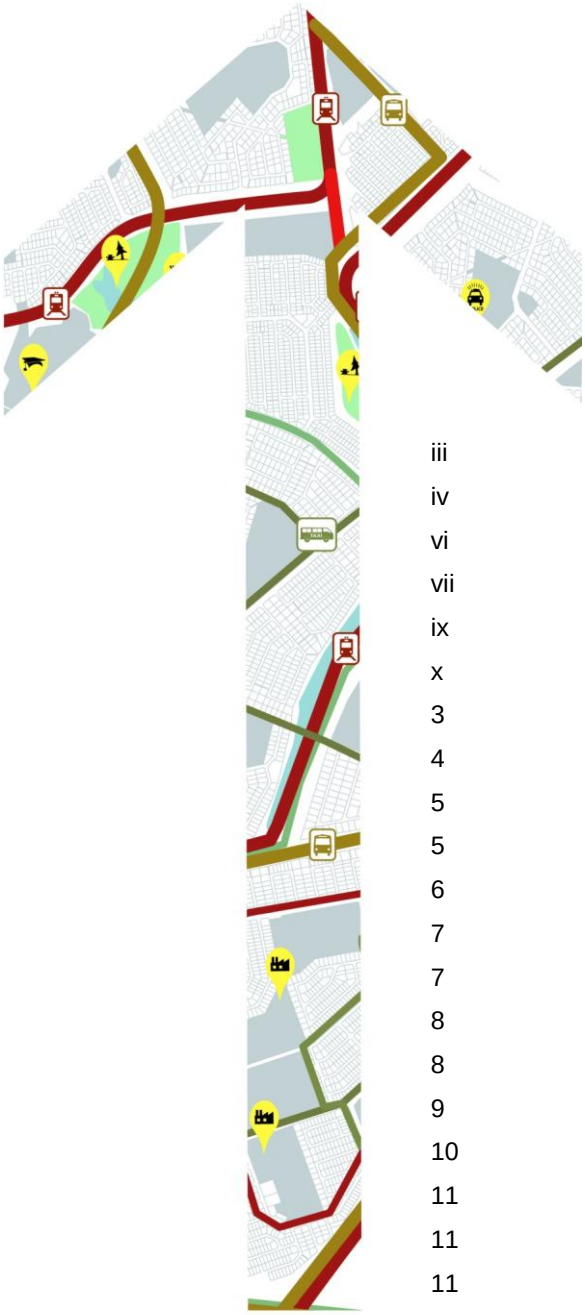

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Glossary of abbreviations

AI	Accessibility Index
AU	African Union
CV	Coefficient of variation
DF	Degrees of freedom
DoT	Department of Transport
DPME	Department of Planning, Monitoring and Evaluation
DU	Dwelling unit
EA	Enumeration area
EC	Eastern Cape
FS	Free State
GHS	General Household Survey
GP	Gauteng
ICT	Information and communication technology
KZN	KwaZulu-Natal
LP	Limpopo
MDGs	Millennium Development Goals
MP	Mpumalanga
MS	Master Sample
MTSF	Medium Term Strategic Framework
NC	Northern Cape
NPC	National Planning Commission
NDP	National Development Plan
NHTS	National Household Travel Survey
NW	North West
O-Ds	Origins and destinations
PSU	Primary sampling unit
RSA	Republic of South Africa
SA	South Africa
SDGs	Sustainable Development Goals
Stats SA	Statistics South Africa
WC	Western Cape

Glossary of concept

Concepts	Definitions
Household	A group of persons who live together and provide themselves jointly with food and/or other essentials for living, or a single person who lives alone. Note: The persons occupy a common dwelling unit (or part of it) for at least four nights in a week on average during the past four weeks prior to the survey interview, sharing resources as a unit. Other explanatory phrases can be 'eating from the same pot' and 'cook and eat together'.
Household head	The main decision-maker, or the person who owns or rents the dwelling, or the person who is the main breadwinner.
Num DF	This is the number of degrees of freedom in the model.
Den DF	This is the number of degrees of freedom associated with the model errors.
Bus	A road-based public transport vehicle that can carry more than 18 passengers (including Bus Rapid Transit system).
Car	A passenger motor vehicle used by a private individual for his/her own convenience.
Commuter	According to the Concise Oxford Dictionary, a commuter 'travels daily, especially by train and car to or from work in the city'. This definition does not clarify the position of those who walk to work. Furthermore, in South Africa, common usage associates the word with those who travel to work by public transport. For the purpose of NHTS a 'commuter' is defined as any person who regularly travels to and from work whether on foot, by bicycle or by motorised transport.
Dwelling unit	A structure, part of a structure or group of structures that can be occupied by a household(s).
Formal sector	Sector of employment made up of all businesses with employees that are registered in any way.
Informal sector	Consists of those businesses that are not registered in any way.
Learner	A person who regularly attends a pre-school, a school, a college, a technikon or any other tertiary education or training institution.
Main mode of travel	The main mode of travel is the highest mode of travel used in the following hierarchy of travel modes: 1. Train 2. Bus 3. Taxi 4. Car driver 5. Car passenger 6. Walking all the way 7. Other.

Glossary of concepts (cont.)

Concepts	Definitions
Metropolitan	Covers the six metropolitan municipalities defined by the Municipal Structures Act, namely the entire jurisdictions of Cape Town, Ekurhuleni, eThekwini, Nelson Mandela Bay, Buffalo City, Mangaung, Johannesburg and Tshwane.
Non-public transport	Any mode of travel except public transport.
Private transport	All forms of motorised transport which were used by individuals and that are not considered public transport. This includes car drivers, car passengers and company vehicles.
Public transport	All transport services for which passengers made payment, including trains, buses and taxis.
Rural	A geographic classification based on the Census 2001 geographic classification. In this case, the settlement type is associated with commercial farming areas (rural formal) and land designated as tribal or traditional.
Total monthly household income	It is calculated by adding the monthly earnings per individual in the household as well as the total grant income for the household. Total grant income for the household is obtained by using the gazetted value for each grant as the guideline.
Taxi	A vehicle which operates an unscheduled public transport service for reward. Most of these operate to or from a taxi rank (includes sedan taxi, metered taxi, minibus-taxi, etc.).
Train	A form of rail transport consisting of a series of vehicles that usually run along a rail track to transport cargo or passengers (includes the Gautrain).
Scholar	A person attending primary or secondary school.
Urban	All areas classified as urban formal or urban informal according to the Census 2001 geographic classification. It excludes areas classified as metropolitan by the Municipal Demarcation Board as per the 2011 classification.
Walking all the way	Walking from one point to another without using any other form of transport.
Worker	In the case of the NHTS, this term applies to any persons who consider themselves as working. No distinction is made between occupational categories or classes, full or part time and/or being employed by someone else versus self-employment.

Preface

This report forms part of a series of thematic reports generated from the 2013 National Household Travel Survey (NHTS). It is the second in a series of thematic reports on transport that will be utilising the data that were collected by Statistics South Africa from the NHTS 2013. Data collection took place between January and March 2013, and a total of 51 341 dwelling units were sampled.

The main purpose of this report is to present insights and investigate social disparities in accessing place of work and educational institution using travel time and travel cost. In addition, public transport accessibility indices are calculated, which are relatively fast, easily understood and could be used to compare different modes between specific origins and destinations. Furthermore, groups of people with poor access in terms of their demographic and socioeconomic status as well as location are identified.

Risenga Maluleke
Statistician-General

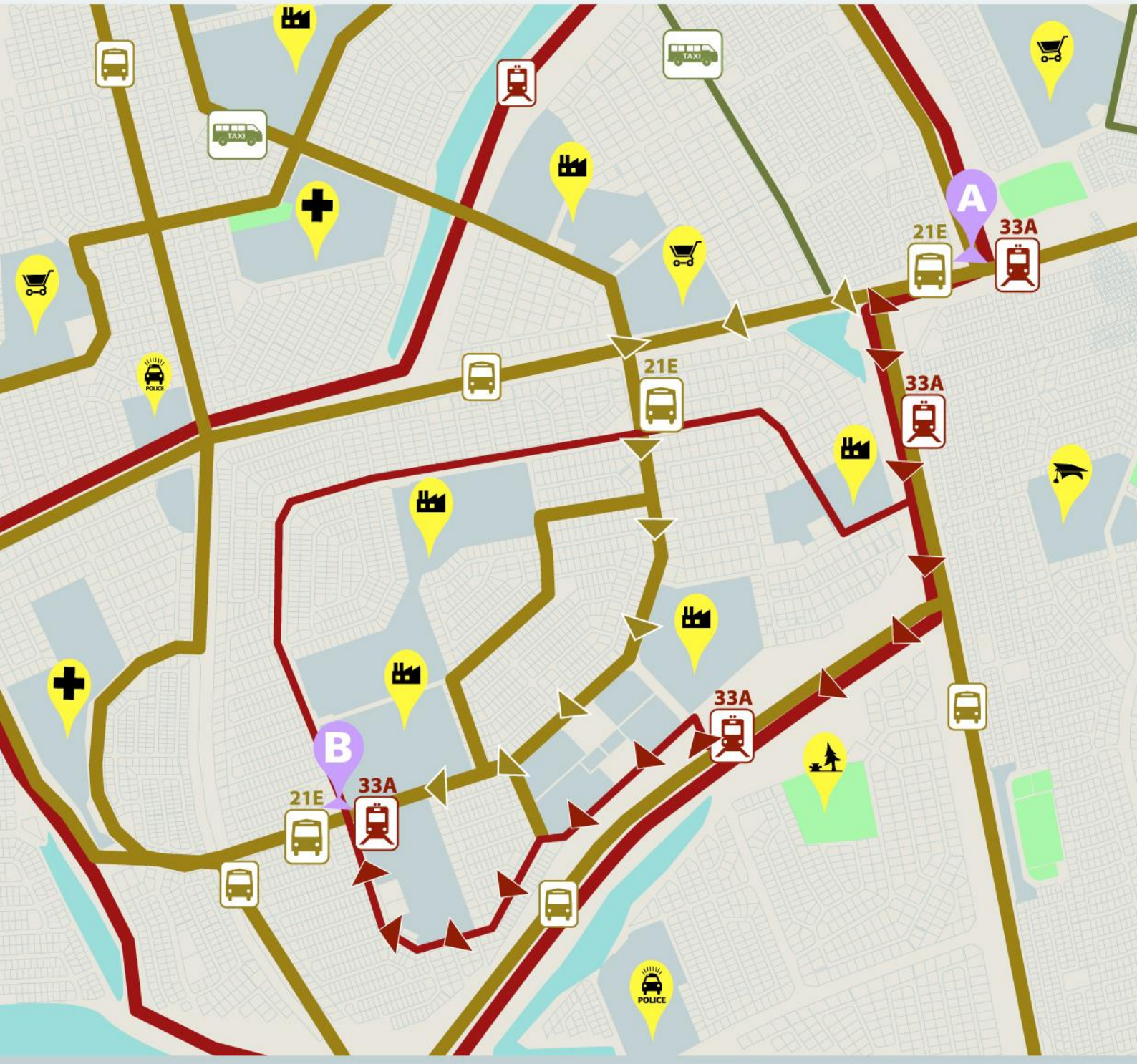
A FROM B

JOURNEY SCHEDULE

CHANGE JOURNEY

PLAN YOUR RETURN JOURNEY

21E	PRICE R49,50	04:45 → 06:30 TRAVEL TIME: 1:45	05:14 → 07:15 TRAVEL TIME: 2:01	05:30 → 7:53 TRAVEL TIME: 2:23
33A	PRICE R33,90	05:01 → 06:20 TRAVEL TIME: 1:19	05:19 → 06:50 TRAVEL TIME: 1:21	05:46 → 8:02 TRAVEL TIME: 1:21



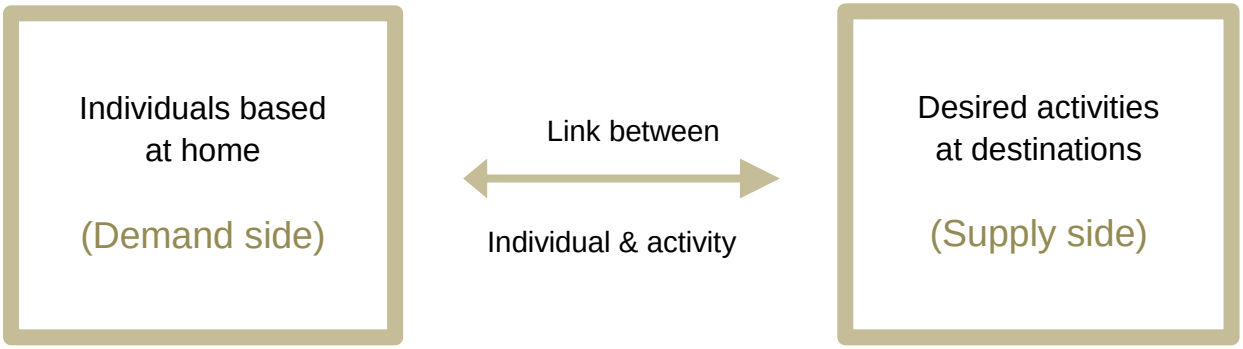
1

Introduction

1.1 Background

In the fields of transport and planning, interest in the concept of accessibility is growing. The transportation and urban planning literature commonly positions accessibility as the ease of reaching destinations or activities, or the potential for interaction, or an individual's ability to reach desired goods, services, activities and destinations (Venter, 2016; Pitot et al., 2006). Jones and Wixey (2005) correctly argue that accessibility is an attribute of people and goods rather than transport modes or service provision, and describe integrated systems from a user perspective. Figure 1.1 shows three primary components that make up accessibility. The demand side refers to individual activity needs, and the supply side is about facilities provided at various destinations to meet people's needs. Transport then provides a link between 'demand' and 'supply'.

Figure 1.1 – Three primary components of accessibility



Source: Jones and Wixey (2005)

The United Nations Secretary-General's High-Level Advisory Group on Sustainable Transport released a breport in 2016 titled "*Mobilising Sustainable Transport for Development: Analysis and Policy Recommendations*" which states that transport is not an end in itself, but rather a means allowing people to access what they need: jobs, markets and goods, social interaction, education, and a full range of other services contributing to healthy and fulfilled lives. This is further emphasised by Zhao et al. (2011) who centred that the key link between transportation and land use is accessibility, since spatial interaction between activities or land uses is promoted by transportation. Accessibility is used to measure this interaction, which reflects both the attractiveness of potential destinations and ease of reaching them.

In South Africa, many areas continue to be hampered by a legacy of racial segregation, poverty, and exclusion from social and economic opportunities. The spatial legacy is one of sprawl, low densities, functional segregation between home and work, and overlapping racial and class separations (Department of Cooperative Governance and Traditional Affairs, 2014:15). The spatial mismatch between place of residence and centres of employment, and social and economic opportunities prevents the poor from breaking the cycle of poverty and restricts access to not only job or education destinations, but also to networking about potential opportunities (Cervero, 2013a; Maunganidze, 2011; Kerr, 2015). Despite the successful transition to a democratic system, many public transport users in the country continue to experience long travel times and high travel costs in terms of accessing employment, education and other facilities; factors which are essential for sustainable economic and social development, despite various transport interventions undertaken by government. The results of urban

sprawl, of poorly integrated public transport systems, and of infrastructure and planning that has historically privileged private cars are to be seen daily on many of the congested South African roads (Kerr 2015; Thomas, 2015; Maunganidze, 2011; Department of Transport (DoT) 2012–2017).

This report seeks to use the National Household Travel Survey (NHTS) 2013 data to explore and provide insights into social inequality in accessing place of work and educational institution using travel time and travel cost. In addition, public transport accessibility indices are calculated, which are relatively fast, easily understood and could be used to compare different modes between specific origins and destinations (O-Ds) using travel time and travel cost. Furthermore, groups of people in terms of their demographic and socioeconomic status and locations with poor levels of access to places of work and educational institutions in South Africa are identified. It is against this background that Statistics South Africa (Stats SA) prepared this report, as it is important for transport policymakers and planners to be guided by accurate information and statistics regarding how easy it is to get from an origin to a specific destination using travel time and travel cost. The report will primarily cover educational and work-related trips.

1.2 Objective of the report

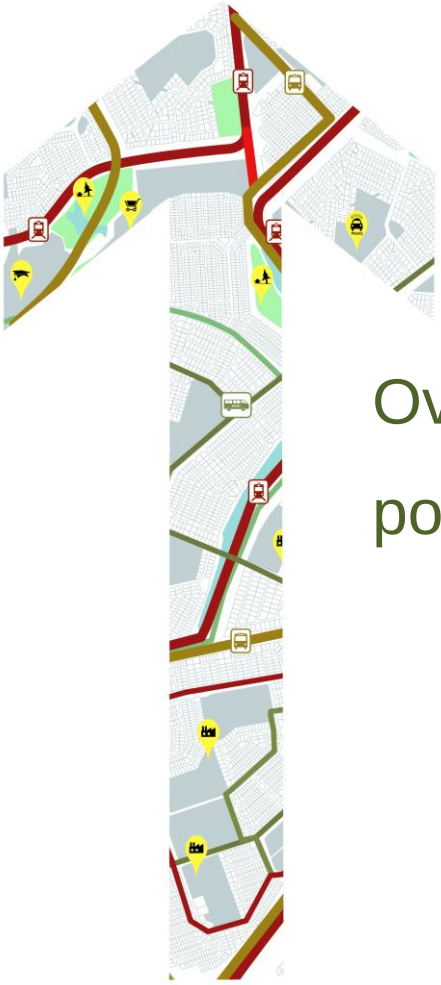
Given the importance of understanding and investigating social inequality in accessing *place of work and educational institution* using travel time and travel cost, this report aims to:

- Investigate travel time and travel cost;
- Explore social inequality using travel time and cost;
- Provide a simple and objective method of portraying absolute and relative measures of accessibility by different modes;
- Identify groups of people with poor access in terms of their demographic and socioeconomic status as well as location;
- Determine significant demographic and socioeconomic factors that may be associated with social inequality in accessing place of work and educational institution; and
- Provide a visual representation of accessibility to workplace and educational institution across different geographical locations.

1.3 Organisation and presentation of this report

This report has twelve sections. Sections 1 and 2 provide key findings, the introduction and objectives, as well as an overview of the legal and policy environment. Section 3 describes the methodology and data sources used and points out some of the limitations. The subsequent sections provide a detailed exposition of the findings of the report, while the recommendations can be found in Section 10.

2



Overview of legal and policy environment

2.1 Introduction

This section outlines key aspects of the legislative framework, policies and strategies that have an influence on public transport. Since the attainment of a democratic dispensation in 1994, policies, strategies and plans were developed and changed to address historical imbalances and to ensure the provision of affordable, accessible and sustainable public transport services to all South Africans in order to advance socioeconomic development goals.

The Constitution of the Republic of South Africa (Act No. 108 of 1996) section 85(1)(b) mandates the Department of Transport with the role of developing a transport policy. This mandate places an immense responsibility on the Department's role to ensure that transport policy development addresses the mobility needs for all citizens (DoT, 2011). Besides the Constitution, the DoT also derives its mandate from the following policies and legislations:

- National Road Traffic Act, 1996 (Act No. 93 of 1996)
- Moving South Africa, 1998
- Public Transport Action Plan, 2007
- National Land Transport Act, 2009
- National Land Transport Strategic Framework, 2015
- Medium Term Strategic Framework (MTSF 2014–2019)
- National Transport Master Plan (NATMAP), 2050

2.2 White Paper on National Transport Policy (1996)

The 1996 White Paper on the National Transport Policy is one of the key transport policy documents in the country. It aims to ensure that the South African transportation system is adequate to meet the basic accessibility needs (to work, health care, schools, shops) in many developing rural and urban areas. The following are some of the strategic objectives that the policy is targeting:

- Provide adequate accessibility together with safety and security within the constraints of social affordability.
- Improve accessibility and mobility, limiting walking distances to less than about one kilometre in urban areas.
- Provide an appropriate and affordable standard of accessibility to work, commercial and social services in rural areas.
- Promote the use of public transport over private car travel, with the goal of achieving a ratio of 80:20 between public transport and private car usage.
- Promote rural development that will improve access to opportunities by ensuring that rural workers are housed in close proximity to their work locations and services, thereby reducing the need to travel.

2.3 National Development Plan

The National Planning Commission (NPC) presented the NDP (NPC, 2011), which is aimed at addressing and eradicating poverty and reducing inequality in the country. Investments in transport infrastructure and improving public transport are viewed as key development areas that are essential for achieving the 2030 objectives. The following are some of the specific strategic objectives that are related to public transport:

- Investments in public transport, which will benefit low-income households by facilitating mobility.
- Establishment of effective, safe and affordable public transport.
- Investments in the transport sector, which in turn will bridge geographical distances affordably, and foster reliability and safety so that all South Africans can access previously inaccessible economic opportunities, social spaces and services.
- Investments in public transport infrastructure and systems, including the renewal of the commuter rail fleet, supported by enhanced links with road-based services.
- Establishment of the user-friendly, less environmentally damaging, cheaper and integrated or seamless public transport.
- Devolve transport management to local government.

2.4 Sustainable Development Goals

Unlike the Millennium Development Goals (MDGs), a new development framework, the Sustainable Development Goals (SDGs) for 2015–2030 has included transport as a key contributor to sustainable development. The SDGs comprise 17 goals and 169 targets; five of those targets directly involve transport, and attaining at least another six will critically depend on transport (Ensink et al., 2015). The following five targets are directly related to the transport sector:

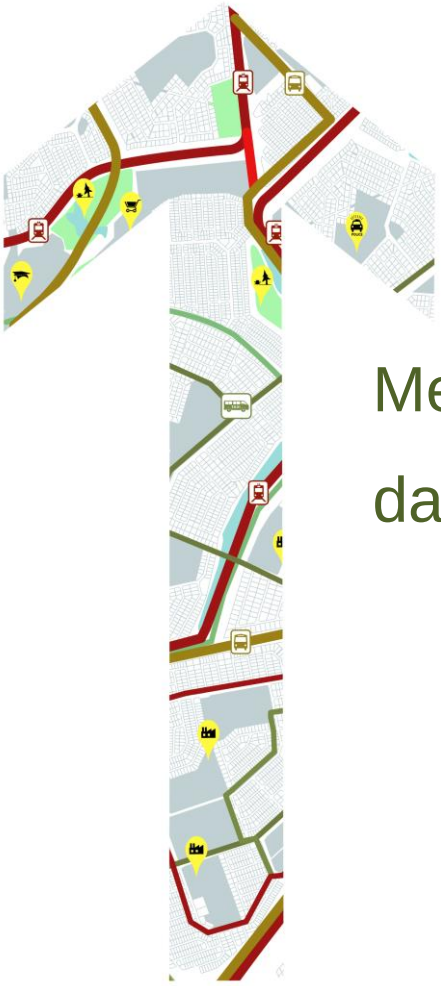
- Target 3.6: By 2020, halve the number of global deaths and injuries from road traffic accidents.
- Target 7.3: By 2030, double the global rate of improvement in energy efficiency.
- Target 9.1: Develop quality, reliable, sustainable, and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.
- Target 11.2: By 2030, provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities, and older persons.
- Target 12.c: Rationalise inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimising the possible adverse impacts on their development in a manner that protects the poor and affected communities.

2.5 Agenda 2063

The African Union (AU) has recognised the need for interventions; and identified transport as one of the aspirations in a strategic framework for the socioeconomic transformation of the continent over the next 50 years – the African Union's Agenda 2063 action plan. The plan declares that by 2063, Africa shall be a prosperous continent, with the means and resources to drive its own development. The plan identifies the cities and other settlements as hubs of cultural and economic activities, with modernised infrastructure, and people have access to all the basic necessities of life including shelter, water, sanitation, energy, public transport and information and communication technology (ICT). The plan envisages that by 2063 the necessary infrastructure will be in place to support Africa's accelerated integration and growth, technological transformation, trade and development. This will include high-speed railway networks, roads, shipping lines, sea and air transport, as well as well-developed ICT infrastructure and the digital economy (African Union, 2014).

The Department of Planning, Monitoring and Evaluation (DPME), in partnership with the DoT and Stats SA, has managed to align the NDP, SDGs, Agenda 2036 and MTSF 2014–2019 targets. These plans recognise sustainable transport, specifically public transport, as the main driver to support and drive sustainable development. As the United Nations Secretary-General's High-Level Advisory Group on Sustainable Transport correctly argue, transport drives development by linking people, connecting local communities to the world, building markets and facilitating trade.

3



Methodology and data sources

3.1 Introduction

The NHTS 2013 was used as the primary data source for this report to enrich insights and explore social disparities in accessing a place of work and educational institution using travel time and travel cost.

3.2 National Household Travel Survey

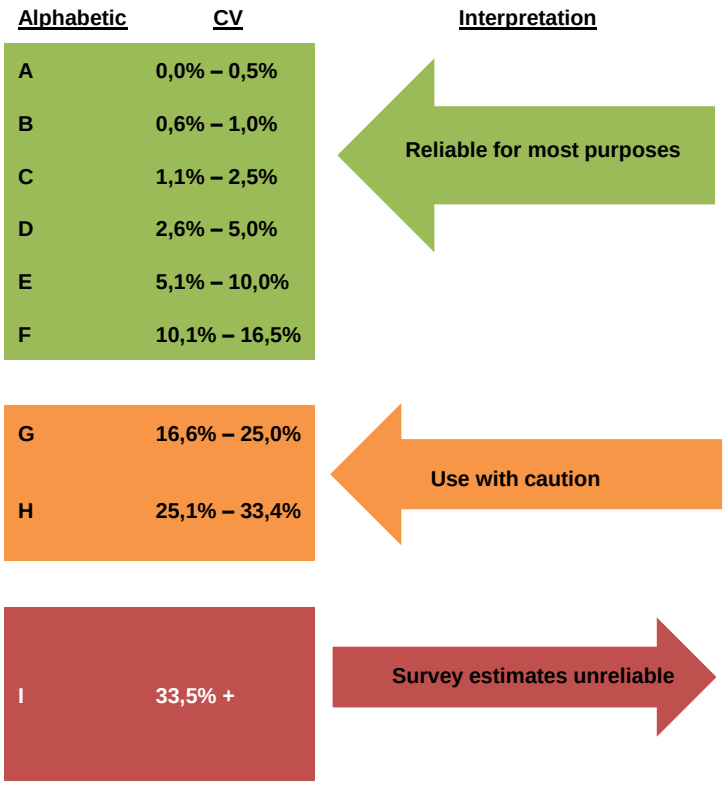
The NHTS is a household survey that was conducted in 2013 and is aimed at providing insights into the travel modes, times and costs of South African households. The aim of the NHTS is to gain strategic insight into the travel patterns and transport problems in the country, and the collected information will serve as the basis for DoT research, planning and policy formulation. The information will further assist transport authorities to effectively target subsidies. The NHTS 2013 was conducted across all nine provinces using a two-staged random stratified sample of 51 341 dwelling units. More details related to sampling, weighting and fieldwork methodology can be found in the NHTS 2013 technical report.

3.3 Data analysis

All data were analysed using the statistical analysis programs SAS 9.3 and SAS Enterprise Guide 4.3, and ArcMap 10 for spatial data analysis. Note that missing and unknown values were excluded from the analysis and frequency values were rounded off to the nearest thousand, unless otherwise specified.

The standard error and coefficient of variation (CV) for some of the key variables used in this report are provided in the annexure. The CVs were based on the sample weights as determined by the current weighting methodology implemented for the NHTS. Figure 3.1 below illustrates a model that is generally used to determine the reliability of survey estimates, based on the CV_s obtained for the survey estimates.

Figure 3.1 – Level of coefficient of variation for survey estimates



3.3.1 Accessibility Indices (AIs)

Salonen & Toivonen (2013) correctly argue that analysing the accessibility disparity of different modes between specified O-Ds is recognised as an efficient way to assess the environmental and social sustainability of transport and land use arrangements. Travel times and costs by different travel modes form an essential part of such an analysis.

In this report, two accessibility indices (travel time AI and travel cost AI) for different travel modes between important locations are created based on a methodology utilised by Schoon et al. (1999). Travel time AIs for a particular mode were calculated by using average travel time of a particular mode to the average travel time across all modes. Travel cost AIs were calculated in much the same way (Mamun, 2011). For example, the AI for a taxi is defined as:

$$AI_{taxi} = \frac{average\ travel\ time\ by\ taxi}{average\ travel\ time\ across\ all\ modes}$$

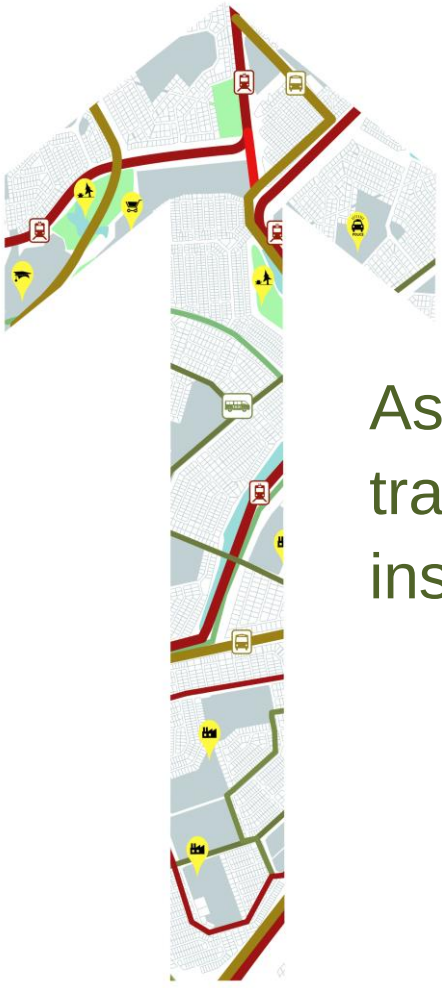
As Levinson (1998) rightly argues, the interaction between two locations declines with increasing disutility (distance, time, and cost) between them, but is positively associated with the amount of activity at each location. Therefore, these indices will provide insight into how easy it is to get from an origin to a specific destination by using different travel modes.

3.4 Limitations of the study

Since the NHTS 2013 is a sample survey and relies on population estimates and a weighting process to extrapolate sample estimates to population estimates, the absolute number of cases does not always correspond with census or administrative data sources.

The use of a proxy method poses a particular challenge – it might provide different estimates for travel cost and mode compared to the self-reported method. It is important to note that the report will only focus on educational and work-related trips.

4



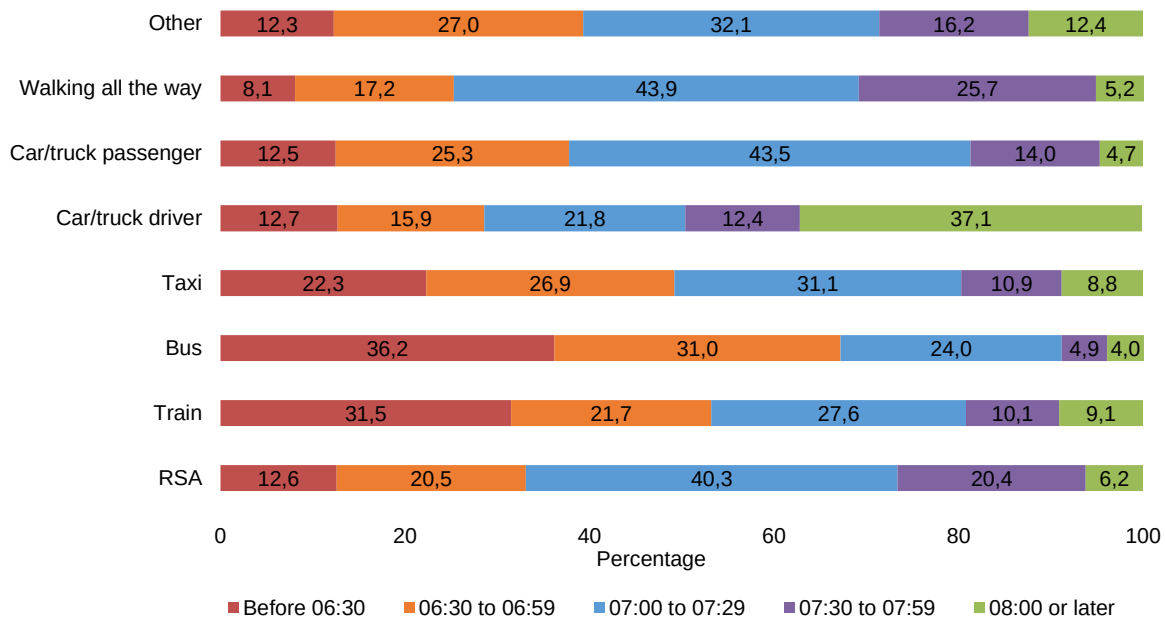
Assessing travel time and travel cost to educational institutions

4.1 Introduction

This section focuses on education-related travel and more specifically, departure time and walking time to get to the first transport in terms of modes of transport, geographic location and per capital monthly household income of learners.

4.2 Departure time and walking time to get to the first transport

Figure 4.1 – Time learners leave for educational institutions by main mode of transport, 2013



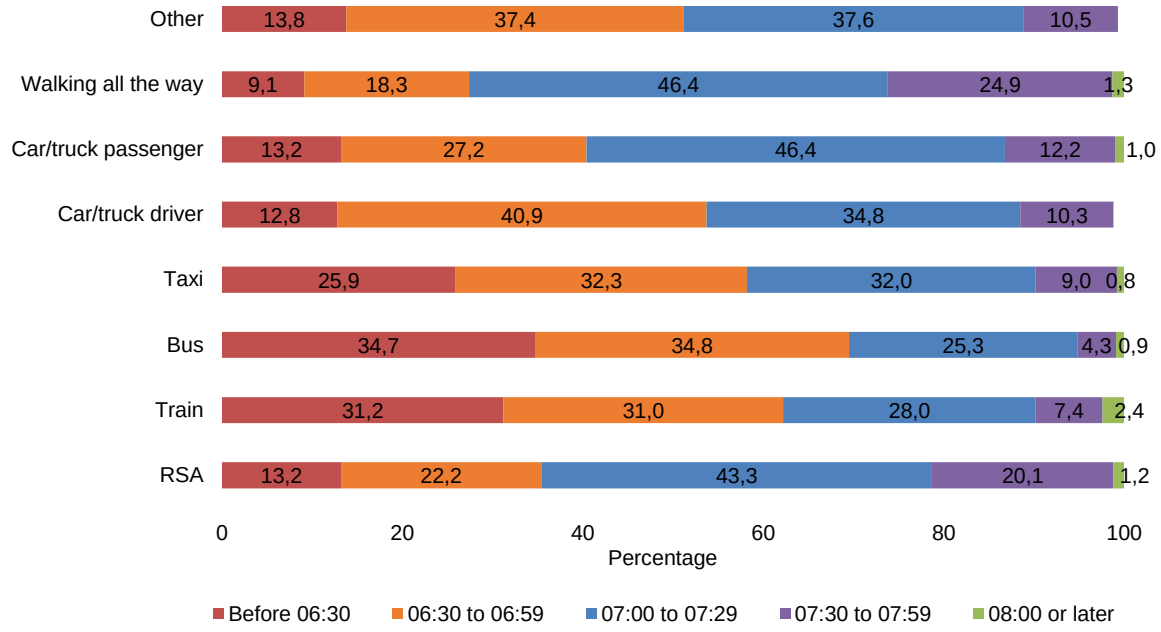
Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and time learners leave home were excluded.
Source: NHTS, 2013

Nationally, most learners (40,3%) left their home between 07:00 and 07:29 in the morning, followed by those who travelled between 06:30 and 06:59 (20,5%) and those who left between 07:30 and 07:59 (20,4%).

However, this pattern is different for learners who used public transport. Learners who used public transport were more likely to leave their home earlier than other learners. For example, learners who used either buses (36,2%), trains (31,5%) or taxis (22,3%) started travelling before 06:30. About 13% of learners who used private transport left their home before 60:30 – 12,7% of those who drove and 12,5% as passengers.

Figure 4.1 further shows that those who drove had the highest percentage (37,1%) of learners that travelled at 08:00 or later compared to other modes. This clearly highlights the advantages of private transport travel.

Figure 4.2 – Time scholars leave for school by main mode of transport, 2013



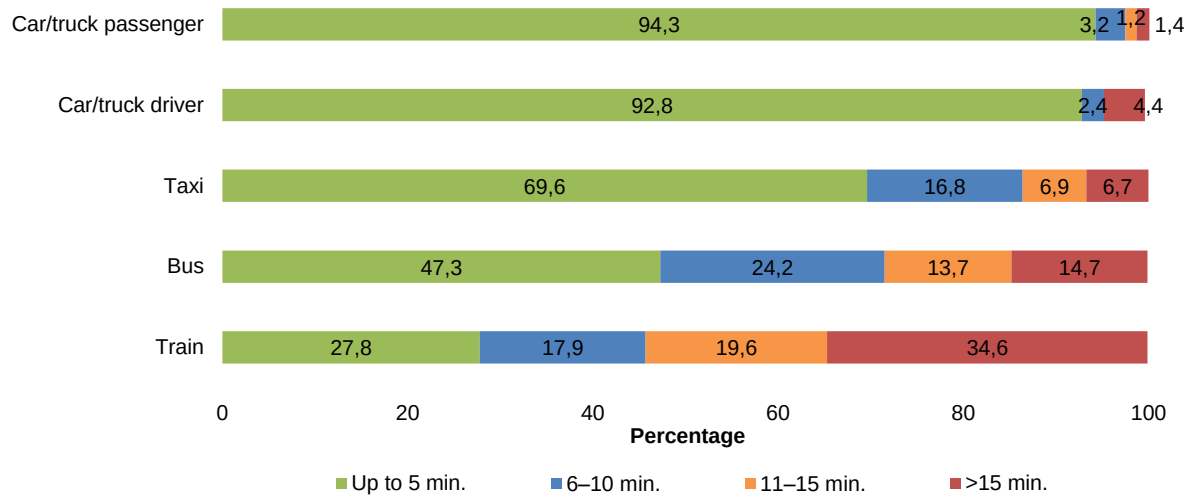
Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and time scholars leave for school were excluded.
Source: NHTS, 2013

When considering the time that scholars leave for school, nationally, scholars had similar patterns as learners – more than one in four (43,3%) scholars left their home between 07:00 and 07:29 in the morning, followed by those who travelled between 06:30 and 06:59 (22,2%) and those who left between 07:30 and 07:59 (20,1%).

Similar to the above result, the time scholars leave for school varies in terms of mode of transport. Public transport users were more likely to leave their home earlier compared to other users. For example, scholars who used either buses (34,7%), trains (31,2%) or taxis (25,9%) started travelling before 06:30. Conversely, very few scholars who used private transport left their home at that same time – 12,8% of those who drove and 13,2% as passengers.

The findings from NHTS 2013 show that walking all the way was the primary method used by scholars to reach their destination, and the bulk of them left their home between 07:00 and 07:29 (46,4%) in the morning, followed by those who left between 07:30 and 07:59 (24,9%).

Figure 4.3 – Time it takes learners to walk to get to the first transport by main mode of transport, 2013



Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and walking time were excluded.
Source: NHTS, 2013

As expected, most (about 90%) learners who used private transport tended to walk up to 5 minutes to their first transport car drivers (92,8%) and passengers (94,3%) on the other hand, walked up to 5 minutes.

Figure 4.3 clearly indicates the disadvantage of train travel: learners who used trains (34,6%) constituted the highest percentage of learners who walked for more than 15 minutes to get to their first transport, followed by those who used buses (14,7%) and taxis (6,7%). These findings clearly demonstrate the convenience of using private transport and taxis.

4.3 Total travel time and travel cost to educational institutions

4.3.1 Total travel time and travel cost for learners

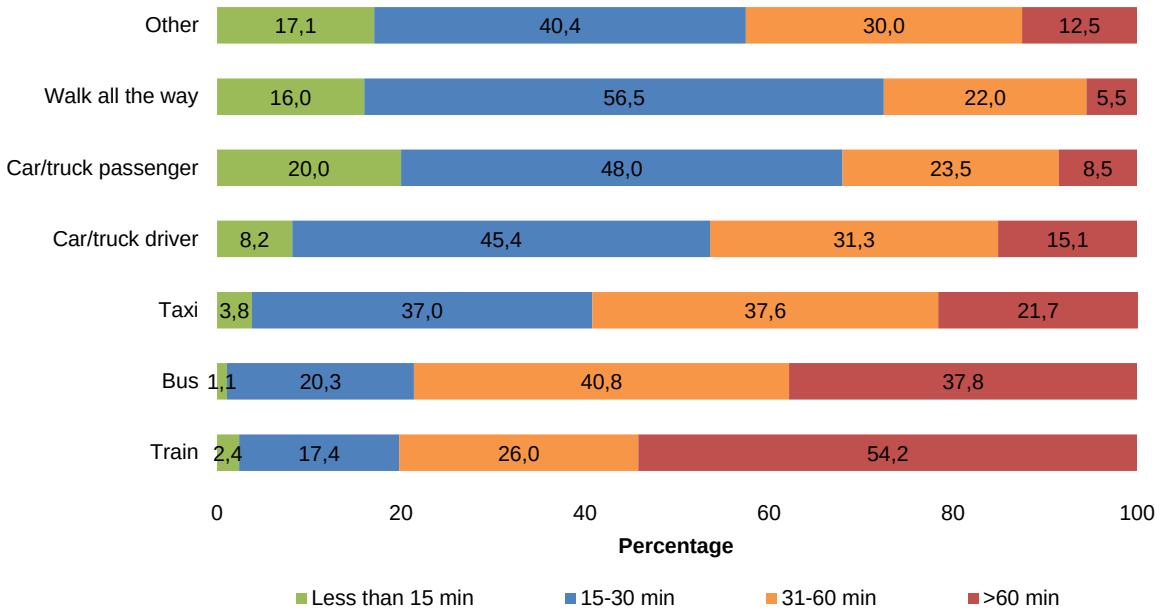
Table 4.1 – Total travel time for learners by main mode of transport, 2013

Main mode of transport		Number of learners ('000)	Total travel time for learners				
			Less than 15 min.	15-30 min.	31-60 min.	>60 min.	Total
Public transport	Train	199	2,4	17,4	26,0	54,2	**100,0**
	Bus	889	1,1	20,3	40,8	37,8	**100,0**
	Taxi	2 507	3,8	37,0	37,6	21,7	**100,0**
Private transport	Car/truck driver	250	8,2	45,4	31,3	15,1	**100,0**
	Car/truck passenger	2 185	20,0	48,0	23,5	8,5	**100,0**
Walk all the way		10 827	16,0	56,5	22,0	5,5	**100,0**
Other		141	17,1	40,4	30,0	12,5	**100,0**
Total		**16 997**	**13,6**	**49,9**	**25,7**	**10,8**	100,0

Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and total travel time were excluded.
Source: NHTS, 2013

According to Table 4.1, about 17 million learners travel to their respective educational institutions in the morning. Nationally, 49,9% of learners travelled between 15 and 30 minutes, followed by 25,7% who travelled between 31 and 60 minutes and about 11% who travelled more than 60 minutes in the morning.

Figure 4.4 – Total travel time for learners by main mode of transport, 2013

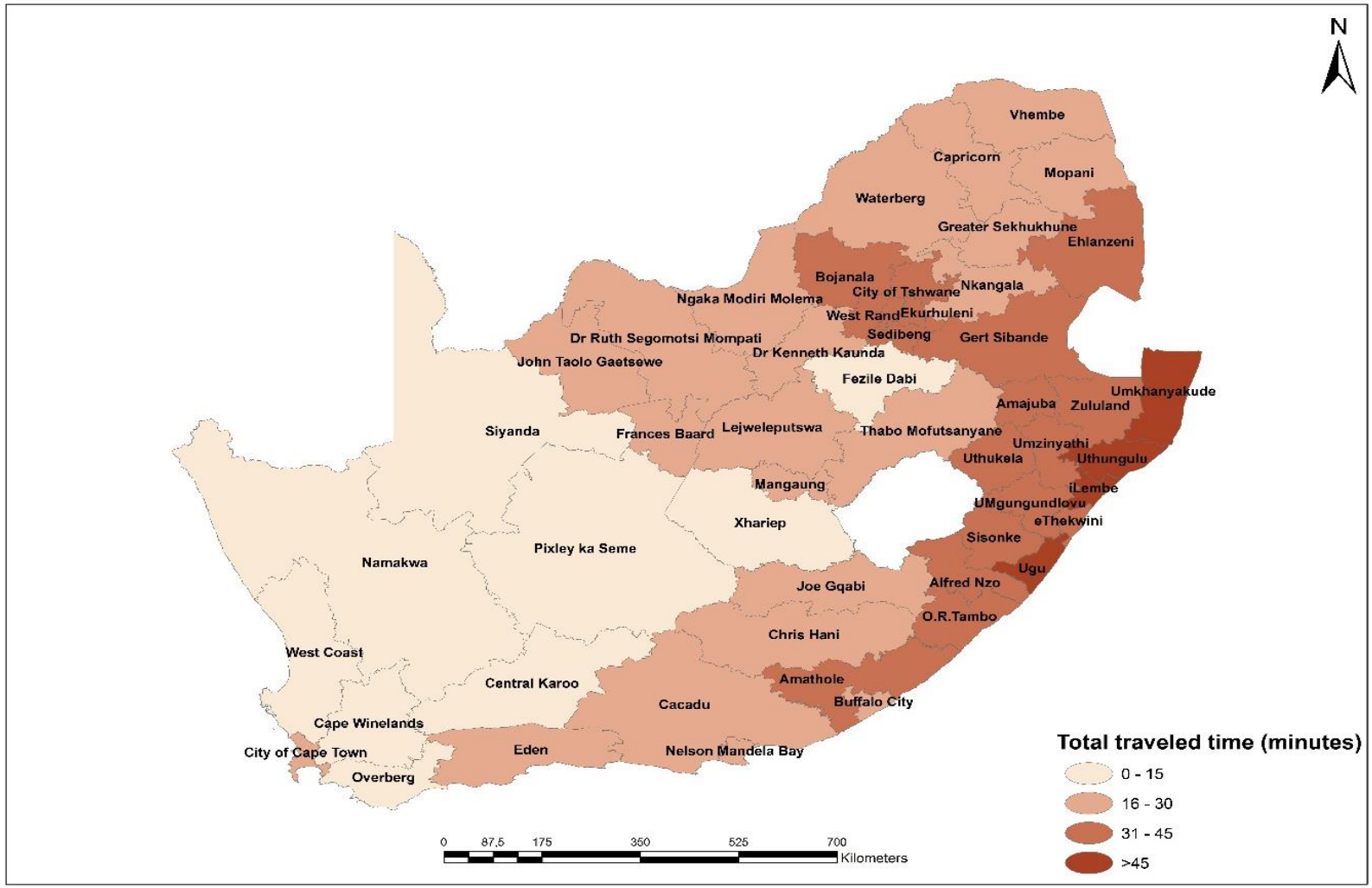


Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and total travel time were excluded.
Source: NHTS, 2013

It is evident from Figure 4.4 that most of the learners who used trains as opposed to users of other public transport modes travel for more than 60 minutes to get to their destination – trains (54,2%), buses (37,8%) and taxis (21,7%). A different picture emerges for private transport, as only 8,5% of car passengers travelled for more than 60 minutes, while 45,4% drivers travelled between 15 and 30 minutes, followed by those who took between 31 and 60 minutes (31,3%) and another 15,1% who travelled for more than an hour. These results highlight the advantage of taxis and car travel and support previous results that some of the modes are severely affected by long travel times.

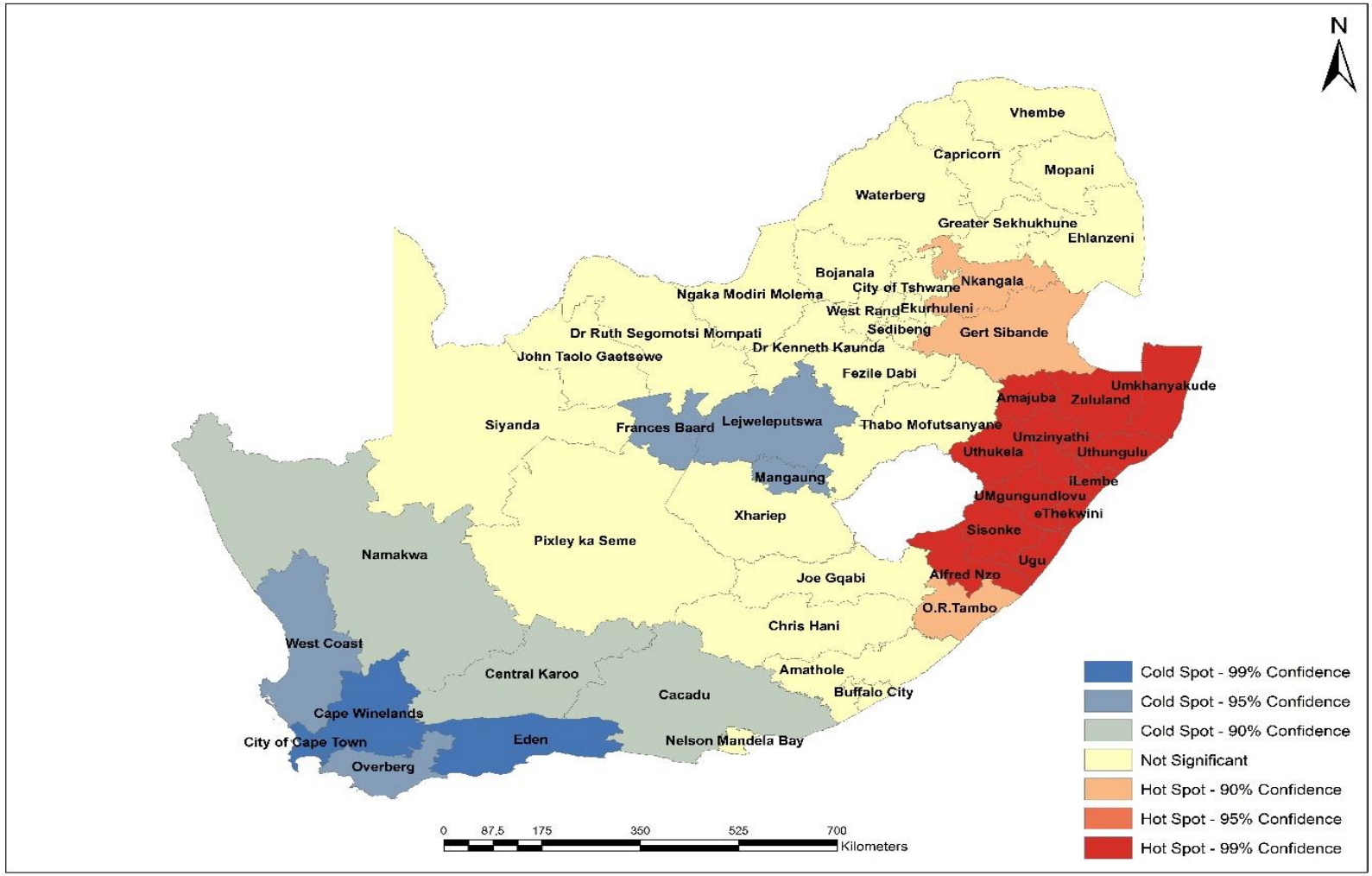
Regardless of the findings from NHTS 2013 that show walking all the way as the main mode of travel used by learners to reach their educational institutions, only 5,5% walked for more than an hour.

Map 4.1 – Total travel time for learners who travelled to educational institutions by district municipality, 2013



Source: NHTS, 2013

Map 4.2 – Hot-spot analysis for total travel time for learners who travelled to educational institutions by district municipality, 2013



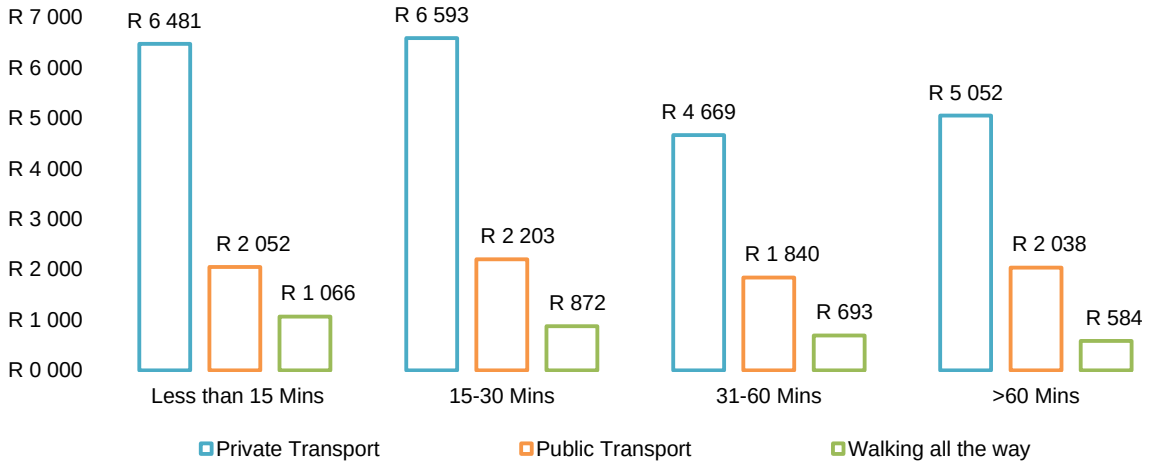
Source: NHTS, 2013

The distribution of total travel time to educational institutions is presented in Map 4.1. The darkest colours represent district municipalities that had learners who needed more time to get to educational institutions, while the lightest colours represent district municipalities that had learners who needed less time.

The map shows that it was mainly district municipalities in KwaZulu-Natal (such as Uthungulu, iLembe, Umkhanyakude, and Ugu) that had more learners who needed more time (more than 45 minutes) to get to their educational institution. In Gauteng and some districts in Eastern Cape (such as Alfred Nzo, O.R. Tambo, Amathole and Buffalo City), learners needed between 31 and 45 minutes to travel to their educational institutions.

Map 4.2 shows the clustering of districts that had learners who needed either more (red) or less (blue) time to get to their educational institution. Total travel time to educational institutions was substantially longer in KwaZulu-Natal and part of Eastern Cape and Mpumalanga than in most other provinces represented in red. The blue areas indicate the districts with less total travel time. Lower total travel times were observed in some parts of the Free State and Western Cape.

Figure 4.5 – Average per capita monthly household income for learners by main mode of transport and total travel time to educational institutions, 2013



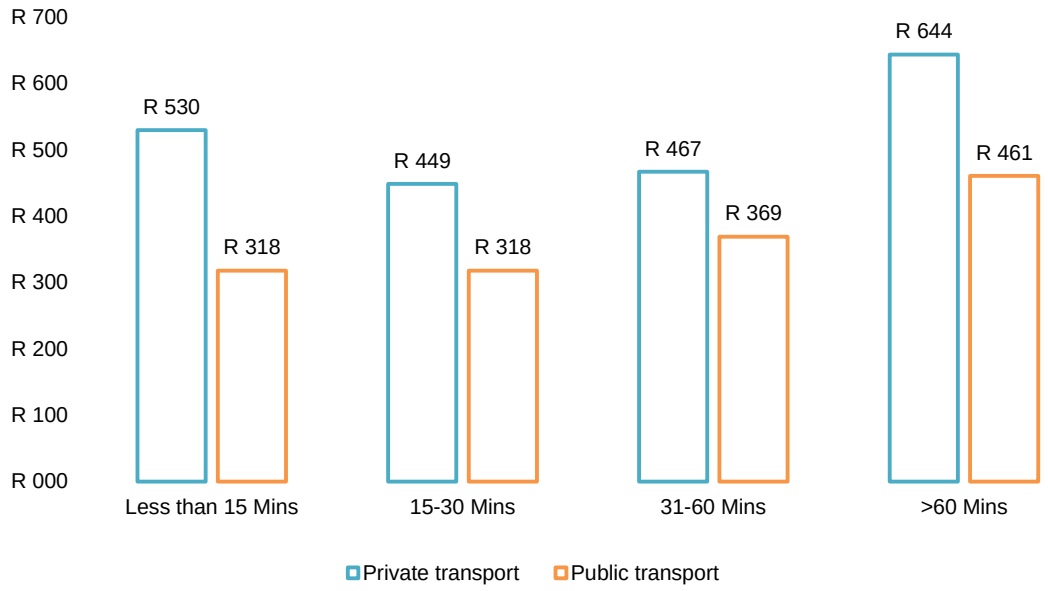
Unspecified cases of transport modes, household income per capita and total travel time were excluded.
Source: NHTS, 2013

In general, learners who used private transport as their main mode of transport reported the highest average per capita monthly household income across all travel time intervals when compared to other learners, as shown in Figure 4.5. Furthermore, wealthier learners tend to stay closer to their educational institutions, as the average per capita monthly household income tends to be higher for total travel times less than 30 minutes.

For example, learners who used private transport and travelled for more than an hour reported the highest average per capita monthly household income (R5 052), which is higher than the average per capita monthly household income values reported by public transport users and those who walked (R2 038 and R584, respectively).

Notwithstanding, those who walked all the way for more than an hour were most likely to come from households that reported the lowest average per capita monthly household income.

Figure 4.6 – Average travel cost for learners by main mode of transport and total travel time to educational institutions, 2013



Unspecified cases of transport modes, total travel time and cost were excluded.
Source: NHTS, 2013

As expected, across all travel time intervals, private transport appeared to be the most expensive mode of travel compared to public transport, as shown in Figure 4.6. The figure further confirms and shows that those who travelled more than 60 minutes were most likely to pay more for their transport – R644 for private transport and R461 for public transport.

Although public transport appeared to be the least expensive mode of travel, it is important to note that more than fifty-five per cent (56,4%) of learners were from households that spent more than 20% of their monthly household income per capita on public transport. This is above the benchmark set by government. According to the 1996 White Paper on Transport Policy, the benchmark of 10% of disposable income is set to measure the affordability of public transport (Stats SA, 2015).

4.3.2 Total travel time and travel cost for scholars

Table 4.2 – Total travel time for scholars by geographical location and main mode of transport, 2013

Indicator		Number of scholars ('000)	Total travel time for learners				
			Less than 15 min	15-30 min.	31-60 min.	>60 min	Total
Geographic location							
Metro		3 600	14,2	51,0	25,3	9,5	**100,0**
Urban		3 087	15,8	55,0	22,2	7,1	**100,0**
Rural		6 008	9,2	49,1	30,1	11,6	**100,0**
RSA		**12 695**	**12,2**	**51,1**	**26,8**	**9,9**	**100,0**
Main mode of transport							
Public transport	Train	71	3,0	27,9	21,0	48,0	**100,0**
	Bus	634	1,1	21,4	44,2	33,4	**100,0**
	Taxi	1 587	3,6	37,0	38,2	21,2	**100,0**
Private transport	Car/truck driver	41	13,3	34,3	41,2	11,2	**100,0**
	Car/truck passenger	1 436	17,5	49,8	24,6	8,2	**100,0**
Walk all the way		8 574	13,8	56,4	23,7	6,0	**100,0**
Other		81	12,6	35,6	35,9	15,9	**100,0**
Total		**12 425**	**12,2**	**51,0**	**26,8**	**9,9**	**100,0**

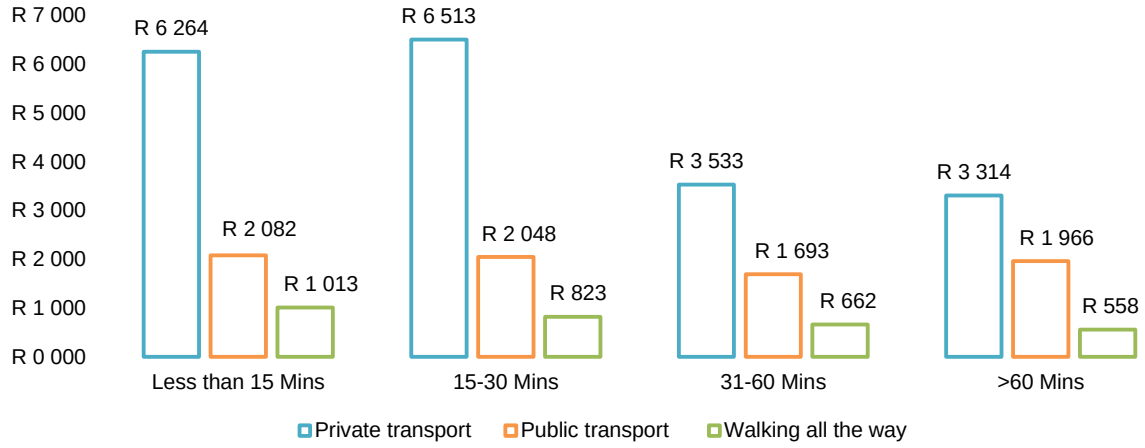
Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and total travel time were excluded.
Source: NHTS, 2013

Numerous studies have found that the distance from a school impacts the academic success of a scholar, as those living further from schools have poorer academic success compared to those living close to their schools. This impact is often negative and therefore a better understanding of a school trip is needed to inform policy (Gasparovic, 2014). According to Table 4.2, nationally, most scholars (51,0%) tended to travel between 15 and 30 minutes, followed by those who travelled between 31 and 60 minutes (26,8%) and less than 15 minutes (12,2%).

Regardless of location, a high percentage of scholars travelled to their school between 15 and 30 minutes. However, the highest proportion of scholars who needed more time in the morning were found in rural areas – 30% needed between 31 and 60 minutes and about 12% needed more than an hour (11,6%) . This is not surprising, because according to the NHTS 2013, of all scholars who walked all the way to school in the country, KwaZulu-Natal (23,7%), Eastern Cape (18,0%) and Limpopo (16,8%) made the biggest contribution to the total (Stats SA, 2014a).

Similar to the results in Table 4.1, travel time varies in terms of mode of transport. Public transport users travel longer than private transport users to get to school. Trains (48,0%) had the highest percentage of scholars who travelled more than 60 minutes, followed by bus (33,4%) and taxi (21,2%) users. Although a large number of scholars (8,5 million) walked all the way to school, most of them walked between 15 and 30 minutes (56,4%), followed by those who walked between 31 and 60 minutes (23,7%).

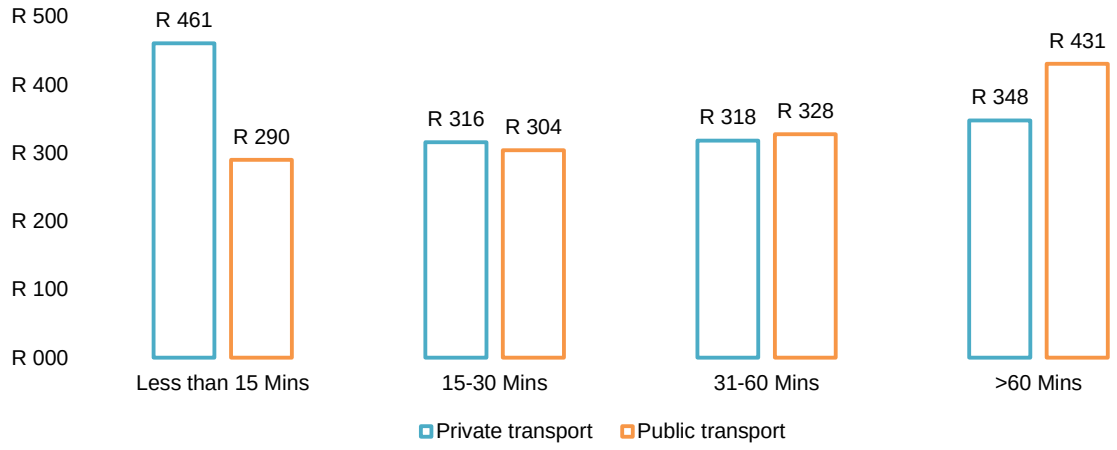
Figure 4.7 – Average per capita monthly household income for scholars by main mode of transport and total travel time to school, 2013



Unspecified cases of household income, transport modes, total travel time and cost were excluded.
Source: NHTS, 2013

Figure 4.7 confirms that scholars who used private transport were from households with the highest average per capita monthly household income across all travel time intervals. For those who walked all the way to school, the opposite was the case – most scholars were from households with the lowest average per capita monthly household income. Similar to learners, those who walked all the way for more than an hour were most likely to come from households that reported the lowest average per capita monthly household income.

Figure 4.8 – Average travel cost for scholars by main mode of transport and total travel time to school, 2013



Unspecified cases of transport modes, total travel time and cost were excluded.
Source: NHTS, 2013

Figure 4.8 shows that travel cost for public transport users (R431) was the highest for those who travelled more than 60 minutes compared to their counterparts who used private transport (R384). This result shows that public transport users experience a "double jeopardy" – they face both long travel times and high travel costs.

4.4 Summary and conclusion

This section profiled education-related travel and more specifically, departure time and walking time to get to the first transport in terms of mode of transport and geographic location.

When departure times for learners were reviewed, nationally, most learners left their home between 07:00 and 07:29 in the morning, followed by those who travelled between 06:30 and 06:59 and those who left between 07:30 and 07:59. However, this pattern is different for learners who used public transport. They were more likely to leave their home earlier than other learners.

In terms of walking time to first mode of transport, contrasting times between modes of transport were observed. About ninety per cent of learners who used private transport tended to walk up to 5 minutes to their first transport compared to other learners. On the other side, learners who used trains had the highest percentage of learners who walked for more than 15 minutes to get to their first mode of transport compared to other public transport users. These findings clearly demonstrate the convenience of using private transport.

It can be observed that nationally, about fifty per cent (49,9%) of learners travelled between 15 and 30 minutes, followed by 25,7% who travelled between 31 and 60 minutes and about 11% who travelled more than 60 minutes in the morning. However, the great majority of learners who used trains in the morning travelled for more than 60 minutes when compared to other public transport users – trains (54,2%), buses (37,8%) and taxis (21,7%). A different picture emerges for private transport, as only 8,5% of car passengers travel for more than 60 minutes and 45,4% travelled between 15 and 30 minutes, followed by those who took between 31 and 60 minutes (31,3%) and another 15,1% who needed to travel for more than an hour. These results highlight one of the advantages of taxis and car travel, and supports previous results that some of the modes are severely affected by long travel time.

In most areas, a high percentage of scholars travelled to their school between 15 and 30 minutes in the mornings. Notwithstanding, the highest proportion of scholars who needed more time in the morning were found in rural areas – 30% needed between 31 and 60 minutes and about 12% needed more than an hour (11,6%). An analysis of total travel time to educational institutions by district shows that district municipalities in KwaZulu-Natal (such as Uthungulu, iLembe, Umkhanyakude and Ugu) had more learners who needed more time (more than 45 minutes) to get to their educational institution. In Gauteng and some districts in Eastern Cape (such as Alfred Nzo, O.R. Tambo, Amathole and Buffalo City), learners needed between 31 and 45 minutes to travel to their educational institutions.

For scholars, travel cost for public transport users (R431) was the highest for those who travelled more than 60 minutes compared to their counterparts who used private transport (R384). The result also shows that public transport users experience a "double jeopardy" – they are facing both long travel times and high travel costs.

These results confirm that there are social disparities in accessing educational institutions, especially for learners who use public transport modes.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100
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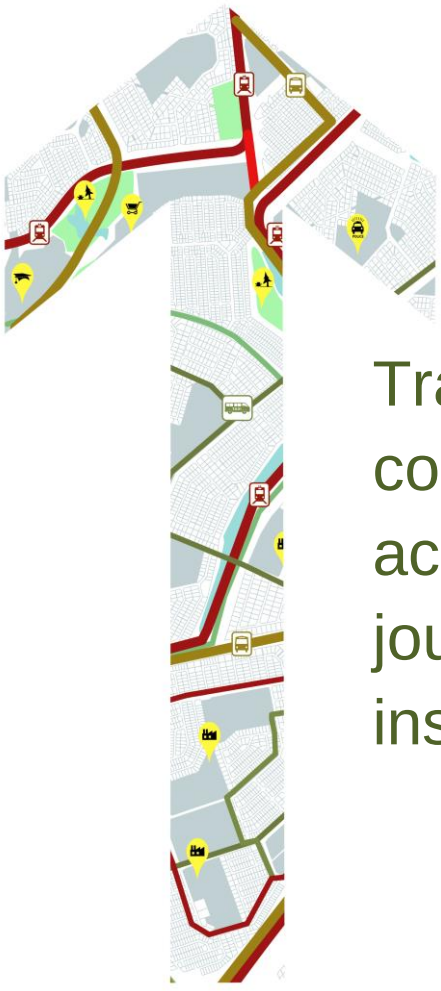
5



Travel time and travel cost indices as relative accessibility in the journey to educational institutions

5.1 Introduction

In this section, as mentioned in the methodology section, two accessibility indices (travel time AI and travel cost AI) for different travel modes between important locations are calculated based on a methodology utilised by Schoon et al. (1999). Travel time AIs for a particular mode were calculated by using average travel time of a particular mode to the average travel time across all modes. Travel cost AIs were calculated in much the same way.

The travel time AIs reflect travel time related to average travel time value

A value of 1,0 (average travel time value) signifies parity in traveling experiences for users in terms of time

A value below 1,0 suggests that learners experience short travel time (easy access to their educational institution)

A value above 1,0 suggests that learners experience long travel time (difficult reaching their educational institutions)

5.2 Accessibility indices for travel time to educational institutions

This subsection sets the context for the rest of the report by discussing accessibility indices (travel time AI) in relation to the main modes of transport and then compares travel time AI of public transport modes across different sociodemographic variables.

Table 5.1 – Distribution of learners by main mode of transport and average travel time to educational institution, 2013

Main mode of transport		Number of learners ('000)	Per cent	Average travel time	CV (%)	Std. error of mean
Public transport	Train	199	1,2	74	3	2,2
	Bus	889	5,3	62	1	0,7
	Taxi	2 507	14,9	49	1	0,4
Private transport	Car/truck driver	250	1,5	42	3	1,4
	Car/truck passenger	2 185	13,0	32	1	0,4
Walking all the way		10 827	64,2	30	1	0,1
Total		**16 857**	**100,0**	**35**	**1**	**0,1**

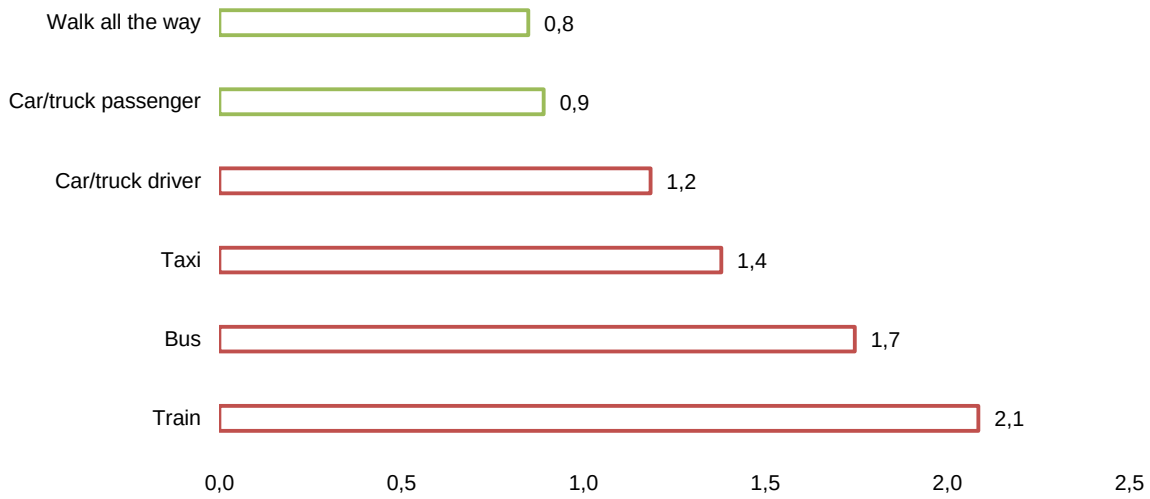
Unspecified cases of transport modes and total travel time were excluded.
Source: NHTS, 2013

Table 5.1 shows the average travel times to educational institutions with their standard errors and coefficients of variation. All estimates are highly accurate, as the coefficients of variation are small.

Nationally, learners needed on average 35 minutes to get to their educational institutions. However, learners who used public transport experienced long travel time in the morning – train users travelled for 74 minutes, bus users travelled 62 minutes and taxi users travelled 49 minutes. On the other hand, those who drove all the way to their educational institutions needed on average 42 minutes, which is above the national average travel time.

Despite walking all the way being the main mode of travel (64,2%) to educational institutions, learners who used this mode needed on average 30 minutes to arrive at their institution, which is below the national average travel time of 35 minutes.

Figure 5.1 – Travel time accessibility index by main mode of transport, 2013



Unspecified cases of transport modes and total travel time were excluded.
Source: NHTS, 2013

The travel time accessibility index scores vary quite substantially between different modes of transport. Figure 5.1 shows that the highest travel time AI scores were estimated for trains (2,1), buses (1,7), taxis (1,4) and car/truck driver (1,2), while the lowest travel time AI scores were estimated for car/truck passenger (0,9) and walking all the way (0,8).

These travel time AI values suggest that public transport users and car drivers were most likely to experience difficulty in accessing educational institutions, especially train users, who should budget twice as much time compared to other users.

Table 5.2 – Distribution of learners by public transport mode and average travel time to educational institutions, 2013

Public transport modes	Number of learners ('000)	Per cent	Average travel time	CV (%)	Std. error of mean
Train	199	5,5	74	3	2,2
Bus	889	24,7	62	1	0,7
Taxi	2 507	69,7	49	1	0,4
Total	**3 594**	**100,0**	**54**	**1**	**0,4**

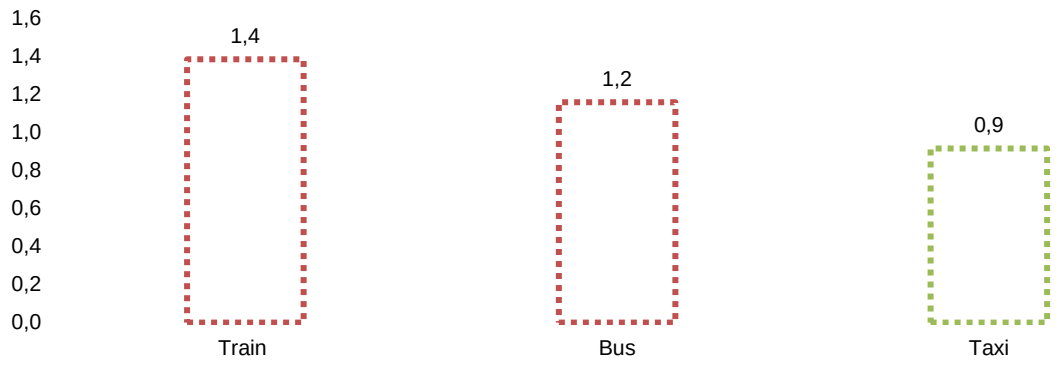
Unspecified cases of public transport modes and total travel time were excluded.
Source: NHTS, 2013

Table 5.2 shows the average travel times for learners who used public transport to get to their educational institutions, with their standard errors and coefficient of variations. All estimates are highly accurate, as the coefficients of variation are small.

Of the 3,6 million learners who used public transport as their main mode of travel, most of them used taxis (2,5 million), followed by buses (889 000) and about 200 000 used trains (199 000).

Nationally, learners needed on average 54 minutes to get to their educational institutions. Train and bus users were more likely to experience longer travel times to their educational institution compared to taxi users – train users needed 74 minutes, bus users needed 62 minutes and taxi users needed 49 minutes. The results show and confirm that the average travel times for public transport users are above the benchmark set by the government – travel time to educational institutions by public transport should be less than 30 minutes.

Figure 5.2 – Travel time accessibility indices for learners by public transport mode, 2013



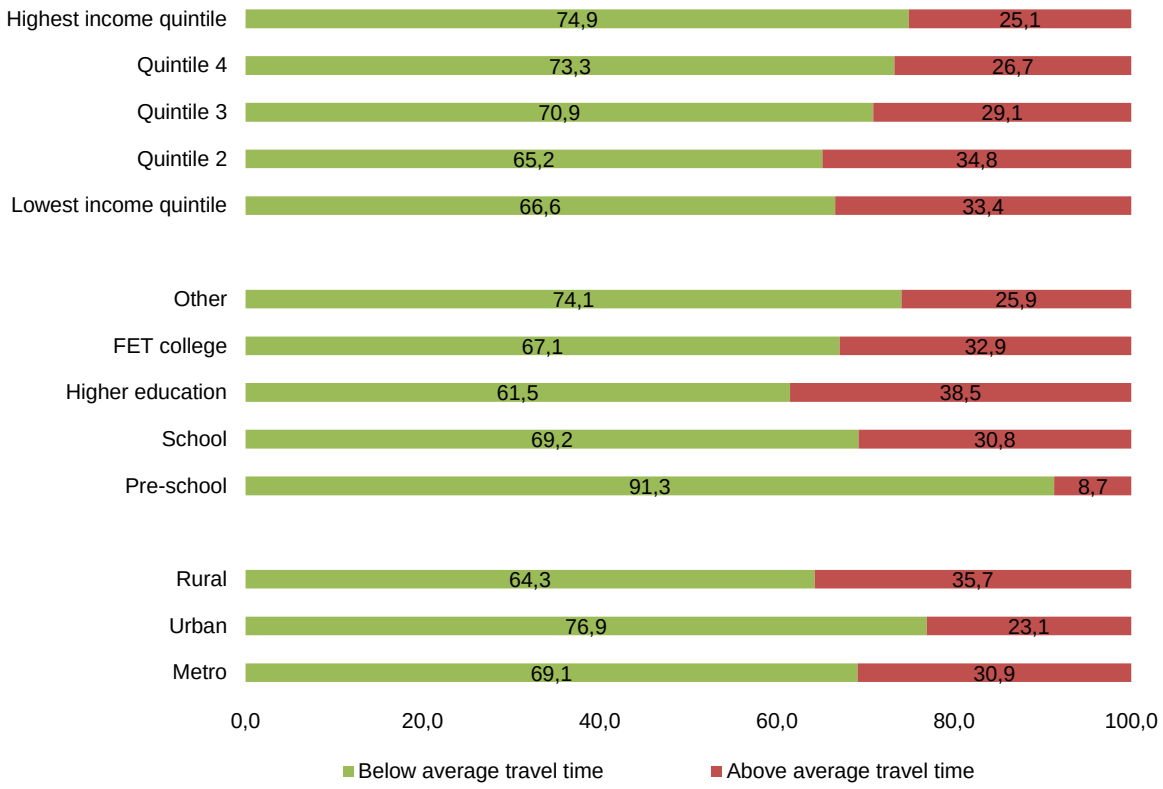
Unspecified cases of public transport modes and total travel time were excluded.
Source: NHTS, 2013

Figure 5.2 clearly shows that taxi users were more likely to have better access to educational institutions compared to other public transport users. Taxis had the lowest travel time AI score (0,9), followed by buses (1,2). Trains had a travel time index score of 1,4, which indicates that train a trip will be 40 per cent longer compared to the average public transport trip.

Therefore, this provides more proof that learners who used trains or buses as their main mode of transport are experiencing a long travel time to educational institutions in the morning.

5.2.1 Comparison of travel time accessibility indices among public transport users by different sociodemographic variables

Figure 5.3 – Travel time accessibility indices by household income quintile, educational institution and geographical location, 2013



Unspecified cases of total travel time, household income quantile and educational institutions were excluded.
Source: NHTS, 2013

Figure 5.3 presents travel time accessibility indices by household income quantile, educational institution and geographical location among public transport users. The coefficients of variation of these estimates are outlined in Tables B2 to B4 (see Annexure). Estimates where coefficients of variation are in red must be used with caution, as the errors are beyond reliable levels.

The figure illustrates a negative relationship between household income quintile categories and the percentage of learners who travelled above the national average travel time. Learners in households from the lowest income quintile (33,4%) are more likely to travel above the national average travel time compared to learners in households from the highest income quintile (25,1%).

In terms of educational institutions, learners who attended higher education and FET institutions were more likely to travel above the national average travel time compared to other learners. About 39% of higher education institutions learners (38,5%) travelled above the average travel time of 35 minutes, followed by FET learners (32,9%).

Results further show that rural and metro learners were most likely to travel above the national average time – 35,7% in rural areas and 30,9% in metro areas. This is mainly driven by the public transport

modes that they used. For example, across all geographic locations, taxis were the most commonly used mode of transport. However, rural and metro learners were more likely to use either trains or buses compared to urban learners (Stats SA, 2013). Furthermore, Figure 5.1 highlighted these modes as the slowest public transport modes.

5.3 Accessibility indices for travel cost to educational institutions

The literature shows that accessibility is typically measured based on travel time and/or distance. However, travel time and/or distance is only one of the limiting components of accessibility. The cost of transport also constrains individuals in reaching their desired destinations (El-Geneidy et al., 2016).

This section explores travel cost accessibility indices in relation to the public transport modes and key sociodemographic variables. These indices are calculated based on a methodology utilised by Schoon et al. (1999).

The travel cost AIs reflect travel cost related to average travel cost value

A value of 1,0 (average travel cost value) signifies parity in traveling experiences for users in terms of cost

A value below 1,0 suggests that learners experience low travel cost (easy access to their educational institution)

A value above 1,0 suggests that learners experience high travel cost (difficult reaching their educational institutions)

Table 5.3 – Distribution of learners by main mode of transport and average travel cost to educational institution, 2013

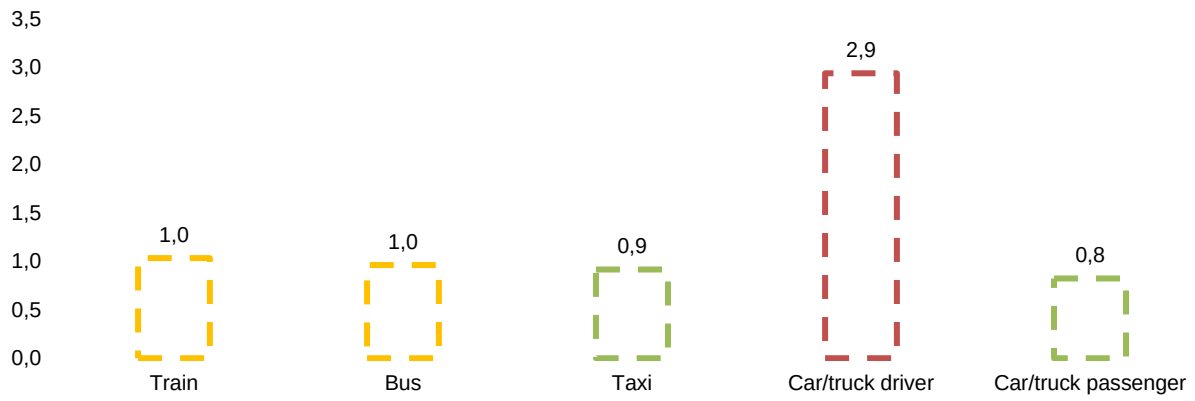
Main mode of transport		Number of learners ('000)	Per cent	Average travel cost	CV (%)	Std. error of mean
Public transport	Train	152	4,0	422	10	40,8
	Bus	526	13,8	393	4	16,8
	Taxi	2 224	58,5	375	2	5,8
Private transport	Car/truck driver	169	4,4	1 202	5	64,4
	Car/truck passenger	728	19,2	337	3	11,5
Total		**3 799**	**100,0**	**409**	**1**	**6,1**

Unspecified cases of transport modes and total travel cost were excluded.
Source: NHTS, 2013

Table 5.3 shows the average travel cost between place of residence and educational institution with the standard errors and coefficients of variation. All estimates are highly accurate, as the coefficients of variation are small.

Driving cars appeared to be the most expensive mode of travel, with an average monthly cost of R1 202, followed by travelling by train (R422) and by bus (R393). Using a car/truck as a passenger was the least expensive mode of travel compared to all the other modes, with a mean of R337.

Figure 5.4 – Travel cost accessibility indices for learners by main mode of transport, 2013



Unspecified cases of transport modes and total travel cost were excluded.
Source: NHTS, 2013

Figure 5.4 depicts travel cost accessibility index scores for different modes of transport. Parity (equality) is reached at 1,0. Any value below 1 suggests that learners experience low travel costs when commuting to educational institutions in the morning (easy access to their educational institution) and a value above 1 suggests that learners experience high travel cost (difficult access).

The results indicate that the highest travel cost AI score was found for car/truck driver (2,9), while the lowest travel cost AI scores were estimated for car/truck passenger (0,8) and taxis (0,9). These travel cost AI values suggest that car drivers were most likely to experience high travel cost when commuting to educational institutions – they should budget almost three times more than other users.

Table 5.4 – Distribution of learners by public transport mode and average travel cost to educational institutions, 2013

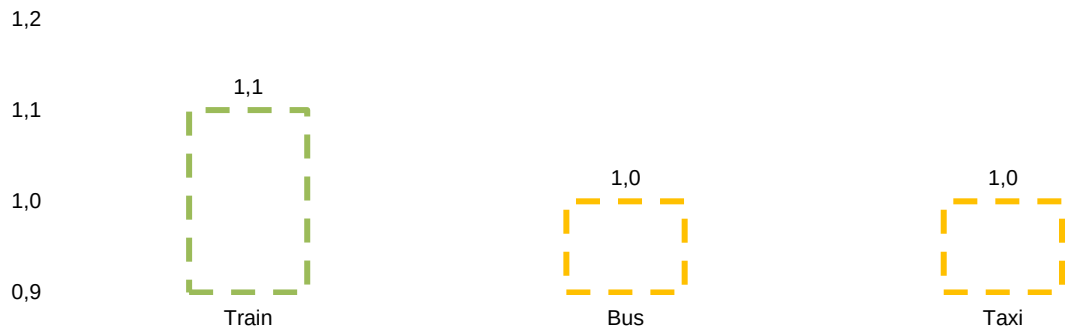
Public transport mode	Number of learners ('000)	Per cent	Average travel cost	CV (%)	Std. error of mean
Train	152	5,2	422	10	40,8
Bus	526	18,1	393	4	16,8
Taxi	2 224	76,6	375	2	5,8
Total	**2 902**	**100,0**	**381**	**2**	**5,8**

Unspecified cases of public transport modes and total travel cost were excluded.
Source: NHTS, 2013

Few studies have indicated that the cost of public transport also constrains individuals in reaching their desired destinations. According to the General Household Survey (GHS) 2016, nearly one-fifth (18,7%) of learners cited a lack of money as one of the main reasons for not attending an educational institution (Stats SA, 2017).

Trains appeared to be the most expensive public transport mode of travel for learners with an average monthly travel cost of R422, followed by travelling by bus (R393) and taxi (R375).

Figure 5.5 – Travel cost accessibility indices for learners by public transport mode, 2013



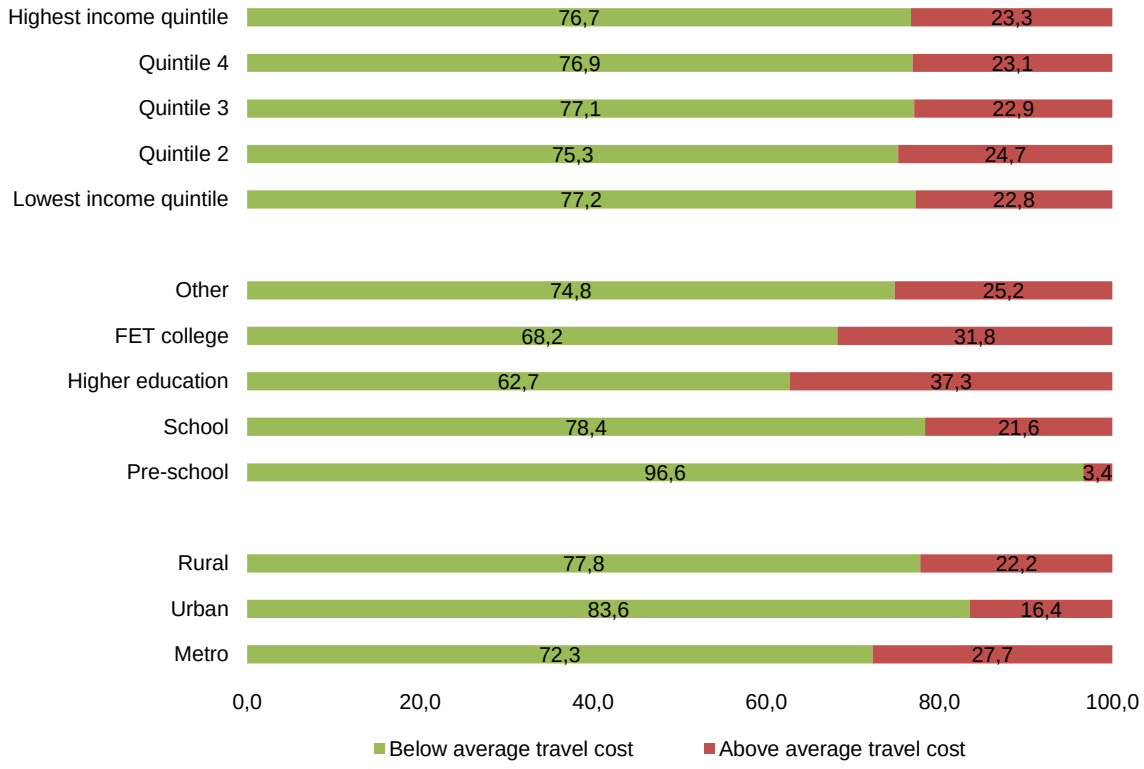
Unspecified cases of public transport modes and total travel cost were excluded.
Source: NHTS, 2013

Figure 5.5 confirms the findings of Table 5.4 above that learners who used trains as their main public transport mode experienced higher travel costs compared to other public transport users. Taxis and buses had similar travel cost AI scores (1,0). This indicates parity with the average public transport cost.

The findings therefore show that learners who used trains as their main mode of transport are having less equitable travelling experiences to their educational institution in the morning.

5.3.1 Comparison of travel cost accessibility indices among public transport users across sociodemographic variables

Figure 5.6 – Travel cost accessibility indices for travel cost by household income quintile, educational institution and geographical location, 2013



Unspecified cases of household income quantile, education institutions, and total travel cost were excluded.
Source: NHTS, 2013

Figure 5.6 presents travel cost accessibility indices among public transport users by household income quantile, educational institution, and geographical location. The coefficients of variation of these estimates are outlined in Tables B6 to B8 (see Annexure). Estimates where the coefficients of variation are in red must be used with caution, as the errors are beyond reliable levels.

It is clear that households from income quintile 2, metropolitan areas and higher educational institutions had the highest percentage of learners who pay above average travel costs to get to their educational institution when compared to other learners. This is mainly driven by the transport modes that they used.

The findings corroborate the previous findings that learners who used trains as their main mode of transport are having less equitable travelling experiences to their educational institution in the morning.

5.4 Summary and conclusion

The travel time accessibility index scores vary quite substantially between different modes of transport. Results show that the travel time AI scores were highest for trains (2,1), followed by buses (1,7), taxis (1,4) and car/truck driver (1,2), while the lowest travel time AI scores were found for car/truck passenger (0,9) and walking all the way (0,8).

Different patterns emerged when looking at only public transport modes. Taxi users were more likely to have better access to educational institutions compared to other public transport users. Taxis had the lowest travel time AI score (0,9), followed by buses (1,2). Trains had a travel time index score of 1,4. This indicates that train trips will be 40 per cent longer compared to the average public transport trips. Therefore, this provides more proof that learners who used trains or buses as their main mode of transport are experiencing a long travel time in the morning.

A comparison of accessibility indices for travel time across sociodemographic variables shows that learners in households from the lowest income quintile are more likely to travel above the national average travel time compared to learners in households from the highest income quintile. Rural and metro learners were most likely to travel above the national average time – 35,7% in rural areas and 30,9% in metro areas. This is mainly driven by the transport modes that they used.

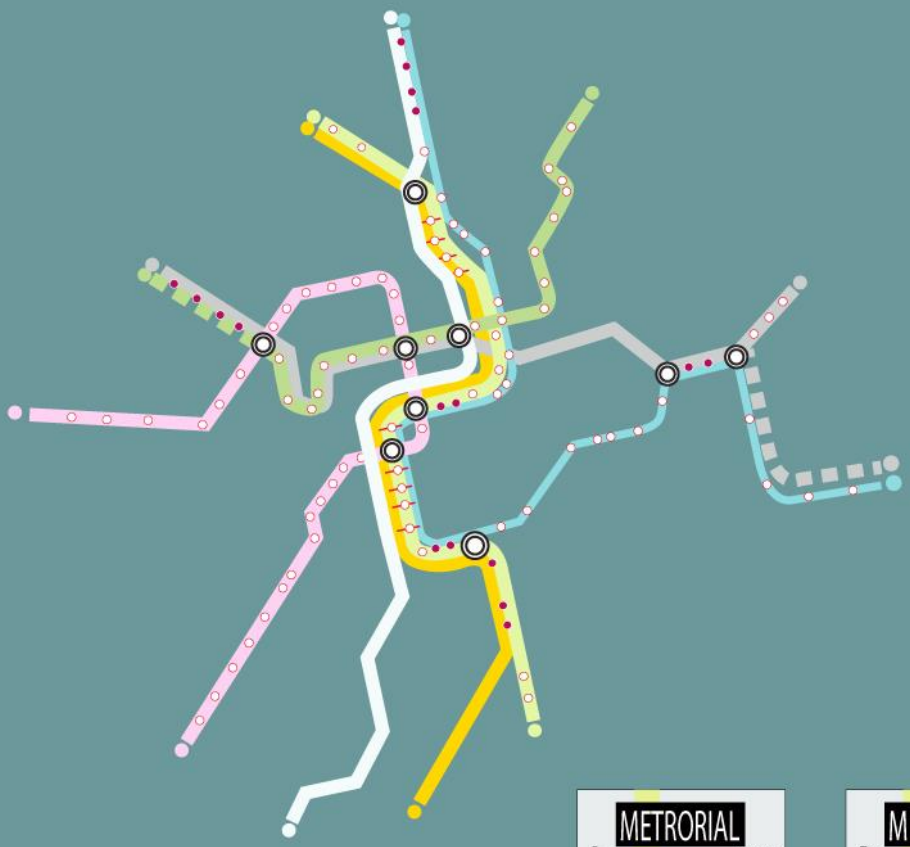
The results further show that learners who attended higher education and FET institutions were more likely to travel longer than the national average travel time. About 39% of higher education institution learners (38,5%) had above average travel time of 35 minutes, followed by FET learners (32,9%).

Focusing on travel cost accessibility index scores for different modes of transport, the results show that the highest travel cost AI score was estimated for car/truck driver (2,9) , while the lowest travel cost AI scores were estimated for car/truck passenger (0,8) and taxis (0,9). These travel cost AI values suggest that car drivers were most likely to experience high travel costs when commuting to educational institutions – they should budget almost three times more compared to other users.

When zooming in on public transport modes, learners who used trains as their main public transport mode experienced higher travel costs compared to other public transport users. Taxis and buses had similar travel cost AI scores (1,0), which indicate parity with the average public transport cost for those two modes.

These travel time AI values suggest that public transport users, especially train users, were most likely to experience difficulty in accessing educational institutions, as they need to budget twice as much time compared to other users.

It is clear from the findings that learners in households from income quintile 2, metropolitan areas and higher educational institutions were the most likely to pay above average travel costs to get to their educational institution when compared to other learners. This is mainly driven by the transport modes that they used. The findings corroborate the previous findings that learners who used trains as their main mode of transport are facing a long travel time in the morning.



METRORIAL

2016 /01/07
05:20

3392 546 334455 021

CAPE TOWN 401

FROM: CAPE TOWN

TO: LANGA

SINGLE

ADULT
CASH

PRICE: R8,50

NO CONCESSION

EFF: 2016/01/07

EXP: 2016/01/07

METRO PLUS

CAPE TOWN 401

For up to date train info visit –
www.metrorail.co.za

METRORIAL

2016 /01/09
05:55

3392 546 392756 429

DURBAN 944

FROM: TONGAAT

TO: KWA-MASHU

SINGLE

ADULT
CASH

PRICE: R11,30

NO CONCESSION

EFF: 2016/01/09

EXP: 2016/01/09

METRO PLUS

DURBAN 944

For up to date train info visit –
www.metrorail.co.za

METRORIAL

2015 /11/16
10:47

6421 39271546 435

PRETORIA 346

FROM: SOSHANGUVE

TO: PRETORIA

SINGLE

ADULT
CASH

PRICE: R12,70

NO CONCESSION

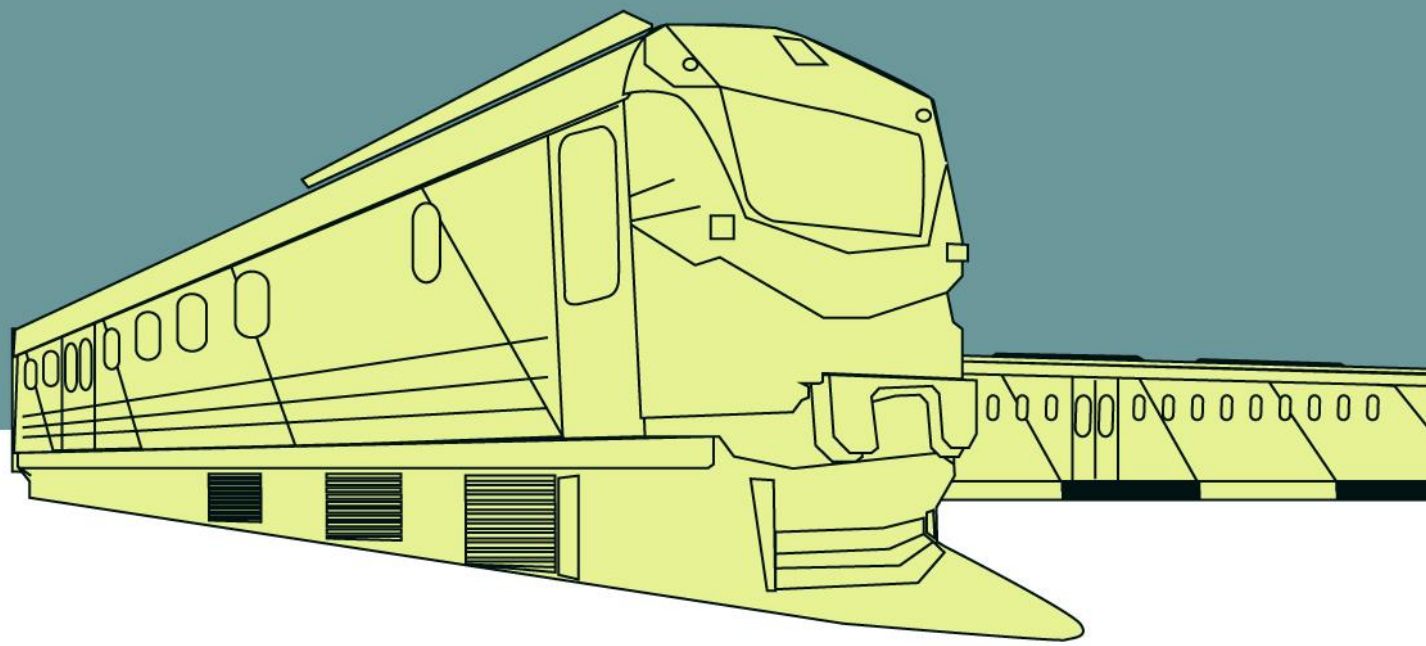
EFF: 2015/11/16

EXP: 2015/11/16

METRO PLUS

PRETORIA 346

For up to date train info visit –
www.metrorail.co.za



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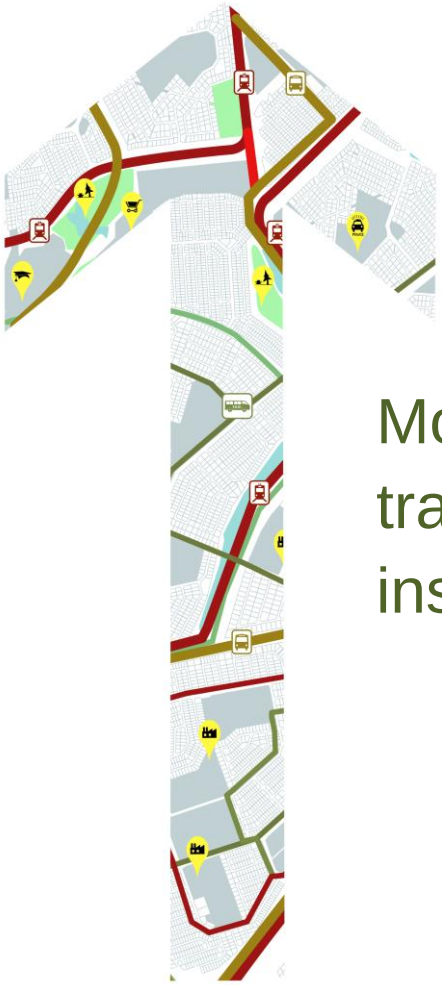

Modelling travel time and travel cost to educational institutions

This section will take a closer look at factors associated with travel time to educational institutions using logistic regression. The logistic regression presented a list of variables hypothesised to be associated with travel time to educational institutions. In this simple model, the dependent or predictor variable is total travel time (where 1 denotes the probability of travelling more than national average travel time and 0 denotes the probability of travelling less than or equal to national average travel time)

6.1 Factors associated with total travel time to educational institution

Table 6.1 – Levels of the variables used in the logistic regression model, 2013

Predictor	Level
Population group	1 = Black African 2 = Coloured 3 = Indian/Asian 4 = White
Geographical location	1 = Metro 2 = Urban 3 = Rural
Main mode of transport	1 = Public transport 2 = Walking all the way 3 = Private transport
Household income quantile	1 = Lowest income quintile 2 = Quintile 2 3 = Quintile 3 4 = Quintile 4 5 = Highest income quintile
Educational institution	1 = Pre-school 2 = School 3 = Higher education/FET college and other institutions

Source: Own analysis using NHTS, 2013

The independent variables used to model accessibility indices for total travel time are shown in Table 6.1. These variables are population group, geographical location, main mode of transport, household income quintile and educational institution.

Table 6.2 – Model fit information and chi-squared test of independence between total travel time and predictors, 2013

Testing Global Null Hypothesis: BETA=0				
Indicator	**Statistic**	**ndf**	**ddf**	**p-value**
Likelihood ratio	173,89	12,9994	592 553	<,0001*
Score	388,48	13	45 571	<,0001*
Wald	308,93	13	45 571	<,0001*
Type 3: Analysis of effects				
Population group	108,5	3	45 581	<,0001*
Geographical location	215,28	2	45 582	<,0001*
Main mode of transport	1 296,56	2	45 582	<,0001*
Household income quintile	19,11	4	45 580	<,0001*
Educational institution	281,33	2	45 582	<,0001*

Note: Second-order Rao-Scott design correction 0,0001 applied to the likelihood ratio test
*Significant at 0.05 level.
Source: Own analysis using NHTS, 2013

The results of the likelihood ratio, score and Wald tests and their associated p-values are displayed in Table 6.2. All three tests have small p-values, which indicates that our model as a whole fits significantly better than an intercept-only model. Furthermore, the analysis of effects results indicate that each of the five variables in the model significantly improve the model fit.

Table 6.3 – Predictors associated with total travel time to educational institution, 2013

Parameter	Estimate	Std. error	t -value	Pr > |t|	Odds ratio
Intercept	-0,7956	0,0952	-8,36	<,0001*	0,451
Population group					
Black African	0,8326	0,0911	9,14	<,0001*	2,299
Coloured	0,0145	0,104	0,14	0,8893	1,015
Indian/Asian	-0,2269	0,1327	-1,71	0,0873	0,797
White (reference category)					
Geographical location					
Metro (reference category)					
Urban	-0,3131	0,0366	-8,56	<,0001*	0,731
Rural	0,3604	0,0342	10,53	<,0001*	1,434
Main mode of transport					
Public transport	0,7343	0,0509	14,42	<,0001*	2,084
Walking all the way	-0,9838	0,0487	-20,2	<,0001*	0,374
Private transport (reference category)					
Household income quantile					
Lowest income quintile	0,5026	0,0621	8,09	<,0001*	1,653
Quintile 2	0,4446	0,0621	7,16	<,0001*	1,560
Quintile 3	0,2994	0,0649	4,61	<,0001*	1,349
Quintile 4	0,3531	0,0638	5,54	<,0001*	1,424
Highest income quintile (reference category)					
Educational institution					
Pre-school	-1,5702	0,0695	-22,59	<,0001*	0,208
School	-0,5801	0,0538	-10,77	<,0001*	0,560
Higher education /FET college and other institutions (reference category)					

*Significant at 0.05 level.
Source: Own analysis using NHTS, 2013

Table 6.3 shows that black African, geographical location, main modes of transport, household income and educational institutions were significant predictors of travel time to educational institutions, while Indian/Asian and coloured were not significantly associated (p<0,8893 and p<0,0873, respectively) with the independent variable.

The result also confirms our earlier observation of substantial differences between racial groups in terms of travel time. The odds of black African learners were 2,299 times more likely to travel more than the national average travel time to educational institutions than white learners, while controlling other variables. This means that black African learners were 130% more likely to experience long travel times to their educational institution in the morning compared to white learners.

Looking at the main modes of transport, when public transport is used as the main mode of transport, the odds of travelling above the national travel time are twice as high as when private transport is used.

The literature suggests that spatial structural characteristics contribute to travel time. It is worth noting that rural learners were 43% more likely to travel longer than the national average travel time compared to metro learners. Urban learners were 27% less likely to travel longer than the national average travel time.

Learners in households from the lowest income quintile were 65% more likely to travel longer than the national average travel time compared to learners in households from the highest income quintile. This is not surprising, because most learners in households from the lowest and middle-income quantiles were heavily reliant on public transport, which is associated with longer travel times.

Regarding educational institutions, pre-scholars or scholars were less likely to need more than the national average travel time compared to those who attend higher education institutions, while controlling other variables.

These results led to the authentication of our research hypothesis that household income, population group, transport mode and educational institution are all statistically significant predictors of the odds to travel longer than the national average travel time to educational institutions in the morning.

6.2 Factors associated with travel cost to educational institutions

The following section deals with factors associated with travel cost to educational institutions. This section looks only at factors associated with travel costs, and not at household/individual expenditure on transport. The logistic regression presented a list of variables hypothesised to be associated with travel cost to educational institutions. The dependent or predictor variable is travel cost (where 1 denotes the probability of paying more than the national average travel cost and 0 denotes the probability of paying less than or equal to the national average travel cost).

Table 6.4 – Levels of the variables used in the logistic regression model, 2013

Predictor	Level
Population group	1 = Black African 2 = Coloured 3 = Indian/Asian 4 = White
Geographical location	1 = Metro 2 = Urban 3 = Rural
Main mode of transport	1 = Public transport 2 = Car/truck passenger 3 = Car/truck driver
Household income quantile	1 = Lowest income quintile 2 = Quintile 2 3 = Quintile 3 4 = Quintile 4 5 = Highest income quintile
Educational institution	1 = School 2 = Pre-school 3 = Higher education/FET college and other institutions

Source: Own analysis using NHTS, 2013

Table 6.4 displays the independent variables that were used to model accessibility indices for travel cost. These are population group, geographical location, main mode of transport, household income quintile and educational institution.

Table 6.5 – Model fit information and chi-squared test of independence between travel cost and predictors, 2013

Testing Global Null Hypothesis: BETA=0				
Indicator	**Statistic**	**ndf**	**ddf**	**p-value**
Likelihood ratio	34,58	12,9904	114 770	<,0001*
Score	70,6	13	8 823	<,0001*
Wald	48,1	13	8 823	<,0001*
Type 3: Analysis of effects				
Population group	3,71	3	8 833	0,0111*
Geographical location	39,84	2	8 834	<,0001*
Main mode of transport	16,16	2	8 834	<,0001*
Household income quintile	22,03	4	8 832	<,0001*
Educational institution	95,07	2	8 834	<,0001*

Note: Second-order Rao-Scott design correction 0,0007 applied to the likelihood ratio test.
*Significant at 0.05 level.
Source: Own analysis using NHTS, 2013

Based on significant p-values of three (likelihood ratio, score, Wald) tests, Table 6.5 shows that there is at least one independent variable in the model that is statistically significant. The Analysis of Effects test and associated p-values indicate that each of the five variables in the model significantly improve the model fit.

This means that population, geographical location, household income, main mode of transport and educational institution may be regarded as significant predictors of odds of travel cost to educational institutions in the morning.

Table 6.6 – Predictors associated with travel cost to educational institutions, 2013

Parameter	Estimate	Std. error	t -value	Pr > |t|	Odds ratio
Intercept	-1,5697	0,2541	-6,18	<,0001*	0,208
Population group					
Black African	-0,5094	0,1967	-2,59	0,0096*	0,601
Coloured	-0,6391	0,2245	-2,85	0,0044*	0,528
Indian/Asian	-0,1803	0,2589	-0,7	0,4861	0,835
White (reference category)					
Geographical location					
Metro (reference category)					
Urban	-0,5269	0,0743	-7,09	<,0001*	0,591
Rural	-0,6375	0,0829	-7,69	<,0001*	0,529
Main mode of transport					
Public transport (reference category)					
Car/truck passenger	-0,2346	0,0874	-2,69	0,0073*	0,791
Car/truck driver	0,9227	0,1863	4,95	<,0001*	2,516
Household income quantile					
Lowest income quantile (reference category)					
Quintile 2	0,1591	0,1061	1,5	0,1338	1,172
Quintile 3	0,2205	0,1063	2,07	0,0381*	1,247
Quintile 4	0,5664	0,1034	5,48	<,0001*	1,762
Highest income quantile	0,9209	0,1126	8,18	<,0001*	2,512
Educational institution					
Pre-school (reference category)					
School	0,5387	0,1369	3,93	<,0001*	1,714
Higher education/FET college and other institutions	1,4772	0,1468	10,07	<,0001*	4,381

*Significant at 0.05 level.
Source: Own analysis using NHTS, 2013

Table 6.6 shows that population group, geographical location and car passenger are factors that decrease the odds of experiencing high travel cost when travelling to educational institutions. For example, controlling for other variables in the model, being black African decreased the odds by 40%, while residing in rural areas decreased the odds by 47% and being a car passenger only decreased the odds by 20%.

Having said that, when considering main modes of transport, the odds that learners who drove all the way to their educational institutions will experience higher travel cost is 2,5 times higher than for public transport users. While learners in households from the highest income quintile were 151% more likely to pay above the national average travel cost compared to learners in households from the lowest income quintile. It is important to understand that travel costs are primarily driven by the mode of transport used. Those who use private transport are more likely to experience high travel costs than those using other transport modes.

In terms of educational institutions, the odds ratios show that learners who attend higher education institutions and schools were most likely to experience high travel cost.

6.3 Summary and conclusion

The study confirms population groups, geographical location, main mode of transport, household income and educational institution were significant predictors of travel time to educational institutions. While Indian/Asian and coloured were not significantly associated with the independent variable, black African learners were 130% more likely to experience long travel times to educational institutions in the morning compared to white learners, when controlling for other variables in the model.

However, when public transport is used as a main mode of transport, the odds of travelling longer than the national average travel time are twice as much than when private transport is used. In terms of geographical location, rural learners were 43% more likely to need more than the national average travel time compared to metro learners. Urban learners were 27% less likely to travel above the national average travel time compared to metro learners.

Learners in households from the lowest income quintile were 65% more likely to travel longer than the national average travel time, when compared to learners in households from the highest income quintile.

Looking at factors associated with travel cost to educational institution, the results show that population group, geographical location and car passenger are factors that decrease the odds of high travel cost when travelling to educational institutions when controlling for other variables in the model. For example, being black African decreased the odds by 40%, residing in rural areas decreased the odds by 47% and being a car passenger only decrease the odds by 20%.

However, learners who drove all the way to their educational institutions are 2,516 times more likely to experience higher travel cost than those who use public transport, while learners in households from the highest income quintile were 151% more likely to pay above the national average travel cost compared to learners in households from the lowest income quintile. It is important to understand that travel costs are primarily driven by the mode of transport used. Those who use private transport are more likely to experience high travel costs compared to other users.

In terms of educational institutions, the odds ratios show that learners who attend higher education institutions and schools were most likely to incur travel costs.

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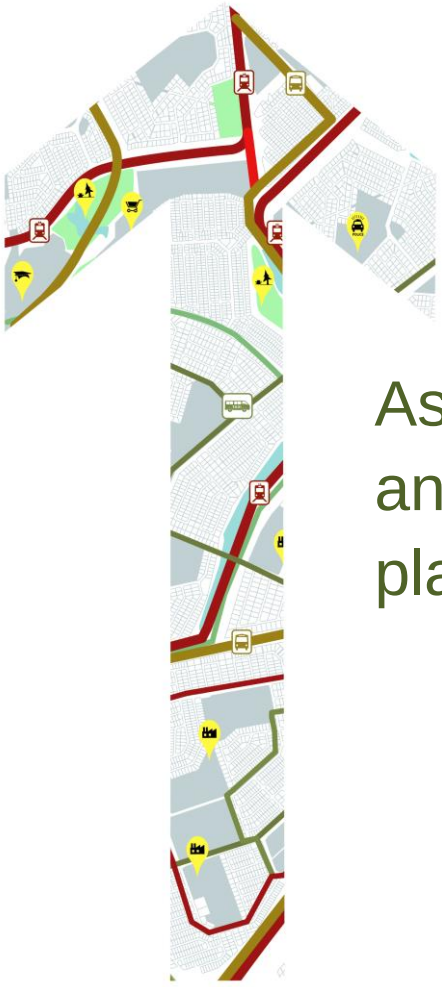


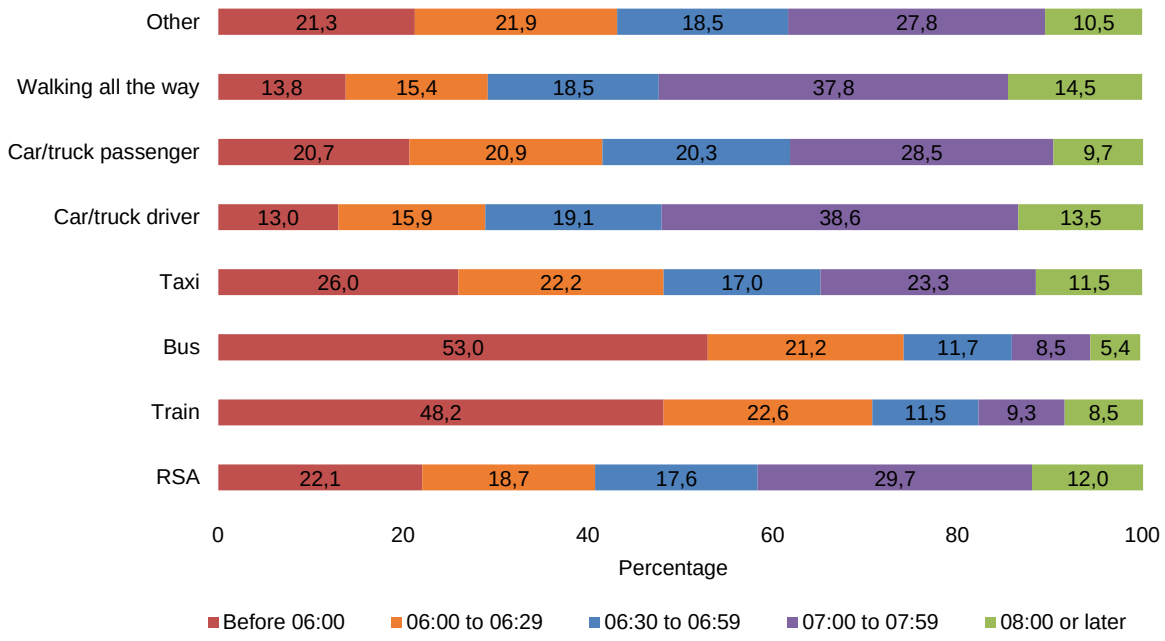
Assessing travel time and travel cost to place of work

7.1 Introduction

This section focuses on work-related travel and more specifically, assessing travel time and travel cost to place of work in terms of mode of transport, household income, geographic location and household income quintile.

7.2 Departure, waiting and walking time to get to the first transport

Figure 7.1 – Time workers leave for work by main mode of transport, 2013



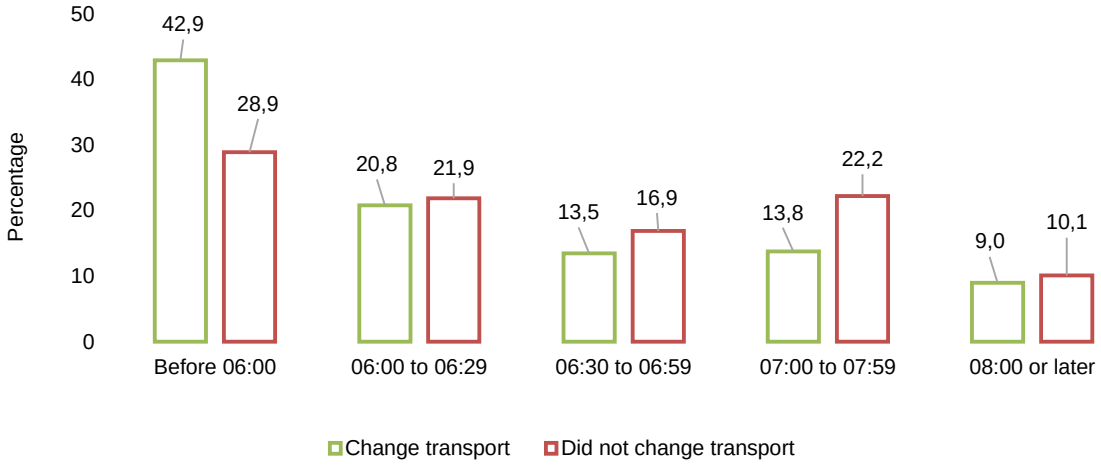
Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and time workers leave home were excluded.
Source: NHTS, 2013

Figure 7.1 shows that nationally, many work trips commence between 07:00 and 07:59 in the morning (29,7%), followed by trips before 06:00 (22,1%) and those that commence between 06:00 and 06:29 (18,7%).

Notwithstanding, workers who used buses and trains were more likely to leave their home earlier than other workers. For example, workers who used either buses (53,0%) or trains (48,2%) started travelling before 06:00. Unlike the other public transport modes, taxis registered the lowest proportion of workers who left their home before 06:00 (26,0%).

About 34% of workers who used private transport left their home before 06:00 – 13,0% of those who drove and 20,7% as passengers. Those who walked and drove had the highest percentage of workers who travelled at 08:00 or later compared to other workers (14,5% and 13,5%, respectively).

Figure 7.2 – Percentage of workers who changed and did not change transport on the way to work by leaving time to place of work, 2013

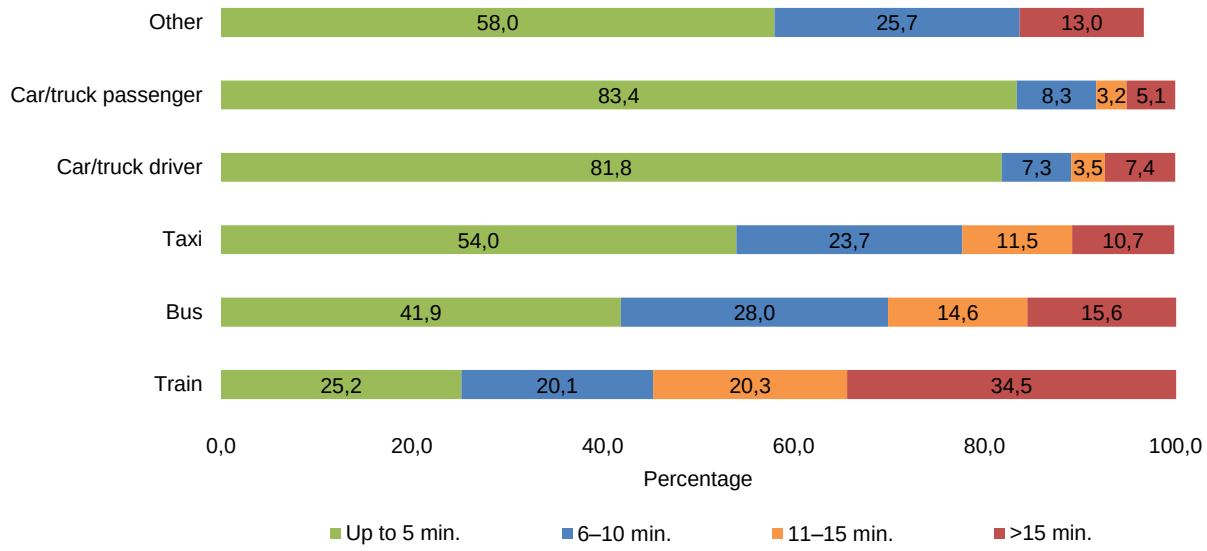


Unspecified cases of changing transport and time workers leave home were excluded.
Source: NHTS, 2013

Figure 7.2 illustrates the percentage distribution of workers who changed and did not change transport on the way to work by departure time. Those who changed transport were mostly likely to leave their home in the morning before 06:00 – 42,9% left home before 06:00.

About three in ten (28,9%) workers who did not change transport in the morning left their place of residence before 06:00, followed by 22,2% who left between 07:00 and 07:59 and 21,9% who left between 06:00 and 06:29.

Figure 7.3 – Time workers take to walk to get to the first transport by main mode of transport, 2013



Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and walking time to first transport were excluded.
Source: NHTS, 2013

The distribution of walking time from home to the first transport by main mode of transport is shown in Figure 7.3. This figure shows the disadvantages of train and bus users. Workers who used trains (34,5%) had the highest percentage of workers who walked for more than 15 minutes to get to their first transport, followed by those who used buses (15,6%).

Those who use private transport as passengers (5,1%) and drivers (7,4%) had the lowest percentage of users who walked more than 15 minutes. These findings clearly show the convenience of private transport.

7.3 Total travel time and travel cost to place of work

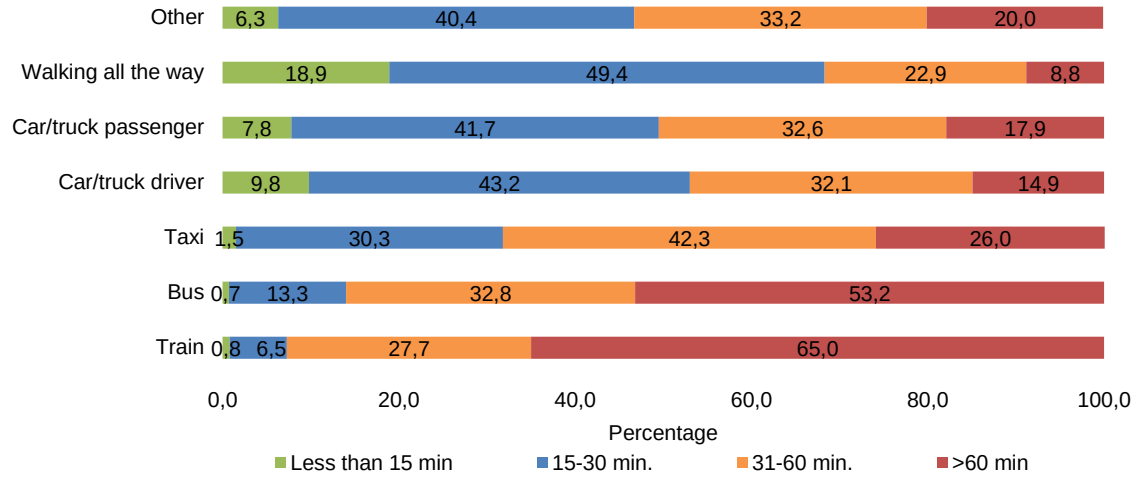
Table 7.1 – Total time travelled to place of work by main mode of transport, 2013

Main mode of transport		Number of workers ('000)	Total travel time				
			Less than 15 min.	15-30 min.	31-60 min.	>60 min.	Total
Public transport	Train	678	0,8	6,5	27,7	65,0	**100,0**
	Bus	1 036	0,7	13,3	32,8	53,2	**100,0**
	Taxi	3 579	1,5	30,3	42,3	26,0	**100,0**
Private transport	Car/truck driver	4 157	9,8	43,2	32,1	14,9	**100,0**
	Car/truck passenger	1 029	7,8	41,7	32,6	17,9	**100,0**
Walking all the way		2 844	18,9	49,4	22,9	8,8	**100,0**
Other		171	6,3	40,4	33,2	20,0	**100,0**
RSA		**13 496**	**8,2**	**36,8**	**32,7**	**22,3**	**100,0**

Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and total time taken to place of work were excluded.
Source: NHTS, 2013

Table 7.1 shows the total time travelled to work by main mode of transport used. Nationally, 36,8% of workers travelled between 15 and 30 minutes, followed by 32,7% who travelled between 31 and 60 minutes, while 22,3% travelled more than 60 minutes in the morning.

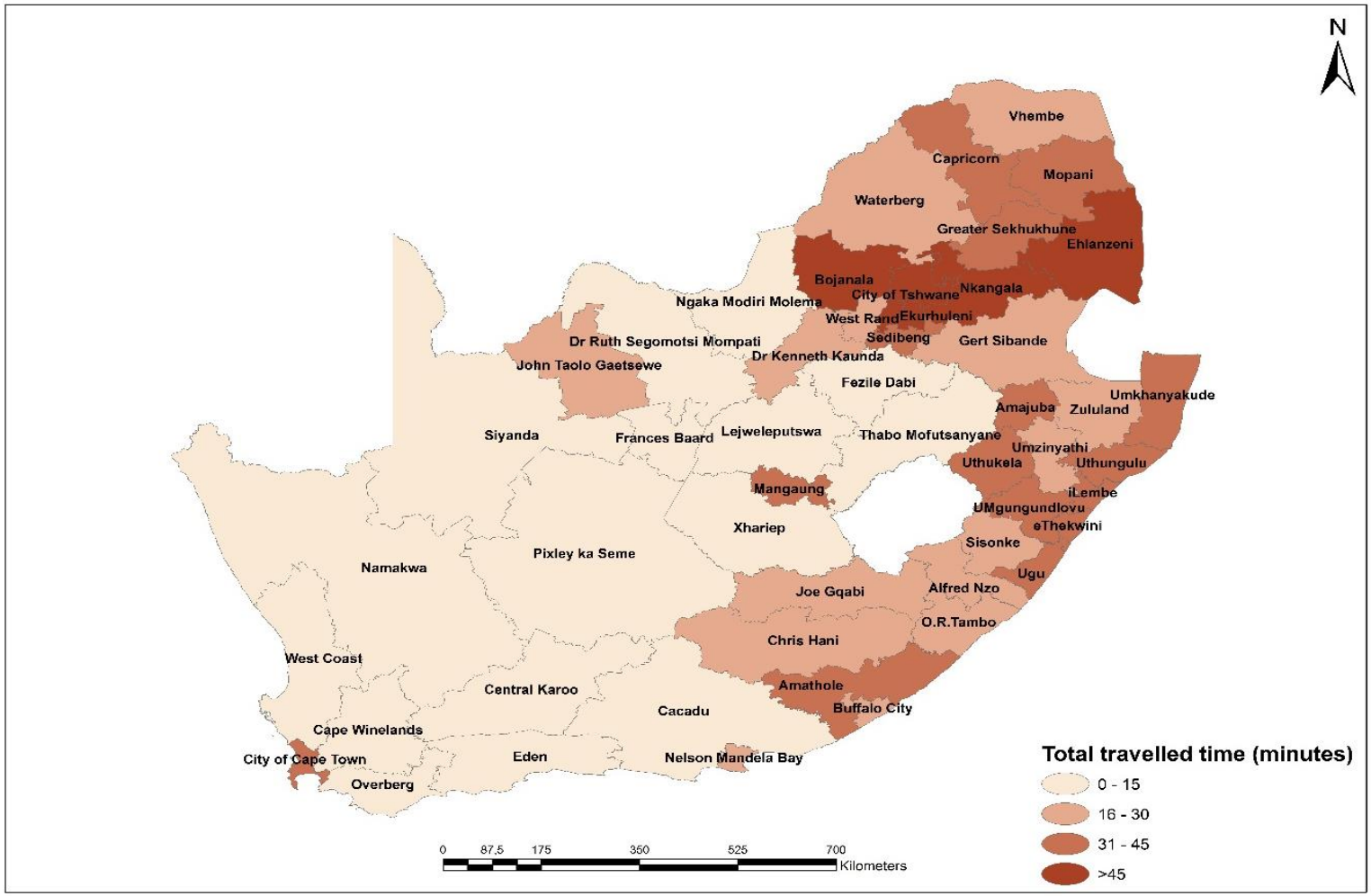
Figure 7.4 – Total travel time to place of work by main mode of transport, 2013



Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and total time taken to place of work were excluded.
Source: NHTS, 2013

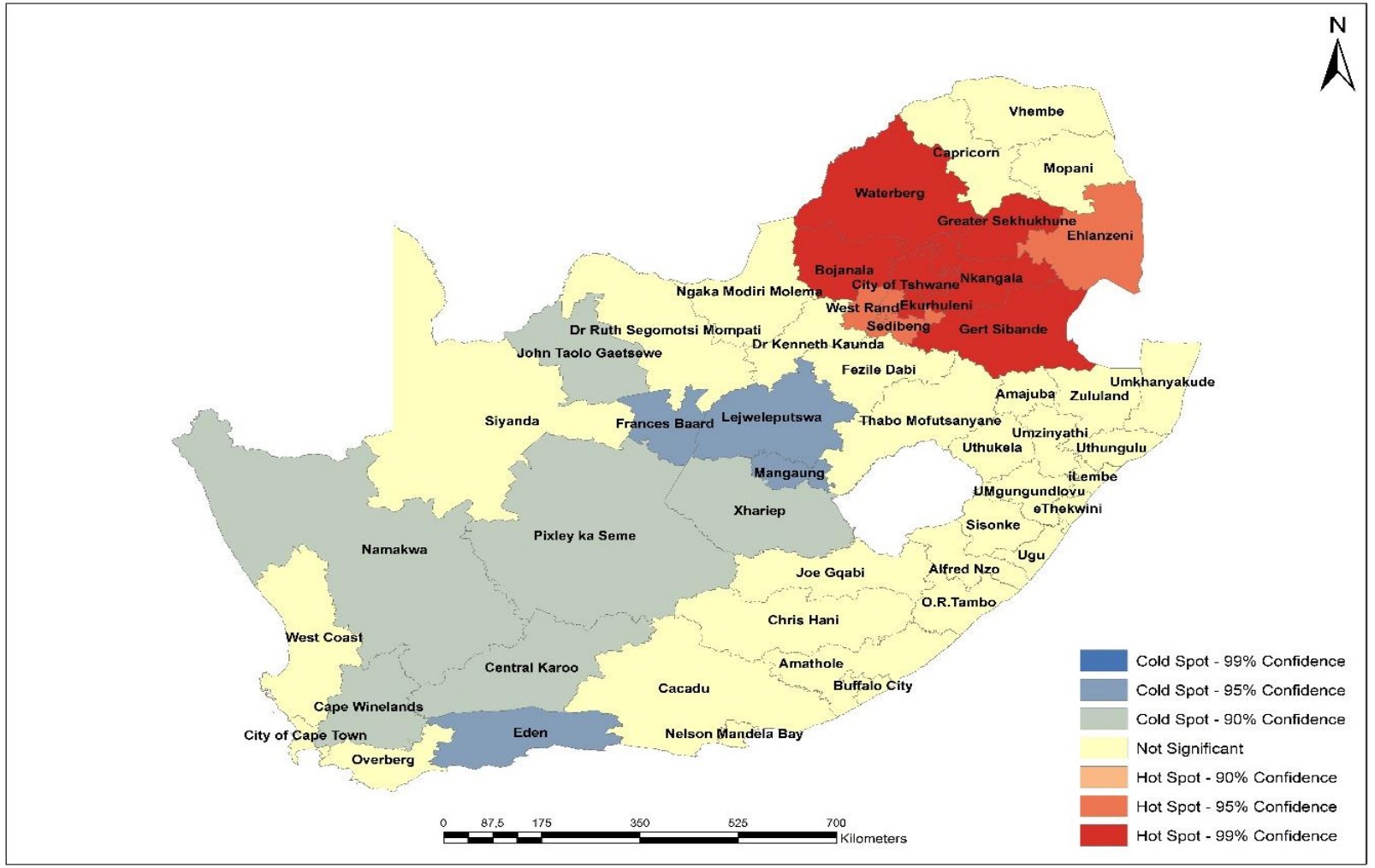
Figure 7.4 shows that most of the workers who used trains (65,0%) travel for more than an hour to get to their destination compared to other public transport users. The comparative figures are 53,2% for buses and 26,0% for taxis. In contrast to this, less than two-tenths of private transport users travel for more than an hour – car passengers (17,9%) and car drivers (14,9%). Similarly, those who walked all the way had the lowest percentage (8,8%) of workers who travelled for more than an hour.

Map 7.1 – Total travel time for workers who travelled to work by district municipality, 2013



Source: NHTS, 2013

Map 7.2 – Hot-spot analysis for total travel time for workers who travelled to work by district municipality, 2013



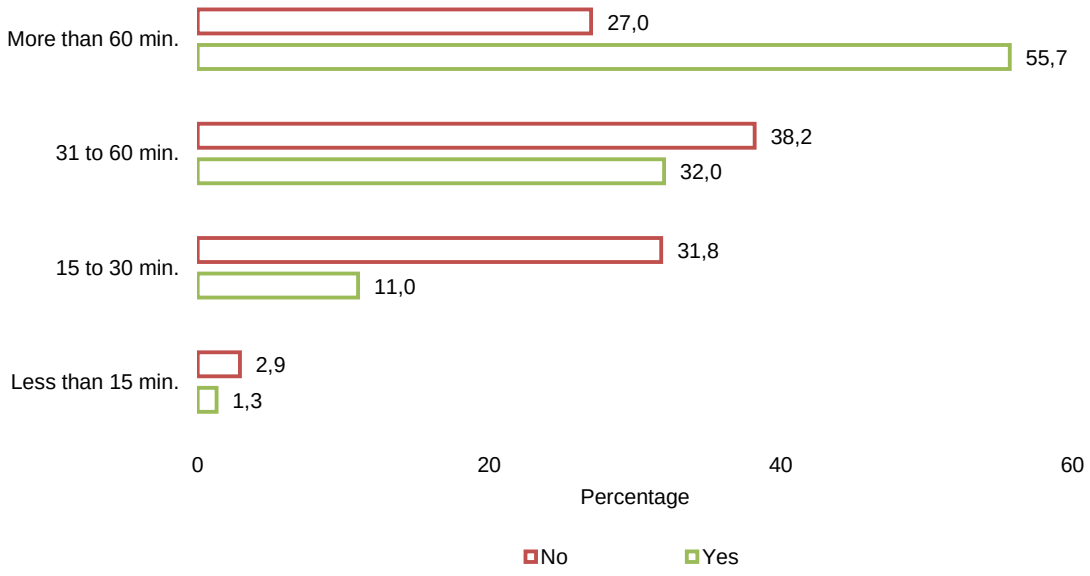
Source: NHTS, 2013

In general, total travel time appeared to be higher in the centres of employment (largely metropolitan and urban areas), where workers have to travel greater distances and may encounter traffic delays when they travel to work.

Map 7.1 shows that it was mainly metropolitan areas and their surrounding district municipalities that had a significant number of workers who needed more time (more than 45 minutes) to get to their workplace, for example, City of Tshwane, City of Johannesburg, Ekurhuleni, Cape Town, eThekwini, Mangaung Bojanala and Nkangala. On the other hand, districts such as Sedibeng, West Rand, Amathole and some in KwaZulu-Natal also had a large number of workers who needed between 31 and 45 minutes to travel to their workplace.

Map 7.2 shows the clustering of districts that had workers who needed either more (red) or less (blue) time to get to their place of work. Total travel time to work was substantially longer in Gauteng and part of North West, Mpumalanga and Limpopo than in most other provinces represented in red. The blue areas indicate the districts with less total travel time. Lower total travel times were observed in some parts of the Free State and Western Cape.

Figure 7.5 – Percentage of workers who changed and did not change transport on the way to work by total travel time, 2013

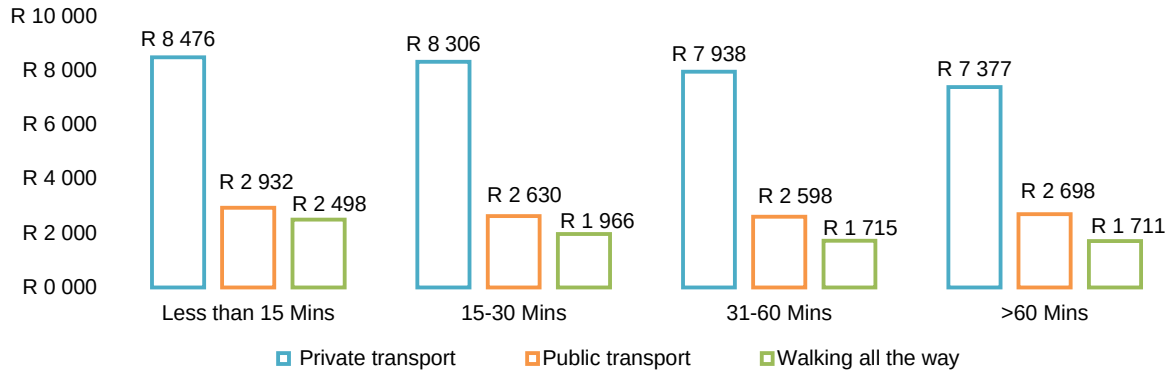


Unspecified cases of changing transport and total travel time by workers were excluded.
Source: NHTS, 2013

As expected, workers who changed transport on their way to work are more likely to experience longer travel times compared to those who did not change transport. More than fifty-five per cent (55,7%) of workers who changed transport on their way to work needed more than an hour compared to twenty-seven per cent who did not change transport.

By contrast, those who did not change their transport were most likely to travel between 31 and 60 minutes (38,2%) or 15 and 30 minutes (31,8%).

Figure 7.6 – Average per capita monthly household income by main mode of transport and total travel time to work, 2013

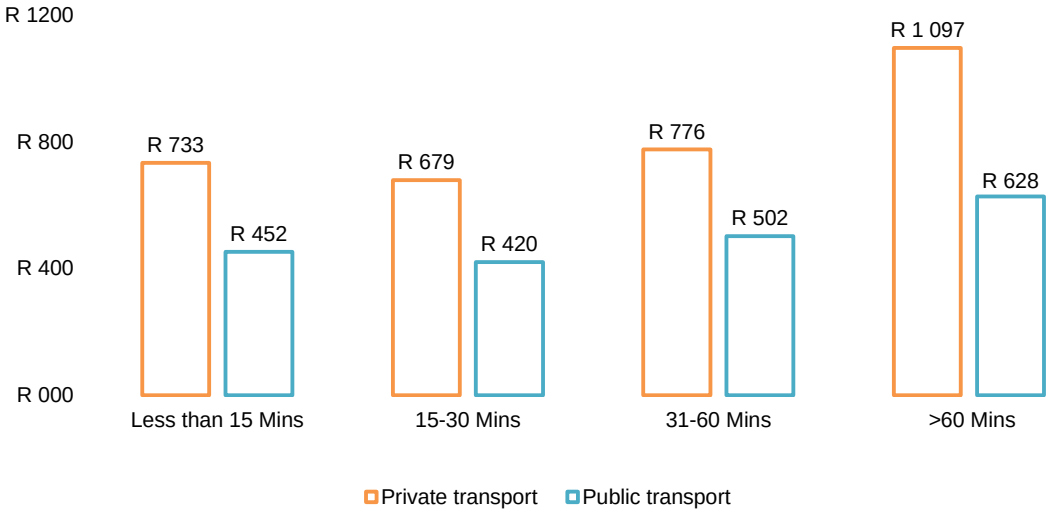


Unspecified cases of transport modes, household income per capita and total travel time were excluded.
Source: NHTS, 2013

The average per capita monthly household income by main mode of transport and total travel time to work are presented in Figure 7.6. The figure shows that workers who used private transport were from households with the highest average per capita monthly household income across all travel time intervals. In contrast, those who walked all the way to work were from households with the lowest average per capita monthly household income.

In terms of workers who travelled for more than an hour, those who walked all the way were most likely to come from households that reported the lowest average per capita monthly household income.

Figure 7.7 – Average travel cost by main mode of transport and total travel time to work, 2013



Unspecified cases of transport modes, total travel time and cost were excluded.
Source: NHTS, 2013

Figure 7.7 shows that across all travel time intervals, private transport appeared to be the most expensive mode of travel compared to public transport. The figure further shows that those who travelled

more than 60 minutes were most likely to pay more for their transport – private transport (R1 097) and public transport (R628).

Even though public transport appeared to be the least expensive mode of travel, Stats SA published a report titled "Measuring household expenditure on public transport" in 2015, which states that most workers (59,3%) were from households that spent more than 20% of their monthly household income per capita on public transport, which is above the government set benchmark (Stats SA, 2015).

7.4 Summary and conclusion

Nationally, many work trips commence between 07:00 and 07:59 in the morning (29,7%), followed by trips before 06:00 (22,1%) and those that start between 06:00 and 06:29 (18,7%). Notwithstanding, workers who used buses and trains were more likely to leave their home earlier than other workers. Almost 34% (33,7%) of workers who used private transport left their home before 60:00 – 13,0% of those drove themselves and 20,7% were transported as passengers. Those who walked and drove had the highest percentage of workers that travelled at 08:00 or later compared to other workers (14,5% and 13,5%, respectively). It is not surprising to note that those who changed transport were mostly likely to leave their home in the morning before 06:00.

The study further shows the disadvantages of using trains and buses. Workers who used trains (34,5%) recorded the highest percentage of workers who walked for more than 15 minutes to get to their first transport, followed by those who used buses (15,6%). Those who used private transport as passengers (5,1%) and drivers (7,4%) had the lowest percentage of users who walked more than 15 minutes.

Nationally, 36,8% of workers travelled between 15 and 30 minutes, followed by 32,7% who travelled between 31 and 60 minutes and 22,3% who travelled more than 60 minutes in the morning. However, train users travelled for more than an hour to get to their destination compared to other public transport users – trains (65,0%), buses (53,2%) and taxis (26,0%). In contrast to this, less than two-tenths of private transport users travelled for more than an hour – car passengers (17,9%) and car drivers (14,9%). Similarly, those who walked all the way had the lowest percentage (8,8%) of workers who travelled for more than an hour. This finding highlights that some of the modes are severely affected by long travel time. Furthermore, it also shows the advantages of using private transport instead of public transport.

Spatial analysis shows that total travel time appeared to be higher in the centres of employment (largely metropolitan and urban areas), where workers have to travel greater distances and may encounter traffic delays when they travel to work. For example, City of Tshwane, City of Johannesburg, Ekurhuleni, Cape Town, eThekwini, Mangaung Bojanala and Nkangala had more workers who needed more time (more than 45 minutes) to get to their workplace. On the other hand, some workers in districts such as Sedibeng, West Rand, Amathole and some in KwaZulu-Natal needed between 31 and 45 minutes to travel to their workplace.

It is important to note that workers who used private transport were from households with the highest average per capita monthly household income across all travel time intervals. In contrast, those who walked all the way to work were from households with the lowest average per capita monthly household income. In terms of workers who travelled for more than an hour, those who walked all the way were most likely to come from households that reported the lowest average per capita monthly household income, except public transport users.

Across all travel time intervals, private transport appeared to be the most expensive mode of travel. Furthermore, those who travelled more than 60 minutes were mostly likely to pay more for their transport – private transport (R1 097) and public transport (R628).

These findings attest to the hypothesis that there are social disparities in accessing the workplace.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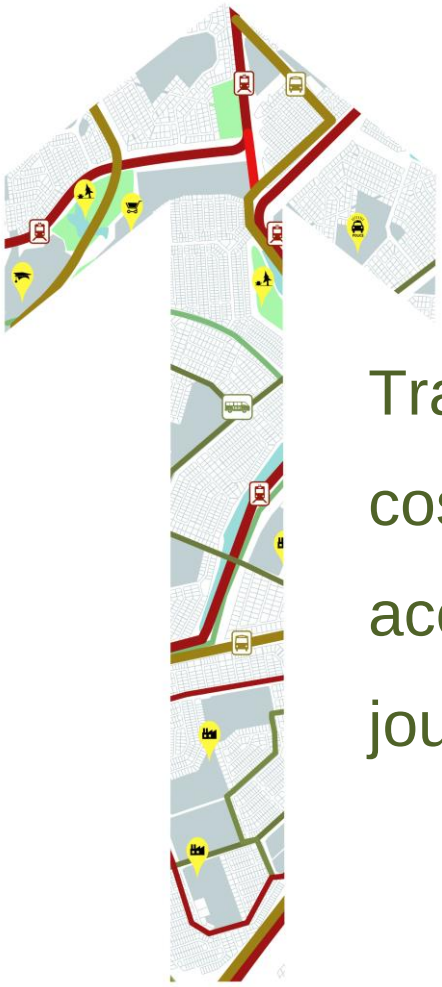


Travel time and travel cost indices as relative accessibility in the journey to work

8.1 Introduction

This section contains an analysis of two accessibility indices (travel time AI and travel cost AI) for different travel modes between place of residence and workplace. These indices were calculated based on a methodology utilised by Schoon et al. (1999) as discussed earlier. Travel time AIs for a particular mode were calculated by using average travel time of a particular mode to the average travel time across all modes. Travel cost AIs were calculated in much the same way.

The travel time AIs reflect travel time related to average travel time value.

A value of 1,0 (average travel time value) signifies parity in traveling experiences for users in terms of time

A value below 1,0 suggests that workers experience short travel time (easy access to their workplace)

A value above 1,0 suggests that workers experience long travel time (difficult reaching their workplace)

8.2 Accessibility indices for travel time to place of work

In this subsection, we will discuss travel time AI in relation to the main modes of transport, then compare travel time AI of public transport modes across different sociodemographic variables.

Table 8.1 – Distribution of workers by main mode of transport and average travel time to work, 2013

Main mode of transport		Number of workers ('000)	Per cent	Average travel time	CV (%)	Std. error of mean
Public transport	Train	678	5,1	91	2	1,4
	Bus	1 036	7,8	80	1	0,9
	Taxi	2 579	26,9	56	1	0,4
Private transport	Car/truck driver	4 157	31,2	43	1	0,4
	Car/truck passenger	1 029	7,7	45	2	0,7
Walking all the way		2 844	21,3	34	1	0,4
All modes		**13 323**	**100,0**	**50**	**1**	**0,2**

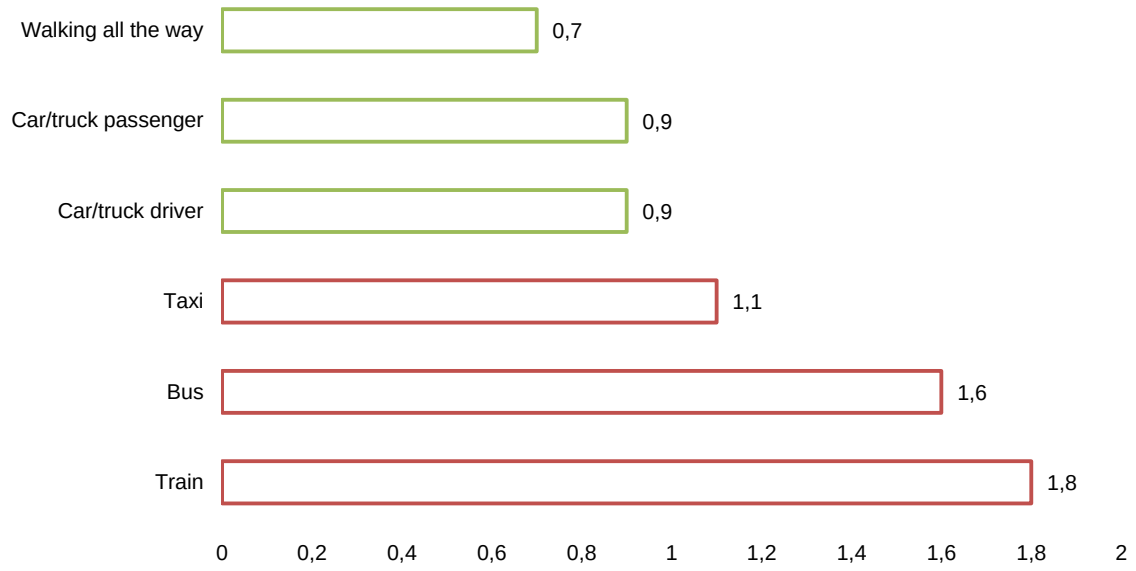
Unspecified cases of transport modes, total travel time were excluded.
Source: NHTS, 2013

The results presented in Table 8.1 show average travel times to the workplace, standard errors and coefficients of variation. All estimates are highly accurate, as the coefficients of variation are small.

Overall, workers in the morning needed on average 50 minutes to get to their place of work. However, public transport users experience longer travel times in the morning to get to their workplace – trains (91 minutes), buses (80 minutes) and taxis (56 minutes).

In terms of private transport, car drivers needed on average 43 minutes, and car passengers travelled on average 45 minutes. Both are above the national average travel time. Those who walked all the way to their place of work travelled on average 34 minutes.

Figure 8.1 – Travel time accessibility indices for workers by public transport mode, 2013



Unspecified cases of transport modes and total travel time were excluded.
Source: NHTS, 2013

Figure 8.1 reveals that travel time accessibility index scores for public transport modes are generally high compared to private transport modes. The highest travel time AI scores were estimated for trains (1,8), buses (1,6) and taxis (1,1), whereas the lowest travel time AI scores were estimated for both car passengers and car drivers at 0,9. Walking all the way had a score of 0,7.

These results show that public transport users were most likely to experience difficulty in accessing their workplace in the morning, especially train users who needed more time compared to other users.

Table 8.2 – Distribution of workers by public transport modes and average travel time to work, 2013

Indicator	Number of workers ('000)	Per cent	Average travel time	CV (%)	Std. error of mean
Train	678	12,8	91	2	1,4
Bus	1 036	19,6	80	1	0,9
Taxi	3 579	67,6	56	1	0,4
Public transport	**5 294**	**100,0**	**65**	**1**	**0,4**

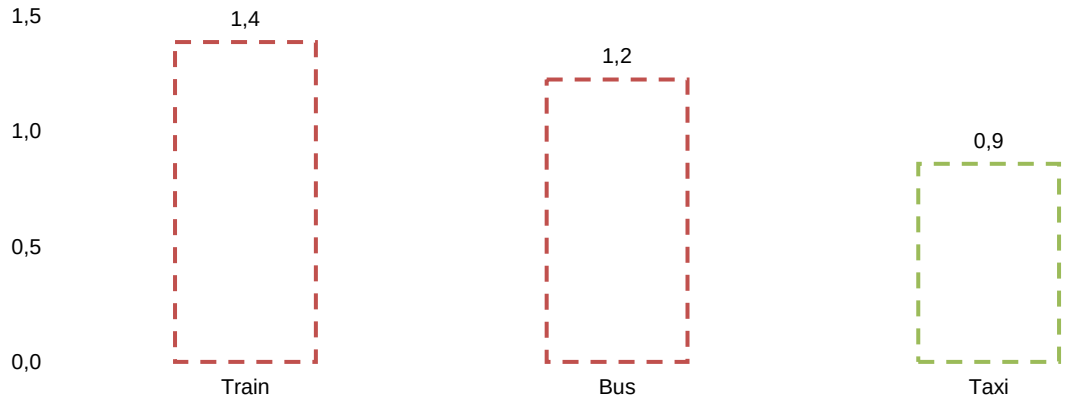
Unspecified cases of public transport modes and total travel time were excluded.
Source: NHTS, 2013

Table 8.2 shows average travel time for workers who used public transport, with their standard errors and coefficients of variation. All estimates are highly accurate, as the coefficients of variation are small.

A very high number of workers used taxis as their main mode of travel (3,6 million), followed by buses (1 million) and six hundred and eighty thousand used trains (678 000). Workers who use public transport took on average 65 minutes to get to their place of work. Train and bus users were most likely to experience longer travel times – train users needed 91 minutes, bus users needed 80 minutes and taxi users needed 56 minutes. Taxis are the only public transport mode estimated travel time that is below the national travel time.

This result shows and confirms that average travel times for train and bus users are above the benchmark set by government – travel time for work trips by public transport should be less than an hour.

Figure 8.2 – Travel time accessibility indices for workers by public transport mode, 2013



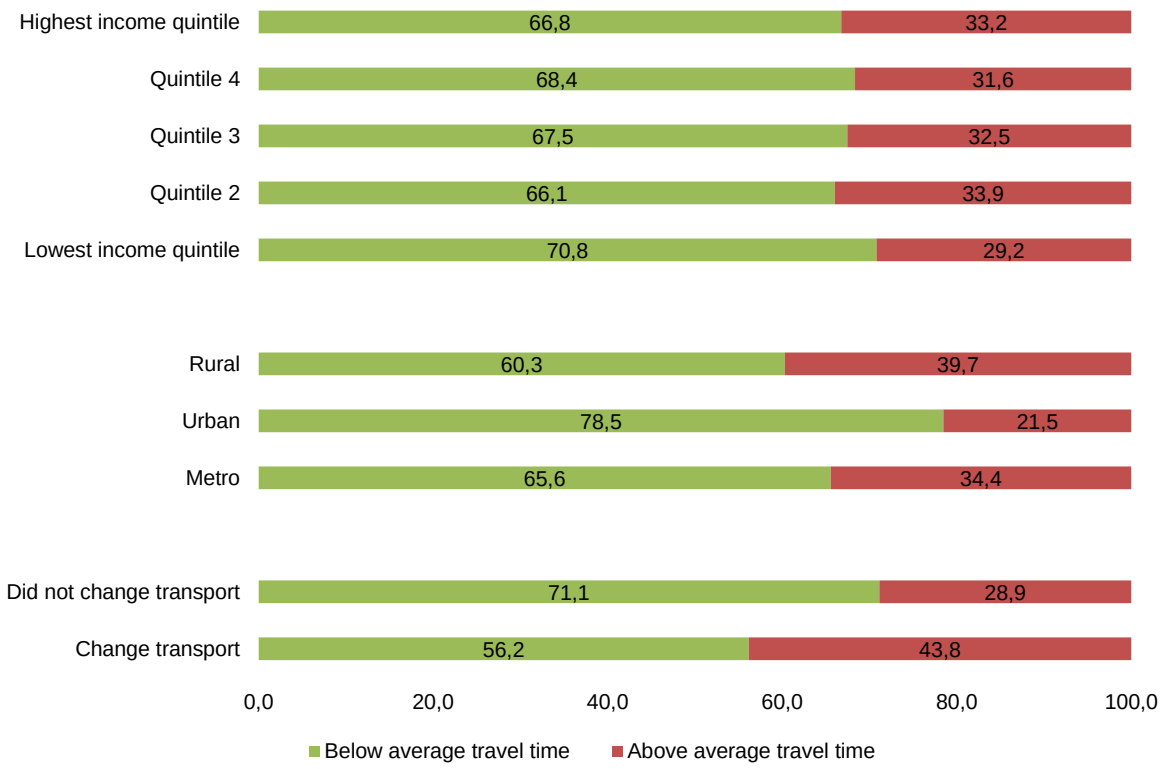
Unspecified cases of public transport modes and total travel time were excluded.
Source: NHTS, 2013

An analysis by public transport mode, as shown in Figure 8.2, shows that taxi users were more likely to have better access to the workplace than other public transport users. Taxis had the lowest travel time AI score (0,9), followed by buses (1,2). Trains had a travel time index score of 1,4, which indicates that a train trip will be 40 per cent longer compared to the average public transport trips.

This supports the view that train and bus users are having unequitable travelling experiences to their place of work.

8.2.1 Comparison of travel time accessibility indices among public transport users across sociodemographic variables

Figure 8.3 – Travel time accessibility indices by household income quintile, geographical location and workers who changed or did not change transport, 2013



Unspecified cases of income quintile and change of transport were excluded.
Source: NHTS, 2013

Figure 8.3 presents travel time accessibility indices among public transport users by household income quantile, geographical location and workers who changed or did not change transport. All estimates are highly accurate, as the coefficients of variation are small, as shown in Tables D2 to D4 (see Annexure).

Proportionally, workers in households from the lowest income quintile were less likely need more than the national average travel time to travel to work (29,2%). This could be attributed to the fact that workers in households from the lowest income quintile were most likely to use taxis as their mode of travel, while workers in households from quintile 4 and the highest income quintile were more likely to use trains as their mode of travel when compared to households from the lowest income quintile (Stats SA, 2015).

As expected, four out ten (43,8%) workers who changed transport on their way to work, used more than the national average travel time when compared to 28,9% who did not change transport.

In terms of geographical location, rural and metro workers were most likely to have unequitable travelling experiences to work in the morning. About 39,7% in rural areas and 34,4% in metro areas travelled for longer that the national average travel time. This is mainly because workers in rural and metro areas were most likely to use either trains or buses as their second most used modes of travel. In addition,

these modes were highlighted as slowest transport modes (as presented in Figure 8.1). It is important to note that across all geographic locations, taxis were the most used mode of transport.

8.3 Accessibility indices for travel cost to place of work

In this section, we focus on travel cost accessibility indices for different main modes of transport and compare these indices across key sociodemographic variables. The travel cost AIs reflect travel cost related to average travel cost value. These indices were calculated based on a methodology utilised by Schoon et al. (1999) as discussed earlier.

The travel cost AIs reflect travel cost related to average travel cost value.

A value of 1,0 (average travel cost value) signifies parity in traveling experiences for users in terms of cost

A value below 1,0 suggests that workers experience low travel cost (easy access to their workplace)

A value above 1,0 suggests that workers experience high travel cost (difficult reaching their workplace)

Table 8.3 – Distribution of workers by main mode of transport and average travel cost to work, 2013

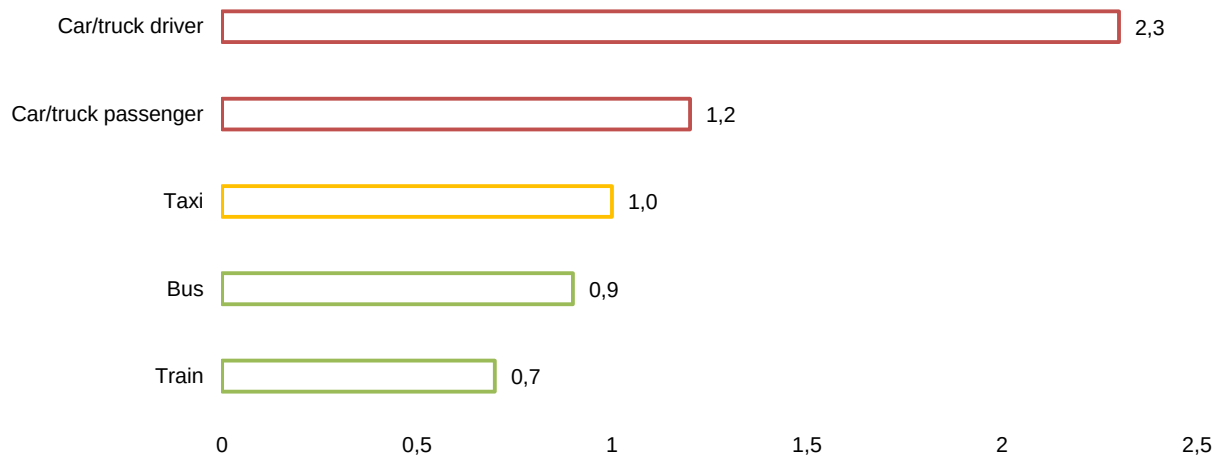
Main mode of transport		Number of workers ('000)	Per cent	Average travel cost	CV (%)	Std. error of mean
Public transport	Train	667	12,2	402	4	15,7
	Bus	910	16,7	502	2	8,8
	Taxi	3 397	62,4	561	1	5,4
Private transport	Car/truck driver	102	1,9	1 264	8	96,8
	Car/truck passenger	368	6,8	680	4	27,5
Total		**5 444**	**100,0**	**553**	**1**	**5,0**

Unspecified cases of transport modes and total travel cost were excluded.
Source: NHTS, 2013

The average travel costs between place of residence and workplace with their standard errors and coefficients of variation are presented in Table 8.3. All estimates are highly accurate, as the coefficient of variations are small.

There is a clear visible difference between private transport and public transport in terms of average travel costs. Of all the modes of travel, trains were the least expensive for workers to use with a mean of R402 a month, followed by buses (R502) and taxis (R561). On the other side of the scale, travel costs were the highest for car/truck drivers (R1 264) and car/truck passengers (R680).

Figure 8.4 – Travel cost accessibility indices for workers by main mode of transport, 2013



Unspecified cases of transport modes and total travel cost were excluded.
Source: NHTS, 2013

Figure 8.4 shows travel cost accessibility index scores for different modes of transport. Parity (equality) is reached at 1,0. Any value below 1 suggests that workers experience low travel cost when commuting to work in the morning (easy access to their workplace) and a value above 1 suggests that workers experience high travel cost (difficult access).

A breakdown of the results by travel cost accessibility index scores shows that the highest travel cost AI score was estimated for car/truck drivers (2,3), followed by car/truck passengers (1,2), while the lowest travel cost AI scores were found for trains (0,7) and buses (0,9). These travel cost AI values suggest that car drivers were more likely to experience high travel cost when commuting to work in the morning – they should budget twice more compared to other users.

Table 8.4 – Distribution of workers by public transport mode and average travel cost to work, 2013

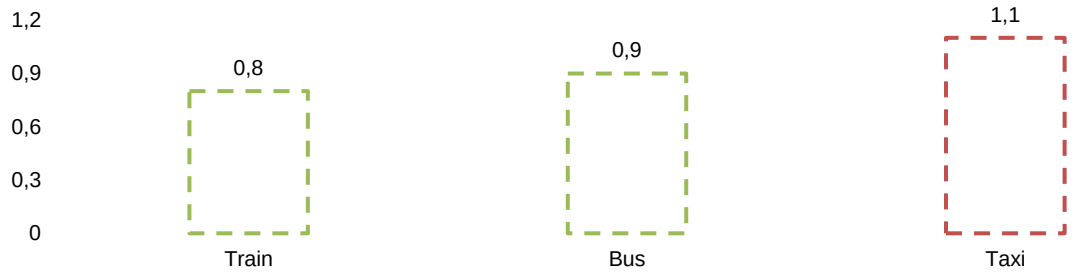
Indicator	Number of workers who use public transport ('000)	Per cent	Average travel cost	CV (%)	Std. error of mean
Train	667	13,4	402	4	15,7
Bus	910	18,3	502	2	8,8
Taxi	3 397	68,3	561	1	5,4
Public transport	**4 974**	**100,0**	**529**	**1**	**4,5**

Unspecified cases of public transport modes and total travel cost were excluded.
Source: NHTS, 2013

Table 8.4 shows average travel cost to work for public transport users with their standard errors and coefficients of variation. All estimates are highly accurate, as the coefficients of variation are small.

The table reveals that trains are the cheapest public transport mode of travel for workers in the morning with an average monthly travel cost of R402, followed by travelling by bus (R502) and taxi (R561).

Figure 8.5 – Travel cost accessibility indices for workers by public transport mode, 2013

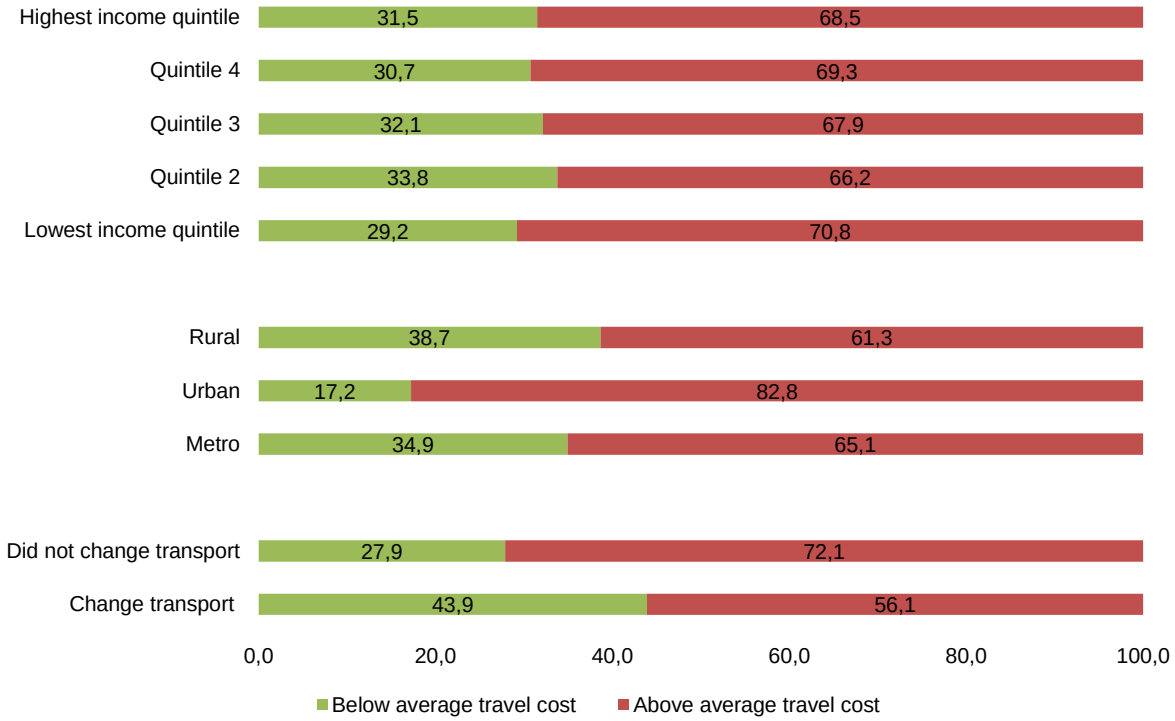


Unspecified cases of public transport modes and total travel cost were excluded.
Source: NHTS, 2013

With regard to using public transport modes, Figure 8.5 confirms that workers who used taxis as their main public transport mode experience higher travel cost compared to other public transport users. On the other hand, trains (0,8) and buses (0,9) had travel cost AI scores that are less than 1. This indicates that workers who use these public transport modes were most likely to experience low travel cost to work in the morning

8.3.1 Comparison of travel cost accessibility indices among public transport users across sociodemographic variables

Figure 8.6 – Travel cost accessibility indices by household income quintile, geographical location and workers who changed or did not change transport, 2013



Unspecified cases of income quintile and changing of transport were excluded.
Source: NHTS, 2013

Travel cost accessibility indices by household income quantiles, geographical location and workers who changed or did not change transport are presented in Figure 8.6. All estimates are highly accurate, as coefficient of variations are small as shown in Tables D5 to D7 (see Annexure).

It is clear that workers in households from the lowest income quintile, and who resided in urban and metro areas were most likely to pay above average travel fees to get to their workplace when compared to other workers. Likewise, those who did not change their transport were more likely to pay more than those who changed transport.

This phenomenon is mainly driven by the public transport mode used. For example, those who did not change transport were more likely to use taxis as their main mode of travel compared to other workers (Stats SA, 2014a). In addition to this, taxis were identified as the most expensive public transport mode, as shown in the previous findings. For these reasons, workers who use taxis as their main mode of travel are most likely to pay more compared to other users in the morning.

8.4 Summary and conclusion

In this section, we discussed travel time and cost accessibility indices in relation to the main modes of transport. The results show that the travel time accessibility index scores for public transport modes are generally high compared to private transport modes. The highest travel time AI scores were estimated for trains (1,8), buses (1,6) and taxis (1,1), whereas the lowest travel time AI scores were estimated for both car passengers and car drivers at 0,9. Walking all the way had a score of 0,7. These findings show that public transport users were most likely to experience difficulty in accessing their workplace in the morning, especially train users who needed more time compared to other users.

Analysis by public transport mode show that taxi users were more likely to have better access to their workplace than other public transport users. Taxis had the lowest travel time AI score (0,9), followed by buses (1,2), while trains had the travel time index score of 1,4, which indicates that train trips will be 40 per cent longer compared to the average public transport trip. This supports the view that train and bus users are having unequitable travelling experiences to their workplace in the morning. In addition, it also confirms that the average travel times for train and bus users are above the benchmark set by government – travel time for work trips by public transport should be less than an hour.

Proportionally, workers in households from the lowest income quintile were less likely to travel longer than the national average travel time compared to other workers (29,2%). As expected, four out of ten (43,8%) workers who changed transport on their way to work needed more than the national average travel time, compared to 28,9% who did not change transport. In terms of geographical location, rural and metro workers were most likely to face a long travel times in the morning. Almost 40% (39,7%) in rural areas and 34,4% in metro areas travelled above the national average travel time. This is mainly because workers in rural and metro areas were most likely to use either trains or buses as their second most used modes of travel. In addition, these modes were highlighted as the slowest transport modes.

The result show that the highest travel cost AI score was found for car/truck drivers (2,3), followed by car/truck passengers (1,2). The lowest travel cost AI scores were estimated for trains (0,7) and buses (0,9). These travel cost AI values suggest that car drivers were most likely to experience high travel costs when commuting to work in the morning – they should therefore budget twice more than other users.

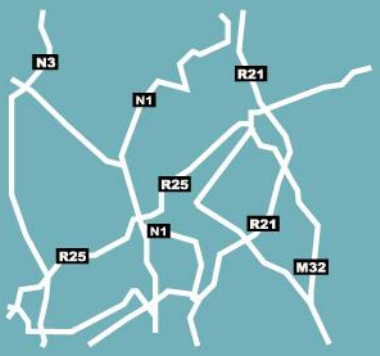
With regard to using public transport modes, workers who used taxis as their main public transport mode experienced higher travel cost compared to other public transport users. On the other hand, trains (0,8) and buses (0,9) had travel cost AI scores that are less than 1, which indicates that workers who use these public transport modes were most likely to experience low travel cost to work in the morning.

It is clear that households from the lowest income quintile and from urban and metro areas had the highest percentage of workers who paid above average travel cost to get to their workplace when compared to other workers. Likewise, those who did not change their transport were more likely to pay more than to those who changed transport.

This is mainly driven by public transport modes used. For example, those who did not change transport were more likely to use taxis as their main mode of travel compared to other workers. In addition to this, taxis were highlighted as the most expensive public transport mode, as was shown in the previous findings. For these reasons, workers who use taxis as their main mode of travel are most likely to pay more than other users when travelling to work.

TAXI ROUTES

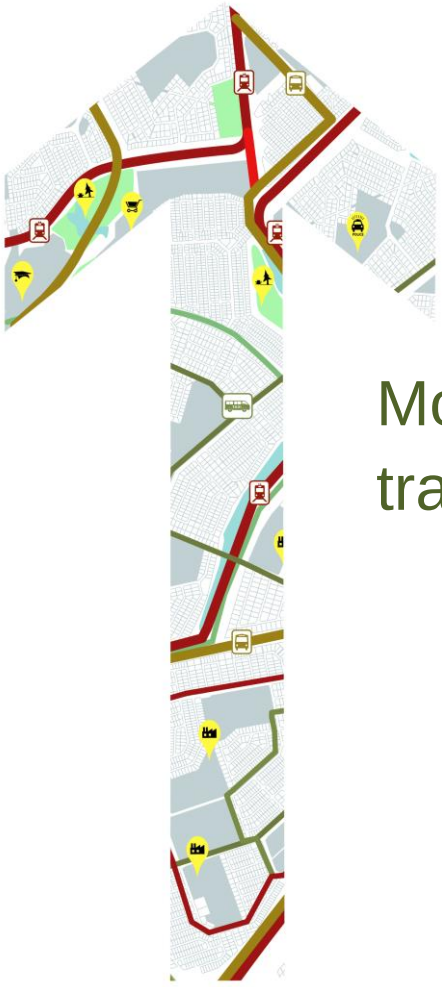
COUNTRYWIDE



CITY TO CITY
AND LOCALLY

RURAL TO TOWN

9



Modelling travel time and travel cost to workplace

Many scholars have agreed that social disparities and exclusions come from uneven levels of access. Many factors could contribute towards this, for example socioeconomic and travel characteristics of commuters. Other scholars have even argued that if someone experiences challenges in accessing activity spaces of normal everyday life, such socio-spatial "deprivation" can lead to a reduction in quality of life (Niedzielski & Boschmann, 2014).

This section will examine factors associated with total travel time to work in the morning using logistic regression. The logistic regression presented a list of variables hypothesised to have an effect on travel time to work. Our dependent or predictor variable is total travel time (where 1 denotes the probability of travelling more than national average travel time and 0 denotes the probability of travelling less than or equal to national average travel time).

9.1 Factors associated with total travel time to work

Table 9.1 – Levels of the variables used in the logistic regression model, 2013

Predictor	Level
Population group	1 = Black African 2 = Coloured 3 = Indian/Asian 4 = White
Geographical location	1 = Metro 2 = Urban 3 = Rural
Main mode of transport	1 = Public transport 2 = Walking all the way 3 = Private transport
Household income quantile	1 = Lowest income quintile 2 = Quintile 2 3 = Quintile 3 4 = Quintile 4 5 = Highest income quintile

Source: Own analysis using NHTS, 2013

Table 9.1 shows the independent variables used to model total travel time to work. These are population group, geographical location, main mode of transport and household income quintile.

Table 9.2 – Wald testing and Chi-squared test of independence between travel time and predictors, 2013

Indicator	Testing Global Null Hypothesis: BETA=0 Statistic	ndf	ddf	p-value
Likelihood ratio	156,16	10,9992	389 779	<,0001*
Score	341,19	11	35 427	<,0001*
Wald	266,32	11	35 427	<,0001*
Type 3: Analysis of effects				
Population group	68,06	3	35 435	<,0001*
Geographical location	298,61	2	35 436	<,0001*
Main mode of transport	822,06	2	35 436	<,0001*
Household income quintile	13,06	4	35 434	<,0001*

Note: Second-order Rao-Scott design correction 0, 0001 applied to the likelihood ratio test.
*Significant at 0.05 level.
Source: Own analysis using NHTS, 2013

It is evident from Table 9.2 that all three (likelihood ratio, score and Wald) tests have small p-values, which indicates that our model as a whole fits significantly better than an intercept-only model. Furthermore, the analysis of effects results show that each of the four variables in the model significantly improve the model fit.

Table 9.3 – Predictors associated with total travel time to work, 2013

Parameter	Estimate	Std. error	t -value	Pr > |t|	Odds ratio
Intercept	-1,1877	0,058	-20,547	<,0001*	0,305
Population group					
Black African	0,6409	0,0586	10,94	<,0001*	1,898
Coloured	0,1575	0,0681	2,31	0,0207*	1,171
Indian/Asian	0,4355	0,0943	4,62	<,0001*	1,546
White (reference category)					
Geographical location					
Metro	0,2103	0,0364	5,78	<,0001*	1,234
Urban	-0,5895	0,0385	-15,32	<,0001*	0,555
Rural (reference category)					
Main mode of transport					
Public transport	0,747	0,0358	20,86	<,0001*	2,111
Walking all the way	-0,7962	0,0443	-17,97	<,0001*	0,451
Private transport (reference category)					
Household income quantile					
Lowest income quintile	0,3063	0,0667	4,59	<,0001*	1,358
Quintile 2	0,2944	0,0491	6,00	<,0001*	1,342
Quintile 3	0,1251	0,0461	2,72	0,0066*	1,133
Quintile 4	0,0461	0,0417	1,11	0,269	1,047
Highest income quantile (reference category)					

*Significant at 0.05 level.
Source: Own analysis using NHTS, 2013

Table 9.3 presents the estimates and odds ratios for each level of the predictor variable. The model confirms largely our findings based on the descriptive statistics that black African, Indian/Asian and coloured workers were respectively 90%, 55% and 17% more likely to travel more than national average travel time to work in the morning compared to white workers.

Workers in metropolitan areas were 23% more likely to need more than the national average travel time compared to workers in rural areas, while the odds of urban workers travelling above the national average travel time were less. This is expected considering the level of traffic congestion in the morning, urbanisation and high levels of car ownership in metropolitan areas.

Interesting findings are observed when looking at main modes of transport. When public transport is used as a main mode of transport, the odds of travelling above national travel time are twice more than when private transport is used. At the same time, those who were walking were 55% less likely to experience long travel time.

In terms of household income quantiles, workers in households from the lowest income quintile were 36% more likely to travel above the national average travel time compared to workers in households from the highest income quintile.

9.2 Factors associated with travel cost to workplace

As pointed out correctly by El-Geneidy et al. (2016), many studies have identified travel time as a constraint to accessibility. Notwithstanding, financial access to transport is also important. In the next section, factors associated with travel cost to work are presented. The logistic regression contains a list of variables hypothesised to have an effect on travel cost to work. The dependent or predictor variable is travel cost (where 1 denotes the probability of paying more than national average travel cost and 0 denotes the probability of paying less than or equal to national average travel cost).

Table 9.4 – Levels of the variables used in the logistic regression model, 2013

Predictor	Level
Population group	1 = Black African 2 = Coloured 3 = Indian/Asian 4 = White
Geographical location	1 = Metro 2 = Urban 3 = Rural
Main mode of transport	1 = Public transport 2 = Private transport
Household income quantile	1 = Lowest income quintile 2 = Quintile 2 3 = Quintile 3 4 = Quintile 4 5 = Highest income quintile
Work sector	1 = Formal sector 2 = Informal sector

Source: Own analysis using NHTS, 2013

Independent variables used to model travel cost to workplace are presented in Table 9.4. The variables are population group, geographical location, main mode of transport, household income quintile and work sector.

Table 9.5 – Wald testing and Chi-squared test of independence between AI travel cost and predictors, 2013

Testing Global Null Hypothesis: BETA=0				
Indicator	**Statistic**	**ndf**	**ddf**	**p-value**
Likelihood ratio	13,85	10,9967	144 540	<,0001*
Score	28,41	11	13 134	<,0001*
Wald	26,78	11	13 134	<,0001*
Analysis of effects				
Population group	19,05	3	13 142	<,0001*
Geographical location	55,78	2	13 143	<,0001*
Main mode of transport	22,3	1	13 144	<,0001*
Household income quintile	12,96	4	13 141	<,0001*
Work sector	13,97	1	13 144	0,0002*

Note: Second-order Rao-Scott design correction 0, 0003 applied to the likelihood ratio test.
*Significant at 0.05 level.
Source: Own analysis using NHTS, 2013

The likelihood ratio, score and Wald tests in Table 9.5 indicate at least one independent variable in the model that is statistically significant. The Type 3 Analysis of Effects results show that each of the five variables in the model significantly improve the model fit.

Therefore, this means that population group, geographical location, main mode of transport, household income, and work sector may be regarded as significant predictors of travel cost to work in the morning.

Table 9.6 – Predictor variables and odds ratio estimates affecting travel cost, 2013

Parameter	Estimate	Std. error	t -value	Pr > |t|	Odds ratio
Intercept	-1,2171	0,1089	-11,17	<,0001*	0,296
Population group					
Black African (reference category)					
Coloured	-0,4924	0,0795	-6,19	<,0001*	0,611
Indian/Asian	0,317	0,1392	2,28	0,0227*	1,373
White	0,4844	0,1669	2,9	0,0037*	1,623
Geographical location					
Metro	0,0229	0,0555	0,41	0,6799	1,023
Urban	-0,5014	0,0631	-7,95	<,0001*	0,606
Rural (reference category)					
Main mode of transport					
Private transport	0,3567	0,0755	4,72	<,0001*	1,429
Private transport (reference category)					
Household income quantile					
Lowest income quantile (reference category)					
Quintile 2	0,28	0,1125	2,49	0,0128*	1,323
Quintile 3	0,3388	0,109	3,11	0,0019*	1,403
Quintile 4	0,5131	0,1086	4,72	<,0001*	1,670
Highest income quantile	0,6682	0,1162	5,75	<,0001*	1,951
Work sector					
Formal sector	0,2037	0,0545	3,74	0,0002*	1,226
Informal sector (reference category)					

* Reference variables used are in the model: Black African, rural, public transport, lowest income quintile and informal sector.
*Significant at 0.05 level.
Source: Own analysis using NHTS, 2013

Table 9.6 shows that population group, urban areas, main modes of transport, household income and educational institutions are significant predictors of travel cost to work, while metro was not significantly associated (p<0,6799) with the independent variable.

In terms of population group, being coloured decreased the odds by 39%; on the other side, being Indian/Asian and white increased the odds by 37% and 62%, respectively, while controlling for other variables in the model.

Notwithstanding, workers who used private transport were 1,4 times more likely to experience high travel cost compared to those who used public transport. It is not surprising to note the strong direct relationship between household income quintiles and odds of travel cost – as the household income quantile level increases, the odds also increase. For example, workers in households from the highest income quintile were 95% more likely to pay above the national average travel cost compared to workers in households from the lowest income quintile. In terms of work status, being a formal worker increased the odds by 23%, while controlling other variables in the model.

As explained before, travel costs are primarily driven by the mode of transport used. Those who use private transport are more likely to experience high travel costs compared to other users. These findings support that view.

9.3 Summary and conclusion

The model largely confirms the findings based on the descriptive statistics that black African, Indian/Asian and coloured workers were more likely to travel for longer than the national average travel time to work in the morning than white workers. Likewise, workers in metropolitan areas were 23% more likely to travel above the national average travel time when compared to workers in rural areas. The odds of urban workers to travel above national average travel time were less. This is expected, considering the level of traffic congestion in the morning, urbanisation and high levels of car ownership in metropolitan areas.

When public transport is used as a main mode of transport, the odds of travelling for longer than the national travel time are twice more than when private transport is used. Those who are walking were 55% less likely to experience long travel time. Workers in households from the lowest income quintile were 36% more likely to travel for longer than the national average travel time when compared to workers in households from the highest income quintile.

Regarding predictors associated with travel cost to work, the analysis shows that population group, urban areas, main modes of transport, household income and educational institutions are significant predictors of travel cost to work. Metro was not significantly associated with the independent variable. In terms of population group, being coloured decreased the odds by 39%; on the other side, being Indian/Asian and white increased the odds by 37% and 62%, respectively, while controlling for other variables in the model.

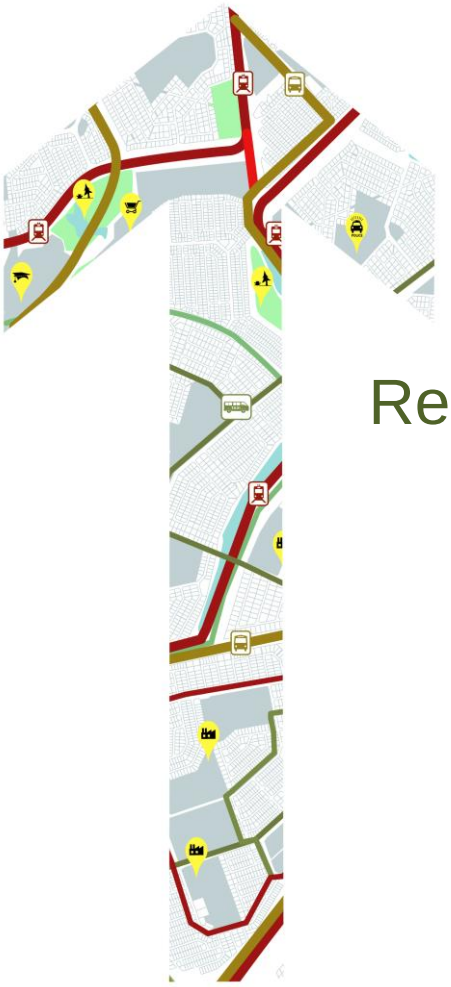
Notwithstanding, workers who use private transport were 1,4 times more likely to experience high travel cost compared to those who use public transport. It is not surprising to note the strong direct relationship between household income quintiles and odds of travel cost – as the household income quantile level increases, the odds also increase. For example, workers in households from the highest income quintile were 95% more likely to incur travel costs above the national average compared to workers in households from the lowest income quintile. In terms of work status, being a formal worker increased the odds by 23%, while controlling other variables in the model.

As explained before, travel costs are primarily driven by the mode of transport used. Those who use private transport are more likely to experience high travel costs compared to other users. These findings support that view.

In conclusion, the study affirms the position that there is social inequality in accessing centres of employment or potential employment opportunities in the morning by workers.


TAXI
CHURCH
SHOP
CLINIC
SCHOOL

10



Recommendations

Understanding and exploring social disparities in assessing the workplace and educational institutions using travel time and travel cost is an issue that needs to be measured on a continuous basis. While recognising that many factors contribute to how learners and workers travel in the morning, it is imperative to understand how travel time and travel cost play out in different geographical and socioeconomic settings across the country.

The NHTS provides a valuable source of information on travel patterns, transport modes used and other factors affecting travel. However, it is not a regular survey. The latest survey was conducted in 2013 and due to financial constraints, it is not certain when the next NHTS will be conducted. This implies that the NHTS will not be able to provide updated insights and trends to policymakers and transport planners on educational and work-related trips on a continuous basis.

In the absence of a regular transport survey, it is advisable to include appropriate questions in the GHS and the next census questionnaires in order to provide insights and trends on these issues on a continuous basis.

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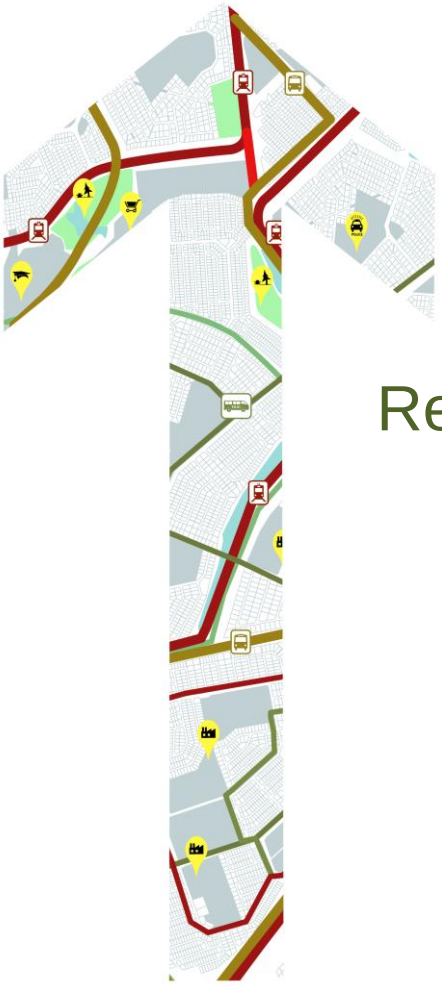

References

African Union. 2014. African Agenda 2063: The Africa we want. Accessed on: June 2017 from: http://archive.au.int/assets/images/agenda2063.pdf

Adom-Asamoah, G., Asare Okyere, S. and Senayah, E.A.K. 2015. Factors influencing school travel mode choice in Kumasi, Ghana. Accessed on: June 2017 from: https://isdsnet.com/ijds-v4n1-1.pdf

Cervero, R. 2013a. Linking urban transport and land use in developing countries. *Journal of Transport and Land Use*, 6, 1: 7-24.

Department of Cooperative Governance and Traditional Affairs. 2014. Draft Integrated Urban Development Framework. Discussion document. Accessed on: June 2017 from: http://www.cogta.gov.za/index.php/iudf/1212-integrated-urban-development-framework-iudf-2014-15/file.

Department of Transport. 1996. White paper on national transport policy. Pretoria: Department of Transport.

El-Geneidy, A., Levinson, D., Diab, E., Boisjoly, G., Verbich, D. and Loong, C. 2016. The cost of equity: Assessing transit accessibility and social disparity using total travel cost. Transportation Research Part A: Policy and Practice, 91, pp.302-316. Accessed on: May 2018 from: http://daneshyari.com/article/preview/310384.pdf

Ensink, B., Minovi, S., Gorham, R. & Vandycke, N. 2015. The Next Step for Transport in the SDGs: Devising the Right Indicators Shaping Transport's SDG Impact. Connections; No. 20. World Bank, Washington, DC. World Bank. Accessed on: June 2017 from: http://pubdocs.worldbank.org/en/103591443110462813//1603859-TransportICT-Newsletter-Note-20.pdf

Gasparovic, S. 2014. Impact of transport disadvantage on education of high school population of the City of Zagreb. In ICTTE Belgrade 2014-International Conference on Traffic and Transport Engineering. Accessed on: June 2018 from: https://bib.irb.hr/datoteka/736154.Gasparovic_ICTTE_Transport_disadvantage_education.pdf

Jones, P. & Wixey, S. 2005. Measuring accessibility as experienced by different socially disadvantaged groups. Accessibility Analysis Literature Review Working Paper 3. Funded by the EPSRC FIT Programme. Accessed on: May 2017 from: https://www.researchgate.net/publication/37183599_ Measuring_accessibility_as_experienced_by_different_socially_disadvantaged_groups

Kerr, A. 2015. Taxi(i)ing the poor? Commuting costs in South Africa. Accessed on: June 2017 from http://www.redi3x3.org/papers.

Mamun, S. 2011. Public transit accessibility and need indices: approaches for measuring service gap. Accessed on: July 2017 from: http://digitalcommons.uconn.edu/cgi/viewcontent .cgi?article=1118&context=gs_theses

Maunganidze, L. 2011. The role of bus rapid transit in improving public transport levels of service, particularly for the urban poor users of public transport. Master thesis report. Cape Town: University of Cape Town, Department of Civil Engineering.

National Planning Commission. 2011. National Development Plan 2030: Vision for 2030. Our future – make it work. ISBN: 978-0-621-40475-3. The Presidency, Pretoria.

Niedzielski, M.A. & Boschmann, E. 2014. Travel time and distance as relative accessibility in the journey to work. Annals of the Association of American Geographers, 104(6), pp.1156-1182. Accessed on: May 2018 from: https://scinapse.io/papers/2084814181

Pitot, M., Yigitcanlar, T., Sipe, N. & Evans, R. 2006. Land Use & Public Transport Accessibility Index (LUPTAI) tool: the development and pilot application of LUPTAI for the Gold Coast. In *ATRF06 Forum Papers)*. Planning and Transport Research Centre (PATREC). Accessed on: July 2017 from: https://eprints.qut.edu.au/32102/1/c32102.pdf

Republic of South Africa (1996) Constitution of the Republic of South Africa (Act 108 of 1996), Pretoria.

Salonen, M. & Toivonen, T. 2013. Modelling travel time in urban networks: comparable measures for private car and public transport. *Journal of Transport Geography*, *31*, pp.143-153.

Schoon, J., McDonald, M. & Lee, A. 1999. Accessibility indices: pilot study and potential use in strategic planning. *Transportation Research Record: Journal of the Transportation Research Board*, (1685), pp.29-38.

Statistics South Africa. 2014a. National household travel survey 2013: Statistical release. Report P0320. Pretoria: Statistics South Africa.

Statistics South Africa. 2017. General Household Survey 2016. Statistical release P0318. Statistics. South Africa: Pretoria.

Statistics South Africa. 2015. *Measuring household expenditure on public transport: In-depth analysis of the National Household Travel Survey 2013-Technical report. Report 03-20-11.* Pretoria: Statistics South Africa.

Thomas, D. 2013. The Gautrain project in South Africa: a cautionary tale. Journal of Contemporary African Studies, 31, 1: 77-94.

United Nations Secretary-General's High-Level Advisory Group on Sustainable Transport. 2016. Mobilising Sustainable Transport for Development: Analysis and Policy Recommendations. Accessed on: June 2017 from: https://sustainabledevelopment.un.org/content/documents/2375Mobilizing%20Sustainable%20Transport.pdf

Venter, C. 2016. Developing a common narrative on urban accessibility: A Transportation perspective. Accessed on: June 2017 from: https://www.brookings.edu/wp-content/uploads/2017/01/transportation-digital.pdf

Zhao, F. & Li, P.M.T. 2001. Integrating Land Use and Transportation in a GIS Visualization Tool. Accessed on: May 2017 from: https://www.researchgate.net/profile/Jill_Strube/publication/237731799_Integrating_Land_Use_and_Transportation_in_a_GIS_Visualization_Tool/links/00b7d53c01d3d3ba31000000.pdf

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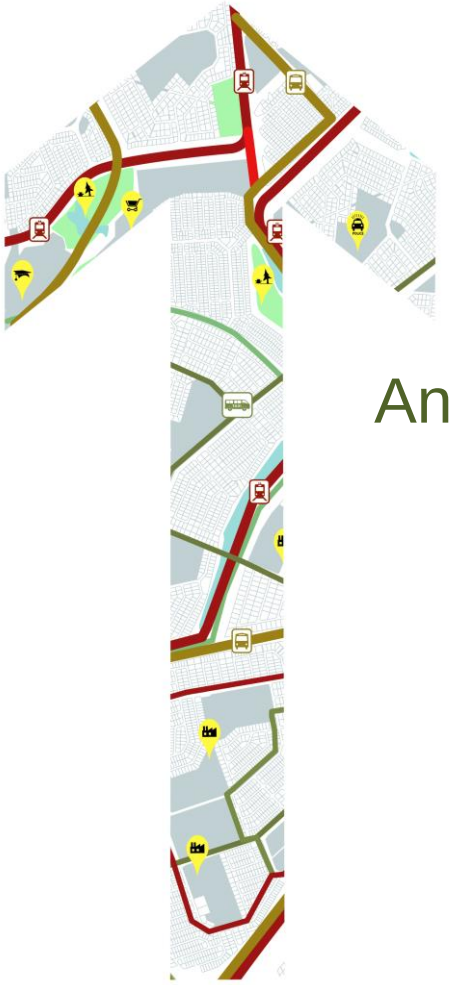


Annexure

A: Departure, waiting, walking and arrival to educational institutions

Table A1 – Time learners leave for educational institutions by main mode of transport, 2013

Main mode of transport		Number of learners ('000)	Time learners leave for educational institutions: Before 06:30	06:30 to 06:59	07:00 to 07:29	07:30 to 07:59	08:00 or later	Total
Public transport	Train	199	31,5	21,7	27,6	10,1	9,1	**100,0**
	Bus	889	36,2	31,0	24,0	4,9	4,0	**100,0**
	Taxi	2 507	22,3	26,9	31,1	10,9	8,8	**100,0**
Private transport	Car/truck driver	250	12,7	15,9	21,8	12,4	37,1	**100,0**
	Car/truck passenger	2 185	12,5	25,3	43,5	14,0	4,7	**100,0**
Walking all the way		10 827	8,1	17,2	43,9	25,7	5,2	**100,0**
Other		141	12,3	27,0	32,1	16,2	12,4	**100,0**
Total		**16 997**	**12,6**	**20,5**	**40,3**	**20,4**	**6,2**	100,0

Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and leaving time to educational institutions were excluded.
Source: NHTS, 2013

Table A2 – Time scholars leave for school by main mode of transport, 2013

Main mode of transport		Number of scholars ('000)	Time scholars leave for school: Before 06:30	06:30 to 06:59	07:00 to 07:29	07:30 to 07:59	08:00 or later	Total
Public transport	Train	71	31,2	31,0	28,0	7,4	2,4	**100,0**
	Bus	634	34,7	34,8	25,3	4,3	0,9	**100,0**
	Taxi	1 587	25,9	32,3	32,0	9,0	0,8	**100,0**
Private transport	Car/truck driver	41	12,8	40,9	34,8	10,3	*	**100,0**
	Car/truck passenger	1 436	13,2	27,2	46,4	12,2	1,0	**100,0**
Walking all the way		8 574	9,1	18,3	46,4	24,9	1,3	**100,0**
Other		81	13,8	37,4	37,6	10,5	*	**100,0**
Total		**12 425**	**13,2**	**22,2**	**43,3**	**20,1**	**1,2**	100,0

Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and time scholars leave for school were excluded.
Source: NHTS, 2013

Table A3 – Time learners take to walk to get to the first transport by main mode of transport, 2013

Main mode of transport		Number of learners ('000)	Time learners walk to first transport				
			Up to 5 min.	6–10 min.	11–15 min.	>15 min.	Total
Public transport	Train	152	27,8	17,9	19,6	34,6	**100,0**
	Bus	692	47,3	24,2	13,7	14,7	**100,0**
	Taxi	2 157	69,6	16,8	6,9	6,7	**100,0**
Private transport	Car/truck driver	265	92,8	2,4	*	4,4	**100,0**
	Car/truck passenger	21 51	94,3	3,2	1,2	1,4	**100,0**
Other		53	85,0	8,8	*	4,5	**100,0**
Total		**5 470**	**76,6**	**11,6**	**5,5**	**6,3**	**100,0**

Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and walking time were excluded.
Source: NHTS, 2013

Table A4 – Total travel time for learners by main mode of transport and its corresponding coefficient variation, 2013

Main mode of transport	Number of learners ('000)		Total travel time: Less than 15 min.		15-30 min.		31-60 min.		>60 min.	
	('000)	CV %	('000)	CV %	('000)	CV %	('000)	CV %	('000)	CV %
Train	199	6	5	31	35	14	52	11	108	8
Bus	889	2	10	19	180	5	362	3	336	4
Taxi	2 507	1	94	7	926	2	942	2	544	3
Car/truck driver	250	6	20	16	114	8	78	12	38	12
Car/truck passenger	2 185	2	437	4	1 049	3	513	3	187	6
Walking all the way	10 827	0	1 728	1	6 116	1	2 385	1	599	3
Other	141	6	24	15	57	9	42	11	18	17
Total	**16 997**	**0**	**2 318**	**1**	**8 476**	**1**	**4 374**	**1**	**1 829**	**2**

Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and total time taken by learners were excluded.
Source: NHTS, 2013

Table A5 – Total travel time for learners by main mode of transport, 2013

Main mode of transport		Number of learners ('000)	Total travel time for learners				
			Less than 15 min.	15-30 min.	31-60 min.	>60 min.	Total
Public transport	Train	199	2,4	17,4	26,0	54,2	**100,0**
	Bus	889	1,1	20,3	40,8	37,8	**100,0**
	Taxi	2 507	3,8	37,0	37,6	21,7	**100,0**
Private transport	Car/truck driver	250	8,2	45,4	31,3	15,1	**100,0**
	Car/truck passenger	2 185	20,0	48	23,5	8,5	**100,0**
Walk all the way		10 827	16,0	56,5	22,0	5,5	**100,0**
Other		141	17,1	40,4	30,0	12,5	**100,0**
Total		**16 997**	**13,6**	**49,9**	**25,7**	**10,8**	**100,0**

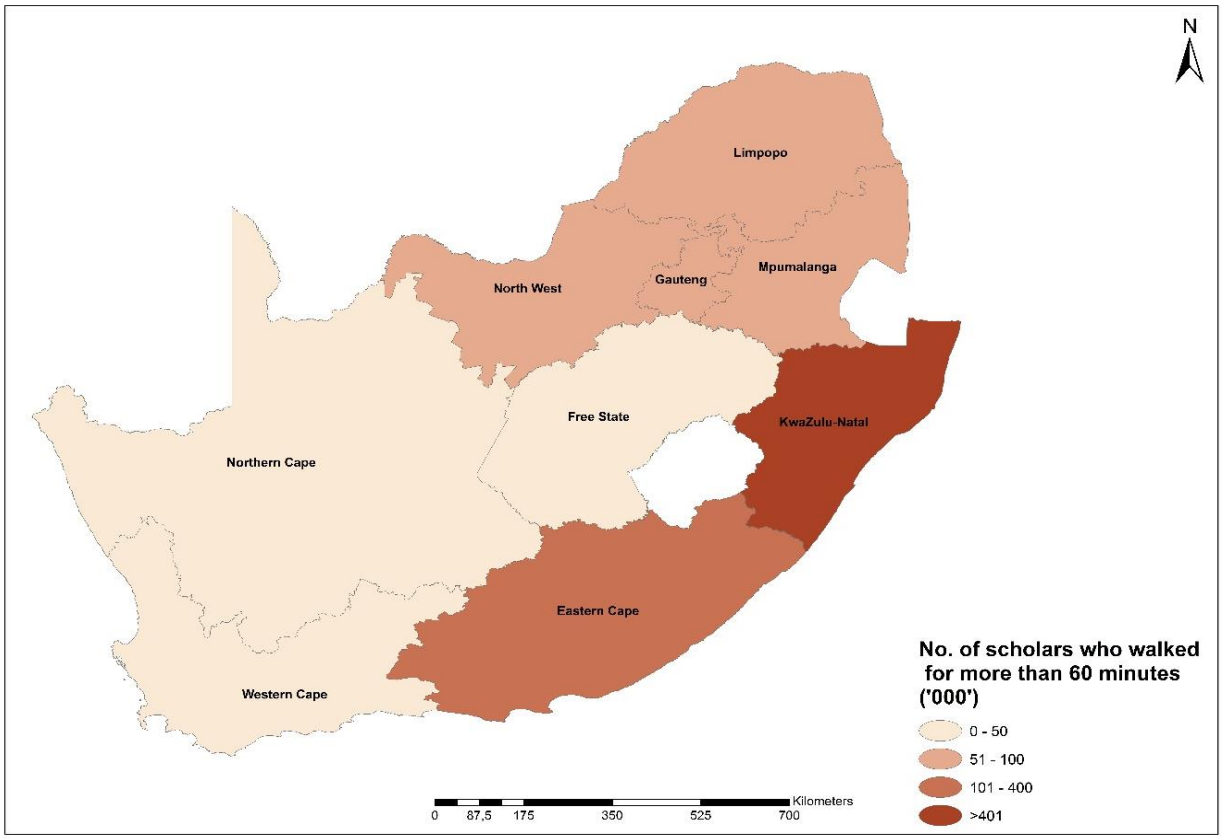
Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and total travel time were excluded.
Source: NHTS, 2013

Table A6 – Total travel time for scholars by geographic location and main mode of transport and its corresponding coefficient variation, 2013

	Number of scholars ('000)		Total travel time scholars: Less than 15 min.		15-30 min.		31-60 min.		>60 min.	
Indicator	**('000)**	**CV %**	**('000)**	**CV %**	**('000)**	**CV %**	**('000)**	**CV %**	**('000)**	**CV %**
Geographical location										
Metro	3 600	1	510	3	1 837	2	912	2	341	4
Urban	3 087	1	487	3	1 696	1	686	2	218	5
Rural	6 008	1	554	3	2 951	1	1 808	1	695	2
RSA	**12 695**	**0**	**1 551**	**2**	**6 484**	**1**	**3 406**	**1**	**1 254**	**2**
Main mode of transport										
Train	71	10	2	56	20	19	15	17	34	15
Bus	634	3	7	22	136	5	280	4	212	5
Taxi	1 587	2	56	9	587	3	606	3	337	4
Car/truck driver	41	16	5	29	14	18	17	34	5	29
Car/truck passenger	1 436	2	251	5	715	3	353	4	118	7
Walking all the way	8 574	0	1 185	2	4 838	1	2 035	1	517	3
Other	81	8	10	24	29	13	29	12	13	20
Total	**12 425**	**0**	**1 516**	**2**	**6 339**	**1**	**3 335**	**1**	**1 234**	**2**

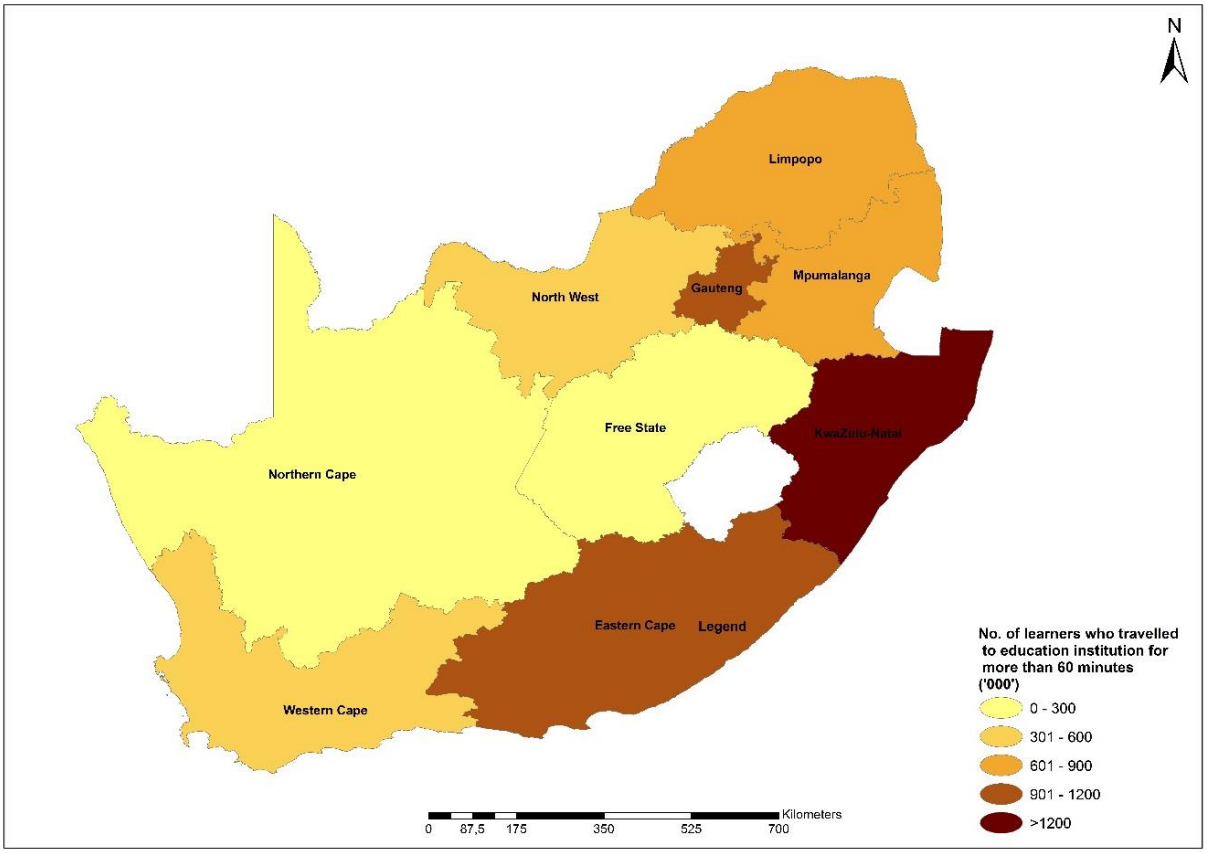
Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes, location and total travel time were excluded.
Source: NHTS, 2013

Map A1 – Number of scholars who walked all the way to school for more than 60 minutes, 2013



Source: NHTS, 2013

Map A2 – Number of learners who travelled to educational institutions for more than 60 minutes, 2013



Source: NHTS, 2013

B: Travel time and travel cost indices as relative accessibility in the journey to educational institutions

Table B1 – Travel time accessibility index by main mode of transport, 2013

Main mode of transport	Travel time accessibility index	Number of learners ('000)
Train	2,1	199
Bus	1,7	889
Taxi	1,4	2 507
Car/truck driver	1,2	250
Car/truck passenger	0,9	2 185
Walking all the way	0,8	10 827

Unspecified cases of transport modes and total travel time were excluded.
Source: NHTS, 2013

Table B2 – Travel time accessibility indices by household income quintile, 2013

Household income quintile		Number of learners ('000)	CV %	Per cent	CV %
Lowest income quintile	Below average travel time	481	3	66,6	2
	Above average travel time	242	4	33,4	3
Quintile 2	Below average travel time	529	3	65,2	2
	Above average travel time	283	4	34,8	3
Quintile 3	Below average travel time	591	3	70,9	2
	Above average travel time	243	4	29,1	4
Quintile 4	Below average travel time	569	3	73,3	2
	Above average travel time	207	5	26,7	4
Highest income quintile	Below average travel time	313	4	74,9	2
	Above average travel time	105	7	25,1	6

Unspecified cases of total travel time, household income quantile and educational institutions were excluded.
Source: NHTS, 2013

Table B3 – Travel time accessibility indices by educational institution, 2013

Educational institution		Number of learners ('000)	CV %	Per cent	CV %
Pre-school	Above average travel time	18	15	8,7	14,1
	Below average travel time	192	4	91,3	1,3
School	Above average travel time	705	2	30,8	2,1
	Below average travel time	1 587	1	69,2	0,9
Higher education	Above average travel time	104	7	38,5	5,6
	Below average travel time	167	5	61,5	3,5
FET college	Above average travel time	92	8	32,9	6,3
	Below average travel time	188	5	67,1	3,1
Other	Above average travel time	26	13	25,9	12,1
	Below average travel time	74	9	74,1	4,2

Unspecified cases of total travel time, household income quantile and educational institutions were excluded.
Source: NHTS, 2013

Table B4 – Travel time accessibility indices by geographic location, 2013

Geographic location		Number of learners ('000)	CV%	Per cent	CV%
Metro	Below average travel time	1 128	2	1	1
	Above average travel time	504	3	3	3
Urban	Below average travel time	717	2	1	1
	Above average travel time	215	4	4	4
Rural	Below average travel time	661	2	1	1
	Above average travel time	368	3	2	2

Unspecified cases of total travel time were excluded.
Source: NHTS, 2013

Table B5 – Travel cost accessibility indices for learners by main mode of transport, 2013

Main mode of transport	Travel cost accessibility indices	Number of learners ('000)
Train	1,0	152
Bus	1,0	526
Taxi	0,9	2 224
Car/truck driver	2,9	169
Car/truck passenger	0,8	728

Unspecified cases of transport modes and total travel cost were excluded.
Source: NHTS, 2013

Table B6 – Travel cost accessibility indices by household income quintile, 2013

Household income quintile		Number of learners ('000)	CV %	Per cent	CV %
Lowest income quintile	Below average travel cost	398	3	77,2	2
	Above average travel cost	117	6	22,8	5
Quintile 2	Below average travel cost	465	3	75,3	2
	Above average travel cost	153	6	24,7	5
Quintile 3	Below average travel cost	532	3	77,1	2
	Above average travel cost	158	6	22,9	5
Quintile 4	Below average travel cost	519	3	76,9	2
	Above average travel cost	156	6	23,1	5
Highest income quintile	Below average travel cost	291	4	76,7	2
	Above average travel cost	88	8	23,3	7

Unspecified cases of household income quantile, education institutions and total travel cost were excluded.
Source: NHTS, 2013

Table B7 – Travel cost accessibility indices by educational institution, 2013

Education institution		Number of learners ('000)	CV %	Per cent	CV %
Pre-school	Above average travel cost	6	27	3,4	27
	Below average travel cost	169	5	96,6	1
School	Above average travel cost	386	3	21,6	3
	Below average travel cost	1396	1	78,4	1
Higher education	Above average travel cost	90	7	37,3	6
	Below average travel cost	151	6	62,7	4
FET college	Above average travel cost	81	8	31,8	7
	Below average travel cost	175	5	68,2	3
Other	Above average travel cost	22	14	25,2	13
	Below average travel cost	66	10	74,8	4

Unspecified cases of household income quantile, education institutions and total travel cost were excluded.
Source: NHTS, 2013

Table B8 – Travel cost accessibility indices by geographical location, 2013

Geographic location		Number of learners ('000)	CV %	Per cent	CV %
Metro	Below average travel cost	1 024	2	72,3	1
	Above average travel cost	392	4	27,7	3
Urban	Below average travel cost	643	2	83,6	1
	Above average travel cost	127	5	16,4	5
Rural	Below average travel cost	557	2	77,8	1
	Above average travel cost	159	5	22,2	4

Unspecified cases of household income quantile, education institutions and total travel cost were excluded.
Source: NHTS, 2013

C: Assessing travel time and travel cost to place of work

Table C1 – Time workers leave for work by main mode of transport and its corresponding coefficient variation, 2013

			Time workers leave for work									
	Number of workers		Before 06:00		06:00 to 06:29		06:30 to 06:59		07:00 to 07:59		08:00 or later	
Main mode of transport	('000)	CV %	('000)	CV %	('000)	CV %	('000)	CV %	('000)	CV %	('000)	CV %
Train	678	3	327	4	153	6	78	9	63	9	57	11
Bus	1 036	2	549	3	220	5	121	6	89	7	56	10
Taxi	3 579	1	930	2	796	2	610	3	832	2	412	3
Car/truck driver	4 157	1	539	3	660	3	792	3	1 603	2	563	3
Car/truck passenger	1 029	2	213	5	215	5	209	5	293	4	100	8
Walking all the way	2 844	1	391	3	437	3	527	3	1 076	2	413	3
Other	171	5	36	11	38	11	32	11	48	10	18	16
RSA	**13 496**	**0**	**2 986**	**1**	**2 519**	**1**	**2 369**	**1**	**4 003**	**1**	**1 619**	**2**

Other includes: Bicycle, scooter, etc.
Unspecified cases of transport modes and time workers leave for work were excluded.
Source: NHTS, 2013

Table C2 – Coefficient of variation for time workers leave for work by workers who changed and did not change their transport, 2013

	Time workers leave for work				
Changed transport	Before 06:00	06:00 to 06:29	06:30 to 06:59	07:00 to 07:59	08:00 or later
Yes	2	4	5	5	7
No	2	2	2	2	3

Source: NHTS, 2013

Table C3 – Time workers take to walk to get to the first transport by main mode of transport and its corresponding coefficient variation, 2013

Main mode of transport	Number of workers		Time workers walk to first transport							
			Up to 5 min.		6-10 min.		11-15 min.		>15 min.	
	('000)	CV %	('000)	CV %	('000)	CV %	('000)	CV %	('000)	CV %
Train	608	3	153	6	122	7	124	7	210	5
Bus	873	2	365	4	244	5	127	6	136	6
Taxi	3 204	1	1 730	2	760	2	370	4	344	4
Car/truck driver	318	4	260	4	23	12	11	18	24	13
Car/truck passenger	938	2	782	2	78	8	30	10	48	9
Other	14	18	8	24	4	36	*	*	2	42
RSA	**5 955**	**0**	**3 299**	**1**	**1 231**	**2**	**662**	**3**	**763**	**2**

Other includes: Bicycle, scooter, etc.
* Un-weighted numbers of 3 and below per cell are too small to provide reliable estimates.
Unspecified cases of transport modes and time taken by workers were excluded.
Source: NHTS, 2013

Table C4 – Coefficient of variation for total time travelled to place of work by main mode of transport, 2013

Main mode of transport		Total travel time (CV%)			
		Less than 15 min.	15-30 min.	31-60 min.	>60 min.
Public transport	Train	42	11	5	2
	Bus	23	5	3	2
	Taxi	10	2	1	2
Private transport	Car/truck driver	3	1	2	3
	Car/truck passenger	7	3	3	5
Walking all the way		2	1	2	4
Other		20	6	7	11

Unspecified cases of transport modes and total time taken by workers were excluded.
Other includes: Bicycle, scooter, etc.
Source: NHTS, 2013

Table C5 – Coefficient of variation for total travel time by workers who changed and did not change their transport, 2013

	Time workers leave for work (CV %)			
Changed transport	Less than 15 min.	15-30 min.	31-60 min.	>60 min.
Yes	20	6	3	2
No	5	1	1	2

Source: NHTS, 2013

Table C6 – Average travel time by workers who changed and did no change transport on their way to work, 2013

Changed transport	Number ('000)	Mean (Minutes)	Std. error of mean	95% CL for mean		CV (%)
Yes	1 296	84	0,9	82	85	1
No	5 340	56	0,3	55	56	1

Significant at 0.05 level

D: Travel time and travel cost indices as relative accessibility in the journey to place of work

Table D1 – Accessibility indices for travel time indices for workers by public transport mode, 2013

Main mode of transport	Travel time accessibility indices	Number of workers ('000)
Train	1,8	678
Bus	1,6	1 036
Taxi	1,1	3 579
Car/truck driver	0,9	4 157
Car/truck passenger	0,9	1 029
Walking all the way	0,7	2 844

Unspecified cases of transport modes and total travel time were excluded.
Source: NHTS, 2013

Table D2 – Travel time accessibility indices by household income quintile, 2013

Household income quintile		Number of workers ('000)	CV %	Per cent	CV %
Lowest income quintile	Below average travel time	191	5	70,8	3
	Above average travel time	79	8	29,2	7
Quintile 2	Below average travel time	606	3	66,1	2
	Above average travel time	311	4	33,9	3
Quintile 3	Below average travel time	1 003	2	67,5	1
	Above average travel time	483	3	32,5	3
Quintile 4	Below average travel time	1 258	2	68,4	1
	Above average travel time	582	3	31,6	3
Highest income quintile	Below average travel time	521	3	66,8	2
	Above average travel time	259	4	33,2	4

Unspecified cases of household income quantile and total travel time were excluded.
Source: NHTS, 2013

Table D3 – Travel time accessibility indices by geographical location, 2013

Geographical location		Number of workers ('000)	CV %	Per cent	CV %
Metro	Below average travel time	2 024	1	65,6	1
	Above average travel time	1 063	2	34,4	2
Urban	Below average travel time	967	2	78,5	1
	Above average travel time	265	3	21,5	3
Rural	Below average travel time	588	2	60,3	2
	Above average travel time	387	3	39,7	3

Unspecified cases of total travel time were excluded.
Source: NHTS, 2013

Table D4 – Travel time accessibility indices by workers who changed or did not change transport, 2013

Changed transport		Number of workers ('000)	CV %	Per cent	CV %
Yes	Below average travel time	700	3	56,2	2
	Above average travel time	546	3	43,8	2
No	Below average travel time	2 827	1	71,1	1
	Above average travel time	1 147	2	28,9	2

Unspecified cases of travel time and changing of transport were excluded.
Source: NHTS, 2013

Table D5 – Travel cost accessibility indices by household income quintile, 2013

Household income quintile		Number of workers ('000)	CV %	Per cent	CV %
Lowest income quintile	Below average travel cost	74	8	29,2	7
	Above average travel cost	180	5	70,8	3
Quintile 2	Below average travel cost	294	4	33,8	3
	Above average travel cost	577	3	66,2	2
Quintile 3	Below average travel cost	449	3	32,1	3
	Above average travel cost	949	2	67,9	1
Quintile 4	Below average travel cost	533	3	30,7	3
	Above average travel cost	1 201	2	69,3	1
Highest income quintile	Below average travel cost	225	5	31,5	4
	Above average travel cost	491	3	68,5	2

Unspecified cases of household income quintile and travel cost were excluded.
Source: NHTS, 2013

Table D6 – Travel cost accessibility indices by geographical location, 2013

Geographic location		Number of workers ('000)	CV %	Per cent	CV %
Metro	Below average travel cost	1 034	2	34,9	2
	Above average travel cost	1 928	1	65,1	1
Urban	Below average travel cost	190	4	17,2	4
	Above average travel cost	910	2	82,8	1
Rural	Below average travel cost	352	3	38,7	3
	Above average travel cost	559	2	61,3	2

Unspecified cases of total travel cost were excluded.
Source: NHTS, 2013

Table D7 – Travel cost accessibility indices by workers who changed or did not change transport, 2013

Changed transport		Number of workers ('000)	CV %	Per cent	CV %
Yes	Below average travel cost	520	3	43,9	2
	Above average travel cost	664	3	56,1	2
No	Below average travel cost	1 036	2	27,9	2
	Above average travel cost	2 681	1	72,1	1

Unspecified cases of travel time and changing of transport were excluded.
Source: NHTS, 2013

Table D8 – Accessibility indices for travel cost indices for workers by main mode of transport

Main mode transport	Travel cost accessibility indices	Number of workers ('000)
Train	0,7	651
Bus	0,9	892
Taxi	1,0	3 319
Car/truck driver	2,3	95
Car/truck passenger	1,2	360

Source: NHTS, 2013
Unspecified cases of transport modes and total travel cost were excluded.

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