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Effects of transport planning on induced traffic

Ayanda Pasiya

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Jméno a příjmení:	**Ayanda Pasiya**
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Introduction
1.Analysing effects of transport planning
2.Causes of induced demand
3.Possible solutions to induced traffic
Conclusion

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Vedoucí bakalářské práce: **Ing. Michaela Ledvinová, Ph.D.**
Katedra technologie a řízení dopravy

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prof. Ing. Bohumil Culek, CSc.
děkan

L.S.

doc. Ing. Pavel Drdla, Ph.D.
vedoucí katedry

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I declare:

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Effects of transport planning on induced traffic

Annotation

The aim of the thesis is to analyze the effects of building new roads, increasing the capacity of already existing road infrastructure on induced traffic. The thesis will also be looking at how the improvement of other forms of transport can affect induced traffic and how public transport can be improved and how other factors such as price affect induced traffic. The thesis also proposes plans to relieve congestion on Johannesburg roads.

Key words

Induced traffic, Republic of South Africa (RSA), Induced demand, Johannesburg

Titul

Vliv dopravního plánování na indukci dopravy

Anotace

Cílem práce je analyzovat vliv na dopravního plánování, především výstavby nových pozemních komunikací a zvýšení kapacity již stávající silniční infrastruktury na indukci dopravy. Práce se rovněž zabývá tím, jaký může mít vliv na indukci dopravy zlepšení parametrů jiných druhů dopravy (např. Veřejné) a jaké faktory indukci dopravy ovlivňují. Práce rovněž opatreni plání ke snížena dopravní provozu na pozemnich komunikacih v Johannesburgu.

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LIST OF ABBREVIATIONS

CBD	Central Business District
CT	Cape Town
DBN	Durban
GPS	Global Positioning System
GIS	Geographic Information System
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
ITMP	Integrated Transport Master Plan
IFM	Integrated Fare Management
ITS	Intelligent Transport System
JHB	Johannesburg
NMT	Non-Motorized Transport
ORT	Open Road Toll
PRASA	Passenger Rail Agency of South Africa
RRRBTTN	Reliable Railway, Bus and Taxi Transport Network
RSA	Republic of South Africa
SANRAL	South African Road Agency Limited

Introduction

Induced traffic has been a problem in road transport around the world and in developing countries, such as RSA. Induced traffic can lead to road congestion and in South Africa the lack of funding for transport infrastructure, has led to discussions on the importance of investing in transport infrastructure in order to alleviate congestion on South African roads.

The discussions have been focused more on whether increasing road capacity or adding new networks links can be appropriate means of solving traffic congestion around major cities, during peak traffic hours which are usually in the morning and in the afternoon.

Even though South Africa is a developing country compared to other countries in the world, it still deals with the problem of induced traffic as developed countries. This is because of the large population and the high number of cars on RSA roads in the urban areas.

The aim of the thesis is to analyze the effects of building new roads, increasing the capacity of already existing road infrastructure on induced traffic. The thesis will also be looking at how the improvement of other forms of transport can affect induced traffic and how public transport can be improved and how other factors such as price affect induced traffic. The thesis also proposes plans to relieve congestion on Johannesburg roads.

1 ANALYSING THE EFFECTS OF TRANSPORT PLANNING

Transport planning has always been a field involved with the evaluation, assessment, design and the development of transport infrastructure (bicycle lanes, public transport lines, streets and highways). However transport planning has evolved and transport planners are required to have a multi skilled approach, since the has been a growing concern and importance of environmentalism. This basically means that transport planners must be able to persuade drivers or potential car owners to abandon or not to buy cars, but instead use public transport which could elevate congestion on roads. This shows that transport planning is no longer just about the tactical analysis but now also includes promoting sustainability.

Transport planning has various effects on roads and they can be negative or positive, aim of transport planners is to relieve the negative impact on roads, road users, economy and environment. The negative impacts on roads can be:

- Quality of Life - it is because of increased travel time between work and home, and decreased private time for family and leisure.
- Productivity - many productive hours are wasted as a result of increased travel times.
- Environmental Impact - the impact of the increase of vehicle emissions on the environment as a result of traffic congestion is obvious. Worldwide, great emphasis is placed on reducing environmentally unfriendly vehicle emissions, which are a contributor to global warming.
- Development potential - the inability of traffic to access certain areas (new developments) or the additional burden to the state to provide transport infrastructure as condition of approval, many of these developments are non-viable. As a result of this additional cost burden, businesses have and will continue to relocate and/or scale down their local operations.

1.1 Cost of travelling

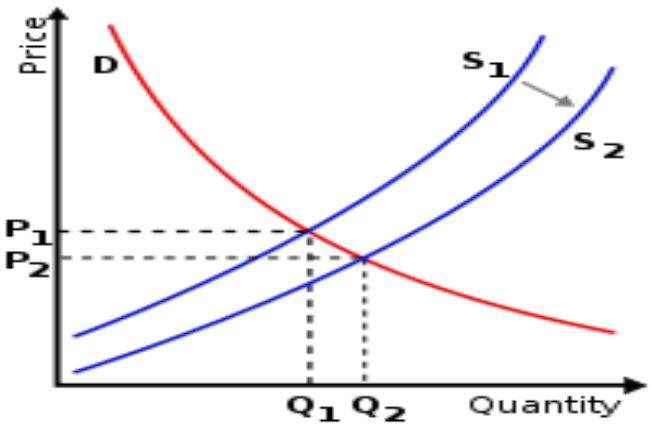
A journey on a road is considered to have a cost or a price which can be dived into two:

- the out-of -pocket cost(includes fuel costs and tolls), extended trip time and stop-go conditions increase fuel consumption, and vehicle wear and tear.
- the opportunity cost of the time spent travelling ,which is calculated by the product of travel time and the value of travellers' time(value of traveller's time is the amount that a traveller would be willing to pay in order to save time, or the amount they would accept as compensation for lost time).

Reducing the cost of a journey is usually used by transport planners as a justification to build a new road, so the cost of travelling can be reduced for road users.

A change in the cost (or price) of travel results in a change in the quantity consumed. This can be explained using the simple theory of supply and demand.

The theory of supply and demand simply explains that if S1(supply) shifts to S2,then the price(P) will drop from P1 to P2 and the quantity consumed(Q) will increase from Q1 to Q2, as illustrated in the picture no. 1 below. (Source: 1)



Pic no.1: Supply and demand (Source: 1)

This theory simply means that if more roads are built or capacity of roads is increased then the will be a reduction in the cost of travelling and therefore leading to less congestion on the roads.

1.2 Road capacity

The idea of increasing road capacity is to create more road space per vehicle travelling on the road than the was before, which transport planners hope will reduce congestion on the road. An example of road capacity being increased is in South Africa, between two major cities namely Johannesburg and Pretoria.

The N1 Freeway (also known as The Ben Schoeman Freeway) between Johannesburg and Pretoria is estimated to carry 157 000 cars per day and is the busiest road in South Africa, this is during peak traffic hours as shown on picture no. 2. The capacity of the N1 is being increased in order to accommodate the large number of cars travelling between Johannesburg and Pretoria. (Source: 2)

Pic no.2 : congestion between JHB and PTA (Source: 2)

These constructions are being made because it is estimated that traffic will increase by 7 % every year. Increasing of road capacity seems to be a short-term solution to induced traffic, but it has shown that in the long term it might not be a sufficient solution.

1.3 Induced travel demand

Induced demand is an idea or theory that after supply increases, then more of a good will be demanded or consumed. This is used by transport planners as a factor to build new roads or widen existing roads.

When new roads are built transport planners take into future traffic growth, but the traffic growth is only calculated from increase in car ownership and economic activity and they do not take into account traffic that may be induced by the building of new roads. (Source: 4)

1.3.1 Occurring of induced travel demand

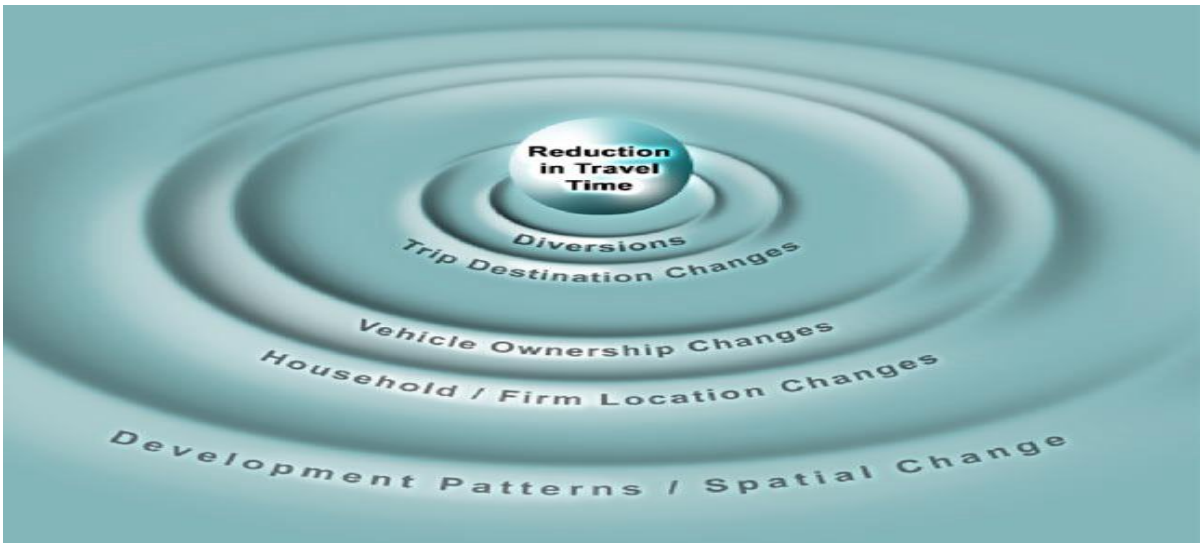
The discussion of induced travel up until now has been somewhat abstract, It has been defined and explained the concept of induced demand, and presented a broad theoretical justification for its existence as a real phenomenon, but we have said very little about the actual mechanisms that cause it.

Those mechanisms can be quite complex and tortuous; there are multiple "pathways" by which induced demand can occur, so much so that untangling them can require sophisticated data collection techniques, analytical skills and mathematical simulation models of transportation and urban systems.

In a strictly economic sense, the details of this analysis are arguably irrelevant; indeed, an economist might even argue that trying to untangle the sources of induced travel adds an unnecessary layer of complexity to the analysis of transport problems, that simply understanding the basic dynamics of supply and demand is sufficient to be able to diagnose and remedy the problem.

In practice, though, planners, engineers and increasingly, environmentalists not economists grapple on the front lines with questions about induced travel, so we must be able to frame the discussion in their terms. Planners and engineers, for example, tend to be the practitioners that use the modelling and forecasting tools (sometimes well, sometimes poorly) that could quantify induced travel demand if applied properly.

Induced travel is fundamentally about time, so time is a good conceptual entry point into this discussion, as shown in picture no. 3 below. Imagine that the transportation and land-use network is a pond, calm at equilibrium, and that a measure that reduces point-to-point travel time (like a new service, or a widened roadway) is dropped into this pond.



Pic no : 3 Induce travel demand (Source: 4)

That pebble is represented by the travel-time reduction in the centre of the diagram, it produces ripple effects that spread throughout the transportation and land-use "pond" over time. These ring waves spread out from the most immediate reactions to the pebble.

to the most diffuse and longest term: short-run diversions, changes in trip destinations, changes in selection of vehicles to own and use on a day to day basis, changes in the location choices of households and firms, and changes in the development patterns that real estate markets produce. To help organize the discussion, we distinguish these effects as direct and indirect, and instantaneous, short-run, and long-run effects. (Source: 3)

These distinctions are admittedly somewhat arbitrary, reasonable people can disagree about which effect falls in which category.

1.3.2 Characteristics of induced travel demand

The following are characteristics of induced travel demand:

- Induced travel demand at the metropolitan or major city level is concerned with travel as a whole, not trip-making per se - Induced travel does not necessarily result from people making more or more frequent trips. Rather the term refers to the overall amount of travel that is undertaken.

- The concept of induced travel applies to the entire transportation sector, not just one mode of transport - Improvement in air travel or public transport are just as capable of creating induced demand as improvements to road facilities. In public transport, increased ridership might be observed in response to travel time reduction achieved through more frequent or more direct services, as well as reduction in passenger fares and improvements in perceived comfort and safety.

  Travel can also be induced across modes. For example, extensions of commuter rail services into previously undeveloped areas may induce market demand for particularly low-density housing that necessitates car travel for discretionary (non-work) trips. Similarly, provision of high speed rail between two cities might increase the amount of car travel between them, because it increases economic or lifestyle interactions.

- Induced travel is not the only source of growth in the demand for travel - The notion that induced travel represents an increase in travel resulting from an improvement in transportation condition implies that there are increases in travel that do not result from improvements in transportation conditions.
- These increases in travel not resulting from improvements in transportation conditions are referred to as natural demand growth, in contrast to induced travel demand. It is critical both conceptually and practically, to distinguish between the two. There many factors that can cause demand for transport services to grow naturally, including changes in population, employment, income, socio-demographic and tastes.

1.3.3 Generated traffic

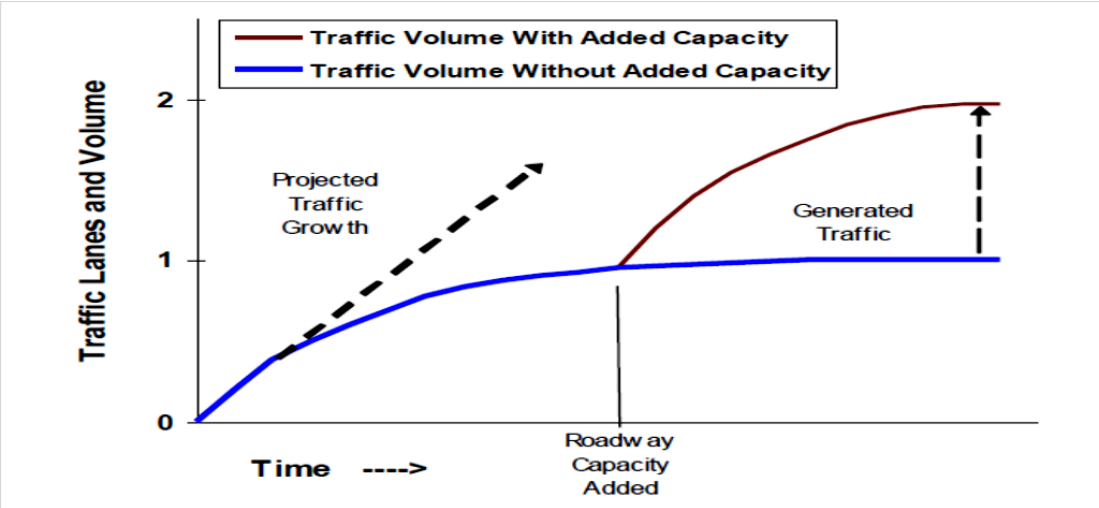
It is the additional vehicle travel that occurs from a road improvement. Congested roads cause road users to change trips that are not urgent, therefore choosing alternative routes and modes of transport. Generated traffic consists of:

- induced travel - means an increase in total kilometres travelled due to road improvement, which increase vehicle trip and distance but excludes travel shifted from other times and routes.
- diverted travel - which is a shift in time and route.

Even decisions taken by road users can generate traffic, for example:

- road users can decide to travel to closer destinations when roads are congested and travel further destinations when roads are less congested.
- Longer trips can be cost effective when the is no congestion, but not when congestion is heavy.
- People shift the mode of transport to avoid congestion on the roads.

The expansion of road capacity can reduce congestion but studies have shown that, the expansion of road capacity can generate traffic (congestion) as illustrated in the following picture no.4.



Pic no.4 : Generated traffic (Source: 3)

The graph simply shows how traffic grows when roads are uncongested but the growth rate declines as congestion develops, reaching an equilibrium (indicated by the curve becoming horizontal). If road capacity increases, traffic will grow until it reaches a new equilibrium. This additional peak period. (Source: 4)

Generated traffic can be considered from two perspectives Project planners are primarily concerned with the traffic generated on the expanded road segment, since this effects the project's reduction benefits. Secondly they are concerned with changes in total vehicle travel (induced travel) which affects overall benefits and costs.

Different types of generated traffic:

- Longer route: Improved roads attracts traffic from more direct routes.
- Shorter route: Improved roads allows drivers to use more direct routes.
- Time change: Reduced peak period congestion reduces the need to defer trips to off-peak periods.

1.3.4 Elasticity of travel demand

Perhaps the first recognition that the demand responded to internal factors was the assertion that congestion is self-regulating, implying an automatic balancing of supply and demand. More recently, the economist concept of demand being a relationship between price and quantity demanded has become accepted, if not necessarily applied in practice. From this perspective. all endogenous changes in volume are movement along the demand curve, whether they are called latent, induced, or something else. If "price" is generalized to include travel time, operating costs, and accidents, then changes in capacity and alignment alter the "price" thereby cause movements along the demand curve.

- Short run and long run elasticity's:

The short run can be any period of time over which something remains fixed. What is fixed might be the capacity of a highway, fuel efficiency of the vehicle fleet, locations of employment, or anything else that changes slowly. The long run is enough time for these characteristics to change. The run is typically assumed to be a year in transportation planning, but the dividing line depends upon the practical context.

1.3.5 Short-Run elasticity's

Demand "elasticity" is the responsiveness of quantity demanded to changes in price. Price is generalized for travel demand purposes to include travel time, operating costs, and accidents, as well as user charges. Everything included in this generalized price is an endogenous factor with respect to induced traffic.

An increase in capacity that lowers travel time, for example, results in additional travel if the elasticity is not zero. Short run demand elasticity tends to be lower (less elastic) than long run elasticity, because more opportunities to increase or reduce consumption can be developed over the long run than in the short run, while short run options do not diminish in the long run.

If the price of fuel goes up, for example, highway travellers can reduce fuel consumption by taking fewer trips and chaining trips together, by carpooling to share expanses, by driving in ways that achieve better mileage, and by taking larger share of trips on transit.

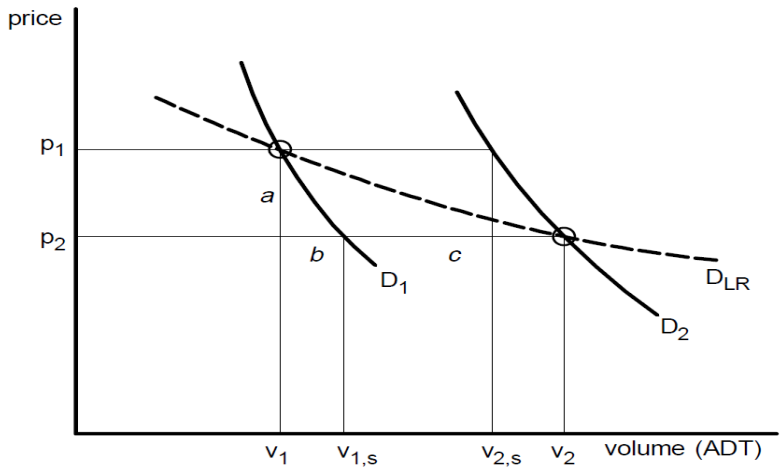
In the long run they also switch to more fuel-efficient vehicles, and change their workplace and residence location. If the price stays high, vehicle manufactures will develop and produce more fuel-efficient vehicles, and better transit service may be offered.

1.3.6 Long-Run elasticity's

While the distinction between short run and long run demand is really a continuum rather than two discrete states, the separation is useful in both conceptually and modelling purpose. In picture no. 5 below, two short run demand curves are shown in relation to their common long run demand curve (the latter indicated by a dashed line).

Demand could be for a facility, a corridor, or even travel in a region. At a "long run" price of p1 the volume is v1 and the short run demand curve D1 applies, such that changes in volume along this demand curve in the short run. If the price stays at the level for the long run, then the short run demand curve will shift outward to D2, resulting in the volume V2 at that price. If the price were to go back to P1, volume would only drop to V2, in the short run, but eventually back to V1 in the long. (Source: 5)

Picture no.5 shows a diagram of long and short run elasticity's.



Pic no.5 : Short and long run elasticity (Source: 4)

In picture no.5, no time direction is implied on the horizontal dimension; the shape of the long run demand curve does not mean that price declines over time. Nor are the short run demand curves necessarily ordered from one to two; demand could start at *D*2 and then shift to *D*1. The diagram shows only the relationship between price and volume under short run and long run conditions.

A similar distinction can be made between "induced traffic" (or induced travel) and "induced demand," by applying the short run and long run concepts: demand is assumed fixed in the short run, so changes in volumes are the result of movements along the demand curve, whereas the short run demand curve can shift in the long run.

Thus these terms are defined such that "induced traffic" is a movement along the *short run* demand curve, while "induced demand" is a movement along the *long run* demand curve, or an endogenous *shift* in the short run demand curve.

1.4 Transport forecasting

Forecasting is the process of estimating the number of people or vehicles that will use a specific transportation facility in the future. A forecast may estimate the number of vehicles on a planned road, bridge, the ridership on a railway line, the number of passengers visiting an airport, or the number of ships calling a seaport.

Traffic forecasting starts with the collection of data on current traffic. The traffic data is then combined other known data such as population, employment rate, trip rates, travel costs to develop a traffic demand model for the current situation, Feeding it with predicted data from population, employment results in estimates of future traffic, typically estimated for each segment of the transportation infrastructure.

Traffic forecasts are used for several purposes in transportation policy, planning and engineering to calculate the capacity of infrastructure e.g., how many lanes a bridge should have, to estimate the financial and social viability of projects.

Four step model of urban transportation planning system model are:

- Trip generation - determines the frequency of origins of trips in each zone by trip purpose, as a function land use and household demographics, and socio-economic factors.
- Trip distribution - matches origins with destinations, often using a gravity model function, equivalent to an entropy maximizing model.
- Mode choice - computes the proportion of trips between each origin and destination that use a particular transportation mode.
- Route assignment - allocates trips between an origin and destination by a particular mode to a route. Often for highway route assignment.

Accurate traffic forecasting are critical to arriving at the right capacity for transport infrastructure that, is for building infrastructure that is neither to large or too small to meet the demands over a given period.

Accurate traffic forecasting is also critical to obtaining valid results from:

- Cost-benefit analysis - a systematic process for calculating benefits and costs of a project, its purpose is to determine if it's a sound investment and to provide a basis for comparing projects.
- Environmental impact aspect assessment - an assessment of the possible positive or negative impact that a proposed project may have on the environment.
- Social impact assessment - a method to review the social effects of infrastructure projects and other development interventions.

The above are typically used to form basis for decisions on whether to build new transportation infrastructure or not. Research has illustrated that a large number of forecasts are in accurate, in particular to road transport were road projects are overestimated.

2 CAUSES OF INDUCED DEMAND

As explained earlier in the previous topic induced demand is an idea or theory that after supply increases, then more of a good will be demanded or consumed. This is used by transport planners as a factor to build new roads or widen existing roads.

Now the thesis will elaborate more on induced demand and what are its causes, inverse effects and how it could be avoided.

2.1 Diverted travel

Diverted travel is caused by an increase in traffic on a rote that a road user usually uses on a daily basis, because of the increase in traffic road users may seek alternate routes which may be longer distance. The alternate routes may offer short term solutions to road users, in the long run using them will increase the time spent on the road and cost of travel. Eventually road users will or might return to the more direct route even though they are high volumes of traffic.

A prime example of this is the route I have chosen between JHB and PTA, the N1 is a more direct route between these two cities. In low traffic time it approximately takes 55mins from JHB to PTA but in high traffic times it takes almost 2 hours. The distance between JHB and PTA is 68,5 Km

The alternate routes which are not highways, it takes 1hour 30mins in low traffic times meaning that in high traffic times the alternate routes take even longer because of high number of road users whether be it private car owners or public transport users trying to avoid the N1. The distance between JHB and PTA is 62,2 km - 70.6 km depending on which alternate route is taken

Picture no.6 shows the route between JHB and PTA using the N1 which is the direct route and picture no.7 shows the alternate routes between JHB and Pretoria. Both pictures show the routes during high traffic time.

Picture no.6 :N1 route between JHB and PTA(source:14 edited by author)

On the above picture no. 6 illustrates the more direct route between JHB and PTA. The route is highlighted in blue and the areas that are in maroon, are the areas with high volumes of traffic.

Picture no.7 :Alternate route between JHB and PTA (source:14 edited by author)

Picture no. 7 illustrates the alternate route between JHB and PTA, as in the previous picture the route is highlighted in blue and the area highlighted in maroon, are the areas affected most by a high volume of traffic.

They are also inverse effects to induced demand which is called reduced demand. Reduced demand is caused by reducing road capacity which also increases the cost of travel, meaning that demand is reduced.

So the closure of a road or reduction in it's capacity(e.g. reducing the number of lanes available) will result in behavioural changes in road users in order to compensate, for example condense multiple trips into one retime their trips to a less congested time, or switch to public transport.

2.2 Changes in income and car ownership

The traffic growth caused by the increase in income and car ownership, can be attributed to many factors.

- Lack of quality(comfortable) public transport - The state of public transport in South Africa is not the greatest and often than not people do not feel comfortable. The minibus taxis which are the most used form of public transport, some of them are not up to standard and do not deserve to transport people, which forces people to buy cars rather than use public transport on a daily basis.
- Safety of public transport - Safety is a serious issue in public transport around the world and in South Africa, Because of the high number of accidents that are either caused by taxis or that involve taxis and other cars on South African roads. People do not feel safe and are not in control of the situation and so they chose to buy cars, where they will be in control of their own safety.

  Safety in public transport also applies to trains where a lot of crime takes place e.g. pick pocketing inside the train, a lack of visible security at train station and in trains discourages people to use trains and forces them to either buy a car or use another form of public transport.
- Congestion in public transport - This factor can be divided into two:

  1. People buy new cars assuming that they will be not stuck in traffic in traffic for a long period of time, because they think now that traffic can be avoided by taking different routes which in many cases are longer routes to their destination.

  It is not true, by them taking longer routes it increases the cost of travel and they quickly realize that even though the more direct route is more congested, it is better to save money than have high costs of travel.

2. In South Africa the is a large number of people that rely on public transport approximately 68 % of the population uses taxis on a everyday basis. This means that on a daily basis especially in the major cities travellers have to wait in long queues for a long period of time, just to be picked by a taxi and end up being stuck in traffic due to congestion.

- Better jobs - With better jobs comes better income and when this happens people buy cars with their increased income.

- Flexibility - Owning a car means that the car owners can choose when they want to go, where they want to go. This means that they do not have to necessarily conform to a time-table like people who uses buses. Car owners can travel as far as they want to because they are no areas that are restricted to them.

2.3 Changes in the place of work and residence

This factor is caused by:

- Companies changing location because of different things affecting the market - the company changing locations, this could me that for some employees they have to change their time of travel, the route of travelling and in some other case even change the form of transport.
- People buying houses in suburban areas - this because of people trying to get closer to they are work place.
- Job sprawl - It is defined as low-density, geographically spread-out patterns of employment, where the majority of jobs in a given in a particular city are located outside the CBD, and increasingly in the suburban periphery.

Many companies desire to locate in low-density areas that are often more affordable and offer potential for expansion.
This means that because jobs are not in areas that are easily accessible by public transport, people are forced to move closer their work place.

A term called spatial mismatch is a contributing factor to people changing their work of place or residence. Spatial mismatch is defined as a situation where poor, urban predominantly minority.
citizens are left without easy access to entry-level jobs. As a result of increasing job sprawl and limited transportation options to facilitate a reverse commute to the areas they reside.

Urban sprawl and spatial mismatch make it almost impossible for people to rely on public transport to make reverse commutes between work and their place of residence, because these two place are placed so far apart.

People are faced with a conundrum of choosing whether to move closer to work and keep relying on public transport or stay where they currently live, and just buy a car.

2.4 Changes in mode of transport

People change the mode of transport due to different reasons such as safety, reliability and comfort. In South Africa when changing a mode of transport, it is usually from public transport (e.g. train, taxis) to buying private cars. This will obviously cause induced traffic because of the high number of cars on the roads.
Other factors that may make people change the mode of transport they use on a daily basis:

- Time loss
- Price fluctuations
- Poor customer service
- Rush hour inconvenience
- Delays and unreliability

The reason for this is because of a lack of comfortability, safety, and the time lost while waiting for a train or taxi to come. It seems much easier to just get a private car and be able to move freely and make multiple trips to different destinations.

The is an inverse for this, where on rare occasions people decide to changing from private transport to using public transport. In many European countries it is very easy to change from private to public, because of the following few examples:

- Multitasking - When driving a person has to focus on the road at all times, for your safety and others using the road. When using a bus or train for an hour, a person can get to other tasks such reading, start doing their even before they get to work or simply reply to emails.
- Reliability - Public transportation generally follows fairly reliable schedules and timings, while there's no flexibility up front if you're in a hurry (they don't wait for you), you have some predictability around when you will reach your destination. With driving, you don't have that luxury.
- Cheaper - Despite their tendency to get delayed at times, in the majority of instances, your journey from A to B will be quick and often direct.
- No parking - One of the most frustrating things about driving a car or motorbike is the hunt for a parking space once you arrive at your destination. Parking is often scarce, and usually expensive. The bonus of getting on public transport is being able to step out of a bus or train and not be worried about looking for parking space. Parking can often add extra time to your driving journey.
- Insurance Costs - If you have a long commute to work or do a lot of daily driving, you could be paying more for insurance. You might be able to save on car insurance by taking public transportation and driving significantly less.

In RSA it is not common for people to switch from private transport to public transport, because of lack of quality in the public transport sector.

Another factor that does not encourage people in South Africa to switch from private transport to public transport, is the inaccessibility of trains meaning that on average they have to walk on average 20 - 30 minutes to the train station.

Bus and taxi services can be found 15 - 25 minutes from people's homes on average.

2.5 Change in the number of trips taken

This is brought on by the flexibility that comes with a private car, either multiple trips can be made, or one single trip. When people use public transport they usually make one trip in order to avoid high costs, but with car owners they can afford to make multiple trips without incurring significant costs.

2.6 Shifts in departure time

When road users realize that the normal routes they use are highly congested, even the alternate routes start to get congested, road users often look to change the departure time either to an earlier time or later departure time in order to avoid traffic. Then road users have similar behavioural tendencies it does not make a huge difference.

Shifts in departure time is only a temporary solution but in the long term, congestion on the road will continue, as mentioned above because of similar behavioural tendencies amongst road users.

Road improvements can cause shifts in departure, because of road users trying to avoid lengthier congestion on the roads.

2.7 Trips generated by new development

Increasing of road capacity attracts road users to the improved road corridor, the new road users that will be using the improved road corridor, add on to the high number of vehicles that were using that road even before the improvements.

The improvement of roads does not reduce traffic but only manages to attract new road users, which then increases congestion on roads.

The newly improved corridor also generates high number multiple trips from the old road users that have been using the road before the improvement, and the new road users that start using the road after the improvement.

2.8 Parking

Parking is closely tied to car travel, increasing parking supply is one of the most efficient ways to encourage driving and induce demand for road space. Free and increased parking capacity on residential roads encourages motorists use private cars, thus leading to them parking for long period of time.

Increasing availability of parking space also contributes to congestion in residential roads or areas, because motorists will be encourage to drive around looking for parking space but if they were no parking spaces available or even charges on parking. People would seek other means to move from point A to B.

Parking chargers are implemented to deter traffic or revenue generation by local or national government. These chargers are implemented differently depending on the objective, as a parking management strategy, prices for the most convenient parking spaces (such as on-street spaces in commercial areas) should encourage turnover, with lower prices or no priced parking at other locations.

As a congestion pricing strategy, to address local traffic and parking problems, rates should be higher during peak periods, and the rate structure should be applied consistently throughout the area (such as a commercial centre). As a regional strategy, to reduce congestion problems and pollution emission, pricing should be applied throughout a region to avoid simply shifting travel from one location to another, and coordinated with other strategies that encourage use of alternative modes.

If implemented for revenue generation, parking prices should be set as high as the market will bear, and competition (such as nearby free parking) should be minimized.

Methods can be implemented to encourage parking:

- Pass - parkers purchase and display a pass, it is common for leased parking.
- Single-space meters - parkers prepay a mechanical electronic meter located at each space.
- Pay box - parkers prepay into a box with a slot for each space.
- Pay and display meter - parkers prepay a meter, which prints a ticket that is displayed in their vehicle window.

- Electronic pay-per-space - parkers prepay an electronic meter.
- In vehicle meter - parkers prepay to use a small electronic meter displayed in the vehicle when it is parked, that counts down minutes.
- Attendant - parkes pay an attendant when entering or leaving a parking space
- Automated controlled access system - parkers pay a machine when entering or leaving a parking space.
- Valet - parkers pay an attendant who parks their car.
- Automatic vehicle identification - system automatically records vehicles entering and leaving a parking area and can bill for use.

2.2 Reducing induced demand

Induced traffic can be avoided if the generalised cost of travel does not decrease when new road capacity is added, it can be achieved by implementing measures to either discourage people from buying private cars or stop using cars and move to using public transport.

2.2.1 Road pricing

Direct charges levied for the use of roads, including road tolls, distance or time based fees. Meaning that the user pays for the journey time reduction.

Currently in South Africa a system to charge road users is being introduced, the ORT or free flow tolling is the collection of tolls on toll roads without the use of toll booths. Whereby an electronic toll system is used.

The major advantage of ORT is that users are able to drive through toll plaza's without stopping or slowing down to pay the toll, ORT may also reduce congestion at the toll plaza by allowing more vehicles per hour/per lane.

A disadvantages of ORT is that road users who do not pay may either be written off as an expense by the toll operator or offset in part or as a whole by fees and fines collected by the violator.

Other options of road pricing that can be explored are:

- High-Occupancy Toll (HOT) Lanes – This system features lanes which are free for users in high occupancy vehicles (HOV), but also allows drivers of single-occupant vehicles to use the system upon paying a toll.

The system provides economic incentive for drivers to carpool and offers single-occupant vehicle drivers the flexibility of high level-of-service lanes when they require it.

- Vehicle-Miles-Travelled (VMT) Charges – Users are charged a fee based on how far they drive their vehicles on the roadway.
- Weight-Distance Taxes – Users are charged a fee based on how far they travel and the weight of their vehicle. This would be most beneficially applied to the freight industry.
- Smog Fees – Users are charged based on the number of travelled miles and the pollution their vehicle creates per kilometer.

These options show increasing sophistication, but also require greater implementation technology as one moves down the list. VMT charges would discourage all roadway use, which could simultaneously reduce congestion and pollution, making it ideal to more congested areas.

Smog fees, which would be most difficult to implement, would also encourage users to shift to more fuel-efficient vehicles, while not necessarily requiring a decrease in vehicle-miles travelled. Thus, smog fees may be better-suited to less-congested areas, where only reduction in pollution is desired.

2.2.2 Increasing parking charges

Parking pricing refers to direct charges for using a parking space. Efficient parking pricing can provide numerous benefits including increased turnover and therefore improved user convenience, parking facility cost saving, reduce traffic.

This includes on the street (curb) parking, parking lots at campuses and building, and commercial parking (parking provided for profit).

Price parking also has different variations like:

- Unbundling - Parking is rented separately from building space, meaning that instead of paying a fixed amount for an apartment that includes a parking spaces. Occupants can pay a certain amount for the apartment and another different amount for the parking space that they will use.
- Cash out - Commuters who are offered a subsidized parking space have the option of choosing its cash value.
- Residential parking - Residents can purchase a pass which will allow them to park on residential streets. Pass prices can be high enough to generate a profit.

Park pricing can cause various transportation system when it is increased, changes such as:

- Reduced vehicle ownership (particularly pricing residential parking).
- Mode shifts (from driving to cycling, walking, ridesharing and public transit).
- Destination shifts (to areas with cheaper parking).
- Parking location changes (areas with free parking).
- trip schedule changes (from priced to unpriced periods).
- Shorter stop duration.

The benefits of increasing parking pricing depend on the scale of implementation. Implemented at a local level the benefits will obviously be locally, but if implemented throughout the whole province it can reduce congestion significantly, energy consumption and accidents.

Parking pricing can reduce traffic congestion, by reducing traffic caused by motorists cruising for unoccupied parking space and by shifting travel to alternative modes, particularly if implemented throughout a urban area.

2.2.3 HOV lanes

Restricted lanes used by vehicles with 2 or more people occupying a car, including carpool and transit buses. Travelling cost for those that HOV lanes decrease, thus encouraging others to use them.

HOV lanes are created to increase higher average vehicle occupancy with the goal of reducing traffic congestion. HOV lanes provide better use of road infrastructure, a typical highway lane

in RSA can carry 1 500 - 2 200 vehicles per hour, but a lane full of buses and carpools moves many more people than a general traffic.

Even though HOV lanes are primarily used during peak rush hour traffic periods,providing carpoolers and transit users with a reliable trip time at all hours of the day and allowing them to avoid periodic congestion and save time.

HOV lanes in South Africa were first introduced in the year 2006 on the Ben Schoeman Freeway between JHB and PTA, as a pilot project to test its effectiveness on RSA roads and how people respond to the addition of HOV lanes.

Even though in RSA HOV lanes were not as effective as in other countries such the USA, Canada, New Zealand and Australia.

2.2.4 Reversible lanes

Is a lane in which traffic may travel in either direction, depending on certain conditions. Typically, it is meant to improve traffic flow during rush hours, by having overhead traffic lights and lighted street signs notify drivers which lanes are open or closed to driving or turning.

Where certain sections of highway operate in the opposite direction on different times of the days of the week, to match asymmetric demand. This may be controlled by Variable-message signs or by movable physical separation.

Reversible lanes are primarily used during peak hour traffic, they are measure implemented to establish a physical separation between allowed and disallowed lanes of travel.

The measures used to divert traffic from a reversible lane:

- Concrete barriers.
- Retractable cones.
- Bollards that are built on the road.
- Retractable fences which can divert traffic from a reversible lane.

2.2.5 Increasing cost of travel

Increasing fuel prices or by simply increasing car registration cost, in an effort to disancourage potential car owners from buying cars.
Many taxes are implemented in different countries to somehow combat congestion on the roads, taxes such as:

- Congestion Pricing - a system of surcharging users of public goods that are subject to congestion through excess demand such as higher peak charges for use of bus services, electricity, metros, railways, telephones, and road pricing to reduce traffic congestion. This pricing strategy regulates demand, making it possible to manage congestion without increasing supply.

  Market economics theory, which encompasses the congestion pricing concept, postulates that users will be forced to pay for the negative externalities they create, making them conscious of the costs they impose upon each other when consuming during the peak demand, and more aware of their impact on the environment.

- Fuel tax - A fuel tax (also known as a petrol, gas tax, or as a fuel duty) is a tax imposed on the sale of fuel. In most countries the fuel tax is imposed on fuels which are intended for transportation. Fuels used to power agricultural vehicles, and/or home heating oil which is similar to diesel are taxed at a different, usually lower rate.

  The fuel tax receipts are often dedicated to transportation projects so that the fuel tax is considered by many as user free . In other countries, the fuel tax is a source of general revenue. Sometime, the fuel tax is used as an ecotax ,to promote ecological sustainability.

- VMT tax - tax is a policy of taxing motorists based on how many miles they have travelled. Instead of using a tax on fuel consumption as a way of financing road infrastructure, a VMT tax would charge motorists based on their road usage measured in mileage.

  A VMT charge is implemented using GPS units on board a vehicle to record distance, assign it to the appropriate taxing jurisdiction, and calculate the amount owed. Only the

final billing information would be released outside the unit, to protect privacy.VMT charges could differentiate the charges based on vehicle class, when they drive, where they drive, and the type road surface they drive on.

- Road pricing - are charges levied for the use of roads, including road tolls, distance or time based fees congestion charges and charges designed to discourage use of certain classes of vehicle, fuel sources or more polluting vehicles.

  These charges may be used primarily for revenue generation, usually for road infrastructure financing, or as a transportation demand tool to reduce peak hour travel and the associated traffic congestion or other social and environmental negative externalities associated with road travel such as air pollution, green house gas emissions, visual intrusion, noise and road accidents.

3 Possible solutions to induced traffic

The ITMP25 proposes a radical paradigm shift in spatial and transport planning. It's a point of departure from apartheid spatial planning, land use and mobility patterns, and ushers in an innovative way of structuring our future societal development.

Additionally the plan sets out a "strategic framework" to better the lives of residents, stimulate economic growth and render the province as an attractive destination for investment and tourism.

The 25 year plan, developed by an inter-disciplinary team of experts led by Gautrain CEO Jack van der Merwe, provides an assessment of the current transport and land-use challenges. It also forecasts economic and population growth scenarios, which have been used to plan the future transport needs and solutions in the province.

The ITMP25 predicts that Gauteng's population will increase from the current 12.3 million residents to 18.7 million and its working population will grow to 8.6 million, thereby increasing the passenger trips to approximately 25 million per day. This will result in serious traffic congestion.

To facilitate the implementation of the ITMP25, eight mutually supportive "strategic interventions" have been identified. These interventions are arranged into the following four clusters with its associated interventions:

- Land Use Development

Subsidised housing provision within urban core areas, and land use densification in support of public transport.

- Strategic Public Transport Network

Mainstreaming non-motorised transport (NMT) and reinforcing passenger rail network as the backbone of the system. Extending the integrated rapid and road-based public transport networks.

- Road Transport

Travel demand management, and continued provincial wide mobility.

Emphasis is being put that as the provincial public transport system is expanded residents should adopt a shift in transport modes from motorised to non-motorised trips; private to public transport, and from road to rail.

Given the prospect of the population growing to 18.7 million and a sharp increase in the use of privately-owned cars, residents of Gauteng would live through the nightmarish scenario of unparalleled traffic gridlocks.

The ITMP25 therefore prioritised public transport with the rail system being the backbone of the network. This will enable a shift from private vehicles to public and non-motorised transport that will reduce congestion, enhance efficiency and promote sustainability. This means planning for the transport of people and considering person trips as opposed to vehicle trips.

The modelled forecasts indicate that the cost of "doing nothing" will be severe and increasingly impact on the built and natural environment; the sustainability of the Gauteng Global City Region's economy, and the quality of life of all its residents.

By continuing with the existing trends and not intervening in the present urban structure and the manner in which land is developed; not changing people's travel patterns and choices, and not investing in more friendly technologies, Gauteng would increasingly become a far less pleasant and unhealthy urban area to live in.

The strengthening of freight rail and the movement of long-haul freight from road to rail is a key departure point, which includes the focus on the development of major rail-based freight logistic hubs located on the periphery of the core urban areas.

The ITMP25 also includes references to aviation and cross-cutting transport system elements such as Intelligent Transport Systems (ITS), Geographic Information Systems (GIS); sustainable ("green") transport, and the construction of new freeways.

Possible longer-term funding options and institutional arrangements to successfully deliver on the proposed plan were also developed. It proposes the establishment of a province-wide transport authority and a fourfold increase in funding for transport infrastructure over the period.

Implementing the eight strategic interventions and other recommendations proposed by the ITMP25 would work towards achieving an integrated and efficient transport system that promotes sustainable economic growth, skills development and job creation; fosters quality of life; socially includes all communities, and preserves the environment. (Source: 17)

3.1 Reliable Railway, Bus and Taxi Transport Network

The economical prosperity of any country lies in ability to integrate its public transport. An affordable public transport network is the heartbeat of any civilized country around the world. A country’s success heavily relies in its willingness to integrate public transport. Integrated transport networks cater to the ever growing demand of a perfectly integrated transport structure.

As RSA is one of the fast emerging countries in Africa and its most developed country, it is in the country’s best interest to have a well structured integrated transport network infrastructure in place, with a sophisticated, reliable, secure, integrated and an affordable form of public transport. South African roads have increasingly became more deadly to both pedestrians and road users alike due to the high dominance of the minibus taxi's increased recklessness on our roads.

The South African government has over the years been battling and continues to do in trying to regulate and manage the use of minibus taxis. Often their intervention is met with violence, this thesis presents a questions-answers approach and diagnosis needed in implementing RRRBTTN in order to finally resolve this continuous long existing strife that the RSA government had been experiencing whenever they wanted to completely get rid of the use of minibuses.

This proposed new network will introduce factors that define a reliable, integrated public transport network which incorporates buses, rail and minibus taxis with emphasis on rail and bus as a preferred mode of transport. Its successful implementation can be able to finally put to rest these conflicts and subsequent decreases minibus taxis usage and deaths on our roads. This will allow both private and public operators to still be able to economically benefit from its successful implementation.

A remodeled integrated, cost effective, reliable, people oriented, and timely transport network and RRRBTTN is a solution to fixing these current transport network challenges. JHB has a population of over twelve million people which are living and working in and around the JHB metropolitan area. A good and reliable transport network is what all four major cities: PTA, JHB, DBN and CT needs in order to address the challenges identified, such as congestion and lack of transport facilities in some areas.

RRRBTTN is a timely people-oriented and integrated transport network which incorporates rail, bus and taxi with emphasis in rail and bus to be able to give South African people a seamless inter-connected mode of transport which comprises of the following:

- The Network is to be people cantered instead of profit driven; profits will still be made as satisfied customers will be regular customers.
- The Network is to have a centralized control station that will monitor traffic in all four modes of transport, to enforce its reliability and effectiveness.
- Interconnections of the network in the frequency of every ten minutes during peak hours and fifteen to twenty minutes during off-peak hours, this is to intensify and enforce smoothness of the network.
- The Network to be affordable, centralized, secure and safe for the users. This will enforce network's robustness and its usability.

The objective of the RRRBTTN is to shift the over sixty percent of passengers from minibus to rail and bus transportation as preferred mode of transport.

Another objective of this network proposal is to re-design the current PT by first identifying the problems associated with it. Transport network that can actually address these adversities with a more passenger-oriented design approach, to maximizing railway transport usage.

3.2 Suggestions to relieve induced traffic

Induced traffic has been a problem in transport planning for a long time and it effects everyone who uses transport, especially road transport as form of travel every day. This is a problem that keeps growing due to the continues growth in the number of people who use transport infrastructures such as roads, and the growth of people buying private cars, growth of public transport users.

This problem can be solved by improving other forms of transport such as rail transport and buses can elevate congestion on roads and possibly decrease the number of people buying or currently using private cars . Improvements that can be made are:

- reliability
- safety
- comfort
- price

Other solutions that can be implemented and have been proven to work in other countries around the world:

- Provide exclusive lanes for public transport

Exclusive public transport lanes means the lane on which the bus or streetcar runs is not open to private vehicle traffic. Exclusive lanes enable buses and trams to avoid congestion helping increase their speed, reliability and attractiveness. Unfortunately, exclusive lanes are often controversial since they ‘take’ space that could otherwise be used by private vehicles.

Exclusive lanes come in many shapes and sizes, for example:

- Taxicabs are allowed to use exclusive lanes in some cities (e.g. Vienna, San Francisco. Paris).

- Bicycles are often allowed to use exclusive lanes.
- Exclusive lanes as illustrared in picture no. 8 can be time-based, in other words exclusive during certain times (peak periods) and reverting to mixed-flow or parking lanes at other times.

Pic no.8 :Exclusive bus lanes (Source no.13)

The method of separating exclusive lanes from other traffic is an important factor in determining their effectiveness. Simply put, the better the separation – the more effective. Painted lanes are least effective and lanes separated by barriers or on their own right of way are best.

Building a separate right of way (for example, a bus way) is a costly improvement but can be worthwhile especially if it serves as the catalyst for implementing other transit priority improvements. Furthermore, even given their high cost, these improvements can be less expensive than building new heavy rail public transport systems. The most effective purpose built exclusive guide ways are designed to serve several different public transport routes (for example, a bus tunnel in a downtown area). (Source: 13)

- Use regulations and traffic engineering to control traffic

Traffic regulations can be used to reduce congestion impacts on public transport. This means adding traffic restrictions that help public transport and removing traffic restrictions that hurt public transport. Examples of traffic regulations include:

- Parking Restrictions - one main cause of delays to transit vehicles is waiting while private vehicles maneuver in and out of parking spaces. Parking restrictions and

controls can be implemented to reduce the impact of parking movements on transit vehicles and to provide space needed for exclusive transit lanes.

- Turn Restrictions - turning vehicles are another significant source of delay for transit vehicles. Implementing turn restrictions carefully can significantly reduce these delays.

- Transit Exemption from Turning Requirements – in some cases, restrictions to turning movements can lengthen and delay transit routes. In these cases, it can be beneficial to exempt transit from the turning movement restriction.

- Loading Restrictions - historically, vehicle loading on public streets has been a problem in cities throughout history. In ancient Rome, goods delivery was banned during the day because of congestion. Careful design of loading areas can improve transit priority by reducing interference with transit vehicles.

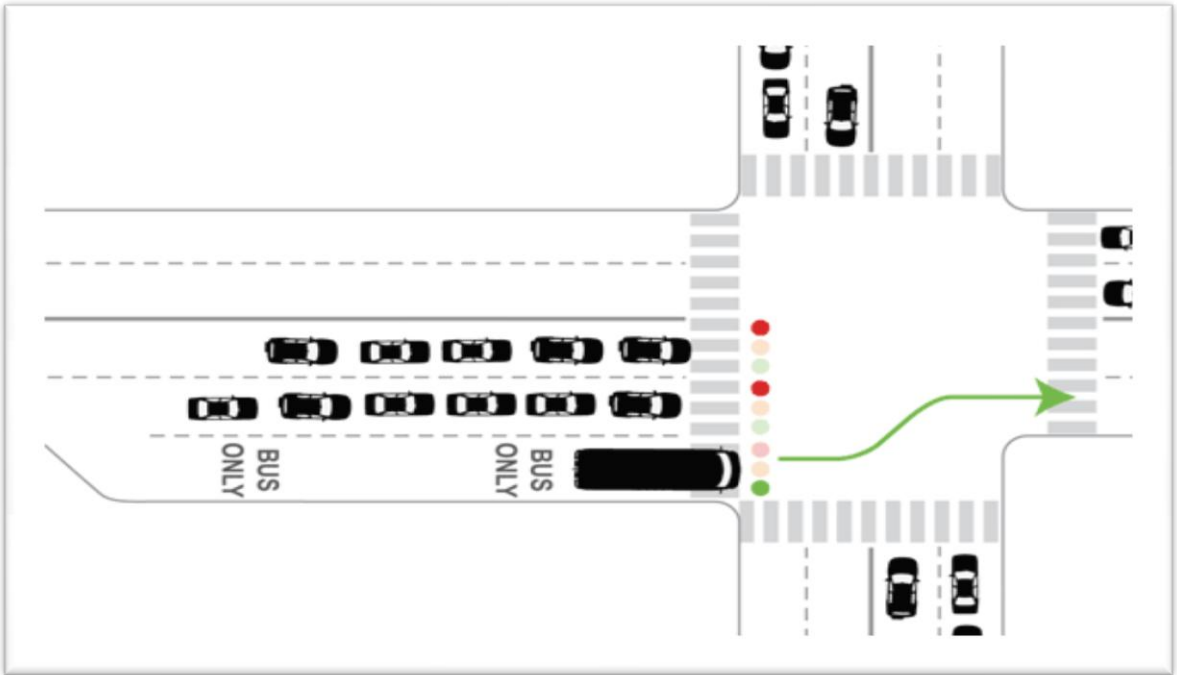
- It's important to note that traffic regulations (e.g. removing parking) can be controversial. This means that they should be developed and implemented with public input, and that they need to be designed to minimize unnecessary negative impacts. One effective method is including traffic regulations as part of a comprehensive program designed to improve neighbourhood liveability.

Use innovative ideas to reduce traffic impacts on public transport:

- Clever Application of Existing Technology

There are many opportunities to use clever traffic engineering to reduce the impacts of traffic on public transportation. Often these combine traffic signals with short sections of exclusive public transport lanes. Two common examples are:

- Queue bypasses - are short sections of exclusive roadway located near an intersection that enable transit vehicles to bypass congestion at the intersection.
- Queue jumps - are queue bypass physical improvements with the addition of change in traffic signal timing that enables transit vehicles to start ahead of private vehicles essentially jumping ahead of them,as shown in picture no. 8 (Source: 13)



Pic no.9. :Queue jumps (Source: 13)

Implementing these types of measures involves careful analysis of specific local conditions. Again the best way to do this is as part of developing a comprehensive plan for making a street more liveable.

- New Technology

New technologies are being developed that could reduce the impact of traffic congestion on public transport. Some specific examples include:

- Real time public transport lanes are lanes that use real time traffic control devices (for example, changeable message signs) to clear street lanes for public transport vehicles exactly when the public transport vehicles are present; when public transport vehicles are not present the lanes are free for use by any traffic.

The 25-year IMTP will contain a full implementation strategy for the transformation of the transport system in JHB and the Gauteng province as a whole over the next 25 years. However, given the current state of transport in JHB, this thesis proposes a number of key initiatives and projects that should be considered for implementation in immediate future. It consists of 11 types of initiatives and key focus areas, in the below table no. 1:

table no.1 : Initiatives and key focus areas

Initiatives and key focus areas	
1	Transport Authority for Gauteng
2	Provincial-wide Public Transport Information centre
3	Integrated Fare/Ticket Management System
4	Integration with commuter Rail Corridor Modernization Project
5	Transformation of the Taxi Industry
6	Travel Demand Management, Less Congestion and Shorter travel times
7	Access to Major Freight nodes
8	Pedestrian paths and Cycle ways
9	Continued provincial wide mobility
10	Effective Management of Existing transport Infrastructure
11	Regulations and Enforcement

(source: author)

In this thesis I discuss the above-mentioned key short term initiatives in detail.

1. Transport Authority for Gauteng

In contrast to other cities in South Africa, Gauteng City Region is unique in the sense that it spreads across a significant portion of the province. Whereas eThekwini and Cape Town are comprised of one central metropolis surrounded by smaller urban areas, Gauteng consists of three metropolitan municipalities and multiple district and local municipalities ranging from urban to high density in nature. Each of the municipalities is at different levels of transport planning and implementation, resulting in fragmented and uncoordinated service delivery.

The transport challenges that Gauteng is facing can be ascribed to the lack of cross municipal boundary integration of public transport services. Improved public transport accessibility, affordability, consistency and safety is required to give effect to redressing apartheid spatial planning; allowing economic growth; and reducing economic and social opportunity cost for communities to access economic opportunities.

2. Provincial-wide Public Transport Information centre

The potential for collecting and integrating passenger travel information has always existed, but never realized because complex surveys were necessary to record this data. However, this problem has been resolved with the advent of Integrated Fare Management and, in particular, the requirement for fare collection systems to comply with National Regulations through the of use bank issued fare media.

Many such electronic fare collection systems calculate and deduct a passenger's public transport fare through a tap-on tap-off process. With the aid of vehicle satellite tracking systems this data translates into information on passenger travel patterns and volumes.

A central data warehouse is required to be established in order to collect and collate this passenger travel data from different operators. The data can then be analyzed to produce passenger travel information and real-time data for schedule information systems at stations and on-board busses.

The advent of fast, reliable and affordable wireless/Internet communication has made it possible for travel information to be disseminated timeously and reliably via, web sites and electronic signs and mobile phone (short-message-service or social media).

The core of this initiative is the setting up of a Provincial Passenger Information Call Centre, which could assist public transport passengers with service information. It may even go to the extent of providing "real time" information.

The Call Centre should be linked to a back office, which is linked to various information sources; manages an extensive transport data basis; and possesses efficient reporting capacity. It should also have the ability to disseminate information on a "real time" and "historic" basis.

It should accommodate the national data structure and data collected through and integrated public transport ticketing system. The “historic” information should not only be available for passenger information and communication purposes, but also for tactical and operational planning of services, as well as the management of operations.

3. Integrated Fare/Ticket Management System

The objective of Integrated Fare Management (IFM) is to make it possible for seamless travel and transfer across an entire journey using a single fare media (and possibly a single fare) for different operators and modes of transportation. Furthermore, it is to promote an integrated fare collection system that will improve the transit experience and convenience for commuters.

The IFM approach is to make public transportation systems more efficient by reducing the need for cash and cash management, and improving boarding times, which in turn reduces delays leading to better schedule adherence. IFM relates to multiple operators (and multiple modes such as bus, rail, taxi) who deploy and accept the same fare collection mechanism for public transport services within a defined region.

This type of system allows customers to travel throughout the region in a seamless manner. At a minimum, the use of a common fare media permits commuters to load individual Transit Products (e-Tickets or passes) from multiple operators as well as e-Money (electronic cash for fare payment) onto a single card.

IFM not only facilitates an efficient public transport service, but also supports the secure storage of fare transactions to provide information on public transport operations and commuter travel patterns. This facilitates the better planning of routes and integrated schedules and provides operators with the intelligence and insight they need to visualize trends in usage, enabling them to optimize the use of the assets and networks.

Successful IFM involves coordination and cooperation among stakeholders to ensure that formal institutional arrangements are understood and are in place. This will ensure the effective management and transformation of transport related institutions, systems and

processes. The vision for IFM in JHB and the rest of Gauteng should maximize the accessibility and convenience of public transport, while also offering value for money.

4. Integration with commuter Rail Corridor Modernization Project

Commuter rail services have reached a state where the role that this mode is able to play and to contribute towards transport is diminishing. This is as a result of the reported underinvestment
in the commuter rail system. As the commuter rail network is viewed in terms of stated government policy as the "back-bone" of the public transport system, this trend clearly needs to be redressed.

A major component of the PRASA rail modernization initiative is the revitalization of the aging train fleet (rolling-stock). Investments must also be made for the modernization of track, signaling and electrical infrastructure. This must include the improvement of access to stations and the upgrade of station facilities.

PRASA's objective is to also create a fresh new service experience for the commuter rail service users and to attract passengers back to the rail mode of transport. This is also viewed as a pilot project to change their approach towards operational planning and management of services.

The vision for all rail corridors in Gauteng is that safe, reliable, affordable and comfortable rail transport should be delivered at global standards of quality and reliability. In addition, this vision implies that PRASA should intend to achieve the following:

- Extended hours of service.
- Improved travel times, improved customer experience and improved security.
- Uncompromised safety on trains and on rail stations, including railway station precincts.
- Improved service levels in terms of reliability, availability and predictability.
- Punctuality to at least 98% right time arrivals at all times and zero cancellations.
- Full system accessibility.

- Provide capacity to ultimately move 60 000 - 80000 passengers per hour in peak periods.
- Modal integration, seamless transfer between different modes and coordination with planning authorities and public transport operators.
- Transit oriented development around stations and improved business.

5. Transformation of the mini-bus Taxi Industry

Despite being the largest mover of passengers in Gauteng, the slow rate of reorganization and formalization of the industry, this impacts on the potential role that mini-bus taxis could play and sustainability of this mode. This causes marginally viable operations and often destructive competition.

It has also lead to unsafe operations often using old vehicles, which are expensive to maintain. This also has an impact on the efficiency of the transport system as a whole.
This initiative is aimed at transforming the mini-bus taxi industry and placing it on a more sustainable path in the future through:

- Stream-lined registration and licensing systems.
- Development of business opportunities, with associated financial support.
- More effective urban & CBD planning for taxi facilities.
- Training and facilitation.
- Improved service quality and safety.
- Improved viability and sustainability.

6. Travel Demand Management, Less Congestion and Shorter travel times

The population of Gauteng is estimated to double by 2037. Two of the policy objectives of government are to reduce poverty and create jobs. Assuming these policies are implemented successfully and as people progress economically, there is a tendency to prefer car ownership over public transport. This will result in private car travel increasing significantly.

As choice, public transport services are available to some extent as an alternative to some, but these services are often fragmented, unreliable and unsafe. It may be unrealistic to expect a major shift by the middle and higher income private car users to public transport in the short- to medium term (especially for all trip purposes).

Gauteng is the economic hub of Southern Africa. Transportation is the highest contributor to the cost of logistics, while the cost of logistics in South Africa is one of the highest relative to global standards. The results of congestion are loss of productivity, higher energy consumption, pollution and loss in family time. Addressing congestion aggressively is important to achieve better quality of life.

The following initiatives are possible with the current road network and public transport system:

- Creation of the capacity within the Gauteng Department of Roads and Transport.
- Set new standards for public transportation and rationalize municipal public transport corridors according to the new standards (for example, there is currently duplication of services between municipal bus services, provincial subsidized services and taxi operators).
- Implementation of HOV lanes on parts of the regional road network.
- Application of ITS for congestion and incident management (i.e. variable message
- signs and cell-phone messaging).
- Support to municipalities with respect to capacity, analysis.
- related initiatives (i.e. reversible lanes, continuous assessment of traffic signals to optimize signal timing plans and maintenance of traffic signals).
- Parking policies to disincentive private car use.
- Feasibility studies into spreading of working-hours; and Active promotion of integration with land uses development to facilitate densification and mixed use.

7. Access to Major Freight nodes

The following key principles and points should underpin any initiative to provide effective commuter and freight access to major decentralized freight terminals on the periphery of the urban core of the Gauteng City Region:

- Decrease in heavy freight vehicles numbers in core urban areas and central business districts.
- Adequate linkages outside the province (i.e. Gauteng - KZN Corridor).
- Supporting infrastructure to freight intermodal facilities.
- Align freight intermodal facilities with Transnet's Container Strategy for Gauteng and Durban port developments.
- Adequate public transport to the intermodal freight facilities and associated developments around them.
- Integration with the PRASA Passenger rail network.
- Finalization of integrated public transport network.
- Upgrade and development of key road links and section.
- Creation of dedicated freight routes on the periphery of the province for freight to flow.
- Pedestrian paths and Cycle ways.

8. Pedestrian paths and Cycle ways

A very significant portion of daily commuters walk to access public transport. This is often done under very unsafe, insecure and inconvenient conditions caused by the lack of good non-motorized transport facilities. This explains the fact that 40% of road fatalities are of pedestrians.

However, the challenge remains to establish a coordinated approach towards non-motorized transport across the Gauteng City Region and integrating them. Furthermore, the provision of non-motorized transport facilities and amenities are relatively inexpensive and can make a huge difference to the quality of life of most inhabitants of Gauteng, especially those living in previously disadvantaged communities.

Key principles and points of an initiative that will provide for convenient and safe NMT, as well as promoting the greening and sustainability of the transport system as a whole, are:

- Promoting the greening of transport and reducing traffic congestion through popularizing of cycling and short distance walking trips to destinations.
- Using NMT modes (walking and cycling) as feeder systems to public transport and provide for the "last mile" access to public transport facilities and interchanges.
- Development of 50km pedestrian paths.
- Development of 50km cycle ways.
- Provision of 200 cycle racks at key public transport interchanges.
- The launch of and a continuous program campaign on NMT awareness, education, law enforcement, and safety.

9. Continued provincial wide mobility

The national road network in Gauteng constitutes a small percentage of the entire road network (470 km), but carries high traffic volumes and provides the freight network. The provincial road network, comprising 14.1% of the roads (4 830 km), performs an important role in linking the national road network with the main municipal road network.

The proper maintenance of the provincial road network is restricted by budget allocations and is a major concern, especially considering the required mobility function of the network. The provincial road network also performs an important role in catering for public transport either in mixed traffic conditions or exclusive public transport/high occupancy vehicle lanes as well as freight traffic.

Continued road planning and development of the strategic road network is an extremely valuable element to enable economic growth in Gauteng. The Gauteng Department of Roads and Transport rely heavily on the Gauteng Freeway network as the backbone mobility road network of the province. It is, therefore, critical that cohesive planning be achieved between SANRAL and the Gauteng Department of Roads and Transport to ensure that continued and acceptable mobility and service levels are maintained.

10. Effective Management of Existing transport Infrastructure

Approximately 80 % of the total road network in Gauteng has a pavement structure older than 20 years, which is normally considered the design life for a pavement. In other words, 3100km have already reached the end of their design life.

In order to maintain and preserve the provincial road network diligently, about 100km to 200km of road should be reconstructed or rehabilitated each year.

Key points that need to be addressed for effective management of existing transport infrastructure:

- Creating further roads engineering capacity within the Department of transport (i.e. Road Pavement and Bridge expertise).
- Have the annual pavement, bridge, and storm water assessment done (where capacity is lacking this may be outsourced).
- Develop an Annual Report, containing project prioritization, as well as budget estimates for preventative maintenance, rehabilitation and upgrades.

11. Regulations and Enforcement

Law enforcement can be defined as the act of enforcing, ensuring observance of or obedience to any law. This includes the prevention, combating and investigation of crime, to maintain public order, to protect and secure the inhabitants of the Republic and their property, and to uphold and enforce the law.

The main contributing factors to unlawfulness related to public transport, freight and non-motorized transport on the roads in Gauteng include speeding, alcohol abuse, none-roadworthy or unregistered private and public transport vehicles, general driver attitude, overloading, operating without an operating license or a valid operating license, and a general lack of non-motorized facilities, but to name but a few.

Under ideal circumstances, regulation and enforcement deal with these problems accurately and swiftly. Unfortunately the current situation is far from ideal and the lack of effective enforcement leads to high rates of traffic and transport infringements, which in turn results in very high rates of road traffic accidents and fatalities in JHB.

In addition, for effective public transport control and enforcement, enforcement officials need to be empowered and capacitated to simultaneously deal with the legality of public transport operations, covering:

- Legality of the operations.
- Quality and condition of the vehicle.
- Driver fitness.
- Driver behavior.

The initiative needs to also deal with over-loading of freight and other heavy vehicles, the revitalization of effective enforcement and the re-operationalisation of provincial weighing stations and weigh bridges.

Closure

Urban traffic congestion tends to maintain equilibrium. Congestion reaches a point at which it discourages additional peak-period trips. Increasing road capacity allows more vehicle travel to occur. In the short term this consists primarily of generated traffic: vehicle travel diverted from other times, modes, routes and destinations. Over the long run an increasing portion consists of induced vehicle travel, resulting in a total increase in regional VMT. This has several implications for transport planning:

- Ignoring generated traffic underestimates the magnitude of future traffic congestion problems, overestimates the congestion reduction benefits of increasing roadway capacity, and underestimates the benefits of alternative solutions to transportation problems.

- Induced travel increases many external costs. Over the long term it helps create more automobile dependent transportation systems and land use patterns.

- The mobility benefits of generated traffic are relatively small since they consist of marginal value trips. Much of the benefits are often capitalized into land values.

Ignoring generated traffic results in self-fulfilling predict and provide planning: Planners extrapolate traffic growth rates to predict that congestion will reach gridlock unless capacity expands. Adding capacity generates traffic, which leads to renewed congestion with higher traffic volumes, and more automobile oriented transport and land use patterns. This cycle continues until road capacity expansion costs become unacceptable.

The amount of traffic generated depends on specific conditions. Expanding highly congested roads with considerable latent demand tends to generate significant amounts of traffic, providing only temporary congestion reductions.

Generated traffic does not mean that roadway expansion provides no benefits and should never be implemented. However, ignoring generated traffic results in inaccurate forecasts of impacts and benefits. Road projects considered cost effective by conventional analysis may actually provide little long-term benefit to motorists and make society overall worse off due to generated traffic. Other strategies may be better overall.

Another implication is that highway capacity expansion projects should incorporate strategies to avoid increasing external costs, such as more stringent vehicle emission regulations to avoid increasing pollution and land use regulations to limit sprawl.

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