

TOWARDS RESOLVING CONGESTION IN GAUTENG

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1. INTRODUCTION

In the 1985 Transport updating study for the region that forms Gauteng today, a minimum construction programme for the development of transport infrastructure was proposed. It was also cautioned that the effects in the future of the area of neglecting such investments would initially not be seen, but would result in serious congestion and transport inefficiencies 10 to 15 years later. Unfortunately these investments were not done and the resultant effects on the transportation systems of the Province are all too evident today; to such an extent that whereas Gauteng previously was responsible for more than 40% of the country's GDP, it has now dropped to 38% ⁽¹⁾. Even so, this represents approximately 9% of Africa's GDP.

The need to reinvigorate Gauteng's economy has recently renewed attention with various ambitious developmental projects being launched by Government ⁽²⁾. At the same time the need was very evident to embark on a holistic and wide-ranging initiative to resolve the congestion problems being experienced in the Province. In considering the issues involved it was clear that it would not be possible to build the province out of the problem, but that an integrated approach including land use/transportation interaction, would be required. However, it was also realized that new capacity would have to be created as well.

This paper sets out to consider the issues, focuses on the nature of congestion, and discusses options available in the traffic and transportation engineering toolkits as well as in the ambit of land-use planning, to ensure a holistic and wide-ranging approach being brought to bear on the problem.

The paper hastens to acknowledge that much has been done over the years in this regard. Gauteng's transportation would not have been in the reasonably healthy, albeit declining, position it is in, but for efforts in this regard by many practitioners in the past. However, it is believed that the only way to reverse present trends and to ensure a vigorous future economy is by a concerted coordinated drive, adequately supported by holistic transport planning and implementation. It is trusted that this paper will contribute to this goal.

2. OVERVIEW AND DEFINITION

Congestion in generic terms can best be defined as a situation so crowded that it hinders freedom of movement, i.e. that it affects reaching destinations with ease. In this regard it is important to note that congestion is not restricted to road use and can affect all modes of transport. Some of our rail lines are notorious for the congestion experienced by commuters. However, in this paper, attention will be focussed mainly on road congestion. Such congestion is understood as a demand for road space that exceeds the available capacity.

Congestion is often time-related, coinciding with peaks in the traffic stream. It is transient in time and space and can be heavily influenced by incidents in the traffic stream. The more severe congestion becomes, the longer the congested condition lasts, involving and affecting an ever-increasing portion of the community.

However, in essence congestion is also a sign of success and a successful system. In terms of a free market approach, this success (increased demand) should be accompanied by commensurate adjustments in the price and increases in supply. This is not taking place at present and results in an imbalanced situation experienced on Gauteng's roads and the stifling effects it has on economic growth.

3. TRANSPORT AS A CATALYST FOR ECONOMIC GROWTH IN THE URBAN ENVIRONMENT

Urbanisation and the migration of people to cities are well-known facts. People see cities as the passport to a better life. Here they secure higher paying jobs, better health care and better access to education for their children. Furthermore, city dwellers have a better quality of life and have a longer lifespan than their rural counterparts.

The reason why incomes are higher in cities is that the concentration of people makes cities more productive. As a general rule, the larger the city, the higher its productivity. Studies by the University of Paris ⁽³⁾ on large cities in the world such as Tokyo, New York and Los Angeles have confirmed this observation. The Government of India "considers that the mega-cities are the engines of national economic growth and generators of national wealth".

Urban growth, particularly the growth of large cities such as Johannesburg and Pretoria should be welcomed and encouraged.

Big cities are sometimes said to be too big and therefore inefficient. The facts do not substantiate this. What is true, is that big cities are more difficult to manage than small cities. The successful utilisation of the productivity potential of large cities is very much dependent on good management, including the management of its transport system.

Efficient urban transportation is the key to unlock the full productivity potential of large cities. The reason is that transportation gives access to larger labour markets and hence assists in the more successful placement of the right person in the right job.

The challenge for Gauteng is to manage the factors that increase the labour markets of its large cities. Three distinct factors: size, density and speed determine this, as shown in Figure 1.

Referring to Figure 1, obviously the overall population of the conurbation, determines the size of the labour market, but it is not the only factor. Density and its inverse, sprawl, or more precisely the relative location of jobs and households, and speed of travel, also influence the size of the labour market. It is obvious that a dense city will have a larger labour market than a dispersed city. Speed, which is a measure of the efficiency of the transport system, which in itself is a function of the quantum of transportation infrastructure and the quality of the management thereof, determines the geographical size of the market catchment area.

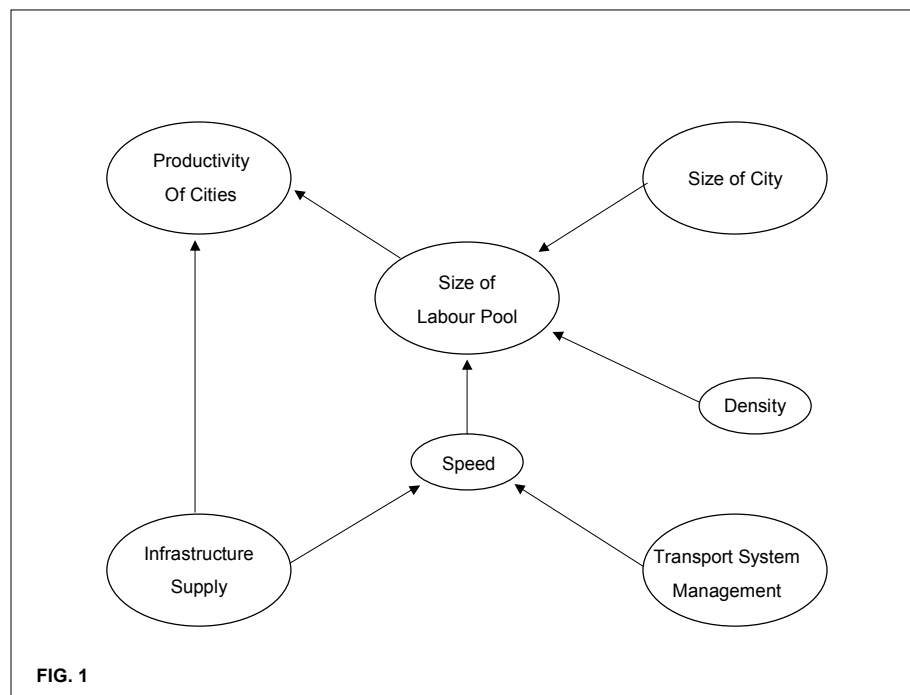


Figure 1 The Superior Productivity of Mega Cities

It can therefore be concluded that urban transport policy is a key element of development policy. Together with location (land-use) policy they determine the efficiency and thus the global competitiveness of a region.

In addition to its more directly discernable goals, another purpose of efficient transport policies is to increase the size of the labour market. In Gauteng terms, it is to ensure access to work opportunities for as many people as possible in Gauteng and thus improving employment levels. The purpose is not merely to reduce congestion.

Reducing congestion, all other things being equal, would obviously contribute to enlarging the effective size of the labour market. But if congestion is reduced by changing “other” factors such as dispersing jobs and people to the urban edges, it can lead to a shrinkage of the effective labour market and to the fragmentation of a large labour market into many small labour markets. There is no congestion in rural areas, but productivity is also much lower.

It is sometimes argued that proposed transport improvements are of no use because they do not reduce congestion. It is said that a new road will attract more vehicles, become congested and defeat its own purpose, and therefore need not be built. This reasoning has no substance. The road has enabled the pent-up demand to be satisfied, and the effective labour market to be

enlarged. The fact that the new road is being used is a sign of success. This reasoning should therefore not be entertained as an argument against transport investments in urban areas. It is well known that analysis has found that, for urban highway expansion, the nett present value of social benefits typically exceeds costs.

Another argument, which is often used, is that public transport should be provided instead of new road infrastructure. This argument is simplistic and unrealistic. The fact is that both have to be developed. Public transport is not a substitute for roads, it is part of a holistic solution for the overall movement of goods and people.

4. EXTENT OF CONGESTION IN GAUTENG

The unfortunate neglect of investment in transport infrastructure over the last two decades has resulted in extensive congestion in the province.

This is equally true of road as well as rail systems and for South Africa as well as Gauteng. The extent to which infrastructure development has lagged behind transport demand is best illustrated by the fact that during the 4 year period 1995/96 to 1999/2000, traffic on the freeway system in Gauteng has increased by 26,5% in vehicle kilometres travelled, whereas there has only been a 2,5% extension of the freeway system itself. Incidentally, travel on gravel roads has increased by approximately 18%, with virtually no change to the length of gravel roads in the Province. To this should be coupled the fact that in the different sub-regions of the province, between 68% and 84% of public transport in the Province takes place on the road system.

The nett result of the increasing congestion on the road system in Gauteng is a loss in productivity owing to longer travel times, increased fuel consumption, increased air pollution and general lowering of quality of life. It also restricts regional accessibility, the exposure of workers to employment opportunities and leads to a never-ending relocation of business to less congested areas and hence urban sprawl.

The extent of congestion on the provincial and national road network is illustrated in Figure 2. Not shown on the figure because of its endemic nature is congestion on the local networks. Congestion is not only a concern for Gautrans, but for all road authorities in the Province. What is also particularly noteworthy is that the transport demand has increased despite the lack of increases in infrastructure development. This is partly a natural phenomenon of industrialisation and urban life and partly due to migration from rural areas.

5. CONGESTION : A THREAT TO GROWTH

While a certain amount of congestion can be seen as a sign of a thriving economy and hence of success, excessive congestion will lead to economic stagnation and eventually urban blight. The point at which congestion becomes excessive is not constant, and depends on geographical area, duration, regularity, user expectation and tolerance. In most urban areas a limited amount of congestion is expected and is tolerable and hence will not affect development decisions. Consequently, provided the congestion is managed, the negative effects will be minimal.

Figure 3, adapted from Stover (USA)⁽⁴⁾ by Burnett and Andersen⁽⁵⁾ illustrates the importance of managing congestion. Two scenarios are presented: the first, where congestion is addressed, results in a healthy cycle of development and growth. The second, where no action is taken, results in a degradation spiral.

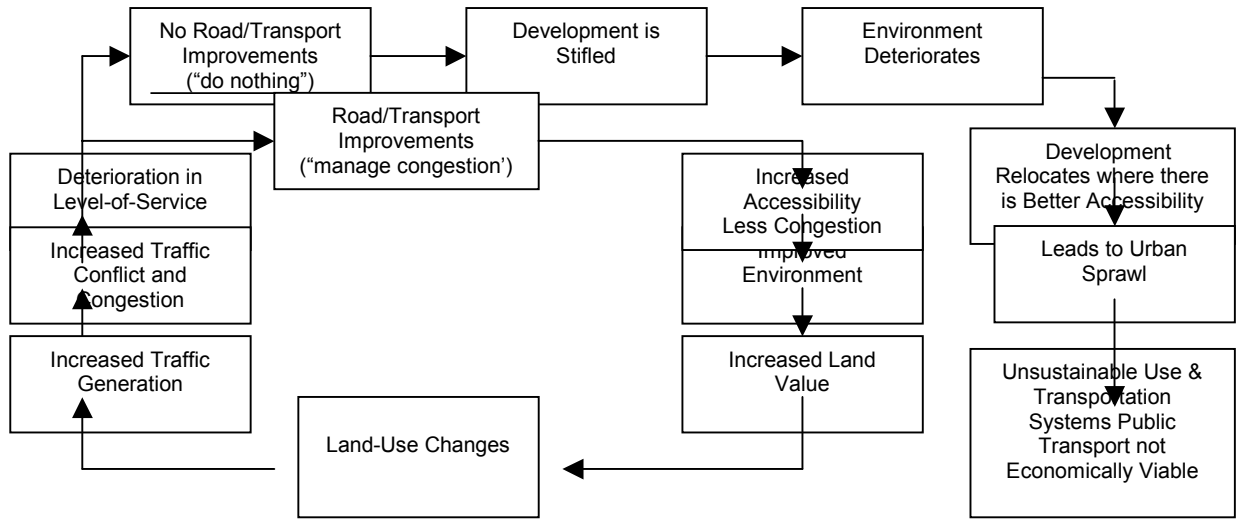


Figure 3 : Managing Congestion ⁽⁴⁾ ⁽⁵⁾

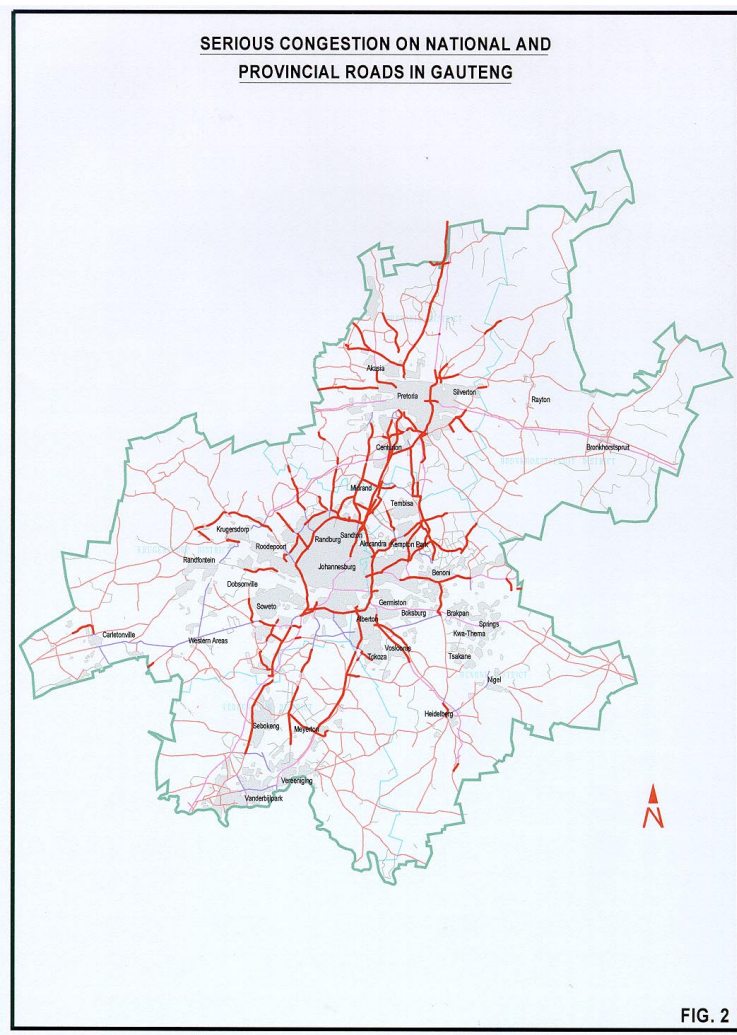


Figure 2 : Extent of Congestion on Provincial and National Roads in Gauteng

In Gauteng, a question that needs to be answered is “at what point does congestion begin to stifle economic development?” According to the literature, this point is reached when average speeds on the road system fall to less than 25km/h.

Experience in the Sandton CBD area has indicated that this point has now been reached, even in off-peak periods. The result is that urban sprawl has begun. Developers are no longer taking up the available rights in the CBD area but are rather seeking to rezone alongside the access routes such as Katherine Street, Rivonia Road and William Nicol Drive. The result is a demand for “strip development” which will in turn impinge even further on the viability of the Sandton CBD.

A recent study by Potgieter et al⁽⁶⁾, approximately three years ago showed that the average speed on the network in Roodepoort was about 52 km/h. With no road improvements, and taking projected growth trend into account, this was expected to drop to some 4 km/h – although practically urban sprawl and re-location of business would take place before such a figure would be realised.

Something similar has happened in many cities around the world. Congestion and excessively long travel times have forced many businesses to move out of the city centres. As they leave, economic stagnation and “crime and grime” sets in. Once begun, the cycle is very difficult to break.

A brief investigation by Del Mistro⁽⁷⁾, into the relationship between land-use and public transport has yielded the following information:

<u>Size of activity node</u>	<u>Type of transport required to support it</u>
Less than 500 000 sq m	Private transport
500 000 to 1 000 000 sq m	General road-based public and private transport, e.g. Sandton CBD
More than 1 000 000 sq m	Dedicated public transport e.g. rail, general road-based public and private transport, e.g. Johannesburg CBD

When the size of an activity node reaches approximately 750 000 sq m, the authorities have to take a conscious decision about its future. Should the decision be that continued growth is desired, investment in dedicated public transport along with road upgrades becomes essential.

6. WAYS AND MEANS OF MANAGING AND ALLEVIATING CONGESTION

Actions to manage and alleviate congestion can generally be grouped into one of three categories. These comprise:

- land-use related measures and policies, mainly aimed at densification to create conditions for public transport;
- supply side measures and policies focusing on increasing road capacity by various construction and traffic management alternatives;
- reducing demand.

A detail description of the various measures, collectively known as congestion tools, falls outside the scope of this paper. However, it is evident that selecting one or two of the “tools” and focusing on them would have little likelihood of success. A holistic integrated approach is required to establish sustainable congestion management, and in this regard it is envisaged that the national-provincial and local authorities in Gauteng should co-operate to resolve the various issues on a sustainable basis. This is viewed as absolutely essential for the success of a congestion strategy.

6.1 Land-use

Long-term, land-use related measures and policies that are transport-friendly, are of prime importance to ensure a sustainable approach to congestion and development management. The natural tendency of engineers to avoid involvement in these matters has to be resisted and engineers should make it their business to ensure that long-term sustainable land-use/transport interfaces.

Inter alia land-use related actions comprise:

- land use densification, increasing the densities of people working and living in particular areas, especially along development corridors, defined/characterised by nodal development along linear alignments. Mixed land use, enhancing the walking mode, is another option;
- close cooperation of land use and transportation planning officials to achieve integration of goals and objectives. It may also require achieving institutional integration;
- revitalising central business district (CBDs) with an emphasis on mixed land use activities;
- protection of land use planning and enforcement of the restrictions and requirements pertaining to it. Local business and political expediencies have to be resisted and officials should receive the necessary political support in this regard;
- street and road reserves should be managed and kept free of all trading activities;
- reverting to pedestrian and public transport-friendly town planning design principles. This is also advocated in the “New Red Book”⁽⁸⁾ on urban service provision;
- establishing a uniform approach to the payment of bulk contributions by developers for the provision of transport infrastructure, commensurate with the traffic-generating capabilities of the development in question. No waiving of such contributions should be possible and the contributions should be earmarked for transport infrastructure improvements. Should a local authority wish to attract development to a specific location, it could subsidise such contributions but would then have to pay the required monies from general revenues into a dedicated fund;
- restricting or prohibiting access to areas highly susceptible to congestion during certain hours. This can also apply to parking. Alternatively, access can be priced: the higher the congestion, the higher the price to gain vehicular access. Access restrictions can also be applied to certain types of vehicles, eg. goods vehicles during business hours. Alternatively, incentives may be allowed to businesses by means of concessions on rates and taxes for not taking deliveries during peak hours;

- parking management, which can take different forms, eg. pricing, restrictions, prohibitions, park and ride schemes, incentives for employers to subsidise their personnel using public transport, *in lieu* of providing parking. In general monetary instruments are favoured over enforcement approaches;
- management of road intersection spacing and driveway accesses. Well-spaced intersections commensurate with the function of the road in question and not allowing direct access to properties off higher order mobility routes, are essential measures to alleviate congestion. This requires developing a proper hierarchy of roads;
- growth management and growth capping. Growth management goes hand in hand with infrastructure and/or service provision. As such it is also closely related to transport bulk contributions. Growth capping appears to be a last resort action and is not favoured as there is a high risk of stagnation and decay involved.

6.2 Supply side

In the shorter term the following options present themselves.

(a) Increasing road space

With annual reduced budgets for roads, provision of significantly higher capacity through construction of new roads from normal budgetary sources is becoming less feasible. Low-cost measures such as repainting lane markings and using shoulders to create an extra lane are short term solutions which cause problems of their own in terms of safety and necessitating lower speeds in the narrower lanes. Thus off-budget funding of road infrastructure provision has become a necessity for extending roadway capacity.

However, appreciable improvements can be effected on some major arterials by judicious local improvements mainly involving the construction of climbing lanes, some overtaking lanes and the removal of local bottlenecks. These works should be done under normal budgetary funding.

(b) Intersection management

The most effective way of minimizing disruptions to traffic flow on a road is through limiting the number of roads and driveways intersecting with that road. The effect of this limitation is to allow “platoons” of vehicles to flow along a road without having to slow down (or stop) to allow other vehicles to enter or leave the roadway.

At present, action in this field is by way of:

- the Committee of Transport Officials (COTO) initiative in striving for nationally compatible Road Access Management Standards;
- protection of the provincial road network by allowing access to major roads at intervals, which will optimise traffic flow along those roads.

Developers often regard management and curbing of access to major roads as preventing development, but this strategy should rather be seen as being essential for preserving mobility.

(c) Interchange ramp design

In addition to repainting and allowing for multiple (turning and through) lanes at ramp terminals and on the cross road, improvements can also be effected by repainting the convergence of the on-ramps with the outside lane, utilizing the freeway shoulder to create an acceleration lane. This follows the German and Dutch interchange design approach and is expected to result in smoother traffic operations on freeways.

(d) Increasing the efficiencies of intersections and intersection control devices

It is also believed that appreciable advantages in alleviating congestion can be made by increasing the efficiencies of intersections and their control mechanisms.

These actions comprise:

- the better utilization of existing road space by repainting lanes to increase intersection capacity;
- widening of intersections with the same aim in mind;
- improving the settings of traffic lights and their coordination on a route.

Most of these actions are low cost and can be implemented in the short term.

(e) Intelligent Transport Systems

Intelligent Transportation Systems (ITS) offers potential for increasing mobility through holistic integrated planning and real-time management of traffic operations. These would include but need not be limited to:

- variable message signs providing dynamic route guidance and giving advanced warning of delays to motorists, allowing them to avoid areas of temporary low mobility;
- variable message signs at strategic positions on the roadway, incorporating variable speed control, dictated by traffic density;
- demand-based synchronization of traffic signals, tailoring settings to prevailing traffic conditions, allowing a “platoon” to catch green lights over long stretches of road.

The application of these technologies is in its infancy in this country, although Cape Town has done pioneering work on an integrated ITS system involving incident management, CCTV, etc and is operational. Durban also has started on three highway intersections which are covered live by CCTV linked to a control centre.

In the medium to long term the following are considered appropriate regarding ITS:

- through ticketing promoting modal integration and public transport. Smart cards are expected to play a major role in this regard;
- freeway and arterial surveillance by closed circuit TV, coupled to traffic control and incident management. Incorporated is the establishment of control buildings, gantries to mount cameras and the required electronic hard and software. As such this would require substantial funding;

- providing information on roadway conditions to road users before they embark on a journey. This can be achieved by on-line internet systems that would inform motorists of travelling conditions. Ideally this approach should be integrated with all other modes of travel, providing a comprehensive travel guidance service;
- intersection management comprising one or more of the following:
 - traffic signal optimisation / coordination. Various intermediate levels are possible with SCOOT type traffic control at the one end of the scale and a simple prohibition of right turns and U-turns at the other;
 - bus, High Occupancy Vehicle (HOV) priority at intersections.
- on freeways, ramp metering and electronic toll collection are further elements of ITS technologies that can assist in alleviating and preventing congestion. Ramp metering is sometimes seen as potentially problematic as it is thought that the supporting road system would probably not be able to handle traffic not willing to queue for an opportunity to access the freeway in question. On the other hand, the traffic will be queuing anyway at the on-ramp – the ramp metering system allows the traffic joining the freeway to do it more easily by finding gaps in the outside lane and releasing on-ramp traffic into these gaps. This results in smoother flowing freeway traffic offsetting any delays due to the ramp metering. Electronic tolling on the other hand is considered essential for tolling roads under urban conditions. It might also provide the impetus to the development of a wide range of ITS type applications in transport systems in the country.

(f) Traffic management during road works

It is considered that this aspect of transport management often is the most neglected one in terms of capacity improvement in South Africa. Major improvements in congestion management could be effected if roadway occupations were to be pro-actively managed from a capacity improvement point of view.

6.3 Demand Management

Demand management focuses primarily on influencing the demand to result in a more efficient handling of the transport needs. Options for Transport Demand Management are generally of a medium to long term nature and comprise inter alia:

- (i) Increasing the average occupancy of vehicles, generally by pricing or prohibition means.
- (ii) Reducing the numbers of persons who need to use the road by:
 - making an alternative mode more attractive, including making other modes less attractive by pricing mechanisms;
 - making the use of an alternative mode more feasible e.g. by densification in a corridor;
 - shortening trips;
 - removing the need for the trip.

Options that would further these objectives are:

(a) High Occupancy Vehicle lanes

Increasing the average occupancy of vehicles is best promoted by way of the concept of High Occupancy Vehicle (HOV) lanes, which are lanes reserved for vehicles carrying more than a specified number of persons. However, in order to make room for such lanes, additional roadway capacity needs to be constructed, as at least three lanes per direction are needed to introduce a HOV lane. HOV also only offers a narrow window of effectiveness (Samuel 1996). If fewer than 10% of vehicles on an eight-lane highway are HOV, the HOV lane would not be adequately utilized. If the utilization is greater than about 15%, the HOV lane will be too crowded to offer the time advantage needed to persuade HOV use.

(b) Mode Change

Reducing demand by making rail a more attractive mode would probably be the most effective way of reducing travel demand on the road network. However, a number of factors mean that this will probably be very difficult to implement. The time required to overcome these potential obstacles, listed below means, this is only viable as a long-term option:

- poor security track record;
- low level of service in terms of comfort and convenience;
- perception that trains are for the poor / only poor persons use trains;
- high valuation by motorists of their independence of movement from others;
- lack of a public transport culture amongst private transport road users;
- high cost of establishing rail modes.

Mode changing, apart from changing from a private transport mode to a public transport mode, can also refer to changing from bus to taxi or to rail. Effecting a mode change, particularly from private transport to rail would require a paradigm shift in travelling philosophy. New patrons would have to be attracted by the speed, comfort, convenience, security and service provided by the alternative mode, whilst the price of travelling by private mode would have to be set at a level to induce consideration of the alternative. Studies in Europe⁽⁹⁾ suggest that in order to achieve any meaningful shift, travel costs of private vehicle use would have to increase three to five fold. Mode changing on this scale would have to be corridor bound and the outcome of the work on the envisaged “Gautrain” between Pretoria, Johannesburg and the Airport will be very enlightening.

Improved bus and minibus services coupled to good modal transfer facilities, through-ticketing, and improved information systems are considered more appropriate to the provision of an upgraded general public transport service.

The use of bus and minibus-taxi services would be of particular value in cross-linking nodes or suburbs. One of the major shortcomings in public transport is that it only provides a radial service to CBD areas, making it difficult or awkward to move between suburbs or suburban centres.

Subjectively, fixed guideways, and trams are not considered appropriate to the Gauteng situation owing to high cost/capacity ratios. Cycling is also not seen as a major contender, mainly owing to safety and the rolling topography of the main centres in the Province, unless supported by complementary actions.

The value of a mode change can best be appreciated by the following comparisons:

- in 1999 the Ben Schoeman (N1) south of Allandale Road interchange carried approximately 7400 vehicles south bound in the peak hour and 7000 vehicles north bound at an average of 1,5 persons per vehicle; this equates to 11 100 persons moving in the peak direction, fully occupying 3 lanes;
- were these trips to be made by public transport the road space required would be as follows:
 - minibus taxi at 8 passengers per vehicle : 1 400 vehicles per hour
= 1 lane
 - bus at 40 passengers per vehicle : 280 vehicles per hour
= less than 1 lane
- were these trips to be made by train, they would require only 6 trains at 2000 passengers per train per hour.

Regarding public transport, generally it has to be realized that world-wide mass public transport systems rarely exist without some form of subsidy or another. Although the subsidy may be less than the cost of providing additional infrastructure and save expensive imported fuels that may make it worthwhile, effecting a modal change to relieve congestion merely to increase the subsidy burden on transport authorities would be counter-productive.

As far as feasible, retaining the principle of user-pays, should also guide Transport demand management measures.

As in marketing a service or a product, retention of existing clients is as important as acquiring new clients, if not more so. In this regard it is also necessary to focus on present public transport and particularly rail users. Improving service provision to existing users of train, bus and taxi services must have a high priority in any congestion strategy.

(c) Flexible working hours

To a certain extent, travel time shifts have occurred naturally as congestion increased on the road system, with people either starting work earlier and leaving early or starting late and leaving late. More often than not it has also transpired to be a case of starting earlier and earlier and leaving later and later. However, a coordinated and concerted effort by local authorities to arrange staggered work starting times by city block on the

basis of a core period between 09:00 and 16:00 and variable times between 07:00 and 09:00 and between 16:00 and 17:30 could be considered and earlier efforts by Johannesburg in this regard revisited⁽¹⁰⁾. A similar approach was attempted in the past in Pretoria where arrangements were made between different government departments and the city bus service⁽¹¹⁾. The intention was to bring about a saving in the number of buses needed to provide the required level of service. It had limited success mainly due to the lack of strong coordination.

(d) Not travelling at all (Working from home)

The need to travel, especially during peak periods can be substantially reduced if people work from home. For some years, it has been predicted that this will become a reality in future, but with experience the extent to which this will happen has been revised downward. Two aspects worth pursuing are:

- living at or within walking distance of the shop, office or business;
- telecommuting, i.e. computer based working and networking, moving intellectual products electronically instead of moving people to offices. This phenomenon points to a fourth type of city being developed: the information city. According to Knox (1994), new communication forms are as much shapers of urban form as were the tram and automobile. Freeing companies and people of some of the frictions of distance can be expected to lead to a more dispersed urban landscape.

Both these approaches may occur more frequently in future, but are not expected to have a significant effect in the short and medium term.

(e) Managing freight movements

Management of freight vehicle movements can comprise a number of options, inter alia:

- not permitting heavy vehicles on freeways during peak periods/certain hours. The downside of this option is that appropriate lay-byes or stopping places would have to be constructed for such vehicles to park during the hours stopped. This in turn raises the need for such areas to be policed to ensure the safety of goods and drivers. Other issues are the increased cost to freight operators and the fact that the economic value of a heavy vehicle is far greater than the inconvenience to predominantly single or two occupant cars;
- not permitting overtaking by heavy vehicles on freeways with less than three lanes per direction and not at all during peak hours. This appears to be more practicable but would require policing/surveillance and control;
- enforcing minimum speeds on the freeways, raising the present minimum speed to 80km/h. This would again require enforcement, will clash with the maximum speed limit for some heavy vehicles and may not be practicable. As an alternative, slow-moving vehicles could be pulled off the road by traffic officials. Again this would require some form of regular traffic monitoring;

- legislation to improve engine capacity/vehicle mass ratios and braking systems to ensure heavy vehicles with adequate traction and braking power to maintain freeway operating speeds. This appears promising, but because of the size of the truck fleet and slow rate of replacement would take many years to achieve;
- lastly, a totally new approach requiring an integration of road and rail freight transport could be considered. However, this would require a considerable amount of research, investigation, liaison and persuasion. As such it is seen as a medium to long-term strategy.

(f) Miscellaneous measures

Contributory measures, invariably designed to assist one or more measures discussed earlier, include:

- allowing space for taking cycles on public transport vehicles. This would allow persons to cycle to the public transport route, taking their cycles with them, and continue their journey at the other end. This approach would widen the catchment areas of a public transport route appreciably from the present approximately 0,5 to 1,0km on either side, to up to 5km or more where the topography permits;
- prohibiting vehicle use in densely built-up areas, but allowing cycle access;
- grid-like and/or circular taxi services of a high quality in inner city areas, running at closely spaced intervals. Such a service can make the use of a car for business purposes unnecessary;
- employing ITS technology to provide up-to-date information on all public transport services. Ideally this should be real-time information, for example at a bus stop or station on the number of minutes until the arrival of the next bus or train.

8. COST OF CONGESTION AND MEASURES TO ALLEVIATE

In order to assess the order of magnitude of the costs and benefits of congestion and measures to relieve it, a first-cut analysis indicated the following:

Currently, savings in congestion costs, were it possible to upgrade all provincial and national roads simultaneously, have been estimated to be of the order of R1 500 million per annum. Conversely this can be said to represent the present annual cost of congestion in the Province on these roads.

In the attempt to obtain ballpark estimates of the effect of congestion and the benefit of alleviating it, the morning peak hour traffic for the year 2010 was assigned with a transportation demand model on the existing road network and the road sections with a volume/capacity ratio of greater than one were identified. The road improvements required to improve the levels of service to at least a level “D” were then made to the network. Metropolitan roads were not included in the possible improvements. The total cost of the proposed improvements of R4 950 million, is easily outweighed by the savings in travel costs.

According to the Gautrans transportation demand model, the improvements will result in the following during the morning peak hour:

- reduction in total kilometres travelled : more than 120 000kms;
- reduction in total travel time : more than 32 000 vehicle hours i.e., approximately a twelve percent improvement overall, but much more markedly on the main corridors.

In another perspective on the cost of congestion, transportation practitioners have estimated that for a vehicle to stop causes an additional cost of 11 cents for a car and R1-15 for a heavy vehicle⁽¹²⁾.

9. CONCLUSION

It is apparent that there is no simple, short-term solution to alleviate congestion and improve mobility. This can only be achieved through an integrated approach combining elements of:

- (a) Applying best traffic engineering practises in managing existing road infrastructure (short to medium-term).
- (b) Judicious local improvements to congestion hot spots (short to medium-term).
- (c) Providing new road infrastructure, where feasible, following the user-pays principle (medium to long-term).
- (d) Reducing or managing demand on the road network (medium to long-term). In some instances, this also requires additional road capacity to succeed.

It is apparent, that in addition to some local relief that can be effected by traffic engineering measures, short term steps to restore mobility to the province's major routes must rely heavily on provision of new road infrastructure and a concerted move to promote the use of public transport. However, it has to be stressed that this has to be accompanied by concerted efforts to effect land usage that can be supportive of an efficient transport system in the long-term.

What is important is that transport authorities at all three spheres of government see congestion as their collective problem and they take hands to solve it.

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TOWARDS RESOLVING CONGESTION IN GAUTENG

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CURRICULUM VITAE

SURNAME : 1. GARNER
FIRST NAMES : Dudley
PROFESSION : Professional Engineer
POSITION IN FIRM : Director
BORN : 1940
COUNTRY OF BIRTH : South Africa
NATIONALITY : South African
YEAR OF JOINING FIRM : 1965



KEY EXPERIENCE:

Dudley Garner is a director in the Planning and Design Division of VKE Engineers with specific responsibilities for strategic road planning related technology and management. He is a Professional Engineer with 37 years of experience in most aspects of transportation, civil and municipal engineering including planning, design, contract documentation, construction supervision and project management. He has been involved in a wide variety of civil engineering projects ranging from geotechnical, materials and pavements, roads and streets, airports and aerodromes, municipal wet services and miscellaneous civil works. His experience includes major developmental master planning projects and acting as secretariat to a Consortium of consulting engineers and town and regional planners which assists the Gauteng Department of Transport and Public Works in strategic planning of the provincial transportation system.

(a) PROFESSIONAL STANDING

Mr Garner is registered as a Professional Engineer with the Engineering Council of South Africa (Pr Eng (SA) 690704). He is a fellow of the South African Institution of Civil Engineering and has served as Pretoria Branch Committee Member, Treasurer, Chairman, Branch Representative on National Council and on the National Council Executive Committee as Chairman of the Standing Committee for Membership. He is currently the Vice President : Growth and Participation.

CAREER RECORD

Date	Employer	Position
2001 -	VKE Engineers,	Director responsible for strategic road planning, related technology and management.
1995 – 2000	VKE Engineers, Pretoria	Director-in-charge of Civil Works, Pretoria.
1984 – 1994	VKE Engineers, Pretoria	Associate-in-charge of Design Section.
1972 - 1984	VKE Engineers, Pretoria	Associate and Engineer Design and Construction.
1965 - 1972	VKE Engineers, Pretoria	Resident Engineer on Construction of Townships and Roads ranging from Rural Roads to Urban Freeways.
1963 - 1965	South African Civil Service	Engineer on Design and Construction of Rural Low Cost Townships.