

NEEDED: A PARADIGM SHIFT IN THE PROVISION OF ROAD INFRASTRUCTURE IN GAUTENG

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ABSTRACT

The paper evaluates the existing provincial road network in Gauteng within the framework of the responsibilities of provinces and municipalities to provide road infrastructure. It is concluded that a paradigm shift is required that would lead to better integration between land use and transportation, provide for all road users, allocate the responsibility of the provision of road infrastructure to the appropriate tier of government and ensure sufficient capacity to accommodate the demand of adjacent land development. It is also necessary to establish a statutory framework to ensure a consultative process that takes the input of all stakeholders into consideration.

SCOPE

The Gauteng provincial strategic road network was developed more than three decades ago in an era of a different political system and completely different socio-economic development challenges, as well as a land use management system entirely different from the emphasis on consultative development planning that forms the foundation of the current planning approach in South Africa.

A lack of new road construction or the meaningful upgrading of the existing provincial road network is considered to be a real threat to the sustainable development of Gauteng province and the implications of the Gauteng Transport Infrastructure Act (Act 8 of 2001) (as amended) imposes such a burden on land owners and development that the act has a paralyzing effect on development.

A paradigm shift is required to create a philosophy towards the provision of road infrastructure in Gauteng that represents a holistic approach and that addresses the current development realities in the province that can certainly be described as the heartbeat of the economy of South Africa if not the African continent.

The paper considers the following:

- The basis of the existing provincial road network.
- The function of national, provincial and municipal government as far as road infrastructure is concerned.
- Transportation planning as an element of development and land use management.
- Technical realities that indicate the obsolescence of the current planned provincial road network.
- A proposed approach to develop an appropriate road network for Gauteng.

It is beyond the scope of this paper to document the deficiencies of the provincial road network, but some examples will be used to illustrate the principles presented in the paper.

HISTORY OF THE DEVELOPMENT OF THE PROVINCIAL ROAD NETWORK

The history of the development of the South African road network is well documented by Floor (1985) and provides valuable information regarding the co-ordination between different authorities

and levels of government, as well as the need for financial assistance to provinces and local authorities by the national government for the purpose of road construction, dating back to 1929.

The legal framework at that time included the Motor Transport Act, 1930 that regulated the competition between road and rail transport and the National Road Act, 1935 (Act 42/1935) that established a National Road Board and National Road Fund. The network of fourteen national routes with a total length of 8634 km proposed in 1936 created the backbone of the current national road network. It is interesting to note that it was recommended that between 20 and 25 percent of the total length should be constructed to tarred road standards - the vast majority of roads being gravel roads at the time.

The jurisdiction of municipalities was restricted to municipal areas that formed only a tiny proportion of the land, while the rural areas were served by roads provided by provincial administrations that all had a strong design, construction and maintenance capacity.

The report of the Committee of Enquiry into Urban Transport Facilities in the Republic (Driessen (1974) introduced the emergence of a new generation of transportation planning in the 1970's and the introduction of computerized transport demand modelling and resulted in a structured approach to transport planning and transport system management in South Africa. In particular, more emphasis was placed on urban transport matters and Metropolitan Transport Advising Boards were created to promote an integrated approach to the development of the transportation system in urban conurbations.

The (then) Transvaal Roads Department that now forms part of the Gauteng Department of Public Transport, Roads and Works, in consultation with the municipalities in the area, developed a comprehensive network of major roads for the Pretoria-Witwatersrand- Vereeniging (PWV) area that has essentially become Gauteng Province. The planned road network comprised a grid of north-south and east-west freeways complemented by a finer grid of conventional dual carriageway roads with at-grade intersections. Although large areas such as the municipal area of Johannesburg and Soweto at the time were excluded from the road network, many urbanized areas such as the northern and eastern parts of the City of Tshwane and rapidly expanding areas of the Ekurhuleni Metropolitan Municipality were criss-crossed by major roads that have since acquired the status of provincial roads.

The development of current transportation policy in South Africa is based on the principle that the majority of transport should be provided by public transport and the provincial transport demand model in Gauteng was adapted and further developed to make provision for strategic public transport corridors.

A significant element in the provision of transportation infrastructure in Gauteng was the promulgation of the Gauteng Transport Infrastructure Act, 2001 (Act 8, 2001) (as amended). The Act concretizes the planning and design process and prescribes procedures for the route determination and preliminary design of provincial roads and railway lines and specifies measures that regulate any land use development along published provincial routes. The current status of planning is that the entire strategic road network has been published as provincial routes. Some preliminary designs that have previously been completed have been accepted and published as such in the provincial gazette. In many instances, including densely developed urban areas, as well as remote rural areas, the preliminary design has either not been done or the completed preliminary design has not been accepted, resulting in a 400m wide corridor where any application for a change in land use or environmental authorization is subject to a report by the applicant on the impact or effect of the granting of the application on the provincial road planning.

SHORTCOMINGS OF THE PROVINCIAL ROAD NETWORK

The major concerns regarding the provincial road network include the following:

- There is no linkage between the provincial road network and an integrated development plan at provincial level. A road network cannot respond to socio-economic development strategies unless it forms part of a formalized integrated development plan that identifies priorities and the allocation of resources on a provincial level.
- There is no firm implementation plan. In fact, there is a belief that the Province will not be in a position to construct the provincial roads within any reasonable planning horizon. The funding of provincial roads remains the most important unresolved issue.
- There is no logical transition from the existing road network to the planned road network. This makes decisions on land development very difficult. Developers are confronted by the choice between a development that is based on the existing road network and that will in future not benefit from the advantages of the implementation of the planned route, or alternatively, to base the development on a future road that will probably not materialize within the economic life of the development. This illustrates that the road planning does not contribute to proper planning, efficient land use management or optimum use of land and resources.
- Some elements of the strategic public transport network follow future provincial routes and public transport services can therefore not be implemented. This situation compromises the type of integrated land-use / transport framework that is desired along public transport corridors. A specific example is the K54 and K105 in the south-eastern part of the City of Tshwane. Although these routes form part of the strategic public transport network, there are no realistic plans for their construction and it is unlikely that the type of density that is desirable from a Transit Oriented Development perspective will be reached in the areas traversed by these routes.
- At a technical level, the traffic demand along provincial roads that have been designed as K-roads, i.e. conventional dual carriageway roads with at-grade intersections controlled by traffic signals, cannot be accommodated by the planned infrastructure and will require grade separation structures. Some examples where at-grade intersections have been replaced by a combination of a grade-separation structure and a quarter link are K46 and K60 at the Monte Casino complex and Fourways Mall and intersections along K72, including the intersection of K60 at the Clearwater Mall. An example where the projected traffic demand exceeds the capacity of an at-grade intersection and where adjacent land use prohibits the implementation of a suitable interchange configuration, is the intersection of K69 (Hans Strijdom Drive) and K34 (Lynnwood Road). The comprehensive planning process has not ensured a road network that will be able to accommodate future traffic demand.

At least some of the provincial K-routes have to be revised to ensure sufficient capacity, which will require the rationalization of the number of intersections and the provision of adequate road reserve to accommodate an appropriate interchange design. Although the quarter link solution goes a far way to increase the capacity of an intersection, it does not have the significant benefits of a proper interchange and is therefore not considered to be the most effective solution.

- Provincial routes occupy corridors in the urban environment that serve a municipal rather than a provincial function. Furthermore, the lack of provincial and municipal roads increasingly leads to land development that is focused on national roads. An example is the section of the N1 in the eastern part of the City of Tshwane where the vast majority of the peak hour traffic demand is short distance commuter trips. The function of provincial roads and the responsibility for their construction, viz à viz municipal and national roads need to be clarified.

The Gauteng Transport Infrastructure Act allocates the responsibility for the construction, financing, control, supervision, management, development, maintenance, protection, rehabilitation of all provincial transport infrastructure to the MEC of the Province responsible for provincial roads. The increasing size of the backlog in the implementation of the provincial road network clearly shows that the currently published provincial road network is far beyond the capacity of the provincial government to deliver.

In many cases it would be more appropriate to construct published provincial roads as municipal roads by the Municipality according to appropriate standards that can optimally serve their function within the municipal road network and integrated transport plan.

PROVINCIAL ROADS AS PART OF PROVINCIAL INTEGRATED PLAN

Functions of provincial roads

Two types of provincial roads can be distinguished, namely:

- Roads within a rural environment that can provide access to low density rural living areas, agricultural land, rural communities or tourism / heritage areas.
- Major roads that provide a link between different municipalities or development area or adjacent provinces.

It can be expected that regional nodes would establish along the major provincial routes that provide accessibility with a longer range of connectivity and therefore serve a larger catchment area; therefore these roads can be expected to carry very high traffic volumes.

There is a clear difference between the presence of provincial roads in the three metropolitan areas in Gauteng, i.e. Johannesburg, Tshwane and Ekurhuleni, and the remaining three metropolitan areas in South African namely, Cape Town, Ethekewini and Nelson Mandela. In Gauteng, provincial roads form a grid with a typical spacing of four kilometres even in areas without any proposed urban structure, while no such planning for future provincial roads exists in the metropolitan areas in other provinces. The network in Cape Town seems to be more appropriate where metropolitan freeway routes form the mobility skeleton of the metropolitan transport system.

Municipalities have executive authority to administer local government matters, including municipal planning and municipal roads. Provincial government must monitor and support local government in the province and promote the development of local government capacity to enable municipalities to perform their functions and manage their own affairs (Constitution of the Republic of South Africa, Act 108 of 1996).

The extent of the published provincial road network in Gauteng is considered to go beyond the authority of the province regarding provincial roads. Many of these roads perform a municipal function and should therefore not be provincial roads. The need for these roads and their potential future construction as important components of a municipal road network are in most cases acknowledged, but they do not currently and are not expected to in future perform a function of provincial significance.

Suitability of a grid network

Within a large urbanized area, a grid network of roads provides access in all directions. The reality of spatial development patterns, however, is a high concentration of development within development nodes such as the Central Business Districts of municipalities that may be better served by a network of circular and radial routes. Many metropolitan areas in the United States are based on a major roads network of concentric circles and radial routes and this pattern can also be observed in the road networks being implemented in cities in China.

The specific needs of the development patterns as they emerge in Gauteng are not necessarily best served by a grid road network that was conceptualized in the 1970's and the traffic demand of macro developments such as the Zonk'iziswe mixed-use shoppertainment development in Midrand should be taken into consideration during a continued re-assessment of the long term road plan.

The implementation of the Gauteng Transport Infrastructure Act has cast the provincial road network in concrete and it is extremely difficult and costly to amend elements of the provincial road network, particularly when a new alignment would traverse properties that are not currently affected by the provincial route. The grid pattern of the Gauteng road network is referred to as a timeless plan, but what is needed is an evolutionary process that ensures that the road network responds to the development dynamics of the province.

Geometric design standards

Current provincial road standards do not provide for the needs of pedestrians and the provincial standards that have been developed for public transport infrastructure have proven not to meet the needs of passengers. Throughout the Gauteng province large volumes of pedestrians walk along provincial roads without any paved walkways to provide the minimum level of comfort and convenience, while minibuses operate without any infrastructure to provide shelter to passengers and large numbers of taxis form informal ranks and holding areas within the road reserves of provincial roads.

Where provincial roads run through urbanized areas, such as Lynnwood Road (K34) and Atterbury Road (K40) in the east of the City of Tshwane, it is unavoidable that these routes would generate high volumes of pedestrians and public transport passengers and it is essential that geometric standards and ancillary road infrastructure be developed to ensure the efficiency and safety of all road users. It may in many instances be the preferred option to delegate the responsibility for the road to the municipality because the function of the road is more at a municipal scale.

Existing provincial design standards are not suitable to accommodate the level of land use development that is currently experienced in Gauteng. The floor to area ratios that are typically found in office and commercial developments are on the increase, and the density of cluster housing and apartment buildings has increased from typically 25-30 units per hectare to 80-200 units / ha in some areas.

Partial intersections and one-way roads may be some technical solutions to ensure that adjacent land use can be properly served and in many cases it may be preferable to transfer the route to the jurisdiction of the municipality. In other cases it may be essential to protect the functional integrity of the provincial road network and to apply strict rules regarding access control and the spacing of intersections and to, in fact, design roads to a higher standard to ensure that the roads provide the required traffic carrying capacity.

Impact of toll roads

The intention with the implementation of the Gauteng Freeway Improvement Scheme is that all freeways in Gauteng will be tolled. The upgrading of the existing freeways will certainly provide a much improved level of service, but on the other hand, it can be expected that many drivers would try to avoid paying toll and therefore divert away from the toll road onto provincial and municipal roads.

The tolling of all freeways can be expected to result in an increase in traffic demand on provincial and municipal roads, despite the increased capacity of the freeway improvement scheme. This will create an increased burden on the provincial and municipal road network and has to be taken into consideration in the planning and development of the road network.

Environmental considerations

Environmental impact assessments have resulted in significant amendments to the design of some provincial roads and in some instances where provincial roads traverse wetlands, authorization to proceed with the construction of the road was denied. The exclusion of a section of road along the length of a provincial route has a devastating impact on the function and feasibility of the route. It is therefore essential that all provincial roads be assessed so that the necessary diversions or amendments can be made timeously to protect the functionality of the route.

Conclusion

It is concluded that many external factors affect the demand for and traffic volumes on provincial roads and that the planning and design of the provincial road network should be responsive to these externalities.

Where roads are necessary for the development of municipalities, these roads should be transferred to the municipality as part of an integrated transport and land use system. Where roads perform a function at the provincial scale, the planning and design of these roads should be re-assessed to ensure that they have the necessary capacity, and it is expected that in many cases it would require the significant upgrading of existing planning to make provision for interchanges rather than signalized at-grade intersections that are unable to accommodate the projected traffic demand.

THE PARADIGM SHIFT

Paradigm shift defined

Paradigm shift is a term first used by Thomas Kuhn in his influential 1962 book "*The Structure of Scientific Revolutions*" to describe a change in the basic assumptions within the ruling theory of science. The paradigm is not simply the current theory, but the entire worldview in which it exists, and all implications that come with it.

There are anomalies for all paradigms, and when enough significant anomalies have accrued against a current paradigm, it is thrown into a state of crisis until eventually a new paradigm is formed and a paradigm shift has occurred. (*Wikipedia, The Free Encyclopedia*).

The need for a paradigm shift in the provision of transport infrastructure in Gauteng

The most important issues regarding the current provincial road network include:

- There is currently no suitable programme for the provision of a road network that can support the economic development of the Gauteng Province and the network of provincial roads (freeways and dual conventional dual carriageway road) cannot accommodate projected traffic volumes. Existing congestion on national, provincial and municipal roads has an enormous cost to the economy of the province.
- There is not a sufficient source of funding for provincial roads and it is essential that appropriate levels of funding be made available by the National Government for the maintenance and upgrading of existing roads and the construction of new major roads in Gauteng.
- Transport is a derived need and the development of the road network in the province should not be a supply driven process. The Provincial Department of Development Planning and Local Government should as a matter of urgency, formulate a Provincial Integrated Development Plan as envisaged in the Gauteng Planning and Development Act, 2003 (Act 3, 2003). The purpose of a Provincial Integrated Development Plan is to provide a strategic framework and implementation strategy for development in the

province, to guide resource allocation and to provide information that will guide development decisions, development projects and municipal spatial planning.

- Although the importance and priority of public transport are generally accepted and included in integrated transport plans, road planning and design must provide in the need of all users, including pedestrians, bicycles, public transport, freight and private vehicle travel.

WAY FORWARD

The past three decades have seen the evolution of transportation policies that are aimed to provide safe, efficient, reliable transport, etc for all road users. It has also seen the establishment of the disciplines of Traffic Engineering, Transportation Planning and Transport Economics that are well equipped to address the challenges of the transportation system for a highly developed province such as Gauteng.

However, the current provincial road network has to be drastically transformed to sustain economic and social development in the province. For this purpose the following strategy is proposed:

- Finalize the National Land Use Management Bill and develop a provincial integrated development plan that would provide guidance for the re-assessment of the provincial road network in Gauteng.
- Rail transport will play an increasingly important role in the province. The emerging density of development in Gauteng cannot be served by roads alone and the road network has to be amended to fully support rail transport and provide the necessary infrastructure for road-based public transport feeder services.
- Renewed emphasis on public transport, such as the Bus Rapid Transit systems that are being implemented require improved road infrastructure. It is a fallacy that public transport can replace the need for the improvement of the road network.
- Roads that do not fulfil a specific provincial function should be removed from the provincial road network and transferred to municipalities.
- The capacity of municipalities must be strengthened to ensure that they can plan, provide and manage the necessary road infrastructure. This must include primary arterials and a comprehensive hierarchy of roads.
- A Gauteng Transportation Institute should be established to ensure a source of well-trained professionals for the industry.
- Proper design standards must be developed for the road network in the province. These standards should be based on the following:
 - They must cater for all road users.
 - They must ensure sufficient capacity. This applies specifically to intersections, and the inability of at-grade intersections to accommodate the projected traffic demand on provincial roads must be recognized and designs must be amended accordingly.
 - They must employ design solutions such as one-way systems, partial and marginal intersections at the planning stage of the road network and the spatial framework or urban design stage of urban development to ensure an integrated transport and land use system that will function effectively and efficiently.

- Ensure the environmental feasibility of all road infrastructure to enable the timely modification of planning proposals to avoid unacceptable environmental impacts.
- Establish forums at provincial and municipal level that can facilitate the development of the provincial and municipal road networks with due regard to all stakeholders and the consultative basis that underpins the development planning philosophy in South Africa.

It is essential that at both the provincial and municipal level, the clusters that are responsible for economic and development planning and the provision of infrastructure should closely co-operate to transform the municipal and provincial road networks.

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