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Optimisation of Infrastructure Systems for Melbourne

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Abstract

Infrastructure is an integral part of a countries economy and requires the precise implementation of Infrastructure Systems. The demands on Infrastructure services for Melbourne have increased exponentially, causing significant congestion within the main Infrastructure services. Rapid urbanisation in Melbourne is straining the public sector's ability to provide essential Infrastructure services hence the significance towards developing a sustainable community for Melbournians. Although there is progress towards extending power, water, telecommunications, transportation and waste collection services, the delivery of these services lags far behind the needs, and the quality of some services remains poor.

To ensure that Melbourne's Infrastructure needs are successfully met, specific Infrastructure Assets Planning is required. This is necessary not only to provide sufficient Infrastructure to a community, but it must also be efficient and innovative so that it produces optimised engineering and economic systems. A optimised Infrastructure System must incorporate engineering techniques that will be sustainable for future years and maintained at acceptable levels. The fundamental challenges for optimization of Infrastructure with Melbourne include the ability to manage and sustain maintenance of Infrastructure to provide the acceptable level of service required by the community in a most effective manner which also strengthens service delivery to contribute towards Melbourne's future.

This paper investigates the optimisation processes such as structural integrity, which are necessary to rehabilitate and maintain the most necessary Infrastructure Systems for Melbourne and surrounding areas. Furthermore, this research focuses on the performance of the existing Infrastructure, asset condition analysis and assessment by investigating the remedies of improvement for urban Infrastructure in order to establish and implement Infrastructure advancements.

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Introduction

Infrastructure is seen as the interconnectivity between the physical and organisational structure that is required to support and develop a country. It is therefore essential to manage the Infrastructure well, in order to provide continuous sustainable and economic services to a community. Finnerty (2007) suggested that the development and maintenance of essential public Infrastructure is an important ingredient for sustained economic growth and fundamental urban planning. It can be argued that inadequate Infrastructure is perhaps the most binding constraint to urban growth throughout Australia. As a country develops and grows, the demand on the local Infrastructure is tested and governments at all levels need to manage and monitor the performance of their Infrastructure effectively and precisely.

As communities expand, they depend on greater Infrastructure and governments inevitably are required to ensure that budget constraints are met satisfactorily and that adequate means are sustain for Infrastructure growth and future maintenance.

Congestion is a growing concern of many global cities and the demands on Infrastructure services within a locale coupled by the rising expectations from the growing population and the stress this places on these cities. The population expansion and urbanization policy, such as the Melbourne 2030 or Melbourne at 5 million, should identify and respond to the importance of Infrastructure investment toward the sustainability of a growth city, and to maintain a high level of economic growth that supports a nation's social objectives such as Health, Education, efficient Water and Sanitation services.

Influence of Infrastructure Planning and Development on Urban Growth Boundary

The Department of Sustainability and Environment (DSE) in their development of Melbourne 2030 (in 1999) identified that in the next 30 years, Melbourne will grow by up to one million people and will consolidate its reputation as one of the most liveable, attractive and prosperous areas in the world for residents, business and visitors.

This increase in mass places strain on the current Infrastructure and amenities that service greater Melbourne. In recent years there have been a number of changes in establishing neighbourhoods and urban planning. Economic, social and environmental matters have played an integral part in the development of the Melbourne 2030 plan. The governments concern focused on maintaining liveability within the metropolitan growth boundaries that were established to give a high-level overview of the direction in which Melbourne metropolitan areas will take in future years.

Analysis of the organisationally relationships was required to provide government with the political and planning processes ideologies to underpin future practices.

In June of 2010 the Planning and Environment Amendment (Growth Area Infrastructure Contribution) Act 2010 (GAIC) was given the royal assent. Thus

the passing of the GAIC legislation has triggered the Government's expansion of the Urban Growth Boundary (UGB) through a planning scheme amendment which will redefine the city's boundary, and establishing new parameters that will focus on Infrastructure initiatives.

Department of Sustainability and Environment (DSE), 2000 planned, the Melbourne 2030 scheme as a means of managing urban growth and a mechanism to share the responsibilities amongst government, the community and industry. The schemed was designed to better plan communities and develops strategies that enhanced land usesand to provide a sense of identity, affordability and sustainability.

The rationale behind Melbourne 2030 is to extend the Urban Growth Boundary in order to accommodate unprecedented population growth in Victoria. Will the liveability be reduced as Infrastructure struggles to keep pace with the expansion of people? It should be feasible to see Infrastructure spending explode experientially to maintain momentum and cater for the stress placed on the environment, the land and the people, however the initial impact of Melbourne 2030 may be small in nature considering the overall population it is still insignificant .

In the three capital cities across Australia's eastern sea board (Melbourne, Sydney and Brisbane), the public has come to understand that the urban Infrastructure has fallen well behind demand and reasonable levels of provision for the future. Wilmoth (2003)

As Australia grows and outstrips supply, the impact can have a detrimental effect on the environment thus impeding on the nations sustainability. It is for this reason that "Systematic alignment of Melbourne Urban Plan Factors", should be constructed and observed to ensure there isn't a negative impact on the environment nor the creation of a poorly organised community without Infrastructure.

In addition, urban sprawl can impact and increase Green-house emission. The destruction of native land and depletion of wetland throughout Melbourne and Australia as whole. Managing Infrastructure planning and the development of efficient communities are in line with Melbourne 2030 policy and should harvest more robust policies that influence the design, structure and implementation of future urban design.

Optimisation of Infrastructure within the Melbourne Urban Plan.
(A Systematic Alignment)

Good urban planning needs to engineer "Systematic alignment between the engineering components, the social and economic situation coupled by the environmental factors is outlined in Figure 1.

Figure 1. Systematic alignment of Melbourne Urban Plan Factors
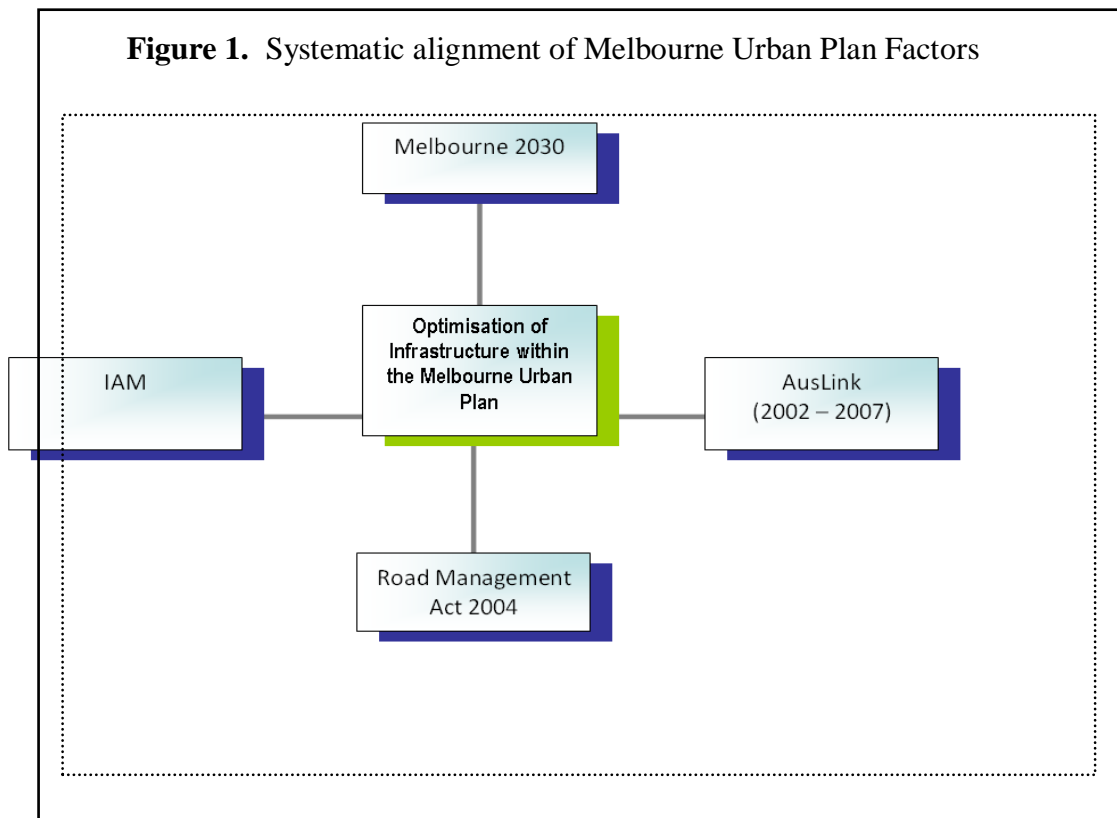
The Melbourne urban plan factors such as Infrastructure Asset Management (IAM) and Melbourne 2030 are key elements in establishming regulation for sustainable urban planning. Sahely etl (2005) expressed that research in the area of sustainable urban infrastructure reflects the need to design and manage engineering systems in light of both environmental and socioeconomic considerations. The systematic alignment is seen as the optimisations of these factors and is considered to be the critical processes for creating a liveable city. To achieve this goverrmnets must optimise processes and place consideration towards the Engineering, Economic, Social and Environmental issues of a municipality.

The Melbourne urban plan factors, such as AusLink and the Australian Road Management Act 2004, are also significant in establishing regulation for sustainable urban planning to not only, increase the liveability, but to sustain future growth. A principal challenge for any optimasation of infrastructure is the engineering development of tools that allows gentrification of urban infrastructure over its life cycle. This is crucial to ensure that the framework focuses on the interactions displayed in figure 1 and generates feedback for future works.

Melbourne 2030

During its establishment in early 2000, Melbourne 2030 (planning for sustainable growth) was a 30-year plan to manage growth, the change across

metropolitan Melbourne and the surrounding region (within the state of Victoria). It emphasised Melbourne's interdependence with regional Victoria, to provide maximum benefit to the whole State of Victoria.

In 2000 the department of Sustainability and Environment stated that Melbourne will grow by up to one million people and will consolidate its reputation as one of the most liveable, attractive and prosperous areas in the world for residents, business and visitors. In order to achieve a balance between liveability and infrastructure requirements the Melbourne 2030 strategy provides a framework for governments at all levels to respond to the diverse needs of those who live and work in and near to Melbourne and those who visit, through a set of Principles and nine Key Directions.

The plan is anchored in the stated principles of: sustainability; innovation; adaptability; inclusiveness; equity; leadership; and partnership.

Drawing on these principles and as noted by Butterworth etl (2005) there are nine key directions are outlined in the Melbourne 2030 scheme and they are defined as follows:.

(i) a more compact city; (ii) better management of metropolitan growth; (iii) networks with the regional cities; (iv) a more prosperous city; (v) a great place to be; (vi) a fairer city; (vii) a greener city; (viii) better transport links; and (ix) better planning decisions and careful management.

As Melbourne expands and the population grows, and the demand on Infrastructure increases it is crucial that the principles and key directions of Melbourne 2030 are utilised to ensure that Melbourne retains the qualities that people enjoy and the social relationship that Melbournians have with the surrounding regions.

Melbourne 2030 focuses primarily on the metropolitan Melbourne urban area and the nearby non-urban areas. However, it also deals more broadly with the wider region where, development is linked to and affected by increasingly metropolitan Melbourne area in terms of commuting, business and recreation.

Wood etl (2008) identified that the two key thrusts of the strategy, enshrined in the state planning policy framework are: designation of a network of inter-metropolitan "activity Centres", and the creation of Urban growth boundaries". Furthermore some of the more important key questions which the Melbourne 2030 tackles include:-

1. How to successfully meet the growing population's demand and ensure that the communities live within the available resources of water, land and energy.
2. How should urban development be controlled and what pattern of Infrastructure expansion should be planned.
3. What additional Infrastructure will be needed to support a growing city such as Melbourne?

Responding appropriately to these questions is a fundamental process of "Optimisation of Infrastructure within the Melbourne Urban plan". In addition, "Optimisation of Infrastructure within the Melbourne Urban plan" took on a

new direction in December 2008, with Melbourne at 5 million which is an extension of Melbourne 2030 and focuses on the creation of a multi-centre city through six (6) new Central Activities Districts (CAD); in Box Hill, Broadmeadows, Dandenong, Footscray, Frankston and Ringwood.

Moving from one centre (the Central Business District) to a number of centres will reduce congestion and enable people to spend less time commuting to and from work and more time with their family as noted by The Department of Infrastructure and Transport in their Nation Building Program over the six year period from 2008-09 to 2013-14.

With the creation of these CAD the juxtaposition of IAM, AusLink and Road management is critical in assuring that Melbourne 2030 has the ability to sustain the requirements of the growing demand for cross-town movement of freight, commercial and commuter traffic to the long-term development and the economy viability of Melbourne. An example of this progress can be seen in a paper written by Imran Muhammad and Nicholas Low in December 2006 where they identify the significance of infrastructure linkages between major highways that operate throughout Melbourne. It was at the end of the 1980s when the government had decided to review Melbourne road system in order to enhance travel and decrees congestion.

As a result of this a number of high speed freeways such "City Link" where created to

Provide a link between freeways to the north, west and south of the CBD in Melbourne.

Australian Road Management Act 2004

Achieving effective and efficient, Infrastructure sufficient Melbourne is dependant on planning, development and introduction of policy that ensures current and future Engineering, Economic, Social and Environmental requirements of the Melbourne urban plan are appropriately satisfied.

One of the projects that addressed that need is the "Road Management Act" 2004 that has regulated road management responsibilities in Victoria (and other states) in conjunction with respective authorities to maintain road assets to the standards. Standards adopted in consultation with community and end-users. Subsequently, each municipality's Road Management Plan (RMP) identifies responsibilities, maintenance standards and inspection processes required to manage civil liability. Furthermore, each municipality's RMP should demonstrate that the Council as the road authority is responsible for managing all the road assets under its control.

The department of Infrastructure, Transport, Regional Development and local Government under its Auslink program have adopted some general principles of Road Management Planning that have been categories into four main elements:-

1. A register of public roads which entails the list of roads for which the Council is responsible.

2. A road asset register, which includes a list of all assets in the road reserve and includes valuation of these assets.

3. A road asset management system which provides an outline of how road assets will be managed to deliver a safe and efficient road network.

4. A schedule of maintenance standards which contains the development of responsible maintenance standards to meet community expectations.

The Road Management Act 2004 is a key part of the "Optimisation of Infrastructure within the Melbourne Urban plan". Effective utilisation of this Act ensures that improved control and restriction mechanisms are applied during the urban development which allows the community at large to gain the maximum benefits. These restrictions should be centred within the overall Melbourne 2030 planning provisions and will assist future endeavours that are been developed across both Greenfields & Brownfields developments. This collaborative approach will ensure better road transport systems and distribution of responsibilities towards road management.

AusLink (2002 – 2007)

In 2002, the Australian Federal Government and the department of transport and regional services initiated a cooperative transport plan called AusLink, One of the key components of the AusLink process is the development of a strategy for each corridor of the AusLink National Network. A Corridor Strategy is a statement of the shared strategic priorities of the Australian and State/Territory Governments for the long-term (20-25 year) development of the corridor Department of Transport and Regional Services 2007. As a result the Commonwealth government injected $15 billion in funding for road and rail projects in a five year plan as at 30 June 2007.

The primary aim behind AusLink was to develop transport corridors of strategic national importance in order to improve logistics, enhance trade, and promote connectivity that is consistent with sustainability. Many factors influenced this project with the main objective being the delivery and determination of Melbourne's road networks to ensure the demand on capacity is met and to help improve the quality of decision making and in the allocation of resources. The AusLink project looked at new cost-effective and technological enhancement that could be implemented on road management practices in-order to ease congestion on urban arterial roads and improve the transportation link via other services and ports. Gharehbaghi (2005) identified that there is much importance placed on facilities and that the AusLink program was designed to improve and enhance rail and road links between cities to encourage connections between production/manufacturing areas and their distribution centre. This was achieved by stronger linkages between major ports and arterial roads.

One of the key components of the AusLink process was to development of a strategy for each corridor of the AusLink National Network. A Corridor

Strategy is a statement of the shared strategic priorities of the Australian and State/Territory Governments for the long-term (20-25 year) 'AusLink' is both the generic name for the federal Government's ideas to reform the way in which transport Infrastructure of national importance is funded in Australia, and, is the title of a Green Paper (AusLink: Towards the national land transport plan) released in November 2002, and written by Kilsby (2003).

In 2002 AusLink developed a five-year multimodal national plan for the network, based on input from both the public and private sectors which encouraged and identified that more integrated and efficient Infrastructure policies were required to be invested upon. Gharehbaghi (2009). In part, the strategic and operational decision were allocated to projects that best contributed towards national objectives on strategic transport networks, and incorporated best solutions embracing, wherever possible, new technology and better management systems.

To be effective, Government at all levels needed to be successfully involved in this extensive exercise, including the creation of broad and detailed Acts such as Infrastructure Road Management Act 2004, which in turn involved the refinement of processes and practices. In 2003 a new inter-Governmental agreement was proposed between the Federal, State and Local Governments that underpinned the new planning and funding arrangements for the network. Gharehbaghi (2009) discussed the need for Public Private Partnership (PPP) and how this joint venture between public and private sectors would enhance development and encourage investors to buy into Infrastructure projects to increase the funds contributed towards major projects and their completion.

In addition to Auslink a national advisory body was established to advise transport ministers (at both state and federal levels) on priorities for national Infrastructure investment and reforms, further supporting the inter-modal integration and Infrastructure pricing. To be effective and ensure evolution occurs it was proposed that eventually AusLink would transform into a broader national transport policy by integrating improvements to the Infrastructure Asset Management policy (IAM) practices.

Infrastructure Asset Management (IAM)

The Infrastructure Investment Plan is a measure to better meet the challenges, which Australia faces in the global market place. Franks Etl (2008) identified that the Infrastructure Asset Management (IAM) is the discipline of managing Infrastructure assets that underpin an economy and its management methodology for sustainability. Gharehbaghi (2005). Identified that the IAM is the process of guiding the acquisition, its use and disposal of assets to make the most of their service delivery potential and manage the related risks and or costs over their lifetime. The IAM approach incorporates the economic assessment of trade-offs among alternative investment options and uses this information to help make cost-effective investment decisions. Hardwicke (2005) further supports this and also states that this process underpins the

delivery of essential services, drives economic growth, supports social needs and is closely linked to high quality of life.

Effective IAM implementations are both operational and trategic and formulate the base for continuous improvement within asset management. Gharehbaghi (2005) (2006) indicates that IAM is an engineering and management tool. A mechanism that assists in the decision-making and formulation of frameworks to cover an extended period and draws from the economic environment to consider a broad range of assets as well as potential design issues,

As Melbourne approaches a population of 5 million, the IAM process is critical and extremely necessary to investigate environmental changes and service demands to the general public now and well into the future. With ever increasing system demands, budgetary requirements and accountability to the public, efficient IAM is necessary. Gharehbaghi (2009), identified that today's transportation environment is characterised by high user demand, stretched budgets, declining staff resources, and a transportation system that is showing the signs of age.

At many levels Infrastructure such as design, construction, maintenance and operations, can be appropriately aligned to the change management required to systematic alignment of Melbourne Urban plans factors outlined in Figure 1. The IAM can be seen as the optimization of changes in the transportation environment and changes in public expectations. Gharehbaghi (2009) distinguished that the public has to make significant investments in the design, construction, maintenance, and operation of the Infrastructure systems and expects that Federal, State, and Local Government and other authorities inclusive of organisations will be responsible for these investments.

Conclusions

This paper has investigated some of the fundamental issues within the Melbourne urban plan such as Infrastructure Asset Management, AusLink and the Australian Road Management Act 2004, which the Governments at all levels must deal with to provide an economically viable solution to the changing Infrastructure so it may suits the needs and services the strategies of a metropolis. The paper also addressed the need for urban plan and how specific Infrastructure Assets Planning is needed not only to provide sufficient Infrastructure to a community, but ability to build a sustainable community that has a recognition of population growth, changing demographics and the ever changing urban development on both a macro and micro level.

As the demand for better and improved Infrastructure increases, the Governments (at all levels) need to be aware of the amplified demand and create an optimised IAM process that meets the escalating urban demand. Governments will need to assess their master-planned communities, its policy and required budgetary spend to maintain and produce sufficient infrastructure systems that will cater for Melbourne's future growth.

In generating "Melbourne Urban Plan Factors" alignment, this paper investigated some of the fundamental issues in urban planning such as Infrastructure Asset Management, AusLink and the Australian Road Management Act (2004), which the Governments at all levels must deal with precisely.

Infrastructure is an integral part of the Australian economy and is becoming increasingly popular to both local and state governments, and developers, as a means of residential provisions within sustainability. As a result the demands on Infrastructure services within a locale coupled by the rising expectations from the growing population show the need for well implement and thought out systematic alignments for urban development of communities. The ability to manage and sustain maintenance of Infrastructure to provide the acceptable level of service required by the community is challenging and must be carried out in a most effective manner which also strengthens service delivery to contribute towards Melbourne 2030 and builds a conclusive picture of the community requirements by understanding and recognition of population growth, changing demographics and government policy.

Implementation of future residential development will need to adopt the new methodology of master-planned estates which are becoming increasingly popular to both local and state governments, and developers, as a means of residential provision. The linkages between the policies address in this paper are become ever more important and interdependent. IAM require specific Infrastructure Assets Planning, not only to provide sufficient Infrastructure to a community, but also be efficient and innovative, so that it produces optimised management and engineering techniques that will be sustainable for decades to come by maintaining an acceptable level of services to its intended community in an effective manner which also strengthens service delivery. Urban plan and the optimisation of Infrastructure is case specific in its application and needs to address the possible challenges for decades to come.

On the other hand, AusLink, Road Management Act 2004, and Melbourne 2030 are comprehensive representation of a government's response to a wide-ranging population growth together with service optimisation within Melbourne metropolitan area.

The ability to plan and link Infrastructure around IAM, AusLink, the Road management Act and Melbourne 2030 creates a clear focus for the future management of growth, land use and Infrastructure investment. Infrastructure contribution will provide a vital context for urban development and specific scope to the overall Melbourne urban planning scheme and the directions metropolitan Melbourne is expected to take.

This paper has investigated the fundamental issues that contribute to "Optimisation of Infrastructure within the Melbourne Urban Plan", and demonstrated that when it comes to collective infrastructure and service provision for the broader socio-economic group, it isn't limited to one factor but more the development of a National Network strategy that best suits a developing community. Finally the paper identifies and highlights the

importance of innovative process which included systematic alignment of Melbourne Urban Plan Factors that help develop sustainable communities for the future.

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