

**LAURA SCHMAHMANN***Senior Consultant**SGS Economics and Planning*[Laura.Schmahmann@sgsep.com.au](mailto:Laura.Schmahmann@sgsep.com.au)**UNLOCKING 'CITY SHAPING' POTENTIAL THROUGH INTEGRATED TRANSPORT AND LAND USE PLANNING**

The need for better integration of transport and land use planning is a long-standing issue. The 'traditional' idea of transport and land use planning integration, identifies the urban planning system as the means by which city structure – both at the macro and corridor levels – can be reshaped so as to better facilitate efficient and/or more sustainable transport operations. Full integration of transport and land use planning requires a much more strategic response and a systematic approach to harness the power of real integration. It needs to recognise the city shaping power of some transport investment decisions.

Once it is recognised that major transport decisions can redirect the pattern of urban development, or change its density and land use mix, transport planning can become a pro-active agent in the formulation of a preferred city structure.

The underlying philosophy of setting new approaches for integrating transport and land use, relies on optimising responses to challenges or 'problems' that might arise in the achievement of transport system objectives. The coordination of infrastructure is important to maximise the potential of the infrastructure investment and realise the potential combined transport and land use benefits. Governance arrangements will be key to implementing a best practice approach to integrated transport and land use planning.

## 1. Introduction

This paper draws on material developed for the steering committee of the *National Guidelines for Transport System Management (NGTSM) Revision Project* (Transport and Infrastructure Council, 2016a, 2016b).<sup>1</sup> The focus is on understanding the true city shaping power of infrastructure and moving beyond the traditional planning approaches to fully integrated transport and land use planning (ITLUP).

ITLUP is focused on addressing a city or region's longer-term challenges, working to a shared vision of what a city or region aspires to be in the future, and coordinating investments and policy decisions to achieve that vision. The approach guides strategic decisions regarding growth corridors, designated centres, major transport and other infrastructure that influence how a place works – where jobs, housing and transport connections will be located, how they connect across the existing network and how local places work.

Australian cities are growing rapidly. Both federal and state governments are committing significant funding to infrastructure initiatives<sup>2</sup>, and there is a need to ensure resources are wisely invested (Prosser, Fensham and Schmahmann, 2015). There is a focus across all governments for greater transparency and robust investment appraisal processes. These investment decisions have a long legacy and reversing them takes significant time and is often costly. Strong integration between land use and transport can avoid these issues, while also creating an efficient transport and land use system

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<sup>1</sup> The authors acknowledge the input of the steering committee members, in particular Peter Tisato, however the opinions within this paper remain those of SGS Economics and Planning.

<sup>2</sup> The term initiative here is used in NGTSM instead of project. An initiative includes both investment/infrastructure and non-investment/non-infrastructure interventions.

that can generate a range of economic, social and environmental benefits. The benefits must be adequately understood and captured during the integrated planning and appraisal process. With this in mind, an understanding of the two-way impact between transport (particularly infrastructure) and land use through integrated ITLUP will be important to informing these decisions.

The notion of integrated transport and land use planning has been proposed for a long time, and the need for better integration of transport and land use planning is a long-standing issue in the literature. Something of a 'break through' came in the early 2000s when the Commonwealth sponsored the production of a National Charter for Integrated Transport and Land Use Planning (Australian Transport Council, 2003) which identified the potential for integrated land use and transport planning to deliver an efficient transport and land use system.

The traditional understanding of ITLUP, generally reflected within existing guidelines and policy frameworks, has been that better structuring of urban areas can facilitate better transport outcomes. This 'cluster and connect' approach, while reasonable, underplays the crucial fact that the transport network is more than a servant of a city structure; it can be the principal shaper of that city structure.

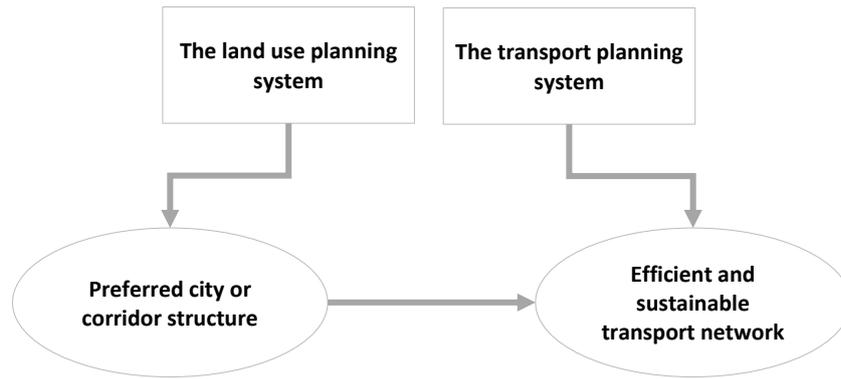
In the latest version of NGTSM, new guidelines on ITLUP have been included (Transport and Infrastructure Council, 2016b). They provide an introduction to the important issue of the city shaping impact of transport. In the absence of such coverage in previously published guidelines, they provide an important first step in developing an awareness, capability and practice in this important aspect of integrated planning.

While the city shaping power of major transport investment is increasingly evident in a range of recent infrastructure initiatives across Australia, it is not yet mainstream nor necessarily well understood. There has been significant progress in ITLUP in terms of the identification of corridors for growth, but there remains a gap in integrated planning guidelines on city shaping infrastructure.

This is particularly pertinent for NSW where the NSW Government as a 'matter of priority' is looking at 'game changing' enabling infrastructure, transport and other government initiatives with city shaping potential (NSW Government, 2016). Only a small number of initiatives could be classed as city shaping as few have the capacity to significantly shift transport movements across a metropolitan area. It will be important that there is a consistent understanding of city shaping infrastructure in developing this list as these decisions have long-lasting impacts.

## **2. Approaches to ITLUP**

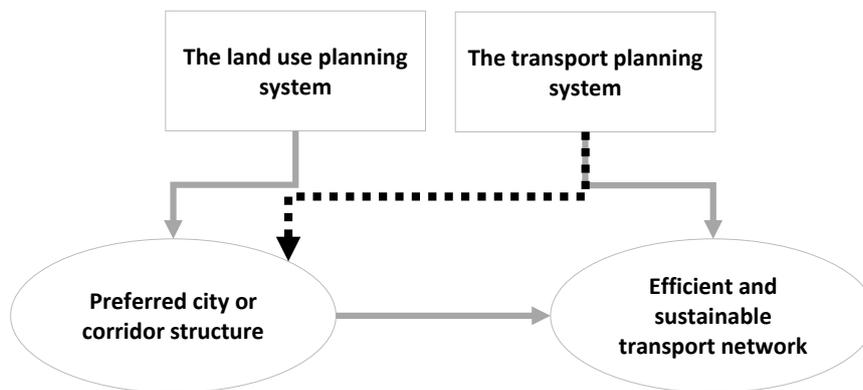
As mentioned previously, the traditional idea of ITLUP sees the urban planning system as a means to reshape a city at the district and corridor levels to facilitate efficient and more sustainable transport operations. This suggests an urban planning approach directed at increased densities around high capacity public transport links or striving to balance local job stock and housing to reduce the need for travel (see Figure 1).



**Figure 1** 'Traditional' concept of transport and land use planning integration (Transport and Infrastructure Council, 2016b)

This cluster and connect model plays an important role at local and district levels, and contributes to the overall structure of the metropolitan area. For example, at the neighbourhood level, the cluster and connect approach has a strong place-making focus by consolidating important community facilities around public transport and, occasionally, using some forms of public transport such as light rail to calm traffic and promote local development activity. The cluster and connect model is already subject to significant guidance in terms of urban design and structure planning to achieve better integration at the district, corridor, suburb and neighbourhood levels (see Transport and Infrastructure Council, 2016b for references).

As mentioned above, the cluster and connect approach underplays, the crucial fact that the transport network is more than a servant of a city structure: it can be the principal shaper of the structure of a city. Full integration of transport and land use in planning requires recognition of the city shaping power of some transport investment decisions and taking on a systematic approach to harnessing this power. This relationship is depicted in Figure 2.



**Figure 2** 'Emerging' concept of transport and land use planning integration (Transport and Infrastructure Council, 2016b)

ITLUP should go beyond the role of cluster and connect and recognise an emerging approach that harnesses the city shaping power of some transport investments. Spiller et al (2012) have noted that failure to recognise the city shaping effects of strategic transport infrastructure will lead to sub-optimal urban outcomes, which become locked in because of long gestation periods and reinforced planning efforts. To avoid this, practitioners should fully integrate transport and land use planning in a way that recognises the city shaping power of some transport investment decisions and adopt a systematic approach to harnessing this power.

Once it is recognised that major transport decisions can redirect the pattern of urban development, or change its density and land use mix, transport planning can become a proactive agent as a city's vision is formed. This goes a step further than the traditional land use planning approach where optional land use futures are tested for transport efficiency, and transport investment largely responds to a cluster and connect framework.

### 3. Types of transport infrastructure investment

Infrastructure initiatives, including transport initiatives, can be differentiated according to their impacts on household and business location decisions and therefore on the pattern, structure and density of urban development. This differentiation underpins the improved approach to planning which is achieved by using the following typology of infrastructure initiatives or assets:

- Strategic (or city-shaping) infrastructure
- Structural (or district) infrastructure
- Local (or follower) infrastructure.

#### **Strategic/City-Shaping infrastructure**

Strategic or city-shaping infrastructure includes works that are almost exclusively in the transport domain and have the power to alter relative accessibility across the metropolis (for example, the Sydney Harbour Bridge, Melbourne Underground Rail Loop or the Sydney M7 Motorway). These investments drive where people live and where businesses locate. They create new agglomeration economies, boosting productivity and taxation revenues.

Only a small number of initiatives could be classed as strategic infrastructure as few have the capacity to significantly shift transport movements across a metropolitan area. Generally, the smaller the city, the more likely a greater range of transport initiatives are considered strategic infrastructure, because existing accessibility contours will be more subject to change (Spiller et al., 2012).

#### **Structural/District infrastructure**

Structural or district infrastructure represents higher-order or trunk facilities and networks (excluding strategic infrastructure) that form a region's urban framework. It includes arterial roads and district public transport connections. These items are distinguished by their districts service catchments and their cost.

#### **Local/Follower infrastructure**

Local or follower infrastructure includes services and facilities with localised service catchments. While vital to community wellbeing and business efficiency, local infrastructure neither shapes development patterns nor provides an overarching structure for settlement and industry development. It provides services into a suburb or neighbourhood once the area has been enabled by investment in higher order infrastructure initiatives.

Neither structural nor local infrastructure have a significant enough impact on relative accessibility to influence the shape of the city.

These three infrastructure categories are summarised in Figure 3.

**Strategic or city-shaping infrastructure**

Shifts relative accessibility across a city area, influencing location decisions of households and businesses and shaping settlement patterns.

Examples: Sydney Harbour Bridge, Melbourne Underground Rail Loop and the Sydney M7 Motorway.

**Structural or district infrastructure**

The high level network elements and nodes that form the structure of a subregion or district.

Examples: Sydney CBD and South East light rail and Gold Coast light rail.

**Local or follower infrastructure**

The local services that flesh out a city's urban structure.

Examples: suburban and neighbourhood bus routes and cycling infrastructure.



**Figure 3** Overview of transport infrastructure investment (Transport and Infrastructure Council, 2016b)

## 4. City-shaping infrastructure

As discussed above, the accessibility effects of major transport initiatives can change a city's development patterns and growth trajectory. This can change the decisions people and businesses make about where to locate, setting a new geography of land values. The market then signals where new and/or intensified urban development is warranted, creating a shift in urban form and, sometimes, structure.

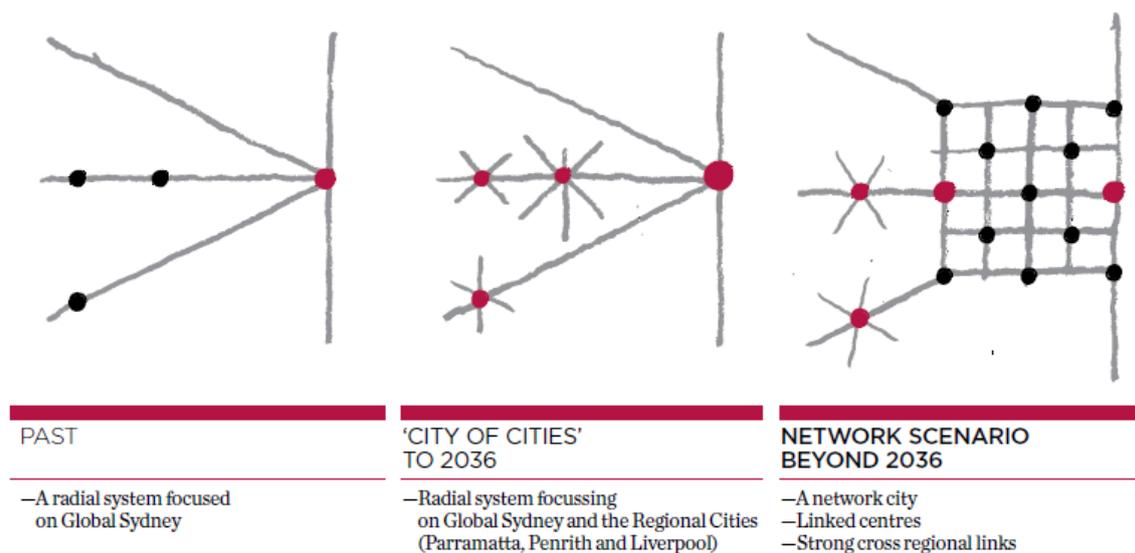
Clearly, major transport investments can be a powerful policy lever for determining a city's structure, with land use regulation playing a supplementary role in managing urban development. This means that strategic transport initiatives need to be conceptualised within the context of a preferred urban structure rather than a traditional approach where transport investment simply responds to demonstrated demand.

## 4.1 City structure

Urban or city structure is defined by the distribution and relationships of the dominant land uses, and the networks that serve them (Westerman, 1998). City Structure is concerned with how land uses are arranged and all aspects of how a city functions. The structure and economic geography influences the social, economic and environmental characteristics of the city. City structure has a strong influence on the opportunities and constraints shaping future land use and infrastructure investment decisions.

A clear and compelling vision for the future structure of a city is necessary to guide land-use planning decision making, guide private investment activity and provide the wider community with a degree of certainty and purpose as a city grows or evolves. Investments in transport can set a city towards the vision, or inadvertently steer it elsewhere.

For example, the *Metropolitan Plan for Sydney to 2036* contained a vision for Sydney to develop into “a more compact, connected and increasingly networked city that supports a wider range of prospects for urban renewal and employment growth in areas that have potential for sustainable growth networked city” (NSW Department of Planning, 2010, p. 26). This concept or vision is reflected in Figure 4.



**Figure 4** Towards a network city, vision for the city structure of Sydney (NSW Department of Planning, 2010)

This represents a clear long-term vision for the structure of Sydney which city shaping infrastructure can contribute to. The *Metropolitan Plan for Sydney to 2036* identified that transport initiatives within the *Metropolitan Transport Plan* would strengthen this structure through connections between the regional cities and other strategic centres (NSW Department of Planning 2010, p. 26).

The concept of the networked city was reflected within the 2012 *NSW Long Term Transport Master Plan* (refer to Figure 5) with the focus again on connections between regional and strategic centres across Sydney, moving away from the radial network and towards a connected network. This is an example of an integrated vision across different government agencies which does not necessarily require one document or process. This approach is closely aligned with the concept of city shaping infrastructure presented within this paper.

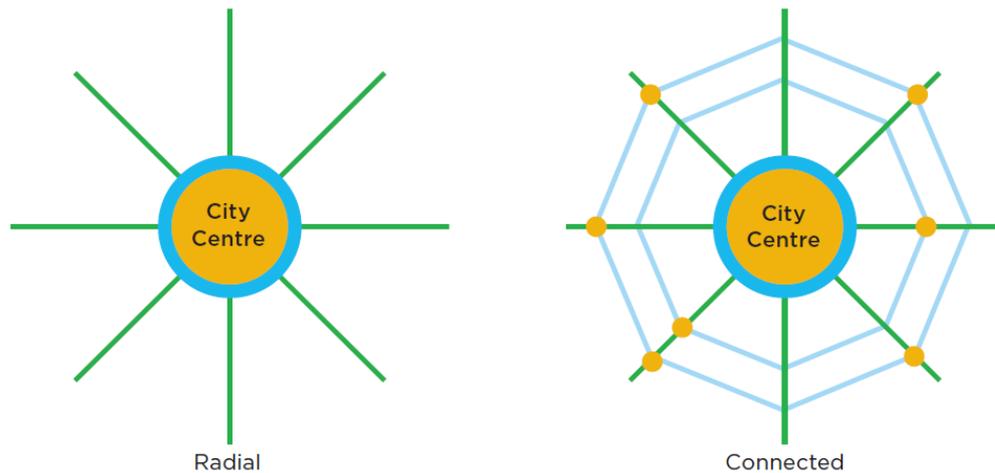


Figure 5 Radial versus connected network (Transport for NSW 2012)

## 4.2 Identifying strategic transport infrastructure

Alongside setting a clear vision for the city structure, it is important to understand what constitutes city shaping infrastructure and how it can impact the economic geography of the city. Identifying strategic city shaping initiatives requires a suitable land use and transportation simulation model that measures shifts in relative accessibility across a city, given the addition or withdrawal of strategic links and/or the spatial reallocation of substantial numbers of jobs through other policy interventions. Only initiatives that can demonstrably and significantly raise or lower the relative accessibility of a particular area of the city would merit strategic designation (Spiller et al., 2012).

Questions to consider when identifying whether infrastructure is city shaping include:

- Will the initiative demonstrably and significantly raise accessibility?
- Will the initiative substantially redistribute jobs across the region?
- Will the initiative substantially redirect the property market or increase desirability of a particular area?
- Are there opportunities to strategically shift land uses through land use planning in response to the proposed initiative?

Answers to these questions can be measured by looking at effective job density (EJD)<sup>3</sup> or access to jobs. An initiative with a big impact is city shaping infrastructure initiative. A simpler measure involves calculating the jobs accessible within 30 minutes. The change in these measures produced by the transport initiative indicates the scale of their impact.

Initiatives that result in a significant shift in mode share rather than land use are not considered strategic city shaping. For example, while the Gold Coast light rail is an important transport initiative for the city and has resulted in an increase in public transport usage, it is considered structural infrastructure rather than city shaping because it has not significantly shifted the way land is used.

Recent examples of city shaping infrastructure initiatives have been detailed below, highlighting why these initiatives would be considered to be city shaping.

<sup>3</sup> Effective Job Density is statistical index of agglomeration in economic activity; it comprises the number of jobs in a locality plus all the jobs situated elsewhere that can be reached from that locality, divided by the travel time involved in reaching them.

**City shaping case study: Sydney Metro City and South West (NSW)**

The proposed Sydney Metro City and South West infrastructure initiative will extend the Sydney Metro North West from Chatswood to Bankstown with a new metro line between Chatswood and Sydenham and conversion of the existing railway line between Sydenham and Bankstown to metro operations. It is intended to increase the number of trains travelling through the CBD during peak hour. A number of new stations are proposed along the new rail line between Chatswood and Sydenham including a station at Barangaroo and Waterloo (refer to Figure 6).

The Sydney Metro City and South West is expected to substantially increase accessibility from the corridor to employment opportunities concentrated across Global Sydney. The initiative is considered to be city shaping because of this substantial shift in accessibility for residents within the Sydenham to Bankstown corridor as well as its impact on the property market and opportunities to strategically shift land uses.

The station at Waterloo is expected to not only increase the proportion of jobs accessible within 30 minutes for existing residents but also shape land use near the railway station. The NSW Government-owned land (social housing) was marked for redevelopment as a mixed housing estate, with the station at Waterloo driving the future redevelopment. This highlights that land use considerations such as redevelopment opportunities, should be incorporated into the detailed alignment of a transport infrastructure initiative. Similarly, structure planning along the Sydenham to Bankstown section of the corridor has been focused on identifying and addressing constraints to increasing housing supply and opportunities to improve amenity.

The land use context must be considered to understand if there are opportunities for land use development associated with the shift in accessibility. If, hypothetically, there are too many constraints within the corridor such as fragmented land ownership, or substantial redevelopment has already taken place, then the opportunities for significant change and therefore city shaping may be limited.

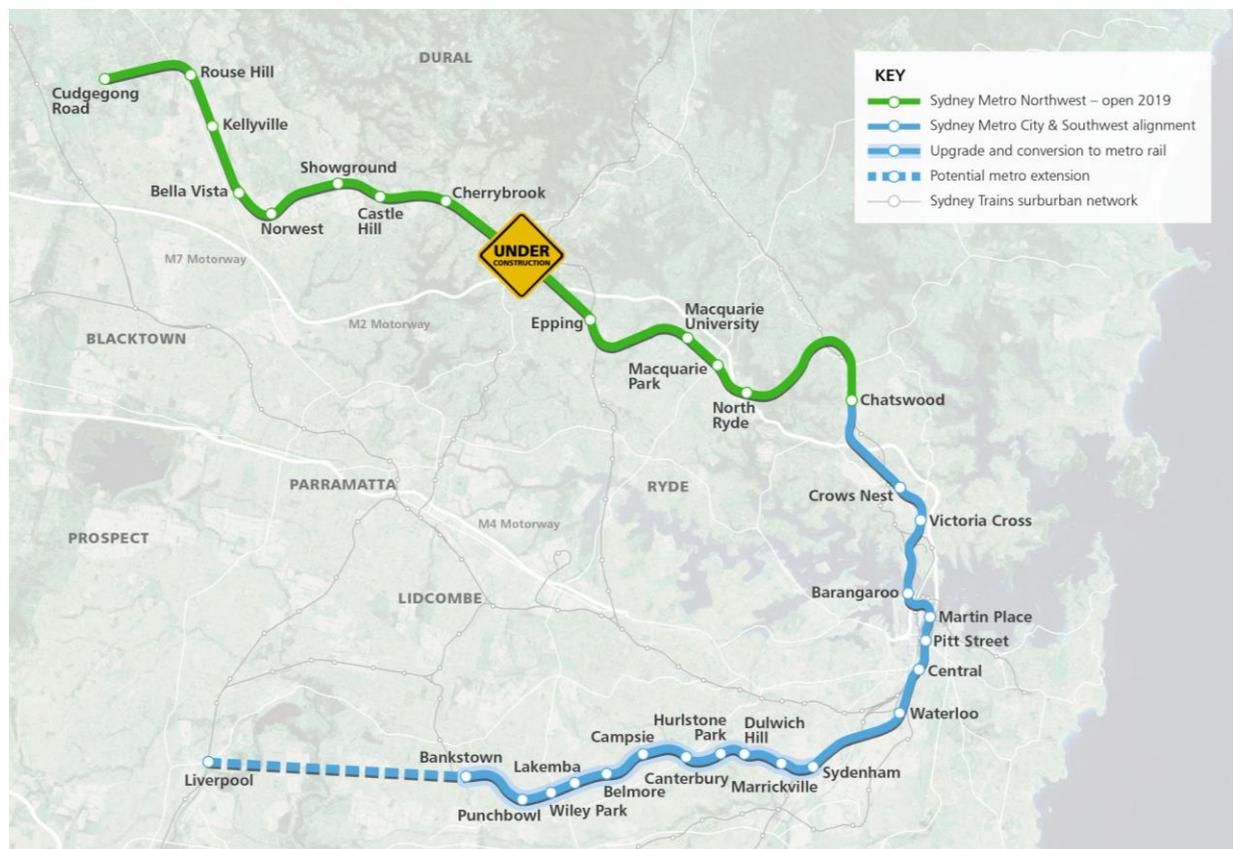


Figure 6 Sydney Metro City and South West alignment (Transport for NSW, 2015)

**City shaping case study: Crossrail (London, United Kingdom)**

Crossrail is currently under construction in London and will link Heathrow Airport, the West End, the City of London and Canary Wharf through an underground tunnel under central and south east London. The initiative is expected to improve access for 750,000 workers who currently commute into London (Crossrail, 2015). Figure 7 highlights the projected impact on accessibility to jobs, illustrating the spatial extent of this increase in accessibility.

Crossrail is also expected to impact London's economic structure, particularly the finance and business services market. New jobs expected as a result of Crossrail are likely to be internationally mobile jobs, that is, if they were to locate elsewhere, they would likely locate in other major global cities such as Paris or Frankfurt rather than other areas of the UK (Meeks et al., 2002). This demonstrates the significant structural shift and city shaping potential of Crossrail.

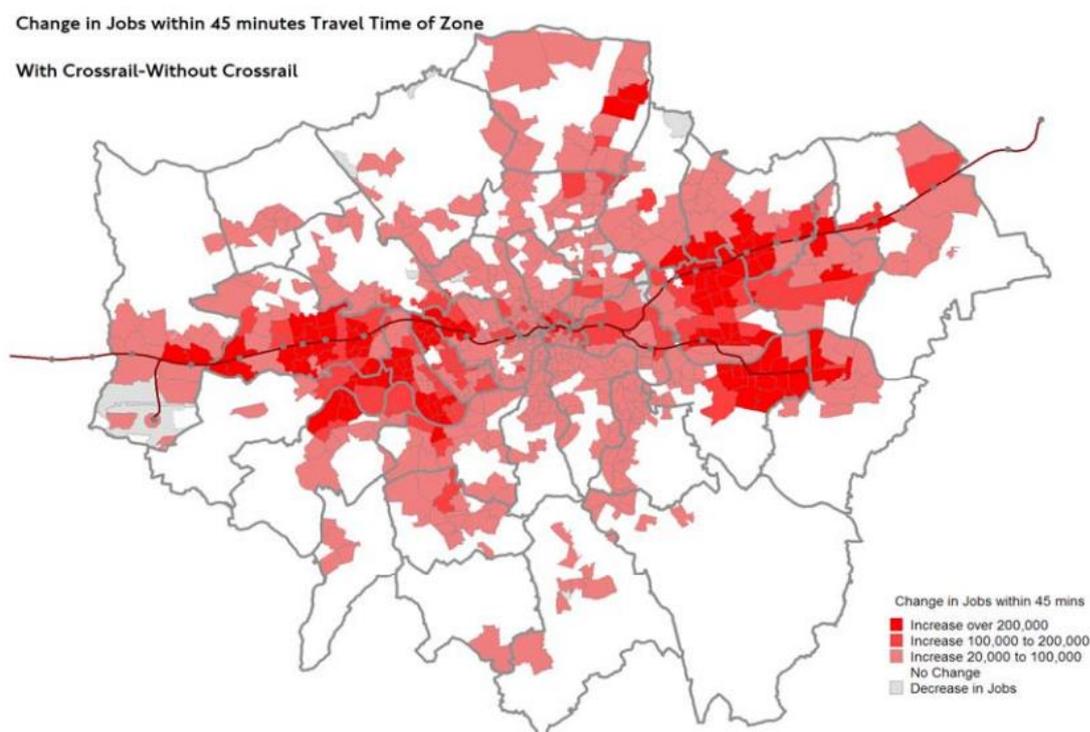


Figure 7 Crossrail impact on access to jobs (Crossrail, 2011)

**City shaping case study: Mandurah railway line (Western Australia)**

Investment in modern heavy rail commuter infrastructure is transforming Perth's urban structure. The Mandurah railway line opened in 2007. It is a suburban railway line that runs through the south western suburbs of Perth connecting Perth with Mandurah, via Rockingham. While operating conditions in the new suburban rail system are not always ideal - for example, some train services run down the centre of freeways (refer to Figure 8) - the community has flocked to the network. It has influenced more compact forms of satellite development in the northern growth areas of Perth while improving accessibility to the Perth CBD.

More recently, investment in a new southern line linking to Mandurah has established the potential for a string of transit oriented developments that are actively being pursued by the WA Government in line with the vision set out in successive metropolitan strategies.



Figure 8 Mandurah Line (clockwise from left: stops and feeder bus routes; park and ride facilities and new hospital; Murdoch station) (McIntosh et al., 2015)

## 5. Appraisal processes

Understanding the city shaping effects of strategic transport initiatives will impact the tools used by planning and infrastructure agencies to assess the merits of competing investment opportunities. There are two main appraisal techniques which are generally used to appraise transport infrastructure initiatives: cost-benefit analysis, and multi-criteria analysis.

### 5.1 Cost benefit analysis

The key investment appraisal tool is a cost benefit analysis (CBA), which determines whether an initiative's economic benefits (including reductions in maintenance, operating and external costs) justify the capital costs, especially when the same resources could be deployed to other socially productive uses. It is important to acknowledge that a CBA is not without its limitations and these are well-documented (see for example Prosser et al., 2015 and Terrill et al., 2016). However a CBA is considered to remain the best appraisal tool available (Terrill et al., 2016).

### 5.2 Multi-criteria analysis

Multi-criteria analysis (MCA) is a more qualitative assessment option. An MCA can be used prior to a CBA, at early stages of options assessment or when limited quantitative data is available even for a rapid CBA. An MCA requires specification of criteria on which to rate options and consideration of how each option measures up against each criterion. The criteria can also be weighted to account for their relative importance. Each option's rating can be compared to other options based on the sum of its performance against the weighted criteria (Prosser et al. 2015).

However, an MCA can involve risks of bias, lack of transparency and ease of manipulation to obtain a predetermined result (see Transport and Infrastructure Council (2016a) Part F3, sections 3.2 and 3.3, especially Box 1). Transparent use of MCA, and limiting its use to early comparison of options prior to a CBA, will help mitigate those risks.

Jurisdictional goals, objectives and policies can be used to formulate the criteria for an MCA. This could include elements of the metropolitan vision for the form and structure of the city as set out in the metropolitan plan or other government documents. This allows for initiatives or transport corridors to be assessed against the achievement of government policies.

As discussed by Prosser et al. (2015) an MCA is flexible - it can be applied to both the identification of high level strategic transport corridors across a metropolitan area, as well as the comparison of specific routes for a transport initiative. An MCA's objectives and criteria can be altered and amended throughout the process if they are considered to be inappropriate or irrelevant (Prosser et al., 2015). Again, this must be done with rigour, scrutiny and transparency to ensure an unbiased assessment.

Both techniques are expected to play an important role in the emerging new integrated planning that accounts for the city shaping effects of strategic transport infrastructure. An MCA can play a useful role for high level assessment of city shaping infrastructure by providing an early focus on the extent of alignment with a city vision and the jurisdiction's broader goals, objectives and policies. The CBA then ultimately provides the tool for asking the question whether the strategic infrastructure delivers net benefits.

## 6. Governance and leadership

Governance arrangements can have a significant impact on the coordination of ITLUP. Governance arrangements are critical to linking all parties together, developing a shared vision and, most importantly, providing infrastructure to enable the vision to become a reality. Delivering successful ITLUP requires a detailed understanding of the existing governance arrangements that operate in the relevant state or territory.

The experience across Australia differs, with some states and territories combining the planning and transport infrastructure agencies into one department - for example the South Australian Department of Planning, Transport and Infrastructure. In most jurisdictions, planning and transport departments remain separate, which often restricts the ability to coordinate strategies as well as initiatives. This is particularly apparent when considering that the South Australian Government (2015) has released an integrated transport and land use plan, while most other states and territories have separate planning and transport strategies.

Alongside this, the plans or strategies often have varying timeframes or have been released at different points in time. There are likely to be many practical, and political reasons for these staggered timeframes. A comparison of strategic plans is contained in Table 1.

This comparison highlights that the transport plan may be developed prior to the land use plan. This somewhat suggests that the land use plan is responding to the transport infrastructure reflecting the cluster and connect approach described earlier in this paper. There would be benefits to the design of the strategic land use and transport plans if they were based on the development of a vision for the overall shape of a city at the metropolitan scale that can then be the basis for identifying city shaping infrastructure (as well as structural and local infrastructure) in support of this vision.

**Table 1** Comparison of strategic land use and transport plans across Australia

City	Strategic land use plan	Strategic transport plan
Adelaide	<i>The 30-Year Plan for Greater Adelaide</i> (volume of the SA Planning Strategy) Released: 2010 Timeframe: 2036	
		<i>The Integrated Transport and Land Use Plan</i> Released: 2015 Timeframe: 2036
Brisbane	<i>Brisbane City Plan 2014</i> Released: 2014 Timeframe: 2031	<i>Transport Plan for Brisbane 2008-2026</i> Released: 2008 Timeframe: 2026
Canberra	<i>ACT Planning Strategy</i> Released: 2012 Timeframe: 2030	<i>Transport for Canberra</i> Released: 2012 Timeframe: 2031
Melbourne		<i>Plan Melbourne</i> (contains land use and transport strategies) Released: 2013 Timeframe: 2051

City	Strategic land use plan	Strategic transport plan
Perth	<i>Directions 2031 and Beyond</i> Released: 2010 Timeframe: 2031	<i>Public Transport for Perth in 2031</i> Released: 2011 Timeframe:
Sydney	<i>A Plan for Growing Sydney</i> Released: 2014 Timeframe: 2031	<i>NSW Long Term Transport Master Plan</i> Released: 2012 Timeframe: 2031

Alongside governance arrangements, there is a need for visionary leadership which will drive the vision for the urban structure and promote city shaping infrastructure, building on the land use and transport plans. Spiller (cited in Jewell, 2015) highlights that regional city shaping infrastructure is something that should be managed at the metropolitan governance level. He notes that local government are naturally locally focused and state governments need to represent the whole state so there is a geography community of interest at the metropolitan level which presents a gap in the governance structure of Australian cities. This is particularly evident when considering that the metropolitan land use and transport plans are all developed by state government departments (aside from Brisbane). The establishment of the Greater Sydney Commission presents an opportunity to address this gap in Sydney. The Commission will need to drive the metropolitan planning agenda for Sydney, including a strong vision for Sydney, and identify city shaping infrastructure which can contribute to this vision.

## 7. Conclusion

This paper considers integrated transport and land use planning. The need for better integration of transport and land use planning is a long-standing issue within the literature.

The paper has focused on highlighting and understanding the true city shaping power of major transport infrastructure, and the need to move to an enhanced integrated planning model that effectively uses that city shaping power.

With significant investment in infrastructure expected to occur at both the state and federal government levels across Australian cities in future, there is a need for good planning and decision making. These investment decisions have a long legacy, and reversing them would take a long time and be particularly costly.

It will be important: that proposed infrastructure initiatives having a strategic basis to them, resulting from a best practice integrated transport and land use process; that initiatives are justified via a robust appraisal process; and that there is a transparent understanding of how investment decisions are made. Those processes should include identifying city shaping infrastructure and properly understanding and assessing its influence and merit.

The traditional approach to integrated planning has been the cluster and connect model. Unfortunately, it fails to recognise the city shaping potential of infrastructure, particularly transport infrastructure. The city shaping power of transport investment is increasingly evident in a range of recent infrastructure initiatives across Australia, although it is not yet mainstream nor necessarily well understood. This paper has focused on developing a greater understanding of that city shaping power of major transport infrastructure, and its potential to support a vision for the optimal urban structure of a city.

City shaping infrastructure is better coordinated at the metropolitan level and the establishment of the Greater Sydney Commission presents an opportunity to drive this agenda forward in Sydney.

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