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**Paper title:** Greater Western Sydney Regional Transportation Study:  
forecasting travel demand

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**Abstract (200 words):**

This paper is based on a consulting project undertaken for the Western Sydney Regional Organisation of Councils (WSROC) to help understand the travel demand patterns that might arise from various land use and transport infrastructure scenarios to inform the planning framework for Greater Western Sydney (GWS). This paper reports on the findings from the second stage of the project which modelled various possible future scenarios for the distribution of population and employment and the development of transport infrastructure and services, with a view to identifying some strategic issues and possible directions for employment location and transport planning in the region. The Sydney Strategic Travel Model (STM), which is developed and operated within the Transport and Population Data Centre at the Department of Infrastructure Planning and Natural Resources, was used to model the future land use and transport scenarios for GWS. The results provide valuable insight into the impact on travel demand of concentrated versus more dispersed employment policies and the provision of major rail links from GWS to the Sydney CBD in the context of greater population growth in Western Sydney.

### **Introduction**

This paper is based on a project undertaken for the Western Sydney Regional Organisation of Councils (WSROC) to help understand the travel demand patterns that might arise from various land use and transport infrastructure scenarios in Western Sydney.

The eleven WSROC Councils, together with Camden and Campbelltown ('Greater Western Sydney'), are currently in the process of developing a planning framework for Western Sydney, to influence and guide the actions of government agencies in the region. The Western Sydney Regional Transportation Study was part of the investigations undertaken to inform this framework. The first stage of the study examined current travel patterns in Greater Western Sydney (GWS). The second stage modelled various possible future scenarios for the distribution of population and employment and the development of transport infrastructure and services.

This paper reports on the modelling process and interprets the findings of these investigations with a view to identifying some strategic issues and possible directions for employment location and transport planning in the region. A detailed discussion of these findings is to be found in PPM Consultants (2003) *Greater Western Sydney Regional Transportation Strategy: Travel Demand in Greater Western Sydney*.

While much of the study involved a highly quantitative analysis of the available data, the focus of this paper is more qualitative, involving an interpretation of the data in the light of current policy questions about the future structure and functioning of the Sydney region.

The paper does not come to any definitive conclusions, but lays out some of the strategic choices available and the implications of moving in one direction or another. It is intended both to inform the understanding of what would be a desirable future for GWS and to help develop the framework for action in Western Sydney towards this end.

### **Current patterns of travel**

Residents of GWS depend on the use of the private car. Most travel for residents of GWS takes place within the GWS region and predominantly in private vehicles.

Public transport, either bus or train, is not extensively used within GWS. The train is important however for travel to other parts of Sydney, especially for work. The high use of cars in GWS puts pressure on the arterial road network, which also has to accommodate a high level of freight and commercial vehicle travel. The resulting congestion adds to the difficulties of bus travel in the region. Places of employment are widely dispersed both within GWS and the rest of Sydney, making it difficult to serve them by public transport. The main travel patterns, based on data from 2001, are summarised below.

#### Travel to work

In GWS work trips account for 28% of all trips on an average weekday compared with 32% in the rest of Sydney. Approximately one third of all trips to work by residents of GWS are within the same Local Government Area (LGA). Another third are to an LGA within GWS

and a further third to the rest of Sydney. This pattern has remained unchanged for the past 10 years.

### Travel for all purposes

The distribution of trips taken by GWS residents for non work purposes is similar to the rest of Sydney on both weekdays and weekends, with the exception of education trips which represent a slightly higher proportion of total trips in GWS, reflecting a younger population.

Travel for non work purposes tends to be more localised than work travel with a higher proportion of non work trips being within the same LGA and within the GWS region. On weekdays, two thirds of these trips are within the same LGA, 23% to an LGA within GWS and 10% to the rest of Sydney. On weekends the pattern is similar. For non-work travel such as for education, shopping and social and recreation trips, over 90% are within GWS, with less than 10% to other areas in Sydney.

### How people travel

The way in which residents in GWS travel depends on where they are going and for what purpose. In general cars are used for trips within GWS. Train becomes a more significant mode for travel to the rest of Sydney, especially for work. For the journey to work 76% of GWS residents use their car, compared with 69% for the rest of the Sydney. The train share is 15% compared with 16% for the rest of Sydney and bus 2% and 6% respectively.

For all trip purposes on weekdays, 71% of residents in GWS use their car, compared with 53% for the rest of Sydney. There is less public transport use and walking in GWS than in the rest of Sydney. On the weekend 81% of residents in GWS use their car, compared with 68% in the rest of Sydney.

### Distribution of employment

In GWS 37% of employment is located in regional or local centres. Of the one third of all work trips from GWS to other parts of Sydney, approximately 30% are to centres and the remainder to a wide array of dispersed locations. The main location for employment for GWS workers outside GWS is the Sydney CBD which attracts 7% of GWS workers.

### Travel times

Average travel times for commuting trips by car and public transport are longer in GWS than in the rest of Sydney. The average commuting trip by car in GWS in the morning peak is 35 minutes compared with 29 minutes in the rest of Sydney.

There is an even greater difference in public transport commuting times. The average commuting travel time by public transport in GWS is 59 minutes compared with 39 minutes in the rest of Sydney. This partly reflects longer travelling distances by public transport,

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especially train. Average travel times for other purpose trips in GWS are similar to those in the rest of Sydney.

#### **Land use and transport scenarios**

The Sydney Strategic Travel Model (STM), which is developed and operated within the Transport and Population Data Centre at the Department of Infrastructure Planning and Natural Resources, was used to model the future land use and transport scenarios for GWS. The STM is a multi modal model (ie incorporates private vehicles and public transport) which essentially follows a traditional 4 step travel demand model structure of trip generation, trip distribution, mode choice and network assignment. However the STM, which was originally designed in the early 1970s, was redesigned and re-estimated in the late 1990s to enhance its capability. This work is reported in Milthorpe et al (2000). It is the best such strategic urban travel demand model in Australia and is in line with international best practice.

A total of seven scenarios were analysed in this project which covered a number of combinations of urban development and transport infrastructure projects particularly relevant to GWS. The scenarios explored were by necessity limited by the time and budget available for this project. While advancements in computing capability have greatly reduced the computing time required for model runs using such a large scale strategic model, a considerable amount of time and expertise is still required in setting up the inputs for the model, checking, validating, interpreting and reporting on the results. Unfortunately a large scale strategic model of the complexity of the STM is still not suitable for quick processing of a large number of scenarios.

The seven scenarios that were analysed were chosen as they represented the most likely population and employment scenarios for GWS and included the large scale transport infrastructure projects which have been put forward by Government in the most recent strategic transport plan. Given that transport solutions for GWS are often perceived primarily in terms of rail development, it was considered important to focus on the potential benefits of new infrastructure in the region. It is acknowledged that such large scale infrastructure projects are not the only means of addressing transport issues and it was regrettable that other approaches such as changes in bus services and networks and other travel demand management policies were not able to be included within the scope of this project.

The results however provide valuable insight into the impact on travel demand of concentrated versus more dispersed employment policies and the provision of major rail links from GWS to the Sydney CBD in the context of greater population growth in Western Sydney.

#### Overview of scenarios

Seven land use and transport scenarios were tested to help assess which combination of land use and transport arrangements was most likely to contribute to a positive outcome for GWS. The land use component of the scenarios was defined by:

- The extent to which population growth in Sydney was contained in areas of existing development as against being accommodated in new development on the fringe, i.e. “urban consolidation” versus “fringe growth”

- The extent to which new employment, related to population growth, was concentrated in centres as against being dispersed

For the purposes of the testing, it was assumed that under all scenarios the population of Sydney would be the same, i.e. around 4.8 million by 2021, growing from just over 4 million in 2001. In the various scenarios the distribution of the population changes, but the total population remains the same. Similarly with employment it was assumed that the total number of jobs was the same for all scenarios in 2021 (around 2, 225,000, up from 1,860,000 in 2001).

The transport component of the scenarios was defined by:

- Whether all new infrastructure elements contained in *Action for Transport 2010* were included in the testing, or whether new infrastructure elements contained in *Action for Transport 2010* were included, except for the new rail links to the south-west (Leppington spur line) and the North West Rail Link.
- An assumed level of service for buses, including to new areas, that matched existing levels of service (the rationale for this assumption is explained above).

The seven scenarios included a base year for 2001 and six future scenarios for 2021 which are described as:

**Scenario 1** is the “base case”, i.e. the situation as it existed in 2001.

**Scenario 2** assumes that:

- population growth between 2001 and 2021 will be distributed between established urban areas and new fringe development in the same proportion as currently occurs with new growth, i.e. 70% in established areas and 30% in fringe growth
- employment will be distributed in centres to the same extent as in 2001.
- the Parramatta Rail Link West (between Epping and Parramatta) will not be provided

**Scenario 3** assumes that:

- there is “more fringe” population so that a relatively greater proportion of new population growth (45%) will be accommodated in fringe areas, as against 55% in established urban areas
- employment will be located in centres to the same extent as in 2001, but there will be more employment in fringe areas, related to the relatively greater distribution of population in fringe areas
- the Parramatta Rail Link West (between Epping and Parramatta) will not be provided

**Scenario 4** assumes that:

- the “more fringe” population growth used in Scenario 3 is updated to take account of the recently discussed planned releases in the north-west and south-west sectors.
- employment will be located in all existing centres to a greater extent than in 2001 as well as in new centres at Bringelly and Rouse Hill (50% of new jobs in these areas will be located in these new town centres).
- the Parramatta Rail Link West (between Epping and Parramatta) will not be provided

**Scenarios 2 – 4** assume that all new transport infrastructure elements contained in *Action for Transport 2010*, with the exception of the Parramatta West Rail Link (Parramatta to Epping),

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are included and that the level of service for buses matches the existing services, including in new areas of population development.

**Scenario 5** assumes that:

- there is the same “more fringe” population growth distribution as in Scenario 3 ie relatively greater proportion of new population growth (45%) will be accommodated in fringe areas, as against 55% in established urban areas
- employment will be located in centres to the same extent as in 2001, but there will be more employment in fringe areas, related to the relatively greater distribution of population in fringe areas
- new transport infrastructure elements contained in *Action for Transport 2010* will be provided, with the exception of the Parramatta West Rail Link (Parramatta to Epping) and also excluding the new rail links to the south-west (Leppington spur line) and the North West Rail Link.
- the level of service for buses matches the existing, including in new areas.

**Scenario 6** assumes that:

- there is the same distribution of population growth as in Scenario 4, i.e. the updated “more fringe” growth
- employment will be located in all existing centres to a greater extent than in 2001 as well as in new centres at Bringelly and Rouse Hill (50% of new jobs in these areas will be located in these new town centres).
- new transport infrastructure elements contained in *Action for Transport 2010* will be provided, with the exception of the Parramatta West Rail Link (Parramatta to Epping) and also excluding the new rail links to the south-west (Leppington spur line) and the North West Rail Link.
- the level of service for buses matches the existing, including in new areas

**Scenario 7** assumes that:

- there is the same distribution of population growth as in Scenario 4, i.e. the updated “more fringe” growth
- employment will be located in all existing centres to a greater extent than in 2001 as well as in new centres at Bringelly and Rouse Hill (50% of new jobs in these areas will be located in these new town centres)
- new transport infrastructure elements contained in *Action for Transport 2010* will be provided, including the Parramatta Rail Link West (between Epping and Parramatta)

### Modelling results

The results of the future scenarios for 2021 described above are shown in Table 1 for the Sydney Statistical Division (the Sydney metropolitan area generally) and in Table 2 for Greater Western Sydney.

**Table 1. Broad comparison of a.m. peak performance of scenarios for 2021 – Sydney Statistical Division**

- **Scenario 2** – Business as Usual - “base case” for 2021; transport infrastructure as for *Action for Transport 2010*, but no Parramatta Rail Link West
- **Scenario 3** – Relatively more population on the fringe; same extent of employment in centres; transport infrastructure as for *Action for Transport 2010*, but no Parramatta Rail Link West

- **Scenario 4** – Relatively more population on the fringe; relatively more employment in centres; transport infrastructure as for *Action for Transport 2010* but no Parramatta Rail Link West
- **Scenario 5** – Relatively more population on the fringe; same extent of employment in centres; transport infrastructure as for *Action for Transport 2010* but no Parramatta Rail Link West and no new rail links to south-west and north-west
- **Scenario 6** – Relatively more population on the fringe; relatively more employment in centres; transport infrastructure as for *Action for Transport 2010* but no Parramatta Rail Link West and no new rail links to south-west and north-west
- **Scenario 7** – Relatively more population on the fringe; relatively more employment in centres; transport infrastructure as for *Action for Transport 2010* including PRL West.

	<b>Scenario 2</b>	<b>Scenario 3</b>	<b>Scenario 4</b>	<b>Scenario 5</b>	<b>Scenario 6</b>	<b>Scenario 7</b>
<b>Car trips (‘000)</b>	1973	1964	1964	1997	1996	1961
<b>VKT (‘000)</b>	15208	15447	15781	15889	16208	15752
<b>% mode split to car (commuters)</b>	68.0	67.9	67.6	69.5	68.9	67.5
<b>Average trip length by car (commuters)</b>	15.6 km	16.0 km	16.3 km	16.1 km	16.4 km	16.3 km
<b>Average trip length by rail (commuters)</b>	24.4 km	25.9 km	25.5 km	23.6 km	23.7 km	25.4 km
<b>Rail trips (‘000)</b>	277	283	282	257	258	284
<b>Rail passenger kms (‘000)</b>	6314	6757	6695	6006	6039	6725
<b>Bus trips (‘000)</b>	160	152	158	158	166	157
<b>Bus passenger kms (‘000)</b>	2459	2415	2502	2537	2639	2493

For the *Sydney Statistical Division* some findings of the testing of the scenarios are that:

- For all scenarios where there is more population growth on the fringe compared with the “business as usual” Scenario 2, the result is longer average commuter trip lengths by car. This leads to higher “vehicle kilometres travelled” (VKT). In other words, putting more population on the fringe results in higher VKT for Sydney.
- Limiting rail investment (i.e. no Leppington spur line or North West Rail Link, as in Scenario 5) results in the highest use of cars relative to other modes and the highest number of car trips. This same scenario, with more employment concentrated in centres (Scenario 6), encourages more bus and rail trips. However, because car trips to work are longer (due to the reduction in dispersed employment), this scenario produces the highest level of VKT for Sydney.
- Scenario 7 is exactly the same as Scenario 4 except that Scenario 7 includes the Parramatta Rail Link West (PRL West). The inclusion of this rail link results in an extra 2,200 rail trips in the a.m. peak and an extra 30,000 rail passenger kilometres. This represents about 7,000 additional rail trips on the rail system throughout Sydney on an average day, which is less than 1% of the total number of rail trips. The PRL West has virtually no impact on car mode share and results in only a small reduction in VKT for Sydney as a whole. Average commuter trip lengths by car and rail are also unchanged as a result of including the PRL West.
- It should be noted that the model produces long term results regarding mode use which are based only on the relative times and costs for each mode choice. The model does not consider any other influences on mode choice such as the predisposition of the people to use a particular mode. For example there is a very strong “car use culture” for trips to the North Ryde area, as a result of past and current land use developments and transport choices. To achieve the outputs produced by the model may require a change in this culture. The rail line alone may not be sufficient to bring about a change in mode use unless it is supported by other transport and land use policies.

**Table 2. Broad comparison of a.m. peak performance of scenarios for 2021 – Greater Western Sydney**

- **Scenario 2** – Business as Usual - “base case” for 2021; transport infrastructure as for *Action for Transport 2010*, but no Parramatta Rail Link West
- **Scenario 3** – Relatively more population on the fringe; same extent of employment in centres; transport infrastructure as for *Action for Transport 2010*, but no Parramatta Rail Link West
- **Scenario 4** – Relatively more population on the fringe; relatively more employment in centres; transport infrastructure as for *Action for Transport 2010* but no Parramatta Rail Link West
- **Scenario 5** – Relatively more population on the fringe; same extent of employment in centres; transport infrastructure as for *Action for Transport 2010* but no Parramatta Rail Link West and no new rail links to south-west and north-west

- **Scenario 6** – Relatively more population on the fringe; relatively more employment in centres; transport infrastructure as for *Action for Transport 2010* but no Parramatta Rail Link West and no new rail links to south-west and north-west
- **Scenario 7** – Relatively more population on the fringe; relatively more employment in centres; transport infrastructure as for *Action for Transport 2010* including PRL West

	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
<b>Population ('000)</b>	2036	2122	2128	2122	2128	2128
<b>Employment ('000)</b>	768	788	845	788	845	845
<b>Car trips ('000)</b>	838	862	888	888	914	886
<b>VKT ('000)</b>	7406	7757	7936	8130	8284	7918
<b>% mode split to car (commuters)</b>	71.3	70.8	70.7	74.0	72.9	70.5
<b>Average trip length by car (commuters)</b>	16.7 km	17.0 km	17.0 km	17.3 km	17.2 km	17.0 km
<b>Average trip length by rail (commuters)</b>	29.8 km	30.4 km	29.8 km	30.3 km	29.8 km	29.7 km
<b>Rail trips ('000)</b>	113	120	117	100	100	119
<b>Rail passenger kms ('000)</b>	3098	3399	3194	2795	2722	3218
<b>Bus trips ('000)</b>	29	29	35	30	38	35
<b>Bus passenger kms ('000)</b>	722	734	805	808	894	799

For *Greater Western Sydney* some findings of the testing of the scenarios are as follows:

- It is not surprising that in Scenarios 3 to 7, where there is relatively more population growth in the West, there is an increase in car trips and VKT in GWS. Car trips and VKT increase to a greater extent under Scenarios 5 and 6 where new rail links to the south-west and north-west are not provided.
- While car trips and VKT increase under Scenarios 5 and 6, the use of cars for commuting trips, relative to other modes, is highest in Scenario 5. Scenario 6, which is the same as Scenario 5 except that it involves more employment concentrated in centres, encourages more bus use. This increases public transport mode share compared with Scenario 5.
- Scenarios 3 and 4 both include new rail links to the south-west and north west. Scenario 4 includes the new centres in the north-west and south-west as well as increased employment in the existing centres. Compared with Scenario 3 it results in an increase in car trips and VKT as the car is used to access local employment centres at the expense of longer haul rail trips. There is some increase in bus trips, but not in rail trips. Both Scenarios 3 and 4 result in lower mode shares to car, shorter car trip lengths and hence lower VKT than for Scenarios 5 and 6 which do not have the new rail investments.
- The impact of including PRL West can be seen by comparing Scenario 7 and Scenario 4. PRL West results in an additional 1,500 trips on the rail system in GWS in the a.m. peak, or 4,500 on an average day. This represents an addition of approximately 1% to rail trips.

### **Some strategic issues**

This section of the paper discusses a number of strategic issues that arise out of the modelling of the land use and transport scenarios for GWS. It needs to be remembered that to the extent that the modelling produces “results”, these are limited by the assumptions that are fed into the model for each scenario and the technical limitations of the model itself. Where the modelling can be of assistance in a strategic sense is in helping to understand, in broad terms, what the consequences are of going in a certain direction and what the consequences might be of making different strategic choices.

The discussion of the modelling results implies a set of objectives for GWS which are generally consistent with those adopted by government for GWS and for Sydney as a whole, viz. to facilitate accessibility to work, services and facilities and other activities; to increase the proportion of trips made by public transport; to reduce VKT; and to reduce travel distances and travel times. These objectives inform the discussion.

### **Implications of fringe development**

There are many reasons why it is likely that there will still be substantial development in the north-west and, most significantly, the south-west fringe of Sydney. Primary amongst these is the view that increasing the supply of land on the fringe of Sydney will increase the affordability of housing in Sydney generally by increasing housing supply. (It is

recognised that new housing on the fringe is not likely itself to be ‘affordable’ as discussed in Gleeson et al (2002).) There is also the reality that land on the fringe was designated as being for “future urban” purposes in the 1968 Sydney Region Outline Plan and in the 1988 Metropolitan Plan, creating a long standing expectation on the part of landowners for future urban development rights. Thus despite environmental issues to do with air quality, threatened species and habitat and the effect on the water catchment, and despite the fact that development in the south-west sector has previously been delayed because of air quality concerns, which have not changed, it is likely that new development at the fringe will proceed progressively.

All the scenarios tested except Scenario 2 (the 2021 ‘base case’) assumed that there would be relatively more development on the fringe than had been the case in Sydney’s recent past. The current distribution of development between established and fringe areas is 70% to 30%. Scenarios 3 – 7 assume that 45% of new development will be located on the fringe and 55% in established areas. As explained above, it is assumed that under all scenarios the population of Sydney will be the same, i.e. around 4.8 million by 2021, growing from just over 4 million in 2001. This might not be realistic proposition, as more fringe development will not necessarily mean a lesser extent of development in established areas. For the purposes of the modelling, it had to be assumed that there would be no difference in the total Sydney population amongst all the scenarios so as to have a common basis for comparing the implications of changes in the distribution of the population and in the development of transport infrastructure.

The model results show that the location of relatively more people on the fringe results in more use of cars and higher VKT for Sydney. In GWS the location of relatively more people on the fringe results in more use of cars, longer average commuter trip lengths by car<sup>1</sup> and higher VKT. Table 2 shows that relatively more people on the fringe results in 862,000 – 914,000 car trips in the a.m. peak (3.8 million to 4 million daily) in GWS in 2021 (for Scenarios 3 and 6 respectively), compared with 838,000 a.m. peak (3.7 million daily) car trips in GWS under Scenario 2, which assumes less fringe development. In other words, an increase in the proportion of Sydney’s new development that takes place on the fringe results in between 100,000 and 300,000 more trips by car, every day, in GWS. The VKT in GWS ranges between 7.8 million in the a.m. peak (38.8 million for an average weekday) for Scenario 3 to 8.4 million in the a.m. peak (41.4 million daily) for Scenario 6, compared with 7.4 million in the a.m. peak (37 million daily) for Scenario 2. In other words, the number of vehicle kilometres travelled, every day, increases by 1.8 to 4.4 million with more development on the fringe.

The increase in the number of car trips with relatively more development on the fringe reflects the relative lack of transport choice for the population on the fringe, compared

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<sup>1</sup> Car commuting is predominantly short distance relative to rail commute trips. In 2001 GWS car commuter trips were about 18 km (which was about the same as for Sydney as a whole, but for the Sydney excluding GWS it was 14 km). Within GWS there is a difference between the north-west, where the car commuter trip was 17 km, and the south-west, where it was 22 km. Rail commuter trips were about 31 km in GWS (compared with 23 km for Sydney as a whole and about 14 km for Sydney excluding GWS). Rail commuter trips for the south-west were on average 34 km compared with 31 km for the north-west.

Rail commuter trip lengths are much longer than those for cars. The rail scenarios tested tended to cater for long distance travel to the CBD, which is a small part of the commuter travel generated by GWS. The scenarios with major rail investment tend to promote travel to/from the CBD rather than to/from other local centres.

with the choice they would have if located in established areas of Sydney. As explained above, it is assumed for Scenario 3 that new transport infrastructure would include that described in *Action for Transport 2010* and that the level of service for buses would remain at today's standards, and for Scenario 6 that new transport infrastructure would include that described in *Action for Transport 2010* but without new rail links to south-west and north-west, and that the level of service for buses would remain at today's standards.

Were there a substantial change in availability of public transport choices in GWS, over and above those included for e.g. Scenarios 3 and 6, then there could be some reduction in car use and VKT with relatively more fringe development. However, it is considered that even the new transport infrastructure described in *Action for Transport 2010*, including new rail links to south-west and north-west, is an ambitious goal which will not be easily realised. Any increase in the level of public transport choice, over and above that envisaged in *Action for Transport 2010* will be even more difficult to realise. It is likely therefore that any scenario involving relatively more development at the fringe will result in relatively more car use and higher levels of VKT.

### Locating employment in centres

The modelling results show that for Sydney generally, Scenario 6 (relatively more population on the fringe; relatively more employment in centres; transport infrastructure as for *Action for Transport 2010* but no new rail links to south-west and north-west) encourages slightly more bus and rail trips compared with Scenario 5 which has the same conservative rail investment but more dispersed employment. However, because car trips to work are longer (due to the reduction in dispersed employment), this scenario produces the highest level of VKT for Sydney.

In GWS while car trips and VKT increase under Scenarios 5 and 6, the use of cars for commuting trips, relative to other modes, is highest in Scenario 5, which involves less employment concentrated in centres than Scenario 6. Scenario 6 encourages more bus use, which increases public transport mode share compared with Scenario 5.

Again in GWS, Scenario 4, which includes the new centres in the north-west and south-west as well as increased employment in the existing centres, results in an increase in car trips and VKT compared with Scenario 3, which has less employment in centres. For Scenario 4 there is some increase in bus trips, although not in rail trips, and no change in modal shares.

It can be seen from these results that the distribution of employment has complex and contradictory effects. Increasing local employment accessibility in the outer areas does not necessarily encourage public transport use and may result in an increase in car trips and VKT. Increased growth of employment in centres encourages increased trip lengths as this growth is at the expense of more local dispersed employment growth.

In the light of these results, it is worth reviewing the background to and the history of Sydney's centres policy, with a view to establishing a policy perspective on the issues. A centres policy has been part of metropolitan planning for Sydney since the 1948 County of Cumberland Scheme which, following British town planning tradition of the time,

promoted the idea of a hierarchy of centres in Sydney, including twenty district centres at points along the rail lines. The 1968 Sydney Region Outline Plan (SROP) reinforced this approach by identifying a limited number of commercial centres for special growth, especially for office employment. Various metropolitan plans for Sydney since have continued to promote the idea that a more even distribution of jobs throughout the metropolitan region would make jobs and other activities more accessible, shorten journeys to work, reduce traffic congestion and reduce the development pressure in the Sydney CBD.

Primarily, the metropolitan plans for Sydney have had in mind a number of centres at significant points on the suburban rail system that would be accessible by public transport, train in particular. They were not greatly concerned however about the prospect of suburbanisation of employment, i.e. the decentralisation of employment from the core, but not to centres at highly accessible locations.

Current work (in progress) on a metropolitan strategy for Sydney continues to focus on centres “where there is capacity at rail stations and interchanges, and on bus routes, or where it can be provided most easily”. There is a new emphasis on “corridors” with the same capacity, and also a recognition of where decentralised jobs have actually located and the travel implications of this:

“The recent performance of urban centres has been mixed. Jobs in some car based, lower density employment areas such as Macquarie Park and Norwest increased rapidly.... Unchecked growth in lower density car based employment areas may generate unsustainable travel patterns and car dependence.” (Sydney Futures Forum, 2004).

There does not however appear to be a recognition of the travel implications of jobs that have actually located in centres designated for growth. As discussed below, this has not led to any great use of the public transport capacity that is available.

The decentralisation of urban activity in Sydney has probably exceeded expectations, but it has largely been a suburbanisation rather than decentralisation of the type envisaged, with significant consequences for the pattern of travel. Throughout GWS only 37% of employment is in designated centres.<sup>2</sup> Consequently “there is significant cross-hauling of workers, travelling largely in private motor vehicles.... Rather than reducing commuting as such, suburbanisation of employment ... has made commuting patterns more complex for many GWS residents” (Fagan et al, 2003:12). The dispersal of employment, with relatively small numbers of workers going to a large number of employment destinations in GWS and the wider Sydney metropolitan area means that it is extremely difficult to

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<sup>2</sup> Defined as “key attractors of employment ... based on the number and density of employed persons. In general, travel zones representing an employment density greater than 2000 employees per km<sup>2</sup> are included as part of a centre” (PPM Consultants, 2003).

3. While not all the centres used in this analysis are located near a railway station, the centres used in the example given for the Parramatta LGA include the commercial centres of Epping, Granville and the Parramatta CBD as well as the Westmead Hospital. The centres used in the Liverpool LGA are the Liverpool commercial centre and Liverpool Hospital.

service this demand by public transport. The journey to work data for 2001 shows the dominance of car travel for all local government areas in GWS, ranging from 62% of work trips being made by car in Auburn to over 80% in some of the outlying areas such as Baulkham Hills (84%), Hawkesbury (83%) and Camden (85%) (PPM Consultants, 2003).

Despite significant employment development in GWS in recent decades (to the extent that we 'should bury any remaining urban mythology about outer suburban areas functioning primarily as 'dormitory settlements' for the greater metropolis' (Fagan et al, 2003:11)), these jobs are not generally accessible by public transport. To the extent that jobs have decentralised to centres, including those on railway lines, they too are not being accessed by public transport to any great extent. For example in the Parramatta Local Government Area (LGA) where 66% of employment is located in centres, public transport is still only used for 18% of the trips to work to that LGA and in the Liverpool LGA where 29% of jobs are in centres only 7% of work trips are by public transport (see Table 4 in Appendix 1)<sup>3</sup>. Existing conditions at these destinations, including the supply of parking and, in many cases, environments that are not conducive to pedestrian comfort and convenience, are contributory factors. These centres attract cars partly because of their supply of parking and their environments are degraded by the provision that has to be made for cars, making them even less attractive for non-car travel. Further, the development densities in and around these centres in GWS are currently, even in Parramatta, insufficient to support the development of public transport and deter car users. There would need to be significant changes at most centres to make it more likely that people would access them by public transport.

Thus while there has been a generally rising employment self-sufficiency ratio in GWS over the last two decades (Fagan et al, 2003), it would appear that this has been at the cost of increased private vehicle travel, increased congestion, adverse effects on local air quality and, most likely, increased transport disadvantage for those without access to private vehicles. It must therefore be questioned whether, on balance, increased employment self-sufficiency in GWS has, *of itself*, provided net benefits for the region.

The principal benefit for the region of increased employment self-sufficiency is likely to have been the increased potential to access jobs in closer proximity to places of residence and, consequently, the increased potential to reduce travel times for the journey to work. This is reflected in the degree of transport "containment", i.e. the proportion of workers in GWS that work in the local government area in which they live, the proportion of GWS residents working within GWS (although not in their own local government area) and the proportion of GWS workers working in local government areas adjacent to GWS. Two thirds of trips to work by residents of GWS are either within the same local government area or to a local government area within GWS, with only a further third to other destinations in the rest of Sydney. Ninety per cent of non-work trips have a destination within the region. This pattern, which has remained unchanged over the past 10 years, represents significant "regionalisation" and "localisation".

On the face of it, it would appear that the decentralisation of employment has been a success story for GWS. However, there is no way of knowing whether the high level of containment is an indication of the difficulty of accessing jobs by means other than private vehicles; or a confirmation of the proposition that people will generally only allocate a certain amount of time (a 'time budget') for the journey to work and that travel to job opportunities in the rest of Sydney, including by public transport, would exceed this "budget". Whatever the case, the high dependence on private vehicle travel for trips to

work (which is even higher for trips for other purposes) raises the questions of whether the suburbanisation of employment should be more forcefully discouraged.

More generally the modelling results and the history and effects of employment decentralisation in GWS raise the policy questions of whether and how:

- the location of employment should be encouraged in fewer, larger centres and actively discouraged in the larger number of smaller centres.
- the provision of parking in various levels of centres should be more conservatively managed so as to lessen the inducement for travelling by car to these centres. (This is a difficult issue for local centres, all of which wish to attract custom through the provision of parking. The failure to develop a metropolitan parking policy reflects this. However, it remains a key policy issue if other policy objectives are to be achieved to any degree.)
- the internal environments of existing centres may be made significantly more hospitable to modes other than private vehicles and how development densities in and around centres may be actively used to promote pedestrian oriented environments and public transport, especially buses.
- bus travel to selected centres in GWS may be significantly improved to contribute to the above outcomes. Bus travel in GWS is currently an extremely limited mode providing a shallow level of service, with only 2% using buses for the journey to work, compared with 6% for the rest of Sydney. It is likely that substantial investment in the development of bus services in GWS would be required to make a difference.

#### New rail investment

The modelling shows that a reduction in “planned” rail investment would reduce the use of public transport and increases car use. The highest number of car trips and highest VKT are produced in Scenarios 5 and 6 where there are no new rail links in the north-west and south-west. In these scenarios there are fewer rail trips than in scenarios that include the planned rail investment. In Scenario 5 where there was “conservative” rail investment, there was also a reduction in bus trips in GWS compared with Scenario 4.

For GWS the absence of new rail links in the north-west and south-west (i.e. Scenario 6 compared with Scenario 4) means 17,000 fewer rail trips in the a.m. peak (51,000 on an average day) or 14% less than if these lines were provided. This has an impact on the commuter mode share to car, which is 71% in Scenario 4 and 73% in Scenario 6 without the new rail. Conversely the public transport mode share goes down by 2%, from 25% to 23%. This reduction is attributable to the reduction in train trips; although there is some increase in bus trips in Scenario 6, this is not sufficient to have an effect on the mode share.

The decrease of 2 percentage points in the mode use for car in Scenario 4 compared with Scenario 6 is considered significant, but the modelling serves to indicate how much investment and control of the location of employment is required to achieve this difference. Moreover, given the slowness of behavioural change, this change would occur over a period of time, not immediately following changes in transport provision. Scenario

4 assumes not only the provision of the Leppington spur line and the North West Rail Link, but also that two new regional centres in the outer areas (at Bringelly and Rouse Hill) will be developed to their intended maximum extent and contain, in concentrated form, a significant amount of employment. As well, although employment generally is also more concentrated in centres under Scenario 6, the lack of investment in rail encourages more car use to those centres.

### **Concluding comments**

The results envisaged under Scenario 4 may not be unachievable, but it is important to understand that it involves major investment in the form of the new rail links and significant control over the location of employment, both not certain outcomes. Scenario 4 also serves to demonstrate that difficult as they may be to achieve, the new rail links and a high level of employment in centres is not sufficient to achieve what many would consider to be an appropriate target for change in mode share, viz. around 10%. It is possible that new rail investment will not be forthcoming in the foreseeable future, making it even more important for strategic consideration to be given, inter alia, to:

- Reforms to the bus system in GWS that might contribute to transport choice and a reduction in transport disadvantage, even if not to a significant shift in mode share.
- Measures to encourage a regional view of the distribution of employment and other activity, so that each centre and local government area are not competing for a limited amount of activity, to the detriment of all. The supply and management of parking is a significant if difficult consideration in this respect, as is the pricing of access generally.
- A strengthening of controls on vehicle emissions, as whatever the case, there is likely to be higher VKT in GWS and in Sydney generally.
- Appropriate “taming” of traffic, along with acceptance of a degree of congestion in some locations as a demand management tool, with a clearer distinction between roads that are intended to facilitate mobility and those that are intended to contribute to the urbanity and civility of the environment of GWS, rather than to mobility alone. The consequence of this would be a revisiting of the design consequences of various major roads in GWS being categorised (and funded) as “arterials”, thereby eliciting a design response (and a design speed), which is inconsistent with other urban environmental outcomes that GWS might wish to achieve.

The most important consideration for GWS Councils may be the recognition that the promotion of a large number of centres in the GWS area as employment locations may not be in the best interests of the region generally, in terms of transport planning. Moreover, even if a substantial number of jobs are located in relatively few centres in the future, and if major new rail investment is in place, there is no guarantee that this will lead to greater use of public transport and fewer cars on the roads at peak times. Strategically, therefore, there may need to be more attention given than ever before to the potential to reconfigure bus movements and the level of service for buses in GWS generally and to centres in particular. This may be timely in terms of the NSW Government’s current review of bus operations. Moreover, as the supply of parking across GWS is likely to continue to be difficult to regulate, the way in which parking is managed – including its pricing – may be one means by which GWS

Councils may have an effect on the way in which people travel to and use the centres in the GWS region.

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