# TRANSIT CITY

## A WA2.0 PROJECT

THE GREENS


GREENS.ORG.AU/WA/TRANSITCITY

# Contents




Transit CIty was produced by the Office of Senator Scott Ludlam in June 2016.

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Many thanks to all who contributed to and inspired this work.

Map 1: The proposed Transit City network

Key:
- Heavy Rail:
- Light Rail:
- Bus Priority Transit
- Frequent buses :

# Executive Summary

## TRANSIT CITY: A comprehensive Public Transport Plan for Perth

After years of inadequate planning and insufficient investment in efficient and reliable transport options, Perth residents have become heavily dependent on private vehicles. Unless we change the way public transport is currently planned and prioritised, congestion will continue to worsen, impacting individuals, businesses and the environment.

Transit City will provide all residents and visitors, including those in the outer suburbs, with the opportunity to go from anywhere to anywhere efficiently and conveniently.

Transit City is the Greens' vision for the future of Perth in which the whole community is provided with a multi-modal, interconnected network of high frequency public transport.

The plan includes:

- 71km of new rail that links existing rail lines to create a better network effect
- 65km of light rail built over 10 to 15 years to revitalise neighbourhoods, encourage urban infill and provide better transport service
- 283km of Bus Priority Transit to link strategic centres.
- An 811km network of high frequency buses with priority lanes and signalling, and dramatically increasing the frequency of all services to make public transport more convenient
- Filling the gaps in the network to provide a better service no matter where you live

Transit City incorporates ten key principles that would make Perth's public transport work most effectively and get more people using it more often, all across Perth:

1. A grid network
2. A hierarchy of transport modes
3. Simple and direct route structures
4. Network consolidation
5. Speed and reliability
6. Fast and convenient transfers
7. Pedestrian and cyclist integration
8. A network which is easy to use and understand
9. An integrated fare system
10. Travel behaviour change initiatives

We have etimated the cost of this plan at $9.65 billion. To implement this vision the Greens would prioritize spending on public transport to create a game changing upgrade of the public transport network over the next 10 to 15 years. We would also encourage private sector through value capture and private public partnerships.

We can't keep doing what we've always done and expect a different outcome. As Perth heads towards having seven of the most congested roads in Australia by 2031, we need a dramatic change of course. Towards a Transit City.

Image: Senator Scott Ludlam (Credit: Jean-Paul Horre)

Image: Separate Bike Lane in Vancouver, Canada (Credit: Paul Krueger)


Image: Bus Rapid Transit in China (Credit: Scania Group)

# Introduction

## Transit City: The Time Has Come

Transit City is a vision for the future of Perth in which the community is provided with a multi-modal, interconnected network of high frequency public transport. Transit City will provide all residents and visitors, including those in the outer suburbs, with the opportunity to go from anywhere to anywhere efficiently and conveniently.

Most of us live in the suburbs and and 80% of Perth's jobs are in the suburbs. Yet our public transport network is focused on getting people in and out of the CBD.

To prosper in the long term, it is critical for Perth to recognise and tackle the challenges of the 21st century including climate change, growing congestion and changes to the ways people move. As a result of years of inadequate planning and insufficient investment in efficient and reliable transport options, Perth residents have become heavily dependent on private vehicles for movement. Without changing the ways public transport is currently planned and prioritised, congestion will continue to worsen which will impose excessive costs on individuals, businesses and the environment. Car dependency also means that fair and equitable mobility is not provided to all our residents and visitors.

The Greens believe that, by incorporating best practice transport planning, Perth can provide fast and flexible movement options for people while improving ecological sustainability. To achieve this, significant changes are required to the current approach to transport policy making, network planning and funding mechanisms.

This document provides a comprehensive platform to design and deliver high quality passenger transport services through the provision of an integrated, reliable transit system that can serve the people of Perth as a viable alternative to the private car.

Image: Tram in Amsterdam, Netherlands (Credit: Peter Eijkman)

# 1. Why Public Transport?

**The current public transport system in Perth does not provide the level of service that people want.**

In late 2015, the Committee for Perth and RAC conducted a survey that asked more than 2,000 Perth commuters what kind of practical, long-term public transport system they want.[1] The survey found that:

- 71% of people use their car because it's convenient, 70% because it's faster;
- 64% of drivers are frustrated by congestion;
- 65% of train users and 42% of bus users believe the services are overcrowded;
- 65% of bus users and 56% of train users use these services because they are cost efficient;
- Only 48% of bus users find it convenient;
- The average cost of paying for parking is $9.70 a day; and
- Light rail is the number one public transport option for middle and inner areas of the CBD.

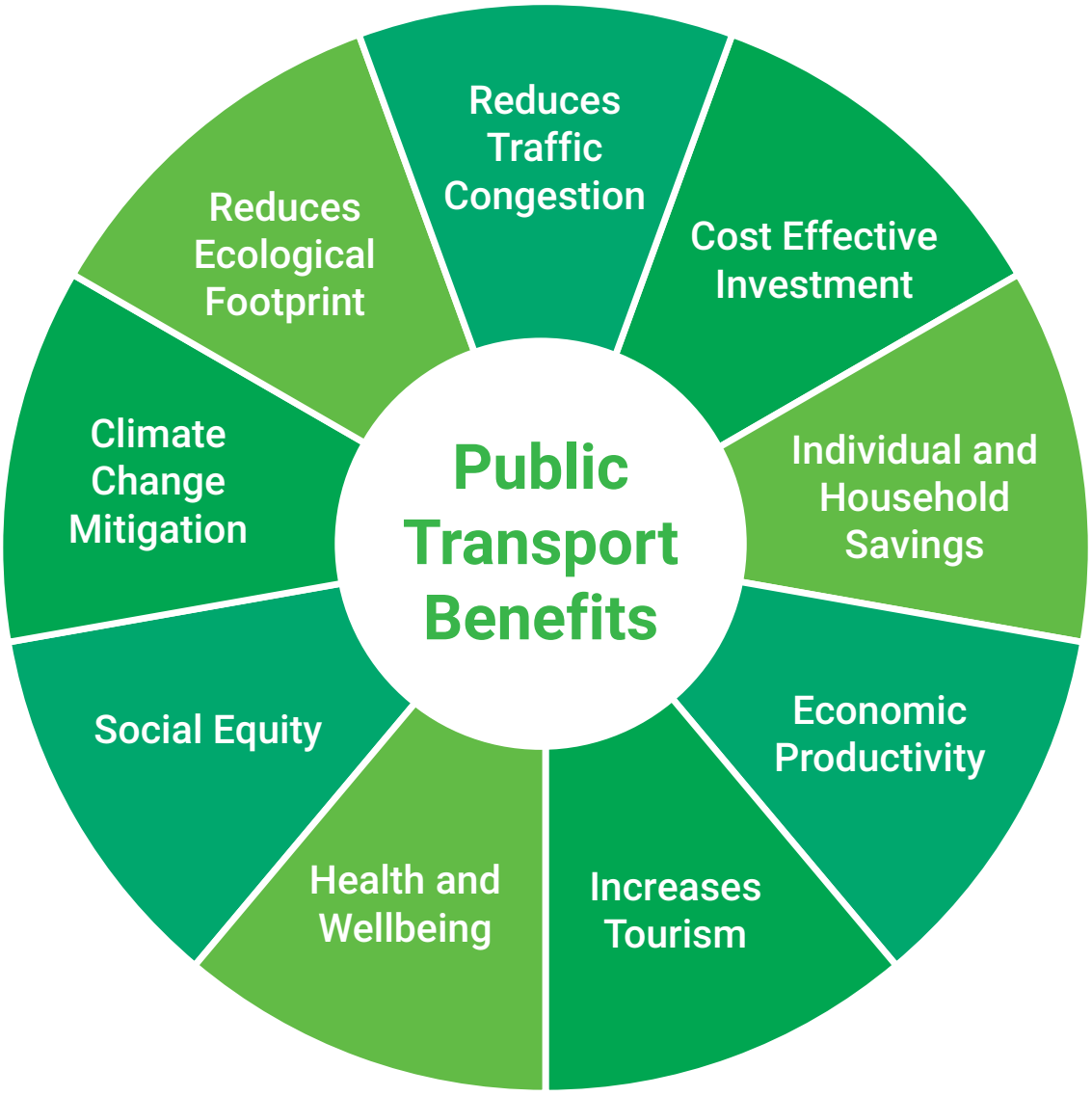



Figure 1: The Benefits of Public Transport

1. Committee for Perth (2015), Media Release: Get a Move On! https://www.committeeforperth.com.au/assets/documents/get-a-move-on/GAMO-MR-25-November-Final.pdf

## Addressing Traffic Congestion

Congestion is detrimental to our national productivity and is taking a toll on commuters and families. Western Australia is expected to face growing congestion as an additional one million motorised vehicles are expected on our roads by 2020.[2]

The Bureau of Transport and Regional Economies (BTRE) estimated that the avoidable cost of congestion for the Australian capital cities was $16.5 billion for the 2015 financial year, which increased from $12.8 billion in 2010. This cost is comprised of:

- $6 billion in private time costs;
- $8 billion in business time costs;
- $1.5 billion in extra vehicle operating costs; and
- $1 billion in extra air pollution costs.[3]

Between 2002 and 2011, Perth experienced the highest increase in average network delay in the country due to congestion[4]. The provision of more roads to address congestion defeats the purpose, as roads encourage car-dependant lifestyles and result in more private vehicle travel. Transit systems and cycling networks that are competitive with road traffic are the only long-term solution to the congestion problem.

## Public Transport: A Cost Effective Investment

There are significant economic grounds to justify investment in public transport.[5]

The Western Australian Department of Transport calculated in 2011 that the benefit-cost ratio, or the value for money for the community, of investment in public transport is 1.8 for 30 years and 2.2 for 40 years.[6] Whilst very conservative assumptions were used, the outcome still justified investment in public transport.

Investment in additional road infrastructure does not provide similar cost efficiencies. Government costs due to accidents, pollution, noise etc. are higher than the government revenue benefits of the road system in Australia.[7]

## Individual and Household Savings

Perth is the most expensive city in Australia to own a car and to drive to work. Commuters travelling to work in the Perth CBD annually spend anywhere from $9,180 for a 5 km commute to the CBD up to $22,306 for a 25 km commute.[8] This is much higher than the Australian city averages.

Commuters in Perth would save between $700 and $1,500 per annum or $14 to $30 per week for a 5 to 25 kilometre journey if they use public transport rather than drive a medium sized car.[9] In summary:

- Leaving your car at home and travelling to the CBD by public transport could save up to $10,000 every year.
- Forgoing your car, or a second car, in favour of public transport could save as much as $20,000 each year.[10]

## Productivity Outcomes

An effectively functioning public transport system can increase productivity for the economy as a whole by enhancing access to jobs, increasing business and freight movement efficiently, and easing road congestion pressures.[11]

Investment in public transport creates jobs, training and business opportunities for companies of all sizes in all sectors. A survey of businesses conducted by RAC in 2013 highlighted the impact of traffic congestion on the profitability and productivity of business. 'Loss of productivity' was identified by 78% of respondents as a key impact of congestion. More than one third of respondents stated that they had lost existing work contracts due to problems related to congestion.[12]

## Tourism

Many tourists use public transport as their preferred way of exploring a city. A good public transport system can itself become an attraction, such as Melbourne's tram network.

Image: Melbourne Tram
(Credit: Philip Mallis)

2. RAC (2014), Submission to the Senate Standing Committee on Rural and Regional Affairs and Transport: The Role of Public Transport in Delivering Productivity Outcomes http://rac.com.au/cs/idcplg?IdcService=GET_FILE&dDocName=racstg057939&allowInterrupt=1&RevisionSelectionMethod=LatestReleased&noSaveAs=1
3. Bureau of Infrastructure, Transport and Regional Economics (BITRE) (2015), Traffic and Congestion Cost Trends for Australian Capital Cities https://bitre.gov.au/publications/2015/files/is_074.pdf
4. Department of Infrastructure and Regional Development (DIRD) (2015), State of Australian Cities 2014-2015 https://infrastructure.gov.au/infrastructure/pab/soac/files/2015_SoAC_full_report.pdf
5. Committee for Perth (2014), What is your commute costing you https://www.committeeforperth.com.au/assets/documents/transport-and-congestion/Cost-Of-Living-6-Commuting-costs.pdf
6. WA Department of Transport (2011), Draft Public Transport for Perth in 2031 http://www.transport.wa.gov.au/mediaFiles/about-us/ABOUT_P_PT_Plan2031.pdf
7. Newman, Peter and Scheurer, Jan (n.d.) The Knowledge Arc Light Rail: Sections A, B, C, D and E http://www.curtin.edu.au/research/cusp/local/docs/pb-cusp-research-paper-section-abcd.pdf
8. Committee for Perth (2014) What is your commute costing you? https://www.committeeforperth.com.au/assets/documents/transport-and-congestion/Cost-Of-Living-6-Commuting-costs.pdf
9. Committee for Perth (2013) Have Transport Costs Fuelled Congestion in Perth? https://www.committeeforperth.com.au/assets/documents/cost-of-living/Cost-Of-Living-5.pdf
10. Ibid.
11. Senate Standing Committee on Rural and Regional Affairs and Transport (2014) Senate Inquiry: Role of Public Transport in Delivering Productivity Outcomes http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Rural_and_Regional_Affairs_and_Transport/Public_transport/~/media/Committees/rrat_ctte/public_transport/report.pdf
12. RAC (2014) Submission to the Senate Standing Committee on Rural and Regional Affairs and Transport: The Role of Public Transport in Delivering Productivity Outcomes http://rac.com.au/cs/idcplg?IdcService=GET_FILE&dDocName=racstg057939&allowInterrupt=1&RevisionSelectionMethod=LatestReleased&noSaveAs=1

## Social Benefits of Public Transport

An estimated 30% of Australians do not own or use a car. For them, public transport provides the only means to access employment, education and services.[13] This is particularly the case with youth, the elderly and people with a disability.

Public transport is also a key contributor to social cohesion. Public transport involves travelling with others and therefore provides more opportunities for social interaction, mutual assistance and trust.[14]

Catching public transport, there is greater likelihood for individuals to get exposed to and interact with cultures different to that of their immediate communities.

## Health and Wellbeing Benefits of Public Transport

Using public transport supports a more active lifestyle as it potentially includes more walking, cycling and general physical activity compared to driving.

Congestion affects the wellbeing and quality of life of individuals. A study commissioned by the Australian Railway Association found that a 50% reduction in congestion would give the average Perth commuter an extra 73 hours per year, the equivalent of almost two weeks annual leave.[15]

## Climate Change Mitigation

The transport sector is the fourth largest contributor to global greenhouse gas emissions. The transport sector also emits non-CO2 greenhouse gases and aerosols that are climate forcers.

The IPCC's Fifth Assessment Report identifies great opportunities in the transport sector to mitigate climate change through a modal shift from private vehicles to high speed public transit. The report compares the emissions of Bus Rapid Transit (BRT), Light Rail and Metro rail and suggests that BRT systems can offer similar benefits and capacities as light rail and metro systems at much lower capital costs, but usually with higher GHG emissions (Table 1). The emission however depends on the local electricity grid GHG emission factor. High occupancy rates are also important to achieve the emission reduction and environmental viability of public transport.[16]

## Reduced Ecological Impact

Public Transport can use the existing road infrastructure and thereby minimise the need for new roads. Road construction usually involves the clearing of vegetation and roads also act as a barrier to the ecological corridors, limiting fauna movements and affecting wildlife migration patterns.[17]

Roads also consist of vast paved areas that adversely affect the water system as they present large impervious surfaces preventing natural stormwater retention and infiltration processes.


Image: Light Rail in Zürich, Switzerland (Credit: Thomas8047)

13. Senate Standing Committee on Rural and Regional Affairs and Transport (2014), Ibid.
14. Currie, Graham and Stanley, Janet (2008) Investigating Links between Social Capital and Public Transport
15. Senate Standing Committee on Rural and Regional Affairs and Transport (2014), Ibid.
16. Intergovernmental Panel on Climate Change (IPCC) (2014), IPCC Fifth Assessment Report: Working Group III Report Climate Change 2014: Mitigation of Climate Change https://www.ipcc.ch/report/ar5/wg3/
17. US National Research Council, Committee on Ecological Impacts of Road Density (2005), Assessing and Managing the Ecological Impacts of Paved Roads, Washington : National Academies Press.

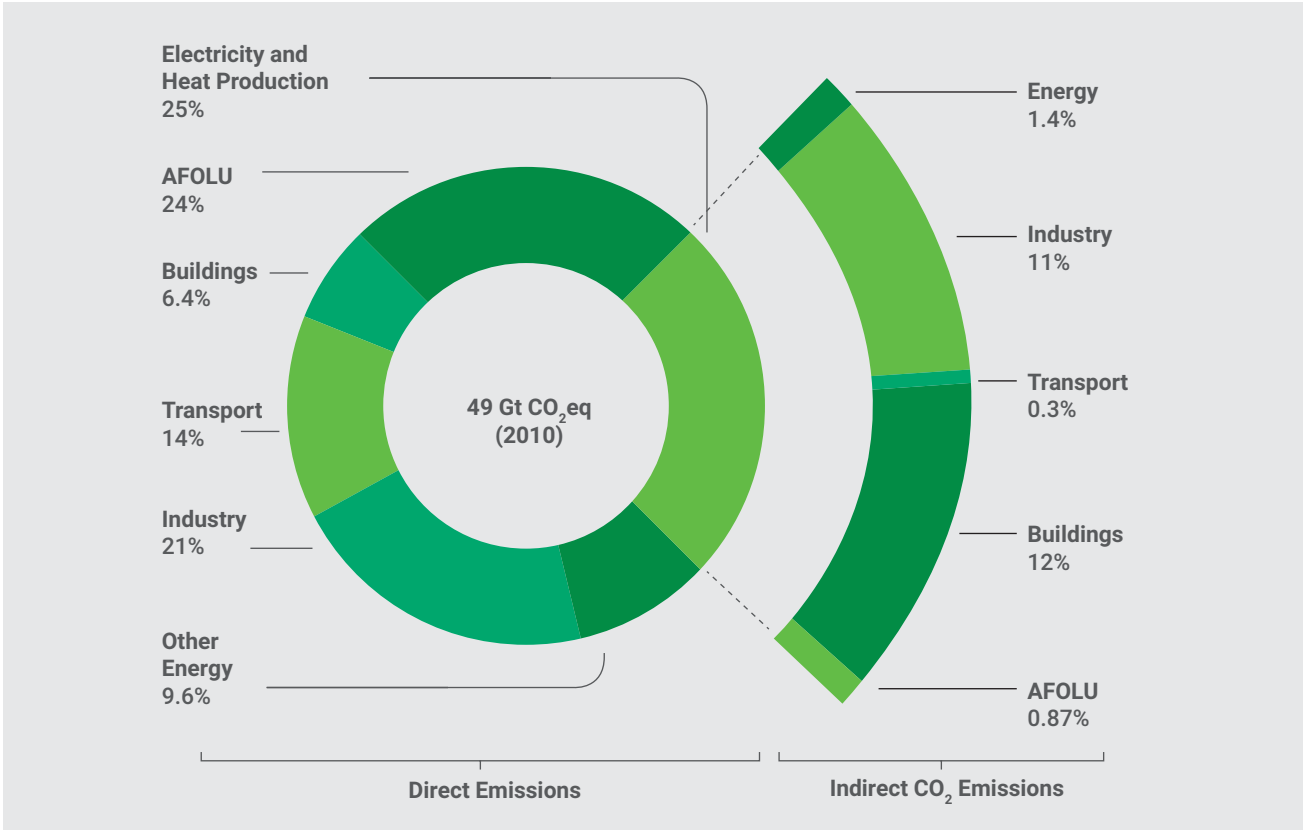



Figure 2: Greenhouse Gas Emissions by Economic Sector (Source: IPCC, 2014)

| | BUS RAPID TRANSIT | LIGHT RAIL | METRO |
|---|---|---|---|
| Capital Cost - million USD (2010) per km | 5-27 | 13-40 | 27-330 |
| Length of Network That Can Be Constructed for 1 USD(2010) billion cost (km) | 37-200 | 25-77 | 3-37 |
| World Network Length in 2011 (km) | 2,139 | 15,000 | 10,000 |
| Direct $CO_2$ Intensity ($gCO_2$/p-km) | 14-22 | 4-22 | 3-21 |
| Capacity (thousand passengers per hour per direction) | 10-35 | 2-12 | 12-45 |

Table 1: Comparison of Capital Costs, Emissions and Capacities for Mass Transit Modes (Source: IPCC, 2014)

# 2. The Current Transport Scene In Perth

## Population Growth

Population forecasts suggest the population of Perth will continue to grow with an estimated forecast of 3.2 million in 2031 and between 4.4 million and 6.6 million in 2061.[18]

Within Perth, while the CBD has been growing rapidly, there is also a distinct outer- ring of growth particularly to the north and south, with some areas experiencing a population growth of over 40%[19] (see Figure 3).

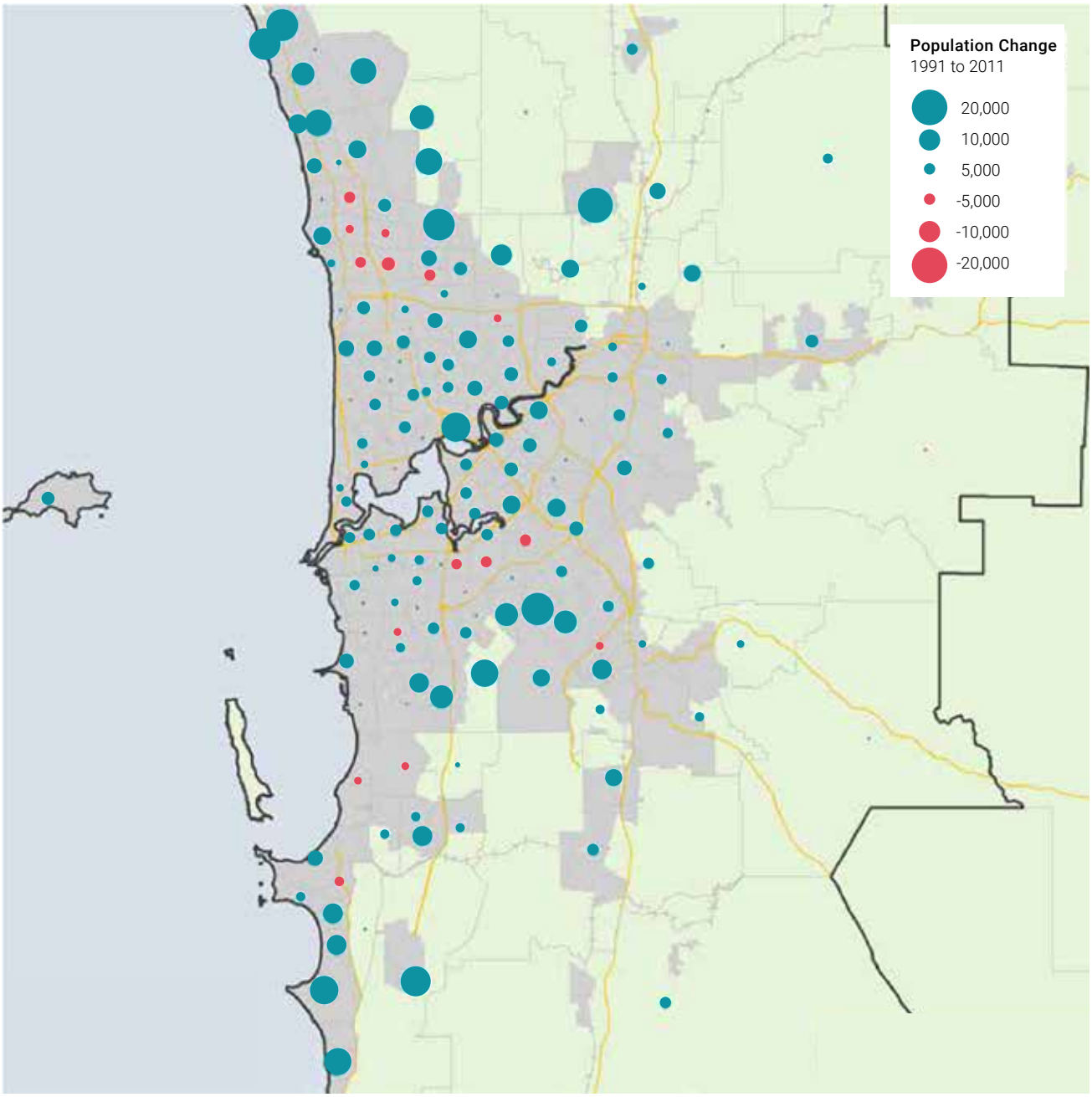



Figure 3: Perth Population Growth Distribution (2006 to 2011) (Source: DIRD, 2015)

18. Australian Bureau of Statistics (2013) Population Projections, Australia, 2012 (base) Western Australia http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/3222.0main+features112012%20(base)%20to%202101

19. Department of Infrastructure and Regional Development (DIRD) (2015) State of Australian Cities 2014-2015 https://infrastructure.gov.au/infrastructure/pab/soac/files/2015_SoAC_full_report.pdf

## The Existing Public Transport System

The WA Public Transport Authority (PTA) states that about 85% of Perth homes have ready access to public transport, defined as the proportion of households that are within walking distance of a Transperth stop which provides an acceptable level of service. An acceptable level of service is defined by the PTA as a service frequency of 20-minute or better in the peak-flow direction during the peak, and at least an hourly service throughout the core of the day.[20] However, the level of service adopted by the PTA is not acceptable as it is far below the frequencies recommended by transport planning scholars, being 6–10 departures per hour at mid working daytime to be strengthened in peak periods.[21] The current low frequencies and waiting times make the public transport system unattractive.

The current mode share for people travelling to work by public transport in Perth is only 10.6%. This is very low compared to the mode share in major World cities, and to the three largest Australian capital cities being 20% in Sydney, 13.9% in Melbourne and 12.8% in Brisbane.[22]

Public transport patronage has grown consistently in Perth, however at a rate lower than Sydney and Melbourne, but higher than Brisbane.[23]

Currently, Perth has a very successful rail transit network. The train network expanded from 66km in the early 1990s to 173km by 2010. Train patronage has increased over the past 10 years by 67% - three times the rate of population growth over the same period[24].

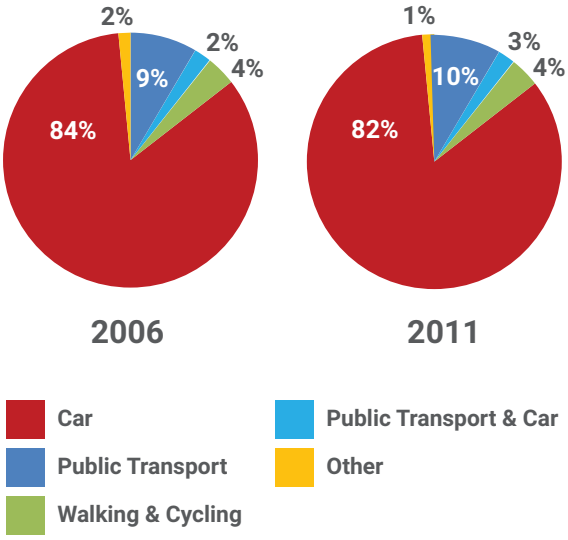



Figure 4: Perth Journey to Work Mode Share 2006 and 2011 (Based on ABS Census data)

The southern Mandurah Line alone moves daily the same numbers of persons as would be required by eight lanes of free flowing freeway and is quite often at full capacity during peak hours.[25] While the existing rail network is a key piece of infrastructure in Perth, it provides very limited spatial coverage and many passengers are highly dependent on park and ride. This is largely due to the existing feeder bus services not providing quick, frequent access to train stations and the timetables often being unreliable due to congestion.

Most buses also meander through suburbs in an attempt to cover the biggest residential areas possible. Circuitous route structures improve spatial coverage at the expense of speed due to frequent stopping and turning. This makes the bus services and the entire public transport journey less attractive and uncompetitive with car travel.[26]

Figure 5 demonstrates an example of meandering bus routes, where a trip from a south eastern suburb to the Bull Creek train station takes a minimum of 38 minutes by bus (excluding waiting times due to low frequencies). The same trip would take 15 minutes by car.

In 2015, the top four reasons cited by Perth bus users for their dissatisfaction were:

- Infrequent services;
- Buses never on time;
- Insufficient off-peak services; and
- Buses and trains don't connect well.[27]

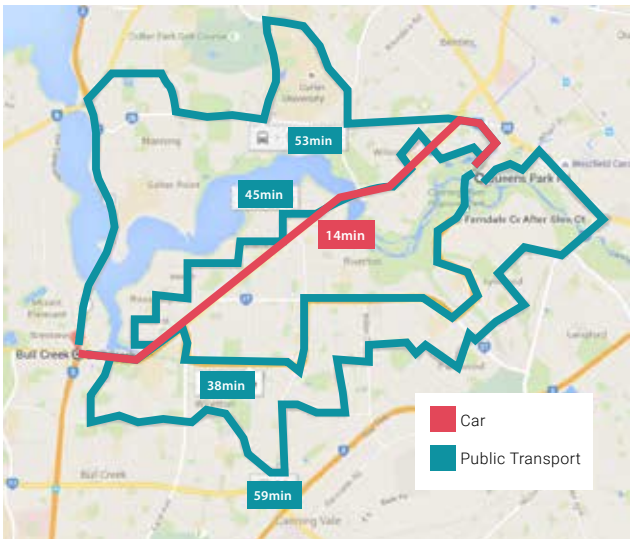



Figure 5: Example of Current Travel Times in Perth Public Transport vs Car (Source: Google Maps)

20. Public Transport Authority (PTA) (2015), Annual Report 2014-15 http://www.pta.wa.gov.au/Portals/0/annualreports/2015/pdfs/PTA%20Annual_Report_2014-15_Full_Report.pdf
21. Nielsen, G., Nelson, J., Mulley, C., Tegner, G., Lind, G. and Lange, T. (2005), Public Transport - Planning the Networks - HiTrans Best Practice Guide , . Stavanger, Norway, European Union Interreg III and HiTrans.
22. Australian Bureau of Statistics (ABS) 2011 census stats: http://www.abs.gov.au/websitedbs/censushome.nsf/home/quickstats?opendocument&navpos=220
23. Bureau of Infrastructure, Transport and Regional Economics (BITRE) (2015), Traffic and Congestion Cost Trends for Australian Capital Cities https://bitre.gov.au/publications/2015/files/is_074.pdf
24. RAC, Public Transport for Perth in 2031 (2011) http://rac.com.au/cs/idcplg?IdcService=GET_FILE&dDocName=raccont065630&allowInterrupt=1&RevisionSelectionMethod=LatestReleased&noSaveAs=1
25. McIntosh et al. (2013), Why Fast Trains Work: An Assessment of a Fast Regional Rail System in Perth, Australia, Journal of Transportation Technologies, 3, 37-47.
26. Mees, Paul (2010), Transport for Suburbia: Beyond the Automobile Age, London, Earthscan.
27. Public Transport Authority (PTA) (2015), Annual Report 2014-15 http://www.pta.wa.gov.au/Portals/0/annualreports/2015/pdfs/PTA%20Annual_Report_2014-15_Full_Report.pdf

## The Suburban Disadvantage

Perth has a highly centralised radial public transport with bus services that are well developed in inner urban areas but less in outer suburbs.

A comprehensive assessment of public transport accessibility was undertaken in 2008, 2009, 2011 and 2014. The assessment takes into consideration multiple criteria including physical access, travel time, efficiency, impediments, speed comparison with road travel, network connectivity and number of transfers.[28]

The two diagrams below show the results of the study in 2007 and 2014, which indicate there has been substantial improvement in the spatial distribution of public transport during this period. However, most of Perth still suffers from average or below average service provision with outer suburbs being the least accessible.

Many of these outer suburban households are also more likely to be impacted by rising fuel prices and transport costs because of their higher travel demand, car dependence, modest incomes and mortgage exposure.

Figure 7 depicts the Vulnerability Assessment for Mortgage, Petrol and Inflation Risks and Expenditure (VAMPIRE) index for Perth.[29] The most vulnerable areas correspond with the population growth areas as indicated in Figure 3. This issue highlights a critical need to provide a high quality public transport network that provides an adequate level of service in the suburbs.

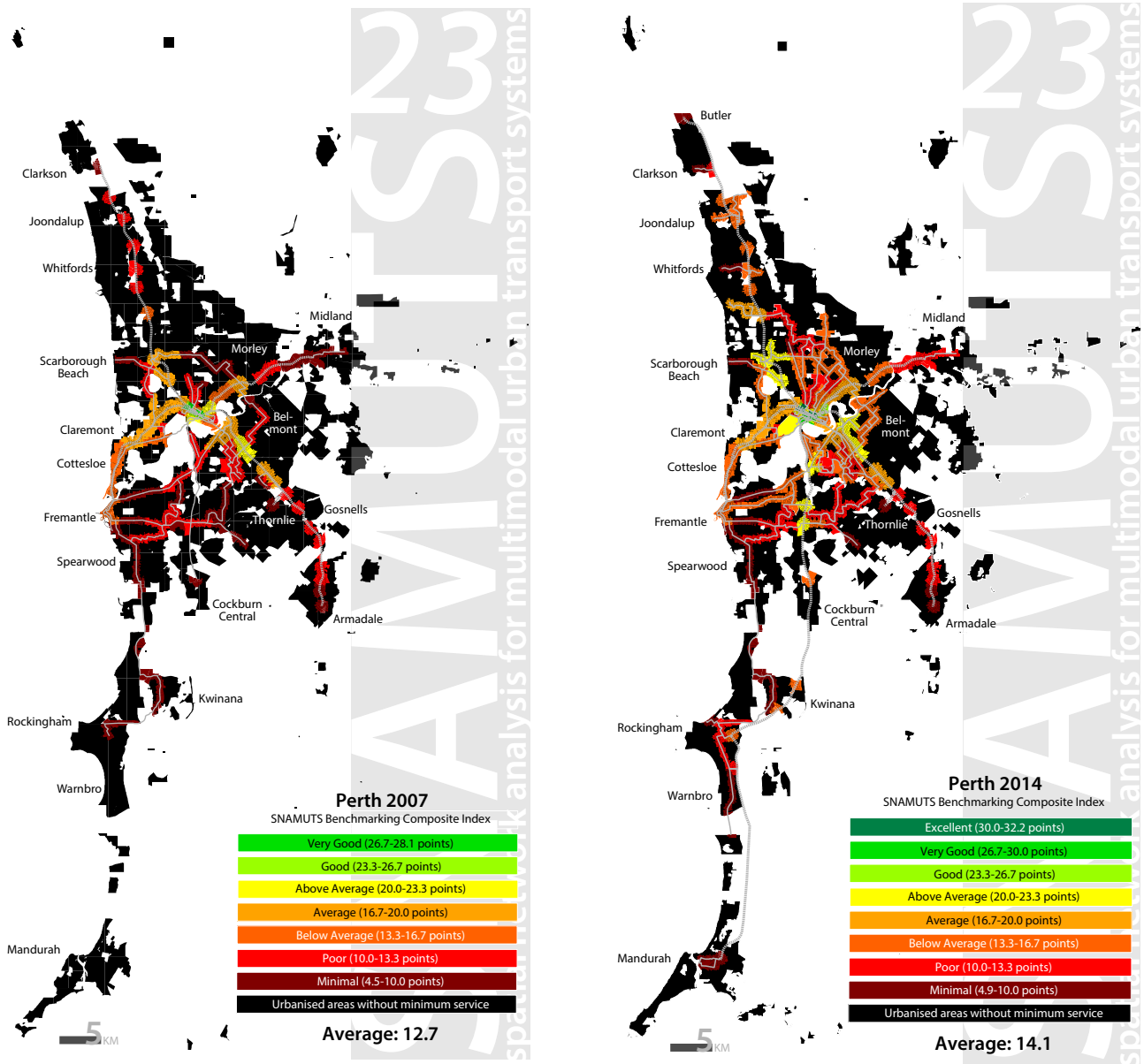



Figure 6: Public Transport Accessibility Synopsis in Perth 2007 and 2014 (Source: Curtis and Scheurer, 2016)

28. Curtis and Scheurer (2016) Spatial Network Analysis for Multi-Modal Urban Transport Systems (SNAMUTS) http://www.snamuts.com/perth.html
29. Dodson, Jago and Sipe, Neil (2008) Shocking the Suburbs: Urban Location, Homeownership and Oil Vulnerability in the Australian City, Housing Studies

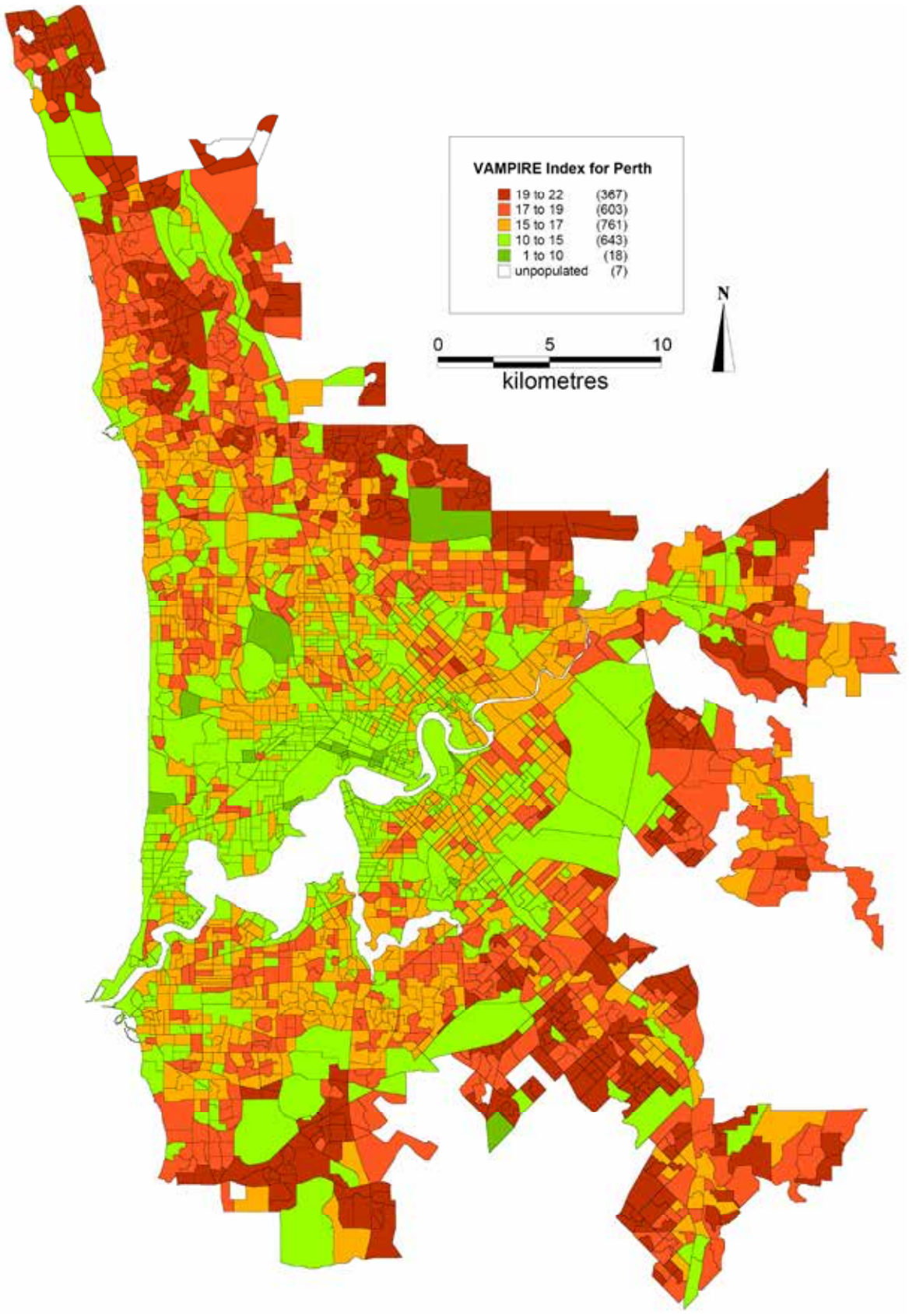



Figure 7: Vulnerability Assessment for Mortage, Petrol and Inflation Risks and Expenditure (VAMPIRE) (Source: Dodson and Sipe, 2008)

# 3. Land Use Planning for Perth

#designperth is a collaboration between the Office of Senator Scott Ludlam, the Property Council of Australia, CODA Architecture and Urban Design, and the Curtin University Sustainability Policy Institute (CUSP) that showcases what could be possible in Perth with world class urban design, and looks at the true cost of urban sprawl.

Building on our award winning 2013 study Transforming Perth, this latest project identifies roadblocks to making Perth a more connected, liveable and sustainable city.

Our report is a joint vision for a connected, liveable and sustainable Perth. #designperth provides what we hope to be a roadmap to all levels of Government and the community on the opportunities we have to move forward to realise this vision.

#designperth articulates the major roadblocks to delivering high quality density and urban regeneration with a particular focus on Transport, Planning, Design and Community, and provides 13 recommendations. These recommendations will assist and encourage all levels of government to work with the community to deliver a sustainable future for our major cities.

Professor Rob Adams from the Department of Transport of Victoria states that intensification of development along road based public transport corridors are key to growth of cities, especially within metropolitan areas.

Urban activity corridors are categorised by mixed use high density, mid-rise centres (6-8 stories) within walking distance of rail transit. Intensification of development along activity corridors benefits the public transport system whilst facilitating accessible affordable housing. Population and employment is critical within 400m (general rule) of the Light Rail to make it effective.[30]

This model is used as the foundation for the precinct case study redevelopment and will be critical in the future when/if the State Government chooses to pursue the previously deferred Metro Area Express (MAX) Light Rail project planned for Perth. Redevelopment of transport corridors created from the planned LRT will further enhance its effectiveness.

The images below depict the potential outcome if the Transforming Perth principles were applied on Albany Highway in Victoria Park.

Current day Victoria Park


Victoria Park as proposed in Transforming Perth

30. (Ginn, 1998)

Image: Ranford Road in Canningvale, present day

Image: Ranford Road in Canningvale as imagined by CODA Studios applying the #designperth principles.

Image: Wanneroo Road today

Image: A visualisation by COX Architects as to how Wanneroo Road could be transformed using the #designperth approach.

#designperth shows how world-class urban design and genuine community engagement can meet our housing needs and transform an area from a dreary thoroughfare into a lively hub, as shown in the examples above.

The study also found hidden cost of fringe development that affects us all:

- Infrastructure (roads, water, communications, power, emergency services, health and education) for a new development area costs $150,390 per lot, compared with $55,830 in infill sites
- Every 1000 infill lots homes saves the taxpayer $94.5 million
- Families who live in outer suburban developments spend $330,000 more over 50 years on transport costs, parking and time lost in traffic.
- The economic cost from air pollution, greenhouse gases and reduced physical activity impacting on healthcare, and productivity is worth $57,933 per lot in greenfield sites.
- Infill development will create 8,400 more jobs for every 1,000 homes built, and save 4.4 tonnes of carbon pollution per household.
- Ten of Perth's largest growing suburbs are on average 33km from the CBD.
- If we were to increase our infill target from 47% to 60%, the state government would save $23 billion on infrastructure costs by 2050.

# 4. Transit City

## 4.1 Public Transport for All – Not Just Where Density Is

For decades, planning practitioners have held the view that the only way to make public transport viable is through density increase and compact settlement where strong demand produces economy of scale. This implies that residents in lower density suburban areas are unlikely to be provided with high quality public transport and have to rely on private vehicles unless a significant increase in density occurs.

However, recent research suggests that density is less critical to public transport compared to the quality of public transport operations and the design of the transit network. Many authors have argued that suburban public transport can offer a competitive alternative to private cars even in highly dispersed cities and this is achievable through a change in transport policy and planning rather than urban form. The crucial challenge is the overall strategic and tactical planning of networks to ensure that people can travel from 'anywhere to anywhere' on a fast seamless interconnected trip that is optimised to provide a competitive travel experience to the private car.[31]

To tackle this challenge, scholars have come up with two types of strategic solution: the radial network and the dispersed network.[32]

### The Radial Network

This network strategy aims at connecting a series of sub-regional nodes or centres via trunk transport corridors. Areas within 20-30km of the nodes are connected to these nodes via radial feeder links. A diagram of a Radial Network is presented in Figure 8.

This approach is similar to the Transit Oriented Development (TOD) model that has been a key principle in land use and transport planning integration. However, the Radial Network's advantage over the TOD model is that it uses public transport feeder routes to add additional radial clusters.

The Copenhagen and Stockholm S-Tog rail networks exemplify this 'beads on a string' model of activity and corridor provision. While this network strategy has potential to offer greater connectivity between centres, there is limited connectivity between the services within each radial cluster. The route structure provides only a limited number of journey paths and limits travel opportunities.[33]

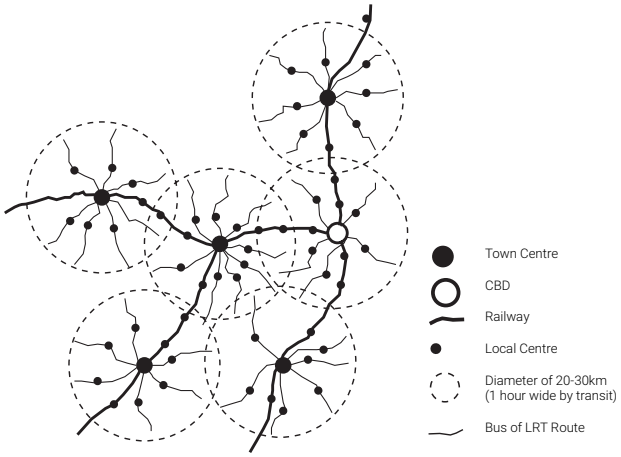



Figure 8: Radial Network Strategy in a Poly-Centric City
(Source: Newman and Kenworthy, 2006)

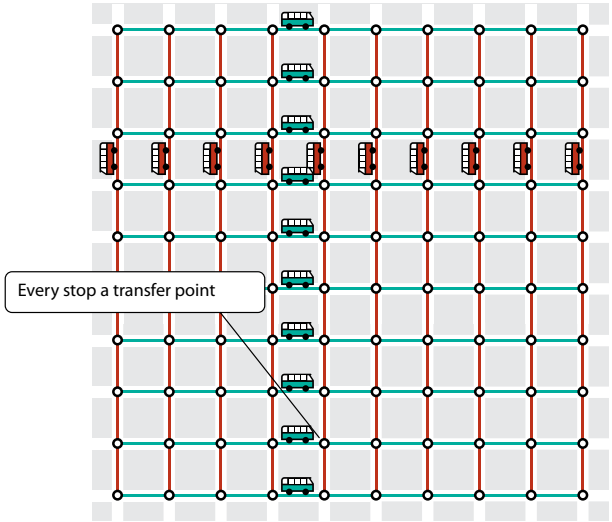



Figure 9: Dispersed Network Strategy (Source: Nielsen et al, 2005; Mees, 2000)

### The Dispersed Network

An alternative strategy to the Radial Network approach is the Dispersed Network. This multi-directional network design consists of a widely distributed array of routes and seeks to provide a seamless grid of movement across an urban area by enabling multiple transfer opportunities at the intersection of public transport lines (Figure 9). This system of direct routes and transfer nodes creates the 'network effect' which allows people to move between multiple origins and destinations.[34]

The Dispersed Network strategy has been deployed in many of the successful public transport systems operating in Europe and in some North American cities such as Toronto and Vancouver.[35]

Public Transport in Zurich is an existing example of an extremely successful Dispersed Network (Figure 10). Zurich has one of the highest per capita usages of public transport in the developed world and has achieved this without having high densities. The Zurich network comprises a set of radial rail and tram lines intersected by multiple bus routes.[36] Each rail, tram or bus line provides the opportunity for multi-directional transfers as it is intersected by multiple other lines.

31. Mees 2000; Newman 2006; Mees 2010
32. Dodson, Jago; Mees, Paul; Stone, John and Burke, Matthew (2011), The Principles of Public Transport Network Planning: A Review of the Emerging Literature with Select Examples, Griffith University Urban Research Program https://www.griffith.edu.au/__data/assets/pdf_file/0005/281552/ip15-dodson-et-al-2011.pdf
33. Ibid.
34. Mees, Paul (2010), Transport for Suburbia: Beyond the Automobile Age, London, Earthscan.
35. Dodson et al, Ibid.
36. Zurich Transport Network (ZVV), Entire Transport Network Plan http://www.zvv.ch/zvv-assets/fahrplan/pdf/s-bahn_dez_2015.pdf

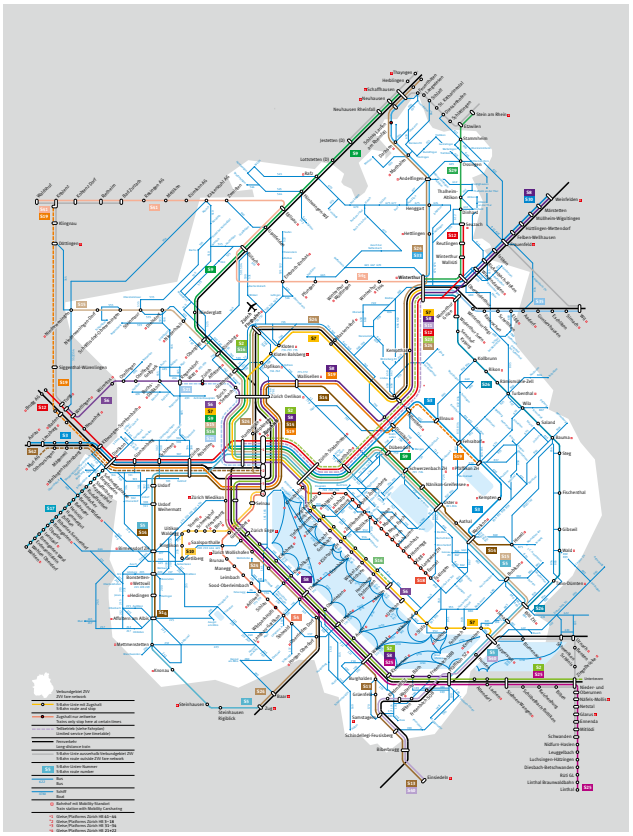


Figure 10: Zurich Public Transport Network Plan
(Source: http://www.zvv.ch/zvv-assets/fahrplan/pdf/s-bahn_dez_2015.pdf)

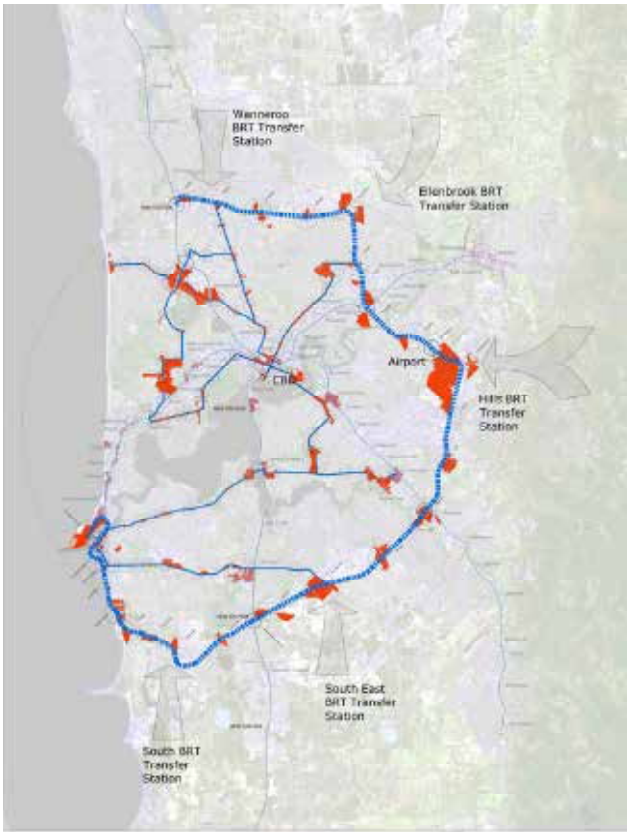



Figure 11: Ring Rail Proposal (Source: Hendrigan and Newman, 2013)

## Towards a Network Model for Perth

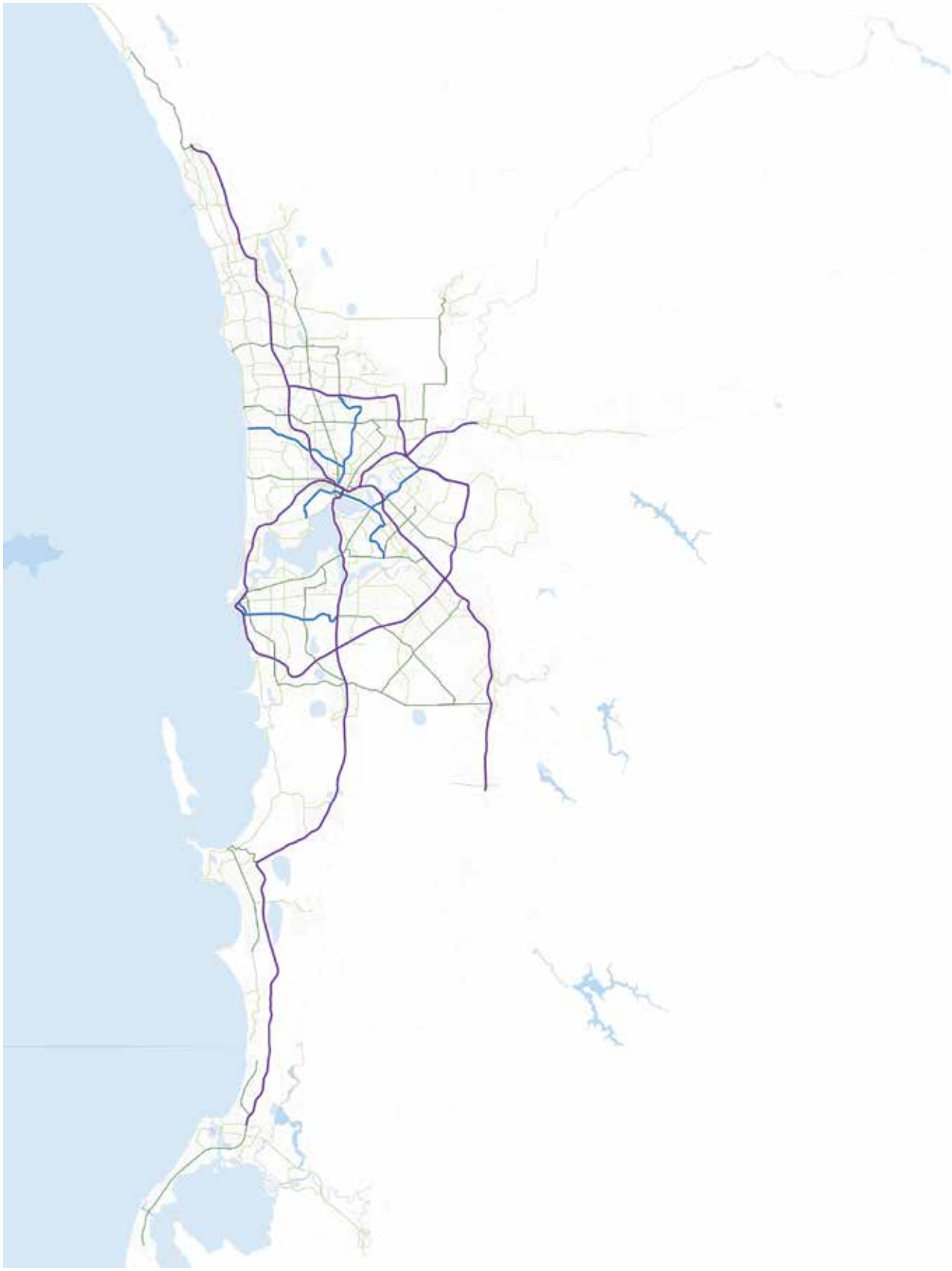
More recently, investigations and modelling have been undertaken by researchers at Curtin University to identify ways to transition Perth from an automobile-dependent city to a 'Transit-Oriented Region' in which transport and land use planning are integrated across the entire region, and not just in specialised TOD areas.[37] This has included integrated planning across the region to build new rail lines, optimise the current high-capacity public transport corridors, up-zone and re-zone to mixed use, reduce parking ratios and reduce expenditures on highways.

The model is based on adding new rail lines, especially a Ring Rail (heavy rail), supplemented by light rail for the inner and middle suburbs (Figure 11). Residents and jobs are focussed around the rail stations. Bus Priority Transit are proposed through the outer suburbs as a way to link these areas to the Ring Rail and existing heavy rail lines.[38]

Image: Light Rail in Seattle, Washington (Credit: Michael B)

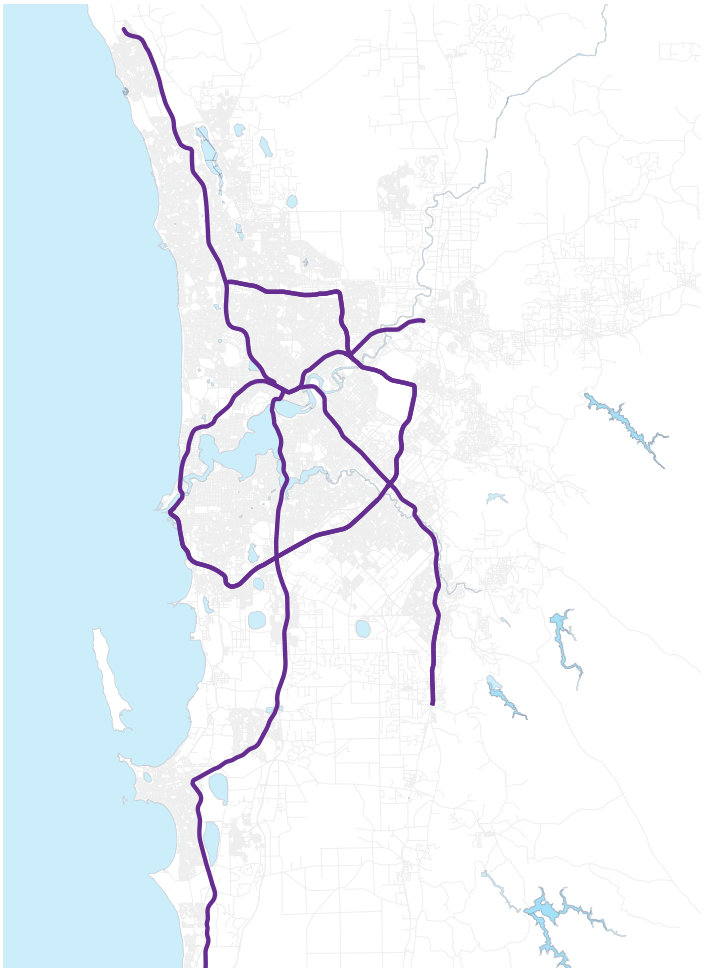
37. Hendrigan, Cole (2014), Towards the Transit-Oriented Region: Polycentric Urbanism to Transform Automobile Dependent Cities
38. Hendrigan, Cole and Newman, Peter (2013), A Three Mode Plan for Perth: Connecting Heavy Rail, Light Rail and Bus with Urban Development to Achieve 21st Century Goals (Draft for public consultation), Curtin University

## 4.2. Transit City: The Network Plan

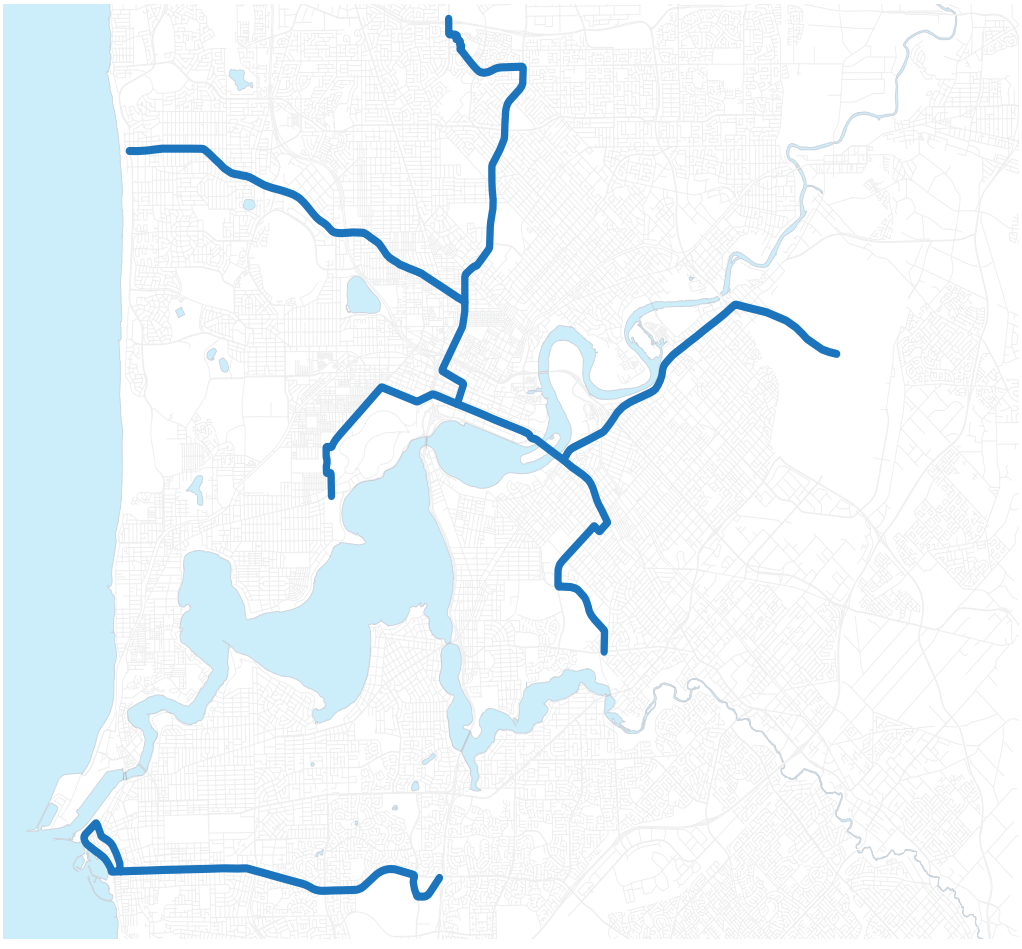


Map 1: The proposed Transit City network

Key:
- Heavy Rail:
- Light Rail:
- Bus Priority Transit
- Frequent buses :



Map 2: The proposed heavy rail network, linking the existing rail to create a ring rail

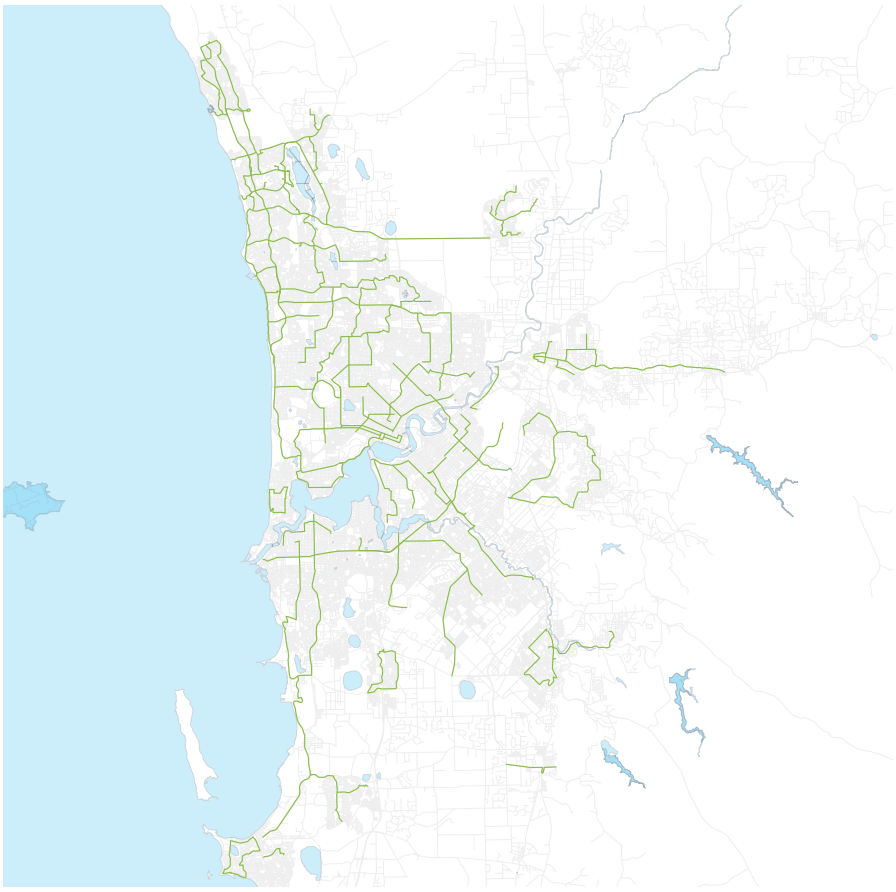


Map 2: The proposed light rail network, Phase 1 MAX light rail and Phase 2 to include South Street, Canning Highway and Scarborough Beach Road

Map 4a: The proposed Bus Priority Transit network in the central area

Map 4b: The proposed Bus Priority Transit network in Alkimos

Map 4c: The proposed Bus Prioity Transit network in the Peel region



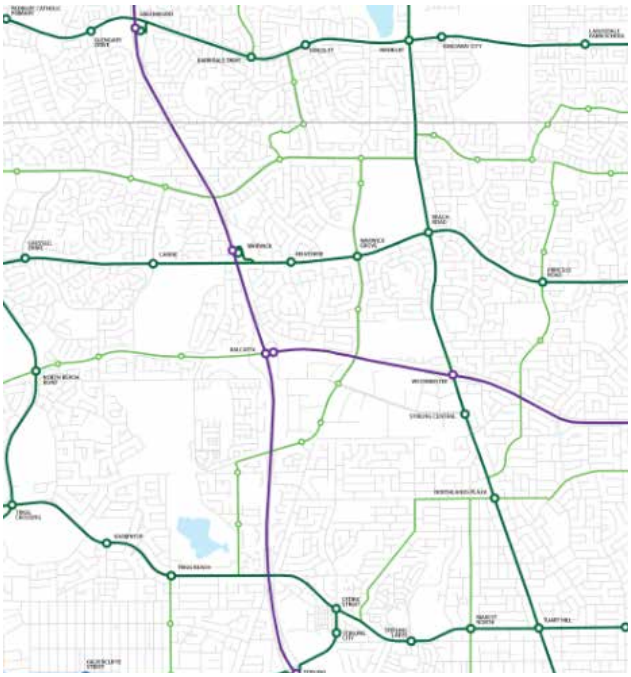
Map 5: The proposed high frequency bus network for the central area. additional services are proposed for Peel region and Perth's far northern suburbs

# 4.3. The Transit City Network: How Is It Designed?

The Greens' Transit City Network proposes a comprehensive interconnected network of public transport that enables anywhere to anywhere travel, quickly and conveniently. Building upon the recent transport planning body of research and literature, the Transit City network has been designed upon the following ten key principles.

## Key Principle 1: A Grid Network

Adopting the grid pattern of the Dispersed Model (Figure 9), the Transit City plan expands and restructures the existing public transport system in Perth and transforms it to an interconnected network of direct lines intersecting at nodes that maximise opportunities for transfers. Multiple transfer points enable people to get from anywhere to anywhere. This grid network means that planners will no longer have to try to anticipate where passengers want to go and lay out highly tortuous, low-speed suburban lines. Instead, high speed linear alignments allow users to choose their own routes to their destination.[39]



## Key Principle 2: A Hierarchy of Transport Modes

Transit City provides for a hierarchy of transport modes that offer a variety of capacity and speed that are appropriate for the scale of operation. The proposed modes are indicated below and are further detailed under Section 4.4 of this report.


39. Mees, Paul (2010), Transport for Suburbia: Beyond the Automobile Age, London, Earthscan.

## Key Principle 3:
## Simple and Direct Route Structures

The Transit City network is made up of a series of interconnecting lines that have been designed to maximise directness and the overall network simplicity. Direct routes result in faster travel times and higher legibility as users can remember them more easily.

Route directness is particularly important for bus lines as they lack fixed physical infrastructure and therefore have routes that are harder to locate and remember. Existing physical barriers inevitably limit line directness in some areas, however, the proposed network avoids unnecessary deviation and the circuitous lengthy route structure, which is a current characteristic of many bus routes in Perth.

The lines operate as cross town routes to support through-passage at key activity centres and interchanges. Direct routes will attract patronage by offering higher frequencies rather than by offering wide spatial accessibility. Any reductions in coverage are made up for through the use of feeder lines.

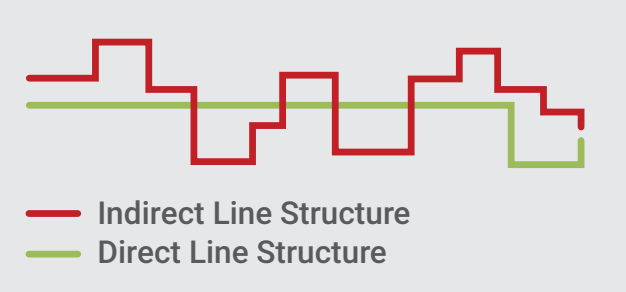



Figure 12: Direct and Indirect Line structures (Source: Dodson et al, 2011)

## Key Principle 4:
## Network Consolidation

All routes are designed with simple, direct structures and as little duplication and overlap as possible. This provides cost efficiency and less complexity for passengers. As Paul Mees outlines:

"While in theory, 20 bus routes running hourly down a joint corridor means a service every three minutes, in practice it means bewildered passengers. A single line running every five minutes would use fewer resources but provide a better service. This approach will often mean employing the 'trunk and feeder' model used in Curitiba and many other places."[40]

In the Transit City network, main routes are operated as single lines using higher capacity/speed modes, while outer routes are converted to feeders operated with smaller vehicles and providing more stopping opportunities. This enables the trunk section to operate economically, avoiding vehicle congestion and saving resources which can be redeployed to provide higher service levels on the feeder routes.[41]

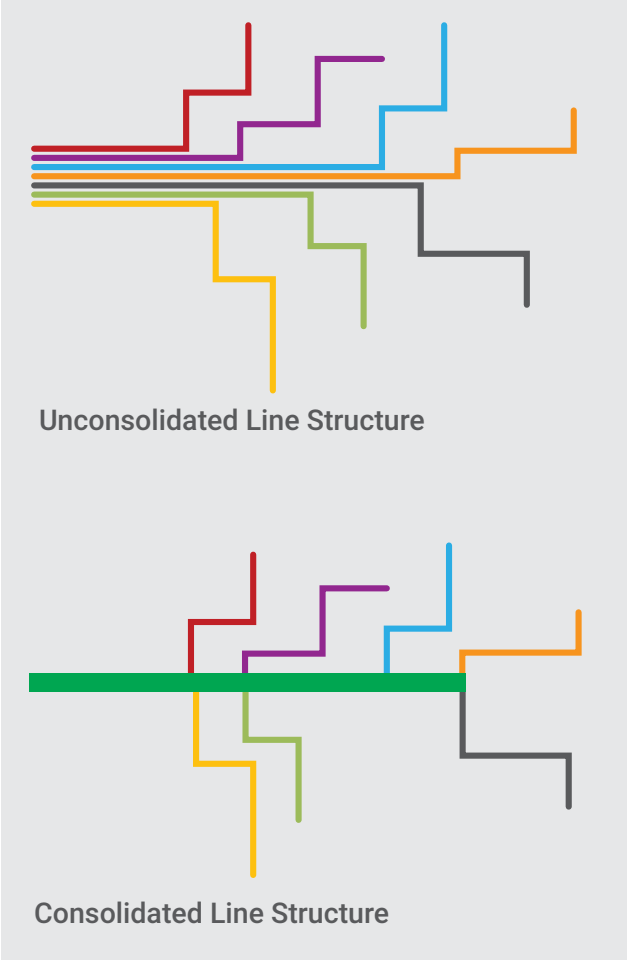



Figure 13: Line consolidation leading to higher frequencies on the trunk service (Source: Dodson et al, 2011)

40. Mees, Paul (2010), Transport for Suburbia: Beyond the Automobile Age, London, Earthscan.
41. Ibid.

## Key Principle 5:
## Speed and Reliability

The main objective in Transit City is to enable people to travel from any origin to any destination in the same time or quicker than the travel times that can be achieved by private vehicles. This requires - in addition to directness of routes – high quality public transport vehicles, dedicated lanes, right of ways, removal of impediments, priority at intersections and quick transfers.

Image: Light Rail in Birmingham, UK (Credit: Elliott Brown)

## Key Principle 6:
## Fast and Convenient Transfers

To create the 'network effect' and support fast journeys to dispersed destinations requires fast and easy transfers between lines. High-speed high frequency trunk routes provide the spine of a public transport network and in themselves require minimal coordination with other routes. Inter-suburban pendulum services feeding the trunk lines require timetable coordination to ensure waiting times for transferring passengers are minimised.[42]

The literature distinguishes between two main timetabling techniques – 'pulse' or 'timed' transfers[43] versus 'forget-the-timetable'.[44]

'Forget-the-timetable' can occur effectively on trunk lines where frequencies are better than ten minutes. This means one basically does not need to check the timetable and can simply 'turn up and go'. In Zurich, for example, services on most of the suburban bus and tram lines operate at frequencies of 7.5 minutes. The result is short waiting times for transfers between most services on the network with regular and easily remembered service times that largely eliminate the need for timetables on most lines.

In a 'pulse' transfer, however, multiple lines arrive at a network node simultaneously to allow passengers to transfer between lines and then depart simultaneously. 'Pulse' transfers are typically used for inter-suburban or feeder services operating at lower frequencies. The concept of a 'clock-face' with arrivals and departures at set regular intervals can be used to enable 'pulse' transfer. For instance, services can arrive at a transfer node at 10, 25, 40 and 55 minutes past the hour allowing time for transfer and then depart at 0, 15, 30 and 45 minutes past.[45] This type of operation is currently practiced at some interchanges in Perth.

High frequencies of rail and bus services in the Transit City network will create the 'forget-the-timetable' effect. Where and when frequencies are over 10 minutes, the 'pulse' timetabling method will be used.

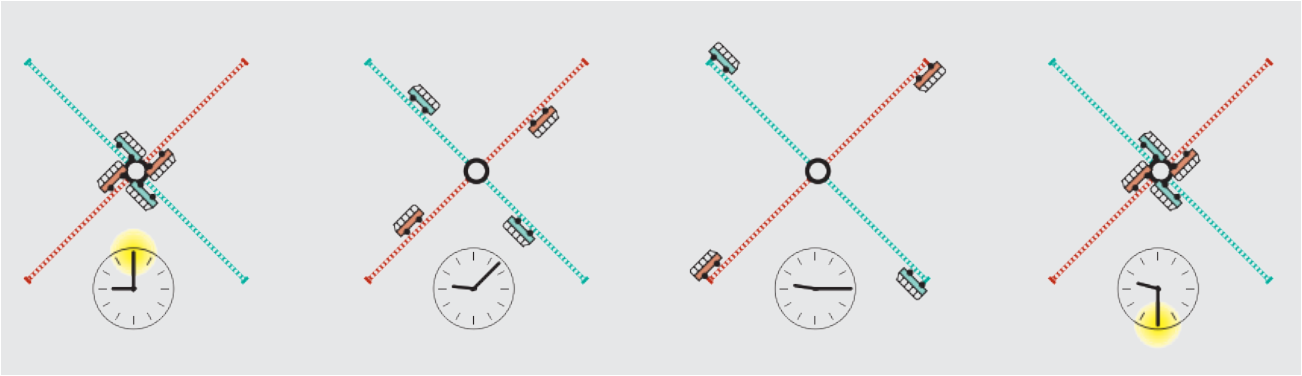


Figure 14: 'Pulse' timetabling transfers (Source: Nielsen et al, 2005)

42. Dodson, Jago; Mees, Paul; Stone, John and Burke, Matthew (2011), The Principles of Public Transport Network Planning: A Review of the Emerging Literature with Select Examples, Griffith University Urban Research Program
43. Mees, Paul (2010), Transport for Suburbia: Beyond the Automobile Age, London, Earthscan.
44. Nielsen, G., Nelson, J., Mulley, C., Tegner, G., Lind, G. and Lange, T. (2005), Public Transport - Planning the Networks - HiTrans Best Practice Guide 2
45. Mees, Ibid.

## Key Principle 7: Pedestrian and Cyclist Integration

Every public transport user is also a pedestrian, or a cyclist, and every passenger may have a disability. All services, platforms and stops are to be accessible, pedestrian and bike-friendly, with dedicated places on high-capacity railcars and rapid bus vehicles for cyclists.

Pedestrian and cyclist access networks are in effect extensions of the public transport network and must be planned on the same principles of speed, connectivity and legibility as the overall public network. Stops and interchanges are carefully positioned at key trip destinations such as activity nodes, transfer points and pedestrian/cyclist routes. Stops are to be located as closely to activity nodes as possible with pedestrians to have access priority over vehicular modes. The following hierarchy of access priorities apply:

- Children, the elderly and the disabled;
- Pedestrians;
- Cyclists;
- Public transport (feeder services);
- Service and delivery vehicles; and
- Private vehicles.

Interchanges, when needed, should be designed to minimise vehicle parking and movement. Park-and-ride facilities are to be progressively reduced in favour of feeder services. At interchanges walking distances between services should be very short - preferably no more than 10 metres.[46]

## Key Principle 8: A Network Which Is Easy to Use and Understand

The network should be as easily and quickly navigable for passengers as roads. Sufficient information should be available to passengers at stops to navigate across the entire public transport network. Information about timetable frequencies for services on that line should be included as well as information about zones and fares. On-line trip planning applications that are easy and quick to use are to be provided. Digital technology can make this easy.

## Key Principle 9: An Integrated Fare System

Integrated fares are essential to the operations of well-planned public transport networks. Perth is already serviced by an integrated fare system which enables free transfers. The current integrated fare system in Perth operates in conjunction with a zone structure. The zoning system should be designed so that public transport is available at affordable prices to suburban areas in particular areas of high socio-economical vulnerability.

To support improved network operations, ticketing should not interfere with the speed of services through increased delays due to ticket issuance by vehicle drivers. Major trunk stations and where possible, stops should provide ticket pre-purchase opportunities as is the case in the Curitiba busways or in Zurich.[47]

Electronic smart cards in Perth (SmartRider) currently enable passengers to store and redeem value for travel, reduce transfer penalties and avoid cash-handling. SmartRider cards should also be widely and easily available for purchase at a range of outlets including at public transport nodes.

## Key Principle 10: Travel Behaviour Change Initiatives

The provision of good quality Public Transport infrastructure and services should also be accompanied by adequate community engagement and travel behaviour change initiatives.

Schools have a key role in influencing the travel behaviour of our future generation by educating the pupils about the benefits of Public Transport and Active Transport and inspiring them to use these modes.

Workplaces also can run travel behaviour change programs. Government departments, in particular, can lead by example, through encouraging their staff to use sustainable transport options for their commute to work, attending meetings and other work-related travel. On the contrary, many government agencies in WA currently incentivise driving through the provision of corporate cars and salary sacrifice options provided to the staff when purchasing vehicles. Incentives should be directed towards the use of Public Transport and Active Transport rather than cars.

46. Nielsen et al, Ibid.
47. Dodson et al, Ibid.


Image: Curitiba Stop in Brazil (Credit: Mariana Gilembarq)

Image: Tram in Amsterdam, The Netherlands (Credit: Peter Eijkman)

Image: Cyclist in Oregon (Credit: Oregon Department of Transportation)

Image: Light Rail on the Gold Coast, Queensland (Credit: Simon Morris)

# 4.4. The Transit City Modes

## Heavy Rail

**The heavy rail network proposed by the Greens will:**

- **Provide high-speed high-capacity links;**
- **Offer maximum 5 minute peak frequencies;**
- **Include rail stations that are termini for LRT, BRT and Frequent Bus services.**

Perth's heavy rail service forms the backbone of our transit network, moving tens of thousands of people an hour at peak times. The aim is to enable the existing radial rail routes in Perth to serve as the main trunk network in the Transit City network. To achieve this, additional rail lines are proposed including a ring rail that will provide the missing connectivity between the existing lines to create the 'network effect'.

The ring rail will start from a new station along the Joondalup Line continuing eastwards crossing the existing Midland line near Bayswater Station and connecting to the Airport and High-Wycombe/Forrestfield. It will then run along the existing freight line connecting to Thornlie line and extending to Canning Vale, with a connection to the Mandurah line at Cockburn Central and then connecting to Bibra Lake, Spearwood, Coogee, South Beach and Fremantle Waterfront.

New rolling stock for peak periods, planned extensions to Byford, and new stations on the Mandurah Line including South Perth will enable the heavy rail network to keep pace with patronage growth as the new feeder services outlined below come on line.

## Light Rail Transit (LRT)

**The LRT routes, including the MAX light rail will:**

- **Provide high capacity inter-suburban links;**
- **Offer maximum 6 minute peak frequencies.**
- **Run along dedicated or shared corridors; and**
- **Integrate easily with various urban and suburban environments without necessarily requiring pavement.**

The Greens have led the campaign for the Perth Light Rail project since 2007. The State Government adopted the policy in 2010 and committed to the 'MAX Light Rail project' prior to the 2013 state election. The Greens secured $500m of Commonwealth funds for the project in 2013. However, the WA Government postponed the project and lost the federal funding towards it.

Light Rail Transit (LRT) requires less construction expense than conventional rail transit. It also has many advantages over buses and Bus Rapid Transit (BRT), including:

- **Capacity:** Large numbers of passengers can be carried with fewer vehicles and staff, and the congestion threshold is significantly higher. LRT can transport more than 10,000 people per hour in one arterial traffic lane that would otherwise move only 800 cars.[48]
- **Speed:** Speed and timetable reliability are generally higher than bus services.
- **Legibility:** LRT routes are inherently more legible and more easily understood than bus systems, especially for non-regular users and visitors.
- **Flexibility:** LRT's operational flexibility allows services to easily meet changing demands by running single or multiple car vehicles when and where required. Further, LRT can operate on dedicated or shared corridors, neither of which necessitates large areas of land or road space.
- **Comfort:** LRT vehicles offer smoother rides than rubber-tyred buses; electric traction is more appealing to both passengers and land uses along the route than diesel haulage, and local noise and pollution impacts are eliminated.
- **Ease of Integration:** LRT integrates safely with pedestrians, cyclists and motor vehicles and can be retrofitted into existing urban environments. It also does not create the physical barrier of a heavy rail line and does not disrupt permeability and connectivity.
- **Community Certainty:** The permanence of LRT routes (versus the relative flexibility in changing bus routes) is an impetus for long-term location decisions of users and landowners, and their implementation is regarded as a strong commitment by authorities to the potential of a particular area.
- **Marketing Potential:** LRT can be more convincingly marketed as a superior transport product in their own right than improved bus services, which will still be regarded as rather trivial by many potential users.

48. Australian Railway Association (ARA), Light Rail: A Sustainable Solution to an Urban Lifestyle http://www.ara.net.au/sites/default/files/u1/Light-rail-fact-sheet-web.pdf

Approximately 400 Light Rail systems currently operate in 50 countries worldwide. Light rail has been introduced to more than 100 international cities in the past decade, making a spectacular comeback in the United States, East Asia and Europe.

In Australia, Sydney, Melbourne, Adelaide and the Gold Coast operate LRT systems. Melbourne has the largest urban tramway system in the world consisting of approximately 250km of track and 500 trams. The light rail line which opened in the Gold Coast in 2014 is a recent example of the delivery of a successful LRT system.

The Gold Coast Light Rail (G:link) opened on 20 July 2014 and consists of a 13km long dedicated light rail corridor providing 16-stations at key destinations. It was delivered via a Public Private Partnership (PPP) with funding commitments from all three levels of government,[49] the Queensland and Federal Governments each contributing $650,000 to the associated Feasibility Study. In the first year of operation, the line carried more than 6.6 million passengers, averaging more than 18,200 trips per day. Since the commencement of light rail on the Gold Coast, regional public transport travel has increased by more than 25 per cent.[50]

Following the success of the line, the Queensland Government announced in August 2015 that it was progressing with plans for the second stage of the project which will connect the existing light rail system at Southport to heavy rail at the Helensvale station.[51] The 7.3 km extension is scheduled to open in 2018.[52]

## Bus Priority Transit

**Bus Priority Transit is the light weight form of Bus Rapid Transit (BRT). It will:**

- **Provide a crucial 'middle tier' public transport service between rail and high frequency buses;**
- **Combine the high speed of LRT with the flexibility of a bus system; and**
- **Bypass traffic through dedicated lanes, enclosed corridors and bus priority at intersections.**

BRT's main features are:

- Dedicated enclosed lanes;
- Comfortable and weather proof stations;
- Level boarding;
- Frequent service;
- Large capacity;
- Traffic signal priority; and
- Intelligent control systems.

As it uses the existing road systems, buses can be cheaper than rail and is considerably cheaper than subways or overhead rail. Ottawa, Curitiba and Bogotá were the first cities to introduce BRTs on a large scale which have all been greatly successful.

There has been significant improvement in the technology and performance of electric buses recently which makes them a viable alternative to the existing fossil fuel operated buses. A prototype all-electric bus was unveiled in Melbourne in late 2015 which can drive 1000km on one charge.[53] The Transit City BRT system will progressively phase in electric buses as the existing fleet is gradually retired so that whenever a vehicle is replaced it would go from diesel to electric.

BRT can bypass traffic and gain extra speed, It can carry between 5000 to 10,000 people an hour along dedicated corridors which is much more than buses which can rarely reach 5,000 people per hour.[54]

BRT will play a key role in a functional transit city - but not at the exclusion of LRT - which is required for greater urban renewal, efficiency and much greater carrying capacity.

The BRT proposed for Transit City is the light weight low cost form, with bus lanes painted on the road, queue jumping at traffic lights and priority signals. This will deliver the greatest speed and efficiency gains at low cost and with minimal infrastructure. We refer to this as Bus Priority Transit.

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49. Queensland Government (2011), Gold Coast Rapid Transit: Lessons Learned from Planning to Procurement http://gcrtlessonslearned.com.au/workspace/assets/uploads/files/gcrt-lessons-learned-executive-4f9f68c6a1d84.pdf
50. Queensland Department of Transport and Main Roads (2015), Gold Coast Light Rail Stage 2 Fact Sheet http://www.tmr.qld.gov.au/Projects/Name/G/Gold-Coast-Light-Rail-Stage-2.aspx
51. Ibid.
52. Ibid.
53. Newman P and Kenworthy J (2015) The End of Automobile Dependence, Island Press, Washington DC.
54. Hendrigan, Cole and Newman, Peter (2013), A Three Mode Plan for Perth: Connecting Heavy Rail, Light Rail and Bus with Urban Development to Achieve 21st Century Goals (Draft for public consultation), Curtin University http://www.curtin.edu.au/research/cusp/local/docs/three-mode-plan-perth-draft-public.pdf
55. http://www.transport.wa.gov.au/mediaFiles/active-transport/AT_CYC_P_WABN_Plan.pdf

## Frequent Buses

**The feeder buses in the Transit City network will:**

- **Provide medium capacity;**
- **Offer 10 minute peak hour frequency;**
- **Have run-of-traffic and traffic light second priority;**
- **Be scheduled to connect seamlessly with BRT, LRT and Heavy Rail services; and**
- **Facilitate easy and comfortable transfers for all passengers.**

The final piece of the transit puzzle is the network of lower frequency buses feeding passengers into the high-frequency hubs and corridors. These services are a mix of existing bus services, new short-haul services and orbital cat bus services to local hubs and corridors.

Frequent bus routes are designed to be as direct as possible, providing access to key destinations and connecting with BRT and heavy rail lines to maximise opportunities for fast and convenient transfers.

## Bike Vision Integration

- **The Greens have a Bike Vision plan for Perth which details a hierarchy of segregated bike paths, cycle lanes and shared paths.**
- **The public transport network will connect seamlessly with the bike network enabling easy and quick transfers, bicycle boarding and parking.**

Both bicycle and public transport ridership can be increased by providing a cycling network that's well integrated with public transport. Initiatives include direct bike paths and lanes to train and bus stations with free, safe, plentiful and convenient bike parking at stations and hubs, and allowing bikes to be carried on buses and trains. Many of Perth's residents live or work within a five km radius of a transit station and this is a reasonable distance to ride especially if safe and comfortable bikeway facilities are available along the route.

However, even the most ideal riding conditions will not be enough if there is nowhere to store the bike safely, or if you cannot take your bike on the train.

Lockable storage for bikes is now more common at train stations and bike connections to stations has become a priority funding for WA Perth Bike Network funding.[55] However it is still sorely inadequate and needs a major funding increase if it is going to serve the needs of the metro area in a reasonable timeframe.


Image: Bike Carrier on a Bus in Washington, DC (Credit: Elvert Barnes Photography)

Image: Bike Lane in Toronto (Credit: Raysonho)

56. Shaheen, Susan and Cohen, Adam (2012), Carsharing and Personal Vehicle Services: Worldwide Market

## Car Share Models

**Car sharing will complement the Transit City network by:**

- **Providing a flexible travel option filling any gaps left by public transport modes;**
- **Reducing the need for car ownership and parking space;**
- **Utilising the potentials of today's communication technology to connect users; and**
- **Operating through a variety of modelling including peer-to-peer or lease-based options.**

Car-sharing can be used in conjunction with public transport, walking and cycling to fill any gaps left by fixed routes and timetables. It also provides a flexible alternative to private car ownership allowing users to do their bulky shopping or go for an out-of-town daytrip, without needing to own their own car.

Car-sharing began appearing in Europe more than 65 years ago and has expanded since to approximately 1,100 cities worldwide in 26 countries,[56] including Sydney and Melbourne. Car-sharing has been adopted by more than a million users worldwide and generally involves short-term hire of passenger and light commercial vehicles for personal and business uses.

The "quick lease" model is the most common where members are provided with access to a fleet of vehicles that can be picked up from unstaffed and distributed neighbourhood locations. Members book vehicles online or by smartphone apps which show the location of vehicles available nearby, then unlock their reserved car using an electronic keycard and drive off.

Car-sharing can also be "peer-to-peer", where an individual car owner makes their car available for others to rent for a short period of time, or one-way, where cars can be picked up and dropped off at different locations, freeing the user from the return journey.

In Australia, car-sharing is currently available in Sydney and Melbourne. In Sydney, almost 26,000 residents and businesses have joined one of the two operating car share schemes. Members can book a car online whenever they need one, and pick it up from one of 700 parking spaces. The ACT Government has also announced a two-year trial of car sharing, with 22 spaces around Canberra designated for the service.[57]

Car-sharing is thriving in Australia even in the relative absence of support from government transport policy. Car-share schemes are not mentioned in New South Wale's Long Term Transport Masterplan, nor in Victoria's Plan Melbourne strategy.

Local governments have a key role in facilitating car share models and can benefit significantly from them. For each car share vehicle, approximately 12 private cars would be taken off the road which also means less car parking spaces will be required in the cities and for dwellings. The planning frameworks can help facilitate car-share models for residential dwellings enabling shared cars to be available to the residents of grouped and multiple dwellings.

Photo Credit: Car Share in Indianapolis (Credit Zax9000)

## Regional Rail Integration

**The Greens want a regional rail network which:**

- **Is fast, high quality and efficient;**
- **Connects major regional centres with reliable services and adequate frequencies; and**
- **Integrates well with the urban transit systems in Perth and the regional centres.**

The Transit City network will also integrate with the Greens proposed regional rail. The integration will enable transfers with urban passengers being able to use the additional capacity of the regional services.

The Greens propose three rail lines to Geraldton, Kalgoorlie (upgrade) and the extension of the Mandurah line to Bunbury and Busselton.

Image: Regional Rail in Austria (Credit: Uwe Schwarzbach)

Developments and Emerging Trends, International Journal of Sustainable Transportation

57. ABC (2016), ACT Government Announces Two-Year Car Sharing Trial Service in Canberra http://www.abc.net.au/news/2016-04-18/car-sharing-arrives-in-canberra/7333134
58. Iacono, Michael; Levinson, David; Zhao, Zhirong and Lari, Adeel (2009). Value Capture for Transportation Finance:

# 5. Funding Transit City

## Options for Funding Public Transport Infrastructure

Even in the case of the world's great public transport systems, fares do not fully recover costs and some level of funding is required. Rail infrastructure in Australia is expensive, and developing a comprehensive network in Perth will require substantial investment. There are a range of potential options for funding and delivering public transport infrastructure, with differing degrees of private sector involvement:

- Full public sector capital;
- Some private and substantial public capital;
- Substantial private and some public capital;
- Totally private capital.

In Western Australia transport infrastructure has been delivered under the first model – full public sector capital.

| CITY | PROJECT | PROJECT COST | PERCENT OF PROJECT COST COVERED BY VALUE CAPTURE |
|---|---|---|---|
| London | Crossrail | £4.1 billion (Business Rate Supplement)<br>£0.6 billion (Community Infrastructure Levy) | 32% |
| Paris | Grand Paris Express | €21.8 billion | 80% |
| Washington, D.C. | New York Avenue Metro Station (2001) | $25 million | 28% |
| Washington, D.C. | Dulles Metrorail Silver Line Expansion | $400 million (Tyson's Corner SAD)<br>$330 million (Reston/Herndon SAD) | 14% |
| New York | Subway 7 Line Extension | $2.1 billion (Hudson Yards TIF-like) | 88% |

Table 2: Major Transit Project Partly Funded Through Value Capture (Source: Salon, Deborah, 2014)

## Full Public Sector Capital

Public transport infrastructure is currently delivered wholly by public sector funding. The public sector performs all network and regional planning, and oversees the detailed design and engineering work, which is performed by private sector engineers.

There are a range of potential mechanisms for raising government revenue from the increase in land values created by public transport infrastructure, which are collectively known as value capture. One recent Australian example of this is the Gold Coast Light Rail, which was partially funded by a levy on all Gold Coast properties.

**Value Capture**
The idea behind value capture is to enable the beneficiaries of Public Transport contribute to its finance. New Transport projects and improvements to existing services create benefits for three groups of beneficiaries:

- The general public, which benefits from broad economic and social benefits;

- Transportation users, who benefit from improved mobility and productivity; and

- Property owners and developers with access to new services, who benefit from increased property values.[58]

Traditionally, the first and second group of beneficiaries above contribute to transport funding through taxes and fares, however, the third group are not always asked to contribute. Value capture mechanisms allow for public transport systems to be paid for in part by these beneficiaries. This involves strategies to capture any sort of location-based value and may include property taxation strategies such as Tax Increment Financing (TIF), special assessment districts, "betterment" taxes; joint development strategies and sale or lease of land, development rights, or air rights; and transit-focused development fees often with associated density bonuses.

Table 2 provides examples of large transit infrastructure projects that have been or are planned to be financed partly using location value capture strategies.[59]

## Some Private and Substantial Public Capital

Private funding can be sourced through a mixture of sources such as parking levies, tolls on associated private traffic, developer contributions, an increase in registration fees or some other form of tax hypothecated to the rail project.

A successful example of this approach is London Crossrail. Crossrail is an underground heavy rail project connecting major employment centres. The project had substantial contributions from developers and a "Business Rate Supplement", an increment on the municipal rates paid by London businesses. Of the £14.8 billion funding for Crossrail, £4.1 billion will be sourced from London businesses through various mechanisms, including the BRS. Financial contributions were also made from some of the key beneficiaries from the project, mostly developers.

## Substantial Private and Some Public Capital

Substantial private capital can be supplemented by some government capital. Expected property tax increases could be hypothecated to cover the public contribution. This approach would ensure that the rail project is still generating all the capital required though some is from public sources at the three levels of government.

The Tokyo rail network is mostly privately funded and operated, by a range of companies, including privatised former public rail companies. Ticketing revenue is often supplemented by the profits of station-area land development and leasing integrated retail premises. In recent years, rising construction costs and a lack of low-cost farming land to develop has eroded profits for the Tokyo rail companies, and their finances have been bolstered by government grants and low-interest loans, guaranteed by the Development Bank of Japan, an effective subsidy.[60]

## Totally Private Capital

Wholly privately-funded rail can be achieved with integrated property development. Government's role would be kept to in-kind activity to ensure land assembly and land acquisition, zoning and other transport planning integration is fully covered. It would mean that the project could be off balance sheet and hence would help with State Government credit ratings. This has been called the Entrepreneur Rail Model by Newman et al, 2016.[61] There is still substantial scope to influence the layout of the network through land assembly. However, the main value in this approach is to achieve public value from additional urban rail funded by the value derived from creating new activity centres around the rail stations.

The Hong Kong Mass Transit Rail Corporation (MTRC), while still majority owned by the Hong Kong Government, operates on commercial principles as if it were a fully private enterprise. Land is leased to the MTRC at pre-rail prices, and transit-oriented developments around the stations provide substantial returns to the MTRC, as well as boosting patronage through better land use integration.

All four mechanisms need to be given higher priority in our urban planning, transport planning and financial planning.

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# 6. Investing in the Transit City

Capital expenditure on transit projects varies widely. The physical environment, any tunnels or bridges required, or existing infrastructure needing to be relocated can add millions onto the capital cost of any mode of transport. As such it is hard to determine an accurate cost estimate for the proposal. However, for the purpose of this study, we have calculated indicative estimates based on cost per kilometre of each mode using recent US and Australian transit projects as a guide.

## Light Rail

Australia's recent Light Rail projects including cost and distance covered are detailed in Table 3.

These costs vary widely due to the details of each project. The extensions of existing lines are far cheaper than construction of a new line. The costs generally include the construction of two tracks, power and signalling infrastructure, stations and any depots or road widening required. The capital costs may also include associated vehicles, light rail stops, sub-stations and associated street works – as indicated by an asterix in Table 3 above.

The "Stirling City Centre Light Rail Feasibility Study - Phase 2"[62] compared the capital and operational costs of recent transit projects. They found that Light Rail ranged between $10 and $100 million per kilometre, noting that a higher cost was attributed to ancillary infrastructure requirements such as grade separation, tunnelling, utility relocation and property acquisition. This is comparable to the average capital cost for light rail in the US which is $110.5 million per kilometre.[63]

The most expensive was Sydney's South East Light Rail, the first light rail constructed in Sydney in recent decades through the centre of Sydney's CBD, which is a dense urban form and very expensive real estate.


Image: Light Rail in Edinburgh, UK (Credit: Andrew Bone)

| PROJECT | TOTAL COST | LENGTH (KM) | COST PER KM ($ MILLION) |
|---|---|---|---|
| Adelaide (Entertainment Centre Extension) | $94m | 2.8 | $33.6 |
| Sydney (Inner West Light Rail Extension) | $176m | 5.6 | $31.4 |
| Sydney (South East Light Rail) | $1.6b* | 12 | $133.3 |
| Parramatta Light Rail (Proposal) | $1.5b* | 30 | $50 |
| Gold Coast (Stage 1) | $1.2b* | 13 | $92.3 |
| Gold Coast (Stage 2) | $150.1m | 7.3 | $20.5 |
| Canberra | $733m* | 12 | $61.1 |
| Perth (MAX) | $1.9b* | 22 | $86.3 |
| TOTAL | | | $63.5m per km |

Table 3: Cost of recent Light Rail projects in Australia. Costs marked* include vehicles, substations and stops.

63. Reconnecting America (2010) http://www.reconnectingamerica.org/RESOURCE-CENTER/JUMPSTARTING-THE-TRANSIT-SPACE-RACE-2011-INTERACTIVE-MAP
64. https://www.mediastatements.wa.gov.au/Pages/Barnett/2015/09/First-birthday-for-Butler-train-extension.aspx

## Heavy Rail

Just as with light rail there are widely varied costs for urban rail projects. The most costly rail project is Brisbane's Bus and Train Tunnel which equates to $877.2 million per km, which was a complex project that was subsequently cancelled in favour of the still highly complex Cross River Rail project. Most of the others are between $28 and $235m per km.

Those at the low end of the scale are extensions of existing rail that do not involve tunnelling. The higher cost projects include extensive tunnelling, such as the Forrestfield Link (8km of tunnel) and Sydney's North West Link (15km of tunnels). The average cost per kilometre for Australian rail projects is $407.5million. This is similar to the average cost for recent US rail projects, which equate to $412.7m per km.

| PROJECT | TOTAL COST | LENGTH (KM) | COST PER KM ($ MILLION) |
|---|---|---|---|
| Perth (Mandurah Rail line) | $2b~ | 70 | $28.6 |
| Perth (Butler extension) | $221m | 7.5 | $29.5 |
| The Moreton Bay Rail Link | $998m | 12.6 | $79.2 |
| Adelaide (Seaford Rail extension) | $291.2m | 5.7 | $51.1 |
| Brisbane (Bus and Train tunnel) (cancelled) | $5b | 5.7 | $877.2 |
| Brisbane (Cross River Rail)* | $5.2b | 10.2 | $509.8 |
| Perth (Forrestfield Airport Link)* | $2b | 8.5 | $235.3 |
| Sydney (North West Rail Link)* | $8.3b | 36 | $230.5 |
| Sydney (South West Link)* | $2b | 11.4 | 175.4 |
| AVERAGE COST PER KM | | | $246.3m per km |
| COST PER KM OF SIMPLE PROJECTS | | | $47.1m per km |

*Projects marked with an asterisk are large projects involving bridges and/or extensive tunnelling, none of which are proposed in Transit City.

Table 4: Cost of major Heavy Rail projects in Australia. ~ Perth-Mandurah rail converted to 2013

Image: S-Bahn train in Zürich, Switzerland (Credit: Tim Adams)

Image: High Speed Rail in Taiwan (Credit: Edwin Rios)

## Bus Rapid Transit

Like other transit modes, the capital costs of any Bus Rapid Transit system can vary widely depending on the specific logistics of the project. There are also fewer examples of recent BRT projects in Australia.

The most expensive example is the Adelaide O-Bahn, which includes dedicated right of way and a section of tunnel. Details of the Ellenbrook BRT proposal are yet to be determined, however it is likely to be more similar to the plan for Adelaide's East-West Bus Corridor, which included bus priority measures along the existing road corridors, painted bus lanes, bus priority infrastructure at intersections, traffic light signalling priority changes and upgrades to stops/interchanges. However it is remarkable to note that there are very few BRT projects in Australia, despite the relatively lower cost.

The lower cost, lighter infrastructure Ellenbrook style BRT would be most suited for Transit City, therefore costing approximately $7.7m per km..This would have less carrying capacity and less value capture and urban redevelopment opportunity than light rail but provide a much needed improvement to services across the network.

Image: BRT in Belo Horizonte, Brazil (Credit: Mariana Gilembarq)

| PROJECT | TOTAL COST | LENGTH (KM) | COST PER KM ($ MILLION) |
|---|---|---|---|
| Adelaide East-West Bus Corridor (Cancelled) | $524.3m | 18 | $29.1 |
| Adelaide O-Bahn Upgrade | $160m | 3.7 | $43.2 |
| Brisbane Northern Transitway | $132m | 3 | $44 |
| Brisbane Eastern Transitway | $100 | 1.5 | $66.6 |
| Ellenbrook Bus Rapid Transit (proposal) | $110m | 14.2 | $7.7 |
| **AVERAGE COST PER KM** | | | **$36.58m per km** |

Table 5: Cost of major Bus Rapid projects in Australia


Image: Bus Rapid System in Bogota (Credit: Claudio Olivares Medina)

## A game changing investment in the new network

| TRANSIT MODE | TOTAL LENGTH | ESTIMATED COST |
|---|---|---|
| Bus Priority Transit | 283km | $2.18 billion |
| Light Rail Transit | 65km | $4.13 billion |
| Heavy Rail New | 71km | $3.34 billion |
| High Frequency Bus | 811km | |
| Total | | $9.65 billion |

Table 6: Estimated total cost of capital works to implement Transit City

## A matter of priority

Using the data above as a guide for estimating cost, the capital cost to deliver Transit City would be approximately $9.65 billion, delivered over 10-15 years.

This transformative investment will, over time, create a city that will function better and be far better to live in.

For decades we have spent billions on new roads and road widening, only to end up where we are now – on the road to the most congested city in Australia.

We must have the courage to invest in the infrastructure of the future, not the past. This will help us transition to a cleaner, more equitable and liveable city.

The first phase would be the construction of MAX Light Rail and the detailed planning and additional buses for the transition to a Dispersed Network (grid) bus service.

## How we pay for it

The Greens are committed to re-instating the $500m of federal funds toward the $1.9b cost of MAX light rail and contributing a further $500m towards implementing Transit City. We would also redirect federal funding from the Perth Freight Link towards other projects.

In June 2016, the Greens announced $25 billion Commonwealth funding over ten years for public transport infrastructure across Australia. This includes $66 million over four years to upgrade Western Australia's bus fleet to cleaner technology, expand the network and improve frequency with 446 new buses.

A plan of this scale would be implemented over 10 - 15 years, meaning an annual investment of less than $1 billion a year. This would be shared between state government, federal government and private investment.

State Government is the primary funder for public transport. Even in the case of the world's great public transport systems, fares do not fully recover costs, and some level of public subsidy is required. However there is a range of potential options for sharing the cost of delivering public transport infrastructure with the private sector (outlined in Section 5 of Transit City).

The #designperth study mentioned in Section 3 found that increasing the infill target from 47% to 60% would save the State Government $23 billion by 2050 in infrastructure spending. This money could be redirected to implement Transit City, thereby serving the dual purpose of increasing density to improve patronage and improving public transport access and efficiency for the whole community.

The Greens have also proposed the Australian Infrastructure Bank (greens.org.au/infrastructure-bank); an ongoing funding mechanism that would fund green infrastructure such as public transport and renewable energy.

# 7. The Politics of Transit City

Three-year election cycles and broken election promises have wasted years of public transport planning and development. Perth needs a multi-party platform on delivering long term, well planned public transport with integrated land use planning.

Public Transport is becoming a mainstream concern of many voters and all sides of politics as congestion worsens and people seek efficient alternatives.

## State Government

State Government is primarily responsible for the planning, provision and funding of public transport. The Barnett Government has a lack of consistency and poor track record in this area.

The WA Government completed the 7.5km extension of the Joondalup line to Butler in Perth's northern Suburbs in September 2014. At a cost of $221 million, it reached its patronage goal of 2000 boardings a day in just nine days.[64] This is similar to the popularity of the Mandurah line when it opened in 2007, again showing that people are eager to use high quality efficient public transit when it is provided.

In mid-2015 the WA Government announced its plan to double the number of railcars over a ten year period commencing in 2019. The proposal to purchase 50 additional 'new generation' railcars would cost $1.2 billion.[65] However, Transport Minister Dean Nalder admitted to be 'reconsidering' the commitment only a few months later due to the state's economic downturn.[66] The 2016/17 State Budget papers show that this order has been reduced to just 10 new three-car train sets.[67]

Additional services will play a vital role in improving service frequency, meeting growing demand and easing congestion. The Government must prioritise transit initiatives over more road building projects if we are to meet the needs of our 21st century city.

The $2 billion Forrestfield-Airport Rail Link is an 8.5km rail extension from Bayswater to the domestic and international airports and to the eastern suburbs of Perth.[68] This rail link fills a gap in the network. In 2010, public consultation done by the Greens identified the need for efficient public transport to the airport. However, the WA Government continues to prioritise private vehicles over integrated land use planning, with 3000 new car bays planned for the 3 stations on the new line. There will also be bus interchanges at two stations and improved feeder services are promised. Construction is due to commence in 2016 and the first service is anticipated in 2020.

Despite first announcing its support for Light Rail in 2010, the Barnett Government has lacked commitment to the plan to re-introduce this middle tier transit service to Perth's network. A 2013 state election commitment was to build "MAX", a 22km light rail line from Mirrabooka to the CBD with lines splitting to Victoria Park in the east and QEII Medical centre in the west. This was aimed to meet the growing patronage demand and congestion along the route. It was also expected to spur urban renewal along the corridor.

Despite plans being well progressed and attracting local support and $500m in Commonwealth funding, the Barnett Government announced the deferral of the MAX Light Rail project for three years. The revised timeframe anticipates construction commencing in 2019, with first services running in 2022. The WA Transport Minister speculated that the project could be delivered as Bus Rapid Transit at half the cost, but the 2016/17 State Budget includes $427 million for "MAX light rail project".[69]

The WA government is currently drafting the Perth Transport Plan for 3.5 million People and Beyond (PTP 3.5). This study looks at options for roads, river crossings, mass transit, cycling, demand management and future technologies while complementing the Perth and Peel @ 3.5 million report.[70] It is crucial that this includes greater emphasis on transit and alternatives transport to the car.

Addressing car dependency requires integrated, multi-modal transport planning so that public transport is given budget priority over road infrastructure for meeting future travel demand.

One of the impediments to integrated transport planning in WA is the current structure of the State Government where Main Roads WA and the Department of Transport are two separate agencies with competing agendas and priorities. Main Roads, as the name suggests, is in charge of roads and its performance is measured by the delivery of roads. Main Roads traffic modellings which inform road projects do not assume any increase in non-car mode share and as a result, Main Roads supports the status quo.

Changing travel behaviour would require diverting funding from roads into transit and should be supported by multimodal transport modelling and planning that aims for an increase in Public Transport mode share. The amalgamation of the Queensland Departments of Transport and Main Roads in 2009 is a successful example of government structural change to address this issue. The amalgamation allowed for the establishment of an integrated Queensland Transport and Roads Investment Program (QTRIP) which enabled integrated transport plans and projects to be delivered in Queensland.

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## Federal Government

In 2013 the Commonwealth Government allocated $500 million towards the Perth Light Rail project. After five years campaigning, light rail was finally on track to return to Perth. During the 2013 federal election Tony Abbott famously said that his government "would not fund public transport". As Prime Minister, he was true to his word and cut the light rail funding.

In just two years, the Liberals abolished the Major Cities Unit, the National Urban Policy and the COAG Cities Reform Agenda. Infrastructure Australia has been gutted and undermined and the federal agenda became about road building.

During the 2008 economic crisis, the Greens negotiated $40million in funding for cycling projects as part of the stimulus package. It was found to have been effective in creating many jobs and economic activity. Since then, the Greens have called for $80 million a year for cycling from the Commonwealth to help meet the transport task.

The Greens have initiated two Senate inquiries into public transport in 2009 and 2013. Both found there was a clear role for federal government in delivering public transport projects and such projects were essential to ensure the productivity and quality of life in Australian cities.

Under Prime Minister Turnbull, we are yet to see any significant shift from Prime Minister Abbott's position. While Prime Minister Turnbull likes to be seen on trams and has re-instated a Minister for Cities, we are yet to see major federal investment in game changing public transport from the Coalition Government.

## Local Government

The high capital cost and network integration of transit mean that Councils cannot deliver an integrated transit network alone. However local governments can play a key role that could sway a sympathetic or visionary future state government. Through appropriate land use planning a business case for better transit can be made and patronage growth can be achieved.

Local government can play a leadership role in public deliberation, local planning and assessment of preferred route alignments, and priority corridor redevelopment and rezoning in concert with neighbouring local government areas and state planning authorities. Local Government can:

- Advocate on behalf of community for service changes and improvements required,
- Collaborate with the Public Transport Authority (PTA) to identify station stops and provide shelter and public amenity like seating, shade, rubbish bins, bike racks or lockers,
- Partner with PTA to deliver Central Area Transit (CAT) services, via a split funding model,
- Initiate or implement land use planning and density codes that facilitate greater patronage along key routes.

Funding from local government can be used to leverage other investment in public transport. Revenue sources from local government can include a fraction of parking revenue over a number of years (with compounding interest) or a development levy. This can fund streetscape upgrades to enhance local transit. It could be used to create public plazas and safe, comfortable walkable precincts around well designed, safe and comfortable light rail stops. Light rail needs people to work. So while light rail is not the role of Council, they do make places people want to be which makes public transport a more attractive option.

### Case Study: Fremantle

**The City of Fremantle is undertaking long-term land use planning and zoning changes that aim to facilitate public transit service improvements in the future.**

**The Council identified South Street as a transit corridor well suited to light rail in the future. Three locations along South Street were selected as future light rail stops that would feature mixed-use multi storey developments. A series of Scheme Amendments were implemented in 2015/16 that will provide local shopping, employment, entertainment and residential opportunities for many people. These sorts of liveable neighbourhoods are highly sought after and can co-exist on the fringe of existing residential areas along major transport routes like South Street. With higher density living in a well-serviced local neighbourhood that adjoins a frequent public transport services, you can see the patronage justification for light rail being met in time.**

Image: Concept for Hilton Town Centre developed by Dillon Gorton as part of the #designperth charette.

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*"An advanced city is not one where even the poor use cars, but rather one where even the rich use public transport."* **Enrique Peñalosa, Mayor of Bogotá.**

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