Planning for Sustainable Accessibility

Carey Curtis
Curtin University, Australia

"Access is what cities are all about. Man invented cities as an economic and social tool to create easy accessibility through co-location"

(Schaeffer and Sclar, 1975, p.2)

Cities worldwide - interest in a more coordinated approach to growth management → sustainable urban form → sustainable transport outcomes.

A popular planning strategy → public transport oriented development (PTOD), more commonly referred to as transit oriented development (TOD)

→need to consider both land use planning and transport planning in an integrated way

→ city planning framed around public transport
→address both the form and structure of the city and
→ quality of the public transport network
to ensure each are mutually supportive and provide for improved accessibility.

We need to distinguish between these terms…

Accessibility

The ease and convenience of reaching some destination

Measured by: -

- Number of people with access to certain facilities;
- Access to the transport system itself

Mobility

Reflects the travel needs and behaviour of individuals and businesses

Measured by:

- Vehicle kilometres travelled
- Traffic speed

My belief is we should focus on accessibility – who gets access and how… rather than simply how much travel is made and how fast

Sustainable Accessibility?

Achieving movement (travel) through accessibility rather than mobility

"A sustainable transport system is one that:

- Allows the basic access and development needs of individuals, companies and societies to be met safely and in a manner consistent with human and eco-system health, and promotes equity between successive generations…

(Centre for Sustainable Transportation, 2002).

- Is affordable, operates fairly and efficiently, offers a choice of transport mode, and supports a competitive economy, as well as balanced regional development…

- Limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, and uses non-renewable resources at or below the rates of development of renewable substitutes, while minimising the impact on the use of land and the generation of noise"

The New Realism

- Goodwin et al, 1991 – the package approach:
  - improvements to public transport;
  - traffic calming;
  - provision for cyclists and pedestrians;
  - traffic management to maximise the efficiency of the existing road network;
  - road pricing;
  - using land use and urban form to manage transport demand; and
  - providing minimal or no increases to road capacity.

Land use transport integration emerges as the solution (the birth of sustainable accessibility?)

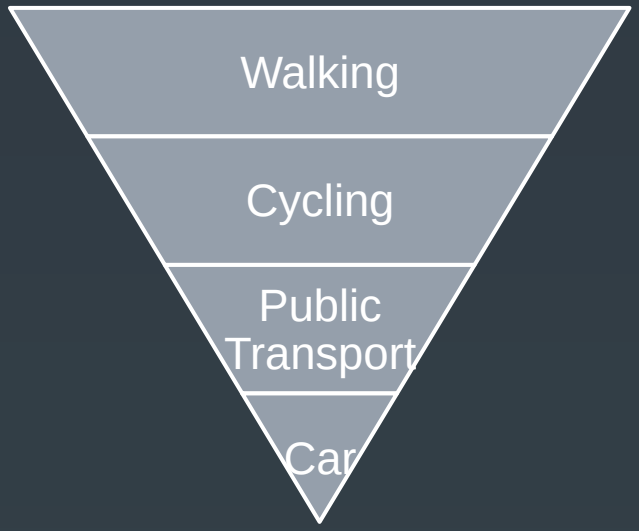
- UK – 1984 - PPG13 :Transport a critical point where transport planning seen as an integral part of the land use planning process.
- Planning policy on:
  - location, scale, density, design and mix of land uses with the aims of reducing the need to travel, reducing journey lengths and making it easier for people to walk, cycle and use public transport.

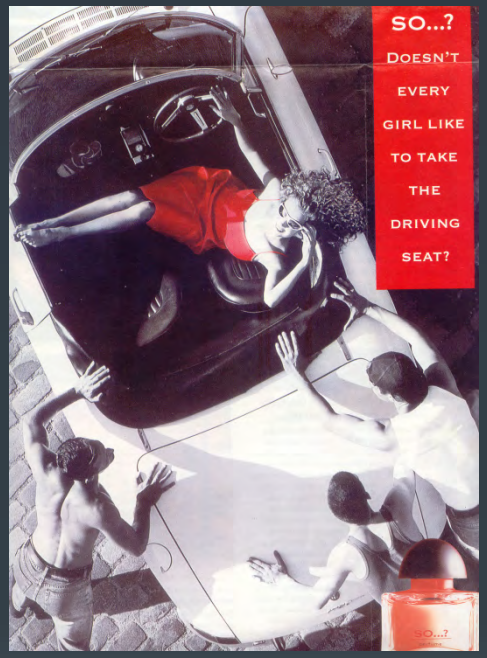
Australia

- Better Cities – 1992-1996:
  - urban consolidation
  - Mixed use higher density devt. at transit nodes
- Australia's National Charter on Integrated Land Use and Transport Planning (2000)

…what is sustainable transport?

Planning for all modes of transport – but dominant mode is not private car





Hardware, software, people (behaviour change)

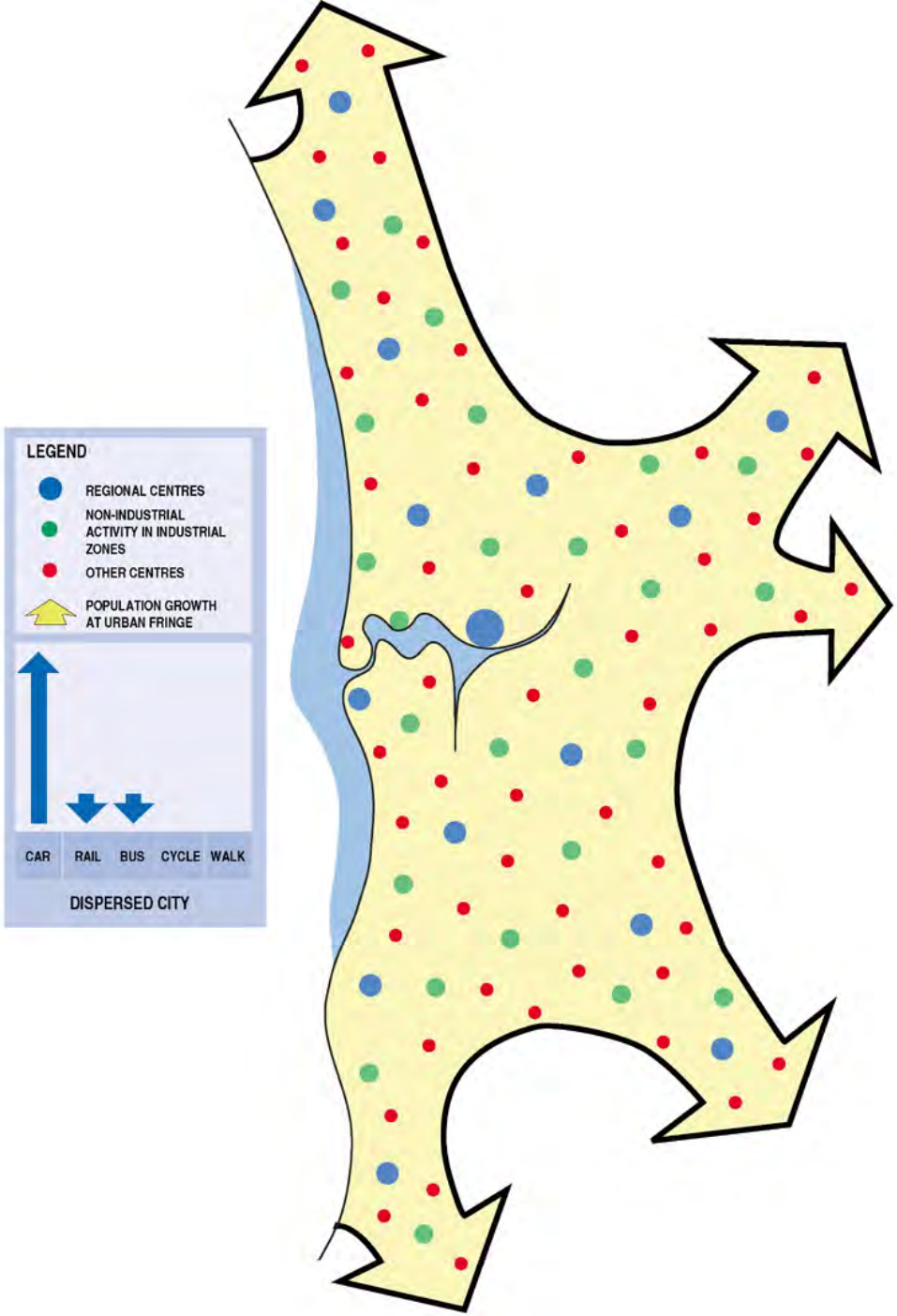
Integrating transport planning with land use planning

Multi-Scalar – from city wide to street-cross section design

Integrating Transport with Land Use:

Using an accessibility tool to capture the strategic transport and land use choices for the city

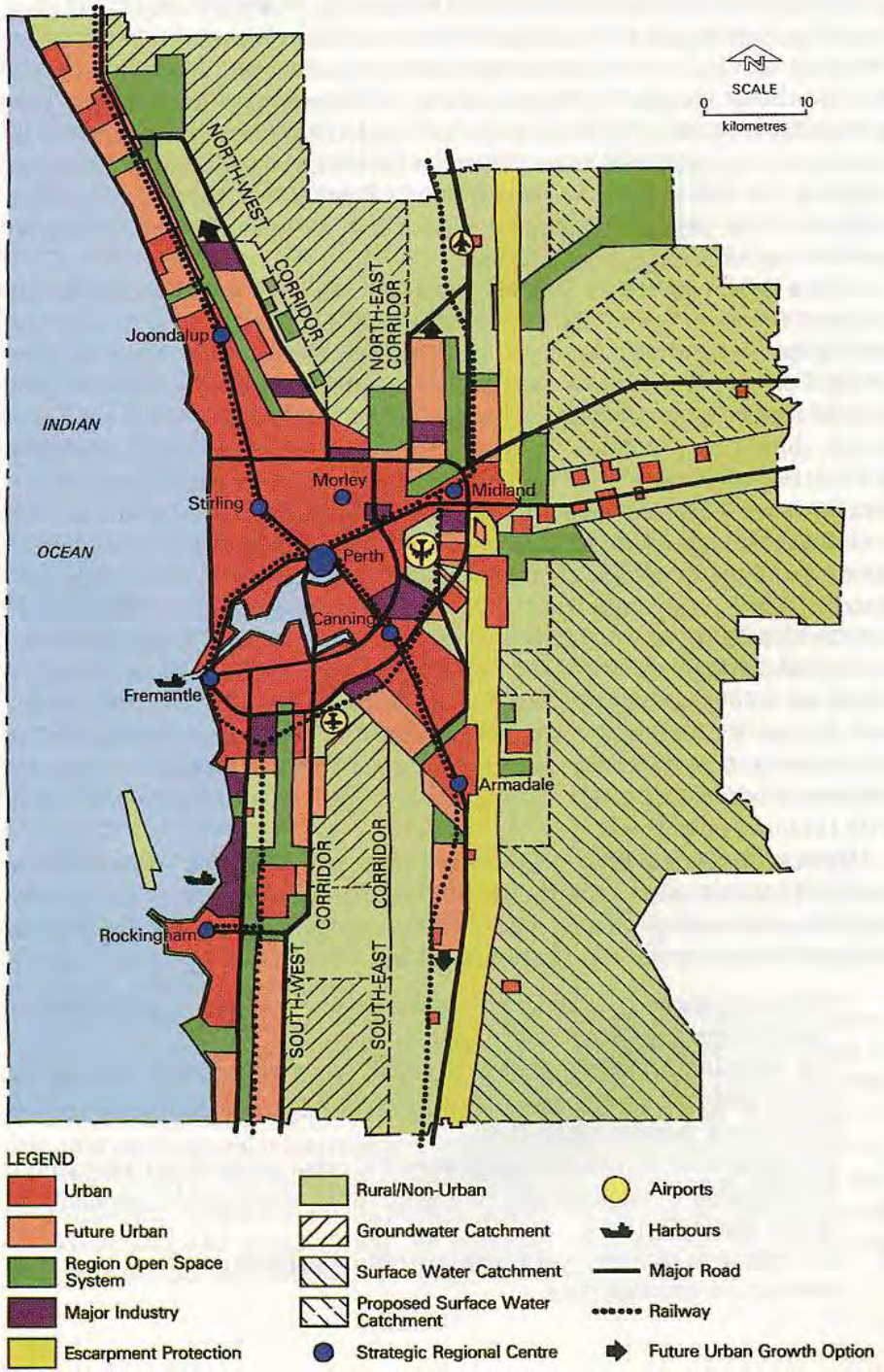
Starting point – Perth – ‘polka dot city’



Reality check… >100 activity centres (defined by non-home based trip destinations

Some planned but many ‘unplanned’

Possibility of supplying high frequency PT system to serve all centres is a significant and expensive challenge

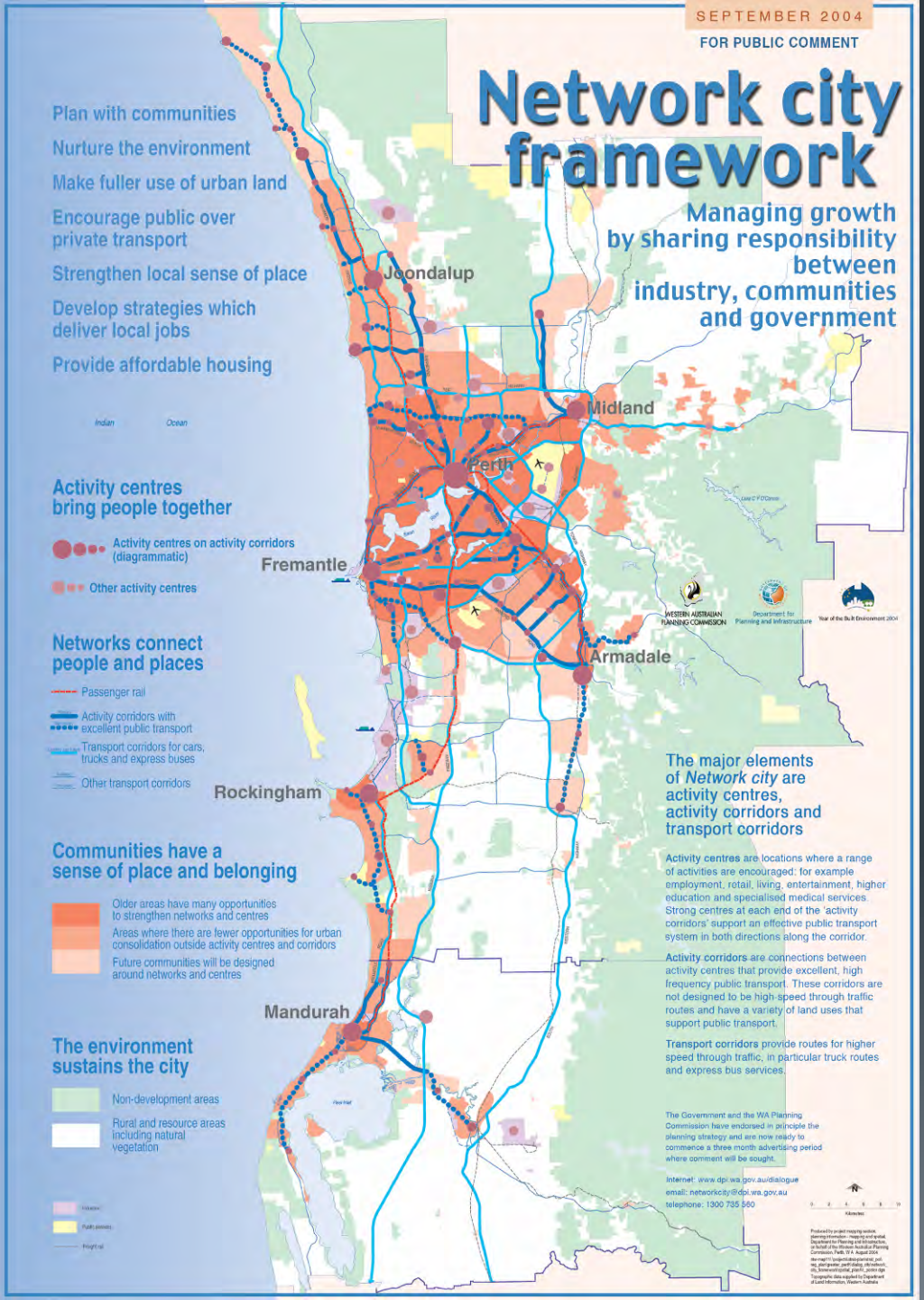


Metroplan 1990

- Centres defined and controlled only by retail floorspace targets
- - 8 Strategic centres, 14 regional centres

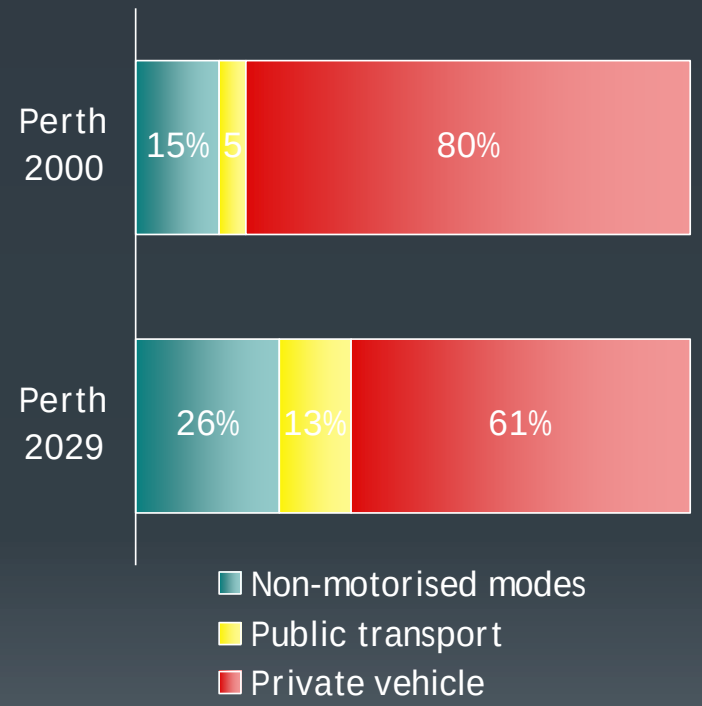
- Not all (100+) centres recognised as centres in plans

- ‘Lip service’ paid to LUPTI
  - No practice of considering access to centres by PT
  - PT aim was social welfare – minimum service levels not a real alternative to car



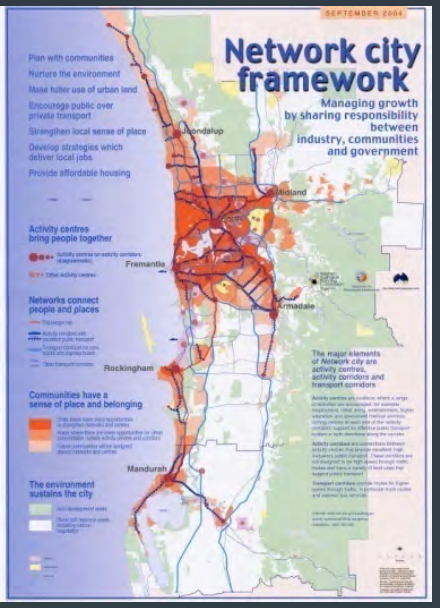
new policy context

- Mode Share Target by trips (1995)
- Metropolitan Strategy (2004)



...targets imply that public transport patronage needs to grow four-fold between 2000 and 2030...

Network City spatial framework



- did not determine which centres should perform which role within the goal of sustainable accessibility
- demanded a multi-dimensional perspective… which centres have or could have mixed use development …also which have or could have more sustainable accessibility
- centres must not be considered in isolation from each other… the way in which they are networked which forms an important component

....the driver

- How to compare regional accessibility of one place over another
  - Focus on public transport

spatial network analysis for multimodal urban transport systems (SNAMUTS)

Accessibility → Transport Network & Place

Purpose: To assess and quantify how transport networks, in terms of geographical configuration and service levels, perform in their urban context (distribution of land use activities).

SNAMUTS is a supply-side tool: it does not provide predictions about usage or capacity levels. Rather it asks: What is the role of the public transport system in facilitating movement and activity across a city region?

SNAMUTS was inspired by the Space Syntax approach (Hillier and Hanson, 1984), and the Multiple Centrality Analysis tool (Porta, Crucitti and Latora, 2006)

compiling a base network …

Our focus is on measuring the ease of movement on a public transport network in ways that come close to user perceptions and motivations…

Public transport users are only marginally interested in geographical distance: the main factors of travel impediment (or spatial separation) are travel time, and the ubiquity of travel opportunities (service frequency).

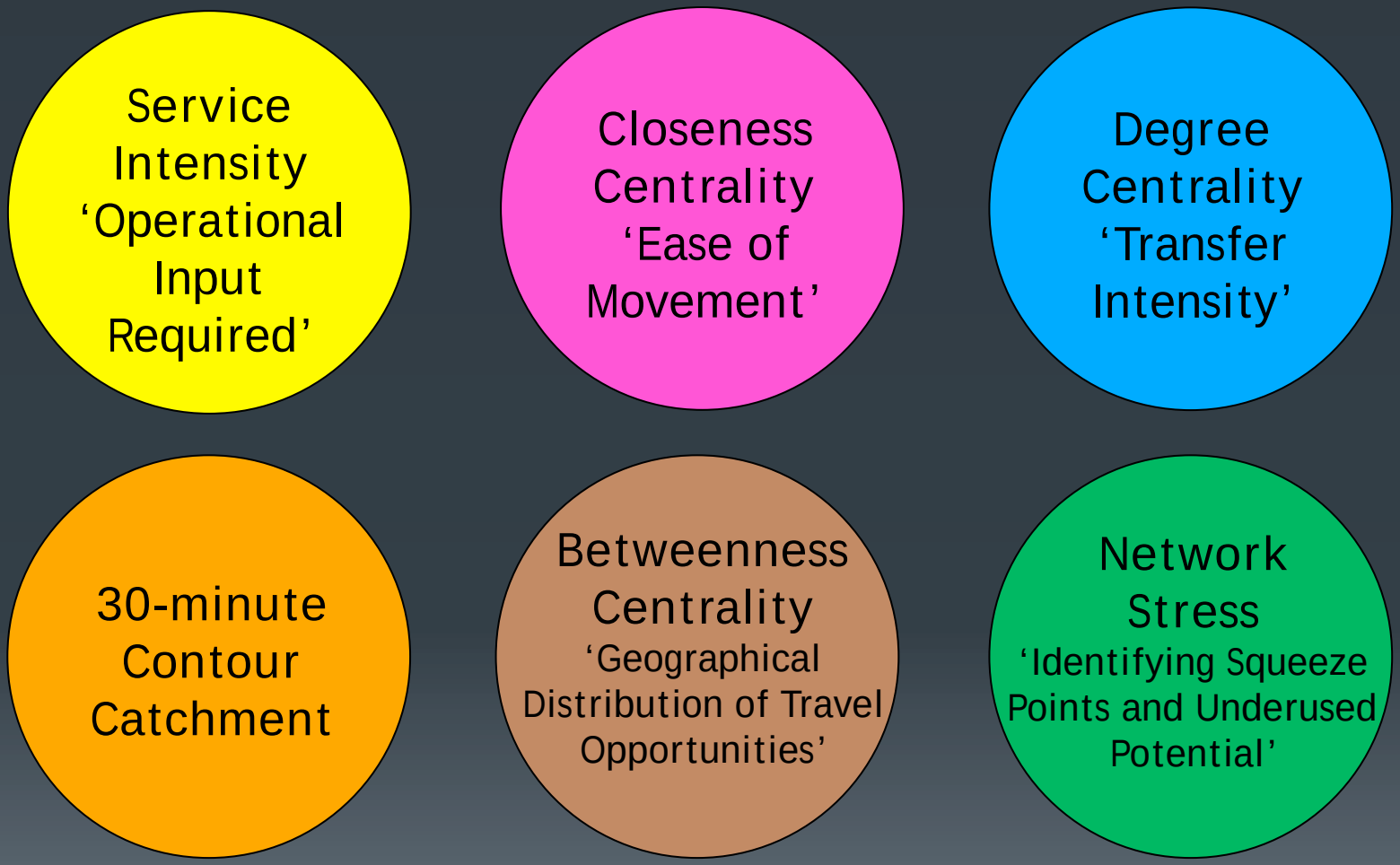
compiling a base network …

Our network model:

-applies a minimum service standard - a 30-minute frequency (or better) during the weekday inter-peak period

- determines a transfer point according to intersections of routes that offer a level of convenience that is functionally and visually co-located, with signposting as required and (relatively) barrier-free access between modes.

6 key snamuts indicators



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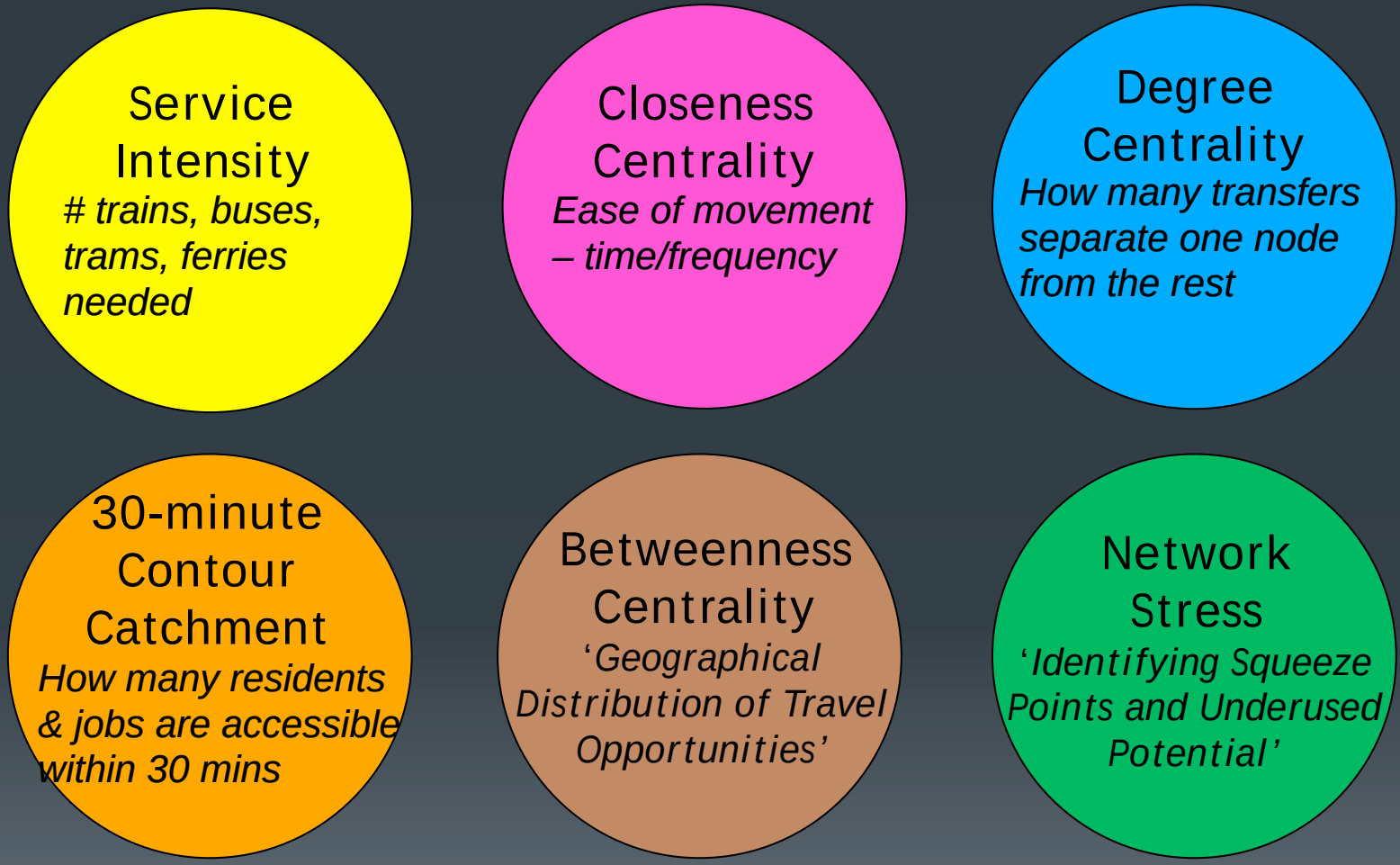
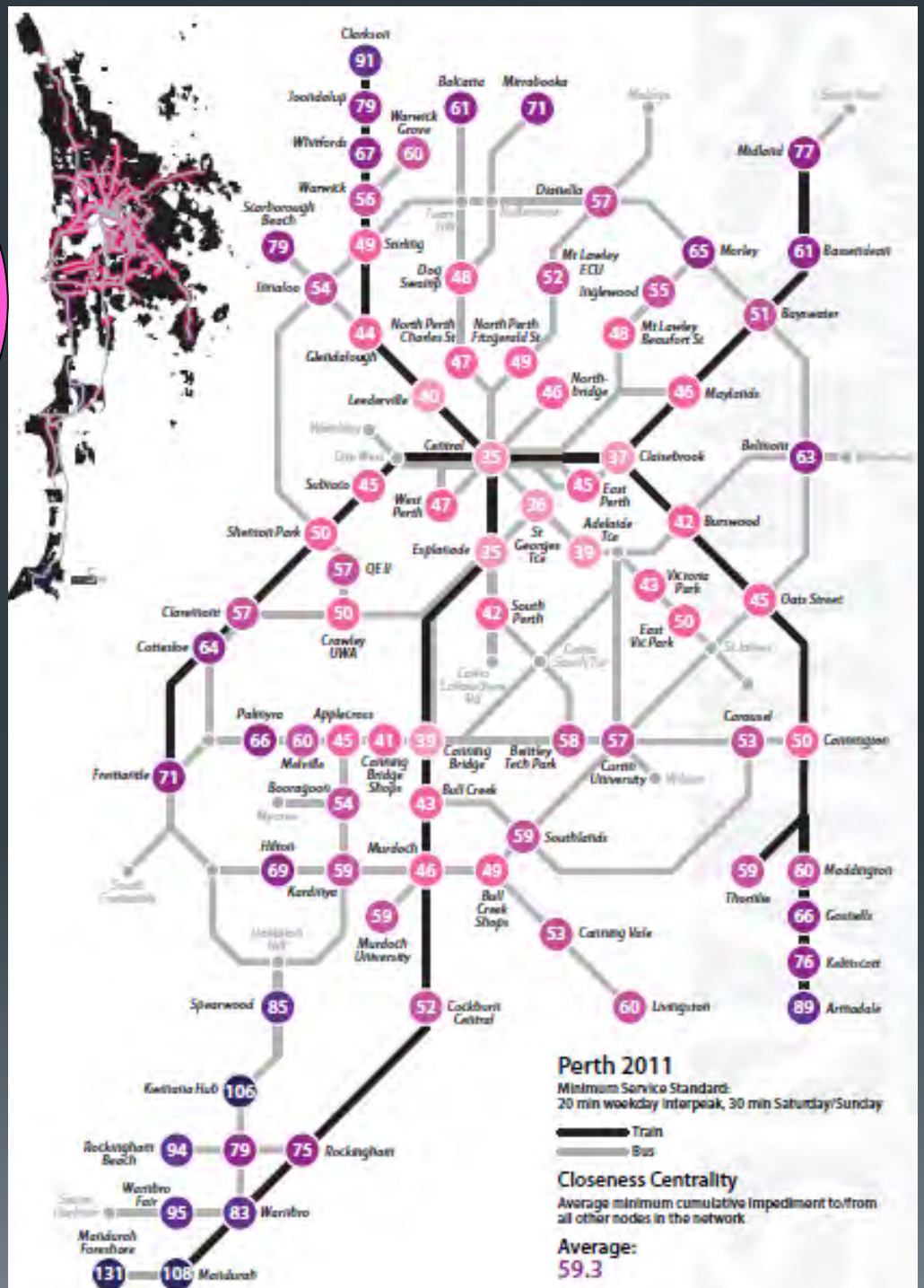
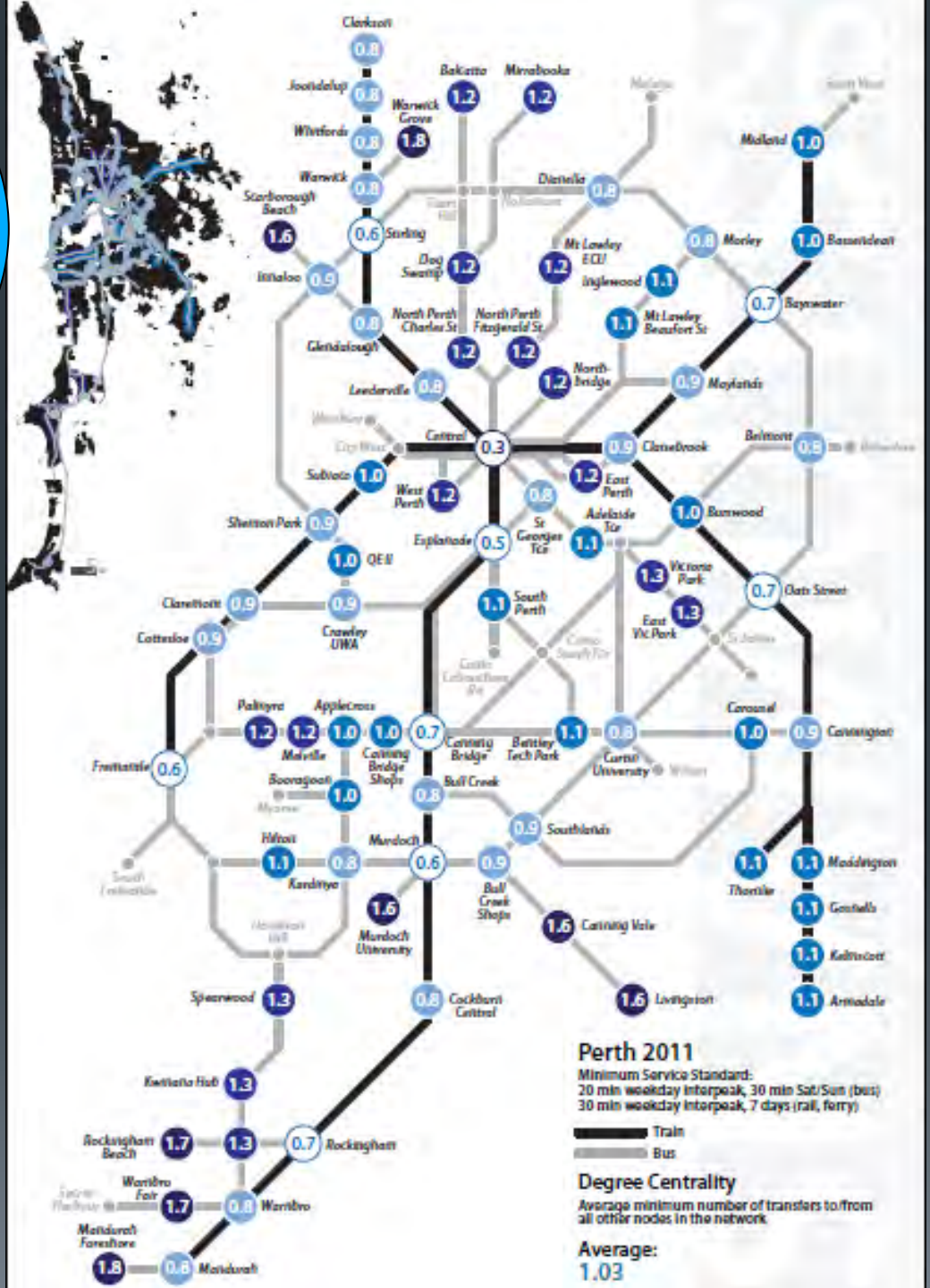


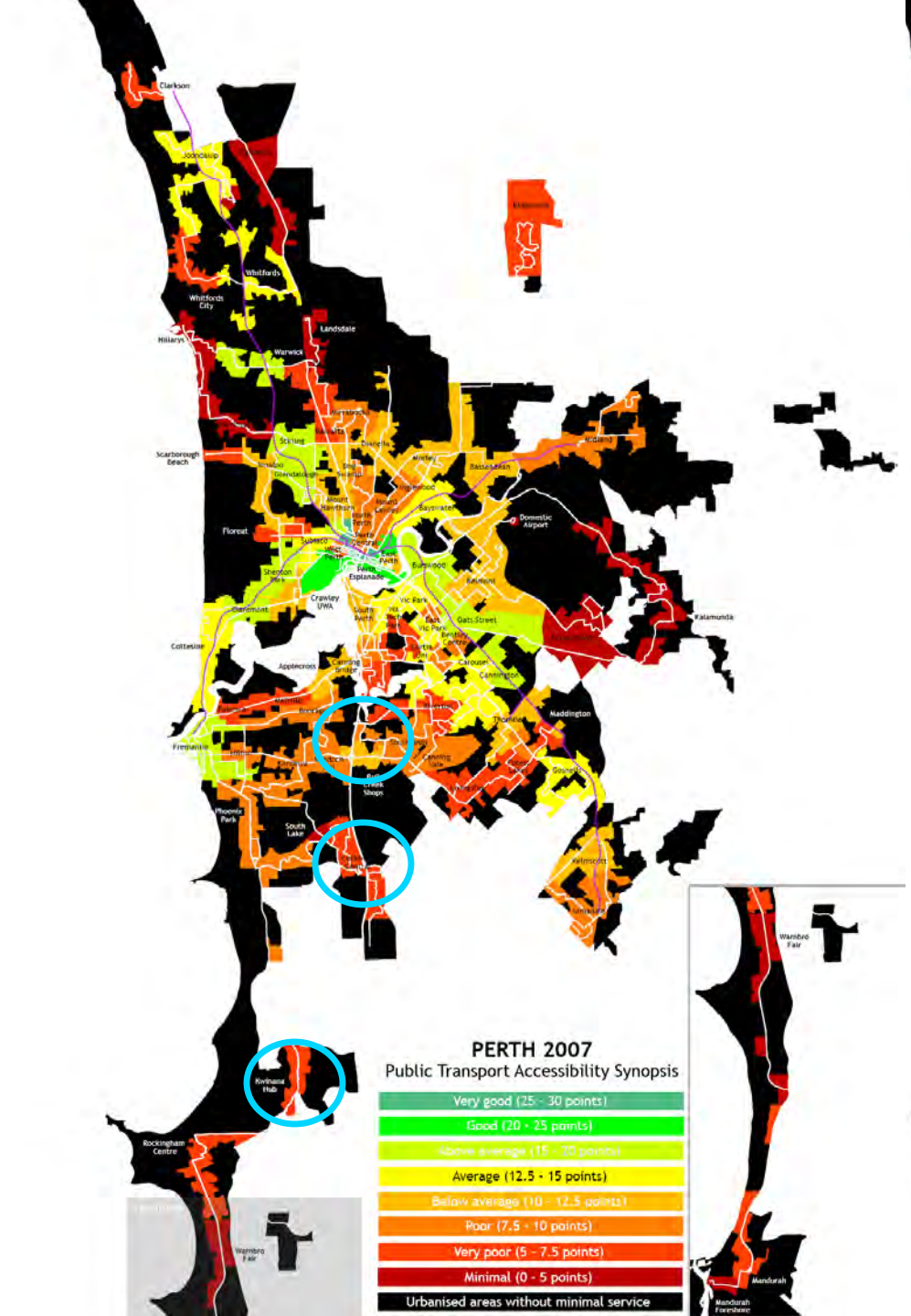
Closeness Centrality ‘Ease of Movement’

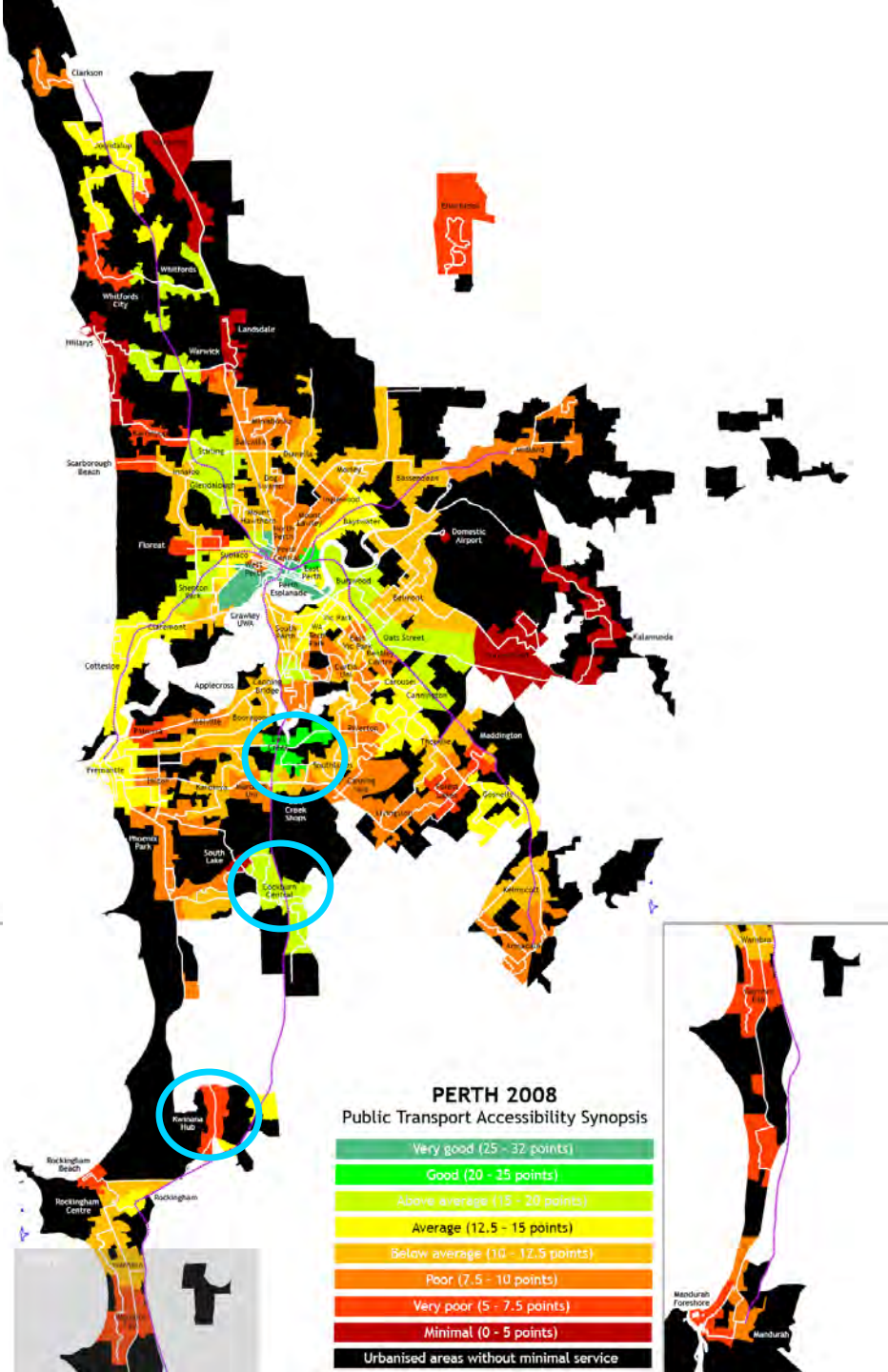


Degree Centrality 'Transfer Intensity'



30-minute Contour Catchment


Clarkson
Whitfords
Whitfords City
Hillarys
Landsdale
Warwick
Scarborough Beach
Floreat
Domestic Airport
Kalamunda
Cottesloe
Applecross
Maddington
Phoenix Park
South Lake
Kwinana Hub
Rockingham Centre
Warnbro Fair
Mandurah
Mandurah Foreshore
PERTH 2007
Public Transport Accessibility Synopsis
Very good (25 - 30 points)
Good (20 - 25 points)
Above average (15 - 20 points)
Average (12.5 - 15 points)
Below average (10 - 12.5 points)
Poor (7.5 - 10 points)
Very poor (5 - 7.5 points)
Minimal (0 - 5 points)
Urbanised areas without minimal service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Urbanised areas without minimal service

Black hole for buses, trains

A high proportion of the western suburbs is a public transport-unfriendly "black hole", according to a study.

Much of Cambridge, parts of Claremont and Cottesloe and riverside suburbs get the worst possible rating by the study.

They are described as "urban areas with no minimal service", the lowest of eight categories in the Spatial Network Analysis of Multimodal Transport Systems.

The 52 page study was produced but yet to be launched publicly.

The study's main focus is the Mandurah rail line, which it says has generally improved public transport across the metro area.

But relative accessibility for the Fremantle rail line stayed the same or dropped.

Curtin University's Corey Curtis told the POST she was surprised by some central and western areas showing poor public transport options.

"We expected that in outlying areas," Professor Curtis said. "It was quite a surprise western suburbs areas were so poor."

Professor Curtis is modelling four scenarios to see what might improve the situation.

A combination of light rail servicing inner and western suburbs and a middle ring of improved public transport could improve public transport options for people in the west.

"The finding is dramatic and not what we were expecting" she said.

Cambridge mayor Simon Withers said planners sought to make car journeys more difficult to encourage public transport use.

"But they are not providing the public transport the result will be a mess," he said.

"When I lived in London our local tube ran every five minutes and it was my main method of transport.

"I now live in City Beach and the bus comes past my house once an hour – guess how often I catch the bus?"

He said there would have to be a massive increase in public transport spending to get people out of their cars and on to buses and trains.

"And I don't see that happening any time soon," he said.

Activity Centres	Walkable Catchment Population 2008	Walkable Catchment Employment 2008	Walkable Catchment Activities 2008	30 min Catchment Population 2008	30 min Catchment Employment 2008	Composite Public Transport Accessibility Value	Rank	
High Accessibility								
Perth Central-Northbridge	9,992	50,987	60,979	352,512	245,786	31.3	1	*(could do with more housing)*
Perth Esplanade	4,011	30,589	34,600	328,179	233,050	27.9	2	*(could do with more housing)*
Bull Creek	14,462	2,019	16,481	215,569	182,530	20.4	3	*(could do with more jobs)*
Claisebrook-East Perth	5,305	6,514	11,819	215,102	194,974	20.0	4	*(could do with more housing)*
Oats Street	5,825	12,430	18,255	176,996	177,829	18.7	9	*(could do with more housing)*
Canning Bridge	8,353	1,653	10,006	227,962	190,196	17.8	10	Unbalanced Node: Intensify Land Use
Medium Accessibility								
Cottesloe-Mosman Park	12,497	1,205	13,702	142,927	157,303	17.2	12	*(could do with more jobs)*
Gosnells	6,687	1,219	7,906	161,131	164,651	16.6	14	Unbalanced Node: Intensify Land Use
Subiaco	11,355	4,073	15,428	145,324	178,868	15.1	16	Unbalanced Place: Improve Accessibility
Thornlie	16,828	1,803	18,631	131,001	164,672	14.5	18	Unbalanced Node: Intensify Land Use
Low Accessibility								
Balcatta	16,828	1,803	18,631	131,001	164,672	14.5	18	Unbalanced Place: Improve Accessibility
								Unbalanced Place: Improve

Using SNAMUTS to inform future metropolitan growth

…research questions

What is the contribution land use-transport integration can make towards the Network City and Metro Transport Strategy goals?

How can SNAMUTS help assess and inform this process…

…which development scenario provides for greatest public transport accessibility potential?

The testing of these types of scenarios enables key Network City questions to be examined…

- Which Activity Centres and Corridors can best be intensified?
- Which Centres should perform a regional role and which a local role?
- Where should public transport investment (infrastructure, service improvement) go?

Answers to these questions will provide a robust basis for decisions about the future metropolitan structure.

Scenario development…

Discursive process…

Phase 1:

Game 1 - Strategic development priorities

Phase 1:

Game 2 – Urban growth trends – 20 yrs on

Phase 2:

Game 1 – strategic development priorities (within each scenario)

Phase 2:

Game 2 – developing a composite scenario

Model development…

Building 2031 network and designation of growth areas and type;

Modelling scenarios

Building Composite network and designation of growth areas and type;

Modelling CWB scenario

Game 1:**STRATEGIC DEVELOPMENT PRIORITIES**

Group discussions about one given strategic direction

Accept or modify public transport infrastructure and explain why:

- Locate Centres
- **Optimise the public transport network**
- Hierarchy of centres
  - Population / employment
  - Size - numbers or symbols - double and triple….

scenarios for testing - 2006-2031

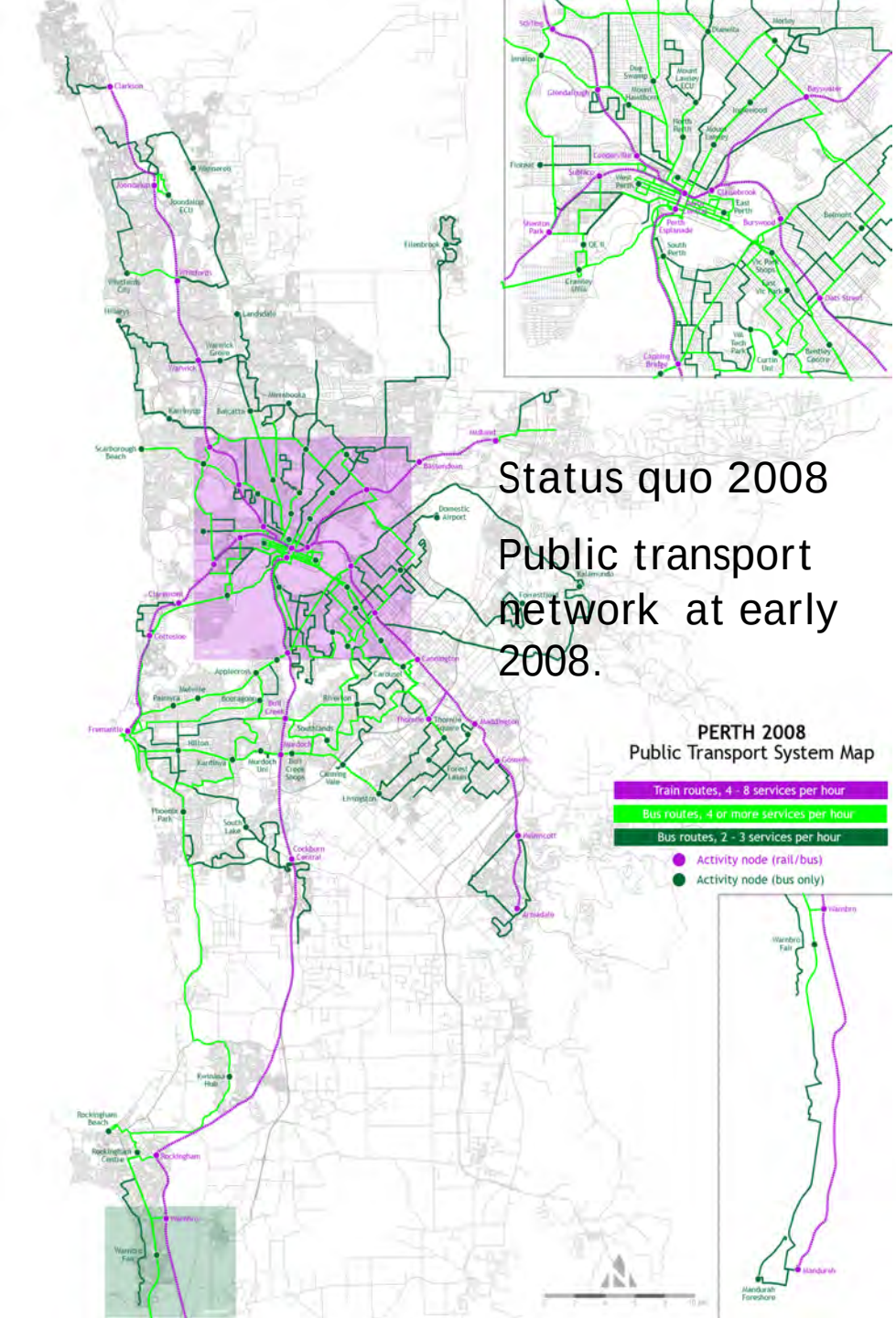
(locating 375,000 more houses)

Status Quo: Public transport network in early 2008.

Frequency Boost: Public transport network after a comprehensive package of service improvements, achievable in the short term.

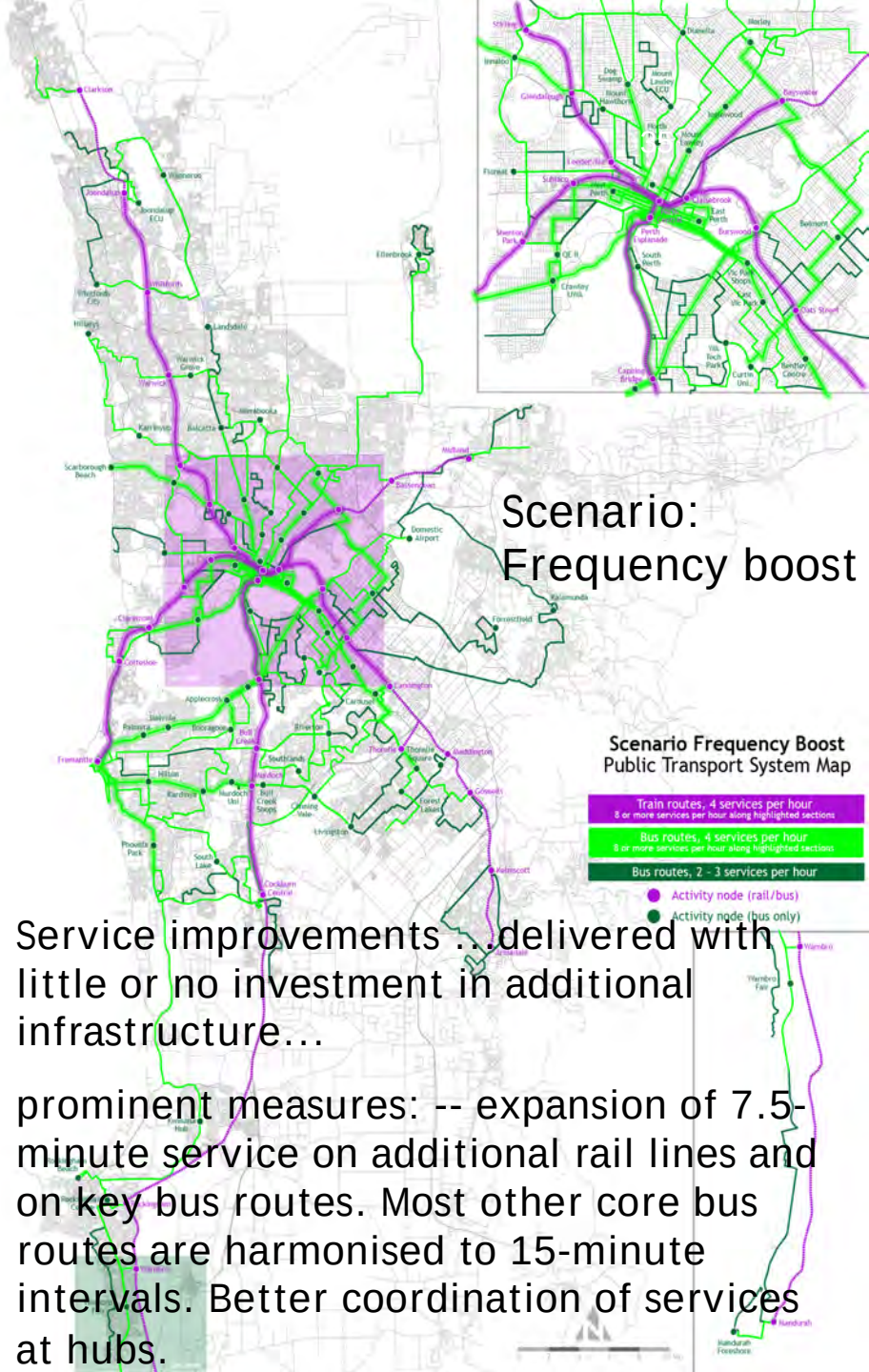
Future land use-transport integration scenarios with a 2031 horizon:

- Light Rail Corridors
- Middle Ring Centres
- Fringe Expansion



Status quo 2008

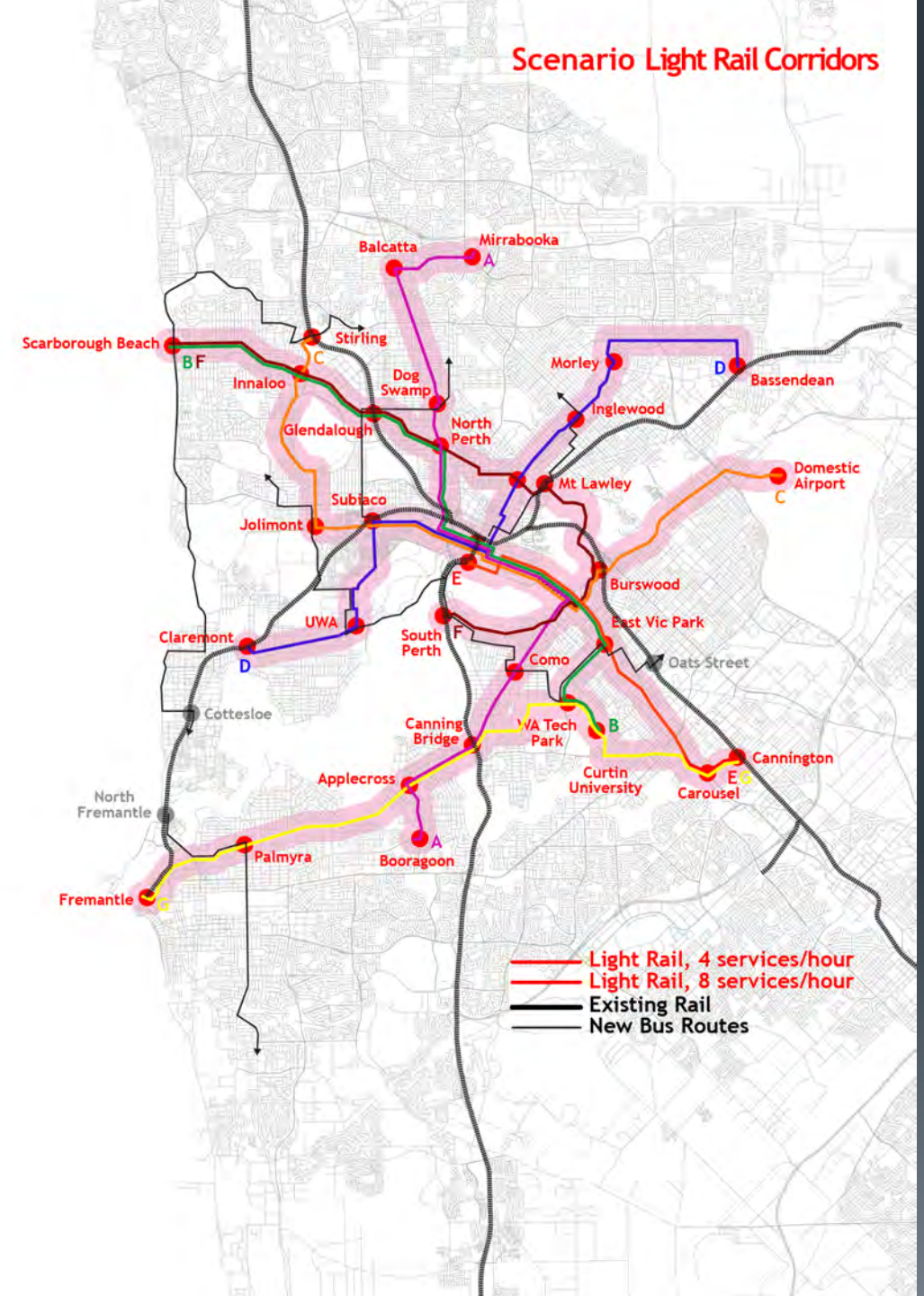
Public transport network at early 2008.



Scenario: Frequency boost

Service improvements ...delivered with little or no investment in additional infrastructure...

prominent measures: -- expansion of 7.5-minute service on additional rail lines and on key bus routes. Most other core bus routes are harmonised to 15-minute intervals. Better coordination of services at hubs.



scenario light rail corridors

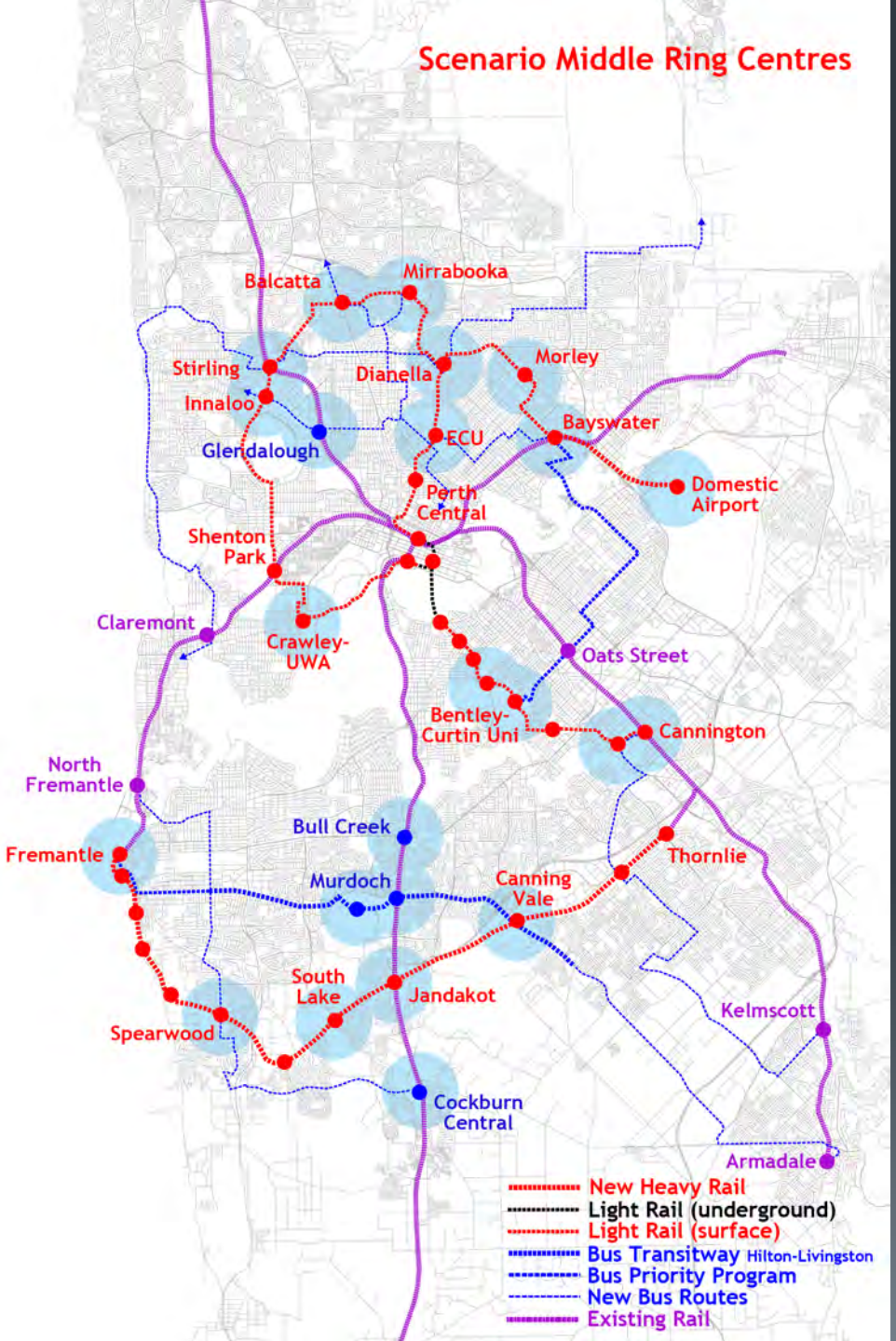
Assumes that all residential and employment growth until 2031 will occur around a gradually introduced network of surface light rail, roughly following the Network City activity corridors in the inner urban area.

Contains 120 km of double-track light rail with priority over road traffic, achieved where necessary through lane conversion and traffic calming.

Land uses in the 400-metre catchment of the light rail corridor will be rezoned to accommodate an average activity density of 104 persons and jobs per hectare in 2031 (208 in Perth's CBD) [say 40du/ha].

85% of urbanised area remains as it is...

scenario middle ring centres

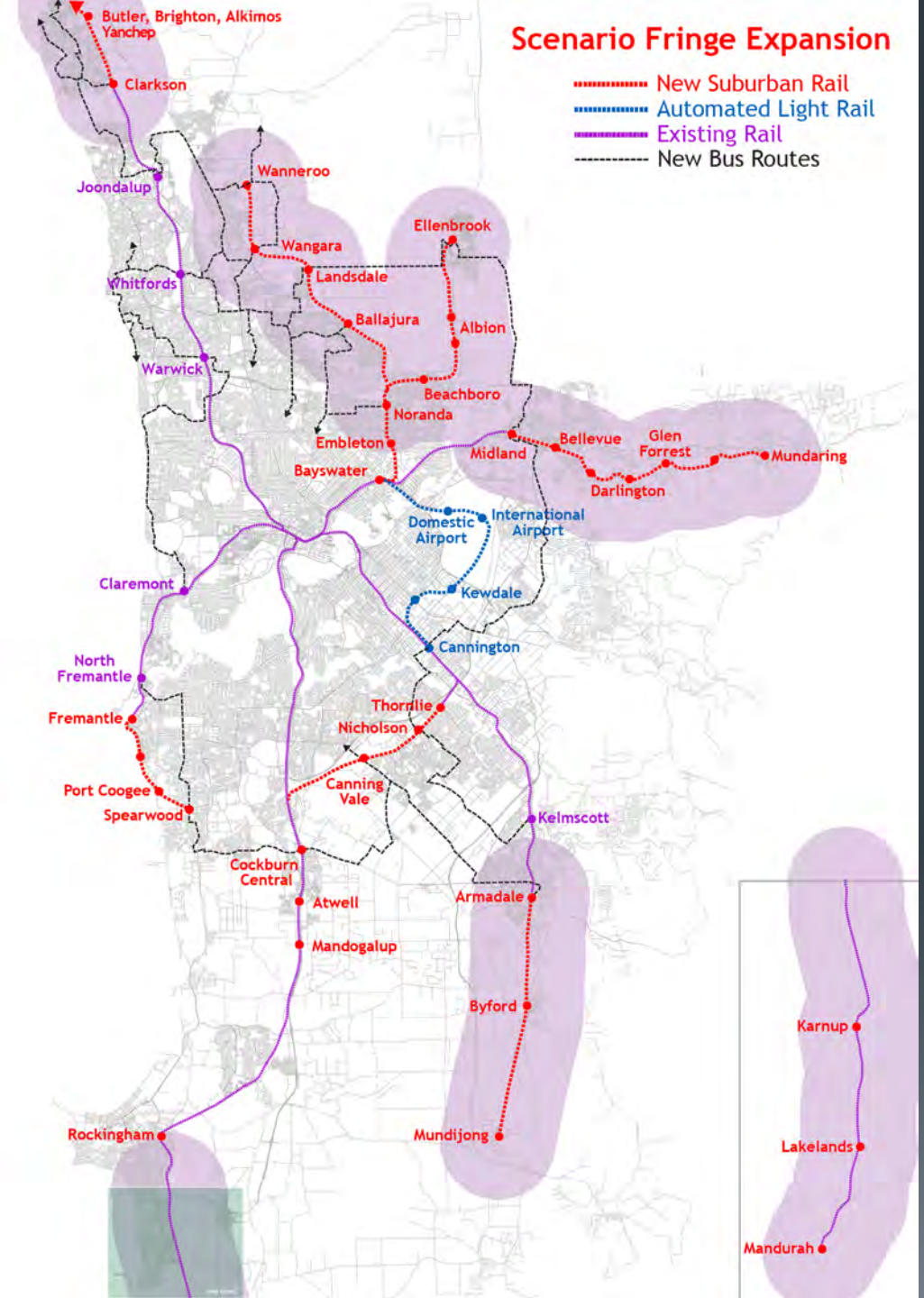


Assumes that all residential and employment growth until 2031 will occur in selected activity hubs forming a ring around Perth's middle suburbs.

Contains 32 km of new double-track railway with 11 new stations (largely on or adjacent to existing tracks), 55 km of light rail (including a 4-km tunnel under the CBD and Swan River), and a 15-km bus transitway along South Street.

Land uses in the 800-metre catchments of the middle ring centres will be rezoned to accommodate an average activity density of 208 residents and jobs per hectare in 2031 (plus a minimum of 104 in central Perth and Fremantle) [say 80du/ha].

94% of urbanised area remains as it is…



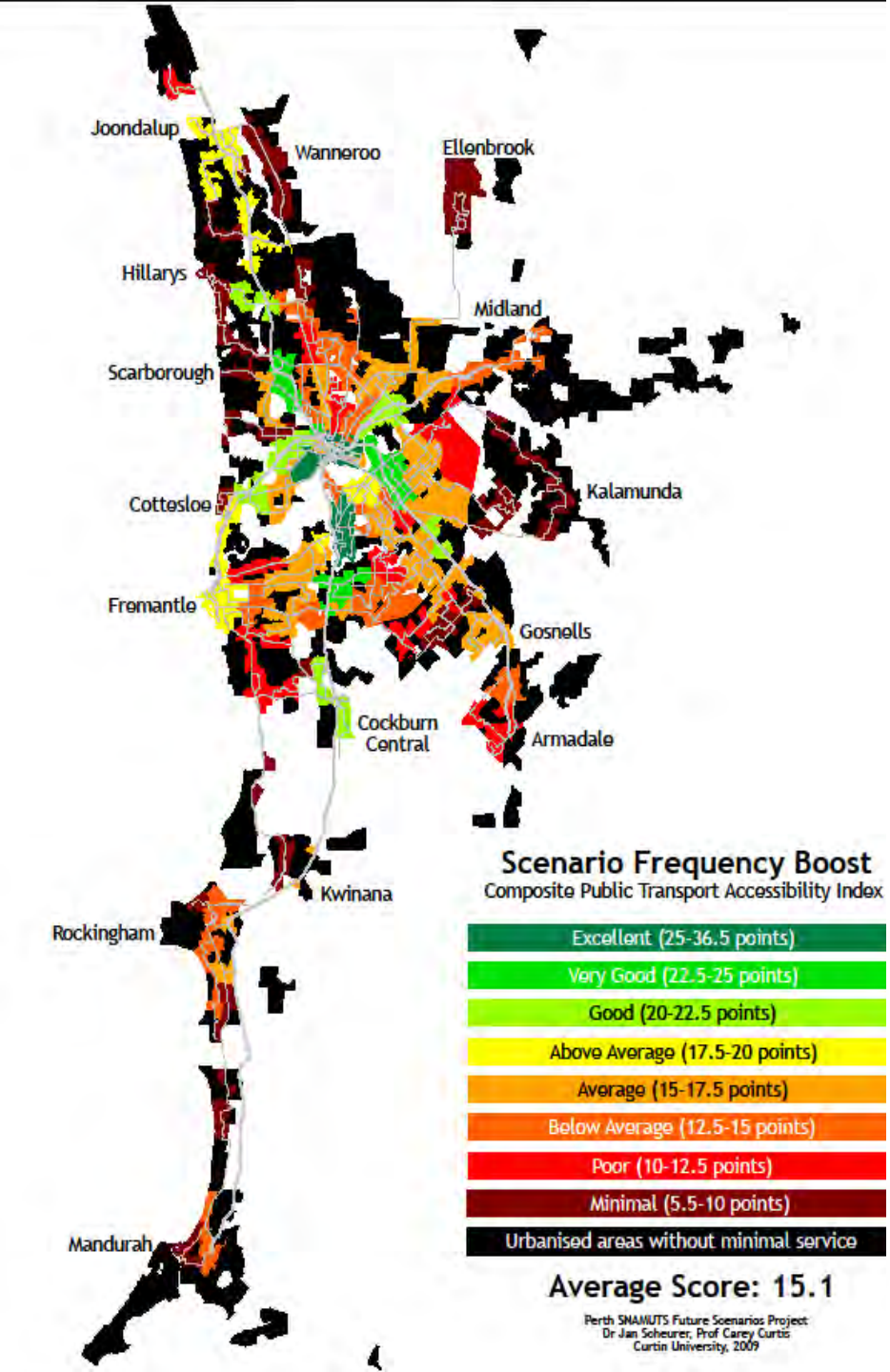
scenario fringe expansion

Assumes that all residential and employment growth until 2031 will occur on Greenfield sites at the fringe of the metropolitan area.

Contains 110 km of new electric railway with 32 new stations (some on or adjacent to existing or reactivated tracks) and a 20-km automated light rail route to link the airport and adjacent areas to the rail system. The bus network has been adapted to provide more frequent cross-suburban links in outer areas.

The 800-metre catchment areas of the new rail stations are designed to accommodate 10,000 residents+jobs (activity density of 50/hectare) [say 20 du/ha].

Outputs phase 1...



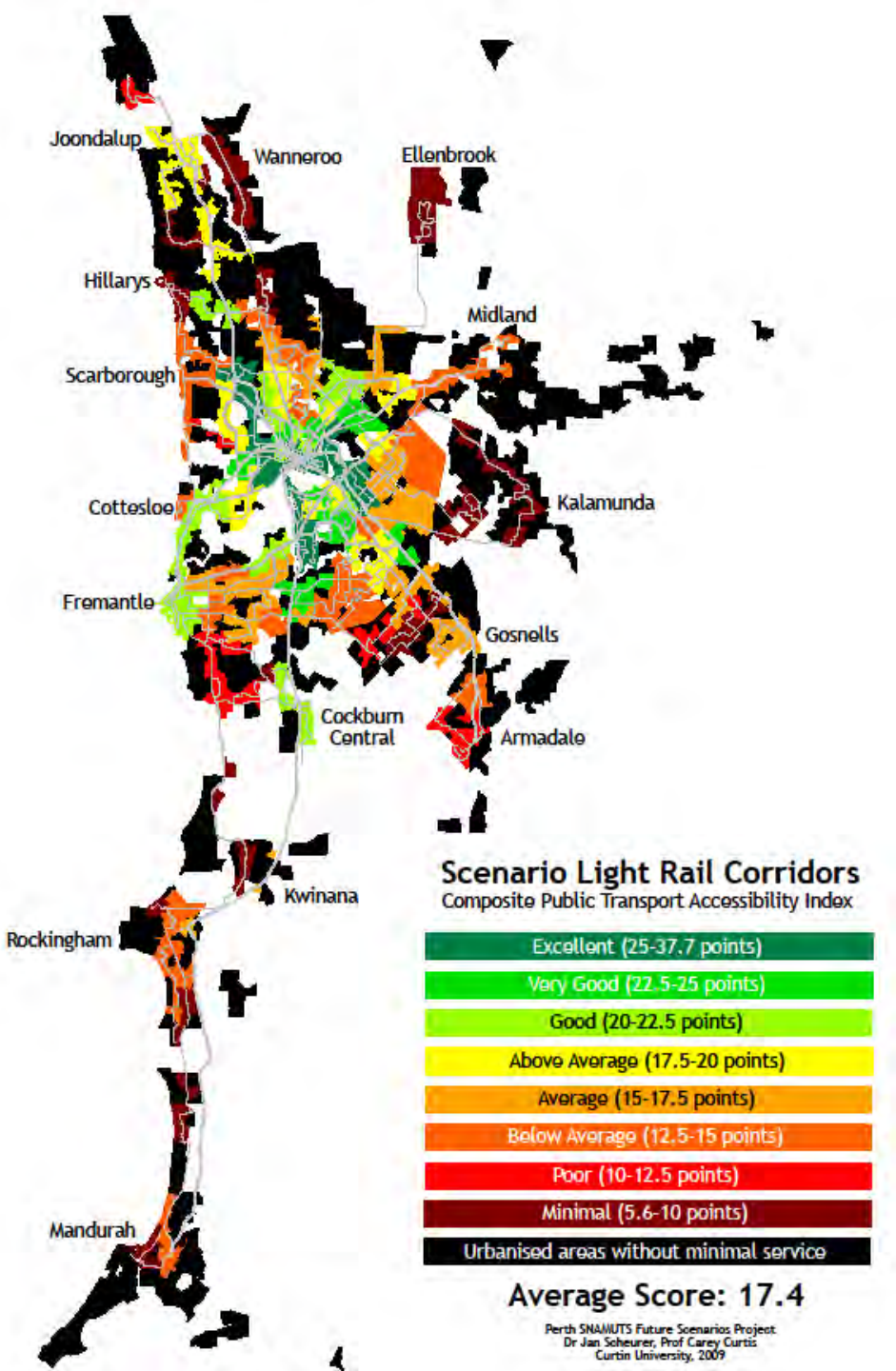
Scenario Frequency Boost

Composite Public Transport Accessibility Index

- Excellent (25-36.5 points)
- Very Good (22.5-25 points)
- Good (20-22.5 points)
- Above Average (17.5-20 points)
- Average (15-17.5 points)
- Below Average (12.5-15 points)
- Poor (10-12.5 points)
- Minimal (5.5-10 points)
- Urbanised areas without minimal service

Average Score: 15.1

Perth SNAMUTS Future Scenarios Project
Dr Jan Scheurer, Prof Carey Curtis
Curtin University, 2009



Scenario Light Rail Corridors

Composite Public Transport Accessibility Index

- Excellent (25-37.7 points)
- Very Good (22.5-25 points)
- Good (20-22.5 points)
- Above Average (17.5-20 points)
- Average (15-17.5 points)
- Below Average (12.5-15 points)
- Poor (10-12.5 points)
- Minimal (5.6-10 points)
- Urbanised areas without minimal service

Average Score: 17.4

Perth SNAMUTS Future Scenarios Project
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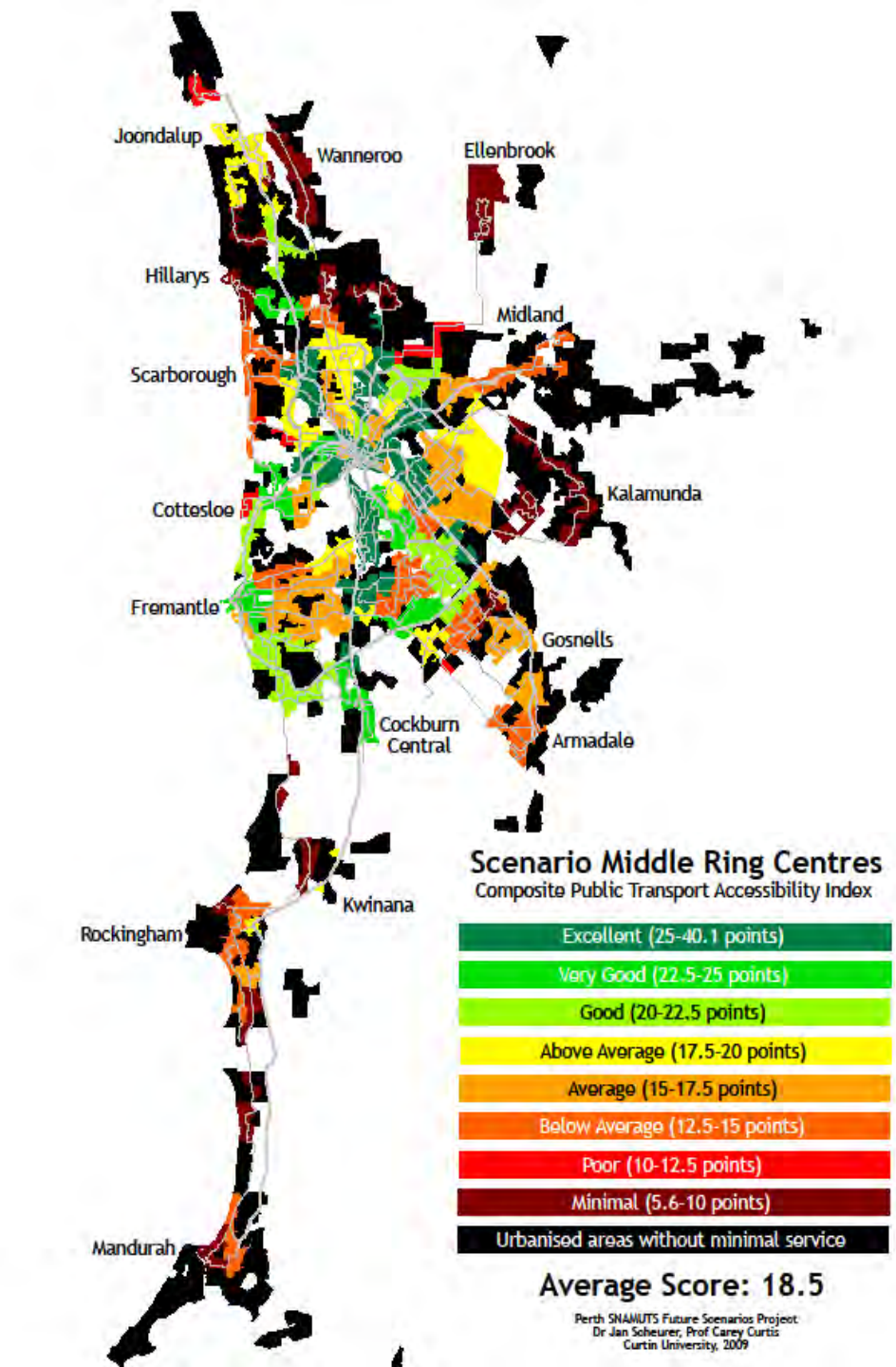
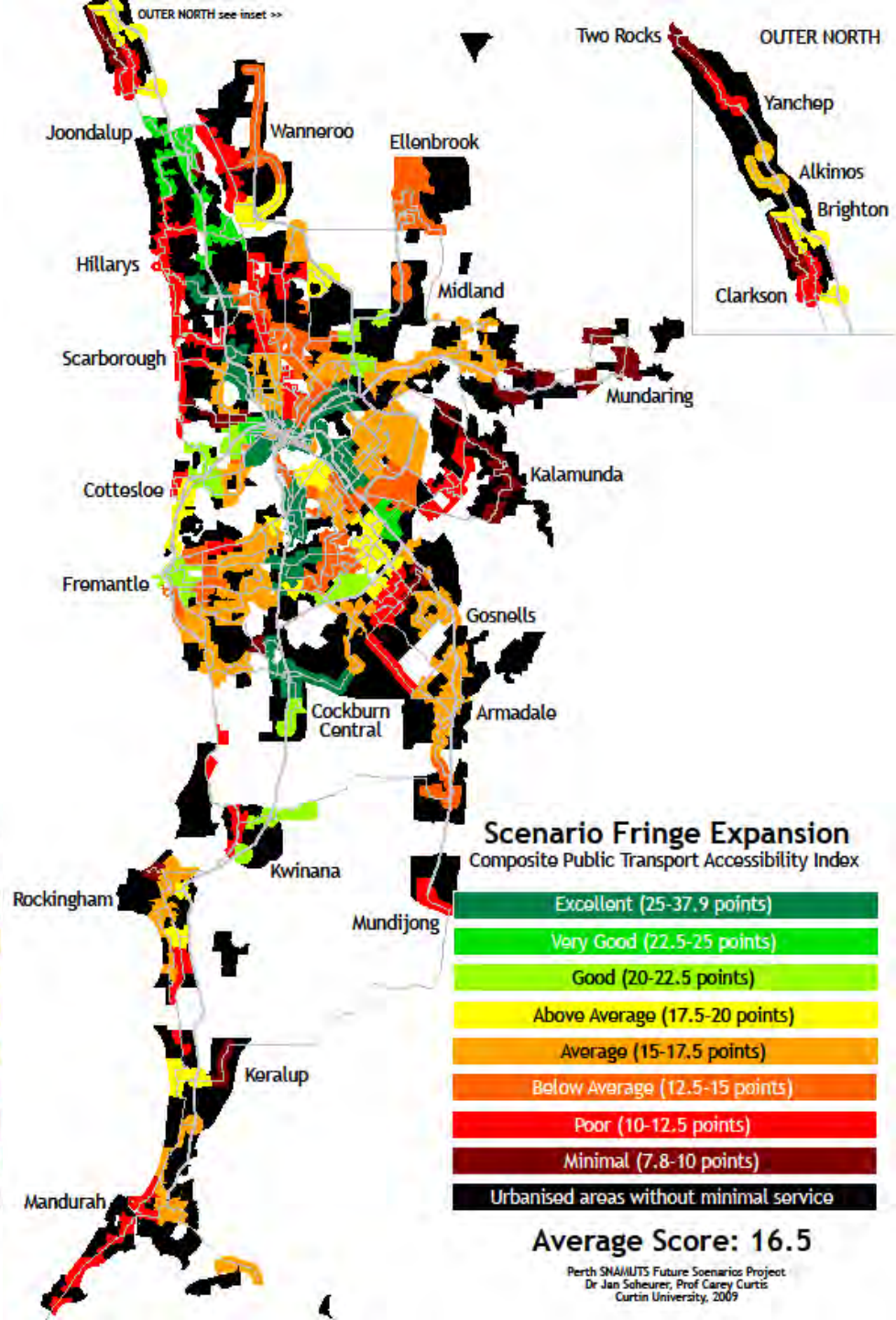
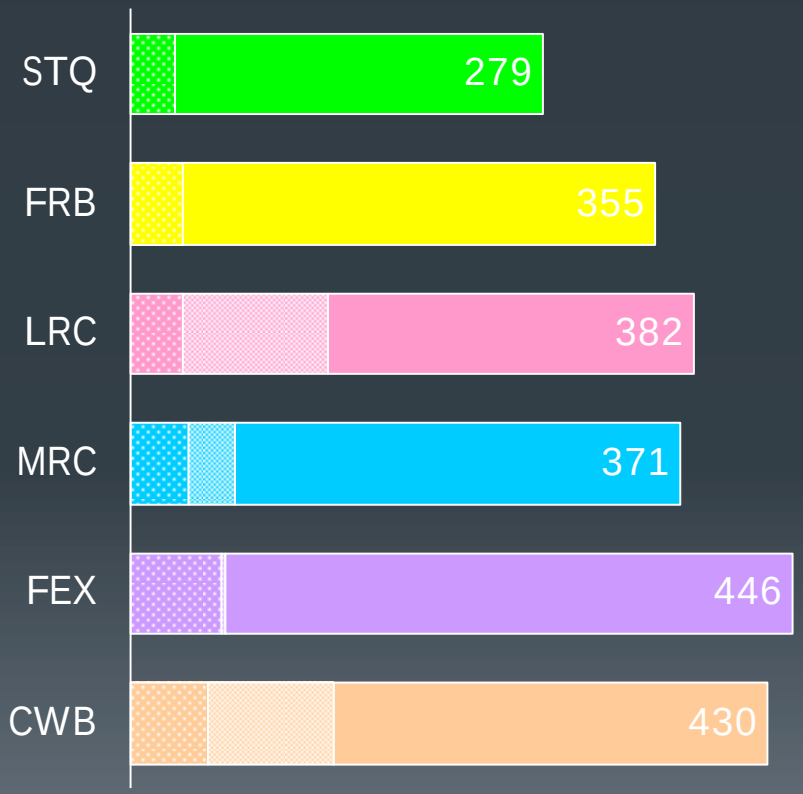
Curtin University, 2009


Joondalup
Wanneroo
Ellenbrook
Hillarys
Midland
Scarborough
Kalamunda
Cottesloe
Fremantle
Gosnells
Cockburn Central
Armadale
Kwinana
Rockingham
Mandurah
Scenario Middle Ring Centres
Composite Public Transport Accessibility Index
Excellent (25-40.1 points)
Very Good (22.5-25 points)
Good (20-22.5 points)
Above Average (17.5-20 points)
Average (15-17.5 points)
Below Average (12.5-15 points)
Poor (10-12.5 points)
Minimal (5.6-10 points)
Urbanised areas without minimal service
Average Score: 18.5
Perth SNAMUTS Future Soenarios Project
Dr Jan Scheurer, Prof Carey Curtis
Curtin University, 2009

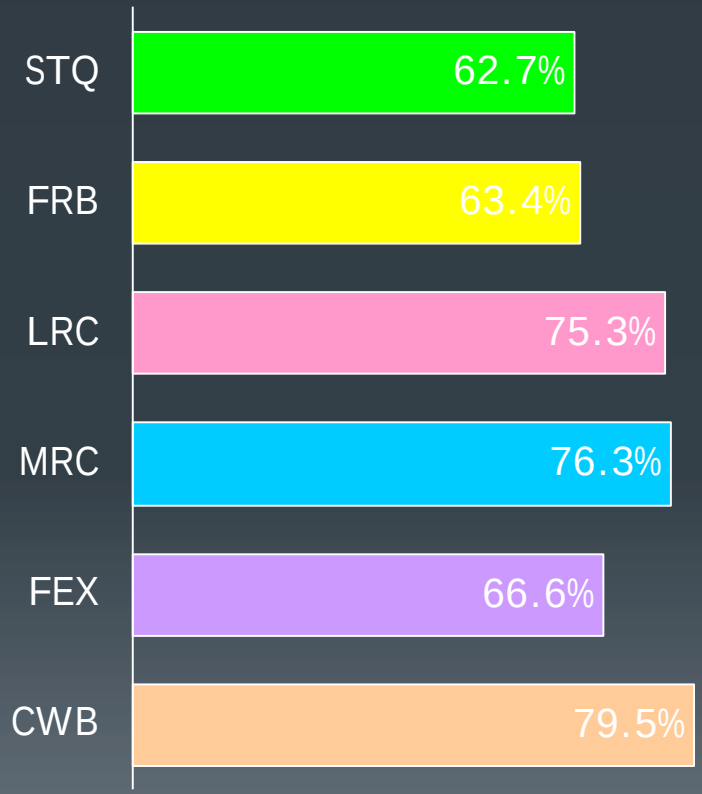

OUTER NORTH see inset >>
Two Rocks
OUTER NORTH
Yanchep
Alkimos
Brighton
Clarkson
Joondalup
Wanneroo
Ellenbrook
Hillarys
Midland
Scarborough
Mundaring
Kalamunda
Cottesloe
Fremantle
Gosnells
Cockburn Central
Armadale
Kwinana
Rockingham
Mundijong
Keralup
Mandurah
Scenario Fringe Expansion
Composite Public Transport Accessibility Index
Excellent (25-37.9 points)
Very Good (22.5-25 points)
Good (20-22.5 points)
Above Average (17.5-20 points)
Average (15-17.5 points)
Below Average (12.5-15 points)
Poor (10-12.5 points)
Minimal (7.8-10 points)
Urbanised areas without minimal service
Average Score: 16.5
Perth SNAMUTS Future Soenarios Project
Dr Jan Scheurer, Prof Carey Curtis
Curtin University, 2009

summary of findings: network coverage

Service Intensity: Service hours per hour (weekday interpeak) on the minimum-standard network



Network Coverage: Percentage of residents and jobs in metropolitan area within walking distance of minimum-standard service



STQ = Status Quo
FRB = Frequency Boost
LRC = Light Rail Corridors
MRC = Middle Ring Centres
FEX = Fringe Expansion
CWB = Composite Wishbone

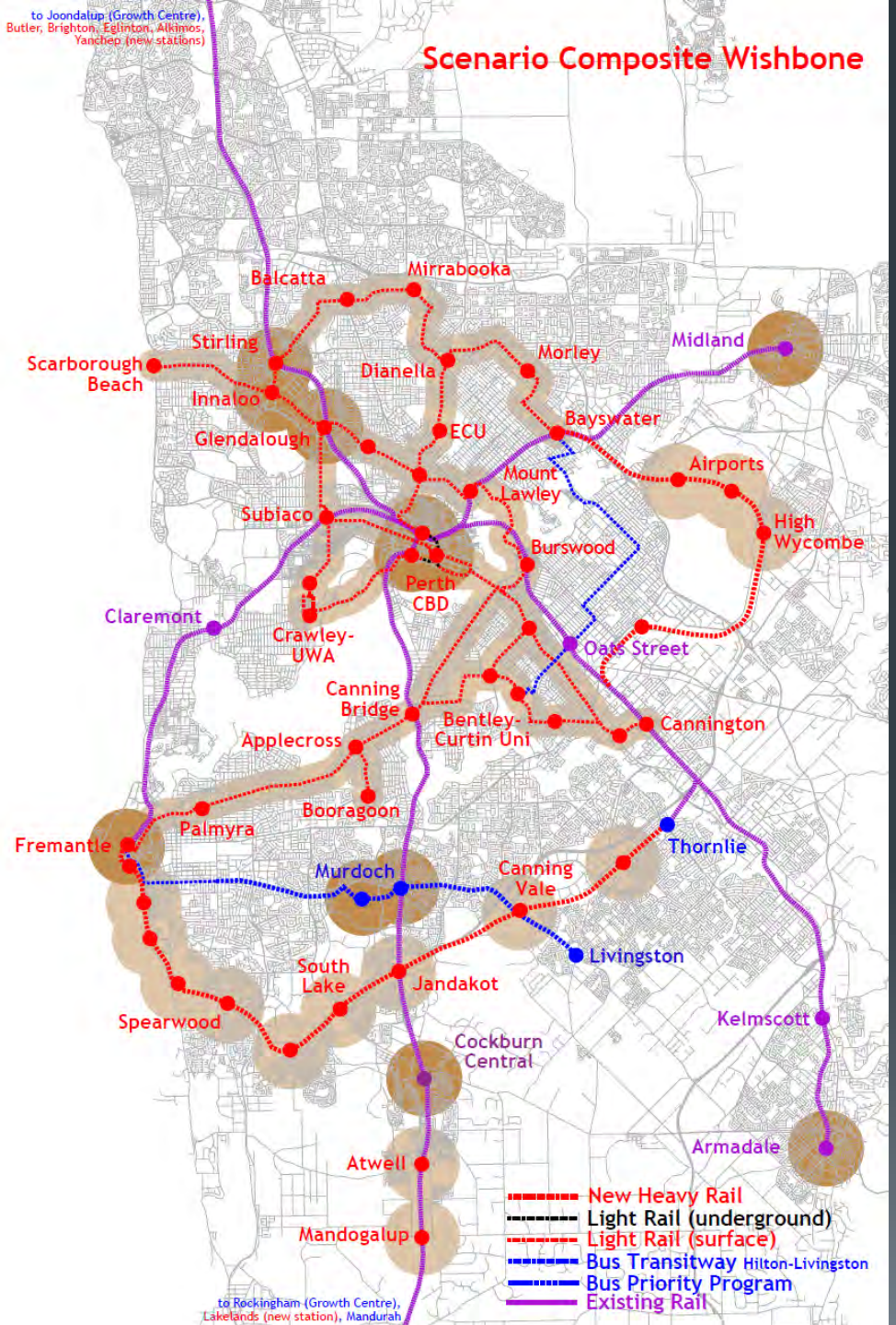
Phase 2 - Game 1
STRATEGIC DEVELOPMENT PRIORITIES (you can't have it all!)

Group discussions about one given scenario

As a public transport users lobby group – which aspects of the network in your scenario should be given priority and why

Phase 2 - Game 2
Creating a meaningful composite scenario

- Re-group (drawing one from each scenario group)
- Each group develops a composite scenario:
  - land use strategy;
  - public transport network.

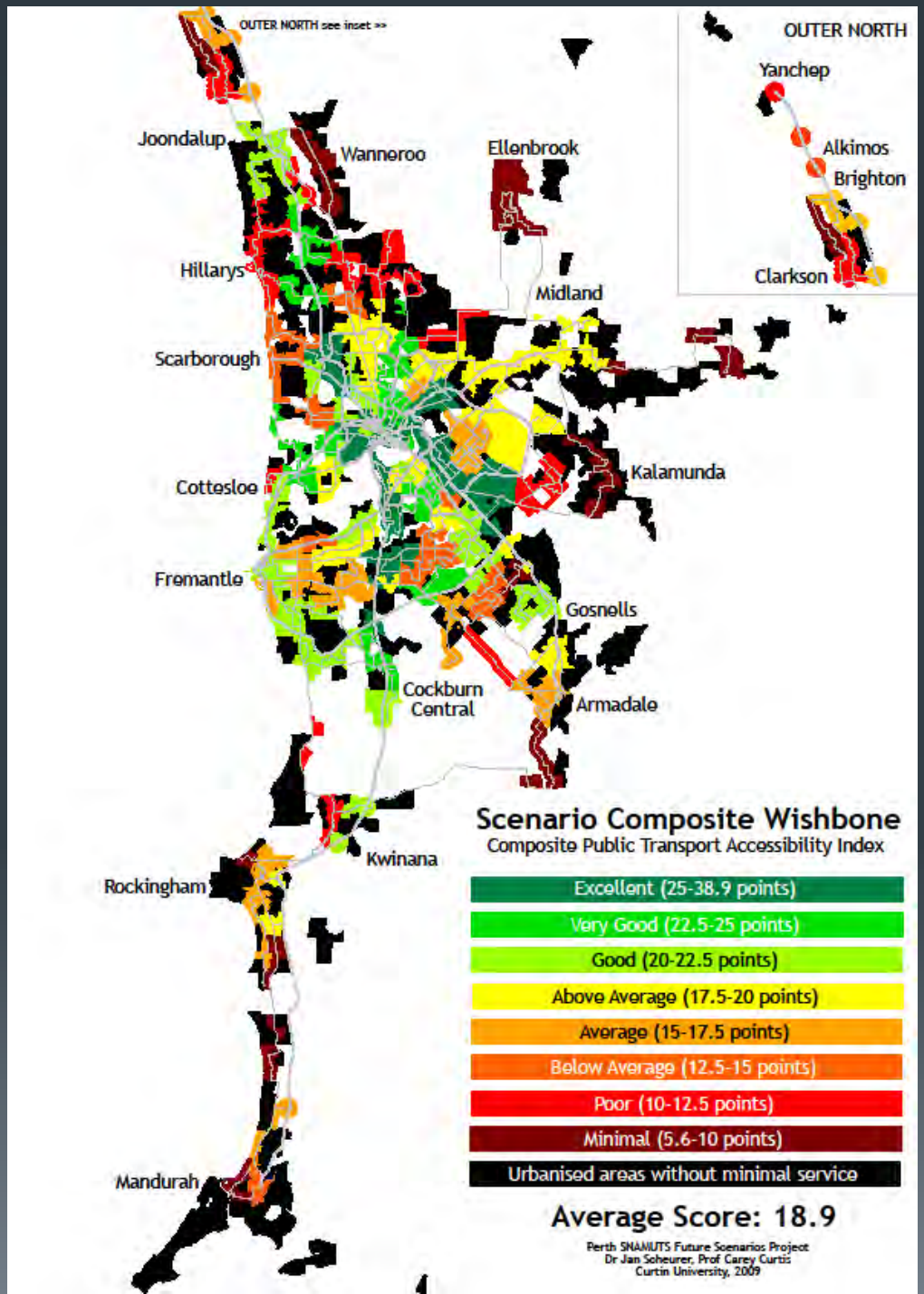


scenario composite wishbone

Incorporates the best-performing elements of the three previous scenarios while allowing for all three forms of urban growth to continue concurrently.

Contains heavy rail extensions between Clarkson and Yanchep (northern corridor) and along a southern orbital between Bayswater and Fremantle via the airport (approx. 60 km), and a 109-km mixed light rail network centred on a wishbone-shaped orbital between Fremantle and Scarborough, a north-eastern radial including a short CBD tunnel and several branch lines. Also includes a bus transitway along South Street (15 km) as well as several new orbital and diagonal bus routes to link the growth areas.

Urban consolidation and growth to occur in the 400/800-metre catchments of all new public transport facilities, at an average target density of 75 residents and jobs per hectare [say 30du/ha] (except in Perth's CBD and in the activity centres of Armadale, Fremantle, Joondalup, Midland, Murdoch, Rockingham and Stirling-Glendalough where the target density is 150 res + jobs per ha).


OUTER NORTH see inset >>
OUTER NORTH
Yanchep
Alkimos
Brighton
Clarkson
Joondalup
Wanneroo
Ellenbrook
Hillarys
Midland
Scarborough
Kalamunda
Cottesloe
Fremantle
Gosnells
Cockburn Central
Armadale
Kwinana
Rockingham
Mandurah
Scenario Composite Wishbone
Composite Public Transport Accessibility Index
Excellent (25-38.9 points)
Very Good (22.5-25 points)
Good (20-22.5 points)
Above Average (17.5-20 points)
Average (15-17.5 points)
Below Average (12.5-15 points)
Poor (10-12.5 points)
Minimal (5.6-10 points)
Urbanised areas without minimal service
Average Score: 18.9
Perth SNAMUTS Future Scenarios Project
Dr Jan Scheurer, Prof Carey Curtis
Curtin University, 2009

Using SNAMUTS to inform future public transport options

Land use assumptions and service input per scenario (2009 = Status Quo, Scenario 2031)

	2009	2031
Service Intensity: Train	44	80 (+81%)
Service Intensity: Bus	587	915 (+56%)
Service Intensity: Ferry	1	3 (+118%)
Service Intensity: Total	**632**	**997 (+58%)**
Number of Nodes	46	49
Activities in metropolitan area	2,629,497	3,655,399
Activities in serviced area	2,528,198 (96%)	3,513,548 (96%)

our evaluation of the network we focussed on the following objectives:

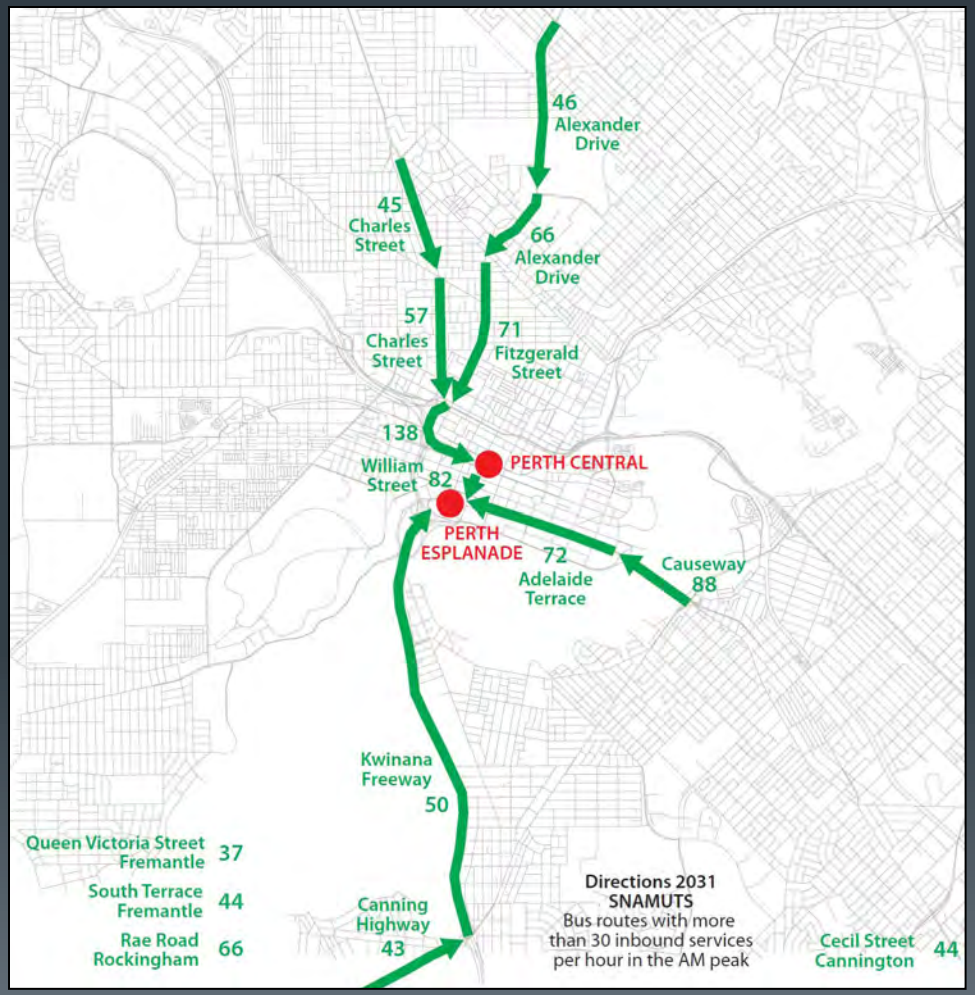
- The extent to which potential accessibility of quality public transport was expanded to a larger proportion of metropolitan residents;
- The extent to which accessibility was enhanced across fourteen key activity centres (defined by PTA);
- The public transport ‘effort’ (performance of different transport modes and across corridors).

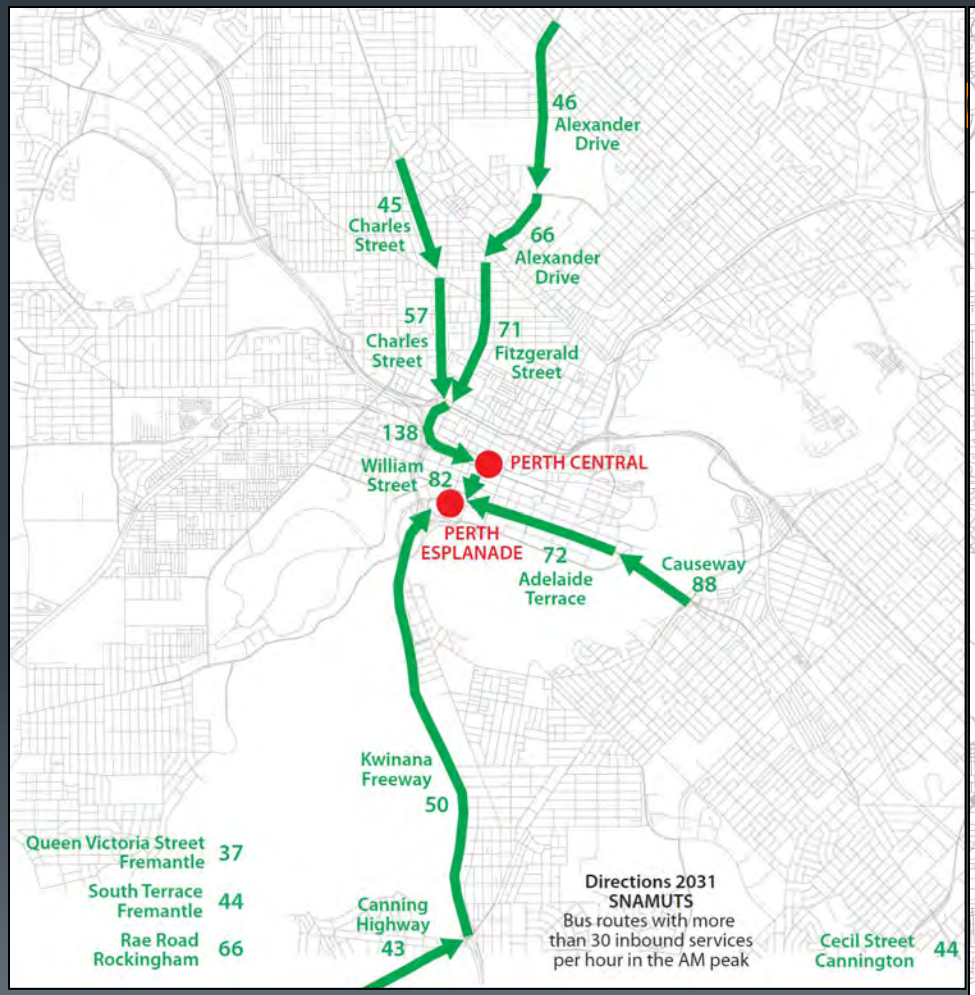
Composite Accessibility Index for key centres	2009	2031
AC1 (outer region)	12.5	15.4 (+2.9)
AC2 (middle region)	16.5	19.5 (+3.0)
AC3 (inner region – major employment centre)	16.3	20.5 (+4.2)
AC4 (inner region)	19.6	21.9 (+2.3)
AC5 (outer region)	20.0	24.0 (+4.0)
AC6 (outer region)	16.0	17.8 (+1.8)
AC7 (outer region)	17.0	19.0 (+2.0)
AC8 (middle region – large employment centre)	24.9	28.8 (+3.9)
AC9 (Airport)	7.3	19.9 (+12.6)
AC10 Perth Central	33.5	37.7 (+4.2)
AC11 (outer region)	16.2	18.6 (+2.4)
AC12 (middle region – major employment centre)	25.6	29.0 (+3.4)
AC13 (inner region – major employment centre)	17.1	22.4 (+5.3)
AC14 (outer region)	-	15.4
Average Key Centres	18.7	22.1 (+3.4)
Standard Deviation Key Centres	*6.5*	*6.1*
Average Network	14.9	18.0 (+3.1)
Standard Deviation Network	*6.2*	*6.5*

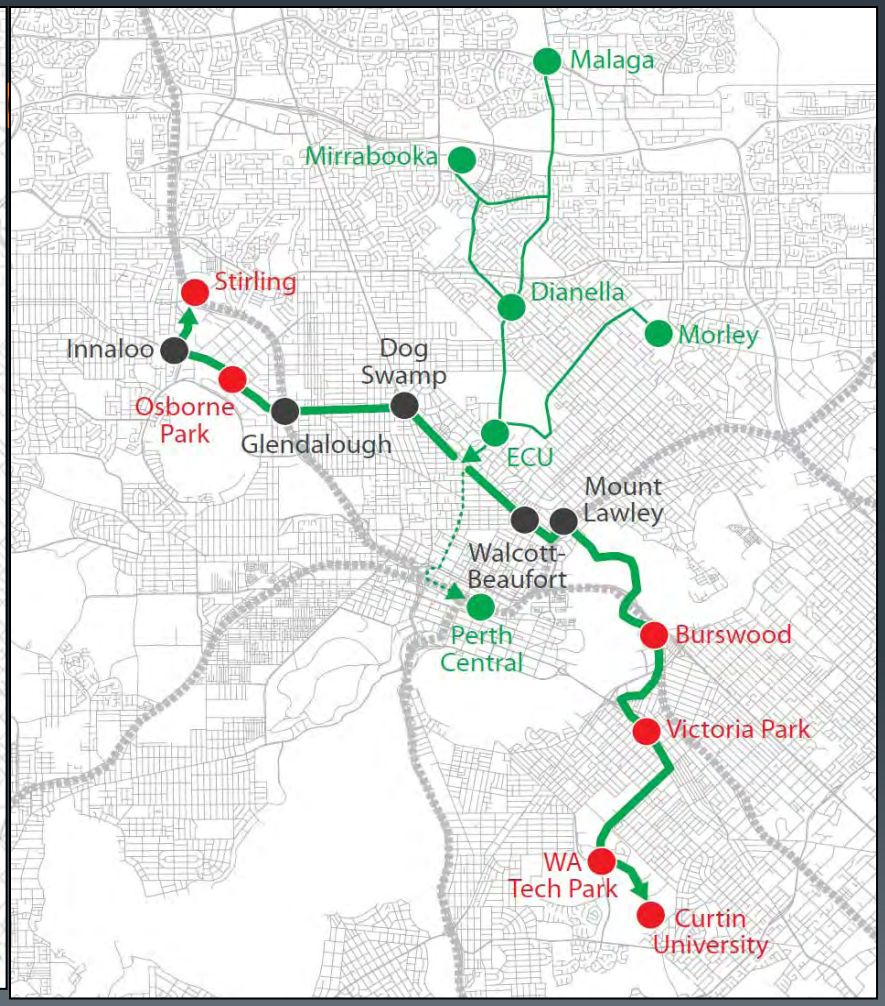
Higher figures indicate better accessibility, up to a theoretical maximum of 45

Contour catchment change for key activity centres	2009	2031
AC1 (outer region)	17.1%	26.6%
AC2 (middle region)	28.2%	31.9%
AC3 (inner region – major employment centre)	36.1%	**46.1%**
AC4 (inner region)	45.2%	45.9%
AC5 (outer region)	35.2%	49.4%
AC6 (outer region)	14.1%	15.9%
AC7 (outer region)	37.8%	40.1%
AC8 (middle region – large employment centre)	62.0%	**80.0%**
AC9 (Airport)	12.2%	56.8%
AC10 Perth Central	77.8%	**83.6%**
AC11 (outer region)	23.3%	26.4%
AC12 (middle region – major employment centre)	66.8%	72.9%
AC13 (inner region – major employment centre)	35.9%	**59.9%**
AC14 (outer region)	-	15.8%
Average Key Centres	**37.8%**	**46.5%**
Standard Deviation Key Centres	*20.5%*	*22.2%*
Average Network	**30.0%**	**40.2%**
Standard Deviation Network	*19.4%*	*21.7%*

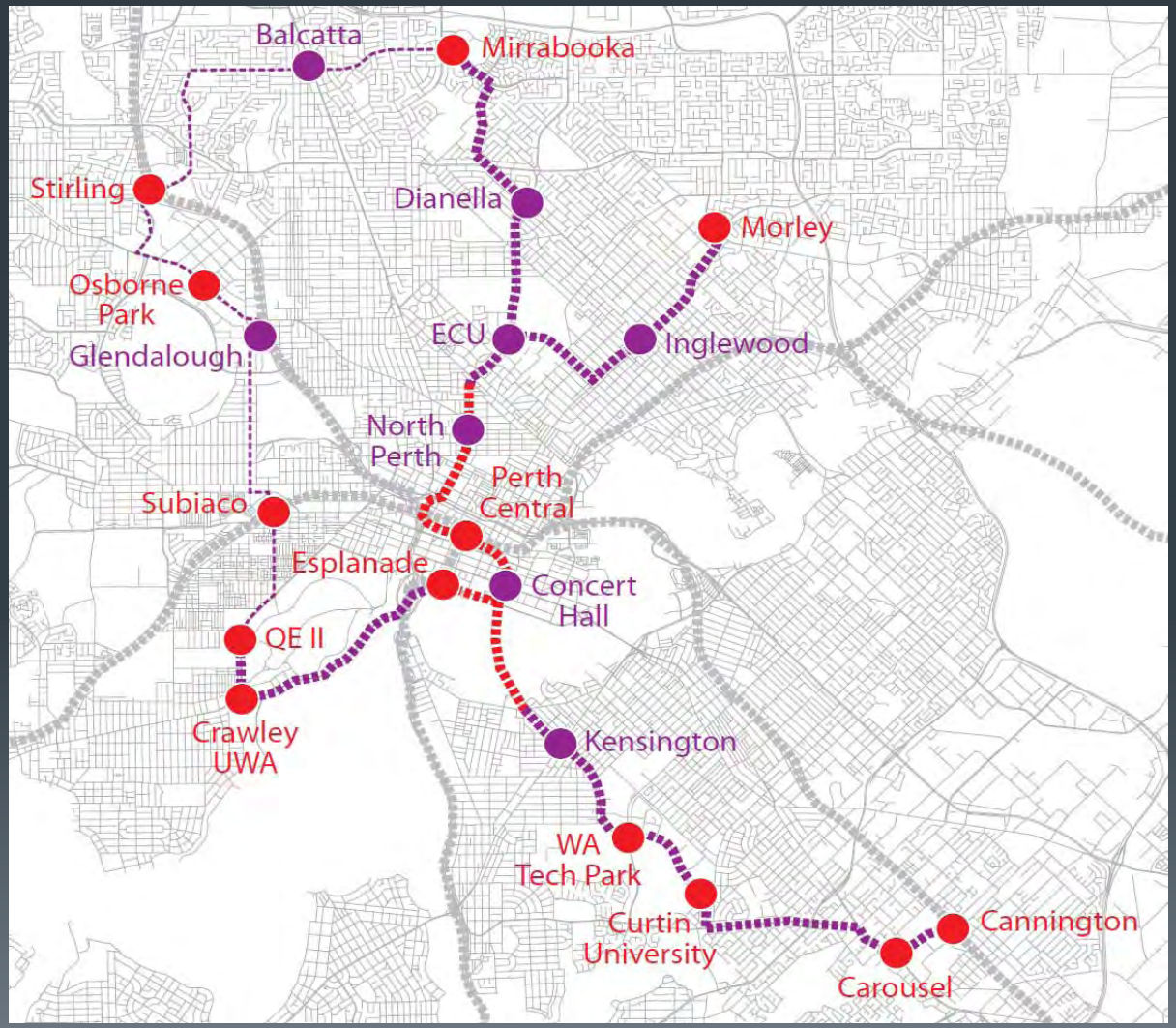
Issue 1: incremental change results in lost opportunity




46
Alexander
Drive
45
Charles
Street
66
Alexander
Drive
57
Charles
Street
71
Fitzgerald
Street
138
William
Street
82
PERTH CENTRAL
PERTH
ESPLANADE
72
Adelaide
Terrace
Causeway
88
Kwinana
Freeway
50
Queen Victoria Street
Fremantle
37
South Terrace
Fremantle
44
Rae Road
Rockingham
66
Canning
Highway
43
Directions 2031
SNAMUTS
Bus routes with more
than 30 inbound services
per hour in the AM peak
Cecil Street
Cannington
44


Malaga
Mirrabooka
Stirling
Dianella
Morley
Innaloo
Dog
Swamp
Osborne
Park
Glendalough
ECU
Mount
Lawley
Walcott-
Beaufort
Perth
Central
Burswood
Victoria Park
WA
Tech Park
Curtin
University

…towards a solution – higher performing mode



Setting a benchmark for public transport accessibility

defining benchmarking (i)

"a standard or point of reference against which things may be compared" (Oxford Dictionary)

At this level of definition we might be asking simply – how do the public transport systems of European cities compare?

"a standard of excellence, achievement etc., against which similar things must be measured or judged" (Online Reference Dictionary)

This definition takes the idea a step further and adds the dimension of excellence or best practice, suggesting the need to establish a benchmark, or metric, for an excellent public transport system.

defining benchmarking (ii)

What metric should we use?

A common measure is public transport patronage, reflecting concerns about investment (demand-side approach)

Another measure relates to the cost of construction and/or operation.

Neither metric corresponds to the salient questions: who (and how many people) get(s) access to public transport, and at what level of service?

What level of public transport accessibility should Australian Cities aim for?

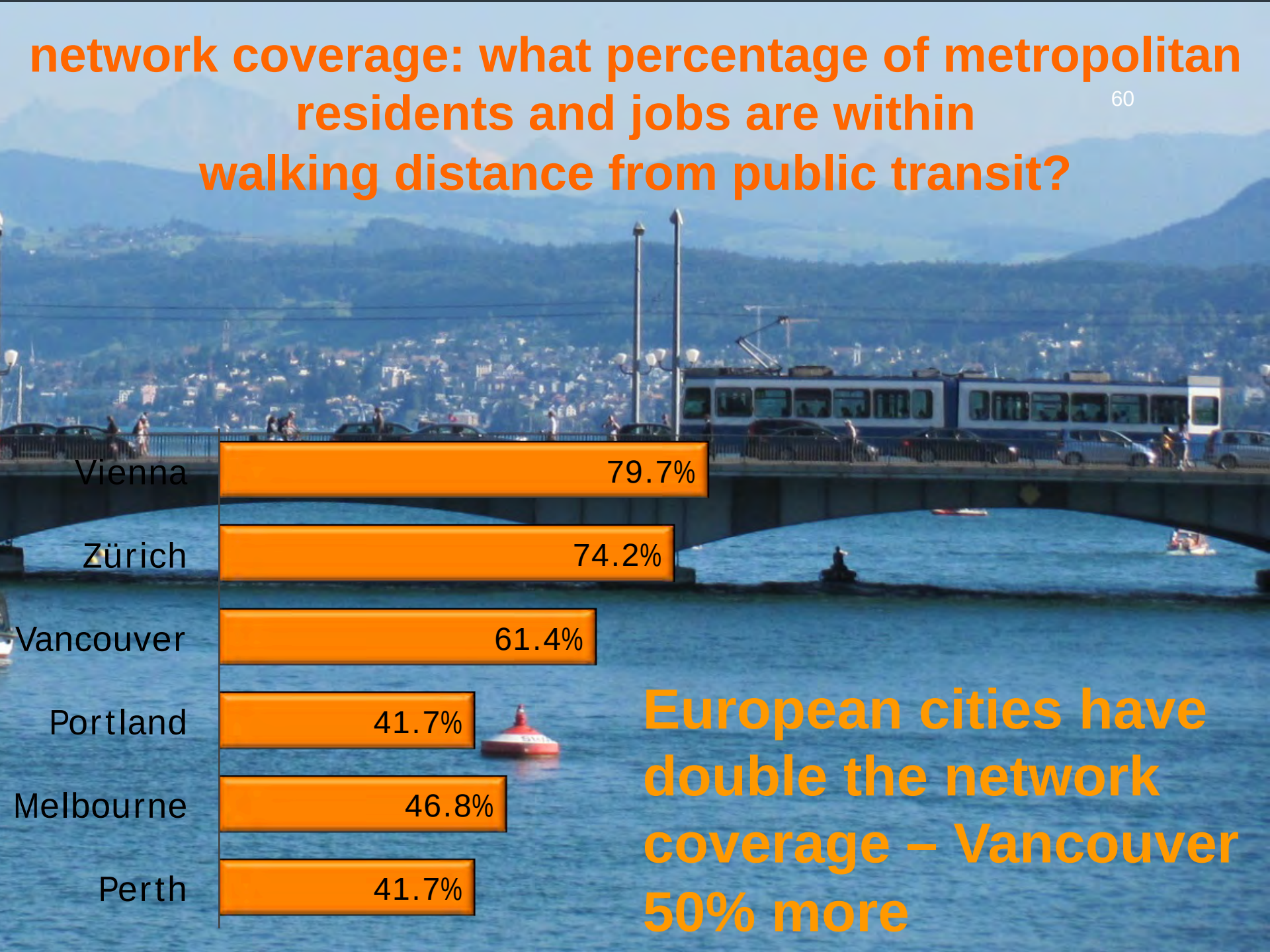
- What can we learn from European and North American cities:
  - Service input per person
  - Network coverage
  - Public transport trips per person per annum

how much service input is required?

number of public transit vehicles/trains (per 100,000 pop) in simultaneous revenue service

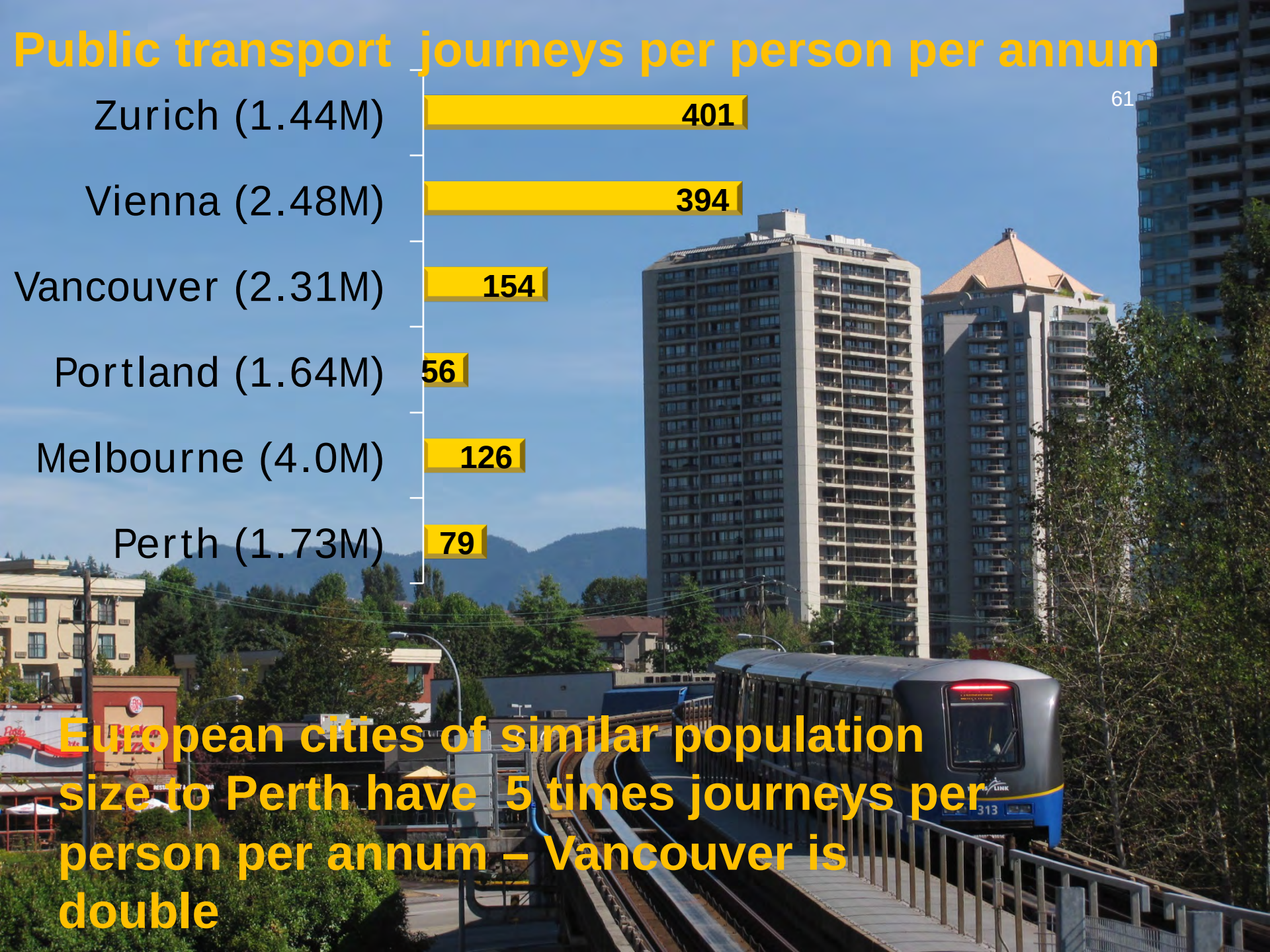
European cities have double the service input of Perth – Vancouver 50% more

network coverage: what percentage of metropolitan residents and jobs are within walking distance from public transit?



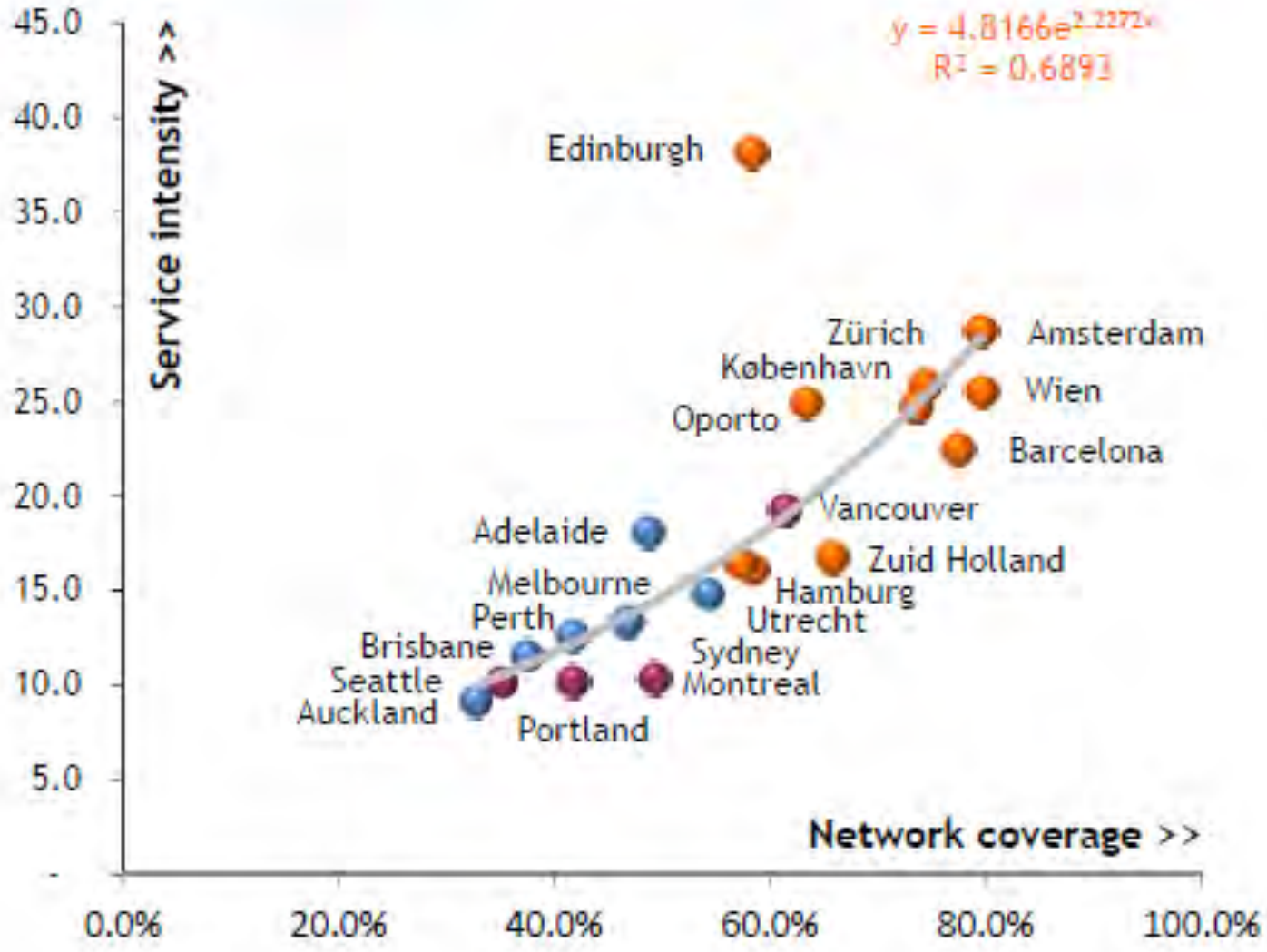
European cities have double the network coverage – Vancouver 50% more

Public transport journeys per person per annum

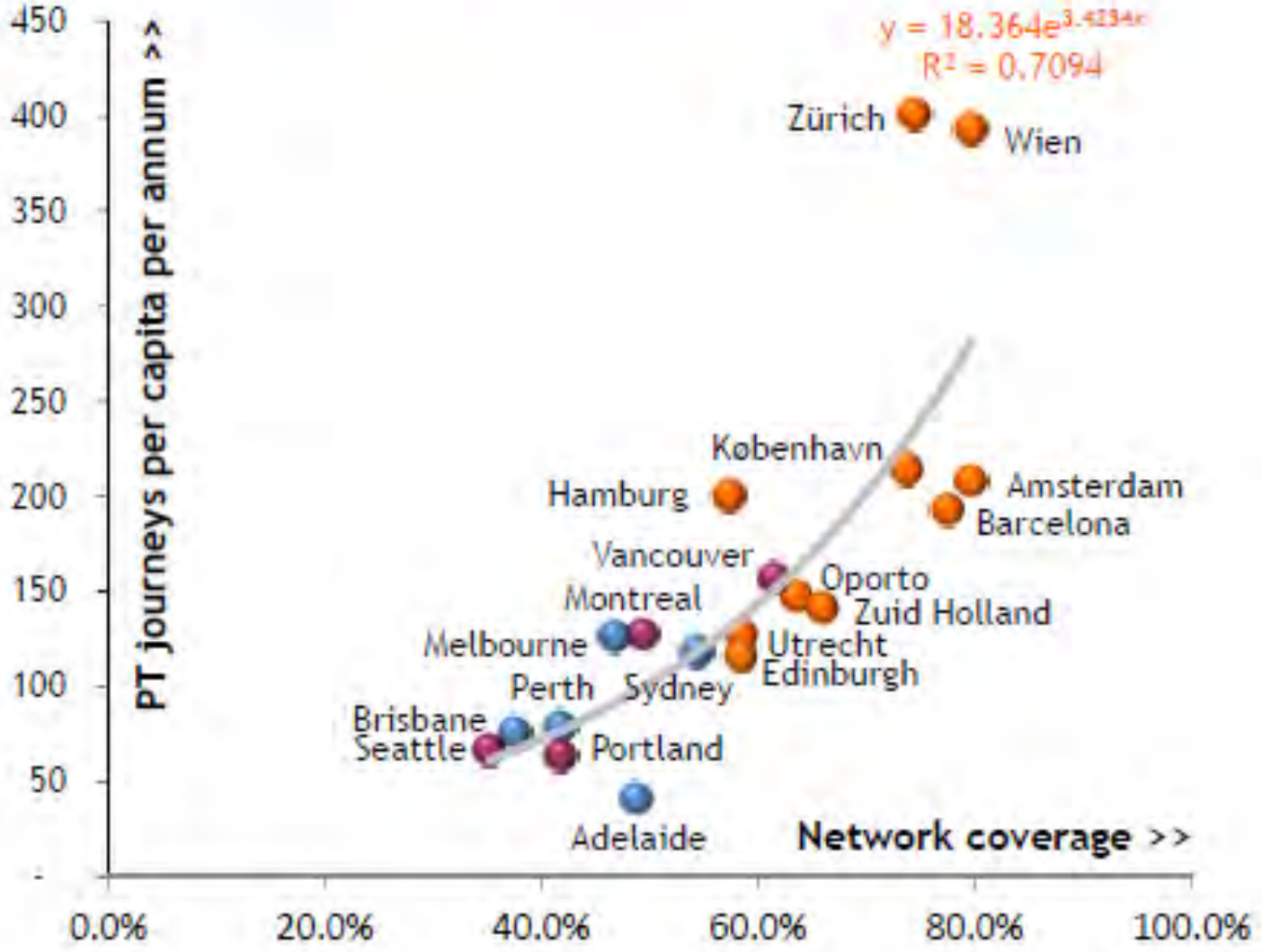


European cities of similar population size to Perth have 5 times journeys per person per annum – Vancouver is double

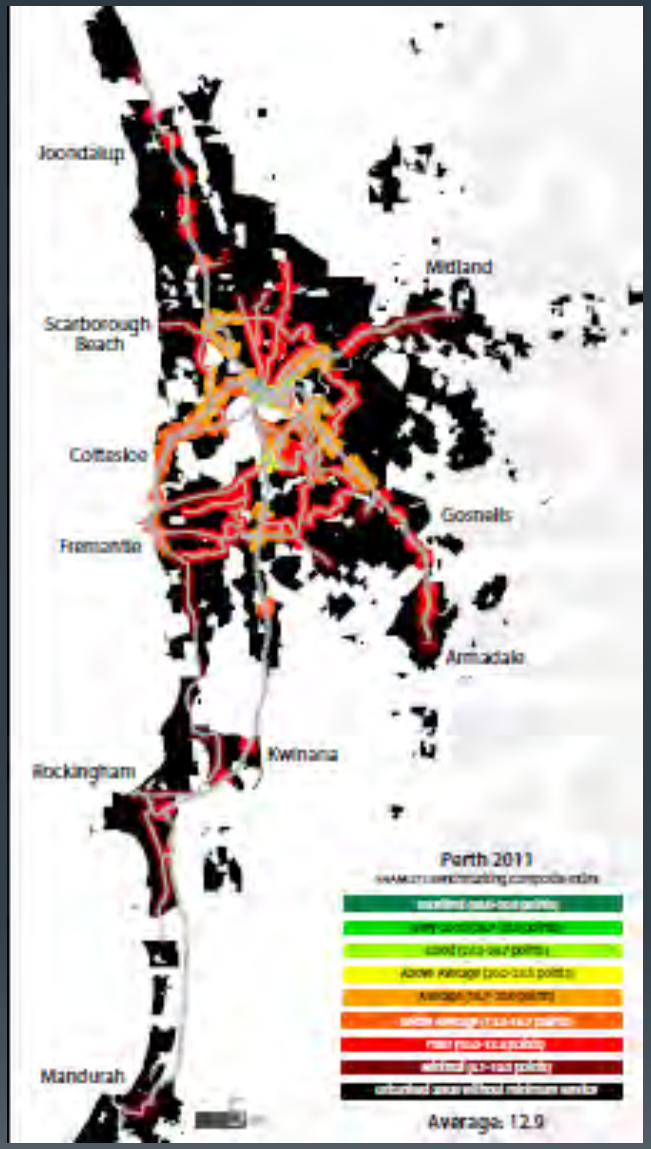
network coverage and service intensity

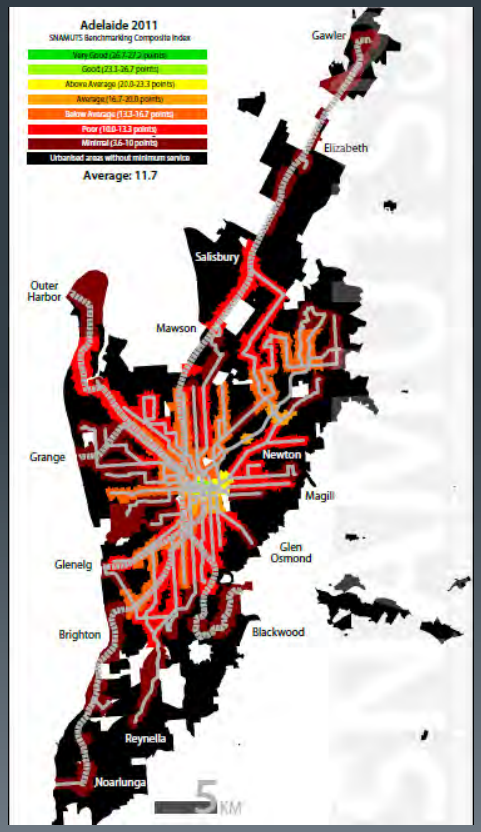


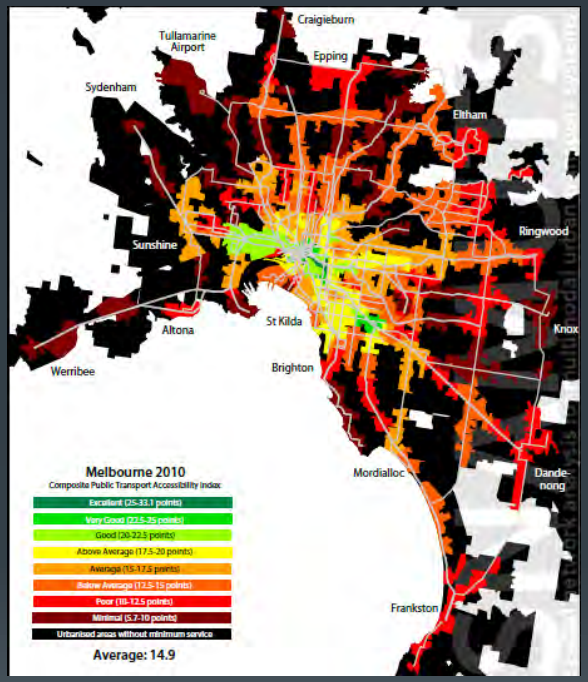
network coverage and journeys ppa



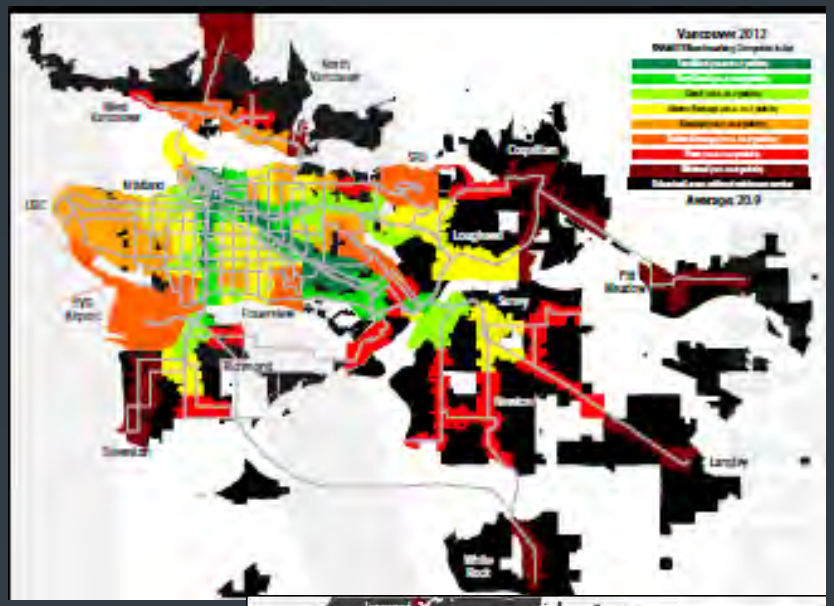
Australian Cities: Composite Benchmark

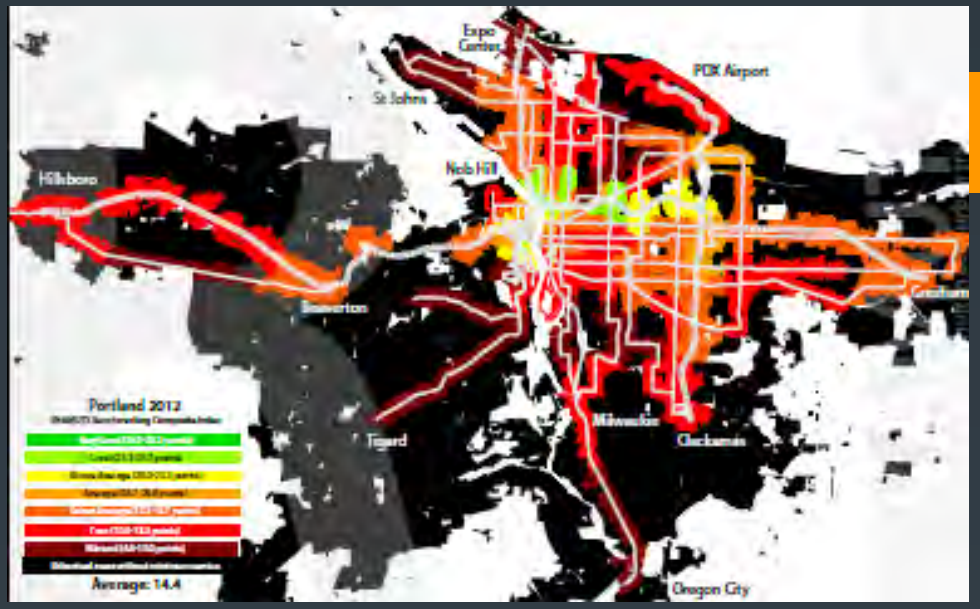


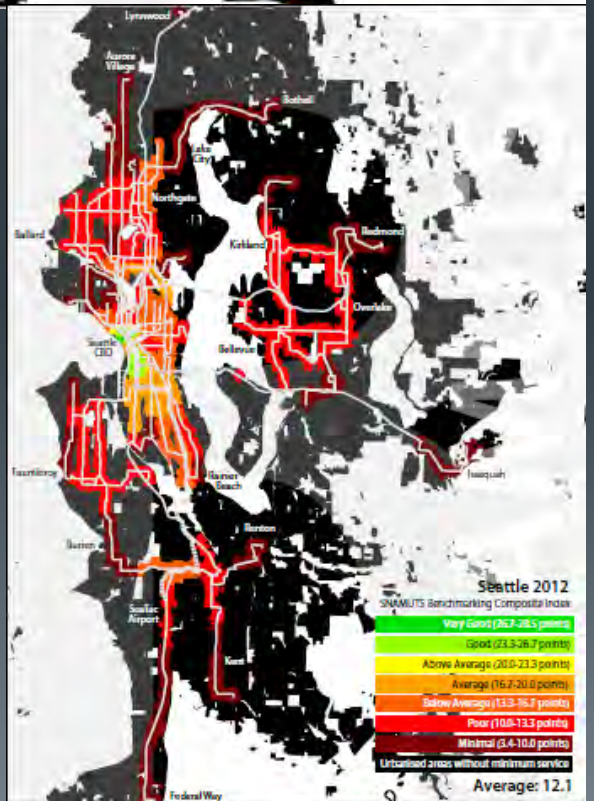


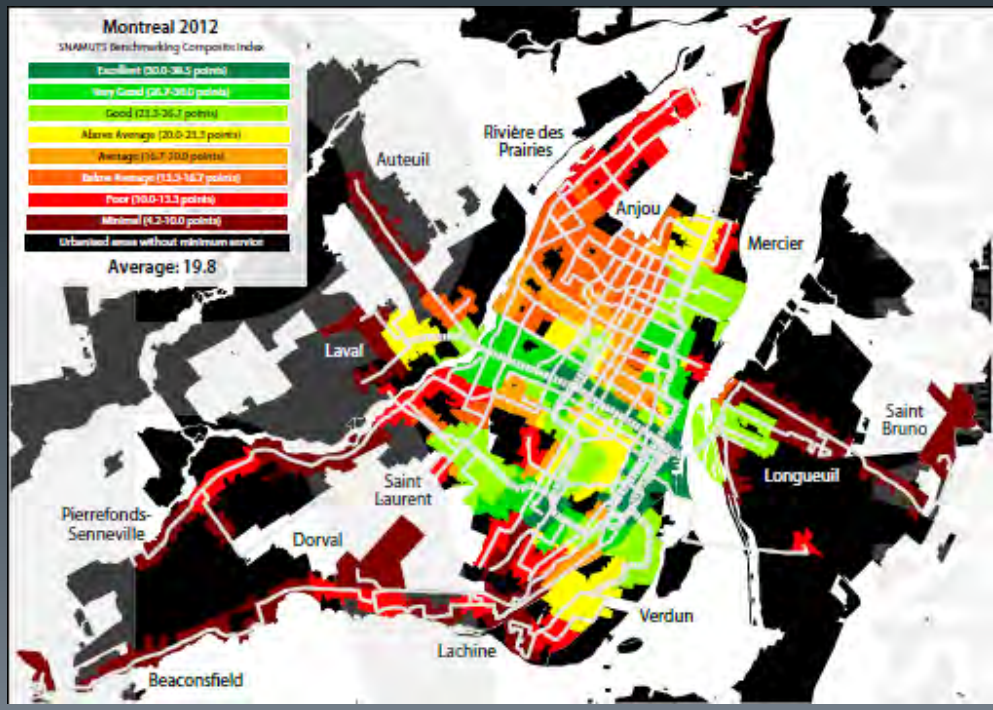


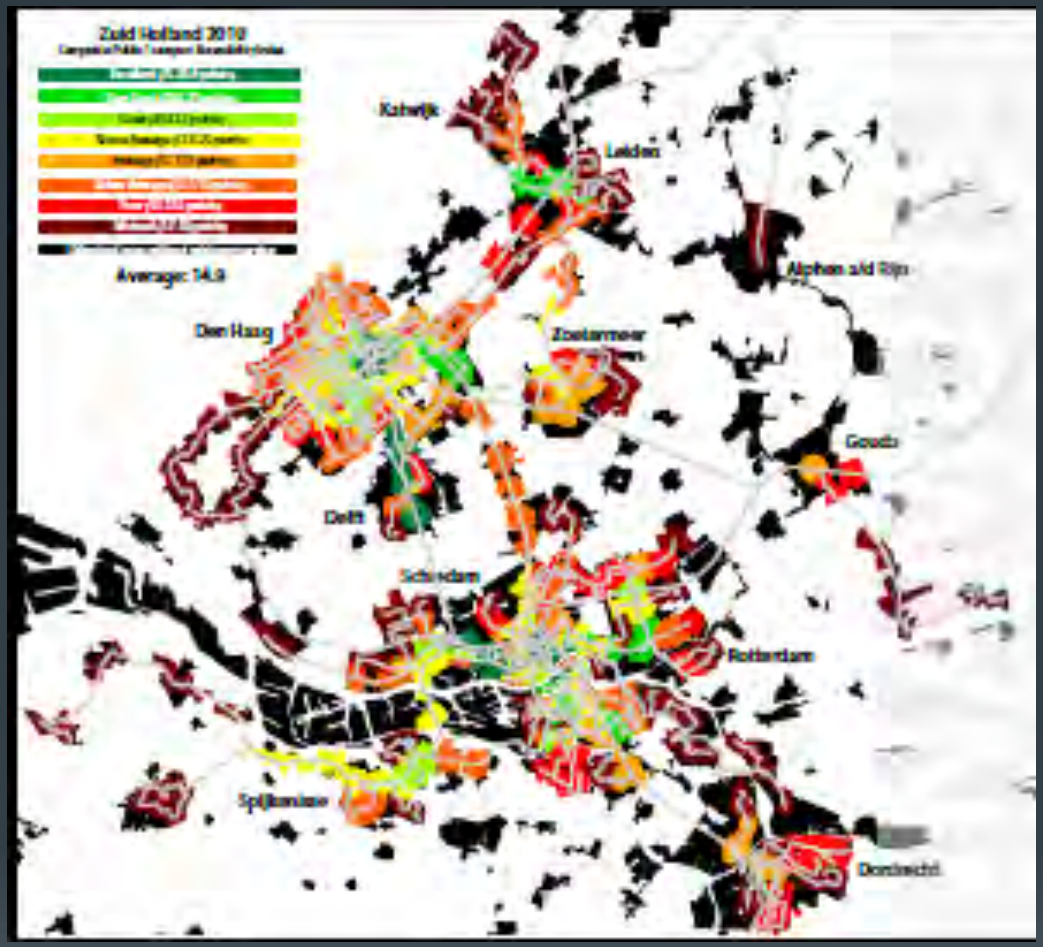
North America










Zuid Holland 2010
Average: 14.9
Katwijk
Leiden
Alphen a/d Rijn
Den Haag
Zoetermeer
Gouda
Delft
Schiedam
Rotterdam
Dordrecht

- *Curtis C (2011) Integrating Land Use with Public Transport: The Use of a Discursive Accessibility Tool to Inform Metropolitan Spatial Planning in Perth.* Transport Reviews Vol 31 (2) pp. 179-197.

- *Curtis C and Scheurer J (2010) Planning for Sustainable Accessibility: Developing tools to aid discussion and decision-making. Progress in Planning Vol 74 (2010), pp.53-106*

- Curtis C (2008) Planning for Sustainable Accessibility: the implementation challenge. *Transport Policy* Vol 15 (2) pp. 104-112

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