

Trackless Trams and Transit Activated Corridors

Peter Newman AO

Professor of Sustainability, Curtin University

Co-ordinating Lead Author for Transport in IPCC

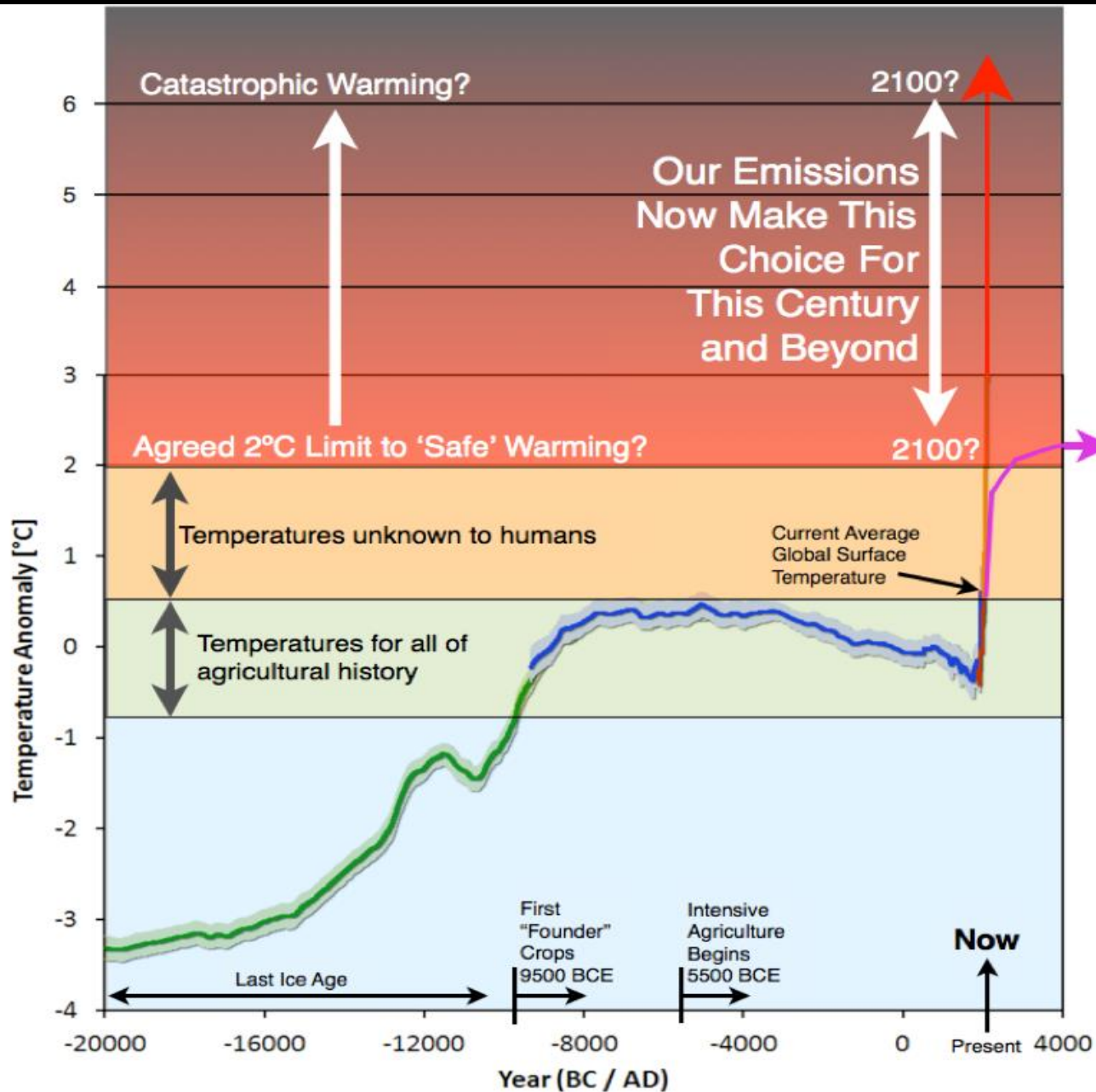
Project Leader in SBEnc 1.84

SBEnc Team:

- Dr Dean Economou, Curtin, TT Trial
- Marie Verschuer, Curtin, TT Trial
- Dr Jan Scheurer, RMIT, SNAMUTS modelling
- Prof Cheryl Desha, Griffith, Sunshine Coast and Social Housing
- Madison Bland, Griffith, Sunshine Coast and Social Housing

This is a Net Zero story...

- What is IPCC saying?
- What have we been doing in SBEnrc that helps us get ready?
- How do we take the first steps?



Leaving the 'safe operating space' 1°C band

Its our cities and agriculture that are threatened....

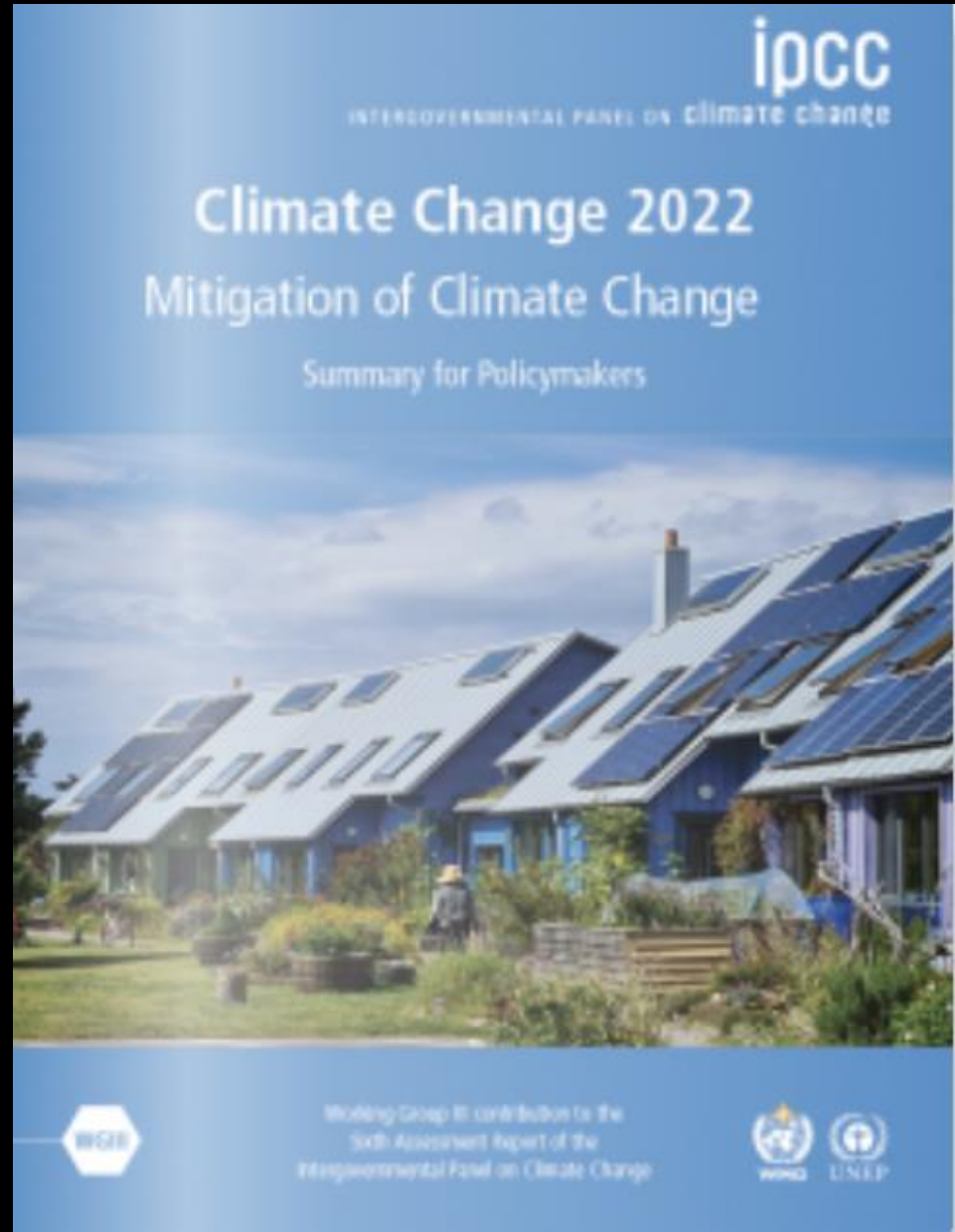
Indigenous Australians 60,000 years survived -3°C

HOPE for a NEW ECONOMY?



‘We are on a fast track to climate disaster...’

IS THIS ALL?



THE CONTEXT.... Intense FOSSIL FUEL lobbying

THE ENERGY SECURITY CRISIS

Oil prices surge over Ukraine war

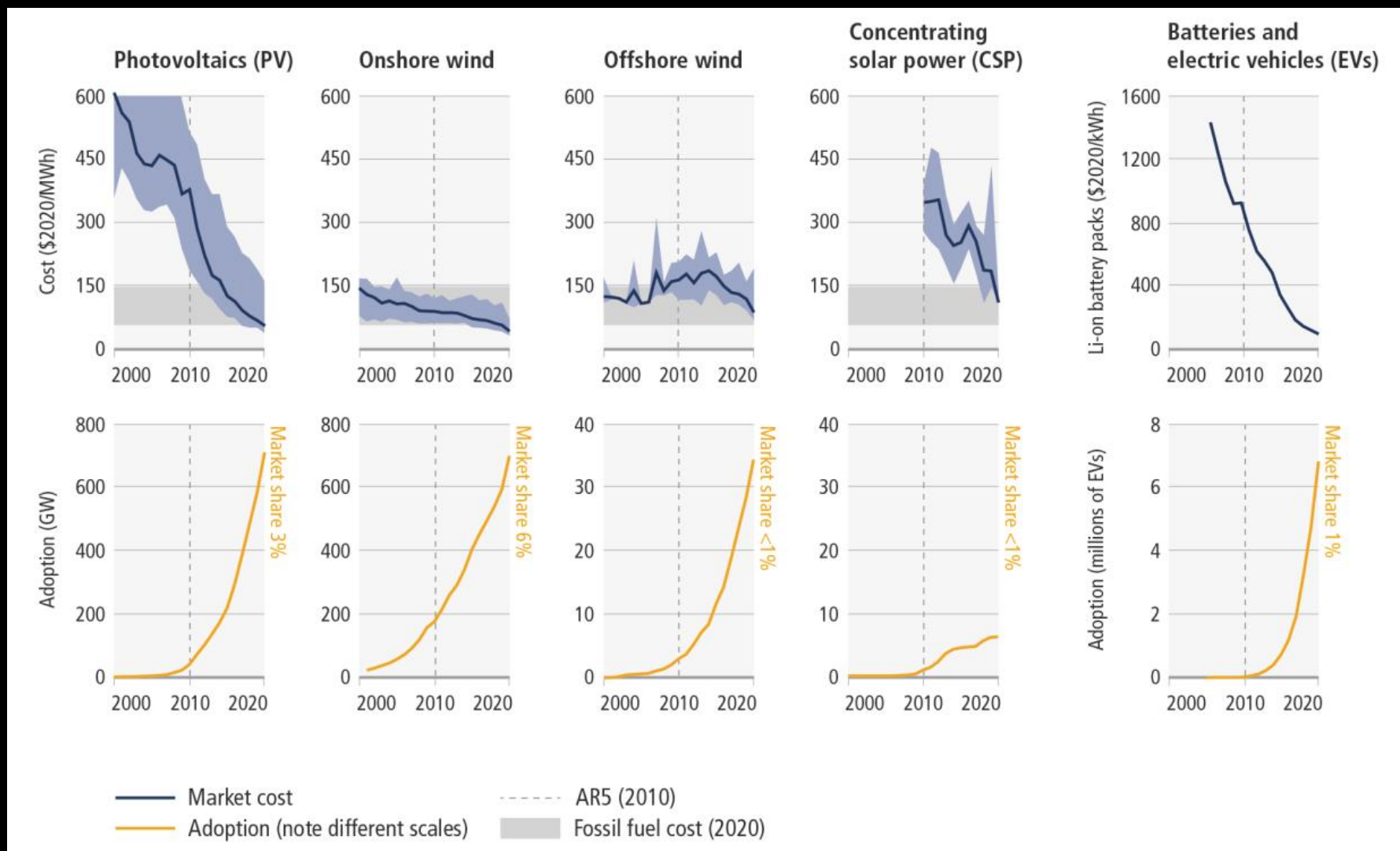


CAN WE GET TO NET ZERO BY 2050 AS AGREED TO AT PARIS?

THE GOOD NEWS –

IPCC MITIGATION REPORT

The unit costs of key low-emission technologies have fallen continuously since 2010 and their adoption continues to rise...

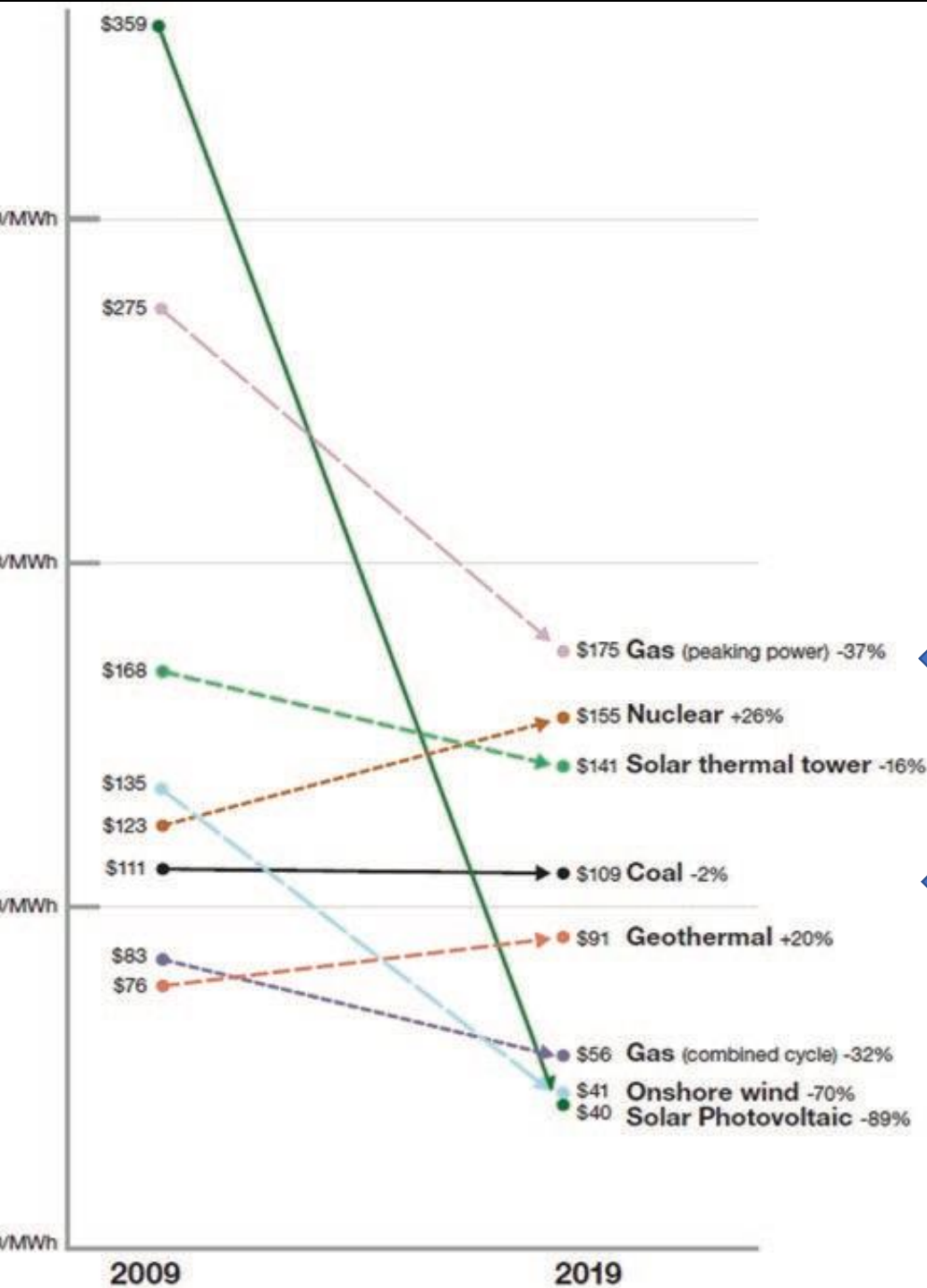


Need to integrate
With smart
technologies

Figure SPM3

Cost of power

Solar is cheaper than any source of power in history



GAS

COAL

SOLAR

Rooftop or Solar Farm?



The new economy is not just happening
because of GOVERNMENT but now FINANCE...

**\$170 trillion
IS ONLY
AVAILABLE
TO
PROJECTS
THAT ARE
NET ZERO...
And
enhance
the SDG's.**



The INNOVATIONS....Ready to go as a Cluster

- RENEWABLES, especially solar and wind.
- BATTERIES, Li-ion.
- ELECTRIC VEHICLES, cars, transit, micro-mobility. 'Electric everything'.
- SMART CITY, integration.

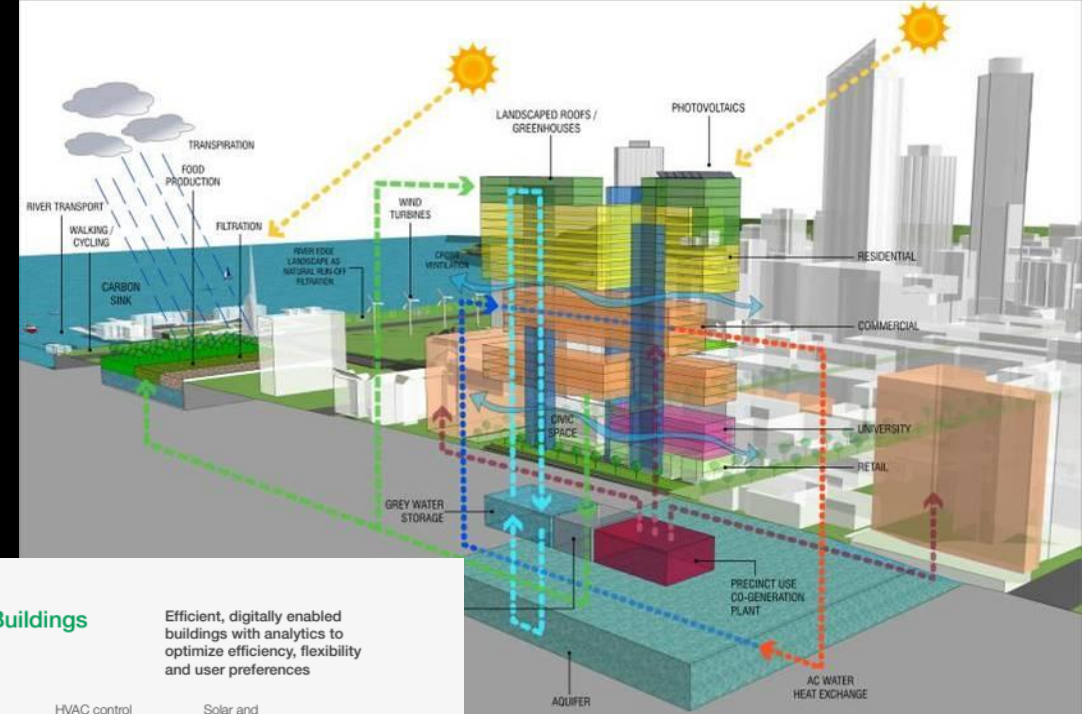
Can buy now...CHEAPER and BETTER THAN EVER.

BUT WE HAVE TO PUT THEM TOGETHER.

ESPECIALLY IN CITIES WHERE MOST OF THE GHG IS MADE

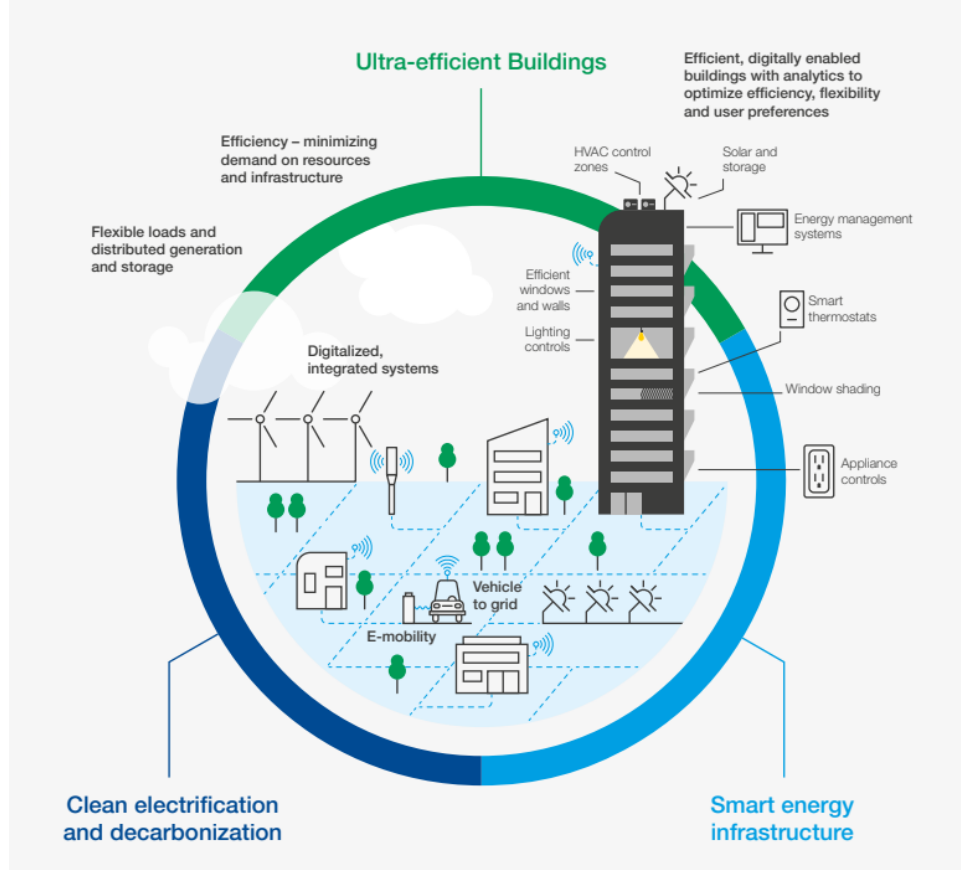
Lots of dreaming about Net Zero Cities...

World Economic Forum



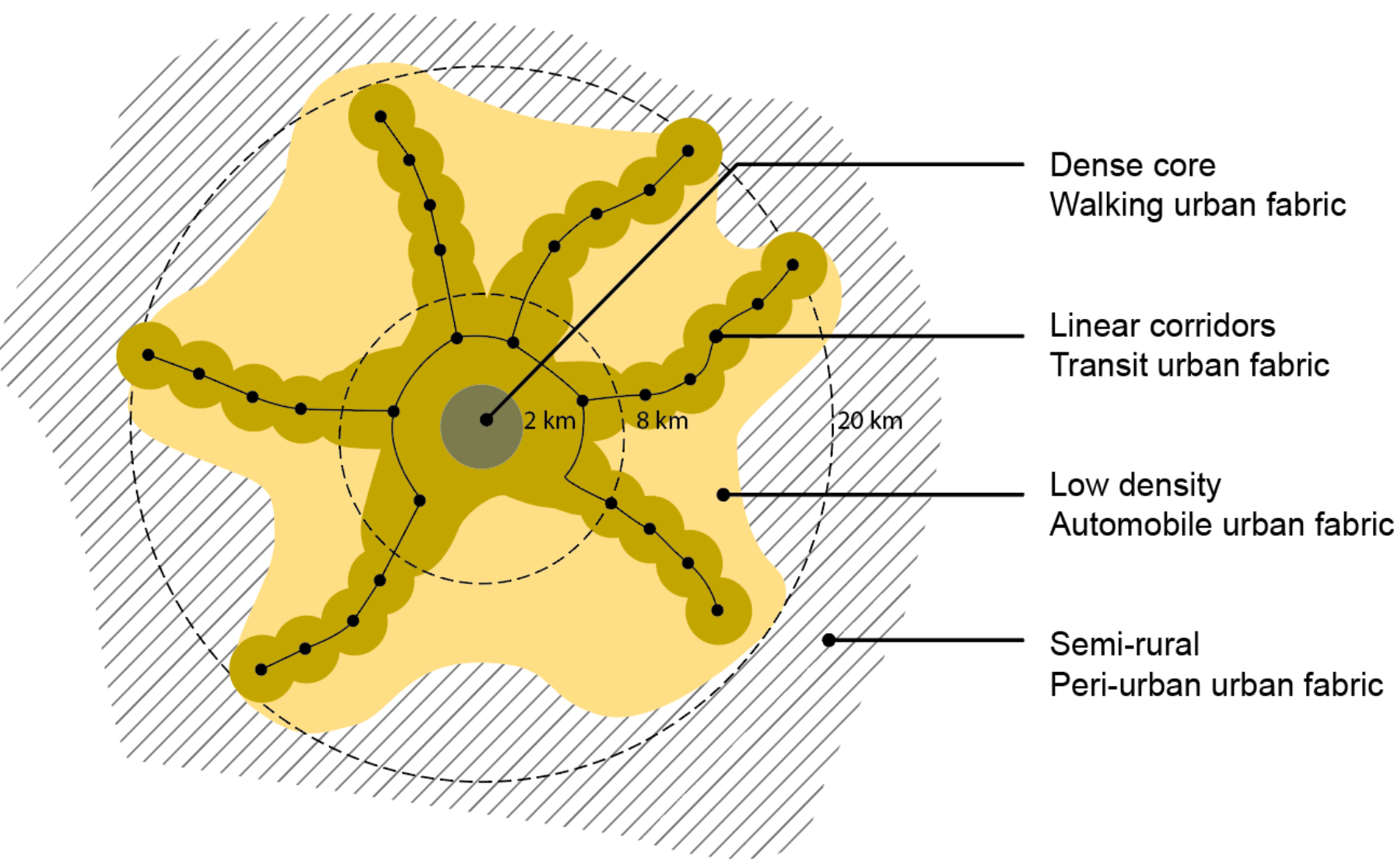
Net Zero Carbon Cities

The urgency of the climate crisis demands immediate actions to turn policy ambitions into impact. The World Economic Forum is uniquely positioned to bring together multi-sectoral



Urban ecosystem

But where do we start?



URBAN FABRICS:

GHG GJ/capita/yr

- **Walking City 20**
- **Transit City 35**
- **Automobile City 50**
- **Peri-urban City 60-100**

Town Planning Reviews
2016

Theory of urban fabrics – four cities exist in all cities based on travel times – each fabric has different Net Zero needs.

New cluster of innovations in five different urban fabrics

Covid, Cities and Climate
Urban Science 2020

Approaches	Walking Fabric CENTRAL	Transit Fabric INNER & MIDDLE	Automobile Fabric OUTER	Peri-Urban and Rural Village Fabric RURAL	Indigenous and Mining Settlement Fabric REMOTE
Outcomes					
Renewable energy SOLAR & BATTERIES	✓	✓ ✓	✓ ✓ ✓	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓
Electro mobility EV'S	Micro Mobility ✓ ✓	Transit and Micro Mobility ✓ ✓ ✓	Cars ✓ ✓ ✓	Cars and Farm Vehicles ✓ ✓	Off Road Vehicles ✓
Walkability and Active Transport WALKING	✓ ✓ ✓	✓ ✓	✓	✓	
Smart city demand mgt SMART CITY	✓ ✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓
Hydrogen for Industry HYDROGEN			✓	✓ ✓ ✓	✓ ✓ ✓ ✓
Circular economy CIRCULAR EC	✓	✓ ✓	✓ ✓ ✓	✓ ✓ ✓ ✓	✓ ✓
Biophilic urbanism BIOPHILIC	✓ ✓ ✓	✓ ✓	✓		
Permaculture PERMACULTURE		✓	✓ ✓	✓ ✓ ✓	

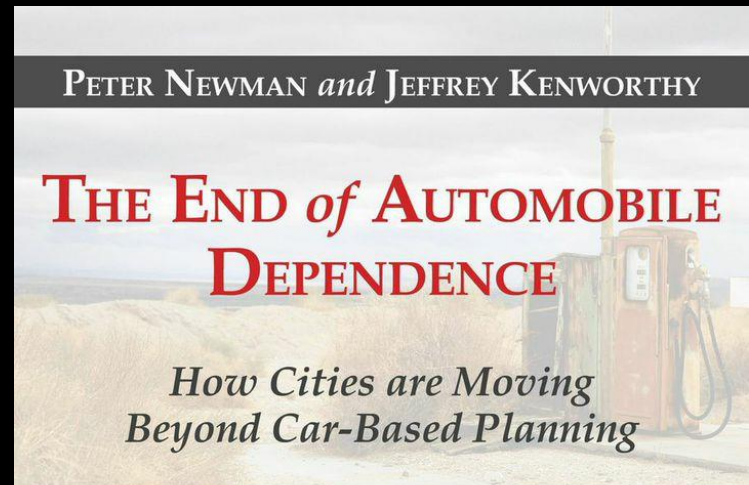
Central and Inner City

Walkability-based urban design for Knowledge Economy jobs



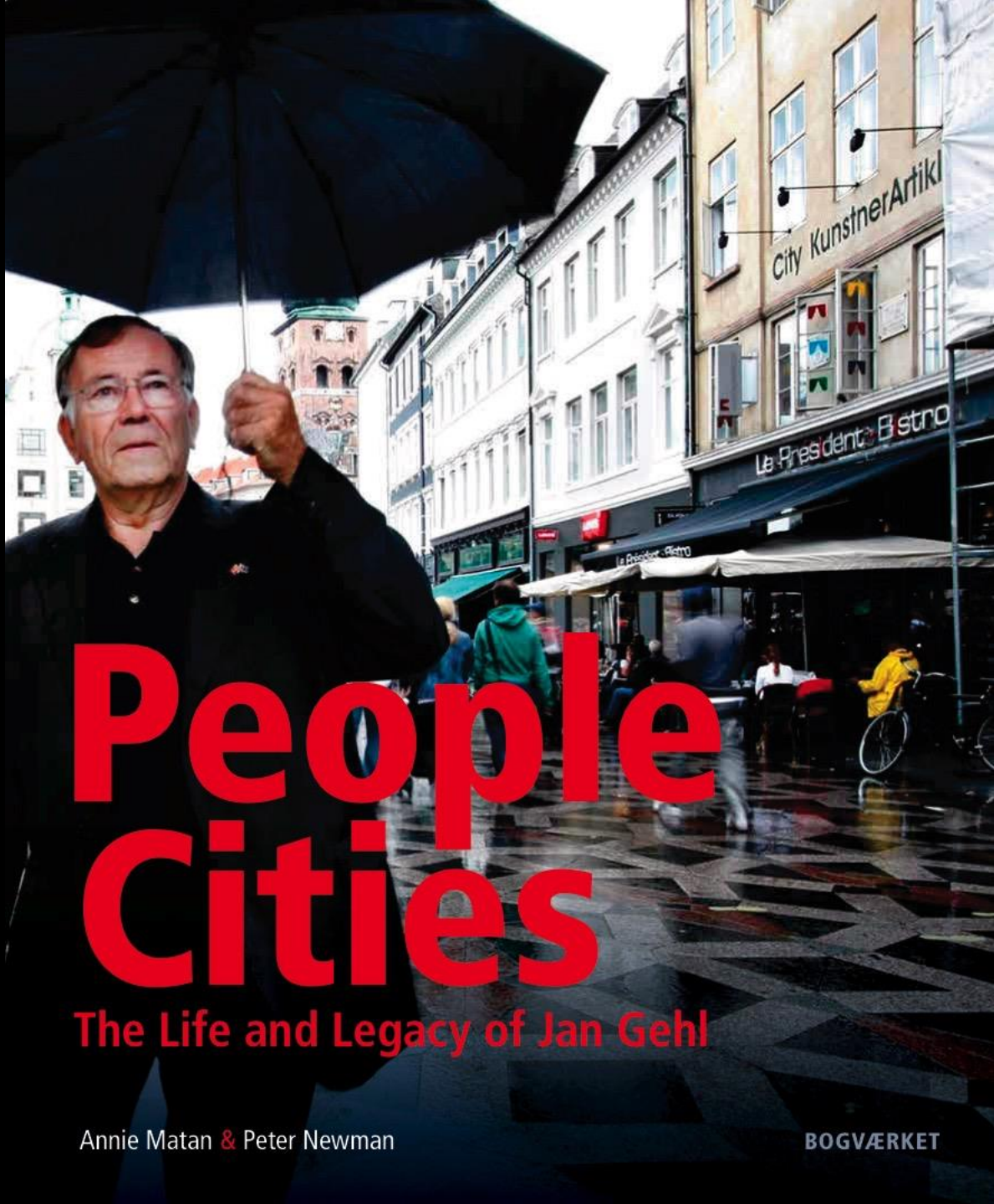
The top 6 most walkable cities in the US have 38% higher GDP.

70% of knowledge economy workers in Boston live in walkable areas.



2015





People Cities

The Life and Legacy of Jan Gehl

Annie Matan & Peter Newman

BOGVÆRKET

Walkability remains central to urban design in centres



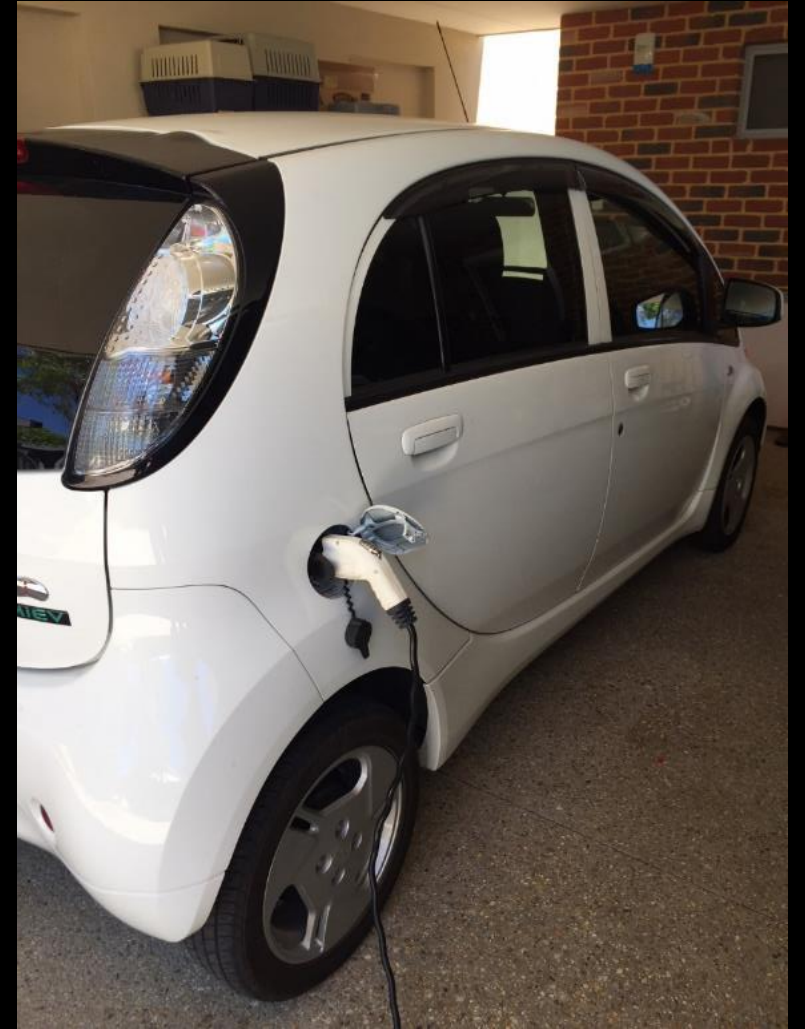
Suburbs are different in their opportunities
and needs....

ENERGY POSITIVE HOME – Josh's House

Josh is the new **Dean of Sustainability Futures at Curtin**



Integrated solar, batteries and EV in his home and proved it was NET ZERO.



HOW DO WE SHARE SOLAR EQUITABLY and PRODUCTIVELY in medium density or social housing?

WGV: Solar-Battery-EV-Blockchain



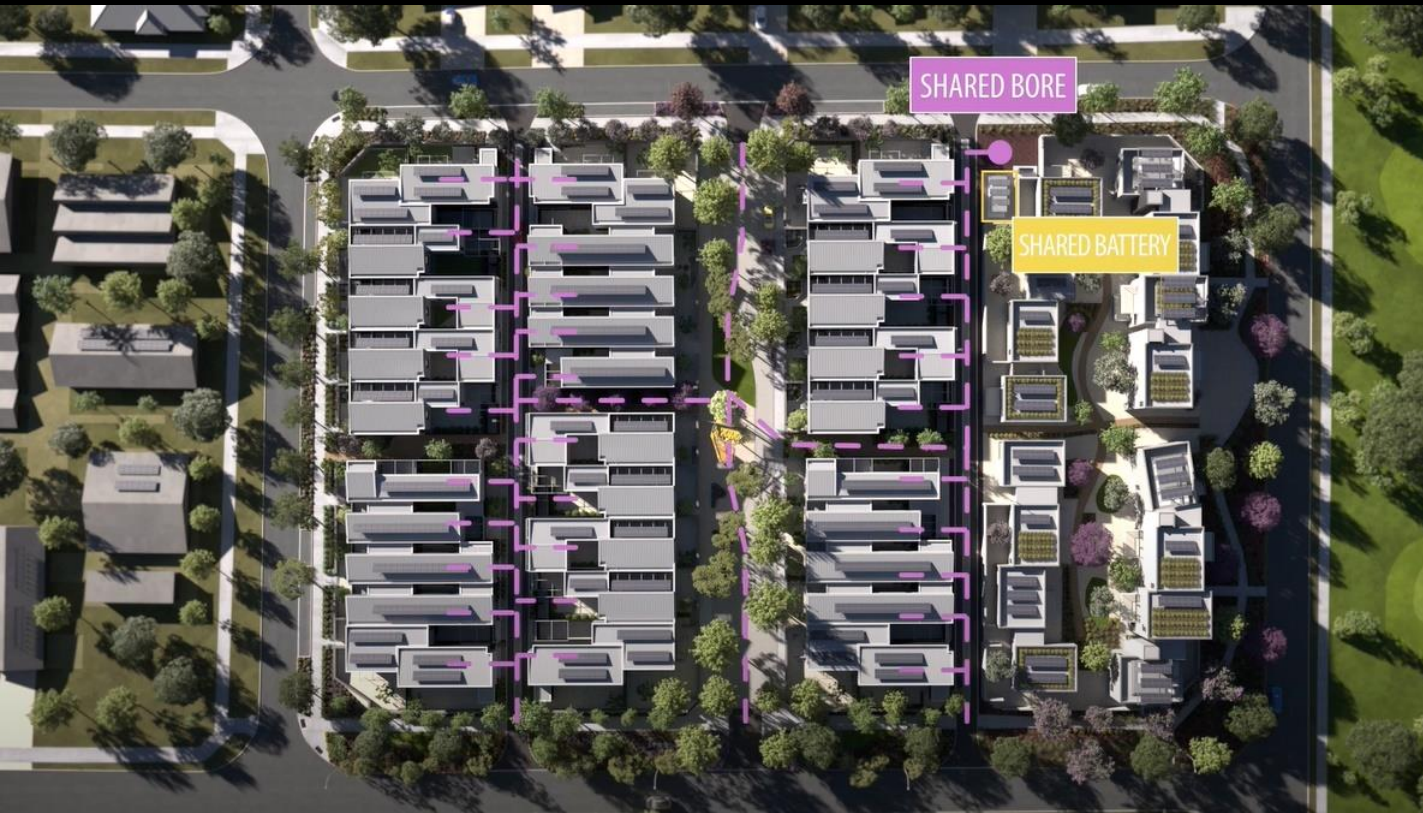
Jemma Green



85 staff
Projects in
25 nations

Powerledger develops software solutions for the **tracking, tracing and trading of renewable energy**. We believe in the democratisation of power, for a sustainable future.'

EAST VILLAGE NET ZERO PRECINCT design and management – shared water bore, shared battery, blockchain-based management... MICRO-GRID

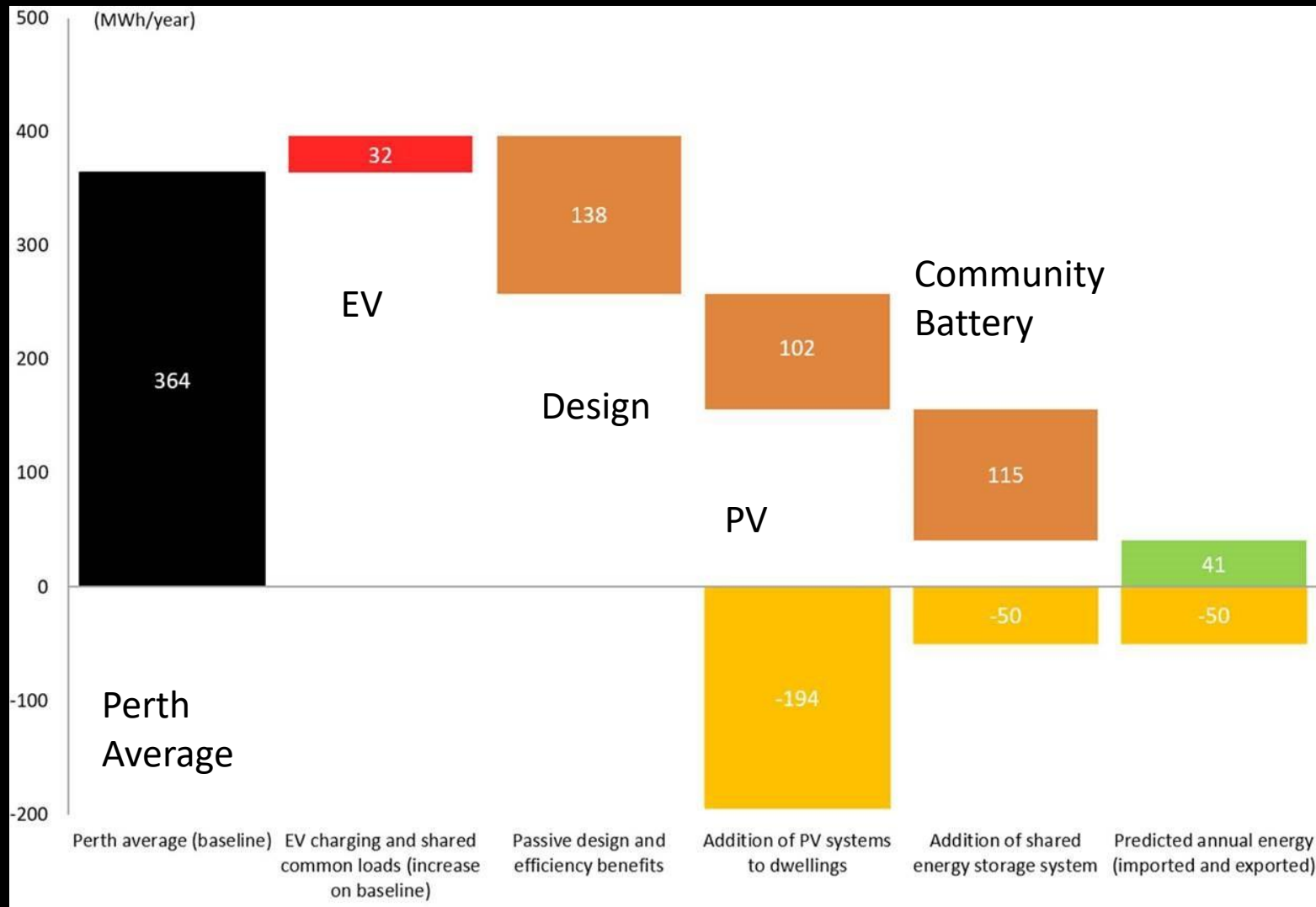


Curtin University



Development WA

NET ZERO, 80-120% less Carbon, 20% less cost



Curtin University



Net Zero Projects gathering momentum in WA...

All have a microgrid with one connection to the grid

- Shenton Village
- Roe Industrial Park
- Smiths Beach
- Witchcliffe Ecovillage
- Peel Industrial Estate

- Who manages the microgrid?
- Can local government be an 'aggregator' of microgrids into a net zero zone?



Can urban regeneration be facilitated as Net Zero, eg in middle suburbs?

31 out of 34 want to redevelop as a Precinct!



palgrave pivot

Greening the Greyfields
New Models for
Regenerating the Middle
Suburbs of Low-Density
Cities

Peter W. Newton
Peter W.G. Newman
Stephen Glackin
Giles Thomson

OPEN ACCESS

palgrave
macmillan

Free book



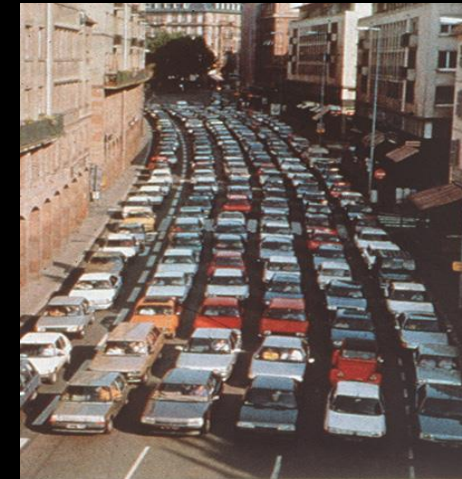
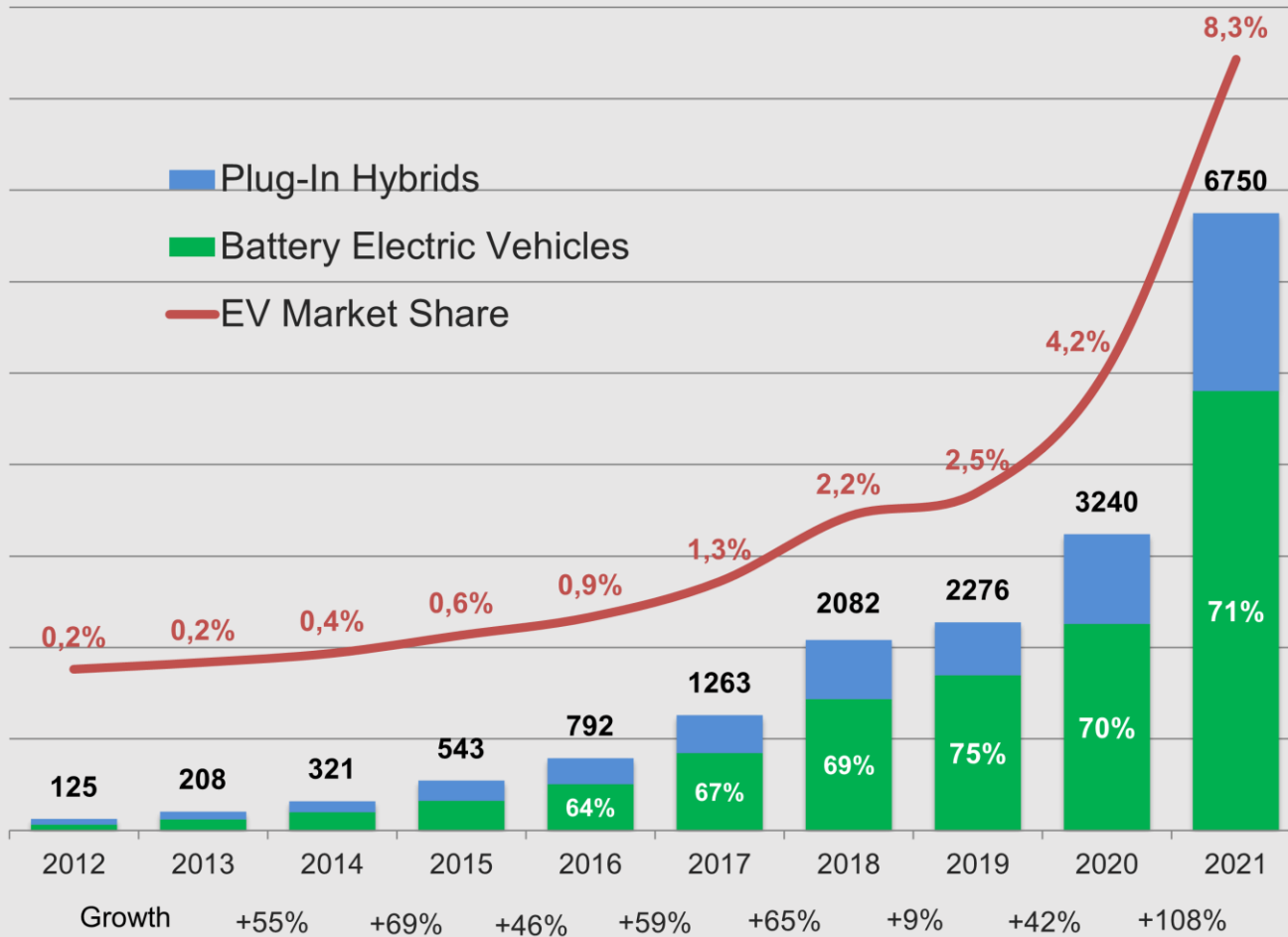
TRANSPORT IS NEXT BIG CHANGE

EV's Batteries have dropped in cost 85% in 2010-19

EV Cars are still cars!

GLOBAL BEV & PHEV SALES ('000s)

EV VOLUMES



240 Persons travel to work:

-- in 177 Cars

-- in 3 Busses

-- in 1 Tram



The alternative...

Creating Transit Activated Corridors



EVERY LOCAL AREA WANTS TO BE LIKE THE INNER CITY....

The remaking of Cecil Avenue, Cannington

This is what most local governments are trying to build....

Mid-Tier Transit makes it possible

TRACKLESS TRAMS...batteries on roof, sensors guiding it along a 'track', mid-tier capacity.



Sustainable
Built Environment
National Research Centre

Delivering Integrated Transit,
Land Development and Finance

A Guide and Manual with Application to

TRACKLESS TRAMS

A GUIDE AND MANUAL WITH APPLICATION TO: TRACKLESS TRAMS - SEPTEMBER 2018



By Peter Newman, Mike Mouritz, Sebastian Davies-Slate, Evan Jones,
Charlie Hargroves, Rohit Sharma and David Adams



Characteristic	BRT	LRT	ART
Speed and capacity	✓	✓✓	✓✓
Ride quality	✗	✓✓	✓✓
Land development potential	✗	✓✓	✓✓
Cost	✓	✗	✓
Disruption to services and local economy in construction period	✓	✗	✓✓
Implementation time	✓	✗	✓
Overall	✓	✓✓	✓✓✓

TRACKLESS TRAMS

70kph, 300-500 capacity, bidirectional

Active suspension, anti-sway, anti-bump, self-guided.

5% land value increase in Gold Coast; 20% in Perth

\$180m/km for LRT; \$4m/km TT without road upgrades.

Can install over a weekend
NO DISRUPTION LOCALLY

Can be built locally in a few months

Pretty good...





Sustainable
Built Environment
National Research Centre

Delivering Integrated Transit,
Land Development and Finance

A Guide and Manual with Application to

TRACKLESS TRAMS

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Charlie Hargroves, Rohit Sharma and David Adams

Free GUIDE and MANUAL
- available

SBEnc.com.au VIDEOS and PAPERS

TRIAL this year...

The TRACKLESS TRAM TRIAL



The origins of TT innovations are from HSR



Partners and Steps....

- We are working with two suppliers to bring different versions of the trackless tram to Perth
 - ART (LIDAR, cameras, etc)
 - DART (magnetic guidance)
- Supporting the City of Stirling's business case with technology due diligence
- Setting up pavement research with Curtin pavement lab, Arup and MRWA.
- Working through Development WA currently evaluating Midland Workshops as a test site
- Building a consortium of partners
- Setting up a PBS modelling certification with ARRB



ART (Autonomous Rapid Transport)



DART (with Intelligent Digital Rail Transit)



**AUSTRALASIAN
LOGISTICS GROUP / PPD**

Example of testing needed...PAVEMENT TEST

Trackless trams have axle loadings between **7.5 and 9 tons**, well within the maximum axle loadings permitted for two-axle buses (drive axle 12 tons, steer axle 7 tons*). Despite this, pavement wear uncertainty is consistently raised as a risk to deployment of the vehicles.

We are considering the question from two perspectives:

- **Reduced or increased** pavement wear and tear on a standard pavement like Scarborough Beach Road? Is the lifecycle cost higher or lower?*
- **What kind of pavement do we need to build if** standard pavement surface impact is too high? How does this compare to the lifecycle cost of light rail infrastructure (factoring in economic disruptions)?

The two approaches to modelling the impact are:

- **Pavement laboratories** physically simulate a tram wheel on a test sample of pavement at accelerated rates. Curtin and ARRB maintain such facilities and core partners of SBEnrc.
- **Computer models** can simulate wear and tear using vehicle specifications. Curtin, Main Roads, ARRB and Arup are experienced in this kind of simulation.

What can a Trackless Tram do to a Corridor? Imagine the Possibilities



Transformation of a city...

How do you make the transition to Net Zero using TT's and TAC's?

CITY SHAPING to create Net Zero Corridors

- along a string of *net zero precincts*

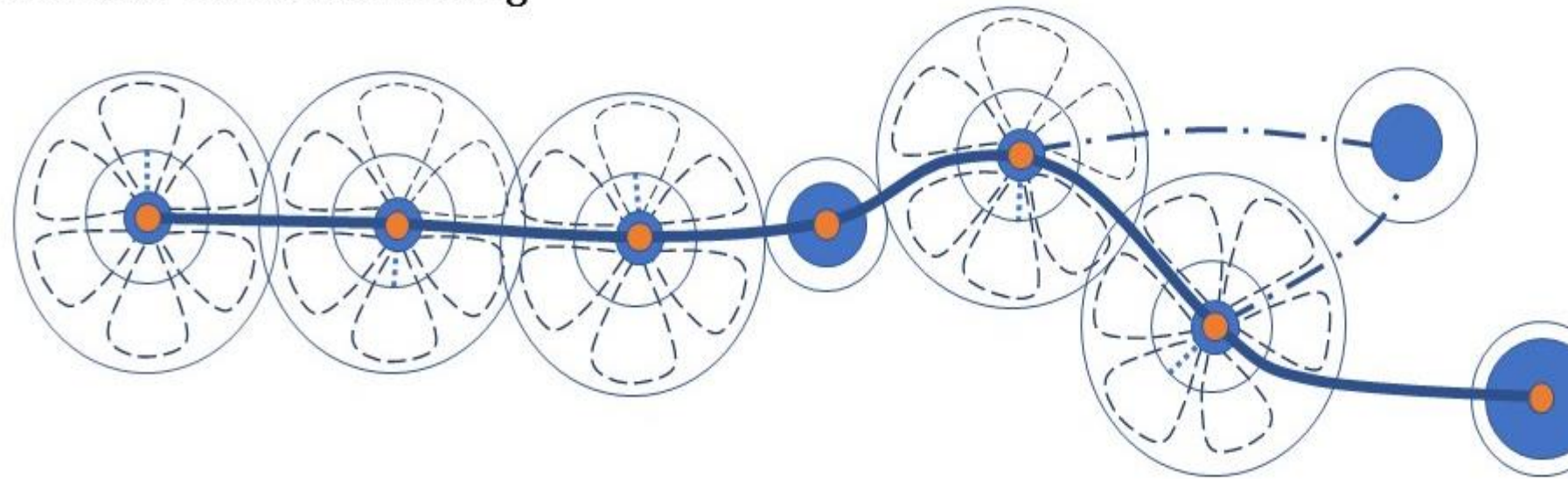
'Movement and Place' Strategies...



Micromobility feed-in, shared and private.



Corridor Transit Commuting



Importance of 'last mile linkage'.... Electric shuttle bus - on-demand managed locally?



Transit Activated Corridor – Trackless Tram with net zero station precincts



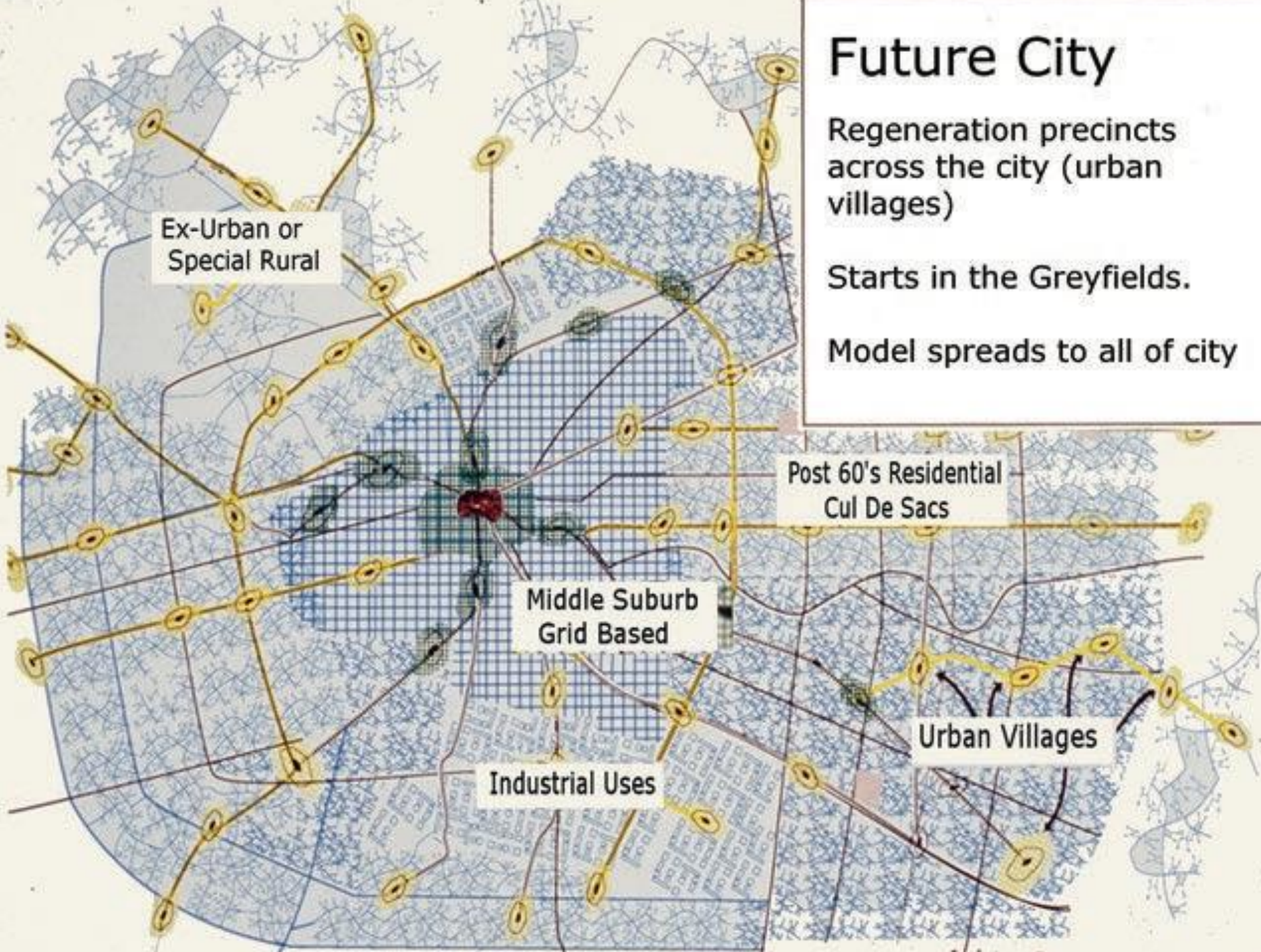
Microgrids in precincts spread into surrounding suburbs like tentacles....

Future City

Regeneration precincts across the city (urban villages)

Starts in the Greyfields.

Model spreads to all of city



Ex-Urban or Special Rural

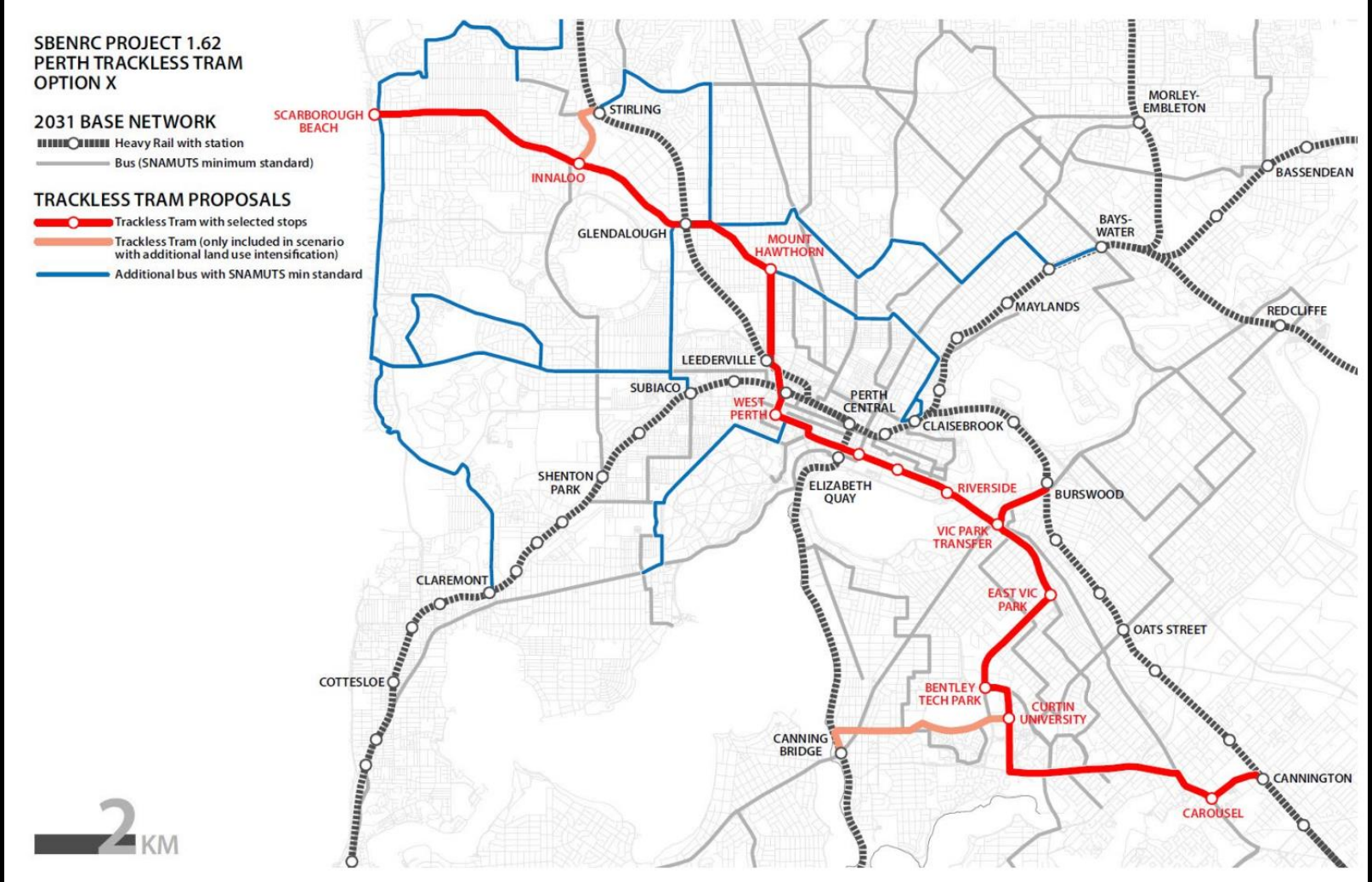
Post 60's Residential Cul De Sacs

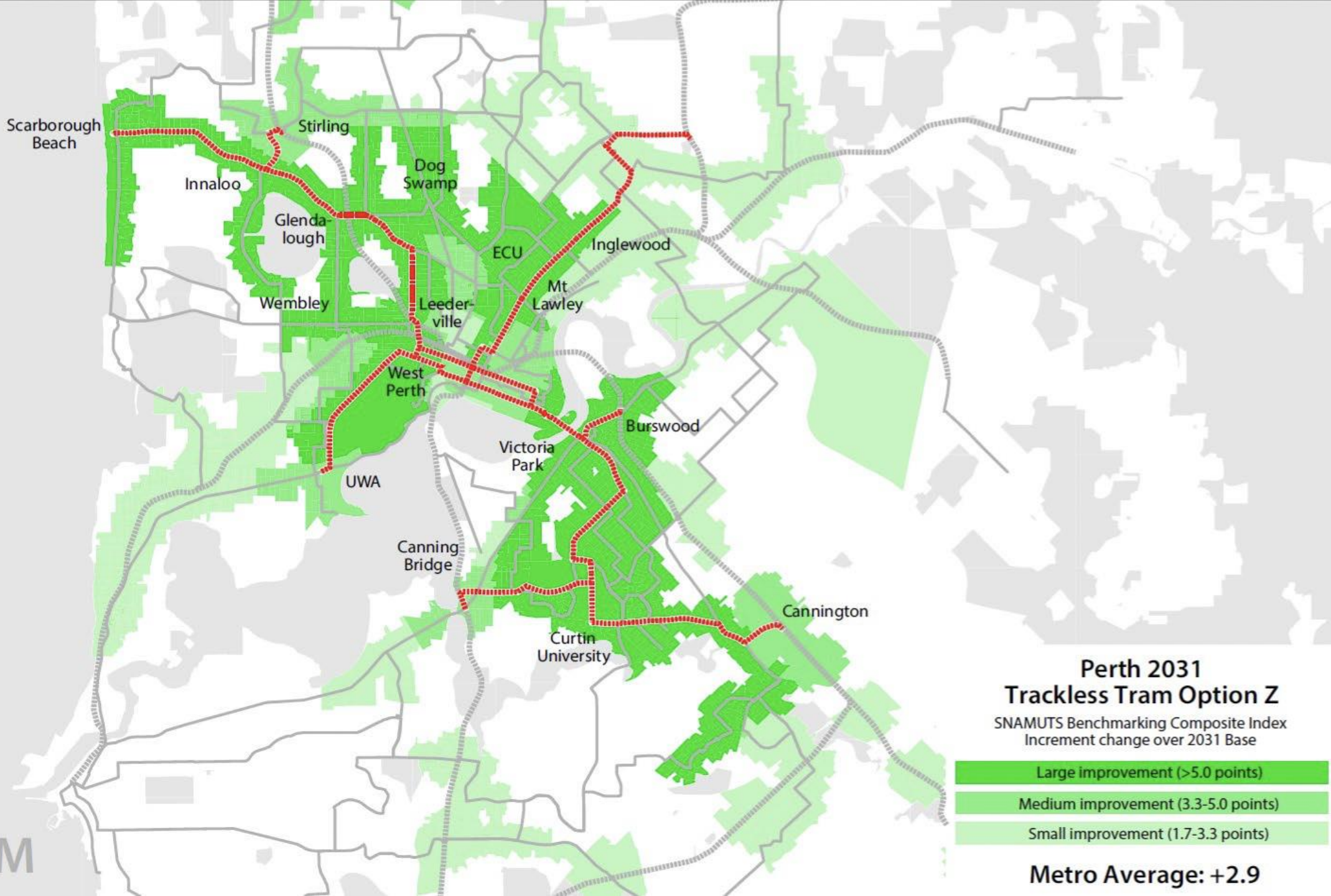
Middle Suburb Grid Based

Industrial Uses

Urban Villages

Need to start down a main road corridor and look for the best redevelopment sites for stations...





Scarborough Beach

Stirling

Dog Swamp

Innaloo

Glendalough

ECU

Inglewood

Wembley

Leederville

Mt Lawley

West Perth

Burswood

UWA

Victoria Park

Canning Bridge

Cannington

Curtin University

Perth 2031 Trackless Tram Option Z

SNAMUTS Benchmarking Composite Index
Increment change over 2031 Base

- Large improvement (>5.0 points)
- Medium improvement (3.3-5.0 points)
- Small improvement (1.7-3.3 points)

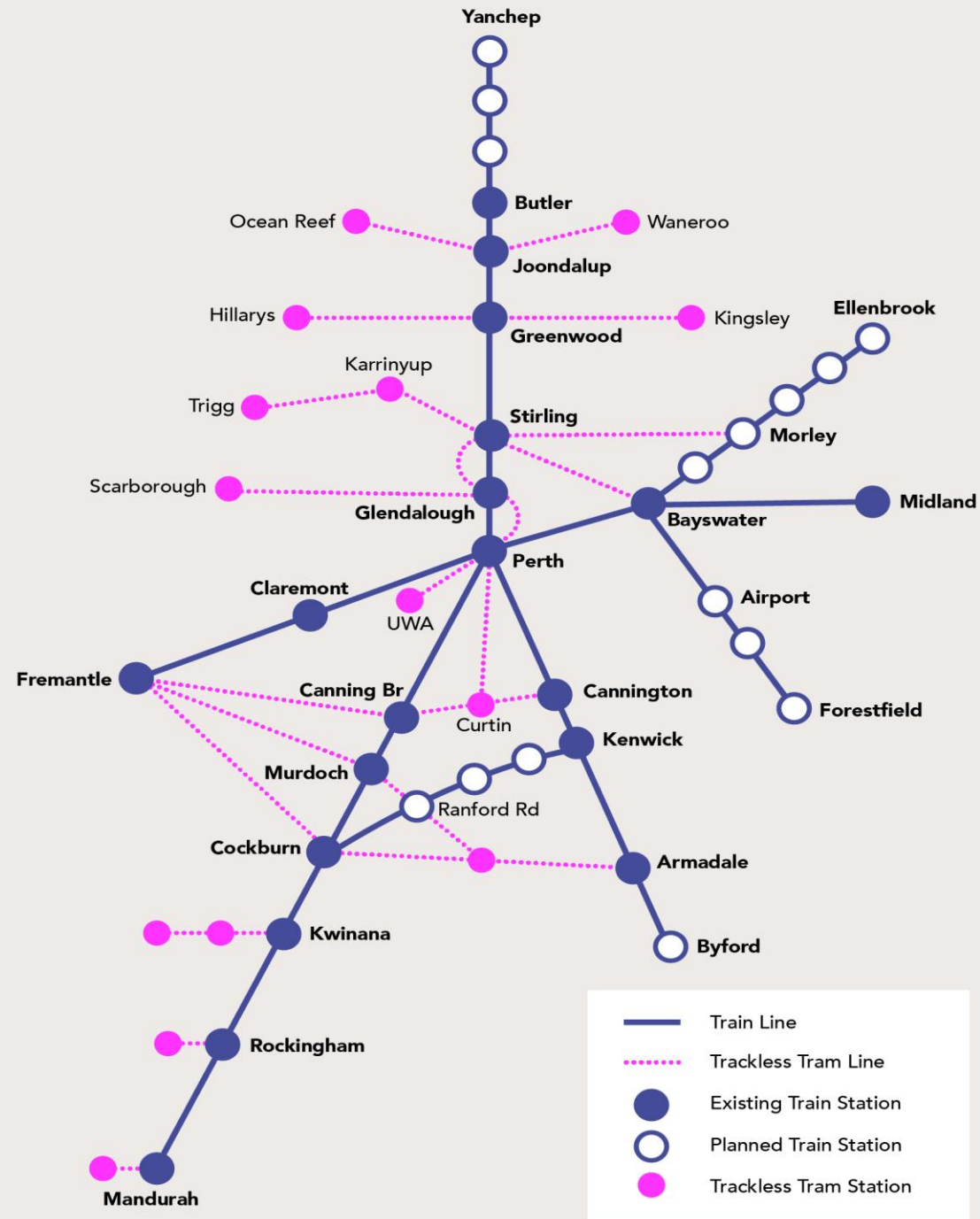
Metro Average: +2.9

5 KM

Mid-Tier
Connections
across the
corridors.

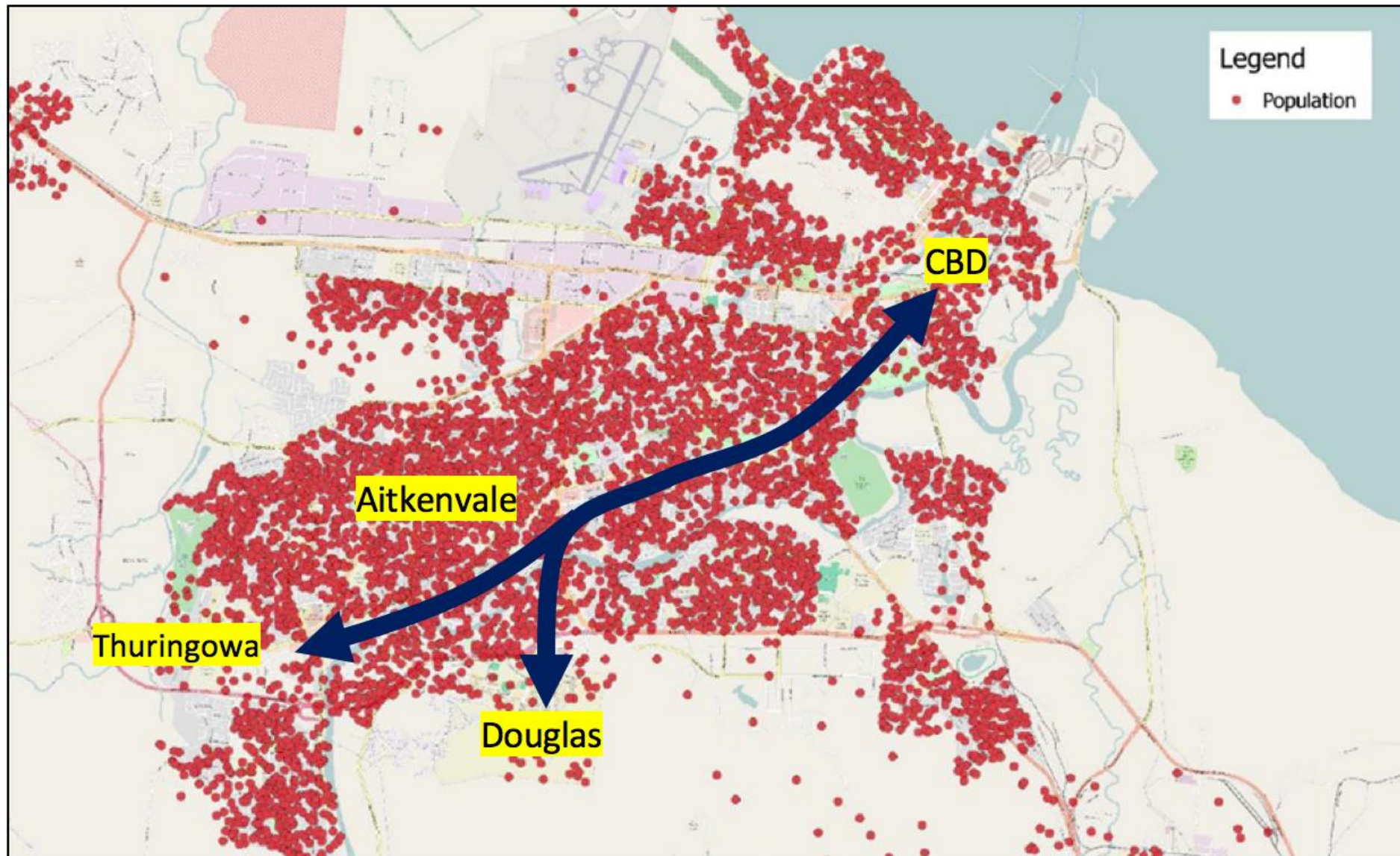
Urban
regeneration
opportunities

Movement
and Place
Strategy



Queensland Projects....

Townsville



²Figure 3: Proposed Metro route in relation and population clusters

Sunshine Coast: Mass Transit Strategy



Sunshine Coast: Precinct Planning/TACs



Affordable Living Paper – Urban Regeneration



Principles of Housing Affordability

- Building on SBEnrc Projects 1.62 & 1.71



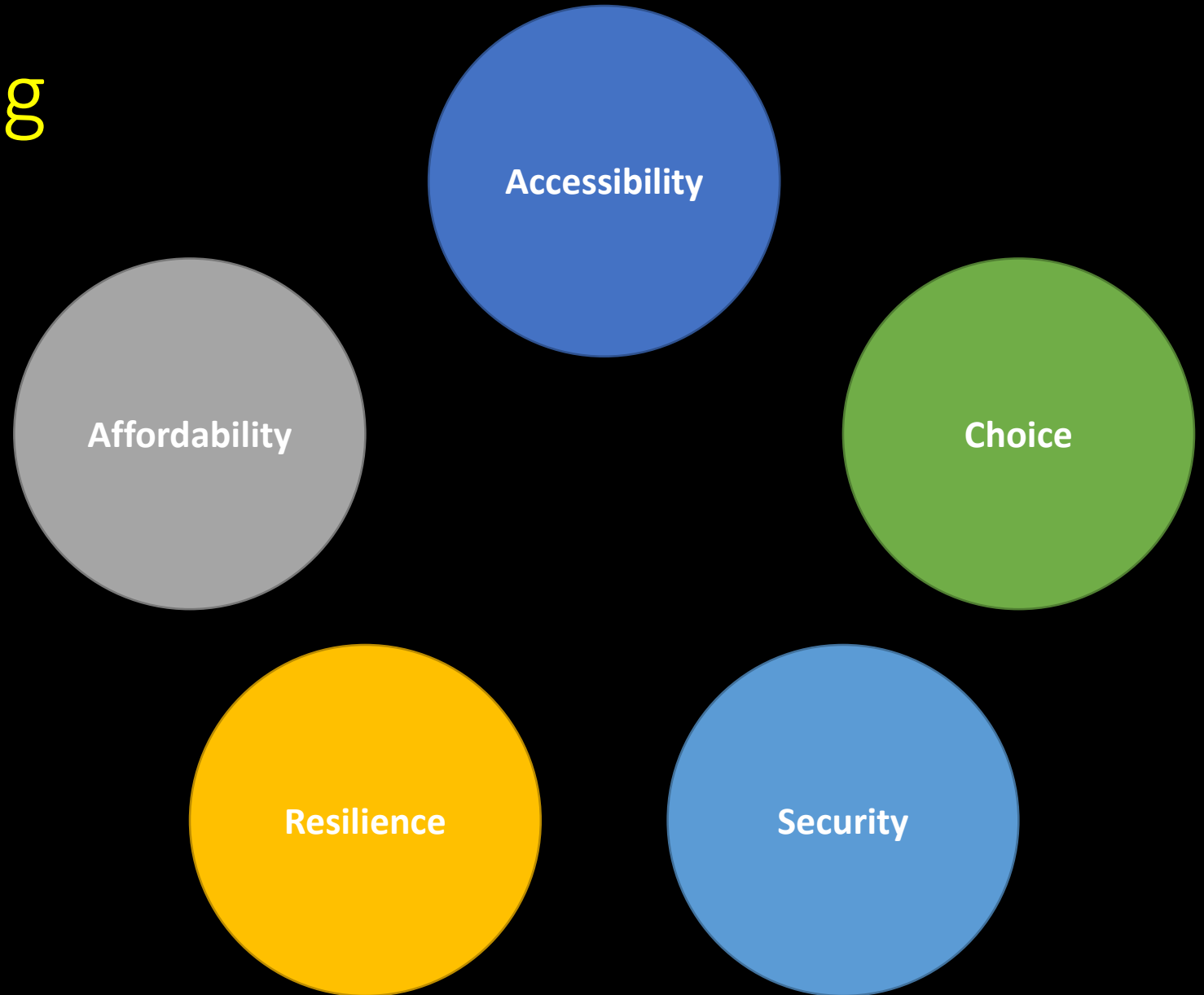
A Liveability Framework for Social and Affordable Higher Density Housing

Final Industry Report, Project 1.71



Indicators of Affordable Living

Using fundamental of SNAMUTS - inform design thinking



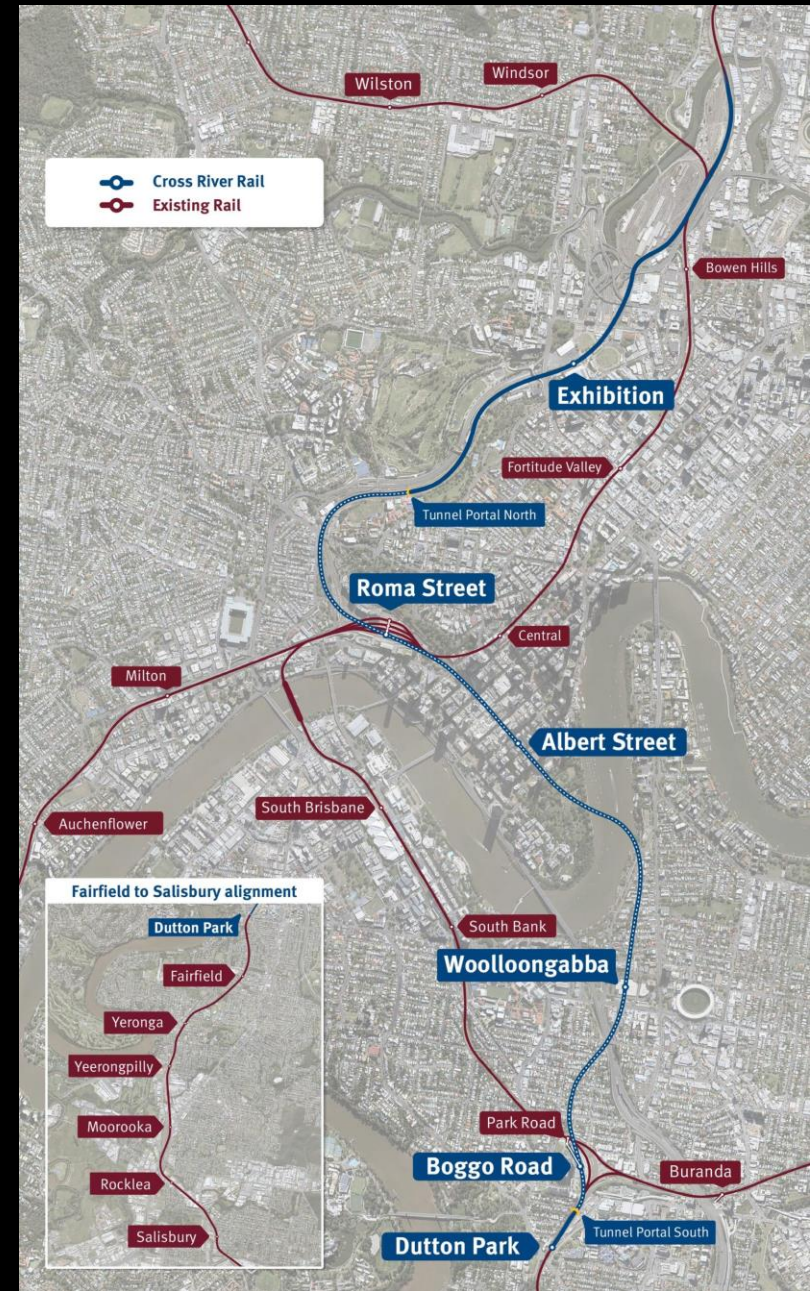
Brisbane Metro. European version of Mid Tier E-Transit



Brisbane urban regeneration opportunities from Cross River Rail and Metro



Olympics



SNAMUTS modelling...

Ensuring that mid-tier transit routes and urban regeneration are integrated and creating a *better transit network* and a *better, less car dependent city*.

spatial network analysis for multimodal urban transport systems (snamuts)

SNAMUTS is a GIS-based analytic tool for public transport network performance, spatial accessibility and integrated land use-transport planning.

It is inspired by the Space Syntax and Multiple Centrality Assessment methodologies and takes a **supply-side, discursive, network-wide perspective** on trans-disciplinary decision-making tasks:

What is the role of the public transport system in facilitating movement and activity across a city region?

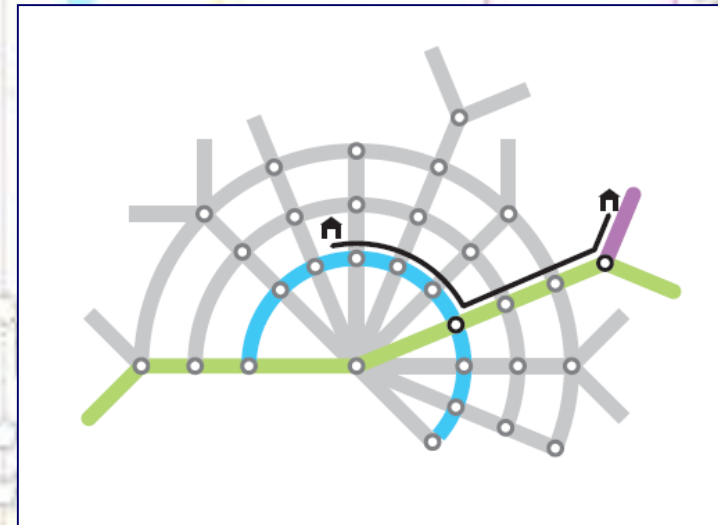


shamuts global

- + Singapore
- + Hong Kong
- + Göteborg
- + Helsinki
- + Stockholm
- + Oslo
- + Zuid Holland
- + Utrecht



'the network effect'



The performance of a network can be improved through **locally optimised routes, good interchange facilities, high and standardised service frequencies, timetable coordination and the presence of routes in different directions (radial, orbital, diagonal).**

Map Sources: www.railpage.com.au, www.hitrans.org

how can smartuts help us make better policy decisions?

Network Effect: The utility of a public transport network is greater than the sum of its parts!

Interplay of Land Use and Transport: How does urban growth translate into added pressure on public transport, and where does it provide new opportunities for movement?

Latent Demand: Identifying public transport market potential in areas where it is currently marginal, and assessing infrastructure and service proposals for their ability to mobilise it

public transport from the user perspective



8 key snamuts indicators

Service Intensity
Operational input

Closeness Centrality
Ease of movement

Degree Centrality
Transfer intensity

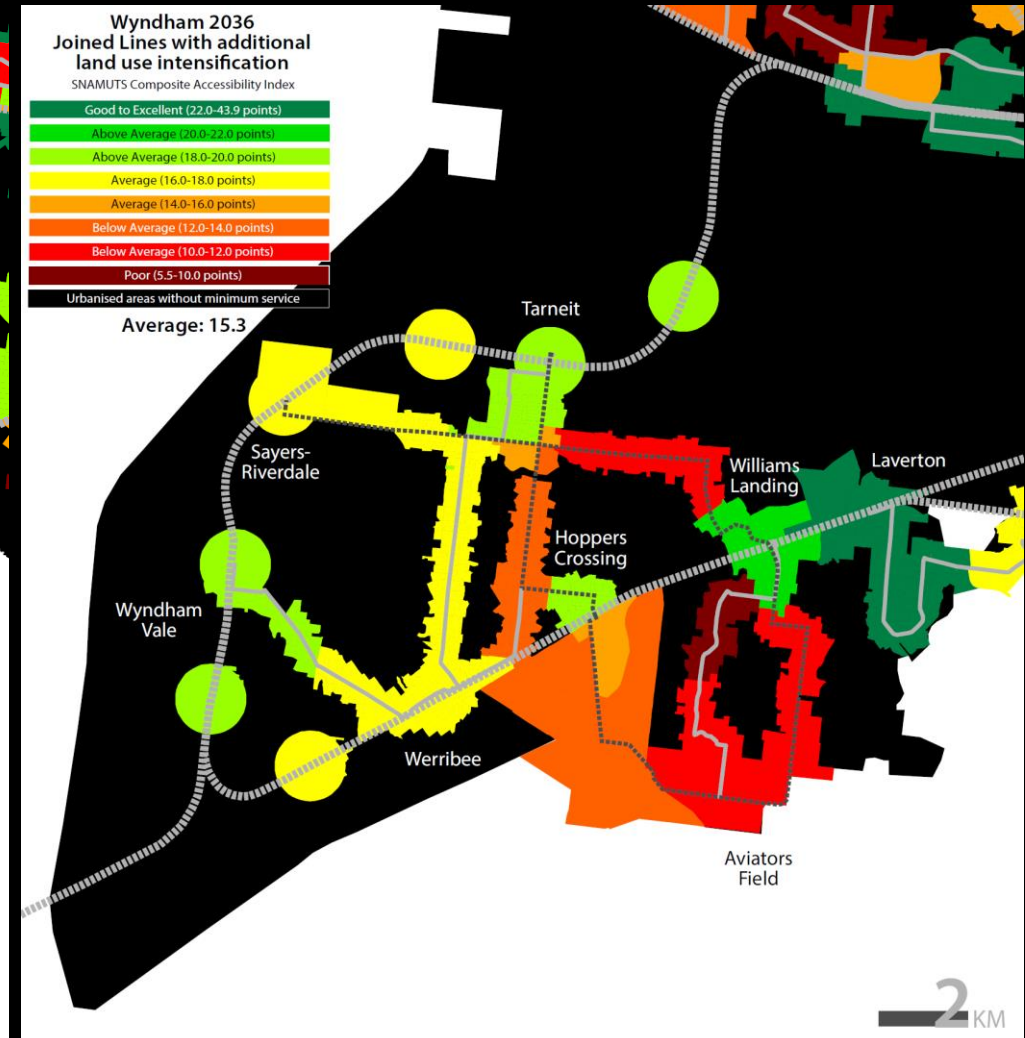
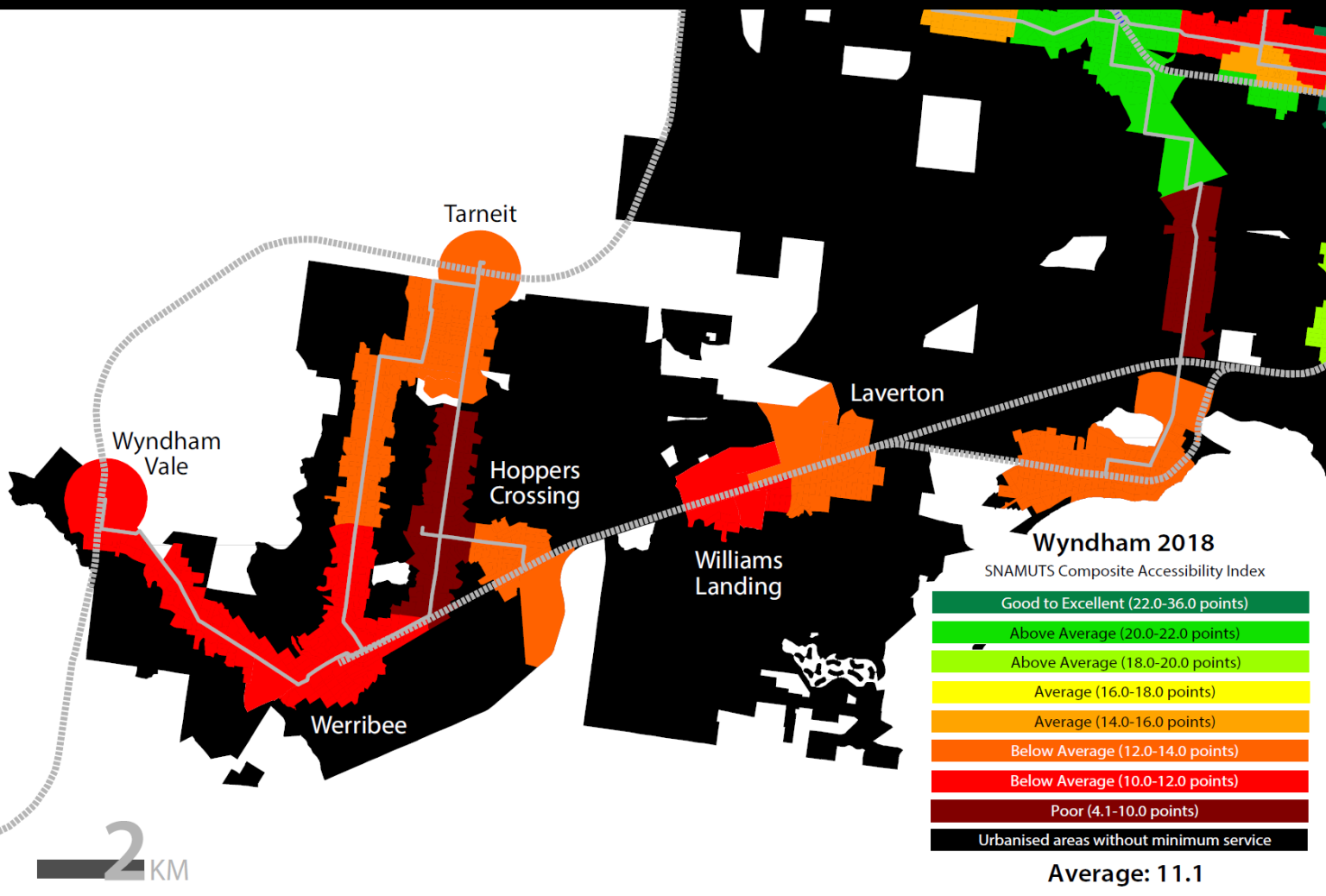
Network Coverage
Who gets access?

30-minute Contour
Catchments

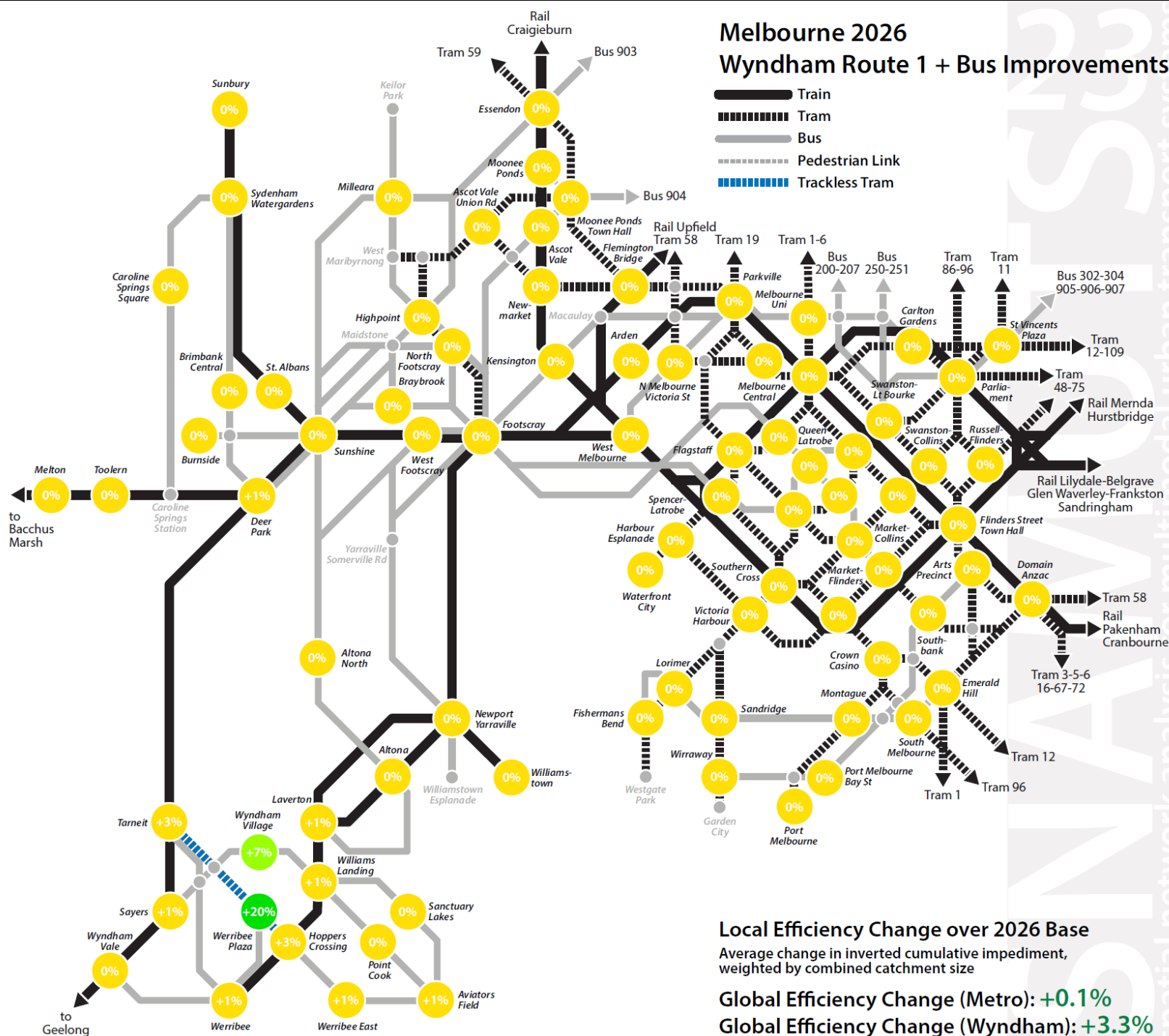
Betweenness Centrality
Presence and distribution of PT travel opportunities

Network Resilience
How future-proof is the public transport system?

Nodal Connectivity
Flexibility of movement in urban space

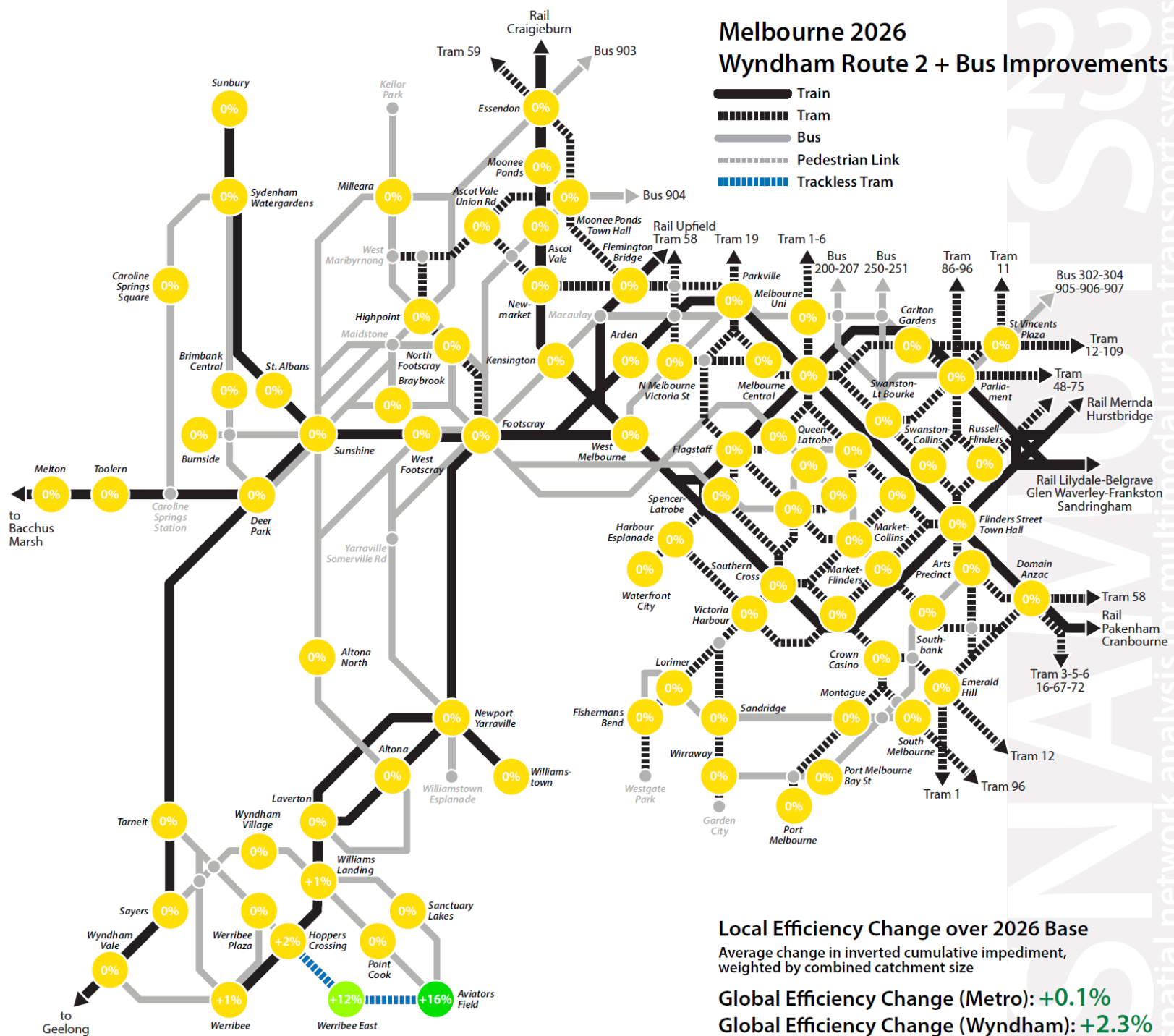


Melbourne 2026 Wyndham Route 1 + Bus Improvements



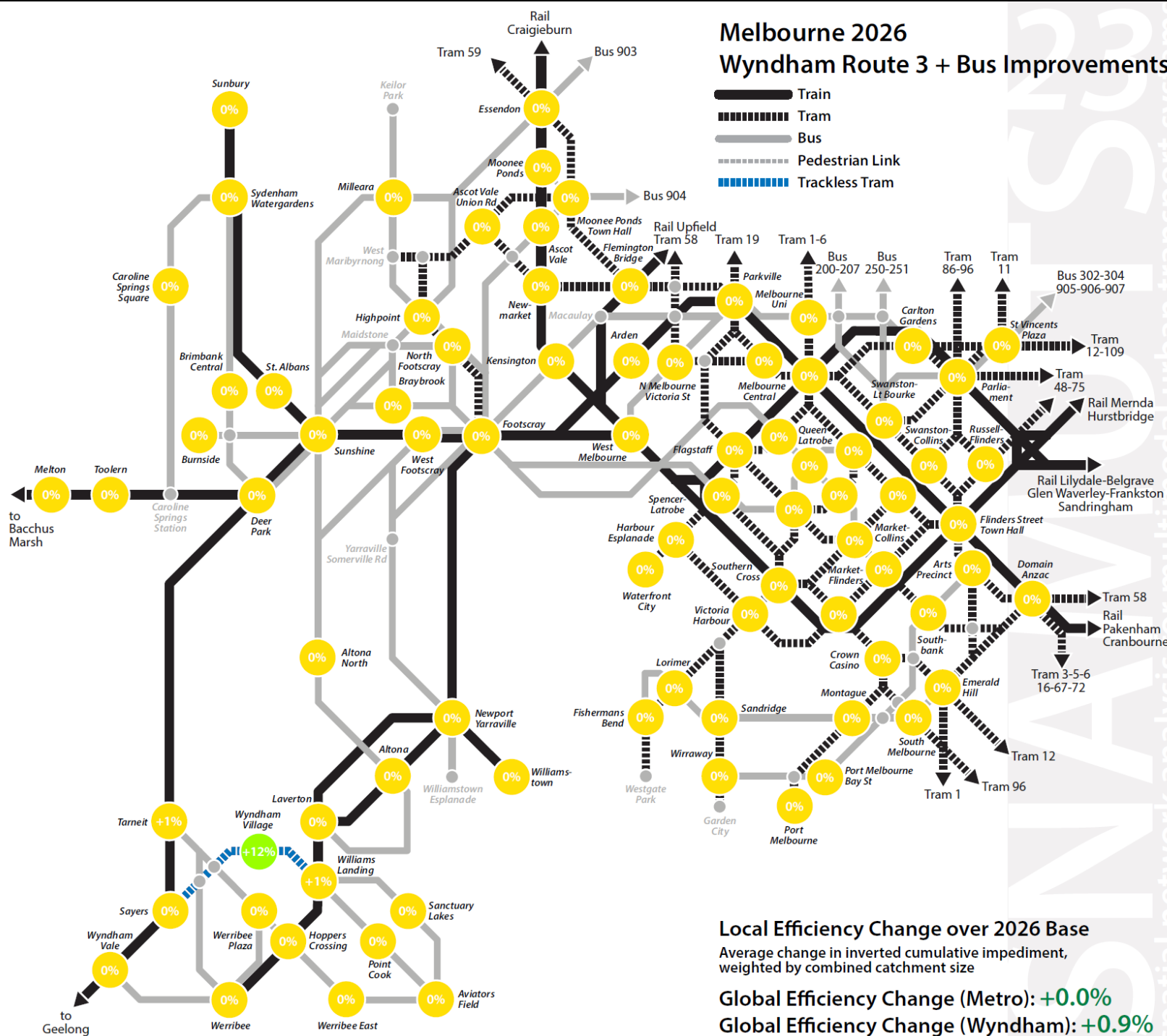
spatial network analysis for multimodal urban transport systems

Melbourne 2026 Wyndham Route 2 + Bus Improvements



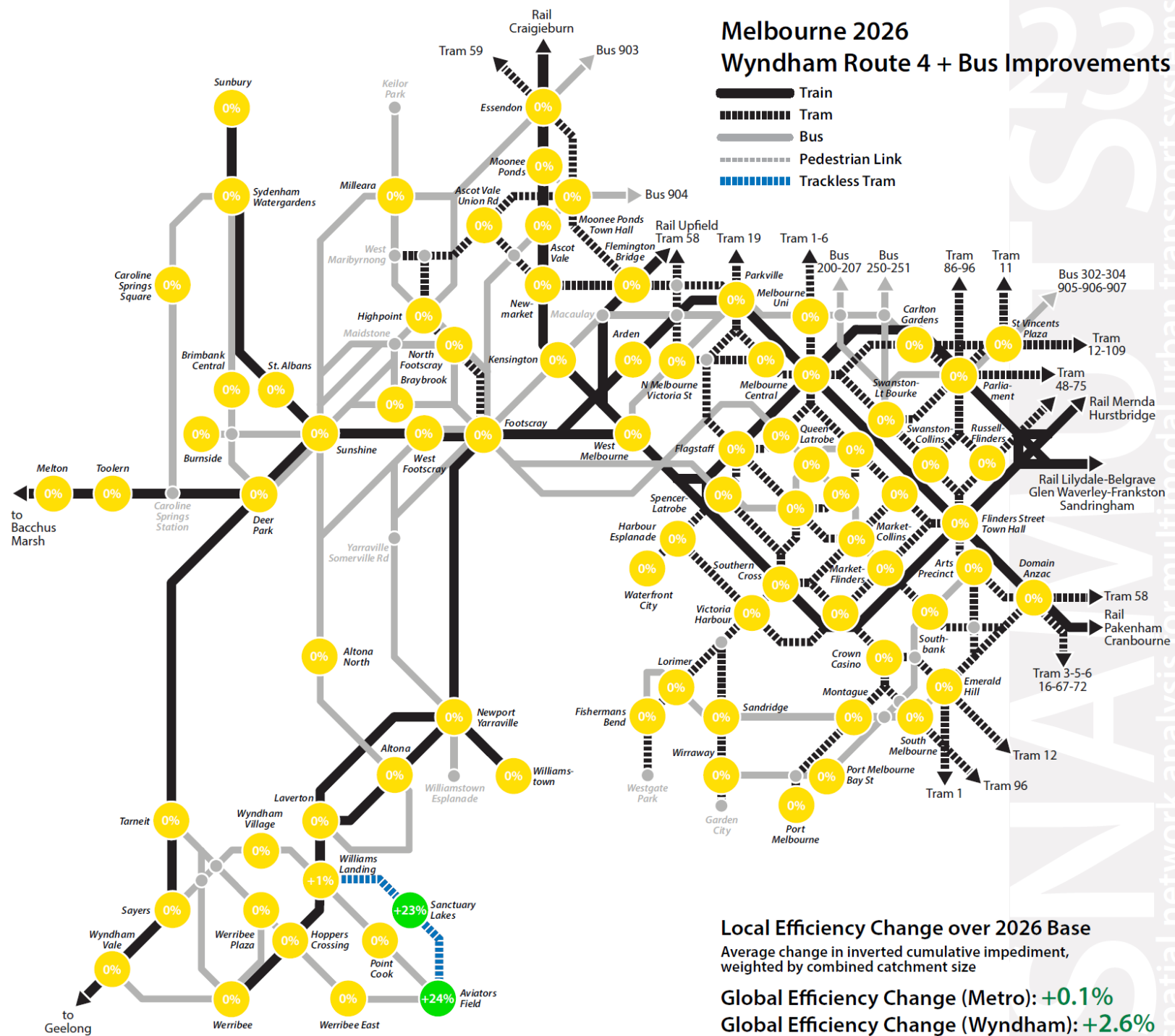
Spatial network analysis for multimodal urban transport systems

Melbourne 2026 Wyndham Route 3 + Bus Improvements



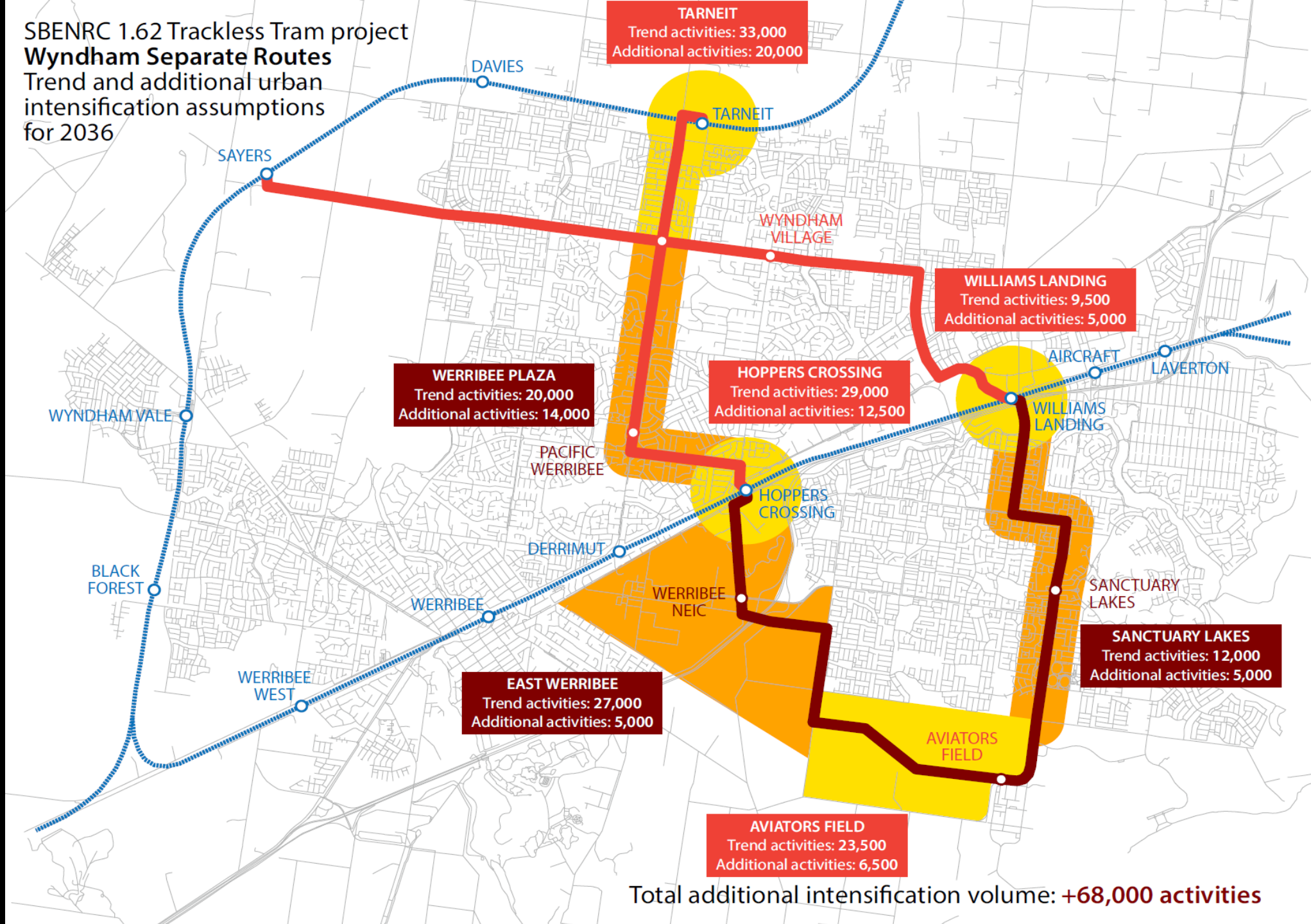
Spatial network analysis for multimodal urban transport systems

Melbourne 2026 Wyndham Route 4 + Bus Improvements



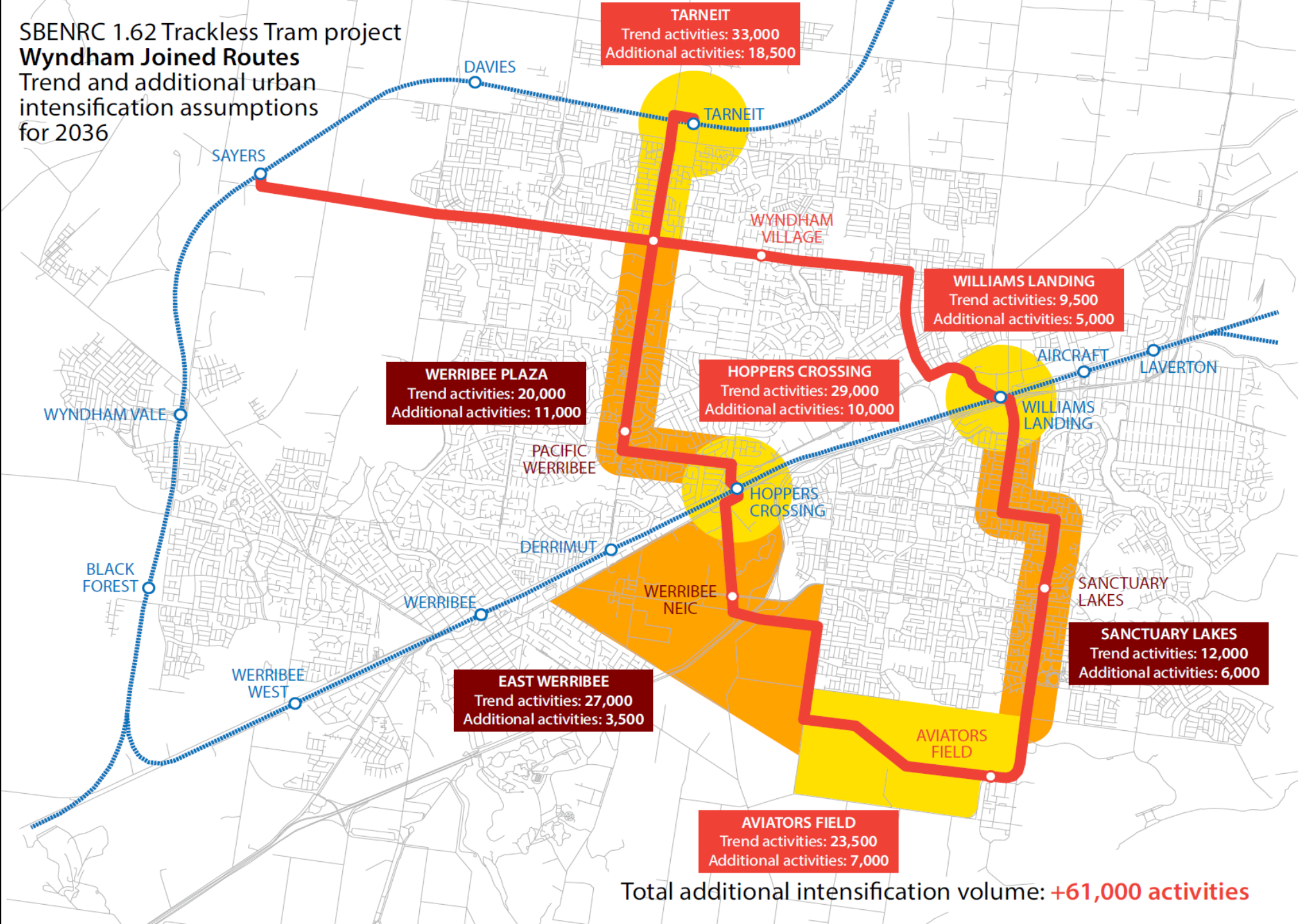
spatial network analysis for multimodal urban transport systems

SBENRC 1.62 Trackless Tram project
Wyndham Separate Routes
 Trend and additional urban intensification assumptions for 2036



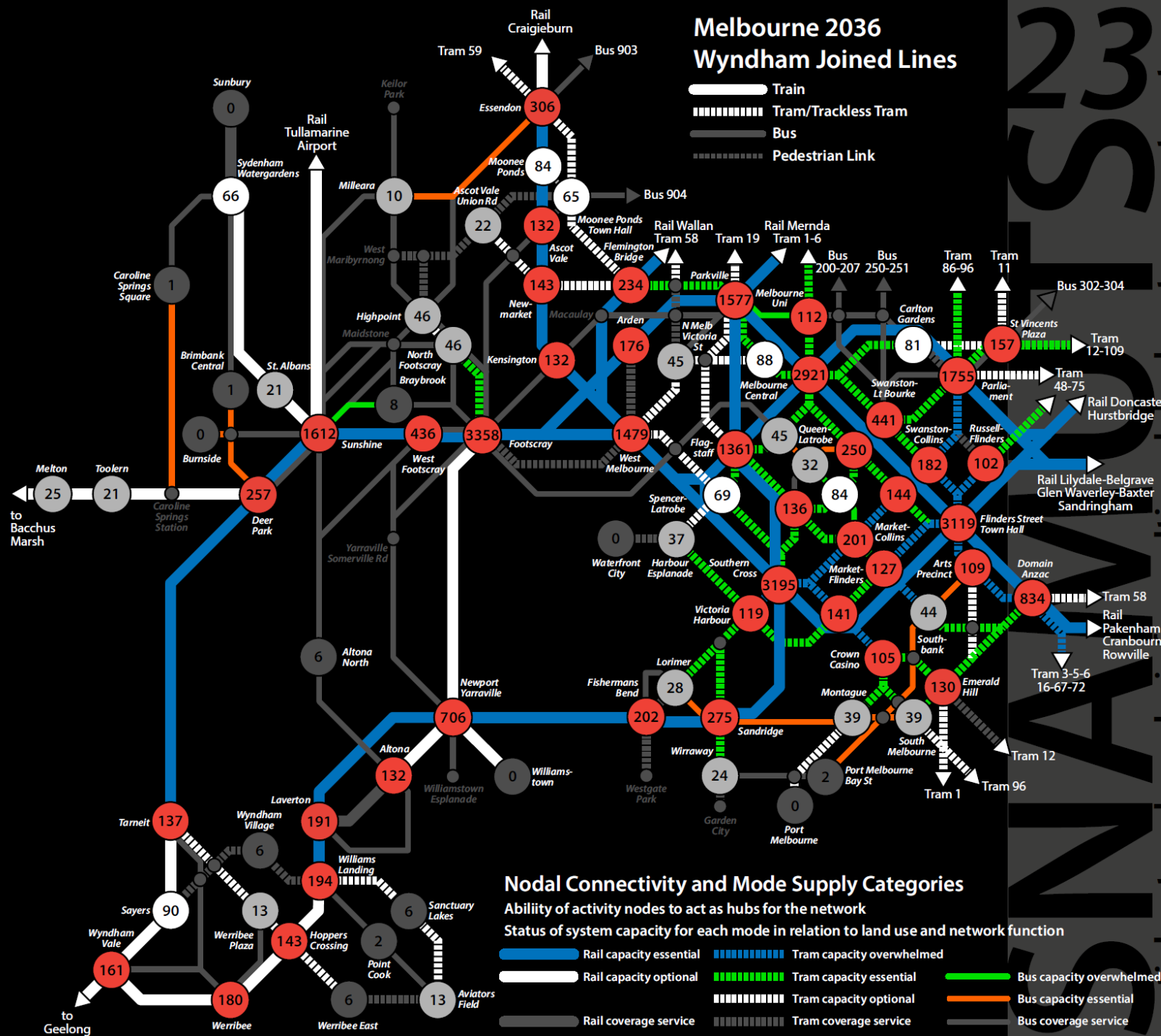
Total additional intensification volume: **+68,000 activities**

SBENRC 1.62 Trackless Tram project
Wyndham Joined Routes
 Trend and additional urban intensification assumptions for 2036



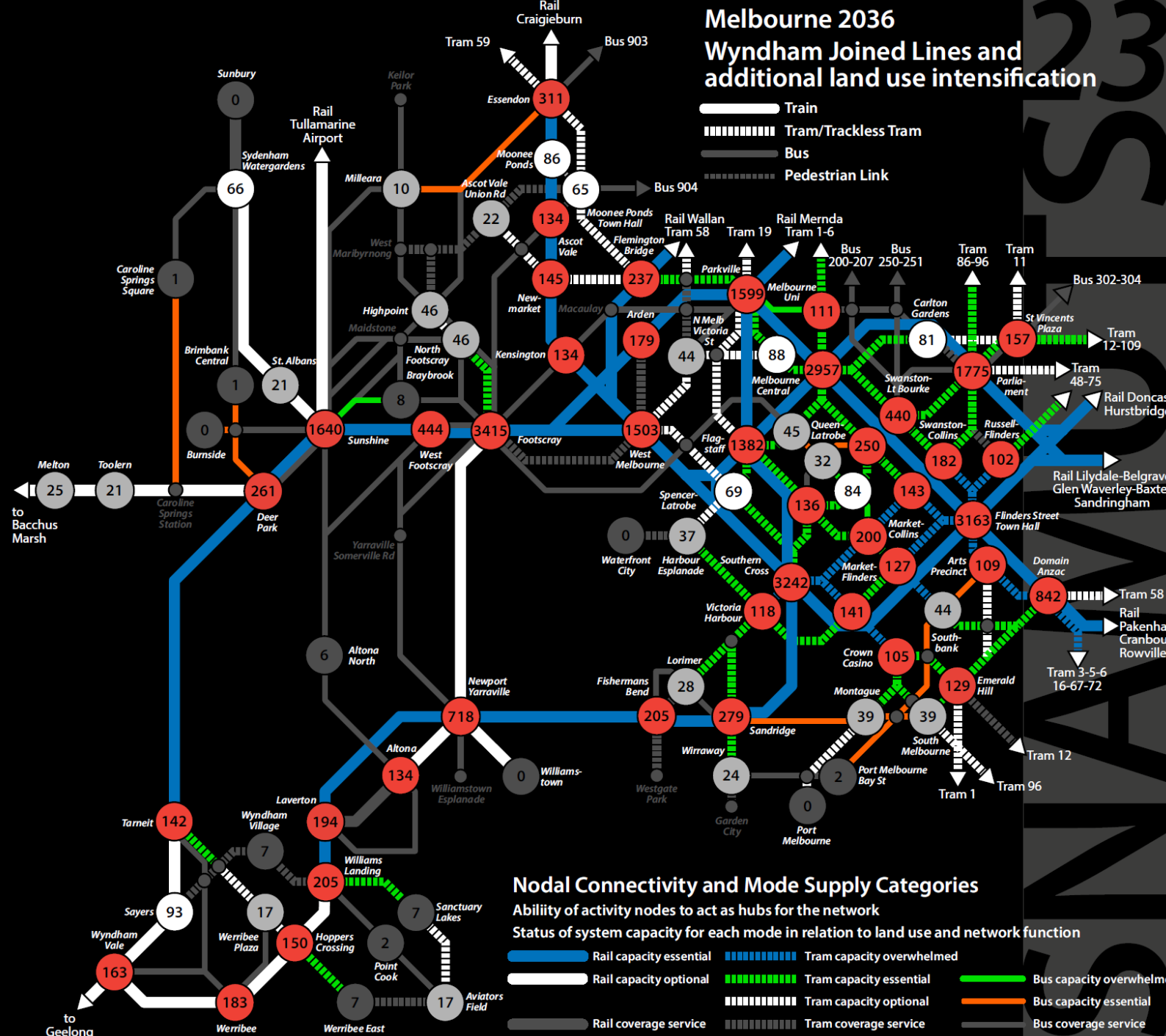
Total additional intensification volume: **+61,000 activities**

Melbourne 2036 Wyndham Joined Lines



23
23
 spatial network analysis for multimodal urban transport systems

Melbourne 2036 Wyndham Joined Lines and additional land use intensification



Nodal Connectivity and Mode Supply Categories

Ability of activity nodes to act as hubs for the network

Status of system capacity for each mode in relation to land use and network function

- Rail capacity essential
- Rail capacity optional
- Rail coverage service
- Tram capacity overwhelmed
- Tram capacity essential
- Tram capacity optional
- Tram coverage service
- Bus capacity overwhelmed
- Bus capacity essential
- Bus coverage service

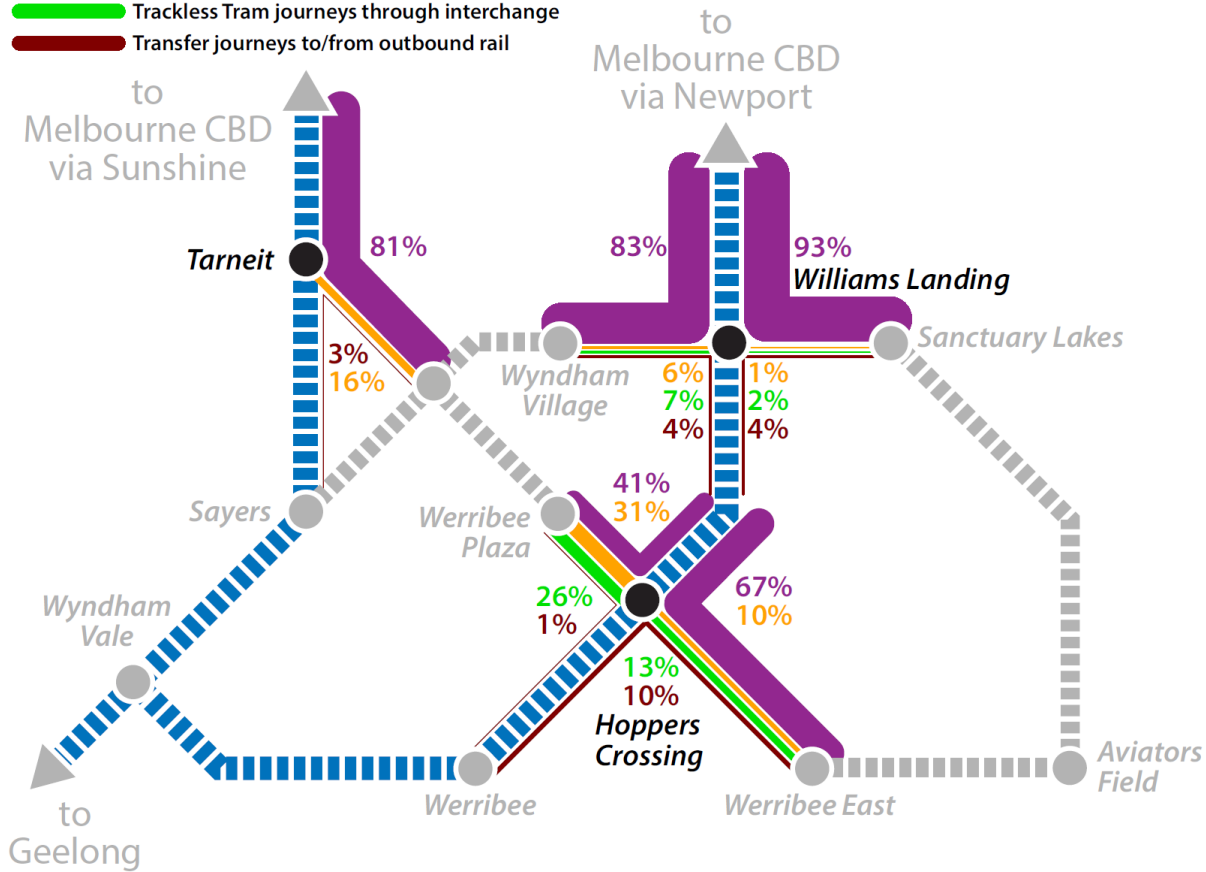
23
MNS
spatial network analysis for multimodal urban transport systems

Melbourne 2036 Wyndham Separate Lines and additional land use intensification

- Train
- Trackless Tram

Travel Opportunity Flow at Rail/Trackless Tram Interchanges

- Transfer journeys to/from inbound rail
- Destination journeys to/from interchange
- Trackless Tram journeys through interchange
- Transfer journeys to/from outbound rail

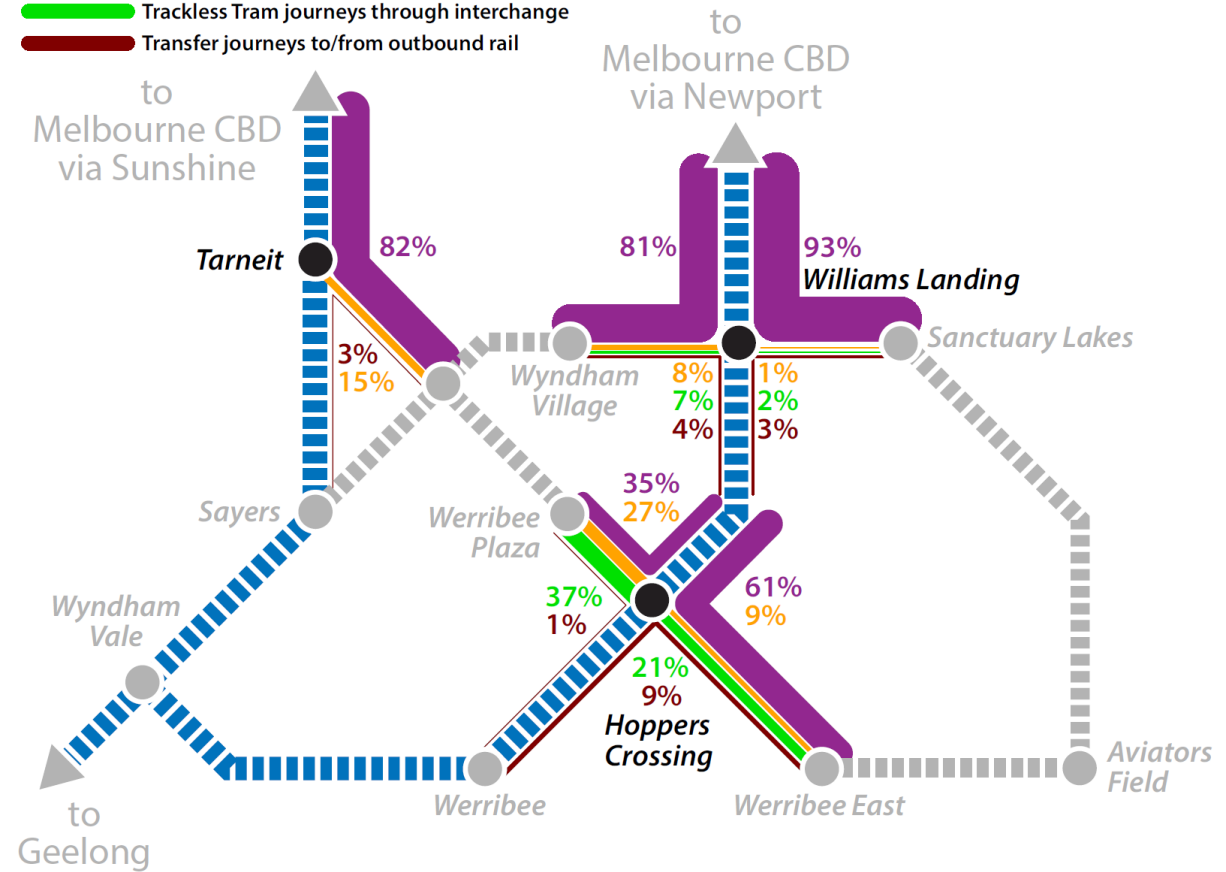


Melbourne 2036 Wyndham Joined Lines and additional land use intensification

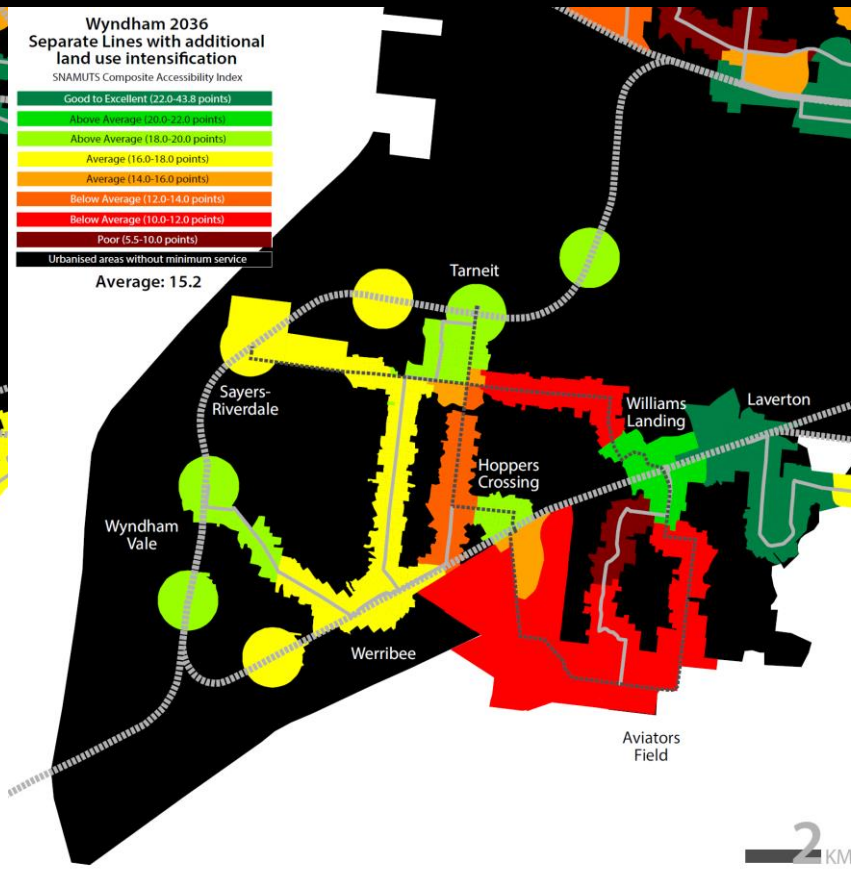
- Train
- Trackless Tram

Travel Opportunity Flow at Rail/Trackless Tram Interchanges

- Transfer journeys to/from inbound rail
- Destination journeys to/from interchange
- Trackless Tram journeys through interchange
- Transfer journeys to/from outbound rail



snamuts composite index



And the next projects applying TT and TAC...

FIFTEENTH AVENUE CORRIDOR



Liverpool TAC....

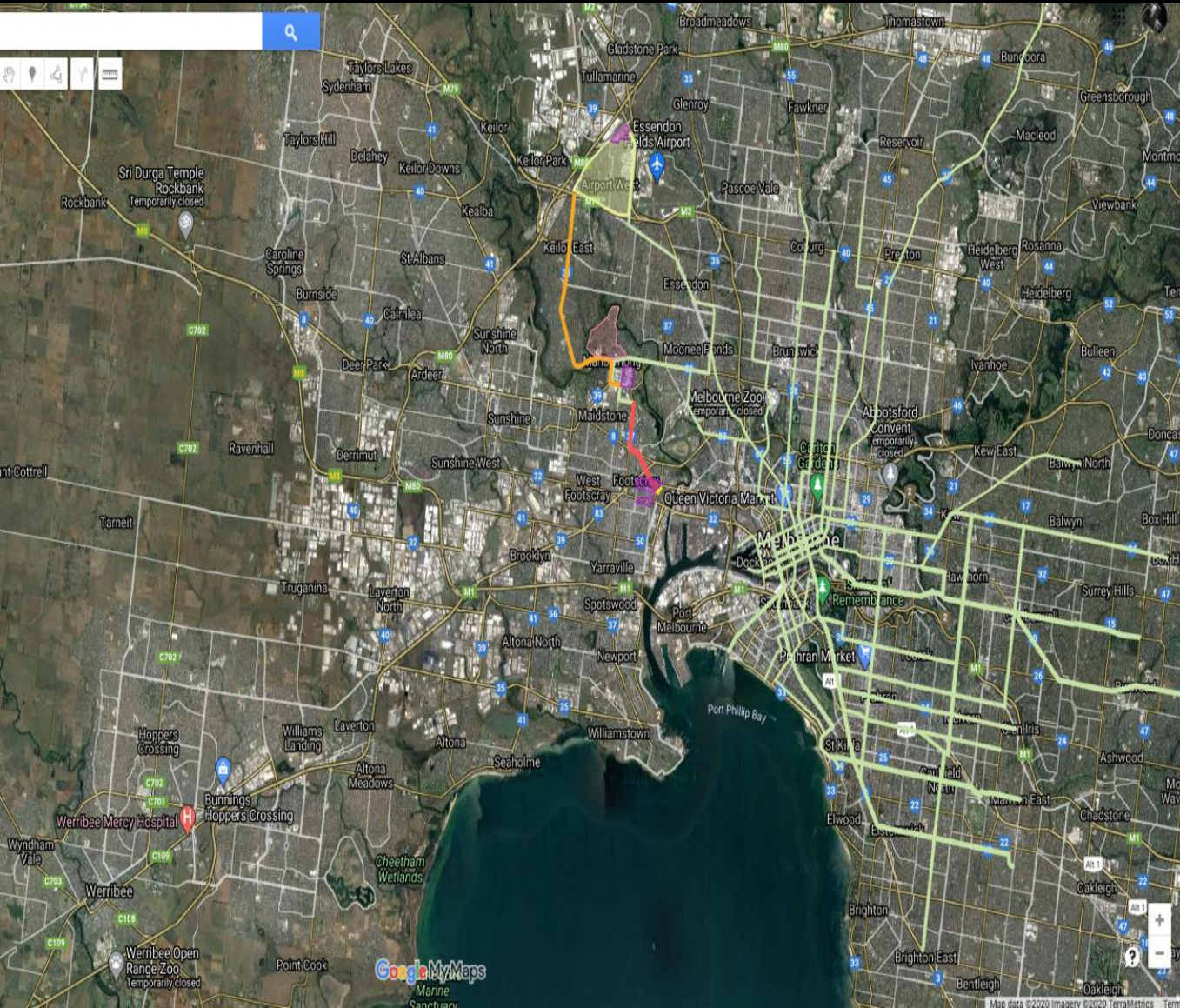




Fishermans Bend

And now...

The West Side Story



Regional Cities Commonwealth Games...

- Demonstrating to the world how to do Net Zero transport and urban villages...QATAR World Cup will have Trackless Trams
- Geelong, Ballarat, Bendigo, Shepparton.
- It is expected that the [Midland Highway](#), which links four host cities ([Geelong](#), [Ballarat](#), [Bendigo](#) and [Shepparton](#)) will receive upgrades in time for the games, with the possibility of a new northern train station to be constructed in Ballarat adjacent to [Eureka Stadium](#).



Geelong



Ballarat

TT's and TAC's not yet in US or Europe





General Electrics Building Boston

- Solar on buildings starting
- EV's mostly cars



Partnerships



- Integrated micromobility and walkability
- Attracts development so why not set up partnerships to help pay for it...

NET ZERO CORRIDORS:

Solar buildings in precincts based on shared microgrids that can expand to surrounding areas...integrating EV's into recharge hubs with e-transit accessibility across the city.

