



Trackless Trams and Transit Activated Corridors in Perth

Mid-Tier Transit and Urban Regeneration

Overview Report

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1 Executive Summary

The new mid-tier technology Trackless Tram is both good for transit and good for unlocking urban regeneration opportunities. Three years of study across Australia has confirmed that communities, investors and governments in regional towns like Townsville, big cities like Sydney and Melbourne, and a consortium of local governments across Perth, are ready to commit to this new technology and to the new process that could unlock major urban developments and create new jobs and improved community outcomes.

This overview report summarises how it can be done in Perth with options for a short central route, the whole corridor from Cannington to Scarborough or in a big Recovery Project for the whole city. The details provided are for the second option. The funding model involves Government purchasing the vehicles and enabling them to be recharged and stabled, with private developers paying to build stations into their development including the road works around them. Further Government funding for roadworks are estimated for the sections between stations and would be staged. Immediate jobs can be created around preparatory work and the whole project working in 18 months with urban development continuing for ten years.

The proposed options are:

1. A small initial project in Perth Central (through to Morley) could be done for AU\$108m in Government cost and would pay for itself in three years due to bus replacement savings.
2. The Cannington to Scarborough project 30km long would cost Government \$130m and with private developers in partnership paying for station precincts of \$180m (100metres either side for road works) for 30 different station precincts by 30 different developers. This would lead to investment in land development of \$19.8b due to the increased land value from the Trackless Tram over a ten-year building project. Roadworks between stations will cost \$576m but would be staged as the system can be running in 18 months. 178,000 jobs would be created directly and 732,600 jobs indirectly from construction and development over ten years with around 10% created each year, i.e. 17,800 directly and 73,260 indirectly.
3. If this model was taken across a series of six other east-west routes in Mandurah, Rockingham, Armadale-Melville-Fremantle, Morley-Karrinyup, Hillarys-Greenwood, and Ocean Reef, then the project would cost Government \$485m with private investment in station precincts costing \$672m. Substantial but un-researched investment in land development and jobs would be created but would be around three times the level in Option 3. Later roadworks would cost \$2.15b to complete the separate transit-ways.

Table 1 - ES Summary of costs and jobs created for Option 2 Trackless Trams and urban development

	Public Investment	Private Investment	Private Investment in Land and Jobs Created
	In Vehicles, Recharge and Depot facilities (\$4.33m/km) ¹ Roadworks (\$19.2m/km) ²	Station precincts with 200m of road around it (\$6m each precinct) ³	from land development, (est value of land; with 9/37 jobs per \$1m) ⁴
Cannington to Scarborough TTS (including Option 1) 30 kms	Stage 1: Vehicles \$130m Stage 2: Roadworks \$576m	30 station precincts \$180m	\$19.8b with 178,000 jobs directly and 732,600 jobs indirectly over 10 years, 10% per year so 17,800 direct and 73,260 indirect.
Whole of Perth Metro TTS (including Option 1 and 2) 112 kms	Stage 1: Vehicles \$485m Stage 2: Roadworks \$2.150b	112 station precincts \$672m	Not researched but likely to be three times above.

The projects can begin almost immediately with road works and urban development procurement in particular sites as well as testing Trackless Trams in Perth and then procuring vehicles, completing roadworks and beginning services along the whole route within 18 months.

Below is more of the rationale for these conclusions and a Core Report gives further detail and analysis.

¹ See Core Report for details of vehicle costs and extra costs of fitting out recharge elements at stations and in Depots.

² See Core Report for estimate of roadworks for TransitWay

³ Based on 100m either side of station precinct with estimated roadworks costs of \$19.2m per km (see Core Report for details of this)

⁴ Jobs estimated at 9 direct and 37 indirect by Kemp (2020) and same as those used by Property Council, UDIA and Master Builders. Land value before Trackless Tram value increase has been used to estimate cost of investment.

2 The Project in Context

The emergence into a new economy due to the 2020 pandemic economic collapse, is a great opportunity. It is also a terrible time of uncertainty and hence the future direction of urban development and infrastructure needs to be something that can bring great hope to people in cities across the world as well as in Perth. This project is a world-first but it offers Perth an opportunity to make something special with a true legacy from this difficult time.

The Trackless Tram and its ability to unlock urban regeneration opportunities, has been an SBEnc project across Australia for the past three years. It has confirmed that communities, investors and governments in small regional towns like Townsville, big cities like Sydney and Melbourne, and a consortium of local governments across Perth, are ready to commit to this new technology and to the new process that could unlock major urban developments and create new jobs and new community outcomes.

What is the new technology in the Trackless Tram and what is the new process that is associated with its implementation?

Trackless Trams are a mid-tier transit system, i.e. they are not a heavy rail metro like MetroNet (which remains critical as the top tier technology for transit due to its speed and capacity down long corridors); it is not a bus which is a third-tier transit system essentially providing a service for many who cannot or do not want to use a car. Buses are more often than not much slower as they are part of the traffic. A second- or mid-tier transit is able to have its own transit lane but it is along main roads rather than along a completely separate permanent way as with a heavy rail. The three mid-tier technologies are Bus Rapid Transit (BRT), Light Rail Transit (LRT) and Trackless Tram Systems (TTS).

The novelty in a TTS is twofold:

1. It is electric with batteries on the roof (making it much cleaner and quieter for people thus enabling urban development around its stations) and
2. It is designed to travel very smoothly down a road with rubber wheels because it has special stabilization in its axles/bogies and sensors that have come from autonomous vehicle technology that guide it very precisely.

It is therefore significantly cheaper and quicker to build than a light rail as a result of not needing rail tracks or an overhead catenary. More detail is given in the Core Report.

The special ability to attract urban development around stations is particularly important as a TTS enables a new partnership approach that can include three levels of government, private developers with investment backing, and communities, to be engaged in enabling its delivery. This is both the route of the TTS and the station locations with their opportunities to create new local centres with a multitude of new services along a main road corridor – a Transit Activated Corridor. This means that a TTS is ideal for a post-pandemic Recovery Program as it can be delivered quickly and yet have long term legacy benefits.

As will be shown below, the Perth TTS is designed as a connector that runs East-West to meet at critical points along the major North-South corridors where METRONET is the necessary first tier system. Perhaps just as importantly this system unlocks major urban development opportunities where major employment can be created, providing a much stronger rationale for urban consolidation.

3 The Project in Overview

The project sets out the following options that could be adopted to bring a Trackless Tram system into Perth. The first option is a small step that could begin immediately in Central Perth with a leg to Morley. The second option is the Perth consortium concept over 30 km which has very detailed planning and costing. The third option is 112km across Perth taking a number of East-West routes to complement METRONET. The details are not complete as in Option 2 but are around three times the costs and jobs created.

3.1 Option 1 – Perth Central to Morley

Figure 1 shows how a Trackless Tram route could be part of a project that removes central city buses on a number of routes and provides a much faster and higher capacity system linking the three main central interchange points of the Vic Park Interchange, the Elizabeth Quay busport and the Central busport. It then goes out to Morley so that a major missing link in mid-tier transit can be filled and joins Morley Shopping Centre to the new Ellenbrook Rail line.

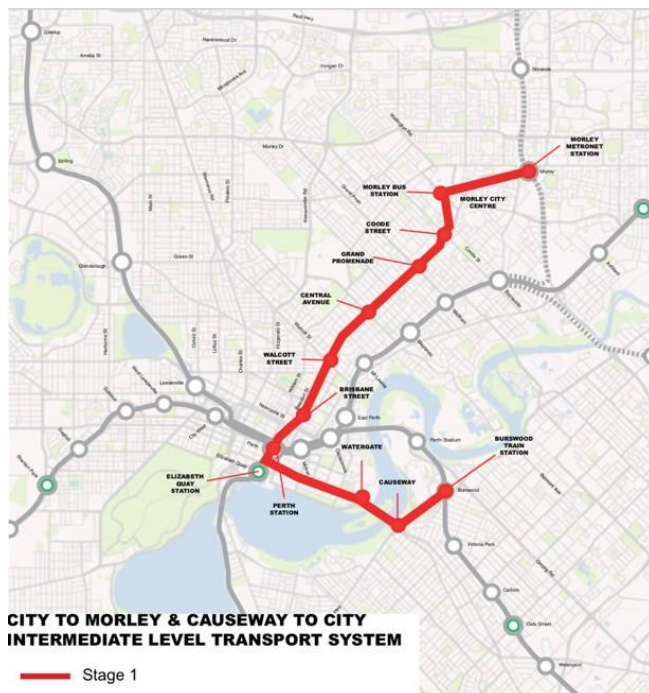


Figure 1. Option 1 Central Perth and Morley

This would require 25 Trackless Trams at a cost of \$108m (\$4.33m per 3 car set). The cost of establishing a trial here in Perth would add another \$2m (more detail in Core Document). Total \$110m. This would not include any work needed on the road surface or traffic lights which will require a detailed Master Plan. Savings of around \$33m per year are anticipated from the rationalization of 28 buses in the city, 17 are fully saved (drivers transferred to TT's) and 11 can be redeployed. Thus the project would pay for itself in three years.

3.2 Option 2 – Cannington to Scarborough

Figure 2 sets out the route that has been determined by the Perth consortium through a series of detailed workshops and research over the past three years. It shows the potential urban development that is likely to happen in the period to 2031 along the Transit Activated Corridor.

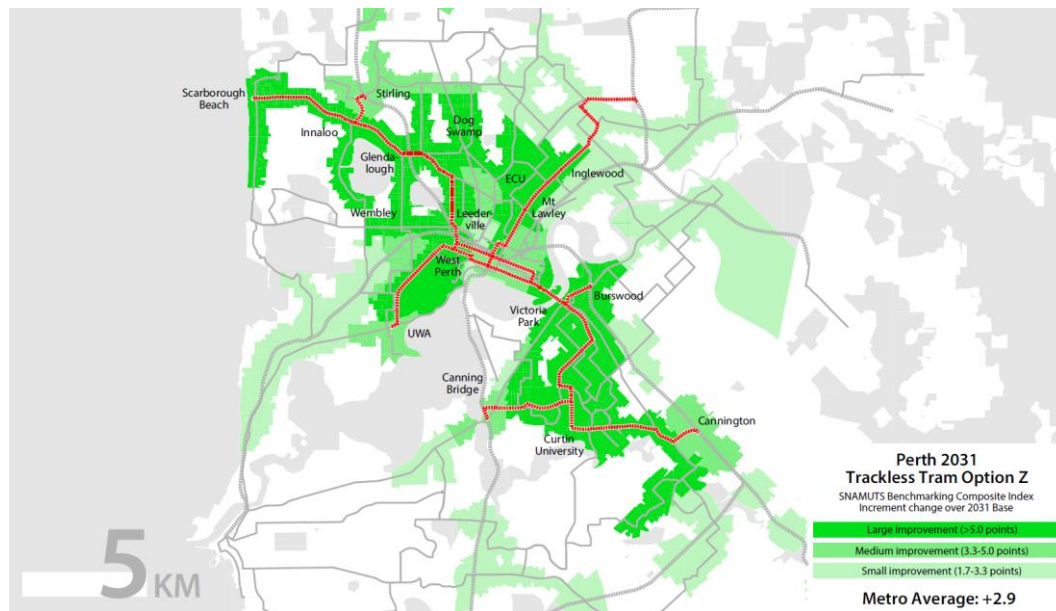


Figure 2 Trackless Tram from Cannington to Scarborough. This corridor route includes the Morley route as well as extensions to Canning Bridge, Burswood (for events) and Stirling City.

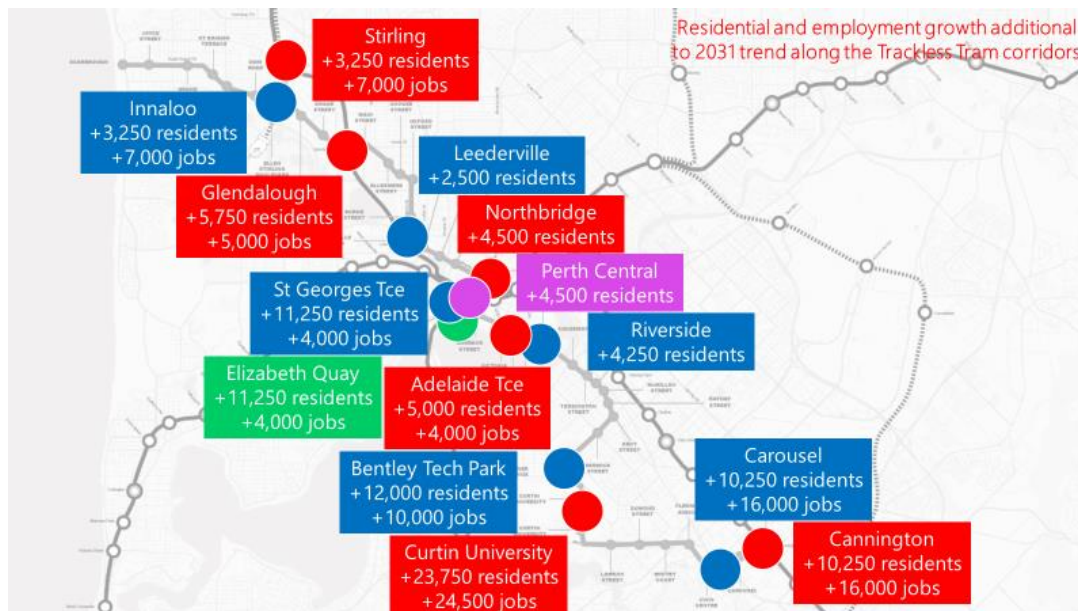


Figure 3 Redevelopment potential along Scarborough to Cannington corridor.

Redevelopment along this corridor has been assessed with the local governments, developers and communities. Thus estimates of the development potential and how much more can be unlocked through the Trackless Tram have been estimated.

Urban development is the fastest way to create new jobs with each new housing unit creating 7 jobs immediately, 3 direct and 4 indirect in the broader economy. Another way to see the economic value is that for every \$1 million spent on construction there are 9 jobs created directly and 37 jobs created in the broader community (Kemp, 2020).

The magic of a Trackless Tram system along a corridor like this is that it will increase urban land value by 20% for residential and 50% for commercial properties (Mcintosh et al, 2015). This can be shown to increase land values along the TAC from around \$19.8b to around \$33.4b. This increase of \$13.6b enables the city to gain development where it is critically needed and can have a substantial proportion of affordable and social housing as well so that the city progresses equitably and with a balanced workforce enabled to live within the area. The costs of development have been estimated based on the value of land in the station precincts before the value increase.

Table 1 Summary of Investments

	Public Investment	Private Investment	Private Investment in Land and Jobs Created
	In Vehicles, Recharge and Depot facilities (\$4.33m/km) ⁵ Roadworks (\$19.2m/km) ⁶	Station precincts with 200m of road around it (\$6m each precinct) ⁷	From land development, (est value of land; with 9/37 jobs per \$1m) ⁸
Cannington to Scarborough TTS (including Option 1) 30 kms	Stage 1: Vehicles \$130m Stage 2: Roadworks \$576m	30 station precincts \$180m	\$19.8b with 178,000 jobs directly and 732,600 jobs indirectly over 10 years, 10% per year so 17,800 direct and 73,260 indirect.
Whole of Perth Metro TTS (including Option 1 and 2) 112 kms	Stage 1: Vehicles \$485m Stage 2: Roadworks \$2.150b	112 station precincts \$672m	Not researched but likely to be three times above.

This project has focussed on the Cannington to Scarborough corridor but as public discussions have happened over the past three years other projects have been proposed with similar goals. Together these projects suggest a bigger picture emerging for Perth's mid-tier transit and urban regeneration potential.

⁵ See Core Report for details of vehicle costs and extra costs of fitting out recharge elements at stations and in Depots.

⁶ See Core Report for estimate of roadworks for TransitWay

⁷ Based on 100m either side of station precinct with estimated roadworks costs of \$19.2m per km (see Core Report for details of this)

⁸ Jobs estimated at 9 direct and 37 indirect by Kemp (2020) and same as those used by Property Council, UDIA and Master Builders. Land value before Trackless Tram improved value has been used to estimate investment.

3.3 Option 3 - Further Option North / South

The biggest change has been to take the same concept of going largely East-West to enable the North-South METRONET corridors to work better:

1. KARRINYUP-MORLEY: From North Beach to Karrinyup Shopping Centre to Karrinyup Station then linking the new Morley station on the Ellenbrook line to Morley Shopping Centre and then down Beaufort Street to Perth as in Figure 2.
2. HILLARYS-GREENWOOD-KINGSWAY: From the Hillarys Marina to Greenwood station then to Wanneroo Road Kingsway Shopping Centre.
3. CANNINGTON-SCARBOROUGH: as in Figure 2.
4. FREMANTLE-ARMADALE: South Street to Murdoch Station then on to Randford Road and Armadale Road to Armadale.
5. ROCKINGHAM: From the station to Read Street Shopping centre to the Rockingham Beach Area.
6. MANDURAH: Station to Mandurah Waterfront.

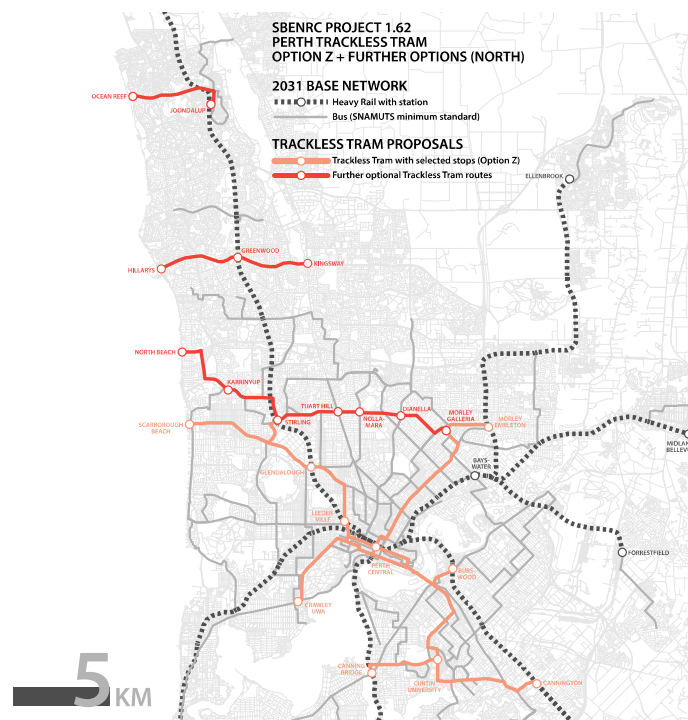


Figure 4.a Potential Trackless Tram routes and Transit Activated Corridors across Perth (North)

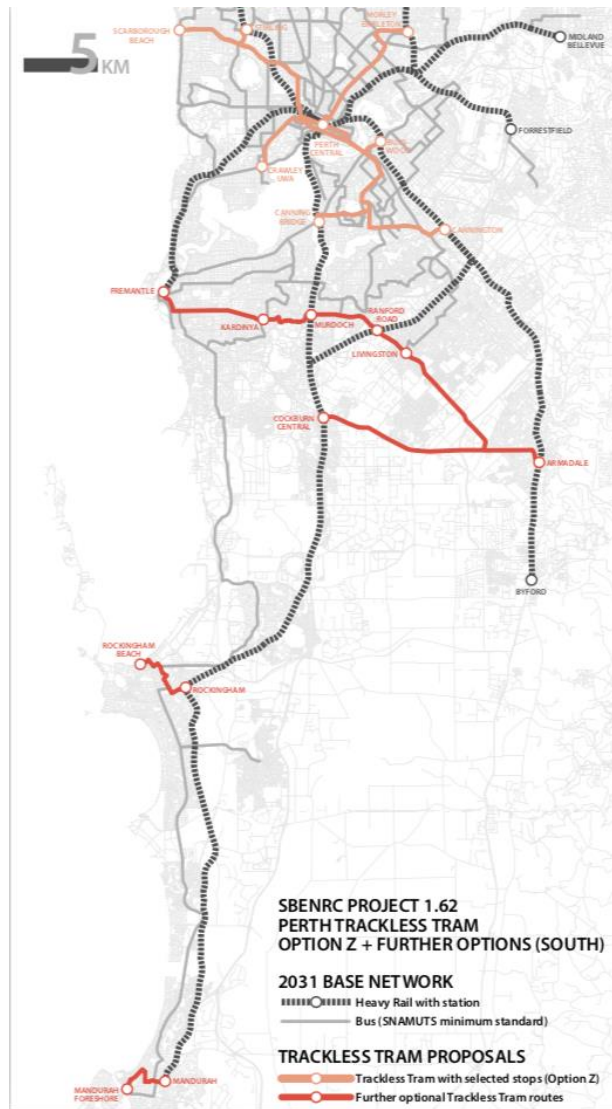


Figure 4.b Potential Trackless Tram routes and Transit Activated Corridors across Perth (South)

Figure 4 shows the East-West links across the North-South corridors linking into MetroNet at various key points and with major urban development opportunities along each route. The urban development potential yield will be less the further out that the projects go. The total package enables a much more significant ability to create a better transit system and a more consolidated city with effective local town centres that can become the core of 21st century home and office development in Perth.

The key point about this project’s applicability to any city, but especially to Perth, in a time of economic rebuilding, is that it lends itself to a full set of partnerships and can be delivered quickly and in stages.

Details of the project in terms of its economic value, community and environmental value, its alignment with government policy and stakeholder support, its deliverability, feasibility and risk, are set out below. Details can be pursued in the accompanying Core Report document.

4 The Project Benefits

4.1 Economics

Economic benefits including jobs, capital value, innovation

The economic benefits of the Cannington to Scarborough TTS and the whole Perth TTS project are set out in Table 1. These show the immediate benefits in terms of investment and jobs from the land development associated with the Trackless Tram, and then over a ten-year period.

The innovation is that:

1. It can fit into the present system quite simply (for example its relatively straight forward to fix the roads in preparation for a TTS, but even more easy to follow the TTS on the Main Roads Command Centre to monitor the services, and also Depots where buses will be stored at night, though a recharge point will be needed for each vehicle);
2. It will bring smart city sensors into transit systems in a way that will need to be applied to all aspects of transport into the future;
3. It will enable Perth to be a demonstration of how the very high take-up of roof top solar can be applied to new station precincts and depot roof tops, and enable the grid to be stabilized through battery-based Recharge Hubs earning money for the operator.
4. By being the first western city to adopt this new transit technology (after a trial conducted with the RAC – see below and in a section in Core Document) cities around the world will be coming to Perth to view the new system and professional jobs in the area will be created to service other cities.
5. Perth can manufacture the TTS here and thus create further jobs and enable us to extend the innovations as we learn how best to make the system work here.

4.2 Community and Environment

Net community benefit including for example social and affordable housing and environmental sustainability

The community and environmental benefits will include:

1. The provision of *Localised Centres* in each Station Precinct with local shops, local services, local place features, that enable the surrounding areas from each station catchment to have a place to walk to, to take micro-mobility (bikes, scooters, skateboards) and provides a meeting place for community activities.
2. A local *Recharge Hub* for any electric vehicle, large and small, and perhaps a local *Delivery Hub* for on-line shopping parcels – see section in Core Paper.
3. *Affordable and Social Housing* in partnership between the developer and the Housing Authority which will vary with the location (eg some stations have substantial government land).
4. *Consolidated Housing* benefits compared to fringe housing developments, with around \$100,000 savings per residential housing unit from infrastructure, \$50,000 savings per housing unit in travel times per year, and \$80,000 per housing unit in health benefits due to making more active lifestyles in walkable urban environments (Trubka et al, 2015).

Climate change emissions reductions of around 2 Tonnes per capita per year as the more urban/inner city quality of housing and transport is 33% less in greenhouse gases. These can be reduced to net zero emissions if the developer chooses to make net zero housing and all the transport becomes electric with solar recharge (Thomson and Newman, 2018). This is expanded in the Core Document.

4.3 Government

Aligns to government policy objectives

The State Government's METRONET policy is to build a modern electric train system with associated METRONET Hubs around stations. This is a \$7b project with seven new rail lines and a large number of Hubs. The Perth TTS project is a complementary project to METRONET, it builds on the North-South alignments of most of the seven new rail lines by connecting to key stations and drawing in key centres. For example:

1. Along the Cannington to Scarborough TTS line Curtin University and Osbourne Park, two of the largest employment and activity centres in Perth, are linked into the city centre and to several METRONET stations as well as a major beach resort area.
2. Along the Morley to North Beach TTS line two major shopping and employment centres of Karrinyup and Morley are linked in to the Northern Suburbs line and the Ellenbrook line.
3. Along from Hillarys (a major tourist destination) to Greenwood station and then to Kingsway shopping centre.
4. Along the Fremantle to Armadale TTS line the major activity centres of Fremantle, Murdoch and Armadale are joined to four METRONET lines at Fremantle, Murdoch, Ranford Road (new Thornlie-Cockburn station) and Armadale.
5. Along the Rockingham TTS line the Southern Rail line is linked through Rockingham Shopping Centre to the Rockingham foreshore activity area.
6. Along the Mandurah TTS line the Southern Railway is linked to the Mandurah foreshore activity area.

As outlined in the Core Document section on Strategic Planning for Perth, the Perth and Peel Plan, the Perth Transport Strategy and Movement and Place Strategy are all consistent with this Perth TTS project.

Most of the local governments associated with these lines have been lobbying for this kind of connection and development-unlocking mid-tier transit opportunity. They have all expressed strong support in seminars and meetings.

The Federal Government have been spoken to through several meetings with Ministers and Departments under the various City Deals being developed in Townsville, Sydney, Melbourne, Hobart, Adelaide and Perth – all of which have Trackless Trams at one level of commitment or another. The meetings all expressed considerable interest and confirmed that the work in Perth (through Curtin) was the most advanced. Brisbane's new electric-bus Metro is a mid-tier transit system with most of the character we have outlined above, but has not been as closely linked to urban development. This proposal follows the City Deal approach of developing partnerships with innovation, sustainability and affordable housing outcomes.

4.4 Stakeholders

Stakeholder support, views are known or can be ascertained in an expedited manner

Stakeholder meetings have been regularly held over the past three years with the Perth Consortium group at Curtin University, led by Ian Callahan, Deputy Vice Chancellor Resources.

Throughout the project a range of processes were used to identify stakeholder perspectives around the notion of mid-tier transit (using the Trackless Tram as the example being tested). Table 2 summarises the perspectives drawn from a range of processes including:

- the Consortium and Stakeholder Risk Workshop in January 2019
- the Consortium and Stakeholder Workshop October 2020 – On Scarborough to Cannington Activated Corridor
- a range of dialogues and meetings with consortium members and stakeholders.

Stakeholder perspectives are outlined on a range from topics associated with land development, governance to high level implementation issues.

Table 2 Challenges and Opportunities – Urban Regeneration through Transit Activated Corridors

Stakeholder	Key perceived barriers	Key perceived opportunities
Development WA	<ul style="list-style-type: none"> • Dynamics of the urban property market - the cost of construction of single dwellings versus costs of apartment construction • Fragmentation of and ownership means – renewal needs to focus on key sites • Market viability for apartments is restricted to CBD/Inner City and high amenity locations such coast and river. 	<ul style="list-style-type: none"> • Have access to some key sites (old Dept. of Agriculture site and Technology Park) and have planning powers that could be utilised • If accessibility and amenity building goes hand in a focussed way along corridors there is some potential
Property Council	<ul style="list-style-type: none"> • Based on the Creating Great Australian Cities project – the evidence is Australian cities generally have poor coordination leading to insufficient investment in key infrastructure to realise potential • Other jurisdictions have developed systems of governance can be learned from 	<ul style="list-style-type: none"> • See potential for new forms of political leadership to emerge through a ‘team’ approach which brings civic minded business leaders and engaged citizens working alongside all tiers of government – the City Deal Model • Has identified the ‘value’ creation potential of the MAX LRT project – so sees potential in TTS
Dept. of Communities	<ul style="list-style-type: none"> • Question if land value uplift will provide sufficient funds implement TTS 	<ul style="list-style-type: none"> • See value in framing the value of this form of investment in activated corridors within framework of ‘Wellbeing Uplift’

General Local Authority sentiment	<ul style="list-style-type: none"> • Variable levels of planning readiness • Variable levels of engagement with businesses and community 	<ul style="list-style-type: none"> • See the value proposition of exploring the potential for the introduction of mid-tier systems • Keen to be part of the solution – and work in coordinated way
Curtin University (as a key activity centre)	<ul style="list-style-type: none"> • Acknowledges the challenges of introducing new type of vehicle into the ‘system’ 	<ul style="list-style-type: none"> • Identified the benefit of creating PT link between the Bentley Campus and Perth City Centre as priority. • Wider campus (Greater Curtin) development benefits and have allocated space for Depot
Dept of Transport	<ul style="list-style-type: none"> • Understand the challenges of ‘system’ change associated with introducing a mid-tier transit systems • Acknowledge the changing PT environment as On-Demand transport emerges as bigger player 	<ul style="list-style-type: none"> • Significant opportunities to align with concepts and policy development in the area of movement and place • See value in developing a ‘model’ for shifting to MaaS
Public Transport Authority	<ul style="list-style-type: none"> • Concerned about existing contracts with bus operators • Concerns about transfer penalties with the introduction of additional mode 	<ul style="list-style-type: none"> • Acknowledge that if a mid-tier systems was introduced then bus operators contacts could be re-assigned / re-negotiated
Wester Power	<ul style="list-style-type: none"> • Have not historically seen themselves just as energy provider 	<ul style="list-style-type: none"> • Identified the potential to of electric mobility to be part of the emerging business model
Exiting Transperth Bus operators	<ul style="list-style-type: none"> • Are implementing corridor transit systems elsewhere and have knowledge from early adoption of issues and advantages of transitioning the network. • Road pavement not suited to vehicles running in same place resulting in rutting and bunching of pavement at stops • One of the barriers to providing high quality bus service is lack of priority • Prepared to partner and support innovation 	<ul style="list-style-type: none"> • More efficient service due to priority • More legible • Drivers like the separation with the ticketless entry • Ticketless entry and multiple doors improve journey times • Have improved operational costs elsewhere • Integrated with on demand and micro mobility as part of whole of service offering.

4.5 Deliverability

Project complexity and speed of delivery e.g. benefits will be realised in the short to medium term with appropriate management of risk and opportunities

It is imagined that the following stages could be used in its delivery.

1. Step 1. Immediate road works can begin to enable the TTS to be fitted into the main roads at designated station precincts for a peak time TransitWay along the Cannington to Scarborough route; some of these roadworks have been planned for a number of years, eg in Stirling. Trial of Trackless Trams can begin immediately with RAC as set out in the Core Document. Procurement of the TTS and of the urban developments associated with the TAC can be conducted in parallel along with community engagement to ensure detailed local place issues are part of the final plan.
2. Step 2. Within 18 months the TTS can be running and the urban developments will have begun to be built along Cannington to Scarborough.
3. Step 3. Bids should be conducted within the first year for which of the other stages in the overall plan should be done next. The partnerships will be able to build on the experience of the first project.
4. Step 4. Full city TTS system with urban regeneration along six TACs completed within 3 years.

4.6 Feasibility

Feasible proposal e.g. demand is evidenced, supply factors mitigated, proof of funding and shovel ready

The project is feasible as it builds on:

1. The experience of Main Roads and the Public Transport Authority on how to make a main road service both cars and buses (but adds an extra dimension of an electric service with much bigger potential for fulfilling the Movement and Place Strategy due to the urban regeneration around stations).
2. It builds on the PTA Depots and MRWA Command Control Centre.
3. It builds on the strong support of UDIA, Property Council and Master Builders Association who in co-ordinating the response of developers can see the need for such a TTS project in the Recovery, and believe that investors are ready to work on the various urban development sites along such routes.

The project can deliver shovel ready roadworks and urban development projects along the routes.

4.7 Risk

Probity can be assured – addressed in assessment process.

The major risk in the project is the need to test the Trackless Tram before it is allowed on public roads. The TTS contains various innovations that have not been design standards in Australia but they are simple to demonstrate as being safe, like having a driver's seat in the middle at both ends like a train, so that they are bi-directional, when the ADR says they must be on the right side alone. A number of companies have agreed to provide for free a test vehicle to be trialled. Thus Curtin has established with the RAC and the State Government Department of Transport, a process to test the TTS at the RAC test facility on airport land in Bentley, and enable all regulations to be cleared. A similar exercise was done with the RAC and Curtin's autonomous buses that were very popular with the public in recent years but were in fact on trial. This trial needs \$2m to bring the Trackless Trams to Perth and to establish and run the trials. This would need to be part of the funding considerations from government but could also be sought from NAB or Macquarie Bank who have both expressed interest and could perhaps provide the funds for the trial in exchange for advertising rights on the sides of the vehicles. The government would be given first rights to this as part of the trial.

5 The Project Opportunity

The Perth Trackless Tram System project is a remarkable opportunity to provide a Recovery Project which can begin immediately and with great public excitement. The arrival of several Trackless Trams in Perth for the Trial (in a matter of weeks) that can be made available for public viewing and riding, will be a chance to show that WA is:

1. Up and running in its new economy,
2. Looking to the future rather than the past,
3. Taking a role as a global leader in innovation.

Within 6 months signs of road works and bid processes will be underway and people being employed on both the transit preparations and the new construction projects.

After 3 years a new transit system that helps make METRONET work better, provides hundreds of new houses and jobs in well located urban centres, and which has enabled thousands of jobs to be created, will be substantially completed.