

## COMMENTARY

# Trackless Trams: An Emerging Transformative Opportunity

**Peter Newman**, *Curtin University, Perth, Australia.*

**ABSTRACT:** Trackless trams are a Chinese innovation that provide net zero opportunities, which are also transformative for cities. They have not yet been used outside China. They are battery-based vehicles with sensors that guide them down roads and have rail-like ride quality with potential to carry the equivalent of six lanes of traffic. This means they can enable net zero transformative potential for reducing car dependence while creating urban regeneration opportunities around stations, thus enabling other social and economic benefits for a city. The personal and research story is outlined of how urban leaders, developers and finance groups, are now discovering how trackless trams can be applied to their cities. Issues are being raised that need answers, but the immediate appeal of a new technology that can compete with cars and help provide a net zero transport solution is real. Significant steps forward in certifying this innovative vehicle are happening in 2023 and ongoing policy discussions are starting to resolve how best to demonstrate the technology so it becomes transformative. The opportunity is suggested to create a new model in cities on how to integrate such transit with urban regeneration in net zero corridors, using procurement with partnerships between private investment and public agencies.

**KEYWORDS:** mid-tier transit; urban regeneration; net zero

### SUMMARY FOR POLICY MAKERS

- Urban policy makers need to ensure net zero means transformative cities. The potential is there for a city to become net zero by using a fully renewable large-scale grid and large numbers of solar-charged electric vehicles replacing the petrol/diesel-based transport. Transformative change will need more quality urban transit and more social and economic change that would come from locally based net zero precincts and corridors.
- The trackless tram-based net zero corridor can enable such transformative urban development as it competes with cars and attracts urban development around its stations.

- It will require planning that enables a trackless tram to be part of a Movement and Place strategy, providing the space along a main road and the tram stations surrounded by net zero precincts.
- This will be enabled by procurement that creates partnerships to integrate land development, finance, transit operations and local communities. Together they can create a transformative corridor.
- The emerging information needed to certify trackless trams and to create net zero corridors of integrated urban development, will be accelerated in 2023 with the delivery of trackless trams for certification in Perth.

## Introduction

The challenge of climate change demands transformative change, especially in cities. Transformative means accelerated removal of fossil fuels and at the same time making cities more equitable, productive, and resilient (The Intergovernmental Panel on Climate Change- [IPCC], 2022). For the past five years I have been working on an emerging technology that could help in this historically important moment: trackless trams, that use digital guidance and battery power to create a tram-like option at considerably lower cost, and which provides the basis for an integrated, transformative approach. I have been working with my research team across five Australian cities, and applied the findings to a number of other global cities (Newman et al., 2018; SBEnrc). This is a story about how our dream of its potential is rapidly becoming possible and some of the issues that remain.

I have been an academic since the 1970s but have had a parallel career as an elected local government councillor, an advisor to politicians at state and national level and an activist, leading campaigns, mostly about stopping the construction of freeways and encouraging the building of railways (Gaynor et al., 2020). My research projects have always been directed at transformative campaigns for cities, especially how we can manage automobile dependence (Newman and Kenworthy, 1989, 1999, 2015). And I have also been working with IPCC on transport for the past three reports (IPCC, 2014, 2018, 2022).

The transformative changes that new urban rail projects bring to cities are not just in reducing automobile dependent traffic but in enabling urban regeneration around stations that can help with equity and resilience (Chava et al., 2018; Newman et al., 2017). But rail projects are often very expensive and slow to construct, causing disruption in local areas. Until the Trackless Tram appeared.

The Trackless Tram is an innovation from Chinese rail manufacturer CRRC. They took six innovations out of high-speed rail and transformed a bus into a rail-like vehicle through digital guidance which makes these trams cheaper than light rail and enables them to be implemented very simply into main roads, with three or four carriages reducing six lanes of traffic due to their speed (up to 70 km/h) and capacity (see Figure 1).



**Figure 1:** One of the first Trackless Trams being demonstrated in Zhu Zhou, China in 2018.

A colleague came across the Trackless Tram while doing a study in Sydney for a potential light rail ([Verschuer and Binning, 2017](#)). She called it Guided Electric Transit System (GETS). I was very suspicious. In my campaigns on urban rail there were always problems with the bus lobby who could never see why their buses weren't just as transformative as rail in getting people out of cars. The evidence I gathered from many cities across the world was very clear—buses are good as a support system but only rail provides a strong transit option that will compete with cars in speed, capacity, and ride quality and it's the only transport system that raises land value to enable walkable density ([Newman and Kenworthy, 1989, 1999, 2015](#)). So, I went to China with two colleagues in 2018 to check out trackless trams in Zhu Zhou. I rode it and was convinced.

The photo below shows me in a trackless tram at 70 km/h, watching a child running up the tram's corridor without needing to be held due to the stable ride quality.

The Trackless Tram uses sensors to guide it down a track (a white line) so it is largely autonomous, which means the steering is very steady. As well, the sensors transfer the up-coming road shape data to the steering and hydraulic suspension to enable a rail-like ride quality. Its batteries on the roof last through the day with short top-ups before an overnight recharge. In terms of patronage benefits, all the benefits of light rail are there in multiple doors for boarding, large windows, and disability access. The cost is an order of magnitude less than light rail or even bus-rapid transit and it could be introduced after small disruptions to any main road.



**Figure 2:** Inside the Trackless Tram; the photo shows the author's moment of realisation that this was like a rail vehicle not a bus

In China the Trackless Tram has been introduced as a mid-tier transit option, that is, not a bus (best used for local, short trips) and not a train (best used as a fast, high capacity option down the whole city). It's a 'connector' linking across the city, and in China's case was made so that people had better access to their Metro stations and high-speed rail stations, while connecting major shopping centres, universities, and sports facilities. The trackless trams in China have a combination of their own right of way and mixed traffic, and local buses can also use the space provided for a trackless tram on the road (especially coming into stations where they both need right of way). The more that trackless trams can be enabled to have their own road space the better as they are likely to become the largest provider of mobility down a main road corridor. Its access advantages mean that people will want to live and work nearby so it should be transformative in terms of car dependence.

## The Research Came Next

We began writing papers and books about trackless trams (Newman et al., 2019, 2021, Newton et al., 2021), and the world began to hear about it from less academic sources, especially after Greenpeace Europe produced a video that has had 3.8 million views. In public presentations, I found that local governments liked the look of it because trackless trams obviously appeared to help with transport and climate change but also enabled urban regeneration to be unlocked; this could then mean that many other Sustainable Development Goals could be implemented as part of a net zero strategy. The aspiration of net zero, transformative cities had an emerging delivery option.

We were asked to develop the concept in four Australian cities (including a concept for 15 local governments in Perth), and later applied it to Thimpu, Philadelphia, Bulawayo, and Chandigarh (see the Transit Activated Corridors project website). All these studies had a strong emphasis on why a trackless tram could provide not just a mid-tier transit solution, but it could enable urban regeneration to be unlocked around the obvious land value increases from being close to stations.

There was a particular appeal for those cities and local governments looking beyond a future city where the only transport decarbonization option was electric vehicles replacing gasoline- or diesel-based automobiles. Trackless trams are an appealing solution as not only are they net zero transport in themselves, but they help control the swarm of electric automobiles taking over our cities and causing just as much traffic as their gasoline-cousins (Newman and Chamberlain, 2022; Newman and Economou, 2022).

## The Need to Certify and Answer Other Vehicle Questions

There were of course many technical issues to consider with such innovative transport, especially as several European bus-like trams on roads had failed. For example, there are issues about whether trackless trams cause too much pavement damage because of its precise wheel positioning, whether its recharging will be adequate or disruptive to grids, and the ultimate costs which will probably need to wait until demonstrations happen outside China (The Iron Road). Soon we had a lot of answers to the questions in videos and around 100 FAQ's to enable people to take it seriously (available on the Transit Activated Corridors project website).

The biggest issue was that the vehicle was not certified to run in a Western city, though it had already clocked up many kilometres and patrons in four Chinese cities. The next step would necessarily have to be how certifiers could be reassured that trackless trams were safe as it is a vehicle travelling at higher speed and capacity than any previous bus service. There is an obvious question about its autonomous qualities, though this question is becoming less of an issue as most new vehicles have increasingly larger autonomous character. High speed rail vehicles are autonomous even though they have a driver, and trackless trams also have a driver due to their operation in mixed traffic. I sat next to the driver in China, and there is a noticeable difference in ride quality whenever he took over the wheel as it switches off the digital guidance. The necessity of a driver means that the trams can be simply driven back to the depot or around traffic jams whenever needed.

A technology assessment research program thus began at Curtin University in 2019 working on how the Trackless Tram could be certified. We began to find opportunities through engineers at CRRC and the Australian agencies responsible for testing new vehicles. Much of it could be done with modelling but at some point, we needed to get a trackless tram to Australia.

## The Need and Opportunity for Broader Urban Transformation

We continued in parallel to the vehicle testing research, to find out how trackless trams could be delivered into cities, so they are not just a transport transformation but an urban transformation. The parallel issues were all about planning, housing, and the growing challenge of achieving net zero outcomes after the Paris Agreement had been signed in 2016. Post-COVID-19 strategic planning was also looking for something special that would help to re-localize services and recreational opportunities (Newman, 2020).

What we found were growing commitments from local governments wanting to see how they could transform their neighbourhoods and corridors with social and affordable housing, walkable centres that could serve as local centres, nature positive resilient precinct development (Newman et al., 2017) and demonstrating new technology associated with net zero buildings and precincts for each part of the city (Newton et al., 2021; Thomson et al., 2016; Thomson and Newman, 2018). Net zero cities was firmly on the agenda (Seto et al., 2021).

Next, the local governments wanted detailed plans and business cases for a trackless tram that integrated such potential land development, associated with this potent new public transport opportunity. They could see it would help unleash the necessary land value uplifts to attract such net zero urbanism. Agencies responsible for broader planning and especially for corridors of main roads have been developing Movement and Place strategies that were first created in London and have spread through the European Union and globally (Eltis, 2016; Transport for London, 2020). These were designed to make better use of road space than just private vehicles, and to enable special areas along such streets to have walkable spaces that favour pedestrians. This seems the right framework in which to fit a trackless tram.

In Perth we had already shown that heavy rail could raise land values over 50% and light rail over 20% for residential and over 50% for commercial (McIntosh et al., 2014), but we do not yet have a Movement and Place strategy to enable such value to be tapped. Our hope is that this can now happen through trackless trams.

To pursue the integration of land development opportunities and public transport upgrading, a model was used called Spatial Network Analysis for Multimodal Urban Transport Systems (SNAMUTS) (Curtis and Scheurer, 2010). This model was able to help whole cities and parts of cities see what would happen to the rest of the transit system if a new mid-tier service was added down a corridor or several corridors. At the same time the model showed how the likely density increases along the corridor would improve the transit system patronage. This planning tool enabled the cities and local governments to show their public transport agencies what could be the next phase for them and to show the planning and housing agencies what could work for them.

In Perth, the State Infrastructure Strategy was released in early 2023 with a core statement that mid-tier transit was the next opportunity for the city and that it needed to be part of a net zero strategy (WA Government, 2023).

The growing interest in Perth and beyond in how a new technology transit could help with all the next urban agendas, led most professionals and politicians to say that the next step in delivery is to actually ride a trackless tram. The need for bringing a trackless tram to certify, and the need to enable politicians, planners, and the public to ride it, had come together.

## The Turning Point

A breakthrough came in November 2022 at COP27 in Sharm El Sheikh, when I had a chance to present briefly to a workshop and then to the main group of nation-states on how the Trackless Tram was the next big thing for cities. Many nations wanted to know more and wondered why it hadn't been happening in Europe or North America, rather than Australia. Finance companies were also very interested as they could see it was a chance to create net zero urbanism along with net zero transport and that meant net zero investment opportunities. At the same time the World Economic Forum released a video to social media, and we felt as though we had hit the spot where global interest was awakening.

In January 2023, the manufacturer contacted us and said that a trackless tram would be on its way for final testing in Perth in late 2023.

The detailed preparations are well underway, and later this year we will have a big Trackless Tram Celebration. Not only will cities be able to come and ride the trams, but they will also be able to join a big event where all their questions can be raised about how to integrate it with net zero urban regeneration.

## What Next?

We now must try to deliver trackless trams, with all the technical issues resolved in the certification process, and we must plan for how to ensure trackless trams are transformative in their delivery in our cities.

Cities looking to enable trackless trams through opportunities in urban land development face significant challenges. Most public transport is funded by government and most land development is funded by private developers and construction companies. The integration is usually left until after the public transport is built. But this is beginning to change, opening up new opportunities.

Increasingly, the chance to create partnerships between transit and urban land development is being pursued by integrating private land development into their projects from the start (for example Jubilee Line and Cross City Rail in London). Some other examples have been demonstrated in India (through their Urban Mass Transit Corporation), in China (parts of their Metros have used private money to create station precincts) and in a few cities in North American light rail projects (Sharma and Newman, 2020).

Thus, it is possible to bring private money into constructing the transit system required to unlock the land value. We called these partnerships the Entrepreneur Rail Model (Newman et al., 2017) and we now believe it is the ideal model for delivering trackless trams and their associated net zero station precincts.

Every city wanting to make a transformative future using integrated mid-tier transit like trackless trams and urban land development will need to create new mechanisms so these can be procured together. The same process happened in the 1890s as trams were rolled out across cities everywhere using private enterprise in partnerships with government (see [Davies-Slate and Newman, 2018](#)). Governments will need to guide the process, but the good news is that a technology now exists to unlock land value in cities that is needed for net zero, transformative urban development.

## Conclusions

A new mid-tier battery-electric transit technology called trackless trams has the potential to offer not just transformation of transport systems, but also urban transformation—catalyzing structural change and enabling social and economic regeneration. Trackless trams have the ride quality of urban rail and can compete with traffic down a corridor, thus enabling land value increases and net zero urban regeneration around new stations. Cities need to plan how to deliver net zero in a transformative way and the Trackless Tram appears to offer this chance. The next steps are certifying the technology and creating new urban development models that can integrate this technology into net zero, walkable, affordable, and resilient urbanism.

## Author Information

**Peter Newman** is the Professor of Sustainability at Curtin University. Peter has written 23 books and over 400 papers on sustainable cities and decarbonization policy. He created the term automobile dependence in the 1980s which is now standard terminology in urban planning and his book with Jeff Kenworthy has been called “one of the most influential planning books of all time.” Newman has worked to deliver his ideas in all levels of government having been an elected councillor, seconded to advise three Premiers in Western Australia (1986, 1989, 2001–2003) and on the Board of Infrastructure Australia 2008–2014. He has been involved in IPCC for ten years and is presently the Co-ordinating Lead Author for the IPCC on Transport. In 2014 he was awarded an Order of Australia for his contributions to urban design and sustainable transport. In 2018–2019 he was the Western Australian Scientist of the Year.

## References

- Chava J., Newman, P., and Tiwari R. (2018) Gentrification of station areas and its impact on transit ridership. *Case Studies of Transport Policy*, 6 (1): 1–10, <https://doi.org/10.1016/j.cstp.2018.01.007>
- Curtis C and Scheurer J (2010) Planning for Sustainable Accessibility: Developing Tools to Aid Discussion and Decision Making. *Progress in Planning*, Vol 74, No 2 <https://doi.org/10.1016/j.progress.2010.05.001>



Davies-Slate, S. and Newman, P. (2018) Partnerships for Private Transit Investment—The History and Practice of Private Transit Infrastructure with a Case Study in Perth, *Australia. Urban Science*, 2(3), 84–104, <https://doi.org/10.3390/urbansci2030084>

Eltis (2016). *Guidelines for Sustainable for Urban Mobility Plans*, European Commission's Directorate General for Mobility and Transport.

Gaynor A, Newman P and Jennings P (2017) (eds) *Never Again: Reflections on Environmental Responsibility after Roe 8*, University of WA Scholar Press, Perth

Glazebrook Garry and Peter Newman (2018) The City of the Future, *Urban Planning* (ISSN: 2183–7635) Volume 3, Issue 2, Pages 1–20 <https://doi.org/10.17645/up.v3i2.1247>

IPCC (2014) *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. UK: Cambridge University Press.

IPCC (2018) *Global warming of 1.5° C: An IPCC Special Report on the impacts of global warming of 1.5° C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. UK: Cambridge University Press.

IPCC, 2022: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. <https://doi.org/10.1017/9781009157926>

McIntosh J., Trubka R., Newman P., (2014) Can Value Capture work in a car dependent city? Willingness to pay for transit access in Perth, Western Australia *Transportation Research—Part A*: Vol. 67, September 2014, 320–339 <https://doi.org/10.1016/j.tra.2014.07.008>

Newman P and Chamberlain L (2022) How trackless trams could help revitalise city suburbs, *The European Sting*, <https://europeansting.com/2022/09/14/how-trackless-trams-could-help-revitalize-city-suburbs/>

Newman P and Economou D (2021) How are we going to get around in a decarbonised world, *360INFO*, 13th December. <https://www.newsroom.co.nz/summer-newsroom-360info-how-are-we-going-to-get-around-in-a-decarbonised-world#:~:text=The%20combination%20of%20e%2Drideables,vehicle%20sector%20could%20take%20longer.>

Newman PWG and Kenworthy JR (1989) *Cities and Automobile Dependence: An International Sourcebook*, Gower, Alderbury.

Newman PWG and Kenworthy JR (1989) *Sustainability and Cities: Overcoming Automobile Dependence*, Island Press, Washington, DC

Newman PWG and Kenworthy JR (2015) *The End of Automobile Dependence: How cities are moving beyond car-based planning*, Island Press, Washington, DC.

Newman P, Beatley T and Boyer H (2017) *Resilient Cities: Overcoming Fossil Fuel Dependence*, Island Press, Washington DC

Newman P, Davies-Slate S, and Jones E (2017), The Entrepreneur Rail Model: Funding urban rail through majority private investment in urban regeneration, *Research in Transportation Economics* <https://doi.org/10.1016/j.retrec.2017.04.005>

Newman, P., Hargroves, K., Davies-Slate, S., Conley, D., Verschuier, M., Mouritz, M. and Yangka, D. (2019) The Trackless Tram: Is It the Transit and City Shaping Catalyst We Have Been Waiting for? *Journal of Transportation Technologies*, 9, 31–55. <https://doi.org/10.4236/jtts.2019.91003>

Newman P, Mike Mouritz, Sebastian Davies-Slate, Evan Jones, Karlson Hargroves, Rohit Sharma and David Adams (2018). *TRACKLESS TRAMS: Delivering Integrated Transit, Land Development and Finance—a Guide and Manual: with Application to Trackless Trams*. Sustainable Built Environment National Research Centre (SBEnc), Australia.

Newman P (2020) Covid, Cities and Climate: Historical Precedents and Potential Transitions for the New Economy, *Urban Sci.* 4(3), 32; <https://doi.org/10.3390/urbansci4030032>

Newman P. Hargroves K, Desha C and Idzapani P (2021) Introducing the 21st Century Boulevard: A Post-Covid Response to Urban Regeneration of Main Road Corridors, *Current Urban Studies* 9, 831–854 <https://doi.org/10.4236/cus.2021.94049>

Newton P, Newman P, Glackin S and Thomson G (2021) *Greening the Greyfields: New Models for Regenerating the Middle Suburbs of Low-Density Cities*, Palgrave MacMillan, Melbourne. <https://library.oapen.org/bitstream/handle/20.500.12657/51917/978-981-16-6238-6.pdf?sequence=1>

Seto K, Churkina G, Hsu A, Keller M, Newman P, Qin B, Ramaswami A (2021) From Low-to Net-Zero Carbon Cities: The Next Global Agenda *Annual Review of Environment and Resources* 46:23.1–23.39 <https://doi.org/10.1146/annurev-environ-050120-113117>

Sharma R and Newman P (2020) Land Value Capture Tools: Integrating Transit and Land Use through Finance to Enable Economic Value Creation, *Modern Economy*, 11, 938–964. <https://doi.org/10.4236/me.2020.114070>

Thomson G, Newton P and Newman P (2016) Urban Regeneration and Urban Fabrics in Australian Cities, *Journal of Urban Regeneration and Renewal* Vol. 10, 2, 1–22 <https://doi.org/10.4135/9781473921788.n15>

Thomson, G.; Newman, P. (2018) Urban Fabrics and Urban Metabolism: From Sustainable to Regenerative Cities, *Resources, Conservation and Recycling*, 132: 218–229 <https://doi.org/10.1016/j.resconrec.2017.01.010>

Transport for London (2021) London's Street Family: Theory and Case Studies. Available online: <https://tfl.gov.uk/corporate/publications-and-reports/rtf-supporting-documents>

Verschuier M and Binning N (2017) *Parramatta Road Public Transport Opportunity Study*, Inner West Council and City of Canada Bay, Sydney.

Western Australian Government (2023) *State Infrastructure Strategy*, WA Government, Perth.