Submission No 52

INQUIRY INTO IMPACT OF THE CBD AND SOUTH EAST LIGHT RAIL PROJECT

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Submission to the Inquiry into the impact of the CBD and South East Light Rail Project,

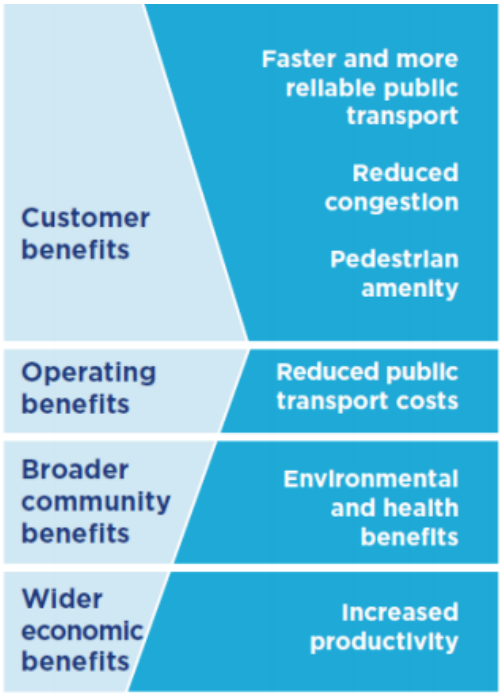
Thank you for the opportunity to make this submission.

1. d) Any other related matters:-

As the CSELR project involves the expenditure of over two thousand Million dollars, and rising, I tried to determine if the benefits accruing from such enormous expenditure far outweighed the costs involved.

Put another way, would it have been better to retain the existing fleet of modern, comfortable flexible Mercedes-Benz buses and update to electric buses as older buses were retired, rather than spend such an enormous sum on reintroducing trams that were retired in the 60s for causing congestion?

Following my examination of the suggested benefits, detailed in the graphic below, I have no doubt that the optimum solution, short of an underground rail extension, would have been to retain the existing modern, flexible, bus fleet.



Transport for NSW chart

1. **Faster**

1.1 Claiming that the Light Rail will be faster for 'customers,' do the mean passengers?, is spurious and unsupported by evidence or facts. It is surprising that a, then, $1.6 billion, now, $2.2 billion and still rising project has been commenced without a business case that could be analysed

1.2 Melbourne trams travelling in am peak on the wide, straight, streets of

Melbourne's CBD Hoddle grid travel at 11kph ABC News
Sydney buses travelling in am peak on notorious Cleveland street, travel with the traffic flow at 13.9 kph DT

So, trams travelling in seemingly ideal conditions of wide, straight streets within Melbourne's CBD are only travelling at 11kph?

Thus, it seems to be counter intuitive to believe that CSELR trams when travelling at grade, on Sydneys unsuited narrow, tortuous, streets can even achieve the 11 kph achieved by Melbourne trams operating in superior conditions?

1. **Reliability**

1.1 It is on record that the existing superior, grade separated, Dulwich Hill Light Rail, that ideally operates on a former good line, and is fully enclosed by fencing after the short city run to the fish matrkets, has been stopped operating by both local flooding and power outages.

1.2 Because of concerns, that include the lack of flood mitigation works along the CSELR rail line, the City of Sydney is currently withholding a $63 million Light Rail payment because of safety concerns and a flood risk report that, apparently has not even been read by the NSW Minister for Transport.

2. **Congestion**

2.1 The reduction of congestion is the elusive holy grail of traffic engineering, Does the reinstallation of tramways in the Eastern Suburbs stand as an exemplar of those who have failed to learn the lessons of history? "Competition from the private car, private bus operators and the perception of traffic congestion led to the gradual closure of lines fromthe late 1930s. Overseas transport experts were called upon to advise the city on its post-war transport issues and recommended closure of the system." Wikipedia

2.2 "Through removal of parking restrictions of east-west movement and right-turns along the project corridor, NRMA believes the CSELR will adversely impact all motorists who live, work and visit the Randwick LGA." NRMA EIS Submission

2.3 "Since the strategy does not identify these inputs, we expect there will be many people right across Sydney who eill be unaware of the full extent of the TfNSW proposals to significantly reduce the numbers of traffic lanes, and the increased number of right turn bans at intersections." NRMA City Access Strategy

2.4 The lack of transparency on where general traffic will be absorbed in the CBD and South East road network suggests that this modelling has not been undertaken or it has, but the results reflect unfavourably on the project and have not been published." Luke, an NRMA traffic engineer

3. **Pedestrian Amenity**

3.1 Many existing bust stops will be closed for the Light RAIL. E.g. the State Govt have removed 5 of the current bus stops that provide access to Centennial Park and replaced them with only one LR stop on Alison Road, for Royal Randwick whilst Centennial P has over 30 times greater number of visitors, than does Royal Randwick. Such stop closures will badly affect young mums, and disabled and elderly residents who will now be forced to walk much further to board a tram

3.2 These, longest in the world, 67 metre long trams running every 4 minutes, will destroy the desired safe, quiet, disruption-free ambience for both shoppers and traders the entire length of the city's principal boulevard, George Street and all other streets in which it operates such as Devonshire Street and ANZAC Parade.

4. Reduced public Transport Costs

4.1 The CSELR **has incurred massive blowouts in both delivery time and costs. Initially, the estimated cost was $1.6 billion, later growing to $2.1 billion and the project is currently over one year behind time, and with still much to do. Further, the government has not provided any documentation showing how reduced transport costs might be achieved in an environment where costs are spiralling out of control. And, with such a project overspend to date, together with a groundswell of claims from businesses, along the route, that have either gone bankrupt or have lost takings and are seeking compensation. Additionally, property owners and residents are taking a class action against the LR project for compensation, for their losses. Given this background, it seems easier to form the view that public transport costs will go up, rather than down!**

5. Environmental and health benefits.

5.1 The LR construction requires the unnecessary destruction of around 1,300 significant, heritage and other trees and many other park and street trees. The loss of almost 10 ha of prescious air cleaning and cooling tree canopy and much public parklands and open space.
A total of 1277 trees are to be 'impacted', in Stage 1, of which 871 are significant or heritage listed. Almost, 10 hectares or 10 Allianz Stadiums worth of important urban tree canopy is to be decimated by this project, and at a time when our enlightened Federal Environment Minister Hunt is urging that; "we need sustainable, green cities with improved amenity for a more liveable environment. Green cities—

cities with high levels of trees, foliage and green spaces—provide enormous benefits to their residents.
Trees can improve the quality of air in our cities by absorbing some types of airborne pollutants, reduce soil erosion, minimise water run-off and limiting the amount of particulate matter entering our waterways; and increase urban amenity."
The 900 trees along the route and the 900 other trees, elsewhere, that you claim to be planting will be less than 5% of the tree canopy that you are currently destroying.

In destroying these heritage, commemorative, trees, our first war memorial to the memory of our soldiers, who fought in the Great War, has been desercrated.
Earlier, a line of 48 large, mature, heritage and other trees that were standing along Alison Rd, Randwick were destroyed from 2am, after the mandatory notice of LR alignment change, from alongside Royal Randwick Racecourse to Council land adjoining Centennial Park on the other side of the road, had been, unfairly, exhibited during the Christmas break, when residents were preoccupied with other matters and did not have time to monitor government notices.
And, when questioned, about the unnecessary, wanton destruction of the 48 trees, by a reporter, Minister Constance dismissively described them as, "a couple of trees!"

Surely, given that the trees mentioned above could have easily been saved by a simple change of rail alignment, I believe that the person who ordered the destruction of these majectic trees should be ientified, charged with vandalism, and placed before a court of Law.

5.2 Wht health benefits? Many unfortunate residents' who live along Anzac Parade, Kensington and Kingsford are stressed and sleep- deprived and are now at teir wits' end as a consequence, not only of toxic fumes that have forced residents to move their bed to the rear of their residence, furtherest from the source, but also the constant commotion, loud banging and screeching noises of theconstruction work, that is severely impacting their lives, without any relief. (Not to mention the stale urine, within the frontage of their property, that they have had to hose away.)
This insufferable all-night work has been carried out, nightly, along Anzac Parade, until around 2am, since last June and it is totally unacceptable, and unreasonable that residents' should have to endure such a ppalling, harmful disturbance, impacts and damage to their health, for even one more night.

5.3 Trams are the least 'green' form of transport, and even trains produce only slightly less greenhouse gases than cars, an Australian study has found. The study by researchers at Melbourne's RMIT University, shows that - over the long term - trams produce the highest amount of

greenhouse gases, followed by trains, cars and buses. Trams are also very expensive to make and cause major traffic problems.

"The problem is low occupancy," Dr Ed Boyapati, a senior lecturer in engineering who led the study, told ABC Science Online.

The research compared greenhouse gas emissions from the public transport systems and private cars in the Melbourne metropolitan area. The team counted the number of passengers and the length of their trips, and averaged the result against the amount of greenhouse gas each vehicle produced.

They found that trams emit approximately 0.74 kg of carbon dioxide (CO_2) per passenger kilometre. Buses showed the least impact, generating just 0.04 kg of CO_2 per passenger kilometre, with cars and trains fairly equal at 0.25 kg of CO_2 per passenger kilometre and 0.23 kg CO_2 per passenger kilometre respectively.

But the findings do not mean we should abandon public transport in favour of cars, according to Boyapati. The solution is to increase the 'loading factor', or number of passengers, using public transport.

The reason for the surprising disparity is that cars always have a passenger in them (the driver), whereas public transport runs at an average of only 25 to 30 per cent capacity. "If we can increase them to `between 80 and 90 per cent it will help, but even then trams will be inefficient," Boyapati said.

But increasing the number of passengers on public transport will not be an easy task, he added. "Public transport can't provide the level of service. If we increase the frequency, then we reduce the loading."

Reducing the number of carriages on trains and offering dramatically cheaper tickets at off peak periods might also help.

While trams on their own are inefficient in greenhouse gas terms, they also have a multiplier effect on emissions by other vehicles. When they stop to pick up and drop off passengers, "up to 40 cars [can] backed up behind a stopped tram," Boyapati said.

After conducting a life cycle analysis of each form of transport, trams were found to add about 80 per cent more greenhouse gas as a result of these flow-on effects. In addition to the high capital cost - about six t imes that of buses - trams carry about the same number of passengers.

"Trams are definitely a lost cause," Boyapati said. "Around the world, they are being replaced by buses."

The study was inspired by a discussion between tram enthusiasts at RMIT in late 2001, where a state government transport expert noted

trams appeared to create a lot of flow-on effects, Boyapati recalled. "Then the question was asked how we know that even buses are efficient, and we decided to pursue that aspect," he added.

Boyapati presented his group's findings at the 8th International Conference on Energy and Environment in Cairo, Egypt, earlier this month. He commented that in Cairo, public transport is run at 120 to 130 per cent capacity, which is better for greenhouse gas efficiency - if not so good for passenger comfort.

6. Increased productivity

6.1 Productive in the sense of achieving a significant amount or result? Given that the buses to be replaced by the Ligt Rail carried more passengers, more quickly to their destination, and in more comfort (at peak, 70% of tram passengers must stand) And doing this without a change of transportation mode; then the clear answer is that Light Rail trams are decidedly less productive than the trams that they replace.

Thus, in summary, it would appear, from my examination, that the light Rail projects' claimed Customer benefits, Operating benefits, Broder community benefits and Wider economic benefits are tenuous and baseless, at best.

Other supporting Information:

Worldwide, cities are increasingly turning to buses because they're relatively low cost and flexible. They come in many forms and can be scaled right up to Bus Rapid Transit; they use existing road space; and they can go wherever they're required, including around unanticipated obstacles, and do not impact the existing or built environment. Buses come in many configurations; single and double deck, articulated and, now, electric buses that can traverse over 1, 000 kilometres on a single charge.

However, like all technologies, buses are not always the right solution for every occasion. High and heavily concentrated patronage precincts stretch the technical limits of buses and demands other mass transit solutions such as heavy and tube/metro rail. Dr John Bradfield, who oversighted the building of the Sydney Harbour Bridge, said that havy electric rail moves the most people for the least cost and it could be added, and for the least disruption, as heavy rail always operates within its own rail reservations.

Tram journey times are longer than the buses they replace. Trams' lack of capacity to handle AM.peak-hour loads. The long term loss of fast and efficient bus services. The PM. peak-hour lack of capacity. Standing room only for most tram commuters, most of the time. Lack of both AM. and PM.capacity to accommodate all of SBHS, SGHS and UNSW passengers.

The reintroduction of trams will require a change of transport mode for many passengers. Journeys for passengers travelling from/to suburbs beyond

Kensington will require those passengers to change to/from trams.

Or, put another way, passengers travelling by bus from suburbs beyond Kensington will be required to break their journey, to transfer to trams. AND passengers travelling by tram to suburbs beyond Kensington will be required to break their journey to transfer to buses.

Tram passenger capacity will be nearly 70% less than that of the current bus services that they replace.

Seating per vehicle drops from 60-75% on buses to <25% on Trams or put another way, greater that 70% of tram passengers will have to stand.

Between Central railway and Moore Park, there will be only one tram stop. How will the very young, the elderly or disabled tram passegers be able to walk the long distance to the soletary tram stop? Where is the passenger focus, when the existing bus services provide many more convenient stops?

Trams will operate at 8 minutes frequency from Kingsford or Randwick in PEAK HOURS, only

The CSELR tram budget figure of 2.1 billion dollars is a high cost to pay for a tram service that will provide longer journey times at around half the capacity of the existing bus services, with around 70% of passenger standing, at peak loading, and with many passengers having to break their journey to change their mode of transport and, also having to walk further to their tram stop. Additionally, as confirmed by university study, polluting trams emit approximately 0.74 kg of carbon dioxide (CO_2) per passenger kilometre, whilst green buses showed the least impact, generating just 0.04 kg of CO_2 per passenger kilometre. It is impossible to find any benefit for such expenditure.p

The construction for the lower capacity tram service requires the unnecessary destruction of around 1,300 significant, heritage and other trees and many other park and street trees. The loss of almost 10 ha of prescious air cleaning and cooling tree canopy and much public park lands and open space.
A total of 1277 trees are to be 'impacted', in Stage 1, of which 871 are significant or heritage listed. almost 10 hectares or 10 Allianz Stadiums worth of important urban tree canopy is to be decimated by this project, and at a time when our enlightened Federal Environment Minister Hunt is urging that; "we need sustainable, green cities with improved amenity for a more liveable environment. Green cities—cities with high levels of trees, foliage and green spaces—provide enormous benefits to their residents.
They can improve the quality of air in our cities by absorbing some types of airborne pollutants, reduce soil erosion, minimise water run-off and limiting the amount of particulate matter entering our waterways; and increase urban amenity."
The 900 trees along the route and the 900 other trees, elsewhere, that you claim to be planting will be less than 5% of the tree canopy that you are currently destroying.

In destroying these trees, our first war memorial to the memory of our soldiers, who fought in the Great War, has been desercrated. 48 mature, large, heritage

and other trees that were growing along Alison Rd, Randwick. And, when questioned, the Minister dismissed them as, ”a couple of trees!

Around 1,000 parking spaces will be removed from in front of homes/businesses along the tram route.

Many suburban streets will become 24hr clearways including in front of the Prince of Wales Hospital.

The claimed tram capacity requires 6 people standing per sqm (up to 4 times more crowded than any other TfNSW public transport mode). This presents a serious threat to school children (State Govt Approval Docs Feb 2015)

180 buses are to be removed per hour [capacity 12600 standard bus-20700 bendy bus] passengers per hour.
To be replaced, in a time of rapidly increasing population, by 15 trams per hour, capacity 6750 passengers per hour!

Additionally, 79 intersections are crossed at grade (meaning at the same level) from Circular Quay to Kingsford – similar to railway level crossings, but without safety fencing, flashing lights and boom barrier. Further, a Gold Coast tram, which is much smaller than the proposed tram, takes 120 metres to stop when travelling at 60kph, thus, the proposed tram will have the likely potential for fatalities, unless travelling slowly.

Furthermore, Anzac Parade is to be reduced from 6 lanes to 4 lanes – with many left and right turn lanes to be removed and, coupled, with the new 1 metre, clear, cyclist rule this great artery will be bottlenecked, causing congestion and gridlock, likely, cascading onto Cleveland Street, the ED and Oxford Street. (Transport and traffic experts have testified to this, but are afraid to speak out in fear of losing their jobs.) Also, to date NRMA concerns about the project have not been addressed, "Through the removal of parking and restriction of east-west movement and right-turns along the project corridor, NRMA believes the CSELR will adversely impact all motorists who live, work and visit the Randwick LGA.

And, the NRMA City Access Strategy, "Since the Strategy does not identify these impacts, we expect there will be many people right across Sydney who will be unaware of the full extent of the TfNSW proposals to significantly reduce the numbers of traffic lanes, and increase the number of turn bans at intersections.”

Premier Baird and colleagues have demonstrated the most outrageous disrespect for those brave soldiers of the Great War, who marched along what was then Randwick Road, (later renamed ANZAC Parade-our first war memorial, honouring and preserving the memory of those brave soldiers who made such sacrifices), on their way to board their ship in Woolloomooloo Bay. Recently, the Baird government has trashed their legacy with this outrage - the shocking destruction of so many majestic heritage and significant trees.

Currently, Anzac Parade is in the process of being destroyed by the Baird Government. Around 1277 trees will be impacted including 871 significant and

heritage listed trees, heritage Moreton Bay fig tree, from being destroyed, some that had been planted around 140 years ago, by Charles Moore.

whilst 10 ha of important air cleaning and purifying tree canopy, that the federal governmewnt is urging the community to grow, is being destroyed. And, a further 40+ trees are set to be root and crown pruned after which, experience has shown, such trees have languished and died after some five years – others, will possibly be chopped in half to allow space for tram tracks, poles and wires, and for what purpose? Trams are the least green form of transport, trams cannot match the comfort of buses (at capacity, around 70% of tram passengers will need to stand), or buses point-to-point travel with no time consuming change from one mode of transport to another, or the metrics of speed of journey or capacity of the existing bus services. (Public transport will be reduced by nearly 70%.)

As to damaging green house gases, buses excel, being cleanest and greenest, as confirmed by university study, whilst trams emit approximately 0.74 kg of carbon dioxide (CO_2) per passenger kilometre. Buses showed the least impact, generating just 0.04 kg of CO_2 per passenger kilometre, with cars and trains fairly equal at 0.25 kg of CO_2 per passenger kilometre and 0.23 kg CO_2 per passenger kilometre respectively
Cities such as Paris get it right when heavy rail services the middle and outer suburbs (and specific high-demand locations) and metros and light rail services the city centres and inner suburbs. What Sydney is getting is a metro that services some outer suburbs, and a new light rail that is getting heavy enough that it probably should be a metro. Worse still, this new "sub-metro" is servicing a very busy corridor that covers SCG/EQ/racecourse/UNSW/PoW with less capacity than the existing bus network. (Even a cursory look at the 891 buses and the sports and festival crowds makes you wonder what they were thinking …A proper metro is the least that was needed for this corridor. And a full heavy rail solution fully integrated into Central Station might have been a far better investment.

Dulwich Hill trams run wholly within an old, fully fenced, former train reservati Anzac Parade is subject to local flooding; train reservations are not.
The billions of dollars currently being wasted by the Baird gov't on replacing flexible, high capacity, bus services with yesteryears trams will result, if built, in chaotic, under-capacity transport services, that will necessitate supplementation by buses, simply because it is the wrong solution for the proposed route. Compare this with the Central to Dulwich Hill tram that works, because after leaving a short, slow speed, partly semi-enclosed route to the Casino, the tram runs wholly within an old train reservation, a good re-use, that when not passing through rock cuttings is fully safety fenced on either side. There are no intersections-thus not mixing it with traffic nor causing bottlenecks, and can safely travel, between stops, at its design speed of up to 70 Km/hr.

Gold Coast tram has the capacity to travel at 70km/hr but taking into consideration the stopping and starting along the route, for stations and junctions, the average speed along the journey will be 23km/hr.

Gold Coast Tram:
Broadbeach to Gold at Hospital

The light rail vehicle is powered by electricity, which it draws from the overhead lines. The driver controls the vehicle's speed and braking as the light rail vehicle is steered along its path by rails, in the same way that trains are on train tracks. It will have air conditioning throughout, dedicated spaces for wheelchairs and prams, seats, standing room, information on where it is stopping and the next stop displayed to passengers. The internal layout will also provide provision for surf boards. Each tram is made up of seven modules with a driving cab at each end. It is 43.5 metres long and has been designed to make it easy to access and travel in. Inside there is room to carry 309 passengers per tram, 80 seated and 229 standing.

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The light rail system will run along its own dedicated corridor and not on the road with other vehicles. This will help to improve the speed and reliability of the service leading to better journey times. It will also be safer than a tramway as the number of interactions with other vehicles will be significantly reduced. The light rail will use the current road traffic signal system.

Melbourne Trams
Around 80 per cent of Melbourne's tram network shares road space with other vehicles.The average speed of a tram is 16 km/h.
But the government is also assuming buses travelling from Leichhardt to the CBD will somehow speed up from an average of 14 km/h in 2011 to 25 km/h in 2031.

Sydney's CSELR is, by contrast, huge, heavy and will operate at grade, wuithout fencing where needed and will operate on already congested roads. Thus it cannot be either reliable or fast and can only add to already bad congestion. Each tram measures a massive 67 metres. (5.4 times the length of a standard bus) This is staggering. The world average is about 27 metres. A standard Sydney bus is 12.5 metres. Our longest current tram is 30 metres. A standard Sydney train carriage 20 metres.
So our most venerable and fragile city precinct (excepting the Rocks) will be dissected by trains more than five times bus-length, Imagine what that will do to crossings, pedestrians ,cycles and traffic, not to mention streets and atmosphereissues that we have already identified such as, the lack of fencing, the removal of two traffic lanes potentially causing traffic gridlock, the 79 intersections, at grade, buses can easily change their route to avoid any local road flooding.
The system stops if a tram breaks down, whereas a bus can readily drive around a broken down bus, etc. And, there are many more issues. e.g. Students from Sydney Boys/Girls High Schools , currently the risk to cyclists who, if riding parallel to the tramlines, may have a tyre caught in the groove, leading to the cyclist being thrown from the bike, and injured, the necessarily slower speed that the CSELR tram would need to travel at, because it will necessarily have to

contend with pedestrians, cyclists and motorists during its journey, unlike the Dulwich Hill tram, with which it will, likely, be compared and which, ideally, operates within an old, mostly, fully enclosed, railway reservation. Also, in an emergency the tram driver cannot be easily contacted, because they are enclosed within a locked cabin, whereas a bus driver is easily contacted and can readily respond, tram poles and wires are subject to storm damage especially by building materials that may be carried by strong winds, trams are subject to stoppage by local road flooding, whereas board their school special buses immediately outside their schools. However, in order to board the trams the students will be required to cross the busy 6 lane Anzac Parade to the other side, which will require a bridge over the road, (Also, required for Randwick racecourse patrons, now that they have, foolishly, moved the tram stop onto the edge of Centennial Park), and for disabled student, a lift and to deter any errant students, who might want to run across the road, will require a fence down the middle of the road-all of which adds even more costs to this wasteful 2.1 billion dollar tramcar project, which appears to lack any visible benefits for either taxpayers or commuters.

Replaced bus services :-

14.5 m Standard 2 door bus combined seating 45, standing capacity 15 Max. 60 pax
18 m Articulated bus combined seating 52, standing capacity 63 115 pax

180 peak hr buses x 60 = 10,800 pax/hour (TfNSW new figure 13,000) in one direction.
180 peak hr buses x 115 = 20,700 pax/hour or 26,000 in two directions

Alsttom agreement for Max 15 services/hr each way along George Street

15X250 / 48 m tram = 3750 pax / hour in one direction.
15x450 / 67 m tram = 6750 pax /hour in one direction.
or 13,500 / hour in two directions.

"More customers will be able to access reliable light rail services with the extension of the inner West Light Rail and the new CBD and South East Light Rail. The light rail network across Sydney is being extended because it provides higher capacity and greater reliability compared to existing bus services. ""

State Infrastructure Strategy 012-2032 Nick Greiner

Buses and Light Rail

The principal issue facing bus services is congestion n the CBD. However, Infrastructure NSW has concluded that a high capacity light rail service on George St is likely to be incompatible with a high quality pedestrian boulevard, and the negative impacts on bus passengers from inner suburbs may be considerable. Infrastructure NSW recommends the development ofan alternative solution: a CBD Bus Rapid Transit (CBD 'BRT') tunnel from the Sydney Harbour Bridge to the Town Hall area, modelled on the underground

bus way that already operates in Brisbane. Wynyard and Town Hall Stations would be reconstructed as rail/bus transport interchanges, and the central part of George St would be fully pedestrianised. Outside the CBD, Infrastructure NSW supports the construction of light rail from Central to Moore Park and the University of NSW via Anzac Parade. This development will improve the quality of transport to these important activity centres and take advantage of a route that was purpose-built for trams.

Trams belong in disused railway reservations -not on the roads at grade

The capital cost for such short line is extraordinary. 12 km

Tram infrastructure (such as island platforms) occupies urban space at ground-level, sometimes to the exclusion of other users, including cars.
The capital cost is higher than for buses, even if a tramcar usually have a much higher lifetime than a bus.
Trams can cause speed reduction for other transport modes (buses, cars) when stops in the middle of the road do not have pedestrian refuges, as in such configurations other traffic cannot pass whilst passengers alight or board the tram.
When operated in mixed traffic, trams are more likely to be delayed by disruptions in their lane. Buses, by contrast, can manouver around obstacles.
Tram tracks can be hazardous for cyclists, as bikes, particularly those with narrow tyres, may get their wheels caught in the track grooves. It is possible to close the grooves of the tracks on critical sections by rubber profiles that are pressed down by the wheelflanges of the passing tram but that cannot be lowered by the weight of a cyclist. If not well-maintained, however, these lose their effectiveness over time.

- Steel wheel trams are noisier than rubber-wheeled buses or trolleybuses when cornering if there are no additional measures taken (e.g. greasing wheel flanges, which is standard in new-built systems). Tram wheels are fixed onto axles so they have to rotate together, but going around curves, one wheel or the other has to slip, and that causes loud unpleasant squeals. A related improvement is rubber isolation between the wheel disc and the rim, as used on Boston (Massachusetts, USA) Green Line 3400 and 3600 series cars. These cars are much quieter than those with solid metal wheels. (This construction requires a flexible cable to electrically connect the tire to the wheel body.)
- Light rail vehicles are often heavier per passenger carried than heavy rail and monorail cars, as they are designed with higher durability (which means more mass) to survive collisions, since they cannot swerve to avoid oncoming objects in emergencies.
- The opening of new tram and light rail systems has sometimes been accompanied by a marked increase in car accidents, as a result of drivers' unfamiliarity with the physics and geometry of trams. Though such increases may be temporary, long-term conflicts between motorists and light rail operations can be alleviated by segregating their respective rights-of-way and installing appropriate signage and warning systems.
- Rail transport can expose neighbouring populations to moderate levels

of low-frequency noise. However, transportation planners use noise mitigation strategies to minimize these effects. Most of all, the potential for decreased private motor vehicle operations along the trolley's service line because of the service provision could result in lower ambient noise levels than without.

- In the event of a breakdown or accident, or even roadworks and maintenance, a whole section of the tram network can be blocked. Buses and trolleybuses can often get past minor blockages, although trolleybuses are restricted by how far they can go from the wires. Conventional buses can divert around major blockages as well, as can most modern trolleybuses that are fitted with auxiliary engines or traction batteries. The tram blockage problem can be mitigated by providing regular crossovers so a tram can run on the opposite line to pass a blockage, although this can be more difficult when running on road sections shared with other road users. On extensive networks diversionary routes may be available depending on the location of the blockage. Breakdown related problems can be reduced by minimising the situations where a tram would be stuck on route, as well as making it as simple as possible for another tram to rescue a failed one.

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- The capital cost is higher than for buses, even if a tramcar usually have a much higher lifetime than a bus.
- Trams can cause speed reduction for other transport modes (buses, cars) when stops in the middle of the road do not have pedestrian refuges, as in such configurations other traffic cannot pass whilst passengers alight or board the tram.
- When operated in mixed traffic, trams are more likely to be delayed by disruptions in their lane. Buses, by contrast, can sometimes manoeuver around obstacles. Opinions differ on whether the deference that drivers show to trams — a cultural issue that varies by country — is sufficient to counteract this disadvantage.
- Tram tracks can be hazardous for cyclists, as bikes, particularly those with narrow tyres, may get their wheels caught in the track grooves. It is possible to close the grooves of the tracks on critical sections by rubber profiles that are pressed down by the wheelflanges of the passing tram but that cannot be lowered by the weight of a cyclist. If not well-maintained, however, these lose their effectiveness over time.
- Steel wheel trams are noisier than rubber-wheeled buses or trolleybuses when cornering if there are no additional measures taken (e.g. greasing wheel flanges, which is standard in new-built systems). Tram wheels are fixed onto axles so they have to rotate together, but going around curves, one wheel or the other has to slip, and that causes loud unpleasant squeals. A related improvement is rubber isolation between the wheel disc and the rim, as used on Boston (Massachusetts, USA) Green Line 3400 and 3600 series cars. These cars are much quieter than those with solid metal wheels. (This construction requires a flexible cable to electrically connect the tire to the wheel body.)
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- The opening of new tram and light rail systems has sometimes been accompanied by a marked increase in car accidents, as a result of drivers' unfamiliarity with the physics and geometry of trams. Though such increases may be temporary, long-term conflicts between motorists and light rail operations can be alleviated by segregating their respective rights-of-way and installing appropriate signage and warning systems.
- Rail transport can expose neighbouring populations to moderate levels of low-frequency noise. However, transportation planners use noise mitigation strategies to minimize these effects. Most of all, the potential for decreased private motor vehicle operations along the trolley's service line because of the service provision could result in lower ambient noise levels than without.
- In the event of a breakdown or accident, or even roadworks and maintenance, a whole section of the tram network can be blocked. Buses and trolleybuses can often get past minor blockages, although trolleybuses are restricted by how far they can go from the wires. Conventional buses can divert around major blockages as well, as can most modern trolleybuses that are fitted with auxiliary engines or traction batteries. The tram blockage problem can be mitigated by providing regular crossovers so a tram can run on the opposite line to pass a blockage, although this can be more difficult when running on road sections shared with other road users. On extensive networks diversionary routes may be available depending on the location of the blockage. Breakdown related problems can be reduced by minimising the situations where a tram would be stuck on route, as well as making it not possible for another tram to rescue a failed tram.

Thank you.
John Boyle