

SUMMARY REPORT

WELLINGTON PUBLIC
TRANSPORT SPINE STUDY

Summary of Key Findings

AECOM

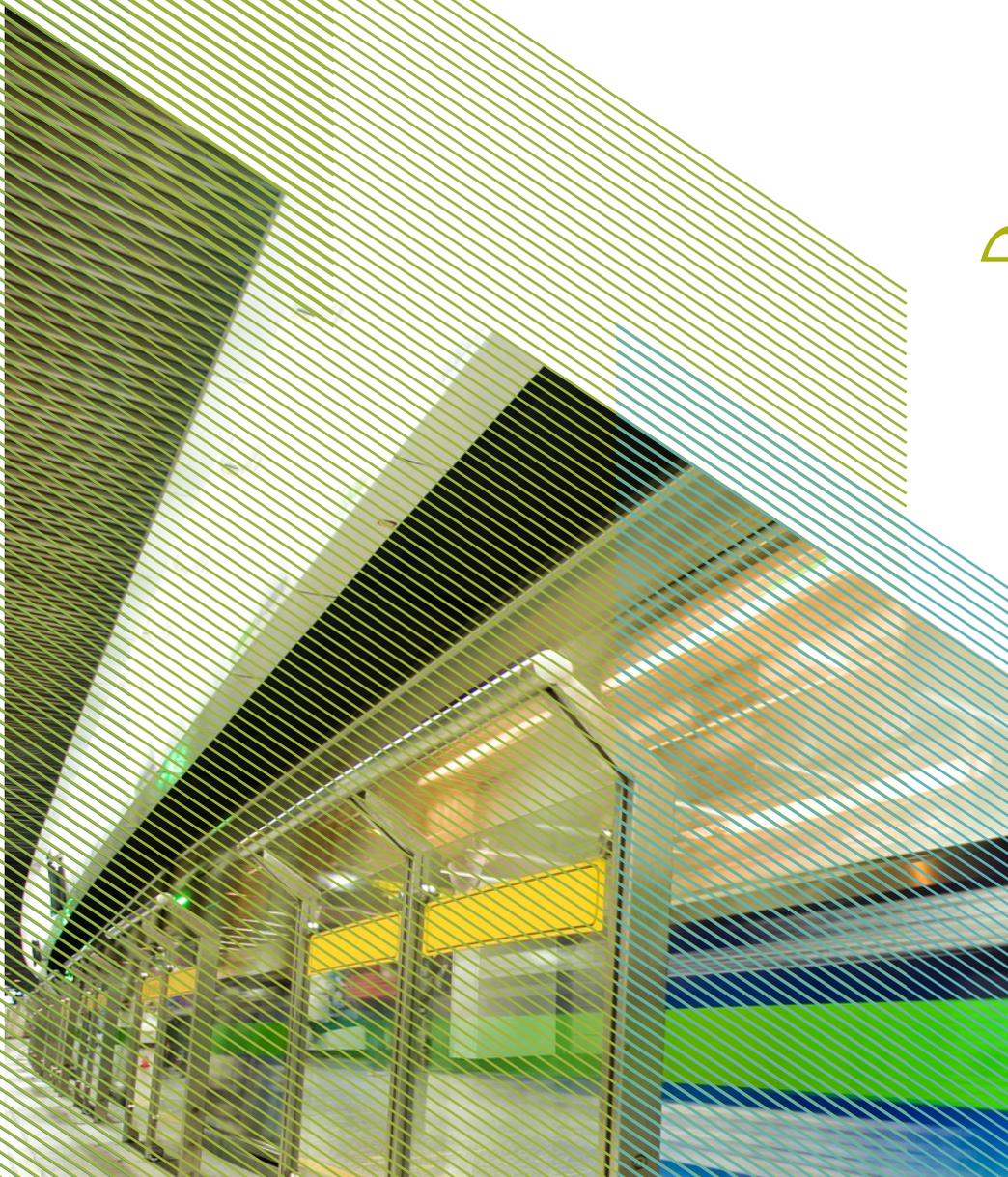


greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao



NZ TRANSPORT AGENCY
WAKA KOTAHI

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POSITIVELY**
ME HEKE KI PŌNEKE
WELLINGTON CITY COUNCIL **Wellington**





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SUMMARY OF KEY FINDINGS

Background

Public transport is about giving people a choice of transport options. It connects people to work, education and leisure, and reduces the levels of congestion in our city. It helps people move around our cities in a more efficient and environmentally friendly fashion, and enables improved economic outcomes.

The Public Transport Spine Study (PTSS) is about determining what a future public transport solution for Wellington might be – one that is high quality, modern and meets the longer term aspirations and demands of the people of our city.

This study has been undertaken by AECOM, and was commissioned by Greater Wellington Regional Council, Wellington City Council and the New Zealand Transport Agency. These three agencies are working in partnership throughout this study to ensure it is aligned with the economic and transport needs in Wellington City and the wider region.

The study

There has been a long history of studies looking at the nature and shape of the public transport network in Wellington. These range from the De Leuw Cather Transport Plan in 1963 to the Ngauranga to Airport Corridor Plan in 2008.

This PTSS responds to a key action from the Ngauranga to Airport Corridor Plan (2008), which seeks major improvements to public transport to provide a high quality, reliable and safe service between the Wellington Rail Station and the regional hospital. It sits alongside significant improvements to the strategic road network that are now being planned and designed as part of the RoNS programme¹ and major upgrades to the rail network.

The PTSS investigates the feasibility of different options to achieve a step change in public transport delivery. It sets out the relative merits of three shortlisted options. A preferred option will be decided through public consultation and a separate decision making process.

The PTSS builds on a range of existing transport and land use strategies and plans and has been guided by the principles of a Treasury Business Case.

The PTSS takes a holistic view of the problem and potential solutions, considering these within the context of the core corridor and the region as a whole.

The problem

The problem² to be addressed by this study is defined as:

- In future years, too many vehicles and modes will share a constrained corridor resulting in longer and unreliable transport journey times which will worsen over time;
- There will be increased traffic congestion in the strategic and local road network and additional environmental impacts as a result of less mode share for public transport;
- There is the potential to unlock economic growth and productivity in Wellington through improved access;
- There will be diminishing returns from current and planned investment in public transport resulting from the uncertain nature and shape of long term future public transport systems.

¹ The Roads of National Significance (RoNS) programme is one of New Zealand's largest ever infrastructure investments, focused on highway improvements to reduce traffic congestion, improve safety and support economic growth. The Wellington Northern Corridor (Levin to Wellington Airport) is a RoNS.

² The problem was defined through the Treasury ILM process and further refined by the project team as the project progressed.

The process

The PTSS approach has progressively narrowed down the number of options (long list, medium list, short list), with each stage providing a more detailed analysis of those options.

The option assessment was underpinned by findings from an international review of public transport systems which informed the study of the characteristics of different transport modes, success factors, design issues, constraints, available technology and procurement processes.

Transport modelling, using a suite of regional models and the latest land use and transport forecasts, has informed the assessment, along with a planning assessment, cost estimates, and an economic analysis.

Throughout the process key stakeholders have been consulted to test emerging directions and findings.

Option development

A range of mode options were considered through the PTSS including:

- Personal rapid transit (small lightweight trams)
- Other bus on-street options such as mini-buses
- Mono-rail (elevated above the street)
- Other Light Rail Transit options including tram-trains running on both the heavy rail network and city streets
- Heavy rail (operating either at street level or underground).

A range of route options were considered throughout the PTSS including:

- Alternatives to the Golden Mile between the Wellington Railway Station and Kent and Cambridge Terraces (such as the Terrace, Featherston Street, Victoria Street, Wakefield Street and along Jervois Quay)
- A secondary route through the CBD for some public transport services at peak times.

The Reference Case

A Reference Case (or base case) was developed to compare three options against. This includes all relevant projects in the Regional Land Transport Programme, including the Roads of National Significance (RoNS), integrated ticketing for public transport and changes planned through the Wellington Bus Review.

The options

The three options considered as part of the short-list evaluation are:

Bus Priority

An enhanced bus network with greater priority at intersections and along key corridors, but using existing vehicle types.

Bus Rapid Transit (BRT)

Dedicated bus lanes for new high capacity vehicles as well as other system improvements to enhance frequency and journey times.

Light Rail Transit (LRT)

Dedicated lanes and tracks for new light rail vehicles as well as interchanges to transfer from other modes.



Potential to connect options north and south

Options to extend the core public transport spine to the north and south were also considered. For extensions to the north it was concluded:

- The average distance for rail users to their final destination from the Wellington Railway Station is short (0.9km) and the majority of these trips are by walking or cycling (60%).
- The majority (86%) of future forecast trips from the north end in the CBD rather than travelling through. This applies for all modes (including cars) in 2031.
- Public transport already has a high share of trips from destinations to the north (40% - 70%), and replacing heavy rail with an alternative mode is unlikely to increase this.
- Converting the Johnsonville line to LRT has its own costs and challenges:
 - There would be significant costs for conversion (tunnel widening, platform lowering, additional passing loops)
 - Double the number of LRT vehicles would be needed to replace the capacity of the 4 car Matangi holding 490 passengers. This would increase the number of vehicles required and necessitate additional infrastructure.
 - There would be significant disruption to services for a long period during construction/conversion.

For these reasons, extending the PT Spine to the north was not pursued further in this study.

For providing high capacity connections to the south and south-east, it was concluded:

- Public transport has a relatively low (for Wellington) share of AM peak hour trips (30% - 40% to the CBD), so provides an opportunity to capture additional passengers.
- The increase in forecast passenger numbers did not justify the extension of LRT from Newtown to Island Bay.
- Extending the LRT/BRT to Kilbirnie would provide a more direct and quicker service to the CBD and is justified by forecast passenger numbers, and is preferable to other options that may require a modal interchange to complete the journey to the CBD.

For these reasons, extending BRT/LRT to Kilbirnie in the south-east was further considered in the PTSS.

The main southern route alignment option involves a split route from the Basin Reserve with one 'branch' travelling east via the Mt Victoria tunnel to Kilbirnie and the other 'branch' continuing via Adelaide Road to Newtown.

A number of sub-options to link through to the south-east via Newtown were also examined and dismissed. These sub-options included using Constable Street and a new tunnel from Newtown to Kilbirnie. Both of these result in longer journey times and have capacity issues due to corridor restrictions.

Summary of the Option Evaluation

Option 1: Bus Priority

Definition

The Bus Priority option provides for peak period bus lanes and priority at intersections to bypass congestion on key corridors, using existing buses. This builds on the current bus priority lanes running along the side of the road in some locations. The service pattern and frequencies would remain the same as the Reference Case.

From the Wellington Railway Station, the route follows the Golden Mile and Manners Street to Courtenay Place. It then travels down Cambridge and Kent Terraces, through the Basin Reserve and on to Newtown, as well as heading south-east through the Hataitai bus tunnel to Kilbirnie. Bus priority measures along the Constable Street and Moxham Avenue corridors are also included but would be implemented as required to respond to congestion and reliability issues.

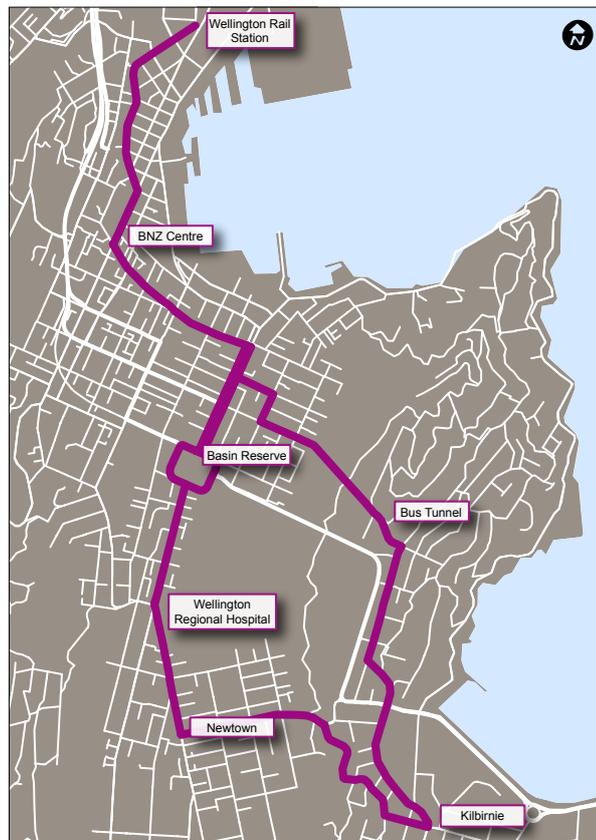
Staging and development

This option is able to be developed incrementally as opportunities arise and as resources are available. Staging would follow the direction given by the Wellington City Council bus priority plan, which starts in the CBD along the Golden Mile and works outwards along key corridors. In addition, opportunities to construct priority bus lanes as part of other planned road construction projects would be taken wherever possible. This includes the Basin Reserve bridge and Adelaide Road upgrade projects.

Limited time would be needed for planning, consultation and environmental assessment along most parts of the route as there is very limited impact on properties and businesses.

Constable Street is likely to be the last stage of development as it is of lesser overall priority due to low passenger demand. This stage has significant constraints due to the restricted road width and potential significant impacts on surrounding properties.

Option 1: Bus Priority



Wellington

Costs

The estimated costs of constructing the Bus Priority option would be about \$59 million (in 2012 dollars). Of this, the changes in Constable Street comprise about \$7.7 million.

The annual costs of running services at \$88 million per year are estimated to be similar to the Reference Case as they both use the same service patterns at the same frequencies.

Benefits

The forecast benefits of the Bus Priority option over a 30 year period are equivalent to \$35 million (in 2012 dollars) and include:

- A three minute travel time saving (22 minutes total trip time) between Kilbirnie and the Wellington Railway Station (2031 morning peak).
- A three minute travel time saving (15 minutes total travel time) between Newtown and the Wellington Railway Station (2031 morning peak).
- A 3.2% increase in morning peak patronage from the south / south-east to the CBD in 2031.

Economic Assessment

Based on total forecast public transport user benefits of \$35 million and estimated costs of \$59 million, and taking into account appropriate discounting of costs, the Bus Priority option has a Benefit Cost Ratio (BCR) of between 0.57 to 0.67. This range depends on the values attributed to elements of the bus journey and other assumptions.

Environmental and Social Assessment

The impacts on pedestrians would be similar to that under the Reference Case. There would be no change to the number of buses travelling through the CBD but overall traffic volumes would reduce on the Golden Mile allowing pedestrians to cross mid-block more easily.

Some on-street parking would be removed during peak periods, which may affect nearby businesses, including restricting access and servicing. Bus stops are rationalised under this option requiring some passengers to walk further.

The impacts on existing properties and activities are minimal as bus lanes are largely within existing road corridors. However along Constable Street widening would be required to provide peak period bus lanes. This could have moderate to significant social and environmental effects.

Other impacts such as noise and vibration are similar to the Reference Case.

Option 2: Bus Rapid Transit

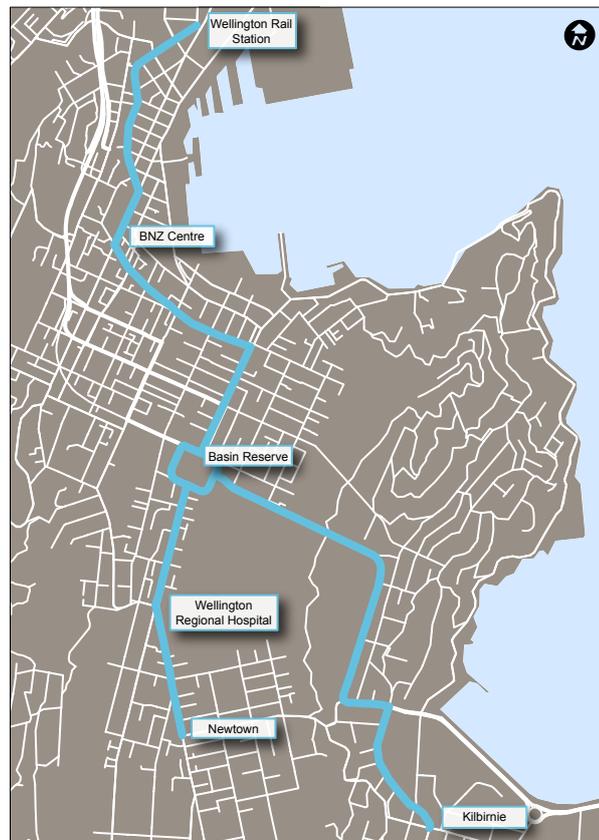
Definition

The BRT option provides new high capacity and high quality buses running on dedicated bus lanes with priority at signals. These could be electric vehicles (using underground induction or overhead wires) or hybrid or diesel vehicles. The dedicated bus lanes are positioned to avoid other vehicles turning movements and run either along the median of the road or along one side of the road. From the Wellington Railway Station, the BRT option follows the Golden Mile to the end of Courtenay Place. Bus only lanes would operate during the day (7 am to 7 pm) but other vehicles would be permitted after business hours. On Kent/Cambridge Terraces BRT would travel alongside the central median to the Basin Reserve. From the Basin Reserve to Newtown, BRT would continue to travel down the centre of the road. To Kilbirnie BRT would use the State Highway corridor through the duplicated Mount Victoria tunnel and along the widened Ruahine Street and Wellington Road.

The ability to use the future Mount Victoria tunnel duplication and widened State Highway 1 corridor is key to the benefits of this option. The flexibility of BRT would also allow local services to make use of the facilities provided and BRT services to travel beyond the core dedicated routes to other terminus points such as Island Bay and Miramar, using the local road network.

The BRT option would operate frequent services during peak hours, providing services every two minutes between the Basin Reserve and the Wellington Railway Station, and every four minutes on the south-eastern and southern branches (to Kilbirnie and to Newtown).

Option 2: Bus Rapid Transit



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Netherlands

Staging and development

As this option requires dedicated bus lanes to be placed in a different road layout, its staging needs to consider how it could be implemented to allow easy transition between road sections for different vehicle types. It is also reliant on other road construction projects such as the Basin Reserve bridge and Mt Victoria tunnel duplication being constructed.

For those sections of the route where bus lanes are proposed along the median (Kent/Cambridge Terraces, Adelaide Road and Riddiford Street), a new road layout will be required. This will require more detailed consideration for locating bus stops and stations. This study has not considered design in detail but has identified that there are feasible solutions such as staggered stations or contraflow bus lanes on Kent/Cambridge Terrace.

The timing of the construction of the Basin Reserve bridge project is currently 2014-16, and the Mt Victoria tunnel duplication is 2018-22. The BRT route to Kilbirnie cannot be developed until these projects are in place.

From a demand perspective, patronage forecasts show that the BRT route to Kilbirnie would have sufficient patronage to justify construction by 2021, whereas patronage on the Newtown route would indicate construction at a later timeframe.

A further factor to be considered is that the benefits of the BRT option also rely on the introduction of higher capacity vehicles. The full benefit of these in reducing bus congestion along the Golden Mile can only be realised once they are in full operation.

An incremental development of the BRT option could be considered to provide sections of the route where transition is possible. However, the maximum benefits of BRT are only realised when a complete system is operational and as such the ideal staging would be for the entire network to be developed in one phase.

Taking these factors into account the optimal staging and timing for completing the BRT option in its entirety is around 2021-22.

Leading towards this timeframe, there are some measures that should be considered for early action:

- Construction of dedicated bus lanes in the BRT option layout from Wellington Railway Station to Courtney Place. These can be developed independently of the other sections of the route.
- Purchase of any land parcels required.
- Ensuring that the BRT option is factored into the planning and design of relevant RoNS projects and other land use and transport planning projects.

Experience of similar sized road projects indicates that approximately three to five years would be required for planning, consultation and environmental approvals, and two years for preconstruction and procurement activities. Construction of the whole BRT system could take around two years.

Costs

The estimated cost of constructing the BRT option in its entirety would be about \$207 million (in 2012 dollars), comprising \$179 million of infrastructure costs and \$28 million of vehicle costs. The cost to operate the system is approximately \$83 million per year which is 6% lower than the Reference Case. This is a reflection of the benefits of faster travel times and reduced vehicle kilometres.

Benefits

The forecast benefits of the BRT option over a 30 year period are equivalent to \$95 million (in 2012 dollars) and include:

- An 11 minute travel time saving (a 13 minute total trip time) between Kilbirnie and the Wellington Railway Station (2031 morning peak) and increased reliability.
- A six minute travel time saving (a 12 minute total trip time) between Newtown and the Wellington Railway Station (2031 morning peak) and increased reliability.
- A 7% increase in morning peak patronage from the south / south-east to the CBD in 2031.
- Potential for property values to increase around stops and along the corridor.

Economic Assessment

Based on total forecast public transport user benefits of \$95 million and estimated costs of \$207 million, and taking into account appropriate discounting of costs, the BRT option has a Benefit Cost Ratio (BCR) of 0.87 to 1.55. This range depends on the values attributed to elements of the bus journey and other assumptions.

Environmental and Social Assessment

In this option there would not be any physical barrier separating BRT lanes from the rest of the road corridor that would create a barrier to pedestrians. This option would involve a decrease in the number of public transport vehicles along the Golden Mile by about 36% with buses from the north rerouted along the parallel spine. Coupled with the removal of general traffic from some sections during business hours and the placement of suitable medians and pedestrian refuges, there would be safety benefits for pedestrians crossing mid-block in the CBD.

Where BRT runs along the median of the road, south of Courtenay Place, passengers would need to access bus stops from the central median requiring them to cross the road from the footpath. The provision of adequate station/stop waiting areas and traffic signals or signalised pedestrian crossings would offset any safety issues.

Bus stops in the CBD have been rationalised under this option requiring some passengers to walk further.

The BRT lanes have been aligned to minimise environmental and social impacts. The option is, however, a significant departure from the existing road layout. Some on-street parking will be permanently removed and this may affect nearby businesses, including restricting access and servicing. Traffic movement will be disrupted in some key locations such as Willis Street, requiring vehicles to find other routes, emergency vehicles will need to be exempt from restrictions. However, overall the rest of the network is able to accommodate additional traffic.

Some localised widening of the road corridor is required, with associated property impacts. More significant widening of the SH1 corridor between the duplicated Mount Victoria tunnel and Kilbirnie Crescent may also be required. This would impact on the Town Belt and other properties to a significant degree.

Other impacts such as noise and vibration are likely to be similar to the Reference Case or would be considered at the detailed design phase.



Option 3: Light Rail Transit

Definition

The LRT option would comprise approximately nine kilometres of rail tracks between the Wellington Railway Station and Newtown and Kilbirnie. New electric tram vehicles would be required.

From the Wellington Railway Station, the LRT option provides for dedicated lanes along the Golden Mile and Manners Street to Courtenay Place. LRT lanes would operate during the day (7am to 7pm) but other vehicles could be permitted after business hours. On Kent/Cambridge Terraces LRT would travel alongside the central median to the Basin Reserve. From the Basin Reserve LRT would continue down the centre of the road to Newtown. To Kilbirnie LRT would use a new dedicated tunnel through Mt Victoria and run alongside the State Highway corridor on Ruahine and Wellington Roads.

A key aspect of the network is a dedicated LRT tunnel through Mount Victoria providing a direct route to Kilbirnie separate to general traffic. This is required to avoid fire and safety issues from sharing a tunnel with general traffic.

The LRT option also involves most bus services from the south/south-east terminating at key interchanges at Kilbirnie and Newtown, requiring passengers to transfer between bus and LRT.

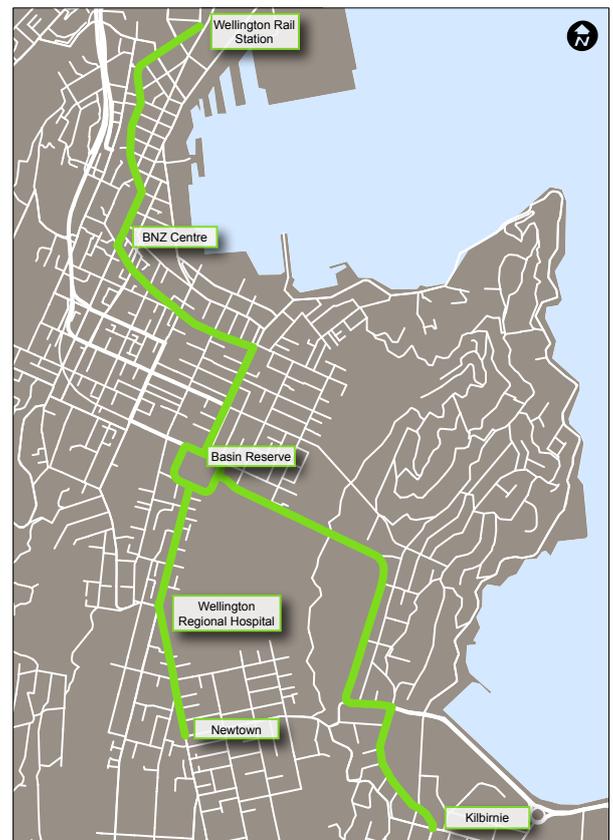
The LRT would operate frequent services during peak hours, departing every two and a half minutes between the Wellington Railway Station and the Basin Reserve, and every five minutes on the south-eastern and southern branches (to Kilbirnie and Newtown).

Staging and development

As this option requires dedicated LRT lanes to be placed in a different road layout, its staging needs to consider how existing bus services will be affected, until the network is fully operational. It is also integrally linked to the timing of other road construction projects such as the Basin Reserve bridge and Mt Victoria tunnel duplication.

For those sections of the route where LRT lanes are proposed along the median (Kent/Cambridge Terraces, Adelaide Road and Riddiford Street), a

Option 3: Light Rail Transit



Seville

new road layout will be required with stops along the median.

Existing buses using these corridors will only be able to use the dedicated LRT lanes if they have doors opening on both sides, which is not likely to be feasible. Alternatively the network could be designed to provide an interim solution to accommodate a combination of contra-flow lanes and stations positioned to allow left hand doors. However there are likely to be very low numbers of buses along this corridor in the LRT option.

The timing of the construction of the Basin Reserve bridge project is currently 2014-16, and the Mt Victoria tunnel duplication is 2018-22. The LRT route to Kilbirnie, which requires a new separate tunnel through Mt Victoria, would ideally be developed in the same timeframe as these projects to minimise cost and disruption.

From a demand perspective, patronage forecasts show that the LRT route to Kilbirnie would have sufficient patronage to justify construction by 2021 whereas patronage on the Newtown route would indicate construction at a later timeframe.

A further factor to be considered is that the benefits of the LRT option also rely on the introduction of higher capacity vehicles at a high frequency. The full benefit of these in reducing public transport vehicle congestion along the Golden Mile can only be realised once the LRT option is implemented in its entirety.

Whilst an incremental development of the LRT option could be considered, at a minimum this would have to provide for the construction of one complete 'branch' of the LRT route. From a demand perspective this would be the route from the Wellington Railway Station to Kilbirnie, which has the highest forecast patronage. Providing a short section of LRT through the CBD would not be successful as this would require bus passengers to transfer close to their final destination.

However an incremental development approach would cause operational difficulties for existing buses. The existing high frequency No 1 bus route (Island Bay to the Railway Station) would continue to operate in this scenario and would either have a forced transfer to LRT at the Basin Reserve or would have to run along the same corridor as LRT. This would be a less preferable design solution that would be confusing for users and undermine the perception of a 'step-change'.

The maximum benefits of LRT are only realised when a complete system is operational, and both 'branches' of the LRT option are operational, providing a two and half minute frequency of service through the CBD, and allowing passengers to transfer in suburban locations. Once fully operational there would be few bus services remaining along the corridor.

Taking these factors into account the optimal staging and timing for the LRT option (excluding economic viability) is to be implemented in its entirety around 2021-22.

Leading towards this timeframe, there are some measures that should be considered for early action:

- Construction of dedicated public transport lanes in the LRT option layout from Wellington Railway Station to Courtney Place. These can be developed independently of the other sections of the route.
- Purchase of any land parcels required.
- Ensuring that the LRT option is factored into the planning and design of relevant RoNS projects and other land use and transport planning projects.
- Early development of a tunnel solution as part of joint project with NZTA for the Mt Victoria tunnel duplication.

Costs

The estimated cost of constructing the preferred LRT alignment in its entirety would be about \$940 million (in 2012 dollars), comprising \$852 million of infrastructure costs and \$88 million of vehicle costs. This includes the cost of the separate LRT tunnel through Mount Victoria which is \$380 million. The cost to operate the system is \$89 million per year which is 1% higher than the Reference Case.

This is due to the high overall costs of running a mixed public transport service comprising both LRT and bus services as well as additional maintenance costs for the LRT tracks and staffing costs.

Benefits

The forecast benefits of the LRT option over a 30 year period are equivalent to \$56 million (in 2012 dollars) and include:

- An 11 minute travel time saving (13 minutes total trip time) between Kilbirnie and the Wellington Rail Station (2031 morning peak) and increased reliability.



- A seven minute travel time saving (11 minute total trip time) between Newtown and the Wellington Rail Station (2031 morning peak) and increased reliability.
- A negligible increase in morning peak patronage from the south / south-east to the CBD in 2031 (due to the transfers required at Newtown and Kilbirnie).
- Potential for increases to property values around stations and along corridors.

Economic Assessment

Based on total forecast public transport user benefits of \$56 million and estimated costs of \$940 million, and taking into account appropriate discounting of costs, the LRT option has a Benefit Cost Ratio (BCR) of 0.05 to 0.10 BCR. This range depends on the values attributed to elements of the journey and other policy assumptions.

Environmental and Social Assessment

The Light Rail Transit option is not required to be fully segregated from pedestrian activity. While the tracks could create a potential hazard for pedestrians, cyclists and wheel chair users, mitigation measures would be considered at detailed design stage – including the appropriate design of the rail and road surface as well as signage.

This option would result in a significant decrease in the number of public transport vehicles along the Golden Mile, by about 40%. Coupled with the removal of general traffic from some sections during business hours, there would be benefits for pedestrians crossing mid-block in the CBD.

Where LRT runs along the median of the road, south of Courtenay Place passengers would need to access stops from the central median requiring them to cross the road from the footpath. The provision of adequate station/stop waiting areas and traffic signals or signalised pedestrian crossings would allow safe crossing of the road.

The number of stops in the CBD have been rationalised under this option requiring some passengers to walk further.

The LRT lanes have been aligned to minimise environmental and social impacts. The option is, however, a significant departure from the existing road configuration. Some on-street parking will be

BRT/LRT: Identification of a Secondary Spine in the CBD



permanently removed and this may affect nearby businesses, including restricting access and servicing. Traffic movement will be disrupted in some key locations such as Willis Street, requiring vehicles to find other routes, however overall the rest of the network is able to accommodate additional traffic.

Some localised widening of the road corridor is required, with associated property impacts. More significant widening of the SH1 corridor between the duplicated Mount Victoria tunnel and Kilbirnie Crescent may also be required. This would impact on the Town Belt and other properties on Paterson Street to a significant degree.

LRT vehicles can produce additional noise and vibration impacts through the interaction of the wheels and tracks. This is an issue that would be further considered at a detailed design phase.

Supporting Policy Interventions

The options aim to provide a high quality, high frequency public transport system through central Wellington. However infrastructure and service improvements do not necessarily deliver significantly improved public transport patronage without supporting policies and actions.

One of the challenges facing all of the PTSS options is that of increased road capacity being delivered in the same timeframe through the RoNS programme. This will provide easier and faster travel to the CBD by car, in competition with public transport.

A number of sensitivity tests have been carried out to assess how the options fare under a range of different scenarios. These include:

- Commuter parking availability and cost
- The geographic distribution of population growth
- Timing of the RoNS programme
- Public transport fare levels.

The results of the sensitivity testing reveals that implementing a range of other policy interventions can have a significant effect on overall public transport patronage and improve the viability of the options.

The tests do however confirm that the relative order of benefits of the options remains the same as reported in the study.

The availability of commuter parking appears to be a key policy intervention that is worthy of further investigation. Restraining the future availability of commuter parking to the same level as in 2011 could result in up to a 7% increase in the share of trips for public transport in all the options.

The geographic distribution of population and economic growth is also an important factor that underpins future public transport patronage. Land use change, such as increased intensification around stations/stops can also result from investment in high quality public transport. It will be important that land use policies direct and allow future growth along the growth spine.

Public transport fares are a further tool that impact directly on passenger numbers as well as overall fare revenue. A decrease in fares would provide for increased passengers but at the expense of revenue. Similarly an increase in fares would reduce the number of passengers but increase revenue. It will therefore be important to consider what proportion of each option's costs can be recovered through fares without reducing forecast patronage.

Aligning of related policies and programs would be necessary to realise the full benefits of any of the options.



Key Findings

The key findings from the Study are:

- A high quality, high frequency public transport spine has an important role within the Ngauranga to Airport Corridor, alongside RoNS, as part of a balanced long-term transport network for Wellington.
- There is a need for future investment in public transport through central Wellington to achieve the goal of growing public transport mode share.
- There are opportunities to improve public transport mode share from the south and south-east of Wellington, however extensions of the options to the north would have limited benefits.
- Bus Rapid Transit provides the highest benefits, followed by Light Rail Transit and Bus Priority.
- The cost of the most expensive option (LRT) is almost five times that of the next most expensive option (BRT).
- BRT has the highest overall Benefit Cost Ratio (BCR), followed by Bus Priority then LRT.
- The Bus Priority and BRT options can be developed incrementally. The optimal staging and timing for the BRT and LRT options, however is one stage and completion around 2021-22.
- It is technically feasible to construct all three of the shortlisted options. For most of the route they can be accommodated within the existing road corridor. However, there are significant impacts on property from BRT and LRT options through Mt. Victoria and along Ruahine Street and Wellington Road.
- Aligning other policies (such as parking and land use) and transport projects would be necessary to realise the full benefits of any of the options. For example, managing any future increases in the availability of commuter parking appears to be key intervention to increase public transport patronage and mode share.

Table 1: Summary of options compared to reference case

		REF CASE	BUS PRIORITY	BRT	LRT
Option	km of dedicated route	–	10	9	10.2
	New vehicles	–	–	40	22
	New Depots	–	–	–	1
	Headway of service on Kent/Cambridge (mins at peak)	1.5	1.5	1.8	2.3
Cost	\$ CAPEX (million)	-	59	207	940
	\$ OPEX per annum (million)	88	88	83	89
Benefits	Passenger numbers: AM peak (in an hour)				
	2021	35600	+200	+700	+200
	2031	34000	+300	+800	+300
	2041	35200	+300	+900	+400
	From Locations to CBD				
	Miramar	1320	1380	1490	1250
	Kilbirnie	680	720	760	770
	Mount Victoria / Hataitai	790	800	740	750
	Island Bay / Berhampore	1140	1170	1240	1080
	Newtown	790	820	880	830
	Travel Measures (2031 morning peak)				
	Travel times to CBD				
From Kilbirnie	24	21	13	13	
From Newtown	18	15	12	11	
Transfers					
Kilbirnie	160	280	210	1340	
Newtown	50	60	150	1020	
CBD	7790	7700	9100	9580	
Economic Assessment (BCR)	EEM	–	0.57	0.87	0.05
	Alternative Approach	–	0.67	1.55	0.10
Environmental and social assessment	Widening		Constable Street	Ruahine Street	Ruahine Street Paterson Street
	Parking		Peak Period	Removal in some locations	Removal in some locations
	Property Access CBD		Impacts during Peak period	Impacts during Working Hours	Impacts during Working Hours
	Planning, environmental and social impacts		Marginal	Significant	Very Significant
Potential broader impacts	Typical property price increase (Source: International Review)	-	Little attraction	Up to 20%	Up to 25%

