
Review of mass transit model assumptions for the LGWM recommended programme of investment (RPI)

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1. Introduction

This note reviews the mass transit model assumptions for the LGWM recommended programme of investment (RPI). This review is based on the following information provided by the LGWM modelling team:

- Recommended programme of investment (RPI)
- WPTM/WTSM public transport model assumptions
- Public transport service level assumptions

The LGWM recommended programme of investment (RPI) includes the two mass transit routes with the following high-level assumptions:

1. LRT between Kaiwharawhara (new ferry terminal) and Wellington Zoo via CBD Waterfront route, Taranaki St, Adelaide Road and Wellington Hospital
2. BRT airport express route from Wellington Station to Airport via duplicate Mt Victoria tunnel.

Please note the above high-level assumptions are assumed to be fixed and therefore this review does not look at the merits or otherwise of different mass transit route options.

2. Key issues identified

The key issues identified during this review are set out below. Some of these issues may need to be addressed as part of the current programme business case process but others could be considered further during subsequent detailed business cases.

1. The description of the recommended programme of investment (refer Table 3.1) and model assumption (refer Table 3.1) do not say how Spine 1 (LRT) will get from Thorndon Quay to the waterfront. We assume this will be via Bunny Street as previously discussed. A key issue with this alignment is that there would be no opportunity for western suburbs passengers to transfer to/from LRT for travel through the CBD¹.
2. The description of the recommended programme of investment (refer Table 3.1) is not clear on how Spine 1 (LRT) will get from Taranaki Street to Adelaide Road. We understand that all the options considered to date have significant issues and/or cost implications. The RPI description includes grade separation at The Basin in which case utilising that alignment would likely deliver better value for money².
3. The description of the recommended programme of investment (refer Table 3.1) has assumed Spine 2 will use Cobham Drive rather than Rongotai Rd. This is a key issue as more passengers would benefit and a better value for money outcome would be achieved by

¹ We note that alternative waterfront alignments such as using the northern end of Lambton Quay with a Lambton Central interchange would increase transfer opportunities and maximise LRT usage.

² Only one stop is affected by the choice of Taranaki Street or Kent/Cambridge Terrace for the LRT alignment. In both cases this stop would be located near the intersection with Vivian Street on the relevant corridor and whichever stop is not served by LRT would be served by high-quality bus or BRT services.

concentrating investment on priority measures along Rongotai Rd (and Kilbirnie Cres) via Kilbirnie Shops.

4. The WPTM/WTSM model assumptions (refer Table 4.1 option B) assume in several places that bus services will not share LRT lanes but instead will have to compete with general traffic. It is not clear that this is the best policy as this approach will likely result in underutilising of road space and a significant reduction in overall benefits for public transport passengers (i.e. less reliable and longer journey times for the majority of passengers³).
5. Mt Victoria tunnel duplication is not essential for delivering high quality public transport services to the Airport but could be used if available⁴. This means that the tunnel is not, from a network planning perspective, on the critical path for delivering Spine 2 to the airport.
6. The phasing is not clear with the description in Table 3.1 stating LRT will stop at the Zoo and not extend further during the period of the programme business case while Table 4.1 option B appears to still assume LRT will be extended to the airport.
7. The design criteria for a reliable public transport service on the Golden Mile is 60 vehicles per hour. The model peak demand estimates for Option B (LRT) will require 101-116 buses per hour on the Golden Mile and 8-16 light-rail vehicles per hour on the Waterfront. It is recommended that further consideration be given to which routes operate along the Waterfront vs Golden Mile corridors as part of a subsequent detailed business case. One option would be to run LRT on the Golden Mile and all BRT/bus services on the Waterfront which potentially has a greater design capacity than the Golden Mile.
8. The model year is 2026 which essentially means vehicle requirements are based on short-term demand only. The number of public transport vehicles operating through the CBD is likely to increase further as demand increases beyond 2026. Further consideration would be required to identify longer term demand and benefits from investment in mass transit.
9. We assume the 2026 evaluation year is nominal for modelling purposes but that the programme is for a longer investment period. We note that network assumptions will need to be made for years well beyond 2026 for economic evaluation purposes. We also note that the number of public transport vehicles operating through the CBD will continue to increase as demand increases beyond 2026.

3. Review of recommended programme of investment (RPI)

The LGWM team have provide a description of the recommended programme of investment (RPI) for the purposes of model testing in 2026 as set out in Table 3.1. Our reviewer comments are provided in the right-hand column.

³ LRT will only be a single line and therefore network wide most passenger will continue to travel by bus.

⁴ An Airport service along Spine 2 is already effectively in place by way of the NZ Bus Airport Flyer service. The model shows that even without Mt Victoria tunnel duplication there would be no overall increase in the number of buses using the existing Hataitai bus tunnel but changes in demand would require the use of higher capacity electric vehicles (e.g. double-decker buses).

Table 3.1 Description of recommended programme of investment (RPI)

Ref	Topic	Description	Reviewer comments
1	Twin Mass Transit spine	<ul style="list-style-type: none"> Spine 1 – Kaiwharawhara to Newtown. For the purposes of facilitating modelling, this is assumed to follow the currently assumed LRT connection running along Thorndon Quay, the Waterfront, Taranaki Street, Adelaide Road and Riddiford Street, terminating at the zoo (acknowledging that there are still alignment options along the corridor that will be considered as part of the DBC phase, including an alternative along Aotea Quay) 	<ul style="list-style-type: none"> We assume Spine 1 is LRT. We note that Spine 1 (LRT) terminates at the Zoo and will not be extended to Kilbirnie or the Airport as part of the programme (but future business case for such as extension is not precluded). We assume that Spine 1 will operate from Thorndon Quay via Bunny Street onto the Waterfront. This means there will be no opportunity for western suburbs passengers to transfer to/from LRT for travel through the CBD. Alternative alignments such as using the northern end of Lambton Quay with a Lambton Central interchange would increase transfer opportunities and maximise LRT usage. Detailed consideration of this issue is recommended as part of the detailed business case. It is not clear how Spine 1 will get from Taranaki Street to Adelaide Road. We understand that all the options considered to date have significant issues and/or cost implications.
		<ul style="list-style-type: none"> Spine 2 – Railway Station to Airport. For the purposes of modelling, this is assumed to be a BRT connection running along Lambton Quay, Courtenay Place, Kent/Cambridge, duplicated Mount Victoria Tunnel, Cobham Drive, and Miramar (acknowledging that there are still alignment options along the corridor). 	<ul style="list-style-type: none"> We assume Spine 2 will be an express bus/BRT service. A duplicate Mt Victoria tunnel is not necessary for this spine given that the Airport Flyer service currently uses and could continue to use the Hataitai bus tunnel. Spine 2 could deliver significant benefits much earlier than a duplicate Mt Victoria tunnel. When the tunnel is constructed consideration could be given to routing Spine 2 to use it. Running Spine 2 along Cobham Drive rather than Rongotai Rd is a key issue. Better value for money would be obtained by concentrating investment on priority measures along Rongotai Rd (and Kilbirnie Cres). This is because any investment in bus priority on Cobham Drive would only benefit Airport passengers and a limited number of commuters. Running Spine 2 along Rongotai Rd would enable investment in bus priority to benefit almost all eastern suburbs bus services and also allows Spine 2 services to integrate with the wider network at Kilbirnie. Running Spine 2 via Miramar is not recommended. We note that routing the airport service via Miramar was proposed for LRT to maximise LRT usage. The bus/BRT situation is different as separate direct routes for both catchments are more cost effective.
2	Supporting bus and rail network improvements	<ul style="list-style-type: none"> RS1 rail capacity improvements High quality bus priority (BRT?) to Johnsonville and Churton Park and on to Lincolnshire Farm/Stebbings Growth Area via Hutt Road bus lanes and new PT interchange at Kaiwharawhara. Bus priority and capacity enhancements on Karori route (additional peak hour bus lanes on Bowen Street, additional services). 	<ul style="list-style-type: none"> Wider network options will be considered further as part of the network design options below.

3	Network changes required to support mass transit spines	<ul style="list-style-type: none"> • Mount Victoria Tunnel duplication with additional lanes on Ruahine Street • Additional lanes serve BRT and T3 only (limited additional traffic capacity to remove traffic from waterfront route and Constable Street) • Basin Reserve grade separation • Removal of one lane of general traffic in each direction from Quays to support Mass Transit spine • Removal of general traffic from northern part of Willis Street and Lambton Quay • Removal of general traffic (other than local access) from Riddiford Street between Rintoul Street and Russell Terrace. 	<ul style="list-style-type: none"> • As noted above Mt Vic tunnel duplication is not essential for delivering high quality PT services but the tunnel could potentially be used if available. There is also potential for a link from Ruahine Street to Hataitai bus tunnel to avoid impacting Moxham Ave area. We recommend considering this further when the detailed business case is prepared for Mt Vic tunnel duplication. • Basin reserve grade separation could provide the opportunity to run Spine 1 via Kent/Cambridge Terrace rather than Taranaki Street to Adelaide Road, particularly as there are significant issues/costs associated with all Taranaki Street to Adelaide Rd link options considered to date. This can be considered further as part of the detailed business case. • General traffic will need to be removed from the length of the Golden Mile (Courtenay Place to Wellington Station). The northern end of Lambton Quay may be able to accommodate some general traffic.
4	Other RPI elements	<ul style="list-style-type: none"> • Wellington City cycle network • Pedestrian improvements across the network (in line with improvements outlined above and in other areas (eg Cuba Street) which do not affect network capacity). Additional severance reduction measures along Karo Drive and Vivian Street (retained as State Highway corridors) • Optimised pricing as a mechanism for TDM 	<ul style="list-style-type: none"> • Noted.
5	Future staging options	<ul style="list-style-type: none"> • Elements that will be considered beyond 2026 with trigger points, but not precluded as part of the preferred programme include: <ul style="list-style-type: none"> ○ LRT connection from Newtown (zoo) to the airport ○ Duplication of Terrace Tunnel, ○ Motorway on-ramp and off-ramp reconfiguration ○ Ngauranga to Aotea Quay southbound widening ○ Karo Drive undergrounding 	<ul style="list-style-type: none"> • We assume these options are outside the recommended programme of investment and are therefore not considered as part of the programme business case. • We assume the 2026 evaluation year is nominal for modelling purposes but that the programme is for a longer investment period (with the options listed here not proposed during this investment period). We note that network assumptions will need to be made for years well beyond 2026 for economic evaluation purposes.
6	Other tests	<ul style="list-style-type: none"> • Tests that will be undertaken as the project progresses <ul style="list-style-type: none"> ○ Confirming the timing for the duplication of the Mt Victoria tunnel duplication by assessing the implications of running BRT through Hataitai and the existing bus tunnel ○ Assessing the implications of running mass transit along Aotea Quay instead of (or as well as) Thorndon Quay ○ Assessing the phasing of LRT and BRT construction 	<ul style="list-style-type: none"> • These are options that could be possibly be considered further as part of detailed business cases. • We note there would be very limited benefit operating LRT along Aotea Quay as there is no catchment in this area compared to Thorndon Quay where there is an existing catchment. Running along Aotea Quay will also require crossing the main trunk line any further extension to the north.

4. Review of WPTM/WTSM public transport model assumptions

In addition to the description of the RPI above the LGWM have provided a more detailed description of the model assumptions as set out in Table 4.1. Our reviewer comments in the right-hand column.

Table 4.1 Review of WTSM/WPTM mass transit model assumptions for the RPI

		Option A - split spine, medium priority (P3+) [BRT]	Option B - single spine, high priority (P5+) [LRT]	Reviewer comments
1	Summary	<ul style="list-style-type: none"> Building upon the early improvements and improved travel choices, this option would deliver a medium level priority BRT on several core corridors to the south and east, to support high quality, high frequency, high capacity bus services, with potential to extend these corridors through to the north / west. A key component of this option is the requirement for two high-priority public transport spines through the central city – Waterfront route and Golden Mile 	<ul style="list-style-type: none"> Building upon the early improvements and improved travel choices, this option would deliver a high level of public transport infrastructure priority and service level along a single spine from Wellington Station to the Airport via Newtown / Kilbirnie. A key component of this option is the requirement for two high-priority public transport spines through the central city – Waterfront route and Golden Mile. 	<ul style="list-style-type: none"> Option B: The RPI (refer Table 3.1) states that LRT will terminate at the zoo, with a possible extension to the airport post-2026. Option B makes no mention of phasing over the longer term. The reference to a single spine is also not accurate.
2	Fleet	<ul style="list-style-type: none"> Higher capacity (100+ seat), higher quality electric vehicles along core routes Existing lower capacity vehicles across remainder of network, majority of which will be electric 	<ul style="list-style-type: none"> High capacity (200+), LRT or similar standard vehicles along a single spine Existing fleet operating across remainder of network 	<ul style="list-style-type: none"> Noted
3	Service frequencies and network characteristics	<ul style="list-style-type: none"> High frequency (at least ten minutes all day, every day) on core routes Reduction in vehicles along Golden Mile due to utilisation of two spines through CBD Small increase in service hubbing and requirement to transfer, particularly during off-peak BRT vehicles mix with non-BRT vehicles Underlying network as per Wellington City 2018 bus networks, with services split between Waterfront Route and Golden Mile 	<ul style="list-style-type: none"> Changes to existing network structure required to accommodate only LRT on segregated corridor; high frequency (5 min at peak times) on single spine, lower frequencies on feeder services and remaining bus routes Reduction in vehicles along Golden Mile due to utilisation of two spines through CBD Increase in service hubbing and requirement to transfer at certain locations during peak and off-peak LRT is fully segregated from general traffic and other buses along majority of the network 	<ul style="list-style-type: none"> Option B bullet 2: Not sure this is correct all bus routes other than LRT will continue to operate along the Gold Mile. Therefore, there will likely be more vehicles along GM than in Option A and possibly the base case (based on our earlier network design work)
3	Hutt Road / Thorndon Quay	<ul style="list-style-type: none"> 24/7 bus lanes along Thorndon Quay, inbound and outbound Dedicated bus lanes along Hutt Road (inbound only) Bus lane on northbound approach to Jardin Mile / Ngauranga Gorge Assess feasibility of southbound HoV lane on Ngauranga Gorge 	<ul style="list-style-type: none"> As per Option A. 	<ul style="list-style-type: none"> Option B: It is not clear whether buses and LRT will share a right-of-way or not Option B: This should possibly mention LRT depot site and arrangements for access to/from site (assume vicinity of Statistics House site)
4	Golden Mile	<ul style="list-style-type: none"> Rationalisation of bus stops to 4 along Golden Mile, with additional two stops along Waterfront Removal of general traffic from central sections of Golden Mile (Manners Mall, Willis Street), broadly as per Opus BRT High 	<ul style="list-style-type: none"> As per Option A. 	<ul style="list-style-type: none"> Option B: There will be no Lambton Quay interchange if LRT is using waterfront route from Bunny Street.

		Option A - split spine, medium priority (P3+) [BRT]	Option B - single spine, high priority (P5+) [LRT]	Reviewer comments
		<ul style="list-style-type: none"> • Segregation of public transport and general traffic along Courtenay Place / Lambton Quay, with eastbound general traffic permitted along both Courtenay Place and Lambton Quay (broadly as per Opus BRT High) • Te Aro Park interchanges, Lambton Quay / Brandon St interchange provide ability to change between services on the two spine routes • Full priority for buses at all intersections 		
5	Waterfront	<ul style="list-style-type: none"> • Dedicated 24/7 bus lanes along Waterfront • Full priority at signalised intersections, together with full priority to enable buses to join / leave Waterfront route 	<ul style="list-style-type: none"> • As per Option A 	<ul style="list-style-type: none"> • Option A: The network design work assumed both corridors would operate along the northern end of Lambton Quay and split at Lambton Central Interchange. • Option B: This is not the same as Option A as assumes LRT on the water from between Bunny Street and Taranaki Street with no Lambton Central interchange.
6	Taranaki Street to John Street	<ul style="list-style-type: none"> • Dedicated 24/7 bus lanes to Taranaki Street / Karo Drive (both northern and southern approaches) extending to stop line with B-phase / signal pre-emption • No bus priority measures along Wallace Street due to constraints of corridor 	<ul style="list-style-type: none"> • Fully segregated LRT from Te Aro Park to Karo Drive, centre running, with one stop in vicinity of Abel Smith Street; buses on same corridor (heading up Taranaki Street / Wallace St) share with general traffic • No bus priority measures along Wallace Street due to constraints of corridor • Fully priority for LRT at Vivian Street / Taranaki Street • New dedicated LRT only link from Taranaki Street (around Webb Street) to Adelaide Road (McDonalds) with priority at intersections 	<ul style="list-style-type: none"> • Option B bullet 1: A core bus route is required along Taranaki Street in addition to LRT and therefore should utilise any priority measures rather than share with general traffic. Also, prima facie, given the modest LRT service levels on most of the network, there would seem a good case for buses sharing the LRT road space. • Option B bullet 4: We understand that all the options considered to date have significant issues and/or cost implications. This means it may not be possible/cost effective to provide this link and an alternative Kent/Cambridge Terrace alignment may be preferable.
7	Kent / Cambridge Terrace	<ul style="list-style-type: none"> • 24/7 PT priority lanes along Kent / Cambridge Terrace • Side running alignment to minimise side friction, B-Phase and signal pre-emption at all intersections to give high level of priority • Double cycling of Vivian Street / Pirie Street; removal of straight ahead from Vivian to Pirie to enable southbound buses to run at same time as SH traffic 	<ul style="list-style-type: none"> • Existing bus lanes along Kent / Cambridge Terrace, extended to 24/7 operation, no signal priority / pre-emption • No changes to intersections for general traffic 	<ul style="list-style-type: none"> • Option B: Bus priority is required on Kent/Cambridge as this be used by the Spine 2 express service from the Airport (particularly if following duplicate Mt Victoria tunnel route) and is required for core bus services from Island Bay (assuming no forced transfers).

		Option A - split spine, medium priority (P3+) [BRT]	Option B - single spine, high priority (P5+) [LRT]	Reviewer comments
8	Elizabeth Street to Kilbirnie (via bus tunnel)	<ul style="list-style-type: none"> • Dedicated, short 24/7 bus lane on both approaches to Kilbirnie Crescent / Hamilton Road / Wellington Road intersection, together with bus B phase and signal double cycling in peak times to reduce delays for general traffic • Removal of RT from Wellington Road to Kilbirnie Crescent, double right turn from Wellington Road to Evans Bay Parade to improve capacity for SH traffic (inbound) and allow for more capacity for Kilbirnie Crescent / Hamilton Road traffic • Restrictions on general traffic down Pirie Street / Waitoa Road to improve capacity and reliability for buses • Changes in Hataitai village road layout to improve bus turning radii, reduce conflicts and provide buses with degree of priority • Signal pre-emption for BRT vehicles (peak direction) at Kilbirnie Crescent / Hamilton Road / Wellington Road • Peak time only bus lanes along length of Kilbirnie Crescent (parking allowed outside peaks) 	<ul style="list-style-type: none"> • Dedicated, short stretch of 24/7 bus lane on both approaches to Kilbirnie Crescent / Hamilton Road / Wellington Road intersection, together with bus B phase • Signal pre-emption for BRT vehicles (peak direction) at Kilbirnie Crescent / Hamilton Road / Wellington Road 	<ul style="list-style-type: none"> • This should cover the duplicate Mt Victoria tunnel assumptions also. Is Spine 2 from above assumed to use the duplicate tunnel? • For both options A & B Ruahine Street could be extended to the existing bus tunnel via a link behind Hataitai Shops. This would allow dedicated right-of-way along eastern side of Ruahine Street. There could be economic benefits in doing this prior to or instead of a duplicate Mt Victoria tunnel (buses could also potentially use the length of Pirie Street instead of Elizabeth Street to minimise impacts of more bigger vehicles in residential areas). These options should be considered further as part of a detailed business case as may show the PT could be better to continue using the existing bus tunnel rather than a duplicate Mt Victoria tunnel. • We understand that one reason for duplicating Mt Victoria tunnel is to avoid impacts on Hataitai and Mt Victoria residential areas. Dedicated bus lanes along a widened Ruahine Street with a new link road to Waitoa Rd, the existing bus tunnel and running the full length of Pirie Street (gradients and road width permitting) could be a more cost-effective option for avoiding impacts along Moxham Ave and reducing impacts in Mt Victoria (to those properties along Pirie Street). We recommend that the impact of both options including cost, amenity and other trade-offs be considered further as part of a subsequent detailed business case.
9	Basin Reserve and Adelaide Road	<ul style="list-style-type: none"> • Signal pre-emption for BRT vehicles at Grandstand apartments and Dufferin Street / Rugby Street to get buses from nearside into central, segregated bus lane • South bound dedicated bus lane around eastern side of Basin reserve, taking up one existing Newtown bound lane 	<ul style="list-style-type: none"> • LRT tunnel emerges onto Adelaide Road around McDonalds • Dedicated centre running LRT lanes along Adelaide Road through to Newtown, requiring removal of one lane of general traffic along entire length • No priority for remaining buses on Adelaide Road; they share with general traffic 	<ul style="list-style-type: none"> • Option B bullet 2: Is lane removal in one or both directions • Option B bullet 3: Island Bay buses will continue to run on Adelaide Road and via The Basin (assuming passenger focused network rather than forced transfer). This is a core bus route that required fast/reliable services and

		Option A - split spine, medium priority (P3+) [BRT]	Option B - single spine, high priority (P5+) [LRT]	Reviewer comments
		<ul style="list-style-type: none"> • Bus lane in both directions along Adelaide Road, extending to stop line at Adelaide Road / Rugby Street intersection with B-phase to enable buses to access inner lane around Basin Reserve (northbound) • Adelaide Road / John Street – bus lanes on both Adelaide Road (N) / Rintoul Street (S) approaches, neither extending to stopline • No bus priority lane for buses travelling northbound around western side of Basin Reserve 		<p>therefore should share any LRT dedicated right-of-way rather than travel with general traffic. The alternative is significant disbenefits for a large catchment.</p> <ul style="list-style-type: none"> • Option B: No mention of grade separation at Basin but this is included in the RPI description in Table 3.1.
10	Adelaide Road to John Street	<ul style="list-style-type: none"> • Dedicated 24/7 bus lanes along Adelaide Road • Signal pre-emption at intersections, bus lanes extend to stop line at Rugby Street / Adelaide Road (but not Adelaide Road / John Street) • Bus lanes do not extend to stop line on northbound approach to Adelaide Road / John Street intersection (from Rintoul St) • Bus lanes extend to stop line on southbound approach to Adelaide Road / John Street intersection, with B signal to enable buses to turn from nearside bus lane into Adelaide Road towards Island Bay (bypassing Newtown) • No bus lanes / priority on John Street arm of intersection 	<ul style="list-style-type: none"> • Fully segregated LRT lanes, signal pre-emption at intersections, segregated lanes run to intersection stop lines between Rugby Street and John Street • Full priority for LRT at Adelaide Rad / John Street intersection – lanes extend to stop line • Buses travel in general traffic • No bus lanes / priority on John Street arm of intersection 	<ul style="list-style-type: none"> • Option B bullet 3: Shared right-of-way required as per #9 above.
11	Newtown	<ul style="list-style-type: none"> • 24/7 bus lanes between Hospital and Riddiford / Rintoul Street • Bus running in with general traffic along Riddiford Street between Rintoul Street and Constable Street; de-powering of road through Newtown Shops, encouraged to be access only, priority for buses and active modes • Bus priority measures (phase extension) at Riddiford Rd / Constable St intersection for buses from Constable to Riddiford 	<ul style="list-style-type: none"> • Removal of general traffic along Riddiford Street between Rintoul Street and Constable Street, creating dedicated LRT / active mode section • Dedicated, segregated LRT lanes between Hospital and Constable Street, including priority at intersections 	<ul style="list-style-type: none"> • Option B: Here there would seem to be a good case for buses sharing the LRT lane through Newtown.
12	Newtown to Kilbirnie	<ul style="list-style-type: none"> • Bus lane on Crawford Road approach (from south) to Crawford Road / Constable Street roundabout with dedicated inbound bus slip lane providing priority 	<ul style="list-style-type: none"> • Segregated LRT lane from Constable Street along Riddiford St to Mansfield St (one narrow GT lane in both directions) • Mansfield Street – removal of general traffic, segregated LRT • LRT enters zoo tunnel near zoo, emerges onto Rongotai Road 	<ul style="list-style-type: none"> • Option B: LRT does not extend from Newtown to Kilbirnie under the RPI assumptions in Table 3.1. • Option B: Should probably note LRT terminus and potential local connecting bus services.
13	Kilbirnie	<ul style="list-style-type: none"> • Bus priority measures at Kilbirnie Crescent / Evans Bay Parade and Evans Bay Parade / Onepu Rd / Rongotai Rd intersection 	<ul style="list-style-type: none"> • General traffic restrictions / removal in Kilbirnie Town Centre under both options to provide highest level priority and stopping facilities for LRT exiting tunnel and heading onto Rongotai Road 	<ul style="list-style-type: none"> • Option B: These provisions only apply if LRT is extended beyond the zoo. Option B should probably be the same as Option A.

		Option A - split spine, medium priority (P3+) [BRT]	Option B - single spine, high priority (P5+) [LRT]	Reviewer comments
		<ul style="list-style-type: none"> Restrictions to general traffic with Kilbirnie Town centre to provide a highest level of priority and segregation for public transport Expanded Kilbirnie bus hub, utilising land in the Kilbirnie triangle 	<ul style="list-style-type: none"> Removal of general traffic from Rongotai Road (Childers Terrace to Onepu Road) Signal pre-emption for LRT at bay Road / Rongotai Road and Rongotai Road / Onepu Road 	
14	Kilbirnie to Airport / Miramar	<ul style="list-style-type: none"> Dedicated bus lanes along Rongotai Road Dedicated bus lane on south side of Cobham Drive between Miramar roundabout and Troy Street roundabout, with slip lane towards Rongotai Road Signals on Cobham Drive W/B approach to troy Street; signals triggered by approaching E/B bus on Troy Street to enable gap for bus to enter roundabout and join W/B Cobham Drive Bus slip lane from Stewart Duff Drive to access city-bound bus lane on south side of Cobham Drive 	<ul style="list-style-type: none"> Dedicated LRT lanes along Rongotai Road (centre running) Signals at Troy Street / Cobham Drive / Rongotai Road to provide priority to eastbound LRT; LRT goes though centre of roundabout to access dedicated seaward side LRT lanes Dedicated LRT lane eastbound / westbound on Cobham Drive (seaward side) and through Miramar cutting (seaward side); maintain 4 lanes on Cobham Drive Re-alignment along Cobham Drive required to fully segregate LRT and general traffic 	<ul style="list-style-type: none"> Option B: These provisions only apply if LRT is extended beyond the zoo. Option B should probably be the same as Option A. Option B: Bus priority on Cobham Drive for Airport Express will not benefit eastern suburb commuters as most bus route via Kilbirnie. The Airport Express and associates bus priority should operate along Rongotai Road and through Kilbirnie Shops interchange for investment in bus priority to benefit commuters rather than limited airport market only.
15	Brooklyn	<ul style="list-style-type: none"> Inbound bus lane and B-phase on Willis Street approach to Karo Drive Outbound bus lane on Victoria Street (Ghuznee to Karo) to signalised stop line 	<ul style="list-style-type: none"> Inbound bus lane and B-phase on Willis Street approach to Karo Drive Outbound bus lane on Victoria Street (Ghuznee to Karo) to signalised stop line 	<ul style="list-style-type: none"> Noted
16	Karori	<ul style="list-style-type: none"> 24/7 inbound bus lane on Glenmore Street to Bowen Street with priority turn into Bowen Street; extension of outbound bus lane to stop line at Glenmore St / Upland Road roundabout Conversion of existing bus lane on Chaytor Street to 24/7 operation Consideration of further bus priority measures / B-phases at intersections in Karori area Priority for buses turning to / from Bowen Street @ Tinakori Road Priority and dedicated bus only turn from Bowen Street to Lambton Quay 	<ul style="list-style-type: none"> As Option A 	<ul style="list-style-type: none"> Option A: Further work is required to determine whether these assumptions are appropriate.
17	Rail network improvements	<ul style="list-style-type: none"> Free bus transfers to regional stations on rail network Extend Melling line frequencies to all day Increase rail frequency (and hence capacity) by 25% 	<ul style="list-style-type: none"> Free bus transfers to regional stations on rail network Extend Melling line frequencies to all day Increase rail frequency (and hence capacity) by 25% 	<ul style="list-style-type: none"> Increase rail frequency and capacity by 25%: is this to be both peak and off-peak? (in peaks, best solution may be to run longer trains; in off-peaks to run more frequent

		Option A - split spine, medium priority (P3+) [BRT]	Option B - single spine, high priority (P5+) [LRT]	Reviewer comments
				services - not sure what the RRP says on this topic).
18	Miramar and Airport	<ul style="list-style-type: none"> Hubs at Miramar and Wellington Airport Dedicated bus lane on Miramar Avenue approach to Cobham Drive roundabout, enabling buses to reach front of queue and enter dedicated inbound bus lane on southside of Cobham Drive Near-side bus lane on Stewart Duff drive (N/B approach to roundabout) providing buses with priority access to southside bus lane, inbound along Cobham Drive 	<ul style="list-style-type: none"> Fully segregated LRT, dedicated lanes and pre-emption, Miramar Avenue, Hobart street Priority at Stewart Duff Drive / Hobart Street to access Airport PT interchange 	<ul style="list-style-type: none"> Refer comments above in Kilbirnie to Airport/Miramar section.

5. Review of public transport service level assumptions

This section looks at the Option B model assumptions (LRT P5+) with regards to routes, frequencies, demand and vehicle capacity. Route speeds and priority assumptions not been reviewed.

We understand that the public transport service frequencies included in the model are based on those set out in the *Rapid transit network options* report (11/4/18) but with some additional feeder routes provided to cover the gaps.

Table 5.1 outlines the number of vehicles per hour required on the Waterfront and Golden Mile corridors based on the model. The modelled demand and assumptions used to calculate these numbers are set out in Appendix A. Key points to note:

- The LRT demand estimates would require a frequency along the Waterfront corridor of 8-16 vehicles per hour during peak periods (3 to 8-minute headway) and 2 vehicles per hour interpeak (30-minute headway). At this level of vehicle demand a dedicated right-of-way for LRT only would likely be an inefficient use of road space. Also, the interpeak frequency is very low. A higher policy-led frequency could be provided but demand per trip would be low and there would likely be pressure in the future to reduce service levels to save money.
- The BRT and Bus demand estimates would require a frequency along the Golden Mile corridor of 101-116 vehicles per hour during peak periods and 38 vehicles per hour interpeak. The current design criteria for reliable bus services along the Golden Mile is a maximum of 60 buses per hour above which reliability and travel times trade-offs start to become unacceptable (particularly for core routes).
- Given the above some BRT services would ideally be moved to the Waterfront. This would require LRT and BRT to share the same dedicated right-of-way and could have an impact on LRT reliability and travel times as 41-57 vehicles per hour would need to be moved off the Golden Mile to meet current design criteria. In addition, some regional services e.g. from Eastbourne may need to be removed from the CBD.
- Further consideration should also be given to whether LRT should operate along the Golden Mile instead of the Waterfront. Running 101-116 buses per hour along the Waterfront would likely have a lesser impact on amenity (even if electric) than running this number of buses along the Golden Mile. The Waterfront route could also potentially have a greater design capacity than the Golden Mile. It is recommended that further consideration be given to the Waterfront vs Golden Mile corridors as part of a subsequent detailed business case.

NB: The range in demand-based frequencies is due to different outputs from WTSM and WPTM models. This is likely due to the WTSM/WPTM model having difficulty allocating demand between parallel routes. In this option the BRT route X1 to Island Bay duplicates much of the LRT route.

Table 5.1 Option B (LRT P5+) Wellington CBD vehicles per hour by corridor and service type (2026)

	Peak frequency (vehicles per hour)		Interpeak frequency (vehicles per hour)	
	Model input	Demand based	Model input	Demand based
Waterfront	12	8-16	6	2
LRT	12	8-16	6	2
Golden Mile	83	101-116	38	36
BRT(a)	60	61-76	30	25
Bus(a)	23	40	8	11
Total vehicles per hour	95	117-124	44	38

Notes:

- Routes X3 and X4 are included under BRT but were coded as Bus in the model. Operating these routes with standard capacity buses would require an additional 12-13 buses per hour on the Golden Mile.
- Bus includes regional services from Eastbourne and Porirua which account for 32 of the 40 peak period vehicles per hour.

6. Conclusions and recommendations

This note reviews the public transport assumptions for the WTSM/WPTM modelling of the LGWM recommended programme of investment (RPI). The key issues that were identified are summarised in section 2 with further detailed feedback provided in the subsequent sections.

Some of the key issues identified may need to be addressed as part of the current programme business case whereas others could be considered further during subsequent detail business cases.

Appendix A Service level assumptions

A.1. Adjustments for capacity calculations

The WTSM/WPTM models output demand for a 2-hour period. This demand has been factored to a 1-hour period using the factors set out in Table A.1 to allow calculation of demand-based service frequencies (i.e. vehicle per hour required to meet demand).

Table A.1 Model demand conversion factors

Peak 2hr:1hr factor	0.7
IP 2hr:1hr factor	0.5

The vehicle capacity assumptions used to determine vehicles per hour are set out in Table A.2. The peak 1-hour planning capacity is set at 85% of vehicle capacity and the interpeak 1-hour planning capacity 50% of vehicle capacity.

Table A.2 Vehicle capacity assumptions

Vehicle type	Vehicle capacity (seated + standing)	Peak 1-hour planning capacity ^(a)	Inter-peak 1-hour planning capacity ^(b)
LRT	218	180	109
BRT	100	85	50
Bus	65	55	33

Notes:

- (a) Peak 1-hour planning capacity assumes 85% vehicle loading factor.
- (b) Interpeak 1-hour planning capacity assumes 50% vehicle loading factor.

A.2. Model demand and service levels

Core routes	AM peak southbound				
	Model frequency	WTSM		WPTM	
		Passenger demand (peak 1-hr)	Demand based frequency	Passenger demand (peak 1-hr)	Demand based frequency
Waterfront					
L1 LRT Newtown to Kaiwharawhara	12	2,773	16	1,273	8
Waterfront total	12	2,773	16	1,273	8
Golden Mile					
X1 BRT Churton Park - Island Bay	12	979	12	1,695	20
X2 BRT Newlands - Seatoun	12	1,697	20	2,225	27
X3 Karori - Lyall Bay (a)	12	1,635	20	1,334	16
X4 Brooklyn - University	12	414	5	548	7
X5 BRT Airport - Station	12	307	4	510	6
Subtotal	60	5,032	61	6,311	76
Other bus routes	23	2,014	40	1,999	40
Golden Mile total	83	7,046	101	8,310	116
Total vehicles per hour	95	9,820	117	9,583	124

Core routes	AM peak northbound				
	Model frequency	WTSM		WPTM	
		Passenger demand (peak 1-hr)	Demand based frequency	Passenger demand (peak 1-hr)	Demand based frequency
Waterfront					
L1 LRT Newtown to Kaiwharawhara	12	1,652	10	1,047	6
Waterfront total	12	1,652	10	1,047	6
Golden Mile					
X1 BRT Churton Park - Island Bay	12	1,467	18	1,517	18
X2 BRT Newlands - Seatoun	12	1,379	17	1,627	20
X3 Karori - Lyall Bay (a)	12	981	12	1,070	13
X4 Brooklyn - University	12	2,160	26	1,175	14
X5 BRT Airport - Station	12	669	8	740	9
Subtotal	60	6,655	81	6,128	74
Other bus routes	13	603	13	683	15
Golden Mile total	73	7,258	94	6,811	89
Total vehicles per hour	85	8,910	104	7,858	95

Core routes	Interpeak (one-way)		
	Model frequency	WPTM	
		Passenger demand (1-hr)	Demand based frequency
Waterfront			
L1 LRT Newtown to Kaiwharawhara	6	185	2
Waterfront total	6	185	2
Golden Mile			
X1 BRT Churton Park - Island Bay	6	362	8
X2 BRT Newlands - Seatoun	6	284	6
X3 Karori - Lyall Bay (a)	6	217	5
X4 Brooklyn - University	6	139	3
X5 BRT Airport - Station	6	136	3
Subtotal	30	1,138	25
Other bus routes	8	307	11
Golden Mile total	38	1,445	36
Total vehicles per hour	44	1,630	38