
SHORT REPORT: PENLINK BUS SERVICES

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From:	Nicolas Reid, Luke Christensen	Date:	28 March 2018
Project:	NZ2303		
Subject:	Potential PenLink bus services and patronage assessment (Version 1.5)		

1 Executive summary

- Two-thirds of bus trips originating on the Whangaparaoa peninsula are local, heading to destinations elsewhere on the peninsula or to Silverdale and Orewa. One-third of bus journeys are to destinations south of the Hibiscus Coast.
- On average there are 285 return trips a day between the Whangaparaoa peninsula and non-local destinations, evenly divided between the North Shore and City Centre. There is currently negligible demand for bus journeys from the peninsula to locations elsewhere in the Auckland region.
- The area of the peninsula east of PenLink currently generates more commuter trips than the area to the west.
- Travel time analysis indicated that PenLink bus routes would afford travel time savings in the range of twenty or more minutes for trips between the peninsula and Albany and the City Centre. These significant travel time improvements would likely lead to increased patronage and mode share on the corridor.
- The existing bus usage patterns that would benefit from the PenLink alignment are highly commuter peak focussed, with little interpeak or weekend demand.
- An estimated 600 inbound passengers would use PenLink bus services across the two-hour morning peak, if it were operational today. This represents demand for approximately six buses per hour in the peak direction.
- Six options for bus routes utilising PenLink were assessed, covering different extents on the Peninsula, peak vs. all-day operation, and routing to Albany or the City Centre. These had a correspondingly broad range of service delivery costs and fleet size impacts.
- A peak-only route operating from Manly Shops via Coast Plaza and Stanmore Bay to Albany Station is recommended as the initial focus for new services using PenLink.
- The relatively low demand, bus patronage and service frequencies anticipated for PenLink do not warrant dedicated bus lanes on PenLink itself. However sections of bus or transit lane should be considered approaching the intersection of PenLink and SH1, and at the intersection of Whangaparaoa Road and PenLink.
- Future rapid transit infrastructure development would improve the efficiency and performance of PenLink buses, particularly a Northern Busway extension to Orewa combined with a bus interchange station at Dairy Flat/Redvale.
- Previous modelling of potential PenLink bus services has used routes that could be improved by a more direct alignment connecting to Albany station, and better coverage of main demand areas to the eastern end of the Whangaparaoa peninsula.

2 Introduction

Purpose

This memo has been requested by Auckland Transport to review bus operations and demands on the proposed PenLink corridor. We understand that the primary purpose of this work is to help inform Auckland Transport's advice to the Hibiscus and Bays local board regarding buses on PenLink.

Recent demand modelling undertaken for bus services on PenLink that has predicted literally zero patronage. This was deemed to be unrealistic and this memo outlines additional demand information for planning and evaluation purposes, as well as advice on appropriate network designs, operational outcomes and cost implications.

Background

PenLink is a proposed 6.8km road that will run from Whangaparaoa Road by Stanmore Bay directly to the Northern Motorway at Dairy Flat, 7 kilometres north of Albany. The will generally be a high-speed road, though the exact form & standard of the road is still under consideration. The road may also may be tolled if required to fill a funding gap.

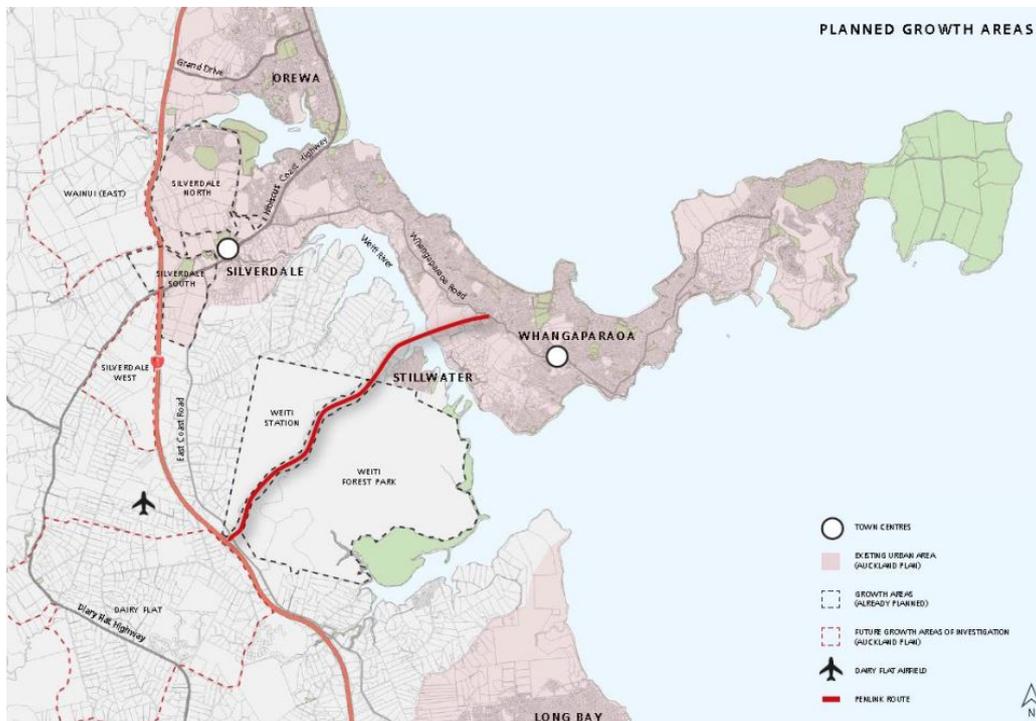
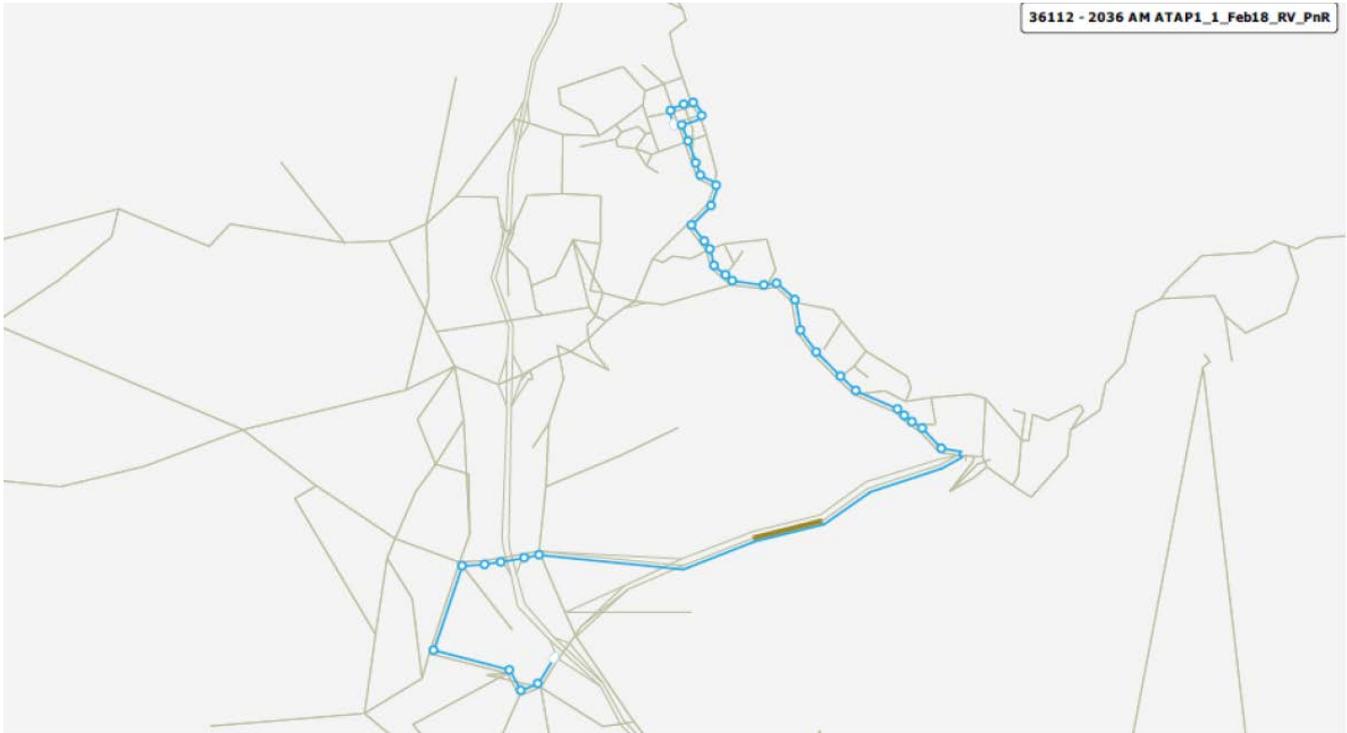


Figure 1: Indicative PenLink Route (PenLink Detailed Business Case, Auckland Transport, 2015).

3 Strategic Transport Model Review

MRCagney have undertaken an initial review of from AFC regarding bus patronage modelling from the wider PenLink corridor. However at the time of writing modelling was not complete and detailed assessment could not be made.



Potentially issues with model route specification

The diagram above shows the route included in recent strategic transport modelling.

The modelled PenLink route appears to focus on serving Orewa and the eastern parts of Silverdale. However, these areas are already well served by buses operating via Silverdale Station, with the route via Hibiscus Coast Highway already being relatively fast and direct. Routing Orewa buses via Whangaparaoa Road to PenLink would be a longer, slower route with more exposure to congestion than the status quo.

The modelled route shown below is somewhat circuitous and will be relatively slow and indirect. This is unlikely to perform well in model assessment or with real life users due to the long route length and relatively low speeds. In particular this route takes an indirect approach to join the SH1 corridor, doubling back to access the Redvale area from the west side of SH1.

Furthermore, this route effectively assumes that an interchange station exists at the location where PenLink joins SH1, so that PenLink feeder buses can connect to trunk Northern Express Buses. In practice this would require a major station with mainline and connecting platforms and the means for buses to access and circulate through both. We expect that such a station would be unlikely in advance of a full busway extension beyond Albany, and that a transfer between buses at Redvale would be infeasible as long as the Northern Express operated via the motorway or shoulder lanes.

The modelled route does not serve the area on the peninsula to the east of PenLink. However this is the area that is worst served by current services and delays along Whangaparaoa Road, and the area that would benefit the most from buses using PenLink.

Suggestions for improved modelling performance

The following are a list of suggestions for improved

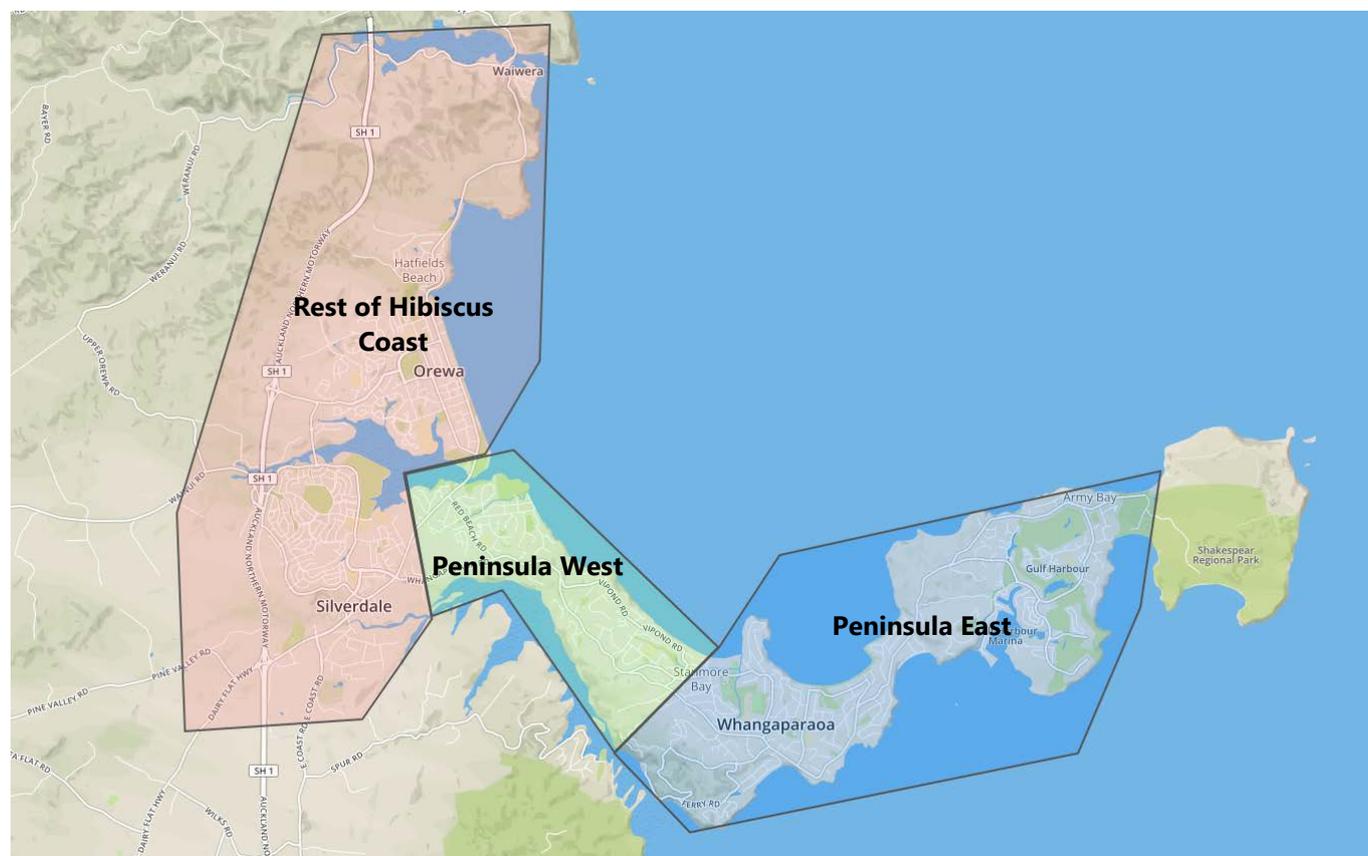
- Consider PenLink buses that serve the eastern part of the peninsula, perhaps in combination with a second PenLink service from the western part of the peninsula.
- Route the PenLink bus route or routes directly to SH1 to avoid the diversion around Dairy Flat. If service coverage of Dairy Flat is a consideration, then a separate bus route operating on the west side of the motorway may be more appropriate.

- Route PenLink buses on Vipond Road to provide better local coverage and avoid exposure to congestion on Whangaparaoa Road.
- Consider routing PenLink buses through to a connection point at Albany Station, particularly in advance of a busway extension including a Redvale interchange station.
- Consider routing some or all PenLink buses to the City Centre, either as peak-only express buses or some combination or spur of the NEX.

4 Patronage analysis

Ticketing data from the HOP tag-on tag-off system were analysed for the week beginning 5th of March 2018, in order to identify patronage levels and travel patterns on existing bus services on the Whangaparaoa peninsula.

This analysis identified all Hop journeys beginning or ending on the Hibiscus Coast at any time during the seven-day data period. These journeys were then subdivided into three groups as shown in the image below. This divided trips into those beginning or ending on the Whangaparaoa peninsula itself (where buses on PenLink would be advantageous), and those beginning or ending in the rest of the Hibiscus Coast where the existing bus services on SH1 would remain the most direct option (i.e. Silverdale and Orewa). The Whangaparaoa peninsula was further divided into zones east and West of the proposed PenLink connection to Whangaparaoa Road.



General patronage

Overall, a grand total of 12,636 bus trips were identified as beginning or ending on the Whangaparaoa peninsula (West + East) across the seven day data period. This translated into an average of 1,153 return journeys per weekday, and 373 return journeys per weekend day, for all trips within and around the local area and to other parts of Auckland.

Excluding trips internal to the peninsula and to the rest of the Hibiscus coast, an average of 285 weekday bus journeys were identified departing the Whangaparaoa Peninsula and travelling 'downstream' to final destinations on the North Shore or City Centre.

This indicates that at least 285 return journeys per weekday would be expected on equivalent PenLink bus services if they were operational today.

Origins on Whangaparaoa peninsula and Hibiscus Coast

Of the average 285 return weekday journeys between the Whangaparaoa peninsula and the North Shore and City Centre, 60% had an origin in the part of the peninsula east of PenLink, and 40% had an origin on the peninsula west of PenLink.

This indicates that future PenLink bus services should ideally include a network of routes that serves both the eastern and western halves of the peninsula. However, if only one new route could be provided, this suggests that it should focus on serving the eastern end, especially as the western end of the peninsular has more direct and convenient access to existing services at Silverdale.

By comparison, there was an average 1,365 return weekday journeys between the remainder of the Hibiscus Coast (i.e. Silverdale, Millwater and Orewa) and the North Shore and City Centre. This is almost five times as many as from the peninsula, despite a similar population. These results suggest that bus trips from the peninsula are currently underrepresented relative to the rest of Hibiscus Coast, presumably due to the relatively slow and unreliable service afforded by existing peninsular bus routes.

Destinations

Overall, two-thirds (63%) of weekday bus journeys originating on the Whangaparaoa peninsula were local trips that did not leave the Hibiscus Coast: 44% were local trips to destinations within the peninsula, while a further 20% local trips to destinations elsewhere in the Hibiscus Coast, primarily Orewa.

The remaining third of weekday journeys starting on the peninsula went 'downstream' to destinations on the North Shore (17%) or to the City Centre (19%). A negligible proportion (<1%) of bus journeys starting on the Whangaparaoa Peninsula went to the Auckland Isthmus, West Auckland, South Auckland or other areas in the region.

On weekends the trip patterns were even more highly localised, with 91% of trips being internal to the Hibiscus Coast and only a small proportion continuing to the City Centre (5%), North Shore (4%).

Based on current bus use patterns, this indicates that the majority of Whangaparaoa bus trips are local and would not directly benefit from PenLink bus services. However, these data also indicate a small but significant market of primarily weekday peak commuter trips to the North Shore and City Centre that would benefit from a shorter and more direct trip to Albany and points further south.

These existing journey patterns suggest that PenLink bus services could supplement existing Northern Express services for a smaller niche of Whangaparaoa peak commuters, however implementing PenLink buses would be unlikely to greatly affect demand or levels of service on the primary Northern Express route operating from Silverdale.

Travel patterns over time and day

Compared to the 285 return journeys per weekday, the number of people identified as making the same trips on weekends was much smaller, with approximately 30 to 40 return trips between the peninsula and points south on Saturdays and Sundays.

Weekday journeys from the Whangaparaoa Peninsula are highly peaky, with very little interpeak usage. Excluding local trips, 89% of journeys between the peninsula and the rest of Auckland departed before 9am in the inbound direction, and 87% of return trips arrived back on the peninsula between 3pm and 7pm.

Overall this indicates that the current bus trips that would benefit from the PenLink corridor are almost exclusively "nine to five" work and school commuter trips, probably best served by peak-only express services to Albany or the City Centre. Meanwhile the majority of bus trips on the Peninsula would continue to be local trips served by regular all-day routes within Whangaparaoa, Silverdale and Orewa.

Transfers

Overall, approximately 90% of all bus journeys starting on the Whangaparaoa peninsula were direct trips using a single bus service to reach the final destination, while 10% were journeys involving a transfer between buses. This is largely due to the high proportion of local bus trips within the peninsula or to the rest of the Hibiscus Coast. The proportion of transfers is slightly higher on weekends and off peak times when fewer direct services run.

However, this pattern was somewhat different for trips between Whangaparaoa and North Shore and City Centre, where 35% and 29%, respectively, involved a transfer between bus services. This indicates that there is already a relatively high willingness to connect from local buses to trunk services (i.e. the Northern Express) to reach regional destinations.

This suggests that bus services using PenLink need not necessarily provide direct service to the final destinations, but should at the least access primary interchange nodes such as Albany to provide onward connections to the North Shore and City Centre.

Peninsula users of Park and Ride at Hibiscus Coast station

Hibiscus Coast station (Silverdale) is the terminus of the Northern Express bus service and currently the major Park and Ride and interchange location serving the Whangaparaoa Peninsula. This station has negligible walking catchment, and practically all users who are not connecting between buses will come from Park and Ride or Kiss and Ride. In the event of bus services operating on PenLink, it is likely that many of these users would shift to taking a PenLink service instead of making the longer and less reliable trip to park or be dropped off at Hibiscus Coast station.

Analysis of Hop data indicates an average of 1,379 boardings at Hibiscus Coast station all day on weekdays. Of these, 805 were boardings on peak inbound services (6am to 8am). Of these 8% (n=62) were connections from other buses, the remainder resulting in an estimated 743 weekday morning peak boardings at Hibiscus Coast station from Park and Ride and Kiss and Ride.

Assuming that the Park and Ride and Kiss and Ride users at Hibiscus Coast Station follow the same distribution of direct bus users identified above, we can expect that 18% of existing users of Hibiscus Coast station arrive from locations on the peninsula.

This suggests that approximately 134 Park and Ride/Kiss and Ride users at Hibiscus Coast station could swap to PenLink buses.

Potential mode share changes

The public transport mode share for journey to work trips for trip originating on the peninsula is relatively low. In the 2013 census the bus mode share across all the census area units on the peninsula¹ was 5.1% of all trips to work.

This is substantially lower than other nearby areas that had direct access to the main bus corridor in 2013. For example the CAU of Silverdale Central had a bus mode share of 7.8%, Weti River (i.e. Hibiscus Coast Highway) 7.1%, while Albany had a bus mode share of 9.8%.

¹ CAUs of: Army Bay, Wade Heads, Gulf Harbour, Manly, Stanmore Bay, Vipond and Red Beach East

If bus services were introduced with PenLink these would provide considerably improved direct bus access between the peninsula and the main radial corridor. A corresponding increase in public transport mode share from the current 5% to approximately 8% could be expected, with the number of peak journeys increasing by 60% as a result.

Indicative patronage estimate

An average of 285 weekday bus journeys were identified departing the Whangaparaoa Peninsula and travelling 'downstream' to final destinations on the North Shore or City Centre.

Additionally, an estimated 134 daily users of the Hibiscus Coast Park and Ride would likely shift to direct buses from the peninsula. This results in an estimate of approximately 419 existing bus users that would swap to PenLink bus services if they were in operation today.

Furthermore, the shorter travel times and more direct bus journeys would likely result in a higher mode share for bus for all trips leaving the peninsula. It is expected that the bus mode share would increase from the current 5% to 8%, achieving a similar modeshare to nearby areas with more direct service.

Applying this modeshare increase to the existing bus users results in a indicative patronage estimate of 670 return bus passengers using PenLink on a typical weekday. Of these the clear majority (approximately 600) would be expected to make the journey inbound during the morning peak and returning in the evening peak.

This indicates demand for a relatively high level of service at peak times, with six or seven buses (or four to five double deckers) per hour required in the peak direction to meet demand with moderate crowding levels.

5 Network Planning

This section evaluates existing bus routes serving the Whangaparaoa peninsula and tests a series of potential routes using PenLink.

Existing Network

MRCagney have undertaken a review of the existing bus services that serve the Whangaparaoa Peninsula, including routing, patronage on these services and key destinations.

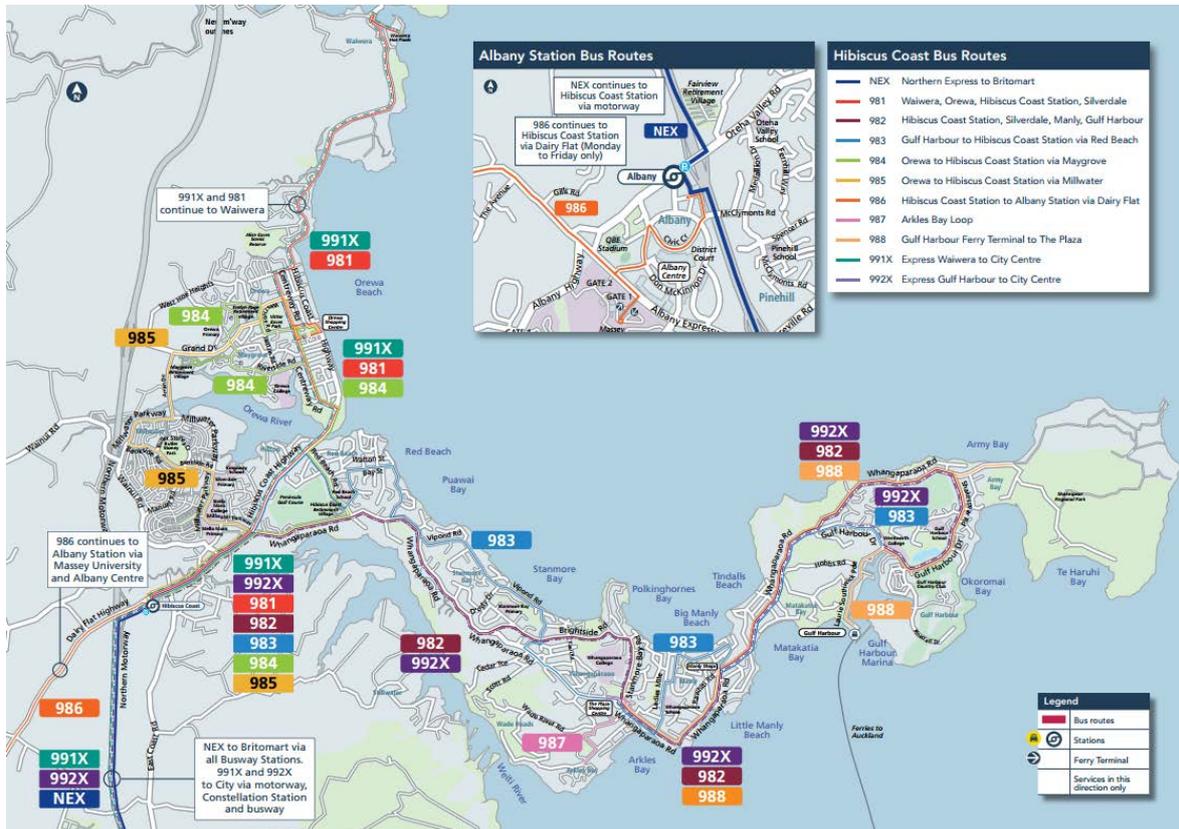


Figure 2: Bus routes serving the Hibiscus Coast

Existing bus routes serving the Hibiscus Coast are as follows:

- Route 982 which runs from Hibiscus Coast station to Manly Shops (every 30 minutes all day) and Gulf Harbour (every 60 minutes all day).
- Route 983 which runs from Hibiscus Station to Gulf Harbour (every 30 minutes at peak & every 60 minutes interpeak)
- Route 992X which runs from Gulf Harbour to Wellesley Street in the City Centre (7 trips morning peak inbound, 8 trips afternoon peak outbound).

At Silverdale Station passengers can interchange to the Northern Express which operates to Britomart via Albany and Northern Busway stations (every 10 minutes at peak and every 30 minutes interpeak, evenings and weekends).

Network Options

MRCagney have investigated a range of bus network options that take advantage of the new PenLink road. Six initial options have been designed and costed as shown below.



1. **Manly Shops to Albany Station.** This would follow the 982 route from Manly Shops to Whangaparaoa Road, then travel via PenLink & SH1 to terminate at Albany Station.
2. **Gulf Harbour to Albany Station.** This would be the same route as Option 1 but would be extended to Gulf Harbour, again following the 982 route.
3. **Orewa to Albany Station via PenLink.** This would start at Orewa, then from there would follow the 983 route from Red Beach to the start of PenLink. The route would then travel via PenLink & SH1 to terminate at Albany Station.
4. **Manly Shops to City Centre.** Same as Option 1 but extended to the City Centre.
5. **Gulf Harbour to City Centre.** Same as Option 2 but extended to the City Centre.
6. **Orewa to City Centre via PenLink.** Same as Option 3 but extended to the City Centre.

Options 1 to 3 would offer an all-day service on a shorter route, while Options 4 to 6 would offer a peak-only service on a longer route.

Opex Costing

Indicative costing was undertaken for each of the route options to understand comparative costs.

- Distance was measured in google maps.
- Travel speeds were taken from existing bus routes where the new routes followed existing routes.
- Speeds for PenLink were taken from timetabled speeds for Northern Express services running on SH1 between Albany & Hibiscus Coast stations.
- Service delivery costs were obtained using standard figures for peak vehicles, service kilometres and service hours. This includes annualization of the purchase costs of vehicles.
- Peak trips were assumed to require to return to a depot at the start of the route due to lack of all-day layover space in the city centre, and driver shift requirements.
- Route that operated during the midday period were assumed to operate 7 days per week.

Table 1 below shows the key operating metric for each route that drive the operating costs.

Table 1: Operating requirements for each route

Option	Corridor/name/details	Peak Vehicle Requirement	Weekday Hours	Annual Hours	Weekday Kilometres	Annual Kilometres
1	Manly Shops to Albany Station	4	36	11,938	1,296	429,768
2	Gulf Harbour to Albany Station	6	56	18,746	2,160	716,280
3	Orewa to Albany Station	7	68	22,876	1,728	573,024
4	Manly Shops to City	9	54	13,500	1,728	432,000
5	Gulf Harbour to City	11	66	16,500	2,304	576,000
6	Orewa to City	12	72	18,000	2,016	504,000

Table 2 below show the key statistics for each route, as well as the overall operating cost.

Table 2: Operating costs for each route option

Route	Trip Length (km)	Peak Speed (kmh)	Interpeak Speed (kmh)	Peak Headway	Midday Headway	Evening Headway	Estimated Annual Cost
1 Manly Shops to Albany Station	18	45	50	15	30	60	\$ 1,497,854
2 Gulf Harbour to Albany Station	30	44	50	15	30	60	\$ 2,422,717
3 Orewa to Albany Station	24	32	35	15	30	60	\$ 2,340,402
4 Manly Shops to City	36	39	42	15	-	-	\$ 1,779,825
5 Gulf Harbour to City	48	40	46	15	-	-	\$ 2,271,342
6 Orewa to City	42	33	36	15	-	-	\$ 2,229,100

These tables show considerable range in fleet size, operating metrics and service delivery costs. As can be expected the shortest route from Manly Shops to Albany station is the cheapest to operate, with the least service kilometres and hours and the smallest peak vehicle requirement. Conversely, the longest service from Orewa to the City has considerably higher operating costs and requires a fleet size triple that of the simple feeder service.

Travel time comparison

We have conducted a brief travel time comparison using the data we have calculated for the purposes of calculating operating costs. Table 2 below shows the travel time for each option from key destinations across Whangaparaoa to Albany and City Centre during the morning peak and at midday.

Table 3: Travel times in minutes for route options from selected key destinations

Route Proposed	Manly Shops to Albany	Manly Shops to City	Gulf Harbour to Albany	Gulf Harbour to City	Vipond Road to Albany	Vipond Road to City

		AM	MD										
1	Manly Shops to Albany Station	22	22	61	57	40	38	79	73	25	25	64	60
2	Gulf Harbour to Albany Station	22	22	61	57	35	33	74	68	25	25	64	60
3	Orewa to Albany Station via PenLink	27	27	66	62	40	38	79	73	20	20	59	55
4	Manly Shops to City	22	22	56	52	40	38	74	68	25	25	59	55
5	Gulf Harbour to City	22	22	56	52	35	33	69	63	25	25	59	55
6	Orewa to City via PenLink	27	27	61	57	40	38	74	68	20	20	54	50
	Existing	49	42	81	72	62	53	95	83	45	44	79	74

Key highlights of this data are as follows:

- All options offer significant time savings from all destinations on the morning peak, even when an extra transfer is required.
- Express options to the City offer the fastest peak time trip to the city given no transfers are required at Albany.
- Express options do not offer any time savings outside of the peak, as passengers will be required to use existing routes, and transfer to the Northern Express at Silverdale Station.

Overall, this analysis suggests that bus services operating via PenLink would offer travel time advantages in excess of twenty minutes at peak times for journeys between the peninsula and Albany or the City Centre. All else being equal such a time saving should attract significant additional patronage to bus routes using PenLink, at least at peak times.

Options discussion

In order to recommend a preferred network option, we have considered a number of implications, including the policies of the Regional Public Transport Plan, understanding of City Centre bus constraints as well as the patronage and model data from section's 2 and 3.

The current patronage data suggests relatively low, but not insignificant bus travel demands between Whangaparaoa and the North Shore and City Centre, particularly at commuter peak times. Nonetheless this is in the context of bus services that are currently long, less reliable and only operate at peak times. Given the considerable travel time savings afforded by PenLink for bus trips, it is likely that both peak and all-day patronage would increase if the appropriate service were provided.

The principles of New network (as outlined in the 2015 Regional Public Transport Plan) are that the bus network should become more focussed on an all-day network that allows high levels of accessibility around the region at all times of the day, rather than just on peak trips. The analysis conducted for this report suggests that the majority of all-day trips in the Whangaparaoa area will remain local, and be catered for on the local bus network. This suggest a peak-only service model for PenLink bus routes overlaid on the local bus service.

Regarding the extend of services, we note that the City Centre has significant constraints on bus capacity at peak times on key entry corridors, at key city centre terminals, and on layover space both at peak times as well as during the day. The East-West Midtown PT Link Indicative Business Case has not made an allowance for services from the Hibiscus Coast, and there is no spare capacity on the planned corridor or in terminals for stops, terminal space, all day layover and afternoon peak staging.

Furthermore, due to the very high travel times from the Whangaparaoa Peninsula to the City Centre, each bus can only make one peak trip in each direction leading to poor vehicle utilisation and high costs per passenger. Due to existing shortages of layover space in the city centre, each trip is assumed to require to return to the depot, which significantly adds to the cost of the route. Constructing additional layover spaces to reduce the operational costs is likely to come at a high capital cost.

This indicates that adding direct peak services between the peninsula and City Centre would be difficult, and that the best option would be services that operate between the peninsula and Albany station, for connection to the Northern Express. Current boarding data indicates that the section from Manly Shops through Coast Plaza and Stanmore Bay is the busiest part of the peninsula for bus trips, suggesting route option 1 should be the initial focus. Extending the route to Gulf Harbour, or adding second route from Orewa and Red beach would lead to much higher operating costs, and may have comparatively little benefit for patronage. These should be investigated as a secondary priority.

This does however raise the possibility of configuring such a service as an extension of the Albany-terminating service patterns of the Northern Express, effectively extending some of these buses to and from Whangaparaoa as a third Northern Express service pattern at peak times. The implication of this on the legibility, reliability and operations of the Northern Express should be considered in more detail. While providing rapid transit style bus service from the peninsula via the busway direct to the City Centre is an attractive proposition from the customer perspective, the cost of delivering the PenLink service pattern with frequent all-day busway service would require very significant costs that may be inappropriate for the relatively small and constrained patronage generated by the Whangaparaoa peninsula.

6 Infrastructure Considerations

PenLink infrastructure

MRCagney have also been requested to provide a high level review of roadway design considerations for bus operations.

Key considerations impacting requirements for bus infrastructure are as follows:

- The quantity of bus services provided and patronage levels on that service.
- The extent of public transport provision and demand throughout the day.
- The spatial and temporal span of vehicle congestion expected.
- The configuration of the road, including if the road has roundabouts, traffic lights or grade separated intersections.

We understand the current concept is for a two lane PenLink road with demand levels managed via toll pricing. While this road will have a lower capacity than a four-lane option, a two-lane road will also have some advantages. As traffic volumes will be lower, there are less likely to be issues will significant queuing at the intersections of PenLink with Whangaparaoa Road. Similarly, PenLink may potentially have ramp signals onto the Northern Motorway if congestion on this section continues to worsen.

We expect that the toll will be set at a rate that ensures that the two-lane road is generally able to perform at an uncongested level. However, there may be localised congestion at certain points along the PenLink Road, especially at either end of the motorway where there will be large scale interchanges and/or intersections.

Overall bus frequencies are expected to be relatively low in line with demands, with options tested in Section 4 having a maximum peak bus frequency of four services per hour. This is not a level at which full bus lanes or bus shoulders are considered essential. However, we suggest that small sections of bus lanes and bus priority are provided at pinch points. This would help ensure public transport trips are reliable, and potentially reduce operational costs that may come from unreliable trips times.

Proposed locations for bus priority are as follows:

- **On-ramp from PenLink to the Northern Motorway.** We expect there to be some level of congestion where PenLink merges with the Northern Motorway. Therefore, having a several hundred metre section of bus or transit lane would be advantageous to ensure bus reliability. This arrangement is common at motorway on-ramps across Auckland such as at Te Atatu and Point Cheavlier along the North-Western

motorway. If ramp metering is installed on this link then a bus/transit bypass lane would be an essential component.

- **In both directions at the intersection of PenLink and Whangaparaoa Road.** The form of the intersection at this location is uncertain, however some queuing of traffic may be expected at peak times. In the morning peak there is likely to be queuing of traffic on Whangaparaoa Road with vehicles accessing PenLink interacting with those leaving, and those continuing along Whangaparaoa Road. Therefore, we suggest that a several hundred metre section of bus or transit lane is proposed in the westbound kerbside lane on Whangaparaoa Road leading up to PenLink. Similarly, in the afternoon peak some queuing is expected for cars leaving PenLink, turning into Whangaparaoa Road. Therefore, again we propose that a short section of bus or transit lane is provided in the eastbound direction along PenLink leading up to the intersection with Whangaparaoa Road.

Future Infrastructure

The 'Supporting Growth' project has identified the following infrastructure is provided along the Northern Motorway between Albany and Silverdale:

- Extension of the Northern Busway from Albany to Silverdale, likely on the west side of the motorway.
- A future bus station and Park & Ride facility where PenLink joins the Northern Motorway.
- A new east west connecting road from the East Coast Road to Dairy Flat Highway, linking with PenLink. This would include a full motorway interchange where PenLink connects with the Northern Motorway.

If this infrastructure is provided, then this may affect service planning.

Interchanges between Northern Express services to the City Centre and buses from Whangaparaoa could take place at a Dairy Flat/Redvale station, which would lower the operating costs of a bus service along PenLink or allow an improved level of service for passengers for the same cost. However, the timescales for the provision of this other infrastructure is uncertain, and such an interchange station has not been assumed for this assessment.

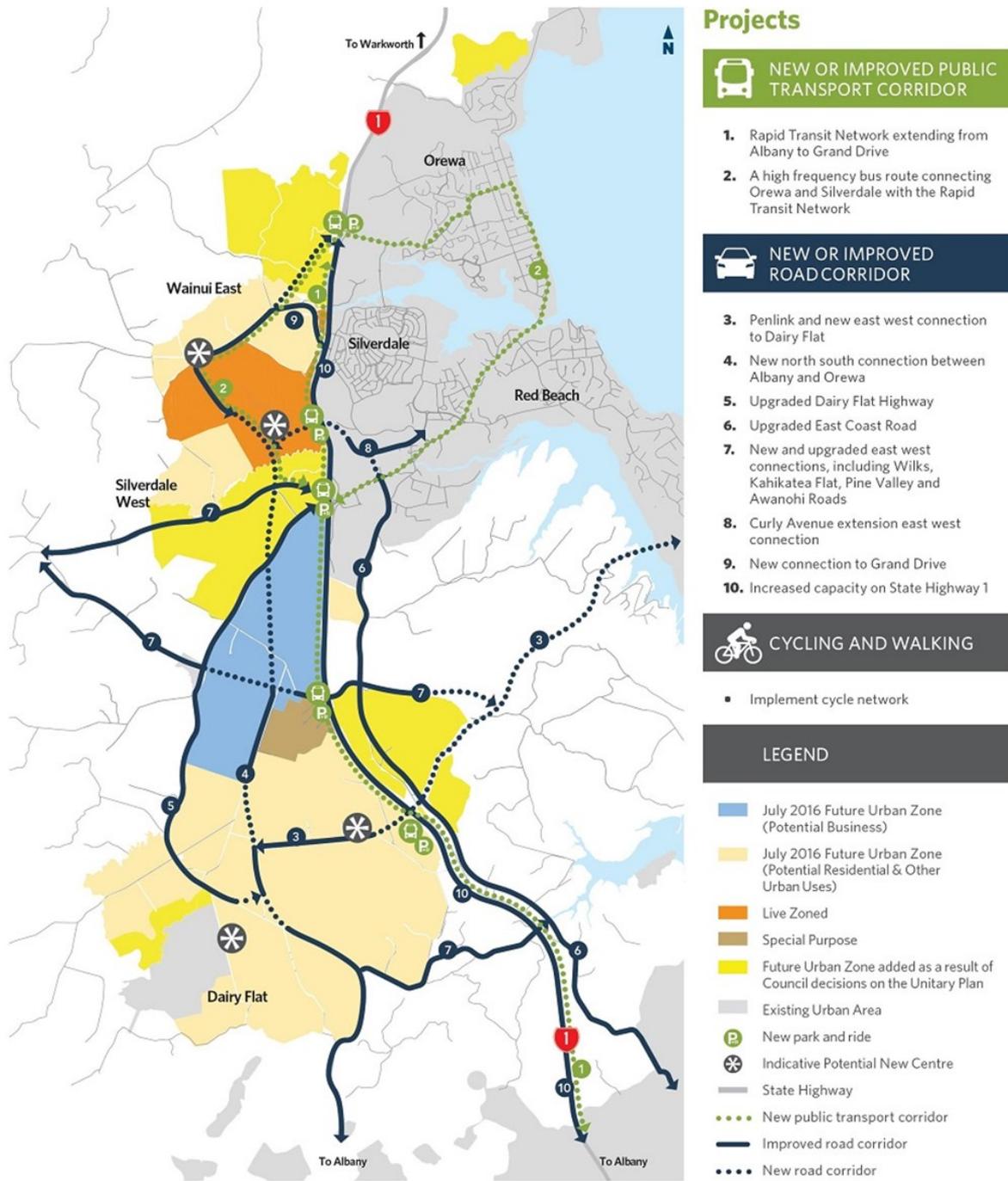


Figure 3: Supporting Growth Transport Network for the north of Auckland