APPENDIX 4

Restoring the Golden Mile
- Taranaki Street to Willis Street

Final Evaluation Report
May 2009

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Executive Summary

Wellington City Council (WCC) has commissioned Opus International Consultants to investigate options to rationalise the bus network between Willis Street and Taranaki Street as part of a package of measures to "Restore the Golden Mile" corridor.

Bus operations through the Wellington CBD and along the Golden Mile are currently unreliable with significant delays for a large number of bus services during both peak and inter peak periods. The recently approved Ngauranga to Airport (N2A) Strategy Study strengthened the need to enhance a public transport (PT) corridor through the CBD with the ability to safeguard for enhanced PT in the future.

WCC is currently considering opening up Manners Mall as part of a package of measures to "Restore the Golden Mile" to relieve one of the most significant bottlenecks and areas of poor legibility for bus operations. In carrying out this assessment, WCC also identified a number of alternative options to be considered and provide the basis for this study, including; two way bus operation on Wakefield Street or Dixon Street and a modified status quo which reduces traffic in Manners Street northbound.

This study has confirmed that public transport growth in the study area is predicted to increase significantly (between 10 and 30% during peak periods) until 2016 and then maintain lower growth beyond this period through to 2026. This growth will place increased pressure on existing operation and infrastructure, highlighting the need for short to medium term enhancements to those locations in which reliability and operational conditions are poor.

The existing issues with poor legibility due to the split route arrangement and the significant delay, congestion, and journey time variability in a northbound direction provide the justification for this study and WCC's desire to focus on this area in order to complement the wider planned improvements to the Golden Mile PT corridor. This proposal not only seeks to enhance PT, but also considers public space, pedestrian desire lines, safety and the urban fabric of the City.

The assessment included a qualitative and quantitative classification of impacts. The assessment has highlighted that the Manners Mall option has the greatest overall level of benefit for PT, while also complementing future aspirations for the "Golden Mile" and wider streetscape improvements. The Manners Mall option results in $19.75m of benefits for PT users. As with all of the options, it does however have dis-benefits to general traffic through redistribution, increased delay and loss of parking spaces. Measures such as improved signal settings, enhanced north south arterial movement and alternative parking space provision will be needed to complement this project. Similarly, the loss of public space associated with the shared PT and pedestrian zone will need to be complemented with enhanced facilities on lower Cuba Street or other suitable locations. We believe that this will help to reinforce pedestrian desire lines and enhance the existing Manners Mall precinct.

With an overall cost benefit ratio of 2.3 the Manners Mall project has been identified as the most appropriate option to complement the wider strategic objectives for the "Golden Mile" and safeguard for increases in PT demand in the future. It is suggested that this position should now be confirmed through a more detailed scheme assessment report and associated funding application.

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1 Introduction

This is a Wellington City Council (WCC) project with support from Greater Wellington Regional Council (GWRC). The project also has the support of other key stakeholders including bus operators, who will support changes that rationalise the bus network making it more reliable and more legible. Bus operations through the Wellington CBD and along the Golden Mile are currently considered to be unreliable with significant delays for a large number of bus services during both peak and inter peak periods.

WCC is currently considering opening up Manners Mall as part of a package of measures to "Restore the Golden Mile" to relieve the most significant bottleneck for bus operations along the Golden Mile. This proposal was developed internally by the council in partnership with GWRC. The purpose of this project is to carry out an independent evaluation of options for Restoring the Golden Mile in the Taranaki to Willis Street precinct.

The main objectives for this study are to:

- Address some of the key issues raised by submitters during the "Restoring the Golden Mile" consultation by carrying out an independent economic and operational evaluation of options for Restoring the Golden Mile in the Taranaki to Willis Street precinct; and
- Feed into the Golden Mile (CBD) operational review which is being commissioned by Greater Wellington in conjunction with this project.

1.1 Report Structure

The report has been developed based upon the requirements of the RFT and fulfilling the objectives of the project, this includes:

(i) Background Review – looking at background information and the strategic context in which the project fits.

(ii) Modelling and Operational Assumptions – the traffic modelling and bus operational assumptions are considered critical in the assessment and evaluation of benefits.

(iii) Project Rationale – provides the justification for the project.

(iv) Design Philosophy and Engineering Standards

(v) Option Descriptions – describing each of the options assessed, the bus stop locations and other criteria in which the project has been evaluated.

(vi) Cost Estimate

(vii) Option Performance – in terms of bus and general traffic impacts.

(viii) Evaluation Criteria

(ix) Evaluation Summary

(x) Conclusions

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2 Background Review

All of the reference material supplied by WCC and GWRC (as listed on pages four and five of the Terms of Reference) was reviewed as part of the project.

This Background Review section focuses on the information that directly relates to the section of the Golden Mile in the Taranaki St to Willis St Precinct (the "Study Area").

2.1 Key Issues Identified in the Study Area

From the Terms of Reference:

Bus operations through the Wellington CBD and along the Golden Mile are notoriously unreliable with a large number of buses and significant delays occurring during peak periods in particular.

This is supported by the key problems identified as part of the part of the Ngauranga to Airport Strategy Study:

- Limitations and delay between Manners St, Willis St and Lambton Quay (primarily northbound);
- Interaction between pedestrians and general traffic (including buses) on Dixon St adjacent to Cuba Mall;
- Delay associated with intersections at Willis St/Manners St, Mercer St/Victoria St, Manners St/Victoria St, Taranaki St/Courtney place/Manners St; and
- Bus stop capacity and dwell times on Manner St and Willis St.

This report will seek to reconfirm these issues and any other issues that may exist in relation to bus operation and the development of a PT spine for the Wellington CBD.

2.2 Previous Option Development

Previous options identified as part of the part of the Ngauranga to Airport Strategy Study (Technical Report Number 1, 2007) included:

- Consideration of two-way bus operation via Lambton Quay, Hunter St, Victoria St, Wakefield St, Cuba St, Manners St and Courtney Place;
- Other options were considered, included two-way on Willis St and using the waterfront (two-way); and
- The study also considered different mode types (light rail, guided bus-ways etc); however these were independent of the route. The different geometric requirements for these modes will have to be considered as part of this project.

Building on the Ngauranga to Airport Strategy Study, WCC officers further refined these options to the following:

- An 'enhanced status quo' – retaining the existing split bus routes, signalising the Wakefield pedestrian crossing, and fine tuning intersection signals to assist peak hour bus movements.
- Mercer / Wakefield / Lower Cuba / Manners East – bringing the bus routes together on these streets; or,
- Dixon Street / Willis (includes a sub-option via Victoria) – bringing the bus routes together on these streets; or,
- Manners Street re-routing via Manners Mall - bringing the bus routes together along the full length of Manners Street (the original Golden Mile route).

The SPC reported that the Manners Street re-routing via Manners Mall was the strongest option based on an un-quantified balance sheet of all of the advantages and disadvantages of each option.

2.3 Other Passenger Transport Improvements

Other passenger transport improvements identified as part of the part of the Ngauranga to Airport Strategy Study and subsequent studies include:

- Dedicated bus lanes or bus ways with general traffic excluded;
- Signal detection and priority at intersections;
- Electronic ticketing;
- Integrated ticketing between modes;
- New buses;
- Real time bus information;
- Improving bus stop and link design and efficiency; and
- Network and streetscape improvements.

2.4 Route Option Assumptions and Considerations

In determining the route for previously identified options the following key assumptions were considered:

- The need to be near the large number of people generators, minimising the walking distance to employment, business and recreational activities;
- The limited road width, particularly in streets with high pedestrian demand;
- The over-reliance of a one-way traffic system for a large number of key corridors within the CBD; and
- The lack of a single 'spine' or corridor that would improve legibility[1] and the connection between Lambton Quay and Courtenay Place.

Consideration of these key assumptions will also be made in the evaluation of the options for this project.

[1] Legibility relates to the ability of the public and users to understand a system and feel comfortable with it, without confusion and uncertainty (clearly knowing they are going in the correct direction and being able to locate the origin of a return trip in the case of bus operation).

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2.5 Other Studies and Considerations

A number of other key studies and investigations have been commissioned by WCC over recent times, most of which consider the development of a PT spine and more explicitly the effects of opening Manners Mall to PT operation. These studies include:

- City to Waterfront, Jan Gehl (2004)
- Retail Impact Assessment, Jones Lang La Salle
- Wellington City Bus Priority Plan – Evaluation, Ian Wallis Associates Ltd with John Bolland Consulting Ltd, 2008

2.6 Crash History

Two intersections along the current proposed routes were in the top five intersections for pedestrian injuries in the period 2003-2007. The two intersections were the Taranaki St-Manners St intersection and the Willis St-Mercer St intersection.

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3 Modelling and Operational Assumptions

3.1 WTSM Modelling Assumptions (Passenger Transport)

Previous modelling tests for WCC and for the Ngauranga to Airport Strategy Study have been undertaken using the Wellington Traffic Model (WTM) which uses the SATURN modelling program. The demands and forecast growth for the WTM is based on the Wellington Transport Strategic Model (WTSM). WTSM includes a number of key assumptions for the future years that will improve passenger transport usage:

- Reduction of private motor vehicle trips into the CBD by five percent due to Travel Demand Management (TDM) measures;
- Reduced boarding times for passenger transport as a result of integrated ticketing and fares; including allowing patrons to use the same tickets and fares for whole journeys regardless of mode thus increasing the attractiveness of passenger transport options;
- Reduced passenger interchange times due to real time information systems; and
- Improved rail frequency and services (new stations, new stock etc.).

These changes in WTSM result in forecast increases in passenger numbers in the future years (2016 and 2026) when compared to the base (2006).

For the forecast years the traffic volumes and passenger transport usage has been based on the central growth rate from WTSM. This assumes population growth and fuel price increase at a medium rate.

3.2 WTSM Modelling Assumptions (Roading Infrastructure)

The WTM SATURN model uses trip data extracted from GWRC's Wellington Transport Strategy Model (WTSM). Future infrastructure included in the Regional Land Transport Strategy (RLTS) is assumed to be constructed in future years for the WTSM model. It was agreed during the workshop held at Opus on Friday the 3rd of April that the SATURN modelling should reflect the same network assumptions as WTSM. The key infrastructure changes included in the future year (2016) SATURN network are therefore:

- Basin Reserve improvement as per the Meritec Option H;
- Rugby Street / Adelaide Road intersection improvements – signalised and lane allocations amended;
- Terrace Tunnel Tidal Flow – coded as two lanes inbound and one outbound in the AM peak and coded as is in the inter peak and PM peaks;
- Ngauranga to Aotea Capacity Improvement – 4 laning in each direction the stretch of SH1 between the SH1 / SH2 merge at Ngauranga to the on and off ramps at Aotea Quay;
- The addition of the Inner City Bypass (ICB) – the base model was built for 2006 to coincide with latest census data and therefore did not include ICB; and

The Ngauranga to Terrace Tunnel Advanced Traffic Management System (ATMS) cannot be replicated by the SATURN model so has not been directly coded.

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3.3 Forecast Bus Passenger Numbers

Plots of forecast bus passenger numbers on specific links have been extracted from WTSM for two hour peak periods for the current (2006) and forecast years (2016 & 2026) (refer to Appendix G).

For modelling purposes the passenger numbers along the Golden Mile have been derived from the average passenger numbers along the current bus routes for northbound and southbound traffic between Taranaki St and Mercer St. Table 1 below shows the passenger numbers used for the bus modelling along the Golden Mile.

Table 1 – Bus Passenger Numbers (1 hour peak)

Year	2006			2016			2026		
Period	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**
Northbound	1694	565	1327	2134	638	1868	2379	628	1915
Southbound	1775	448	1502	2188	513	1854	2199	534	2024

3.4 Forecast Bus Numbers

The forecast passenger numbers for the route were converted to bus numbers along the Golden Mile using an average bus occupancy ratio. The bus occupancy ratio was derived by taking the passenger demand from WTSM in 2006 and dividing by the number of buses along the Golden Mile in 2006 (based on the 2006 Metlink timetable) for the AM, inter peak and PM peak periods.

Table 2 also shows the average current (2006) and forecast bus numbers for 2016 and 2026.

Table 2 – Number of Buses (1 hour peak)

Year	2006			2016			2026		
Period	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**
Northbound	87	44	88	110	50	124	122	49	127
Southbound	79	37	82	98	43	102	98	44	111

The increase in bus numbers is shown in Table 3 below.

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Table 3 – Growth in Bus Numbers

Year	2006 to 2016			2016 to 2026		
Period	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**
Northbound	20.5%	11.1%	29.0%	10.4%	-1.3%	2.4%
Southbound	19.0%	12.9%	19.2%	0.4%	3.7%	8.2%

These significant increases in bus numbers do not take into account operational and service efficiencies that have been recognised by GWRC and an important component of the Central Bus Operational Review currently (mid 2009) being undertaken by GWRC. A sensitivity test has been carried out in Section 8 to identify the benefits of increased patronage, however based upon the existing average bus occupancy, the ability to get additional operational benefits certainly exists.

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4 Project Rationale

The Golden Mile already carries large numbers of buses (as discussed in chapter 3). WCC and GWRC collectively see the section of the Golden Mile between Courtney Place and Willis Street as the most important component of the Passenger Transport spine that links Wellington Railway Station with Newtown. They have identified the need to provide a more legible and passenger transport focused corridor to meet current and future transport needs. Another important component of the central city strategy is the need to revitalise existing pedestrian areas, linkages and public spaces. This will be crucial as the number of people living within walking distance of the city centre increases over time.

This project also aims to take account of future public transport demands and changes in operational conditions through the consideration of growth in bus passengers and associated reduction in personal vehicle trips. Although increases in bus capacity and demand are an important component in the restoration of the Golden Mile, as mentioned earlier, this is part of a wider piece of work being undertaking by GWRC to look at the operational conditions for Central Wellington. This chapter assesses existing and future bus patronage and identifies the sorts of measures that will be necessary to enable adequate future bus operations.

4.1 Existing Bus Operations and Patronage

The operation of buses in the study area between Taranaki Street and Willis Street precinct is characterised by a split route (refer Figure 6.1), with buses travelling in a southbound direction via Mercer Street, Wakefield Street, Lower Cuba Street and Manners Street. The reverse trip in a northbound direction travels via Dixon Street, Victoria Street, Manners Street and Willis Street.

Only one bus stop is located in a southbound direction on Lower Cuba Street, while in a north bound direction, stops are located in Dixon Street (by Cuba Mall) and Manners Street. One of the problems with this arrangement is that passengers alighting in the City centre for the first time may struggle to identify where they need to board for their return journey.

In terms of bus operation, the splitting of routes due to one way systems is common practice in traffic dominated transport systems and this offers efficient traffic management, however it creates a problem in terms of legibility for users and the ability to provide a quality PT corridor that utilises facilities for passengers and buses in both directions and a linkage with the wider transport system (whether it be PT or walking). Increasingly throughout the world, one way systems for buses are being replaced with two way dedicated facilities, bus contra flows, or two way traffic operation.

The number of bus passengers using this route in either direction varies according to location as buses enter and exit the Golden Mile corridor, the current bus passenger numbers have been displayed in Table 4 below.

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Table 4 – Bus Passenger Numbers 2006 (1 hour peak)

Route Section	AM	Interpeak	PM
Mercer St (SB)	2445	510	1630
Wakefield St (SB)	1715	440	1510
Lower Cuba/ Manners St (SB)	1690	430	1410
Courtenay Place (2 way)[2]	(SB 900, NB 1675)	(SB 325, NB 340)	(SB 1395, NB 740)
Dixon St/Victoria St/Manners St	1820	450	1125
Willis St (NB)	1590	640	1625

Although legibility and the lack of a single PT corridor is a major issue in terms of operational conditions, the current bus routings also provide limited bus priority provision and as a result, bus operation is subject to delay and journey time variability. This delay and variability is displayed in Table 5 below, highlighting the significant change between peak time and off peak travel times in a south and north bound direction through the study area.

Table 5 – Recorded Average Travel Times for Buses 2009 (Taranaki St to Willis St)

Route Direction	Average Travel Time [Range] (seconds)		
	AM	Interpeak	PM
Southbound	172 [94-266]	205 [133-295]	197 [128-272]
Northbound	256 [204-305]	271 [174-377]	326 [172-525]

Source: based on Valley Flyer GPS data for weekdays during March 2009.

It is interesting to note that the inter peak period is worse than both the AM and PM peak periods in a southbound direction which is likely to be linked to more vehicle and pedestrian[3] activity over the length of this link. This significant variance in bus travel times (as highlighted by the range in Table 5) through the study area results in the core problem with bus operation at a network level and the main cause of passenger dissatisfaction. This core problem specifically relates to journey time reliability. Passengers are generally accepting of delay if it is timetabled and predictable; however it is the variability and uncertainty that comes with the travel times presented in Table 5 that creates problems for

[2] Courtney Place is outside of the study area, however it has been provided to display the demand as the north and south bound routes split.
[3] Particularly the existing pedestrian crossing outside the Council buildings.

bus operators and frustration for passengers. This essentially means that bus operators can not stick to current timetables and the public have little or no confidence in the arrival or departure times for buses. These implications are not limited to the study area alone; they cover the entire route as buses bunch and fail to stick to the timetable, with the potential to also impact on the wider bus network as buses are not available for other services due to congestion and delay. Ultimately this has a cost implication and creates a public perception that the service is not reliable.

Given the relatively high bus patronage Wellington buses have achieved and maintained over recent years, it is critical that the service is not compromised by problems associated with reliability. One of the key mechanisms in addressing the problem of reliability is the provision of dedicated bus priority facilities. Although some facilities exist in the study area, they are limited to the northbound direction and are forced to integrate with general traffic at critical locations, such as the Manners Street / Willis Street intersection.

By world standards, the study area has a very high bus frequency and carries significant numbers of passengers; therefore the provision of quality infrastructure to support this bus operation is well over due and would appear to be justified based upon current demands and operational conditions.

Although the provision of bus priority facilities is critical to high frequency bus networks, it should also be highlighted that Wellington has capacity to increase bus patronage on certain parts of the bus network and at certain times of the day. This issue is not the focus of this study, however if this can be addressed, it would help to reduce the number of services, operating costs and potentially greater capacity for services on other parts of the network not currently serviced or provided with a limited service. GWRC is currently developing an “Integrated Strategic Network Plan” which will include information on passenger transport route hierarchy. This hierarchy links into the work undertaken as part of the Ngauranga to Airport Strategy Study, which focused on the enhancement of a PT spine through the Golden Mile, with a continuation up to the Basin Reserve and then on to the Hospital in Newtown.

4.2 Forecast Bus Patronage & Implications for Bus Operations

Wellington has a number of targets aimed at increasing the use of PT and other sustainable modes of transport (walking and cycling). The mechanisms in which this will be achieved is based upon a wide range of influences on travel behaviour and travel demand, largely aimed at providing a different balance between the priority given to private vehicle travel and other modes..

Based upon these changes in travel, PT demand is forecast to increase significantly over the next 10 to 20 years. For the purposes of this assessment, the projected passenger numbers from WSTM have been assumed and are displayed in Table 1 earlier.

These numbers not only highlight the significant number of existing passengers using this section of the public transport network (buses), but also the significance in terms of growth in passengers over the next 20 years. In order to accommodate this growth in passengers, bus operation will need to:

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- Have increased frequency (more buses),
- Greater provision for dedicated facilities and bus priority,
- More capacity at bus stops,
- Consider current operational effectiveness of the network and services, and
- Deliver an effective, safe and reliable service to the public.

Public transport usage in Wellington is the highest in the country and this is a result of historic and continuing land development patterns, continuing use of historic passenger transport corridors, lack of space for private vehicles (i.e. parking) and a public desire to achieve a better environment in which to live and work. This tremendous success will, however, create its own problems that if not addressed may significantly impact on the attractiveness and continued viability of passenger transport in Wellington. Unless steps are taken to improve passenger journey times and journey reliability, passengers will experience a reduction in the level of service in future years that will reduce the attractiveness of buses as an alternative to the private motor car.

As highlighted above, this PT provision needs to firstly focus on the key areas of demand and strategic direction for enhanced provision and priority. This is where the Golden Mile and more specifically this study between Taranaki Street and Willis Street fits into WCC's bigger strategy for bus priority and enhanced PT provision for the future.

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5 Design Philosophy & Engineering Standards

The purpose of this project is to carry out an independent evaluation of four options for enhancing the Golden Mile passenger transport corridor between Taranaki and Willis Streets. The four route options were defined in the brief. Part of this study required that each route was scoped to determine how it would operate as a passenger transport corridor, what infrastructure changes would be necessary and how reliability improvements could be introduced.

This chapter describes the design philosophy and engineering design standards that were applied during the development of preliminary designs for each route option. The ideas presented in this chapter were drawn from the Ngauranga to Airport Strategy study and other work relating to passenger transport and the urban environment that has subsequently been completed.

5.1 Design Philosophy

Wellington City Council wants the Golden Mile to provide an effective passenger transport route linking Courtney Place with Willis Street. The vision is for passenger transport services to be directed along a single route. Return services would therefore pass each other on the same roads.

Sections of the route should then be prioritised for passenger transport vehicles ahead of all other motorised traffic including taxis. Priority measures would be designed to improve the reliability of passenger services. Decreases in travel times, although an important objective, are less noticeable to passengers, however they can influence travel behaviour and mode choice.

As part of the route development, bus stop locations will also be investigated. Wellington City Council has a strong desire to maintain a ratio of one bus stop per direction every 500m within the precinct. Ideally these north and southbound stops would be located closer together to improve route legibility. Placing the bus stops close to areas of major demand has a number of benefits for passengers. The layout and location of bus stops will be designed to make best use of available footway widths. Bus stops will be designed to minimise delays and unreliability associated with the number of passenger transport vehicles serving a single stop. Further work is being undertaken as part of an operational review project for the Golden Mile which will define stop locations, accessibility and operational requirements.

Where necessary, parking, loading or taxi waiting bays will be removed to enhance conditions for passenger transport. The effect of such changes will, however be considered when options are assessed. Vehicular access for goods and servicing will be maintained for all properties; however it is anticipated that this may occur outside of core operating hours or rely on servicing via footways during daytime hours. The design philosophy behind the hours of vehicle access to shops and other areas needs to be considered further in light of PT objectives, but also economic viability of businesses, servicing needs and alternatives, and the urban form objectives for shared space areas. It is anticipated that

detailed consultation would need to be carried out before these are defined and it may be feasible to introduce peak hour restrictions initially as a trial.

Where possible, footways will be widened. This will not however be at the expense of carriageway widths sufficient to allow buses or other motor vehicles to safely pass cyclists.

It is anticipated that a high quality passenger transport corridor designed and implemented in accordance with this philosophy will help to maintain or increase the high mode share for the existing and future populations.

5.2 Key Design Criteria

The key design criteria for the passenger transport corridor have been developed on the basis of previous Council decisions and using the findings of scoping studies. The passenger transport design criteria must be measurable whether using qualitative or quantitative methods. They are to provide a passenger transport route that:

(i) allows passenger transport services to operate in both directions using the same roads;

(ii) passes close to as many trip origins / destinations as possible minimising the walking distance to employment, business and recreational activities;

(iii) prioritises passenger transport vehicles ahead of other motorised traffic where access for goods and servicing can be maintained;

(iv) is able to accommodate higher service frequencies allowing passenger transport vehicles to pass one another where necessary;

(v) minimises the number of tight-radius turns;

(vi) minimises the number of turns with conflicting traffic demand;

(vii) provides more capacity at pedestrian friendly bus stops;

(viii) minimises the disruption to pedestrian movements within the city centre;

(ix) will accommodate future bus rapid transit (BRT) or light rail services; and

(x) minimise the loss of parking spaces and impact on servicing requirements, although this study will not look at alternative locations/accessibility as this exercise is being undertaken by WCC internally.

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5.3 Engineering Standards

The following engineering standards have been used for the design and estimation for this project:

Passenger Transport Lanes – aim for 4.2m wide (where cycles might be permitted), minimum width of 3m.

Passenger Transport Bus Stops – have been designed to consider the number of services and the operational conditions, however this is based upon the need for a minimum bus cage of 3m wide x 13m long with clearways at either end, allow at least 3m footway width.

Other traffic lanes – minimum of 2.75m wide, or more if possible to accommodate cyclists

Footways – aim for at least 3m wide, minimum of 2m wide.

Parking, Loading or Taxi Bays – 2m wide.

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6 Option Descriptions

Wellington City Council identified a number of options to be assessed for comparative purposes for the restoration of the Golden Mile strategy, these options included;

- Modified Status Quo with minor changes to improve operation, passenger safety, and accessibility,
- Wakefield Street,
- Dixon Street, and
- Manners Mall

Each of these options has been described in further detail below based upon network configuration and assumptions. Figure 6.1 to Figure 6.5 display each of the options and the wider network modifications that have been assumed in the development of this assessment. Detailed drawings of each of the options have been included in Appendix H – Detailed Drawings of Each Option.

It is important to understand that this work has been carried out as a comparative and feasibility stage assessment in order to evaluate options. All options, including the do minimum have assumed that bus speeds will be reduced to 30 km/hr over the study area in both directions.

Consideration has also been given to the introduction of the signalised pedestrian crossings on Courtney Place and Wakefield Street. The conversion from a zebra crossing to traffic signals is widely recognised as providing benefits to bus operation through the ability to manage pedestrian movements, link signals, improve reliability, provide bus priority detection, and associated travel time savings. Although these improvements do not significantly influence the assessment of the 4 options identified, a specific section has been included in section 6.5 to discuss the existing problem and highlight the level of benefits that might be attributed to the conversion from zebra crossing to signalised crossing.

An additional idea of utilising or enhancing Bond Street (between Willis and Victoria Streets) as a PT route or public space was identified in the public consultation. This has little or no merit in terms of the project objectives; however it is acknowledge that improvements to pedestrian facilities and public space could be made in order to create a more pleasant environment for pedestrians and road users. This is considered to be outside the scope of this project.

6.1 Option A – Modified Status Quo

This option essentially replicates the existing do minimum network, with the exception of the banned right turn from Victoria Street into Manners Street. Therefore the information presented in this option essentially replicates the current operation and provides the comparison in which to assess options B to D, thus avoiding the repeat of information. A

layout diagram of the existing can be seen in Figure 6.1. Details of the existing road attributes can be seen in the accompanying table.

Figure 6.1 - Option A Modified Status Quo

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Table 6 – Existing Route Attributes

Attribute	Northbound	Southbound
Total Length	710m	640m
% Length With Bus Only Lane	33%	3%
No. Signalised Intersections	6	5
No. Bus Priority Facilities At Intersections	2	1
Maximum Lane Width For Buses	4.8m	6m
Minimum Lane Width For Buses	3m	3m
Minimum Turning Radius For Buses	20m	8m

Traffic Diversion

This option requires traffic divert up Victoria Street associated with the banned right turn into Manners Street, in which much of this traffic will be forced to travel up Boulcott Street towards the Terrace and the Urban Motorway. This diversion impact of the banned turn results in traffic being forced up Victoria Street towards the Karo Drive access to SH1 northbound, or using Dixon Street to access Boulcott Street via Willis Street or the Terrace via MacDonald Street.

Intersections

The only modification relates to the right turn from Victoria Street and the ability to change this intersection to improve pedestrian facilities for those walking between Manners Mall and Manners Street north side.

The reduction in traffic on Manners Street north west bound helps to improve the Manners Street / Willis Street intersection and reduce the number of conflicting traffic movements on the Manners Street approach to this intersection.

Removal of Parking

No change to parking provision.

Bus Stops

There will be no changes in the location of the existing bus stops within the precinct.

6.2 Option B – Wakefield Street

Option B would see the establishment of a permanent two-way bus route along the same path as that of the existing southbound bus services between Willis Street and Taranaki Street. This route comprises of Manners Street (South), Lower Cuba Street, Wakefield Street and Mercer Street as can be seen in Figure 6.2. By removing existing northbound bus movements from Manners Street (North) there is now an opportunity to introduce two-way vehicle movements on this road section. An overview of the network changes proposed as part of the option presented within the sections below. A detailed description of Option B by specific network location can be found in Appendix A.

Figure 6.2: Option B – Wakefield Street

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Route Attributes

The implementation of Option B would result in the following physical road attributes for the precinct as specified in Table 7.

Table 7 - Option B Route Attributes (Mercer Street to Taranaki Street)

Attribute	Northbound	Southbound
Total Length	640m	640
% Length With Bus Only Lane	16%	53%
No. Signalised Intersections	5	5
No. Bus Priority Facilities At Intersections	2	4
Maximum Lane Width For Buses	4.2m	4.5m
Minimum Lane Width For Buses	3m	3m
Minimum Turning Radius For Buses	8m	13.5m

Traffic Diversion

Operating Manners Street (West) in a two-way arrangement will allow Boulcott Street south-eastbound traffic to re-route directly towards Victoria Street. This will result in a number of vehicles being diverted away from the Willis / Mercer Street and Willis / Ghuznee Street intersections.

Permitting northbound movements on Manners Street (East) and Lower Cuba Street will result in only minor traffic diversion. It is expected that typically vehicles making this movement will be doing so for servicing or for shopping purposes only.

Intersections

Introducing a right turn for northbound bus movements from Mercer Street into Willis Street will require the removal of the existing pedestrian island at the intersection. By accommodating the new right turn movement out of Mercer Street there will be some disbenefit for vehicles travelling northbound on Willis Street towards Lambton Quay due to the additional signal phase.

Major works will be required at the Mercer / Wakefield / Victoria Street intersection. Specifically, significant modifications to the kerb build-outs and plantations will be required to accommodate bus through movements from Wakefield Street and the northbound bus-only exit lane on Mercer Street.

By introducing a two-way flow on Lower Cuba Street an approach to the Wakefield Street intersection will need to be constructed. This should be in the form of one shared left and

right turning lane for all vehicles. Building the approach requires the use of existing footpath facilities along Lower Cuba Street to be wide enough for left turn bus swept paths.

By introducing a two-way operation along Manners Street (North), the Manners / Victoria Street intersection will require an additional signal phase to allow right turn movements from Manners Street into Victoria Street.

Removal of Parking

A number of existing parking spaces will need to be removed to gain sufficient room to accommodate bus movements in both directions. It should be noted that these losses in parking are a worst case and traffic management mechanisms could be used to reduce the loss of parking. As can be seen in Table 8, the most significant removal of car parks on the route will occur along Manners Street (South).

Table 8 – Option B parking spaces required to be removed

Road Section	Vehicle Parking	Loading Bays	Motorcycle Parking	Taxi Parking
Mercer Street	-	1	75m^2	-
Wakefield Street	-	-	-	-
Cuba Street	7	1	-	-
Manners Street (East of Cuba Street)	20	2	-	4
Total	27	4	75 m^2	4

Bus Stops

In this option both the north and southbound Willis Street bus stops will remain in their current locations between the BNZ centre and Mercer Street. Ideally the northbound stop could be relocated closer to Mercer Street for route legibility. However due to complications in the development of the new Telecom Building this is unlikely to be possible.

The relocation of the northbound bus route proposed as part of this option will see the existing Manners Street (West) stop removed. Instead a new northbound bus stop will be placed just south of the Manners Street (East) / Lower Cuba Street intersection. This will create a more legible service while also allowing passengers to interchange closer to a major attractor (Cuba Mall). Consideration was also given to a complementary stop on Lower Cuba Street for northbound buses; however this would be away for the key attractor and result in a significant loss of parking. The southbound service will use the existing bus stop on Lower Cuba Street as it does now.

APPENDIX 4

Route Constraints / Departures from Standard

The most significant route constraint relates to achieving two way bus movements between Wakefield Street and Mercer Street given the layout of the intersection and other road user demands (pedestrians and general traffic). Although design standards can be achieved, this will be at the cost of other road users and potential capacity improvements at the intersection. However signal technology will need to be utilised to minimise this impacts. This could be achieved through the co-ordination of bus movements through the intersection and the associated lost time.

6.3 Option C – Dixon Street

Option C would see the establishment of a permanent two-way bus route between Taranaki Street and Willis Street using Dixon Street. To achieve this, Dixon Street would need to be modified to accommodate a south-eastbound bus only lane over its entire length. In addition the existing southbound bus only lane on Willis Street would need to be extended until the Manners Street (West) intersection as can be seen in Figure 6.3. By removing existing northbound bus movements from Manners Street (West) there is now an opportunity to introduce two-way vehicle movements on this road section. An overview of the network changes proposed as part of the option is presented within the sections below. A detailed description of Option C by specific network location can be found in Appendix A.

APPENDIX 4

Figure 6.3: Option C – Dixon Street

Route Attributes

The implementation of Option C would result in the following physical road attributes for the precinct as specified in Table 9 below.

Table 9 – Option C Route Attributes (Mercer Street to Taranaki Street)

Attribute	Northbound	Southbound
Total Length	800m	800m
% Length With Bus Only Lane	4%	63%
No. Signalised Intersections	5	5
No. Bus Priority Facilities At Intersections	2	5
Maximum Lane Width For Buses	5m	4.5m
Minimum Lane Width For Buses	2.5m	4.2m
Minimum Turning Radius For Buses	15m	10.5m

Traffic Diversion

Major traffic diversion will occur with the banning of the right turn movement from Boulcott Street into Willis Street. All vehicles will instead be re-routed to travel onto a two-way Manners Street (North) operation. This will be a more direct route towards Victoria Street and thus SH1 to what is now currently present. This scenario will result in a number of vehicles being diverted away from the Willis / Mercer Street and Willis / Ghuznee Street intersections. It will also place an increased number of vehicles at the Victoria Street / Ghuznee Street intersection.

Moderate diversion can be expected from introducing a two-way system within the existing road reserve on Dixon Street. The proposed changes will reduce the existing capacity in the north-westbound direction. Some north-westbound vehicles will redistribute themselves onto other parts of the network such as at Ghuznee and Wakefield Streets.

Only minor diversion can be expected from banning right turn movements from Willis Street into Dixon Street (North). The banning of this right turn movement is expected to force a very small number of vehicles to travel along Ghuznee Street and approach Dixon Street (North) from the south for a left turn access.

Intersections

Introducing a bus-only through movement in the south-westbound direction on Willis Street will require the removal of the existing pedestrian island at the Willis / Mercer Street intersection. By accommodating the new through movement on Willis Street there will be some disbenefit for vehicles travelling northbound on Willis Street towards Lambton Quay.

The Willis / Manners / Boulcott Streets intersection will require a number of changes to allow for the new south-westbound bus movements along Willis Street. Signal phase changes and possible kerb and channel modifications will be required to provide for the

banning of the right turn from Boulcott Street into Willis Street and the allowance of left turn movements from Manners Street into Willis Street.

The Dixon Street / Willis Street signalised intersection will be altered to provide a number of advantages for the bus route. The existing permitted right turn from Willis Street into Dixon Street will be banned. This will effectively remove a phase from the intersection thus reduce delays and congestion at the intersection. Left turn movements from Willis Street into Dixon Street (South) and right turn movements from Dixon Street (South) into Willis Street will be restricted to bus only.

By introducing a two-way operation along Manners Street (West), the Manners / Victoria Street intersection will require an additional signal phase to allow right turn movements from Manners Street into Victoria Street.

Finally a southbound bus phase will be added to the existing signal arrangement at the Dixon / Taranaki Street intersection. In order to get the southbound buses from Dixon Street across to Courtenay Place a bus advance signal may be used in a similar fashion to that at the existing Dixon / Cuba Street arrangement.

Removal of Parking

A number of existing parking spaces will need to be removed to gain sufficient room to accommodate bus movements in both directions, particularly on Dixon Street. As can be seen in Table 10, the most significant removal of car parks on the route will occur along the section of Dixon Street between Victoria Street and Willis Street.

Table 10 – Option C parking spaces required to be removed

Road Section	Vehicle Parking	Loading Bays	Motorcycle Parking	Taxi Parking
Willis Street	17	3	1 Bay=7	4
Dixon Street (Victoria to Cuba)	-	2	-	9
Dixon Street (Victoria to Willis)	26	-	-	-
Total	43	5	7	13

Bus Stops

Both the north and southbound Willis Street bus stops will remain in their current locations between the BNZ centre and Mercer Street. Ideally the northbound stop could be relocated closer to Mercer Street for route legibility. However due to complications in the development of the new Telecom Building this is not possible.

Option C will introduce a new bus stop further down Willis Street between the Boulcott Street and Dixon Street intersections. At this stage it is proposed to place only a northbound stop. While a southbound stop is possible it will be difficult to install due to the high number of access ways present along Willis Streets eastern side. On Dixon Street a new south-eastbound stop will be placed just to the north of the existing north-westbound stop near the Dixon / Cuba Street intersection.

Route Constraints / Departures from Standard

The operation and design of the Dixon Street / Willis Street intersection is likely to be compromised due to the constraints associated with the existing carriageway and the ability to undertake significant widening due to buildings, vegetation and other structures.

Although the provision of cyclist facilities is considered important, it is likely that they will need to be excluded from bus only zones or compromised lane widths provided in general traffic lanes. The ability to provide for cyclists is also linked to the provision of parking, by removing parking provides increased lane widths while also reducing conflict between cars and cyclists.

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6.4 Option D – Manners Street

Both Option D and Option D(i) would see the establishment of a permanent two-way bus route between Taranaki Street and Willis Street using Manners Street. Both Option D and Option D(i) will have a bus only lane on Manners Street in both directions between Willis Street and Cuba Street. In Option D, the short section between Cuba Street and Taranaki Street will have a bus-only northbound lane as can be seen in Figure 6.4. In Option D(i) the short section between Cuba Street and Taranaki Street will instead have a southbound bus only lane between Cuba Street and Taranaki Street as can be seen in Figure 6.5. An overview of the network changes proposed as part of these options is presented within the sections below. A detailed description of Option D by specific network location can be found in Appendix A.

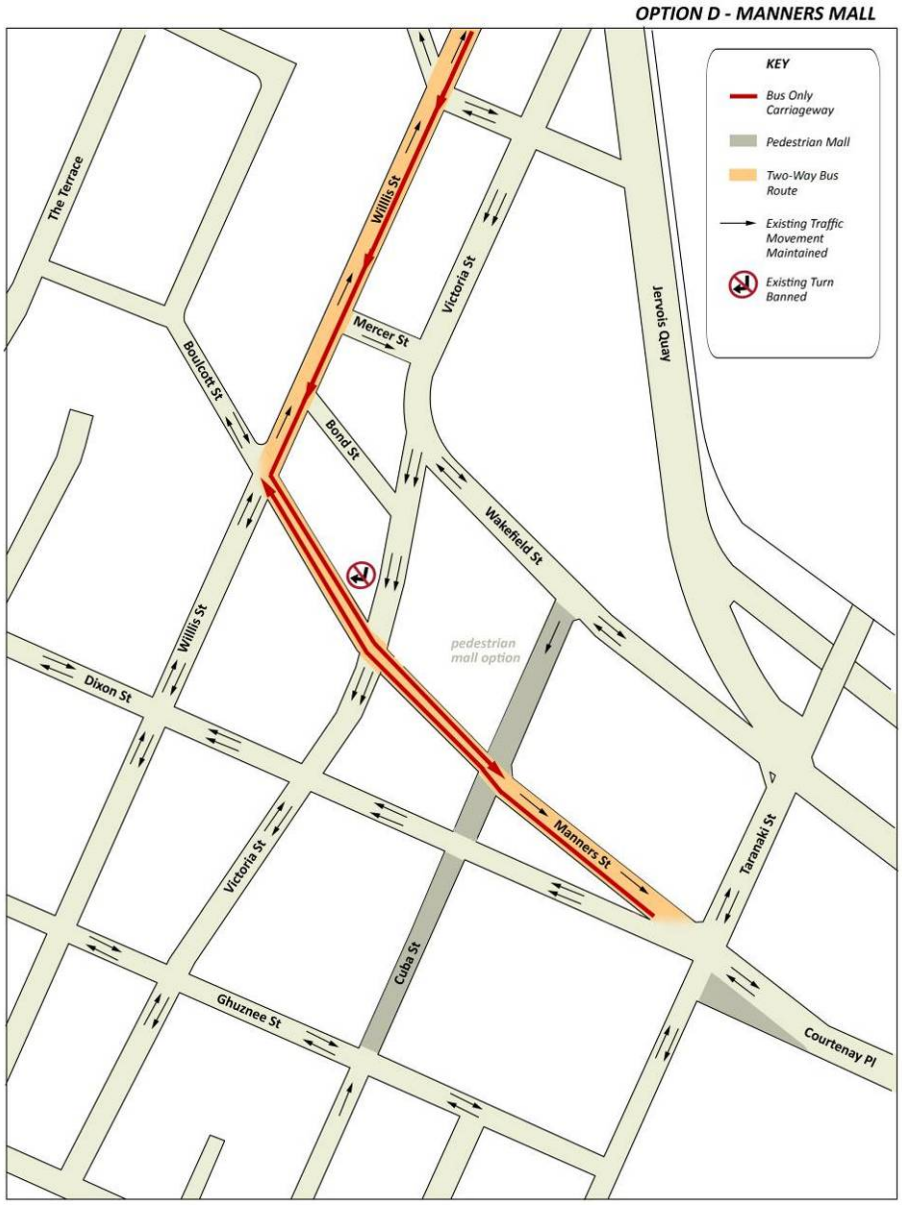

Figure 6.4: Option D – Manners Street

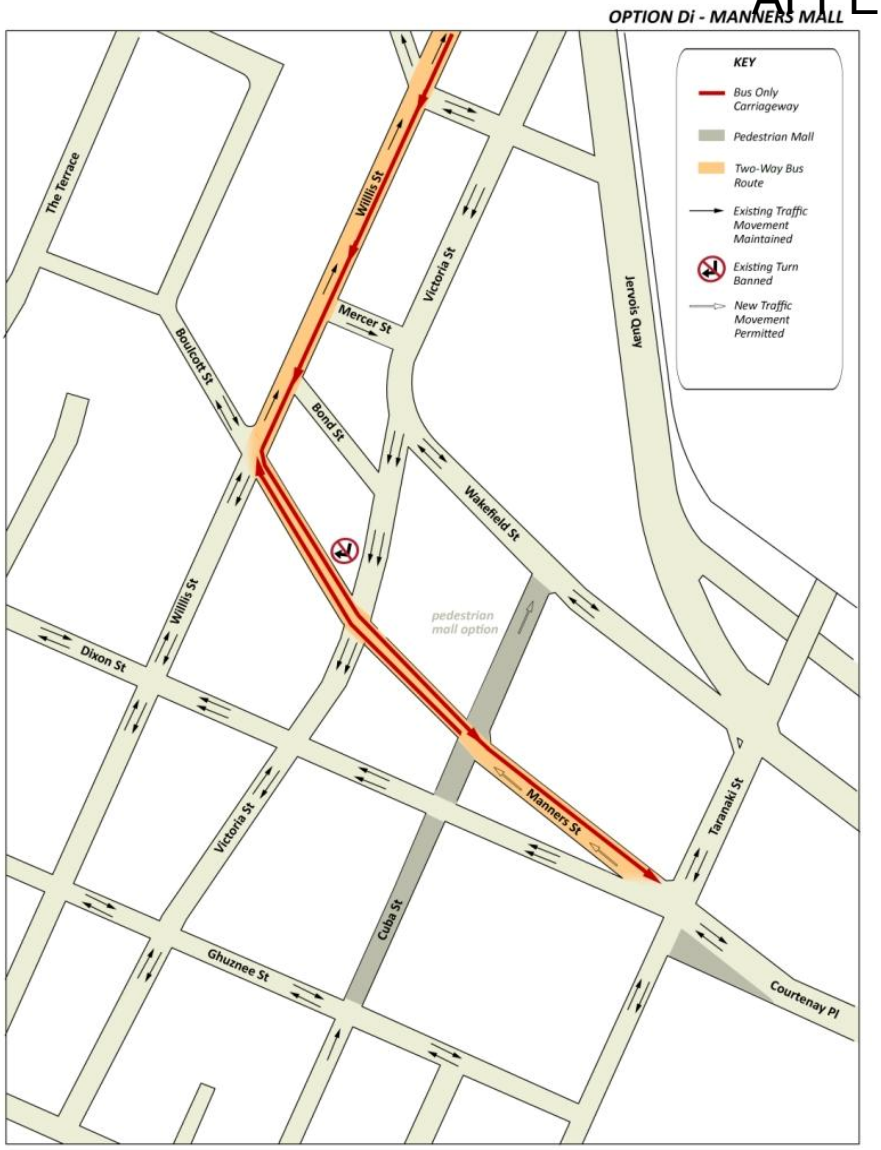

Figure 6.5: Option D(i) – Manners Street

Both Options provide the ability to utilise the space in Lower Cuba Street currently used by buses and traffic to create a pedestrian mall as displayed in Figures 6.4 and 6.5. The WCC Urban Design Team has undertaken further work to look at options regarding this space. This assessment does not include costs or public amenity / accessibility associated with this space. It should be noted that a full pedestrian mall with no access to traffic could have implications on access to businesses while also impacting on vehicle accessibility to Manners Street west. Should either of these options be developed further, consideration should be given to vehicle access, servicing, turning requirements and public amenity.

Route Attributes

The implementation of either Option D or Option D(i) will result in the following physical road attributes for the precinct as specified in Table 11.

APPENDIX 4

Table 11 – Option D Route Attributes (Mercer Street to Taranaki Street)

Attribute	Northbound	Southbound
Total Length	620m	620m
% Length With Bus Only Lane	68% D(i) = 40%	54% D(i) = 83%
No. Signalised Intersections	4	4
No. Bus Priority Facilities At Intersections	2	3
Maximum Lane Width For Buses	4.2m	4.5m
Minimum Lane Width For Buses	3m	4.2m
Minimum Turning Radius For Buses	20m	16m

Traffic Diversion

Adjusting Manners Street into a two-way bus-only operation between Victoria Street and Willis Street will result in some existing northbound traffic being diverted onto Dixon Street. In addition, if Option D(i) is used the available opportunity to make northbound movements on Manners Street (South) and Lower Cuba Street will divert some traffic. It is likely to be only minor with the only expected movements likely to be for servicing or for shopping purposes.

Intersections

Introducing a bus-only through movement in the south-westbound direction on Willis Street will require the removal of the existing pedestrian island at the Willis / Mercer Street intersection. By accommodating the new through movement on Willis Street there will be some disbenefit for vehicles travelling northbound on Willis Street towards Lambton Quay.

The Willis / Manners / Boulcott Streets intersection will require a number of changes to allow for the new bus-only left turn movements into Manners Street. Signal phase changes and possible kerb and channel modifications will be required to provide for the left turn movement.

The Victoria Street / Manners Street signalised intersection will be altered to provide for bus movements between Manners Street (North) and Manners Mall. The existing right turn movement from Victoria Street into Manners Street (North) will be banned. Alterations to the existing pedestrian crossings will also be required.

At the Manners Street / Cuba Street intersection there is some variation between Options D and D(i). In Option D the Cuba Street approach will be for southbound movements only, there will thus be little delay for bus only through movements travelling in the either the

north or south direction on Manners Streets. In Option D(i) Lower Cuba Street will be two-way due to Manners Street between Taranaki and Cuba Streets being available for all vehicles in the northbound direction. Therefore in Option D(i) a right turn movement will need to be provided for movements from Manners Street into Lower Cuba Street to allow the rest of the northbound Manners Street route to bus-only. This is predicted to cause some performance issues at the intersection as a result of this additional movement.

In both Option D and Option D(i) the Taranaki / Manners Street intersection will need to be modified to accommodate north-westbound movements into Manners Street. In Option D an advance bus phase could be added to the existing signal arrangement. This will allow southbound buses from Manners Street across to Courtenay Place in a similar fashion to that at the existing Dixon / Cuba Street arrangement. For Option D(i) the existing phase arrangement will have to be modified to give vehicles on all intersection arms the opportunity to enter Manners Street.

Removal of Parking

A number of existing parking spaces will need to be removed to gain sufficient room to accommodate bus movements in both directions. As can be seen in Table 12 this is particularly evident on Manners Street.

Table 12 – Option D & D(i) Parking required to be removed

Road Section	Vehicle Parking	Loading Bays	Motorcycle Parking	Taxi Parking
Lower Cuba Street	7	1	-	-
Manners Street (South of Manners Mall)	20	2	-	4
Willis Street	-	1	-	-
Total	27	4	0	4

It should be noted that these calculations are a worst case and do not make allowance for additional parking spaces being created on alternative streets such as Dixon Street. Further work is being undertaken by WCC to look at alternative parking locations and the associated costs in creating these spaces.

Bus Stops

Both the north and southbound Willis Street bus stop will remain in their current locations between the BNZ centre and Mercer Street. Ideally the northbound stop could be relocated closer to Mercer Street for route legibility. However due to complications in the development of the new Telecom Building this is not possible.

With Option D and Option D(i) both the existing northbound stop at Manners Street and the southbound stop on Lower Cuba Street will be removed. These two stops will be replaced with a bus stop along the new two-way route within the vicinity of the Manners Street / Lower Cuba Street intersection.

The stop location is considered important in terms of urban design, severance, accessibility, public acceptance, functionality and general bus operation. Two different stop locations have been considered as part of this assessment based upon an assessment of distances between the stops either end of the study area and existing stop locations. In terms of spacing, demands and proximity to existing stops, the idea location would to have both north and south bound stops located in Manners Mall as displayed in Figure 6.6 below. This option is likely to result in significant severance caused by buses dwelling, result in impacts on operational conditions, have environmental impacts, and require additional road space to accommodate bus movements in and out of the stop and impact on the general streetscape. Therefore this option is not considered to be the preferred stop configuration.

The second option is displayed in Figure 6.7, which is also in the centre of an area with strong passenger desire lines being either side of Cuba Mall. The northbound stop will be placed to the east of the intersection. This location is the most appropriate so that it does not interfere with the operation of the traffic signals and to reduce potential delay other passing bus services. The southbound stop will be placed to the west of the Manners Street / Lower Cuba Street intersection so that issues at the stop do not have a flow on effect into the Manners Street / Victoria Street intersection.

The bus stop concept indentified in Figures 6.6 and 6.7 would apply irrespective of which route was identified as the preferred option, due to the strong pedestrian demands and similar bus frequencies.

Figure 6.6 – Option D & D(i) Manners Mall Bus stop Design (Possible Option)

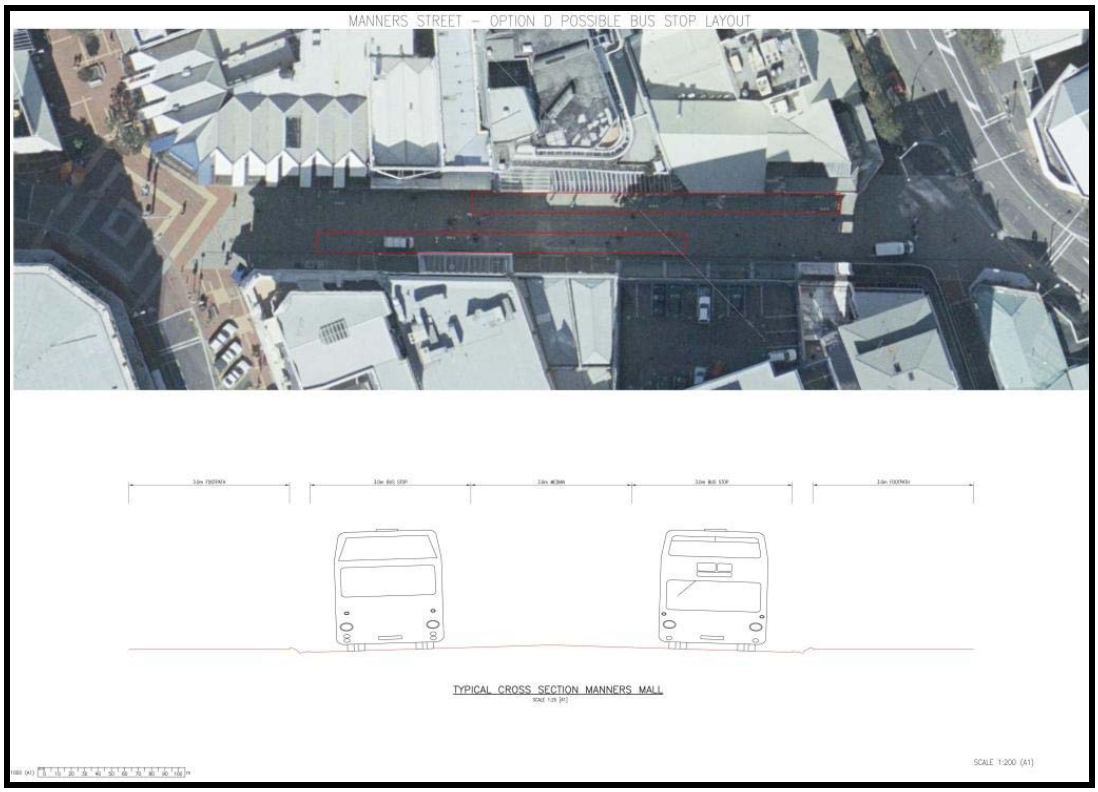

Figure 6.7 – Option D & D(i) Manners Mall Bus stop Design (Probable Option)

Route Constraints / Departures from Standard

The major route constraint relates to the width of the blocks (Willis Street to Victoria Street to Cuba Street) and the limitations this provides for throughput of buses and the location of bus stops. This places increased pressure on the need to deliver effective bus priority and associated detection at signalised intersections to ensure linkages are free flowing and one link becomes a storage area for buses (similar to Manner Street East currently). This could result in severance and associated environmental impacts.

Again the ability provide for cyclists as part of the bus only areas is considered important, it is likely that they will need to be excluded from bus only zones due to lane widths and the trade off between the heavy demands for pedestrian space.

6.5 Conversion of Zebra Crossings to Signals

This assessment has not taken into account the impact of converting existing zebra crossing at Wakefield Street (outside the Council entrance) and Courtney Place to signalised pedestrian crossings. However, consideration for this proposal has been taken into account in both the designs and the consideration of operational conditions.

It is widely acknowledged that the conversion of zebra crossings to a signal controlled crossing has benefits for bus and traffic operation (particularly variability), allowing control of movement and coordination with other traffic management or bus priority facilities, such as signals. The down side of this conversion is the loss of freedom for pedestrians and lower level of service, resulting in longer waiting times and often the use of an alternative or ‘jay’ walking.

Neither crossing has been included in this assessment due to the issues associated with the modelling of the existing zebra crossing and the failure of the model to take account or replicate the variability associated with this facility. The Courtney Place crossing is also considered to be outside the study area, despite impacting on services entering or existing at Taranaki St.

In terms of bus priority, the conversion of these crossing facilities to signals is endorsed, however technology should be used to maximise benefits to buses (bus detection) and minimise the impact on pedestrians.

6.6 Further Development

WCC are undertaking a separate exercise to identify locations for new parking to compensate for the loss of parking that may result if particular options are developed further.

The WCC Urban Design team is also planning to undertake further assessment looking at the further design opportunities each option would provide. This report does not address the impacts of urban design (e.g. if Lower Cuba Street was pedestrianised; however, it is our opinion that this will have little effect on traffic operation).

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7 Cost Estimate

In order to undertake an assessment of the project options the 4 key options have been designed to an indicative level of detail developed in the drawings (refer Appendix H – Detailed Drawings of Each Option) and a cost estimate prepared to a feasibility level. Details of the cost breakdown for each option have been included in Appendix I – Breakdown of the Cost Estimate; however a summary has been displayed in Table 13 below.

Table 13 - Indicative Cost Estimates

Option	Base Estimate	Contingency (%)
Option A	$470,000	59%
Option B	$5,312,000	73%
Option C	$4,287,000	66%
Option D	$5,411,000	68%
Option D (i)	$5,378,000	68%

The assumptions used in developing these estimates have been also been summarised in Appendix I – Breakdown of the Cost Estimate, however it should be noted that this is a feasibility phase estimate and as such significant contingency has been provided to cover the uncertainty around services and trolley bus relocations in particular. It should be noted that the base estimate presented above for Manners Mall aligns well the initial estimate prepared by WCC.

For the calculation of the BCR, the expected estimate has been used; this includes the project contingency and is consistent with NZTA's requirements for the evaluation of projects under the Economic Evaluation Manual (EEM). The contingencies identified above are based upon the base estimate and the level of detail developed for this initial investigation of each option. These contingencies are greater than those presented in the cost estimated prepared for the Wellington City Bus Priority Plan – Evaluation (April 2008), which used an average of 35% of the base estimate.

It is believed that the options developed in this proposal involve large amounts of work relating to service relocations, street improvements, paving, trolley bus route relocations and general traffic management in busy pedestrian and traffic areas. Therefore appropriate levels of contingency have been included in the estimate based upon our experience of similar projects and the nature of the construction activity being undertaken.

As the options develop and further work is undertaken to refine and design the options, this contingency is expected to decrease.

APPENDIX 4

8 Option Performance

8.1 Journey Time Benefit Assessment Approach

Traffic redistribution and transport cost calculation

The Wellington Traffic Model has been used to determine the impact each of the scheme options has on bus delay at intersections, traffic distribution, travel speeds, distance travelled and delay. This in turn has allowed for the calculation of transport cost to compare between options and the do minimum in order to determine the improvements in terms of bus priority and the impact on general traffic associated with each of the options.

A detailed report on the modelling has been attached as Appendix B to this report. This discusses the modelling and results and the impact of the options on the network.

Bus priority and passenger cost calculation

In order to assess the change in benefits and operating conditions for buses and passengers, two key options were considered given the resources and timeframes available, these included;

1. Extracting changes in bus performance through the Wellington Traffic Model, or

2. Undertaking a hand calculation of bus operation through the study area, using the traffic model, existing operational data, and operational conditions to calibrate the results.

The most straightforward method would be the extraction of performance from the Wellington Traffic Model, however it is acknowledged that this model is a strategic traffic modelling tool and has not been calibrated against bus operational conditions and performance (e.g. no consideration for bus stops, bus pre-emption etc.). The degree to which bus operational conditions vary between the model and the recorded bus operation for the study area is displayed in Figure 8.1 below, highlighting that actual operational travel times are up to twice that of the modelled travel times through the same route.

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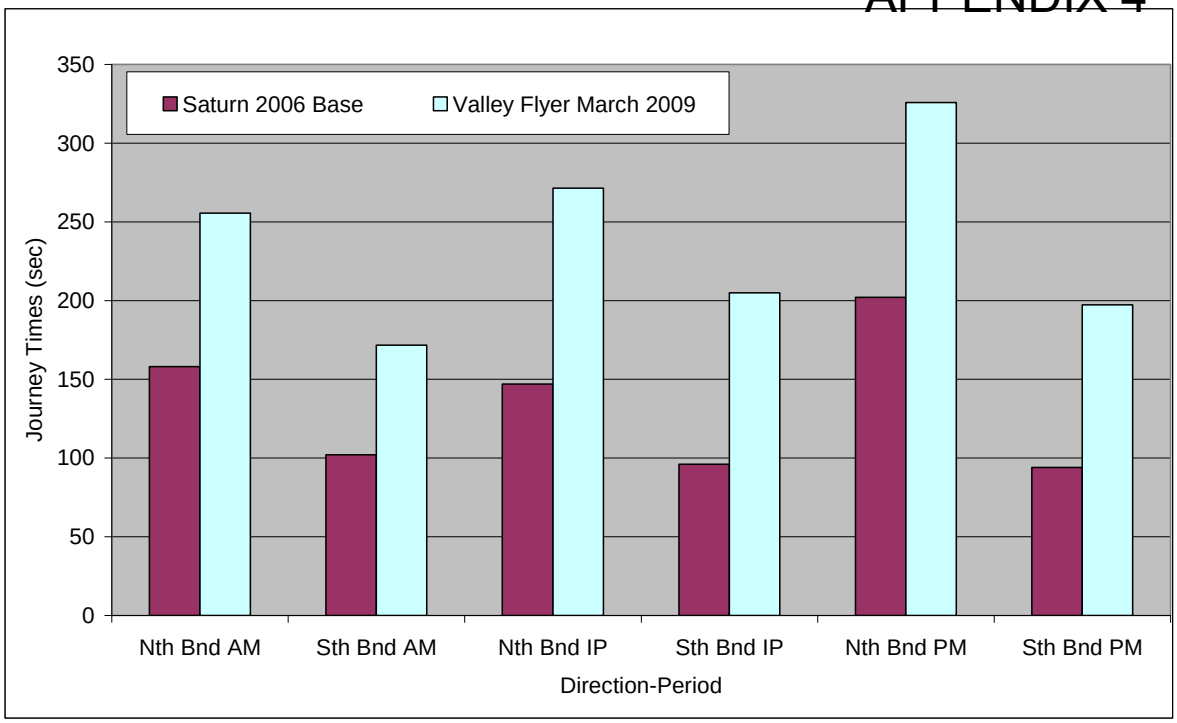

Figure 8.1 – Comparison of Journey Times for the Do Minimum

The data displayed in Figure 8.1 for the Valley Flyer[4] utilises all available GPS data for the study area during the corresponding time periods, this equated to sample sizes of 70 trips in the AM, 122 trips in the interpeak (9 to 4pm) and 64 in the PM peak as shown in Table 14 below.

Table 14 – Sample size for Valley Flyer GPS data

Period	Northbound	Southbound
AM (7am – 9am)	9	61
Interpeak (9am – 4pm)	18	104
PM (4pm – 7pm)	20	44

[4] Although the data supplied by Go Wellington for the Valley Flyer service does not capture the operational conditions of all buses (e.g. Trolley Buses and different routes have different loading patterns), the number of trips recorded and the correlation with data collected in 2006 by Opus for the Golden Mile Study displayed a reasonable level of calibration. Therefore this data has been assumed to be an acceptable for the purposes of this assessment and study. Should further data be made available in the future, this could help to further calibrate the existing journey time data and all associated calculations.

It was decided that a combination of hand calculation and the use of intersection performance information extracted from the WTM would be used to determine bus and passenger impacts. This approach uses the following methodology to take into account bus operation and associated bus priority, which included:

1. Calculation of total distance of the option and the optimum travel speed (30km/hr)

2. Bus dwell time and associated bus stop delay (pulling into and exiting the bus stop)

3. Delay time at signals based upon the delay information extracted from the Traffic Model - this delay does not take into account bus pre-emption/detection which is considered an integral part in achieving bus priority through the Golden Mile, which would contribute to improved reliability, capacity and reduced delay. Depending upon the method of detection used and the other demands at the intersection, anywhere between 10-50% reductions in delay can be achieved. Therefore for the purposes of this assessment we have assumed a 25% reduction in delay at signals associated with bus pre-emption for all options.

4. The combination of these totals provides the total projected operating time for the option in base year (2006).

5. To address the issues associated with increased traffic and increased bus frequency for forecast future years, the Wellington Traffic Model has again been used to display the relative percentage change between travel time in the base against travel time in the forecast years by direction. It should be noted that the model takes into account changes in bus numbers associated with significant increases in bus patronage, however it does not assume improved operating efficiencies and increases in bus occupancy (e.g. getting more passengers on each bus travelling the existing routes or corridor); therefore this approach is considered conservative.

6. This increase in future years has been applied to the base do minimum (current recorded operation) and options to provide forecast year operating conditions.

7. The difference between the do minimum and options has been calculated and the relative change in travel time, passenger numbers and bus numbers has been input into the economic model to determine the relative benefits of each option.

The only exception to this approach was the calculation of bus benefits for the modified status quo (Option A) due to the limited changes being proposed and the lack of bus priority being implemented. This option does nothing for southbound buses and only benefits buses northbound on Manners Street between Victoria and Manners Streets. Therefore, the same approach as adopted for other options was applied to bus travel on Manners Street east (including the intersections at either end) only and not the entire route.

The assumptions used to undertake this calculation and the worksheets have been included in Appendix J – Journey Time Calculation Data, displaying the components of time associated with each of the attributes contributing to the total time identified above, and the relative change between options.

8.2 Bus Benefits

A comparison of the bus journey times for each of the 4 core options and associated sub-options are summarised in the journey time plots shown in Figure 8.2 to Figure 8.5 below. The lower the option(s) journey times when compared to the do minimum journey times the better the bus benefits.

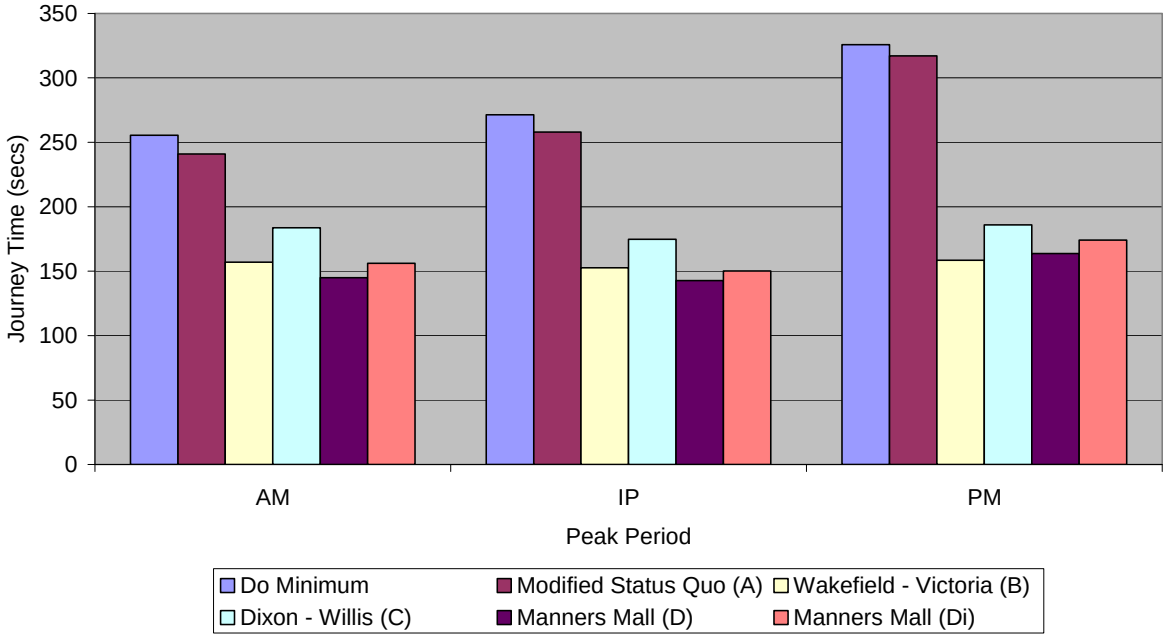

Figure 8.2 – Comparison of Journey Times for 2006 (Northbound)

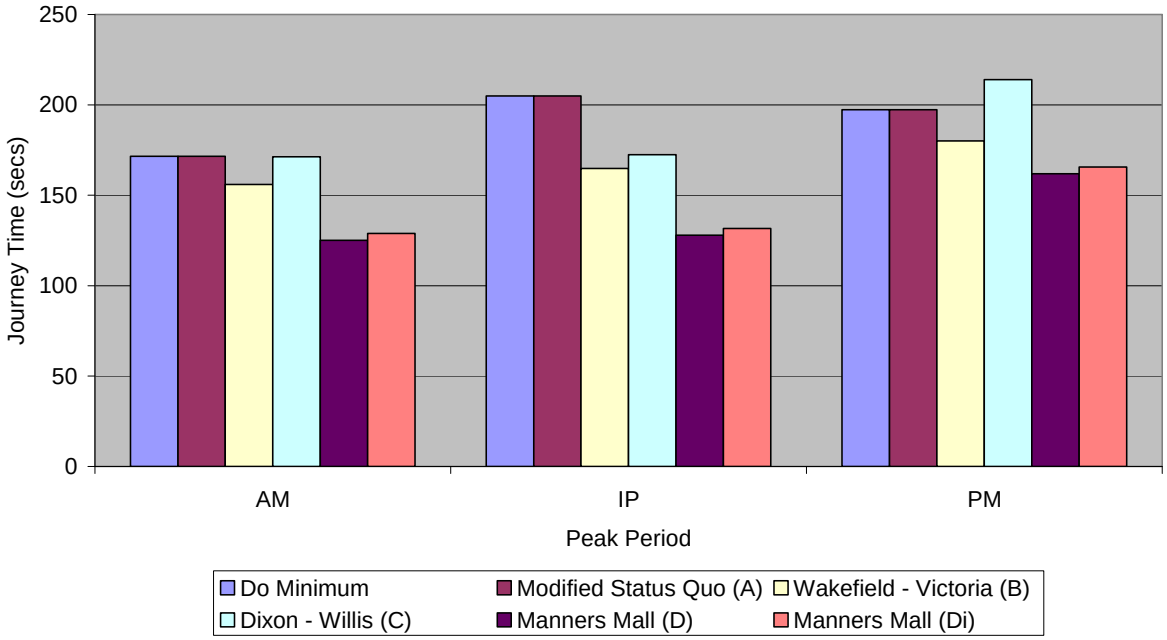

Figure 8.3 – Comparison of Journey Times for 2006 (Southbound)

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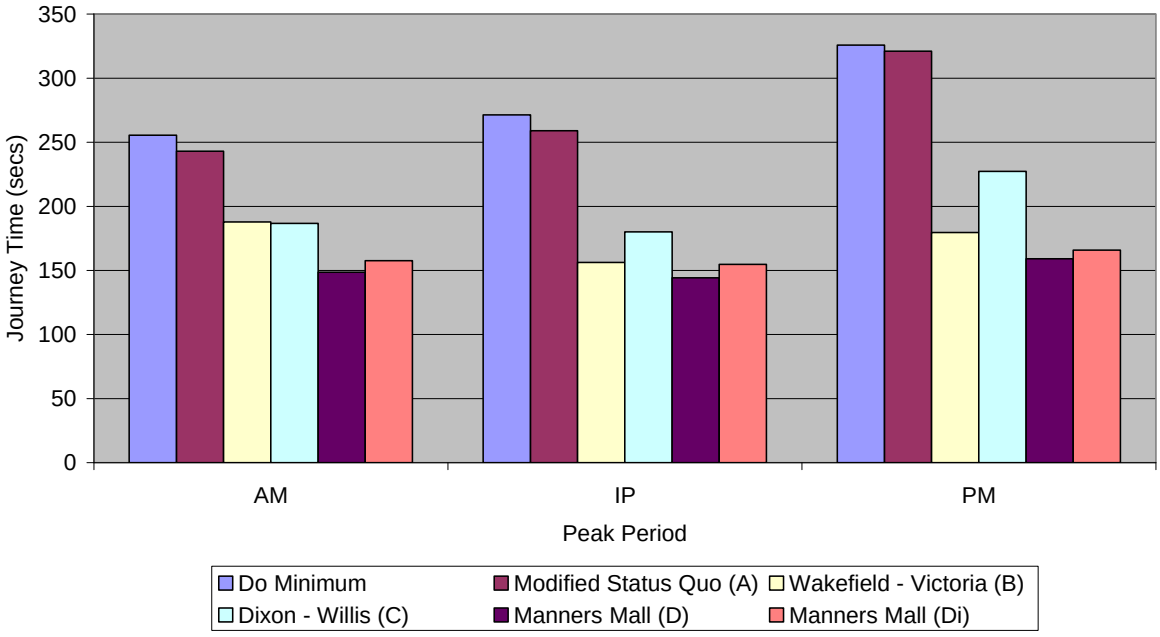

Figure 8.4 – Comparison of Journey Times for 2016 (Northbound)

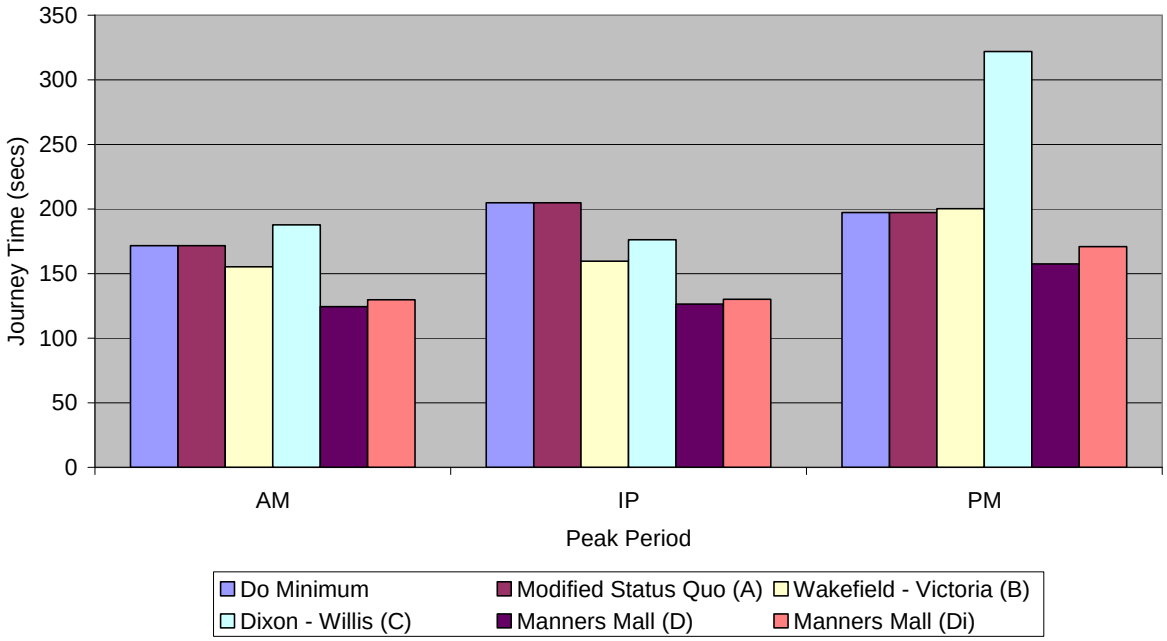

Figure 8.5 – Comparison of Journey Times for 2016 (Southbound)

In general all of the options, with the exception of the Dixon Street option provide bus benefits, with option D and D(i) providing consistently better benefits due to the length of the corridor, the high proportion of dedicated bus space and the number of intersections in which buses are subject to delay.

Each of the options have been assessed using forecast bus demands for 2016 and the ability for the links to provide for these increases in demand are inherently related to the intersection performance at either end, the associated bus stop locations, and operational conditions. The performance of these options in relation to bus stop capacity has been discussed in Section 6 (particularly 6.6 & 6.7); however the link and intersection capacity has been modelling using the WTM. The proposed designs allow for conventional diesel buses to pass one another, however trolley buses would be forced to wait behind a stationary bus (as with existing operational conditions). The modelling and assessment to date suggests that significant spare capacity exists up to 2016. No modelling has been carried out beyond 2016 however the increase in demand up to 2026 used for this project is considered relative small and sufficient capacity exists in which to maintain high levels of service to buses. It has also been assumed that the performance of intersections would be further enhanced for buses through the use of bus pre-emption and associated bus priority interventions.

Once a decision is made as to the preferred option, it is suggests that further work should be undertaken to confirm the operational conditions in detail through the use of the recently updated Wellington Inner City Bypass PARAMICS's model or similar software. This would provide much better representation of current and future PT operation and allow for the consideration of bus priority and bus stop demands/interactions.

8.3 Network Traffic Statistics

The calculation of impacts on the wider network and associated performance has been extracted from the WTM and full details of the traffic modelling have been summarised in Appendix B - Detailed Model Results of this report.

The 2006 (base) and 2016 AM, inter peak and PM peak periods have been used to model both the Do Minimum[5] and bus priority options.

A number of key network statistics (average speed, kilometres travelled, delay and queue time) have been used to provide a high level comparison of change between options in Table 15 and Table 16.

2006 Network Performance

The 2006 network is very similar to the network that exists today (2009), with a certain amount of traffic growth and associated congestion, this performance is summarised in Table 15 below.

[5] Do Minimum – is the network as planned to occur without any changes associated with the Golden Mile Bus Priority Project.

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Table 15 –Network Performance Statistics 2006 (WTM)

		Network speed (kph)	Network travel time (pcu hrs/hr)	Network travel distance (pcu kms/hr)	Network delays (pcu hrs/hr)
Existing	AM	31.8	4,593	145,943	100
	IP	38.6	2,873	110,769	31
	PM	33.1	5,077	168,182	112
Option A – modified status quo	AM	31.7	4,589	145,627	100
	IP	38.4	2,881	110,776	30
	PM	33.0	5,103	168,612	111
Option B – Wakefield S	AM	31.7	4,588	145,359	99
	IP	38.4	2,874	110,289	31
	PM	33.0	5,101	168,489	112
Option C – Dixon St	AM	31.7	4,602	145,651	99
	IP	38.6	2,861	110,461	27
	PM	29.6	5,359	158,813	144
Option D – Manners St	AM	31.6	4,609	145,639	99
	IP	38.5	2,879	110,755	27
	PM	29.5	5,394	159,132	144
Option D (i)– Manners St –	AM	31.6	4,597	145,317	99
	IP	38.5	2,867	110,414	27
	PM	29.6	5,363	158,685	144

Network speeds (which include general traffic, heavy vehicles and buses) in the AM and inter peak periods are virtually unchanged between the base and each of the options, however in the PM peak period, Options C and D result in a slowing of the network overall which is likely to be due to redistributed traffic causing additional delay away from the study area and delay at specific intersections such as Manners Street/Willis Street. Linked to this the network travel times in the AM and inter peak periods are unchanged in general although there is a small drop in option C in the inter peak period. In the PM peak the decreased network speeds under option C and D result in marked increases in overall network travel times as might be expected.

The impact associated with these changes in network conditions are highlighted in terms of the economic assessment (Section 8.4), displaying the changes in transport costs associated with each of the options in comparison to the do minimum network.

2016 Network Performance

The 2016 model period displays growth in the network demand and a significant reduction in performance and associated congestion when compared against the 2006 network

performance. The change associated with the options has been displayed in Table 16 below.

Table 16 – Network Performance Statistics 2016 (WTM)

		Network speed (kph)	Network travel time (pcu hrs/hr)	Network travel distance (pcu kms/hr)	Network delays (pcu hrs/hr)
Existing	AM	31.7	5,003	158,638	102
	IP	38.2	3,063	117,050	27
	PM	29.8	5,698	169,773	115
Option A – modified status quo	AM	31.5	5,032	158,688	101
	IP	37.3	3,124	116,377	30
	PM	29.6	5,746	170,355	115
Option B – Wakefield S	AM	31.6	5,013	158,487	102
	IP	37.9	3,083	116,824	27
	PM	29.6	5,734	169,593	114
Option C – Dixon St	AM	31.6	5,030	158,881	101
	IP	37.9	3,085	117,019	27
	PM	29.6	5,735	169,844	115
Option D – Manners St	AM	31.4	5,050	158,634	101
	IP	37.8	3,099	117,178	27
	PM	29.5	5,759	170,151	115
Option D (i)– Manners St –	AM	31.5	5,039	158,484	101
	IP	37.9	3,083	116,834	27
	PM	29.6	5,735	169,566	114

Network speeds in the AM and PM peak periods are relatively minor with slightly slower routes under option D. In the inter peak period all routes are somewhat slower then existing with the biggest drop in option A. Again this slowing of the network overall is likely to be due to redistributed traffic causing additional delay away from the study area and delays at key intersections.

The network travel times in all periods are virtually unchanged in general when compared with the base model although there is something of an increase in the inter peak in option A when in comparison with the base figure.

In general the change in network wide statistics in all time periods is relatively minor. Option A in the inter peak shows some worsening of network wide results which as mentioned is perhaps down to signal settings at specific locations.

Similar to the 2006 results, the changes in 2016 performance have been converted to transport costs in Section 8.4, displaying significant increases in cost between the do minimum and the options.

8.4 Transport Economic Efficiency Benefits

The transport economic efficiency of each option has been assessed in accordance with New Zealand Transport Agency Economic Evaluation Manual Vol 1 & 2. The Benefit Cost Ratio (BCR) will be based on:

- Bus passenger and driver travel time costs – multiplied by estimated vehicle occupancy;
- Bus Reliability benefits
- Estimated scheme costs

It should be noted that the impact associated with general traffic; (lights & heavies) travel time costs, vehicle operating and carbon dioxide costs have not been included in the project BCR calculation. This is because of a strategic decision has been made that a public transport corridor is needed in order to facilitate modal shift and achieve the objectives of the Regional Land Transport Strategy. Although not included in the BCR calculation the general traffic impacts can be inferred from the WTM outputs (network performance statistics) as discussed in section 8.3 earlier.

8.4.1 Bus Passenger and Driver Time Savings

Travel time savings for the bus passengers and bus drivers for various options have been determined using the calculated travel time savings due to reduction in bus journey times as described in Section 8.1 and Section 8.2.

The passenger and bus volumes have been extracted from the WTSM plots for the Golden Mile project for the AM, IP and PM peak period and annualisation factors applied. Please note that much of the future increases in passenger numbers results from population growth and from general improvements to the passenger transport spine. These increases in passenger numbers are implicitly incorporated within the BCR calculation by taking account of the future increases in bus numbers.

Passenger values of time disaggregated by trip purpose and the proportion of seated and standing passengers were then applied to the calculated travel time savings for buses (drivers) and passengers to determine the total travel time savings. A brief description of assumptions made to allow for the calculation of travel time saving for passengers and buses is included in Section 8.1.

8.4.2 Bus Reliability Benefits

The latest updates to the EEM included guidance on the evaluation of reliability benefits for PT users. The reliability benefits for the current analysis have been carried out in accordance with EEM Vol 2. The calculated benefits correspond to the reduction in uncertainty due to the delay for the passengers who are on the service i.e. “In Vehicle

Travel". The reliability benefits use total passengers per annum, equivalent time to minute ratio from EEM Table 2 value of $0.322 / passenger and the "average minutes late".

The average "minutes late[6]" has been calculated by using the existing bus journey time data sourced from Valley Flyer. The variability in do-minimum has been assumed to be the difference in the upper and lower quartile of the values of the observed data. For the options it has been assumed that installation of dedicated bus facilities and signal pre-emption, combined with the reduction in travel distances will reduce the variability by 10%.The reliability saving is assumed to be the difference in do-minimum variability and option variability. This has been averaged for all directions and peak periods. The resulting decrease in variability ranges from 24 to 32 seconds.

Please note the Section 7.2, EEM Vol 2 states that the total variability benefits cannot exceed any travel time savings. Therefore, reliability benefits have been capped to the total journey time savings calculated for different route options. However, a sensitivity test using the total reliability benefits have been carried out to demonstrate the impact on the BCR, which is considered to be significant.

8.4.3 Transportation costs for General Traffic

The impacts associated with changes in network performance due to the proposed options have been assessed using the WTM as described in Section 8.3. It is obvious from the network statistics included in Table 15 and Table 16 of Section 8.3 that there is a dis-benefit to the private transport users due to the proposed options. These disbenefits have been quantified using SATURN outputs for year 2006 and 2016 (AM, inter Peak and PM Peak) to determine the travel time, vehicle operating, and CO2 emission costs for all vehicles over the network. Further assumptions and values of time used to calculate these transport costs have been included in Section 8.4.4.

8.4.4 Elasticity of Demand

Elasticity's of demand have been calculated with respect to changes in bus journey time based on the similar assumptions used in the Wellington City Bus Priority Plan - Evaluation Report by Ian Wallis Associated Ltd and John Bolland Consulting Ltd, 2008. The report used elasticity of demand in the range of -1.0 to -1.5 for peak and off-peak periods respectively. This value relates to elasticities of demand with respect to total generalised costs. However, the proposed route options for this project relates only to the "in-vehicle time" component of the total generalised cost and the use of elasticities of demand relating to total generalised costs may overestimate the elasticties. Accordingly, based on a "Review of Passenger Transport Demand Elasticities", Transfund New Zealand Research Report No 248, 2004 and National Guidelines for Transport System Management, Australian Transport Council, we have used elasticity of demand in the range of -0.3 to -0.5.

For example, for Option D, the average journey time savings in the peak period (AM and PM peak) is 89 seconds. If we assume the total bus route operating time in the peak period is 45 minutes, it is a 3.2% reduction in total travel time of the bus trip. If the demand elasticity (as noted above) is applied this equates to approximately 124 new passengers (at

[6] Minutes late is a term used by the EEM for variability to PT travel time for the length of the journey

the rate of 0.096% increase in the existing passengers in the peak period). Although there is unlikely to be any significant differences in the degree to which each route option encourages mode shift over the other, the concept of an enhanced PT corridor is believed to have such an impact. However, the impacts of the elasticity of demand have only been analysed as a sensitivity test i.e. they have not been included as part of the main analysis.

8.4.5 Economic Assessment Assumptions

The key assumptions used on the economic evaluation of the proposed bus priority project include:

- All the costs and benefits have been discounted to 1 July 2009 (Time zero)
- A one year construction period has been assumed for the proposed options with the start of the construction period for the economic analysis assumed as 1/07/2009 and finish by 31/06/2010.
- For discounting purposes, it is assumed that construction payment will be made at mid point of first year of construction (i.e.31/1/2009) relative to time zero.
- SATURN outputs for year 2006 and 2016 (AM, inter Peak and PM Peak) have been used to forecast the travel time, vehicle operating and CO2 emission benefits for all vehicles over the network. Benefits for the Intermediate years have been interpolated. However, it should be noted that the network performance for years beyond 2016 has been maintained as a flat profile as SATURN model forecasts do not extend beyond 2016.
- Similar to the vehicle transportation costs, the benefits between 2006 and 2016 have been interpolated for bus passenger, driver and variability benefits. Benefits beyond 2016 have been capped to 2016 values to maintain a consistent approach for evaluation of buses and the general traffic.
- All the bus and vehicle transport costs/benefits have been calculated for 245 days of the year. Off-peak period costs for the weekday and weekend peak costs have not been included in the analysis which is considered to be a conservative approach.
- Crash benefits have not been determined as part of this economic evaluation.
- No allowance for bus operating costs or increase in revenue costs have been carried out as part of this analysis. However, bus driver costs have been included in the analysis.
- An 8% discount rate has been used to discount the costs and benefits to time zero over a 30 year analysis period.
- The latest update factors and vehicle operating costs have been applied in the current analysis in accordance with NZTA's Economic Evaluation Manual Vol 1&2 (EEM).
- For bus patronage benefit calculations, total passengers within the study area (on links) have been broken down into commuting and non-work travel purpose trips of passengers. This was based on the assumption that 90% of the passengers in the AM and PM peak are commuting (to/from work) and only 20% of the passengers are commuting in the Inter peak period. The commuting and non-work travel purpose trips of passengers have been further broken down into Standing and seated passengers. The reason for this level of disaggregation is the EEM recognises different travel time for seated and standing passengers in addition to the passenger trip purpose.

- The passenger volumes have been extracted from the WTSM plots for the Golden Mile project for the AM, IP and PM peak period. These volumes relate to 2 hourly volumes for different peak periods. Therefore the annualisation factors for the economic analysis assumes 1 AM peak period block (2 hours of AM Peak), 3 Inter peak blocks (6 hours of Inter Peak) and 1 PM peak period block (2 hours of PM Peak block).

8.4.6 Economic Assessment Summary

The BCR indicator is essentially a measure of dis-benefit to private motorists plus benefits of passenger transport journey time reduction. This means that even small travel time reductions can result in positive benefits. However the difference in travel time between the current situation and the four options is so small that it is difficult to show benefits given the amount of general traffic affected by the proposal. Over-reliance on transport economic efficiency is also questionable given that most passengers rate reliability ahead of travel time.

A summary of calculated BCR's for different route options is included in Table 17 below. Please note that the calculated BCR's excludes network wide transport disbenefits. However, a summary of percentage change in transportation costs/disbenefits is included in Table 18 below. Full details of the economic evaluation worksheets have been included in APPENDIX K.

Table 17 – Summary of BCR's for different route options– without network wide transport disbenefits

Route Option	Costs (PV)	Benefits (PV)	BCR
Option A	$716,877	$1,114,190	1.6
Option B	$8,864,638	$13,752,970	1.6
Option C	$6,840,638	$5,676,297	0.8
Option D	$8,726,649,	$19,765,236	2.3
Option Di	$8,683,348	$18,071,338	2.1

Table 18 – Summary of % change in Transport costs/Transport Disbenefits

Option	Transport Costs (TT, VOC & CO2 Costs) ($ in Millions) *	% Difference from Do Min
Do Min	$4,563	N/A
Option A	$4,602	+0.85%
Option B	$4,581	+0.39%
Option C	$4,589	+0.57%
Option D	$4,605	+0.92%
Option D (i)	$4,589	+0.57%

**Discounted costs over a 30 year analysis period.*

8.4.7 Sensitivity

A range of sensitivity tests were carried out on the calculated BCR's. The tests include increasing and decreasing the expected estimates or construction costs by +/- 25%, considering the impacts of elasticity demand (as described in section 8.4.4), doubling the value of passengers travel time, no allowance for reliability benefits and finally a tests on the sensitivity of not capping the reliability benefits to the bus travel time savings.

The results of these sensitivity tests are included in Table 19 below.

Table 19 – Summary of Sensitivity Tests

Sensitivity	Option A (1.6)	Option B (1.6)	Option C (0.8)	Option D (2.3)	Option Di (2.1)
Construction costs reduced by 25%	2.1	2.1	1.1	3.0	2.8
Construction costs increased by 25%	1.2	1.2	0.7	1.8	1.7
Elasticity of Demand: - 0.3 for Peak and -0.5 for Off peak	1.8	1.8	0.9	2.6	2.6
Double the value of time for Passengers	2.7	2.7	1.4	4.0	3.7

No allowance for Reliability Benefits	0.8	0.8	0.4	1.1	1.0
No capping of Reliability Benefits to calculated Bus travel time savings	19.0	3.4	3.4	4.0	3.9

The sensitivity tests indicate that the BCR's are predominantly sensitive to reliability benefits, construction costs, and value of time for passengers used in the economic analysis. It could be argued that the improvements to reliability are the core objective of PT projects and they should not be capped at a level which is no greater that the total travel time benefits (as suggested by the EEM). If this was the case and NZTA agreed to this approach, it would almost result in doubling of the BCR for each of the options.

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9 Evaluation Criteria

This chapter presents the intangible evaluation criteria that are used to compare the four route options (note for this evaluation, there is deemed to be no difference between options D and D (i)). The evaluation criteria have been selected with the aim of comparing the effects and impacts of each option. They are also designed to highlight the degree to which each option supports the strategic vision for Wellington City Centre and is able to achieve the design objectives presented in chapter 5.

The following sections describe each criterion and explain how the options will be assessed. The results of this evaluation are presented in section 10 below. The full results of the evaluation are presented in Appendix C - Appendix F.

9.1 Passenger Transport Performance

Assessing the transport economic efficiency of passenger transport improvements rarely finds a high benefit to cost ratio. Passenger transport schemes continue to be progressed because of the intangible (non-monetised) benefits that they are able to provide.

Most passenger transport-users rate service reliability and frequency ahead of travel times. Poor reliability and infrequent services are also factors most often cited by motorists as reasons for not shifting to use passenger transport services. Assessment of each route option's passenger transport performance will enable a comparison of attributes that are important to passengers and for the operation of an efficient service. The focus is on reliability and ability to accommodate increased operating frequencies.

Service reliability is affected by:

- passenger boarding / alighting – there will be no difference in the ticketing regime for each route option, the main factor that will distinguish between them is the ability to provide efficient management of bus stops both in terms of vehicles but also for pedestrians;
- variations in the volume of traffic on individual routes – available traffic models are unable to forecast variations in traffic volumes. Differences between routes within the city centre will also be negligible (i.e. variations tend to affect the whole of the CBD). The provision of bus only facilities and priority at intersections is a way of protecting service reliability. The best way to compare routes could therefore be to use the amount of bus priority as an indicator (e.g. length of priority lanes & number of intersections with priority);
- delays at intersections – routes that cross or turn into fewer high volume traffic flows are less susceptible to poor reliability. The number of such movements and the volumes crossed can therefore be used as an indicator.

The performance of the passenger transport network will also be affected by the available road space and other constraints that affect the movement of passenger transport vehicles. The following indicators will therefore be used as a measure of the physical ability of each route to perform as the primary passenger transport corridor:

- minimum turning radius on route;
- minimum and maximum lane widths used by passenger transport services; and
- The ability for route to be upgraded to BRT or light rail in future also needs to be considered. There is currently no commitment for either type of operation. There are various factors to be considered including the ability:
  (i) to relocate buried services;

  (ii) to introduce appropriate traffic management; and

  (iii) of future fleet to be able to manoeuvre along the route (i.e. though constrained turns).

Of these only (iii) would be a fatal flaw. The ability to address any constrained turns that would prevent the introduction of BRT or light rail will therefore be assessed when minimum turning radius for each route is identified.

The indicators described above will be used as the basis for a subjective assessment of the passenger transport performance of each option. Refer to Appendix C for the full evaluation of passenger transport results.

9.2 Bus Route Legibility / Accessibility

An important objective for this project was legibility and accessibility. The primary passenger transport route in the city must be easy for people to identify and should provide good access to employment, retail opportunities and to public facilities and spaces (e.g. town hall, library, civic square). Indicators for this criterion will therefore be:

- amount of retail floor area within easy reach of each passenger transport corridor;
- number of employment opportunities within easy reach the passenger transport corridor; and
- walking distance from nearest stop to the town hall, city library, and civic square

Figure 9.1 below, is a map showing estimated employment density prepared by WCC. Refer to Appendix D for the full bus route legibility and accessibility results of the evaluation.

9.3 Linking Public Spaces

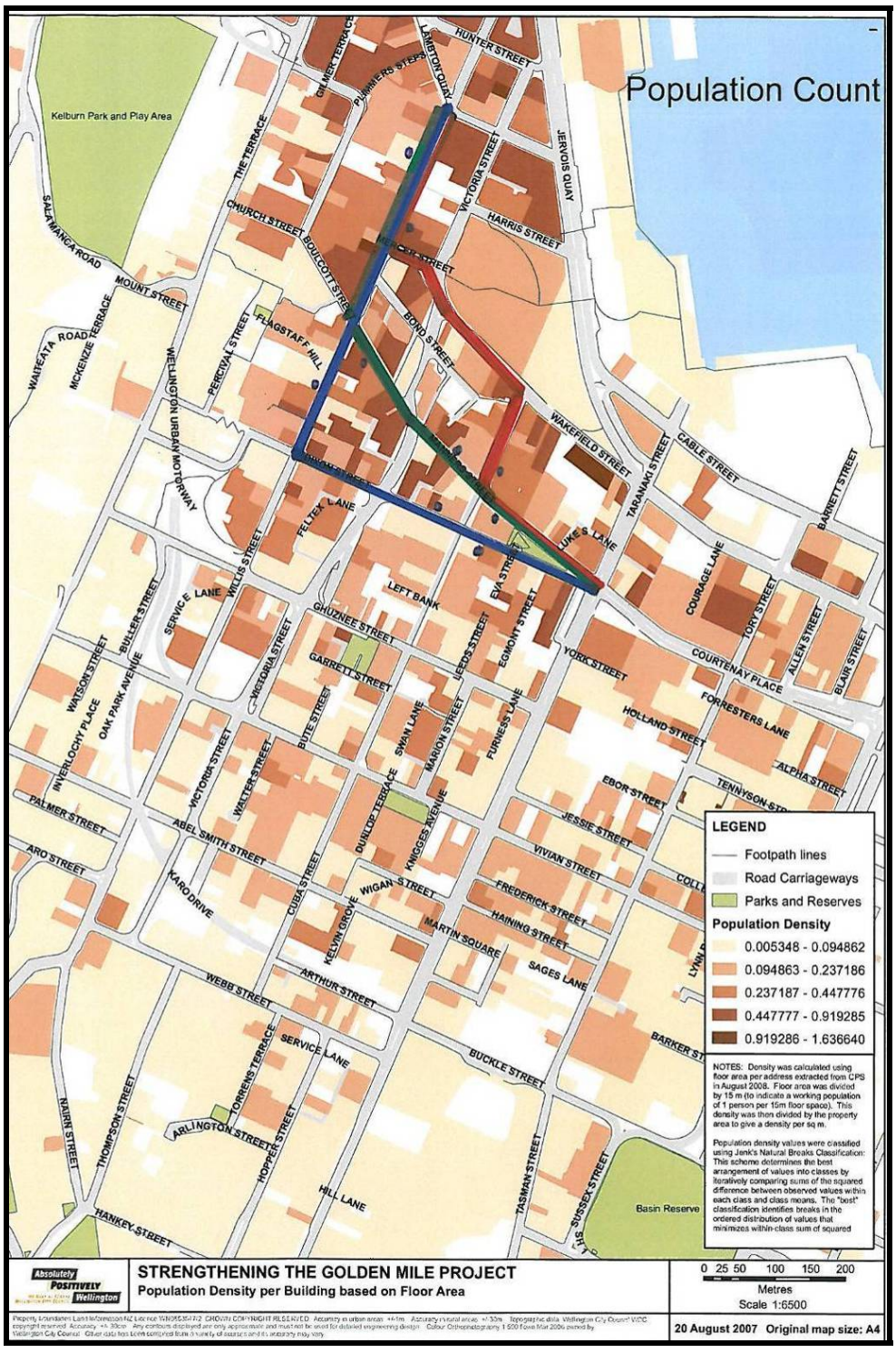
Previous studies have identified that Dixon Street currently acts as disconnect between upper and lower Cuba Mall. Changing the route for the primary passenger transport corridor will change where this disconnect occurs, how many instances of severance there are and how severe the effects. Changing the route could also open up opportunities for improving public spaces and connections between CBD activity areas.

Assessment of city centre connectivity will therefore be descriptive and focus on:

- the number, location (relative to activity areas) and severity of disconnect;
- the number, location and quality of opportunities for improving public spaces.

Figure 9.2 shows the pedestrian desire lines and illustrates the locations where connectivity / severance may be affected by each option. Refer to Appendix E for the full evaluation of public spaces results.

Figure 9.1 – Route Options Overlaid on WCC Plan[7] showing Employment Densities



[7] http://www.wellington.govt.nz/projects/new/goldenmile/pdfs/populationdensity.pdf

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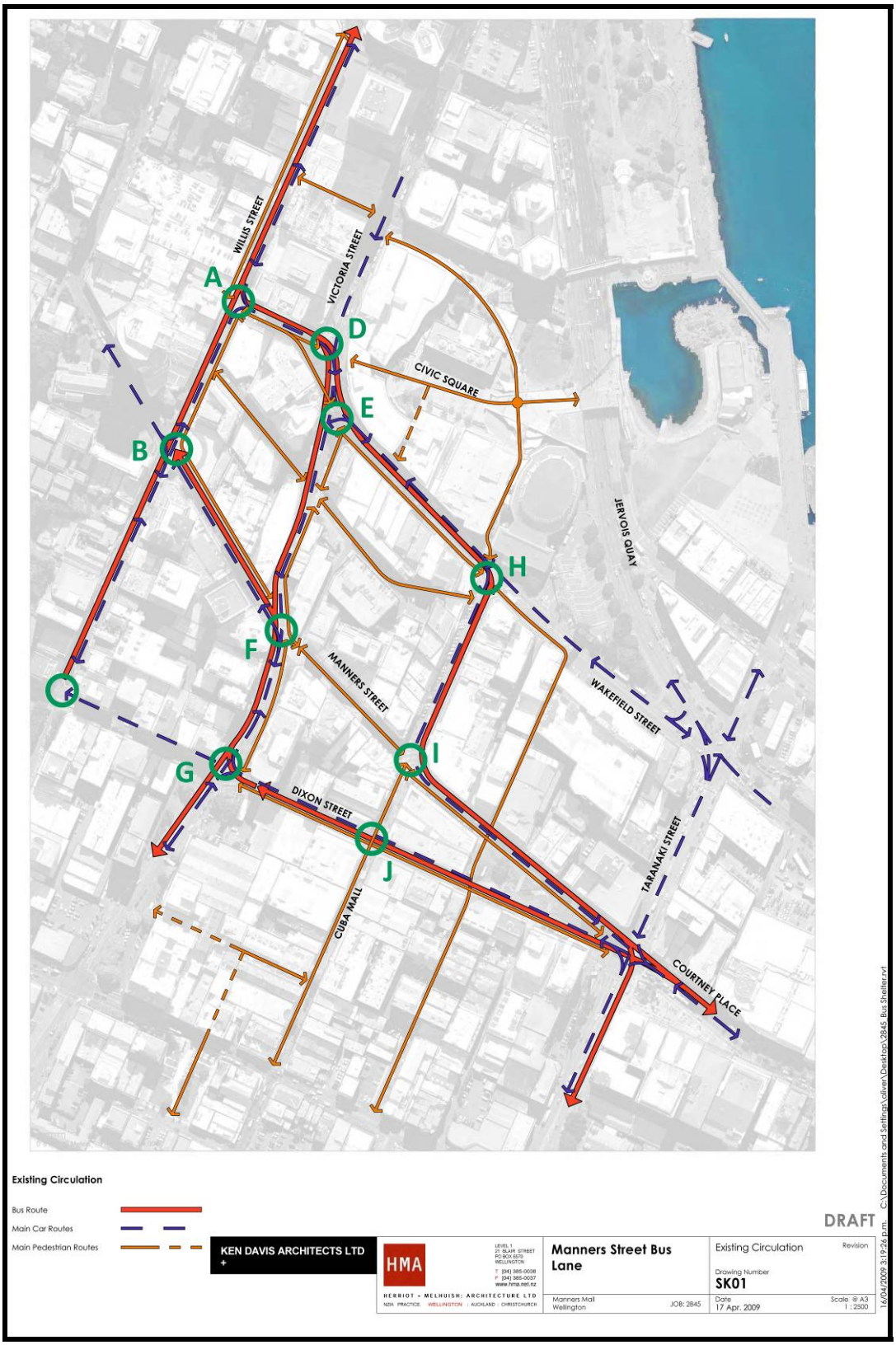
Figure 9.2 – Pedestrian Connectivity Assessment Diagram[8]



[8] Base drawing supplied by WCC and modified for the purposes of this assessment.

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9.4 Pedestrian Amenity

This assessment will aim to provide a comparison of the degree to which each option will impact upon the pedestrian realm. Pedestrian amenity will be affected by large increases or decreases in adjacent traffic flows that result from each option. In this assessment pedestrian amenity is considered to be negatively affected by large traffic flow increases and visa versa.

Figure 9.3 shows the locations (indicated by green dots) where forecast changes in traffic flows have been assessed. The locations were selected on the basis of the main pedestrian desire routes (shown using red arrows). Refer to Appendix F for the evaluation of pedestrian amenity results.

The degree to which amenity is affected will be also driven by the existing or future function of the street. Since pedestrian flows will increase on roads along which buses are routed, adjacent footway width will also be used as an indicator. This assessment will aim to determine the appropriateness of the existing footway widths along each route option.

The background review found that the existing passenger transport corridor and all the four options pass through two intersections[9] that were ranked as having the highest number of pedestrian injuries in the period 2003-2007. At a strategic level there is therefore unlikely to be any material differences between the options

[9] Taranaki / Manners Street and the Willis / Mercer Street intersections

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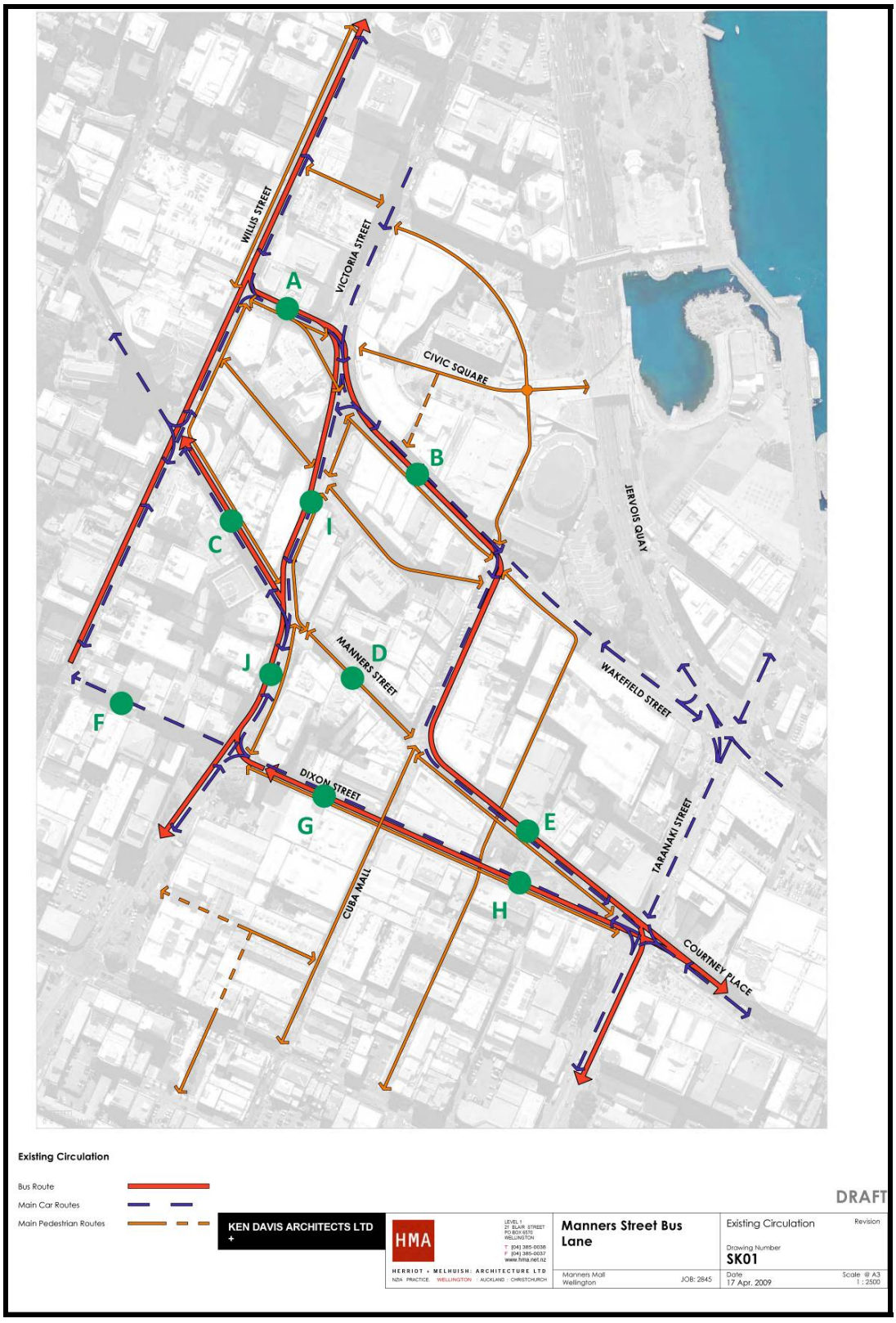
Figure 9.3 – Pedestrian Amenity Assessment[10]



[10] Base drawing supplied by WCC and modified for the purposes of this assessment.

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10 Evaluation Summary

This section summarises the results of the quantitative economic evaluation (refer section 8 above) and the intangible evaluation criteria (refer section 9 above) for each option.

10.1 Quantitative Economic Evaluation

Table 20 – Summary Bus Benefits and BCR's

Option	Bus Benefits	BCR
Option A	$1,114,190	1.6
Option B	$13,752,970	1.6
Option C	$5,676,297	0.8
Option D	$19,765,236	2.3
Option D (i)	$18,071,338	2.1

The summary of bus benefits highlights the benefits attributed to strategic improvement to the Golden Mile. The benefits associated with improvements to the modified status quo (option A) are high due to the low project cost. Although this option fails to address the strategic objectives of the project and the Ngauranga to Airport Strategy, it would provide some immediate benefits for bus operation and passengers. The Manners Mall Option D (or D(i)) offers the greatest bus benefits, with the Wakefield Street Option B being above 1 and still resulting is good bus benefits. The Dixon Street Option C provides some bus benefits, however these are outweighed by the costs.

Table 21 – Summary of % change in Transportation costs/Transport Disbenefits

Option	Transportation Costs (TT, VOC & CO2 Costs) ($ in Millions)	% Difference from Do Min
Do Min	$4,563	N/A
Option A	$4,602	+0.85%
Option B	$4,581	+0.39%
Option C	$4,589	+0.57%
Option D	$4,605	+0.92%
Option D (i)	$4,589	+0.57%

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The overall transport cost associated with general traffic is considered to be significant; however this has not been included in the calculation of the BCR, as per the previous assessment of benefits for the Wellington bus priority project. Options A and D offer similar levels of disbenefit to general traffic due to the banned right turn from Victoria Street and the diversionary effects on the network. Option B offers the least disbenefit to general traffic, closely followed by Option D(i) and then C.

The assessment of qualitative benefits of each of the options has been undertaken across a number of different criteria as discussed in Section 9 earlier. This assessment has been summarised using a subjective classification as listed below:

- Very Poor
- Poor
- Neutral / Little Change
- Good
- Very Good.

Sections 10.2 to 10.5 presents a summary of the headline issues for each criterion in relation to the options assessed. It is critical that these sections are read in conjunction with the full qualitative and quantitative assessments for each of the criteria contained in Appendices C-F and I-K. Although there may be little difference in the justification for each of the classifications for each criteria, the overall classification has been derived from a range of different subjective assessments.

It should also be noted that WCC have proposed to enhance the design of certain options, this has not been considered in full as part of this assessment (e.g. improved public space on lower Cuba Street). This is likely to result in an improved classification of certain options once the details have been determined.

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10.2 Option A – Modified Do Minimum Summary

Base Cost: $470,000	**BCR: 1.6**
Passenger Transport Performance Score	**Neutral / Little Change**
Justification: • Little or no improvement from existing situation • Turn at Wakefield / Lower Cuba Street would require significant upgrades to accommodate BRT or Light Rail.	
Bus Route Legibility / Accessibility Score	**Very Poor**
Justification: • Southbound direction does pass close to public amenities • Return routes use different roads resulting in poor legibility	
Linking Public Spaces	**Neutral / Little Change**
Justification: • No more than at present	
Pedestrian Amenity Score	**Neutral / Little Change**
Justification: • There is little difference between the traffic flows adjacent to pedestrian's desire lines, however the Manners Street / Victoria Street intersection would have enhanced pedestrian amenity.	

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10.3 Option B – Wakefield Street Summary

Base Cost: $5,312,000	**BCR: 1.6**
Passenger Transport Performance Score	**Good**
Justification: • Good footway widths for bus stops. But no opportunity for buses to pass one another without moving into opposing traffic lanes. • Good provision of bus priority on approaches to intersections. • Better directional balance of bus priority. • Northbound buses must cross over high traffic volumes at Wakefield Street (i.e. between Library and Council offices). • Turn at Wakefield/lower Cuba Street intersection would require significant upgrades to accommodate BRT or Light Rail.	
Bus Route Legibility / Accessibility Score	**Poor**
Justification: • Both directions are closer to public amenities such as the City Library, Civic Square and Council offices, but bus stops are not well located to service these trip origins / destinations • Bus routes are now further from both retail and high density employment areas near the Manners / Boulcott / Willis Street intersection	
Linking Public Spaces	**Poor**
Justification: • Crossing Victoria Street close to the library will be harder as pedestrians will need to cross two traffic lanes with increased flows and a contra-flow bus lane • Increased traffic flows and introduction of contra-flow bus lanes will make crossing Lower Cuba Street and Manners Street more difficult for pedestrians • Currently at peak times a wall of buses on Lower Cuba Street makes it harder to pedestrians to cross the road – this option does nothing to ease this problem.	
Pedestrian Amenity Score	**Good**
Justification: • Traffic flows are forecast to decrease along many of the pedestrian desire lines assessed.	

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10.4 Option C – Dixon Street Summary

Base Cost: $4,287,000	**BCR: 0.8**
Passenger Transport Performance Score	**Poor**
Justification: • Narrow footway widths at some bus stops and no opportunity for bus passing. • Unbalanced provision of bus priority (i.e. very little provision for Northbound buses). • Relatively high volumes of conflicting traffic movement. • Minimum turning radius at Dixon/Willis Street is small and will not allow smooth movement for buses and would prevent future provision of BRT or Light Rail.	
Bus Route Legibility / Accessibility Score	**Very Poor**
Justification: • Both directions pass around the fringe of high density employment areas • Not easy to provide bus stops for both directions on Willis Street south of Mercer Street	
Linking Public Spaces	**Very Poor**
Justification: • Crossing intersections along the Victoria Street corridor will become more difficult because flows on Wakefield Street, Manners Street and Dixon Street increase • There is little change in the volumes that must be crossed along the Cuba Street corridor • The option results in several locations where traffic flow becomes two-way (highlighted yellow) making it harder for pedestrians to cross • This option does not present any major opportunities for providing additional quality public space	
Pedestrian Amenity Score	**Poor**
Justification: • Traffic flows are forecast to increase along many of pedestrian desire lines assessed • Only at Mercer Street are significant reductions forecast	

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10.5 Option D and D(i) – Manners Mall Summary

Base Cost (D & Di): $5,411,000 & $5,378,000	**BCR: 2.3 & 2.1**
Passenger Transport Performance Score	**Very Good**
Justification: • Adequate footway width at bus stops but no opportunity for buses to pass one another without moving into opposing traffic lanes. • Excellent provision of bus priority on approaches to all signalised intersections. • Good balance of provision for North and Southbound buses. • Lower Cuba Street and Mercer Street add to conflicting traffic volumes – opportunity to reduce volumes.	
Bus Route Legibility / Accessibility Score	**Good**
Justification: • Buses to operate in both directions and improve legibility for passengers and the public. • Both directions are equidistant from public amenities (City Library, Civic Square and Council offices) and Cuba Street retail area	
Linking Public Spaces	**Very Good**
Justification: • There is an overall decrease in the traffic flows pedestrian are required to cross at the locations assessed. • The location of new bus stops on Manners Mall could result in buses blocking back thereby presenting a barrier for pedestrian wishing to cross the road (as is currently experienced on Manners Street) • Buses are no longer required to pass along Mercer Street and traffic volumes are much reduced. This presents an opportunity to reduce the number of traffic lanes and widen the footway • Dixon Street continues to operate as one-way but with lower traffic flows – this presents an opportunity to reduce the number of traffic lanes and to widen the footway between Taranaki Street and Victoria Street. • De-powering Lower Cuba Street provides opportunities to make the street more people friendly and to provide more public spaces	
Pedestrian Amenity Score	**Good**
Justification: • There is a decrease in traffic flows forecast along many of the pedestrian desire lines	

assessed. Only on Manners Street (parts of which are currently pedestrianised) are flows forecast to increase. These increases are associated with additional bus movements

- There is a risk that queuing buses in Manners Mall may negatively affect the amenity of the route for pedestrians. This would need to be managed and mitigated.

APPENDIX 4

10.6 Evaluation Summary Table

To summarise the evaluations undertaken in above in section 10.1 to 10.5 the results have been displayed in Table 23 below. This summary highlights that the quantitative benefits for Option D are the greatest due to high bus benefits and most direct routing for PT users, while the qualitative benefits for Option D are also considered to be the highest. It should be noted that each of the options except for C provide benefits greater than 1 which is considered to good for a PT project. ,.

Table 22 – Overall Option Evaluation Summary Table

	Option A – Modified Status Quo	Option B – Wakefield Street	Option C – Dixon Street	Option D [D(i)]– Manners Mall
Benefit to Cost Ratio	1.6	1.6	0.8	2.3 [2.1]
Base Capital Cost	$470,000	$5,312,000	$4,287,000	$5,411,000 [$5,378,000]
% Contingency	59%	73%	66%	68% [68%]
Transportation costs (TT, VOC and C02)	$4,619	$4,599	$4,611	$4,620 [4,600]
Passenger Transport Performance	Neutral / Little Change	Good	Poor	Very Good
Bus Route Legibility / Accessibility	Very Poor	Poor	Very Poor	Good
Linking Public Spaces	Neutral / Little Change	Poor	Very Poor	Very Good
Pedestrian Amenity	Neutral / Little Change	Good	Poor	Good

APPENDIX 4

11 Conclusion

This report has highlighted the strategic importance and wider context in which the provision of a high quality PT corridor is essential to the transport network for the Wellington CBD. The provision of such a PT corridor is consistent with the recently adopted Ngauranga to Airport Plan and integrated WCC growth spine approach. The provision of PT is only part of a package of measures that are planned to prioritise routes for general traffic and provide increased opportunity to implement high quality PT, walking, cycling and public space provision. Ultimately this will lead to a reduction in general vehicles in the CBD and greater priority for more sustainable transport modes.

The section of the "Golden Mile" between Taranaki Street and Willis Street currently suffers from poor journey time reliability for buses, indirect routings and poor legibility for passengers. This is largely due to bus routes utilising streets which have been designed to improve general traffic capacity through the use of one way roads and signalised intersections with large numbers of competing demands (not just traffic, but also pedestrians).

This assessment has concluded that in order to fulfil this objective to create a high quality PT corridor and safeguard for PT provision in the future, either the Manners Street of Wakefield Street options provided the best solution.

The Manners Street option (D or D(i)) is the most direct and legible route, with the highest benefits to bus users, resulting in a reduction in journey times in the 2006 base year ranging from 35-162 seconds northbound in the PM peak for D and 32-152 seconds for D(i). Greatest benefits would be achieved during the PM peak; however significant benefits are also achieved during the AM and interpeak periods. This option also offers the highest level of qualitative benefits, with a range of other benefits relating to the enhancement of public space and personal security. Option D does however have the greatest impact on vehicle traffic, however the variation of D(i) has a lesser impact on general traffic. It is expected that a combination of elements from option D and D(i) could be incorporated into the next phase of the project to achieve the optimum solution for PT, public space and general traffic. This option has the highest BCR of 2.3 which is considered good for a PT project.

The Wakefield Street option (B) offers slightly less bus benefits, with a reduction in journey times ranging from 17-167 seconds in the PM peak northbound in 2006. This option has slightly less qualitative benefits and could be considered to offer little to enhance the Manners Mall environment and the need for upgrades to this area. This option has less impact on general traffic and a relatively low cost due to the existing southbound route already operating on this corridor. This option has a BCR of 1.6 which is also considered good for a PT project.

The Dixon Street option (C) provides very little benefits to bus operation, being longer than the existing route and relocate buses away from the core area of pedestrian, retail and business activity. The option provides a reduction in journey times ranging from -17-140 seconds in the PM peak northbound in 2006. This option has very few qualitative benefits and would require significant investment in order to safeguard for a high quality form of PT

in the future. The BCR for this option is below 1 and sits at approximately 0.8 which is clearly lower than each of the other options considered.

The modified do minimum (option A) is relatively simple to implement and results in benefits for northbound buses using the existing route. This option has a large impact on general traffic associated with this diversion. Although the reduction in traffic in Manners Street and improvements to the Victoria Street intersection will result in small benefits to pedestrians and the environmental conditions in this area, the option will do little for bus legibility, reliability and bus operation. Despite this, the option having a good BCR of 1.6 due to the low cost associated with the project, it fails to address the core objectives of the project and should only be considered as the first phase of the Manners Mall option following agreement to proceed.

Each of the options will facilitate the capacity needed for increase bus patronage in the future, however this will be dependent upon the introduction of enhanced signal pre-emption and bus priority measures over the entire section of the study area.

It is recommended that WCC and other key stakeholders should seek funding to proceed with a scheme assessment and associated economic evaluation for the Manners Mall option (D or D(i)) given that it provides the most opportunity for bus operation and the enhancement of the strategic Golden Mile corridor. As a short term measure, the right turn from Victoria Street to Manners Street should be banned as this will offer immediate benefits to buses and will complement the Manners Mall project.

The scheme assessment will need to undertake further consultation with businesses and the community, while also undertaking further assessment into the type of mitigation measures that will be needed and refinement of the design to enhance the benefits to bus operation and minimise the impact on general traffic and other road users.