APPENDIX E

Assessment of Transportation Matters, Carriageway Consulting

Otago Regional Council

Central Dunedin Bus Hub
Notice of Requirement

Assessment of Transportation Matters

CARRIAGEWAY CONSULTING

traffic engineering | transport planning

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1. Introduction

1.1. Otago Regional Council ("*the Council*") is reorganising its bus routes as they pass through the centre of Dunedin, such that they all travel through a central city bus hub (interchange). The location for this hub is Great King Street between Moray Place and St Andrew Street. The on-street hub will also provide facilities for waiting passengers on both sides of the road, and will remain open for use by all vehicle types.

1.2. The Council engaged Carriageway Consulting Limited to carry out a series of assessments relating to the bus hub. Based upon this work, Carriageway Consulting recommended that the Hub can operate safely and efficiently, and the Council then commenced a process of designating Great King Street ("*the proposed site*") for use as a bus hub.

1.3. Carriageway Consulting produced a Transportation Assessment (dated 15 October 2015) that set out a detailed analysis of the transportation issues associated with the proposed designation including changes in travel patterns that were likely to arise. Where potential adverse effects were identified, ways in which these can be addressed were set out. This report supported the proposed designation from a traffic and transportation perspective and concluded that there were no traffic and transportation reasons why it could not be approved.

1.4. This report builds on the earlier Transportation Assessment and includes further details on the proposed indicative scheme, which results in changes to on-street parking, to accesses onto Great King Street, and pedestrian provision.

2. Site Overview

2.1. Location

2.1.1. The proposed site lies 150m to the northeast of the Octagon. It is bounded by Moray Place to the south, and St Andrew St to the north. The location of the site in the context of the local area is shown in Figure 1 and in more detail in Figure 2.

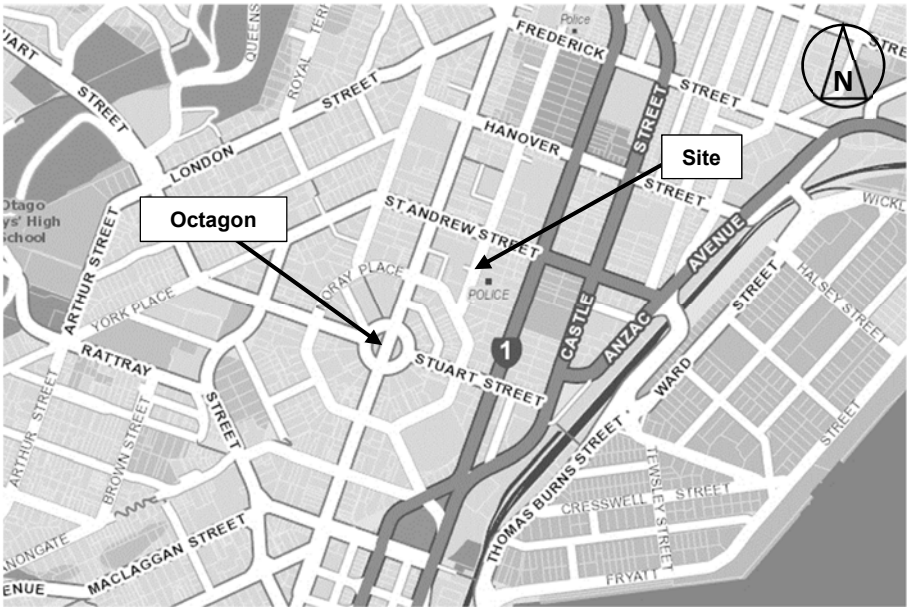


Figure 1: General Location of Proposed Site

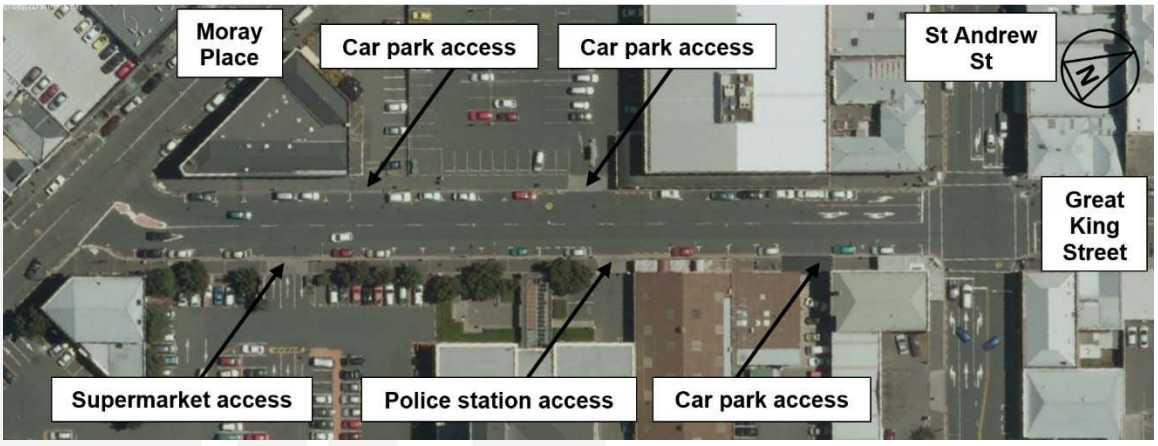


Figure 2: Aerial Photograph of Proposed Site and Environs

2.2. Road Hierarchy

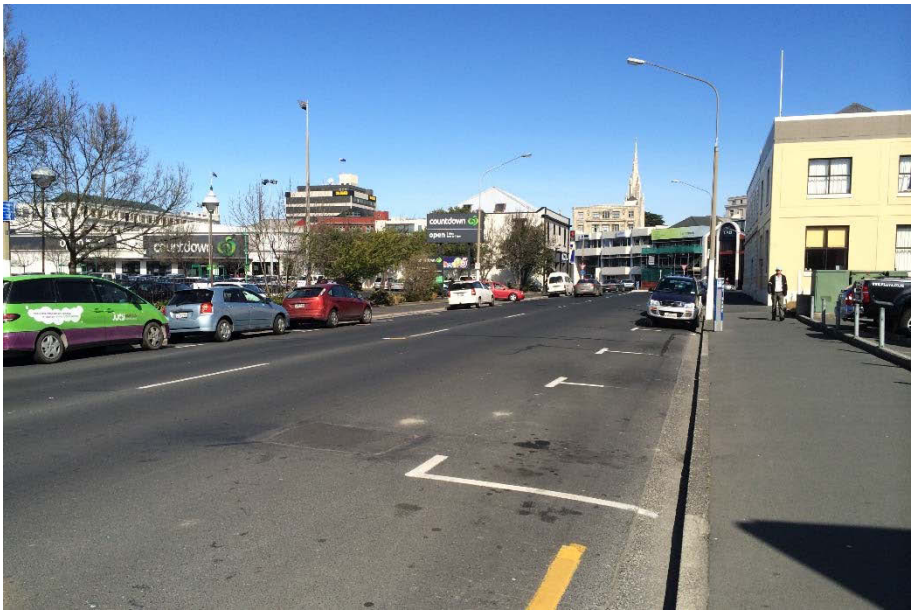
2.2.1. The Dunedin City District Plan classifies this section of Great King Street as a Local Road, meaning that its primary purpose is to provide access to properties, rather than to act as a through route.

2.2.2. Moray Place to the south is a Collector Road, indicating a role in both traffic movement and property access, and distributing traffic within and between neighbourhoods. St Andrew Street to the north is a Regional Road, which is expected to provide for the greatest level of movement with a minimum access function.

3. Current Transportation Networks

3.1. Great King Street

3.1.1. The section of Great King Street subject to the proposed designation has a flat and straight alignment, running in a north-south direction. The carriageway is 13.6m wide, comprising a 2.0m parking lane plus 4.8m traffic lanes on either side. There are several accesses to adjacent properties on both sides of the road, including two off-street car parks on the western side, and public accesses for a discount retail outlet, the police station and a supermarket on the eastern side. There are 3m wide footpaths on both sides of the road.

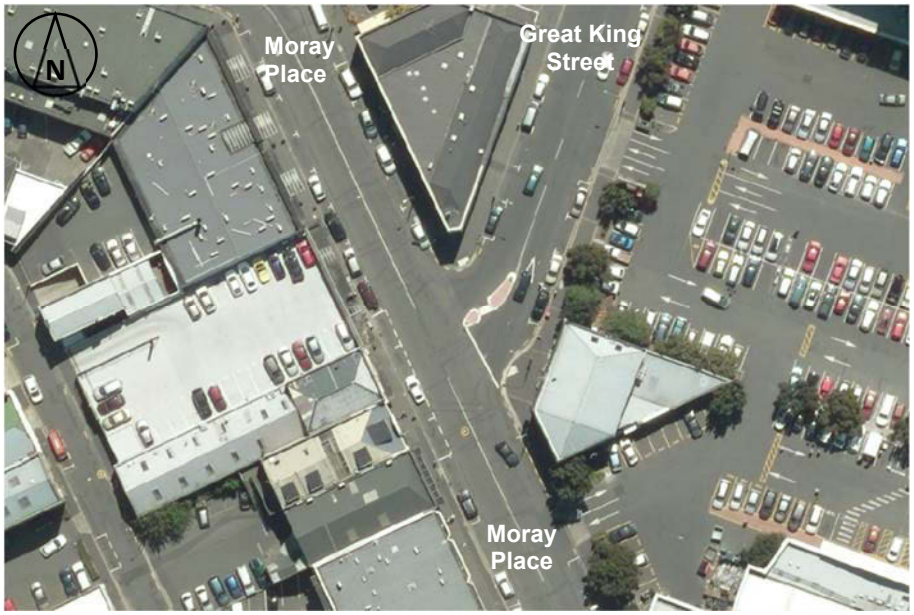


Photograph 1: Typical Cross-Section of Great King Street

3.1.2. In total there are 16 P60 parking spaces on the western side of the road plus 2 P5 spaces, and 18 P60 parking spaces plus 2 P5 spaces on the eastern side of the road.

3.2. To the South

3.2.1. To the south, Great King Street meets Moray Place at a priority intersection where traffic on the former must yield the right of way. Moray Place has a northwest-southeast alignment, and thus on its immediate approach to the intersection, the alignment of Great King Street deviates towards the west.



Photograph 2: Aerial Photograph of Moray Place / Great King Street Intersection

3.2.2. The intersection does not have auxiliary turning lanes although the width of the Great King Street approach is such that two vehicles can queue side by side. There is a raised island at the throat of the intersection, which has a 'cut-through' to assist pedestrians crossing the road. Sight distances for vehicles emerging from Great King Street are 75m towards the south and 90m towards the north, and in both cases were affected by the presence of buildings.

Photograph 3: Moray Place / Great King Street Intersection, Looking South from Great King Street

3.2.3. Moray Place has a carriageway width of 13m, with 4.5m wide traffic lanes and 2.0m wide parking lanes on each side. There are footpaths on either side, but no formal infrastructure for cyclists. There is a slight gradient and the road rises from south to north.

Photograph 4: Typical Cross-Section of Moray Place (Looking North)

3.3. To the North

3.3.1. To the north, St Andrew Street and Moray Place meet at a signalised intersection.

Photograph 5: Aerial Photograph of St Andrew Street / Great King Street Intersection

3.3.2. Two turning lanes are provided on both of the Great King Street approaches, and this is achieved through restricting on-street parking over a short length of road. There are three approach lanes provided on St Andrew Street, achieved through restricting on-street parking and also narrowing the exit lanes from the intersection.

Photograph 6: St Andrew Street / Great King Street Intersection, Looking Northeast from Great King Street

3.4. Future Changes to Land Use and Infrastructure

3.4.1. Under the Dunedin City Integrated Transport Strategy, Great King Street, Moray Place and the western part of St Andrew Street are all noted as being "*inner city priority and secondary routes*" for walking (Figure 19, Integrated Transport Strategy). As such, these are roads where the Council will "*prioritise wider footpaths and better facilities to enhance the pedestrian experience. This may include safety improvements, enhanced crossing points, pedestrian refuges, seating, lighting, greater pedestrian priority at intersections and signals, and general amenity improvements such as paving and planting*."

3.4.2. None of the roads are part of the strategic cycle network.

4. Current Transportation Patterns

4.1. Traffic Flows

4.1.1. Traffic volumes on the roading network have been obtained from a number of sources. The NZTA Crash Analysis System contains details of traffic flows that are sourced from Councils' RAMM databases and the available data for the roads in the vicinity of the site are summarised below.

Location	Average Daily Traffic (Two-way)
Great King Street (site)	5,700
Great King Street (north of site)	6,150
Moray Place (northwest of Great King Street)	3,450
Moray Place (southeast of Great King Street)	6,100
St Andrew Street (east of Great King Street)	7,850
St Andrew Street (west of Great King Street)	5,350

Table 1: Daily Traffic Volumes

4.1.2. To supplement these, a traffic survey was carried out at this intersection during September 2014, and the results are set out below.

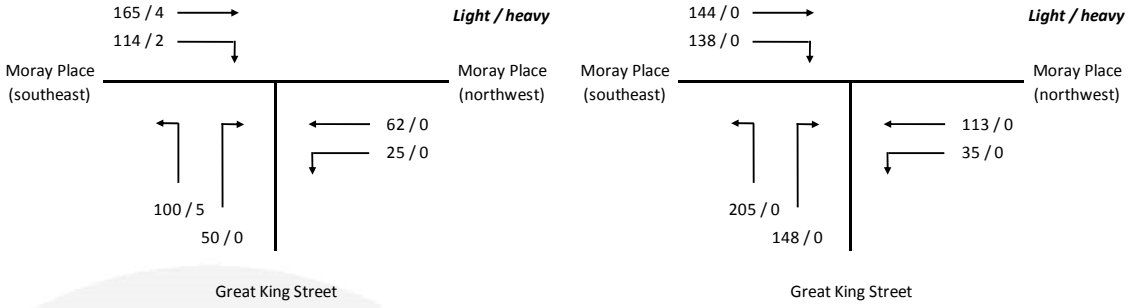


Figure 3: Existing Morning and Evening Peak Hour Traffic Flows at the Moray Place / Great King Street Intersection

4.1.3. Traffic volumes at the St Andrew Street / Great King Street intersection have been extracted from the Dunedin TRACKS transportation model and are set out below.

Figure 4: Existing Morning and Evening Peak Hour Traffic Flows at the St Andrew Street / Great King Street Intersection

4.1.4. It is understood that additional traffic surveys were carried out in 2016 to inform detailed intersection modelling.

4.2. Non-Car Modes of Travel

4.2.1. Also in September 2014, a survey was carried out of pedestrian movements across the roads in the vicinity of the Moray Place / Great King Street intersection, and the results are set out below.

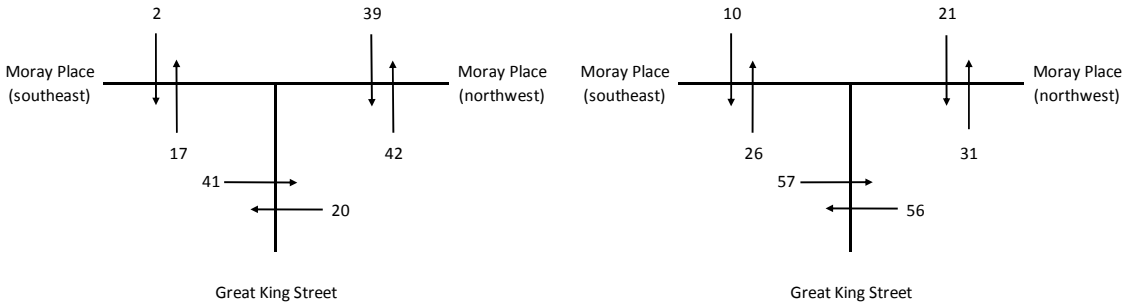


Figure 5: Existing Morning and Evening Peak Hour Pedestrian Flows at the Moray Place / Great King Street Intersection

4.2.2. It is of note that more than 110 people were observed to cross the southern end of Great King Street in the evening peak hour, representing a rate of almost two pedestrians every minute.

4.2.3. As the Moray Place / Great King Street intersection is not currently signalised, the equations of the NZTA Pedestrian Planning and Design Guide have been used to evaluate the level of service provided for crossing pedestrians. This shows that both Moray Place and Great King Street currently provide Level of Service B (noted in the guide as being 'very good')

4.2.4. No data has been collected regarding cycling movements. However from observations the number of movements is relatively small.

4.3. Road Safety

4.3.1. The NZTA Crash Analysis System has been used to identify the location and nature of the recorded traffic accidents in the vicinity of the potential site. All reported accidents between 2012 and 2017 have been identified at the proposed site itself, plus the intersections with St Andrew Street and Moray Place.

4.3.2. At the proposed site itself, three accidents have been recorded, two of which occurred close to the entrance to the Wilsons Parking car park.

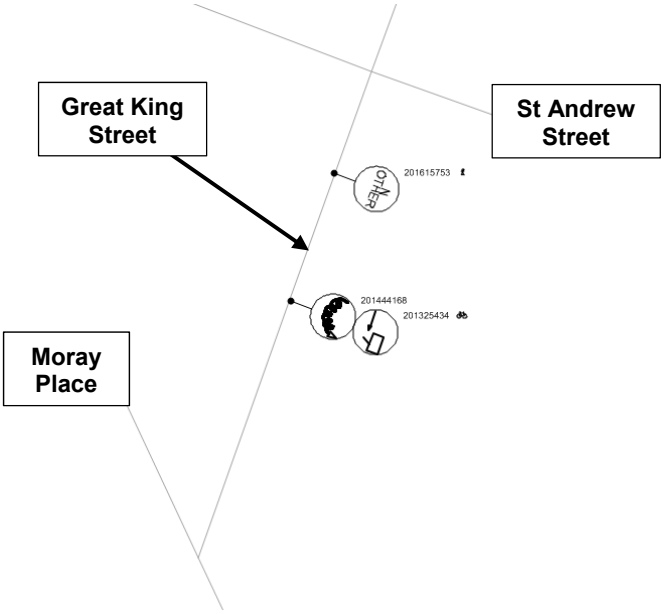


Figure 6: Location and Type of Reported Accidents on Great King Street

4.3.3. One accident at the car park entrance occurred when a driver parked on the eastern side of the road opened their car door directly in front of a southbound cyclist. The second accident occurred when a vehicle had been waiting for some considerable time to turn right into the access to the Wilson Parking car park while another vehicle was waiting to turn left out of the police station access, but was partially blocked by the first vehicle. The driver of the second vehicle became frustrated and attempted to exit the access, but in so doing struck a vehicle that was parked on Great King Street. The accident did not result in any injuries.

4.3.4. One accident occurred to the north of the car park access when a driver was reversing into a parking space on the eastern side of Great King Street, and struck an elderly pedestrian who was crossing the road behind the vehicle. It resulted in minor injuries to the pedestrian.

4.3.5. A total of nine accidents have been recorded at the St Andrew Street / Moray Place intersection.

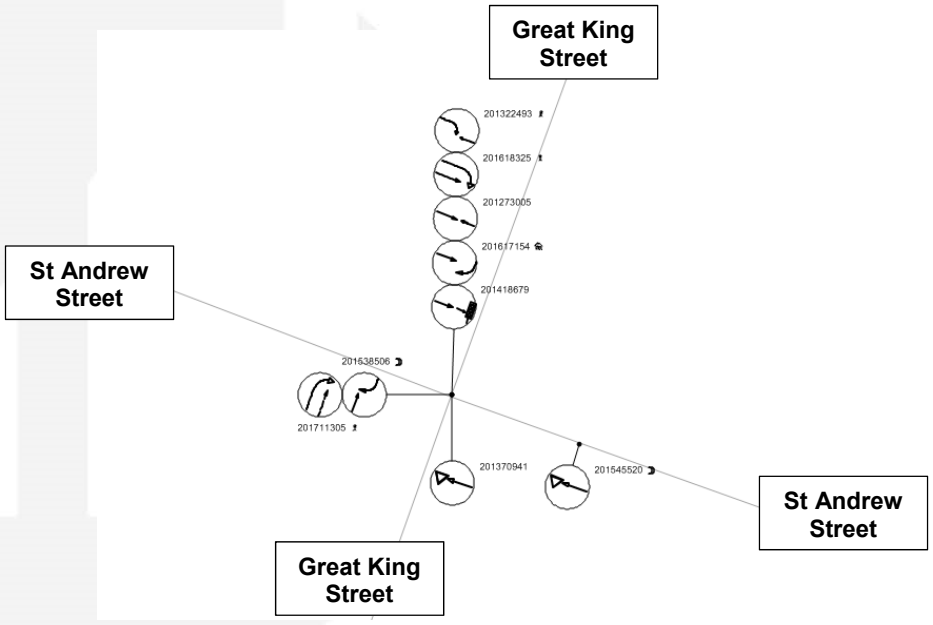


Figure 7: Location and Type of Reported Accidents at the St Andrew Street / Great King Street Intersection

4.3.6. Four accidents involved pedestrians. Two took place when drivers travelling from south to east struck pedestrians crossing St Andrew Street (East), and a similar accident occurred with a driver turning from west to south who struck pedestrians crossing on Great King Street (South). One accident involved a driver turning from west to north, who had stopped to let pedestrians cross Great King Street (North) and was hit from behind by another vehicle.

4.3.7. One accident involved a heavy vehicle that turned from east to south and struck the veranda of the retail unit on the southeast corner of the intersection.

4.3.8. Two accidents occurred as a result of conflicting turning movements. One involved a driver turning from Great King Street (South) to St Andrew Street (East) who was struck by a car travelling from St Andrew Street (West) to St Andrew Street (East). The other involved a northbound driver who was hit by a car turning from Great King Street (North) to St Andrew Street (West).

4.3.9. On accident involved a truck reversing into an access towards the immediate east of the intersection, that struck a lamp-post.

4.3.10. One accident involved a driver who was showing off, and who lost control and hit another vehicle.

4.3.11. Nine accidents have been recorded at the Moray Place / Great King Street intersection.

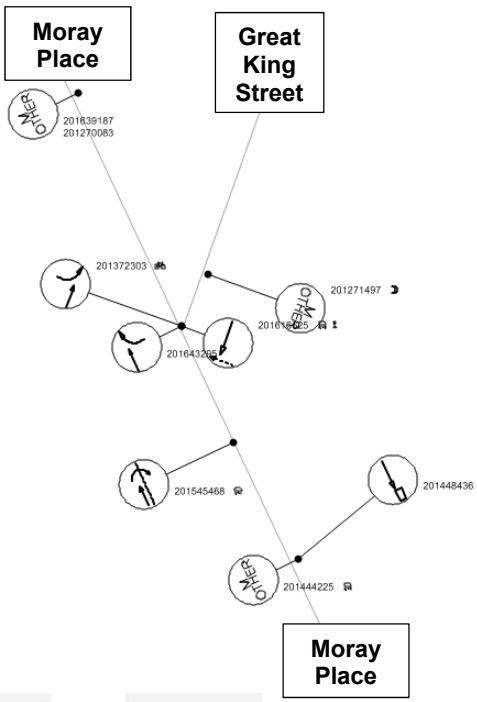


Figure 8: Location and Type of Reported Accidents at the Moray Place / Great King Street Intersection

4.3.12. Two accidents occurred on Moray Place to the north of the intersection, three occurred on Moray Place to the south of the intersection, and one occurred on Great King Street, when parked vehicles were struck by others that were either passing or attempting to park. The accident on Great King Street involved an intoxicated driver.

4.3.13. At the intersection itself, one accident occurred when a driver emerged from Great King Street but failed to see a southbound cyclist on Moray Place and collided with them. Another accident

occurred when a pedestrian crossed Great King Street from south to north heedless of the traffic, and was struck by a vehicle approaching from the east.

4.3.14. Also at the intersection, a northbound vehicle on Moray Place was struck by a vehicle that had emerged from Great King Street to turn northwards, but the driver had failed to give way.

4.3.15. The patterns of accidents at each location are typical for an urban area, and do not indicate any inherent deficiencies in the roading geometry,

5. Proposal

5.1. The proposal is to designate Great King Street for use as a bus hub. This will involve the removal of kerbside parking and the re-marking of the road with parking restrictions and markings for the bus stops. Infrastructure for waiting passengers will also be provided.

5.2. The designation plans are set out below.

Figure 9: Proposed Designation Plan 1 of 2 (Extract from Beca Drawing 'Proposed Designation Plan Sheet 1 of 2', number 3810322-CE-K010, Revision C)

Figure 10: Proposed Designation Plan 2 of 2 (Extract from Beca Drawing 'Proposed Designation Plan Sheet 2 of 2', number 3810322-CE-K011, Revision B)

5.3. It can be seen that this layout provides 11 bays - five on each side of Great King Street plus one on Moray Place. Several accesses which serve existing developments and/or car parking areas on Great King Street will also be revised, and this is discussed subsequently.

6. Traffic Generation and Distribution

6.1. Traffic and Pedestrian Generation

6.1.1. The proposal does not involve a particular land use, but will nevertheless result in an increased number of movements on Great King Street due to bus services. Otago Regional Council has provided details regarding the routes that are proposed to serve the bus hub, and this shows that there will be 33 buses that travel north on Great King Street in the weekday peak hour, plus 38 buses that travel south.

6.1.2. For the purposes of calculating the possible pedestrian volumes crossing Moray Place, an allowance has been made for each bus to carry 20-30 people in the peak hours[1]. This suggests that at the busiest times, there could be a total of well over 1,000 pedestrian movements on Great King Street.

6.2. Traffic and Pedestrian Distribution

6.2.1. The distribution of bus movements has also been provided by Otago Regional Council, as set out below.

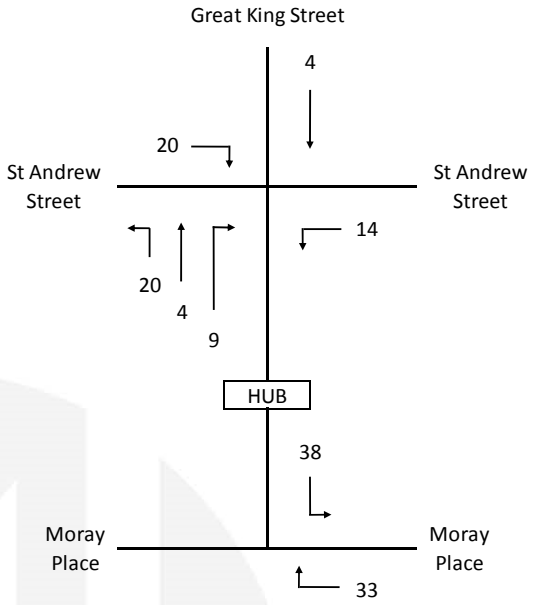


Figure 11: Number and Distribution of Bus Services

6.2.2. Pedestrians walking to and from the bus hub are able to exit towards the north via St Andrew Street or to the south by Moray Place. Taking account of the locations of employment and retail opportunities it is considered likely that there will be a 50-50 split between the two route options.

[1] This should not be assumed to represent formal patronage forecasts, but rather it is solely a mechanism whereby estimates of pedestrian numbers can be found.

7. Effects on the Transportation Networks

7.1. Intersection Capacities and Safety

7.1.1. It is understood that all matters relating to the effects on intersection capacities and safety arising from the proposed hub are addressed in separate reports. No comment has therefore been made on these matters within this report.

7.2. On-Street Parking Provision

7.2.1. As set out previously, in total there are 16 P60 parking spaces on the western side of Great King Street plus 2 P5 spaces, and 18 P60 parking spaces plus 2 P5 spaces on the eastern side of the road. Figure 9 above shows that all parking spaces will be removed, but that provision will be made for a 6m loading bay on each side of the road (approximately 25m south of St Andrew Street). Overall then, 38 public parking spaces will be removed by the proposal, which are provided over a total distance of 210m.

7.2.2. However one outcome of the revisions to the bus services and development of the bus hub is that a number of stops in other locations will be rationalised, either through being shortened or removed completely:

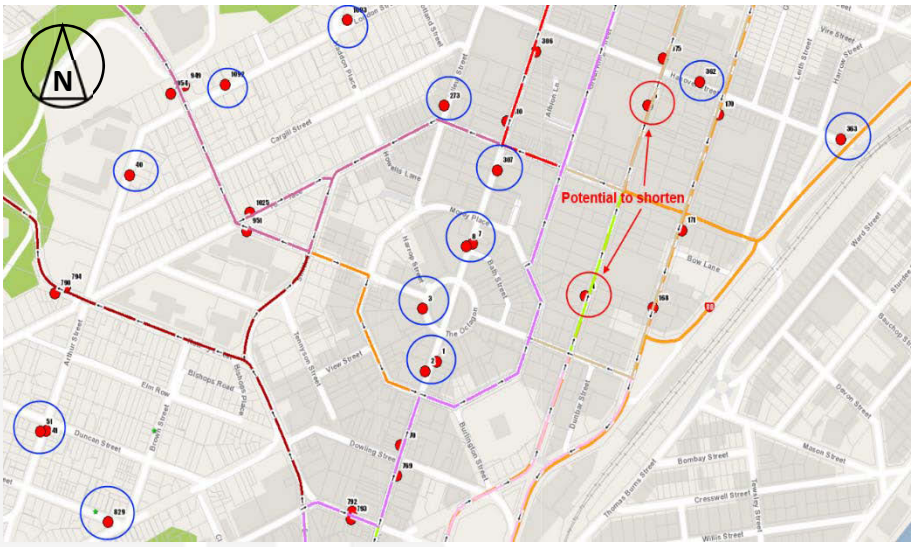


Figure 12: Locations where Bus Stops may be Removed or Shortened

7.2.3. Within 350m of the proposed hub (that is, within a five-minute walking time), the stops that are to be removed are numbered 1, 2, 3, 7, 8, 273, 307 and 362. Two stops, 4 and 5, are to be shortened by a total of 45m. In total, this will yield a total of 309m of kerbspace that could be used for parking[2].

7.2.4. By way of comparison, some 210m of kerbside parking would be removed from Great King Street. Overall then, there is a net gain of 99m in the amount of kerbspace which could be used for car parking. Applying a simple pro-rata calculation shows that this could lead to a net

[2] The provision and control of kerbside parking is a matter for Dunedin City Council rather than the regional council, and so within the context of the proposed designation, no further comment can be made about potential changes to the road layout once the bus stops are removed.

increase of 17 parking spaces, if all of the freed kerbspace was to be made available for parking.

7.2.5. Further from Great King Street, stops 40, 51, 363, 829, 1076, 1092 and 1093 are also to be removed. These will free a further 82m of kerbspace, which if converted to parking could provide an additional 14 spaces.

7.2.6. It is expected that one outcome of the bus hub and associated changes in service routes and frequencies will be to make public transport more attractive to a greater number of passengers, and accordingly the Council anticipates that over the next ten years there will be a 44% increase in patronage. This means that the use of private cars to travel to the city centre will be diminished, and accordingly, it will lower the demand for parking. This will provide further benefits to the management of the on-street parking spaces through relieving pressure on the parking stock over a wider area.

7.3. Pedestrian Movements

7.3.1. One outcome of the bus hub will be the movement of passengers to and from services, and as noted above, there may be well over 1,000 such walking movements in the peak hours. The St Andrew Street / Great King Street intersection already has pedestrian crossing phases, but the indicative scheme shows that the Moray Place / Great King Street intersection is to be signalised and will also have pedestrian crossing phases. Both of these intersections will have associated kerb build-outs to reduce the width of carriageway that pedestrians are required to cross.

7.3.2. In addition, a formal mid-block pedestrian crossing will be provided, just south of the access to the police station and the Wilson Parking car park on the southern side of Farmers department store. This will also have kerb build-outs.

7.3.3. Finally, the configuration of the footpaths on Great King Street are shown as being changed on the indicative layout, in order to facilitate infrastructure for waiting passengers. One outcome of this however is that additional width will be provided to pedestrian movements.

7.4. Potential Effects on Existing Vehicle Crossings

7.4.1. As noted previously, there are several accesses onto Great King Street, and the indicative layout for the bus hub shows that these will be rationalised.

7.4.2. The access to Countdown serves a car park with approximately 220 parking spaces, and carries an estimated peak hour volume of 120-150 vehicle movements (two-way). The access onto Moray Place will continue to have unrestricted turning movements, but the access on Great King Street will be converted to left-in/left-out operation only.

7.4.3. The access to the Community House is presently lightly trafficked with an estimated peak hour flow of 20-25 vehicle movements (two-way). The car park has an existing (but presently closed) access at its western end onto Moray Place, and this is to be reopened with the current access onto Great King Street being closed. This may result in minor changes to the on-street parking arrangements in the vicinity of the reopened access.

7.4.4. The access to the Wilson Parking car park on the southern side of Farmers department store will be changed to allow for vehicles to enter from both the north and the south, but exiting vehicles may only turn towards the north (that is, left-out).

7.4.5. No changes are proposed to the arrangement of the access serving the police station, to ensure the continued effective operation of police vehicles.

7.4.6. The access adjacent to the former 'Just $2' shop also serves a 30-space car park, where the spaces are reserved for guests of the Victoria Hotel. In view of the size of the car park, the access is estimated to carry 35 to 45 vehicle movements (two-way) in the peak hour. The car park has an access onto St Andrew Street which creates the opportunities to revise the manner in which the access onto Great King Street operates. As a result, the access onto Great King Street is to be amended to operate in a one-way direction, accommodating only vehicles exiting the car park.

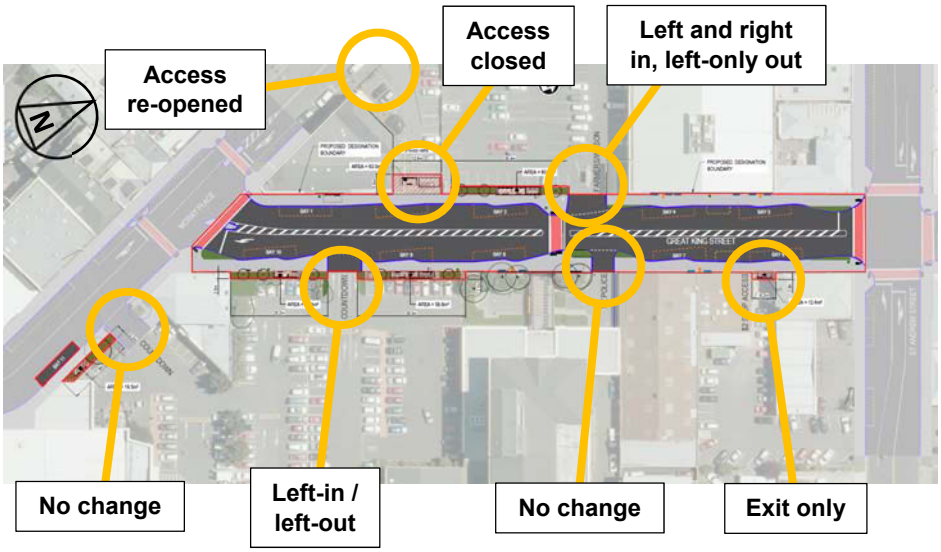


Figure 13: Location and Nature of Changes to Private Accesses Fronting Great King Street

7.4.7. It is understood that agreement has been reached with the respective landowners regarding these changes to the accesses.

8. Conclusions

8.1.1. This report has identified, evaluated and assessed a number of transport and access elements of a proposed designation for a new bus hub on Great King Street, Dunedin. However no comment has been made on the effects of the proposal on intersection capacities and safety, as these are addressed in other documents.

8.1.2. The indicative scheme will result in the loss of some 210m of kerbside parking on Great King Street (presently providing 38 spaces) but it will also facilitate the removal of a number of bus stops and the shortening of others, resulting in an overall net ***gain*** of 99m of kerbspace within a five-minute walking time of Great King Street. If converted to parking, this could provide a net increase of 17 spaces. Further from Great King Street, a further 82m of kerbspace will be available, and if converted to parking, could provide a further 14 parking spaces. Moreover, the increased attractiveness of public transport arising from the bus hub will result in reduced car usage and relieve pressure on the parking stock over a wider area.

8.2. Pedestrian movements to and from the hub are facilitated on the indicative layout through the inclusion of pedestrian phases on the (signalised) Moray Place / Great King Street intersection, and a mid-block crossing.

8.3. Vehicle crossings on Great King Street are to be rationalised, with the access to the Community House being relocated onto Moray Place, the access to Countdown being changed to left-in/left-out only, the right-turn movement out of the Wilson Parking car park on the southern side of Farmers department store being prohibited, and the access to the former 'Just $2' shop being converted to exit only (with entry via St Andrew Street). No changes are proposed to the arrangement of the access serving the police station. It is understood that agreement has been reached with the respective landowners regarding these changes to the accesses.

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June 2017

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