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TRANSPORTATION SPECIALISTS

State Highway 88 Realignment, Dunedin

Transport Assessment for Notice of Requirement

November 2012

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EXECUTIVE SUMMARY

This report provides a transport assessment relating to two designations required to facilitate the completion of the State Highway (SH) 88 Realignment, in the vicinity of Anzac Avenue and the western end of Parry Street West, to support the Notice of Requirement for the proposed designations.

The SH88 Realignment forms part of the proposed Harbour Arterial, a proposal supported in the Council's Transportation Strategy and the New Zealand Transport Agency's National State Highway Strategy. The route is considered to be of major strategic importance to Dunedin City as it links Port Chalmers and North Dunedin with the Southern Motorway.

The SH88 realignment component of the Harbour Arterial was brought forward due to the proposal to develop the new Forsyth Barr stadium for Dunedin in time for the 2011 Rugby World Cup and the desire to remove heavy traffic (and trucks in particular) from that part of the city. The Council made the decision to construct the stadium in February 2009, and the realignment was opened for traffic in July 2011, in time for the World Cup which was held in September-October of that year.

The two designations are summarised as follows:

- Designation 1 seeks to re-designate those areas of the Arterial that have already been constructed but whose original designation was quashed by the High Court in October 2011. A stormwater pond system area has also been included within Designation 1
- Designation 2 relates to a proposed new access road, from the Arterial to 80 Anzac Avenue.

While the SH88 Realignment is mainly operational, there is currently a temporary layout in the vicinity of the intersection of SH88 with Frederick Street/Ward Street. The traffic signals are not operational and Ward Street has been closed, with temporary signs and barriers allowing local access only into the Anzide Properties sites off Ward Street[1].

The need for the temporary layout at the SH88/Frederick Street/Ward Street intersection is due, to a significant extent, to the issues incurred with access to the Anzide Properties. The provision of a secondary access to 80 Anzac Avenue will remove the need for trucks to reverse within the public road, allowing Ward Street to be reopened, and in turn allowing the traffic signals to become operational. This will enable the full benefits of the SH88 Realignment project to be realised, including safety benefits at the SH88/Frederick Street/Ward Street intersection, and it will reduce the current pressure on the western Ward Street ramp.

We are aware that the owner of 80 Anzac Avenue has previously raised concerns with the proposals. Our understanding of the main concerns raised and our response to each of these issues is as follows:

- **Reversing into the site:** it is accepted that the left turn into the site from the SH88 Realignment into the Ward Street access is acute. However, it will no longer be necessary for trucks to reverse into the site, as a result of the provision of a secondary access to the site, off the SH88 Realignment

[1] 70, 76 and 80 Anzac Avenue

- **Inadequate phase time for traffic exiting the site via the new traffic signals:** this report has provided details of the likely operation of the signals, based on SIDRA modelling. This modelling provides average phase times on the basis of the overall balance of flows, which indicates that, on average, the Anzide Properties access will normally only require short green times. However, the pedestrian crossing of Ward Street is assumed to run at the same time as the signal phase for traffic exiting the Anzide Properties, and this pedestrian crossing will require 12 seconds. This is therefore the green time allocated to traffic exiting the Anzide Properties in the SIDRA modelling. In reality, the phase times will be constantly fluctuating as demands on each approach dictate, and as the various pedestrian crossings are or are not called during any particular signal cycle. Therefore this 12 second green time will be able to be allocated to the Anzide Properties access, in the peak hour, even when the pedestrian crossing is not called, to accommodate the possibility of two trucks wishing to leave at the same time. Dunedin City Council should monitor the intersection and, after a settling in period, consider reoptimising the signal phasing (including the maximum phase times) as much as practical
- **Blocking of the intersection, when a truck waiting to exit the site blocks another truck seeking to enter the site (via the Ward Street entrance):** this report has set out the results of probability analysis, which indicates that such an event will happen extremely infrequently – especially as some vehicle movements heading to/from Anzac Avenue can be expected to divert to the proposed secondary access
- **Pedestrian conflicts at the Ward Street entrance:** no pedestrian crossing is proposed, across the site access. This is not uncommon for signalised entrances to private premises and we do not consider this to be a problem. The pedestrian crossing of the SH88 Realignment (on the eastern side of the intersection) previously proposed has now been removed, as a crossing is to be provided across Ward Street, which from observation is the current pedestrian desire line. As a result, it is considered unlikely that pedestrians will wish to cross in front of the Anzide Properties access
- **Queueing at the secondary access:** the analysis indicates that the right turn into the proposed secondary access off the SH88 Realignment will operate with a very low degree of saturation, of around 2%, with modest delays of around 15-16 seconds in the peak hours in 2021. A truck will be able to sit within the median, to wait for safe gaps in oncoming traffic, and the frequency of the event of two trucks arriving at the same time (ie the second truck arriving within 16 seconds of the first) is considered to be extremely rare.

Conclusions

This report has set out the objectives of the Harbour Arterial project, and those of the two specific designations that are subject to this Notice of Requirement in particular. The proposed designations are reasonably necessary to achieve the objectives, from a traffic management point of view, since:

- The proposed designations will connect the existing designations, so that the road can function as an arterial
- The proposed designations will provide an improved solution at the intersection of the SH88 Realignment with Frederick Street/Ward Street, which will significantly improve the safety of the intersection, both relative to the current (temporary) situation and to the previous situation
- This assessment has demonstrated that the proposed intersection of the SH88 Realignment with Frederick Street/Ward Street will operate efficiently, and the proposed secondary access to 80 Anzac Avenue will accommodate those left turning movements by large trucks which cannot satisfactorily be accommodated via the Ward Street access.

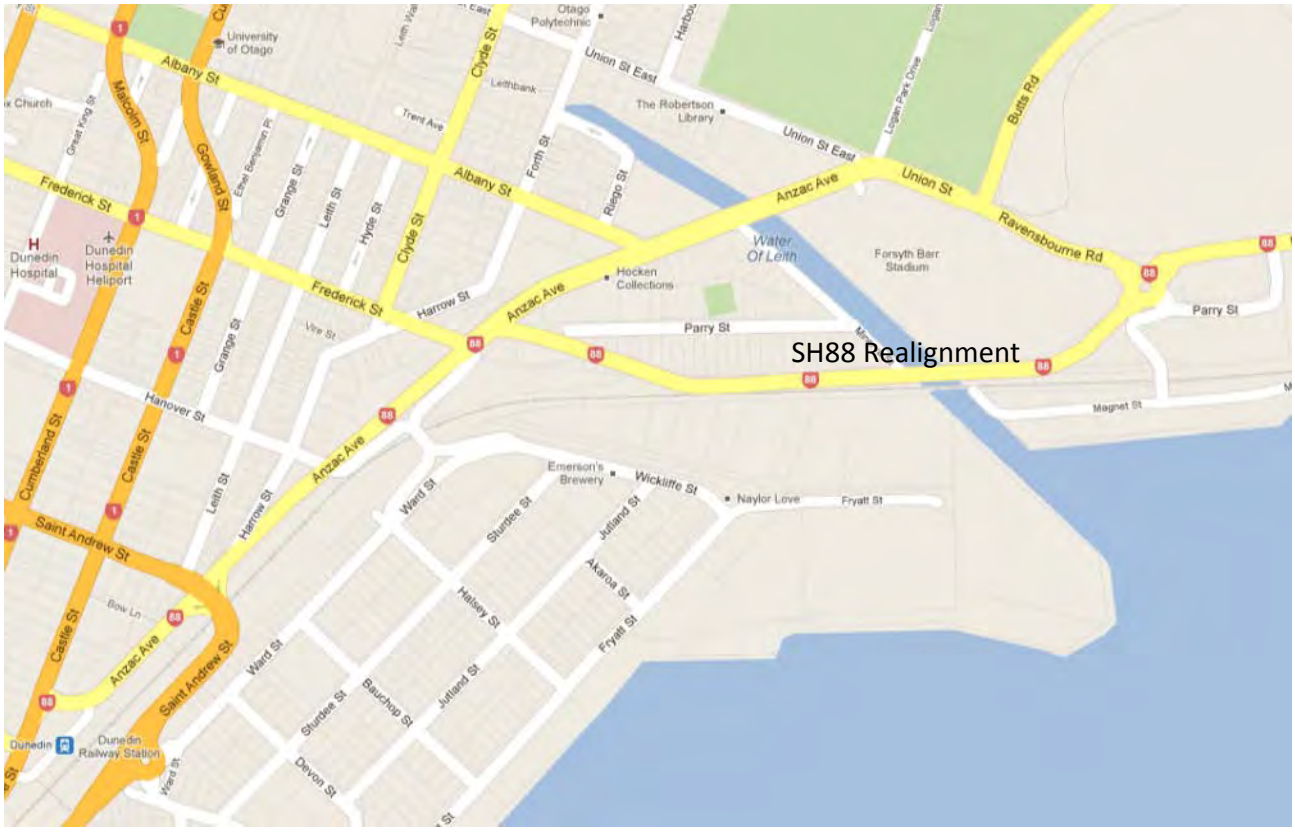
CONTENTS

APPENDICES

1 INTRODUCTION

This report provides a transport assessment for the Notice of Requirement for the State Highway (SH) 88 Realignment project, in Dunedin. The realignment extends from the Anzac Avenue/Frederick Street intersection to Ravensbourne Road, and it allows traffic on the State Highway to avoid the Forsyth Barr stadium. A site location plan is provided at Figure 1.

Figure 1: Site Location Plan



The SH88 realignment was brought forward due to the proposal to develop the new Forsyth Barr stadium for Dunedin in time for the 2011 Rugby World Cup. The Council made the decision to construct the stadium in February 2009, and the realignment was opened for traffic in July 2011, in time for the World Cup which was held in September-October of that year.

This report relates to the designations required over the short section of the realigned route, in the vicinity of Anzac Avenue and the western end of Parry Street West, to support the Notice of Requirement for the proposed designations. The two designations are summarised as follows:

- Designation 1 seeks to re-designate those areas of the Arterial that have already been constructed but whose original designation was quashed by the High Court in October 2011. A stormwater pond system area has also been included within Designation 1
- Designation 2 relates to a proposed new access road (from the Arterial to 80 Anzac Avenue).

Full details regarding the history of the site and the reasons for the need for the designation over the short section of the SH88 Realignment are provided in the Notice of Requirement.

This report has been prepared by Ian Clark, a Director of Flow Transportation Specialists Ltd ("Flow"), and it has been reviewed by Karl Hancock, an Associate of Flow. Mr Clark's Curriculum Vitae is provided at Appendix A.

2 BACKGROUND TO THE PROJECT

The SH88 Realignment forms part of the proposed Harbour Arterial Route. This route is of major strategic importance to Dunedin City as it links Port Chalmers and North Dunedin with the Southern Motorway.

2.1 City Council Transportation Strategy

The background to the SH88 Realignment project is described by Mr Avery, Council's General Manager, Operations, in his evidence that was given to the High Court. This describes the role of the Council's 2006 Transportation Strategy and the changes that were made to that strategy as a result of the construction of the Stadium for the Rugby World Cup 2011. The following paragraphs from Mr Avery's work explain the background to this project.

Background to SH 88 Realignment Project

7. *The realignment of SH 88 to its current position had its genesis in the Dunedin City Council Transportation Strategy, published in July 2006 following public consultation. That Strategy identified a potential harbourside arterial route that would take traffic off the state highway at the Oval and divert it to the harbour side of the railway corridor crossing back at about Ward Street/Frederick Street intersection to provide a faster more efficient route to the Port.*

8. *Subsequent work was done on a number of more detailed design options around the proposed harbour arterial route and eventually a designation process was completed on 10 March 2009, designating land on the route for the proposed harbour arterial. Mr Hall's land was included in the designation.*

9. *The realignment of SH 88 was one component of that strategic corridor.*

10. *That provided a route through the intersection of Frederick Street and down Parry Street, running behind the existing Otago Polytechnic and University areas. The affidavit of Mrs Connolly provides details around the designation that was decided on.*

11. *The need to realign SH 88, ahead of other aspects of the overall strategic corridor proposal was brought forward due to the decision of the Council to build the Forsyth Barr Stadium which was to be constructed in time for the Rugby World Cup 2011. The Council made the decision to construct the Stadium in February 2009.*

12. *The focus of the Council, from a transportation view point, swung onto the realignment which was going to be required in advance of the Rugby World Cup.*

13. *The relocation of SH 88 north of Frederick Street was required as part of the stadium development, with the University of Otago making it a requirement for their commitment to expenditure for University purposes in the Plaza area due to the large number of students they were expecting to cross the road at that point.*

14. *The existing use of Anzac Avenue past the University Plaza and Stadium area as a state highway was anticipated to generate significant pedestrian conflicts as the use of the new stadium and associated university facilities at the University Plaza increased. SH 88 needed to be relocated away from the front of the proposed University Plaza to avoid that pedestrian conflict or congestion.*

15. *The Council removed funding for the remainder of the Strategic Corridor due to more work being required to justify the expenditure on that route and due to NZTA indicating that they were unlikely to provide subsidy for the work. Funding for the SH 88 realignment was included in the 2009/10 Annual Plan and again in the 2010/11 Draft Annual Plan.*

…

31. *It was at this point that it was clear that Mr Hall's land would not be needed for the SH88 realignment, but was required for Stage II of the strategic corridor.*

32. *The new road realignment was put through a Notice of Requirement (NOR) process culminating in the decision in June 2010 that has resulted in these proceedings being initiated. The designation over Mr Hall's land was not affected by that NOR and it remained in place.*

33. *The designation over Mr Hall's land relating to the harbourside arterial was not affected by the SH88 changes.*

34. *However there was a separate process that had been initiated in May 2010 reviewing the need for the remainder of the arterial designation. As a result of that review, the Council made a decision to uplift the designation over the majority of the arterial in August 2010. The affidavit of Mrs Connolly provides information relating to that process and subsequent decision.*

35. *By the time that the NOR for the SH88 realignment was confirmed, the design of new alignment had been completed, tender documents had been issued and a tender was awarded 8 June 2010. Physical construction started via a staged start up over the period from late July to early August 2010. The construction target end date was 30 June 2011, in time for the Stadium opening and the Rugby World Cup.*

Mrs Connolly, who is the Transportation Planning Manager, also provided evidence to the High Court, explaining refinements that the Council undertook from the 2006 Transportation Strategy. This is described by Mrs Connolly as follows:

12. *The Harbourside Arterial Link was a complex strategic roading project divided into 5 stages, of which the SH88 realignment was Stage 1.*

13. *The high level concept design included 4 other stages: construction of a raised gyratory system at the Frederick Street intersection (Stage 2); an extension of Thomas Burns Street over railway owned land to the east of the rail corridor plus 4-laning of Thomas Burns Street (Stage 3); a gyratory system at Andersons Bay (Stage 4); and making the existing one way system between Queens Gardens and Andersons Bay into two 2-way streets (Stage 5).*

14. *At that time, it was seen that the benefits of the overall construction would be a significantly upgraded route for heavy vehicles to access the port, with land use benefits for the area between Queens Gardens and Andersons Bay.*

15. *If significant congestion or safety issues were forecast for the strategic routes around the city, then the designation would still be required. The purpose of the review was to ascertain whether we would need to proceed with construction of subsequent sections of the Harbourside Arterial Link in the near future.*

16. *As a result of this work, my recommendation was that part of the designation be uplifted. This was reported to the Planning and Environment Committee on 30 August 2010 (and subsequently 31 August 2010).*

…

Reasons for partial uplift of Designation 845

18. *To summarise the primary reason for uplifting part of the designation was that the results of traffic modelling showed that even with projected traffic growth (which may or may not eventuate), the network as a whole would continue to function effectively out to 2041, with a small number of hotspots where intersection and other improvements would be likely to ameliorate problems.*

2.2 National State Highway Strategy

The New Zealand Transport Agency's National State Highway Strategy (2007) states that the Council is working on a proposal to develop a Harbour Arterial Route to provide a safer and more direct route for heavy vehicles through the city centre, between the south and Port Otago. NZTA is working with the Council to explore opportunities for the Harbour Arterial route to become a realignment of SH1 and SH88[2].

2.3 District Plan

The proposed work is also consistent with the Council's most significant objectives regarding roading, which are the safety, efficiency and effectiveness of the city's roads, as set out in Section 20 of the District Plan.

Relevant policies and objectives of the District Plan include the following:

[2] New Zealand Transport Agency (2007), *"National State Highway Strategy"* page 38

- Objective 20.2.4 refers to the objective to maintain and enhance a safe, efficient and effective transportation network. The explanation states that safety, efficiency and effectiveness require special consideration because of the reliance of people on the transportation network to achieve their social and economic wellbeing
- Policy 20.3.5 relates to ensuring safe standards for vehicle access
- Policy 20.3.6 relates to encouraging heavy traffic to use appropriate routes.

In line with most road controlling authorities, Dunedin City Council has a road hierarchy, which is set out as method 20.4.2 of the District Plan. The categories of the roads of relevance to this project are as follows:

- SH88 - Ravensbourne Road - Anzac Avenue are designated as National Roads. The district plan predates the opening of the SH88 Realignment, and it can be reasonably expected that this new road has now become the National Road. National Roads are defined as providing for the greatest level of movement with a minimum access function. They connect major localities and link with areas beyond the city
- Frederick Street and Ward Street are designated as District Roads. These roads provide connections between the regional roads and connect major, rural, suburban, commercial and industrial areas.

3 PROBLEM IDENTIFICATION

A summary of the problems with the former SH88 route was provided in the Scheme Assessment prepared by consultants MWH[3], as follows:

- There were conflicts between the arterial function and the access function
- Over the previous five years there had been 31 crashes recorded along the route. Of these crashes, four resulted in serious injury and 13 in minor injuries
- The Frederick Street intersection with Anzac Avenue was classed as a blackspot (being a location where a noticeable number of crashes has occurred), with six reported injury crashes. The Albany Street intersection with Anzac Avenue had previously been classed as a blackspot
- The marked pedestrian crossing just south of the Anzac Avenue/Albany Street intersection had been the subject of numerous complaints. There had been a number of near misses due to the volume of traffic, proximity to the intersection and the number of pedestrians. Several crashes had occurred when traffic stopped suddenly at the crossing
- The likelihood of safety issues was identified relating to pedestrian access and safety following the completion of the Forsyth Barr stadium and the adjacent university buildings
- Cyclists had to share the road with other traffic. In places there was insufficient shoulder available for cyclists. The volume of heavy traffic on the route had implications for cycle safety
- Traffic generated by the stadium was considered likely to cause a deterioration in cycle safety.

[3] MWH (2010), "*Scheme Assessment Report: State Highway 88 Realignment*", page 6

4 OBJECTIVES OF THE PROJECT

The objectives of the previous Notice of Requirement for the Harbour Arterial were as follows:

- To reduce current congestion on the existing arterial network through Dunedin City, allowing an improvement in the safety and efficiency of the existing network
- Remove heavy traffic from the inner city and give it a separate route
- To improve access between the city centre and the east, southeast, and southern suburbs, including the Peninsula, Waverly and South Dunedin
- Improve access from the Southern Motorway to the upper and lower port areas
- To assist with construction of part of the "around the harbour walkways and cycle ways" connections with the central city
- To allow land required for the Harbour Arterial to be identified in the Dunedin City District Plan which will give a clear indication to the public of the requirement for this land to be used to construct this road network.

The more specific objectives for the designations are:

- To realign SH88 away from Anzac Avenue, to avoid conflict and congestion with Stadium and University pedestrian traffic
- To provide an improved design including the intersections of Frederick Street and Ravensbourne Road with the proposed Arterial
- To connect the existing designations so the road can function as an arterial
- To provide additional land for construction of a retention pond to improve stormwater quality
- To avoid having to purchase private land.

5 EXISTING SITUATION

As noted above, the SH88 Realignment, between Frederick Street and Ravensbourne Road, was opened for traffic in 2011. The main features of this project were as follows:

- The provision of a new two lane road between Frederick Street and Ravensbourne Road, including a crossing of the Water of Leith
- Provision of a new roundabout at Ravensbourne Road/SH88 Realignment/Parry Street
- Signalisation of the SH88/Frederick Street/Ward Street intersection (see below)
- Realignment of Anzac Avenue to a new connection with the SH88 Realignment
- The former access to 80 Anzac Avenue, that was located opposite the realigned Anzac Avenue, was not being used and was formally closed
- Closure of Parry Street West, with a turning head at the western end
- Pedestrian and Cycling facility improvements.

The plans showing the Project are provided at Appendix B.

While the route is mainly operational, there is currently a temporary layout in the vicinity of the intersection of SH88 with Frederick Street/Ward Street. The traffic signals are not operational and Ward Street has been closed, with temporary signs and barriers allowing local access only into the Anzide Properties sites off Ward Street[4]. Photographs of the current situation are provided at Appendix C.

6 DETAILS OF PROPOSED PROJECT

This Notice of Requirement is required to allow the SH88 Realignment to operate on the alignment designed. The changes relative to the existing situation are proposed to be as follows:

- The traffic signals at SH88/Anzac Avenue/Frederick Street/Ward Street are to become operational
- The Anzide Properties access off Ward Street, very close to the traffic signals, is to be incorporated within the adjacent signals, forming a fifth leg to the intersection
- A second access to 80 Anzac Avenue is to be provided off SH88
- Ward Street is to be reopened, reducing the current flows on the western ramp to the Ward Street overbridge.

6.1 Layout of SH88/Frederick Street/Ward Street signals

As noted at Section 3 above, the intersection of SH88/Frederick Street/Ward Street was previously identified as a blackspot, with eight crashes reported between 2004 and 2008 and a further three crashes in 2009. Six crashes resulted in minor injuries. The MWH report noted no common factors between the crashes. Vehicles had failed to give way when crossing or turning on to SH88 and others had failed to give way when turning off the highway. Trucks were involved in three crashes[5].

Updated crash data has not been obtained for this intersection, on the basis that the current layout includes several temporary features, including a temporarily low speed limit.

There is reference in the High Court affidavits to the disregard given to the right turn ban from Anzac Avenue to Ward Street and the Anzide Properties sites. (The right turn ban sign is shown in Photograph 3 in Appendix C). From observation, illegal right turns remain a problem at this location, which has clear potential for safety consequences.

The signalised layout that has been constructed but which is not yet operational is shown at Appendix B. The main features of the layout are set out below.

6.1.1 Provision for traffic

The following summarises the lane arrangement at the SH88/Anzac Avenue/Frederick Street/Ward Street intersection:

[4] 70, 76 and 80 Anzac Avenue
[5] MWH (2010), Scheme Assessment Report: State Highway 88 Realignment, page 9

- A single lane is to be retained on the approach from SH88 Anzac Avenue, from the south west, accommodating traffic to Frederick Street and the SH88 Realignment. The right turns to Ward Street and to the Anzide Properties sites are to be banned, as is currently the case. It may be that some vehicles divert to Ward Street, to legally turn right into the Anzide Properties sites in the future. However, it is more likely that some will continue straight through the intersection and turn right at the proposed secondary access (see Section 6.3 below)
- Two approach lanes are to be provided from Frederick Street. The kerbside lane will be for left turning traffic only, with through and right turning traffic in the second lane
- Three approach lanes are to be provided from the SH88 Realignment. The kerbside lane will be for left turning traffic only (to Ward Street and the Anzide Properties), with through traffic to Anzac Avenue in the second lane and right turning traffic to Frederick Street in the third lane
- A single approach lane is to be provided from Ward Street, providing for all movements
- All turning movements are to be permitted from the Anzide Properties arm.

Details regarding the predicted operation of the signalised intersection are provided at Section 7 below.

6.1.2 Provision for pedestrians

Pedestrian crossing facilities are to be provided across Anzac Avenue, Frederick Street and Ward Street.

It was previously proposed that no pedestrian crossing would be provided across Ward Street, but that a crossing would be provided across the SH88 Realignment. From observation, there appears to be a reasonable number of pedestrians that walk over the Ward Street railway overbridge to get to the city centre. Since there is no footpath on the northern side of Ward Street, these pedestrians will need to cross Ward Street at the intersection. (See Photograph 5 at Appendix C, which shows both the lack of a footpath on the one side, plus a pedestrian crossing the street).

It may be that the lack of the pedestrian crossing of Ward Street was a deliberate design feature, as pedestrians to the south of the intersection will have to cross both Ward Street and Anzac Avenue. From observation, few pedestrians currently cross the SH88 Realignment (ie on the northern side of the intersection) and it was recommended to Dunedin City Council that a pedestrian crossing of Ward Street should be provided. This crossing has now been incorporated in the scheme design (see Appendix B).

There is no crossing proposed across the access to the Anzide Properties. Given the low volumes of traffic entering and exiting these sites, we do not consider this to be a significant issue. This is especially the case since with the removal of the crossing previously proposed across the SH88 Realignment, pedestrians will now have no reason to cross the Anzide Properties access.

6.1.3 Provision for cyclists

Cycle lanes are to be provided on the Anzac Avenue, Frederick Street and SH88 Realignment approaches. These are to be kerbside lanes on Anzac Avenue and Frederick Street, while the cycle facility on the SH88 Realignment is to be provided between the left turn lane and the through lane.

6.2 Access to Anzide Properties Sites off Ward Street

The Anzide Properties, at 70, 76 and 80 Anzac Avenue, are occupied by businesses operated by Mr Hall and AJ Allen. As noted above, the access to these premises is to be incorporated within the traffic signals. The following movements are to be provided:

- A specific traffic signal phase is to be provided for traffic exiting these premises. Traffic will be able to exit in all directions as the size of vehicle allows
- The right turn from Anzac Avenue (from the southwest) is to continue to be banned (ie as it is currently)
- The through movement from Frederick Street, and the right turn from Ward Street, are to be provided
- The left turn from the SH88 Realignment is to be permitted from the kerbside lane, but the turn is acute. The manoeuvre can be made satisfactorily by cars and small trucks, but not by large trucks. These left turn manoeuvres by large trucks into 80 Anzac Avenue will be accommodated via the secondary access, as discussed below.

6.3 Secondary Access to 80 Anzac Avenue, off SH88 Realignment

A secondary access to 80 Anzac Avenue is now to be provided, with the access to be located further to the east along the SH88 Realignment, as shown in the plan at Appendix B. This secondary access is to facilitate the movements to 80 Anzac Avenue that are not to be accommodated off at the SH88/Anzac Avenue/Frederick Street/Ward Street intersection (ie the right turn from Anzac Avenue, from the southwest, and the left turn manoeuvre by large trucks from the SH88 Realignment). Also, the secondary access will allow vehicles to enter from one access and exit via the second, avoiding the need for trucks to U turn within the site, or to reverse into the site.

6.4 Pedestrian Facilities along SH88

There are no facilities for pedestrians along the majority of the SH88 Realignment itself. This reflects the industrial environment and the absence of frontage activity and it is considered that the section of Anzac Avenue that is the former SH88 route provides the right environment for pedestrians. However, as noted above, pedestrian crossing facilities are to be provided across three legs of the SH88/Anzac Avenue/Frederick Street/Ward Street intersection, once the traffic signals become operational.

6.5 Cycle Facilities along SH88

Similarly, there are no dedicated facilities for cyclists along the majority of the SH88 Realignment itself. However, while there are no marked cycle lanes, cyclists do use the route, utilising the shoulders along the carriageway. Cycle lanes are to be provided on the SH88, Anzac Avenue and Frederick Street approaches to the proposed signalised intersection.

There is currently a central refuge on the SH88 Realignment, allowing cyclists to cross SH88 when travelling between the western termination of Parry Street and the west. This cycle refuge is to be retained.

7 TRAFFIC ASSESSMENT

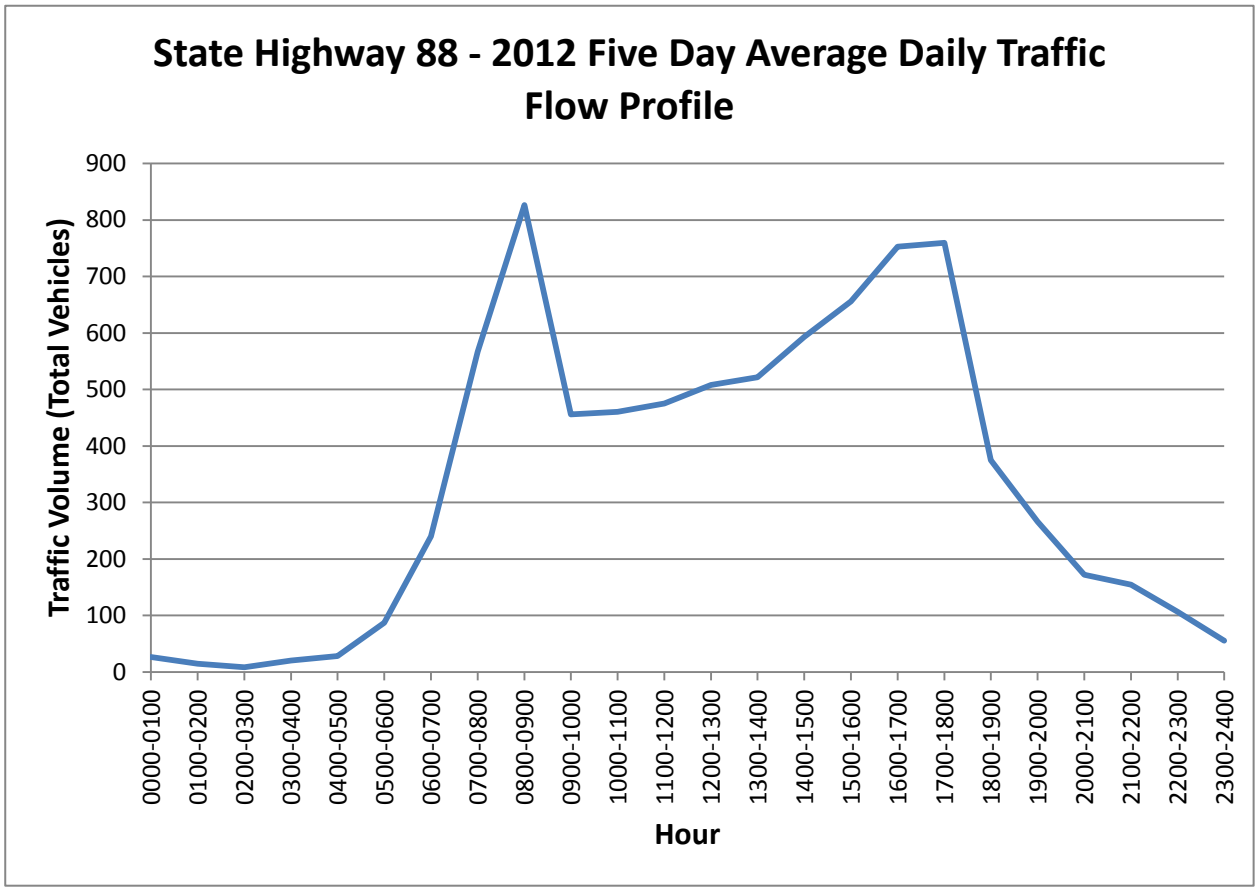
7.1 Existing traffic flows

7.1.1 Ravensbourne Road to Anzac Avenue

The SH88 Realignment currently accommodates around 8,100 vehicles/day, two way, on a weekday[6], between Anzac Avenue and the Ravensbourne Road roundabout. Weekend flows are lower, at around 6,800 vehicles/day on a Saturday and 5,100 vehicles/day on a Sunday. The traffic composition includes around 7% heavy commercial vehicles.

The existing traffic flow profile on the SH88 Realignment is shown at Figure 2. The maximum hourly flows are around 825 vehicles/hour, two way, between 8 to 9 am, and around 750 vehicles/hour between 5 to 6 pm[7].

Figure 2: SH88 – 2012 Five Day Average Daily Traffic Flow Profile



[6] This is based on automatic count data for the week 13-21 June 2012, provided by Dunedin City Council
[7] These hourly figures are based on the Monday to Friday two way average. The maximum recorded hourly flow was about 870 vehicles/hour between 8-9am on a Wednesday.

7.1.2 Anzac Avenue to Frederick Street

The traffic flows on the short section of SH88 between Anzac Street and Frederick Street are somewhat higher than those on the SH88 Realignment to the east of Anzac Avenue. It is noted that:

- The daily flow on Anzac Avenue in 2009, prior to the construction of the SH88 Realignment, was around 13,450 vehicles/day, two way, between Frederick Street and Albany Street
- The current (June 2012) flow on Anzac Avenue is around 5,400 vehicles/day, between Albany Street and Minerva Street. From inspection, most vehicles at the SH88/Anzac Avenue intersection are turning to/from the south, and if one adds the existing flow on SH88 (north) to the Anzac Avenue flow, this would give around 13,500 vehicles/day.

Given the good correlation between the two sets of data (from 2009 and 2012), it seems reasonable to conclude that the existing flow on SH88 between Frederick Street and Anzac Avenue is around 13,500 vehicles/day, and the maximum flows are around 1,400 vehicles/hour in the morning peak (8 to 9 am) and 1,300 vehicles/hour in the evening peak (5 to 6 pm).

7.1.3 Traffic Flows to/from Anzide Properties

The existing flows entering and exiting the Anzide Properties sites were surveyed on Monday to Wednesday 3 to 5 October 2011. The results of these surveys was summarised in the Third Affidavit of Jonathan Stewart, dated 25 October 2011, and Mr Stewart noted that the average number of vehicle movements over the three days was around 164 (entering and exiting the premises occupied by Mr Hall and AJ Allen), with a maximum of 177 vehicles/day, two way. The details are as follows:

- There was an average of 22 vehicles entering and exiting the sites between 8 to 9 am
- There was an average of 12 vehicles entering and exiting between 5 to 6 pm.

A greater level of detail was provided in Mr Stewart's First Affidavit, dated 11 October 2011. The Third Affidavit subsequently noted that some of the earlier analysis of the First Affidavit included errors, but these appear to be quite inconsequential in terms of the quantum of traffic entering and exiting the site. For example, the average number of vehicle movements per day was confirmed as 164 vehicles/day and the morning peak flow was revised from 23 to 22 vehicles.

The profiles of traffic flows to/from the site, based on the tables appended to Mr Stewart's First Affidavit, are set out at Appendix D. The average profile over the three days is shown, along with the flow profiles within the two peak periods, for each of the three days of surveys. Also, the tables appended to Mr Stewart's First Affidavit indicate that the average numbers of truck movements are 9 out and 5 in, between 8 to 9 am, and 2 out and 8 in, between 4.30 and 5.30 pm.

While this data provides a snapshot of movements, it is considered to be a fair representation of traffic flows to and from the sites.

7.2 Forecast Traffic Flows

The forecast flows for this assessment have been taken from the council's TRACKS traffic model, developed and operated by consultants Gabites Porter. Forecast flows have been provided for the years 2006 and 2021, for the morning peak (8 to 9 am), inter peak (12 to 1 pm) and evening peak (5 to 6 pm).

The key points to note are:

- The Dunedin TRACKS model was satisfactorily validated to "normal" standards. (These standards are set out in the NZTA Economic Evaluation Manual)
- Checks were undertaken on the validation of traffic flows within the area to the SH88 Realignment[8]
- The model takes into account anticipated transport and land use changes
- Although the first model year is termed 2006, the model was adjusted to reflect the anticipated day to day operation of the Forsyth Barr stadium[9].

The forecast flows were derived prior to the completion of the SH88 Realignment and it is possible to undertake checks on the actual effects. These are summarised at Table 1, with diagrams showing the predicted effects of the SH88 Realignment provided at Appendix E.

Table 1: Comparison of Predicted and actual effects of SH88 Realignment (vehicles/day, two way)

	Forecast Flows (2006 model)[10]	**Actual flows (2012)**
Ravensbourne Road (Parry Road to Union Street)	3,200	3,500
Anzac Avenue (Albany Street to Union Street)	300	4,900
SH88 Realignment (east of Anzac Avenue)	12,000	8,100

The above figures indicate that the SH88 Realignment was predicted to divert more traffic off Anzac Avenue than has been the case. This may be a result of the modelled assumption that there would be traffic calming measures along Anzac Avenue, reducing the speed environment to 20kph. These measures have not been implemented. However, this issue does not significantly affect the predicted flows at the SH88/Frederick Street/Ward Street intersection (see Section 7.4 below).

[8] Gabites Porter (2010), SH88 Realignment Modelling Report, page 10
[9] We note that the model reflects a "normal weekday", when there is no significant event at the stadium. This is in accordance with standard practice
[10] Gabites Porter (2010), SH88 Realignment Modelling Report, Table 3

7.3 Operation of SH88

The Dunedin City Council TRACKS traffic model indicates an anticipated growth rate of just over 1% per year. This indicates a forecast maximum hourly flow of around 1,550 vehicles/hour, two way by 2021, for the busiest section of the SH88 Realignment (ie between Anzac Avenue and Frederick Street). This is well within the capacity of a two lane road, which is around 2,350 vehicles/hour for a road of this nature[11]. As a result, the main traffic issues to be assessed relate to the operation of the proposed signalised intersection at SH88/Anzac Avenue/Ward Street/Frederick Street, and the provision of access to the Anzide Properties sites.

7.4 Operation of SH88/Frederick Street/Ward Street signals

7.4.1 Proposed Operation

Signalising the intersection of SH88/Anzac Avenue/Frederick Street/Ward Street will ensure that the safety and efficiency of the intersection is improved, compared with the current situation, as follows:

- It will provide dedicated phases for all (permitted) movements
- It will remove the subjective decisions to be made by drivers, benefitting traffic turning to/from Frederick Street, Ward Street and the Anzide Properties
- It will provide safe crossing facilities for pedestrians, and will introduce facilities for cyclists
- It will include the reopening of the connection from Ward Street to the signalised intersection, reducing pressure on the western ramp to the Ward Street overbridge.

The intersection is to operate with up to five signal phases, which are to be as follows:

- Phase A: Anzac Avenue in both directions
- Phase B: a dedicated phase allowing vehicles to exit the Anzide Properties
- Phase C: Ward Street down ramp
- Phase D1: Frederick Street
- Phase E: Anzac Avenue southbound, including a right turn into Frederick Street. The left turn from Frederick Street will also be permitted during this phase.

The green times for certain phases will in part be determined by the calling of signalised pedestrian crossings, which are proposed as follows:

- Crossings of Frederick Street will be permitted during phase A
- Crossings of Ward Street will be permitted during phase B
- Crossings of Anzac Avenue (southwest) will be permitted during phase C.

[11] Roads and Traffic Authority (2002), "Guide to Traffic Generating Developments, Version 2.2". Table 4.4 indicates that the capacity is 1,400 vehicles/hour in one direction, before level of service "F" is reached. We have assumed that the peak flow contributes around 60% of the two way flow in deriving a two way estimate of 2,350 vehicles/hour, two way

7.4.2 Assessment of Operation

The operation of the signalised intersection has been assessed using SIDRA, with the results summarised at Appendix F. The SIDRA models have been based on forecast traffic flows from the TRACKS traffic model.

The results of the SIDRA analysis are summarised at Tables 2 to 4 below.

- Table 2 provides the results for the situation when all pedestrian crossings and the Anzide Properties phase are called, termed Scenario 1
- Table 3 relates to a situation when no pedestrian crossing phases are called, termed Scenario 2. The phase allowing egress from the Anzide Properties would remain (but this phase is allocated 6 seconds by SIDRA)
- Table 4 relates to the situation when neither the pedestrian crossings are called, nor the phase for vehicles exiting the Anzide Properties. This is termed Scenario 3.

Table 2: Results of SIDRA assessment for SH88/Anzac Avenue/Frederick Street/Ward Street Intersection: Scenario 1, with all pedestrian crossings called

	Maximum Degree of Saturation	Predicted Delay (seconds) [12]	Predicted Level of Service[13]
2006 AM Peak	94%	61 (75)	E (E)
2006 PM Peak	84%	31 (57)	C (E)
2021 AM Peak	99%	67 (106)	E (F)
2021 PM Peak	89%	35 (67)	C (E)

Table 3: Results of SIDRA assessment for SH88/Anzac Avenue/Frederick Street/Ward Street Intersection: Scenario 2, with no pedestrian crossings called[14]

	Maximum Degree of Saturation	Predicted Delay (seconds)	Predicted Level of Service
2006 AM Peak	86%	51 (67)	D (E)
2006 PM Peak	81%	24 (46)	C (D)
2021 AM Peak	91%	53 (76)	D (E)
2021 PM Peak	89%	30 (54)	C (D)

[12] Key: 61 (75) = average delay over all movements (average delay for worst movement)
[13] Key: E (E) = Level of service for intersection as a whole (level of service for worst movement)
[14] Key as per Table 2

Table 4: Results of SIDRA assessment for SH88/Anzac Avenue/Frederick Street/Ward Street Intersection: Scenario 3, with no pedestrian crossings called, and the Anzide Phase not called[15]

	Maximum Degree of Saturation	Predicted Delay (seconds)	Predicted Level of Service
2006 AM Peak	91%	37 (47)	D (D)
2006 PM Peak	80%	18 (36)	B (D)
2021 AM Peak	91%	39 (55)	D (D)
2021 PM Peak	85%	22 (39)	C (D)

Scenario 1 represents a conservative worst case, with all pedestrian crossings and the Anzide Properties phase all assumed to be called **every cycle**. It is reasonable to expect either a pedestrian crossing phase, or the Anzide Properties phase, not to be called during many cycles, even during the peak periods. Therefore, the actual performance can be expected to fall somewhere between that currently predicted for Scenarios 1 to 3, with Scenario 1 being the worst case which may be overly conservative and Scenario 3 being the best case which may be overly optimistic.

The intersection is predicted to operate at practical capacity under Scenario 1, with maximum degrees of saturation of 94%, with current (2006) flows, rising to almost 100% with forecast 2021 flows, in the morning peak. However, the level of service for through traffic on the state highway (the through movements from the SH88 Realignment, and on Anzac Avenue) is predicted to be no worse than D **in all cases**, including with 2021 forecasts. We understand that this (level of service D) is considered acceptable by NZTA, for through traffic on the state highway. This level of service D is predicted in the morning peak, with B to C predicted in the evening peak (ie B in one direction and C in the other, both with current (2006) flows, and forecast (2021) flows.

With Scenario 1, the green time for traffic exiting Anzide Properties is set to 12 seconds, according to SIDRA. This is due to the time required for the pedestrian crossing of Ward Street, but this also responds to the concern of the owner of the Anzide Properties sites, in that it covers the possible situation of more than one HCV leaving those sites during a single signal phase.

Under Scenario 2, when none of the pedestrian crossing phases are called, the degrees of saturation are generally predicted to be lower, compared with Scenario 1, with the maximum being 91% in the 2021 AM peak. The modelled cycle times are predicted by SIDRA to fall (with the range being as low as 75 seconds in the PM peak, with current (2006) flows, and up to 120 seconds, with forecast (2021) AM peak flows). The level of service for through traffic on the state highway is still predicted to be D in the morning peak, both with current and forecast flows, but B to C in the PM peak.

With Scenario 2, the green time allocated to the Anzide Properties phase was reduced by SIDRA to the minimum time of 6 seconds, as it was the pedestrian crossing of Ward Street that was causing this phase (Phase B) to be allocated greater time.

[15] Key as per Table 2

Scenario 3, with neither pedestrian crossings nor the Anzide properties phase being called, results in cycle times within the range of 60 to 85 seconds. No significant reductions in the maximum degrees of saturation are predicted (ie the maximum is still predicted to be 91% in the 2021 AM peak), but this is a direct result of SIDRA minimising the predicted delay by reducing the cycle time. The degrees of saturation would be lower if the overall cycle is set to a longer time. The level of service for through traffic on the state highway is predicted to be C to D in the morning peak (ie C in one direction, D in the other, both with current and forecast flows), and A to C in the PM peak (ie A in one direction, with B in the other direction, with current flows, falling to C with forecast flows).

The above tables provide results for the morning and evening peaks. We have also assessed the inter peak period and can confirm that the intersection is predicted to operate well within capacity during this period, as the flows are significantly lower than during the peaks.

The signals are likely to operate in isolation, at least in the first instance[16], which means that it is quite likely that they will operate on a variable cycle. Similarly, the phase times should be set to allow constant fluctuations in response to the ebb and flow of traffic demands from each approach. SIDRA provides an estimate of the average green times, which takes into account the overall traffic flows predicted over an hour, but in reality these signal times will be changing constantly.

A further issue, which is not addressed by the SIDRA analysis, relates to the existing width of the access to 80 Anzac Avenue off Ward Street. This is such that a truck will not be able to enter the site when another truck is waiting at the signals to exit the site. However, this matter has been assessed by Opus, in a Memorandum dated 13 April 2012. This states that the average probability of this event occurring is once every 5.1 weeks (based on the average heavy vehicle movement rate over the three days of observations).

While this calculation suggests that such an event will be quite rare, this would appear to overestimate the likelihood of the event, since the calculation assumes that all truck movements will continue to take place via the Ward Street access, whereas in reality a reasonable proportion of trips are likely to use the proposed secondary access.

7.5 Operation of Secondary Access

SIDRA tests have also been undertaken of the likely operation of the proposed secondary access. These tests indicate that the turns into and out from the site are predicted to operate well within capacity, with a maximum degree of saturation for any turning movement into or out from the proposed access, of around 22% (on the right turn out from the minor arm at the intersection), for the forecast year of 2021. This indicates that these movements should be able to be made with an acceptably low level of risk.

The SIDRA tests indicate that the average delay for right turning vehicles from SH88 will be 16 seconds in the morning peak and 15 seconds in the evening peak, in 2021. Given the low demand for this movement, the degree of saturation for this movement is predicted to be around 2% in both peaks, with minimal queuing.

[16] NZTA have indicated that they expect the signals to operate as part of a coordinated network, at some time in the future

As noted in Section 6.5 above, the central refuge for cyclists on the SH88 Realignment is to be retained. This will limit the length of the right turn bay, but it will be possible for one truck to sit in the median while waiting to turn right into the site. Given the results of the SIDRA tests, this is considered satisfactory, since it will be very rare for two trucks to arrive at the same time (ie with the second truck arriving in the right turn bay within 16 seconds of the first).

7.6 Commentary on access to/from Anzide Properties

While the SH88 Realignment is currently operational, the need for the temporary layout at the SH88/Frederick Street intersection is due, to a significant extent, to the issues incurred with access to the Anzide Properties. The provision of a secondary access to 80 Anzac Avenue will remove the need for vehicles to reverse into the site, allowing Ward Street to be reopened, in turn allowing the traffic signals to become operational.

A key question around the Anzide Properties access relates to the difficulty for large trucks to turn left into the site from the SH88 Realignment. However, this movement is to be facilitated by the new left turn into the proposed secondary access to 80 Anzac Avenue, off the SH88 Realignment. It is reasonable to assume that the vast majority of truck drivers heading to the site will be employees or regular visitors. As such, they will be fully aware of the need to turn left off the SH88 Realignment, before reaching the Ward Street entrance. There will occasionally be truck drivers visiting the site for the first time, but these drivers should be made aware of the access arrangements either by a sign (similar to that existing on site, as shown in Photograph 2), or by prior warning by site personnel. It is quite common for truck movements to be controlled by an operator's traffic management plan and this should further mitigate the potential situation.

8 ASSESSMENT OF ALTERNATIVES

This report has considered the following alternatives:

- No link (ie SH88 is not used) – this is back to the former situation
- The original designated route – through the Anzide Properties
- Retention of the current temporary arrangements
- Alternatives to the second access to 80 Anzac Avenue
- The scheme that was subject to consultation in mid 2012.

8.1 No link (ie SH88 Realignment is not used)

If the re-designation of the section of Arterial is not confirmed, one option would be to reinstate SH88 back along Anzac Avenue.

This alternative is considered as not viable, as the benefits and strategic importance of the SH88 Realignment would be lost. These benefits include:

- The Arterial was designed to improve the safety, efficiency and sustainability of the city's arterial network by giving heavy traffic a direct route to the Port without the need to pass through Anzac Avenue, past the stadium and the tertiary education facilities. Section 7.2 above demonstrated the beneficial effects that the Arterial has had on Anzac Avenue/Union Street/Ravensbourne Road, along the former alignment of SH88
- The implementation of the Arterial was consistent with Council's 2006 Transportation Strategy and the obligation to re-locate SH88 away from the Stadium/University
- The Arterial was also consistent with NZTA's 2007 State Highway Strategy proposal to develop a Harbour Arterial Route to provide a safer more direct route for heavy vehicles through the city centre, between the south and Port Chalmers.

8.2 The original designated route – through the Anzide Properties

The original Dunedin Harbour Arterial designation showed the route of the Arterial going through the Anzide Properties site. This alternative is now not considered viable for the following reasons:

- The new designation allows SH88 to approach the Frederick Street intersection on a gentler curvature than the originally designated route. In particular, this ensures suitable forward visibility of the signal heads for traffic approaching the traffic signals from the SH88 Realignment. This now improves a deficiency with the originally designated route
- Design changes to the Frederick Street intersection allowed the Arterial route to avoid the Anzide Properties land. To return the Arterial to this alignment would mean needlessly acquiring some of Anzide Properties' land
- Also, the section of the Arterial constructed as a result of these improvements is now an existing physical resource. To deconstruct and return the alignment to the original route would result in a loss of this road and entail additional cost and resource to reconstruct the road.

8.3 Status quo – Temporary Access Arrangements becoming Permanent

This option involves taking the temporary measures in place for access to the Anzide Properties and making them permanent.

The current temporary measures include:

- The closure of Ward Street Overbridge on ramp adjacent to Anzide Properties
- The lights at the SH88/Frederick Street/Ward Street intersection not being utilised
- A dedicated slip lane into Anzide Properties Ward Street access from the SH88 Realignment.

This temporary layout was designed to provide satisfactory access to the Anzide Properties, with Ward Street being closed to allow trucks to use this area for reverse manoeuvres. This is not considered appropriate as a permanent solution for the following reasons:

- The status quo is not a safe or efficient option for the Frederick Street intersection, as vehicles turning from Frederick Street and Anzac Avenue are currently negotiating significant opposing traffic flows. As noted in Section 3 above, this has been resulting in a number of crashes. These flows and turning movements would be made safer by the utilisation of the intended traffic signals for this intersection
- There are currently no pedestrian crossing facilities at the intersection and therefore the current arrangement does not provide a safe arrangement for pedestrians
- The continued closure of the Ward Street over bridge on ramp inconveniences the industrial area across the railway line and has meant that vehicles wanting to travel from Frederick Street/Anzac Avenue/Arterial to this area have been forced to find alternative routes. In particular, we note that the intersections of both Ward Street ramps with Anzac Avenue include very acute turns (see Photographs 5 to 7 at Appendix C). If both of these connections are available, then drivers will generally be able to avoid the acute turns, but with the current situation, the alternative is not possible.

8.4 Options for Anzide Properties

8.4.1 Slip lane

A temporary slip lane that could have become a permanent option was considered by the Council, NZTA and Anzide Properties traffic experts, in a joint affidavit to the High Court. The slip lane location would have been from the Arterial to 80 Anzac Avenue, at a point west of the Council property boundary common with the boundary of 80 Anzac Avenue. This alternative was rejected by the experts as there were on-going concerns about the speed of trucks coming into the site from the Arterial along the slip lane.

8.4.2 Option 2 G

Option 2 G included a number of sub options including:

- A one way lane/road on Council land, from the Arterial to the boundary of Anzide Properties, or
- A two way lane/road with one lane on Council land and the other on Anzide Properties land from the Arterial to the Anzide Properties property boundary.

This option and the associated alternatives were rejected by Anzide Properties because of various safety concerns, and the potential loss of some Anzide land.

8.5 2012 Consultation Scheme

The scheme now proposed differs from that subject to consultation in the following respects:

- The pedestrian crossing of SH88, previously proposed immediately to the east of the intersection with Frederick Street/Ward Street, has now been removed
- The existing cycle refuge of the SH88 Realignment, east of Anzac Avenue, is to be retained
- The Ward Street pedestrian crossing is now to be called during a different signal phase.

The reasons for these changes were as follows:

- Concerns were expressed by Anzide Properties at the lack of a pedestrian crossing across the Anzide Properties access off Ward Street. Given that a pedestrian crossing of Ward Street is now proposed, the crossing of the SH88 Realignment, previously proposed, has now been removed. As a result, it is now unlikely that pedestrians will be crossing in front of the Anzide Properties access, as pedestrians will instead use the pedestrian crossings of Anzac Avenue and Ward Street. From observation, this is the current pedestrian desire line, so the removal of the crossing of the SH88 Realignment is not considered to be a deficiency
- The 2012 Consultation scheme proposed the removal of the existing cycle refuge of the SH88 Realignment, east of Anzac Avenue, in order to increase the right turn bay for vehicles turning into the proposed access to 80 Anzac Avenue, off the SH88 Realignment. A route would still be provided for cyclists from Parry Street to Anzac Avenue, but Anzide Properties raised concerns about this issue, and NZTA also asked that the cycle refuge should be retained. Section 7.5 above addresses the question of the adequacy of the right turn bay, as now proposed
- It was suggested that the pedestrian crossing of Ward Street should be called at the same time as traffic exiting the Anzide Properties sites, instead of during phase E, which would have required left turns from the SH88 Realignment to be held. This change has been made and the assessment at Section 7.4 reflects the revised signal phasing.

9 SUMMARY

This report has provided a transport assessment relating to two designations required to facilitate the completion of the State Highway (SH) 88 Realignment, in the vicinity of Anzac Avenue and the western end of Parry Street West, to support the Notice of Requirement for the proposed designations.

The SH88 Realignment forms part of the proposed Harbour Arterial, a proposal supported in the Council's Transportation Strategy and the New Zealand Transport Agency's National State Highway Strategy. The route is considered to be of major strategic importance to Dunedin City as it links Port Chalmers and North Dunedin with the Southern Motorway.

The SH88 realignment component of the Harbour Arterial was brought forward due to the proposal to develop the new Forsyth Barr stadium for Dunedin in time for the 2011 Rugby World Cup and the desire to remove heavy traffic (and trucks in particular) from that part of the city. The Council made the decision to construct the stadium in February 2009, and the realignment was opened for traffic in July 2011, in time for the World Cup which was held in September-October of that year.

The two designations are summarised as follows:

- Designation 1 seeks to re-designate those areas of the Arterial that have already been constructed but whose original designation was quashed by the High Court in October 2011. A stormwater pond system area has also been included within Designation 1
- Designation 2 relates to a proposed new access road, from the Arterial to 80 Anzac Avenue.

While the SH88 Realignment is mainly operational, there is currently a temporary layout in the vicinity of the intersection of SH88 with Frederick Street/Ward Street. The traffic signals are not operational and Ward Street has been closed, with temporary signs and barriers allowing local access only into the Anzide Properties sites off Ward Street[17].

The need for the temporary layout at the SH88/Frederick Street/Ward Street intersection is due, to a significant extent, to the issues incurred with access to the Anzide Properties. The provision of a secondary access to 80 Anzac Avenue will remove the need for trucks to reverse within the public road, allowing Ward Street to be reopened, and in turn allowing the traffic signals to become operational. This will enable the full benefits of the SH88 Realignment project to be realised, including safety benefits at the SH88/Frederick Street/Ward Street intersection, and it will reduce the current pressure on the western Ward Street ramp.

We are aware that the owner of 80 Anzac Avenue has previously raised concerns with the proposals. Our understanding of the main concerns raised and our response to each of these issues is as follows:

- **Reversing into the site:** it is accepted that the left turn into the site from the SH88 Realignment into the Ward Street access is acute. However, it will no longer be necessary for trucks to reverse into the site, as a result of the provision of a secondary access to the site, off the SH88 Realignment
- **Inadequate phase time for traffic exiting the site via the new traffic signals:** this report has provided details of the likely operation of the signals, based on SIDRA modelling. This modelling provides average phase times on the basis of the overall balance of flows, which indicates that, on average, the Anzide Properties access will normally only require short green times. However, the pedestrian crossing of Ward Street is assumed to run at the same time as the signal phase for traffic exiting the Anzide Properties, and this pedestrian crossing will require 12 seconds. This is therefore the green time allocated to traffic exiting the Anzide Properties in the SIDRA modelling. In reality, the phase times will be constantly fluctuating as demands on each approach dictate, and as the various pedestrian crossings are or are not called during any particular signal cycle. Therefore this 12 second green time will be able to be allocated to the Anzide Properties access, in the peak hour, even when the pedestrian crossing is not called, to accommodate the possibility of two trucks wishing to leave at the same time. Dunedin City Council should monitor the intersection and, after a settling in period, consider reoptimising the signal phasing (including the maximum phase times) as much as practical
- **Blocking of the intersection, when a truck waiting to exit the site blocks another truck seeking to enter the site (via the Ward Street entrance):** this report has set out the results of probability analysis, which indicates that such an event will happen extremely infrequently – especially as some vehicle movements heading to/from Anzac Avenue can be expected to divert to the proposed secondary access

[17] 70, 76 and 80 Anzac Avenue

- **Pedestrian conflicts at the Ward Street entrance:** no pedestrian crossing is proposed, across the site access. This is not uncommon for signalised entrances to private premises and we do not consider this to be a problem. The pedestrian crossing of the SH88 Realignment (on the eastern side of the intersection) previously proposed has now been removed, as a crossing is to be provided across Ward Street, which from observation is the current pedestrian desire line. As a result, it is considered unlikely that pedestrians will wish to cross in front of the Anzide Properties access
- **Queueing at the secondary access:** the analysis indicates that the right turn into the proposed secondary access off the SH88 Realignment will operate with a very low degree of saturation, of around 2%, with modest delays of around 15-16 seconds in the peak hours in 2021. A truck will be able to sit within the median, to wait for safe gaps in oncoming traffic, and the frequency of the event of two trucks arriving at the same time (ie the second truck arriving within 16 seconds of the first) is considered to be extremely rare.

9.1 Conclusions

This report has set out the objectives of the Harbour Arterial project, and those of the two specific designations that are subject to this Notice of Requirement in particular. The proposed designations are reasonably necessary to achieve the objectives, from a traffic management point of view, since:

- The proposed designations will connect the existing designations, so that the road can function as an arterial
- The proposed designations will provide an improved solution at the intersection of the SH88 Realignment with Frederick Street/Ward Street, which will significantly improve the safety of the intersection, both relative to the current (temporary) situation and to the previous situation
- This assessment has demonstrated that the proposed intersection of the SH88 Realignment with Frederick Street/Ward Street will operate efficiently, and the proposed secondary access to 80 Anzac Avenue will accommodate those left turning movements by large trucks which cannot satisfactorily be accommodated via the Ward Street access.

APPENDIX A Curriculum Vitae for Ian Clark

flow
TRANSPORTATION SPECIALISTS

curriculum vitae

Ian Clark

Director

Bachelor of Arts (Hons) in Geography, University of Wales (1986)
Master of Science in Transport, University of London (1987)
Diploma from Imperial College in Transport (1987)

Chartered Member of Institute of Logistics and Transport
Member of Transportation Group of the IPENZ
Member of Australian Institute of Traffic Planning and Management
Member of Chartered Institution of Highways and Transportation
Board Member of Trips Database Bureau
Chairman of New Zealand Modelling User Group

Career Summary	*Ian is a Director of Flow Transportation Specialists Limited. He has twenty five years experience in transport planning and modelling, in the United Kingdom and New Zealand. Over the past fifteen years in New Zealand, he has been involved in many different types of traffic and transportation projects, predominantly for local authorities and central government agencies. Ian's experience includes strategic transportation planning, transport and traffic modelling using a variety of modelling suites, traffic and transport assessments of the effects of developments, and bus, cycle and pedestrian projects. He has particular experience in undertaking independent reviews and in providing expert evidence and he has experience in working throughout New Zealand*
Professional History	October 2005 to present – Flow Transportation Specialists Ltd Director November 1997 to September 2005 – Opus International Consultants Ltd Group Manager, Transport Planning (2000 - 2005) Work Group Manager, Transport Planning (1999-2002) Senior Transport Planner (1997 – 1999) July 1992 to October 1997 – Bettridge Turner and Partners Ltd; London Associate Director (1995-1997) Principal Transport Planner (1992 – 1995) 1987 to 1992 – JMP Consultants Ltd, London Senior Transport Planner (1990 - 1992) Senior Assistant (1989-1990) Assistant (1987-1989)

Examples of projects on the South Island

- Presented transport planning evidence for Transit New Zealand (and more recently New Zealand Transport Agency) at the Section 293 Environment Court Hearings related to the proposed development of the Applefields site, Belfast, north Christchurch (2006-11). This included an assessment of the effects of the Western Belfast Bypass on traffic conditions along Main North Road and Johns Road and it was this project that led to the (then) concept of an Interim Bypass

- Responsible for undertaking traffic modelling, as sub consultants to URS, for the SH1/Memorial Avenue interchange, for NZTA (2010-2011) and for preparing a transport assessment of the effects of the project, partly based on outputs from the Christchurch Transport Model
- Submitted transport planning evidence to the Environment Court on Change 1, for New Zealand Transport Agency (2010-11). Included an assessment of the function of the state highways within the wider Christchurch area, a review of previous strategic studies, the identification of deficiencies in the operation of the network and strategic outputs from the CTM. Provided rebuttal evidence in response to the evidence of various submitters, and supplementary evidence on the preliminary assessments of effects of the Canterbury earthquakes
- Provided transport planning and traffic modelling advice to the McConnell Dowell consortium for the Christchurch Southern Motorway Extension tender phase in 2009. Undertook peer review of the traffic signals design report prepared by the successful consortium in 2010
- Assisted NZTA to assess Plan Change 22, for retail development adjacent to Main North Road, Christchurch (2009) and Plan Change 30, for development at Prestons Road, Marshlands (2010-11). Provided evidence to council hearings

Other projects

- Recently prepared transport planning evidence for Auckland Transport, to support the Notice of Requirement for the Albany Highway upgrade project, demonstrating the need for the project (June 2012)
- Responsible for using the Auckland City Centre SATURN traffic model to test the effects of emerging proposals from the City Centre Masterplan, for Auckland Transport. Responsible for subsequent assessments using the model, to assist in understanding the effects of options for Quay Street (including options for narrowing Quay Street or operating Quay Street/Customs Street as a one way pair), the Victoria Street Linear Park and options for Federal Street (2011)
- Responsible for the transportation planning of the Wynyard Quarter Plan Change, for Auckland City (2005-2010), including the development of a SATURN model, preparation of an Integrated Transport Assessment, presentation of evidence and negotiations with appellants. Also responsible for reviews of various development applications in this area (2010-2011)
- Responsible of assessing the predicted effects of SH20 Waterview Extension, for Auckland City Council (2005-2010). Included giving advice on route and interchange options, area wide effects and identification of complementary measures. Provided evidence for Auckland Council/Auckland Transport at the Environmental Protection Agency hearing in 2011
- Undertook an independent review of the proposal for mixed use development on Orakei Peninsula. The review considered the effects of the development and the scope of road works proposed to mitigate the effects. The work was undertaken for Auckland City Council in 2009, but required significant liaison with the local residents group. Presentations were made to the local community board and at a public meeting. Subsequently acted as part of the council reporting planning team
- Undertook an independent review of "the Easton Park Parade question", an issue on Auckland's North Shore, where there was local support for a long standing proposal to restrict through traffic along a local road. This review required consideration of the long standing history and commitments made, and recommendations regarding the way ahead. The work was undertaken for North Shore City Council in 2006, but included convening meetings with the local community board and local residents groups, along with presentations to the full council
- Reviewed the SATURN model developed to assess the Transmission Gully project, for Transit NZ/NZTA (2006-2010). Responsible for a review of the Transport Assessment in 2010-11
- Responsible for peer reviews of traffic modelling and economic assessments in the Tauranga area, for NZTA, including the Tauranga Eastern Link (2006-2010), Harbour Link (2005), Pyes Pa Bypass (2007), Girven Road / Maunganui Road intersection (2010) and Tauriko Bypass (2010-11)

- Responsible for SATURN traffic modelling of Additional Waitemata Harbour Crossing, for NZTA (2010), including assessments of the effects on the local road network
- Chairman of independent review team, responsible for a review of the timing and packaging of the AMETI project, for Auckland City Council (2008). Responsible for the subsequent detailed reviews of the traffic modelling and economic analysis of elements of the AMETI project (2009-2010)
- Responsible for assessing the predicted effects of Victoria Park Tunnel project, for Auckland City Council (2005-2008), including review of the predicted effects of temporary layouts during construction (2010). Acted as part of the council's reporting planning team
- Responsible for peer review of the development and testing of the Waikato Regional Transport Model, for Environment Waikato (2006-2010)
- Responsible for the transport planning and traffic modelling of the Manukau Harbour Crossing project, including economic analysis, for Transit NZ/NZTA, through the Strategy Study (2000-2002) and Scheme Assessment (2003-2005) and consenting (2005-2007) stages. Provided evidence to the council hearings
- Responsible for transport planning and modelling of elements of SH1 Northern Busway, including Esmonde Interchange upgrade, for Transit NZ (1999-2002). Presented evidence to council and environment court hearings

APPENDIX B Plans of SH88 Realignment

300 mm
200
100
50
10 mm
0

1:1 @ A1
0 10 20 30 40 50 60 70 80 90 100 mm

Revision	Amendment	Approved	Revision Date
R1	DIMENSIONS ADDED		17/9/12
R2	Island to be left in place	D.D.	17/10/12

DUNEDIN CITY COUNCIL
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Drawn	Designed	Approved	Revision Date
D.Dickson		R Underwood	17/09/12

Project
DUNEDIN CITY COUNCIL
HARBOUR ARTERIAL STADIUM BYPASS
SH88 REALIGNMENT

Sheet
LINK ROAD PROPOSAL

Project No.	Scale	Drawing No.	Sheet. No.	Revision
6CD026.00	1:500 @ A1	7/583/154/3704	1	R2

Original Sheet Size A1 [841x594] Plot Date 17/10/12 @ 16:31 g:\dunedin city council\projects\6cd026.00 sh88 redesignaton\layout plan r3.dwg - Plan

Phase	PHASE A	PHASE B	PHASE C	PHASE D	PHASE E
Signal Group	16 P1 2 1	13 P4 7	P3 14 5	6 4	6 3 1

PHASING SEQUENCE

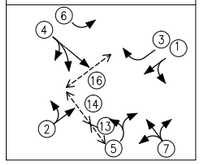
A : B : C : D : E
A : B : C : D1: E

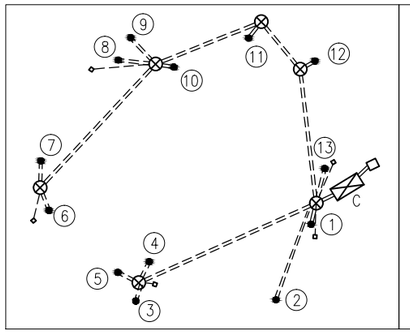
Pedestrian protection of movement P1 provided for the period of walk time by late start of vehicle SG (2)
Pedestrian protection of movement P4 provided for the period of walk time by late start of vehicle SG (7)

SIGNAL PHASING and SIGNAL GROUPS

NTS

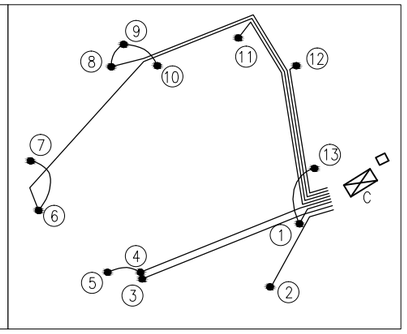
SIGNAL GROUPS





DUCTING DIAGRAM

NTS



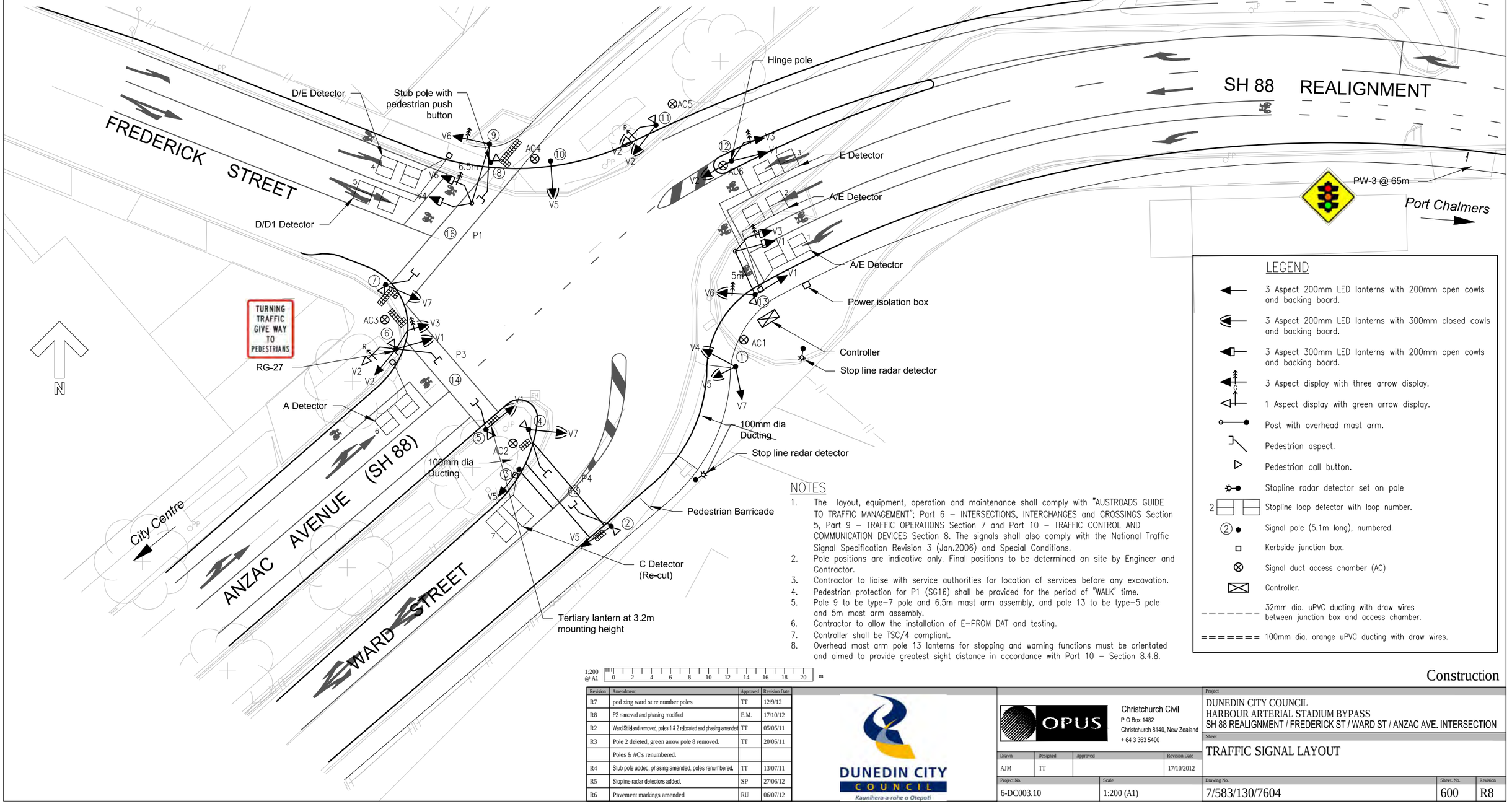
CABLING DIAGRAM

NTS

CABLING RUNS

C 29c to P1, 29c to P13
C 29c to P4, 29c to P5
C 29c to P12
C 29c to P11
C 29c to P8, 29c to P9 to 29c to P10
C 29c to P6, 29c to P7
C 29c to P2 (rev 7)
C 29c to P3 (rev 7)

Note: All loop feeders back to controller (not shown)
Duct locations are approximate only.



NOTES

1. The layout, equipment, operation and maintenance shall comply with "AUSTROADS GUIDE TO TRAFFIC MANAGEMENT"; Part 6 – INTERSECTIONS, INTERCHANGES and CROSSINGS Section 5, Part 9 – TRAFFIC OPERATIONS Section 7 and Part 10 – TRAFFIC CONTROL AND COMMUNICATION DEVICES Section 8. The signals shall also comply with the National Traffic Signal Specification Revision 3 (Jan.2006) and Special Conditions.
2. Pole positions are indicative only. Final positions to be determined on site by Engineer and Contractor.
3. Contractor to liaise with service authorities for location of services before any excavation.
4. Pedestrian protection for P1 (SG16) shall be provided for the period of "WALK' time.
5. Pole 9 to be type–7 pole and 6.5m mast arm assembly, and pole 13 to be type–5 pole and 5m mast arm assembly.
6. Contractor to allow the installation of E–PROM DAT and testing.
7. Controller shall be TSC/4 compliant.
8. Overhead mast arm pole 13 lanterns for stopping and warning functions must be orientated and aimed to provide greatest sight distance in accordance with Part 10 – Section 8.4.8.

LEGEND

- 3 Aspect 200mm LED lanterns with 200mm open cowls and backing board.
- 3 Aspect 200mm LED lanterns with 300mm closed cowls and backing board.
- 3 Aspect 300mm LED lanterns with 200mm open cowls and backing board.
- 3 Aspect display with three arrow display.
- 1 Aspect display with green arrow display.
- Post with overhead mast arm.
- Pedestrian aspect.
- Pedestrian call button.
- Stopline radar detector set on pole
- 2 Stopline loop detector with loop number.
- (2) Signal pole (5.1m long), numbered.
- Kerbside junction box.
- Signal duct access chamber (AC)
- Controller.
- 32mm dia. uPVC ducting with draw wires between junction box and access chamber.
- 100mm dia. orange uPVC ducting with draw wires.

1:200 @ A1 — 0 2 4 6 8 10 12 14 16 18 20 m

Construction

Revision	Amendment	Approved	Revision Date
R7	ped xing ward st re number poles	TT	12/9/12
R8	P2 removed and phasing modified	E.M.	17/10/12
R2	Ward St island removed, poles 1 & 2 relocated and phasing amended	TT	05/05/11
R3	Pole 2 deleted, green arrow pole 8 removed.	TT	20/05/11
	Poles & AC's renumbered.		
R4	Stub pole added, phasing amended, poles renumbered.	TT	13/07/11
R5	Stopline radar detectors added,	SP	27/06/12
R6	Pavement markings amended	RU	06/07/12

DUNEDIN CITY COUNCIL
Kaunihera-a-rohe o Otepoti

OPUS
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Christchurch 8140, New Zealand
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Drawn	Designed	Approved	Revision Date
AJM	TT		17/10/2012

Project
DUNEDIN CITY COUNCIL
HARBOUR ARTERIAL STADIUM BYPASS
SH 88 REALIGNMENT / FREDERICK ST / WARD ST / ANZAC AVE. INTERSECTION

Sheet
TRAFFIC SIGNAL LAYOUT

Project No.	Scale	Drawing No.	Sheet. No.	Revision
6-DC003.10	1:200 (A1)	7/583/130/7604	600	R8

Original Sheet Size A1 [841x594] Plot Date 17/10/12 @ 16:14 g:\dunedin city council\projects\6cd026.00 sh88 redesignaton\signals\7-583-130-7604_600-traffic signal r8.dwg - 1

APPENDIX C Photographs of Existing Situation

Photograph 1, showing SH88 Realignment from opposite Anzac Avenue

Photograph 2, showing temporary closure of Ward Street, with left turn lane for access only

Photograph 3, showing approach to SH88/Frederick Street intersection from Anzac Avenue

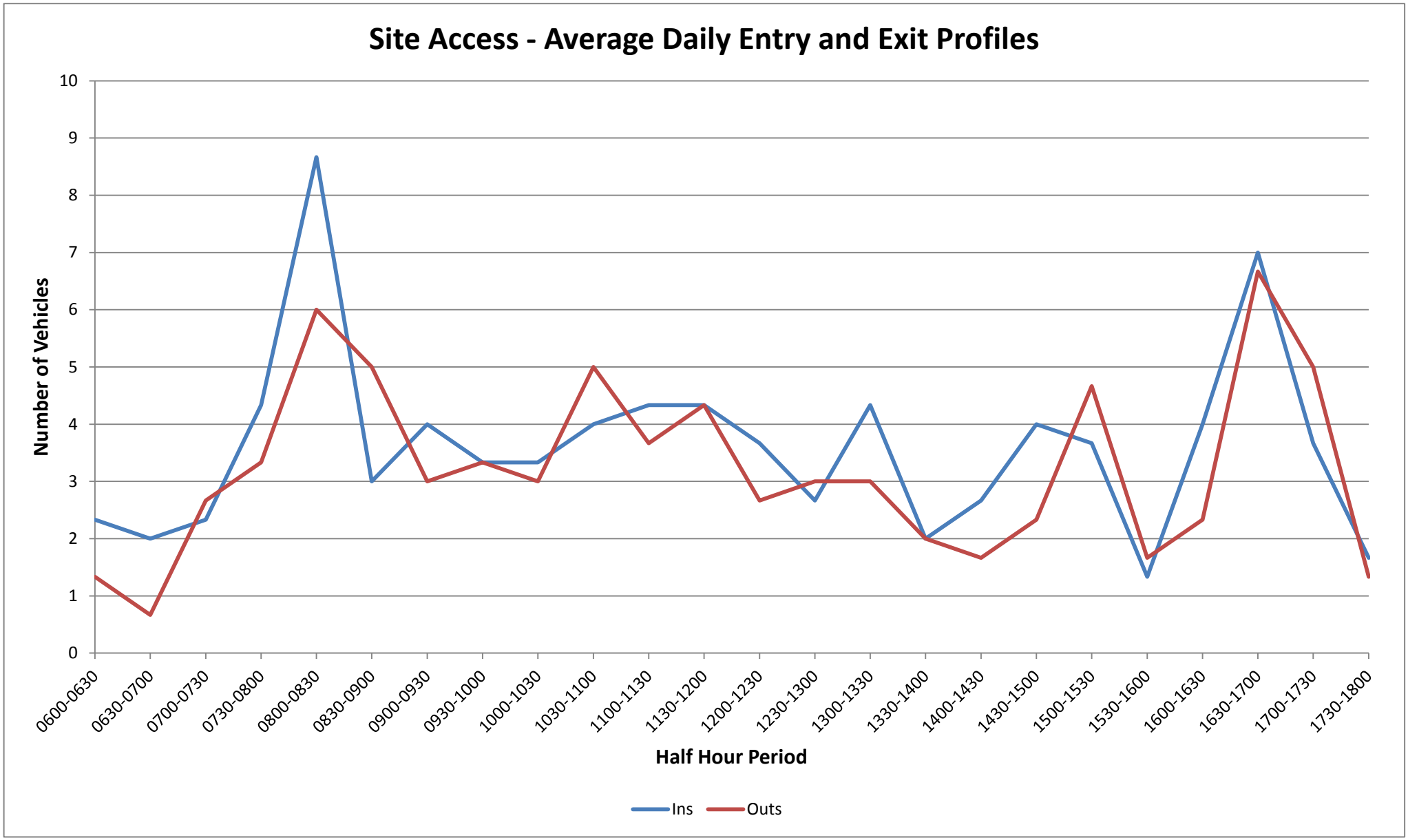
Photograph 4, from SH88/Frederick Street intersection, showing realignment of SH88 away from Anzac Avenue

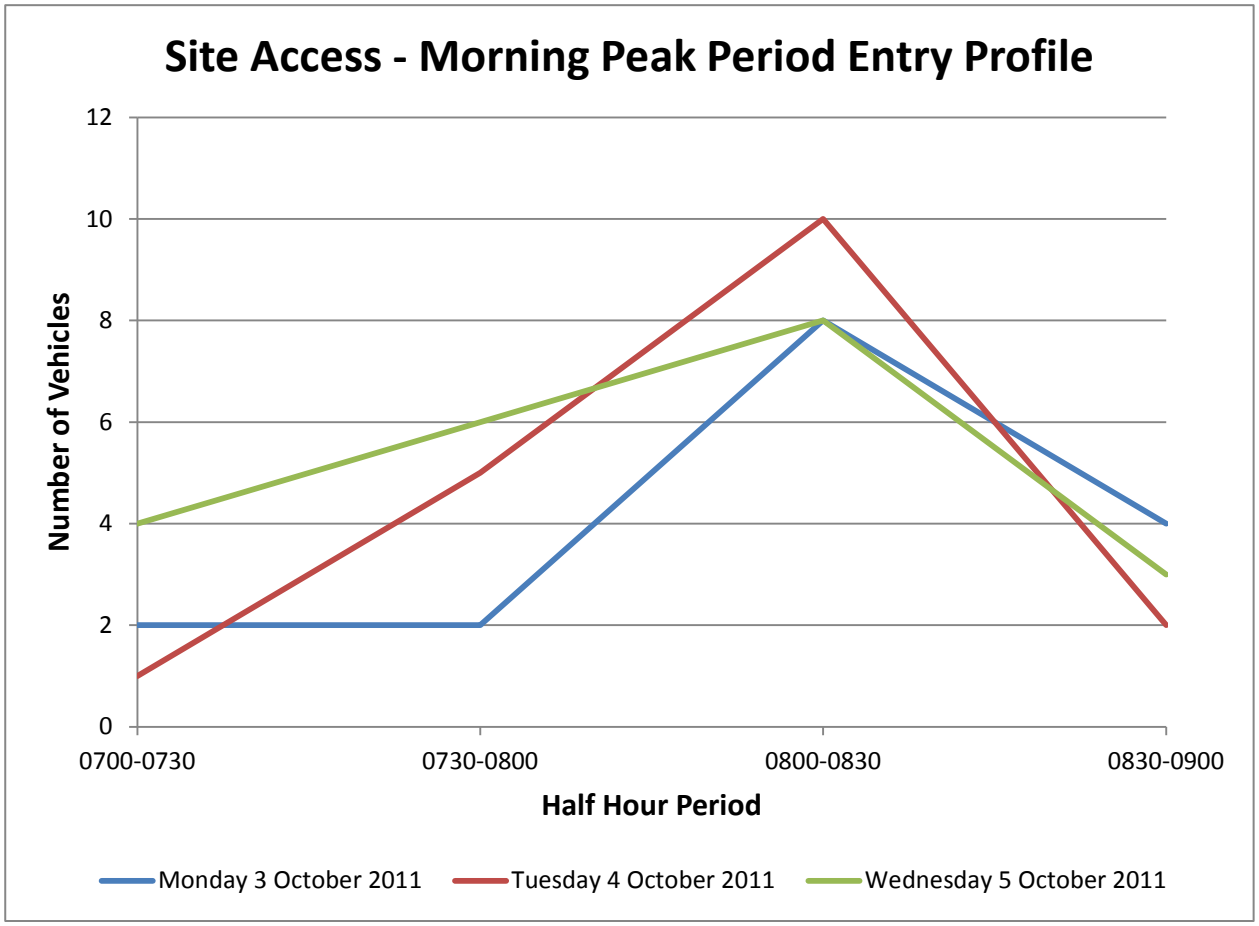
Photograph 5, showing a vehicle approaching Anzide Properties, and about to reverse in, via Ward Street

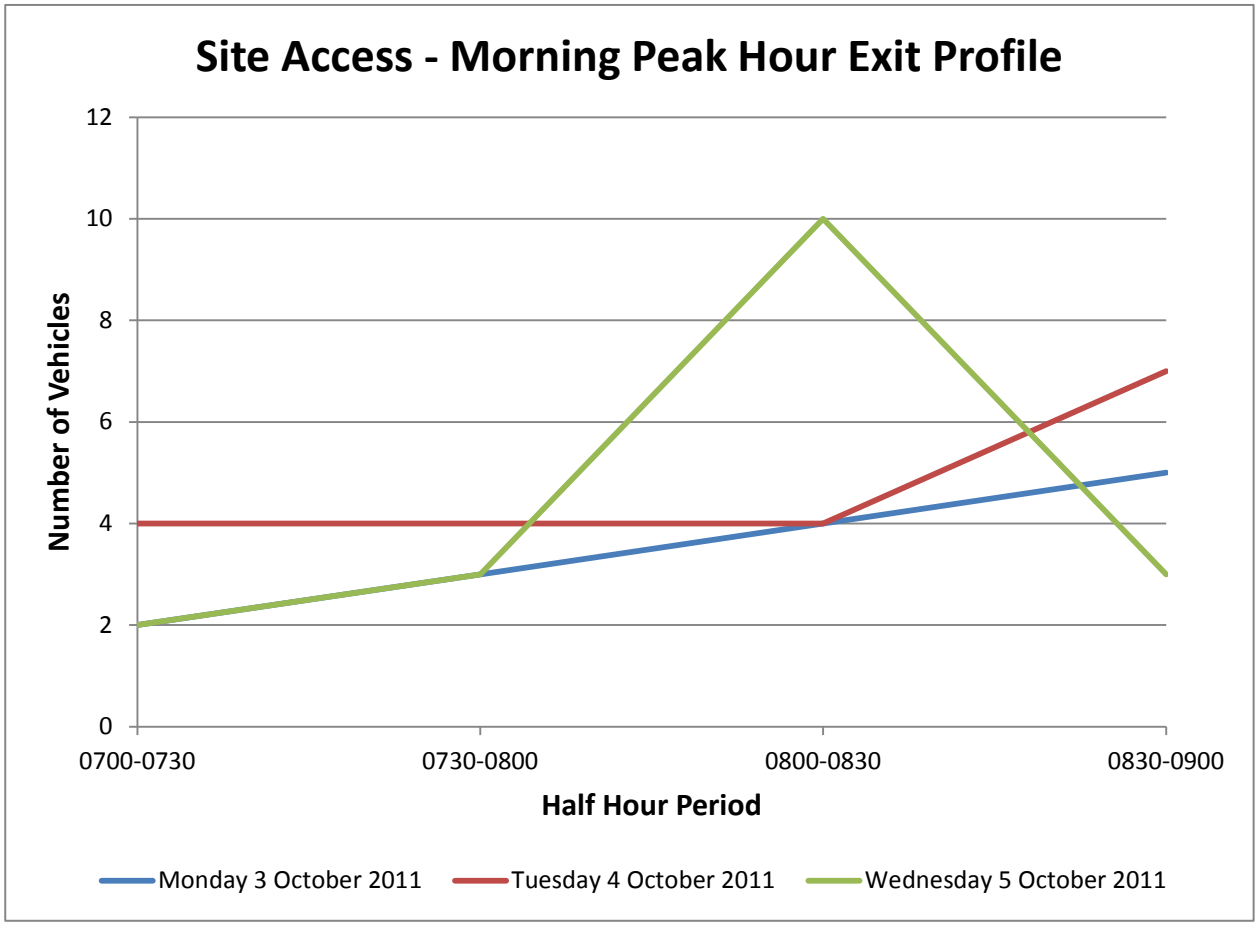
Photograph 6, showing a vehicle using the closed section of Ward Street to reverse into the Hall Bros site

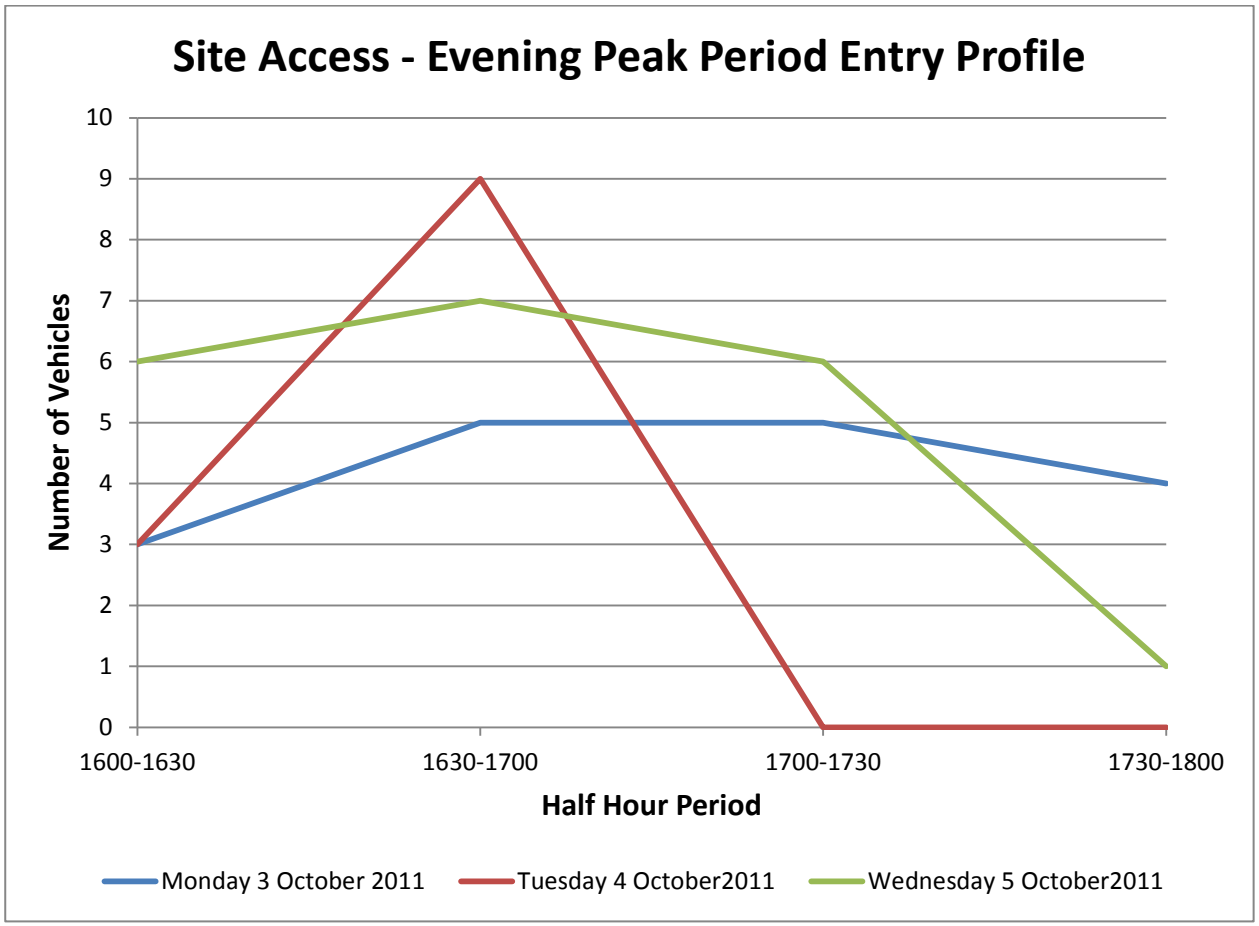
Photograph 7, showing the acute turns at the intersection of Ward Street (west) with Anzac Avenue

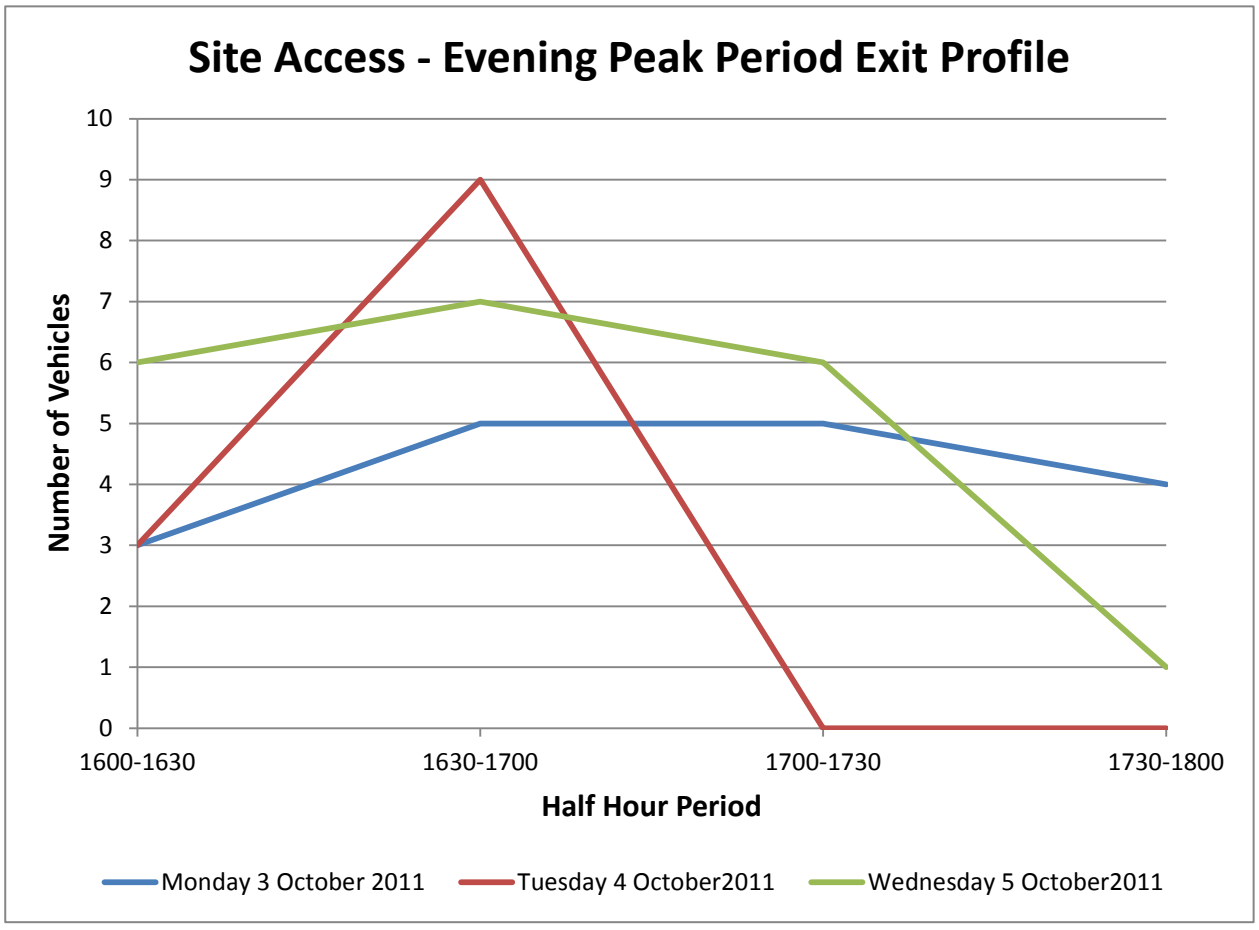
APPENDIX D Traffic Flows to/from Anzide Properties sites


Site Access - Average Daily Entry and Exit Profiles
Number of Vehicles
0
1
2
3
4
5
6
7
8
9
10
0600-0630
0630-0700
0700-0730
0730-0800
0800-0830
0830-0900
0900-0930
0930-1000
1000-1030
1030-1100
1100-1130
1130-1200
1200-1230
1230-1300
1300-1330
1330-1400
1400-1430
1430-1500
1500-1530
1530-1600
1600-1630
1630-1700
1700-1730
1730-1800
Half Hour Period
Ins
Outs

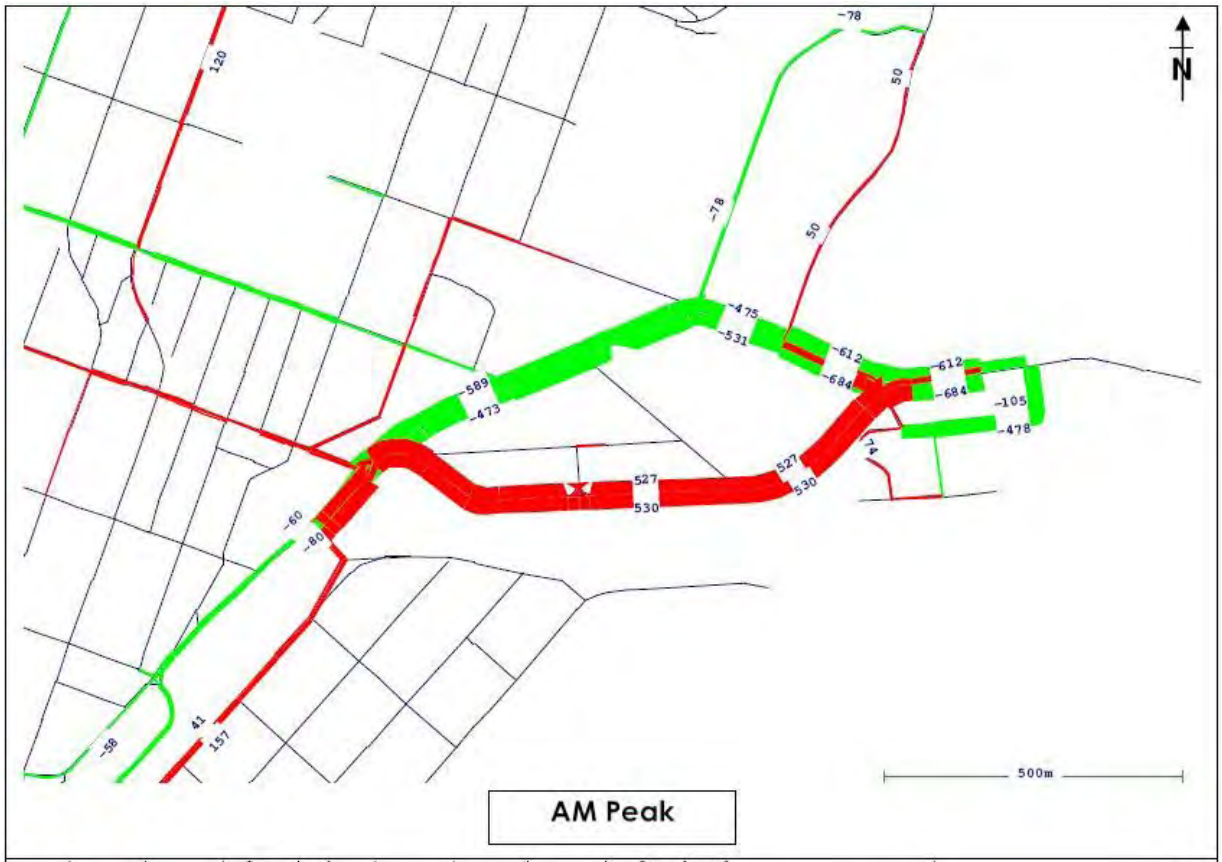

Site Access - Morning Peak Period Entry Profile
Number of Vehicles
0
2
4
6
8
10
12
0700-0730
0730-0800
0800-0830
0830-0900
Half Hour Period
Monday 3 October 2011
Tuesday 4 October 2011
Wednesday 5 October 2011

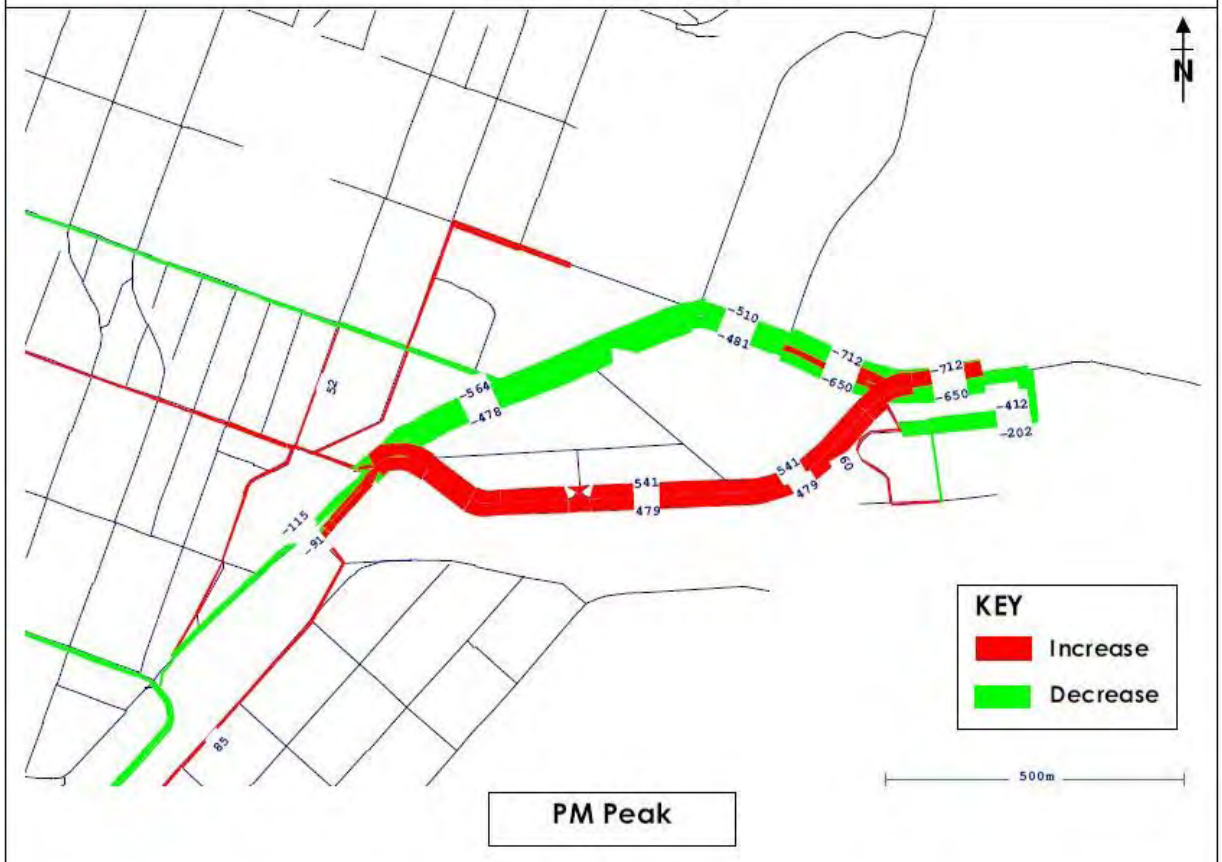

Site Access - Morning Peak Hour Exit Profile
Number of Vehicles
0
2
4
6
8
10
12
0700-0730
0730-0800
0800-0830
0830-0900
Half Hour Period
Monday 3 October 2011
Tuesday 4 October 2011
Wednesday 5 October 2011


Site Access - Evening Peak Period Entry Profile
Number of Vehicles
0
1
2
3
4
5
6
7
8
9
10
1600-1630
1630-1700
1700-1730
1730-1800
Half Hour Period
Monday 3 October 2011
Tuesday 4 October2011
Wednesday 5 October2011

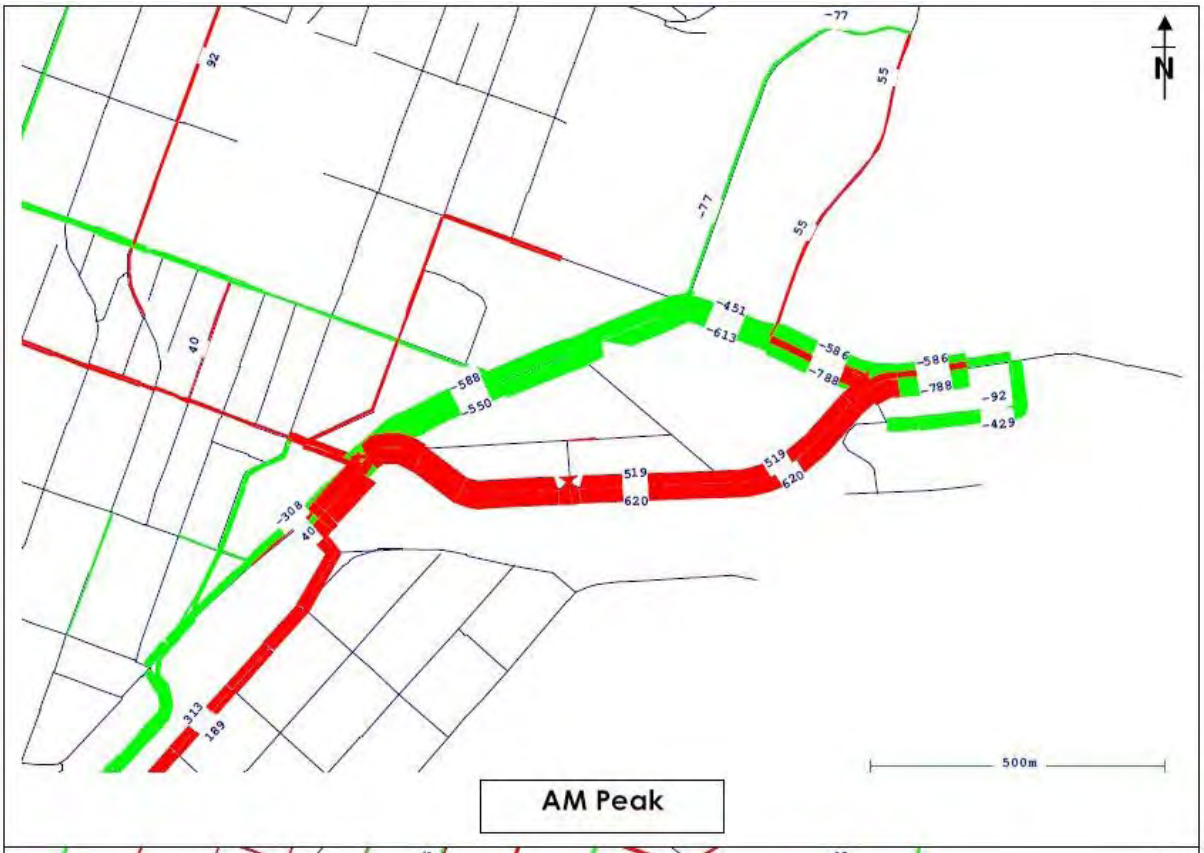

Site Access - Evening Peak Period Exit Profile
Number of Vehicles
0
1
2
3
4
5
6
7
8
9
10
1600-1630
1630-1700
1700-1730
1730-1800
Half Hour Period
Monday 3 October 2011
Tuesday 4 October2011
Wednesday 5 October2011

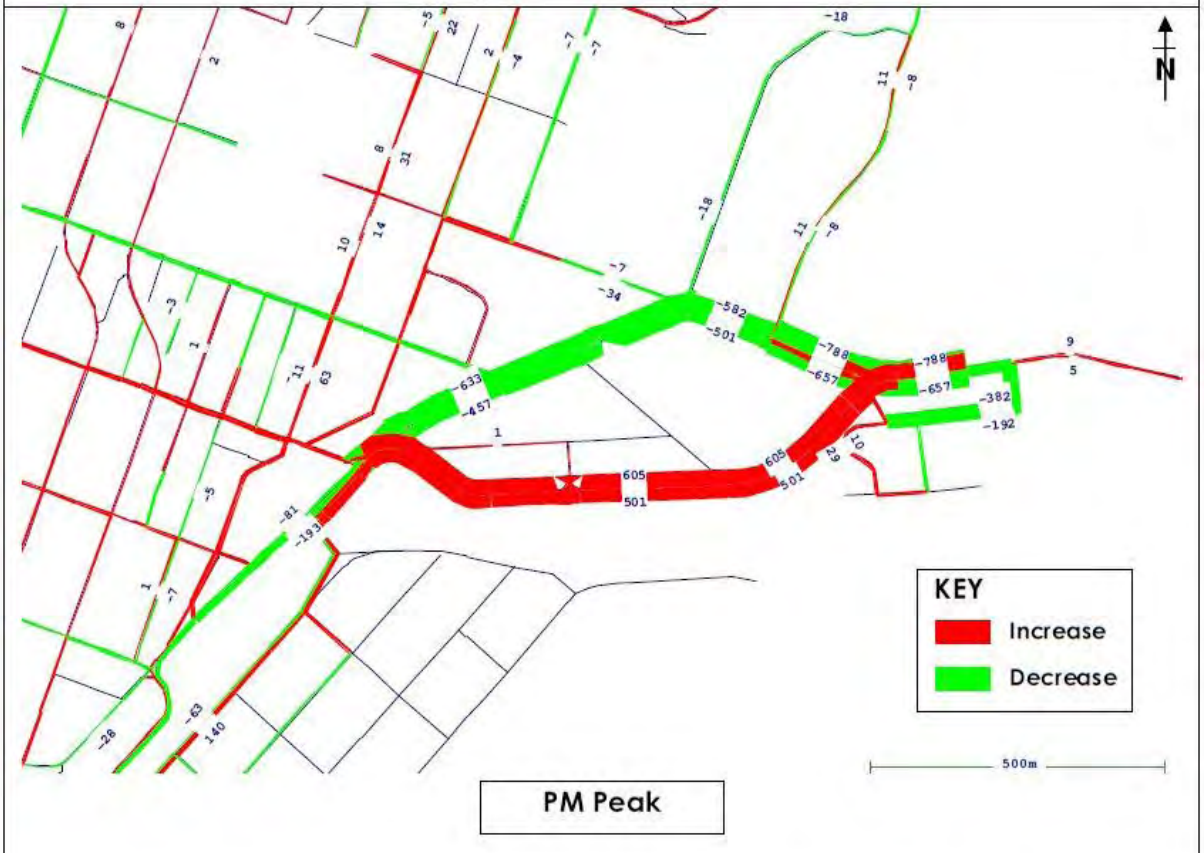
APPENDIX E Predicted Effects of SH88 Realignment





Dunedin Transportation Model	**2006 Change in Traffic Volumes With SH88 Realignment**	**Figure 7**
Gabites Porter		





Dunedin Transportation Model Gabites Porter	**2021 Change in Traffic Volumes With SH88 Realignment**	**Figure 10**

APPENDIX F SIDRA Results

Scenario 1: All Pedestrian Crossings Called

Figure 3: 2006 Morning Peak: No Pedestrian Crossing on SH88 Realignment

MOVEMENT SUMMARY

Site: 2006 AM 5 phase Without Art & Halls, Ward Peds, No SH88 Peds

SH88/Frederick/ANZAC signalised Without Arterial - 5 phase split
With Ward St Ped Crossing, no SH88 crossing
Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ward St South leg											
1	L	84	0.0	0.919	70.4	LOS E	30.0	210.1	1.00	1.06	18.6
3	R	346	0.3	0.919	69.4	LOS E	30.0	210.1	1.00	1.06	18.7
Approach		431	0.2	0.919	69.6	LOS E	30.0	210.1	1.00	1.06	18.7
South East: Hall's Private Access											
21	L	11	100.0	0.111	63.3	LOS E	0.8	9.6	0.94	0.70	21.8
22	T	2	100.0	0.111	55.3	LOS E	0.8	9.6	0.94	0.66	21.0
23	R	1	0.0	0.111	61.3	LOS E	0.8	9.6	0.94	0.70	20.4
Approach		14	92.3	0.111	61.9	LOS E	0.8	9.6	0.94	0.69	21.6
North East: SH88 Realignment East Leg											
24	L	64	1.6	0.172	42.9	LOS D	2.9	20.9	0.82	0.72	24.6
25	T	386	0.0	0.811	50.5	LOS D	22.8	159.4	1.00	0.94	21.8
26	R	77	0.0	0.819	72.2	LOS E	5.0	35.0	1.00	0.91	19.2
Approach		527	0.2	0.819	52.7	LOS D	22.8	159.4	0.98	0.91	21.6
North West: Frederick St NW leg											
27	L	156	0.0	0.509	33.3	LOS C	6.5	45.5	0.76	0.69	28.8
28	T	1	100.0	0.937	69.7	LOS E	31.8	222.8	1.00	1.07	18.3
29	R	438	0.0	0.937	75.1	LOS E	31.8	222.8	1.00	1.07	17.7
Approach		595	0.2	0.937	64.1	LOS E	31.8	222.8	0.94	0.97	19.9
South West: ANZAC Ave SW leg											
30	L	9	0.0	0.653	59.3	LOS E	10.7	74.6	0.97	0.83	21.2
31	T	183	0.0	0.653	53.1	LOS D	10.7	74.6	0.97	0.80	21.2
Approach		193	0.0	0.653	53.4	LOS D	10.7	74.6	0.97	0.80	21.2
All Vehicles		1759	0.9	0.937	60.9	LOS E	31.8	222.8	0.97	0.95	20.2

Figure 4: 2006 Evening Peak: No Pedestrian Crossing on SH88 Realignment

MOVEMENT SUMMARY

Site: 2006 PM 5 phase Without Art & Halls, Ward Peds, No SH88 Peds,

SH88/Frederick/ANZAC signalised Without Arterial - 5 phase split
With Ward St Ped Crossing, no SH88 crossing
Signals - Fixed Time Cycle Time = 95 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ward St South leg											
1	L	96	0.0	0.395	46.2	LOS D	4.7	33.2	0.95	0.78	23.6
3	R	13	8.3	0.395	45.6	LOS D	4.7	33.2	0.95	0.77	23.7
Approach		108	1.0	0.395	46.1	LOS D	4.7	33.2	0.95	0.78	23.6
South East: Hall's Private Access											
21	L	11	100.0	0.088	49.3	LOS D	0.6	7.3	0.91	0.69	24.9
22	T	2	100.0	0.088	41.3	LOS D	0.6	7.3	0.91	0.64	24.0
23	R	1	0.0	0.088	47.3	LOS D	0.6	7.3	0.91	0.70	23.6
Approach		14	92.3	0.088	47.9	LOS D	0.6	7.3	0.91	0.68	24.7
North East: SH88 Realignment East Leg											
24	L	106	1.0	0.183	19.9	LOS B	2.8	19.6	0.60	0.66	33.8
25	T	408	0.0	0.448	18.5	LOS B	12.7	89.2	0.72	0.63	33.3
26	R	26	0.0	0.222	51.5	LOS D	1.2	8.7	0.98	0.71	23.3
Approach		541	0.2	0.448	20.4	LOS C	12.7	89.2	0.71	0.64	32.7
North West: Frederick St NW leg											
27	L	68	0.0	0.226	39.4	LOS D	2.8	19.3	0.89	0.72	26.7
28	T	1	100.0	0.654	51.4	LOS D	3.8	27.0	1.00	0.82	21.4
29	R	76	0.0	0.654	56.8	LOS E	3.8	27.0	1.00	0.82	21.1
Approach		145	0.7	0.654	48.6	LOS D	3.8	27.0	0.95	0.77	23.5
South West: ANZAC Ave SW leg											
30	L	52	0.0	0.839	39.7	LOS D	25.4	177.8	0.94	0.96	26.4
31	T	520	0.0	0.839	33.5	LOS C	25.4	177.8	0.94	0.91	26.5
Approach		572	0.0	0.839	34.1	LOS C	25.4	177.8	0.94	0.91	26.5
All Vehicles		1380	1.1	0.839	31.3	LOS C	25.4	177.8	0.85	0.78	27.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Figure 5: 2021 Morning Peak: No Pedestrian Crossing on SH88 Realignment

MOVEMENT SUMMARY

Site: 2021 AM 5 phase Without Art & Halls, Ward Peds, No SH88 Peds

SH88/Frederick/ANZAC signalised Without Arterial - 5 phase split
With Ward St Ped Crossing, no SH88 crossing
Signals - Fixed Time Cycle Time = 130 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ward St South leg											
1	L	79	0.0	0.989	105.9	LOS F	20.6	146.7	1.00	1.21	14.1
3	R	160	3.3	0.989	105.1	LOS F	20.6	146.7	1.00	1.21	14.1
Approach		239	2.2	0.989	105.4	LOS F	20.6	146.7	1.00	1.21	14.1
South East: Hall's Private Access											
21	L	17	100.0	0.202	69.8	LOS E	1.4	17.8	0.96	0.72	20.6
22	T	4	100.0	0.202	61.8	LOS E	1.4	17.8	0.96	0.70	19.9
23	R	2	0.0	0.202	67.8	LOS E	1.4	17.8	0.96	0.72	19.2
Approach		23	90.9	0.202	68.2	LOS E	1.4	17.8	0.96	0.72	20.3
North East: SH88 Realignment East Leg											
24	L	115	1.8	0.295	37.5	LOS D	5.1	36.5	0.75	0.72	26.3
25	T	426	0.0	0.654	39.8	LOS D	23.0	160.8	0.91	0.80	24.6
26	R	72	0.0	0.827	78.3	LOS E	5.0	35.3	1.00	0.91	18.3
Approach		613	0.3	0.827	43.9	LOS D	23.0	160.8	0.89	0.80	23.9
North West: Frederick St NW leg											
27	L	145	0.0	0.477	31.3	LOS C	6.1	42.4	0.71	0.66	29.5
28	T	2	100.0	0.980	87.8	LOS F	47.7	334.7	1.00	1.12	16.1
29	R	548	0.0	0.980	93.2	LOS F	47.7	334.7	1.00	1.12	15.4
Approach		696	0.3	0.980	80.2	LOS F	47.7	334.7	0.94	1.03	17.2
South West: ANZAC Ave SW leg											
30	L	17	0.0	0.824	59.8	LOS E	24.6	171.9	0.98	0.93	21.1
31	T	382	0.0	0.824	53.6	LOS D	24.6	171.9	0.98	0.91	21.1
Approach		399	0.0	0.824	53.8	LOS D	24.6	171.9	0.98	0.91	21.1
All Vehicles		1969	1.5	0.989	66.5	LOS E	47.7	334.7	0.94	0.95	19.1

Figure 6: 2021 Evening Peak: No Pedestrian Crossing on SH88 Realignment

MOVEMENT SUMMARY

Site: 2021 PM 5 phase Without Art & Halls, Ward Peds, No SH88 Peds

SH88/Frederick/ANZAC signalised Without Arterial - 5 phase split
With Ward St Ped Crossing, no SH88 crossing
Signals - Fixed Time Cycle Time = 100 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ward St South leg											
1	L	116	0.0	0.712	52.7	LOS D	9.1	65.2	1.00	0.87	22.0
3	R	67	7.8	0.712	52.2	LOS D	9.1	65.2	1.00	0.87	22.1
Approach		183	2.9	0.712	52.5	LOS D	9.1	65.2	1.00	0.87	22.1
South East: Hall's Private Access											
21	L	17	100.0	0.155	52.7	LOS D	1.1	13.3	0.93	0.72	24.1
22	T	4	100.0	0.155	44.7	LOS D	1.1	13.3	0.93	0.68	23.2
23	R	2	0.0	0.155	50.6	LOS D	1.1	13.3	0.93	0.72	22.8
Approach		23	90.9	0.155	51.1	LOS D	1.1	13.3	0.93	0.71	23.8
North East: SH88 Realignment East Leg											
24	L	124	1.7	0.220	20.5	LOS C	3.4	24.1	0.60	0.67	33.5
25	T	387	0.0	0.418	18.7	LOS B	12.4	86.5	0.71	0.61	33.3
26	R	33	0.0	0.290	54.7	LOS D	1.6	11.4	0.99	0.72	22.6
Approach		544	0.4	0.418	21.2	LOS C	12.4	86.5	0.70	0.63	32.3
North West: Frederick St NW leg											
27	L	87	0.0	0.297	40.6	LOS D	3.7	25.8	0.89	0.73	26.3
28	T	2	100.0	0.885	60.2	LOS E	7.4	52.8	1.00	1.03	19.8
29	R	129	0.0	0.885	65.6	LOS E	7.4	52.8	1.00	1.03	19.3
Approach		219	1.0	0.885	55.6	LOS E	7.4	52.8	0.96	0.91	21.7
South West: ANZAC Ave SW leg											
30	L	58	0.0	0.825	38.9	LOS D	26.1	183.0	0.92	0.94	26.7
31	T	524	0.0	0.825	32.6	LOS C	26.1	183.0	0.92	0.88	26.8
Approach		582	0.0	0.825	33.3	LOS C	26.1	183.0	0.92	0.88	26.8
All Vehicles		1552	2.0	0.885	34.7	LOS C	26.1	183.0	0.86	0.79	26.8

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Scenario 2: No Pedestrian Crossings Called

Figure 7: 2006 Morning Peak: No Pedestrian Crossings

MOVEMENT SUMMARY — **Site: 2006 AM 5 phase Without Art & Halls, No Peds**

SH88/Frederick/ANZAC signalised Without Arterial - 5 phase split
No Pedestrian Phases
Signals - Fixed Time Cycle Time = 110 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ward St South leg											
1	L	84	0.0	0.843	52.9	LOS D	24.2	170.0	1.00	0.96	22.1
3	R	346	0.3	0.843	51.9	LOS D	24.2	170.0	1.00	0.96	22.2
Approach		431	0.2	0.843	52.1	LOS D	24.2	170.0	1.00	0.96	22.1
South East: Hall's Private Access											
21	L	11	100.0	0.203	66.6	LOS E	0.8	9.6	0.99	0.69	21.2
22	T	2	100.0	0.203	58.6	LOS E	0.8	9.6	0.99	0.69	20.3
23	R	1	0.0	0.203	64.5	LOS E	0.8	9.6	0.99	0.70	19.8
Approach		14	92.3	0.203	65.2	LOS E	0.8	9.6	0.99	0.69	20.9
North East: SH88 Realignment East Leg											
24	L	64	1.6	0.164	41.2	LOS D	2.6	19.6	0.84	0.72	25.1
25	T	386	0.0	0.863	52.5	LOS D	22.5	157.8	1.00	1.02	21.3
26	R	77	0.0	0.751	64.5	LOS E	4.5	31.5	1.00	0.87	20.5
Approach		527	0.2	0.863	52.9	LOS D	22.5	157.8	0.98	0.96	21.6
North West: Frederick St NW leg											
27	L	156	0.0	0.455	28.2	LOS C	5.7	39.7	0.72	0.67	30.7
28	T	1	100.0	0.859	49.2	LOS D	25.3	177.4	1.00	0.97	21.8
29	R	438	0.0	0.859	54.6	LOS D	25.3	177.4	1.00	0.97	21.5
Approach		595	0.2	0.859	47.7	LOS D	25.3	177.4	0.93	0.89	23.5
South West: ANZAC Ave SW leg											
30	L	9	0.0	0.770	60.0	LOS E	10.5	73.7	1.00	0.89	21.1
31	T	183	0.0	0.770	53.7	LOS D	10.5	73.7	1.00	0.89	21.0
Approach		193	0.0	0.770	54.0	LOS D	10.5	73.7	1.00	0.89	21.0
All Vehicles		1759	0.9	0.863	51.2	LOS D	25.3	177.4	0.97	0.93	22.3

Figure 8: 2006 Evening Peak: No Pedestrian Crossings

MOVEMENT SUMMARY — **Site: 2006 PM 5 phase Without Art & Halls, No Peds**

SH88/Frederick/ANZAC signalised Without Arterial - 5 phase split
No Pedestrian Phases
Signals - Fixed Time Cycle Time = 75 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ward St South leg											
1	L	96	0.0	0.727	46.3	LOS D	4.3	30.6	1.00	0.88	23.6
3	R	13	8.3	0.727	45.8	LOS D	4.3	30.6	1.00	0.88	23.6
Approach		108	1.0	0.727	46.3	LOS D	4.3	30.6	1.00	0.88	23.6
South East: Hall's Private Access											
21	L	11	100.0	0.139	45.8	LOS D	0.5	6.4	0.96	0.69	25.9
22	T	2	100.0	0.139	37.8	LOS D	0.5	6.4	0.96	0.67	24.8
23	R	1	0.0	0.139	43.8	LOS D	0.5	6.4	0.96	0.69	24.6
Approach		14	92.3	0.139	44.4	LOS D	0.5	6.4	0.96	0.69	25.6
North East: SH88 Realignment East Leg											
24	L	106	1.0	0.149	14.8	LOS B	2.0	14.3	0.55	0.65	36.9
25	T	408	0.0	0.409	12.4	LOS B	9.3	65.0	0.67	0.58	37.1
26	R	26	0.0	0.175	39.9	LOS D	1.0	6.7	0.96	0.70	26.5
Approach		541	0.2	0.409	14.2	LOS B	9.3	65.0	0.66	0.60	36.3
North West: Frederick St NW leg											
27	L	68	0.0	0.177	28.5	LOS C	2.0	14.3	0.84	0.69	30.6
28	T	1	100.0	0.516	38.6	LOS D	2.9	20.7	1.00	0.76	24.1
29	R	76	0.0	0.516	44.0	LOS D	2.9	20.7	1.00	0.77	24.2
Approach		145	0.7	0.516	36.7	LOS D	2.9	20.7	0.92	0.73	27.0
South West: ANZAC Ave SW leg											
30	L	52	0.0	0.810	31.3	LOS C	19.5	136.2	0.91	0.95	29.5
31	T	520	0.0	0.810	25.1	LOS C	19.5	136.2	0.91	0.88	29.8
Approach		572	0.0	0.810	25.7	LOS C	19.5	136.2	0.91	0.88	29.7
All Vehicles		1380	1.1	0.810	24.1	LOS C	19.5	136.2	0.82	0.75	30.9

Figure 9: 2021 Morning Peak: No Pedestrian Crossings

MOVEMENT SUMMARY

Site: 2021 AM 5 phase Without Art & Halls, No Peds

SH88/Frederick/ANZAC signalised Without Arterial - 5 phase split
No Pedestrian Phases
Signals - Fixed Time Cycle Time = 120 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ward St South leg											
1	L	79	0.0	0.913	76.1	LOS E	16.5	117.5	1.00	1.07	17.7
3	R	160	3.3	0.913	75.3	LOS E	16.5	117.5	1.00	1.07	17.7
Approach		239	2.2	0.913	75.6	LOS E	16.5	117.5	1.00	1.07	17.7
South East: Hall's Private Access											
21	L	17	100.0	0.372	73.5	LOS E	1.4	18.0	1.00	0.72	20.0
22	T	4	100.0	0.372	65.5	LOS E	1.4	18.0	1.00	0.72	19.2
23	R	2	0.0	0.372	71.5	LOS E	1.4	18.0	1.00	0.72	18.6
Approach		23	90.9	0.372	71.9	LOS E	1.4	18.0	1.00	0.72	19.7
North East: SH88 Realignment East Leg											
24	L	115	1.8	0.280	35.6	LOS D	4.8	34.1	0.76	0.72	26.9
25	T	426	0.0	0.666	37.5	LOS D	21.5	150.2	0.92	0.80	25.3
26	R	72	0.0	0.763	70.5	LOS E	4.6	32.0	1.00	0.87	19.5
Approach		613	0.3	0.763	41.0	LOS D	21.5	150.2	0.90	0.80	24.7
North West: Frederick St NW leg											
27	L	145	0.0	0.427	26.5	LOS C	5.3	37.1	0.67	0.64	31.5
28	T	2	100.0	0.905	56.1	LOS E	36.7	257.8	1.00	1.01	20.5
29	R	548	0.0	0.905	61.5	LOS E	36.7	257.8	1.00	1.01	20.1
Approach		696	0.3	0.905	54.2	LOS D	36.7	257.8	0.93	0.93	21.9
South West: ANZAC Ave SW leg											
30	L	17	0.0	0.870	61.0	LOS E	24.3	170.2	1.00	0.98	20.9
31	T	382	0.0	0.870	54.7	LOS D	24.3	170.2	1.00	0.98	20.8
Approach		399	0.0	0.870	55.0	LOS D	24.3	170.2	1.00	0.98	20.8
All Vehicles		1969	1.5	0.913	53.0	LOS D	36.7	257.8	0.94	0.91	21.8

Figure 10: 2021 Evening Peak: No Pedestrian Crossings

MOVEMENT SUMMARY

Site: 2021 PM 5 phase Without Art & Halls, No Peds

SH88/Frederick/ANZAC signalised Without Arterial - 5 phase split
No Pedestrian Phases
Signals - Fixed Time Cycle Time = 80 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ward St South leg											
1	L	116	0.0	0.886	53.9	LOS D	8.5	60.8	1.00	1.07	21.8
3	R	67	7.8	0.886	53.3	LOS D	8.5	60.8	1.00	1.07	21.8
Approach		183	2.9	0.886	53.7	LOS D	8.5	60.8	1.00	1.07	21.8
South East: Hall's Private Access											
21	L	17	100.0	0.248	49.5	LOS D	0.9	11.7	0.97	0.71	24.9
22	T	4	100.0	0.248	41.4	LOS D	0.9	11.7	0.97	0.70	23.9
23	R	2	0.0	0.248	47.4	LOS D	0.9	11.7	0.97	0.72	23.6
Approach		23	90.9	0.248	47.8	LOS D	0.9	11.7	0.97	0.71	24.6
North East: SH88 Realignment East Leg											
24	L	124	1.7	0.186	16.5	LOS B	2.6	18.8	0.58	0.66	35.8
25	T	387	0.0	0.403	14.0	LOS B	9.6	67.3	0.68	0.59	36.0
26	R	33	0.0	0.232	43.1	LOS D	1.3	9.0	0.97	0.71	25.5
Approach		544	0.4	0.403	16.3	LOS B	9.6	67.3	0.68	0.61	35.0
North West: Frederick St NW leg											
27	L	87	0.0	0.239	30.6	LOS C	2.8	19.8	0.85	0.71	29.8
28	T	2	100.0	0.809	45.0	LOS D	5.7	40.8	1.00	0.95	22.6
29	R	129	0.0	0.809	50.4	LOS D	5.7	40.8	1.00	0.95	22.5
Approach		219	1.0	0.809	42.5	LOS D	5.7	40.8	0.94	0.85	25.1
South West: ANZAC Ave SW leg											
30	L	58	0.0	0.848	36.0	LOS D	22.6	158.4	0.95	0.99	27.7
31	T	524	0.0	0.848	29.8	LOS C	22.6	158.4	0.95	0.94	27.8
Approach		582	0.0	0.848	30.4	LOS C	22.6	158.4	0.95	0.95	27.8
All Vehicles		1552	2.0	0.886	30.2	LOS C	22.6	158.4	0.86	0.83	28.4

Scenario 3: No Pedestrian Crossings Called, and Anzide Properties Phase Not Called

Figure 11: 2006 Morning Peak: No Pedestrian Crossings or Anzide Properties Phase

MOVEMENT SUMMARY

Site: 2006 AM 5 phase Without Art, No Halls, No Peds

SH88/Frederick/ANZAC signalised Without Arterial - 5 phase split
No Halls Phase, No Peds
Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ward St South leg											
1	L	84	0.0	0.890	44.2	LOS D	17.8	124.8	1.00	1.10	24.4
3	R	345	0.0	0.890	43.2	LOS D	17.8	124.8	1.00	1.10	24.4
Approach		429	0.0	0.890	43.4	LOS D	17.8	124.8	1.00	1.10	24.4
North East: SH88 Realignment East Leg											
24	L	63	0.0	0.124	25.4	LOS C	1.6	11.5	0.79	0.70	31.0
25	T	386	0.0	0.722	26.8	LOS C	12.7	89.0	0.96	0.87	29.1
26	R	77	0.0	0.478	38.5	LOS D	2.7	18.9	0.99	0.76	26.9
Approach		526	0.0	0.722	28.3	LOS C	12.7	89.0	0.95	0.84	28.9
North West: Frederick St NW leg											
27	L	156	0.0	0.307	17.1	LOS B	3.4	23.9	0.67	0.65	36.2
29	R	438	0.0	0.908	46.9	LOS D	18.9	132.5	1.00	1.11	23.4
Approach		594	0.0	0.908	39.1	LOS D	18.9	132.5	0.91	0.99	26.0
South West: ANZAC Ave SW leg											
30	L	9	0.0	0.858	45.6	LOS D	7.4	51.8	1.00	0.98	24.7
31	T	183	0.0	0.858	39.3	LOS D	7.4	51.8	1.00	0.98	24.7
Approach		193	0.0	0.858	39.6	LOS D	7.4	51.8	1.00	0.98	24.7
All Vehicles		1742	0.0	0.908	37.0	LOS D	18.9	132.5	0.95	0.97	26.2

Figure 12: 2006 Evening Peak: No Pedestrian Crossings or Anzide Properties Phase

MOVEMENT SUMMARY

Site: 2006 PM 5 phase Without Art, No Halls, No Peds

SH88/Frederick/ANZAC signalised Without Arterial - 5 phase split
No Halls Phase, No Peds
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ward St South leg											
1	L	96	0.0	0.572	35.8	LOS D	3.3	23.0	1.00	0.80	26.8
3	R	12	0.0	0.572	34.8	LOS C	3.3	23.0	1.00	0.80	26.9
Approach		107	0.0	0.572	35.7	LOS D	3.3	23.0	1.00	0.80	26.8
North East: SH88 Realignment East Leg											
24	L	105	0.0	0.122	11.3	LOS B	1.5	10.2	0.50	0.63	39.3
25	T	408	0.0	0.377	8.3	LOS A	6.8	47.7	0.61	0.53	40.2
26	R	26	0.0	0.140	31.3	LOS C	0.7	5.2	0.94	0.69	29.5
Approach		540	0.0	0.377	10.0	LOS A	6.8	47.7	0.60	0.55	39.3
North West: Frederick St NW leg											
27	L	68	0.0	0.141	20.5	LOS C	1.5	10.6	0.78	0.67	34.3
29	R	76	0.0	0.404	34.9	LOS C	2.3	15.8	0.98	0.75	27.1
Approach		144	0.0	0.404	28.1	LOS C	2.3	15.8	0.88	0.71	30.3
South West: ANZAC Ave SW leg											
30	L	52	0.0	0.795	26.2	LOS C	15.5	108.7	0.89	0.95	31.8
31	T	520	0.0	0.795	19.9	LOS B	15.5	108.7	0.89	0.87	32.2
Approach		572	0.0	0.795	20.5	LOS C	15.5	108.7	0.89	0.87	32.2
All Vehicles		1363	0.0	0.795	18.3	LOS B	15.5	108.7	0.79	0.72	33.8

Figure 13: 2021 Morning Peak: No Pedestrian Crossings or Anzide Properties Phase

MOVEMENT SUMMARY

Site: 2021 AM 5 phase Without Art, No Halls, No Peds

SH88/Frederick/ANZAC signalised Without Arterial - 5 phase split
No Halls Phase, No Peds
Signals - Fixed Time Cycle Time = 85 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ward St South leg											
1	L	79	0.0	0.882	54.7	LOS D	11.3	79.4	1.00	1.07	21.7
3	R	155	0.0	0.882	53.7	LOS D	11.3	79.4	1.00	1.07	21.7
Approach		234	0.0	0.882	54.0	LOS D	11.3	79.4	1.00	1.07	21.7
North East: SH88 Realignment East Leg											
24	L	113	0.0	0.204	24.8	LOS C	3.2	22.5	0.72	0.71	31.3
25	T	426	0.0	0.613	24.6	LOS C	14.7	103.0	0.88	0.77	30.1
26	R	72	0.0	0.540	47.5	LOS D	3.1	21.8	1.00	0.77	24.3
Approach		611	0.0	0.613	27.3	LOS C	14.7	103.0	0.87	0.76	29.4
North West: Frederick St NW leg											
27	L	145	0.0	0.309	17.4	LOS B	3.5	24.6	0.62	0.62	36.1
29	R	548	0.0	0.887	46.3	LOS D	26.4	185.1	1.00	1.03	23.6
Approach		694	0.0	0.887	40.2	LOS D	26.4	185.1	0.92	0.94	25.6
South West: ANZAC Ave SW leg											
30	L	17	0.0	0.908	52.1	LOS D	19.2	134.1	1.00	1.08	22.9
31	T	382	0.0	0.908	45.9	LOS D	19.2	134.1	1.00	1.08	22.9
Approach		399	0.0	0.908	46.1	LOS D	19.2	134.1	1.00	1.08	22.9
All Vehicles		1937	0.0	0.908	39.0	LOS D	26.4	185.1	0.93	0.93	25.5

Figure 14: 2021 Evening Peak: No Pedestrian Crossings or Anzide Properties Phase

MOVEMENT SUMMARY

Site: 2021 PM 5 phase Without Art, No Halls, No Peds

SH88/Frederick/ANZAC signalised Without Arterial - 5 phase split
No Halls Phase, No Peds
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ward St South leg											
1	L	116	0.0	0.813	39.0	LOS D	5.9	41.5	1.00	0.98	25.8
3	R	62	0.0	0.813	38.0	LOS D	5.9	41.5	1.00	0.98	25.9
Approach		178	0.0	0.813	38.7	LOS D	5.9	41.5	1.00	0.98	25.8
North East: SH88 Realignment East Leg											
24	L	122	0.0	0.144	11.9	LOS B	1.8	12.5	0.53	0.64	38.8
25	T	387	0.0	0.369	8.8	LOS A	6.6	46.3	0.62	0.54	39.8
26	R	33	0.0	0.174	31.5	LOS C	0.9	6.5	0.95	0.70	29.4
Approach		542	0.0	0.369	10.9	LOS B	6.6	46.3	0.62	0.57	38.7
North West: Frederick St NW leg											
27	L	87	0.0	0.180	20.8	LOS C	2.0	13.7	0.79	0.68	34.2
29	R	129	0.0	0.690	37.1	LOS D	4.1	28.7	1.00	0.87	26.4
Approach		217	0.0	0.690	30.5	LOS C	4.1	28.7	0.91	0.79	29.2
South West: ANZAC Ave SW leg											
30	L	58	0.0	0.848	30.0	LOS C	17.7	123.6	0.94	1.02	30.1
31	T	524	0.0	0.848	23.8	LOS C	17.7	123.6	0.94	0.97	30.3
Approach		582	0.0	0.848	24.4	LOS C	17.7	123.6	0.94	0.98	30.2
All Vehicles		1519	0.0	0.848	22.1	LOS C	17.7	123.6	0.83	0.81	31.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements
SIDRA Standard Delay Model used.