Port Otago Ltd

SH88 TRANSPORT REVIEW

TRAFFIC DESIGN GROUP

September 2008

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New Zealand

SH88 Transport Review

QUALITY ASSURANCE STATEMENT

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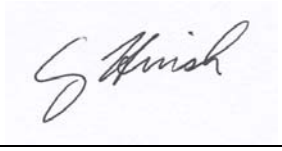

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Approved for Issue by:

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Principal Transportation Engineer

Status: Final

Date: 24 September 2008

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Port Otago Ltd
SH88 Transport Review

1. INTRODUCTION

This report has been commissioned by Port Otago Ltd to ascertain the existing capacity and level of service of State Highway 88 (SH88), the primary road transport link to Port Chalmers. Port Otago are also interested in the potential future capacity of the highway to carry greater volumes of traffic.

This report reviews the existing road based transport network servicing Port Chalmers, and the transport patterns on that network with a view to identifying potential constraints to Port Chalmers being serviced by an increase in heavy vehicle movements. The report specifically focuses on SH88 as the main road link into Port Chalmers, as alternative routes are unsuitable for use by heavy vehicles from Port Chalmers. Transport related community amenity and safety, as well as agency responsibility for improving the level of service to road users is also addressed in the report.

2. TRANSPORT NETWORKS

2.1 Road Network

Figure 1 shows the location of Port Chalmers in the context of the regional strategic road transport network. As can be seen Port Chalmers is located in close proximity to Dunedin and the primary north-south route, State Highway 1 (SH1). State Highway 88 (SH88) provides the primary connection between SH1 and Port Chalmers, starting at Castle Street/St Andrews Street in Dunedin, and terminating at George Street/MacAndrew Road in Port Chalmers. Given the importance of the Port to the regional and national economy NZ Transport Agency (formerly Transit New Zealand) assigns[1] its highest 'National State Highway' status to the highway.

Blueskin Road forms an alternative link between Port Chalmers and Waitati, however, this route involves steep and winding grades not suitable for long term heavy vehicle transport movements from Port Chalmers.

Figure 2 shows the general alignment of the 13km SH88 within the context of Dunedin and surrounding communities. The highway generally stays close to the harbour between Dunedin and Port Chalmers, with limited development or access on the harbour side, except for access to the Roseneath community. On the section from Ravensbourne to St Leonards, the communities straddle the highway and community shops and some houses have individual property access onto the highway.

As can be seen, as the highway follows the harbour it has numerous horizontal bends, often with steep embankments on the north side and a drop off to the harbour on the other side. The road stays to a low vertical elevation above sea level with few hills that restrict truck speeds.

[1] The Transit Planning Policy Manual SP/M/001 assigns a category of National, Regional, and Sub-Regional to each State Highway.

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TRANSIT NZ 'SAWYERS BAY' COUNT SITE

PORT OTAGO CONTAINER PORT

80km/h - 50km/h SPEED SIGN

TRANSIT NZ 'ST LEONARDS' COUNT SITE

80km/h - 50km/h SPEED SIGN

TRANSIT NZ 'FREDERICK ST' COUNT SITE

50km/h - 80km/h SPEED SIGN

SH88 STARTS AT SH1

TRANSIT NZ 'LOGAN PT' COUNT SITE

50km/h - 80km/h SPEED SIGN

Friday, 27 June 2008 9:59:55 a.m.

REVISION	DATE	DESCRIPTION

Port Otago

SH88 General Alignment

DRAWN: DKN
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CHECKED: MB
APPROVED: AAM

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There are numerous intersections along the harbour section of the route, almost all of which are on the north side and either sign controlled, or uncontrolled. These generally service the small communities straddling the highway and do not connect to wider area through roads.

The road operates with a 50km/h speed limit through Dunedin, Ravensbourne and Port Chalmers. On the other sections it operates with an 80km/h speed limit. For the purpose of this report, the descriptions that follow generally group the highway into sections of the route based on speed limit as follows:

- Logan Point to Ravensbourne – the section of SH88 from just east of Leander Street to just west of Adderley Terrace in Ravensbourne
- Ravensbourne – The section from west of Adderley Terrace to east of Jessie Street
- Ravensbourne to Port Chalmers – The section from Jessie Street to Wickliffe Street
- Port Chalmers – The section from Wickliffe Street to MacAndrew Road.

As discussed later, the contribution of the Port related traffic greatly diminishes within the Dunedin City section of the highway, and on this basis the report has concentrated on the harbour section and does not describe in detail the section to the west of Leander Street.

2.2 Logan Point to Ravensbourne

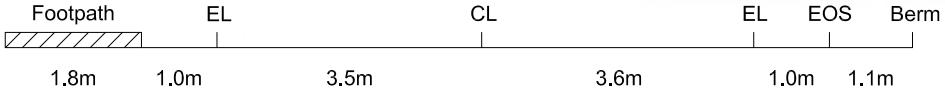
This section of highway operates with an 80km/h speed limit with varying levels of property access. The western section has no property access, whilst moving into the western end of Ravensbourne houses adjoin the highway and some on-street parking is required at those locations. Retaining walls are incorporated into the highway design on both sides at various locations. Photos and cross sections on this part of the highway are shown in Figure 3.

As can be seen the highway includes standard highway traffic lane widths of 3.5m to 3.6m and shoulders of between 0.7 and 1.0m wide. A footpath is provided along the harbour side of the road.

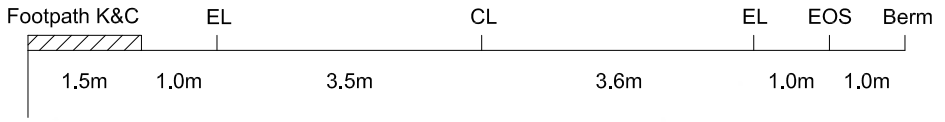
2.3 Ravensbourne

Figure 4 shows the cross-sections of SH88 in Ravensbourne. This section of the highway operates with an urban speed limit of 50km/h, and development is primarily on the northern side. The northern side is generally serviced with a footpath, as are parts of the harbour side of the highway. In parts, parked cars are formally able to park over the footpath, as shown in Photograph 1.

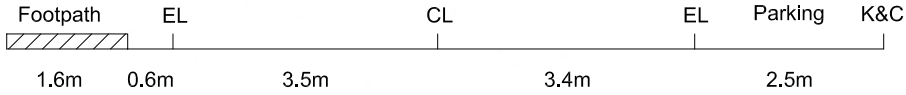
West of Parry Street - Looking Westbound



East of Parry Street - Looking Westbound



West of Tekapo Street - Looking Westbound



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CL=	Centreline
EOS=	Edge of Seal
K&C=	Kerb and Channel

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Port Otago

Logan Point to Ravensbourne - Typical Cross Section

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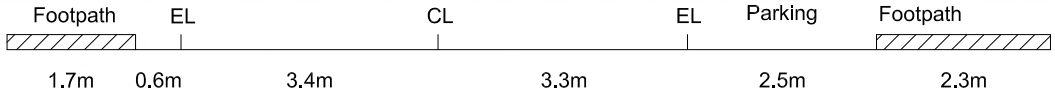
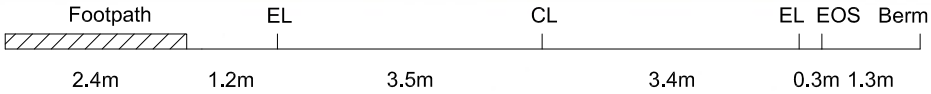
East of Adderley Street - Looking Westbound



East of Ohau Street - Looking Eastbound



East of Jessie Street - Looking Eastbound

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Port Otago

Ravensbourne - Typical Cross Section

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The standard cross-sectional width is again 3.5m lanes plus shoulders of approximately 1m.

2.4 Ravensbourne to Port Chalmers

The section of SH88 between Ravensbourne and Port Chalmers operates with an 80km/h speed limit and is often of a rural formation. However, some sections do include footpaths and on-street parking, particularly through St Leonards.

Figure 5 shows the cross-sections along this part of the highway, which includes standard highway traffic lanes, and shoulders of 0.5m to 1.0m wide.

2.5 Port Chalmers

Within Port Chalmers SH88 has an urban configuration, with parking and footpaths on both sides, and a 50km/h speed limit. Commercial development adjoins the highway, and the highway terminates at the entrance to Port Otago's container terminal.

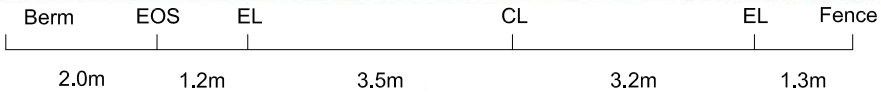
Figure 6 shows the cross-section within Port Chalmers, together with photos of the general traffic management arrangements.

2.6 Cycle Facilities

No cycle lanes are provided on SH88, although an off-road cycle path has recently been developed between Dunedin and Ravensbourne. Figure 7 shows the alignment of the 3.0m wide cycleway, together with photographs of its formation.

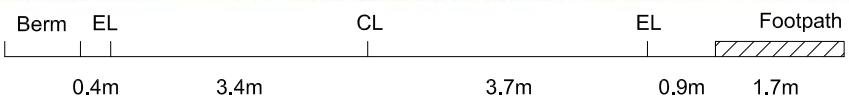
NZ Transport Agency and Dunedin City Council have let a contract to extend the cycle path from Ravensbourne to Maia, and are investigating options for further developments.

East of Burkes Drive - Looking Eastbound



East of Blanket Bay Road - Looking Eastbound

West of Wickliffe Terrace - Looking Westbound



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Port Otago

Ravensbourne to Port Chalmers - Typical Cross Section

SCALE: Not to scale

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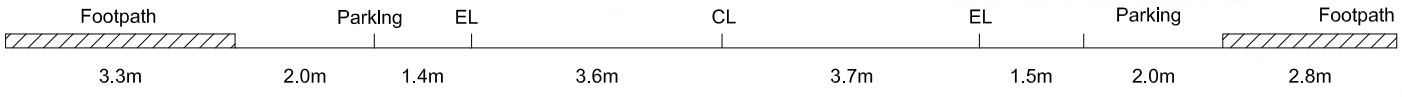
Port Chalmers - Container Port Entrance

Port Chalmers - George Street East of Wickliffe Terrace



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Port Otago

Port Chalmers - Typical Cross Section

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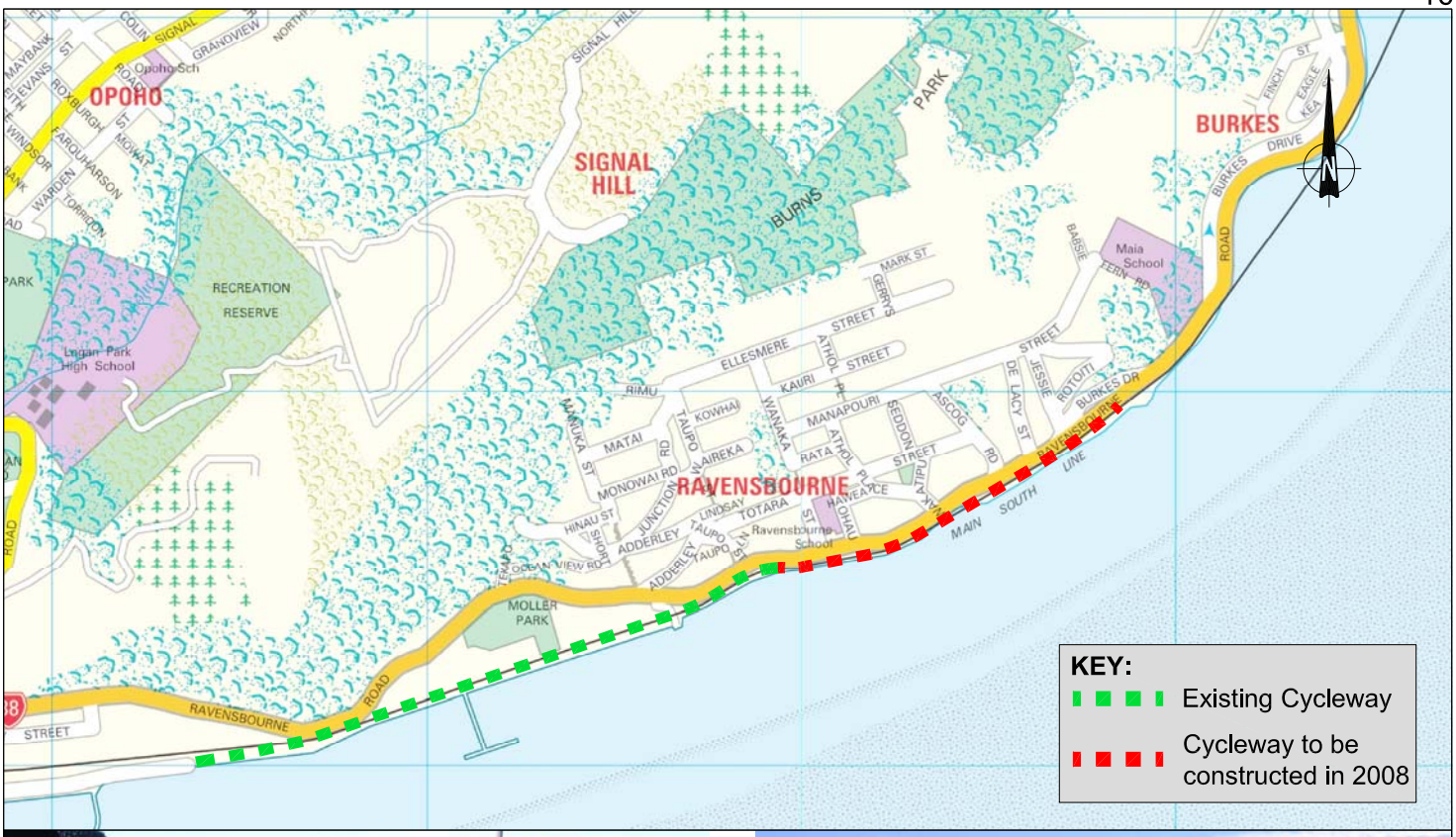

Start of cycleway western side

Start of cycleway looking west

Typical Cross section

Start of cycleway eastern side

Tuesday, 24 June 2008 2:51:25 p.m.

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Off - Road Cycle Path Location and Photographs

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2.7 Footpaths

Figure 8 shows those locations where footpaths are provided on SH88. Typically footpaths are only on one side of the road, and provide continuous connections provided between Maia and Dunedin City, as well as between Roseneath and Port Chalmers. Limited footpaths are provided in St Leonards as part of connections to bus stops. The footpaths are generally located within 0.9m of the traffic lane edgeline, and have a width of 1.2m to 2.4m. The only formal pedestrian crossing location is in Port Chalmers, just east of Wickliffe Street.

2.8 Public Transport

Port Chalmers is serviced by a bus route that connects into Dunedin generally utilising SH88, with deviations on council roads through Sawyers Bay, Roseneath and Ravensbourne. Many of the bus stops are provided with shelters and are recessed off the through traffic lanes. The current bus route is shown in Figure 9.

3. TRAVEL PATTERNS

3.1 SH88 Daily Traffic Volumes

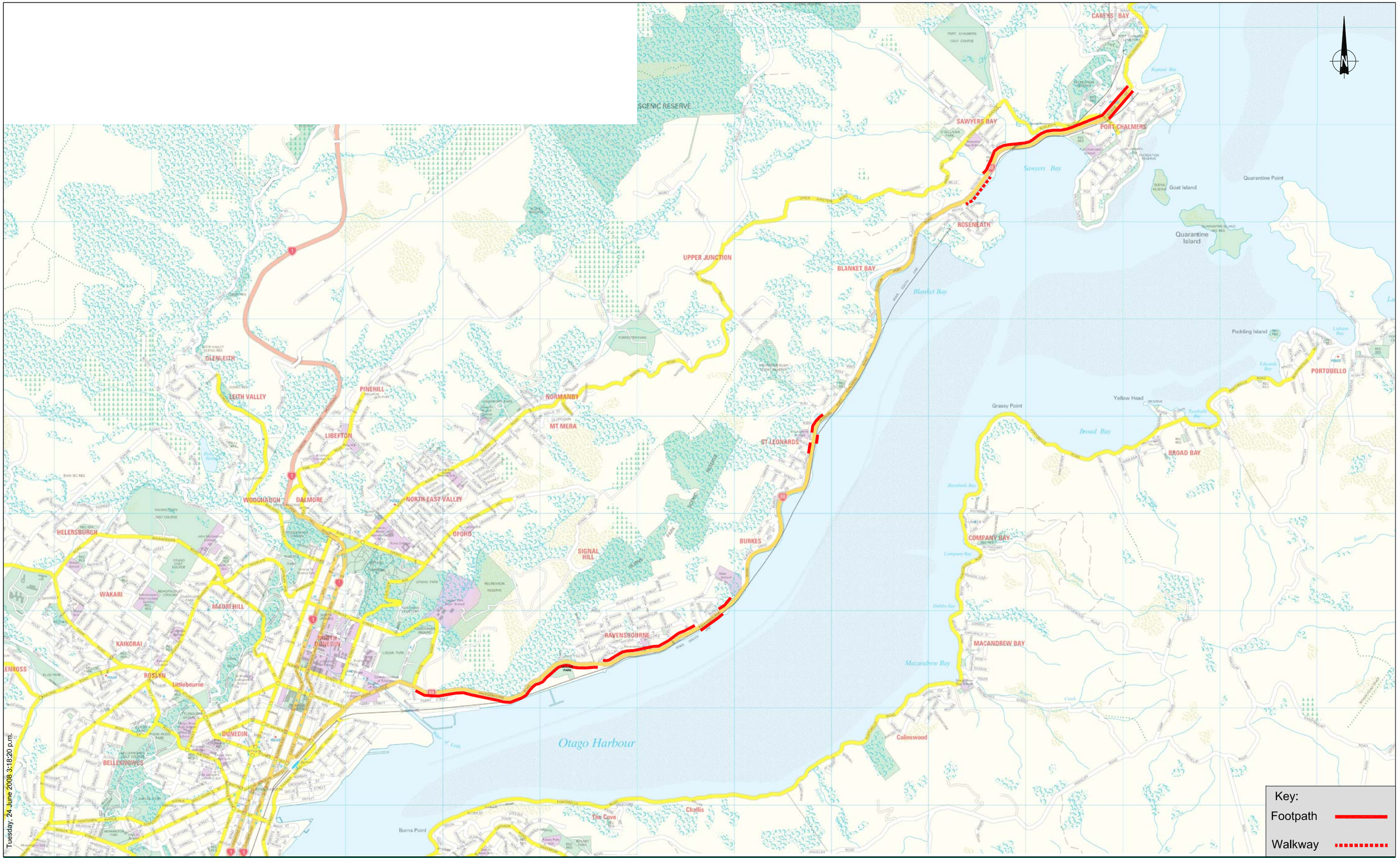
NZ Transport Agency undertakes a programme of regular traffic counting on SH88. The annual average daily traffic volume at each of the traffic count sites is summarised in Table 1 below.

LOCATION	ANNUAL AVERAGE DAILY TRAFFIC VOLUME (AADT)	WEEKDAY HEAVY VEHICLE VOLUME
City - North of Frederick Street	13,176vpd	1,017vpd
Logan Point - West of Tekapo Street	8,506vpd	727vpd
St Leonards – South of District Road	5,422vpd	537vpd
Sawyers Bay - East of Station Road	4,730vpd	529vpd

Table 1 : SH88 Average Daily Traffic Volumes (Year 2006)

As can be seen, the traffic volumes decrease significantly closer to Port Chalmers, indicating the residential traffic associated with the local communities make up a high proportion of traffic on the western end of SH88. The total heavy vehicle volumes on SH88 follow a similar pattern, as the total traffic volumes, with businesses located along the highway contributing to the overall heavy traffic volumes.

The level of traffic growth has been determined by reviewing the last ten years of traffic records at the above sites. As shown in Figure 10, traffic growth has been at a low level of 1.4% growth per annum (based on the 2006 traffic count) at each of the sites adjacent to the harbour.



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Port Otago

Footpaths on SH88

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DATE: 27-06-08
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Port Otago

Port Chalmers Bus Routes

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DATE: 24-06-08
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APPROVED: AAM

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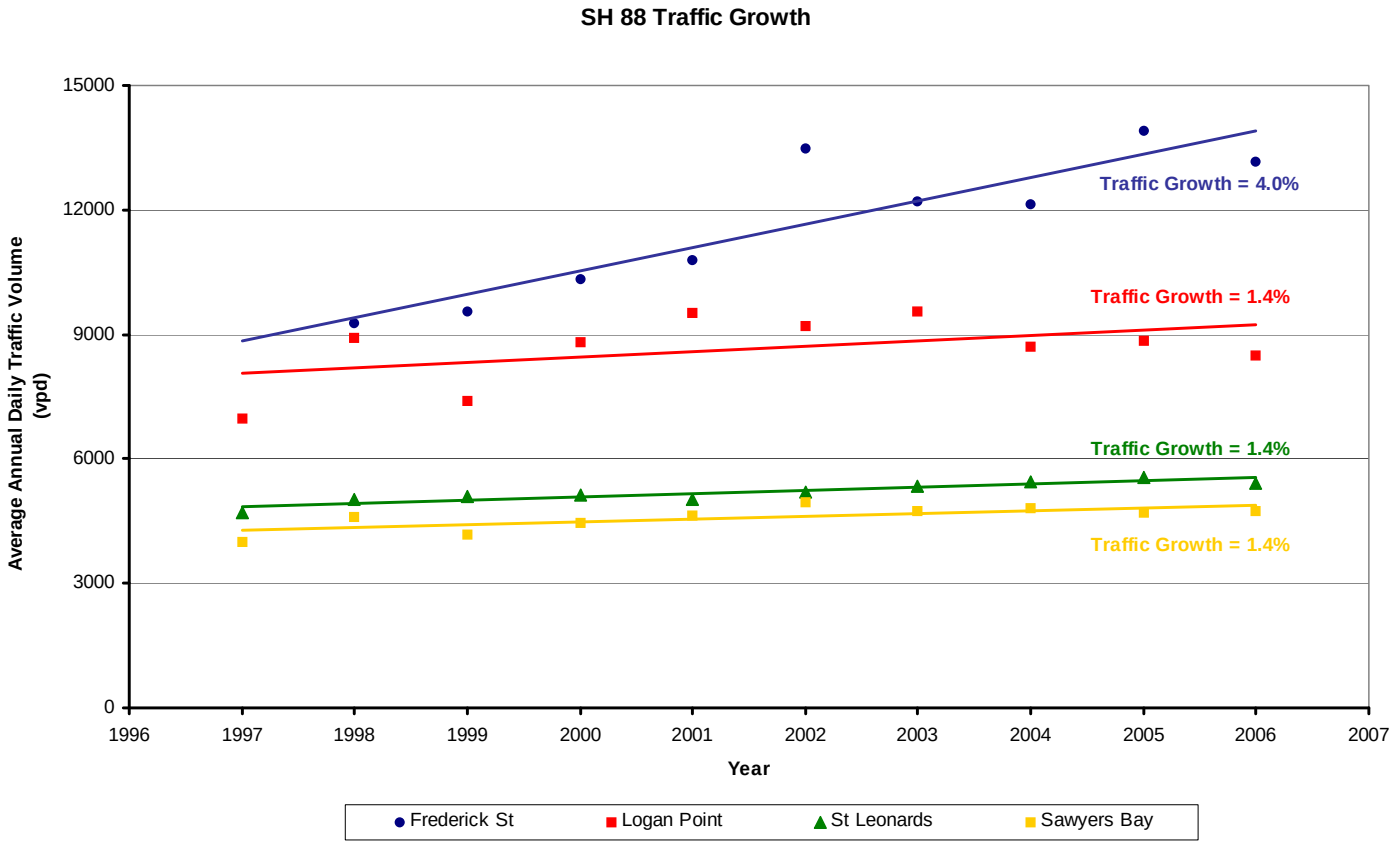

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Port Otago

Traffic Growth for Last 10 Years of SH88

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The St Leonards (Blanket Bay) traffic count was continuous throughout 2006, and the seasonal variations in traffic patterns have been analysed. Figure 11 shows the seasonal traffic variations on a weekly basis for both the average of the full week (7 days), and the average of the weekdays only (5 days). The pattern shows a consistent traffic volume throughout the year with only minor fluctuations through the seasons, typically being within 10% of the average.

SH88 vehicle classifications are summarized in Table 2 below using the Land Transport New Zealand Economic Evaluation Manual (EEM) classification system. The vehicle classification scheme has been used to distinguish between heavy and light vehicles for later analysis, whereby, heavy vehicles are defined as all vehicles included in the medium commercial vehicles (MCV), heavy commercial vehicles 1 with three or four axles (HCVI) and heavy commercial vehicle 2 with five or more axles (HCVII) classifications. The table also includes the heavy vehicle percentage in the peak direction during the morning peak hour.

LOCATION	(AADT)	LCV	MCV	HCVI	HCVII	TOTAL HEAVY	PEAK HOUR HEAVY
Frederick Street	13,176vpd	93%	2%	2%	3%	7%	8%
Logan Point	8,506vpd	94%	2%	1%	3%	6%	6%
St Leonards	5,422vpd	94%	2%	1%	3%	6%	4%
Sawyers Bay	4,730vpd	93%	2%	1%	4%	7%	5%

Table 2 : SH88 Vehicle Composition (Year 2006)

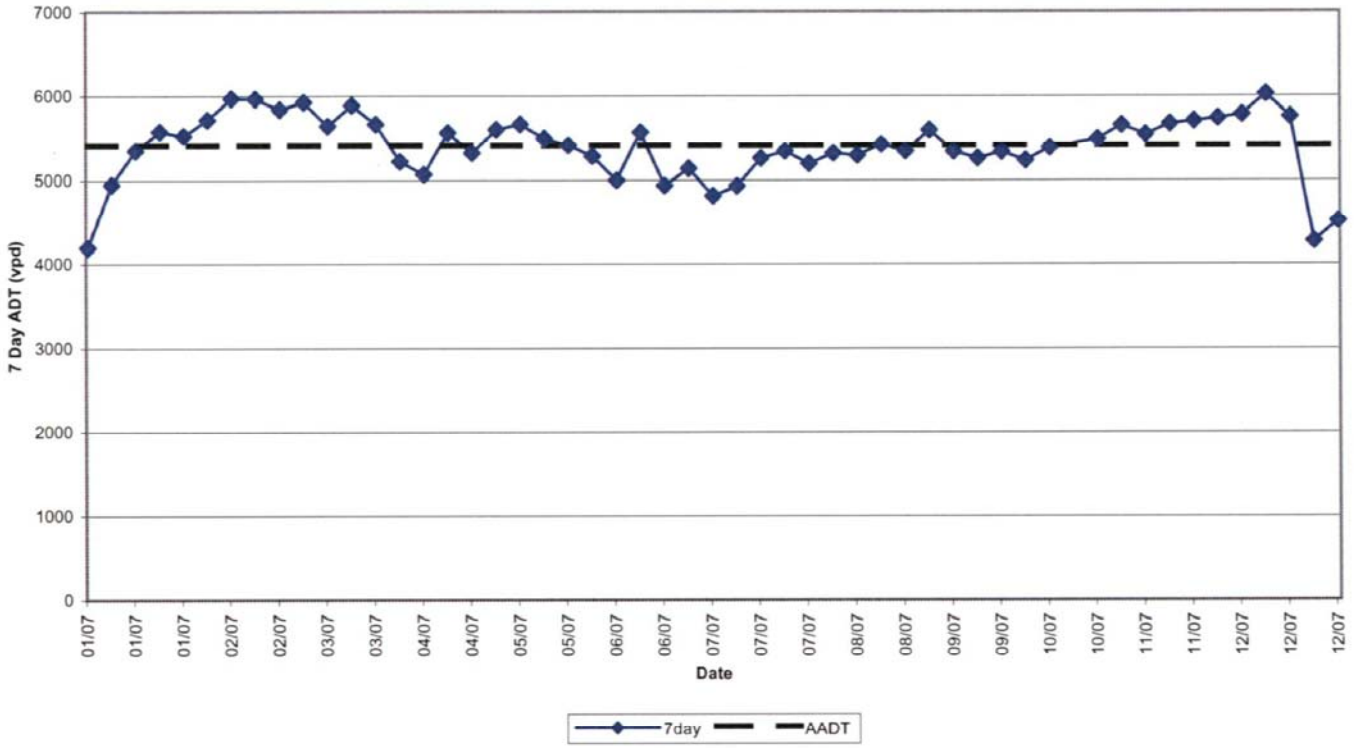
Vehicles associated with the Port Otago operations will typically be HCVI and HCVII, which as can be seen make up a relatively small proportion of overall traffic volumes on SH88. The proportion of HCVII is higher than typical urban arterials, but less than typical strategic rural roads. During the peak hour, the heavy vehicle percentage is slightly reduced from the daily heavy vehicle percentage at the eastern end of the route, and increased within the city.

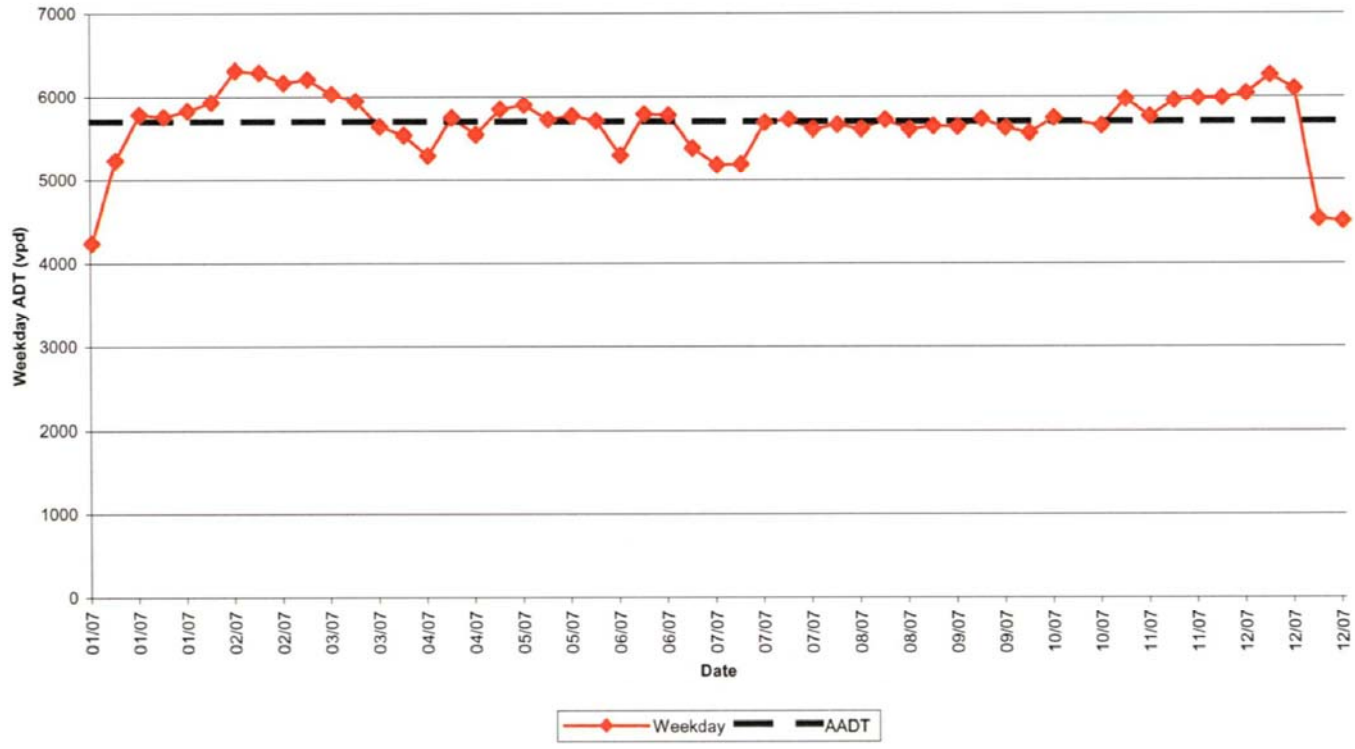
3.2 SH88 Hourly Traffic Patterns

A review has been undertaken of the hourly traffic patterns during the course of a week for recent traffic counts obtained for each of the NZ Transport Agency sites. The seven day hourly patterns are shown at the Sawyers Bay site for a week period in Figure 12. The top graph shows the pattern for all traffic, whilst the bottom graph shows only heavy vehicles

As can be seen in the pattern for overall traffic volumes, each of the weekdays exhibit similar traffic patterns with distinct morning and evening peak periods, and there is a single midday peak during the weekends. Further analysis of the data shows that the weekday morning and evening peak periods are characterised by directional peak traffic into the city in the morning, and from the city in the evening.

The patterns associated with heavy vehicles are somewhat different than the overall traffic patterns, with no defined peaks, and a consistent volume between 8am and 6pm. Heavy vehicle traffic volumes are effectively the same in each direction throughout the day. Outside of the daytime period, heavy traffic volumes rapidly decline. Saturday heavy traffic volumes are lower than during the weekday, and very low volumes are observed on Sundays.





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Port Otago

SH88 at St Leonards - Seasonal Traffic Variations

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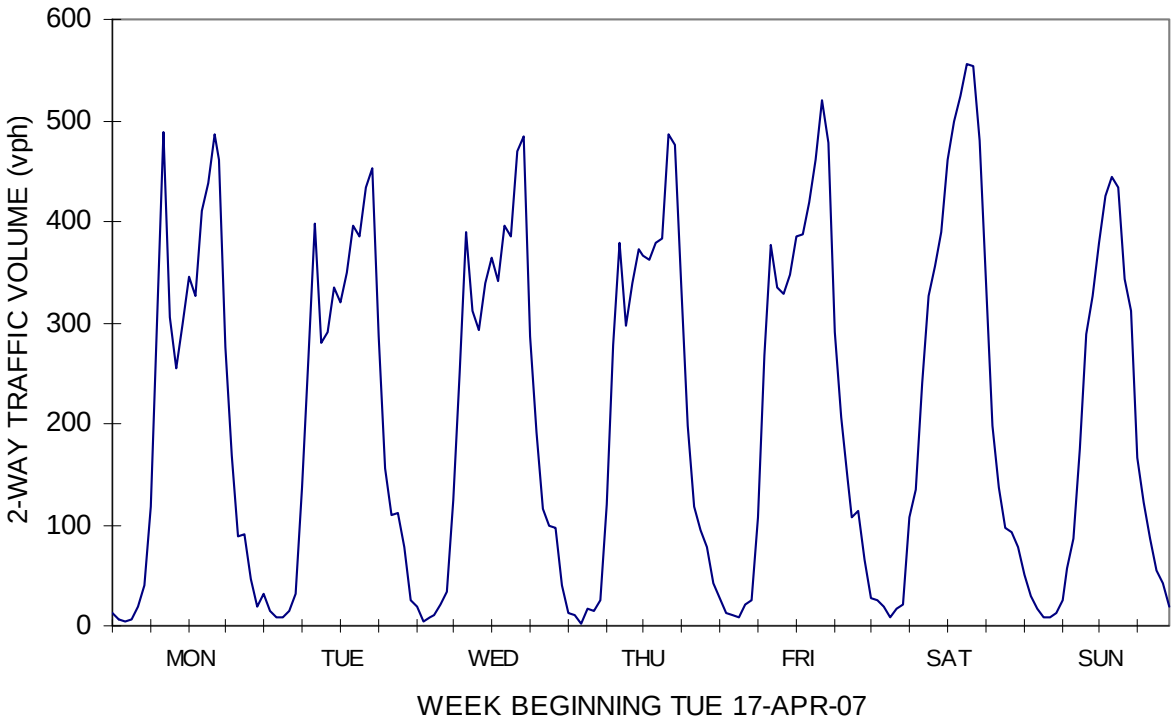
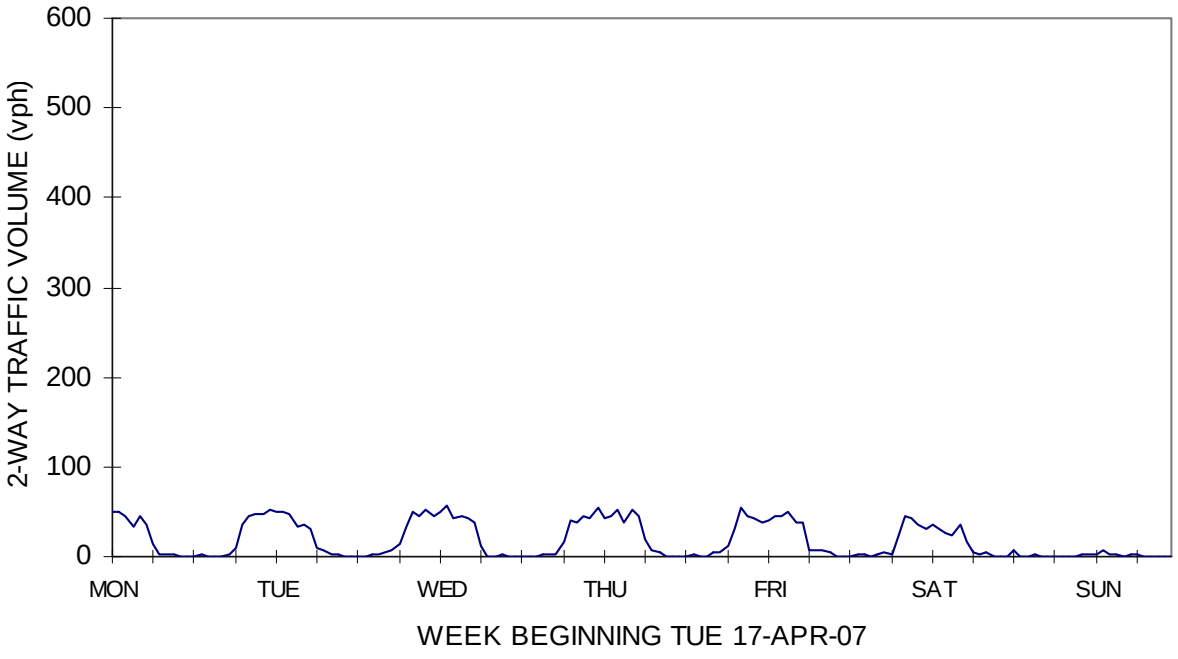
SH88 AT SAWYERS BAY (2-WAY) TOTAL VEHICLE MOVEMENTS



SH88 AT SAWYERS BAY (2-WAY) HEAVY VEHICLE MOVEMENTS



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Daily TraffiC Patterns

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Figure 13 provides further detail of the weekday traffic volumes exhibited at all of the count sites during the weekdays, with the top graph showing all traffic, and the bottom graph representing only heavy vehicles. As can be seen, the western end of the rural section of highway carries over twice as much traffic as it does at the eastern end, indicating the high contribution to traffic volumes by the St Leonards and Ravensbourne communities. Peak traffic volumes on the urban section of SH88 in the city are close to four times higher than the eastern section.

The pattern of heavy traffic indicates that heavy vehicles volumes are higher at the western end of the route, indicating Port Chalmers related heavy traffic on SH88 makes up approximately 70% of heavy traffic at the Logan Point count site, and up to 50% of traffic at the Frederick Street count site. Therefore, the SH88 route is serving more than just Port Chalmers heavy traffic.

3.3 Local Road Traffic Volumes

Records from the Dunedin City Council traffic counts database shows that most of the local roads that intersect with SH88 on the harbour section between Logan Point and Port Chalmers carry low daily volumes less than 500 vehicles per day. Only Adderley Terrace in Ravensbourne with a traffic volume of approximately 1,110vpd, and Station Road at Sawyers Bay with a volume of 2,000vpd have volumes greater than 500vpd. In Port Chalmers, Borlases Road and Wickliffe Terrace intersect with SH88 at a cross road and carry volumes of 1,300vpd and 1,550vpd respectively.

3.4 Speed Profile

SH88 has a relatively flat to rolling alignment and heavy vehicles are rarely constrained in the choice of speed by the road gradient. However, the numerous horizontal bends do place some restriction on the heavy vehicle speed. Container trucks were followed in each direction with the following average speeds recorded on each section of highway.

SECTOR	SPEED LIMIT	LENGTH	TIME TAKEN*	AVERAGE SPEED
Logan Point-Ravensbourne	80kph	1.6km	1min 39sec	58kph
Ravensbourne	50kph	1.8km	1min 57sec	55kph
Ravensbourne-Port Chalmers	80kph	7.0km	6min 01sec	70kph
Total		10.4km	9min 37 sec	66kph**

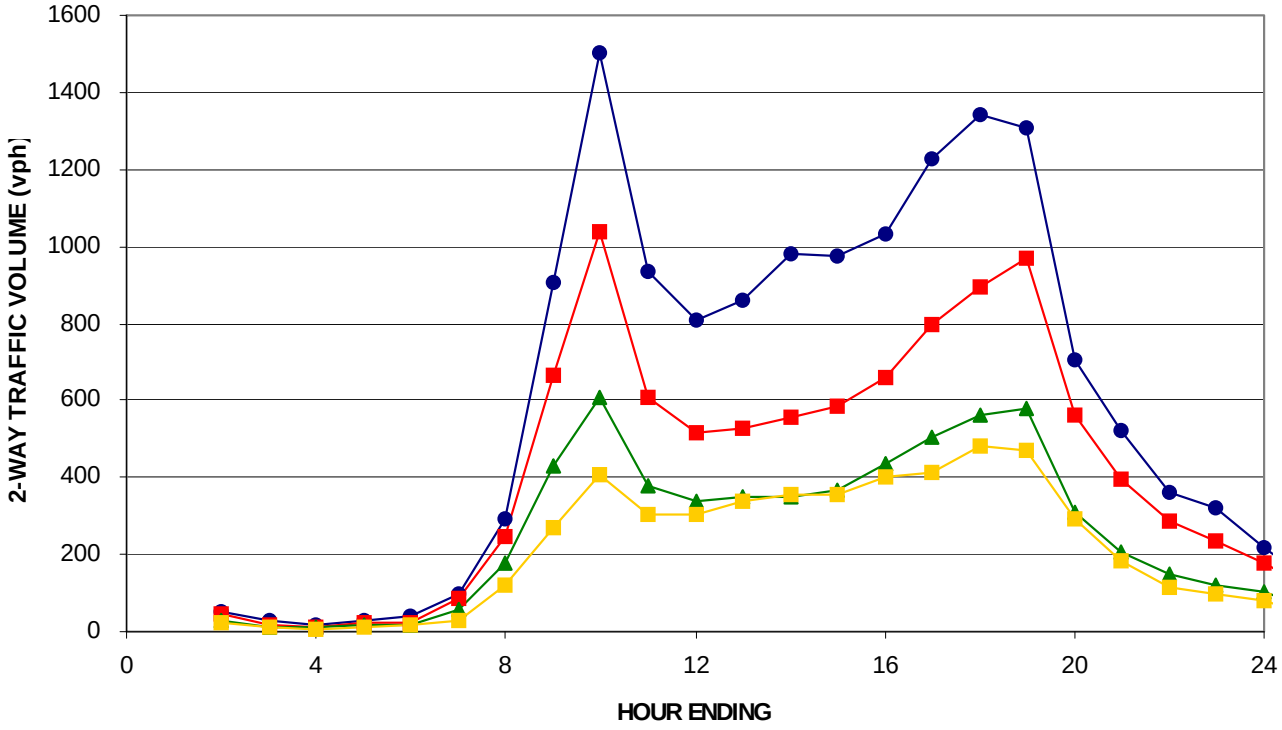
*NB Small sample and speeds reduced by following other traffic in some places

**NB Is the average speed along the total length

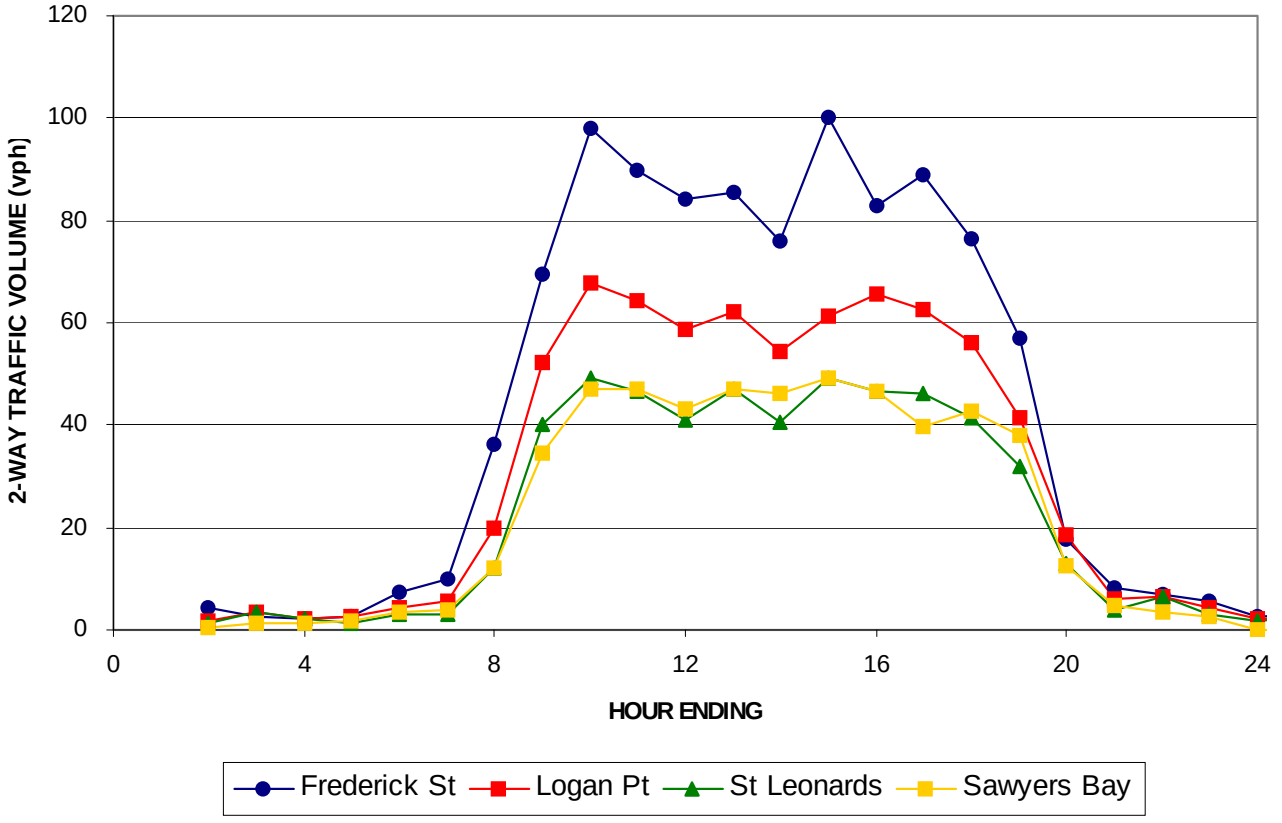
Table 3 : SH88 Heavy Vehicle Travel Speeds

As can be seen, the speeds on the 80km/h sections were lower than the posted speed limit, being 70km/h. Through Ravensbourne, the trucks tended to travel at greater than the posted 50km/h speed limit, particularly at the eastern end.

SH88 AVERAGE WEEKDAY TOTAL VOLUMES



SH88 AVERAGE WEEKDAY HEAVY VOLUMES



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Port Otago

Weekday Hourly Traffic Volumes

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4. ROAD SAFETY

In order to understand the existing road safety issues of SH88, a review of the Land Transport New Zealand Crash Analysis System has been undertaken. Crashes reported within the most recent full five year period 2003 to 2007 inclusive have been reviewed for the length of SH88 between SH1 and Port Chalmers. The road safety review has firstly considered all reported injury crashes along the length of SH88, and then specifically considered those crashes involving trucks, pedestrians and cyclists.

Figure 14 shows the locations of the 84 injury causing crashes on SH88 within the five year review period. The circle size is representative of the number of crashes at grouped crash sites, where the crash site is 30m diameter in urban areas and 250m in rural areas. As can be seen, the reported injury crashes are more prevalent in the higher volume section of SH88 within the city, with the crash sites more dispersed towards Port Chalmers. An analysis of the frequency of injury crashes has been undertaken based on defined lengths of SH88 that have similar traffic and road environment characteristics, and in particular the same speed limit. This analysis is presented in Table 4 below.

SECTOR	LENGTH	SPEED LIMIT	AADT	TRUCK	CYCLIST	PED	TOTAL	INJURY ACC / 10^8 VEH-KM*
SH1 – Logan Point	1.5km	50kph	12,980vpd	6	2	4	38	106
Logan Point-Ravensbourne	1.6km	80kph	8,500vpd	0	0	0	6	24
Ravensbourne	1.8km	50kph	8,000vpd	2	0	0	14	53
Ravensbourne-Port Chalmers	7.0km	80kph	5,400vpd	2	1	0	21	30
Port Chalmers	0.6km	50kph	4,800vpd	0	0	2	5	95
Total	12.5			10	3	6	84	

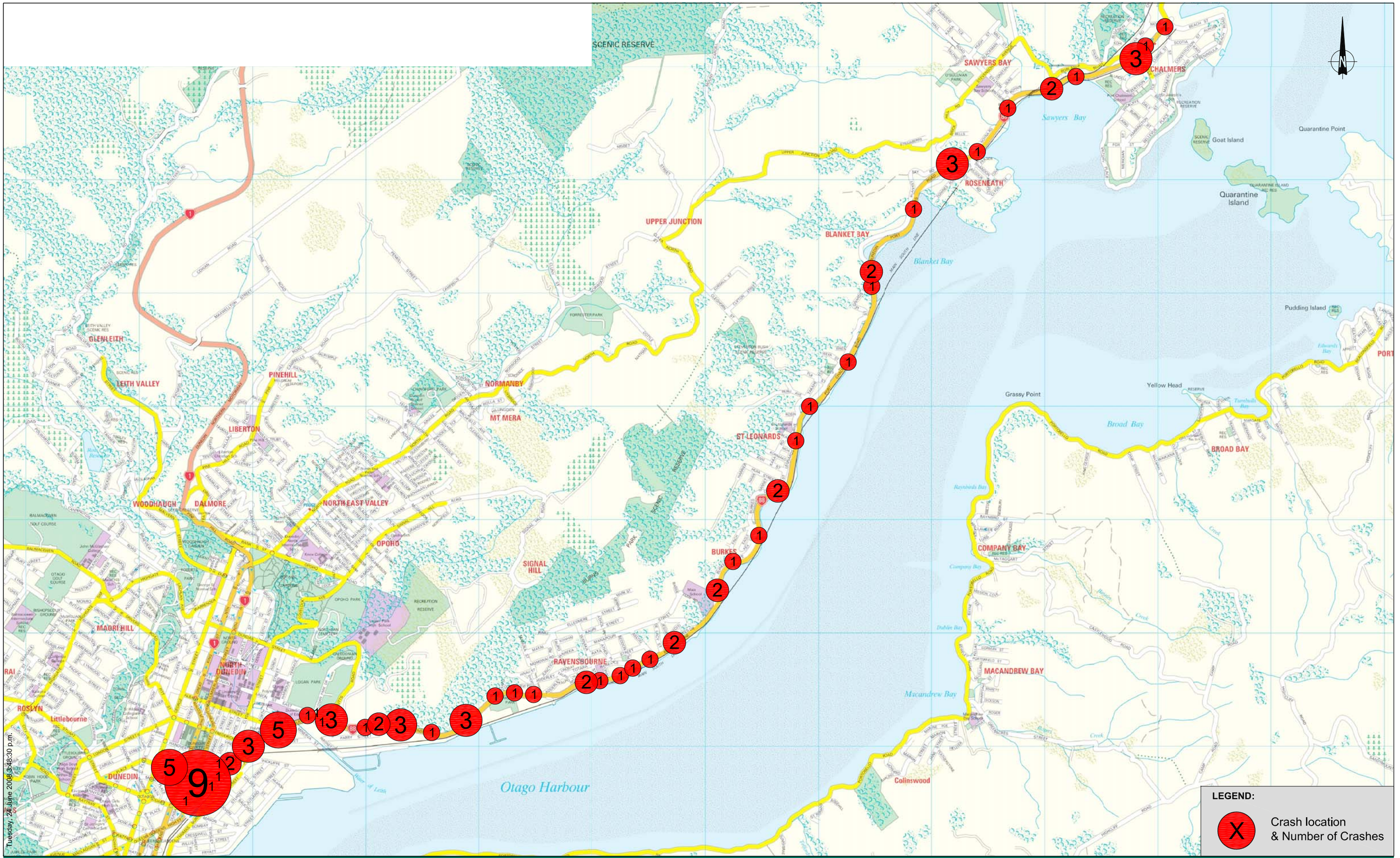
*Includes intersection and mid-block crashes

Table 4 : SH88 Injury Crashes 2003-2007

As can be seen, there is a higher intensity of accidents within the 50kph sections of the highway, where there is a greater level of vehicle manoeuvring and intersection movements.

Figure 15 shows the location of all truck crashes on SH88 east of Logan Point. Four of the ten crashes involved injury, and half of all crashes involved another road user. The heavy vehicle injury crashes involved:

- (Crash number 2521832) A truck was following a turning vehicle too close at a driveway and lost control under heavy braking attempting to avoid the vehicle. The truck hit a car head on.
- (Crash number 2523334) The service brakes of a truck on Jessie Street failed and it missed the intersection with SH88, hitting a kerb.
- (Crash number 2723533) A cyclist lost control when being overtaken by a truck on a narrow section of the highway near Roseneath.
- (Crash number 2623664) A truck lost control near the Station Road intersection after being distracted by the load. This vehicle had been at the Port.



Tuesday, 24 June 2008 3:48:30 p.m.

REVISION	DATE	DESCRIPTION

Port Otago

Crash Locations on SH88 for 5 Year Review Period (2003 - 2007)

DRAWN: DKN
DATE: 24-06-08
CHECKED: AAM
APPROVED: AAM

SCALE: 1:30,000 @ A3
DRAWING NO: 9701-C9A

TRAFFIC DESIGN GROUP

14

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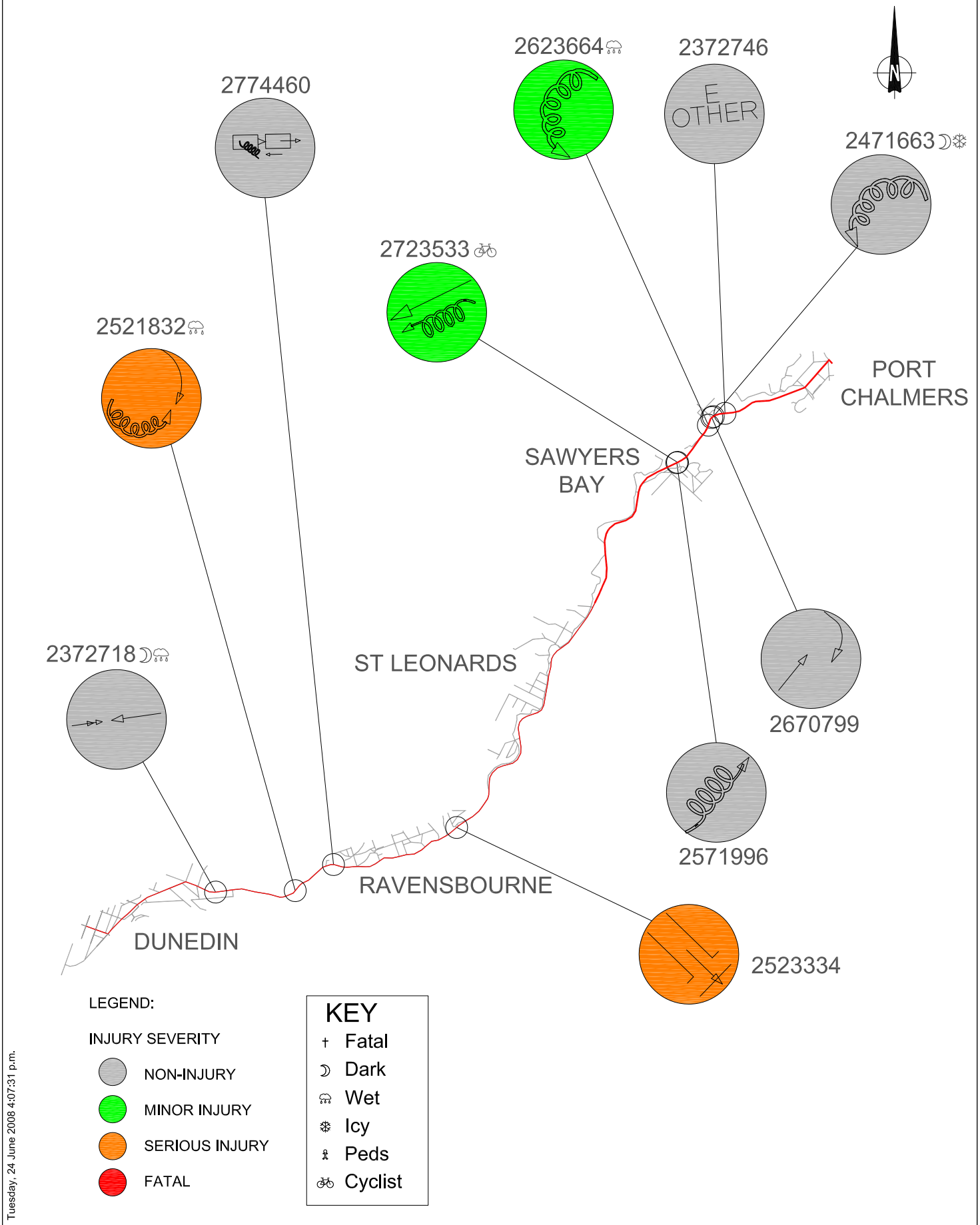

Tuesday, 24 June 2008 4:07:31 p.m.

Port Otago

SH88 Truck Crash Diagram (2003 - 2007)

SCALE: NTS

TRAFFIC DESIGN GROUP

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The data indicates that crashes involving heavy vehicles make up approximately 9% of reported injury crashes east of Logan Point, slightly over-representing the proportion of heavy vehicles on the highway. However, this could partly be explained by an expectation that heavy vehicle crashes will have a higher reporting rate than other types of vehicle crashes. A comparison of the observed heavy vehicle crash rate on the rural sections of highway against prediction models included in the Land Transport NZ Economic Evaluation Manual shows that the two reported crashes is very similar to the predicted 1.7 crashes for the five year period.

The two pedestrian related crashes in Port Chalmers involved adult pedestrians crossing the road heedless of traffic, with one being hit by an oncoming van, and the other being hit by a reversing car.

5. EXISTING LEVELS OF SERVICE

5.1 Definitions

Level of Service (LOS) is a general measure of how well a road can accommodate the travel demand placed upon it. The concept of level of service is defined as a qualitative measure describing the operational conditions within a traffic stream, and their perception by motorists and/or passengers. Factors which define level of service are known traffic conditions, such as road carriageway standards, the level of heavy vehicles and the directional split of traffic over a given time period. LOS assessments are made considering the peak hours of traffic activity of each day. The following LOS definitions are given in Austroads Guide to Traffic Engineering Practice Part 2: Roadway Capacity:

> *LOS A is a condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent*
>
> *LOS B is in the zone of stable flow and drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream, although the general level of comfort and convenience is a little less than with level of service A (excellent).*
>
> *LOSC is also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.*
>
> *LOS D is close to the limit of stable flow and is approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speeds or to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems*
>
> *LOS E occurs when traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause breakdown*

The following table, from the Otago Regional Land Transport Strategy 2005, provides guidelines on acceptable LOS levels.

ROAD TYPE	PEAK TIMES*	OTHER TIMES
Strategic urban road network outside urban areas	Only accept LOS A,B,C or D	Only accept LOS A,B, or C

* Peak times are between 7-9am and 4-6pm weekdays but may vary depending upon the demands of different areas.

Table 5: Otago Regional Land Transport Strategy (2005) - Recommended Minimum Levels of Service

As can be seen, the LOS of SH88 should be D or better during peak periods, and C or better outside of peak periods.

5.2 SH88 Capacity

As SH88 is characterised by an uninterrupted length of road free of intersection controls, a determination of Level of Service over route segments can be based on two lane highway road categorisation, even though some sections are of an urban nature.

Level of service for a highway can be categorised by the average travel speed. In uninterrupted traffic flow, the relationship between travel speed and traffic volume is represented initially by a small decrease in speed for a large increase in traffic volume, and as flows reach closer to capacity, the speed decreases more rapidly with small increases in volume. The indicative traffic volume at the Level of Service thresholds provided by the US Highway Capacity Manual are as follows:

LEVEL OF SERVICE	SEMI-RURAL (FREE FLOW SPEED = 80KM/H) VPH/LANE	URBAN (FREE FLOW SPEED = 55KM/H) VPH/LANE
A	1,050	700
B	1,250	1,000
C	1,350	1,100
D	1,450	1,200
E	1,700	1,400

Table 6: Level of Service Thresholds

The peak volumes on SH88 and associated estimated LOS are provided in Table 7 below.

SECTOR	SPEED LIMIT	PEAK HOUR VOLUME	DIRECTION	LOS
Logan Point-Ravensbourne	80kph	800vph	Westbound AM Peak	A
Ravensbourne	50kph	750vph	Westbound AM Peak	B
Ravensbourne-Port Chalmers	80kph	450vph	Westbound AM Peak	A

Table 7: Level of Service Thresholds

As can be seen, the through traffic volumes on SH88 are currently afforded a high level of service during peak periods, being in the range LOS A to LOS B, and are well below the volumes at which substantial speed reduction will be observed. The existing peak volumes are approximately 55-60% of the volume at which an unacceptable level of service would be observed. Given the low historical traffic growth, it is expected that the highway will continue to operate with a high level of spare capacity and within RLTS recommended minimums well into the future.

5.3 Side Road Intersection Capacity

As through traffic volumes on SH88 increase, it would become increasingly difficult to access the highway from side roads during the peak periods. An assessment has been undertaken of the intersection capacity at the intersection of SH88 / Adderley Terrace, as this has the highest side road volumes at a location on the harbour section of SH88 that has close to the highest through traffic volumes. The critical period for assessment is the morning peak period as vehicles travelling towards town are required to turn right from Adderley Terrace, and are opposed by traffic in both directions.

Analysis utilising the SIDRA Intersection software shows that the right turn out of Adderley Terrace into SH88 currently operates at approximately 25% of its capacity, and with average turning delays of approximately 17 seconds per vehicle. This level of delay represents LOS B and is well within acceptable levels.

Given the ambient traffic growth is low on SH88, and there is limited potential for future growth in Ravensbourne, there is unlikely to be any side road capacity issues in the foreseeable future based on existing growth patterns. Based on existing side road volumes, a through traffic volume increase of up to 45% could be accommodated on SH88 before the level of service was below the RLTS minimums, and alternative intersection controls would be considered necessary. Therefore, the effect of traffic flow on side road capacity is unlikely to be a primary constraint to increased traffic volumes.

5.4 Carriageway Formation

The Transit New Zealand State Highway Geometric Design Manual specifies target lane and shoulder widths for State Highways based on traffic volume. For a rural highway carrying greater than 4,000vpd and with a speed limit of 100km/h, the desirable minimum seal width is 10.0m comprising two 3.5m wide traffic lanes, and two 1.5m wide sealed shoulders. In addition, 0.5m wide unsealed shoulders are required.

On kerbed urban arterial roads, a 3.5m wide lane width is also desired with a separation from the kerb of at least 0.5m, although zero separation may be used if there is street lighting. A minimum width of 3.1m is required for a kerbside lane on a straight alignment. Where kerbs are utilised on roads with a design speed greater than or equal to 70km/h, an offset from the traffic lane to the kerb of at least 1.0m is required.

It is recognised that in some situations, lane widths may need to be reduced, with the absolute minimum state highway lane width being 3.0m, and minimum shoulder widths for general use being 1.0m.

As shown earlier in the cross-sections, the highway has varying lane and shoulder widths, primarily based on the general environment and topographical constraints. Typical traffic lane carriageway formations on SH88 are summarised in Table 8.

SECTOR	LENGTH	SPEED LIMIT	AADT	AVERAGE LANE WIDTH	AVERAGE SHOULDER WIDTH
Logan Point-Ravensbourne	1.6km	80kph	8,500vpd	3.5	0.9
Ravensbourne	1.8km	50kph	8,000vpd	3.4	0.9
Ravensbourne-Port Chalmers	7.0km	80kph	5,400vpd	3.4	1.0

Table 8: Summary of Carriageway Lane Widths

As can be seen, the current lane and shoulder widths do not typically meet the target widths, although do satisfy the absolute minimum carriageway widths. The minimum measured lane widths were 3.2m in constrained locations, and likewise, some sealed shoulder widths were below 0.5m. Separation of the traffic lane from the kerb was between 0.6m and 1.6m, satisfying the minimum requirements.

The existing road safety history did not indicate that the presence of minimum width lanes and shoulders has led to road crashes. However, if heavy traffic was to increase, it would be desirable for the road controlling authorities to continue upgrading the available seal width to increase clearances and minimise the associated safety risks of the presence of minimum width traffic lanes and shoulders.

5.5 Pedestrians

5.5.1 Extent of Network

The footpath network on SH88 is incomplete, and long distance walking trips are not provided for within the rural sections of the highway. In the urban areas, and the length connecting Ravensbourne and Dunedin, a footpath is provided adjacent to the highway. The typical footpath width is greater than or equal to the desirable minimum footpath width of 1.5m, which allows a wheelchair and pram to pass, thereby providing an acceptable level of service to pedestrians. The shared pedestrian/cycle path adjacent to the harbour provides a high level of service to users making longer distance walking trips to Dunedin.

The incomplete pedestrian network is recognised by the road controlling authorities as a concern of the community, with investigations into extending the network forming part of the Dunedin Transport Strategy.

5.5.2 Crossing Level of Service

As previously mentioned footpaths are typically only provided on one side of the road, with the side of road varying between Maia and Dunedin City, as well as between Roseneath and Port Chalmers (see Figure 8). There is only one purpose built pedestrian crossing over the entire length of the road, located in Port Chalmers. Consequently, to evaluate the safety and level of service provided for pedestrians crossing the road the Land Transport New Zealand "Pedestrian crossing facilities calculation tool" has been used. The level of service is determined by calculating average pedestrian crossing delays with the maximum allowable delays given in the following table.

LOS	MAXIMUM AVERAGE DELAY (secs)	STANDARD	
A	5	Excellent	Appropriate for local streets and collector roads
B	10	Very good	
C	15	Satisfactory	Appropriate for Minor Arterial Roads and Major Arterial Roads
D	20	Some Concern	
E	40	Major Concern	Inappropriate for all Situations

Table 9: Pedestrian Crossing Level of Service Thresholds

From Dunedin City to Ravensbourne a pedestrian footpath runs the entire length of the road on the harbour side. The footpath is typically around 1.5m wide and is separated from the road lanes by a 1m shoulder. With the speed limit on this section of the road being predominately 80km/h, the crossing of the peak hour flows results in satisfactory pedestrian LOS C.

At Ravensbourne the footpath switches to the western side of the road and provides pedestrian access resulting from the residential area of Ravensbourne. The speed limit through this stretch of road is 50km/h with 1.2m to 1.6m wide shoulders provided between the footpath and traffic lanes. Whilst demand for pedestrians to cross the road will be low, the pedestrian LOS at current volumes is C.

A small section of footpath is provided for pedestrian movements in the residential area of St Leonard. The carriageway and footpath characteristics at St Leonard are similar to that of Ravensbourne, however, the traffic volume at this location is less. At the posted speed limit of 80km/h, the current pedestrian LOS is B.

The last section of footpath along SH88 connects the residential area of Roseneath with Port Chalmers. The level of service associated with pedestrians crossing the road is LOS A. As already mentioned there is a pre-existing pedestrian crossing located in the main street of Port Chalmers providing a good level of service at this location.

5.6 Cyclists

The only cyclist provision provided is the shared cycle/pedestrian pathway between Ravensbourne and Dunedin. Despite the availability of the path, it is observed that some commuter and recreational cyclists utilise the highway as a more direct route.

The AUSTROADS Guide to Traffic Engineering Practice: Bicycles (including New Zealand supplement), sets out desired design provisions for cyclists. In a 50km/h speed limit the space required is 1.7m from edge of the traffic lane to a kerb, increasing to 2.2m for a 70km/h speed limit.

There is likely to be potential demand for cycling between the communities, and the vertical alignment of the highway is such that cycling is a viable mode of transport. At the current traffic volumes and vehicle speeds, provision for cycle lanes and/or cycle paths is generally warranted given the potential demand. However with the absence of provisions for cyclists east of Ravensbourne, and the narrow width of road shoulders, the level of service for cyclists on this eastern section of the highway route is currently low, and will not be providing adequate facilities to accommodate the demand.

The reported crash history indicated a single cycle related injury accident on the highway, resulting from the narrow shoulder width as a truck passed. This type of accident is symptomatic of the low level of service provided to cyclists, and the low level of service is expected to be addressed by the road controlling authorities as described in the next section of this report.

6. FUTURE CHANGES TO THE TRANSPORT NETWORK

6.1 Dunedin Transport Strategy

The Dunedin Transport Strategy (2006) identified a range of improvement projects to the transport networks between Dunedin and Port Chalmers.

The Strategy includes provision for the Ravensbourne walking/cycling path adjacent to the railway line, which as discussed earlier has already been constructed to Ravensbourne, and will be extended to Maia during 2008. Investigations for the completion of a walkway/cycleway route through to Port Chalmers are currently being undertaken by the roading authorities, and a draft options report is expected to be released for consultation in the near future. It is likely that the options will focus on extending the route along the railway corridor as far as practicable.

The Strategy also includes provision for a realignment of the highway between Frederick Street and Logan Point, and a further realignment of the highway to a position next to the railway, enabling Ravensbourne Road to become a local road. The Frederick Street realignment is expected to occur if the new Awatea Stadium is constructed as this would require a relocation of the highway. Discussions with NZ Transport Agency staff have indicated that the Ravensbourne Road realignment is unlikely to be undertaken in the short term, as the project has a low benefit to cost ratio.

Other possible projects identified in the Strategy are to investigate options to reduce heavy traffic on Port Chalmers main street, possibly by providing a shared rail/road tunnel option.

6.2 Minor Safety Improvements

NZ Transport Agency undertakes regular minor safety improvements on SH88 including projects such as provision for turning vehicles and seal widening. Discussions with NZ Transport Agency have indicated that the target seal width for SH88 is 10m from edge to edge, enabling provision of two 3.5m wide lanes and a 1.5m shoulder. Over time, they expect that further sections of the highway will be widened to achieve the target seal width, however, because of topographical constraints this may not be practical in many locations.

7. SUMMARY

SH88 forms an important link in the national state highway network, connecting Port Chalmers to Dunedin. The route follows the harbour alignment and also provides the primary means of access to the adjacent communities of Ravensbourne, St Leonards, Roseneath, and Sawyers Bay. The route typically operates with an 80km/h speed limit except through Dunedin, Ravensbourne and Port Chalmers.

The carriageway formation is constrained by topography in many locations, included the proximity to the harbour, steep embankments, and adjacent private property. The available carriageway and shoulder widths typically satisfy minimum standards but generally do not satisfy desirable standards for a state highway. NZ Transport Agency will continue to undertake localised widening improvements as part of minor safety works, and in the longer term have included potential larger scale improvements to the alignment in the Dunedin Transport Strategy. Therefore, the geometric standard is considered to be consistent with the function of accommodating Port related heavy traffic.

The highway currently operates with traffic volumes well below its capacity to service the mix of through traffic and side road traffic from the local communities. Ambient traffic growth is low, and it is understood that there is limited planned additional development that may generate significant increases in traffic. Therefore, traffic capacity of the network is considered to be underutilised with scope for additional traffic growth to be accommodated whilst maintaining acceptable levels of service.

The proportion of heavy vehicles is high in the urban environment, however this is reflective of the highest status classification that NZ Transport Agency has placed on SH88 as a key link in the national transport network. The transport related matters of the amenity afforded to the communities are primarily related to the provision of ease of access for all modes of transport, including walking and cycling. A review of the available pedestrian infrastructure indicates that the footpath provisions servicing the communities provide an acceptable level of service, although the network does not extend to provide a full pedestrian route along the highway. NZ Transport Agency and the Dunedin City Council are investigating options to provide a more complete route that also provides a higher level of amenity than the existing footpaths adjacent to the highway.

The cycling network is only partly formed, and the current on-road provision is not adequate to allow safe sharing of the road by heavy vehicles and cyclists. Again, NZ Transport Agency and Dunedin City Council are investigating predominantly off-road cycle network improvements along the route which are likely to provide a future high level of service.

This review of the existing transport environment has shown that additional heavy vehicle transport could be accommodated on SH88 without affecting the capacity or safety of the network for other motorised road users. However, the existing deficiencies in the extent of the cycle and pedestrian network are likely to require action by the agencies responsible to improve the level of service.

Traffic Design Group Ltd
24 September 2008