TRANSPORT ASSESSMENT OF QUAY STREET STREETSCAPE PROJECT, AUCKLAND

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Abstract

Auckland Council published its draft City Centre Masterplan (CCMP) in September 2011, and the final version was launched in August 2012. Flow Transportation Specialists (Flow) has been involved in the assessment of several of the transport components of the CCMP, for Auckland Transport, including the City Rail Link, and proposed projects along Quay Street, Federal Street, Fanshawe Street and Victoria Street.

This paper focuses on the transport assessment for the Quay Street project. The CCMP states that this street "*will progressively change over the life of the masterplan, from a car-dominated road to an important meeting and greeting place and a world-class waterfront boulevard*". This vision requires a new approach to transport assessments - for example, the project involves a street upgrade, and this may involve assessment of some options which reduce traffic capacity, in order to deliver the required streetscape improvements.

This paper therefore outlines some of the issues which are likely to be encountered in numerous locations in our larger cities, where we are progressively moving away from predicting and providing for private vehicle demands.

1 INTRODUCTION

Quay Street represents an interesting challenge which is being faced by many busy streets within our larger urban areas. According to the District Plan (Auckland City Council, 2004a) Quay Street is classified as a Regional Arterial route, while Customs Street, the adjacent parallel route, is classified as a District Arterial route. However, there are significant numbers of pedestrians, either heading to or from the city centre's main public transport rail, ferry and bus interchange at Britomart, or making use of the proximity to the Auckland Waterfront (see Figure 1).

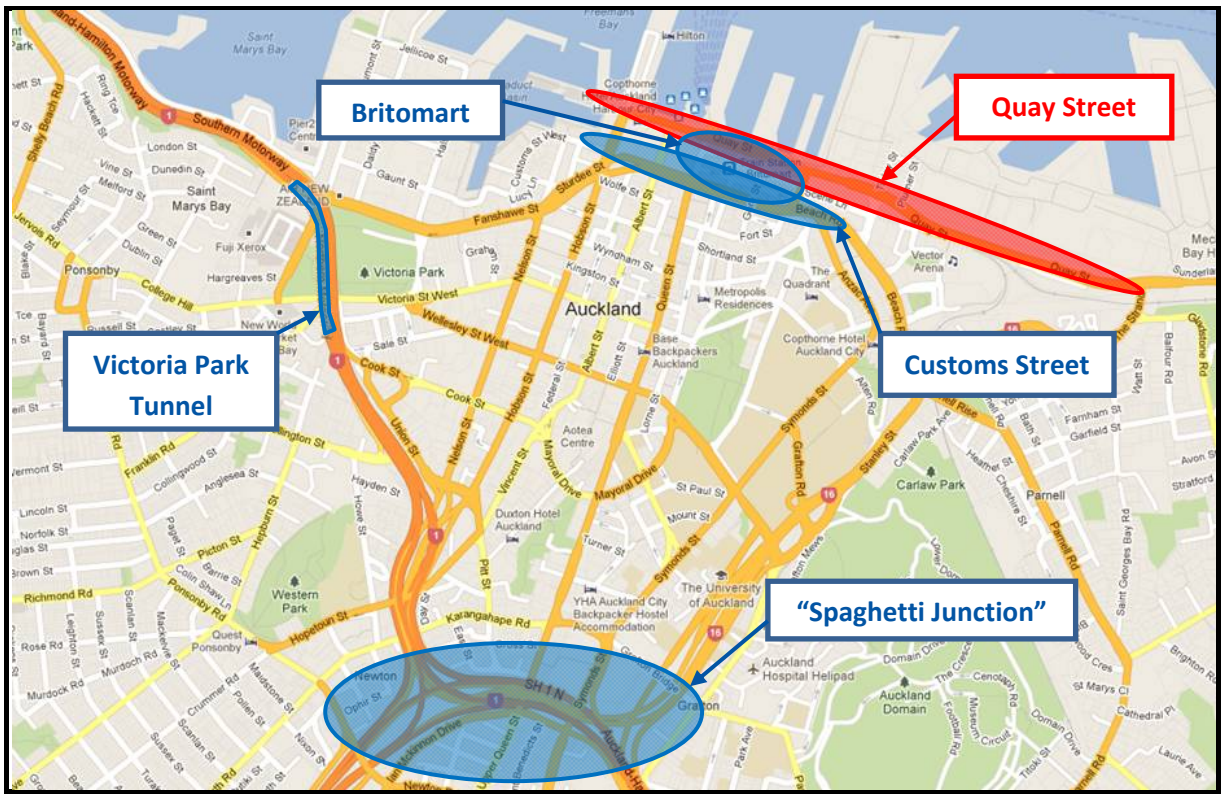

Figure 1: Site Location Plan

The function of Quay Street has changed in recent years and the understanding that Quay Street should not primarily be a place for through traffic has been expressed in various strategic documents[1]. The completion of links within "Spaghetti Junction" and the Victoria Park Tunnel project have provided an alternative route for traffic, allowing extraneous traffic to pass around, rather than through the City Centre. A project to reduce the carriageway width along parts of Quay Street and increase the streetscape amenity was implemented five or so years ago, but Quay Street is still a vehicle dominated route.

[1] For example, the Central Area Access Strategy (Auckland City Council, 2004b) described Quay Street as a "Greenway Distributor", both in the short term and the long term, while Customs Street was anticipated to be downgraded from a Primary Arterial to a Secondary Arterial. It will be interesting to see how the forthcoming Auckland Unitary Plan defines these streets

Also, during the Rugby World Cup in 2011, the proximity of Quay Street to the main "fanzone" area and to the city centre's bus/ferry/rail interchange for public transport trips to/from Eden Park meant that the road was closed to traffic most weekends, for the duration of the tournament. Clearly the World Cup was a temporary event, but it probably fuelled thinking that greater emphasis could be given to people rather than vehicles in this area, on a more permanent basis.

1.1 The City Centre Masterplan

Auckland Council published its draft City Centre Masterplan (CCMP) in September 2011, and the final version was launched in August 2012. The document sets out the vision for the city centre as:

> *"By 2032, Auckland's City Centre will be highly regarded internationally as a centre for business and learning, innovation, entertainment, culture and urban living"* (Auckland Council, 2012a, page 36).

On the transport side, the document seeks a significant shift in focus, with greater emphasis on public transport, walking and cycling, and less emphasis on movement within the city centre by private vehicles.

The CCMP refers to eight "transformational moves", with the first of these being to unite the waterfront with the city centre. More specifically, the CCMP refers to Quay Street as being a Harbour Edge Boulevard. The text of the section on Quay Street is provided in full at Appendix A and it includes:

> *"Quay Street, from Lower Hobson Street to Britomart Place, will progressively change over the life of the masterplan from a car-dominated road to an important meeting and greeting place and a world-class waterfront boulevard"* (Auckland Council 2012a, page 88).

The CCMP states that this will include:

- Calming vehicle speeds
- Increasing the amount of space dedicated to pedestrians and cyclists through a generous pedestrian area on the street's south side, and opportunities for sunny outdoor dining and recreation
- Limiting private vehicle use to local traffic, service vehicles and cruise ship-related activity only, and removing port-related freight traffic as alternative routes are developed
- Enhancing Quay Street's role as a public transport route (and interchange) with a long-term aim of supplementing buses with a light rail system.

1.2 This Paper

Auckland Council, with Auckland Transport and Waterfront Auckland, has commenced investigation work on the Quay Street project, although the ultimate form, functions and interaction with adjoining land uses is likely to take significant time to determine and there is as yet no preferred option.

As such, this paper is based on the broad publicly stated aspirations for the route, and should not be taken as the final word on the project (which remains an under-development proposal). This paper refers generically to the assessments of various options, but not specifically to the predicted effects of any particular option.

This vision for Quay Street, and for similar projects elsewhere, requires a new approach to transport assessments. This paper outlines some of the issues that were encountered during the transport assessment of Quay Street, issues which are likely to be encountered in numerous other locations in our larger cities, where we are progressively moving away from predicting and providing for private vehicle demands.

This paper focuses on the transport assessment. It is noted that urban design considerations have been taken into account by a different workstream.

2 THE ASSESSMENT

The transport assessment was informed by a SATURN traffic model that was developed by Flow for the former Auckland City Council in 2010. This model has been used for assessment of several projects for Auckland Transport over the last few years. The extent of the model is shown in Figure 2 below.

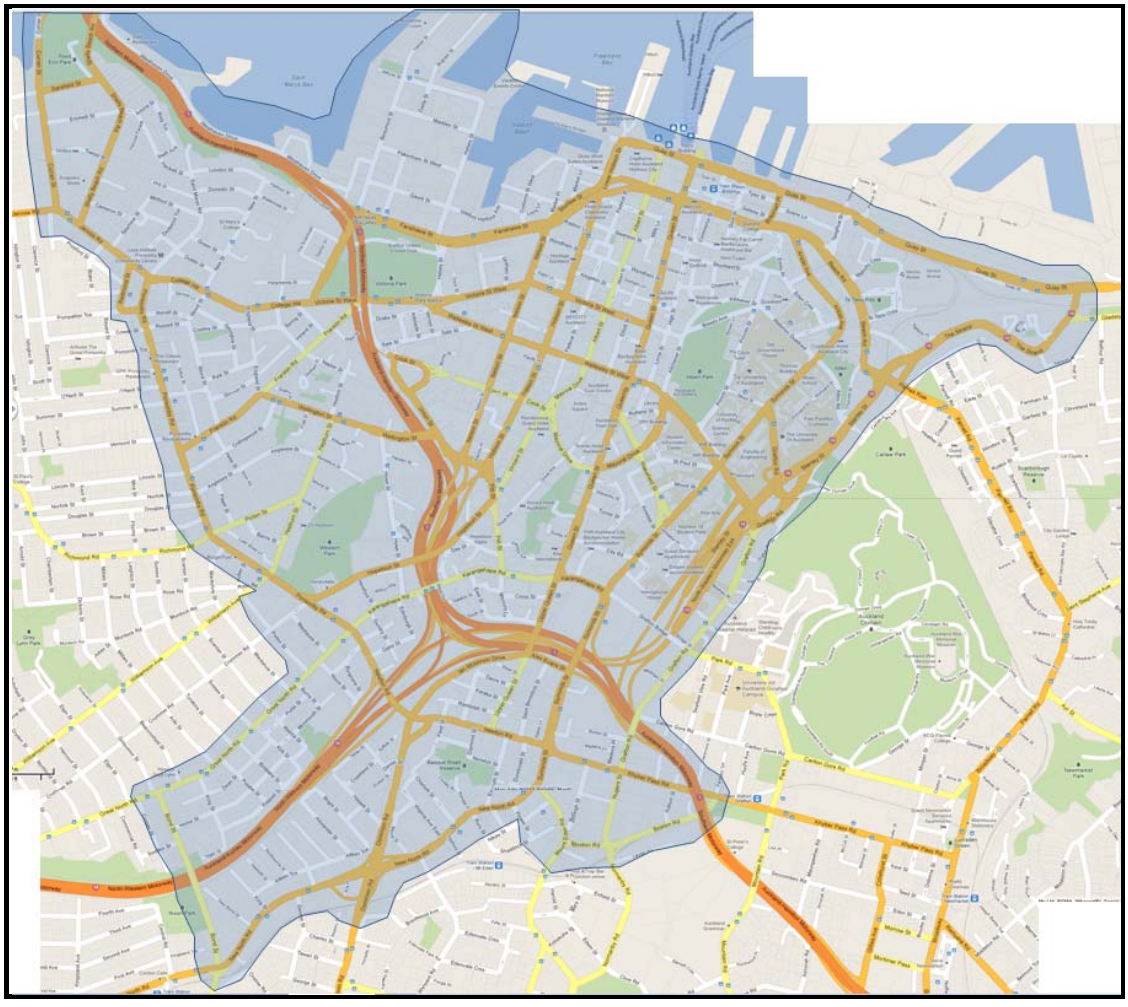

Figure 2: Extent of Auckland City Centre SATURN Model

The assessment was undertaken for a single forecast year, namely 2021. Traffic models were previously available for the weekday morning and evening peak hours, but an inter peak model, covering the period 12 noon to 2pm, was also developed for this project.

3 ISSUES ENCOUNTERED

This section outlines some of the issues that arose during the Quay Street assessment and are likely to be encountered in numerous other locations in our larger cities, where we are progressively moving away from predicting and providing for private vehicle demands.

3.1 Area of Assessment and Modelling Approach

Two general points are noted on the extent of the area of the assessment. These points are relevant for most project types:

- Any assessment needs to be able to identify the wider area traffic and transport effects. This means that the model boundary needs to be fairly wide. In the case of Quay Street it was important that the model was large enough to assess through traffic diverting to the State Highway "bypass" around the city centre
- On the other hand, most assessments also need to assess the local effects of a project in more detail. In the case of Quay Street this included considering the operation of a series of signalised intersections along the route, and indeed along Customs Street, the parallel route.

Key to an assessment of this nature is that there are different types of traffic, including:

- Extraneous or through traffic, which does not need to be in a particular area, but chooses to be there when another alternative exists
- Local traffic, which has a very legitimate reason to be in the local area, as it has a local origin or destination. This particularly relates to service vehicles and public transport.

This is acknowledged in the CCMP section on Quay Street, which refers to the aim to discourage through traffic from entering the City Centre, but the need for Quay Street to provide for traffic access to the surrounding area. We were able to identify the different types of traffic predicted to be using Quay Street (and the adjacent parallel Customs Street) by assessing the origins and destinations of trips in the model, and a key part of the evaluation could therefore be the extent to which any option achieves the objective of removing extraneous traffic from the area. It is perhaps interesting to note that some stakeholders may perceive through traffic to form a far greater proportion of traffic than actually occurs, and so the removal of this traffic may not produce the traffic reduction benefits anticipated.

For the Quay Street project, both the area wide and local assessments were undertaken using the single traffic model. This was entirely adequate for the stage of the Quay Street project, but it is quite possible that more detailed assessments may be required of particular aspects, as a preferred option is identified. Incidentally we are watching with interest the emergence of new modelling technology which will allow both meso and micro assessments to be undertaken within a single model platform.

The Quay Street assessment tested the effects of the project in isolation. It included all committed projects within the city centre, but it did not include the effects of other CCMP projects that had yet to be defined. This was clearly spelt out in the report, and an earlier (preliminary) assessment by Flow had identified the inter relationship of various CCMP projects.

The SATURN model used for this assessment was a SATURN **traffic** model and it is important to ensure that the effects of other modes are taken into account. It is fairly normal practice to model buses in SATURN as a separate user class, with buses coded along their predefined routes (whereas general traffic is allowed to determine optimal routes) and bus lanes can be modelled as being permitted only for use by buses (plus general traffic turning left at the next intersection).

For the Quay Street assessment the following additional steps were taken:

- The effects of bus stops on traffic capacity were taken into account. This may not be necessary in many locations, where buses stopping only occasionally impede traffic in the kerbside lane. However, in central Auckland, around the Britomart transport centre, there is a greater level of "interference", and this is likely to increase in the short to medium term due to expected bus volume growth
- The effects of increases in pedestrian activity on traffic capacity were also taken into account, through the signal phase times. For example, it is common practice to code the pedestrian crossing phases in the model, but the time during which pedestrians will "own the street" (in cases where turning traffic gives way) is likely to increase over time.

3.2 Changes in Demands

A wide area traffic model will allow the assessment to cover the issue of trip reassignment. However, most transport models do not consider the effects of changes in travel behaviour. For example, the Auckland City Centre SATURN model, by default, assumes that the total number of vehicle movements will stay the same, without and with any project. It will cover the issue of reassignment to another route, but not to another mode, or time of day, or even to another destination.

In theory, this question of change in behaviour can be tested through a "higher tier" transport model. The Quay Street project was not tested in Auckland Council's Auckland Regional Transport (ART) model, but it is quite likely that the subtle differences in traffic capacity along Quay Street with the various options would be too detailed for a strategic model of this nature.

The Economic Evaluation Manual (EEM, New Zealand Transport Agency, 2010) includes details on how to undertake Induced Traffic Assessments, in which the total number of trips is different for the scenarios without and with a project. As the name suggests, these are designed with "induced" traffic in mind, and could be adapted to consider trip suppression. To assist this paper we have undertaken some tests in which we have reversed the elasticities recommended in the EEM, and the results are logical, in general, in that they lead to predictions of reduced vehicle trips if one removes capacity. However, we suggest that limited weight should be given to the actual predicted changes in flows, at this stage, when the elasticity factors were not, to our knowledge, derived for projects of this type.

In the absence of reliable information on the effect of a project on changing behaviour and trip suppression, it makes sense to undertake a number of "what if" tests, eg "what would be the case if the project leads to a reduction in, for example, 15% of car trips with a local origin or destination". However, care needs to be taken to ensure that the reader does not pay too much attention to the actual results (ie in this case 15% is only an example, not a prediction). Rather, these tests should be taken to derive trends.

We suggest that further research is required in the New Zealand context on the magnitude of trip suppression.

3.3 Levels of Service

The benchmark of many traffic assessments is the achievement of a certain level of service. However, in congested urban centres this approach has some shortcomings.

Conference delegates may recall my paper that was presented to the 2008 IPENZ Transportation Group Conference (Clark, 2008), which highlighted the limitations of the current level of service classification system that runs from A to F – when much of the network within a congested city is operating at level of service F. For example, any signalised intersection with delay over 80 seconds is classified as level of service F, but one has no idea whether the predicted delay is 81 or 801 seconds.

A related issue to this is the strategic direction for Auckland, as expressed in the Auckland Plan (Auckland Council, 2012b, page 312), to reduce the reliance on private cars as the primary transport mode. The implications for city centre projects are:

- A level of service of F may be entirely appropriate in certain locations, and/or during certain time periods, provided that other transport objectives (such as satisfactory levels of service for public transport, or emphasis on pedestrian provision) can still be achieved
- The question of different level of service targets in certain time periods may be important
- The strategic direction for Auckland (and other larger cities in New Zealand) is toward intensification within key centres. This will lead to inevitable tension between intensification in some centres and the achievement of good levels of service.

It is not at all unusual for transport assessments to focus, to a significant degree, on the conventional weekday commuter peaks, but these are the times of day when level of service F is most likely to be achieved. Also, these peaks only cover about four hours a day[2], and suitable consideration should be given to time periods outside of these peaks, for the following reasons:

- The inter peak period (generally between 9 am and 4 pm) is a period when a substantial proportion of essential freight and business trips is undertaken, when it is important that a reasonable level of service and trip reliability can be maintained

[2] This is assuming that the "conventional" commuter peaks in many of our cities run from around 7-9 am and 4-6 pm

- The average road user in New Zealand has a reasonable expectation that a satisfactory level of service will generally be experienced outside of the commuter peaks
- Journeys to/from work are some of the trips that are most likely to be able to change mode (eg from car to public transport). There are relatively low proportions of these trips outside the commuter peaks.

Levels of service can be defined by delay at an intersection or by average speeds along the links[3]. The average speeds within each level of service category differ according to the free flow speed, so a level of service can be maintained with a reduction in the speed environment.

There is very little guidance in Auckland on desirable or targeted levels of service. From our experience in Canterbury, where the Regional Land Transport Strategy (RLTS, Environment Canterbury, 2008) has for some time set targets, we note that such targets probably have to be overly generic. It is interesting that the latest version of the Canterbury RLTS (Environment Canterbury, 2012) has now gone away from these targets, and instead it now sets targets for reliability, for the network within Greater Christchurch.

The key issue here is that a reduction in level of service is usually seen by traffic engineers as a reduction in the efficiency of the system. This position will still continue to be valid for many situations, but in the case of streetscape projects located in urban or town centres, a reduction in the speed environment would appear to be a good thing, both from an amenity and safety perspective - providing there is sufficient consensus on the appropriate speed environment. A related issue here is that the speed reduction will be considered as a negative economic impact, adversely affecting the benefit/cost ratio, as it will lead to increased travel times. While identification of wider economic effects of transport projects (ie the non transport effects) is now being included in many business cases, we suggest that the positive effects of reducing speed environments may not currently be given sufficient weight.

We therefore suggest that the following issues need to be considered in the assessment for projects of this nature:

- What is to be the targeted level of service, for a specific area?
- What level of increase in travel time is to be accepted?
- What specific triggers are to be considered unacceptable?

In terms of the second and third points, we note that:

- The extent of any difference in travel times should be split into two elements – that which is expected due to the change in speed environment and that which is due to any change in congestion and delay. The latter will relate primarily to intersection operation, but also to the midblock capacity

[3] It is acknowledged that these are not the only two determinants of level of service

- The change in speed environment (ie the free flow speed, or the link speed/flow characteristics) will generally be an input to the traffic model, and this will be determined by the modeller. Care needs to be taken to ensure that persons reading a report are aware of what are outputs from the model, and which aspects are predetermined by the model inputs
- The reference to specific triggers relates to the unique set of circumstances associated with each project. For example, there could be a bus lane extending along part of a route, so the specific trigger to cause concern could be where general traffic queues are predicted to extend beyond the length of the bus lane, meaning that buses will become caught in general traffic congestion. Alternatively, the trigger could be the level of increase in traffic flows along a parallel route which causes conditions to become unstable.

3.4 Adequate Assessment of Effects on all Road Users

The above sections relate primarily to the assessment of vehicular traffic and there is clearly a need to properly consider effects on other modes. The interdependent and often conflicting needs of the various modes, for example traffic capacity versus pedestrian amenity, ensured that traditional comparisons between scenarios could not directly be drawn. Instead, a raft of measures was drawn from the data in an attempt to paint 'the bigger picture' and demonstrate the holistic nature of Quay Street's various modes.

Issues considered in the Quay Street assessment were as follows.

3.4.1 Bus Users

Initial results from the traffic model were split into travel times along key routes for general traffic and for buses, along with total travel times for these two vehicle types. However it was soon apparent that these results needed to be presented in the form of total person travel times, based on average vehicle occupancies, not vehicle travel times. This allows the effects of any proposal on buses to be more fully understood, as clearly an additional minute for a bus will be more important than an increase in a minute for a private car, both strategically and in terms of the economic impact. Additionally, as noted earlier, car drivers typically have the opportunity to divert away from a congested route, which a bus passenger cannot do.

3.4.2 Pedestrians and Cyclists

Specific improvements for pedestrians as part of the options were included in the assessment, such as the removal of free flow left turn traffic lanes and the provision of additional "Barnes Dance" pedestrian phases. Pedestrian (and cycle) impacts were considered through a number of measures:

- Number of traffic lanes: This provided an initial indication of the severance effect of the street, for pedestrians wishing to cross. Given that the road reserve was expected to be the same with all initially tested options, this factor also gave an initial indication of the space able to be allocated to pedestrians and cyclists
- Predicted changes in daily traffic flows: These figures give an indication of the effect of the options on pedestrian and cycle amenity along the route. However, it is clearly necessary to establish routes (away from the project) where increases in flows are predicted

- Predicted changes in the number of vehicles per lane: Reductions in daily traffic flows were taken as an indication of a positive impact on pedestrian amenity. However, where options for Quay Street included a change in the number of traffic lanes, it was recognised that this could adversely affect the amenity of the area, if it meant an increase in the vehicles per lane.

We suggest that further work should be undertaken, in many cases, to quantify the existing and likely future numbers of pedestrians (in particular, but also cyclists) in the vicinity of a project. Traffic and bus numbers are regularly quantified through the use of traffic models, but the lack of real data on pedestrians and cyclists may be disadvantaging these important modes of transport.

3.5 Inter Peak Assessment

The above sections have indicated the importance of assessing conditions outside of the commuter peaks, for streetscape assessments, due to the need to establish:

- The predicted level of service outside of the commuter peaks, and
- Realistic predictions of daily traffic flows.

The daily traffic flow profile along Quay Street is shown in Figure 3.

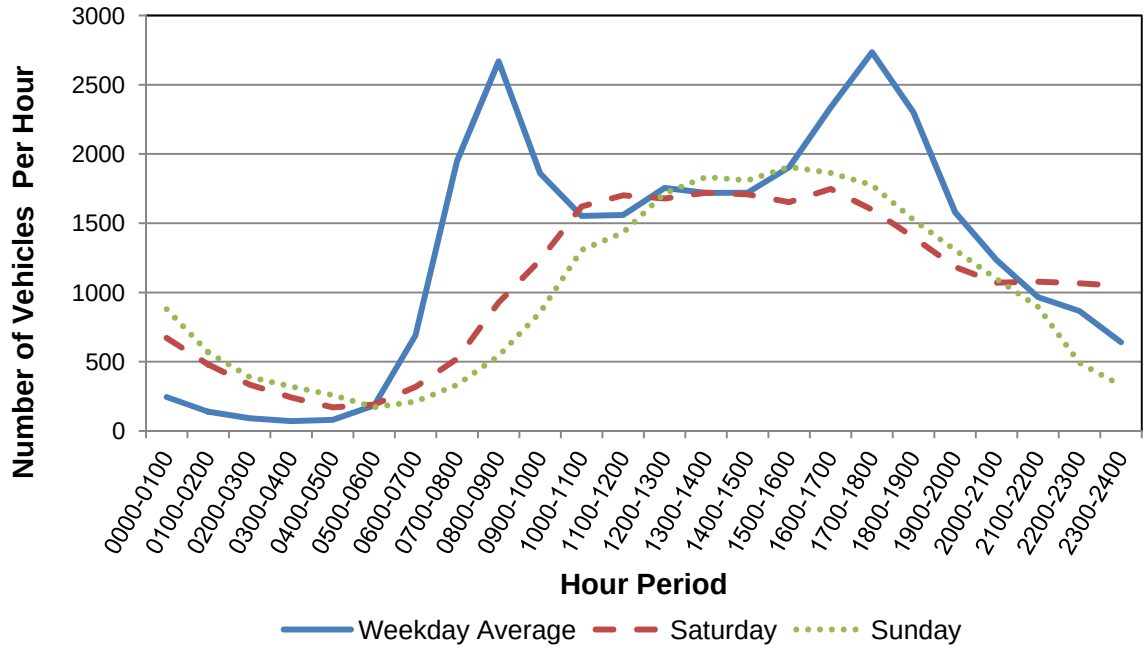

Figure 3: Two Way Traffic Flow Profiles, Quay Street (outside Vector Arena)

The inter peak flows along Quay Street are around 65% of the average of the morning and evening peak hour flows, but this does not mean that the reassignment effects of a project option in the peak hours can simply be factored down to derive estimates of the likely effects in the inter peak period. In the case of Quay Street, there was found to be spare capacity along Customs Street during the inter peak, allowing some route reassignment, whereas there is not the same level of spare capacity in the peak hours, and in the evening peak in particular.

As a result, the daily reassignment away from Quay Street, for a particular option which would remove a traffic lane in each direction, was predicted to be 3,200 vehicles/day, based on extrapolation of only the commuter peak model results, compared with 7,100 vehicles/day when the inter peak results were also taken into account.

Figure 3 also indicates that peak flows along Quay Street at the weekends are similar to the maximum weekday inter peak flows. We are aware that the 2012 NZ Modelling User Group Conference included some discussion on the need for weekend traffic models, and this time period is clearly very important in some locations – but not Quay Street.

4 CONCLUSIONS

The CCMP stated that the Quay Street project is to include:

- Calming vehicle speeds
- Increasing the amount of space dedicated to pedestrians and cyclists through a generous pedestrian area on the street's south side, and opportunities for sunny outdoor dining and recreation
- Limiting private vehicle use to local traffic, service vehicles and cruise ship-related activity only, and removing port-related freight traffic as alternative routes are developed
- Enhancing Quay Street's role as a public transport route (and interchange) with a long term aim of supplementing buses with a light rail system.

It was not Flow's role to identify a preferred option, just to ensure that each of the positive and negative transport related matters were properly identified. In undertaking assessments as part of the initial project investigation, we have identified some issues which we believe will be of interest to the transport profession, not just the transport modelling fraternity.

Matters that we consider have come out from this study include the following:

- It is important that the extent of any model covers the area within which consequential impacts may be felt
- We consider that too many studies focus only on weekday morning and evening peak periods. There is often merit in undertaking assessments of other time periods. For Quay Street a weekday inter peak model was used
- Reductions in speeds are often seen by traffic engineers as a reduction in the efficiency of the system, whereas a reduction in speeds may be quite appropriate for streetscape projects, offering amenity and safety benefits
- Existing level of service definitions are unhelpful in congested urban environments. A level of service which is considered to be "poor" in many circumstances may be acceptable in the peak periods, within city and town centres
- Assessments of streetscape projects will need to quantify the positive and negative impacts for all road users, to a greater extent than other project types
- There would appear to be a need for greater quantification of the number of pedestrians in particular. This is in order to avoid a situation in which a predicted and quantified effect on traffic (either general traffic or specific vehicle types, such as buses or commercial vehicles) is given greater weight than an effect on other transport modes, where that effect has not been quantified

- There is a need for research into the subject of trip suppression (where trips change mode, time of day, or destination)
- In many cases the outputs from a traffic model are inextricably linked to the input assumptions
- There is a need to separate out travel time differences that are a result of changes in the speed environment and those that are a result of changes in congestion/delay.

We suggest that the following issues need to be considered for projects of this nature:

- What is to be the targeted level of service, for a specific area, and for specific time periods?
- What level of increase in travel time is acceptable?
- What specific triggers are to be considered unacceptable?

5 REFERENCES

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APPENDIX A:

CITY CENTRE MASTERPLAN: SECTION ON QUAY STREET

The CCMP (Auckland Council, 2012a) refers to Quay Street as being a Harbour Edge Boulevard. Page 88 of the CCMP states:

"Quay Street, from Lower Hobson Street to Britomart Place, will progressively change over the life of the masterplan from a car-dominated road to an important meeting and greeting place and a world-class waterfront boulevard.

Such a boulevard needs more than a simple upgrade; it will activate adjoining sites and spaces, and offer Aucklanders and visitors more waterfront and city centre experiences.

This will involve:

- *Calming vehicle speeds*
- *Improving the streetscape by using high-quality materials and design, reducing clutter and retaining historic street furniture and surfaces, and public art*
- *Increasing the amount of space dedicated to pedestrians and cyclists through a generous pedestrian area on the street's south side, and opportunities for sunny outdoor dining and recreation*
- *Limiting private vehicle use to local traffic, service vehicles and cruise ship-related activity only, and removing port-related freight traffic as alternative routes are developed*
- *Enhancing Quay Street's role as a public transport route (and interchange) with a long-term aim of supplementing buses with a light rail system*
- *Over time, as the port consolidates eastwards, dedicating the wharf areas beyond the scheduled heritage-listed red fence on the street's water side to recreational and entertainment uses: a promenade with some lightweight kiosk buildings and opportunities for pedestrians to engage with the water*
- *Introducing a range of low-impact design features along Quay Street, including swales and rain gardens, as the final stormwater filter before the harbour*
- *Enhancing important views of landmark buildings and features, including the Ferry Building and the distinctive red waterfront railings, gates and lamps.*

Changes to Quay Street need to be considered in the context of the wider road network and public transport improvements, such as the restructured bus network and the City Rail Link. Through traffic will be discouraged from entering the city centre, although Quay Street will need to provide traffic access to the surrounding area. It will also have a critical role as a diversion route during construction of the City Rail Link. Slower traffic speeds and more provision for pedestrians will naturally encourage freight and unnecessary traffic to use the State Highway network, freeing up Quay Street for an enhanced pedestrian environment with reliable public transport. Consideration of the surrounding road network, especially Customs Street, will be vital to ensure traffic issues are not simply transferred elsewhere in the city centre".