

ONE WAY OR THE OTHER?

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Abstract

Motivated by the debate over whether busy streets within central city areas should be one-way traffic flow or two-way, a Masters' project researched how this decision might be best made by local decision makers.

The literature review found that there are a range of reasons why streets are converted from one type of flow to another; the most common reason cited in the literature for converting one-way to two-way is to contribute to central city regeneration. However no clear link appears to have been established between the type of street system – one-way or two-way – and economic viability. It was also found that aspects such as pedestrian safety on one-way and two-way streets remain areas of strong debate.

A series of industry interviews were undertaken, aimed at better understanding the views of various industries involved in planning our built environment, primarily transport and urban design; and the views of these professionals can often be in conflict.

Dunedin is considering the conversion of two central city streets from one-way to two-way and this real world case study is used for testing the framework that has been developed from the Masters' project. The paper outlines the case study including use of the framework that was tested at a workshop held with Dunedin City Council and New Zealand Transport Agency staff.

INTRODUCTION

Following the 2011 earthquake in Christchurch there was much debate regarding the future of the one-way street system in the central city (Wright, 2012). The diverse views on the possible conversion to two-way traffic flow was the primary motivation for a Master of Engineering in Transportation research project (Ward, 2013) into how best this decision is made. This paper outlines the findings of the research to date.

The objective of the research was to '*develop a framework for decision makers when considering whether high volume streets in central city areas should be one-way streets or two-way streets*'. It was not to decide which type of street is the best in a generic sense, but focuses on what is best for each city given what is trying to be achieved. As other New Zealand cities are investigating conversions it was considered that not only would the research present the current international practice with regard to assessing one-way versus two-way, but that it would also provide an immediate tool for the transport and planning sectors.

A one-way street is a street where traffic only flows in one direction, whereas two-way streets allow traffic flow in both directions. One-way streets systems generally comprise pairs (or couplets) and are often made into an overall grid pattern where circulation is required. An example of a grid system can be found in Christchurch. This research focused on arterial/collector type streets that carry high traffic volumes, at least 15,000 vehicles per day, within central city areas, as opposed to low volume, single lane one-way streets in central cities.

RESEARCH METHOD

The research involved three key stages, a literature review, industry interviews and a New Zealand case study.

The literature review looked into the history of one-way street systems, clarified the advantages and disadvantages of one-way streets and two-way streets and identified any existing conversion assessment methods. This background research assisted in the development of decision making criteria that were applied in the case study.

Five transport professionals and five urban design professionals were then interviewed, with the aim of better understanding the views of those involved in planning our built environment. Anecdotally, the views of these different groups are often in conflict.

Based on the literature review and interviews, a preliminary assessment framework was developed. It was an intent of the research that the framework would be used in practice and consequently it was tested on a New Zealand case study where a conversion from one-way to two-way was being considered. It was important to use a New Zealand case study so the framework would be seen as relevant and readily accepted by local decision makers. The case study involved a workshop with local transport and planning practitioners, Figure 1; this reflected what would occur in reality where collaboration between disciplines allows for more comprehensive assessments, and is considered best practice.



Figure 1: Collaboration at the assessment workshop

LITERATURE REVIEW

Introduction

Most of the literature related to converting between street types in central city areas emerged from Canada and the United States of America (referred hereafter as 'the US'). There was some but generally little literature identified from European countries, Asia or Africa. Some literature is beginning to emerge from Australasia, with at least one Australian city, Perth, converting some central city one-way streets to two-way (Thomson, 2009). Likewise, in New Zealand cities such as Dunedin (Morris, 2012) have mooted conversions from one-way streets to two-way.

Given the predominance of literature from the US the findings were considered carefully to reflect the following key differences between New Zealand and US transport environments:

- Road reserves are generally wider in the US. This means that conversions often have less impact on aspects such as on-street parking provision, space for central medians and footpath width.
- The traffic volumes on some of the one-way streets in comparable sized US cities appear to be less than in New Zealand cities due to expressways being located very close to the central city. This means the importance of traffic capacity will vary with potentially New Zealand streets having a higher importance on capacity issues than US cities.

The literature reviewed in this research generally fell into three categories; literature comparing one-way street and two-way streets, literature based on actual studies into conversion projects and literature that comments on one-way streets and two-way streets as part of a wider topic.

The title of papers, articles and even blogs prepared by advocates for either one-way or two-way streets reflect the passion for this topic. For example a paper titled '*Downtowns – Are we strangling ourselves on one-way networks*' (Walker et al., 1999). This work concluded that one-way streets are unlikely to support vibrant downtowns and appears to have been a catalyst for on-going discussion and debate. This paper, which was also published as a Transportation Research Board Circular, is referenced in most of the subsequent literature.

On the other hand, papers such as '*One-way streets provide superior safety and convenience*' (Stemley, 1998) and '*No two ways about it, one-way streets are better than two-way*' (Cunneen & O'Toole, 2005) present a case for retaining one-ways streets at all costs.

There is a multitude of publically available reports that outline studies made when considering converting from one-way streets to two-way streets in a number of US cities. Some studies are fairly lightweight; others go into full detail of the assessment method and outcomes (Bird Houck, 2011) Within studies relating to transport and urban design, reference was found to aspects of one-way streets; for example, around issues such as pedestrian safety (Zegeer & Zegeer, 1988).

Reasons for considering a conversion

The literature revealed there are many reasons why streets are considered for conversion from one type of flow to another in city centres. The key reasons are typically:

- To improve safety and traffic management (usually two-way to one-way)
- To increase capacity (usually two-way to one-way)
- To retain on street parking (usually two-way to one-way)
- To accommodate bicycle facilities (usually two-way to one-way)
- To support central city regeneration - this is the most commonly found reason to convert from one-way flow to two-way flow.

The advantages and disadvantages of each street type

Based on the literature review it was concluded that the advantages and disadvantages of one-way and two-way streets can be best described in terms of four general themes; safety, efficiency, accessibility and placemaking. Each of these themes is discussed briefly below with respect to the literature reviewed and any aspects that continue to be debated. This is followed by a summary table of advantages of one-way and two-way streets (Table 2). It is acknowledged that some

advantages and disadvantages could fall into more than one of the four themes.

The relative **safety** of one-way and two-way streets, particularly the safety of pedestrians, is one of the most debated aspects in the literature. There are aspects related to geometry and direction of flow that are difficult to dispute; however, the matter of speed appears to be where advocates for either street type disagree. Table 1 summarises the key differences between the one-way and two-way streets in terms of safety. The table is divided into 'agreed' aspects and 'disputed' aspects and is followed by further discussion over several of the disputed aspects. Similar tables were developed for the other three themes however only a summary discussion is included in this paper.

Table 1: Safety aspects of one-way and two-way streets

	One-way streets	Two-way streets
Agreed in the literature	Fewer conflicts between vehicles at intersections	More conflicts between vehicles at intersections
	No mid-block crashes involving right turns at driveways.	Potential for mid-block crashes involving right turns at driveways.
	No U-turn crashes.	Potential for U-turn crashes.
	Reduced risk of head-on collisions due to no opposing traffic	Potential for head-on collisions
	Potential for lane changing crashes	No lane changing crashes
	Generally more red light running crashes (Tindale & Hsu, 2005)	Generally fewer red light running crashes (Tindale & Hsu, 2005)
Disputed	Overall accident rate lower (Zegeer & Zegeer, 1988)	Generally lower speeds therefore accident rate lower (Ewing, 1999)
	Generally higher speeds therefore crash severity likely to be higher	Generally lower speeds therefore crash severity likely to be less (Ewing, 1999)
	Fewer pedestrian and vehicle conflicts at intersections (Stemley, 1998)	Fewer potential pedestrian and vehicle conflicts at intersections than one-way streets (Walker, 1998)
	Drivers can give more attention to pedestrians because they do not have to worry about opposing traffic (Zegeer & Zegeer, 1988)	Drivers are less attentive on one-way streets due to the lack of traffic from the other direction (Wazana et al., 2000).

Pedestrian safety is considered to be important in the one-way versus two-way debate because a people friendly environment with high pedestrian volumes is considered to be an indication of a successful central city (Gehl Architects, 2010). Pedestrian crashes are always of concern given the vulnerability of pedestrians and the increased chance of serious or fatal outcomes. Although cyclists are also vulnerable road users their safety isn't such a focus in the debate however much of the literature acknowledges that a bike friendly environment is also part of a successful city.

The safety of pedestrians is discussed from two aspects in the literature; the potential vehicle-pedestrian conflicts on one-way and two-way streets and the results of studies into the pedestrian accident rates on the two types of streets.

Stemley (1998) established that the reduced number of conflicts at one-way street intersections results in a substantial reduction in vehicle to pedestrian accidents as compared to two-way flow.

This is a function of geometry and direction of flow and cannot be disputed. However Walker et al (1999) posed a different argument stating that there are 30-40% more vehicle-pedestrian conflicts within a one-way street network than in a comparable two-way system. Their argument is based on the number of possible conflict sequences that a pedestrian could encounter. Essentially they are saying that two-way intersections are predictable in the nature of potential conflicts whereas due to the variations in flow direction and iterations of one-way to one-way and one-way to two-way that a pedestrian may encounter at an intersection make it a more complex task. This complexity aspect is certainly true for pedestrians unfamiliar with the intersection however it does not override the fact there are fewer actual conflict points within the intersection.

The **efficiency** theme includes traffic capacity, travel time and distance and also operational matters (such as parking) that contribute to efficiency. Aspects such as emissions and noise are also covered by this theme as they are directly related to a number of the efficiency components; however, it is acknowledged that these could equally be covered in the 'placemaking' theme.

As with safety there were many efficiency aspects that were agreed in the literature. One of the disputed aspects was air quality. Walker et al (1999) and several others believe that one-way streets have lower air quality. However one study (De Coensel et al., 2012) found that wasn't the necessarily the case. De Coensel et al. investigated the influence of traffic signal coordination on air pollutant emissions using a microscopic traffic simulation model. A simplified setting was considered, consisting of an urban arterial road with a limit speed of 50 km/h, and equipped with five consecutive traffic signals, spaced at a distance of 200 m from each other. It was found that the introduction of a coordinated "green wave" could potentially lower the emissions of the considered air pollutants by 10% to at most 40% (if a perfect green wave is achieved).

Accessibility is the ease with which activities, either economic or social, can be reached or accessed by people and depends on the relationship between these three components i.e. capability, opportunity and mobility, and is concerned with both the land use and the transport system (Abley & Halden, 2013). When considered in the context of one-way and two-way streets it includes aspects such as connectivity, way-finding and emergency services access. The latter is one of the more debated aspects, with the literature reflecting the views of engineers (Stemley, 1998) and planners without any way of knowing whether this reflects the views of the emergency service operators themselves.

Placemaking is less about engineering and rather encompasses many aspects. The literature review sought out placemaking aspects that have a relationship with transport; these include walkability, exposure of business to passing trade (all modes) and streetscape/amenity. Walkability was the most extensively discussed aspect, with pedestrian activity seen as a key element of 'place' and hence the environment must attract people to be successful. A debated aspect of placemaking is that of 'severance' caused by traffic flows, some literature stated that one-way streets created severance and vice versa other literature stated two-way streets created severance. None of the literature appeared to have asked the street users how they perceived the streets in terms of severance.

An overall debated aspect that relates to all the themes, although predominantly to that of placemaking, is whether converting a street from one-way to two-way contributes to regeneration of an area and improved economic climate. A number of post conversion studies found that the city officials considered the conversions successful. One researcher (Forbes, 1998) concluded that the evidence establishing a link between one-way streets and economic viability is not clear and what was needed was a more substantive basis for determining whether there is any cause and effect between the direction that traffic flows on a street and the economic vitality of businesses on that street.

Table 2 summarises some of the key points identified in the literature review across the four general themes.

Table 2: Advantages of one-way streets and two-way streets

	Advantages of one-way streets	Advantages of two-way streets
Safety	Fewer conflict points at intersections and driveways (between motor vehicles, cyclists and pedestrians) and therefore generally a lower accident rate.	Generally slower traffic speeds therefore the crashes can be less severe.
	Less chance of head-on collisions as no two way flow or U-turns.	No lane changing crashes and generally fewer red light running crashes.
Efficiency	One-way streets generally provide more vehicular capacity and reduced delay as the intersections are usually co-ordinated.	Eliminates indirect routes, which reduces travel distance (and potentially fuel consumption)
	On-street parking, loading zones and bus stops are generally less disruptive to traffic.	Increased recognition and visibility of public transport routes.
	Traffic flow less interrupted if one lane blocked by emergency or break down.	Favoured by bus users for improved transfers between routes.
	More flexible in terms of layout, e.g. can accommodate an odd number of traffic lanes or allow for cycle facilities by removing a traffic lane.	On-street parking arrangement more traditional and expected (as opposed to having it on both sides in same direction).
	One-way streets can accommodate more on-street parking near intersections due to the reduced need to accommodate turn lanes in both directions.	
Accessibility	Can provide efficient access to high traffic generating activities such as parking buildings and bus interchanges.	Creates direct emergency vehicle access to and from central city (but could be slower if congested).
	Drivers have option to park on either side of the street in the direction they are travelling.	Two-way streets create a less confusing circulation pattern that is more intuitive to all users, particularly visitors.
		Provides more direct access and access options to destinations.
Placemaking	Can provide traffic signal co-ordination to facilitate the slower speeds expected in central city areas.	Traffic speeds are generally lower and therefore can contribute to a friendlier pedestrian environment.
	One-way systems can facilitate other changes in the road network that rely on reduced/removal of traffic, e.g. pedestrian precincts.	Can improve pedestrian perception of the street as less of a barrier.
	Pedestrians need only watch for traffic in one direction when crossing away from the intersections.	Allows of equal exposure of all adjacent businesses to passing motorists.
	Easier for pedestrians to cross the street away from intersection due to gaps in platoons of traffic.	Potentially allows for more traditional streetscape.

Conversion studies

Most of the one-way to two-way conversion projects reviewed did not develop a do-minimum option for comparison with alternatives, however some projects investigated options where the number of traffic lanes was reduced to accommodate cycle lanes on the one-way (Alfred Benesch and Co., 2010). The assessment criteria used in the methods reviewed were generally of the same nature in terms of transport and economic development and appeared to clearly link back to the project objectives. The assessment methods reviewed were generally based on the use of both qualitative and quantitative inputs to assess each criterion. Assessments generally compared the options with the do-nothing in relative 'word based' terms, e.g. better or worse, as opposed to score based assessments.

Surveys of cities that have undertaken conversion from one-way to two-way to contribute to central city regeneration generally show an improvement in the economic climate (Brovitz, 2000). However as these conversions were usually part of a package of initiatives determining whether the street conversion was a critical component of the success is difficult to ascertain. In general no clear link appears to have been established between the type of street system i.e. one-way or two-way, and economic viability (Dowling Associates, 2009; Forbes, 1998). However it is acknowledged that the research in this area is not recent. Cities that considered they had successful conversions were the ones where the both the community and technical staff were in agreement and/or where the project was initiated by requests from the community. Public participation was seen as a critical factor in the buy-in to conversion projects (Bird Houck, 2011).

INTERVIEWS

Introduction

The interviews were undertaken to determine if there is a clear difference in the way that each discipline thinks and if the outcomes of the literature review appeared to be consistent with the interview outcomes. The interviews were also used to determine how closely the disciplines would establish the basis of an assessment framework. The interviews were held face to face and involved nine questions; the answers were not intended to be statistically analysed.

Discussion

Listing the main advantages and disadvantages of one-way streets and two-way streets was the first two questions and the most time consuming part of the interviews; however, it set the scene for the later questions. The interviewees raised a number of points that had not directly emerged from the literature review. For example, one urban designer pointed out that parking occupancy on two-way streets is likely to be higher and therefore creates a more consistent barrier between pedestrians and moving traffic.

Most interviewees felt that if the volume of traffic was greatly reduced the majority of advantages and disadvantages stated would still be relevant, particularly those related to network matters (e.g. connectivity). However, all recognised that, although reduced traffic volumes could contribute to a better 'place', the decrease could also increase the operating speeding, which could in turn influence matters such as the pedestrian environment and other place-related matters.

Most interviewees felt that a well-designed one-way street could overcome some of the disadvantages they outlined at the start of the interview such as speed, more attractive streetscape; however, in general network issues such as connectivity, way finding, and public transport issues would still exist.

There was a varied response to the question of whether two-way streets with banned turning movements at intersections (to lessen the capacity impact and parking loss) would overcome the capacity disadvantages when compared to one-way streets. The urban design/planners were generally comfortable with banning turns however one transport professional felt that banning turns could be more confusing than a one-way system.

Most interviewees felt that converting from one street type to another required a full assessment against the conversion objectives rather than using policy only position (or political position) to justify change. However one transport professional pointed out that it depended on the background to the policy as a full assessment may have already been undertaken that justified the policy. One urban design/planner felt that both policy and a full assessment was required.

The interviews also anecdotally shed light on the way the various disciplines deliberate. For example the urban design/planners generally think more about matters relating to 'place' than the transport professionals and likewise the transport professionals think more about aspects such as 'safety' than the urban designers. However there is alignment with regard to matters such as accessibility and efficiency.

THE ASSESSMENT FRAMEWORK

Introduction

As found in the literature review many cities investigating conversion of their one-way streets to two-way developed a set of assessment criteria to assist the decision making process. The criteria were generally applied in a qualitative rather than quantitative manner. For example in Fargo, US, they rated the variations of the two-way proposal against the ‘no-build’ option in terms of the options being *better*, *slightly better*, *no change*, *slightly worse* or *worse* than the no build (Alfred Benesch and Co., 2010). By examining the symbols in the resulting matrix shown in Figure 2¹, Alternative 1 was selected; however it is not immediately obvious. None of the studies reviewed appeared to have weighted the criteria or scored the options.

	Alternative 1 2+1	Alternative 2 Two-Way, 2-Lane	Alternative 3 One-Way, 2-Lane
Traffic Operations			
Pedestrian Access			
Bicycle Access			
Freight			
Transit			
Parking			
Economic Impact			

Comparison to No Build

- Better
- Slightly Better
- No Change
- Slightly Worse
- Worse

Figure 2: Assessment table for Fargo conversion (Alfred Benesch and Co., 2010)

Assessment method

For this research a multi-criteria analysis (MCA) was considered an approach that would work well for deciding between one-way and two-way streets. This would provide final decision makers and the community with a deeper level of transparency and ultimately confidence in the resulting outcome.

MCA establishes preferences between options by reference to an explicit set of objectives that the decision making body has identified. It also offers a number of ways of aggregating the data on individual criteria to provide indicators of the overall performance of options.

A key feature of MCA is its emphasis on the judgement of the decision making team, in establishing objectives and criteria, estimating relative importance weights and, to some extent, in judging the contribution of each option to each performance criterion. The subjectivity that pervades this can be a matter of concern although ‘objective’ data such as inputs from experts (e.g. traffic modelling results) can also be included.

A standard tool used in a MCA is a performance matrix, in which each row/column describes an option and each column/row describes the performance of the options against each criterion. The individual performance assessments are often numerical, but may also be expressed as ‘bullet point’ scores or colour coding; such as was used in the Fargo assessment example above.

A key advantage of MCA processes is that, when the weighting and the scoring of some criteria are debated by the assessment team, a sensitivity analysis can determine how this variation

¹ Transit is an American term referring to public transport

influences the overall outcome. A recent application of MCA was the Nelson Arterial Study (MWH, 2011) where there was a high level of community interest. A sensitivity analysis was undertaken to determine how different criteria weightings would affect the outcome.

The assessment criteria

As discussed earlier the literature review found that the advantages and disadvantages of one-way and two-way streets can generally be described in terms of four general themes; safety, efficiency, accessibility and placemaking. It was considered that the four themes could be used as the criteria groups. The criteria would then be defined in terms of reflecting the performance of the option in meeting the objectives.

The criteria needed to be able to cover a wide range of objectives and be measurable, albeit qualitatively in some cases. Broad brush or vague criteria were avoided as they are too difficult to assess. For example 'environmental impact' is very high level and best covered by specific criteria relating to aspects such as improving sustainable transport options, which ultimately contribute to environmental impacts.

The number of criteria should be kept as low as is consistent with making a good decision. There is no rule on the number however a typical range is 6 to 20 (Department for Communities and Local Government UK, 2009).

The preliminary MCA framework that was developed for this research included four groups of criteria and 14 criteria, weighting of the criteria could then be undertaken to align with the objectives of the conversion project. Cost/funding was excluded from initial framework with the intention of considering this in more detail in the case study.

Table 3 outlines the assessment criteria.

Table 3: Assessment Criteria

Group	Criteria	Group	Criteria
Safety	Impact on pedestrian safety	Access-ibility	Impact on network connectivity
	Impact on cyclist safety		Impact on property access
	Impact on driver safety		Impact on emergency services
Efficiency	Impact on motor vehicle level of service	Placemaking	Facilitates desired economic growth
	Impact on public transport (or future PT)		Contributes towards success of supporting projects
	Impact on bicycle route directness		Achieves improved pedestrian environment
	Supports desired level of on-street parking		
	Impact on wider transport network		

It was acknowledged in the initial framework that the criteria wording was not consistent in terms of being positive, neutral or negative. However this did not impact the viability of the assessment as the scoring system described below 'enabled' the consistency. The final framework will address the criteria wording issue.

Scoring the options

Each criterion was scored out of five. The lowest possible score was 1 (representing a negative outcome) and the highest possible score 5 (representing a positive outcome). This approach was applied to all the criteria. For all of the criteria, except 'Impact on motor vehicle level of service', a score of 2 represented 'no change'. This score of 2 was chosen in preference to 3 (which is the middle score) because the options to be assessed are likely to have a wider range of positive impacts than negative ones, and therefore the scoring needed to be able to distinguish between the magnitude of positive impacts. The 'Impact on motor vehicle level of service' was a criteria where there was more likely to be a greater range of negative impacts compared to the existing so 4 was chosen as the 'no change score'.

THE CASE STUDY - DESCRIPTION

An example of a one-way pair can be found in Dunedin, Crawford Street (northbound) and Cumberland Street (southbound); both are part of the State Highway (SH) network. This pair system was introduced in 1968 to “provide a high level of traffic service to the major traffic generators in the central area” (Hasell, 1969). As is occurring in many cities around the world, the need for this one-way pair (between Anderson Bay Road and the Leviathan Hotel) is being reconsidered as part of a revitalisation project. It was noted that the University of Otago are looking at ways to improve the integration between the central city campus and street network and have flagged a potential conversion of Crawford Street and Cumberland Street to two-way in that vicinity however the study area was confined to the area as shown in Figure 3.

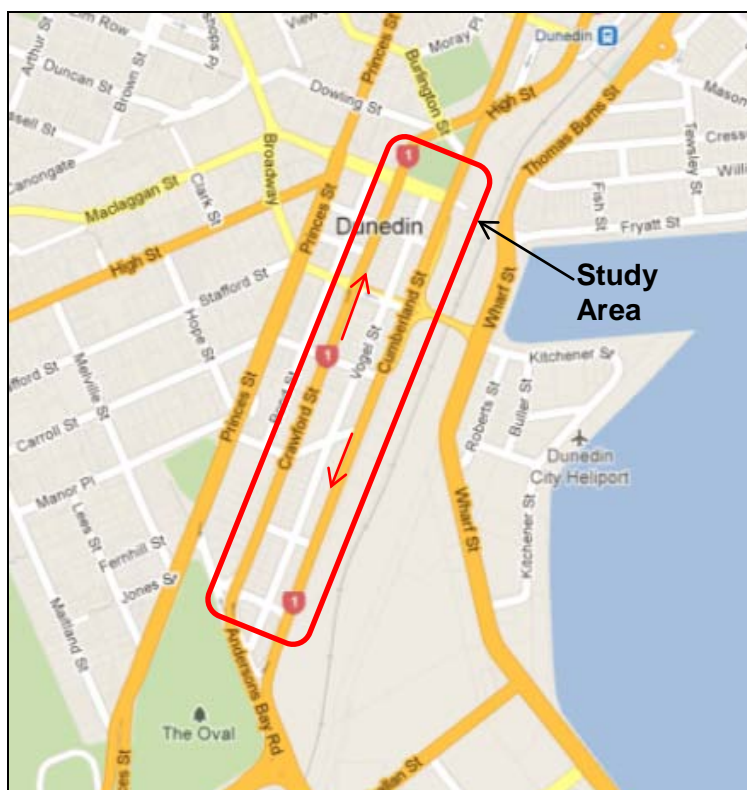


Figure 3: Dunedin one-way pair within the Study Area

Background

In recent years an urban design led project, aimed at revitalising the Dunedin Central city with a specific focus on the Warehouse District, was undertaken with the outcome of the project being the ‘Dunedin Central City – Strategic Directions for the City Centre and Warehouse District’ (UrbanismPlus, 2011). The document proposed a number of initiatives; one of these was the conversion of the Crawford Street/Cumberland Street to two-way south of the Leviathan Hotel. The benefits of converting to two-way were considered to be:

1. Better integration between CBD and Warehouse Precinct (sometimes referred as ‘District’)
2. Revitalisation of the Warehouse Precinct
3. Connectivity between signature open spaces
4. Connectivity between the central city and Steamer Basin
5. Legality of the central city network
6. Reduction in congestion in the five way intersection of Manse/Stafford/Princes/Jetty
7. Reduction in heavy vehicles near the central city (in conjunction with other network changes)
8. Improved pedestrian (and cyclist) safety in Crawford Street
9. Reduction in vehicle kilometres travelled

A number of flow-on benefits were also identified; these were related to opportunities to better use

adjacent land. The plan also acknowledged that there were several disadvantages to the two-way proposal; the most problematic was the likely increase of northbound heavy vehicle flows on Cumberland Street although a number of measures were suggested to mitigate this. Other disadvantages were acknowledged to be the increased conflict points and the financial implications.

The plan put forward a number of conceptual street design options for Crawford Street; all had one lane of traffic in each direction with variations on how the cycle facilities and on-street parking were configured. The aim of the concepts was to illustrate the opportunities presented by the two-way proposal. It was proposed that Crawford Street would no longer be a SH if it became two-way. Cumberland Street would remain a SH and have two lanes of traffic in each direction.

A Project Feasibility Report (PFR) further investigated the proposed changes to the one-way pair (MWH, 2012). This report described how the streets would be configured, how access, parking and active modes would be impacted and the results of transport modelling. It was not an assessment of the proposal against the objectives of the Strategic Directions document but rather whether the project would provide a viable integrated transport and land use solution for vehicles and active transport modes.

The options

The options that were developed for assessment at the workshop were:

Option 1- Do-minimum - Retain the one-way streets as they are, see Figure 4.



Figure 4: Existing street layouts

Option 2- Enhanced one-way streetscape in Warehouse Precinct

In addition to retaining the one-way streets as they are in terms of design, an option that improves the one-way streetscape was considered. This was because a secondary research objective was to establish whether one-way streets can go some way to satisfying revitalisation type objectives if they are made more attractive, more pedestrian friendly etc. This option would focus on improving Crawford Street in the Warehouse Precinct only. This could include gateway treatments to define the precinct, improvements to the intersections that currently feature left in, left out slip lanes, widen footpaths, the introduction of landscaping treatments and themed street furniture.

Option 3 – Two-way streets – solid central medians

Two-way Crawford Street and Cumberland Street as per the cross sections outlined in the PFR. This option included solid central medians on both streets which would restrict some intersections to left in-left out.

Option 4 - Two-way streets – central parking median in Crawford Street

Two-way Cumberland Street as per the cross sections outlined in the PFR. Two-way Crawford Street as per Option A outlined in the Strategic Directions document (UrbanismPlus, 2011), see Figure 5. This design allows for parking in the central medians and could allow all turns at the intersections.

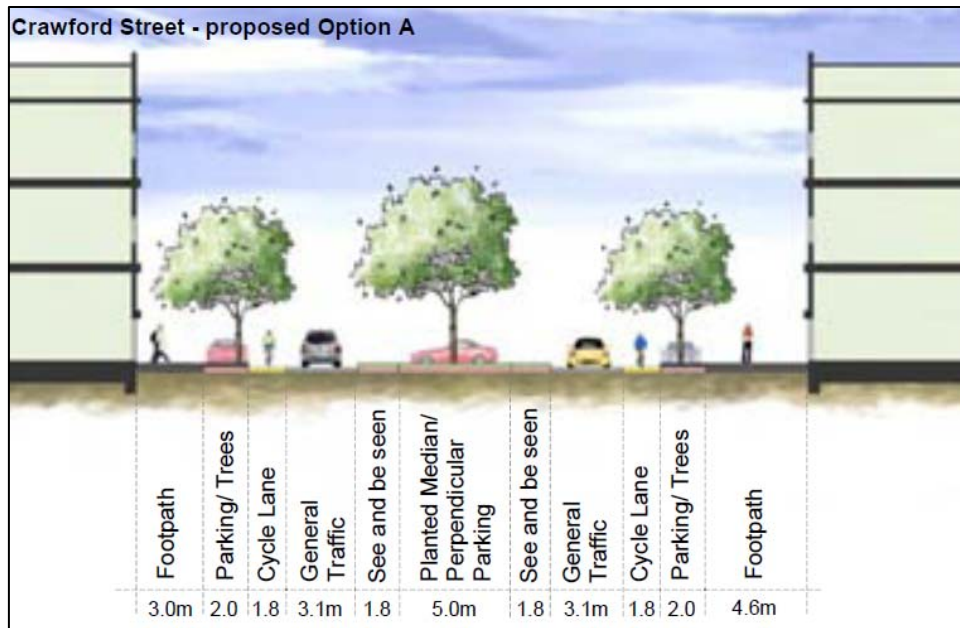


Figure 5: Street layout for Option 4 (UrbanismPlus, 2011)

The workshop

The aim of the workshop was to test the assessment framework by comparing one-way and two-way options for Crawford Street and Cumberland Street south of the Leviathan Hotel.

A three hour workshop was attended by four Dunedin City Council (DCC) staff (two transport planners, a heritage planner and an urban designer) and two New Zealand Transport Agency (NZTA) staff. The first part of the workshop involved discussing the criteria and how they should be applied when scoring. The criteria were generally considered appropriate to undertake the assessment however some of the criteria required more detailed information to be at hand, for example quantification of network connectivity.

It was agreed that pedestrian safety would be confined to real potential risks (e.g. when pedestrian and other users conflict) as opposed to perceived risk (e.g. the level of comfort experienced when walking next to traffic), which would be covered by the pedestrian environment criterion. The same approach would apply to the cycle safety criterion. It was agreed that the ‘facilitating desired economic growth’ criterion would be better termed ‘facilitating desired levels of investment’. It was also agreed that the criteria related to an improved pedestrian environment was too narrow in its focus and should be renamed to reflect the desired outcome of a more attractive destination. This feedback will be incorporated in the final framework.

The second part of the workshop involved each attendee examining the option plans in more detail and then filling in a score sheet. For each option the criteria were scored out of five with guidance provided on the scoring ranges, as discussed earlier; an example for pedestrian safety is shown in Figure 6.

Criteria	Scoring basis		Max
Impact on pedestrian safety	1	Negative impact	5
	2	No change	
	3	Low + impact	
	4	Medium + impact	
	5	High + impact	

Figure 6: Scoring sheet extract

The total possible score for each option was 70. The individual scores were then discussed as a group and agreement reached for each option. Option 3 scored the highest (47), with Option 4 a close second (46). Option 1 scored the lowest (30) with Option 2 scoring only marginally higher (33). Option 4 scored less than Option 3 as the central median parking negatively impacted the pedestrian and driver safety scores.

When the workshop participants were asked why Option 2 did not satisfy the project objectives to the extent that Options 3 and 4 do, the response was that with the streets being two-way the traffic volume and speed on Crawford Street would be reduced and this better meets the objectives than purely streetscape improvements. Overall the outcome did not seem to surprise the participants but it was recognised that ‘cost’ had not been factored in at that stage.

Post workshop analysis

To test the overall robustness of the scoring system three weighting scenarios were developed, one with a ‘link’ focus, one with a ‘place’ focus and the third a balance between the two. The efficiency and placemaking criteria group weightings were altered as these relate most strongly to ‘link and place’, safety and accessibility remain constant over the three scenarios. It is acknowledged that a range of scenarios could be developed however for this case study three were considered sufficient to cover the strategic traffic function of the roads (link) and the desire for an improved Warehouse District (place). The relative weightings of the criteria groups are shown in Figure 7.

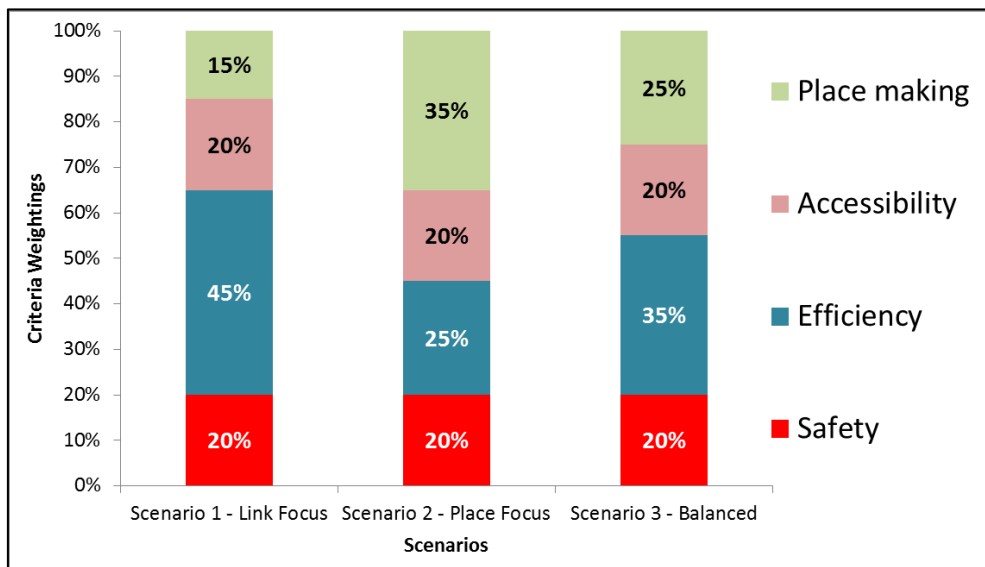


Figure 7: Weightings for each scenario

When these weightings were applied to the raw scores Option 3 was still the highest scoring option, Option 4 second, Option 2 third and Option 1 the lowest scoring.

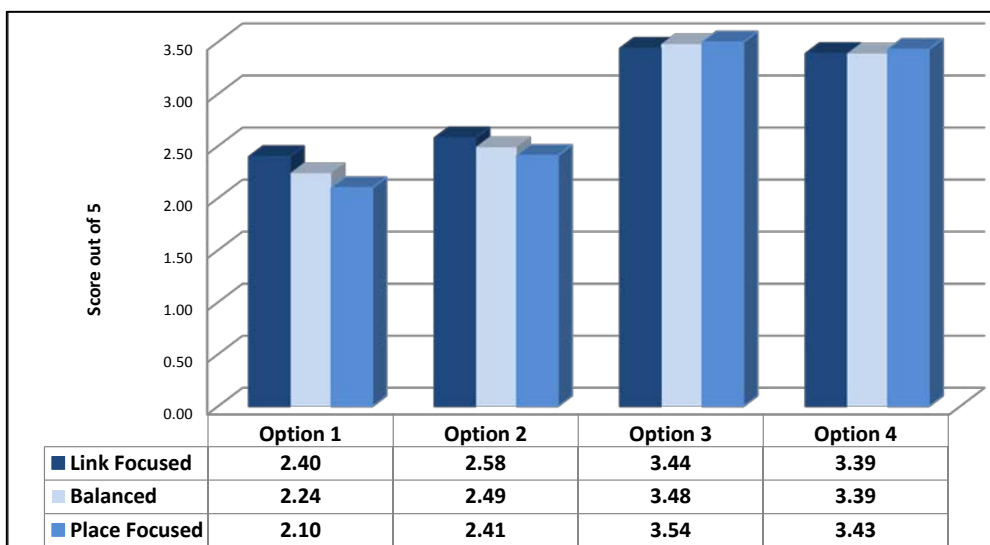


Figure 8: Scores for each weighting scenario

The influence of ‘cost’ was also tested following the workshop by applying the balanced weightings to all the criteria and adding cost as another criterion. The PFR included an estimate for Option 3

and this was assumed to be of the magnitude likely for Option 4. Costs for Option 1 and 2 were estimated in terms of likely magnitude by the lead author. A weighting of 20% was initially applied to cost and this resulted in Option 3 retaining the highest score. When the weighting was increased to 25% Option 3 became equal with Option 1, and 30% tipped the scoring in favour of Option 1 with Option 3 now third. Figure 9 illustrates these results. The research still underway is investigating this in more detail; however, it is apparent that cost is a very sensitive criterion in this assessment. A clear direction on what constitutes cost (it could also include economic benefits) and the role that it plays in the assessment would need to be carefully considered prior to scoring.

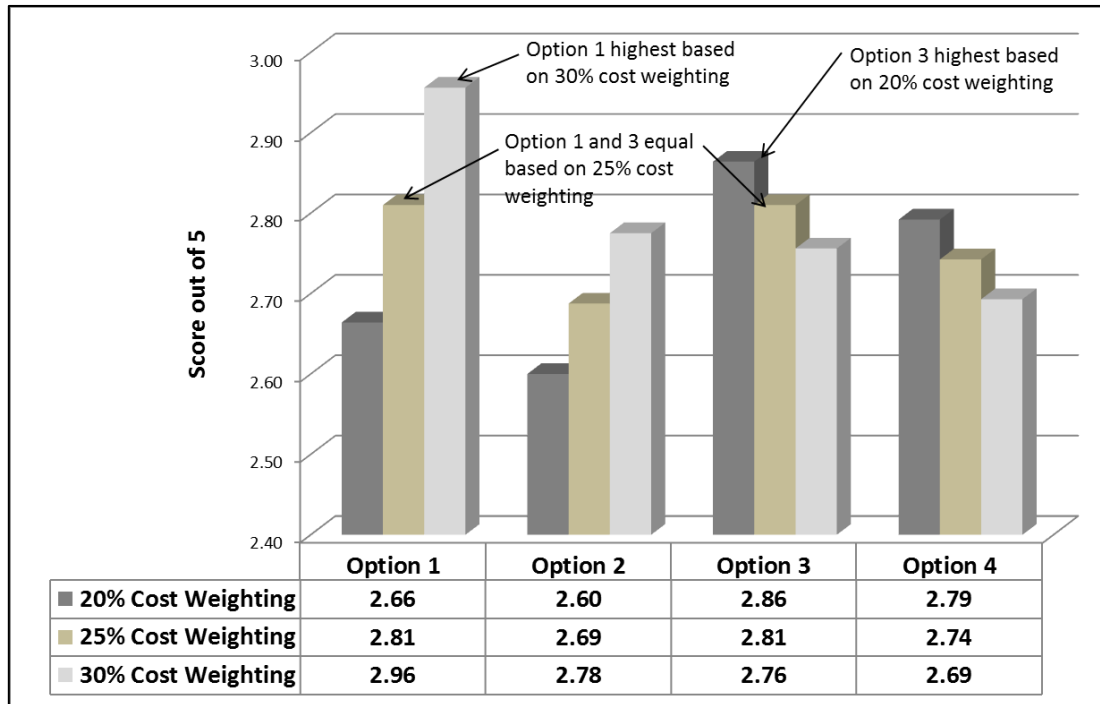


Figure 9: Scores for cost weighted scenarios

CONCLUSIONS

Converting from one-way to two-way or vice versa requires consideration of a number of aspects, these were found to be related to four themes; safety, efficiency, accessibility and placemaking. Ultimately each conversion project will be different in terms of the objectives the project is intending to achieve and will require an assessment that provides flexibility to weight the various considerations.

Although a number of conversions from one-way to two-way have been undertaken to contribute to economic generation, the literature shows no clear link between the direction of traffic flow and improving investment. However a number of the advantages of two-way streets are recognised as ingredients that could contribute to creating a ‘sense of place’. Although one-way streets can also provide some of those ingredients through good design and reducing speed the case study illustrated that these may not go far enough to meet some regeneration objectives.

It is considered that the urban design/planners and transport engineering/planning disciplines have a far greater understanding of each other’s profession today, than in the past. Over time this understanding will only become greater and potentially more aligned.

The assessment framework that resulted from consideration of the literature review findings and industry interviews was tested on a local case study and found to be useful to participants in terms of considering the options in a more detailed manner. This framework is being finalised in the final stage of the research however it is unlikely to differ significantly from that outlined in this paper.

The final research is likely to make recommendations such as where further research would allow better understanding of the disputed aspects of one-way and two-way streets, for example the preferences of emergency services and public transport operators, and the matter of severance.

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