TECHNICAL PAPER

PLANNING TRANSPORT ACTIVITIES FOR URBAN GROWTH AREAS AT A LOCAL LEVEL

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ABSTRACT

The planning of transport activities (infrastructure and services) for urban growth areas requires an in-depth understanding of the interaction between land use activities and transport demand. The traditional approach to this type of planning has focused on the interaction of new development with the wider transport network, but it is at the micro-scale where the real benefits for the community can be obtained and preserved for future generations.

This paper presents an example how this integrated approach to planning transport activities for urban growth areas at a local level has been applied in a recently completed project for the for Christchurch City Council by Abley Transportation Consultants. The paper covers the process and techniques used to develop local area transport plans for the Belfast area within the context of a region wide land use planning framework supported by strategic transport projects. Of particular interest will be the innovative assessment techniques used to ensure residents are provided with genuine travel choices, especially sustainable travel choices, to create an environment that reduces the need to travel.

This presentation will appeal to anyone in the transportation engineering or planning profession that is involved in the planning of transport activities in urban growth areas.

INTRODUCTION

The Greater Christchurch Urban Development Strategy (UDS) provides the primary strategic direction for the future growth of the Greater Christchurch area through to 2041. The UDS and Proposed Plan Change No.1 to the Regional Policy Statement (Change 1) identify Belfast as one of the main areas to accommodate Christchurch's greenfields residential development, and an even larger proportion of Christchurch's industrial growth.

Christchurch City Council (2009) predict that an additional 2,900 households are likely to be provided in Belfast to meet anticipated demand for housing. By 2041, a total of 6,000 households and an estimated 15,000 residents will be calling the Belfast area home.

The Christchurch City Council has been working on an Area Plan for the Belfast area (**Figure 1**) since 2004. An Area Plan is a non-statutory document and an effective means of assessing the opportunities and constraints for land use change within a defined area. It assists a Council in carrying out its functions under both the Resource Management Act 1991 and the Local Government Act 2002.

Figure 1 Location of Belfast Area within Greater Christchurch Area

Part of the Area Plan process involves assessing the transportation implications of land use proposals for the Belfast area as identified in the UDS and Change 1.

Abley Transportation Consultants were engaged by Council in May 2009 to review the initial transportation assessments prepared for the Belfast area by Council in November 2007, to develop and test a preliminary package of transport activities (Transport Plans), and to prepare a Belfast and Upper Styx Area Plan Transportation Assessment (BUSAPTA) report.

OBJECTIVES & GOALS

The key purpose of the BUSAPTA project was to develop Transport Plans for the local Belfast area that would support planned development within and beyond the study area, and complement the strategic level 'Christchurch Northern Access Transport Investigation' (CNATI), which at the time of preparing this paper was being worked on by the New Zealand Transport Agency (NZTA).

The other objectives of the BUSAPTA project were to:

- ✓ Provide a holistic transportation assessment incorporating a number of land use and transport infrastructure proposals and to clearly identify whether the sequencing of land use as identified in Change 1 accords with good transport management of deferring land use until such key infrastructure is in place.
- ✓ Identify any opportunities to bring forward in time any of the land use changes identified in Change 1.
- ✓ Identify any transport improvement opportunities as a consequence of modifications to the State Highway network, and corresponding design improvements to Main North Road.
- ✓ Identify a fully multimodal integrated transport system that takes cognisance of the mode share targets of the New Zealand Transport Strategy (NZTS) and the current Government Policy Statement on land transport funding (GPS).
- ✓ Align with the proposed Greater Christchurch Travel Demand Management Strategy (GCTDMS), other local transport strategies and not preclude future sustainable transport options beyond 2041

Christchurch City Council (2009) defined a transport goal for the Belfast area and formed four objectives to support the goal. The transport goal was:

> *Integrate transport and land use to reinforce a sustainable urban form, with development and intensification. Primarily the network will be based on ensuring that an appropriate level of multi-modal transport infrastructure and services are in place to provide sufficient capacity and function to support further urban development, including development outside of Belfast.*

The four objectives developed by Christchurch City Council (2009) to support this goal were:

> *1. Manage growth to ensure transport and land use patterns are aligned to achieve sustainability, efficiency, and liveability within and through Belfast.*
>
> *2. Manage transport and transport infrastructure to facilitate a multimodal transport network, and integrated transport management that incorporates:*
>
> - ✓ *Increased connections between residential communities, and in particular connections across Main North Road and the rail corridor;*
> - ✓ *A network of cycling and walking facilities through the public open space and Styx and Kaputone esplanade reserve network;*
> - ✓ *Provision of high quality public transport services, including bus priority lanes along Main North Road, a transport interchange at the Radcliffe District Centre, and routes within 400m of any new residential households; and*
> - ✓ *Walking and cycling connections linking Sheldon Park with the Radcliffe District Centre.*

3. Manage the use of the road network to reduce adverse effects of transport on the environment. This does not extend to blanket protection of the transport function of corridors, but recognises that extensive residential land development will be deferred until supported by other major transport infrastructure projects that improve the performance of the arterial road network; primarily through improvements to the State Highway network and the provision of the Northern Arterial. This major infrastructure project will enable the provision of other transport modes for Main North Road and a reduction of the movement function of Main North Road for private motor vehicles.

4. Achieve development opportunities, mixes and densities that can better support public transport, walking and cycling.

The main thrust of all these objectives is to ensure a transport network is developed that will give the Belfast community transport choices, with the focus being on sustainable modes of transport. The Transport Plans prepared for the Belfast AREA were developed with these four objectives and the overarching transport goal for the Belfast area at the forefront on the project teams mind.

LAND USE PROPOSALS

The key land use plan that influences travel within the Belfast area is Variation 4 to Change 1. The urban growth areas as identified in Environment Canterbury (2008), fully and partly within the study area, are shown in **Figure 2**.

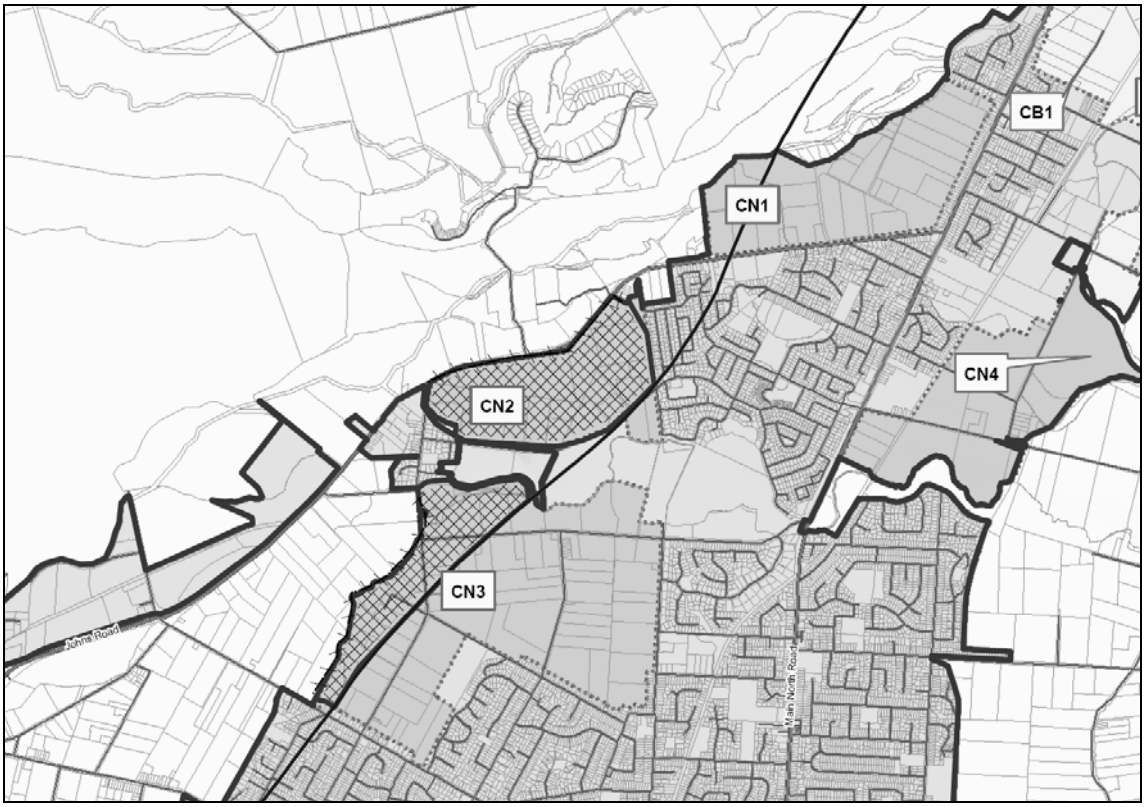

Figure 2 Identified Urban Growth Areas as Proposed by Variation 4 to Change 1

Variation 4 to Change 1 proposes the deletion of area CN2, a reduction in the number of new households in area CN3 and an increase in the number of new households in area CN1. The proposed household yields for the four identified growth areas, fully and partly within the study area are shown in **Table 1**.

Table 1 Potential Household Yield in Identified Urban Growth Areas (Variation 4)

Urban Growth Area	New Households to 2016	New Households to 2026	New Households to 2041
Applefields CN1	1140	360	1500
West Belfast CN2	-	-	-
Upper Styx CN3 *	1525	387	1912
East Belfast CN4	1030	120	1150
* Only partly within study area			

The transport demands associated with two Plan Changes in the Waimakariri District to accommodate a further 1,500 residential units and the full completion and commissioning of the Pegasus township were also taken into consideration in the BUSAPTA project.

CNATI STUDY

The purpose of the concurrent CNATI study is to define an optimum 'Package of Transport Activities' for the northern area of Christchurch through to 2041 at a strategic network level based on land uses specified within the Change 1. While the focus of the CNATI study is different to that for the BUSAPTA project, the CNATI proposed 'Package of Transport Activities' has major implications for the transport system in the Belfast area. These implications are discussed later in this paper.

The proposed CNATI Package of Transport Activities is a multimodal package that includes projects to provide:

- ✓ Additional road capacity,
- ✓ Public transport infrastructure,
- ✓ Active transport infrastructure,
- ✓ Travel behaviour change programmes,
- ✓ Road safety, and
- ✓ Public transport service.

The majority of the projects are associated with the provision of 'additional road capacity'. This is consistent with the current funding environment for land transport projects, as set out in the GPS, which is to prioritise investment in land transport *"…to increase economic productivity and growth in New Zealand"* (Ministry of Transport, 2009).

However, the author considers the shorter term funding focus of the GPS is somewhat incompatible with the longer term objectives of the non-statutory NZTS which provides the context for the GPS. The Ministry of Transport (2009) states *"The government in general terms supports the overall intent of the NZTS, but considers that moving too quickly on modal shift will have a negative impact on environmental and economic efficiency."*

As such, there is some tension between the proposed CNATI Package of Transport Activities, and the objectives and goals for the BUSAPTA project and the Belfast Area Plan which are more aligned with the objectives and targets of the NZTS.

The proposed CNATI 'Package of Transport Activities' (as at December 2009) is shown in **Figure 3**.

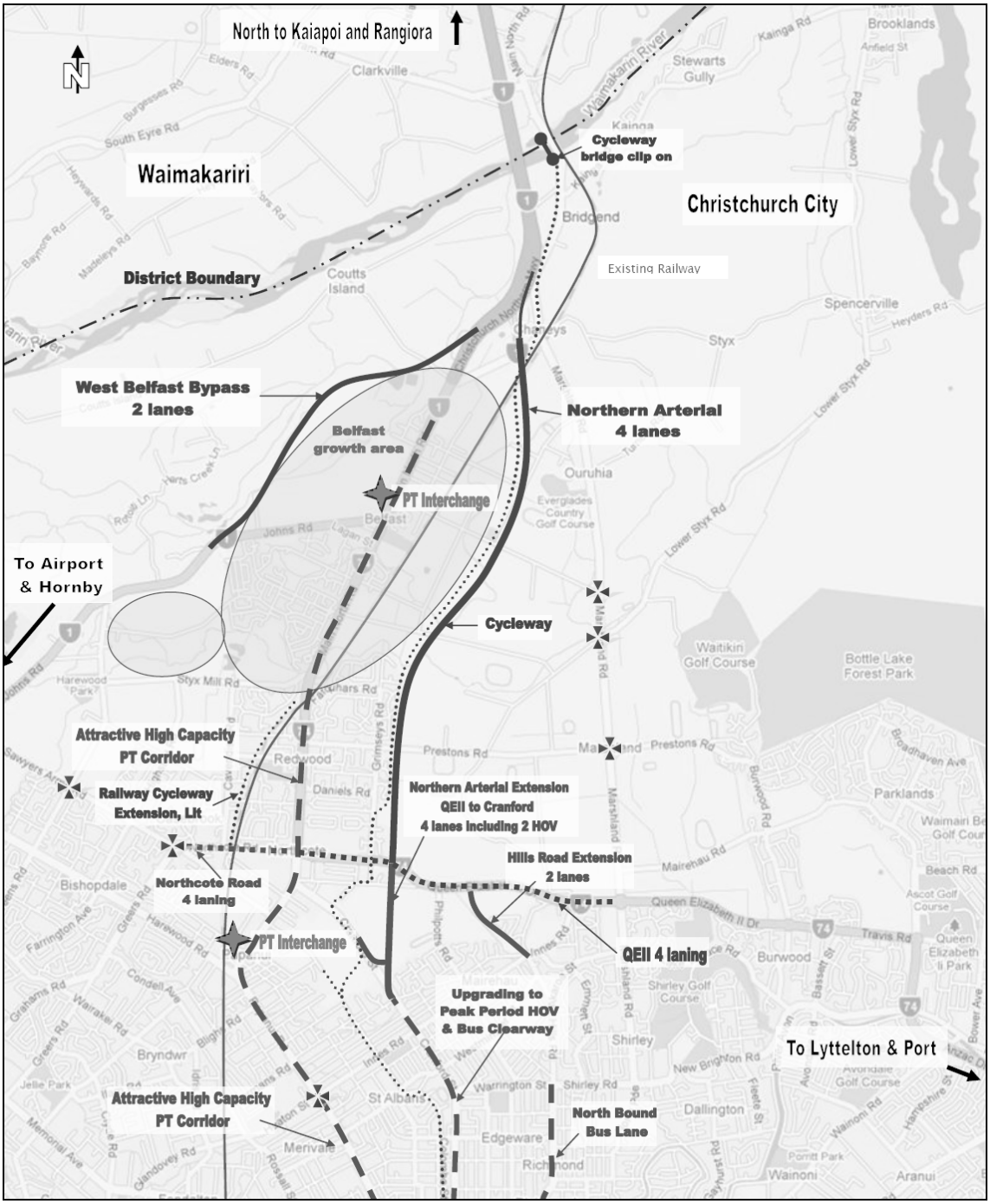

Figure 3 CNATI Proposed Package of Transport Activties (December 2009)

The aspect that creates the greatest tension specifically relates to achieving a mode shift to more sustainable forms of transport to provide better environmental outcomes. This tension arises not from the proposed investment into public transport and active transport infrastructure in the proposed CNATI Package of Transport Activities, but from the comparative over-investment in 'additional road capacity'. The author considers that investing in 'additional road capacity' projects is more closely aligned with the traditional 'predict and provide' approach to transport planning and as such is less likely to produce outcomes that will achieve the vision of the GCTDMS, which is to:

> *"by 2026, people will choose the most efficient and sustainable way to travel and move freight."*

Whilst the proposed CNATI Package of Transport Activities will almost certainly provide a greater variety of transport choices than present, it is unlikely that it will affect any discernable mode shift. This is because the provision of additional road capacity will typically reinforce existing behaviour of those that travel by private car and it is unlikely to improve the relative attractiveness of other modes. This makes the task of affecting mode shift considerably more difficult.

DEVELOPING TRANSPORT PLANS

A holistic and fully multimodal approach was taken in the development of the local area Transport Plans for Belfast area. Separate Transport Plans were produced for the Road Network, the Public Transport Network and for Active Modes, for three periods 2016, 2026 and 2041 to coincide with the land use planning periods.

Roading Network

Main North Road

The existing Belfast area is dominated by major transport routes, being the major gateway to and from the north of Christchurch. The main roads in the Belfast area at present are Main North Road, Johns Road and the Christchurch Northern Motorway (CNM), all of which are classified as State Highways and managed by the NZTA. As such, a high proportion of traffic travelling on these roads is regional or national traffic without an origin or destination in the Belfast area.

Main North Road in particular creates a major infrastructure barrier for the Belfast community. It is a four-lane median divided road with additional non-continuous part-time bus lanes on the approaches to key intersections. The width of Main North Road and the high traffic volumes effectively sever the community between east and west, and discourage cross-community linkages and travel especially by active modes. During consultation on the draft Belfast Area Plan, the Belfast community expressed a strong desire to reduce the effect of this barrier to community cohesion.

The proposed CNATI Package of Transport Activities includes two major transport projects; the Northern Arterial and Western Belfast Bypass, both of which are Roads of National Significance (RONS). These projects are expected to have a major influence on the transport system in the Belfast area and as such the local community. Specifically, following the construction of these projects traffic volumes on Main North Road, north of Johns Road are predicted to decrease by about 55 – 60% from 38,000 vehicles per day (vpd) to around 16,000 vpd while south of Johns Road a decrease of about 35 – 40% is predicted from 30,000 vpd to around 19,000 vpd. On Johns Road the decrease will even be more significant of about 75 – 80%; from 15,000 vpd to around 3,500 vpd.

These significant decreases in traffic volumes on the key roads in the study area have meant that projects to provide additional road capacity on the local road network are not required even with the large increases in traffic demand that will result from planned future urban growth.

In order to create a more liveable community and enhance the opportunity for greater number of connections across Main North Road, a recommendation of BUSAPTA is to, where possible, remove surplus capacity on the road network for general traffic and reassign it to more sustainable modes. Whilst this recommendation may generate consternation amongst decision-makers, the effect of not reducing the capacity of Main North Road for general traffic will lessen the effectiveness of strategic transport projects and assure the barrier to community cohesion in Belfast remains.

This assertion is informed by technical modelling analysis of the effects of reducing Main North Road to two lanes versus retaining four lanes for general traffic. These scenarios were modelled using a refined and finer-grain version of the strategic Christchurch Transport Model (project model). The project model outputs and subsequent micro-intersection modelling using SIDRA Intersection software showed that Main North Road could be decreased to two lanes for general traffic whilst still providing an acceptable level of service for traffic at all key intersections.

Conversely, retaining the existing capacity of Main North Road for general traffic would attract around 3,000 vpd back to Main North Road, and away from the Northern Arterial and Western Belfast Bypass. This would result in a failure to lock-in the benefits offered by the Northern Arterial and attract a greater number of longer distance trips back through Belfast. This outcome would be inconsistent with the desired future function of Main North Road and represent an undesirable outcome for the local community.

Given these findings, the BUSAPTA report concludes that a reduction in the capacity of Main North Road from four lanes to two lanes for general traffic is the preferred approach. This arrangement would provide sufficient space to accommodate a high quality public transport corridor (perhaps located within the central median), improved cycling and walking facilities, improved amenity values, and more frequent and simpler crossing opportunities especially for pedestrians. Ultimately, modifying Main North Road to a form that promotes community integration and connectivity, and removes social severance is the optimum outcome for the local community.

Intersection Form

The general philosophy for identifying road networks for each of the planning periods was to:

- ✓ Determine the new roading layout requirements for the greenfields development areas and connections to and between adjacent developments.
- ✓ Determine appropriate forms of intersection controls to accommodate proposed changes in surrounding land use and traffic.
- ✓ Determine an appropriate road hierarchy structure given the projected increases and decreases in traffic flows across the local road network.

Draft Transport Plans were modelled in the project model to understand the resulting traffic demands and distribution across the transport system in the study area. The outputs from the strategic modelling were analysed and the performance of key intersections within the study area were modelled in SIDRA Intersection.

The purpose of the analysis was to understand the performance of the existing intersection configuration under future traffic demands, and to test other forms of intersection configurations where the existing configuration proved incapable of accommodating these traffic demands. The acceptability of the modelled performance was based on the recommended minimum levels of service specified in Appendix 4 of the Canterbury Regional Land Transport Strategy 2008 – 2018.

Analysis of periods between 2041 and the base year were not considered to be necessary if the modelling indicated that the existing or proposed intersection configuration could acceptably accommodate traffic demands in 2041, as by inference it would also suggest that lesser traffic demands in 2026 could also be accommodated. This is a reasonable assumption because the majority of major road infrastructure identified within the proposed CNATI Package of Transport Activities is assumed to be implemented by 2016, after which the performance of the general traffic network can be expected to deteriorate under increased traffic demands associated with urban development within and beyond the study area.

If the evaluation of the future intersection performance indicated that the intersection would not operate within acceptable performance standards then earlier analysis periods were modelled to determine the extent of effective life of the proposed future intersection configuration.

Public Transport Network

The short, medium and long-term public transport service and routing aspirations for the study area were developed in conjunction with ECan, the responsible authority for providing public transport services in Canterbury.

Active Modes Network

A comprehensive cycle network for Belfast was developed to cater for commuter and recreational cyclist needs. It included dedicated on-road cycle lanes on all classified roads under the responsibility of Council i.e. all roads with a hierarchical classification of Collector, Minor Arterial or Major Arterial.

Formal off-road cycle paths, designed as shared walking facilities, were proposed:

- ✓ As part of the Northern Arterial project;
- ✓ Along one side of the 'Green Corridor' through CN1 (Belfast s293 land);
- ✓ Along Main North Road between Styx Mill Road and Radcliffe Road on both sides; and
- ✓ There are connections linking:
    a. The Applefields CN1 area with the Johns / Main North intersection,
    b. Main North Road with the Railway Cycle Path through Sheldon Park alongside Belfast Primary School, and
    c. Sheldon Park with the East Belfast CN4 area via a grade separated underpass of the railway corridor in the vicinity of the Kaputone Stream.

A key off-road shared walking and cycling path along the western side of the railway corridor was proposed between Radcliffe Road and Belfast Road. This facility would greatly improve walking and cycling access between the commercial centre of Belfast 'Supa Centa' and the community centre around Sheldon Park, including Belfast Primary School.

A link between Riverwood Boulevard (Redwood Springs) and Radcliffe Road across the Styx River was also proposed. This link would greatly improve connectivity between Redwood Springs and CN4 East Belfast. It would also bring the Supa Centa, proposed suburban public transport interchange hub and proposed retail area on the southern side of Radcliffe Road within easy cycling distance of a greater number of households.

The proposed Transport Plan Cycle Network for the Medium-Term (2026) is shown in **Figure 4**.

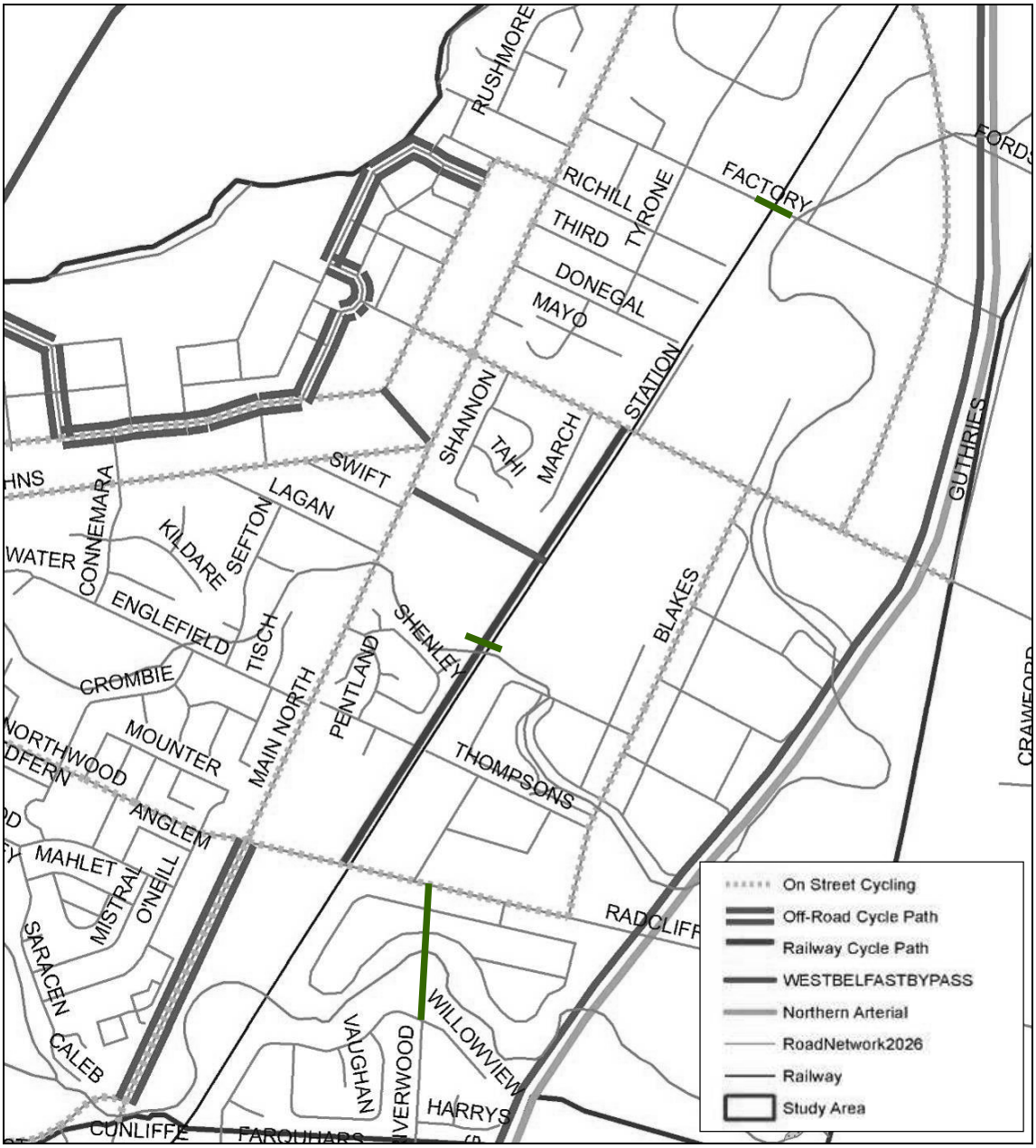

Figure 4 Proposed Medium-Term (2026) 'Transport Plan Cycle Network'

Walking Facilities

In addition to shared walking facilities that also form part of the cycle network, it was proposed that off-road walking routes would be formed alongside the Styx River and Kaputone Stream with grade separated crossings of the Northern Arterial and railway corridor to ensure these facilities did not create barriers to cross movement. It was envisaged that these facilities could also be used by cyclists, but these would be more likely be used for recreational purposes and not commuting or other trip purposes.

A greater level of walking connectivity and permeability was recommended between existing (and proposed) residential areas and the main roading network to improve the level of walking accessibility to key activities and in particular improve access to the 'high capacity public transport corridor' proposed along Main North Road as part of the proposed CNATI Package of Transport Activities.

INNOVATION

The preceding development of the Transport Plans had followed a traditional approach to transport planning of ensuring the road network would provide an acceptable level of service and key intersections, and that networks for public transport, cycling and walking had been identified. To add value to the project, Abley Transportation Consultants used our 'Accessibility Modelling' skills to optimise land use proposals with transport networks to influence changes in travel behaviour, primarily by promoting transport choice and resilient communities.

Accessibility

'Accessibility' is defined as the opportunity to travel to a specific activity through the availability of transport and connections. There are three equally important aspects of accessibility:

- ✓ Access to and provided continuously through the network,
- ✓ The quality of mobility on the network,
- ✓ The importance and number of opportunities at various destinations.

Accessibility varies with need and often the most vulnerable members of the community are the most transport disadvantaged. Accessibility recognises all modes of transport and subsets of the community that may have less transport choice because of age, physical, financial or other variables.

The assessment of accessibility is the measurement of how easy it is for a traveller to reach a desired opportunity based on a set of indicators. The linkage of accessibility measures to economic and demographic measures allows for the targeted improvement of accessibility.

Walkable Neighbourhoods

One of the key aspects of accessibility planning is the development of a 'Walkable Neighbourhood'. A 'Walkable Neighbourhood' is characterised by having a high proportion of households within a walkable distance of a range of facilities, including but not limited to bus stops, local shops, schools, place of employment and medical facilities.

A truly walkable neighbourhood will reduce overall reliance on the private car, especially for short trips through the creation of mixed-use neighbourhoods with interconnected road patterns, where daily needs are within walking distance of most residents. Creating linkages between new development, local facilities, community infrastructure and the public transport network is fundamental to achieving more sustainable patterns of movement and to reducing people's reliance on the car, especially for short trips.

The other key component in the achievement of a walkable neighbourhood is land use planning. Land use planning governs the location in which particular types of activities may establish. If there is a dearth of facility at a local level, then the quality, interconnectedness and permeability of the walking network will be of little value.

Walking Network and Accessibility Modelling

For the BUSAPTA project, walking times were established using a walking network model based on walking routes along formed footpaths and tracks, with a built-in allowance for delays encountered when crossing roads, as a function of traffic volumes and the type of crossing facility provided. Williams (2008) provides a technical description of the development and testing of walking networks.

A model of the walking network in the Belfast area was used to determine the walking catchments with access to three key types of community facilities; bus stops, primary schools and shopping opportunities.

The walking catchment maps show both the mean and 85th percentile walking times, which represent the time 50% and 85% of people are prepared to walk to access a particular activity type. The walking times used in the accessibility modelling were determined from NZTA Research Report 353 National Travel Profiles Part A: Description of Daily Travel Patterns. This research report is based on responses to the Ministry of Transport's National Household Travel Survey (NHTS).

An example of the accessibility modelling scores generated for the BUSAPTA project is shown in **Table 2**. In order to enable the outcomes of the accessibility modelling for the Belfast area to be evaluated, a comparison was made with Christchurch City as a whole and with the three similar outer suburbs of Christchurch namely; Hornby, New Brighton and Halswell.

Table 2 Percentage of Households Within a Walkable Distance of Key Facilities

Modelled Area	Bus Stops		Primary Schools		Shopping Opportunities	
	Mean	85th %ile	Mean	85th %ile	Mean	85th %ile
Belfast 2006	64%	84%	38%	81%	67%	88%
Christchurch City 2006	84%	94%	84%	93%	80%	94%
Hornby 2006	67%	94%	78%	96%	77%	94%
New Brighton 2006	86%	100%	85%	96%	78%	99%
Halswell 2006	60%	93%	88%	93%	76%	93%
Belfast 2041	71%	91%	25%	77%	66%	87%

All accessibility scores, except for Belfast 2041, were based on a model of Christchurch's current walking network and the 2006 census results.

Generally, the accessibility modelling indicated that Belfast had low 'accessibility scores' compared to other suburbs, especially for access to Primary Schools and Shopping Opportunities. These low 'accessibility scores' suggest that in the Belfast area there is likely to be a greater reliance on private car to access these key community facilities than in other suburbs.

Optimising Land Use and Transport

The real strength of accessibility modelling is its ability to be used to integrate transport and land use planning to influence changes in travel behaviour, primarily by promoting transport choice and resilient communities.

An integrated approach was taken for BUSAPTA to identify where accessibility improvements could be achieved through the provision of both transport connections and the location of land use activities. This approach is well aligned with the GCTDMS 'Reduce – Manage – Invest' approach.

An example of accessibility modelling for shopping opportunities is shown in **Figures 5** to **7**. It demonstrates the effect on the walking catchment of firstly providing a walking link between two streets in an area with poor accessibility, and then the cumulative effect of introducing a new shopping opportunity.

The figures show the residential catchments of areas within the mean and 85th percentile walking times of shopping opportunities.

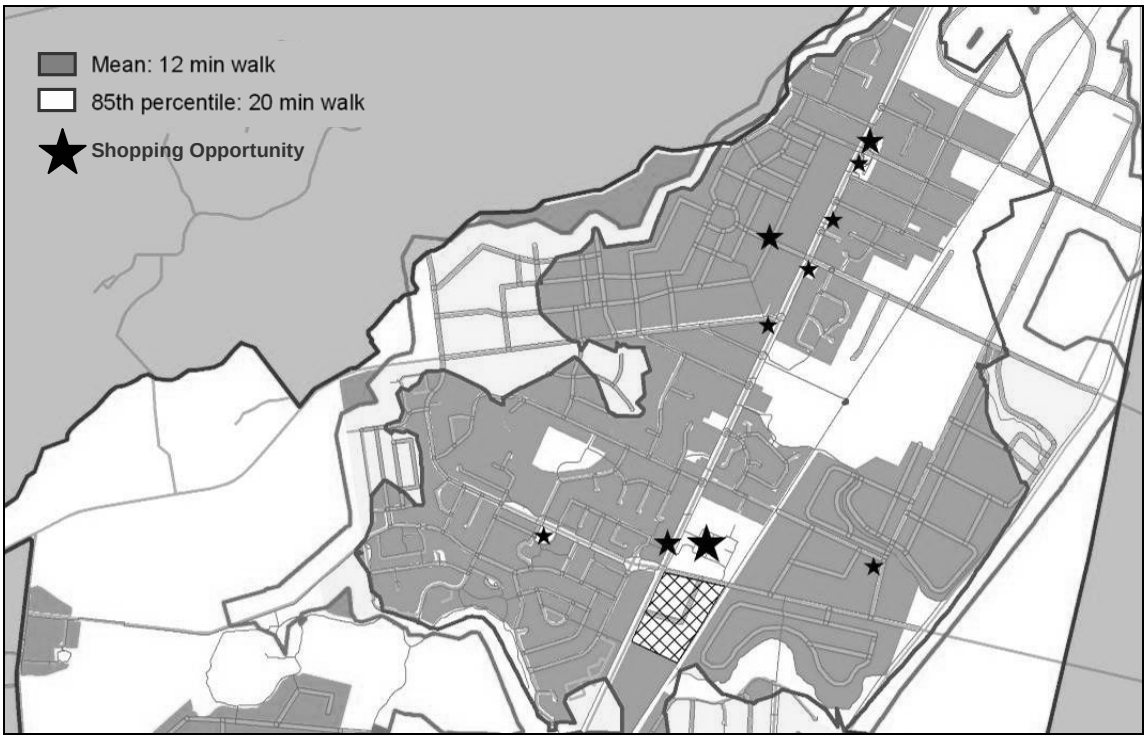

Figure 5 Walking Catchments to Shopping Opportunities (Base Test)

The example shows and quantifies the effect of introducing an additional transport link and new shopping opportunity to the study area. It demonstrates the powerful analytic ability of accessibility modelling and its benefit for application as a travel demand management assessment tool.

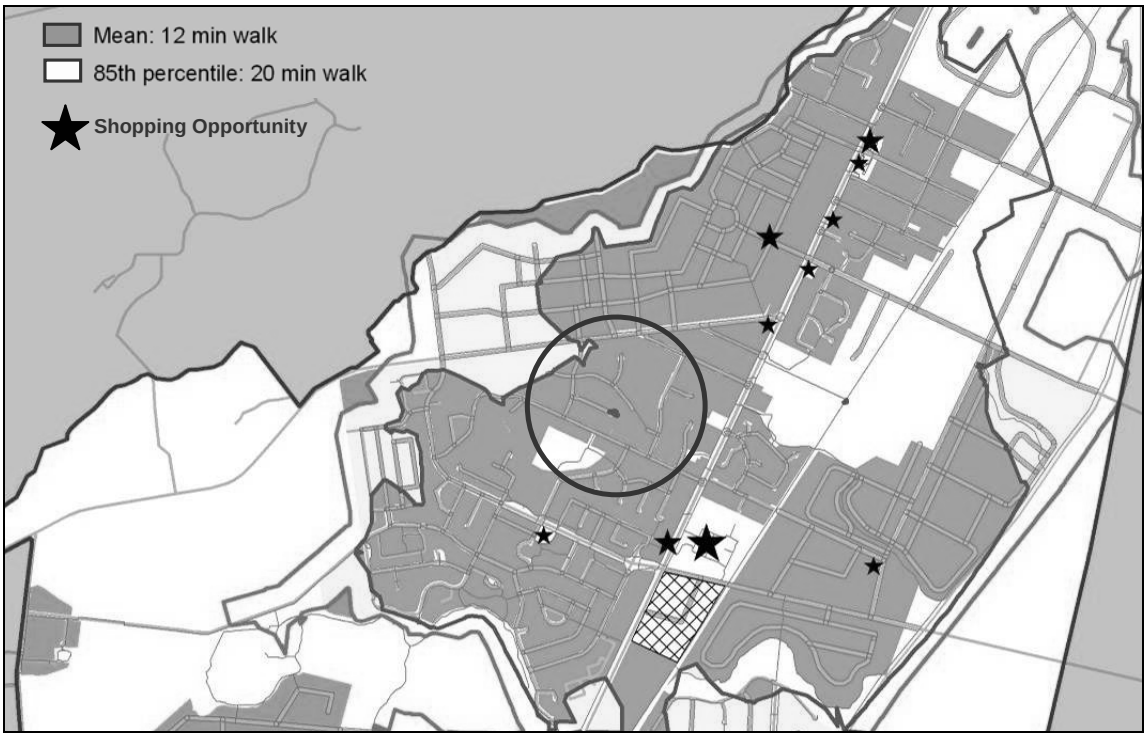

Figure 6 Walking Catchments to Shopping Opportunities (with walking link)

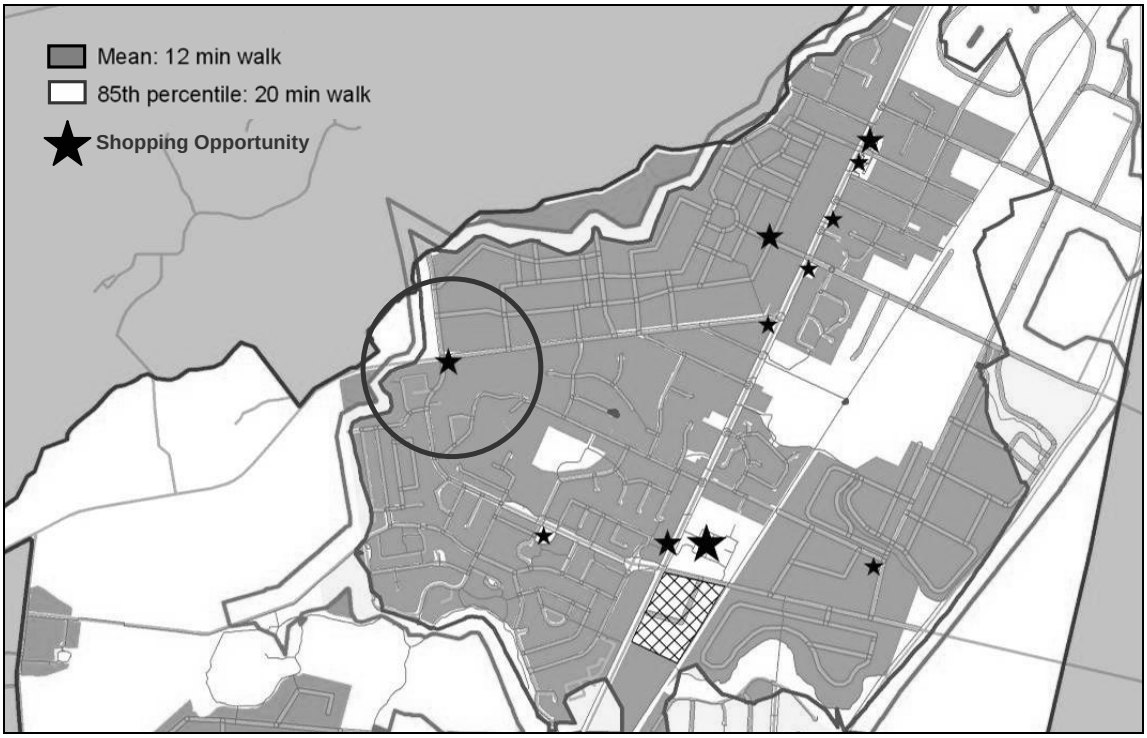

Figure 7 Walking Catchments to Shopping Opportunities (with walking link and new shopping opportunity)

CONCLUSION

The planning of transport activities for urban growth areas at a local level is vital to achieving desirable long-term and sustainable outcomes for a community. This planning requires an integrated approach and an in-depth knowledge of the interaction between land use activities and transport demands. The interactions are complex and complicated especially when proposed land use changes and transport projects outside the study area will have a direct effect on the transport environment within the study area.

The planning of transport activities at a local level differs from strategic transport studies. The focus is much more on achieving outcomes for individuals rather than the transport system. The use of accessibility modelling is an innovative technique that enables sustainable transport outcomes for individuals to be assessed. This paper has covered access to key facilities by walking, but equally it could be applied to any mode including combinations of modes e.g. walk to a bus stop and travel on a bus to a destination. Access to any facility can be measured with this tool.

The real strength of accessibility modelling is its ability to integrate transport and land use planning to influence changes in travel behaviour, primarily by promoting transport choice and resilient communities.

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