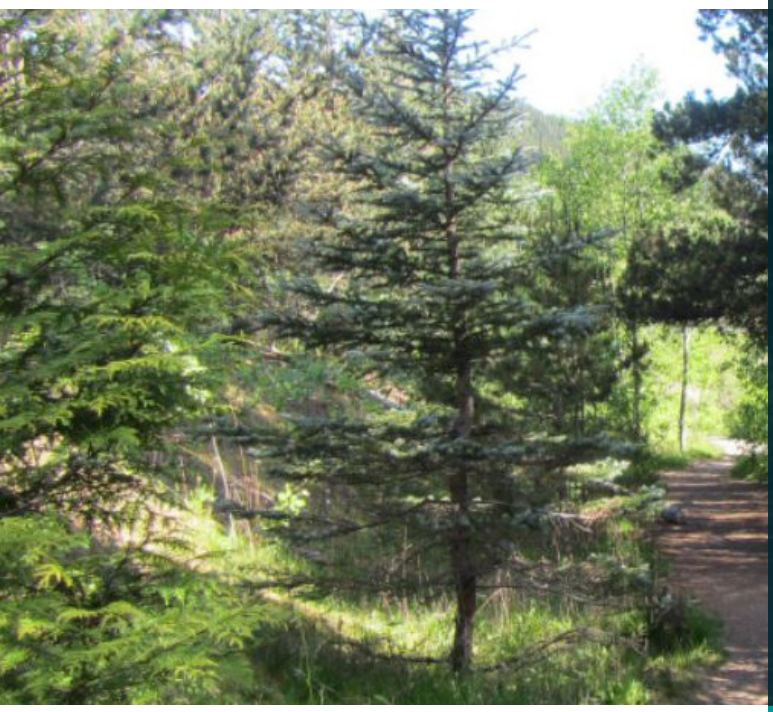

TRANSPORTATION MASTER PLAN

City of Terrace

File No. 2341-02105-0 | May 2017

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EXECUTIVE SUMMARY

The City of Terrace has remained at a stable population of approximately 12,000 for many years. However, new forecasts predict a potential 50% increase in population over the next 10 years based on local economic growth associated with mines, port expansions, energy transmission, and a proposed 2,400 acre industrial park near the regional airport. To address this growth, and to complement recent community planning studies and bylaw updates, the City has commissioned this *Transportation Master Plan*. The objective of the Plan is to provide direction to the City of Terrace for the planning, design, and management of the transportation system improvements to accommodate the expected city growth, while being consistent with the Community Vision and goals for sustainability.

The study began with the compilation of relevant background from recent city plans, maps, strategies and policies. This was followed by comprehensive community engagement, including two stakeholder meetings and a public open house (February 2016), and an online public survey. The survey asked 14 questions about the transportation system, and priorities for improvement. In total, 319 responses were received (i.e. almost 3% of the population), with even representation from all neighbourhoods in the city. The survey results indicated that a large proportion of the respondents considered the following projects as "High" or "Very High" priorities:

1. Upgrade of Lanfear Drive (64%)
2. New pedestrian / cycle overpass over CN rail line (47%)
3. Upgrade of Skeenaview Drive (46%)
4. New vehicular overpass at Kalum Lake Road (45%)
5. Upgrade of Lakelse Avenue / Sparks Street intersection (45%)
6. Upgrade of Lakelse Avenue / Eby Street intersection (45%)
7. Downtown Street Lane Improvements (38%)
8. Upgrade of Thomas Street / McConnell Avenue intersection (31%)

To evaluate how the increase in population would affect the transportation system, future traffic patterns were estimated based on existing traffic counts at 27 key intersections, and the expected city growth in the Keith Estates and Upper Bench neighbourhoods. The analysis was used to revisit the functional classification of the Terrace network, and to identify issues with the performance of major road corridors and intersections. The results indicated that most of the Terrace road network would manage the expected city growth with acceptable Levels of Service. Key concerns were the capacity of roads connecting to the Upper Bench (e.g. especially Lanfear Drive), the need for a new road link across the CN rail line, and operational issues at 12 intersections of various priorities.

The past five years of ICBC claims data (2008 to 2013) was analyzed to evaluate the safety performance of the Terrace road network. The safety analysis confirmed that collisions are generally proportional to traffic volumes (as expected), and that winter conditions are a significant contributing factor. Also, nearly half of all reported collisions were related to parking manoeuvres.

The safety analysis also identified and evaluated the collision trends at the Top 20 locations (based on collision frequencies, rates, and severities). The top non-highway location in Terrace was found to be the intersection of Keith Avenue / Kenney Street, which warrants a four-way stop.

To complement the technical analysis, the Transportation Master Plan included high-level discussions of the following:

- Downtown Transportation: to improve traffic flow, the four lane sections of Kalum Street and Lakelse Avenue should be converted to three lanes. Also, more bike lanes and traffic calming measures are recommended to improve the Downtown for active transportation.

- Pedestrian and Cycle Network: the four identified priorities are (a) a grade-separated crossing of the CN rail line; (b) improved connections to the Upper Bench; (c) a formal trail crossing at the bottom of Lanfear Drive; and (d) an improved trail connection between Terrace and Thornhill.

- Transit System: the routes, schedules, on-street infrastructure, and local transit policy should be revisited in consideration of the future ridership expected with city growth.

- Truck Routes: Keith Avenue is a good candidate for a parallel truck route, and is currently used by heavy truck traffic now. However, this route should not be formalized as a truck route (with associated regulations and enforcement) until Keith Road is upgraded, and a new CN overpass is constructed to eliminate at-grade rail crossings.

- Traffic Calming Measures: the City can implement a number of road improvements to help reduce traffic speeds in residential and commercial neighbourhoods, including horizontal constraints, vertical deflections, and intersection treatments.

- Transportation Demand Management (TDM): to reduce the demand for vehicular traffic, there are a number of initiatives that are effective and appropriate in northern BC communities, including improvements to the active transportation and transit systems, and development incentives.

The Transportation Master Plan recommendations were prioritized into short, medium and long term improvements (Figure ES-1). The top priorities for major network improvements were a new rail overpass at Highway 16 / Kalum Lake Road, a new pedestrian overpass at the east end of the CN yard (with associated upgrades to the trail connections), the upgrade of Lanfear Drive, the four-way stop at Keith Avenue / Kenney Street, and the lane diets in the Downtown.

A number of recommendations for further study, and general system and policy initiatives, were also provided. These included the continued implementation of the Active Transportation Plan recommendations, the continued efforts to improve accessibility, a comprehensive Transit System Study, and a Downtown Parking Study.

There are a number of sources available for funding the recommendations of the Transportation Master Plan, such as senior government grants, ICBC cost sharing of road safety improvements, city bylaws to facilitate Local Area Service agreements and developer contributions, and other public/private partnerships.

Depending on the rate of growth which occurs in Terrace, the findings of this study should be revisited within the next 5 to 10 years.

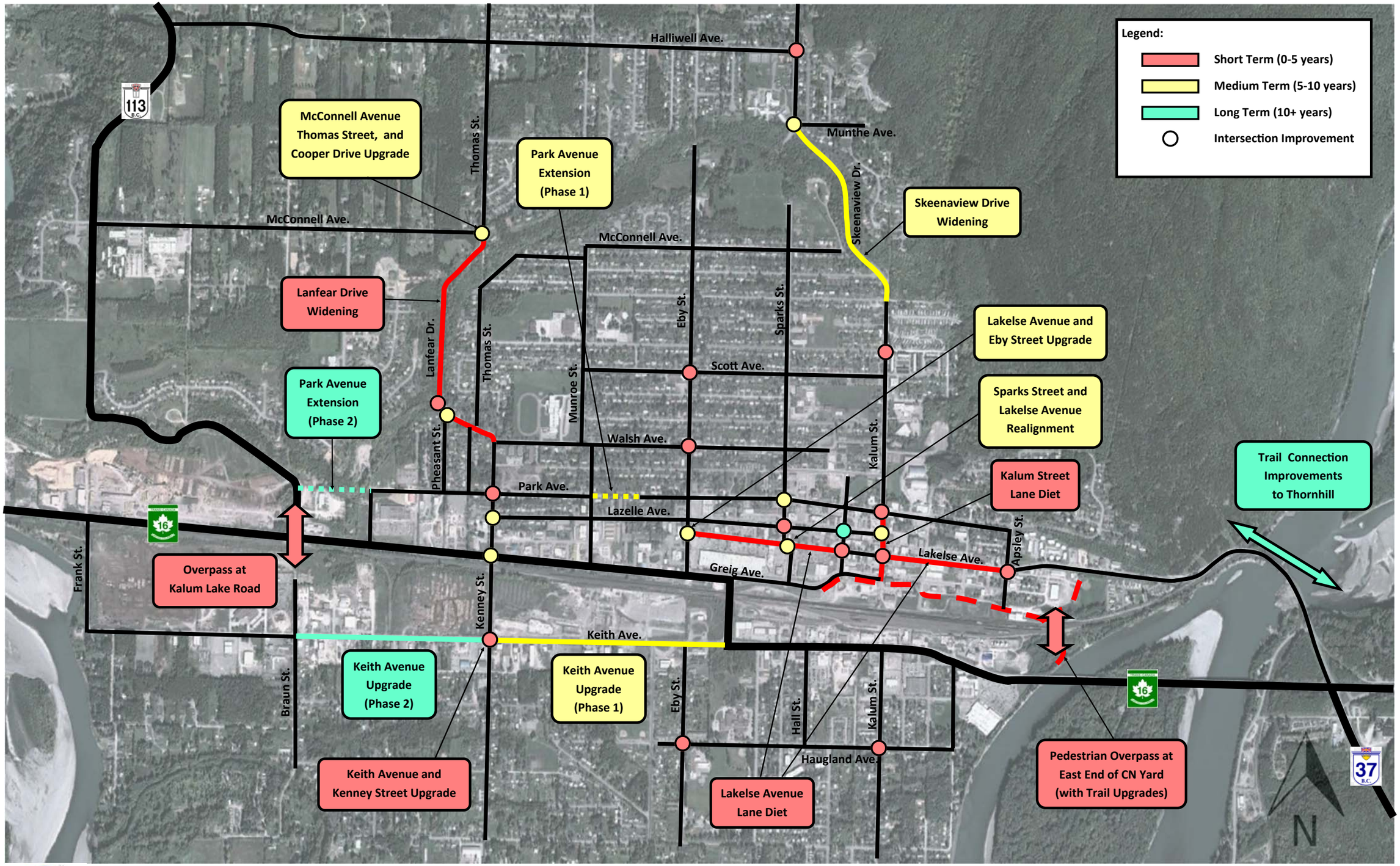

Figure ES-1: Recommended Improvements
Terrace Transportation Master Plan

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1 INTRODUCTION

1.1 BACKGROUND

As the major urban centre in the Kitimat-Stikine District, the City of Terrace has remained at a stable population of approximately 12,000 for the past three decades. However, a recent economic study forecasts a population increase of over 50% over the next 10 years as a medium growth scenario (Figure 1). This growth is based on the assumptions of up to three new mines in the region, port expansions, energy transmission (e.g. Liquefied Natural Gas (LNG), and hydro), and the new 2,400 acre Skeena Industrial Development Park proposed within the airport lands.

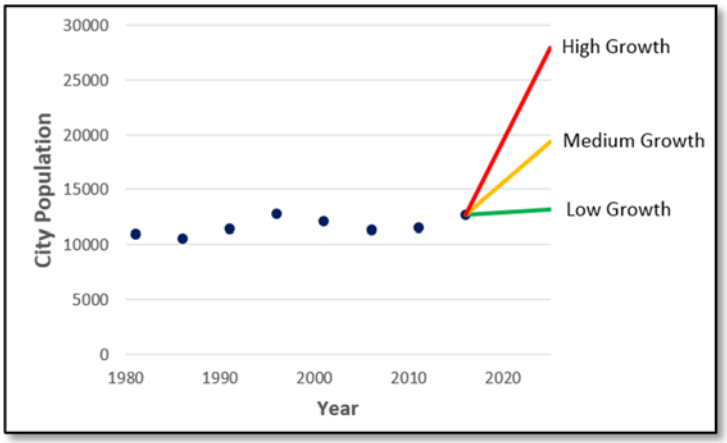


Figure 1: City Population Forecasts
(Sources: Statistics Canada; Big River Analytics)

In response to this expected growth, the City has updated the Zoning Bylaw and the Official Community Plan, and has commissioned an Infrastructure Scoping Study, an Active Transportation Plan, and a Parks and Recreation Master Plan.

To complement this recent planning work, the City commissioned the Transportation Master Plan (the "Plan"). This Plan is intended to align with the Official Community Plan objectives (Table 1), and provide City staff with a prioritized list of effective, affordable, and achievable road network improvements to ensure the city can accommodate the expected growth. In this respect, the Plan must be the foundation on which to respond to development pressures (e.g. Keith Estates, etc.) to ensure the principles of safety, connectivity, mobility, sustainability, and economic viability are preserved. In addition, the Plan shall identify and address existing network issues (e.g. geometric challenges, road capacity constraints, and deficiencies in the active transportation network) to ensure these facilities can safely accommodate the increase in user demands.

This report summarizes the research, consultation, technical analysis, and recommendations of the study, and provides the City with comprehensive and dynamic Plan for use in developing capital programs, negotiating with local developers and industry, and applying for cost-sharing opportunities.

Table 1: Relevant Objectives from the Official Community Plan

OCP Objective	Comments
Build roads and develop infrastructure to meet our current needs within our means.	All recommended system improvements must be viable, cost-effective, and technically feasible. Larger projects may require senior government or private investment partners
Take a long-term and holistic perspective on all infrastructure upgrades, including the consideration of lifecycle costs, sustainability and regional benefits.	The Plan is based on the principles of sustainability, addressing the existing growth projections while considering the long term costs and implications. Effective solutions may extend beyond physical infrastructure, also considering Transportation Demand Management (TDM) initiatives which can delay or offset the need for costly investments.
Local economic viability and vitality.	To support the local economy, the Plan addresses issues with road network capacity. Traffic needs to flow safely and efficiently to support the transport of goods to, from, and within the community.
A thriving Downtown.	The Plan considers how the road network affects the Downtown as a space for people, beyond just the accommodation of automobiles (i.e. "*Complete Streets*")
Neighbourhoods and districts across the City shall be linked to provide safe walking, cycling and efficient public transit opportunities to residents.	Discontinuities in the Active Transportation Network are identified and addressed to ensure neighbourhoods are effectively connected to reduce the community reliance on motorized transportation (e.g. multi-modal grade-separated crossings of the railway tracks).
Improve the safety and available modes for active transportation users.	To be effective and attractive for users, the Active Transportation System must be safe, reliable, accessible, and integrated.
Maintain and protect a high level of air quality.	By addressing issues with peak hour congestion, and by inviting shifts in local travel behaviour, the Plan can help reduce vehicle emissions.
Support active citizens and provide ongoing opportunity for engagement.	The Plan actively engages local residents and stakeholders to ensure all issues are identified, improvement opportunities are explored, and the final Plan is supported by the community.

1.2 COMMUNITY PROFILE

The City of Terrace covers an area of 57 km2, which is divided into four areas (Figure 2): the City Centre, bounded by the Bench to the north and the railway tracks; South Terrace, bounded by the railway tracks and the Skeena River; the Upper Bench, located in the north of the city; and the Airport Lands, which are under the jurisdiction of the municipality, but have generally been omitted from the scope of this study.

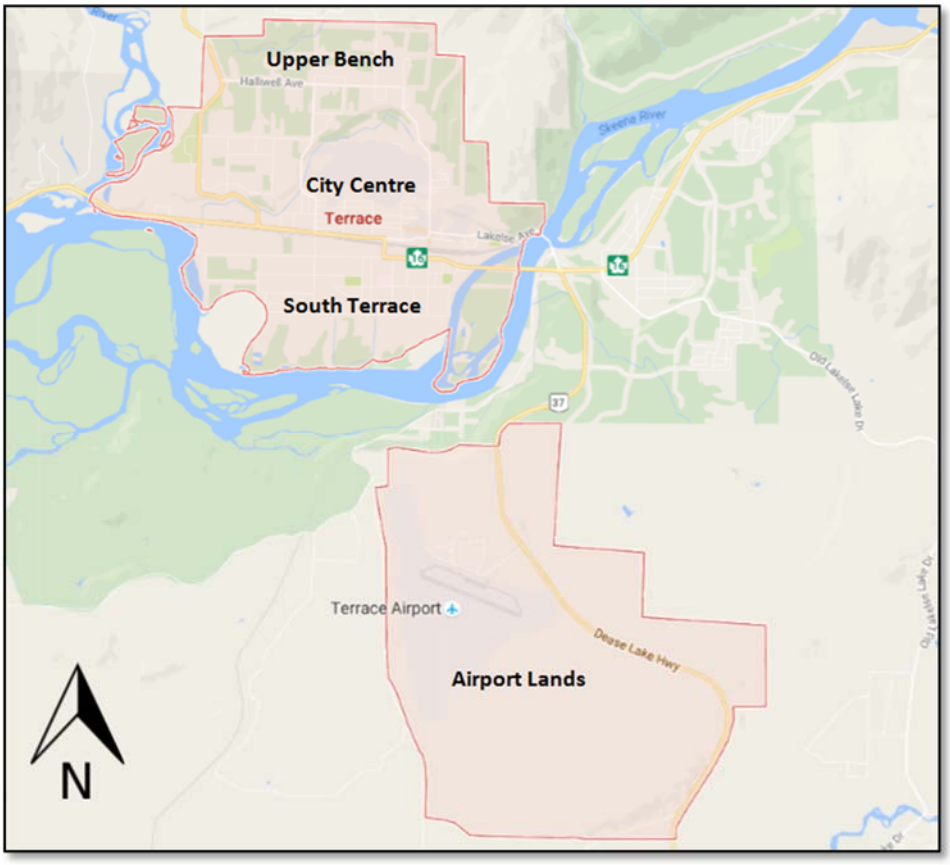


Figure 2: Areas of Terrace

From a demographic perspective, Terrace is a young city relative to the rest of the province (Figure 3). Consequently, with the pressures of commuting for school and employment, the relatively low population density, and the winter climate, Terrace has become strongly reliant on the passenger vehicle as the primary mode of transportation (Table 2).

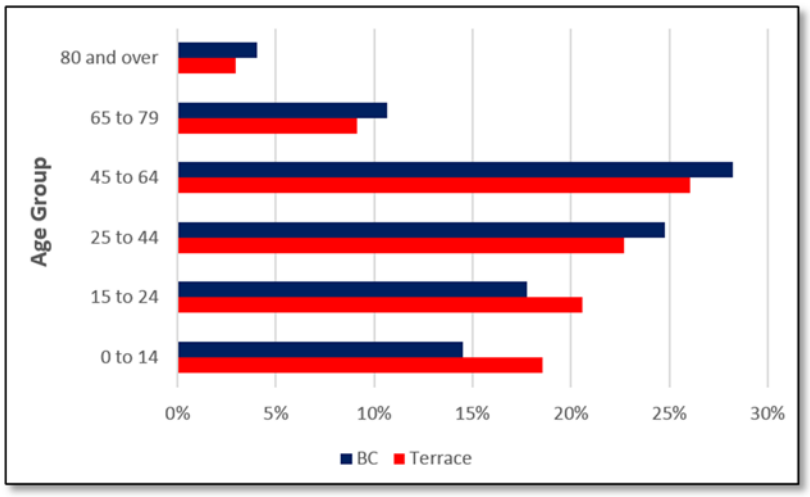


Figure 3: Age Demographics in Terrace versus BC

Table 2: Transportation Modes in Terrace versus BC

Transportation Mode	Terrace	B.C.
Car, Truck or Van as Driver	74%	72%
Car, Truck or Van as Passenger	11%	8%
Public Transit	1%	10%
Walk/Bicycle	13%	9%
Other	1%	1%

(Source: Statistics Canada, 2006 Census)

The challenge of the Transportation Master Plan is to safely address the expected future traffic demand while providing the opportunities and encouragement for citizens to choose more sustainable modes of transportation.

Figure 4: Terrace

1.3 OBJECTIVES

The objectives of the Transportation Master Plan are:

1. To be consistent with the Community Vision, as well as other recent planning and policy documents concerning City development and the transportation system;

2. To provide direction to the City of Terrace for the planning, design, and management of the transportation system improvements necessary to accommodate the expected population growth over the next 10 years; and

3. To support the community's sustainability goals in the implementation of the Transportation Master Plan.

1.4 SCOPE AND METHODOLOGY

The development Transportation Master Plan was comprised of the following scope:

1. A review of all relevant background literature concerning community development, population forecasts, plans and policies.

2. Comprehensive public and stakeholder consultation, including meetings with key agencies and user groups, a public open house, and an online survey.

3. Transportation Demand Forecasting to identify and analyze the expected growth in traffic volumes and changing traffic patterns in Terrace.

4. Classification of the road network, and analysis to identify deficiencies such as road capacity constraints, inadequate road laning/geometry, and necessary changes to traffic control.

5. Traffic safety analysis, including identification of trends in local collisions, and a Network Screening to determine and analyze the Top 20 intersections of concern (and determine solutions to reduce the risk of collisions at those locations).

6. Review of local issues and plans concerning active transportation (i.e. walking, cycling, and transit).

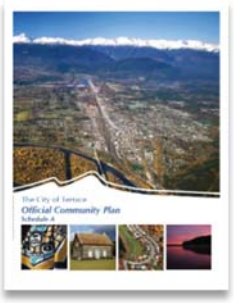
7. Identification, analysis, and selection of options to address the identified issues.

8. Development of an Implementation Plan to prioritize the implementation of the recommendations in a cost-effective and sustainable fashion.

2 LITERATURE REVIEW

Different aspects of the Terrace transportation system have been studied for the past few years. Recent plans, studies, and City policy documents have relevance to the development of Transportation Master Plan, as summarized below.

2.1 OFFICIAL COMMUNITY PLAN



The City of Terrace Official Community Plan (OCP) Bylaw No. 1983 (2011) outlines the policies and objectives for the future development of Terrace. At the time of writing (2009), the OCP predicted an annual population growth of 0.8% in the coming years, which followed the trends of the past 40 years. More recently, the population has been estimated to grow by up to 30% over the next 10 years due to forecasted investment and economic activity.

Key policies from the OCP include:

- Develop a family friendly downtown core through a focus on enhancing the pedestrian experience and public spaces.
- Consider designating a transport vehicle route on Keith Avenue to enable smooth traffic flow.
- Maintain unimpeded vehicle and pedestrian access north-south across the railway corridor.
- Balance the provision of vehicle parking in the downtown while increasing opportunities for active transportation.
- Promote an accessible and affordable transportation system. Public pedestrian routes to be designed and constructed for accessibility, when feasible.
- Pedestrian routes such as sidewalks, crosswalks and intersections shall be easily identifiable and clearly distinguished from vehicular routes.
- Continue to build active transportation connections within Terrace and between adjacent communities.
- Work with community partners, such as RCMP and ICBC, to raise community awareness and establish a culture of shared roadways for all modes.
- Support the implementation of cycling education programs in schools and provide information regarding rules of the road related to cycling etiquette and helmet use.
- Support the enhancement of the cycling network and the pedestrian network including sidewalks, pathways and trails.
- Increase the number of bicycle parking areas and bike racks in downtown public spaces and on commercial properties as a condition of the development permit.
- Work with BC Transit to undertake a ridership survey to improve levels of service, such as frequency and route selection, and to ‘right-size’ the transit system.
- Support BC Transit in accommodating the mobility requirements of all transit users.
- Coordinate with BC Transit for the provision of appropriate benches, shelters, posted schedules, trash receptacles and other features at transit stops.

2.2 SUBDIVISION AND DEVELOPMENT BYLAW

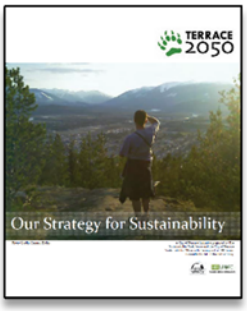
According to Section 3.8 of the Subdivision and Development Bylaw No 1591-1997, the purpose of the bylaw is to "… guide the natural growth of the City in a systematic and orderly way for the ultimate benefit of the community as a whole…". Sections of the bylaw of relevance to the Transportation Master Plan include:

- The street alignment shall be sufficient and suitable for the anticipated traffic volume and land contours, not only within the area being subdivided, but to the street system already established or which may be required to provide access to the lands lying beyond or around and to the general street pattern of the City;
- Where required by the Official Community Plan and/or the Park Plan, walkways shall be dedicated and constructed to provide convenient pedestrian circulation or access to and from schools, playgrounds, shopping areas, watercourses, community facilities and other transportation routes such as cul-de-sacs prior to subdivision approval or building permit approval.
- Where required by the Official Community Plan and/or the Park Plan, bicycle paths shall be dedicated and constructed to provide convenient cyclist circulation or access to and from schools, playgrounds, shopping areas, watercourses, community facilities and other transportation routes such as cul-de-sacs prior to subdivision approval or building permit approval.
- The City shall require development applicants to provide transit bays, traffic signals and other traffic control where deemed necessary by the City or a Traffic Impact Study.
- All works and services required for subdivision or development under the bylaw shall be designed and installed in accordance with Schedule "H" of the bylaw.
- Section 00500 of Schedule "H" outlines the design criteria for highways (i.e. streets and roads), intersections, walkways, bicycle paths, transit bays, and traffic control in Terrace.

2.3 STREET AND TRAFFIC BYLAW

The Terrace Street and Traffic Bylaw No. 1313 (2002) outlines the regulations for the control of traffic, pedestrians, cyclists, and parking in Terrace. A number of these are of interest to the Transportation Master Plan, including the regulation prohibiting pedestrians from crossing the street except at marked or unmarked crosswalks, i.e. "jaywalking" (Clause 5.7); prohibiting cyclists from using the sidewalk (Clause 15.1); and prohibiting roller bladers and skateboarders from using the streets or sidewalks (Clause 15.3).

2.4 TERRACE 2050



The Terrace 2050 report (2009) outlines the community strategy for sustainability, based on comprehensive stakeholder consultation. The document formulates nine Strategic Directions intended to guide the development of subsequent planning studies and policy updates (e.g. Official Community Plan). The eighth strategy is to "*provide a network of safe and convenient pedestrian paths, bikeway and transit routes that lessen dependence on driving*", which in turn improves public health and reduces greenhouse gas emissions. The three objectives arising from this strategy are to (a) maintain walking and cycling networks throughout the city; (b) promote the transit system; and (c) increase awareness of alternative modes of transportation. The study helped initiate the subsequent Active Transportation Plan.

2.5 TRANSPORTATION (HIGHWAY 16) CORRIDOR STUDY

In 2009, CN Rail was considering the closure of the Kenney Street at-grade rail crossing. In response, the City, MoTI, and ICBC jointly commissioned the Terrace Transportation Corridor Study to identify grade-separated solutions along Highway 16. The study findings included the need for future laning, geometric and traffic control improvements on the existing Sande Street overpass. Three new options for grade-separated rail crossings were identified at Kenney Street, Kalum Lake Road, and Brooks/Blakeburn Street. The Kenney Street crossing was favourable from the perspective of the economic and technical analysis, while the Kalum Lake Road crossing was favoured by the public. The three options were all considered viable, and were recommended for future consideration; however, the study also argued against further consideration of grade-separated crossings at Kalum Street (due to the presence of the rail yard), and at Frank Street (due to the limited benefits from this remote location).

A concurrent review of the local collision statistics revealed no significant collision-prone locations on Highway 16. The most collision-prone intersection was found to be Keith Avenue at Kenney Street.

No changes to the local truck routes were recommended. The primary and secondary truck routes were considered to be appropriate for the existing network. However, the truck route network should be updated at the same time as any new grade-separated rail crossings are implemented.

Other recommendations from the study included the need to revisit traffic control at the Eby Street/Lakelse Avenue intersection, the need for new sidewalks along Keith Avenue, and the potential extension of Park Avenue to Kalum Lake Road (i.e. as part of the Kalum Lake Road overpass option).

2.6 HIGHWAY 16 CORRIDOR STUDY

The Ministry of Transportation and Infrastructure (MoTI) commissioned a study of Highway 16 in 2015, which included the corridor through Terrace (Figure 5). This study was in progress during the development of the Transportation Master Plan.

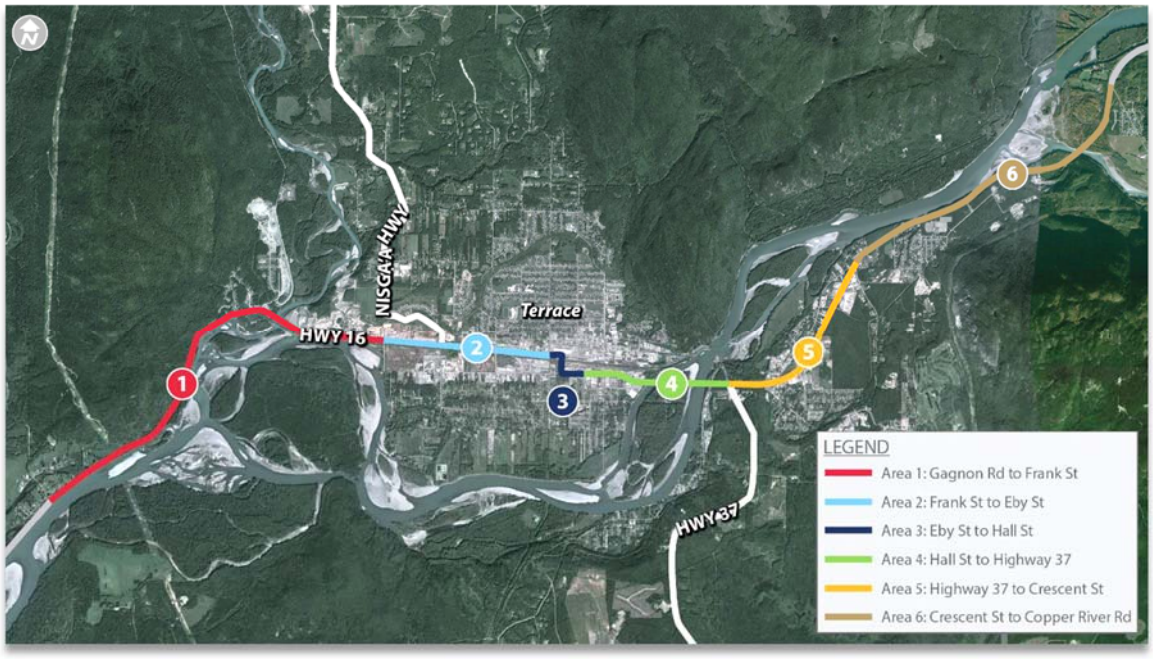


Figure 5: Highway 16 Corridor Study Limits

In a series of memos, some early draft findings from the analysis included the following:

- The peak hour traffic operation along Highway 16 is generally at acceptable Levels of Service, except for the intersection of Sande Street / Keith Avenue (which was subsequently converted to a signalized intersection), and the intersection of Highway 16 / Highway 37.
- The existing truck routes (especially Keith Avenue) are effective at diverting industrial traffic around the Downtown area.
- An evaluation of the collision statistics from MoTI's Collision Information System (CIS) was completed using data from 2009 to 2013. The evaluation concluded that there was an abnormal spike in collisions in 2012. However, the collision rates were below the provincial averages for similar highway facilities. The intersections with the highest collision rates were Highway 16 / Kenney Street and Highway 16 / Kalum Street.
- Although both the Northwest Community Readiness Project and BC Statistics estimate the future annual population growth rate in Terrace to be less than 1%, the Highway 16 Corridor Study used three more aggressive growth scenarios: 1.5% (low scenario), 2.0% (moderate scenario), and 3.0% (high scenario).
- Based on the assumed growth rates, unacceptable Levels of Service (LOS F) are predicted during the 2025 and 2040 peak hours at Highway 16 (Sande Street) / Keith Avenue (based on the previous traffic control); and Highway 16 / Hall Street.

- A closure of the Old Skeena Bridge would exacerbate the 2040 performance of the highway intersections between Sande Street and Highway 37.
- An eastbound left turn lane is not warranted at the Highway 16 / Kalum Lake Road intersection for the foreseeable future.
- Short term signage improvements should be installed on the Highway 16 bridges to improve safety for pedestrians and cyclists traveling to and from Ferry Island and Thornhill. Long term strategies are required to improve these links.
- Access to private development (esp. commercial) should be provided via side streets wherever possible, rather than the Highway.

2.7 TERRACE INFRASTRUCTURE UPGRADE SCOPING STUDY

The 2015 Infrastructure Upgrade Scoping Study involved a high-level planning analysis of the road and servicing improvements necessary to accommodate the expected population growth in Terrace over the next 10 years. The road improvements included the following:

- CN Rail overpass at Highway 16 / Kalum Lake Road, and associated upgrade of Braun Street;
- Upgrade of Lanfear Drive;
- Upgrade of Skeenaview Drive;
- Upgrade of Keith Avenue; and
- Upgrade of Park Avenue, and extension to Kalum Lake Road.

The report provided conceptual designs and preliminary cost estimates for each improvement. To help pay for these improvements, the report provided a case for Development Cost Charges, whereby developers would pay a pre-determined fee toward major city infrastructure improvements.

2.8 TERRACE POPULATION SURVEY AND PROJECTIONS

Using a local population survey from 2015, this economic study projected the future community population to the 10 year horizon in three separate scenarios: low growth, medium growth, and high growth. Under the medium growth scenario (considered the most likely by the City), the population would increase from 12,494 in 2015 to 19,363 in 2025. This increase is based on the assumptions of ten new manufacturing facilities in the Skeena Industrial Development Park, three regional mines, and two LNG facilities.

2.9 DOWNTOWN DESIGN GUIDELINES

As Appendix C to the City of Terrace Official Community Plan, the Downtown Design Guidelines were created in recognition of the unique and important role provided by the Downtown, and to guide the development of the Downtown Neighbourhood in a consistent, attractive, and people-friendly fashion. The guidelines mainly focus on

site/building design, landscaping and streetscaping requirements. Some key guidance that affects the Transportation Master Plan includes:

- On-street parking is permitted and encouraged on local streets to reduce on-site parking requirements.
- The commercial core should have a pedestrian focus; all streets should incorporate wide and safe pedestrian areas.

2.10 DOWNTOWN PLAN

As Appendix G to the City of Terrace Official Community Plan, the Downtown Plan was initiated in 2006 to "… *provide a comprehensive vision for the downtown area*," which included establishing a functional and visual sense of place through design strategies; creating a thriving economic, cultural, and historic centre for the community; and encouraging investment and redevelopment in the Downtown neighbourhood. The defined Downtown area is shown in Figure 6.

Figure 6: Downtown Revitalization Plan
Source: Terrace Downtown Plan, EBA Engineering, 2007

Some of the relevant findings and recommendations are as follows:

- With reference to the 1998 Downtown Assessment, the Plan confirms five official gateways to the Downtown: Hwy 16 / Sande Street (south); Hwy 16 / Eby Street (west); and Lakelse Avenue / Apsley Street (east); George Little Park / Kalum Street (north); and the VIA Rail Station on Kalum Street.
- The City should endorse a unified streetscaping design for the Downtown.
- Sidewalks should be widened wherever feasible, even by the reduction in traffic lanes. Sidewalk extensions (or "bulb-outs") should be used at the Downtown intersections and crosswalks where appropriate to reduce traffic speeds and reduce pedestrian crossing distances.
- Bicycle racks should be installed at approved locations Downtown, potentially as part of a sponsorship program.

- The City should commission a Downtown Parking Plan to investigate ways to increase opportunities for on-street parking, and to reduce off-street parking requirements.
- Traffic calming should be considered on streets in the Downtown to reduce traffic speeds, and improve the safety and comfort of vulnerable road users.

2.11 KEITH ESTATES NEIGHBOURHOOD CONCEPT PLAN

The City of Terrace commissioned the Keith Estates Neighbourhood Concept Plan (NCP) in 2014 as a high-level planning exercise to generate land use ideas for the redevelopment of the 29 hectare industrial site south of Highway 16, between Sande Street and Blakeburn Street. The study was developed in consideration of the expected surge in local population, and the opportunities Keith Estates may afford to accommodate that surge.

The study recommended that the NCP include a mixed-use of commercial, residential, institutional and industrial activities. The west of the site would be more commercial and industrial uses, with residential uses further east. A linear park is proposed to buffer the neighbourhood from the railway tracks. The development summary is outlined in Table 3.

Aside from identifying potential land use plans and determining preliminary estimates of future traffic volumes, the study identified the following necessary improvements:

- Signalization of Keith Avenue / Sande Street (subsequently implemented);
- Improved transit service to the area when warranted by demand; and
- Sidewalks on Keith Avenue, with a separate pathway for cyclists along the north side of the road.

Table 3: Keith Estates NCP Development Summary

Keith Estates NCP Development Summary *(all numbers are approximate)*					
Sector	**Light Industrial (floor area m^2)**	**Commercial (floor area – m^2)**	**Institutional (floor area- m^2)**	**Residential (# units)**	
				apartment	**townhouse**
West	21,900-27,400 m^2	3,700-9,100 m^2	1,800-3,700 m^2	-	-
Central	3,500-4,700 m^2	8,200-10,600 m^2	Up to 2,400 m^2	210-250	40-50
East	n/a	5,100-7,700 m^2	2,600-5,100m^2	370-420	40-50
Subtotal				580-670	80-100
Total	25,500-32,100 m^2	17,000 -27,400 m^2	4,400-11,200 m^2	660-770 units	
			Population	1,700-1,900 people[18]	

Source: Keith Estates Neighbourhood Concept Plan, Urban Systems, 2014

2.12 AIRPORT LANDS AREA CONCEPT PLAN

The Terrace Airport Lands Area Concept Plan (2008) outlines the development criteria and objectives of the existing and future expansion of the airport lands (a total study area of 2,320 ha). The Plan (shown in Figure 7) identifies the vision for the airport lands as follows: "*The airport and surrounding lands will provide a major employment centre, providing a wide range of types of employment for the region, focusing on the excellent integrated transportation network, the developability of the land and the strong partnerships working together to service and develop these areas*." The Plan recommends a balance between the economic development in the airport lands and the rest of the city, with larger parcels for business and industry focused in the airport lands.

The primary access to the airport lands will be via Highway 37. Collector roads within the future subdivisions will have a minimum 30 metre right-of-way, and a 10 metre wide paved surface. Internal (local) roads will have a minimum 20 metre right-of-way, and an 8 metre wide paved surface. Furthermore, a system of 3 metre wide trails shall connect the development sites to the open space corridors.

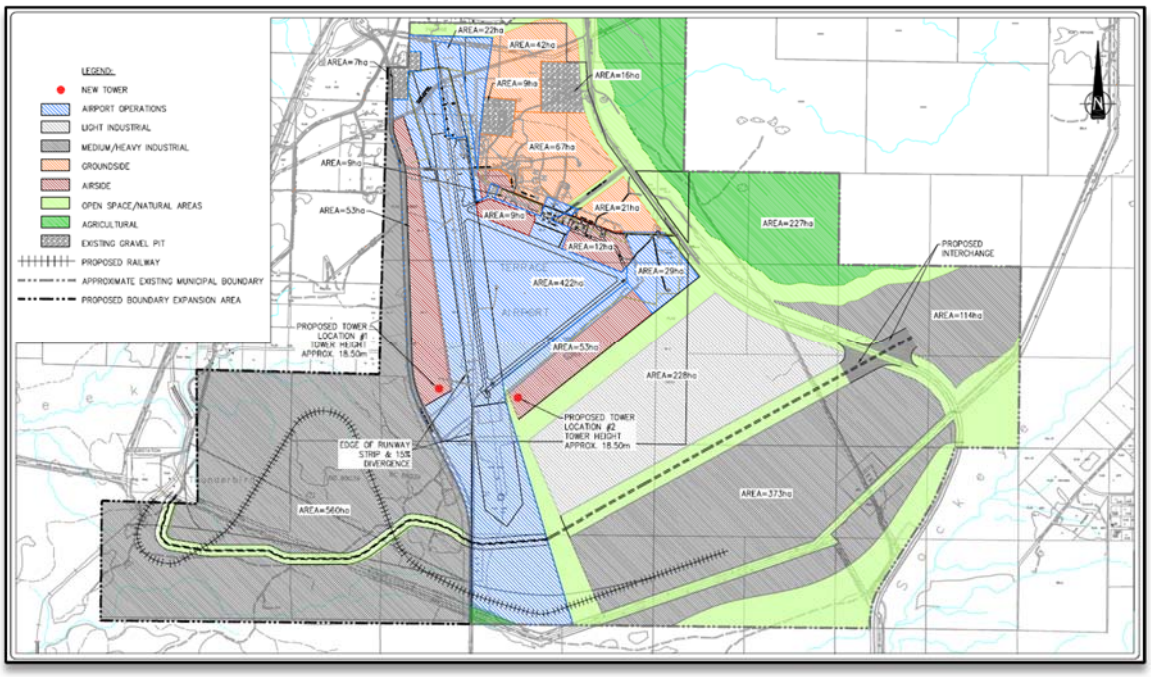


Figure 7: Airport Lands Area Concept Plan – Proposed Land Use
(source: Terrace Airport Lands Area Concept Plan)

2.13 ACTIVE TRANSPORTATION PLAN

The City commissioned the Active Transportation Plan in 2009 to improve the safety and connectivity of the active transportation network, to encourage more residents to partake in active transportation, and to ultimately reduce the greenhouse gas emissions through shifting trips to more sustainable modes. The Plan recognized that the size and layout of the city allow shorter trips, which are conducive to active transportation.

The study identified the major barriers to active transportation in Terrace as:

- the lack of facilities to cross the river (i.e. to Thornhill),
- the lack of safe opportunities to cross the CN rail line, and
- the safety and accessibility concerns with the trail facilities on Skeenaview Drive and Lanfear Drive.

The study provided the following recommendations of relevance to the Transportation Master Plan:

1. Widen the sidewalk on the Old Skeena Bridge to accommodate bi-directional cycle traffic, or other options to improve the use of the bridge for cyclists.
2. Improve the gravel shoulders on the north side of Lakelse Avenue, and create a multi-use path on the south side of Lakelse, to connect Apsley Street and the Old Skeena Bridge.
3. Construct a multi-use trail underpass under the west end of the New Skeena Bridge on Hwy 16.
4. Construct a pedestrian/cyclist overpass across the CN yard at Kalum Street.
5. Construct staircases to the Upper Bench at Eby Street and Thomas Street.
6. Consider upgrading the Howe Creek trails with paving and regrading for accessibility.
7. Install a controlled crosswalk with associated traffic calming at the bottom of Lanfear Drive.
8. Add more sidewalks on the arterial and collector roads, especially around schools.
9. Complete a trail along the river to create a continuous loop around the south half of the city.

2.14 GRAND TRUNK PATHWAY MASTER PLAN

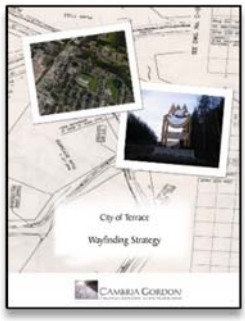
The Grand Trunk Pathway Master Plan was completed in 2008 to establish the planning and design for the pathway on the south side of Highway 16, connecting Kalum Street to the Kitsumkalum River on the west side of Terrace (4.8 km total). The scope of the Plan continued from the existing Millennium Trail (Kalum Lake Road to Eby Street) for a total cost of $1.9 Million.

The Plan outlined the trail design specifications, including recommendations for surfacing, signage, lighting, benches, landscaping, and other amenities. Since the completion of the Plan, the trail has been extended west to Frank Street.

2.15 TERRACE HOUSING ACTION PLAN

The Northern Development Initiative Trust initiated the Terrace Housing Action Plan in 2014 to address concerns about providing enough housing in anticipation of the expected economic growth, particularly from the natural gas sector. The majority of the report focused on ways to accommodate low income housing, and includes recommendations for secondary suites in all zones and other higher density residential development initiatives.

2.16 WAYFINDING STRATEGY



The Wayfinding Strategy was commissioned by the City of Terrace in 2010 to facilitate guidance to the city's trails, facilities and other attractions for both residents and tourists. The two directional tools identified in the study were pole signs (indicating directions and distances to key destinations) and kiosks (providing maps and community information).

The study recommended a number of short and long term wayfinding improvements, largely situated around the city core.

Figure 8: Old Skeena Bridge

3 PUBLIC AND STAKEHOLDER CONSULTATION

3.1 STAKEHOLDER MEETINGS

Two stakeholder meetings were held at Terrace City Hall on Wednesday, February 10th and Thursday, February 11th, 2016. The first meeting was with government agencies, and the second was with identified user groups. A third meeting was held with City Council and staff at the Committee of the Whole on Wednesday, February 10th, 2016. Those individuals who were unable to attend one of the meetings were invited to provide feedback in writing afterwards.

The combined comments from these three meetings are summarized below. The detailed minutes of each meeting are included in Appendix B.

3.1.1 Downtown Terrace

1. Eby Street / Lakelse Avenue has atypical traffic control (i.e. free flow traffic from the stem of the T intersection), and experiences peak hour delays and queuing issues. However, the intersection operates well for local residents who understand the traffic control. A roundabout may be a potential solution, with its safety and aesthetic advantages. However, the laning and the spacing with Lazelle Avenue would have to be addressed.

2. Eby Street / Lazelle Avenue: the lane drop on Eby just north of this intersection causes northbound vehicles to move into the lane serving the left turn from Eby into Lazelle, prior to this intersection. This conflicts with traffic exiting Lakelse also making this left turn.

3. The offset “T” intersection at Lakelse Avenue / Sparks Street should be realigned, if possible, to create a four leg intersection. This will reduce traffic delays, but would be a costly improvement.

4. The south transition of the Kalum Street Two-Way Left Turn Lane can be confusing. The left lane moves right, but has right-of-way. These paint markings should be revisited. Also, the lane diet can create blind spots in the middle lane, especially at pedestrian crosswalks. The crossing distance is relatively long, and pedestrians don’t always follow the rules, nor cross in designated locations. In rain or darkness, it is difficult to see the pavement markings. In-laid thermoplastic may be a viable solution.

5. Lakelse Avenue: there is a lot of activity around the Skeena Mall, including four lanes of traffic, frequent turning conflicts (especially at Tim Hortons), on-street parking, and a mid-block pedestrian crosswalk. Many pedestrians are not watching for traffic when they cross. A lane diet may improve the situation, if the traffic volumes, bus routes, and left turn demand permit. Education is key. Improved overhead lighting, or pedestrian-activated flashing lights would help make this crossing safer.

6. Lazelle Avenue and Lakelse Avenue could be developed as a one-way couplet, which would improve traffic flow and safety. However, traffic circulation and wayfinding downtown would then be more challenging. This would invite more incidences of short-cutting through private parking lots as drivers attempt to circulate between the blocks.

3.1.2 Grade Separations

1. The at-grade rail crossing at Kenney Street creates long delays when trains are crossing, which is a concern for emergency response. Also, the at-grade rail crossings at Kenney Street and Frank Street are problems for large trucks. A second vehicle overpass is necessary particularly for emergency response. Frank Street is too far west to be a viable grade-separated rail crossing. The Kalum Lake Road / Braun Street intersection appears to be the preferred location for an overpass over the tracks, as identified in previous reports. An overpass at this location would also promote development on the west side of Terrace, and accommodate the Mill Lands development. Furthermore, a crossing at this location would tie into the Grand Trunk Pathway to achieve an active transportation loop.

2. Pedestrians currently cross the CN rail yard to travel between the Kalum Street neighbourhood residences and the businesses on the highway (especially Walmart). There is extreme danger involved, and there have been a few incidents in the past. This is the most desired location for a pedestrian overpass, but would be cost-prohibitive to build a clear span across multiple tracks. A new overpass should include fencing around the CN Yard for safety.

3.1.3 Kalum and Lanfear Hills

1. The narrow, windy geometry on these roads is a problem for larger vehicles, including buses, and traffic speeds are a concern. The pedestrian/cycle path could potentially be relocated outside the corridor. Options are outlined in the City's Active Transportation Plan.

2. Lanfear Drive / McConnell Avenue: there are concerns with vehicle queuing on McConnell Avenue especially around school drop-off and pick-up times. The hill is posted at 40 km/h, but traffic speeds can be as high as 70 km/h.

3. There are pedestrian safety concerns at the bottom of Lanfear Drive at the trail head due to the curve in the road, limited sight distance, traffic speeds, and limited lighting at night.

4. Kalum Street / Munthe Avenue: the limited sight distance is addressed with a mirror, which appears to be working well. Collision statistics should be checked.

3.1.4 Keith Avenue at Kenney Street

This is a large intersection with heavy truck movements, potential sight distance issues due to the adjacent hydro pole, and growing levels of delay at the stop conditions on Keith Avenue. The size of the intersection also means that heavy vehicles require bigger gaps in traffic on Kenney Street in order to enter the intersection. There is a problem with drivers on Keith Avenue failing to observe the stop condition because they either mistake the intersection as a four-way stop, or they do not notice the stop sign (especially with this being the only stop condition on the corridor). A four way stop could be considered, but must not cause queuing across the rail tracks to the north.

3.1.5 MoTI Issues

1. Highway 16 (Sande Street)/Keith Avenue: the recent signal upgrade has created a more logical and effective traffic control. There was some initial confusion concerning the right-of-way of the eastbound movement, which has since been addressed by the Ministry.

2. Highway 16 / Kerr Street (Big Bertha): The turning movements for trucks entering the highway from the bulk fuel plant are challenging, and have restricted sight lines. A new egress route that makes use of the existing traffic signal at Walmart would be preferred, but must consider the existing traffic pattern in the plant (which has been configured to accommodate loading only in the eastbound direction). There is a road right-of-way designated opposite the Walmart access, however there is no construction timeline.

3. Highway 16/Eby Street: the speed at which some drivers negotiate the southbound right turn onto the highway makes it difficult for ambulances to safely enter the highway in an emergency. Emergency vehicle siren detection for signal activation should be considered.

3.1.6 Active Transportation Issues

1. Cycling in Terrace would likely increase with more facilities and improved network connections (e.g. Lanfear and Skeenaview Drive).

2. In general the trail networks between the top and bottom of the Horseshoe are good. However, the grades and surfaces are not accessible for strollers and wheelchairs. The stairs on the Howe Creek trail are an issue for the mobility-challenged users.

3. The Grand Trunk Pathway trail should be extended if possible, especially to create a loop around the City connecting trails along the north and south sides of the tracks.

4. The City should consider a designated bike route on the Lakelse Avenue bridge crossing the Skeena River, rather than cyclists using the Highway 16 bridge.

5. Pedestrian crossings on Lakelse Avenue at the Skeena Mall could be improved with sidewalk extensions and pedestrian-activated flashers. The existing flashers are continuous, and are more likely to be ignored by drivers.

6. The existing overpass on Sande Street should be improved for pedestrians and cyclists. There is poor connectivity for pedestrians at the south end of the bridge. Any new grade separations must accommodate pedestrians and bikes.

7. If possible, bike lanes should be further offset from the traffic lanes. In locations where the pavement edge is higher than the gutter pan, there is a hazard for cyclists.

8. A new crosswalk should be considered at Walsh Avenue and Eby Street.

9. A pedestrian crossing should be reviewed on Kenney Street for school children.

3.2 PUBLIC OPEN HOUSE

A public open house for the Transportation Master Plan was hosted at City Hall between 6:00 and 9:00 pm, on Wednesday, February 10th, 2016. There were 12 attendees during the evening. Their input is summarized below.

Discussion Notes:

1. A new truck layover would be beneficial on the highway.
2. Land should be protected for a future overpass at Braun Street.
3. Ambulance drivers often do not know where dead-ends are until they arrive at them.
4. Car navigation systems direct drivers wanting to access the top of the Horseshoe to Eby Street, which does not connect up the hill.
5. McElhanney Consulting Services will contribute the designs for two staircases adjacent to Lanfear Drive and at Eby Street.
6. If a pedestrian bridge is built at Kalum Street to cross the railway tracks in favour of any other vehicle crossing, then it should also accommodate ambulances.
7. The steep gradient on the westbound approach of Park Avenue to Kalum Street is problematic in icy conditions.
8. The Lanfear Drive/Pheasant Street intersection is a concern, and requires redesign to reduce traffic speeds entering Pheasant.
9. The trail along the railway corridor has safety concerns, especially when compared to Grand Trunk Pathway.
10. Barrier curb is preferred to roll-over curbs as it makes pedestrians feel safer. Boulevard separation would be ideal.
11. The study will define preferred typical cross sections for the different road classes.

Identified Locations for Consideration:

Using red dots on a map, attendees identified the following areas of concern:

- Keith Avenue at Kenney Street
- Lanfear Hill, top, middle, and bottom
- Sande Street (Highway 16) Overpass
- Lakelse Avenue at Eby Street
- Eby Street at Hamer Avenue
- Lakesle Avenue at Sparks Street
- Sparks Street at Straume, Tuck and McConnell Avenues
- Park Avenue at Emerson Street
- Kalum Street at Park Avenue
- Kalum Street at CN rail yard (pedestrian crossings)

Using green dots, attendees also identified positive issues in the Terrace transportation network, including: the street-scaped block of Lakelse Avenue (Emerson to Kalum Street); the new lane diet on Kalum Street; the Grand Trunk Pathway; the trail network around Skeenaview; and the opportunity for a new rail overpass at Braun Street/Kalum Lake Rd.

3.3 PUBLIC SURVEY

An online public survey was developed to invite input from the public into the development of the Transportation Master Plan. The survey asked 14 questions, and was available for the four weeks between February 12th and March 12th, 2016. A copy of the survey is provided in Appendix B.

In total, 319 responses were received (i.e. almost 3% of the population). Over 90% of the respondents were from Terrace, and were evenly distributed between neighbourhoods. Each pin in Figure 9 represents between 1 and 5 survey responses, and is placed at the geographic centroid of the respective postal code area of those responses.

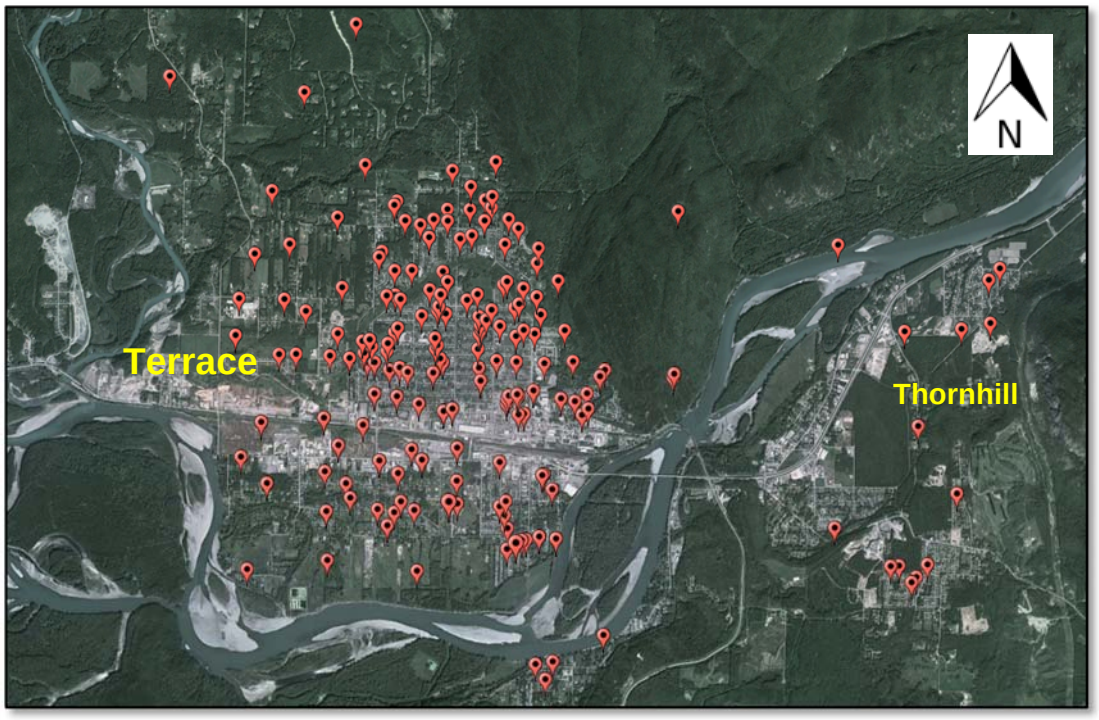


Figure 9: Postal Code Areas of Respondents

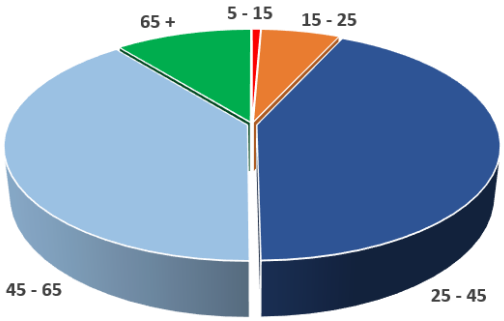


Figure 10: Ages of Respondents

Approximately 6% of respondents were from the Thornhill community to the east, and another 3% were from outside the area (e.g. Kitimat, Colwood, Dawson Creek).

The survey was answered by a diverse mix of age groups, with over 80% between the ages of 25 and 45 (Figure 10).

The responses to the survey are summarized in the following sections.

3.3.1 Impressions of the Transportation System

The survey asked for respondents' impressions of the safety, reliability, convenience and guidance/wayfinding of the existing transportation system. The rankings were between 1 (very poor) and 5 (very good).

The overall safety of the transportation system received a weighted average score of 2.8, which indicated that road safety was a concern for respondents (Figure 11). Road safety and the local collision history is studied in detail in Section 6.

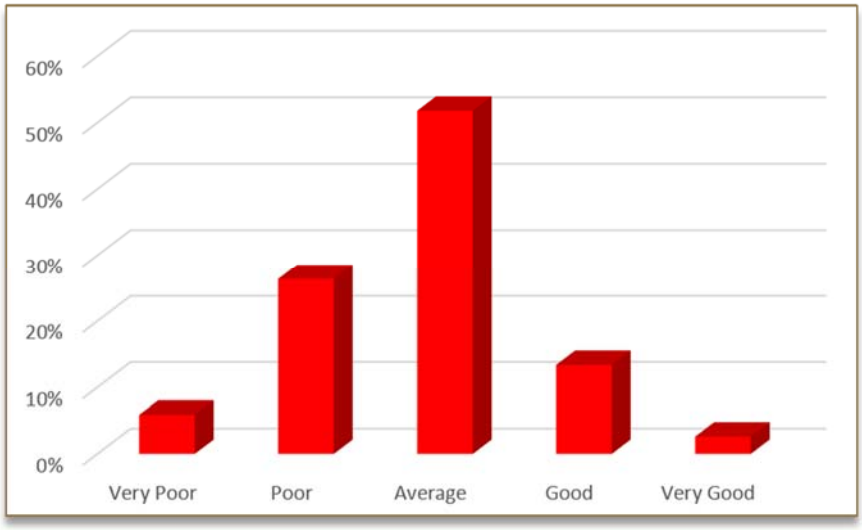


Figure 11: Public Impression of Road Safety

The reliability of the transportation system scored better, with a weighted average of 3.1 (Figure 12). This is likely due to the available capacity on the roads, and the relatively low traffic volumes and delays.

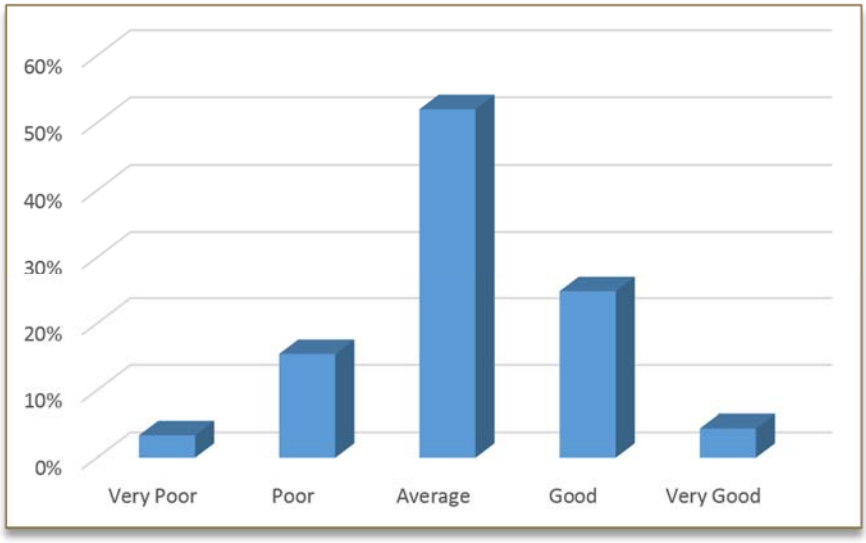


Figure 12: Public Impression of System Reliability

The convenience of the transportation system scored a weighted average of 2.8 (Figure 13). The lower score may be indicative of a concern about the limited opportunities to cross the railway tracks.

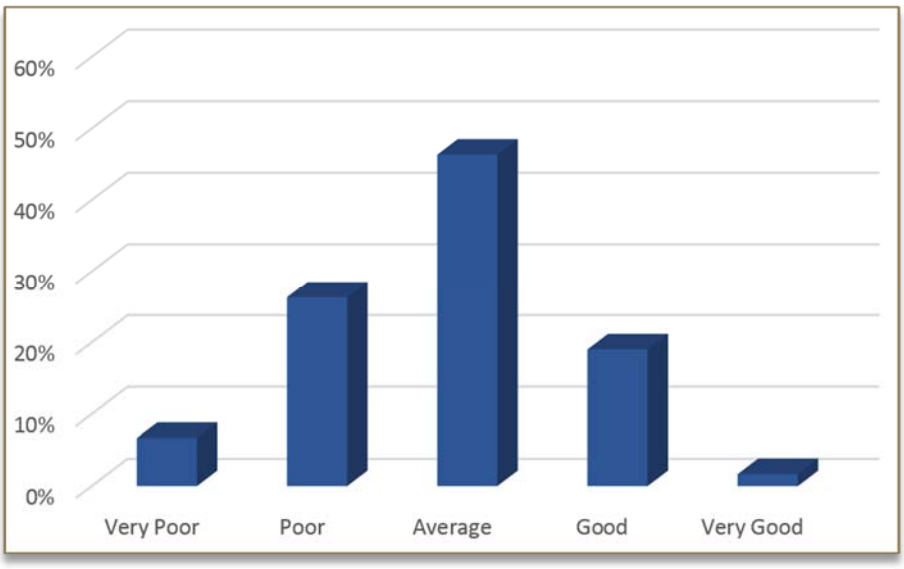


Figure 13: Public Impression on System Convenience

The guidance and wayfinding in Terrace scored a weighted average of 2.9 (Figure 14). This indicates that system users may be having difficulty finding their way around the city.

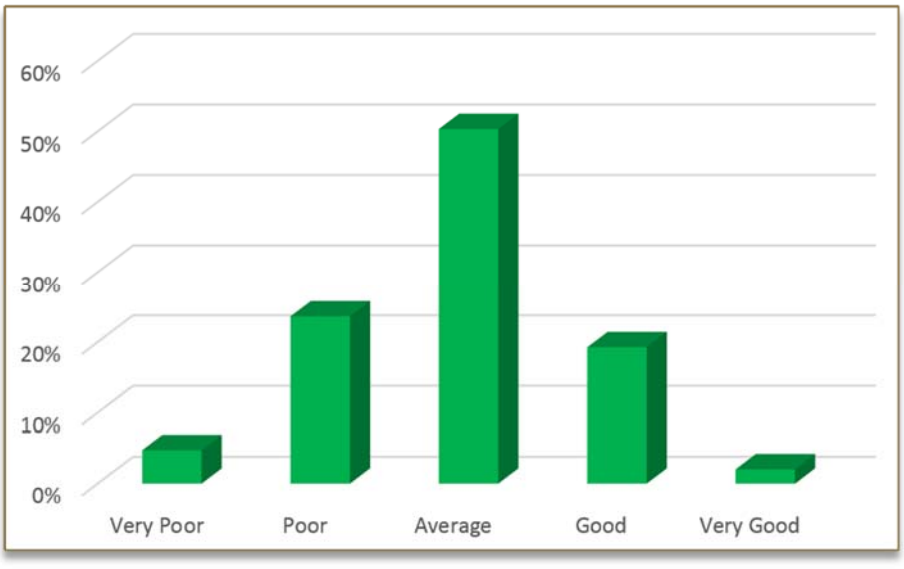


Figure 14: Public Impression of System Guidance / Wayfinding

3.3.2 Appreciated Aspects of the Transportation System

The survey asked respondents to identify what they appreciated most about the Terrace transportation system. The question was answered by 220 respondents; the comments are summarized below. The complete list of responses is provided in Appendix C.

1. Traffic Mobility: The most frequent responses was an appreciation for the ability to move freely through the road system, with specific mention of:
   - Low volumes of traffic, short delays, and few traffic signals (33).
   - Convenience, especially with the grid network and proximity to amenities (20).
   - Recent improvements to the Keith Avenue / Sande Street signal (36).
   - Ease of guidance / wayfinding through the city (12).

   There were also positive comments about the recent laning improvements on Kalum Street (3), the traffic signage in general (2), and the two available river crossings (2).

2. Walking and Cycling: The second most frequent responses concerned the pedestrian and cycle systems in Terrace. Specific mention was made of:
   - The walkability of Terrace due to available pedestrian infrastructure and the compact layout of the city (15). Recent improvements were appreciated (3).
   - The ability to cycle around the city (10), with appreciation for the recent bike route improvements (4)
   - The availability and quality of the local trail system, including the Grand Trunk ("Millenium") Trail (11) and the Howe Creek Trail (2).

3. Transit System: Many respondents expressed appreciation for the local transit system, with comments about its convenience (10), availability (4), and affordability (4).

4. Road Maintenance: A number of respondents liked how well the roads were maintained, especially the continual rehabilitation (7), and snow removal (4).

5. Parking: Three respondents mentioned the ease and convenience of parking as an important local benefit.

6. Traffic Safety: Two respondents identified their appreciation for the safety of the road system.

3.3.3 Concerns with the Transportation System

The survey asked respondents to list their main concerns with the existing transportation system. The question was answered by 273 respondents. The results included comments about the system in general, and specific locations of concern, as summarized below. The complete list of responses is included in Appendix C.

General Concerns:

1. Transit System: The most frequent concern was the desire for improved transit service (i.e. greater coverage, longer service hours, Sunday service, more bus stops, and more service to Thornhill) (36). There were also concerns expressed about the need for better information on the routes and schedules (4), bus driver education (3), and accessibility (1). Six respondents asked if a larger number of smaller buses may better suit Terrace.

2. Pedestrian Network: There was a large response in favour of making Terrace more walkable (35), i.e. with the construction of more sidewalks, especially in the north and south areas of the city. Nineteen respondents identified pedestrian safety as a concern, with many citing the need for more illumination of sidewalks and crosswalks. Snow clearing on sidewalks (5), and accessibility of the pedestrian network (2) were also concerns.

3. Cycle Network: Another frequent concern was the desire to improve the cycle network (27), with bike lanes and trails. The safety of the existing cycle network was identified as a concern (8). Respondents also mentioned their desire for more bike racks for secure bicycle parking (3), and the need to sweep the bike lanes (3).

4. Road Condition: There were twenty (20) respondents who identified concerns with the condition of the pavement in Terrace. Specific locations included Eby Street by City Hall (4), Greig Avenue (3), and Loen Avenue (1). The visibility of painted lane lines was also a concern (5). Two respondents mentioned the need for more dust suppression on gravel roads.

5. Intersection Traffic Control: Ten respondents mentioned that they found some intersection traffic control to be confusing. Three wanted more roundabouts, and one wanted more traffic signals. The sight lines at intersections was also identified as a concern (3).

6. Heavy Truck Traffic: The presence of large trucks in Terrace was a significant concern (14), with a clear desire for a designated truck route on Keith Avenue.

7. Parking: Four respondents mentioned a desire for more parking Downtown. There were also two who wanted parking kept out of the bike lanes, and three who expressed concern about the obstruction of sight lines caused by parking.

8. Driver Education: Many respondents were concerned about other drivers in Terrace. This included their lack of understanding of traffic control (8), speeding, especially in school zones (7), and awareness of cyclists and pedestrians (4).

Location-Specific Concerns:

- Need for better connectivity between the north and south areas of the city (6), including another grade-separated rail crossing (e.g. at Kalum Lake Road) (31), and a pedestrian overpass (e.g. at Kalum Street) (7).
- Keith Avenue and Kenney Street traffic control (27)
- Lakelse Avenue lane design, safety, and traffic speeds (16)
- Lanfear Hill: need for trail (11); safety (5); traffic speeds (5); crossing at bottom (2)
- Skeenaview Drive: need for trail (11); safety (2); lighting (1); traffic speeds (1)
- Confusing traffic control at intersection of Eby Street / Lakelse Avenue (13)
- Four-way stop at Highway 16 / Highway 37 (13)
- Lakelse Avenue / Sparks Street offset T intersection (7)
- Kalum Street: traffic congestion and pedestrian crossing safety at Lazelle Ave (5); transition to three lanes at south end (3); illumination at bottom of hill (3); red light running at Park Avenue (2).
- Recent Sande Street / Keith Avenue signal improvements, and the desire for an advance eastbound left turn phase (6)
- Sande Street overpass pedestrian and cycle safety (5)
- Pedestrianization of Downtown (3), incl. traffic calming (1) and streetscaping (1)
- Skeena River Bridge bicycle accommodation (4)
- Keith Avenue flooding issues (3)
- Pedestrian safety and parking congestion on Haugland Ave at Cassie Hall School (3)
- Improved access to the “Bench” (3)
- Thomas Street / McConnell Avenue congestion and sight distance (2)
- More access to the Grand Trunk Trail across Highway 16 (2)
- Traffic speeding around Halliwell Avenue and Sparks Street (2)
- New sidewalk requests on Eby Street North (2); Park Avenue, east of Eby Street (1); and Keith Avenue, east of Kenney Street (1).
- Expand north road network (1), including extending Thomas to Johnson (1)
- Inadequate hospital access to the Sande Street overpass (1)
- Eby Street / Lazelle Avenue pedestrian crossing safety (1)
- Skeenaview Drive / Munthe Avenue intersection safety (1)
- Erosion and degradation on Howe Creek Trail (1)
- New pedestrian signal request at Highway 16 / Clark Street (1)
- Insufficient sight lines at Highway 16 / Munroe Street (1)
- Traffic signal operation at one-lane bridge (1)
- Park Avenue extension between Eby Street and Munroe Street: connect (1); do not connect (1).

3.3.4 Transportation Priorities

The survey asked respondents to rank their top priorities for the transportation system. Applying a weighting to the answers, the following results were received (Figure 15).

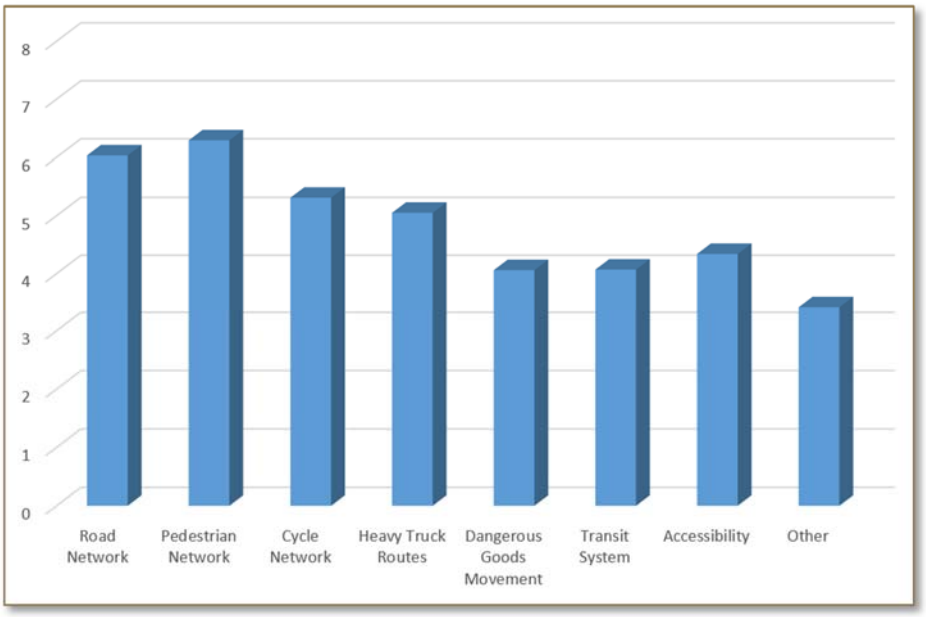


Figure 15: Respondents' Transportation Priorities

The highest priority was the pedestrian network, indicating a desire to improve the walkability of the city. The next highest priorities were the road network, the cycle network, and managing heavy truck traffic. The respondents who identified "Other" priorities listed the following:

- Another rail overpass for vehicles (8)
- Better access to the "Bench" (6)
- Pedestrian/cycle overpass, esp. near Kalum Street (6)
- Improved pedestrian network (5)
- Heavy truck traffic (4)
- Improve cycle network (3)
- Traffic speeds (3)
- Improved enforcement (3)
- Street lighting (3)
- Road condition (2), as well as road markings (2) and road drainage (1)
- Keith Avenue / Kenney Street intersection (2)
- Four way stop at Highway 16 / Highway 37 (2)
- Development of alternate routes into and out of the city (2)
- Transit service (incl. new service to airport) (2)
- Audible traffic signals for visually impaired (1)
- Eby Street / Lakelse Avenue intersection (1)
- Streetscaping Downtown (1)
- On-street parking regulation (1)
- Winter road maintenance (1)

3.3.5 New Rail Overpass at Kalum Lake Road

The respondents identified their priority for a new vehicle overpass over the CN rail line, currently proposed at the Kalum Lake Road intersection on Highway 16 (Figure 16).

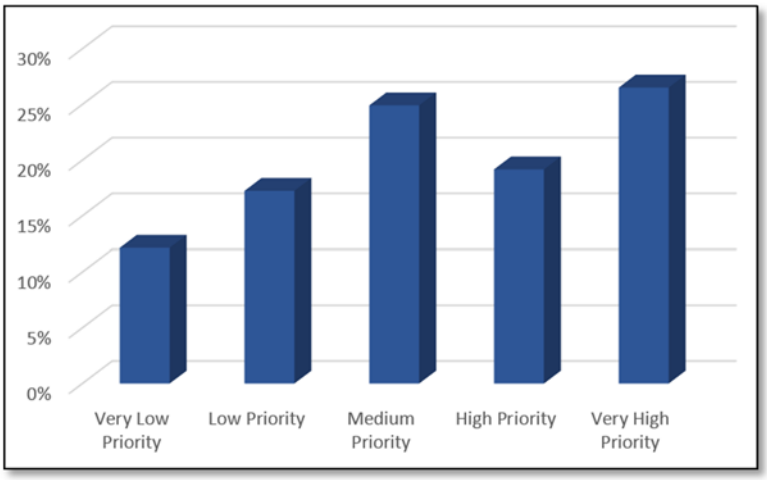


Figure 16: Respondents' Priority of a New Vehicle Overpass

Over 45% of respondents ranked this improvement as a "High" or "Very High" priority, with another 25% ranking this as a "Medium" priority. The weighted average score was 3.3/5.0.

3.3.6 New Pedestrian / Cycle Overpass

The respondents identified their priority for a new pedestrian / cycle overpass over the CN rail line to connect the north and south neighbourhoods of the city (Figure 17).

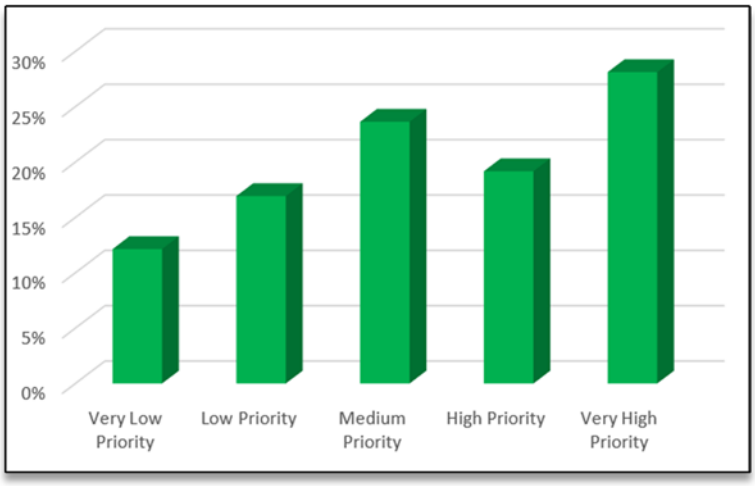


Figure 17: Respondents' Priority of a New Pedestrian / Cycle Overpass

Over 47% of respondents ranked this improvement as a "High" or "Very High" priority, with another 24% ranking this as a "Medium" priority. The weighted average score was 3.3/5.0.

3.3.7 *Bench Access via Lanfear Drive and Skeenaview Drive*

The respondents identified their priorities for improving access to the "Bench" via both Lanfear Drive and Skeenaview Drive (Figure 18).

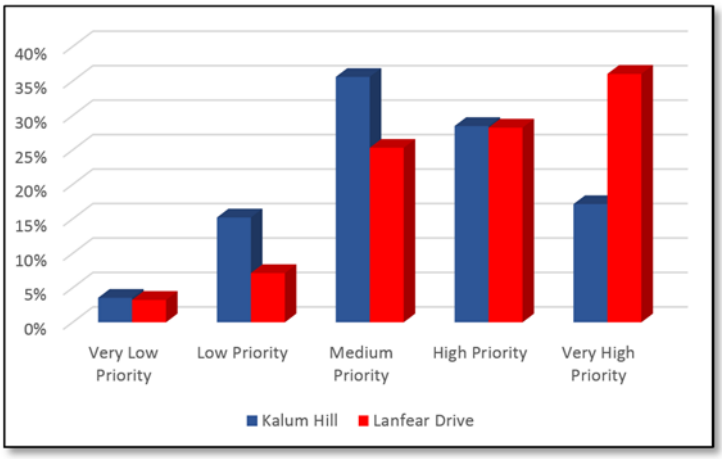


Figure 18: Bench Access Priorities

The respondents strongly favoured improvements to Lanfear Drive, with 64% identifying this as a "High" or "Very High" priority, and a weighted average score of 3.9/5.0. The scores for Skeenaview Drive were 46% and 3.4/5.0 respectively.

3.3.8 *Downtown Street Laning Changes*

The respondents were asked to identify their priority for revisiting the existing laning on Lakelse Avenue, through Downtown Terrace, in an effort to improve the pedestrian and cyclist environment, and reduce traffic speeds and conflicts (Figure 19).

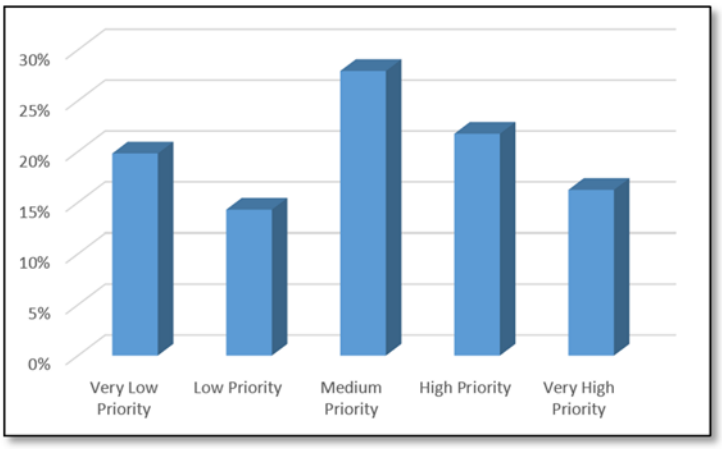


Figure 19: Downtown Street Laning Priorities

Approximately 38% of respondents ranked this improvement as a "High" or "Very High" priority, with another 28% ranking this as a "Medium" priority. The weighted average score was 3.0/5.0.

3.3.9 Intersection Upgrades

Three intersections with traffic control and/or geometric issues were presented to the respondents to identify their priorities for improvements (Figure 20):

1. Eby Street / Lakelse Avenue has atypical traffic flow, with right-of-way given to westbound traffic on Lakelse Avenue (i.e. the stem of the "T" intersection).
2. Lakelse Avenue / Sparks Street is a signalized offset "T" intersection in Downtown Terrace, which incurs long delays due to the split signal phasing.
3. Thomas Street / McConnell Avenue / Cooper Drive is an offset "T" intersection at the top of Lanfear Drive Hill, and has a heavy commuter pattern and sight distance concerns.

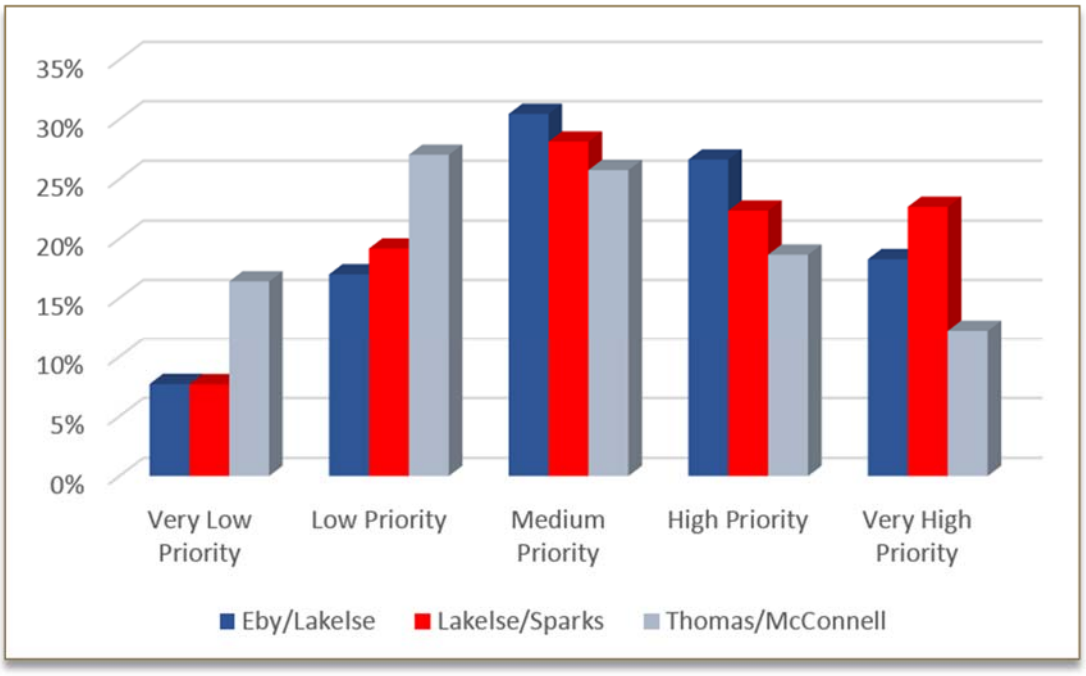


Figure 20: Intersection Upgrade Priorities at Three Intersections

The highest intersection priority was Lakelse Avenue / Sparks Street, with 45.0% of respondents identifying this as either a "High" or a "Very High" priority, and a weighted average score of 3.3. The second priority was Eby Street / Lakelse Street, with 44.9% and 3.3 respectively. The Thomas Street / McConnell Avenue intersection ranked third, with 30.9% and 2.8 respectively.

3.3.10 Other Issues and Comments

Respondents were invited to identify other issues or comments they may have with the Terrace Transportation System. Most comments reinforced the issues outlined above. The following responses were received, in descending order of frequency. The complete list of comments is provided in Appendix C.

1. More bike lanes (28) and trails (2), including on local bridges (e.g. Sande Overpass (4), Ferry Island (3)). Also more secure bike racks (3).
2. More sidewalks (25), esp. in the north and south areas of the city. Also more crosswalks (3), with lighting (5) (esp. Lakesle), and accessibility (1). Clear snow on sidewalks (5).
3. Upgrade the traffic control at Keith Avenue / Kenney Street (22).
4. Reduce traffic speeds (15), esp. with traffic calming (7) and enforcement (4).
5. Lakelse Avenue lane widths are a problem (15). Tim Horton's drive thru causes queuing problems on-street (2). Lane diets are not desirable for some people (5).
6. New pedestrian overpass over rail line (14), esp. around Kalum Street.
7. More pavement rehabilitation and pothole repair (14), esp. Munro (1), Greig (1), Davis (1) and Loen (1).
8. New vehicle overpass over rail line (12), although Kalum Lake Rd may not be right location (6)
9. Upgrade the four-way stop at Highway 16 / Highway 37 (11).
10. Lane lines are not visible; paint doesn't last (11)
11. Safety concerns on Lanfear Drive (9), esp. pedestrian crossing at bottom of hill. Consider closing access to Pheasant Street (1).
12. Need to develop Terrace for the future (7), including better access to Bench. Develop the network (2), connect Davis (1), and densify the town (1).
13. Sande Street / Keith Avenue signal upgrade appreciated (5), but reprogramming (e.g. with eastbound advance left turn phase) is requested to help manage conflicts (6).
14. More transit service (6), esp. a route to the airport (3). More stops (1) and shelters (1).
15. More parking (6), esp. Downtown. Consider angle parking (2).
16. Reroute heavy truck traffic out of town (e.g. to Keith Avenue) (5).
17. More street lighting (5).
18. Improve sidewalks and lighting on Eby Street North (3).
19. Kalum Street lane diet was supported (4); unsupported (3).
20. Need driver education (5), as well as for cyclists (1) and pedestrians (1).
21. Pedestrian crossing concerns at Kalum/Lazelle (5); Kalum/Loen (1); and top of Skeenaview Drive (1).
22. Improve snow removal on streets (5), and sweep winter sand/gravel (2).
23. Concern with Munthe Avenue intersection on Skeenaview Drive (3).
24. Other intersection concerns are at Eby/Lakelse (2); Park/Kalum (2); Halliwell/Sparks (2); left turn restrictions at Hwy 16/Tetrault (2); Halliwell/Keith signal (1); Hwy 16/Feeney signal timing (1); advance EB left turn desired at Hwy 16/Eby (1).
25. Traffic noise should be managed/abated (2).
26. Keep traffic signs visible and unobstructed (2).
27. Need longer walk times at signalized crosswalks (2).
28. Pave gravel roads (2).
29. Install roundabouts (2).
30. On-street parking blocks sight lines at Lazelle/Park/Sparks (2).
31. Upgrade link to town on one-way bridge (1) including revamping bridge signal (1).

4 TRANSPORTATION DEMAND FORECASTING

4.1 EXISTING TRAFFIC PATTERNS

Traffic counts at 27 key intersections were collected to analyze the traffic patterns in Terrace. These included 11 highway intersections (taken from the recent Highway 16 Corridor Study, Ref. 20), and 16 city intersections (mostly counted in March 2016 on regular school days).

The traffic patterns on Highway 16 at the four MoTI short count stations are shown in Figure 21. There was no clearly defined AM Peak Hour, as the traffic volumes continue to grow during the morning hours. The PM Peak Hour is typically around 4:00 to 5:00 PM. The directional split is close to 50 / 50 (eastbound versus westbound) at each station. However, at the station west of Highway 37, the commuter pattern of Thornhill residents working in Terrace appears to be reflected by a slightly higher westbound volume in the morning, and slightly higher eastbound volume in the afternoon.

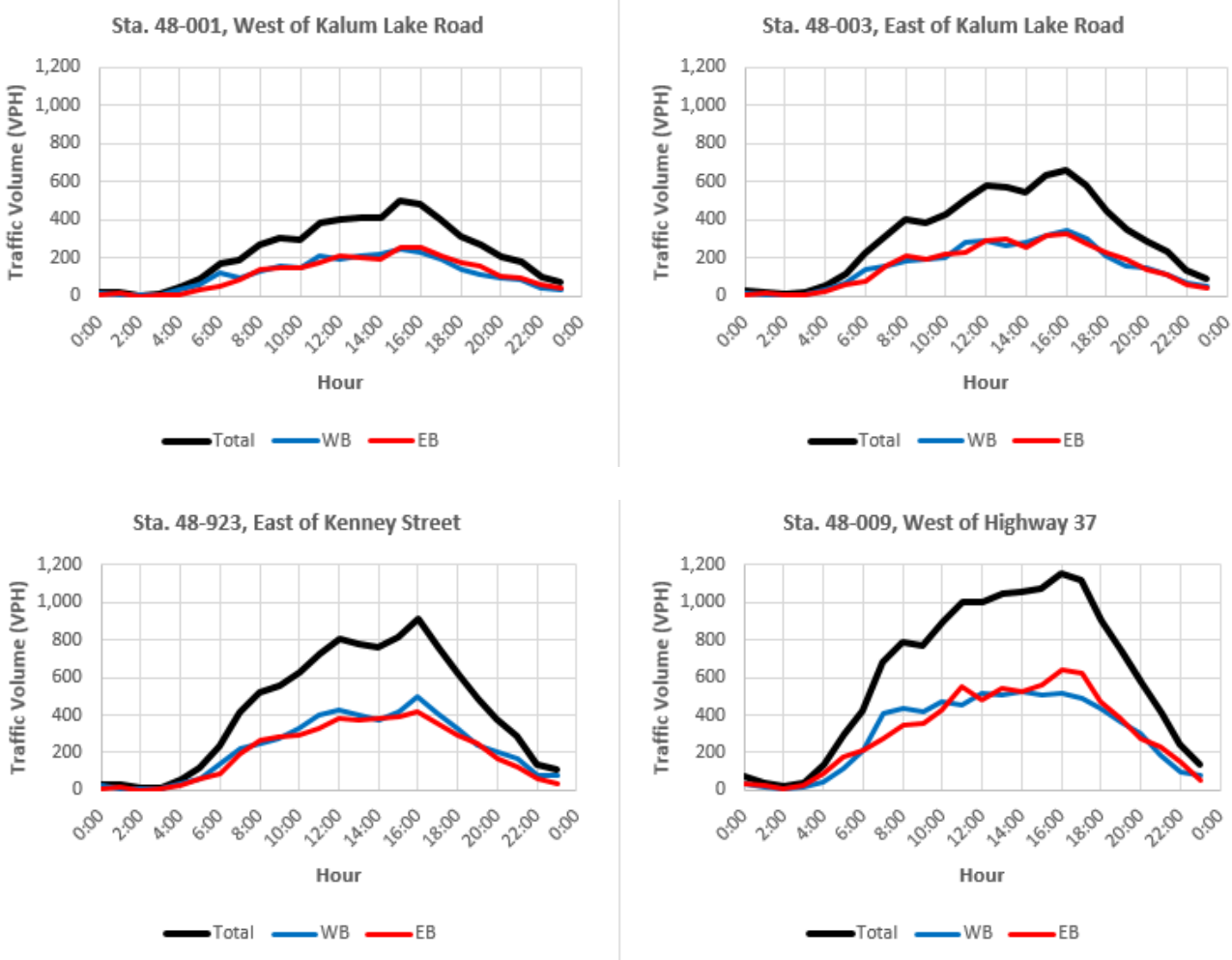


Figure 21: Hourly Traffic Volumes on Highway 16 through Terrace
(Source: MoTI short count stations, July 2014)

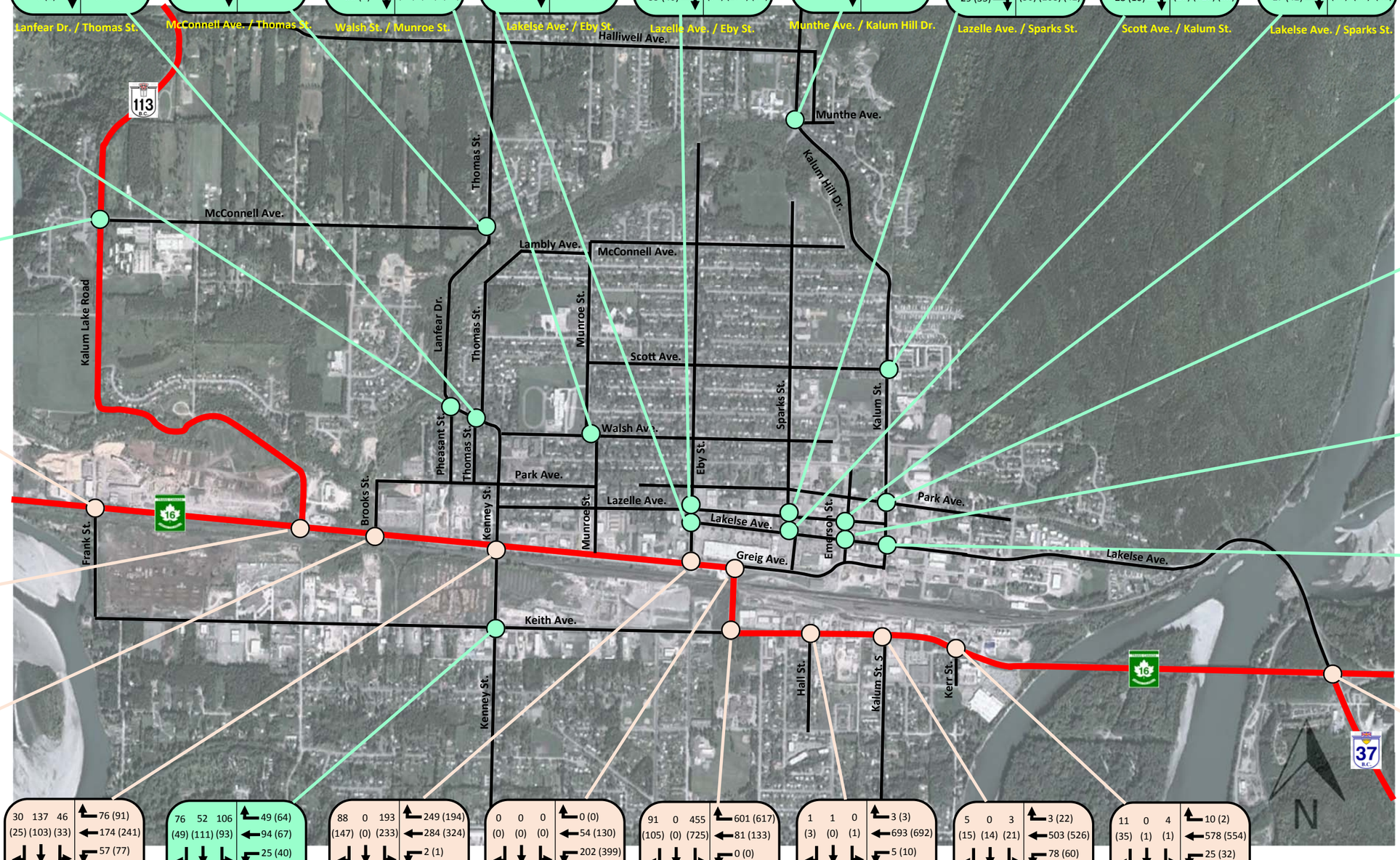
The 16 city intersections where new traffic counts were completed are listed in Table 4. Based on the data, the Peak Hours in the Downtown were typically around 8:15 and 9:15 AM in the morning, and 4:15 to 5:15 PM in the afternoon. Outside the Downtown area, the peak hours were typically earlier, especially in the vicinity of schools.

Table 4: Traffic Counts at City Intersections

	East - West Road	North - South Road	Count	AM Peak		PM Peak	
				FROM	TO	FROM	TO
1	Munthe Ave	Kalum Drive	Mar-16	7:45	8:45	16:15	17:15
2	Lakelse Avenue	Eby Street	Mar-16	8:15	9:15	15:45	16:45
3	Lakelse Avenue	Emerson Street	Mar-16	8:15	9:15	16:15	17:15
4	Lakelse Avenue	Kalum Street	Mar-16	8:15	9:15	15:45	16:45
5	Lakelse Avenue	Sparks Street	Mar-16	8:30	9:30	16:15	17:15
6	Lanfear Drive	Pheasant Street	Mar-16	8:15	9:15	16:15	17:15
7	Lanfear Drive	Thomas Street	Mar-16	8:00	9:00	16:30	17:30
8	Lazelle Avenue	Emerson Street	Mar-16	8:30	9:30	16:00	17:00
9	Lazelle Avenue	Sparks Street	Mar-16	8:15	9:15	15:30	16:30
10	McConnell Avenue	Kalum Lake Road	Mar-16	8:00	9:00	16:30	17:30
11	Walsh Avenue	Munroe Street	Mar-16	8:00	9:00	16:15	17:15
12	Scott Avenue	Kalum Street	Mar-16	8:00	9:00	16:30	17:30
13	McConnell Avenue	Thomas Street	Mar-16	8:00	9:00	14:45	15:45
14	Park Avenue	Kalum Street	May-14	8:15	9:15	14:45	15:45
15	Keith Avenue	Kenney Street	Aug-14	7:45	8:45	16:15	17:15
16	Lazelle Avenue	Eby Street	Sep-16	8:15	9:15	15:15	16:15

For the purpose of the network analysis, the Peak Hours at all city and highway intersections were assumed to be concurrent. Also, no seasonal adjustments to the city data were made in consideration of the relatively consistent traffic volumes typical of an urban setting.

The existing traffic volumes at the 27 study intersections are shown in Figure 22.



Lanfear Dr. / Thomas St.: 63 9 53 (32) (3) (21) | 68 (57) | 204 (257) | 3 (2) | 87 (26) | 259 (172) | 0 (1) | 3 7 2 (0) (3) (5)

McConnell Ave. / Thomas St.: 62 199 0 (41) (134) (0) | 6 (1) | 0 (0) | 7 (8) | 36 (39) | 0 (0) | 144 (132) | 155 118 4 (118)(144) (14)

Walsh St. / Munroe St.: 49 34 8 (26) (14) (10) | 28 (7) | 33 (61) | 8 (7) | 98 (53) | 84 (49) | 30 (6) | 14 31 15 (12) (26) (13)

Lakelse Ave. / Eby St.: 0 160 90 (0) (162) (80) | 86 (101) | 0 (0) | 123 (154) | 0 (0) | 0 (0) | 0 (0) | 0 128 90 (0) (164)(104)

Lazelle Ave. / Eby St.: 33 188 78 (14) (195) (26) | 33 (37) | 69 (116) | 25 (25) | 26 (17) | 82 (115) | 35 (46) | 46 182 25 (34) (170) (40)

Munthe Ave. / Kalum Hill Dr.: 0 231 1 (0) (159) (2) | 8 (3) | 0 (0) | 56 (14) | 0 (0) | 0 (0) | 0 (0) | 0 (0) 94 23 (228) (41)

Lazelle Ave. / Sparks St.: 60 91 26 (45) (111) (12) | 17 (25) | 53 (122) | 9 (32) | 50 (64) | 102 (116) | 29 (35) | 16 112 19 (36) (108) (42)

Scott Ave. / Kalum St.: 6 285 2 (5) (225) (8) | 5 (7) | 9 (4) | 21 (15) | 3 (8) | 6 (6) | 28 (10) | 13 142 13 (20) (317) (33)

Lakelse Ave. / Sparks St.: 29 55 38 (55) (105) (37) | 49 (52) | 153 (216) | 43 (46) | 20 (39) | 137 (170) | 17 (42) | 32 69 29 (47) (85) (42)

Lanfear Dr. / Pheasant St.: 0 0 0 (0) (0) (0) | 0 (0) | 268 (285) | 2 (4) | 0 (0) | 342 (191) | 12 (7) | 11 0 4 (10) (0) (8)

Lazelle Ave. / Emerson St.: 21 37 6 (27) (75) (5) | 13 (12) | 57 (93) | 20 (15) | 13 (31) | 54 (81) | 33 (51) | 19 30 6 (26) (59) (23)

McConnell Ave. / Kalum Lake Rd.: 8 45 16 (2) (53) (7) | 9 (9) | 1 (9) | 11 (11) | 1 (0) | 7 (2) | 7 (3) | 3 32 38 (9) (72) (15)

Park Ave. / Kalum St.: 31 241 25 (45) (289) (19) | 21 (26) | 41 (41) | 8 (21) | 14 (66) | 23 (48) | 20 (59) | 40 179 24 (43) (263) (42)

Hwy 16 / Frank St.: 1 3 1 (0) (8) (17) | 0 (1) | 99 (133) | 11 (15) | 0 (0) | 105 (151) | 12 (27) | 20 0 17 (15) (1) (21)

Lakelse Ave. / Emerson St.: 38 29 3 (54) (50) (16) | 8 (15) | 187 (249) | 11 (4) | 7 (3) | 102 (240) | 25 (21) | 20 40 18 (25) (76) (32)

Hwy 16 / Kalum Lake Rd.: 25 0 138 (21) (0) (114) | 122 (100) | 97 (131) | 0 (0) | 30 (28) | 104 (159) | 0 (0) | 0 0 0 (0) (0) (0)

Lakelse Ave. / Kalum St.: 74 103 107 (122)(117) (89) | 192 (174) | 129 (160) | 2 (11) | 53 (117) | 67 (153) | 7 (13) | 5 71 9 (18) (112) (11)

Hwy 16 / Brooks St.: 4 0 9 (24) (0) (16) | 2 (6) | 172 (284) | 0 (0) | 12 (19) | 228 (318) | 0 (0) | 0 0 0 (0) (0) (0)

Hwy 16 / Hwy 37: 64 27 85 (51) (66) (198) | 179 (151) | 382 (259) | 37 (35) | 9 (18) | 193 (374) | 116 (251) | 141 54 33 (160) (68) (37)

Hwy 16 / Kenney St.: 30 137 46 (25) (103) (33) | 76 (91) | 174 (241) | 57 (77) | 37 (35) | 152 (234) | 57 (53) | 35 115 92 (36) (129)(142)

Keith Ave. / Kenney St.: 76 52 106 (49) (111) (93) | 49 (64) | 94 (67) | 25 (40) | 36 (101) | 59 (97) | 4 (17) | 14 89 29 (12) (123) (41)

Hwy 16 / Eby St.: 88 0 193 (147) (0) (233) | 249 (194) | 284 (324) | 2 (1) | 75 (124) | 243 (321) | 0 (2) | 2 0 2 (3) (2) (5)

Hwy 16 (Sande St.) / Greig Ave.: 0 0 0 (0) (0) (0) | 0 (0) | 54 (130) | 202 (399) | 0 (0) | 93 (127) | 344 (431) | 477 0 223 (389) (0) (351)

Hwy 16 (Sande St.) / Keith Ave.: 91 0 455 (105) (0) (725) | 601 (617) | 81 (133) | 0 (0) | 98 (122) | 145 (184) | 0 (0) | 0 0 0 (0) (0) (0)

Hwy 16 / Hall St.: 1 1 0 (3) (0) (1) | 3 (3) | 693 (692) | 5 (10) | 1 (3) | 477 (816) | 17 (30) | 10 0 5 (18) (0) (8)

Hwy 16 / Kalum St.: 5 0 3 (15) (14) (21) | 3 (22) | 503 (526) | 78 (60) | 12 (24) | 343 (671) | 101 (99) | 200 5 78 (143) (11) (89)

Hwy 16 / Kerr St.: 11 0 4 (35) (1) (1) | 10 (2) | 578 (554) | 25 (32) | 33 (10) | 377 (745) | 14 (10) | 4 0 0 (4) (0) (16)

Legend: AM (PM)

Figure 22:

Existing Traffic Volumes

4.2 EXPECTED GROWTH

As discussed in Section 2.8, a recent economic study for Terrace identified three potential growth scenarios over the next ten years (Ref. 1). The City identified the Medium Growth Scenario as the most likely, and advised that this was planned for use in the update to the Official Community Plan. In the medium scenario, the study estimated the population to grow from 12,494 in 2015 to 19,363 in 2025. This is a 55% increase in population at an annual growth rate of 4.5%. As assumed in the study, this growth would be based on rapid increases in employment and industry, such as ten new manufacturing facilities in the Skeena Industrial Development Park, three mines in the region, and two LNG facilities (i.e. one in Kitimat, and one in Prince Rupert).

By reviewing the available lands for development and their applicable zoning and development potential, the City has provided an estimate of where the residential growth is expected to occur. The city was divided into twelve zones, as shown in Figure 23. The existing and 2025 horizon population in each zone is calculated as shown in Table 5.

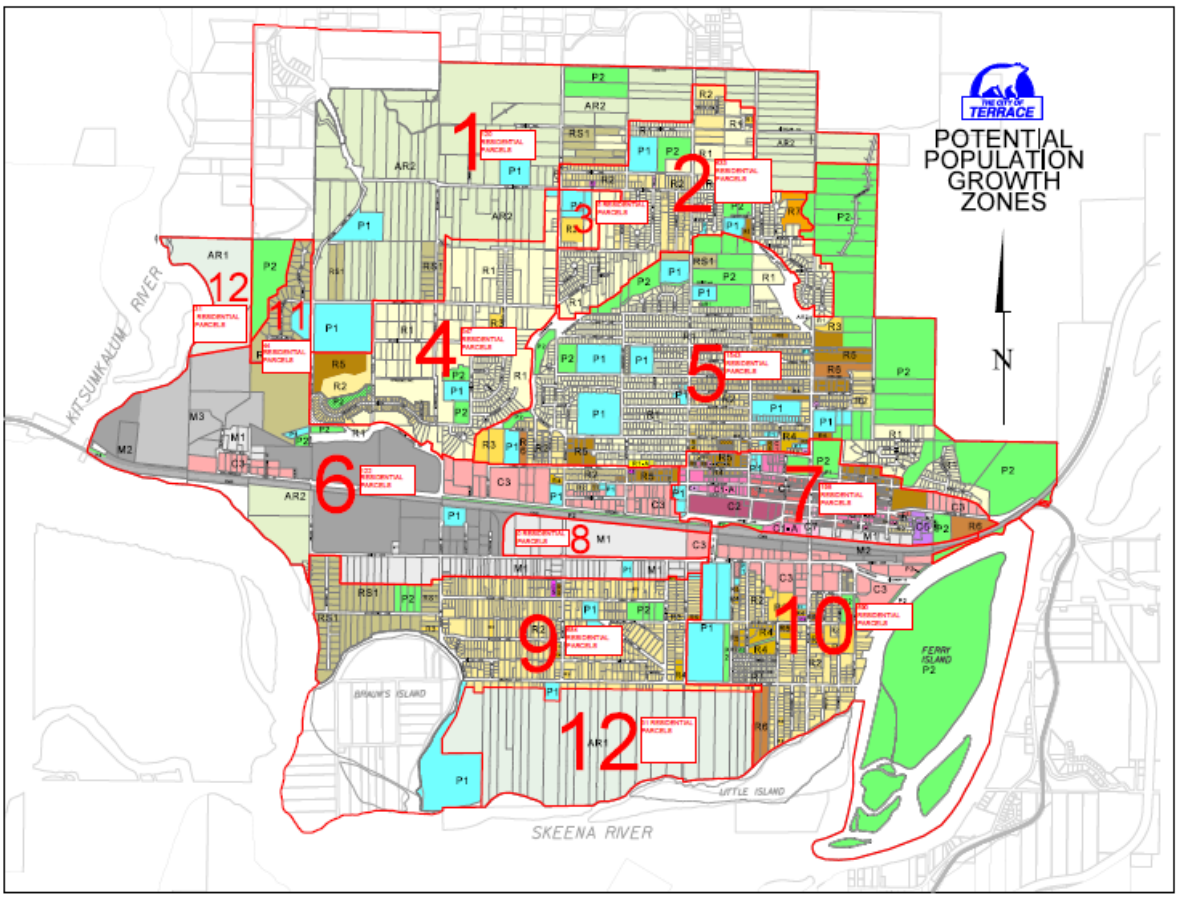


Figure 23: Identified Zones for Development in Terrace
(Source: City of Terrace)

Table 5: 2025 Population Estimates by Zone

Zone	Current Number of Parcels or Units	Current Residential Population* (2015)	Potential New Parcels or Units	Potential New Residents**	Estimated New Residents by 2030	Estimated New Residents by 2025	Estimated New Parcels or Units by 2025**	Estimated Additional Traffic (vpd)
1	120	340	2000	5040	5040	4536	1800	10,800
2	633	1796	112	282	282	253	101	604
3	12	34	97	242	242	218	86	518
4	347	984	354	892	892	803	319	1,911
5	1543	4377	100	252	252	227	90	540
6	122	346	17	42	42	38	15	90
7	198	562	17	42	42	38	15	90
8	0	0	660	1663	496	496	197	1,182
9	684	1941	60	151	151	136	54	324
10	690	1958	60	151	151	136	54	324
11	44	125	0	0	0	0	0	0
12	31	88	0	0	0	0	0	0
Totals	**4,424**	**12,551**	**3,476**	**8,757**	**7,590**	**6,881**	**2,730**	**16,383**

(Source: City of Terrace)

* Assuming 2.84 persons per household.

** Assuming 2.52 persons per household.

The City's original population and development estimates were based on a 2030 horizon. To adjust this to the 2025 estimate used in the study, the populations in all zones except Zone 8 (Keith Estates) were reduced by 10%. The Keith Estates development is already assumed to be only 30% developed by 2030, and so was left as originally estimated.

By the above calculations, the estimated 2025 population is approximately 19,400, to match the population predicted in the City's economic study. From these demographic assumptions, the additional daily traffic generated by each zone was estimated assuming 2.5 weekday trips per person (as per data from the ITE Trip Generation Manual, Ref. 9), and the assumed 2.52 persons per household. The result is six daily vehicular trips per household, which was the assumption used in the Infrastructure Upgrade Scoping Study (Ref. 12).

Additional non-vehicular (i.e. walking, cycling and transit) trips may be expected from each zone. This is more likely in multi-family residential development due to the typical lower vehicle ownership, and the proximity to employment and services.

As with any forecasts, these growth assumptions may be realized sooner or later than anticipated. The analysis and subsequent recommendations should therefore be considered as a function of the assumed development intensity, rather than linked to the 2025 horizon year itself. If the growth occurs at a slower pace, the implementation of the identified network improvements can be delayed. If the growth occurs faster than assumed, the improvements will likely need to be implemented earlier, and the technical analysis revisited.

4.3 FUTURE TRAFFIC PATTERNS

Of the 12 identified city zones, the estimated growth is significant only in two areas: the Upper Bench (Zones 1-4) and Keith Estates (Zone 8). Therefore, the traffic from these neighbourhoods was studied in detail.

On the Upper Bench, the estimated Average Daily Traffic for each zone (Table 6) was assigned to the network as follows:

- 20% of traffic was assumed to remain internal to the Upper Bench neighbourhood (i.e. trips to school, university, daycare, etc), or trips north on Kalum Lake Road. The other 80% would travel south toward employment, services and shopping.
- Traffic on Kalum Lake Road would be comprised of trips from 25% of Zone 1 and 50% of Zone 4.
- Traffic on Lanfear Drive would be comprised of trips from 45% of Zone 1, 50% of Zone 2, 100% of Zone 3, and 50% of Zone 4.
- Traffic on Skeenaview Drive would be comprised of trips from 30% of Zone 1 and 50% of Zone 2.
- Combined together, 20% of the the traffic generated by the four zones would use Kalum Lake Road, 40% Lanfear Drive, and 20% Skeenaview Drive.

The estimated additional daily traffic on each route to the Upper Bench was calculated as shown in Table 6.

Table 6: Trip Distribution of Estimated New Traffic

Zone	Estimated New Daily Traffic (vpd)	External Daily Traffic (vpd)	Kalum Lake Road Traffic (vpd)	Lanfear Drive Traffic (vpd)	Skeenaview Drive (vpd)
1	10,800	8,640	2,160	3,888	2,592
2	604	483	0	241	241
3	518	415	0	415	0
4	1,911	1,529	765	765	0
Total	**13,833**	**11,067**	**2,925**	**5,309**	**2,833**
Percent of Total	**100%**	**80%**	**20%**	**40%**	**20%**

To estimate the PM peak hour traffic, a K Factor (i.e. the proportion of the average daily traffic to the peak hour traffic) of 9.0 was used, which was based on the recent hose counts conducted by the City. A K Factor of 10 was used for the AM Peak Hour, which typically has a slightly lower volume than the PM Peak Hour. Applying ITE directional split data for single family dwellings, 75% of the AM Peak Hour traffic was assumed to be travelling south, and 25% was assumed to be returning north. In the PM Peak Hour, the directional split was assumed to be 37% and 63% respectively. The calculated new traffic volumes on the three roads are as shown in Table 7.

Table 7: Peak Hour Traffic Assignment to and from the Upper Bench (Zones 1-4)

Scenario	Kalum Lake Road	Lanfear Drive	Skeenaview Drive
Average Daily Traffic (vpd) (from Table 6)	2,925	5,309	2,833
AM Peak Hour (vph)	292	531	283
1. Southbound (vph)	219	398	213
2. Northbound (vph)	73	133	71
PM Peak Hour (vph)	325	590	315
3. Southbound (vph)	120	218	116
4. Northbound (vph)	205	372	198

For the traffic in Zone 8 (Keith Estates), 10% of the new trips were assumed to remain in the vicinity. The peak hour traffic volumes were calculated the same as for the Upper Bench. For the directional split, ITE data for multi-family (i.e. townhouse and low rise apartments) was used. In this respect, the AM Peak Hour was assumed to have 20% inbound trips, and 80% outbound trips. In the PM Peak Hour, the directional split would be 67% and 33% respectively. The traffic volumes for Zone 8 are shown in Table 8.

Table 8: Peak Hour Traffic Generated by Keith Estates (Zone 8)

Scenario	Keith Estates
Total Average Daily Traffic (vpd)	1,182
External Average Daily Traffic (vpd)	1,064
AM Peak Hour (vph)	106
5. Inbound (vph)	21
6. Outbound (vph)	85
PM Peak Hour (vph)	118
7. Inbound (vph)	79
8. Outbound (vph)	39

Based on the known major origins and destinations, and the ambient traffic patterns, the assumed distribution of the new traffic from the Upper Bench and the Keith Estates is as shown in Figures 24 and 25 respectively.

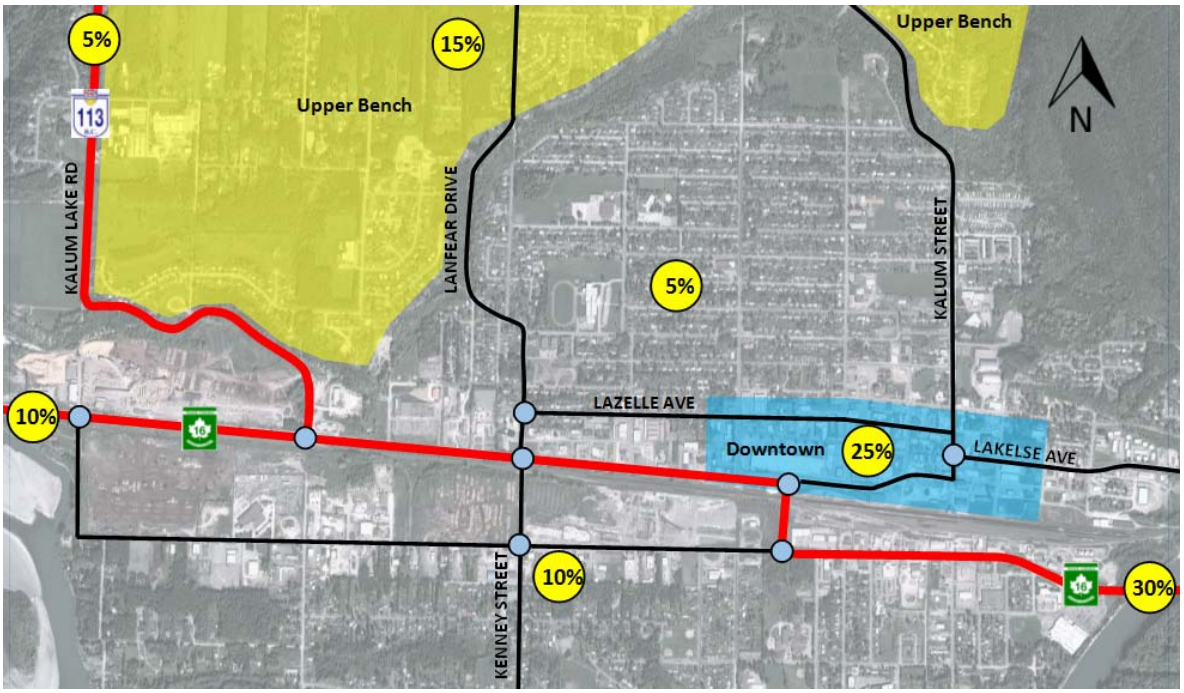


Figure 24: Assumed Trip Distribution of the Upper Bench Traffic

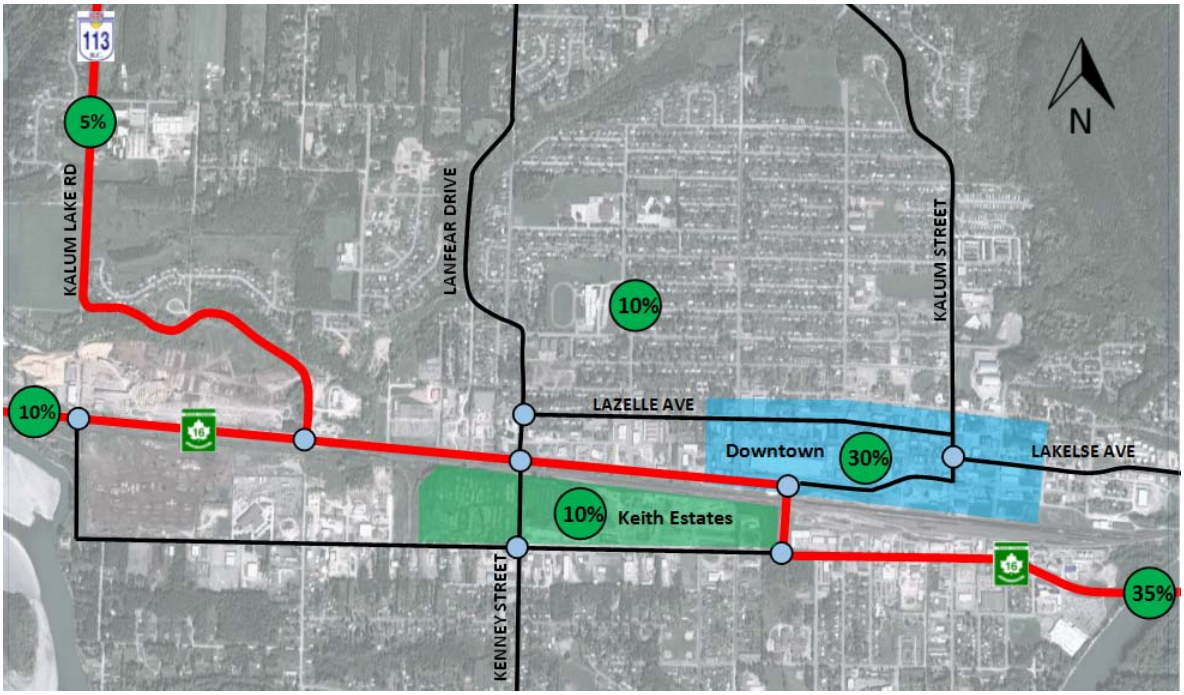


Figure 25: Assumed Trip Distribution of the Keith Estates Traffic

To account for other growth in the city traffic volumes (i.e. not associated with the zones in the Upper Bench or Keith Estates), the following assumptions were made:

1. All traffic movements internal to the Downtown were increased by 40%, which is less than the total anticipated growth in the community, but recognizes Downtown as a key activity centre.

2. All traffic movements outside the Downtown, and not associated with the Upper Bench or Keith Estates, were increased by 10%, which is the combined estimated growth of the remaining zones.

3. The through traffic on the highway was increased by 20%, which follows a 2% annual linear growth rate. This growth rate was confirmed by data from the MoTI short count station 48-009 on Highway 16, just west of the Highway 37 junction (Figure 26). This station has the advantage of count data dating back to 2005, and is sufficiently outside the city core to be a reasonable gauge of highway through traffic.

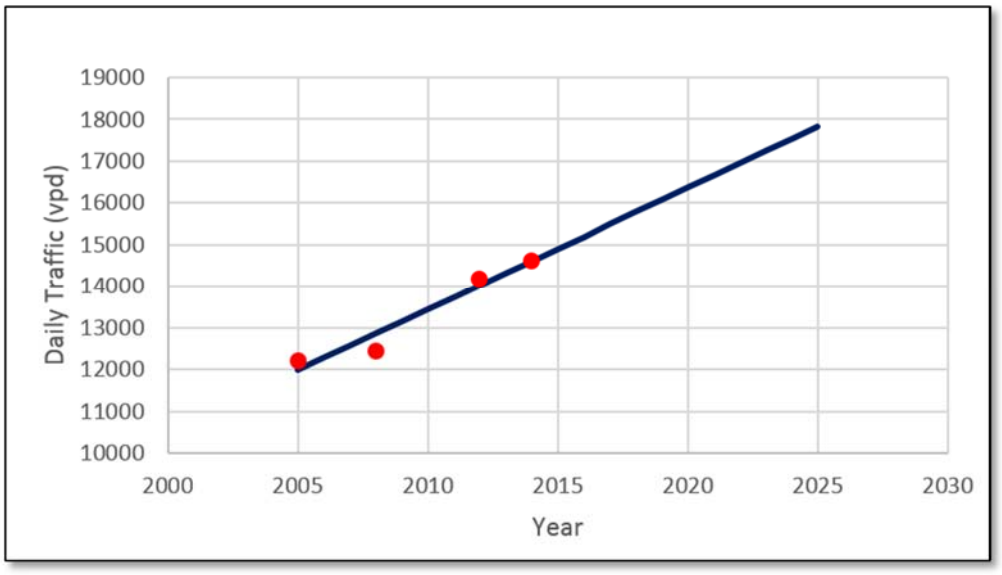
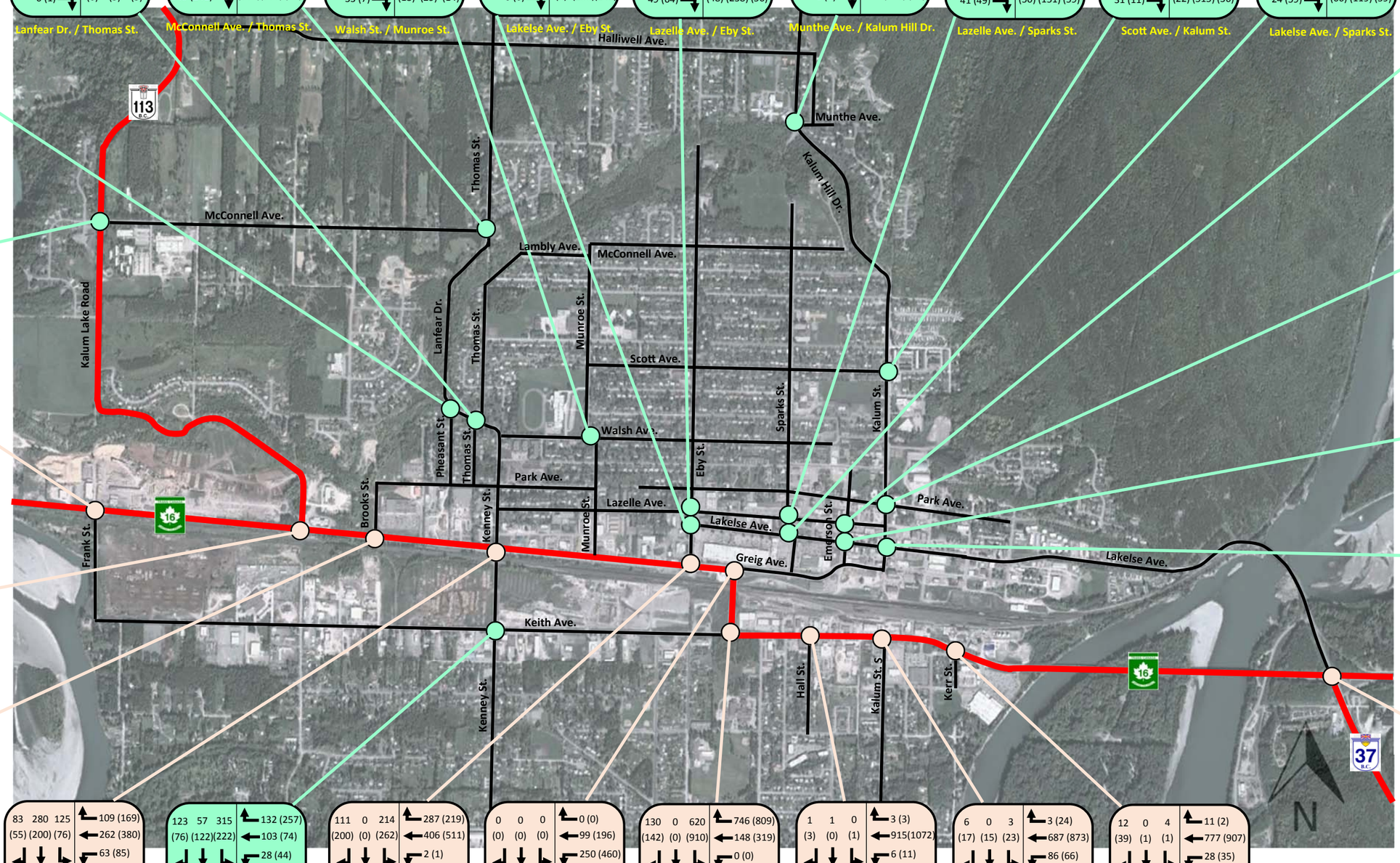


Figure 26: Highway 16 Projected Traffic Growth
(source: MoTI count station 48-009)

Applying the growth assumptions as outlined above, the estimated 2025 peak hour traffic volumes were calculated as shown in Figure 27.



Lanfear Dr. / Thomas St.: 71 9 53 / (54) (3) (21) | 68 (57) / 329 (607) / 3 (2) | 111 (39) / 633 (377) / 0 (1) | 3 7 2 / (0) (3) (5)

McConnell Ave. / Thomas St.: 62 398 0 / (41) (243) (0) | 6 (1) / 0 (0) / 7 (8) | 36 (39) / 0 (0) / 343 (241) | 222 185 4 / (304)(330) (14)

Walsh St. / Munroe St.: 54 37 9 / (29) (15) (11) | 31 (8) / 36 (67) / 9 (8) | 108 (58) / 92 (54) / 33 (7) | 15 34 17 / (13) (29) (14)

Lakelse Ave. / Eby St.: 0 224 126 / (0) (227)(112) | 120 (141) / 0 (0) / 172 (216) | 0 (0) / 0 (0) / 0 (0) | 0 179 126 / (0) (230)(146)

Lazelle Ave. / Eby St.: 46 263 109 / (20) (273) (36) | 46 (52) / 97 (162) / 35 (35) | 36 (24) / 115 (161) / 49 (64) | 64 255 35 / (48) (238) (56)

Munthe Ave. / Kalum Hill Dr.: 0 444 1 / (0) (275) (2) | 8 (3) / 0 (0) / 56 (14) | 0 (0) / 0 (0) / 0 (0) | 0 (0) 165 23 / (426) (41)

Lazelle Ave. / Sparks St.: 84 127 36 / (63) (155) (17) | 21 (35) / 74 (171) / 13 (45) | 70 (90) / 143 (162) / 41 (49) | 22 157 27 / (50) (151) (59)

Scott Ave. / Kalum St.: 7 498 3 / (6) (341) (9) | 6 (8) / 10 (4) / 23 (17) | 3 (9) / 7 (7) / 31 (11) | 14 213 14 / (22) (515) (36)

Lakelse Ave. / Sparks St.: 41 77 53 / (77) (147) (52) | 69 (73) / 214 (302) / 60 (64) | 28 (55) / 192 (238) / 24 (59) | 45 97 41 / (66) (119) (59)

Lanfear Dr. / Pheasant St.: 0 0 0 / (0) (0) (0) | 0 (0) / 401 (657) / 2 (4) | 0 (0) / 740 (409) / 13 (8) | 11 0 4 / (10) (0) (8)

McConnell Ave. / Kalum Lake Rd.: 8 101 16 / (2) (87) (7) | 22 (16) / 1 (9) / 121 (71) | 1 (0) / 7 (2) / 7 (3) | 3 54 74 / (9) (125)(117)

Hwy 16 / Frank St.: 1 3 1 / (0) (9) (19) | 0 (1) / 231 (221) / 12 (17) | 0 (0) / 163 (287) / 13 (30) | 22 0 19 / (17) (1) (23)

Hwy 16 / Kalum Lake Rd.: 57 0 359 / (40) (0) (246) | 213 (300) / 201 (203) / 0 (0) | 45 (60) / 153 (271) / 0 (0) | 0 0 0 / (0) (0) (0)

Hwy 16 / Brooks St.: 4 0 10 / (26) (0) (18) | 2 (7) / 358 (567) / 0 (0) | 13 (22) / 494 (571) / 0 (0) | 0 0 0 / (0) (0) (0)

Hwy 16 / Kenney St.: 83 280 125 / (55) (200) (76) | 109 (169) / 262 (380) / 63 (85) | 58 (86) / 272 (350) / 174 (129) | 88 174 101 / (148)(260)(156)

Keith Ave. / Kenney St.: 123 57 315 / (76) (122)(222) | 132 (257) / 103 (74) / 28 (44) | 54 (148) / 65 (107) / 4 (19) | 15 98 32 / (13) (135) (45)

Hwy 16 / Eby St.: 111 0 214 / (200) (0) (262) | 287 (219) / 406 (511) / 2 (1) | 123 (158) / 416 (472) / 0 (2) | 2 0 2 / (3) (2) (5)

Hwy 16 (Sande St.) / Greig Ave.: 0 0 0 / (0) (0) (0) | 0 (0) / 99 (196) / 250 (460) | 0 (0) / 152 (187) / 489 (563) | 610 0 267 / (542) (0) (417)

Hwy 16 (Sande St.) / Keith Ave.: 130 0 620 / (142) (0) (910) | 746 (809) / 148 (319) / 0 (0) | 143 (171) / 344 (300) / 0 (0) | 0 0 0 / (0) (0) (0)

Hwy 16 / Hall St.: 1 1 0 / (3) (0) (1) | 3 (3) / 915(1072) / 6 (11) | 1 (3) / 830(1117) / 19 (33) | 11 0 6 / (20) (0) (9)

Hwy 16 / Kalum St.: 6 0 3 / (17) (15) (23) | 3 (24) / 687 (873) / 86 (66) | 13 (26) / 670 (943) / 111 (109) | 220 6 86 / (157) (12) (98)

Hwy 16 / Kerr St.: 12 0 4 / (39) (1) (1) | 11 (2) / 777 (907) / 28 (35) | 36 (11) / 710(1032) / 15 (11) | 4 0 0 / (4) (0) (18)

Lazelle Ave. / Emerson St.: 29 52 8 / (38) (105) (7) | 18 (17) / 80 (130) / 28 (21) | 18 (43) / 76 (113) / 46 (71) | 27 42 8 / (36) (83) (32)

Park Ave. / Kalum St.: 85 400 28 / (74) (376) (21) | 23 (29) / 45 (45) / 9 (23) | 32 (115) / 25 (53) / 22 (65) | 44 232 26 / (47) (412) (46)

Lakelse Ave. / Emerson St.: 53 41 4 / (76) (70) (22) | 11 (21) / 262 (349) / 15 (6) | 10 (4) / 143 (336) / 35 (29) | 28 56 25 / (35) (106) (45)

Lakelse Ave. / Kalum St.: 109 165 199 / (148)(159)(141) | 237 (264) / 142 (176) / 2 (12) | 67 (155) / 74 (168) / 8 (14) | 6 89 10 / (20) (162) (12)

Hwy 16 / Hwy 37: 70 90 113 / (56) (103)(231) | 197 (166) / 479 (374) / 44 (42) | 10 (20) / 299 (484) / 330 (404) | 231 79 40 / (371)(128) (44)

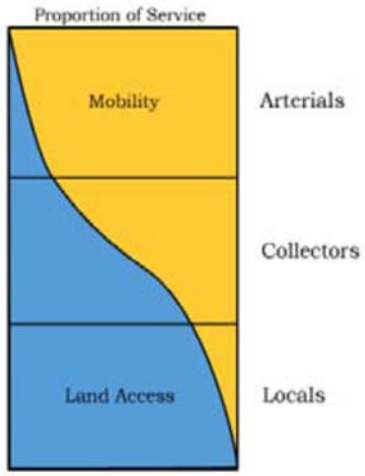
Legend: AM (PM)

Figure 27: Estimated 2025 Traffic Volumes

5 ROAD NETWORK ANALYSIS

5.1 ROAD FUNCTIONAL CLASSIFICATION

To form the basis for the network analysis and the development of standard cross sections, the existing and future roads in Terrace were functionally classified in accordance with the definitions from the Transportation Association of Canada (TAC). These are:



Arterial Roads: intended primarily to move large volumes of traffic safely and efficiently over relatively long distances. Arterials typically have higher traffic speeds, with little or no direct access to adjacent properties. These roads generally support heavy truck traffic and bus routes. Minor arterials may serve between 5,000 and 20,000 vpd. Major arterials (e.g. provincial highways) may serve between 10,000 and 20,000 vpd (Ref. 18).

Figure 28: Arterial Road Example – Greig Avenue

Collector Roads: intended to connect neighbourhoods to the arterial road network with a moderate degree of traffic mobility, while also accommodating a higher degree of property access. Collector roads are also typically used for bus routes, and may have some heavy truck traffic (especially in industrial areas). Collectors typically serve between 1,000 and 12,000 vpd (Ref. 18).

Figure 29: Collector Road Example – Munroe Street

Local Roads: intended primarily to provide access to adjacent properties. On local roads, there is generally less tolerance for large volumes of traffic and fast traffic speeds. Local roads are often candidates for traffic calming measures (see Section 10.2), especially in residential areas. Traffic volumes on local roads are typically less than 3,000 vpd (Ref. 18).

Figure 30: Local Road Example – Cooper Drive

In revisiting the existing functionally classified network from the Terrace Official Community Plan (Ref. 14), the following three principles were considered:

1. The major road network should achieve a balanced spacing to provide a sufficient level of network redundancy to permit multiple route options for each trip.

2. The arterial and collector roads should interconnect with other similar roads wherever possible, thereby forming a continuous network with no unconnected streets.

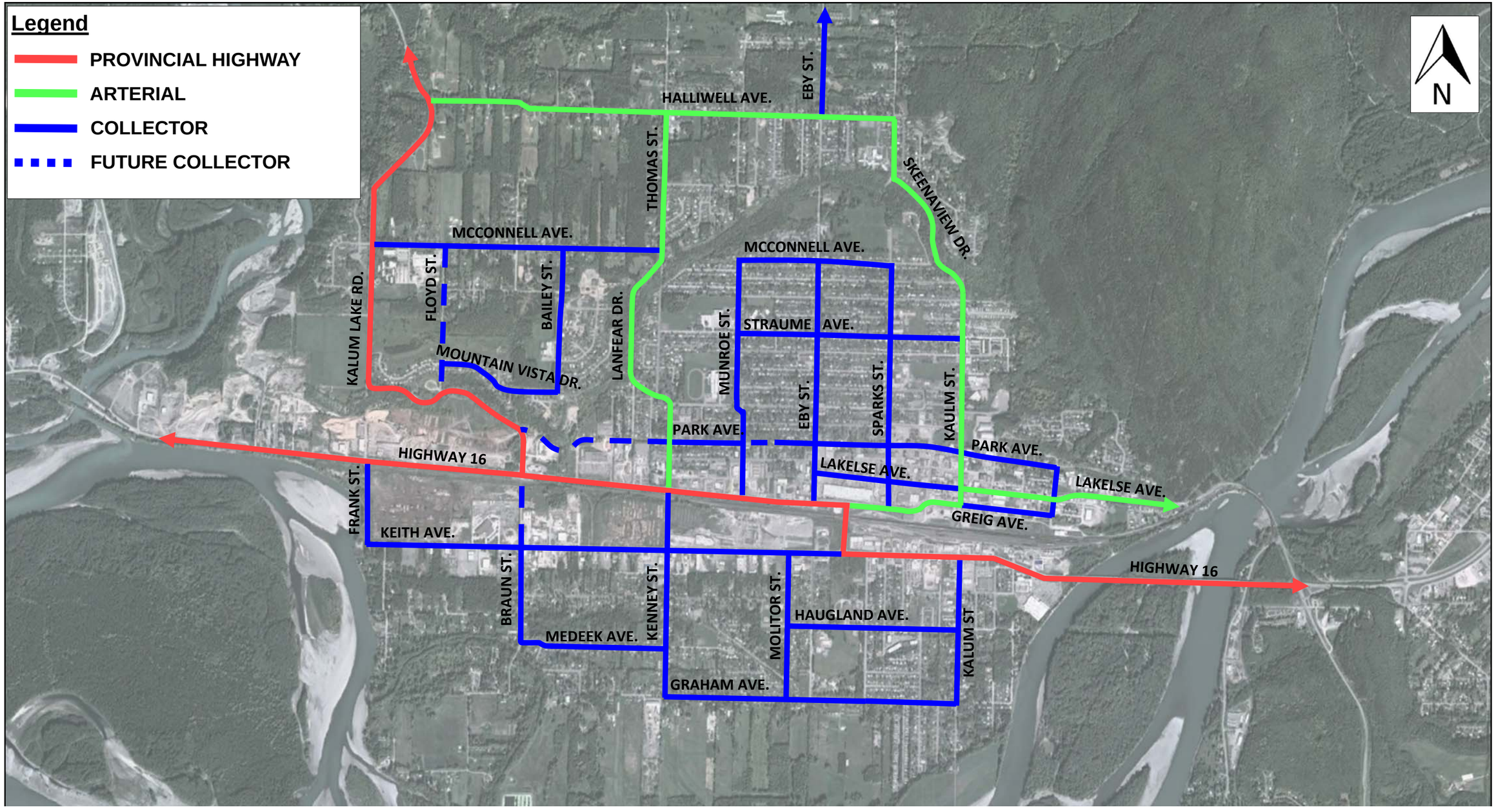
3. The roads should ideally have the design characteristics, traffic control, and access density to support their functional classification.

The proposed functional classifications are shown in Figure 31. The most significant proposed change is the completion of the designated arterial road network on the Upper Bench, in the north half of the city. Halliwell Avenue is the only available east-west link that interconnects the three arterial routes to the city core (i.e. Kalum Lake Road, Lanfear Drive, and Skeenaview Drive). The high residential access density on the north side of Halliwell Avenue (between Sparks Street and Thomas Street) is undesirable for an arterial road. However, the access density on the south side of the road is much lower due to residential properties being accessed via side-streets. As the area develops, direct access should be discouraged in favour of more side-streets.

The proposed changes to the collector road network are primarily intended to establish a more defined and continuous grid network in the city, which is achieved by linking collectors and arterials. Proposed new collectors therefore include:

- McConnell Avenue, between Sparks Street and Munroe Street
- Straume Avenue, between Kalum Street and Munroe Street
- Mountain Vista Drive, between Bailey Street and Floyd Street
- Medeek Avenue, between Kenney Street and Braun Street
- Graham Avenue, between Kalum Street and Kenney Street

Braun Street between Keith Avenue and Highway 16, is also designated as a future collector, together with the future proposed grade separation of the railway line. This would become the future designated truck route (see Section 5.7).



McElhanney

Figure 31: Proposed Road Functional Classification

5.2 ROAD CROSS SECTIONS

Schedule "I" of the Subdivision and Development Bylaw (Ref.16) identifies two standard widths for road right-of-way in Terrace: 20 metres and 24 metres. With the 20 metre right-of-way, there are currently provisions for 7.5 metre, 9.0 metre, 12.0 metre, and 14.0 metre road widths. Within the 24 metre right-of-way, the standards show an 18 metre road width.

For local roads, a 7.5 metre road width would be suitable providing there was little or no demand for on-street parking (Figure 32).

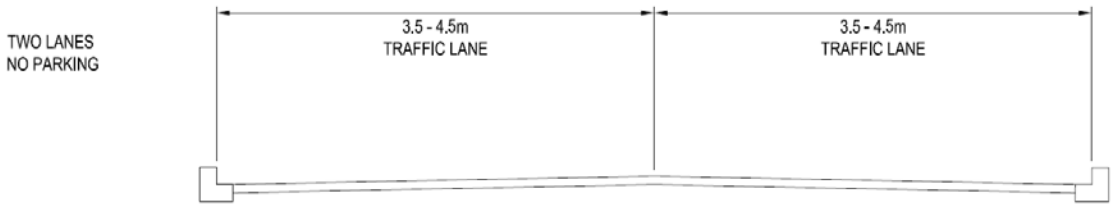


Figure 32: Local Road Cross Section (7 - 9 metre width)

To accommodate on-street parking (which typically requires in the order of 2.4 metres width), the road width should be between 9.0 and 10.0 metres (Figure 33).

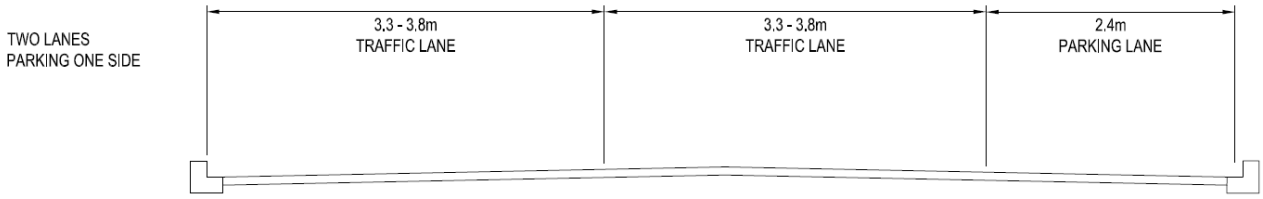


Figure 33: Local Road Cross Section (9 – 10 metre width)

For collector roads, additional width is usually required for turning lanes, on-street parking, bike lanes, and/or bus stops. Collector roads should therefore be typically between 10 metres and 13 metres in width, depending on their specific requirements. Proposed cross sections for collector roads are shown in Figures 34 to 36 below.

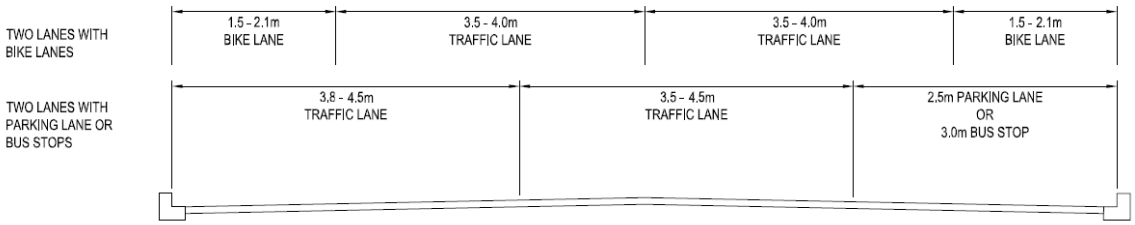


Figure 34: Collector Road Cross Section (10 – 12 metre width)

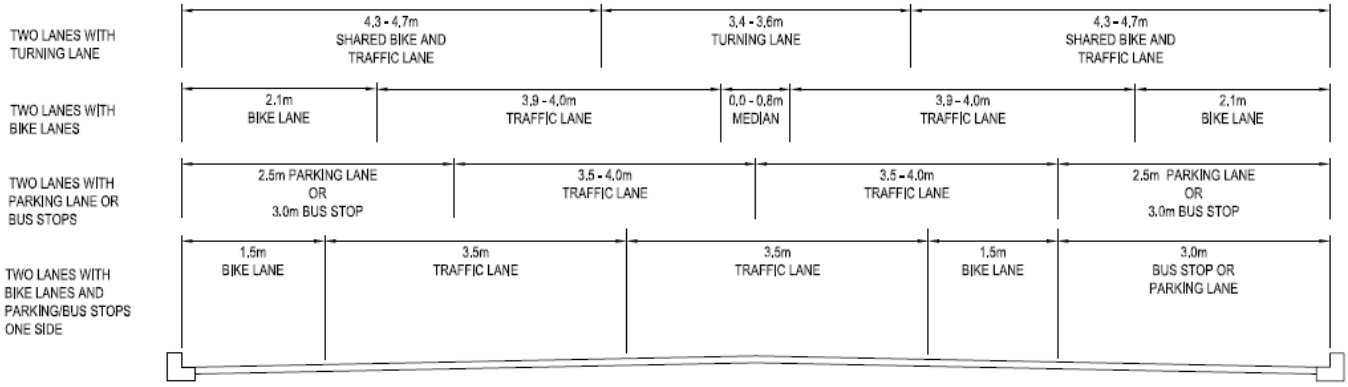


Figure 35: Collector Road Cross Section (12-13 metre width)

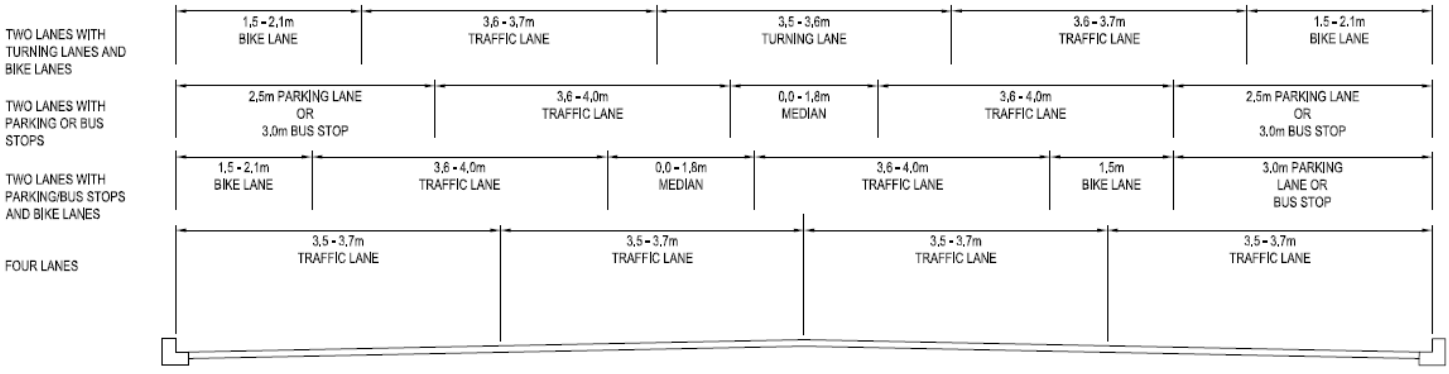


Figure 36: Collector Road Cross Section (13-14 metre width)

For two-lane arterial roads, the road width should be a minimum of 10 metres, with extra width to accommodate left turn lanes, etc. Potential arterial road cross sections can be similar to those for collector roads (as shown in the figures above), with additional width as required to accommodate additional traffic lanes and on-street parking.

The streets in Terrace that have identified issues with cross sections are:

1. Lakelse Avenue, a collector which currently accommodates four lanes of traffic and on-street parking on both sides in approximately 17 metres of width (Figure 37). There is insufficient road width for the current laning, as is evident from the concerns about weaving, turning, and parking conflicts. This will become a growing safety concern as traffic and parking demand increase. The road is a candidate for a "lane diet" (i.e. two traffic lanes with a Two-Way Left Turn Lane, with either on-street parking or bike lanes).

Figure 37: Lakelse Avenue

2. Lanfear Drive and Skeenaview Drive: both roads are classified as arterials, but have right-of-way and topographical constraints that prevent construction of a standard road width. The roads do not require turning lanes, since there are no accesses or intersections on the hills. Therefore, to accommodate simply the traffic lanes and shoulders (or bike lanes), the road width should be ideally 10.0 metres.

3. Keith Avenue: with the development of the proposed Keith Estates, there will be increasing traffic, pedestrian, and cycling demands on Keith Avenue. The road will also be used by heavy trucks, especially if it is officially designated as a truck route. Therefore, a 14.6 metre road width in a 24 metre right-of-way is proposed. This will accommodate two lanes of traffic, a Two-Way Left Turn Lane (which is necessary with the high density of access along Keith Avenue), and two 1.8 metre shoulders (which could be used as bike lanes, or simply as a buffer for pedestrians). On-street parking should not be permitted in order to eliminate parking conflicts, and maintain sight lines at intersections. The boulevard could be used for two 1.8 metre sidewalks, or one 1.8 metre sidewalk and a 3.0 metre multi-use trail on the north side. Both options are shown in Figure 38.

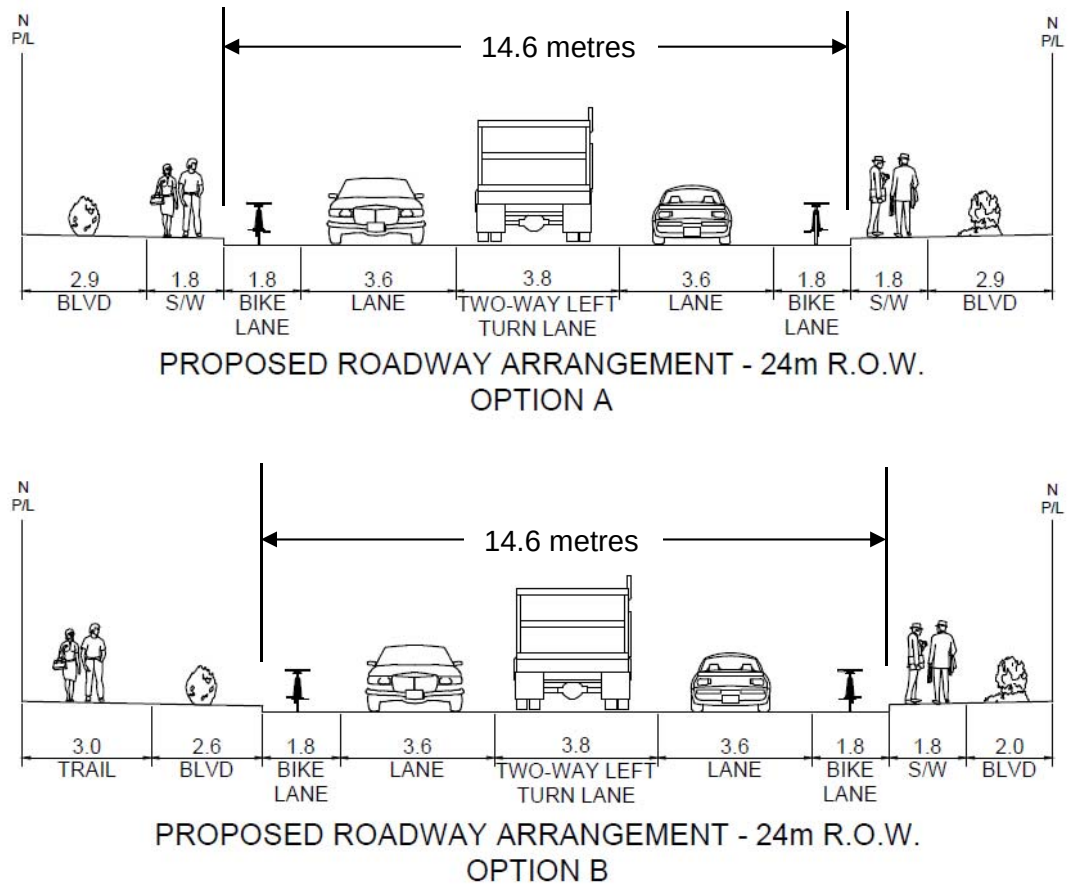


Figure 38: Proposed Cross Section Options for Keith Avenue

5.3 ROAD CAPACITY ANALYSIS

The theoretical maximum capacity of a lane of road is approximately 1,800 vehicles per hour, which is based on a 2 second headway between vehicles. However, this traffic demand would create heavily congested conditions. Furthermore, the actual road capacity is influenced by other factors, such as turning movements at accesses and intersections, the presence of trucks and other slow moving vehicles, and bus stops.

In the Lower Mainland, the accepted practice is to target a maximum traffic demand of between 800 and 1,000 vehicles per lane per hour (i.e. a vehicle approximately every 3-4 seconds). In Terrace, a more acceptable maximum is assumed to be closer to 600 vehicles per lane per hour (i.e. a vehicle approximately every 6 seconds).

Evaluating the estimated 2025 traffic volumes in Figure 27, all roads in Terrace are projected to have sufficient capacity for the traffic volumes except for Lanfear Drive (Figure 39). With the anticipated growth in the Upper Bench, Lanfear Drive is estimated to have over 700 vph southbound in the morning peak hour, and over 600 vph northbound in the afternoon peak hour. If peak hour traffic congestion becomes a concern for residents, it is likely that many will divert to alternate routes (i.e. Kalum Lake Road and Skeenaview Drive), both of which have available capacity.

In any case, this analysis underscores the importance of improvements on Lanfear Drive to ensure the road has the necessary width and geometry to safely accommodate the future peak hour traffic demand. The improvements on Lanfear Drive may be considered a higher priority than improvements to Skeenaview Drive due to the higher demand, and the more challenging geometry.

Figure 39: Road Capacity Issues on Lanfear Drive

5.4 INTERSECTION ANALYSIS

Most intersections in Terrace should accommodate the increased traffic demand shown in Figure 27, due to the excess road capacity currently available. The intersections which had identified issues with traffic capacity are as follows:

1. Keith Avenue at Kenney Street: the current traffic demand causes peak hour delays in excess of 30 seconds on Keith Avenue, and satisfies the TAC volume warrants for a four-way stop. The existing two-way stop would cause the intersection performance to fail under the estimated 2025 traffic demand. The future traffic patterns will also warrant left turn lanes on all approaches, and a right turn lane on the westbound approach, which will be triggered by excessive delays and queue lengths. The intersection will likely be a candidate for future signalization or a roundabout.

2. McConnell Avenue at Thomas Street: the offset T intersection at the top of Lanfear Drive (Figure 40) is currently operating well, although is the subject of concerns from residents as the traffic from the Upper Bench converges at this location. Peak hour delays on the eastbound approach are currently less than 15 seconds per vehicle, with an average queue length of two vehicles. No immediate improvements appear necessary. However, with the expected growth in the area, the average eastbound delay will gradually increase to 35 seconds by the horizon year, with queues up to six vehicles long. The future peak hour delay on the westbound approach will exceed 90 seconds, although the westbound traffic volume is significantly less. A major intersection upgrade of the laning, geometry and traffic control will be required to accommodate the future traffic demand, and also address the offset T intersection with Cooper Drive.

Figure 40: McConnell Avenue at Thomas Street

3. Lanfear Drive at Pheasant Street: the residents on Pheasant Street have identified a concern with high traffic speeds, especially from southbound vehicles traveling between Lanfear Drive and the retail development on Highway 16. While traffic counts indicate the current turning volumes at the Lanfear Drive/Pheasant Street intersection are low, more drivers may choose to divert through Pheasant Street in the future as the traffic volumes increase.

4. Lazelle Avenue at Kenney Street: at the bottom of Lanfear Drive, traffic traveling to and from the Downtown is likely to turn at Lazelle Avenue. This pattern was reflected in the higher traffic volumes at the Lazelle Avenue / Eby Street intersection. If this route remains preferred by traffic, a southbound left turn lane will likely be warranted to separate turning movements from the through traffic for safety and operational reasons. This improvement will be triggered by the growth of queues behind southbound left turning vehicles on Kenney Street.

5. Lazelle Avenue at Eby Street: as discussed above, this intersection is part of the connection between Lanfear Drive and the Downtown. The four-way stop control may not sustain future traffic demand as the Upper Bench develops. However, any modifications at this intersection must be in consideration of the intersection of Lakelse Avenue and Eby Street immediately to the south.

6. Lakelse Avenue at Eby Street: the traffic control at Lakelse Avenue / Eby Street (Figure 41) gives priority to Lakelse Avenue traffic (i.e. the stem of the T intersection), which is not considered intuitive for drivers according to TAC guidelines. The increasing traffic demand is expected to cause the intersection performance to fail by 2025, requiring a major upgrade to the traffic control (e.g. signal or roundabout). However, any modifications at this intersection must be in consideration of the intersection of Lazelle Avenue and Eby Street, immediately to the north.

Figure 41: Lakelse Avenue at Eby Street