



*TERRACE TRANSPORTATION
CORRIDOR STUDY*



JAN 9 2009

File: 854

EXECUTIVE SUMMARY

The City of Terrace is an important hub for Northwest BC with rail and highway routes traversing the city. CN Rail is considering opportunities for increasing rail traffic and train lengths through Terrace along the existing 12,000 foot siding, which may require the closure of the at-grade Kenney St road crossing. There is therefore a need to identify the preferred location(s) of a grade separation and potential strategies to mitigate or eliminate any identified highway impacts. To facilitate the investigation of grade separation options, an investigation of road network characteristics was undertaken to establish current and future concerns and needs from the perspective of vehicles, large trucks, pedestrians, cyclists, and transit. The project was commissioned by the City of Terrace, along with the Ministry of Transportation and ICBC.

The road network review found that traffic conditions were of greatest concern for the current and future traffic conditions along the Sande Overpass. In the near term, signalization at the Sande / Keith Ave intersection would improve levels of service and community connectivity. In the longer term (20-year horizon) geometric and operational improvements would be required at both Sande / Keith Ave and Sande / Greig Ave to meet capacity requirements. Dual left turn lanes at the intersections or a two-lane roundabout would be required, with Sande / Keith Ave being a roundabout candidate and Sande / Greig Ave being a dual left-turn lane candidate. (These options were dictated by land constraints.) A review of road safety conditions at key intersections, using ICBC collision data, found that there were no acute safety concerns for key intersections along Hwy 16 in terms of collision rate or collision frequency. The worst intersection in terms of both rate and frequency was found to be Kenney St and Keith Ave, but even this intersection had a collision frequency lower than what is generally considered severe. The existing Terrace truck route was found to facilitate both through-Terrace and intra-Terrace truck trips, and no network changes are recommended. Pedestrians are well-served along Hwy 16, but sidewalks are a future consideration along Keith Ave west of Sande Overpass (with the priority being in the east, decreasing to the west). Pedestrians and cyclists need to be considered in the design of any new rail crossing. Terrace is currently well-served by transit, and new routing opportunities should be considered if a new rail grade separation is constructed.

From a comprehensive list of rail grade separation alternatives, three options were identified for detailed review based on base feasibility considerations in discussions with the City of Terrace, the Ministry of Transportation, and ICBC. These three options, namely Kenney St rail overpass, Brooks / Blakeburn rail underpass, and Kalum Lake Dr rail and highway overpass, were evaluated and compared based upon a broad range of criteria including financial, customer service and road safety, site and community impacts, social impact and consistency with the OCP, and environmental impact.

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Based on the review, all of the options were similar in terms of a viability ranking and could each therefore be considered as acceptable based on the review. (The Kenney St rail overpass option was ranked best, followed closely by the Kalum Lake Dr rail and highway overpass option and then the Brooks/ Blakeburn rail underpass option.) The results from a public open house found that the Kalum Lake Dr option was the most preferred, followed by the Brooks/ Blakeburn underpass and then the Kenney St overpass option. It is recommended that one or more of the three options be carried forward for functional design. The City should work with CN Rail to refine the alignments/configurations taking into consideration potential vertical and horizontal track adjustments/realignments and property acquisitions.

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1.0 INTRODUCTION

The City of Terrace is an important hub for Northwest BC with rail and highway routes traversing the city. CN Rail is considering opportunities for increasing rail traffic and train length through Terrace, and is considering using the existing twin-track between the Sande Overpass and Frank St as a siding for “meets” between trains travelling in opposite directions. Given the possibility of CN Rail requiring the closure of the at-grade crossing at Kenney Street to accommodate a 12,000 foot siding there is a need to identify the preferred location of a grade separation and potential strategies to mitigate or eliminate any identified highway impacts. Rail grade separation options were evaluated and compared based upon a broad range of criteria including traffic efficiency, traffic safety, construction and maintenance costs, economic impact, social impact, and environmental impact. The project was commissioned by the City of Terrace, along with the Ministry of Transportation and ICBC.

1.1 Background

On July 18, 2007, Western Economic Diversification Canada announced Federal Government funding in the amount of \$4.25 million for a grade separation in Terrace through the Asia-Pacific Gateway and Corridor Initiative. Canadian National Railway (CNR) is the project proponent and considers the grade separation a key component of its capacity upgrade program.

The City of Terrace is located on the CN rail line serving the Port of Prince Rupert. In order to fully realize the design capacity of the new container terminal, sidings along this rail corridor are being lengthened. Phase I of the Container Port Expansion in Prince Rupert was completed in the fall of 2007. Initially it is expected that the number of trains moving through Terrace will increase by two per day and the length of the trains will increase from 7,000 feet to 12,000 feet (container trains only). CN Rail is proposing to construct a siding within the City of Terrace to allow the trains to pass each other. A 12,000 foot siding would extend from the east end of the City (Apsley Street) west to Frank Street and would close off the existing Kenney Street level crossing and a future possible level crossing connecting Braun Street to Kalum Lake Drive at Highway 16. Phases II (2010) and III (2015) of the port expansion will see significantly more trains move along the rail corridor through Terrace.

In the 1960s and 1970s, the City of Terrace experienced significant growth. In the mid 1970s, the construction of the Sande Overpass and the Dudley Little Bridges directed traffic away from the downtown. Although maintaining a vibrant downtown core continues to be a challenge, the redirected traffic has facilitated the growth of a strong commercial business zone along Keith Avenue, east of the Sande Overpass.

The most recent Highway 16 Corridor Planning Study was completed in 1990 and projected traffic flows to the horizon year 2010. Since the completion of the 1990 study, three intersections along the Highway 16 corridor through Terrace have been fully signalized.

The concerns regarding the increased rail traffic from the container port development and a potential grade separation have prompted this study. These concerns include ensuring traffic flow efficiencies through Terrace, maintaining healthy and vibrant business districts (Downtown, West Keith, Highway 16, etc), environmental, safety, and social issues.

1.2 Study Objectives

The study objectives were as follows:

- Document and define existing transportation problems and concerns.
- Project future conditions with and without rail grade separation/siding improvements.
- Evaluate and compare possible rail grade separation options.
- Identify, evaluate, and compare other highway improvement alternatives within the study area.
- Recommend and present an improvement strategy that best serves the public interest.
- Integrate the recommended improvement strategy with municipal and provincial initiatives and major road networks.
- Provide concept drawings and construction estimates on grade separation options and recommended highway improvements.

2.0 STUDY APPROACH

The study approach involved meetings with project committee members from the sponsoring agencies (City of Terrace, Ministry of Transportation, ICBC), public consultation (meetings with agencies, open house), data collection and field visits, data analysis, preliminary option screening, and detailed evaluation of the three options, followed by conclusions. The project study area is shown in **Figure 1**.



Figure 1: Study Area

3.0 TERRACE TRANSPORTATION NETWORK REVIEW

3.1 Data Collection

Data collection for this study consisted of resources provided by the City of Terrace and traffic counts (intersection turning movement counts and licence plate counts). Resources provided by Terrace consisted of base mapping (including cadastral and orthophotos) and a number of previously conducted transportation studies that were relevant to the project. ICBC provided collision data for intersections along Hwy 16 and Keith Ave in the City of Terrace (bounded by Sande Overpass to the east and Frank St to the west).

3.1.1 Intersection Turning Movement Counts

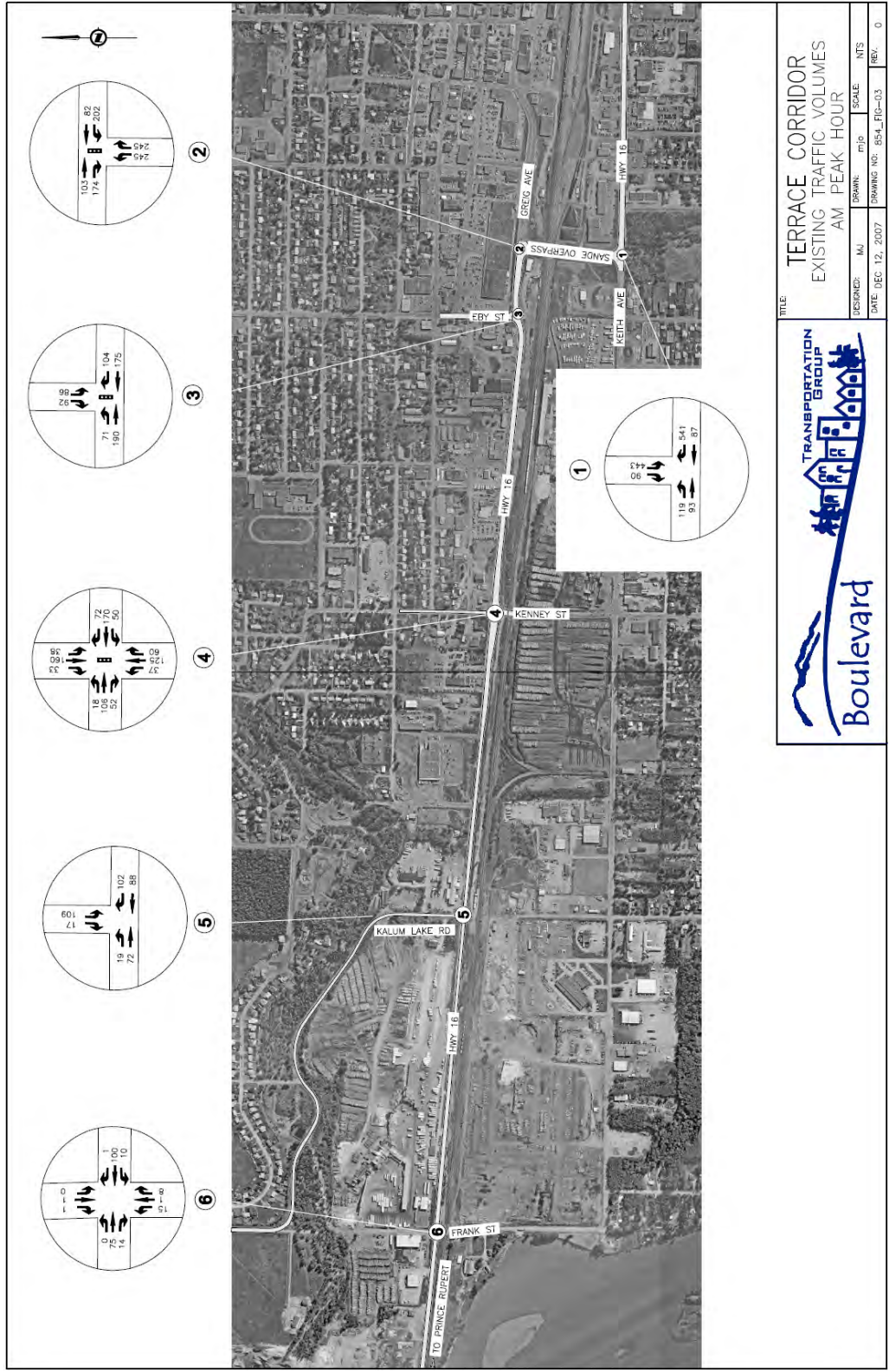
Turning movement counts were taken at six intersections along Hwy 16: (1) Sande Overpass & Keith Ave; (2) Sande Overpass & Greig Ave; (3) Hwy 16 & Eby St; (4) Hwy 16 & Kenney St; (5) Hwy 16 & Kalum Lake Dr; and (6) Hwy 16 & Frank St. Traffic volumes at these six intersections were determined by manual turn movement counts undertaken on November 13, 2007. The traffic counts were performed in three time intervals for a total of seven hours at each location, and captured the AM peak hour traffic, the midday peak hour traffic, and the PM peak hour traffic. The time intervals were 8:00 AM to 10:00 AM, 11:00 AM to 1:00 PM, and 2:30 PM to 5:30 PM. The traffic volumes are shown on **Figures 2, 3, and 4**.

The following are some general turning movement count observations:

- At most of the intersections, the recorded AM peak hour is between 8:00 AM and 9:00 AM.
- The midday peak hour was found to be between 12:00 PM to 1:00 PM (in all but one location).
- The traffic volumes at midday peak hours for most intersections are greater than the AM peak hours in all but one location: Kenney / Hwy 16.
- Traffic volumes at the six intersections typically peak from 3:00 PM to 4:30 PM, but the PM peak hour for each intersection was slightly different.
- For the intersections counted, the traffic volumes were highest for the eastern-most intersections (closest to downtown) and dropped in magnitude the further west they are located.
- The PM peak hour traffic volume at Frank / Hwy 16 is 16.5% of the traffic volume at Keith / Sande Overpass, showing that the majority of traffic volumes at Sande Overpass are generated locally rather than vehicles travelling through Terrace.

As these counts were taken in November, they are representative of typical local Terrace-based travel. The volumes would likely be higher in the summer, and summer volumes may also include a higher percentage of through-city tourist travel.

TERRACE TRANSPORTATION CORRIDOR STUDY



TERRACE CORRIDOR EXISTING TRAFFIC VOLUMES AM PEAK HOUR

DESIGNED: MAJ DRAWN: mpj SCALE: NTS
 DATE: DEC 12, 2007 DRAWING NO: 854_FIG-03 REV: 0

TRANSPORTATION GROUP

Boulevard

Figure 2: AM Peak Hour Volumes

TERRACE TRANSPORTATION CORRIDOR STUDY

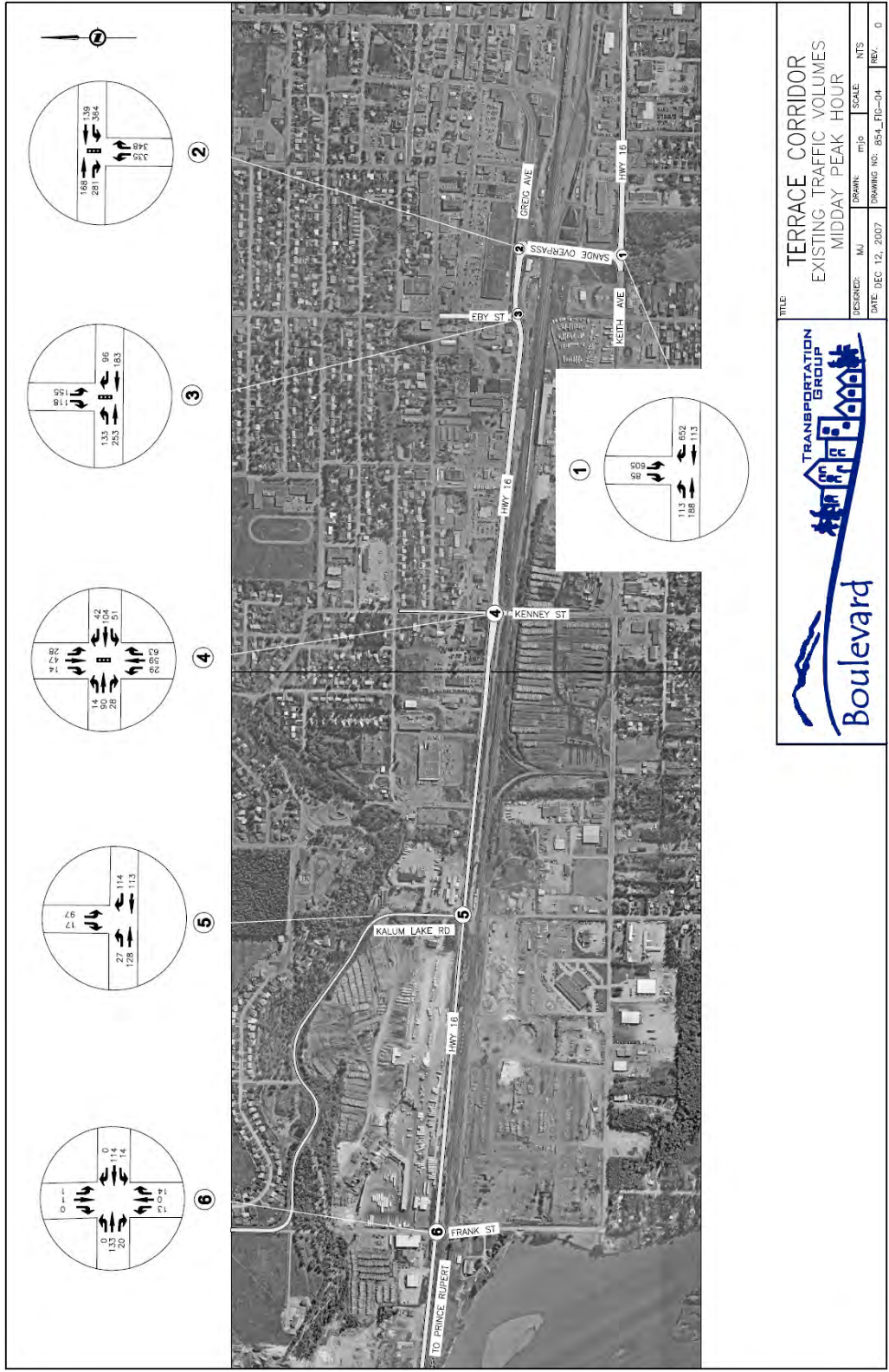


Figure 3: Midday Peak Hour Volumes

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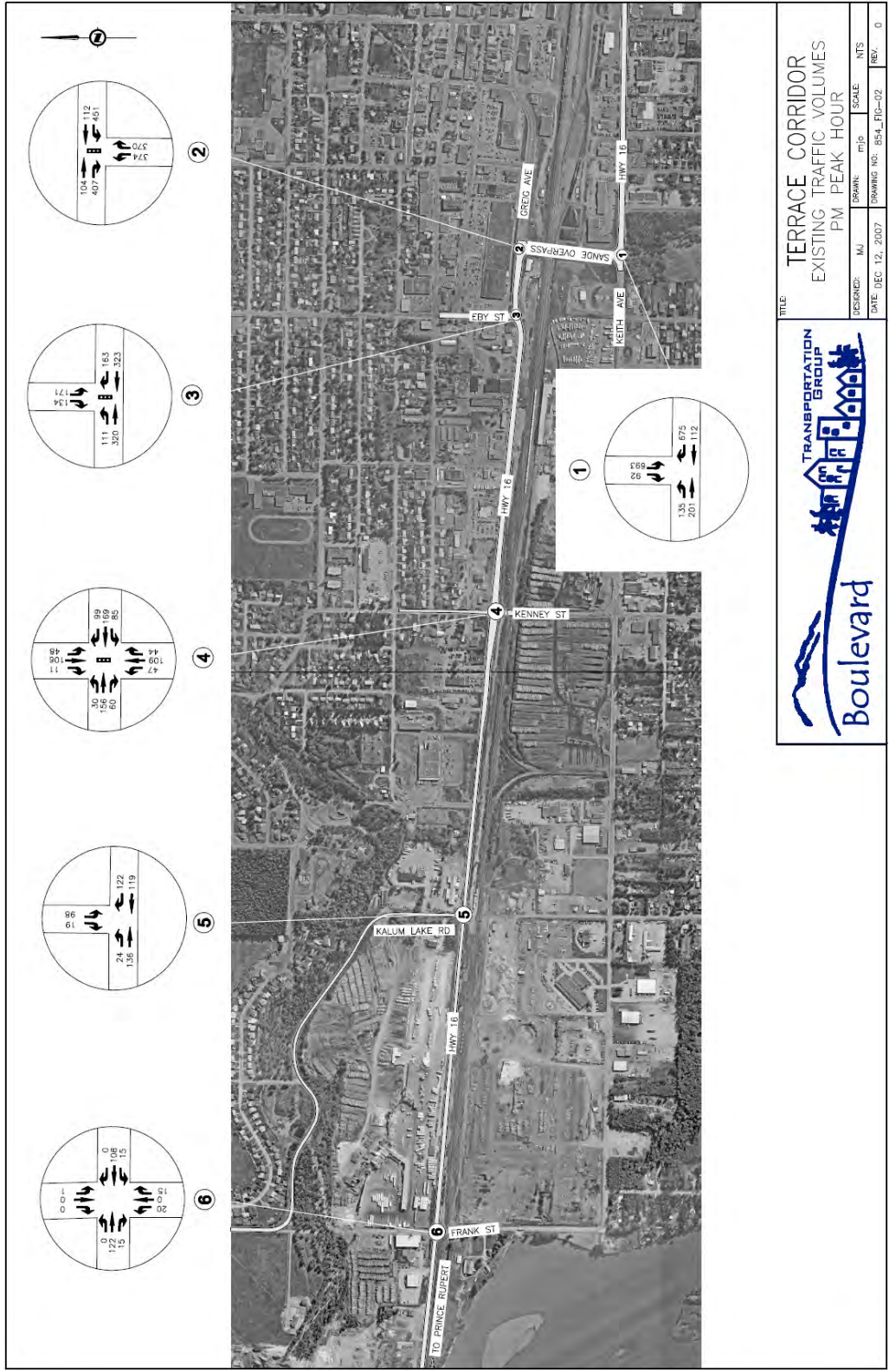


Figure 4: PM Peak Hour Volumes

3.1.2 Licence Plate Counts

License plate counts were undertaken to determine the percentage of traffic on the highway passing through the Hwy 16 corridor and using local roadways. These screening counts were performed for four hours on Nov. 14, 2007 (8:15 AM to 10:15 AM and 2:30 PM to 4:30 PM) at several locations, where the first three or four licence plate digits were recorded. Note that there were challenges in collection of licence plate count data due to large platoons of vehicles on the Sande Overpass and high vehicle speeds at other locations such as Hwy 16 at Frank St. As such, the data does not represent a fully accurate picture of true origin/destination vehicular volumes, but does provide a picture of relative origin destination volumes from Sande Overpass to other roadways to the west, namely Kenney St, Kalum Lake Dr, and Hwy 16 west of Frank St. **Table 1 and 2** show the results of licence plate counts in the PM (2:30 p.m. to 4:30 p.m.) and AM (8:15 a.m. to 10:15 a.m.) on Nov 14 2007.

Table 1: Result of License Plate Counts (2:30-4:30 PM, Nov 14, 2007)

	To Kenney North (334)	To Kalum Lake (257)	To HWY 16 at Frank (WB) (246)	To Sande Overpass - SB Left (1146)
From Sande Overpass - WB Right (1025)	14 Matched	47 Matched	10 Matched	
From Kalum Lake (257)				1 Matched
From Kenney				1 Matched
From Frank (EB) (222)				3 Matched

Table 2: Result of License Plate Counts (8:15-10:15 AM, Nov 14, 2007)

	To Kenney North	To Kalum Lake	To HWY 16 at Frank (WB)	To Sande Overpass - SB Left
From Sande Overpass - WB Right	2 Matched	16 Matched	20 Matched	
From Kalum Lake				3 Matched
From Kenney				2 Matched
From Frank (EB)				1 Matched

The results in the PM period indicate that, for vehicles travelling westbound on Hwy 16 (Keith Ave) then turning right onto Sande Overpass, that more vehicles are headed to Kalum Lake Dr (47 vehicles) than to Kenney St north (14 vehicles) or Hwy 16 west of Frank St (10 vehicles). In the AM period, Hwy 16 at Frank St was found to have the most vehicle matches (20 vehicles), followed by Kalum Lake Dr (16 vehicles) and then Kenney St. N (two (2) vehicles).

The number of licence plate matches found to travel from west Terrace (Hwy 16 at Frank St, Kalum Lake Dr, or Kenney St N) through to Sande Overpass south was low in all cases, and much lower than was found for the reverse direction of travel. The reason for this difference is unknown.

The evidence indicates that both Kalum Lake Dr and Hwy 16 west of Frank St are destinations for through-traffic originating from the Sande Overpass, but that compared to the total volume of traffic at the Sande Overpass, only a small portion of vehicles are through vehicles.

3.2 Traffic Conditions Investigation

3.2.1 Traffic Modelling Background

Traffic conditions were investigated using the two-part Synchro and SimTraffic traffic modelling software. Synchro is based on the Highway Capacity Manual (HCM) methodology, while SimTraffic integrates established driver behaviours and characteristics to simulate actual conditions by randomly “seeding” or positioning vehicles travelling throughout the network. The simulation is run five times (five different random seedings of vehicle types, behaviours and arrivals) to obtain statistical significance of the results. The measures of effectiveness considered were delay measured in level of service (LOS) and 95th percentile queue lengths, where level of service is given as a letter grade from LOS A (minimal delay) to LOS F (failing / unstable conditions). LOS D is generally considered the threshold between acceptable and unacceptable conditions. Details can be found in Appendix A.

3.2.2 Traffic Conditions - Network

Traffic conditions were investigated for key intersections along the Hwy 16 corridor, for the three time-of-day periods: (1) AM peak hour; (2) Mid-day peak hour; and (3) PM peak hour. The level of service results for these three periods can be found in **Figures 5, 6, and 7** respectively.

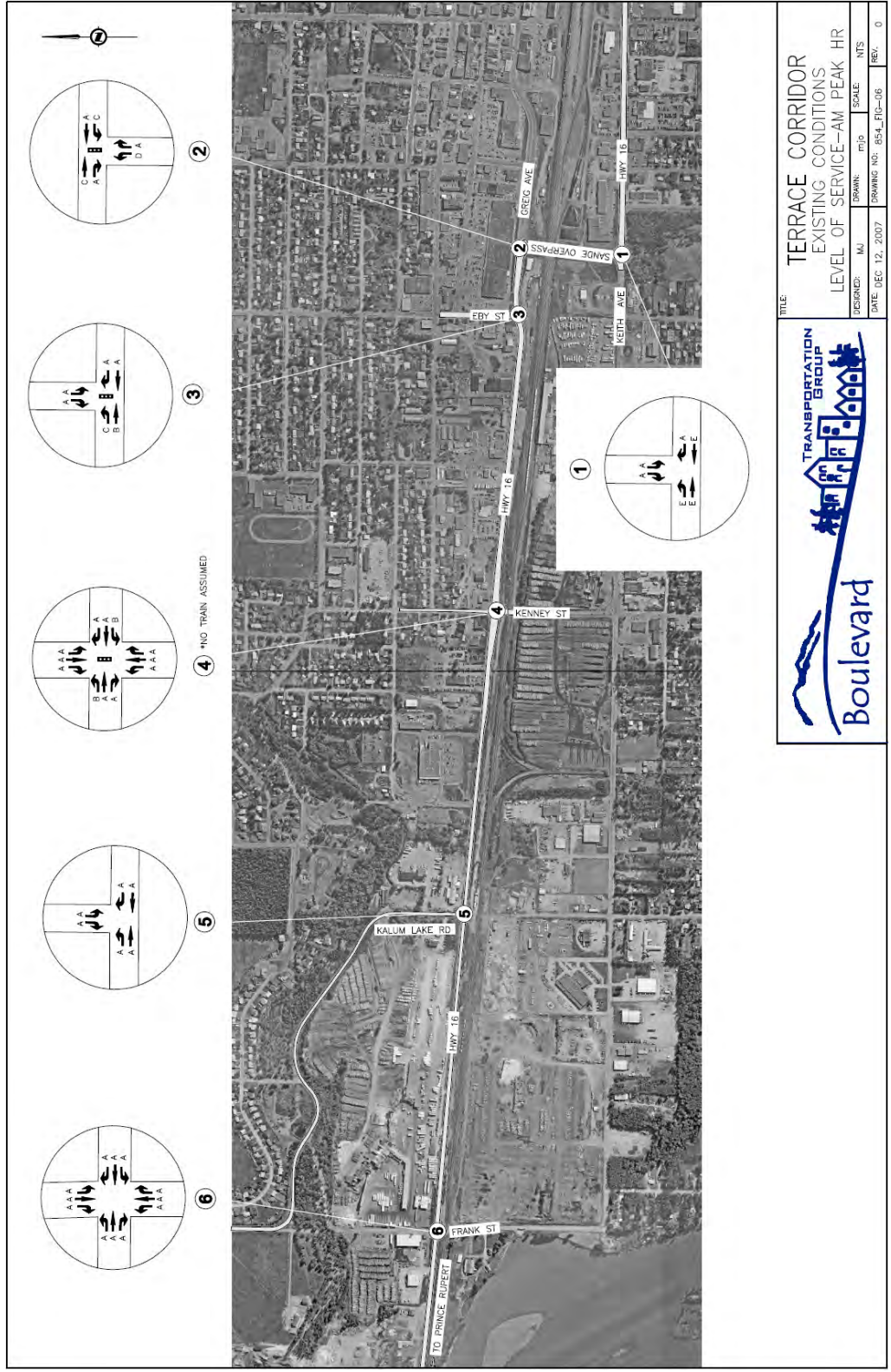


Figure 5: AM Peak Hour Level of Service

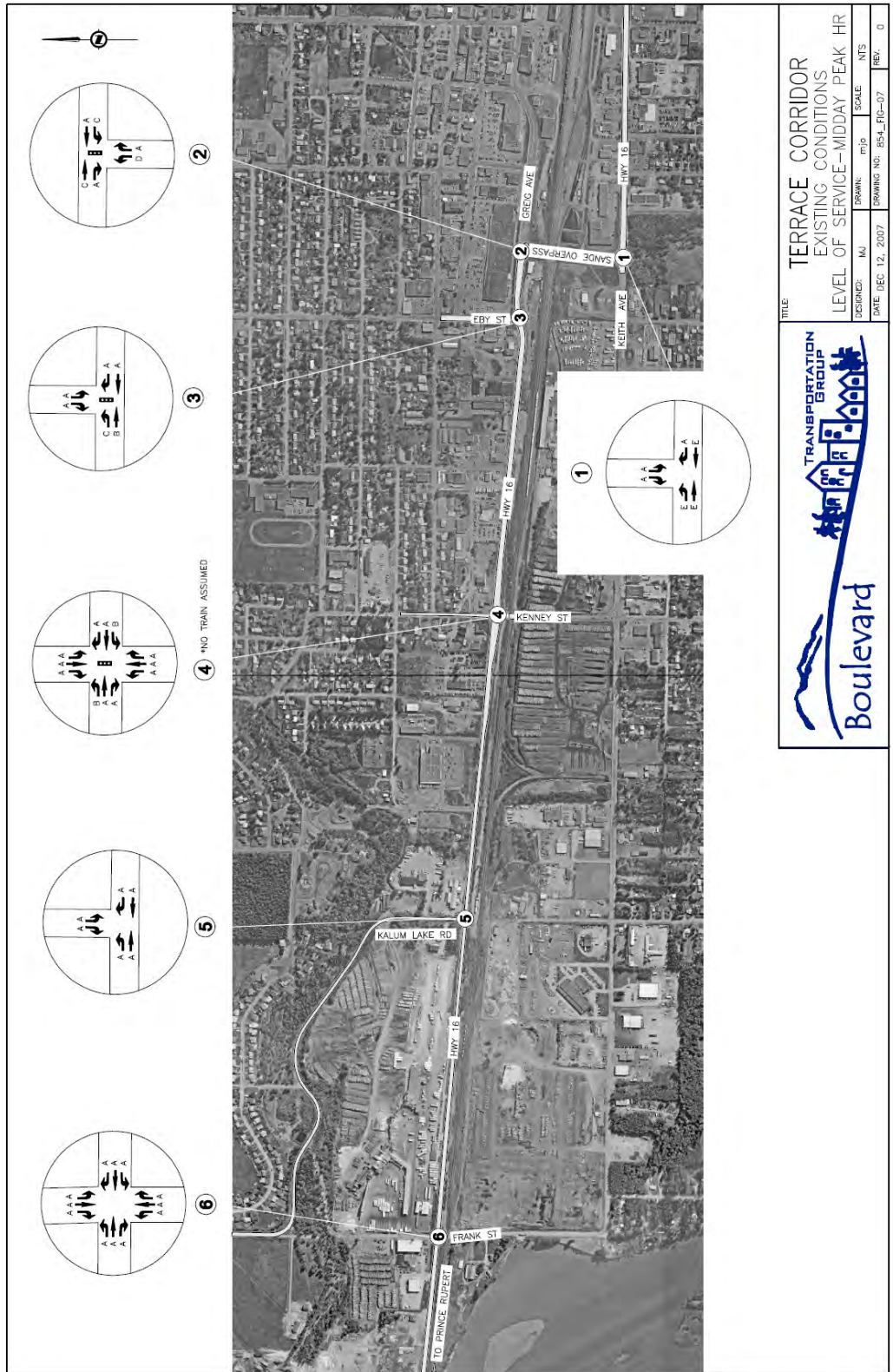


Figure 6: Midday Peak Hour Level of Service

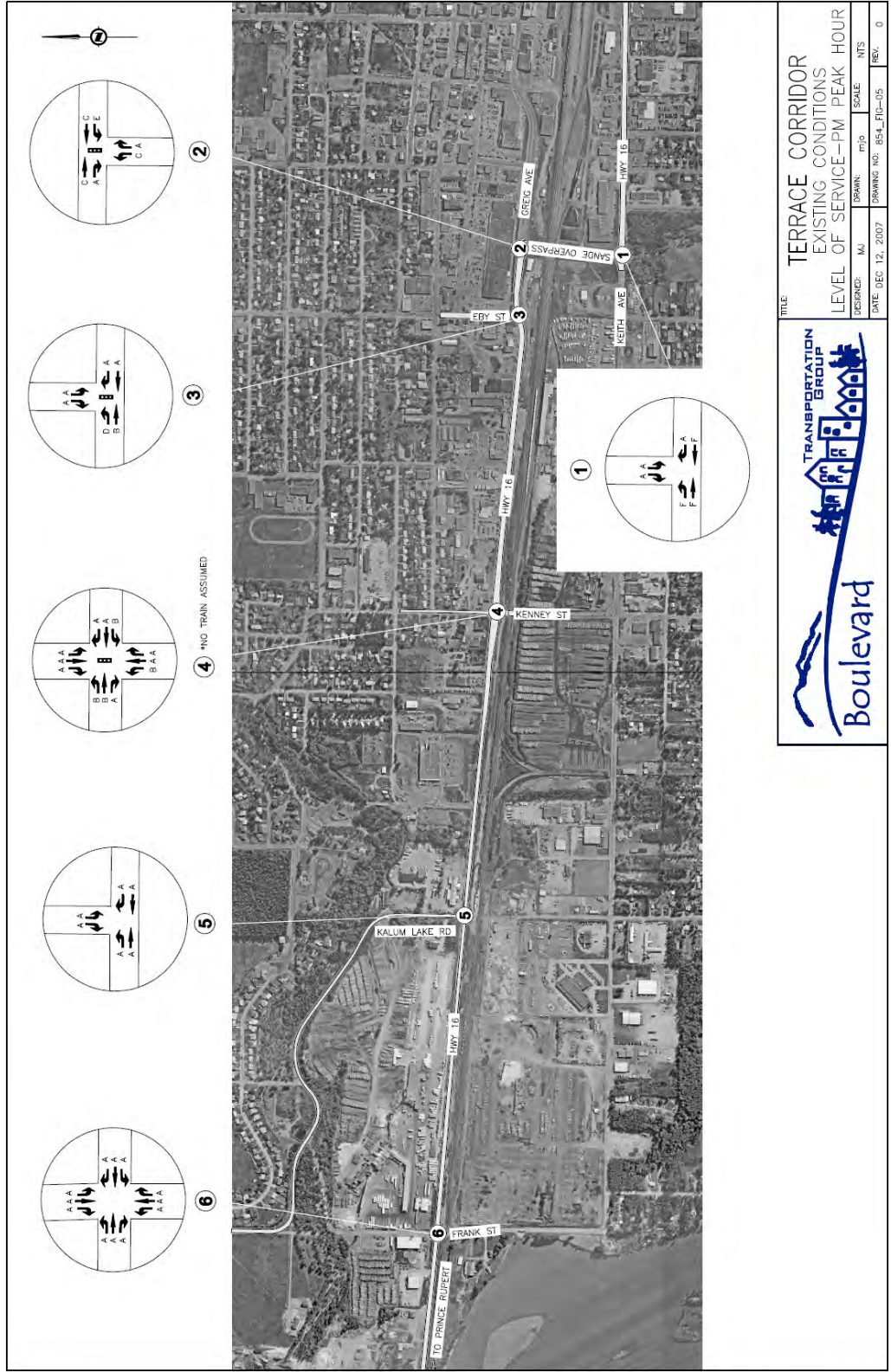


Figure 7: PM Peak Hour Level of Service

The results indicate that traffic conditions are generally worst in the PM peak hour at most intersections investigated, and that there are failing traffic movements at the intersection of the Sande Overpass and Keith Ave in the eastbound direction and the westbound through direction. Conditions at Sande Overpass and Keith Ave are also at LOS E in the AM and midday periods.

3.2.3 Detailed Sande Overpass Traffic Operations - Methodology

Due to the traffic condition level of service issues identified at the Sande Overpass, as well as Sande's importance in the overall Terrace road network, Sande overpass traffic conditions were further reviewed to better understand the nature of the traffic problems and implications of different placements of a second overpass over the CN rail line. Of specific interest were the investigations of traffic conditions at the intersections on either end of the overpass, as they related to level of service and queue lengths. Three traffic volume assignment scenarios were conducted (representing different second-overpass location alternatives), along with an assessment of traffic conditions under various mitigation scenarios.

As the PM peak hour was found to have the worst level of service, this time period was chosen for the analysis. Scenarios were analysed for three horizon years: 2007, 2017, and 2027. Future traffic volumes were projected based on a 2.0 percent annual growth rate. (It was found that Hwy 16 had a 2 percent growth based on historic trends.) For each of these cases, the traffic was investigated for various traffic control scenarios, starting from "Base" (i.e. existing traffic control), and varying by traffic control change (such as signals) or geometry changes. The following traffic assignment scenarios were investigated:

1) Existing Assignment

This scenario is a review based on the existing traffic assignment, which may be an approximation to no secondary overpass built and with the Kenney at-grade crossing remaining open.

2) Full Assignment

This case represents the scenario where a second overpass is located at Frank St, with Kenney St at-grade crossing closed, whereby the Sande Overpass is the overwhelmingly desirable option from a travel-time perspective.

3) Split Assignment

This case represents the scenario where a second overpass is built in such a location where traffic to/from north Terrace (west of downtown) is equally likely to use either overpass. (This would represent an overpass located at Kenney St or to the east of Kenney St.)

3.2.4 Sande Overpass Traffic Operations - Results

The preliminary traffic volume results for the Sande Overpass are presented below for the existing assignment, full assignment, and split assignment scenarios in the PM peak hour. This was done for the base 2007 year, 10-year (2017) and 20-year (2027) horizon years. The request for proposals suggests a horizon year of 2038 however to project volumes over 30 years at finite detail is redundant. This redundancy is caused by the unknown development over this period of time and the potential improvements made to the road network over this time period. Often 30-year projections are used for regional studies to identify additional corridors and regional links. It is obvious with the analysis described above that no regional links are required and that operational improvements will suffice for the long term.

Key results for the existing assignment are:

- 2007 Base conditions – failing at Sande & Keith Ave (on Keith)
- 2007 with signal at Keith & Sande - gives good LOS
- 2017 with signal at Keith & Sande – acceptable LOS (one movement at LOS D)
- 2027 with signal at Keith & Sande – unacceptable LOS (several movements at LOS F)
- 2027 with dual lefts and signal at Keith & Sande – good LOS
- 2027 with two-lane roundabout at Keith & Sande - good LOS (LOS B or better)

- 2007 Base Sande & Greig – good LOS
- 2017 Base Sande & Greig – unacceptable LOS (one movement LOS F)
- 2017 optimized signal Sande & Greig – acceptable LOS (several movements at LOS D)
- 2027 opt. signal Sande & Greig – unacceptable LOS (several movements at LOS F)
- 2027 dual lefts Sande & Greig – acceptable LOS

Key results for the full assignment are:

- 2007 Base – failing at Sande & Keith Ave (on Keith)
- 2007 with signal at Keith & Sande - gives acceptable LOS (several movement at LOS D)
- 2017 with signal at Keith & Sande – unacceptable LOS (several movements at LOS F)
- 2017 w/signal & dual lefts at Keith & Sande – acceptable LOS (one movement at LOS D)
- 2027 with dual lefts and signal at Keith & Sande – acceptable LOS
- 2027 with two-lane roundabout at Keith & Sande - good LOS (LOS B or better)

- 2007 Base Sande & Greig – good LOS
- 2017 Base Sande & Greig – unacceptable LOS (several movements LOS F)
- 2017 optimized signal Sande & Greig – unacceptable LOS (several movements LOS F)
- 2017 dual lefts Sande & Greig – acceptable LOS
- 2027 dual lefts Sande & Greig – acceptable LOS

It should also be noted that queuing concerns were also experienced in conjunction with poor LOS.

Key results for the split assignment are:

- 2007 Base – failing at Sande & Keith Ave (on Keith)
 - 2007 with signal at Keith & Sande - gives acceptable LOS (LOS C or better)
 - 2017 with signal at Keith & Sande – nearing unacceptable LOS (key movements at LOS D)
 - 2017 w/signal & dual left at Keith & Sande – good LOS (one movement at LOS C)
 - 2027 with dual lefts and signal at Keith & Sande – acceptable LOS (one movement at LOS D)
 - 2027 with two-lane roundabout at Keith & Sande - good LOS (LOS B or better)
-
- 2007 Base Sande & Greig – good LOS
 - 2017 Base Sande & Greig – acceptable LOS (LOS C or better)
 - 2017 dual lefts Sande & Greig – good LOS (LOS B or better)
 - 2027 existing geometry Sande & Greig – unacceptable LOS (key movement at LOS E)
 - 2027 dual lefts Sande & Greig – acceptable LOS (LOS C or better)

The traffic conditions are currently failing at the Keith and Sande intersection, and mitigation is required to improve the level of service for the through and left-turning Keith movements.

Under existing assignment (i.e. no second overpass but Kenney crossing open), the traffic on Sande Overpass can be managed with signalization alone (no geometric modifications are required) for the 10 year horizon. In the 20-year 2027 horizon, geometric improvements are also required, such as dual left turn lanes on Sande or a two-lane roundabout.

For the full assignment (Kenney St crossing closed, overpass at Frank St), the traffic on Sande is manageable in 2007 with signals only, however for the 10 year horizon dual left turn lanes are required. Dual left turn lanes provide acceptable LOS performance for the 20-year horizon as well.

Under the split assignment scenario, traffic conditions are acceptable in 2007 and drop to LOS D for some movements (including the key southbound left turn movement) by 2017 at Sande/Keith with signalization and existing geometry. By 2027, traffic conditions fail under existing geometry and signalization at Sande/Keith, and are at LOS E at Sande/Grieg. With dual left turn lanes at these intersections, traffic conditions are acceptable in 2027 (LOS C or better). With a two-lane roundabout at Keith/Sande in 2027, there would be a good level of service (LOS B or better).

As a two-lane roundabout provides the best level of service and provides safety benefits, it is recommended for consideration for the intersection of Keith and Sande. A functional design of a roundabout that accommodates 2027 conditions at this intersection is shown in **Figure 8**.

Due to geometric and land constraints at Sande/Grieg, a roundabout is not recommended for this intersection. Dual left turn lanes in the northbound and westbound direction are recommended, however, as they provide acceptable levels of service in the 20 year horizon. A functional design of a lane assignment and configuration that accommodates 2027 traffic conditions at Sande/Grieg is shown in **Figure 9**. This would require conversion of the existing eastbound right turn to a controlled movement (signal or yield sign) from the existing free movement. Note that these designs are based on a WB-20 design vehicle. This design vehicle represents a large highway vehicle and is typically used by the Ministry of Transportation for highway designs.



Boulevard			
TITLE: TERRACE CORRIDOR SANDE/KEITH TWO-LANE ROUNDABOUT			
DESIGNED: NJ	DRAWN: mjp	SCALE: 1:500	REV: A
DATE: MARCH 28 2008		DRAWING NO: 854-FG-10	

Figure 8: Sande / Keith Ave Two-Lane Roundabout Option



Figure 9: Sande / Grieg Ave Dual Left Turn Lane Mitigation Option

3.3 Safety Analysis

Collisions along the Hwy 16 corridor as well as Keith Ave were investigated at key intersections to understand and establish the road safety characteristics of the area. Collision frequencies (collisions/year) and collision rates (in terms of collisions per million entering vehicles (MEV)) were established for key corridor intersections. It is important to consider both collision rates and collision frequencies as they each illuminate different aspects of road safety at a particular location. For example, a collision rate may appear high at a particular location, but that may be a result of only one annual collision at a low-volume location. Similarly, collision frequency may be comparatively high at an intersection but if the location has very high traffic volumes then the collision rate may be low and the intersection may be considered to operate within acceptable safety thresholds. Note that for this analysis all collisions were considered, irrespective of severity. (Property damage only, injury, and fatality collisions were all combined in the analysis.)

Collision data for the Hwy 16 corridor and Keith Ave were received from ICBC, for the period covering 1996-2006. For this analysis, the nine-year period from 1998-2006 was used for collision analysis as a signal was installed at Hwy 16 and Kenney St in 1997 thereby resulting in the current intersection operations for the period from 1998 to the present. Collision rates were compared to the provincial average for urban areas and between Terrace intersections, while collision frequencies were considered against a typical urban intersection “trouble spot” collision threshold of 6.0 collisions/ yr or more (a typical base comparison value for urban areas in BC) as well as between Terrace intersections. Collision frequencies and rates for the six investigated intersections are shown in **Table 3**.

Table 3: Collision Rates at Major Intersections on Hwy 16 Corridor

Intersection	Number of Collisions (1998-2006)	Collision Frequency (Coll/Yr)	Average Daily Traffic (ADT) Entering the Intersection*	Collision Rate (Coll / MEV)
Sande / Keith Ave	18	2.00	19,080	0.29
Sande / Greig Ave	15	1.67	18,180	0.25
Hwy 16 / Kenney St	17	1.89	9,640	0.54
Hwy 16 / Kalum Lake Dr	6	0.67	5,180	0.35
Hwy 16 / Frank St	2	0.22	2,960	0.21
Keith Ave / Kenney St	27	3.00	7,200**	1.14

*ADT is estimated as being 10 times the PM Peak Hour Traffic

**Traffic volume was estimated based on known Kenney St and Keith Ave volumes (no intersection count was conducted or available)

Average provincial collision rates for intersections are:

- 15,000-20,000 ADT, Undivided 4-lane Arterial -- 0.23 Collisions/MEV
- 5,000-10,000 ADT, Undivided 4-lane Arterial -- 0.40 Collisions /MEV
- 5,000-10,000 ADT, Undivided 2-lane Arterial – 0.22 Collisions/MEV
- 1-5,000 ADT, Undivided 2-lane Arterial -- 0.52 Collision/MEV

In comparing the collision rates of Terrace intersections to the provincial average, Sande & Keith Ave and Sande & Greig Ave have slightly higher collision rates than the provincial average, Hwy 16 and Kenney St has 35 percent higher than average collision rate, while Hwy 16 & Kalum Lake Dr and Hwy 16 & Frank St have lower than average collision rates. The intersection of Keith Ave and Kenney St, however, has a much higher collision rate than the provincial average and more than twice the rate of any other intersection investigated. Therefore, in terms of collision rate, the intersection of Keith Ave & Kenney St & is of greatest concern, while the intersections along the Hwy 16 corridor are not of particular concern.

In addition to collision rate, the collision frequency is also an important consideration in ascertaining a more comprehensive overview of the collision problem. In terms of overall frequency, Keith Ave & Kenney St has the most collisions (3.00 collisions/yr), followed by Sande & Keith Ave and Hwy 16 & Kenney St (2.00 and 1.89 collisions/yr respectively) and Sande & Greig Ave (1.67 collisions / yr). The other intersections average less than one collision per year. All locations have less than the typical 6.0 collisions/yr limit that is usually considered as the threshold when establishing trouble intersections. The worst location has only half the threshold frequency (Keith Ave & Kenney St at 3.00 collisions/yr). (In comparison, the top ten collision intersection locations in Courtenay BC (similar size to Terrace) have at least eight (8) or more collisions/yr.) Therefore, in terms of overall frequency, intersection collisions are not a major concern in Terrace for the major Hwy 16 intersections investigated or along Keith Ave west of Sande Overpass.

3.4 Truck Network Considerations

Truck travel in the modern economy is vital for providing goods and services both within and between communities. The large size and weight of these vehicles results, however, in inherent safety issues in urban areas, due to compatibility issues between trucks and other road users (cars, bicycles, pedestrians), and the roadway geometric requirements of trucks (particularly at intersection turns and on grades). Because of this, there is a need to regulate which roads large trucks are allowed upon as well as to explicitly recognise these vehicles in the design of those roadways. Truck route networks can be used to establish a policy of where and when trucks are allowed, as well as specifying the size

and weight allowances of trucks on various routes. This is important to ensure the truck route roads are constructed to appropriate loadings and geometric conditions.

The existing truck route network in Terrace consists of three roadway designations: (1) major truck route, (2) secondary truck route, (3) non-truck route. The major truck route streets are comprised of Keith Ave, Hwy 16, Sande Overpass, Frank St, Kenney St (between Keith Ave and Hwy 16), and Kalum Lake Dr. Secondary truck routes include Grieg Ave (east of Sande Overpass, west of School St), Braun St south of Keith Ave, Kenney St south of Greig Ave, Graham Ave, Halliwell Ave, Kalum St south of Hwy 16, and McConnell Ave between Marshall St and Kalum Lake Dr.

This existing network connects the major trucking areas, and requires any large trucks destined to/from north-central Terrace to bypass downtown and use Kalum Lake Dr. Within the city limits of Terrace, trucking activities are primarily located in two areas: along the Hwy 16 corridor (both east and west of Sande Overpass), and along Keith Ave, between Sande and Frank St.

As the existing truck routes connect the trucking service areas of town, no network expansion is recommended. Should, however, a new rail grade separation be constructed, it is recommended that the new link be designated as a major truck route between Hwy 16 and Keith Ave. As such, for two of the three proposed options, namely the Brooks/Blakeburn option or the Kalum Lake Dr option, a new major truck route segment would be required to replace the existing Kenney St truck route. Also, should any new industrial lands be designated, expansion of the truck network should be considered at that time. **Figure 10** shows existing and recommended truck routes in Terrace.

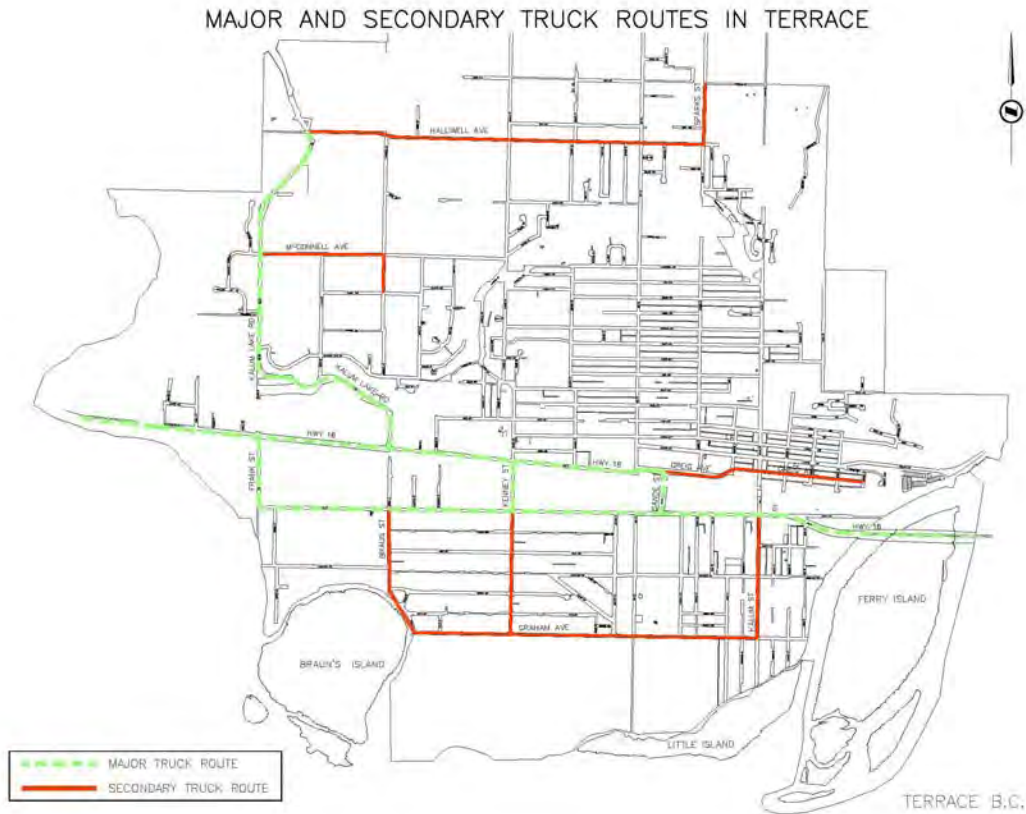


Figure 10: Existing and Recommended Truck Routes in Terrace BC

3.5 Other Transportation Modes

In addition to motor vehicle traffic, other transportation modes are an important component of Terrace’s transportation system. Active transportation modes such as walking and cycling (as well as rollerblading, skateboarding, etc) are important for both utilitarian and recreational trips. Transit also provides an important connection between different neighbourhoods and Terrace downtown, as well as to neighbouring communities. These modes are all important considerations in the context of the Terrace corridor study.

3.5.1 Pedestrians and Cyclists

Pedestrians are currently accommodated in various ways throughout the community, with sidewalks (on major roads in the core area), multi use trails (such as the Grand Trunk Pathway) or road shoulders / on-street (on lower-volume and/or rural roads). Cyclists are facilitated either on-street, in some cases with bike lanes or shoulders, or on trails such as the Grand Trunk Pathway.

The combination of Grand Trunk Pathway and sidewalks provides good east-west pedestrian and cyclist service along Hwy 16 north of the CN rail line from downtown (Kalum St) to Kalum Lake Dr. The east-west connections south of the rail line are facilitated along Keith Ave (or residential avenues further south). Keith Ave does not, however, have sidewalks west of Sande Overpass (although it does have sidewalks to the east of Sande).

Pedestrians and cyclists are currently permitted legal rail line crossings at the same locations as motor vehicles, namely Sande Overpass, Kenney St, and Frank St. Any new rail grade separation option would have to be designed to accommodate cyclists and pedestrians. It is recommended that sidewalks be constructed along both sides of the connecting roadway between Hwy 16 and Keith Ave, as well as bike lanes. Pedestrian and cyclist design tie-ins to the Grand Trunk Pathway are also an important consideration. Depending upon the rail separation design, such a connection could either be made at-grade or facilitated with a stairway or ramp structure for scenarios where the Grand Trunk Pathway is grade-separated along with the rail line.

Along Keith Avenue, sidewalks should be considered a long-term item, with priority being highest in the east (near Sande) and decreasing to the west. They are, nonetheless, of particular consideration and benefit between Sande Overpass and any secondary rail crossing to the west (be it Kenney St, Brooks St, or Braun St), as a sidewalk would allow for safe separation between large trucks and vulnerable pedestrians. As identified in Section 7.1, Keith Ave is designated as a major truck route. In the furthest-west sections of Keith Ave, sidewalks are a lower priority due to the lower traffic volumes and limited development. However, should increased development occur in the west Keith area, sidewalks would be recommended.

Cyclists should be accommodated by roadways of appropriate width, be it shared car/bike roadways or roads with dedicated bike lanes or paved shoulders along any main rail-crossing route or east-west route.

3.5.2 Transit

Terrace is currently served by seven BC Transit routes, all of which intersect at the Skeena Mall in downtown Terrace, to the north of the Sande Overpass on Lakelse Ave. There is one route that serves south Terrace to the west of Sande, that being Route 3, which travels westbound on Haugland Ave and Agar Ave and eastbound on Medeek Ave and Graham Ave. This route crosses into downtown at Sande Overpass. With an additional rail grade separation, more reliable routings (i.e. not stopped at tracks by trains crossing at-grade) that cross the rail line west of Sande could be scheduled if demand was deemed sufficient.

3.6 Network Improvement Considerations

Based on the traffic volume and safety investigations of the previous sections, the key areas for network improvements, in addition to any grade separation considerations, involve improvements to the Sande Overpass, specifically at the intersections at each end (Greig Ave and Keith Ave). As identified, the need and timing for the improvements shown are in part dependent upon the phasing of any new rail grade separation. The recommended options, as shown in Figure 8 and Figure 9, are as follows:

- Sande / Keith Ave, Two-Lane Roundabout: \$750,000
- Sande / Greig Ave, Dual Left Turn Lanes & Signal Improvement: \$350,000

In regards to improvements away from the Sande Overpass, there is the future consideration of minor widening of the road and adding sidewalks along Keith Ave (see Section 3.5.2 for pedestrian discussion). This item would cost approximately \$115/m² not including widening, which equates to \$162,000 for a sidewalk between Kenney St and Sande Overpass along Keith Ave, per side of the street (for a sidewalk 1.5m wide). To extend such a sidewalk to Braun St along Keith Ave would cost an additional \$140,000 per side of the street.

The Park Avenue connector has been considered as a component of the options however it is not a requirement of any option but an enhancement to the Kalum Lake option.

The final consideration for network improvements involves the traffic control at Eby St & Lakelse Ave. This intersection has the same traffic control as Sande Overpass & Keith Ave, where the T-approach of a three-leg intersection has the free movement and the through-approaches (in this case Eby St) has the stop directive. This type of traffic control is atypical and contravenes recommended Transportation Association of Canada practice. While the traffic control works, it requires local knowledge to function in a “safe” capacity and it is highly unexpected by visitors to the region. Recommended traffic control would be all-way stop control (for all approaches), which would only somewhat alter the existing operation, and only for westbound Lakelse Ave traffic (and this forced stop is offset by the fact that all westbound Lakelse Ave traffic has to slow down to turn in any case). If in the future traffic volumes dictate, this intersection could be signalized or converted to roundabout traffic control.

4.0 PRELIMINARY GRADE SEPARATION OPTION SCREENING

A preliminary screening of grade separation options was conducted for a list of possible locations in order to establish a smaller list of three options for further detailed investigation. Options were considered from Frank St in the west, to east of Sande Overpass in the east. Options were considered in a high-level manner based on merits of the grade separation location, feasibility of construction at a site, and utility of the location for grade separation. The final three options were agreed upon by the City of Terrace, the Ministry of Transportation, and ICBC.

4.1 Options Not Considered for Further Investigation

The possibility for an overpass east of Sande Overpass at Kalum Street was considered but was not pursued since the width of the rail yard would require a long bridge span without a central support column (due to the presence of rail tracks below), which would greatly increase the capital cost of this option. It would also require the relocation of the historic George Little House and require steep approach grades in order to connect Keith and Greig Avenues.

No overpass options between Sande Overpass and Kenney St were investigated as no available construction right-of-way was evident between the rail line and Keith Ave, and any option located in this area would be within such close proximity to Sande that west Terrace is not well served.

The option for an overpass at Frank St was also not considered for further investigation for several reasons. First, it is so far west that it is an inconvenient option for local traffic. It would result in increased traffic and further vehicular stress on the Sande Overpass and would result in increased mileage for those that do opt to use the Frank St crossing. Second, as shown by the traffic count data, this location has the least amount of existing traffic, and would be underutilized as compared to the other options. Third, the terrain in the area, with Frank St dropping in elevation towards the river to the south of the CN Rail line as well as the close proximity of the rail line to Hwy 16, would require more extensive and expensive construction works. Fourth, and finally, Frank St would remain an at-grade crossing, as the rail line is single-track only at Frank St and therefore there is no need to close the crossing to facilitate train meets.

4.2 Options Considered for Further Investigation

An overpass option at Kenney St was considered for further investigation as it represents a status-quo option, whereby existing traffic flow patterns would be effectively retained. This is beneficial for many roadway users as there are considerable north-south Kenney St traffic volumes that cross Hwy 16 and the rail line, and they would not have to be diverted (as would be the case with other grade

separation options). For this option, a rail overpass with an at-grade intersection with Kenney St was considered because a full rail/highway flyover would result in an increase in traffic on residential roadways and would not provide good route connections, in addition to increased structure costs.

The option for a rail underpass at Brooks / Blakeburn was also considered for further investigation. This option takes advantage of existing topography (dip in the Hwy 16 elevation) and is located midway between Kenney St and Kalum Lake Dr.

The final option considered for further investigation was a rail and highway overpass at Kalum Lake Dr. This option was considered because it is the western limit that would effectively serve Terrace, it is the intersection of two provincial highways, it provides route continuity and connection for Kalum Lake Dr to south Terrace, and it does not promote a Keith/Braun routing for east-west Terrace through traffic (instead retaining the existing Hwy 16 layout as the obvious through-Terrace east-west route).

5.0 DETAILED EVALUATION OF THREE OPTIONS

5.1 Description of Alternatives

5.1.1 Kenney St Rail Overpass

In this option the existing Kenney St at-grade crossing would be replaced by a rail overpass. The intersection with Hwy 16 would be at-grade and signalized, with Hwy 16 raised on earthen embankments. The basic network would be unchanged in this case. Access to Grieg Ave would be closed at Kenney St. In addition, up to three building sites may be required in order to accommodate the proposed work, namely the School Board office and a service station. **Figure 11** shows the Kenney St overpass option overview, and **Figure 12** shows plan, profile, and cross-section details



Figure 11: Kenney St Rail Overpass Option Overview

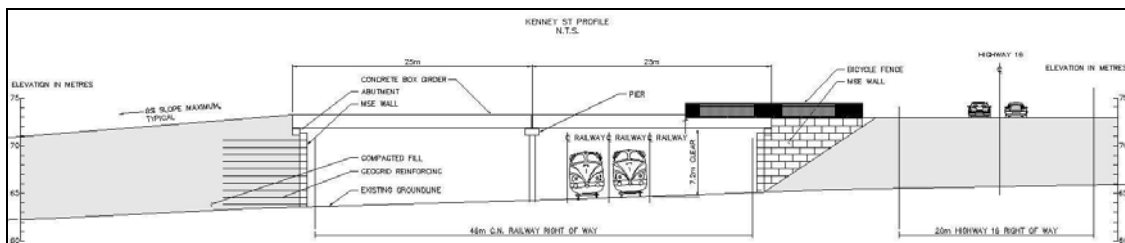
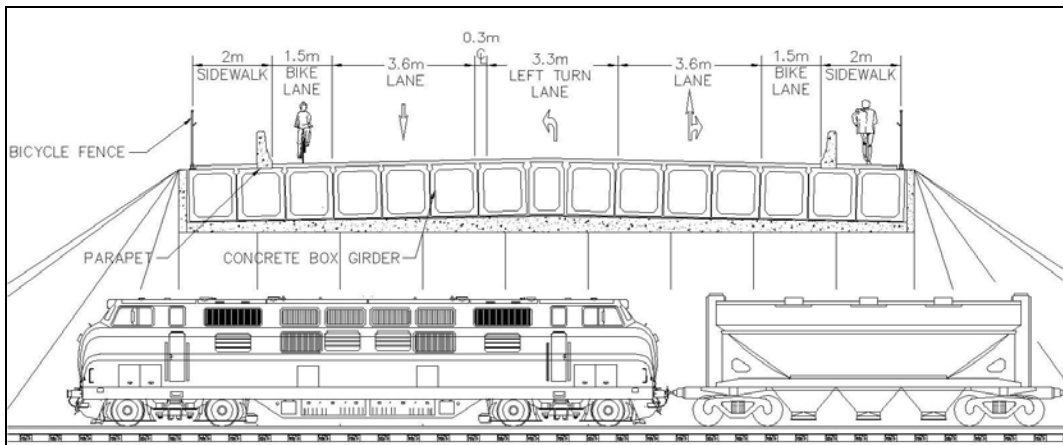


Figure 12: Kenney St Rail Overpass Option Details

5.1.2 Brooks / Blakeburn Rail Underpass

The Kenney St at-grade rail crossing would be closed in this option and a new road constructed from Highway 16 to Keith Ave along Blakeburn St. There would be an underpass under the rail line, with an at-grade intersection with Hwy 16. A pedestrian overpass at Kenney St would be required. **Figure 13** shows the Brooks / Blakeburn rail underpass option overview, and **Figure 14** shows plan, grade, and cross-section details



Figure 13: Brooks / Blakeburn Rail Underpass Option Overview



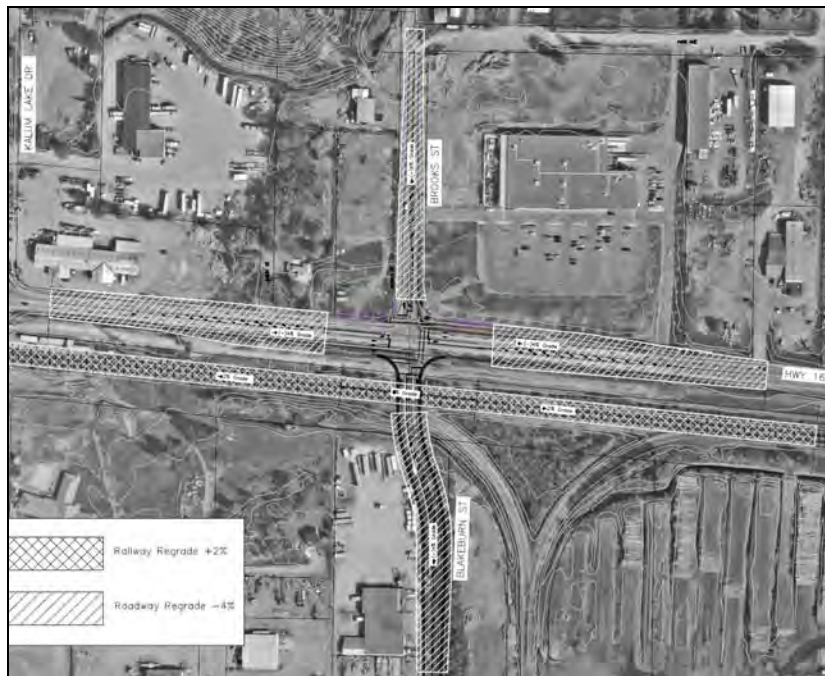
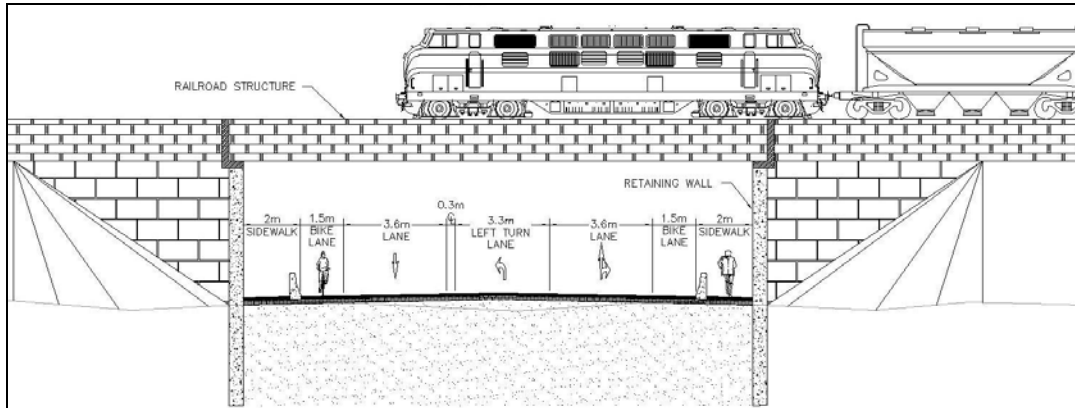


Figure 14: Brooks / Blakeburn Rail Underpass Option Details

5.1.3 Kalum Lake Dr Overpass (Rail and Hwy 16)

In this option, Kalum Lake Dr and Braun St would be raised on earth embankments and an overpass would be constructed to cross the CN line as well as Hwy 16. There are several options for connecting Hwy 16 to Kalum Lake Dr (the options shown are a few of several possibilities and are only shown for graphical purposes). The existing at-grade Kenney St. rail crossing would be closed. Traffic that formerly would have used Kenney St would be rerouted to either Kalum Lake Dr or Sande Overpass. A pedestrian overpass at Kenney St would be required. **Figure 15** shows the Kalum Lake Dr overpass overview, and **Figure 16** shows plan, profile, and cross-section details.



Figure 15: Kalum Lake Dr Overpass (Rail and Hwy 16) Option Overview



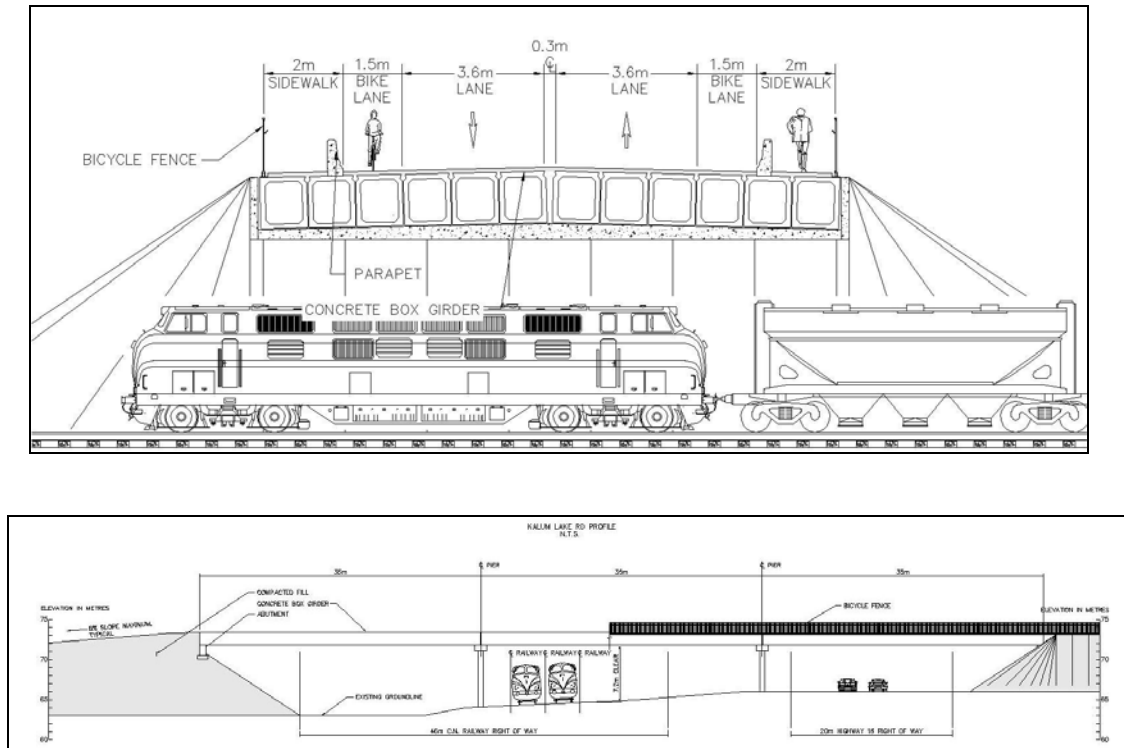


Figure 16: Kalum Lake Dr Overpass (Rail and Hwy 16) Option Details

5.2 Evaluation Criteria

The BC Ministry of Transportation Guidelines for the Cost Benefit Analysis of Highway Improvement Projects recommends consideration of a number of factors under four broad headings: Financial, Customer Service and Road Safety, Site and Community Impacts, Social Impacts and Consistency with the OCP, and the Environment. This analysis is simplified and intended for a high level screening of the options. Factors addressed are:

Financial – this includes land and road construction costs including expenditures to modify access for properties affected. Capital cost estimates were not detailed and cannot be used for budgeting, but are adequate for showing the relative merit of each option.

Customer Service & Road Safety – this includes travel time, valued at \$11.80¹ per hour and vehicle operating costs at \$0.25 per kilometre. It is necessary to view these results with caution. While travellers may value savings in their time, savings of only a few seconds or a minute are probably not

¹ MoT uses \$11.17 per hour for 2003. We have escalated this rate at 1.5% per year.

valued highly. Further, if travel times become excessive, or if new destinations are built closer to the traveller, their travel patterns will change and these calculated benefits may be lost. Nevertheless, they are a measure of the overall efficiency of the road network.

This criterion also considers road safety ramifications of each option. The road safety was estimated for the three options using the Ministry of Transportation and Infrastructure's "Collision Prediction Models for British Columbia" methodology. These models give collision estimates in terms of number of property damage only collisions and the number of severe (injury and/or fatality) collisions for a given intersection or road segment, based on that segment's or intersection's geometry, traffic control, and volume. For each option, the number of collisions by type was estimated for the Hwy 1 corridor between Kalum Lake Dr and Sande Overpass, for Keith Ave between Braun St and Sande Overpass, and for the Braun St, Blakeburn St, Kenney St, and Sande Overpass north/south links. Collision costs were then estimated using the MoT's average collision cost values, which are \$7,500 per property damage only collision and \$290,000 per severe collision.

Site Impacts & Community Impacts – this consists of localized land impacts (buildings required, real estate acquisition required, access relocations required), considerations of noise and disruption from the roadways, and the extent to which the roadway severs one part of the community from the other.

Social Impacts / Consistency with the Official Community Plan - this assessed whether the options are in agreement with key prerogatives outlined in the Official Community Plan (OCP), in terms of matching the objectives of promoting downtown development, contained urban growth patterns and encouraging large format commercial development along the Hwy 16 corridor.

Environment - this includes fuel consumed, carbon emissions, site rehabilitation, wildlife, water pollution and special areas. Note that land requirements, which are also an environmental consideration, have been reflected under costs and site and community impacts. Only a small amount of undisturbed land would be permanently required for the alternatives investigated. Issues of site rehabilitation, water pollution, wildlife and special areas are not significant concerns in the options investigated. Fuel consumption and carbon emissions are two measures of the same thing and are shown in the summary tables.

5.3 Analysis of Options

5.3.1 Kenney St Option Analysis

Pros

- Pedestrian overpass included in structure
- Maintains north-south route continuity, is consistent with OCP
- Maintains existing traffic flows, accommodating the existing north-south Kenney St volumes without route circuitry
- Improvements to Sande Overpass not required as soon as for other options

Cons

- Constructability issues - the right-of-way along Hwy 16 not wide enough to incorporate a construction detour; Kenney St closed during construction.
- Greig Ave to be closed at Kenney St; access issues
- Land acquisition or retaining walls required
- Impact to skyline

Financial

<i>Land</i>	\$1,690,000	Includes acquisition of School Board office and disruption of that site. Access to a service station would be lost and that business would have to be acquired. Access to Greig Avenue would be lost.
<i>Structures</i>	\$5,100,000	
<i>Related Expenses</i>	\$700,000	Reconstruction of Kenney St between Keith Ave and the Overpass (\$500,000); improvements to Keith Ave / Kenney St intersection (\$200,000)
<i>Total</i>	\$7,490,000	

Customer Service and Road Safety

<i>Annual Travel Time</i>	\$3,540,000	Assumes \$11.80 per hour.
<i>Annual Vehicle Operating Costs</i>	\$2,774,000	Assumes \$0.25 per kilometre
<i>Collision Cost</i>	\$1,997,000	Assumes \$7,500 per property damage only collision and \$290,000 per severe collision
<i>Total</i>	\$8,311,000	

Site Impacts and Community Impacts

<i>Residences Taken</i>	0	
<i>Businesses Taken</i>	2	A preliminary assessment indicates that the District School Office may be required. Use of a retaining wall may offset the land costs but would increase construction costs. A service station would be acquired as it access to Highway 16 would be cut off by the embankment. Existing vacant lot in northeast corner would be required.
<i>Residences Affected</i>	0	
<i>Businesses Affected</i>	6	Access to six sites north of Highway 16 would need to be revised, and in some cases land would be required. Closure of Grieg Avenue makes local access less convenient. Options are available.

Social Impacts / Consistency with OCP

<i>Community Severance</i>	Good	Existing traffic patterns are maintained or enhanced.
<i>Community Plans</i>	Good	
<i>Safety / Security</i>	Good	

Environment

<i>Fuel (kl)*</i>	0	Best option
<i>Carbon Emissions (t)*</i>	0	Best option
<i>Noise</i>	Fair	Elevated roadway may result in larger road “noise envelope”
<i>Special areas</i>	Good	No significant change

*Compared to existing baseline

5.3.2 Brooks/Blakeburn Option Analysis

Pros

- Ties in with future Park Ave connector
- Maintains use of Kenney St during construction
- Minimizes land acquisition and disruption to businesses
- Maintains Hwy 16 as “obvious” through-route (consistent with the OCP)
- Does not affect skyline, utilizes existing topography

Cons

- Existing Kenney St traffic diverted to either Blakeburn or Sande Overpass
- North-south route discontinuity
- Requires an additional major intersection on Hwy 16
- Construction challenges; raise rail grade and lower highway grade, rail and roadway construction detours likely required
- Grand Trunk Pathway crossing at-grade at an intersection
- Some access reconfiguration required
- Improvements to Sande Overpass required sooner than Kenney St Option
- Pedestrian overpass required at Kenney St

Financial

<i>Land</i>	\$530,000	
<i>Structures</i>	\$10,000,000	
<i>Related Expenses</i>	\$2,200,000	Includes a pedestrian overpass at Kenney (\$1.2 million). A new Blakeburn Rd would be required between Keith and Highway 16 (\$500,000) and a new intersection on Highway 16 at Brooks St (\$200,000). The railway track would require re-grading (\$300,000)
<i>Total</i>	\$12,730,000	

Customer Service and Road Safety

<i>Annual Travel Time</i>	\$4,106,000	Assumes \$11.80 per hour.
<i>Annual Vehicle Operating Costs</i>	\$3,009,000	Assumes \$0.25 per kilometre
<i>Collision Cost</i>	\$2,015,000	Assumes \$7,500 per property damage only collision and \$290,000 per severe collision
<i>Total</i>	\$9,130,000	

Site Impacts and Community Impacts

<i>Residences Taken</i>	0	
<i>Businesses Taken</i>	0	
<i>Residences Affected</i>	0	
<i>Businesses Affected</i>	2	Right-of-way from two businesses would be required, and access would be affected. It was assumed that a right-of-way could be found that did not require the acquisition of any buildings.

Social Impacts / Consistency with OCP

<i>Community Severance</i>	Fair	Traffic would be diverted from the most direct route but the distances involved are not great
<i>Community Plans</i>	Fair	Does not provide route continuity for general traffic or truck route continuity. Does not support the OCP policy of concentrated growth areas.
<i>Safety / Security</i>	Good	Tunnel does create issue of pedestrian safety / security (although minor concern in this case)

Environment

<i>Fuel (k l)*</i>	273	
<i>Carbon Emissions (t)*</i>	2350	
<i>Noise</i>	Good / Fair	Added noise along Blakeburn Rd frontage
<i>Special areas</i>	Good	No significant change

*Compared to existing baseline

5.3.3 Kalum Lake Dr Option Analysis

Pros

- Maintains existing Highway 16 east-west through-Terrace traffic flow
- Kenney St usable as rail crossing location during construction
- Provides north – south route continuity (Kalum Lake Dr into the West Keith / South Terrace industrial areas)
- Potential to connect to downtown via new Park Ave connector in future
- Accommodates Grand Trunk Pathway underneath overpass, with no trail road intersection, & possible Howe Creek Trail connection w/out at-grade Hwy 16 crossing

Cons

- Existing Kenney St traffic displaced to Kalum Lake Dr or Sande Overpass
- Longer span length (compared to Kenney Option)
- Land acquisitions and associated infrastructure works (Park Ave connector, hydro relocation etc.)
- Access reconfiguration for some businesses required
- More complex traffic routing
- Improvements to Sande Overpass required sooner than Kenney St option
- Pedestrian overpass required at Kenney St

Financial

<i>Land</i>	\$1,680,000	
<i>Structures</i>	\$5,900,000	
<i>Related Expenses</i>	\$2,200,000	Includes a pedestrian overpass at Kenney and signalization of Keith at Sande (\$1,200,000). A connection to Highway 16 is \$500,000, and an upgrade of Braun St (between Keith Ave and Hwy 16) is \$500,000 (including the intersection of Keith Ave and Braun St)
<i>Total</i>	\$9,780,000	

Customer Service & Road Safety

<i>Annual Travel Time</i>	\$4,036,000	Assumes \$11.80 per hour.
<i>Annual Vehicle Operating Costs</i>	\$3,091,000	Assumes \$0.25 per kilometre
<i>Collision Cost</i>	\$2,093,000	Assumes \$7,500 per property damage only collision and \$290,000 per severe collision
<i>Total</i>	\$9,220,000	

Site Impacts and Community Impacts

<i>Residences Taken</i>	0	
<i>Businesses Taken</i>	1 to 3	There is one building in the northeast corner of Hwy 16 and Kalum Lake Dr that would be required and two others that may be required depending upon Hwy 16 / Park Ave connector options.
<i>Residences Affected</i>	0	
<i>Businesses Affected</i>	5	Land is required for roads and some changes to access for five businesses (these buildings would be untouched)

Social Impacts / Consistency with OCP

<i>Community Severance</i>	Fair	The loss of the Kenney Street crossing requires some traffic diversion. A proposed pedestrian overpass maintains pedestrian connectivity. A possible extension of Park Avenue could improve connectivity and provide an alternative to Hwy 16.
<i>Community Plans</i>	Good/ Fair	Pro: Provides north-south truck route connectivity between Kalum Lake Dr and Braun St (and hence Hwy 16 and West Keith industrial areas) Con: Provides a direct bypass of downtown Terrace and Hwy 16 business area for Kalum Lake Dr traffic (these areas are designated as key commercial growth areas in the OCP). Does not support the OCP policy of concentrated growth areas.
<i>Safety / Security</i>	Good	

Environment

<i>Fuel (k l)*</i>	216	
<i>Carbon Emissions (t)*</i>	3200	
<i>Noise</i>	Good	
<i>Special areas</i>	Good	No significant change

*Compared to existing baseline

5.4 Ranking / Evaluation

Comparison of Options

	<i>Option 1 Kenney St At Grade</i>	<i>Option 2 Brooks/Blakeburn Underpass</i>	<i>Option 3 Kalum Lake At Grade</i>
<i>Financial</i>	\$7.5M	\$12.7M	\$9.8M
<i>Customer Service & Road Safety</i>	\$8.3M	\$9.1M	\$9.2M
<i>Site & Community Impacts</i>	Poor	Good	Good
<i>Social / Consistency with OCP</i>	Good	Fair	Good
<i>Environment (kt of CO₂ per year)*</i>	0	2360	2670

*increase in emissions compared to baseline

Option Ranking

	Option 1 Kenney St At Grade	Option 2 Brooks/Blakeburn Underpass	Option 3 Kalum Lake At Grade
Financial	1	3	2
Customer Service & Road Safety	1	2	2
Site & Community Impacts	3	1	1
Social / Consistency with OCP	1	2	1
Environment	1	2	2
Total	7	10	8

Based on the preceding ranking, all of the options are of comparable rank in terms of overall magnitude of impact (with a lower rank score being equated with less impact). By category, in terms of financial costs, the Kenney St option was cheapest, the Brooks/Blakeburn underpass the most expensive, and the Kalum Lake overpass option approximately in the middle. The Kenney St option was best in terms of customer service and road safety, with the other two options ranking fair. This was due to higher travel times and vehicle operating costs of the Brooks/Blakeburn and Kalum Lake Dr options (the estimated annual collision costs for the three options were very close to each other). The Kenney St option ranked poor in terms of site and community impacts while the other options ranked as good. In terms of social impacts and consistency with the OCP, the Kenney St and Kalum Lake Dr options ranked as good and the Brooks/Blakeburn ranking fair.

Overall, the Kenney St option was ranked “best” at seven (7) points, followed closely by Kalum Lake Dr at eight (8) points, then Brooks/Blakeburn at ten (10) points. In terms of this comparative assessment, all options can be considered feasible.

6.0 PUBLIC CONSULTATION

6.1 Meetings with Agencies

The consultant met with a number of agencies that have interest in the study results, such as Terrace Economic Development Authority, West Keith Business Group, Terrace and District Chamber of Commerce, and Fire & Emergency Services. Some points and ideas raised by the various agencies were:

- a truck route network separate from residential streets is required
- a Kalum Street pedestrian overpass is seen as a significant requirement
- it is important to connect Hwy 16 to downtown and residential areas
- Keith should be upgraded to a major east-west arterial road
- Rework Sande Overpass (overpass over Keith, free-flow east-west)
- Upgrade Frank St crossing, encourage this for use by commercial vehicles
- Pedestrian overpasses are needed at Kenney St and Kalum St (east of Sande Overpass)
- Improvements to south end of Sande Overpass needed regardless of final plan

Full minutes of the meetings can be found in Appendix C.

6.2 Public Open House, June 5 2008

6.2.1 Process

A public open house was conducted on June 5 2008, at the Coast Inn of the West in downtown Terrace. A series of poster boards were presented that featured background project information, traffic analysis findings, and a more detailed review of three grade separation options (Kenney St Overpass, Brooks/Blakeburn Underpass, and Kalum Lake Dr Overpass). A formal presentation was also given by Boulevard Transportation Group. Questionnaires were distributed to attendees, which featured three questions:

- (1) In what area of Terrace do you reside and work?
- (2) What are the top three factors that are important to you in assessing the best rail grade separation options for Terrace (Cost, Site Impacts, Safety Considerations, Social Impacts, Environmental Impacts, or Other)
- (3) Please rank your order of preference for the three grade separation options listed, from 1 (most preferred) to 3 (least preferred).

Respondents were also given the opportunity to add any other comments or ideas.

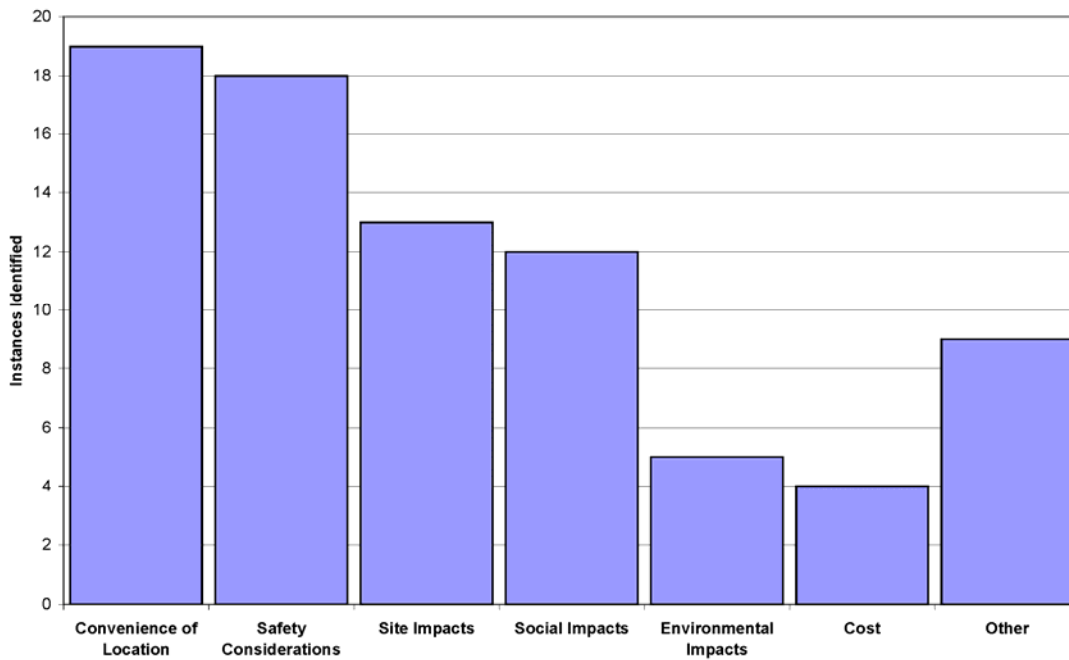
The presentation slide show and questionnaire was posted on the Terrace website, which allowed for feedback from Terrace residents unable to attend the open house. The survey questionnaire is shown in Appendix D

6.2.2 Open House Results

The feedback of the open house questionnaires was compiled and summarized from both those responses received at the open house and those received within the next 30 days.

For the top factors in assessing the best rail grade separation option, the following order was determined, based on each factor getting one point per instance identified, as shown in **Figure 17**:

Figure 17: Top Factors in Assessing the Best Rail Grade Separation Option

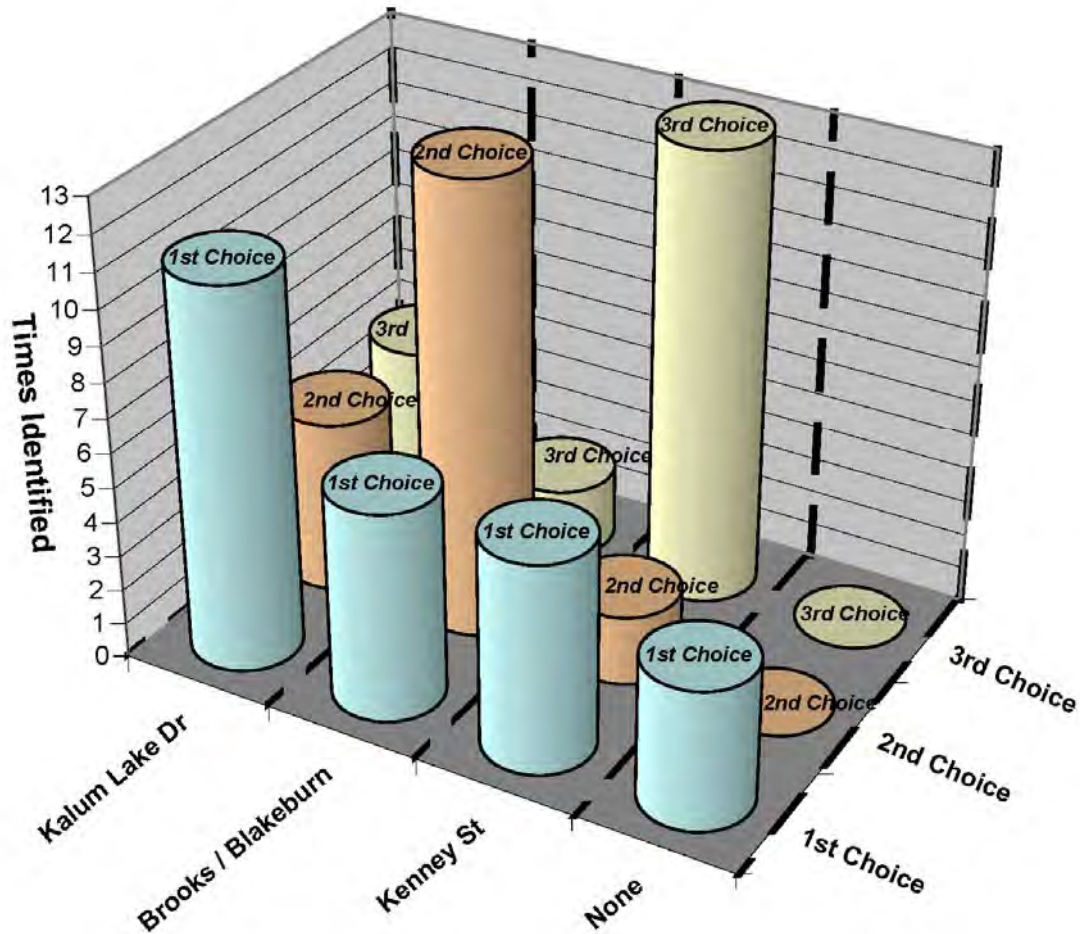


Therefore, these can be assessed as:

- *Most Important:* Convenience of Location and Safety Considerations (includes ambulance service)
- *Mid Important:* Site Impacts and Social Impacts
- *Least Important:* Environmental Impacts and Cost

In terms of the preferred grade separation options, the preference order came as shown in **Figure 18**.

Figure 18: Grade Separation Preference



The Kalum Lake Dr overpass option was the most preferred (with more first place votes than second or third place votes combined). While both the Brooks / Blakeburn underpass and Kenney St overpass options had six first place votes apiece, the Brooks / Blakeburn option was deemed the second most preferred as it had only two third place votes to the Kenney St option's thirteen third place votes. The no-overpass option received four votes.

In terms of general comments and feedback regarding the study and options presented, the following themes reoccurred:

- Pedestrian overpass should be considered at Kalum St, to connect downtown to southeast Terrace
- Displeasure with all three options; “back to the drawing board”
- Improvements to existing Sande Overpass should be a priority
- Kenney crossing provides best convenience (many noted that the existing at-grade rail crossing at Kenney good enough)

A full list of feedback comments is available in Appendix E.

7.0 CONCLUSIONS

The following conclusions are made from the transportation corridor study, which investigated transportation network conditions and characteristics (including traffic volumes and conditions, road safety, truck routes, pedestrian, cyclist, transit and truck route considerations, as well as future network requirements), new rail grade separation options with detailed investigation of three options, and the undertaking of community consultation.

Road network volumes were investigated along the Hwy 16 corridor from the Sande Overpass at Keith Ave (east end) to Hwy 16 and Frank St (west end). It was found that traffic volumes were greatest at the Sande Overpass and progressively decrease the further west along Hwy 16 one goes. The PM peak hour was found to generally have the highest traffic volumes, as compared to the AM and midday periods. Based on licence plate counts, in the PM it was found that more vehicles travelled westbound to Kalum Lake Dr from northbound Sande Overpass than to Hwy 16 west of Frank St, and that the reverse was true in the AM period. Results for eastbound traffic (from Hwy 16 west of Frank St, Kalum Lake Dr, and Kenney St) were inconclusive.

In terms of traffic conditions, existing traffic conditions at Sande and Keith Ave have some failing movements (LOS F) in the PM peak hour and near failing movements (LOS E) in the AM and midday peak hours. As conditions on the Sande Overpass were found to be the most acute (and since this street is the busiest corridor in Terrace) a more detailed investigation of Sande Overpass conditions was undertaken. This detailed analysis found that mitigation could address existing concerns and that in the future (2027) under a fully loaded traffic assignment it is possible for the Sande Overpass to handle all traffic with signal and geometric modifications (these modifications would be required at both Sande / Keith Ave and Sande / Greig Ave)

An investigation of ICBC collision data was conducted, whereby both collision rate (collisions per entering vehicles) and collision frequency (collisions/yr) were established for key intersections along Hwy 16 (between Sande Overpass and Frank St) and along Keith Ave. It was found that most of the intersections had collision rates close to the provincial average (by road type and volume), with the exception being Kenney St & Keith Ave which had more than double the average collision rate. In terms of collision frequency, however, all of the investigated intersections were found to have low collision frequencies as compared to a base threshold of 6.0 collisions/yr (a typical base value). The worst intersection in terms of collision frequency was also Kenney St & Keith Ave, with 3.0 collisions/yr. Therefore, none of the investigated intersections have particularly acute safety concerns,

although Kenney St & Keith Ave could be considered as the intersection of greatest concern based on this review.

A review of truck routes for Terrace was conducted. It was found that the existing network of major truck routes (Hwy 16, Keith Ave, Frank St, Kenney St (between Keith Ave and Hwy 16) and Kalum Lake Dr) and secondary truck routes provides good connections for through-Terrace truck traffic as well as to various truck-activity / industrial areas in the community. It is therefore recommended that the existing truck route network be retained, but updated as appropriate should any new rail grade separation be constructed.

A review of pedestrian, cyclist, and transit networks was conducted. For pedestrians and cyclists it was found that they are well-served east-west along the Hwy 16 corridor with the Grand Trunk Pathway, but that there are no sidewalks east-west along Keith Ave (east of Sande Overpass) for pedestrians. As Keith Ave is both a main roadway in Terrace and a major truck route, sidewalks are an important consideration, with greatest importance to the east (between Sande Overpass and Kenney St) and decreasing further west. Cyclists should be accommodated along major roadways with either bike lanes or shared car/bike lanes of adequate width. Pedestrian and cyclist considerations are important to any future rail grade separation project, and need to be appropriately considered in any designs. It was found that a number of transit routes serve Terrace, with one route serving the area south of the CN line and west of Sande Overpass. Should a new rail grade separation be constructed, new transit routing opportunities may be considered.

Based on the network review, the following improvements would be beneficial for the community to accommodate future needs.

- Sande Overpass intersection improvements: (1) two-lane roundabout at Sande & Keith Ave (\$750,000); (2) dual left turn lanes and signal improvement at Sande & Greig Ave (\$350,000).
- Keith Ave sidewalks (\$162,000 from Sande to Kenney St, \$140,000 from Kenney St to Braun St, per side)
- Traffic control improvements at Eby St and Lakelse Ave (all-way stop control; in future signal or roundabout)

Based on a preliminary screening of numerous grade separation options, the following three options were carried forward for further investigation: (1) Kenney St Overpass (Rail); (2) Brooks/ Blakeburn Rail Underpass and (3) Kalum Lake Dr Overpass (Rail and Hwy 16). A list of pros and cons for these three options was developed, and they were investigated in terms of financial, customer service and

road safety, site and community impacts, social impacts and consistency with the OCP, and environment. The assessment of these criteria for the three options found that overall the options had comparable rankings, with the Kenney St option ranking best (score of 7), followed by the Kalum Lake Dr option (score of 8) and then the Brooks/Blakeburn option (score of 10).

A number of agencies were contacted to obtain feedback regarding their concerns and ideas about a potential second rail grade separation. An open house was also held in order to understand the issues and concerns from that perspective. The results of the public process helped inform final report considerations. Based on public feedback, the preferred option identified was the Kalum Lake Dr overpass option, followed by the Brooks/Blakeburn underpass option and then finally the Kenney St overpass option.

It is recommended that one or more of the three options be carried forward for functional design. The City should work with CN Rail to refine the alignments/configurations taking into consideration potential vertical and horizontal track adjustments/realignments and property acquisitions.

APPENDIX A

Synchro Description

SYNCHRO MODELLING SOFTWARE DESCRIPTION

The traffic analysis was completed using Synchro and SimTraffic traffic modelling software. Results were measured in delay, level of service (LOS) and 95th percentile queue length. Synchro is based on the Highway Capacity Manual (HCM) methodology. SimTraffic integrates established driver behaviours and characteristics to simulate actual conditions by randomly “seeding” or positioning vehicles travelling throughout the network. The simulation is run five times (five different random seedings of vehicle types, behaviours and arrivals) to obtain statistical significance of the results.

Levels of Service

Traffic operations are typically described in terms of levels of service, which rates the amount of delay per vehicle for each movement and the entire intersection. Levels of service range from LOS A (representing best operations) to LOS E/F (LOS E being poor operations and LOS F being unpredictable/disruptive operations). LOS E/F are generally unacceptable levels of service under normal everyday conditions.

The hierarchy of criteria for grading an intersection or movement not only includes delay times, but also takes into account traffic control type (stop signs or traffic signal). For example, if a vehicle is delayed for 19 seconds at an unsignalized intersection, it is considered to have an average operation, and would therefore be graded as an LOS C. However, at a signalized intersection, a 19 second delay would be considered a good operation and therefore it would be given an LOS B. The two tables below indicate the ranges of delay for LOS for signalized and unsignalized intersections.

Table A1: LOS Criteria, by Intersection Traffic Control

Level of Service	Unsignalized Intersection Average Vehicle Delay (sec/veh)	Signalized Intersection Average Vehicle Delay (sec/veh)
A	Less than 10	Less than 10
B	10 to 15	11 to 20
C	16 to 25	21 to 35
D	26 to 35	36 to 55
E	36 to 50	56 to 80
F	More than 51	More than 81

APPENDIX B

Option Comparison Calculation Details

TERRACE CORRIDOR STUDY - SUMMARY OF COST ESTIMATE

OPTION	Kenney St COMMENTS	Brooks / Blakeburn COMMENTS	Kalum Lake Dr COMMENTS
Land	<p>South Side</p> <p>\$50,400 1. Two corner cuts 2x140m x 8 m x \$45/m2</p> <p>\$50,400 Total</p> <p>North Side</p> <p>\$605,000 3. Loss of two story commercial building 22m x 22m @ \$1250/m2</p> <p>\$127,400 4. Land for 2 ramps 130m x 8 m @ \$70/m2 ea</p> <p>\$50,000 Allowance to modify parking and access</p> <p>\$27,300 7. Land for west side ramp 60 x 7 @ \$70/m2</p> <p>\$203,840 Service station land 56m x 52 m @\$70/m2</p> <p>\$187,000 Building 17m x 11 m @ \$1000/m2</p> <p>\$300,000 Car wash building 20m x 20m @\$750/m2</p> <p>\$50,000 Construct cul de sac</p> <p>\$84,000 Additional land to move structure north 8m x 150@\$70/m2</p> <p>\$5,000 Corner cut</p> <p>\$1,639,540</p> <p>\$1,689,940 Total</p>	<p>\$534,600 Land 300 m x 22 m at \$45/m2</p> <p>\$534,600 total</p>	<p>South Side</p> <p>\$405,720 A. Land 92m x 98 m @ \$45/m2</p> <p>\$825,000 Building 55m x 30 m @ \$500/m2</p> <p>-\$923,040 Salvage 75%</p> <p>\$390,000 B. Land for service road 300 m x 20 m @ \$65/m2</p> <p>\$51,750 Land for ramp on east side 10 x 115 m @ \$45</p> <p>\$5,000 Small corner cut</p> <p>\$754,430</p> <p>\$247,500 Shop</p> <p>\$194,400 Office building</p> <p>\$858,000 Land 120 x 110 m @ \$65/m2</p> <p>-\$600,600 Salvage assume %70 of land</p> <p>\$20,000 East side land allow \$20000</p> <p>\$10,000 East side access modification allow</p> <p>\$85,800 6. Land 60 x 22 @ \$65/m2</p> <p>\$110,688 4. Assume half of lot purchased and half of that salvaged</p> <p>\$925,788</p> <p>\$1,680,218 Total</p>
RELATED EXPENDITURES			
	<p>\$500,000 Kenney Reconstruction</p> <p>\$200,000 Kenney / Keith Improvements</p>	<p>\$1,200,000 Kenny Street Ped Overpass</p> <p>\$500,000 New Blakeburn Rd</p> <p>\$200,000 New Hwy 1 Blakeburn Int</p> <p>\$300,000 Railway Regrading</p>	<p>\$1,200,000 Kenny Street Ped Overpass</p> <p>\$500,000 Hwy 16 Connection (road link and ramps)</p> <p>\$500,000 Braun St Upgrade (incl int w/Keith)</p>
total:	\$700,000	\$2,200,000	\$2,200,000

Synchro output - Terrace Corridor Study

	Base Case	Kenney St	Brooks Blakeburn	Kalum Lake Dr
Traveller Hours	100	100	116	114
Fuel (l)	503	503	594	575
CO2 (kg)	9245	9245	10030	10302.5
Distance (km)	3698	3698	4012	4121
Operating Cost @\$.25/km	\$925	\$925	\$1,003	\$1,030
	change			
		0	16	14
		0	91	72
Factor	3000	0	785	1057.5
		0	314	423
		\$0	\$79	\$106
	Change			
	Traveller Hours	0	48000	42000
	Fuel (l)	0	273000	216000
	CO2 (kg)	0	2355000	3172500
	Distance (km)	0	942000	1269000
	Operating Cost \$	0	235500	317250
	Value of Time @ \$11.80/hr	\$0	\$566,400	\$495,600
	Annualized Travel cost	\$3,540,000	\$4,106,400	\$4,035,600
	Annualized vehicle cost	\$2,773,500	\$3,009,000	\$3,090,750

Collision Prediction -- Kenney St At-Grade Option

Section	Type	V _{mi} (AADT)	V _{mi} (AADT)	Length (km)	CPM - Base PDO (col/5yrs)	CPM - Base Severe (col/5 yrs)
Hwy 1	Hwy 1 - Kalum Lake Dr	4010	1170	-	2.47	1.13
	Hwy 1: Kalum Lake Dr - Brooks	4750	-	0.31	1.5	1
	Hwy 1 - Brooks*	4750	0	-	0	0
	Hwy 1: Brooks - Kenney	5030	-	0.51	4.01	2.83
	Hwy 1 - Kenney	6240	3650	-	4.09	3.33
	Hwy 1: Kenney - Monroe	6070	-	0.41	3.31	2.4
	Hwy 1: Monroe - Eby	8880	-	0.4	3.4	2.62
	Hwy 1 - Eby	9170	3050	-	4.92	4.36
	Hwy 1: Eby - Sande	9970	-	0.18	1.55	1.22
	Hwy 1 - Sande	10740	7440	-	5.7	1.97
	Keith - Braun	700	300	-	1.25	0.26
	Keith: Braun - Blakeburn	800	-	0.34	0.72	0.47
	Keith - Blakeburn	910	0	-	0	0
	Keith: Blakeburn - Kenney	910	-	0.49	1.1	0.72
Keith	Keith - Kenney	4510	1580	-	4.04	1.75
	Keith: Kenney - Sande	5400	-	0.97	5	3.32
	Keith - Sande	11230	7850	-	5.86	2.05
	Braun	200	-	0.2	0.22	0.14
	Blakeburn	0	-	0.2	0	0
North-South	Kenney	4510	-	0.33	1.56	1.04
	Sande	16680	-	0.27	2.5	2.12
	Total:				53.2	32.73

Segments - Base Lane Width CMF	Shoulder	Median (None)	Intersections - Base			CMF - PDO	CMF - Severe	Total PDO Collisions	Total Severe Collisions	
			it lane - PDO	it lane - Severe	rt lane - PDO					rt lane - Severe
1	1	1	1	1	0.86	0.77	0.860	0.770	2,124	0,870
1	1	1	1	1	1	1	1,000	1,000	1,500	1,000
1	1	1	1	1	1	1	1,000	1,000	0,000	0,000
1	1	1	1	1	1	1	1,000	1,000	4,010	2,830
1	1	1	0.81	0.83	0.96	0.91	0.778	0.755	3,180	2,515
1	1	1	1	1	1	1	1,000	1,000	3,310	2,400
1	1	1	1.08	1.06	1	1	1,000	1,000	3,400	2,620
1	1	1	1	1	1	1	1,080	1,060	5,314	4,622
1	1	1	1	1	1	1	1,000	1,000	1,550	1,220
1	1	1	0.93	0.94	0.96	0.91	0.893	0.855	5,089	1,685
1	1	1	1	1	1	1	1,000	1,000	1,250	0,260
1	1	1	1	1	1	1	1,000	1,000	0,720	0,470
1	1	1	1	1	1	1	1,000	1,000	0,000	0,000
1	1	1	1.88	1.98	1	1	1,880	1,980	1,100	0,720
1	1	1	0.93	0.94	0.96	0.91	0.893	0.855	5,000	3,320
1	1	1	1	1	1	1	1,000	1,000	5,232	1,754
1	1	1	1	1	1	1	1,000	1,000	0,220	0,140
1	1	1	1	1	1	1	1,000	1,000	0,000	0,000
1	1	1	1	1	1	1	1,000	1,000	1,560	1,040
1	1	1	1	1	1	1	1,000	1,000	2,500	1,210
								54,654	33,051	

*no lane width or shoulder cmf's assumed, for all options (would only have small effect in any case, of equal weight)

*Note: where no volumes available on low-volume approaches, 0 peak hour vehicles per direction were assumed (i.e. the intersection was assumed to have no safety impact)

**AADT was assumed to be 10 times the PM Peak Hr. volumes

***Keith/Sande was assumed signalized for all options

****All segments were assumed to be straight



Collision Prediction -- Brooks / Blakeburn Rail Underpass Option

Section	Type	V _{inj} (AADT)	V _{min} (AADT)	Length (km)	CPM-Base PDO (col/5yrs)	CPM-Base Severe (col/5 yrs)	Segments - Base			Intersections - Base			CMF - Severe	Total PDO Collisions	Total Severe Collisions
							Lane Width CMF	Shoulder Median (None)	It lane - PDO	rt lane - Severe	rt lane - PDO	rt lane - Severe			
Hwy 1	Hwy 1 - Kalum Lake Dr	4010	1470	-	2.68	1.23	1	1	1	0.86	0.77	0.860	0.770	2.305	0.947
	Hwy 1: Kalum Lake Dr - Brooks	4750	-	0.31	1.5	1	1	1	1	0.86	0.77	1.000	1.000	1.500	1.000
	Hwy 1 - Brooks	5320	1570	-	2.96	1.59	1	1	1	0.67	0.86	0.576	0.501	1.706	0.796
	Hwy 1: Brooks - Kenney	5810	-	0.51	4.09	2.95	1	1	1	0.93	0.94	1.000	1.000	4.090	2.950
	Hwy 1 - Kenney	5560	1650	-	3.04	0.93	1	1	1	0.93	0.94	0.893	0.855	2.714	0.796
	Hwy 1: Kenney - Monroe	4720	-	0.41	3.19	2.23	1	1	1	1.08	1.06	1.000	1.000	3.190	2.230
	Hwy 1: Monroe - Eby	8880	-	0.4	3.4	2.62	1	1	1	0.93	0.94	0.893	0.855	3.400	2.620
	Hwy 1 - Eby	9390	3470	-	5.15	4.51	1	1	1	1.08	1.06	1.000	1.000	5.562	4.781
	Hwy 1: Eby - Sande	10610	-	0.18	1.57	1.24	1	1	1	0.93	0.94	1.000	1.000	1.570	1.240
	Hwy 1 - Sande	11590	-	-	6.14	2.16	1	1	1	1	1	0.893	0.855	5.482	1.848
	Keith - Braun	700	300	-	1.25	0.26	1	1	1	1	1	1.000	1.000	1.250	0.260
	Keith: Braun - Blakeburn	800	-	0.34	0.72	0.47	1	1	1	1	1	1.000	1.000	0.720	0.470
Keith - Blakeburn	2370	1660	-	2.42	0.85	1	1	1	1	1	1.000	1.000	2.420	0.850	
Keith: Blakeburn - Kenney	4040	-	0.49	2.2	1.46	1	1	1	1	1	1.000	1.000	2.200	1.460	
Keith - Kenney	6690	2170	-	4.86	2.05	1	1	1	1	1	1.000	1.000	4.860	2.050	
Keith: Kenney - Sande	11670	-	0.97	5.53	3.68	1	1	1	0.93	0.94	1.000	1.000	5.530	3.680	
Keith - Sande	11670	8700	-	6.11	2.15	1	1	1	1	1	0.893	0.855	5.455	1.839	
Braun	200	-	0.2	0.22	0.14	1	1	1	1	1	1.000	1.000	0.220	0.140	
Blakeburn	3230	-	0.37	1.5	0.99	1	1	1	1	1	1.000	1.000	1.500	0.990	
Kenney	200	-	0.2	0.22	0.14	1	1	1	1	1	1.000	1.000	0.220	0.140	
Sande	17970	-	-	0.27	2.52	2.17	1	1	1	1	1.000	1.000	2.520	2.170	
Total:					61.27	34.82							58.413	33.256	

*Note: where no volumes available on low-volume approaches, 0 peak hour vehicles per direction were assumed (i.e. the intersection was assumed to have no safety impact)

**AADT was assumed to be 10 times the PM Peak Hr. volumes

***Keith Sande was assumed signalized for all options

****All segments were assumed to be straight

*****New Intersections were assumed to have left and right turn lanes

*****No modification factor was applied to Keith-Kenney for the Brooks or Kalum Lake options for left turns, as the north leg would effectively have zero volume and hence few if any left-turn conflicts in one of two mainline directions (i.e. along Keith Ave)



Collision Prediction -- Kalam Lake Dr Hwy Overpass Option

Section	Type	V _{maj} (AADT)	V _{min} (AADT)	Length (km)	CPM-Base PDO (col/5yrs)	CPM-Base Severe (col/5 yrs)	Segments - Base			Intersections - Base			CMF - Severe	Total PDO Collisions	Total Severe Collisions	
							Lane Width	Shoulder	Median (None)	It lane - PDO	It lane - Severe	rt lane - PDO				rt lane - Severe
Hwy 1	Kalam Lake Dr - KLDr Connector	2740	2820	-	3.03	1.16	1	1	1	0.67	0.65	0.86	0.77	0.576	1.746	0.581
	Kalam Connector	4960	-	0.25	1.24	0.82	1	1	1	0.67	0.65	0.86	0.77	1.000	1.240	0.820
	Hwy 1 - Kalam Connector	5070	2140	-	3.26	1.72	1	1	1	0.67	0.65	0.86	0.77	0.576	1.878	0.861
	Hwy 1: Kalam Lake Dr - Brooks	6180	-	0.31	1.7	1.13	1	1	1	1	1	1	1	1.000	1.700	1.130
	Hwy 1 - Brooks*	5340	0	-	0	0	1	1	1	1	1	1	1	1.000	0.000	0.000
	Hwy 1: Brooks - Kenney	5560	1650	-	3.04	2.95	1	1	1	0.93	0.94	0.96	0.91	0.893	2.714	0.796
	Hwy 1 - Kenney	4720	-	0.41	3.19	2.23	1	1	1	1	1	1	1	1.000	3.190	2.230
	Hwy 1: Kenney - Monroe	8880	-	0.4	3.4	2.62	1	1	1	1	1	1	1	1.000	3.400	2.620
	Hwy 1: Monroe - Eby	9390	3470	-	5.15	4.51	1	1	1	1.08	1.06	1	1	1.080	5.562	4.781
	Hwy 1 - Eby	10610	-	0.18	1.57	1.24	1	1	1	0.93	0.94	0.96	0.91	1.000	1.570	1.240
	Hwy 1: Eby - Sande	11590	8880	-	6.14	2.16	1	1	1	0.73	0.71	0.86	0.77	0.628	2.725	1.848
	Hwy 1 - Sande	2270	1960	-	4.34	1.49	1	1	1	1	1	1	1	1.000	1.440	0.960
	Keith: Braun - Blakeburn	3580	0	0.34	1.44	0.96	1	1	1	1	1	1	1	1.000	0.000	0.000
	Keith - Blakeburn	4040	0	-	0	0	1	1	1	1	1	1	1	1.000	2.200	1.460
Keith: Blakeburn - Kenney	4040	2170	-	4.86	2.05	1	1	1	1	1	1	1	1.000	4.860	2.050	
Keith - Kenney	6690	-	0.97	5.53	3.68	1	1	1	1	1	1	1	1.000	5.530	3.680	
Keith: Kenney - Sande	11670	8700	-	6.11	2.15	1	1	1	0.93	0.94	0.96	0.91	0.893	5.455	1.839	
Keith - Sande	3230	-	0.54	2.19	1.45	1	1	1	1	1	1	1	1.000	2.190	1.450	
Braun	200	-	0.2	0.22	0.14	1	1	1	1	1	1	1	1.000	0.220	0.140	
Blakeburn	200	-	0.2	0.22	0.14	1	1	1	1	1	1	1	1.000	0.220	0.140	
Kenney	17970	-	0.27	2.52	2.17	1	1	1	1	1	1	1	1.000	2.520	2.170	
Sande																
Segments				Total:	65.44	37.16								59.932	34.559	

*Note: where no volumes available on low-volume approaches, 0 peak hour vehicles per direction were assumed (i.e. the intersection was assumed to have no safety impact)
 **AADT was assumed to be 10 times the PM Peak Hr volumes
 ***Keith/Sande was assumed signalized for all options
 ****All segments were assumed to be straight
 *****New Intersections were assumed to have left and right turn lanes
 *****This option assumed there would be a new link connecting two new intersections, to accommodate traffic between Hwy 1 and Kalam Lake Dr. (The option of full interchange ramps would be similar in effect but not modelable based on available methodologies)
 *****No modification factor was applied to Keith-Kenney for the Brooks or Kalam Lake options for left turns, as the north leg would effectively have zero volume and hence few if any left-turn conflicts in one of two mainline directions (i.e. along Keith Ave)



BC MoT average Collision Cost Values

PDO Cost \$7350 / incident
 Severe Cost \$290,000 / incident

	PDO Collisions / Yr	Severe Collisions / yr	Total Collisions / yr	PDO Cost / yr	Severe Cost /yr	Total Cost / yr
Kenney St Option	10.93	6.61	17.54	\$ 80,341.60	\$ 1,916,932.31	\$ 1,997,273.91
Brooks - Blakeburn Option	11.68	6.65	18.33	\$ 85,867.50	\$ 1,928,835.88	\$ 2,014,703.38
Kalum Lake Dr Option	11.99	6.91	18.90	\$ 88,099.84	\$ 2,004,417.30	\$ 2,092,517.14



APPENDIX C

Stakeholder Feedback

Meeting Minutes

Subject of Meeting: Terrace Corridor Study – stakeholder discussions
 Meeting Location: Terrace Inn
 Date: Dec 14, 2007 – noon till 1:30
 Job No. 854

Present: Sam Harling, Bert Husband, Bruno, Lael McKeown, Anna Beddos, Steve Smyth, Kevin, Stacey Mann, Rod Cox, Dave Pernarowski, Mike Skene, Brian Downie (1:15)

The following are notes of comments from the meeting and not a record of the actual discussions:

Item	Description	Action By
1	Roundtable introductions were done. Mike then introduced Boulevard Transportation Group and its background and history.	
2	Mike updated the group as to verbal discussions with CN	
3	A number of questions were raised to clarify the scope of the study	
4	Issues relative to connecting Kalum Rd across the tracks and developing a city wide truck route system was discussed	
5	Steve Smyth felt that a truck route system separate from residential traffic was required and he felt that Keith Rd is the most appropriate.	
6	Kalum Rd pedestrian overpass was seen as a significant requirement and should be part of the Grand Trunk Pathway study	
7	There was discussion of the importance of connecting Hwy 16 to downtown and to the residential areas (bench area)	
8	A number of times the group wanted clarification as to why my “hands were tied” to respond to their concerns. My response was that my hands were not tied to respond within the context of the terms of reference for this study	
9	<p>The following issues were raised by the Steve Smyth of the West Keith Business Group:</p> <p>“After consideration and consultation amongst ourselves, The West Keith Business Group is advocating a “holistic” approach to overpass development. We feel the following steps are required for safe and efficient transportation though and within Terrace</p> <p style="margin-left: 40px;">1) Acquire land along Keith and Braun ensuring that it remains full width. Along with this step, Keith needs to be upgraded to a major east west artery. Reposition stop signs and lights so that Keith is free flow and</p>	

	<p>EVENTUALLY BE AT LEVEL GRADE at Sande Overpass South</p> <ol style="list-style-type: none"> 2) Rework the Sande overpass so that it crosses over Keith- traffic could still access the overpass from the Southside but east west traffic would pass under the overpass with no stoppages 3) Upgrade the Frank crossing and direct all commercial (heavy) and dangerous goods traffic across Frank and along Keith. This not only improves safety by eliminating dangerous goods from the downtown core, it should reduce the traffic flow on Sande overpass by at least 30% (that's a Wise ass guess) which makes the current overpass much more user friendly, safer and more accessible for the Southside residents 4) Build 2 enclosed pedestrian overpasses at Kalum and at Kenny to increase pedestrian and bicycle access to downtown as well as ensure continued free flow access to the two high schools in the area. 5) If its determined that there is room to turn safely right/left onto Keith at Braun then build a new vehicular overpass at Braun/Keith and tie it in to Kalum Lake Drive-If not, then through the old SCI sort yard OR the Porier yard on an angle to enhance flow off the highway and onto Keith in both easterly and westerly directions” 	
	<p>Notes received from Sam Harling of the TEDA:</p> <ol style="list-style-type: none"> 1. You heard plenty about the need for an overall transport study in the Terrace area. 2. The south end of the current Sande Overpass will need some changes regardless of where the new overpass goes. The west bound Keith traffic is currently a problem. The most simple solution discussed was to install traffic lights. 3. There is a need to address pedestrians crossing the tracks. If Kenney is closed, this poses big problems for the current amount of pedestrian and bicycle traffic using this crossing. We also discussed the potential of connecting the east end of the Grand Trunk Pathway (at George Little House) to a pedestrian crossing to Keith. 4. It seemed to me that there were 2 potential overpass sites identified by the group on Friday: Kenney St. and Kalum Lake Dr./ Braun. I, personally, have leaned towards the Kalum Dr./ Braun site. However, some of the points on the Kenney St. crossing were very good. I now find myself 'sitting on the fence'. <p>There are, clearly, many things to consider in regards to this overpass. Much of which, you can't possibly cover in this study. One thing that Stacey and I would be concerned with is the future placement of the Visitor Info and potential relocation of Chamber, TEDA, Kermodei Tourism, etc... under one roof. We would like this to be in a practical location for tourists and for downtown access.</p>	

M Skene
 Author

The content of this report reflects the writer's interpretation of the proceedings. Participants shall advise the author of any errors or omissions within 5 days of receipt of this Meeting Report.

APPENDIX D

Open House Survey



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TERRACE TRANSPORTATION CORRIDOR STUDY EXIT SURVEY

Q.1 In what area of Terrace do you reside and work?

Reside: _____

Work: _____

Q.2 Please select your top three factors that are important to you in assessing the best rail grade separation option for Terrace:

- Cost
- Site Impacts (e.g. effects on accesses, land requirements, visuals etc)
- Safety Considerations
- Convenience of Location
- Social Impacts (e.g. downtown impacts, west Keith Ave impacts, etc)
- Environmental Impacts
- Other (please describe) _____

Q.3 Please rank your order of preference for the following grade separation options, from 1 (most preferred) to 3 (least preferred)

- Kalum Lake Drive Overpass (Rail and Hwy 16)
- Kenney St Overpass (Rail)
- Brooks / Blakeburn rail underpass

Please feel free to elaborate as to your reasons for grade separation option preferences below

APPENDIX E

Open House Survey Results



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TERRACE TRANSPORTATION CORRIDOR STUDY EXIT SURVEY – RESULTS JUL 8 2008

Q1) Please select your top three factors that are important to you in assessing the best rail grade separation option for Terrace.

Number of times identified:

- Convenience of Location - **19**
- Safety Considerations - **18** (*note: this frequently interpreted as “ambulance service”*)
- Site Impacts (e.g. effects on accesses, land requirements, visuals etc) - **13**
- Social Impacts (e.g. downtown impacts, west Keith Ave impacts, etc) - **12**
- Environmental Impacts - **5**
- Cost - **4**
- Other - **9** (*Winter, Grades, Snow Removal – Urban vs Rural – Long Term Planning - Traffic Efficiency – Increase in Traffic Noise, Property value, Skyline Impact will decrease, Impact on Residential Neighbourhoods, Overall long term transportation impacts of the decision*)

Q2) Please rank your order of preference for the following grade separation options, from 1 (most preferred) to 3 (least preferred).

Number of votes:

Kalum Lake Drive Overpass (Rail and Hwy 16):	1st – 11	2nd – 5	3rd - 5
Brooks / Blakeburn rail underpass	1st – 6	2nd – 13	3rd - 2
Kenney St Overpass (Rail)	1st – 6	2nd – 2	3rd - 13
NONE	- 4		



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Please feel free to elaborate as to your reasons for grade separation option preferences below

-What about access for businesses, When will businesses & residents be connected?

- \$4 Million Move Siding, 10 Million to build workarounds, Why are we putting an urban solution to a rural problem? All three solutions are 2-3X the cost of mobbing the siding. It makes no sense whatsoever!

- Think there has to be more study, any pedestrian overpass over Kieth needs to accommodate bicycles

- Kalum Lake will require one less intersection on Hwy 16

- Crossing intersection of 2 Highways – most logical option

- Kalum Lake Rd. is straight through to southside, no turns, I'm confused by proposed roundabouts. Why not a cloverleaf? Sande Overpass is a torture device for patients in an ambulance. I suffered so!

- None of these options provide solutions to current problems – only create more of the same, if not worse!

- Kenney – closest to downtown; Brooks – easier

- Brooks – Blakeburn seem to provide the best traffic flow by reducing the Kalum Lake Rd hook up with Park Ave would create a 4 way junction with the least amount of impact to the area businesses. – Kenney Street pedestrian crossing could be under the tracks. A second pedestrian crossing should be added at the Old Kalvin Street crossing. – An underpass at Kenney would probably cost less than an overpass. We could focus on a more elaborate pedestrian crossing at the Kalum Street.

- While Kenney may be convenient, it'll be a huge eyesore and conflict to adjacent properties, Can Kenney remain open as long as possible? What about pedestrians? How will they cross? Long way to walk..

-I would like to see a level crossing opened at Kalum Lake Dr and a Kenney St Overpass. I would also like to see a pedestrian crossing near Skana bridges (level crossing ok)



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-Kenney St is already an established crossing site. Closing an existing crossing to open a non-existing crossing does not make sense. Kenney St crossing will maintain east-west-north-south continuity. Please construct crossing for benefit of citizens of today and the future!

-Kalum Lake Option is only convenient for people going down Kalum Lake Drive. People coming down Kenney would add burden to Sande Overpass as access to Kalum Overpass from Hwy is difficult and wouldn't be used. Kenney Option keeps traffic patterns the same.

-I believe the parameters of the RFP were to narrow this should be include as part of a larger transportation study & it's impacts over the next 20 to 30 years.

-Kenney St is the closest for south side residents. I believe any other over/underpass is ridiculous.

-Kenney St overpass has a major effect on the businesses currently fronting the highway (BP and Copperville for example) basically putting them out of business. As for improvements to the Sande Overpass, I think the sooner the better. It is a treacherous corner. The Kalum Lake Dr overpass option seems logical as long as Park Ave is extended to allow access to downtown from the Bench. The Grand Trunk & Howe paths would have safe crossings, which is crucial.

-There are a lot of high speed traffic already on Keith Avenue. I live on Keith and I fear for people who have to walk it. To add more traffic is too much.

-Kenney Street traffic coming from Horseshoe & Bench is high. Because of the Railway actually affects traffic from BOTH directions. Students from the south side ride bikes & walk to senior schools. So a safe crossing at Kenney would be appropriate. Kalum Lake & Brooks have no traffic from both directions.



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Please feel free to add any additional comments, concerns, or ideas.

- 1. Residents living in close proximity to 3 options have not been consulted. 2. Residents are stakeholders. 3. Will the City consult with residents?

– Bandaaid solutions at best – Sande intersection would be the first project – Kenney overpass is a no go – Go back to the drawing board

– The east side of town could be helped by a pedestrian overpass from curling rink area to Irly Bird area, as tracks are fewer. Funds for GT Pathway should be diverted to make a safe pedestrian over pass for our impoverished neighbours

1 – Back to the Drawing Board 2. – Take commercial traffic into consideration 3 – Designate a truck route

– Regardless of which plan the Kenney Street should remain open and pedestrian overpasses should be built at Kenney and Kalum Street.

– It would be nice if improvements could be made to the existing overpass – landscaping completed – south approach improved so traffic flows better – New over/underpass needs to be fully landscaped and sidewalked!

– This crossing (vehicle and pedestrian) could be reconsidered and maybe eliminated as Blakeburn is only a block away. A large percentage of people heading north to south are not continuing up Kenney once they reach the highway anyway. We shouldn't cause a traffic flow that encourages people to use Lanfear Hill. Pedestrian crossing at Kalum Street could utilize some old logging equipment to create a “unique” span across the tracks. The City should consider buying the Old Roll Ind building and move the tourism info. This crossing should become a focal point encouraging Tourism traffic to stop and with the appeal of the “Little House” and the pedestrian crossing available we should be able to develop the old Coejs property int. many different venues to encourage tourist to stay and check it out.



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– The three proposals for a second Overpass/Underpass are fundamentally flawed because they repeat the worst problem of the existing Sande Overpass, which regrettably requires right angle turns of all traffic off Keith and Greig Avenues to make the track crossing. Whether we like it or not, the highway truck traffic will see an ever increasing volume of trucks, which will be getting larger, longer and more powerful. It is unfortunate that the traffic volume study was made in November when there is an absolute minimum of reefer trucks transporting seafood from landings in Prince Rupert and Alaska. Truckers and our Community will be better served with a truck route along Keith as far west as possible with a diagonal railway crossing near Frank Street. Taking the bulk of the truck traffic off the Sande Overpass will result in a much improved flow of local traffic. However, if needed one could suggest closing the Frank Street level crossing and re-locating it, as well as the closed Kenney Street crossing. To a new one opposite the foot of Kalum Lake Drive. As a confirmation of more desirable diagonal crossings please look to Highway 16 West, where all the newer overpasses (Exstew, Kasiks and Tyee) had the Highways Department build extended ones to keep them in line with the Highway direction. Also with the traffic flow through the city of Quesnel there is only one right angle turn required for the north bound traffic only.

-It is too bad Kalum St is no longer a consideration. The future planning for Terrace has shown no foresight. Sande Overpass is not good for traffic wanting to go west or to make a left turn off Keith.

- I am concerned about the traffic that will be overflowing onto Keith Avenue. There are a lot of semis and big rigs that use that street already. The few cars that use it speed. I live on the corner of Braun and Keith. I have 5 children. The added traffic would concern me because the traffic is now bad. To add more is worse.