TECHNICAL MEMORANDUM

DATE: September 10, 2014
PROJECT NO: 5861.03
PROJECT: **Wilkinson Road Corridor Improvement Traffic Management Planning Project**
SUBJECT: **Traffic Analysis**

TO: Steve Holroyd - District of Saanich

FROM: Daniel Fung / Billy Dong / Sharon Lee – Bunt & Associates

As part of the Wilkinson Road Corridor Improvement Traffic Management Planning Project, Bunt & Associates has been tasked to recommend the optimal closure scenario, brought on by construction to improve Wilkinson Road between Mann Avenue and the Quick Bottom's Trail Connection, and also any necessary mitigation measures to best minimize the traffic impacts in the study area. With that, Bunt prepared this technical memorandum to summarize the traffic analysis work performed.

This memorandum is separated into the following sections:

1. Data Collection;
2. Traffic Analysis Methodology; and
3. Conclusions & Recommendations.

1. DATA COLLECTION

As part of the project, turning movement counts and road tube data count were provided by the District of Saanich at key study intersections while some intersection short counts were performed by Bunt & Associates. The following is a listing of count information received or collected during the AM and PM peak hours:

- Mann Avenue / Wilkinson Road (May 2014);
- Miller Road / Wilkinson Road (May 2014);
- Lindsay Street / Wilkinson Road (May 2014);
- Greenlea Drive / Wilkinson Road (May 2014);
- West Saanich Road / Wilkinson Road (May 2014);
- West Saanich Road / Elk Lake Drive (May 2014);
- West Saanich Road / Viewmont Avenue (May 2014);

- West Saanich Road / Royal Oak Centre (May 2014);
- Mann Avenue / West Glanford Avenue (May 2014);
- Quadra Avenue / West Saanich Road (May 2014);
- Viaduct Avenue / Viewmont Avenue (May 2014);
- February Daily Traffic Information for Prospect Lake Road; and
- March / April Daily Traffic Information for Interurban Road.

Utilizing Ministry of Transportation and Infrastructure (MOTI) permanent count station data (Station: Royal Oak P-11-2NS – NY, Route 17, 0.5 km north of Quadra Street, Saanich) a seasonal traffic volume increase of 2% was applied to all the collected traffic counts to account for increase in traffic during the summer months.

In addition to the above information, we had also received output from the Capital Regional District's (CRD) TransCAD regional model for the existing and closure conditions (further described in Section 2.1) as guidance for the analysis.

2. TRAFFIC ANALYSIS METHODOLOGY

2.1 Closure Scenarios

The District has proposed temporary closure scenarios on Wilkinson Road between Mann Avenue and Greenlea Drive when Wilkinson Road will be improved. In order to assess the feasibility of the closures from a traffic standpoint, the following scenarios were analyzed for both the AM and PM peak hours:

- Scenario 1: Wilkinson Road closed in the Northbound direction;
- Scenario 2: Wilkinson Road closed in the Southbound direction; and
- Scenario 3: Wilkinson Road closed in both direction (Full Closure).

2.2 Trip Re-assignment

The closure or partial closure of Wilkinson Road will ultimately result in a traffic re-assignment for the road network. Bunt studied CRD's TransCAD regional model vehicle direction distributions for the existing and traffic closure scenarios, and reassigned / re-routed volumes accordingly based on existing traffic count information. **Figure 2.1** and **2.2** below show the traffic volumes for the existing condition and the full closure scenario, which we assume full re-routing of traffic within the study network, respectively.

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Exhibit 2.1

Existing Traffic Volumes

Wilkinson Road TMP
5861.03 July 2014 Scale NTS

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Exhibit 2.2

Traffic Volumes Scenario 3 - Full Closure

Wilkinson Road TMP
5861.03 July 2014 Scale NTS

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2.3 Traffic Operations Analysis

The existing operations of study area intersections and access points were assessed using the methods outlined in the 2000 Highway Capacity Manual (HCM) and was prepared using the Synchro 8.0 analysis software. The traffic operations were assessed using the Levels of Service (LOS) and Volume-to-Capacity (v/c) ratio measures of effectiveness.

The LOS rating is based on average vehicle delay and ranges from "A" to "F" based on the quality of operation at the intersection. LOS "A" represents optimal, minimal delay conditions while a LOS "F" represents an over-capacity condition with considerable congestion and/or delay. Delay is calculated in seconds and is based on the average intersection delay per vehicle.

The volume to capacity (v/c) ratio of an intersection represents ratio between the demand volume and the available capacity. Generally, a v/c ratio less than 0.85 indicate that there is sufficient capacity to accommodate demands and generally represents reasonable traffic conditions. A v/c value between 0.85 and 0.95 indicates an intersection is approaching practical capacity; a v/c ratio over 0.95 indicates that traffic demands are close to exceeding the available capacity, resulting in saturated conditions. A v/c ratio over 1.0 indicates a very congested intersection. For the purposes of construction traffic management, we have assumed a v/c ratio of 1.00 as the worst case acceptable.

3. ANALYSIS RESULTS

To outline our analysis results, the intersections of the existing conditions and the proposed closure conditions as outlined in Section 2.1, are analyzed. Note only critical intersections are reported.

3.1 Existing Conditions

Table 2.1 summarizes the operational issues of the study network under existing conditions.

Table 2.1 Operational Issues – Existing Conditions

Intersection	Peak Period	
	AM	PM
Wilkinson Road / West Saanich Road (Signalized)		Eastbound left turn movement v/c = 1.2 Overall intersection approaching capacity at v/c = 0.99
Glanford Avenue / Quadra Street (Signalized)	Overall westbound through movement approaching capacity v/c = 0.91	Overall westbound movements at LOS E/F and v/c ≈1.10
Glanford Avenue / Mann Avenue (Unsignalized)	Eastbound movement LOS F and v/c = 1.03 (stop controlled)	Eastbound movement LOS F and approach capacity at v/c = 0.95 (stop controlled)

Using the existing conditions as a base-line, the above intersections pose near or above capacity operational conditions. These intersections were evaluated based on the available existing signal timing information as provided by the District. Some of these operational issues could be improved with optimizations to the signal timing plans where intersections are signalized. Of specific note, the eastbound Glanford Avenue / Mann Avenue unsignalized intersection is currently operating near or at capacity. With most of the closure scenarios below, this movement further deteriorates since this movement fosters the most (likely) attractive route. The SB movement on Glanford Avenue has a queue of 150m in the AM and 130m in the PM peak hours, which exceeds the length of the link.

The Glanford Avenue / Quadra Street signalized intersection is nearing or at capacity with the WB queues on Quadra Street being about 155m long in the AM peak hour and 190m in the PM peak hour.

Interurban Road is generally a corridor with a 2-lane cross-section in the near vicinity of the closure area. Reviewing the March / April daily count information through various sections (near Hector Road, Grange Road, and Columbine Way), the counts ranged between 9,000 and 12,300 vehicles per day. Based on experience from other corridors, these volumes could increase 10% during the summer months, and with that, the corridor would be at near capacity conditions. This is echoed by District staff indicating the corridor peaking at 12,000 – 14,000 vehicles per day with constraints at the intersections. With the general assumption that the average daily traffic volumes equate roughly 10% of the daily peak hour volumes, we estimate the corridor to have in the order of 200 vehicles per hour (combined both directions) reserve capacity.

Prospect Lake Drive is generally a rural corridor with a 2-lane cross-section in the near vicinity of the closure area. Reviewing the February daily count information through various sections (near Munn Avenue, Viaduct Avenue, Deer Road, and Saanich Road), the counts ranged between 900 and 2,000 vehicles per day. As such, we expect there is reserve capacity available on this corridor even with potential 10-15% increases between general February and summer month counts.

Based on MOTI traffic information, Highway 17, between the Highway 17A (Royal Oak Drive) Interchange and Quadra Street Interchange houses in the order of 60,000 vehicles per day during the summer months with a 4-laned cross section. The peak hour volumes reach in the order of 5,000 vehicles. Some reserve capacity is expected to be available on the highway. An approximate conservative expectation of highway capacity would be in the range of 1,500 vehicles / hour / lane under free flow conditions.

3.2 Scenario 1: Northbound Closure Scenario

Signalized intersections for this scenario are assumed to be further optimized from the existing conditions. **Table 2.2** summarizes the operational issues of the study network with the northbound direction closure.

Table 2.2 Operational Issues – Scenario 1: NB Closure Scenario

Intersection	Peak Period	
	AM	PM
Wilkinson Road / West Saanich Road (Signalized)	-	Eastbound left movement approach capacity at v/c = 0.97
Glanford Avenue / Quadra Street (Signalized)	Overall v/c = 0.98. All movements approaching or at capacity. LOS Es for all movements.	Overall v/c = 1.01. All movements approaching or at capacity. LOS Es/Fs for all movements.
Glanford Avenue / Mann Avenue (Unsignalized)	Eastbound movement LOS F with excessive v/c ratio.	Eastbound movement LOS F with excessive v/c ratio. Overall intersection LOS E.

Although some movements for the Wilkinson Road / Saanich Road intersection approaches capacity, the re-routing of vehicles, due to the closure, will improve the intersection's overall performance from the existing conditions.

The Glanford Avenue / Quadra Street intersection will be nearing or at-capacity with NBL turn queues (180m) on Glanford Avenue exceeding past the next intersection in both the AM and PM peak hours. The WB queues on Quadra Street will be approximately 160m long in the AM peak hour and 180m in the PM peak hour.

The Glanford Avenue / Mann Avenue intersection eastbound movements will fail as a result of the stop control for the eastbound Mann Avenue approach. With the existing conditions already failing for this movement, the operations further deteriorate. Note it is expected a majority of the drivers will continue to utilize the Glanford Avenue / Mann Avenue intersection as part of detour routing and a large proportion re-routed of traffic is not expected to be feasible. Excessive queues will be created with the unsignalized configuration at this location where EBL turn movements will queue 1,290m in the AM and 880m in the PM peak periods. Also, the SB movements on Glanford Avenue will queue past the next intersection (120m) in the PM peak hour. Of note, signalization of Glanford

Avenue / Mann Avenue at this intersection would yield acceptable results for this scenario. The SB movement on Glanford Avenue will have a queue of 130m in the AM peak hour and 200m in the PM peak hour, which exceeds the length of the link.

With that, Mann Avenue is expected to foster an extra 390 / 290 vehicles during the AM / PM peak hour, while Interurban Road and Highway 17 is expected to foster an extra 70 / 100 vehicles and 80 / 125 vehicles during the AM / PM peak period, respectively. Should delay / congestion be worse than those depicted by the Highway 17 or Interurban Road traffic volumes, some traffic may choose to use Prospect Lake Road instead.

3.3 Scenario 2: Southbound Closure Scenario

Note that the signals for these intersections were further optimized (timing) from existing conditions based on the re-routed volumes. **Table 2.3** summarizes the operational issues of the study network with the southbound direction closed.

Table 2.3 Operational Issues – Scenario 2: SB Closed

Intersection	Peak Period	
	AM	PM
Wilkinson Road / West Saanich Road (Signalized)	-	Eastbound left movement approach capacity at v/c = 0.92
Glanford Avenue / Quadra Street (Signalized)	Northbound left turn movement approach capacity.	Overall v/c = 0.91. Some eastbound and westbound movements approaching capacity.
Glanford Avenue / Mann Avenue (Unsignalized)	Eastbound movement with excessive v/c ratio above capacity.	Eastbound movement with excessive v/c ratio above capacity.

Due to the re-routing of southbound vehicles accessing the West Saanich Road / Elk Lake Road intersection instead of the Wilkinson Road / West Saanich Road, the Wilkinson Road / West Saanich

Road intersection improves in operations as compared to the existing conditions with manageable queues.

The Glanford Avenue / Quadra Street intersection will be nearing or at capacity. The WB queues on Quadra Street will be approximately 100m long in the AM peak hour and 180m in the PM peak hour.

The Glanford Avenue / Mann Avenue eastbound movements will fail as a result of the stop control for the eastbound Mann Avenue approach. With the existing conditions already failing for this movement, the operations will further deteriorate with the SB movements on Glanford Avenue queuing past the next intersection in both the AM peak hour (150m) and the PM peak hour (160m). Of note, signalization of Glanford Avenue / Mann Avenue will yield generally acceptable operations results for this scenario in terms of delay and v/c ratios. After signalization, the SB movement on Glanford Avenue will have a queue of 165m in the AM peak hour and 300m in the PM peak hour, which exceeds the length of the link.

With that, Mann Avenue is expected to foster an extra 150 / 140 vehicles during the AM / PM peak hour, while Interurban Road and Highway 17 is expected to foster an extra 40 / 50 vehicles and 60 / 70 vehicles during the AM / PM peak period, respectively.

We also tested additional laning options at the Glanford Road / Quadra Street and at the Glanford Road / Mann Avenue intersections. By including a southbound right turn lane (approximately 50m) at the Glanford Avenue / Mann Avenue intersection (and assuming the existing shared through and right turn lane will be a through only lane), the intersection operates acceptably with southbound queues to be in the order of 145m during the PM peak hour. Although queues still extend onto the next intersection (Quadra Street / Glanford Road), the queue will be reduced significantly as compared to existing laning configurations. Northbound improvements, either at the Glanford Avenue / Mann Avenue intersection or the Glanford Avenue / Quadra Street intersection only improves the intersections minimally.

3.4 Scenario 3: Full Closure Scenario

Similar to the above two Scenarios, signalized intersections for Scenario 3 are assumed to be further optimized from the existing case. **Table 2.4** summarizes the operational issues of the study network with both directions closed.

Table 2.4 Operational Issues – Scenario 3: Full Closure

Intersection	Peak Period	
	AM	PM
Glanford Avenue / Quadra Street (Signalized)	Overall v/c = 0.98. All movements approaching or above capacity.	Overall v/c = 1.01. All movements approaching or above capacity.
Glanford Avenue / Mann Avenue (Unsignalized)	Eastbound movement LOS F with excessive v/c ratio capacity.	Eastbound movement LOS F with excessive v/c ratio above capacity.

Due to diversion of some of the Wilkinson Road / West Saanich Road intersection volumes to Elk Lake Road / West Saanich Road, the Wilkinson Road / West Saanich Road intersection will improve as compared to the existing conditions with manageable queues.

The Glanford Avenue / Quadra Street intersection will be at the fringe of failure with NBL turn queues (180m) on Glanford Avenue exceeding past the next intersection in both the AM and PM peak hours. The WB queues on Quadra Street are about 160m long in the AM peak hour and 200m in the PM peak hour. This is expected based on the already near capacity operations during the existing conditions however, it must be noted that the general delay will be within acceptable levels.

The Glanford Avenue / Mann Avenue intersection eastbound movements will fail as a result of the stop control for the eastbound Mann Avenue approach with the EBL turn movements will have a queue of approximately 1,160m in the AM and 1,190m in the PM peak periods. The SB movements on Glanford Avenue will have queues past the next intersection (140m) in the PM peak hour. The failure will be further emphasized with additional traffic from both northbound and southbound detour vehicle routing. With the detoured volumes, signalization of this intersection will still yield unfavorable results.

Testing of additional laning options at the Glanford Road / Quadra Street intersection or at the Glanford Road / Mann Avenue intersections were conducted. By including a southbound right turn lane (approximately 50m) at the Glanford Avenue / Mann Avenue intersection (and assuming the existing shared through and right turn lane will be a through only lane), the intersection operates

acceptably with southbound queues in the order of 150m. Although queues will still extend onto the next intersection (Quadra Street / Glanford Road), the queue will be reduced significantly as compared to existing laning configurations. Northbound improvements, either at the Glanford Avenue / Mann Avenue intersection or the Glanford Avenue / Quadra Street intersection only improves the intersections minimally.

As further study (to the Glanford Avenue / Mann Avenue intersection), we further re-routed approximately 100 vehicles per hour (50 vehicles / hour for the eastbound left turn movement and 50 vehicles / hour for the southbound right turn movement) anticipating that commuters would redirect themselves to less congested routes once they have gotten used to traffic patterns during construction. With this further re-route of 100 vehicles, this signalized intersection will operate within acceptable manner. The SB movement on Glanford Avenue will have a queue of 190m in the AM and 300m in the PM, which exceeds the length of the link. Mann Avenue is expected to foster an extra 540 / 430 vehicles during the AM / PM peak hour, while Interurban Road and Highway 17 is expected to foster an extra 110 / 150 vehicles and 140 / 195 vehicles during the AM / PM peak period, respectively.

4. CONCLUSIONS & RECOMMENDATIONS

- Under existing conditions, Glanford Avenue / Quadra Street and Glanford Avenue and Mann Avenue intersections are already approaching capacity. In order for the diverted traffic to operate within acceptable manner at the Glanford Avenue / Mann Avenue intersection, signalization is required. We expect a signal would cost in the order $150,000 to $250,000. Note that signalization analysis was conducted for Glanford Avenue / Mann Avenue to be on one controller or two separate controllers with Glanford Avenue / Quadra Avenue. It was found that the two intersections will need to be operated as two separate signals (coordinated if/where appropriate) in order to yield acceptable operations for the base case (existing conditions).

- The northbound closure scenario (Scenario 1) will create challenging operation conditions for both the AM and PM peak hours. Both the southbound closure scenario (Scenario 2) and the full closure scenario (Scenario 3) will be favorable options during construction with the southbound closure scenario producing the least overall impacts to the network as a whole.