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URBANSYSTEMS.

MEMORANDUM

date: October 15, 2007
to: Dave Gold, C.Tech - District of Peachland
cc: Dan Huang, MCIP - Urban Systems Ltd.
from: Sheldon Gull, ASCT
file #: 0655.0131.01
subject: **Princeton Avenue Upgrade**

The purpose of this memorandum is to summarize the work that has been completed regarding the Princeton Avenue Upgrade project. The various concepts upon which this document is based will be described and a brief evaluation of their respective benefits, costs, and potential impacts will be provided in this memo.

Background

Princeton Avenue is one of two Arterial roads within the District of Peachland as identified in its Roadway Network Plan, May 2004. This road services much of the southern portion of the municipality, and provides the major feeder spine from upland Collector roads including Somerset, Lipsett, and Turner Avenues. In April 2005, the District updated its Development Cost Charge program identified Princeton Avenue, from Columbia Avenue to Turner Avenue (approximately 1680 metres), as a road DCC within the 20 year horizon. Princeton Avenue upgrades from Turner Avenue to the municipal boundary were envisioned beyond the 20 year horizon. The estimated cost and subsequent DCC were based on conceptual level design, with additional concept development and analysis recommended as development proceeds.

Due to the increasing level of development in recent years (current and proposed applications) that will utilize the Princeton Avenue corridor, the timing is appropriate to undertake more detailed concept design for this arterial road. Although there were some minor roadway and sidewalk improvements to Princeton Avenue between Highway 97 and Columbia Avenue as part of the sanitary sewer project, it is now apparent that a new and consistent concept should be developed starting at Highway 97.

For this assignment, the scope and budget allowed for detailed survey and concept development for Princeton Avenue from Highway 97 to Blacksmith Place, and detailed intersection analysis for Princeton/Lakeview, Princeton/Princess, and Princeton/Columbia. A baseline intersection improvement has been assumed for Princeton/Lipsett, as the scope and budget did not allow for detailed survey or concept development of this intersection. The Princeton/Somerset intersection was analysed by Urban Systems and discussed with District staff and Council as part of a previous exercise. A design and cost estimate has been extrapolated for Princeton Avenue improvements between Blacksmith Place and Ellison Avenue, which forms the extent of this concept development. Finally, it should be noted that any proposed road alignments identified as part of the Lower Princeton Neighbourhood Plan, under preparation by private developers in the area, should coordinate with the concept design proposed in this memo.

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Princeton Avenue – Main Corridor

The objective of this exercise was to examine the existing road alignment and cross-section and to provide conceptual design for an improved roadway that would accommodate current and projected traffic volumes while providing safe passageway for both pedestrians and cyclists. Some of the design criteria used for the Princeton Avenue upgrade concept are as follows:

- Upgrade road to the "Arterial Cross-Section – Urban 20m Right-of-Way" as identified in the District's *Roadway Network Plan*. The cross-section includes concrete curb and gutter (both sides), sidewalk (north side), and two shared cyclist/vehicle travel lanes (one each direction of travel);
- Upgrade storm drainage system as needed to provide adequate storm drainage collection from the roadway; and
- Limit impacts to landscape and private property wherever possible.

Further to the main corridor, we examined the feasibility of upgrading the intersections of Columbia Ave / Princeton Ave and Princess Street / Princeton Ave in order to increase sight lines and accommodate easier vehicle turn-movements while preserving or increasing user safety.

The Princeton Avenue Upgrade design is a culmination of those efforts noted above along with past conceptual design, completed in March 2006, for the Somerset Ave/Princeton Ave Intersection.

Princeton Ave./Princess St. and Princeton Ave./Columbia Ave. Intersection Concept

In July 2007, as a first step to this conceptual design process, USL reviewed the existing intersections of Princeton Avenue with both Columbia Avenue and Princess Street. Keeping with the above noted design criteria and terms of reference, three concepts along with benefit-analysis were developed.

A couple of properties adjacent to the area were currently under redevelopment so there was opportunity to revise the intersection alignments to maximize potential while negotiating with the developers over small land impacts.

It was determined that "Concept #4" provided the greatest benefits to all users and has therefore been incorporated into the Princeton Avenue conceptual design and cost estimate. Refer to "Figure 4" attached.

Princeton / Somerset Intersection Concept Development

In order to address the various issues at the intersection of Princeton Avenue and Somerset Avenue, several improvement concepts were developed. Key design constraints at this intersection included:

- Significant grades along both Princeton Avenue and Somerset Avenue.
- Restricted Sight Distance due to the large 'Heritage' tree within the existing intersection.

- The desire to accommodate the 'Heritage' tree in any proposed design, if possible.
- The desire to accommodate projected future traffic growth, as described above.

The Somerset Intersection concept included in this Princeton Avenue upgrade is based on "Concept #2" of earlier work completed by USL in March 2006 (Princeton Avenue Intersection Improvements – USL project #0655.0121.01). Concept #2 was recommended by USL as the best solution in order to fulfill the design constraints noted above. Concept #2 was developed to take advantage of an alternate alignment in order to improve the intersection, while avoiding any impact to the 'Heritage' tree. By re-aligning Somerset Avenue to the west, grades approaching Princeton Avenue can be improved to less than 3%. In addition, the angle of intersection and sight distance can be improved, as well as accommodating proper lane channelization. A westbound right turn lane with an acceleration lane on Somerset Avenue is included. In this concept, both overall intersection capacity and intersection safety can be expected to improve. This concept would be expected to provide adequate service to traffic projected for the proposed developments on Somerset Avenue. While this concept provides the greatest improvement to intersection operation and safety, property impacts and construction costs would be significant.

Some of this cost may be deferred by the fact that land east of the new alignment may potentially be reclaimed for other uses (such as a district fire hall).

Note: Highlighted items have changed since the writing of the original memo.

Cost Estimates

Schedules of quantities and prices have been calculated for the Princeton Avenue upgrades in three phases and have been attached to this document. These phases have been identified based on their ability to be constructed independent of each other but can also be combined to work in conjunction with each other. The following is a breakdown of the phasing with station 10+000 located at the intersection of Princeton Avenue and Highway 97:

Station: 10+000 – 10+230 (Lower Phase)

Basic road widening and improvements with minimal upgrades to intersections.

Station 10+230 – 10+800 (Middle Phase)

Roadway and intersection re-alignments (Columbia Ave, Princess Street and Somerset Ave) along with storm drainage system extension and upgrade.

Station 10+800 – 11+330 (Upper Phase)

Basic road widening and improvements with minimal upgrades to intersections. Storm drainage system extension and upgrade.

There was insufficient survey data to provide a detailed analysis for roadway improvements from Sta. 11+330 to the intersection of Princeton Ave/Ellison Ave (Station 11+570) but improvement would likely be similar to those identified in the "Upper Phase" and therefore a per linear meter cost could be extracted from the "Upper Phase" estimate and applied to this area for budget purposes.

$\$1,009,798.40 \div (11330\text{m} - 10800\text{m}) \approx \$1,905/\text{m}$
Therefore, $\$1,905/\text{m} \times (11570\text{m} - 11330\text{m}) = \$457,200.00$

Please keep in mind that these preliminary cost estimates do not include the cost of any potential utility impacts, the cost of property acquisitions, or any unknown geotechnical conditions.

Summary and Recommendations

Based on the ground survey and the parameters outlined for this exercise (roadway cross-section, sightline improvements, existing driveway preservation, and so forth), the estimated budgetary cost estimates for Princeton Avenue upgrades between Highway 97 to Ellison Road are as follows:

Station	Distance	Budget Estimate (Including construction, E&C, and GST)	Estimated Cost per Lineal Metre
10+000 to 10+230	230 metres	\$283,921.40	\$1,235
10+230 to 10+800	570 metres	\$1,999,832.84 (Includes Intersection Improvements)	\$3,500
10+800 to 11+330	530 metres	\$1,009,798.40	\$1,905
11+330 to 11+570	240 metres	\$457,200.00 (extrapolated)	\$1,905
TOTAL	1,570 metres	\$3,750,752.64	\$2,390

Please consider the above information and the conceptual design that has been proposed. As you are aware, the constraints of topography, property impacts, and heritage concerns in this area make the conditions for any proposed improvements challenging.

We trust that this information has been helpful and will aid in the decision making and budgeting process. Please keep in mind that this design and cost estimates were developed only at a conceptual design level and that if the conceptual design is advanced to detailed design the results of this work (including cost estimates) could be expected to change with improved data. Please do not hesitate to undersigned if you have any questions or require clarification of this memo.

Sincerely,
URBAN SYSTEMS LTD.



Sheldon Gull, ASCT
Senior Technologist

Reviewed by:



Dan Huang, M.U.R.P., MCIP
Senior Planner / Principal

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MEMORANDUM

date: March 30, 2006
to: Dave Gold - District of Peachland
cc: Ian Chapman & Dick Fletcher – Urban Systems Ltd.
from: James Donnelly, P.Eng.
file #: 0655.0121.01
subject: **Princeton Avenue Intersection Improvements (revised)**

The purpose of this memorandum is to summarize the work that has been completed regarding the Princeton Avenue Intersection Improvement project. The various Improvement concepts will be described and a brief evaluation of their respective benefits, costs, and impacts will be provided.

Background

The Intersection of Princeton Avenue and Somerset Avenue on Peachland has long been identified as a concern due to its irregular configuration and limited sight distance. The *District of Peachland Roadway Network Plan* states that *'the key issue at this intersection is limited sight distance to the west. Sight distance can be increased and the overall safety of the intersection improved by diverting Somerset Avenue to the east of the large tree which is currently located in the centre of the roadway at the intersection. As well, the southbound approach lane should be at least 5 m wide at the intersection, so that left turning vehicles do not impede right-turning vehicles.'* Increased development activity levels in the immediate area will increase the volume of traffic making use of this intersection, and the District of Peachland is investigating opportunities to improve its configuration and enhance public safety.

The *District of Peachland Roadway Network Plan* has also identified the intersection of Princeton Avenue and Lipsett Avenue as requiring improvement. As described in the above document *'key issues at this intersection include limited sight distance to the west and a sharp eastbound-to-southbound right turn which is difficult for larger vehicles to negotiate.'*

The purpose of this assignment was to re-visit the above with the purpose to develop improvement concepts at each intersection. The goal was to provide potential improvement concepts (at a conceptual design level only), including preliminary cost and impact assessments. This would serve to aid the decision-making process and would aim to achieve consensus on a preferred alternative.

Princeton / Somerset Traffic Analysis

In addition to the existing geometric deficiencies at the intersection of Princeton Avenue and Somerset Avenue, proposed development in the area will result in significantly increased traffic volumes using this intersection. In order to better understand the future requirements of this intersection, traffic forecasts were developed based on what was known at the time regarding proposed developments in the area. In

consultation with the District of Peachland it was assumed that the following development would occur along Somerset Avenue:

- 1,200 Residential Units
 - 70% retired/recreational
 - 30% single family/working
- 36 Holes of Golf
- Recreational Facility (Curling Club?)
 - The closest similar facility found in the ITE Trip Generation Manual was a Racquet Club.

Trip Generation

For the PM Peak hour the total new trips generated, based on the above development and standard ITE trip generation rates, and are estimated to be:

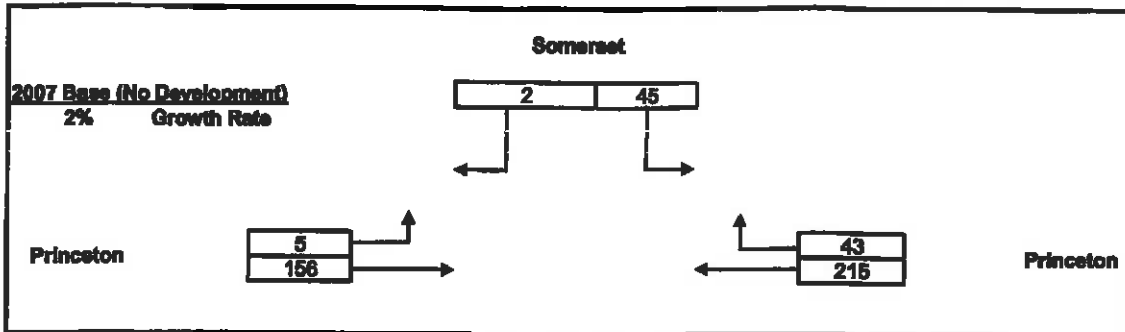
- Total New Residential Trips = 590 (350 in / 240 out)
- Golf Course = 100 (40 in / 60 out)
- Recreational Facility = 60 (30 in / 30 out)
- **Total of 750 new trips (420 in / 330 out)**

Based on a 70/30 split of Development traffic between a Somerset Ave. access and a Ponderosa Dr. access the following new trips can be expected at the Princeton Ave. / Somerset Ave. Intersection:

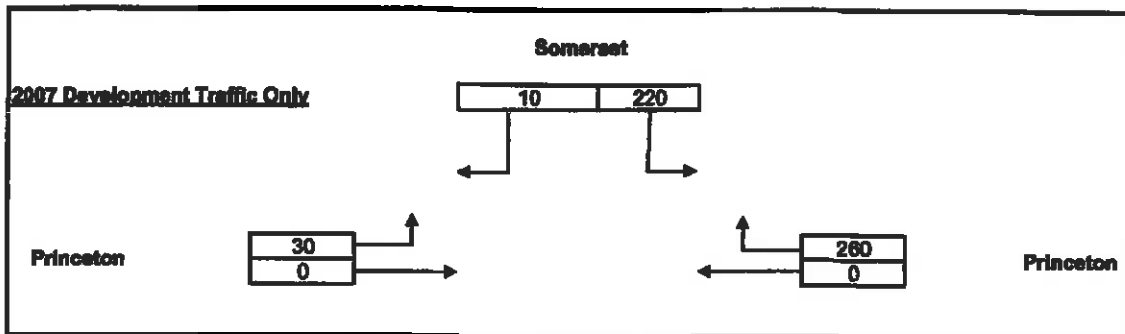
- **Total of 520 new trips (290 in / 230 out)**

Trip Assignment

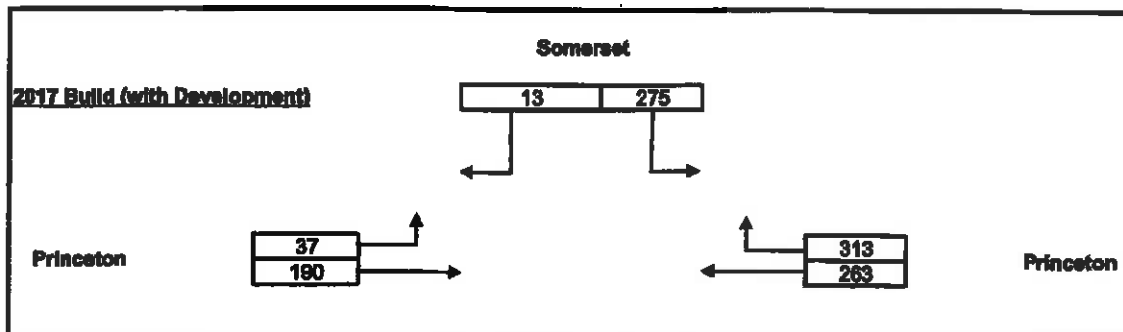
In 2003, manual traffic counts were undertaken at this and other Intersections within Peachland in support of the 2004 Road Network Plan. Using the Afternoon Peak Hour observed traffic counts from the Princeton Ave. / Somerset Ave. intersection and a background traffic growth rate, projected 2007 traffic conditions can be estimated. 2007 has been assumed as the "opening day" of the proposed development and based on a 2% per year background traffic growth rate, which is typically used in the Okanagan region, the following Base Traffic Volumes (not including any new development) are forecast for 2007:



Using the above observed turning percentages at the intersection, in addition to the trip generation numbers the following development traffic can be expected to be added to the Princeton Ave. / Somerset Ave. intersection:



As would be expected the majority of traffic from this primarily residential development will likely travel to and from Highway 97 via the Princeton Ave. / Somerset Ave Intersection. When the above development traffic is added to the 2007 Base traffic volumes, the 2007 Build Traffic volumes are as follows:

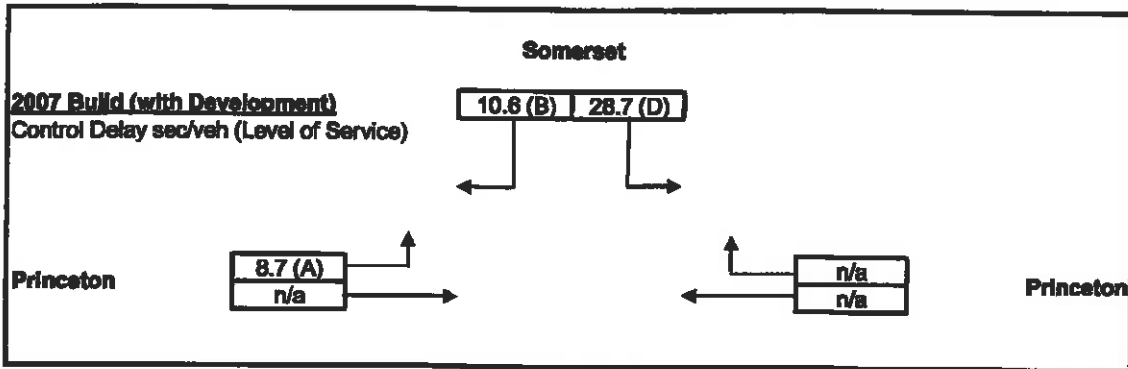


Level of Service Analysis

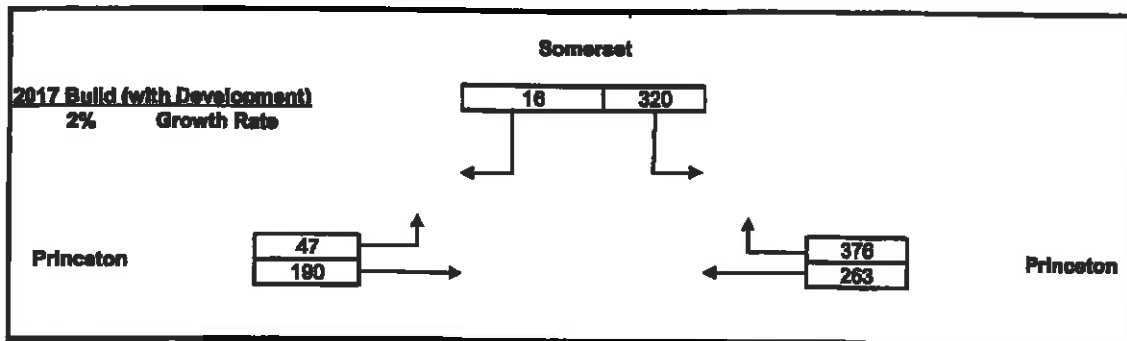
An analysis of this intersection using Highway Capacity Software (HCS) was completed. According to the Highway Capacity Manual (HCM) level of service expectations for unsignalized intersections are as follows:

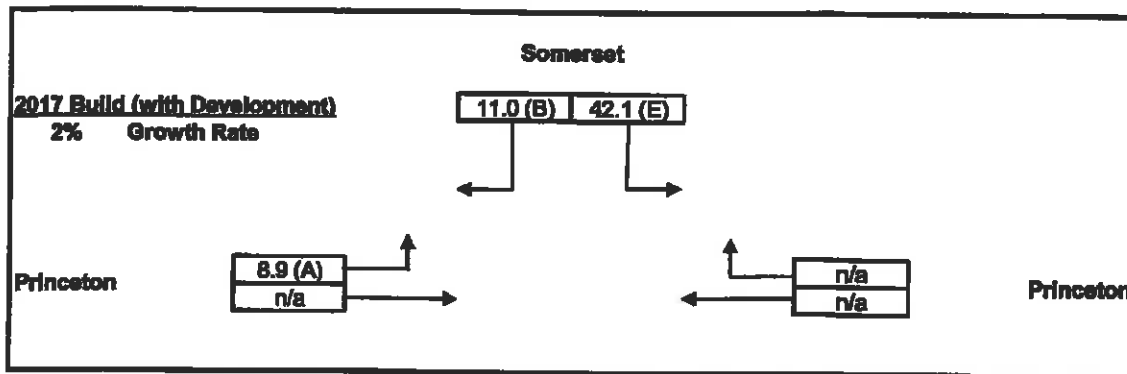
Level of Service	Avg. Control Delay (sec/veh)
A	0-10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

Typically Level of Service (LOS) "E" or better is desirable on non-Ministry of Transportation roads. The 2007 Build Level of Service results are shown below:



A projection of traffic volumes to the year 2017 (opening day + 10 years) was also considered and the following traffic volumes and LOS results were found:





As is shown above, the southbound left turn from Somerset Ave. is the critical movement and is showing a LOS E. While delays at this location would be significant, keeping in mind the relatively large number of vehicles making this movement, this would normally be considered acceptable. Improvements to the alternate access via Ponderosa Drive may positively impact the Princeton Ave. / Somerset Intersection. It should be noted that under this assumption Ponderosa Drive would be required to accommodate approximately 160 new trips in the afternoon peak hour. Increased use of Ponderosa Drive by development traffic would improve the operation of the intersection, conversely if Ponderosa Drive is unable to accommodate this level of traffic performance at the Princeton Ave. / Somerset Ave. Intersection could be degraded to levels which may not be deemed acceptable.

Please keep in mind that this analysis is very preliminary and based on several assumptions as has been discussed in our past meetings. Without knowing additional details regarding the specific type and use of the proposed development it is difficult to confidently predict its impact on the adjacent road system. Any change in the scope or type of development from what was assumed here could significantly alter the results of this analysis. The above analysis assumes that the intersection will operate as efficiently as possible, and would have adequate sight distances, proper lane channelization for the southbound left and right turn movements, and an improved westbound right turn lane; all of which will be incorporated into the final design for this upgraded intersection, as per the goals of this project.

Princeton / Somerset Concept Development

In order to address the various issues at the intersection of Princeton Avenue and Somerset Avenue, several improvement concepts were developed. Key design constraints at this intersection included:

- Significant grades along both Princeton Avenue and Somerset Avenue.
- Restricted Sight Distance due to the large 'Heritage' tree within the existing intersection.
- The desire to accommodate the 'Heritage' tree in any proposed design, if possible.
- The desire to accommodate projected future traffic growth, as described above.

Three separate Intersection Concepts were developed, they are as follows:

Concept 1:

Concept 1 was developed to maintain the existing right-of-way as much as possible and to accommodate the 'Heritage' tree, while providing a limited level of improvement to the intersection's configuration. In this concept all southbound movements on Somerset Avenue are made on the west side of the 'Heritage' tree, while the left and right turns from Princeton Avenue on to northbound Somerset Avenue occur on the east side of the tree. These modifications, in conjunction with enhanced signage, paint markings, and raised channelization islands, would result in a less confusing intersection configuration. A westbound right turn lane with an acceleration lane on Somerset Avenue would provide some improvement to traffic operation for this movement, however all other movements would not benefit from significantly increased capacity with this proposed concept. Grades and sight distance are not significantly improved, and apart from the provision of improved delineation and crosswalks any improvement to intersection safety would be expected to be minimal. This concept would not accommodate the forecasted demands of the proposed developments described above. In order to minimize property impacts; a lock-block wall and barrier has been included along the east side of Somerset Avenue; in addition the existing ditch along Princeton Avenue has been replaced by a closed storm system through the intersection.

The cost of this concept is estimated to be **\$444,000.00 + GST** (Includes engineering services and contingency allowance). Please keep in mind that this preliminary cost estimate **does not** include the cost of any potential utility impacts, the cost of property acquisitions, or any unknown geotechnical conditions. Please see the attached drawings of Concept 1.

Concept 2:

This concept was developed to take advantage of an alternate alignment in order to improve the intersection, while avoiding any impact to the 'Heritage' tree. By re-aligning Somerset Avenue to the west grades approaching Princeton Avenue can be improved to less than 3%. In addition, the angle of intersection and sight distance can be improved, in addition to proper lane channelization. As with Concept 1, a westbound right turn lane with an acceleration lane on Somerset Avenue is included. Please note that in order to avoid any impact to the 'Heritage' tree; the deceleration lane on the westbound right turn would need to taper directly from the through lane. In this case, on an uphill grade a deceleration lane is not considered essential, however some reduction in westbound capacity would be expected due to vehicles needing to slow within the travel lane. If this concept is advanced, it may be possible to explore moving the alignment further west in order to provide increased westbound right-turn deceleration and taper distance. This would come at the expense of increased property impacts to the west. In this concept, both overall intersection capacity and intersection safety can be expected to improve. This concept would be expected to provide adequate service to traffic projected for the

proposed developments on Somerset Avenue. While this concept provides the greatest improvement to intersection operation and safety, property impacts and construction costs would be significant.

The cost of this concept is estimated to be **\$466,000.00 + GST** (Includes engineering services and contingency allowance). Please keep in mind that this preliminary cost estimate does not include the cost of any potential utility impacts, the cost of property acquisitions, or any unknown geotechnical conditions. Some of this cost may be deferred by the fact that land east of the new alignment may potentially be re-claimed for other uses (such as a district fire hall). Along with the attached drawings of this concept, a section has been taken through this area for the purposes of investigating any future land use.

Concept 3:

For the purposes of comparison, a final concept was developed which assumed the removal of the 'Heritage' tree and minimized impacts to property. As with the previous concepts a westbound right turn lane with an acceleration lane on Somerset Avenue is included. The angle of intersection and sight distance is improved, and this more standard configuration would result in greater intersection performance. However, by maintaining the existing alignment grades along Somerset Avenue can not be improved.

The cost of this concept is estimated to be **\$193,000.00 + GST** (Includes engineering services and contingency allowance). Please keep in mind that this preliminary cost estimate does not include the cost of any potential utility impacts, the cost of property acquisitions, or any unknown geotechnical conditions. Please see the attached drawings of Concept 1.

Princeton / Lipsett Concept Development

In order to address concerns at the intersection of Princeton Avenue / Lipsett Avenue, only one concept was developed. As described in the *District of Peachland Roadway Network Plan 'key issues at this intersection include limited sight distance to the west and a sharp eastbound-to-southbound right turn which is difficult for larger vehicles to negotiate.'* With no significant developments or associated traffic growth anticipated at this intersection, only geometric concerns were considered.

In order to improve sight distance from Lipsett Avenue looking west, this concept proposes the cutting back of the bank to the north of Princeton Avenue. As shown in the attached drawings, this would involve impacts to three properties and would require the consolidation of two driveway accesses to these properties. Increased pavement width at the intersection allows vehicles up to WB-15 in size to negotiate the eastbound-to-southbound right turn; however this movement would likely involve some off-tracking into opposing travel lanes. The cost of this concept is estimated to be **\$89,000.00 + GST** (Includes engineering services and contingency allowance). Please keep in mind that this preliminary cost estimate does not include the cost of any potential utility impacts, the cost of property acquisitions, or any unknown geotechnical conditions.

Recommendations

Please consider the above information and the various concepts that have been proposed. As you are well aware the constraints of topography, property impacts, and heritage concerns in this area make the conditions for any proposed improvements difficult. However, once these concerns have been considered it is apparent that at the intersection of Princeton Avenue / Somerset Avenue only Concept 2 provides any significant improvement to intersection safety and operation. This concept is also the most likely to accommodate traffic growth projected due to potential development along Somerset Avenue.

I trust that this information has been helpful and will aid in the decision making process. Please keep in mind that these concepts and cost estimates were developed only at a conceptual design level and that if a preferred concept is advanced to detailed design the results of this work (including cost estimates) could be expected to change with improved data. As always, please do not hesitate to contact me if you have any questions or concerns.

Sincerely,

URBAN SYSTEMS LTD.


James Donnelly, P.Eng.

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