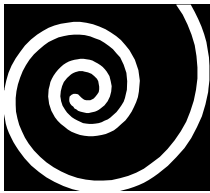


APPENDIX B



TRAFFIC SUMMARY



**TRAFFIC REVIEW FOR
THE PROPOSED OKANAGAN HILLS
NEIGHBOURHOOD PLAN
VERNON, BRITISH COLUMBIA**

**Engineering and
Planning Consultants**



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Quality Assured*

**TRAFFIC REVIEW FOR
THE PROPOSED OKANAGAN HILLS
NEIGHBOURHOOD PLAN
VERNON, BRITISH COLUMBIA**

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October 2003

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EXECUTIVE SUMMARY

A neighbourhood plan is being prepared for the Okanagan Hills community which is located some 3.5 kilometres west of downtown Vernon in the Bella Vista Highlands District. The development area is approximately 297 hectares (735 acres) and is proposed to support a diversity of low-density resort residential uses, village resort commercial, working vineyard and retail winery, golf course and a network of linear parks, natural open spaces and recreational trails.

The development is planned to consist of approximately 1,200 recreation residential units. The residential units are planned to be terraced, ground oriented single-family and multi-family homes and estate villas with a variety of lot sizes. They are situated within the low density residential precinct along the southern boundary of the development area, as well as on the upper plateau to the north. Of the 1,200 residential units, 65 percent will be used as homes and 35 percent will be used as rental units for golfers and visitors.

The Tourist Commercial uses include approximately 50,000 square feet of retail space, and a 150-room hotel and conference facility for 400 persons. In addition, an 18-hole golf course with a club house winds through the upper neighbourhood terraces and narrow valley glen, beginning and terminating at the Village Centre. The development is assumed to be completed in 15 years.

The purpose of this traffic review is to identify development traffic impacts to the following four intersections on Bella Vista Road: Entrance Road, Tronson Road, Appaloosa Road and 41st Street. A road safety review for Bella Vista Road between Tronson Road and 41st Street was also conducted.

Traffic from the proposed development was forecast based on the results of the Predator Ridge Golf Resort customer survey (*Commonage Road Traffic Profile*, Hamilton Associates, August 2003). The current Predator Ridge Golf Course marketing theme of “Come Play, Come Stay” has been quite successful. This theme will reduce traffic generation. The traffic generated by the conference facility will also be reduced because participants will stay at the hotel and cottages.

The traffic review included the analyses of base traffic without development to the year 2018. Base traffic was assumed to grow at a compounded annual rate of three percent. While this rate may be applicable to the downtown area, it may be considered conservatively high for Bella Vista Road.

The traffic analysis indicated that the critical traffic issue is located at the intersection of Bella Vista Road and 41st Street. Current traffic conditions (without the Okanagan Hills development) warrant the installation of a traffic signal and a left turn bay for westbound traffic, with general geometric improvements. The left turn bay should be approximately 20 metres in length depending on traffic growth. These improvements should be provided at the earliest available opportunity.

The improved intersection is anticipated to be adequate to accommodate base traffic growth and Okanagan Hills development traffic to the year 2018. Towards the year 2015, and depending on base traffic growth, the eastbound through movement is anticipated to approach Level of Service E. While this Level of Service is not considered critical, traffic should be reviewed at that time to consider the provision of two eastbound through lanes. Improvements to other studied intersections are not required.

The efficiency of Bella Vista Road could be improved by installing consistent and uniform curves and speed signing, Chevron signing and delineation. Some sections of the road could benefit from the installation of barriers along steep embankments. In addition to these improvements, the width of Bella Vista could be increased to accommodate both pedestrians and bicycles. However, it should be noted that these are current road operation issues and not a result of the proposed Okanagan Hills development.

This review concluded that the current road system, with the improvement of the Bella Vista Road and 41st Street intersection, will accommodate the traffic generated by the Okanagan Hills development.

1.0 INTRODUCTION

1.1 Background

A neighbourhood plan is being prepared for the Okanagan Hills community which is located some 3.5 kilometres west of downtown Vernon in the Bella Vista Highlands district. The development area is approximately 297 hectares (735 acres) and is planned for a diversity of low-density resort residential uses, village resort commercial, working vineyard and retail winery, golf course and a network of linear parks, natural open spaces and recreational trails.

The development is planned to consist of approximately 1,200 recreation residential units. The residential units are planned to be terraced, ground oriented single-family and multi-family homes and estate villas with a variety of lot sizes. They are situated within the low density residential precinct along the southern boundary of the development area, as well as on the upper plateau to the north. Of the 1,200 residential units, 65 percent will be used as homes and 35 percent will be used as rental units for golfers and visitors.

The Tourist Commercial uses include approximately 50,000 square feet of retail space area, 150 room hotel and conference facility for 400 persons. In addition, an 18-hole golf course with a club house, winds through the upper neighbourhood terraces and narrow valley glen, beginning and terminating at the Village Centre. The development is assumed to be completed in 15 years.

The location of the Okanagan Hills development site is shown in FIGURE 1.1 and a preliminary land use plan is shown in FIGURE 1.2.

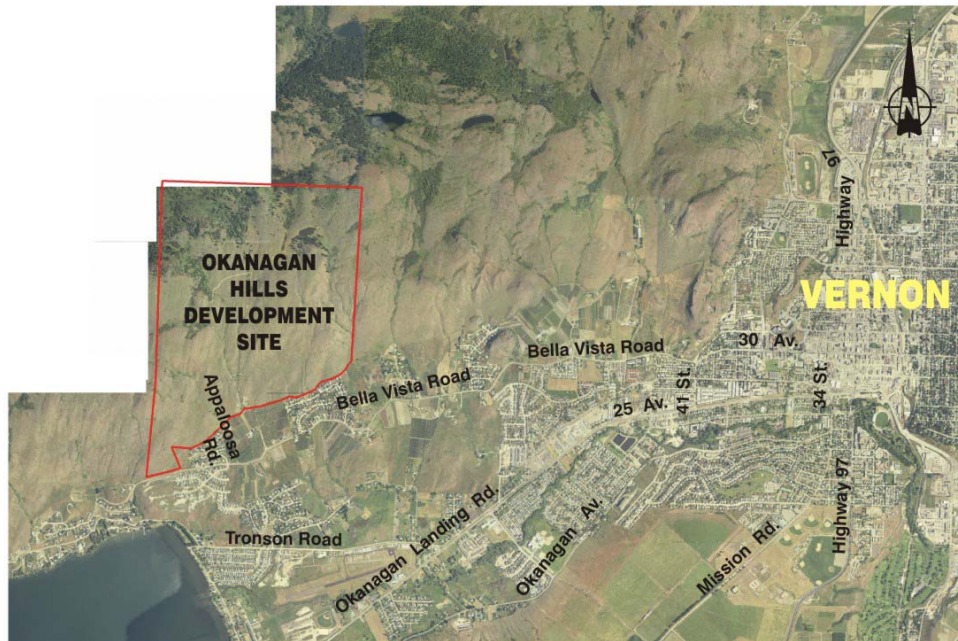
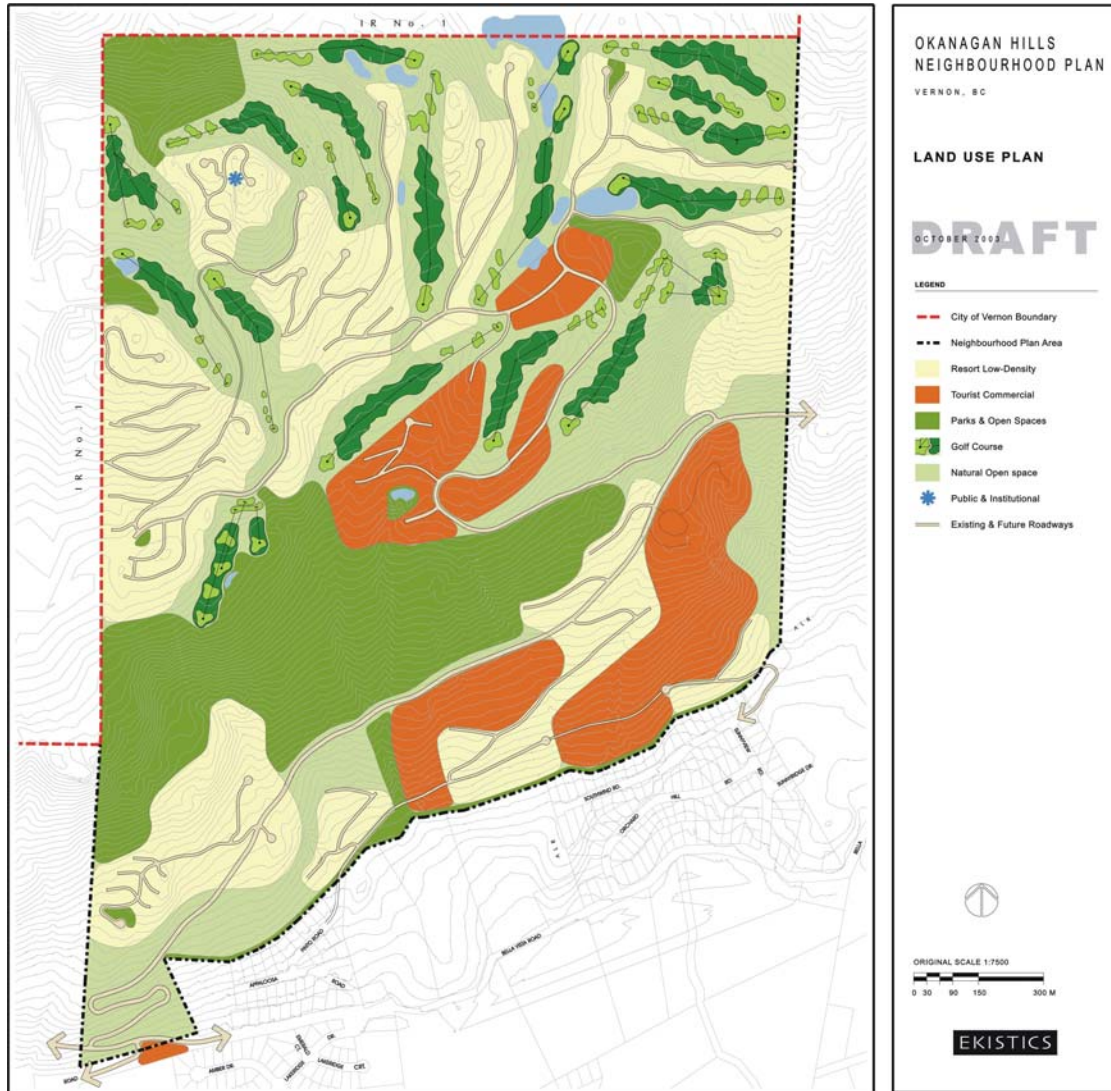


FIGURE 1.1 SITE LOCATION PLAN

1.2 Study Objectives

The objective of this study is to provide input and support to the preparation of the Neighbourhood Plan. Specifically, the study analyzed the following:

- Traffic generations and distributions of the Proposed Neighbourhood Plan;
- The capacity performance of the intersections of:
 - Development Access Road at Bella Vista Road;
 - Bella Vista Road and Tronson Road;
 - Bella Vista Road and Appaloosa Road; and
 - Bella Vista Road and 41st Street.
- The identification of roadway improvement requirements, if any.



**FIGURE 1.2 THE PROPOSED OKANAGAN HILLS
NEIGHBOURHOOD PLAN**

1.3 Study Methodology

The study was completed by taking the following steps:

- A. Conducting traffic counts at three study intersections;
- B. The determination of traffic generation rates and directional distribution for various land uses;
- C. The simulation of traffic distributions and the evaluation of capacity performance of the four intersections described above by using the computer modeling software VISSIM and Synchro. The evaluations were conducted for the weekday morning and afternoon peak periods.
- D. The identification of improvement options when Levels of Service of traffic movements at the four study intersections are E or worse;
- E. The review of findings with the City of Vernon; and
- F. The preparation of draft and final reports.

2.0 DEVELOPMENT TRAFFIC VOLUME FORECAST

The traffic characteristics of the Okanagan Hills development are anticipated to be similar to those of Predator Ridge Golf Resort, which consists of similar development components. The estimations of traffic generation by this development are based on the survey conducted for the Predator Ridge Golf Resort, documented in Commonage Road Traffic Profile, by Hamilton Associates, dated August 2003. Copies of this report were submitted to the City of Vernon.

2.1 Trip Generation by Golf Course Operation

A. Travel Survey of Golf Customers

The proposed golf course operation and residential development will be similar to the Predator Ridge Golf Resort. The Predator Ridge Golf Resort's marketing plan is based on the "Come Play, Come Stay" theme. Surveys of golf customers were conducted in July 27, 2003 to determine their origins. With the "Come Play, Come Stay" theme, and taking into account marketing changes to areas outside of Vernon, 25 percent of golf course traffic is assumed to be from Vernon. The remaining 75 percent is considered to be from the south using Highway 97.

B. Trips Generated by Golf Operation

Trip Generation, 6th Edition, 1997, published by the Institute of Transportation Engineers indicates that golf course operation generates 2.22 vehicles per hole during weekday morning peak hour and 2.74 during weekday afternoon peak hour. According to the 2003 survey, 53 percent of the golf customers are residents and guests staying at the guest cottages, thus resulting in a reduced peak hour trip generation rate. Based on the survey results, an average of 30 percent trip reduction is anticipated for golfers who play golf and stay at the cottages and lodges. The 2003 survey has also indicated that 13 percent of golfers arrived by air. This percentage is anticipated to increase over time. In this study, an average of 20 percent reduction in trip generation is anticipated with air travel and then shuttle bus services.

The adjusted peak hour trip generation rates by the golf course operation are shown in TABLE 2.1. It should be noted that the golf season in Vernon is between mid-April to September, approximately six months. The golf course closes its operation during winter months.

TABLE 2.1 GOLF COURSE TRIP GENERATION

DESCRIPTION	AM PEAK HOUR	PM PEAK HOUR
ITE Rates	2.22 vehicles per hole	2.74 vehicles per hole
Adjustment Factor	Less 50%	Less 50%
Trips per hour For 18 Holes	20	25
Origin Direction	10% Vernon & North 90% South	10% Vernon & North 90% South

2.2 Trip Generation by Guest Cottages

A. Travel Survey of Guest Cottages

Survey results of guests using cottages at Predator Ridge Golf Resort indicated that 96 percent came from areas outside Vernon; 77 percent travel by car; 90 percent of car travel were with one or more passengers; 60 percent stayed two or more nights; and 93 percent of those stayed will play golf.

B. Trips Generated by Cottages

According to the Institute of Transportation Engineers' (ITE) *Trip Generation*, recreation homes generate 0.16 vehicles per unit during weekday morning peak hour, and 0.19 during weekday afternoon peak hour. The majority of guests are assumed to arrive randomly during late morning and early afternoon. Trips generated by golfers who were staying at cottages and lodges were adjusted. Trips generated by cottages are shown in TABLE 2.2.

TABLE 2.2 COTTAGE TRIP GENERATION

DESCRIPTION	AM PEAK HOUR	PM PEAK HOUR
ITE Rates	0.16 vehicles per unit	0.19 vehicles per unit
Average Reduction Factor	Less 40%	Less 40%
Traffic for 420 units	40 vehicles per hour	48 vehicles per hour
Origin Direction	4% North of Vernon 96% South	4% North of Vernon 96% South

2.3 Trip Generation by Residential Homes

A. Travel Survey of Residents

Survey results of Predator Ridge Golf Resort residents indicated that 40 percent of the homes sold are full time residents. The remaining homes are occupied by part-time users. Survey results also indicated that 95 percent of the households consist of more than one person; 9 percent travel to work during the morning and afternoon peak periods (or assuming 60 percent of the peak period traffic occurs during one hour, the peak hour generation rate is about 5 percent); 75 percent work in Vernon; 25 percent return from work during the afternoon peak hours (or 15 percent during peak hour); 19 percent shop during the morning peak hours (or 12 percent during the peak hour); and 71 percent return during noon to 1600 hours (outside the morning and afternoon peak hours).

B. Trips Generated by Residents

According to the 1997 Institute of Transportation Engineers (ITE) *Trip Generation*, recreation homes generate 0.16 vehicles per unit during weekday morning peak hour and 0.19 during weekday afternoon peak hour. The 2003 survey results indicated that the corresponding rates are 0.135 vehicles per unit for the morning peak hour, and 0.176 for the afternoon peak hour.

The surveyed rates and ITE rates are similar, thus the ITE rates were used as base rates in this analysis. The ITE rates were reduced by 20 percent for those who live in the Community and play golf, and a further 20 percent for unoccupied homes at any time. Trips generated for residents are shown in TABLE 2.3.

TABLE 2.3 RESIDENTIAL HOMES TRIP GENERATION

DESCRIPTION	AM PEAK HOUR	PM PEAK HOUR
ITE Rates Used in This Study	0.16 vehicles per unit	0.19 vehicles per unit
Average Reduction Factor	Less 40%	Less 40%
No. of Homes 780 Units	75 vehicles per hour	89 vehicles per hour
Origin Direction	75% Vernon Area 15% South	75% Vernon Area 15% South

2.4 Hotel and Conference Traffic Generation

A. Hotel Traffic Generation

A 150-room resort hotel is proposed with a 400-person capacity conference facility. The hotel and conference facilities are to be developed to complement the golf course operation and in sharing the cottages. It is expected that there will be a reduction in traffic generation by sharing the usage of facilities.

The hotel is planned for the international market. The anticipated travel modes of its customers are 60 percent by plane (and will be picked-up by the hotel's shuttle bus) and 40 percent by car. The typical traffic generation rates for a resort hotel, shown in the 1997 Institute of Transportation Engineers (ITE) *Trip Generation*, were used as a base and were adjusted to account for the reduction in vehicle trips. The air travel and shuttle bus pick-up of hotel guests is anticipated to reduce the trip generation rate by 45 percent.

Using Institute of Transportation Engineers (ITE) trip generation rate of resort hotel, the traffic generated by the 150-room hotel was adjusted for its market origins: 60 percent of hotel guests will arrive by air and shuttle buses, and shuttle buses are also planned for employees. The average trip reduction factor of 45 percent was used. Traffic volumes generated by the hotel operation are shown in TABLE 2.4.

TABLE 2.4 HOTEL TRIP GENERATION

DESCRIPTION	AM PEAK HOUR	PM PEAK HOUR
ITE Rates Used in This Study	0.31 vehicles per unit	0.42 vehicles per unit
Average Reduction Factor	Less 45%	Less 45%
Traffic Volume 150-room Hotel	26 vehicles per hour	35 vehicles per hour
Origin Direction	25% Vernon & North 75% South	25% Vernon & North 75% South

B. Conference Facility Traffic

The trip generation rates for conference facilities are unavailable in the ITE manual. There are two components of conference facility traffic: the participants and the employees (in addition to the hotel employees). Traffic generated by the conference facility is shown in TABLE 2.5. It is assumed that 25 percent of the conference participants will be staying at the hotel, and 15 percent at the cottages. The net increase in the number of participants is therefore 240. Of this net increase, 25 percent is assumed to arrive by air and to be picked-up by shuttle buses.

The remaining number of participants arriving by car is estimated to be 180. Using a vehicle occupancy rate of 1.5 persons per vehicle, the number of vehicles arriving by the remaining 180 participants is 120. Of these 120 vehicles, 50 percent, or 60 vehicles, are assumed to arrive and leave during the morning and afternoon peak hours.

It is assumed that the conference facility will require an addition of 30 employees. With a hotel shuttle bus service, the number of employees who may drive a vehicle is estimated to be 23 persons. With a vehicle occupancy rate of 1.5 persons per vehicle, the traffic volume generated by the conference facility employees is estimated to be 15 vehicles during the morning and afternoon peak hours. The total traffic volume generated by the conference centre is estimated to be 75 vehicles during the morning and afternoon peak hours.

TABLE 2.5 CONFERENCE FACILITY TRAFFIC GENERATION SUMMARY

USE	MORNING PEAK HOUR	AFTERNOON PEAK HOUR
Conference Facility 400 Persons	60 vehicles per hour	60 vehicles per hour
Conference Employee	15 vehicles per hour	15 vehicles per hour
Origin Distribution	25% Vernon & North 75% S. on Hwy 97	25% Vernon & North 75% S. on Hwy 97

2.5 Retail Development

A total of 50,000 square feet retail space is proposed to be developed. The retail space is planned to be visited by local residents, cottage guests and golfers. The Institute of Transportation Engineers Trip Generation Manual suggested a trip generation rate of 1.03 vehicles per 1,000 square feet and 3.74 vehicles per 1,000 square feet of retail space for the morning and afternoon peak hours respectively.

These generation rates are reduced by 50 percent to account for the internal shopping trips by residents, cottage guests and golfers. The resulting trip generation for the retail component of the development is shown in TABLE 2.6.

TABLE 2.6 RETAIL SPACE TRIP GENERATION SUMMARY

DESCRIPTION	AM PEAK HOUR	PM PEAK HOUR
ITE Rates Used in This Study	1.03 vehicles per unit	3.74 vehicles per unit
Average Reduction Factor	Less 50%	Less 50%
Traffic Volume 50,000 sq ft Retail	26 vehicle per hour	94 vehicles per hour
Origin Direction	40% Vernon & North 60% South	40% Vernon & North 60% South

2.6 Development Traffic Generation Summary

The total development traffic generated by the proposed development is summarized in TABLE 2.7. The development is scheduled to be completed in 15 years.

TABLE 2.7 TOTAL TRAFFIC GENERATION SUMMARY

USE	MORNING PEAK HOUR	AFTERNOON PEAK HOUR
Hotel & Conference	101 vehicles per hour	110 vehicles per hour
Residents and Cottages	115 vehicles per hour	137 vehicles per hour
Golf	20 vehicles per hour	25 vehicles per hour
Retail Commercial	26 vehicles per hour	94 vehicles per hour
Combined Traffic Volume	262 vehicles per hour	366 vehicles per hour

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3.0 2003 (CURRENT) TRAFFIC ANALYSIS

The current traffic conditions were evaluated at the following three intersections:

- Bella Vista Road and Tronson Road;
- Bella Vista Road ant Appaloosa Road; and
- Bella Vista Road and 41st Street

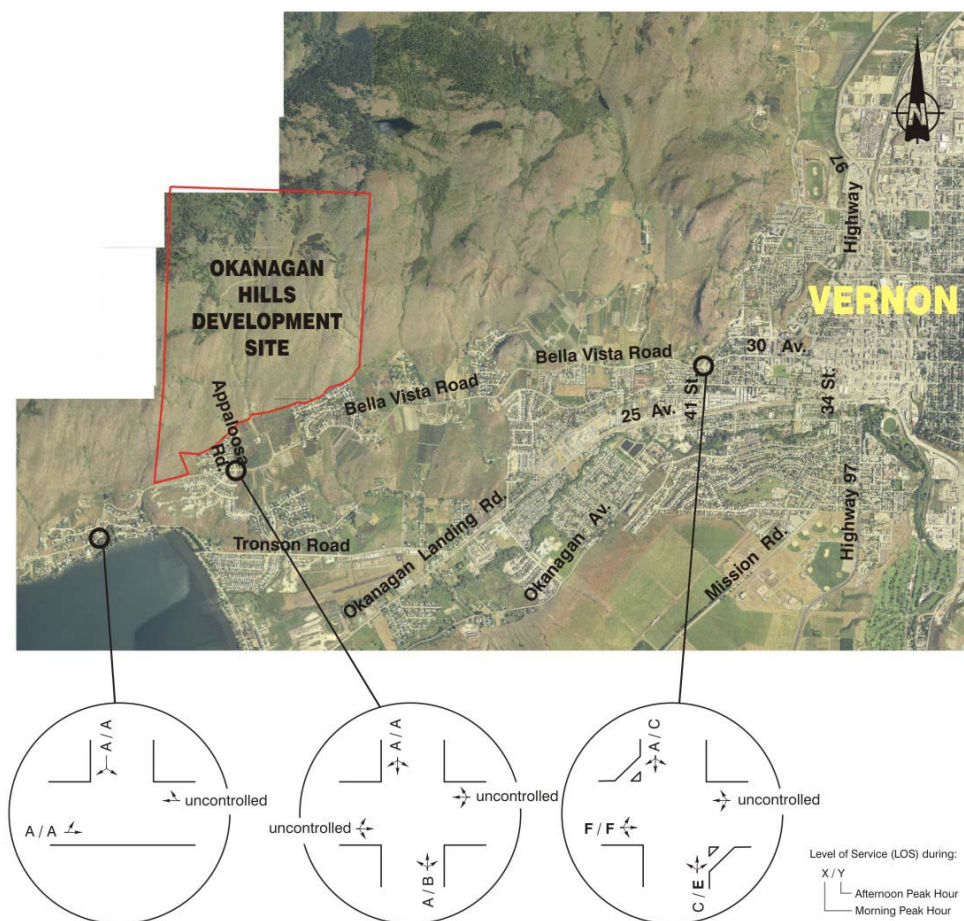
Morning and afternoon peak hour traffic volumes at these intersections were counted on Thursday and Friday, September 25 and 26, 2003. Current lane configurations are shown in APPENDIX A. Current traffic volumes are shown in APPENDIX B. Intersections were evaluated by calculating the Levels of Service of traffic movements. Levels of Service A and B represent an excellent operation with minimum or no delays. Levels C and D are typical operating levels when some delays occur. Levels E and F are congested levels and improvements could be considered. Levels of Service at these intersections are shown in FIGURE 3.1.

3.1 Bella Vista Road and Tronson Road Intersection

The intersection is currently operating at Level of Service A for both morning and afternoon peak hours. This is an excellent operating level and improvements are not anticipated.

3.2 Bella Vista Road and Appaloosa Road Intersection

All movements were found to be operating satisfactorily at Levels of Service A and B for the morning and afternoon peak periods respectively. Improvements are not anticipated.



**FIGURE 3.1 LEVEL OF SERVICE FOR
CURRENT TRAFFIC CONDITION**

3.3 Bella Vista Road and 41st Street Intersection

Currently this intersection is operating at Level of Service F during the morning and afternoon peak hours. This is an unacceptable level and improvements should be considered.

The poor level of service at this intersection is due to the STOP sign arrangement and the high volumes of the westbound left turn and northbound right turn movements. It is an unusual STOP sign arrangement to stop eastbound and southbound traffic. Drivers who are strangers to the area may assume traffic from the opposite direction is required to stop, as they are required to stop at the STOP sign. In addition, left turn movements usually do not have the right-of-way at an intersection and are required to yield to on-coming traffic. The free westbound left-turn and northbound right-turn movements therefore add to driver confusion.

One of the common improvement options at this intersection is the installation of a traffic signal. Using the Canadian Traffic Signal Warrant Procedure (Transportation Association of Canada, 2003), a signal is found to be warranted at this intersection under current traffic conditions. The traffic signal will need to be augmented by a left turn bay of approximately 20 metres in length for the westbound left turn movement. Analysis results indicated that, with the installation of a traffic signal and a westbound left turn bay, the intersection performance will improve from Level of Service F to B. This improved performance will remain beyond the year 2018, assuming traffic will grow at an annual compounded rate of three percent.

However, despite the traffic growth rate on Bella Vista Road, this intersection is recommended to be improved at the earliest available opportunity.

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4.0 TRAFFIC PERFORMANCE REVIEW

The development is scheduled to be completed in 15 years. Current traffic volumes were assumed to grow at an annual compounded rate of three percent. The base traffic volumes for the year 2018 were therefore estimated by using this growth rate. The study findings concluded that combined traffic conditions for the year 2018 are acceptable. Findings for intermediate years are therefore not presented in this report.

The three percent annual traffic growth rate is used by the City. While the three percent growth rate may be applicable in the downtown area, it is considered a conservatively high growth rate on Bella Vista Road. In comparison, the average annual growth rate on Highway 97 is two percent. Future traffic conditions may be better than those indicated in this study if the traffic growth rate is less than three percent. In addition to the three intersections indicated in Section 3.0, the entrance road intersection was also analyzed. Intersection performance for the four intersections was analyzed using Synchro and VISSIM computer software. Printouts of capacity calculations are shown in APPENDIX D.

4.1 Development Traffic Distribution

The origins of the traffic generated by the development are shown in the trip generation tables. The development is resort oriented for guests and visitors from outside the Vernon area, and attracts most of them from the British Columbia Lower Mainland and the United States. The origins were similar to those surveyed for Predator Ridge Golf Resort and documented in Commonage Road Traffic Profile by Hamilton Associates, August 2003. The origins of traffic for the various development components are shown in FIGURE 4.1. For traffic distributions within Vernon, three scenarios were analyzed:

- 100%, 80% and 60% of development traffic using Bella Vista Road, with remaining traffic using Tronson Road.

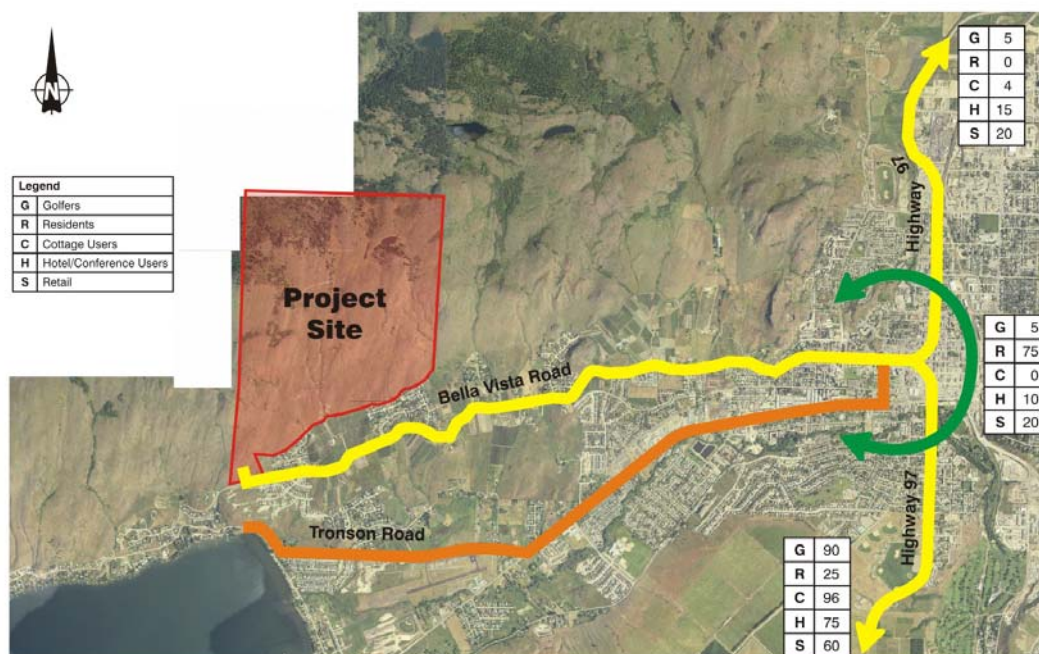
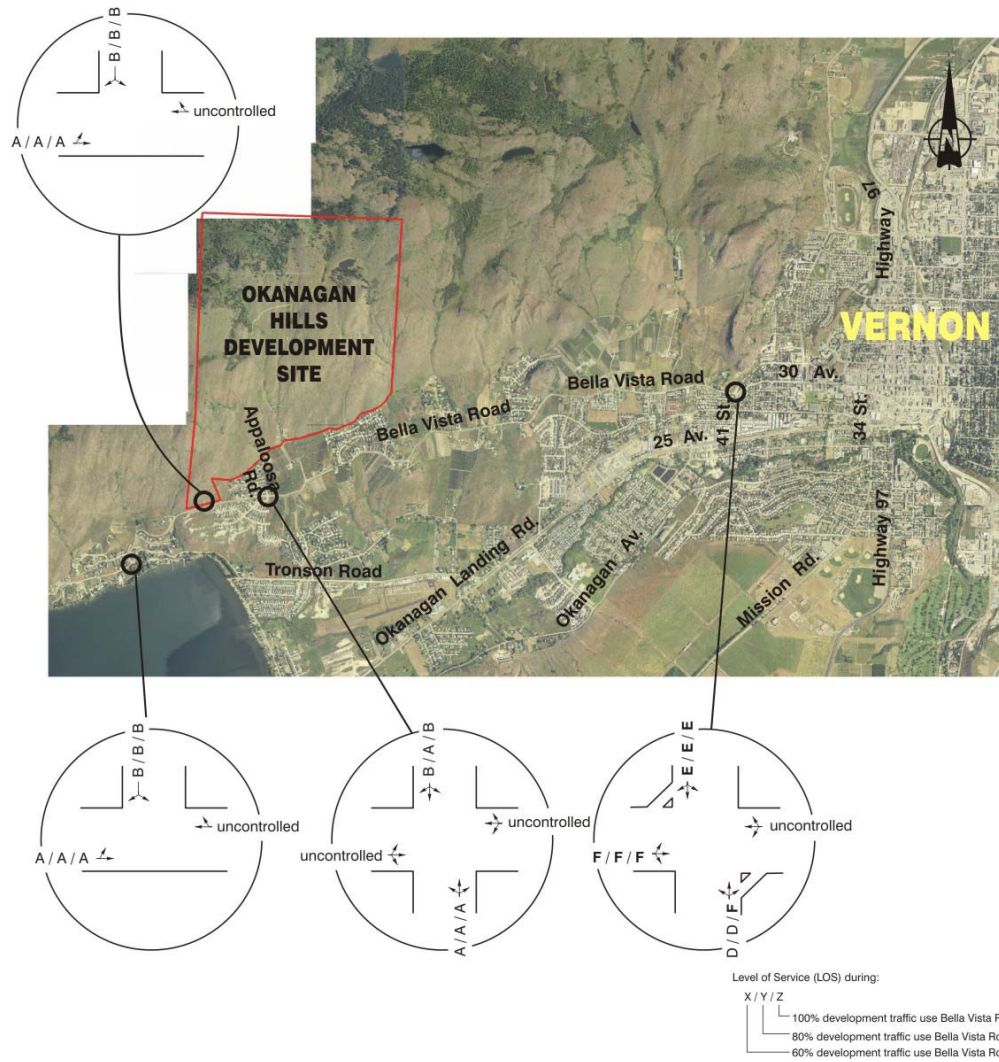


FIGURE 4.1 TRAFFIC ORIGIN DISTRIBUTION

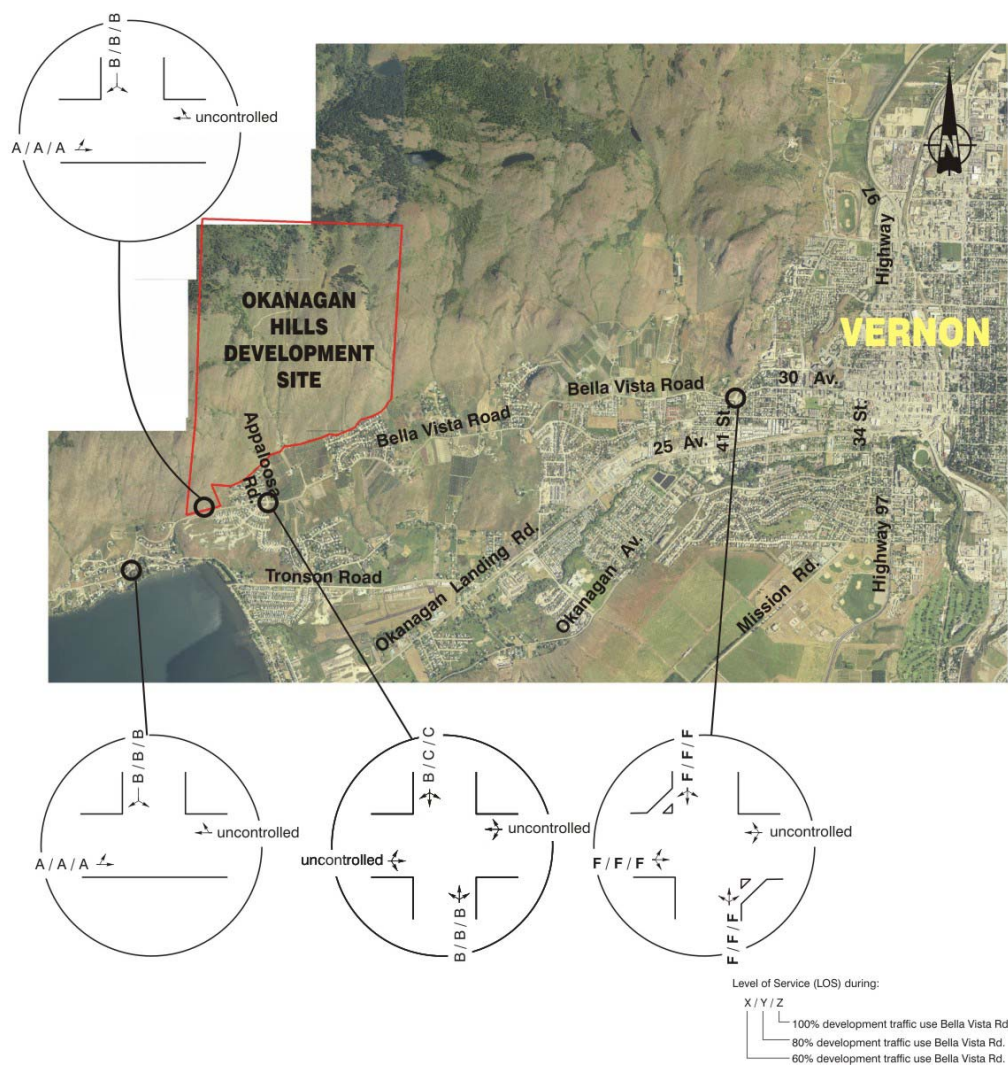
Analysis results indicated that there is no significant impact on traffic performance on Bella Vista Road. However, traffic should be encouraged to use Tronson Road, especially those which travel south on Highway 97. This could be achieved by directional signing to guide traffic to Tronson Road. The year 2018 combined traffic volumes are shown in APPENDIX C. The morning and afternoon peak hour intersection performance for the three distribution scenarios are shown in FIGURE 4.2 and FIGURE 4.3 respectively.

4.2 Bella Vista Road and Development Entrance Road

A two lane entrance road was analyzed: one lane for inbound traffic and one lane for outbound traffic. The intersection performance in the year 2018 with combined development and base traffic was found to be operating at Level of Service B for both morning and afternoon peak hours. The intersection is anticipated to perform at a similar Level of Service B for all three distribution scenarios.



**FIGURE 4.2 LEVEL OF SERVICE FOR MORNING PEAK HOUR
YEAR 2018 COMBINED TRAFFIC**



**FIGURE 4.3 LEVEL OF SERVICE FOR AFTERNOON PEAK HOUR
YEAR 2018 COMBINED TRAFFIC**

4.3 Bella Vista Road and Tronson Road

In the year 2018, this intersection is anticipated to perform at Level of Service B for the morning and afternoon peak hours and for all three distribution scenarios. No improvements are required.

4.4 Bella Vista Road and Appaloosa Road

In the year 2018, this intersection is anticipated to perform at Levels of Service B and C for the morning and afternoon peak hours respectively. The levels of service remain unchanged for all three distribution scenarios. No improvements are required.

4.5 Bella Vista Road and 41st Street

As concluded in Section 3.3, this intersection is currently operating at Level of Service F for both morning and afternoon peak hours. One of the options to ameliorate the intersection performance is the installation of a traffic signal, a westbound left turn bay, and other geometric improvements. With these improvements, the intersection is anticipated to operate at Level of Service B, to beyond the year 2018, without development traffic.

The improved intersection is anticipated to operate satisfactorily with development traffic, as shown in TABLE 4.1. Towards the year 2015, depending on base traffic growth, the eastbound through movement is anticipated to approach Level of Service E. While this level of service is not considered critical, traffic should be reviewed at that time to consider the provision of two eastbound through lanes.

**TABLE 4.1 INTERSECTION PERFORMANCE
BELLA VISTA ROAD AND 41ST STREET**

TRAFFIC CONDITION	MORNING PEAK HOUR	AFTERNOON PEAK HOUR
Current Condition	F	F
Current Traffic With Improvements	B	B
2018 Combined 60% on Bella Vista	B	C
2018 Combined 80% on Bella Vista	C/B*	C/B*
2018 Combined 100% on Bella Vista	C/B*	D/B*

Note: C/B represent levels of service with one and two eastbound through lanes respectively. This requirement depends on base traffic growth and is not considered critical.

5.0 OVERVIEW

The traffic analysis indicated the critical traffic issue is the intersection of Bella Vista Road and 41st Street. A traffic signal with a left turn bay for westbound traffic could be considered. The left turn bay should be approximately 20 metres in length depending on traffic growth. The improved intersection is anticipated to be adequate to accommodate base traffic growth and Okanagan Hills development traffic to the year 2018. Improvements to other studied intersections are not required.

The improved intersection is anticipated to be adequate to accommodate base traffic growth and Okanagan Hills development traffic to the year 2018. Towards the year 2015, and depending on base traffic growth, the eastbound through movement is anticipated to approach Level of Service E. While this Level of Service is not considered critical, traffic should be reviewed at that time to consider the provision of two eastbound through lanes. Improvements to other studied intersections are not required.

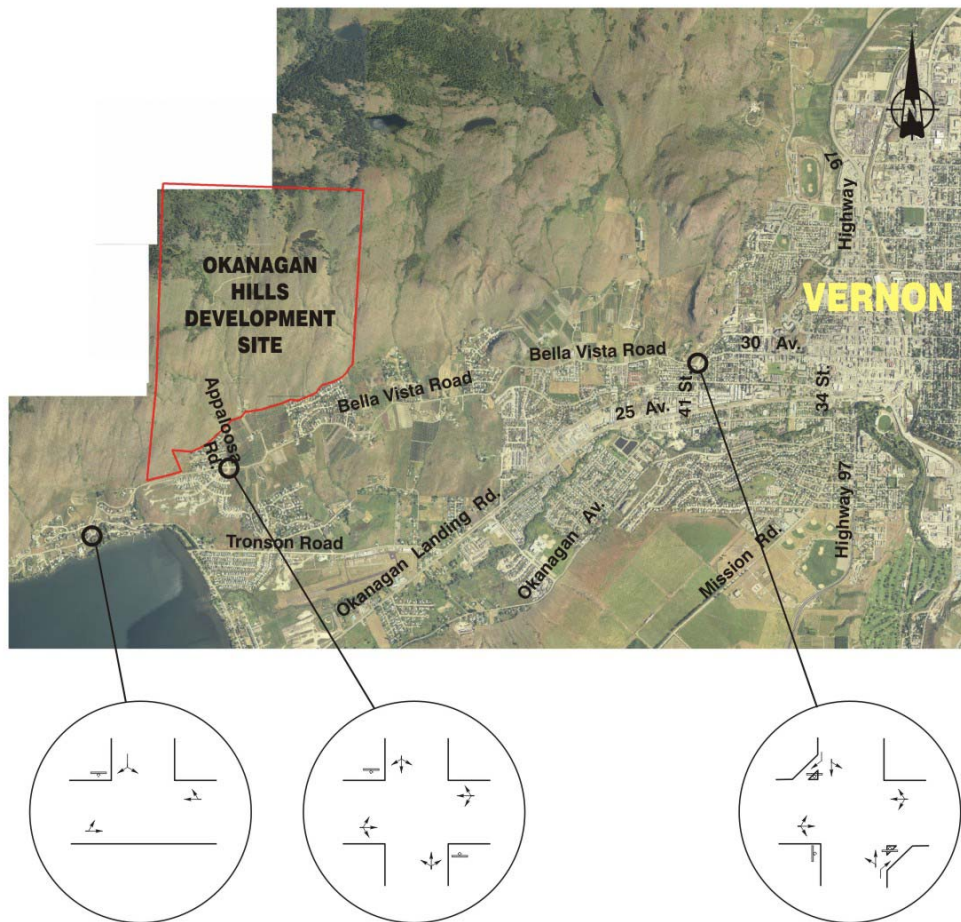
The efficiency of Bella Vista Road could be improved by installing consistent and uniform curves and speed signing, Chevron signing and delineation. Some sections of the road could benefit from the installation of barriers along steep embankments. In addition to these improvements, the width of Bella Vista could be increased to accommodate both pedestrians and bicycles. However, it should be noted that these are current road operation issues and not a result of the proposed Okanagan Hills development.

This review concluded that the current road system, with the improvement of the Bella Vista Road and 41st Street intersection, will accommodate the traffic generated by the Okanagan Hills development.

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APPENDIX A

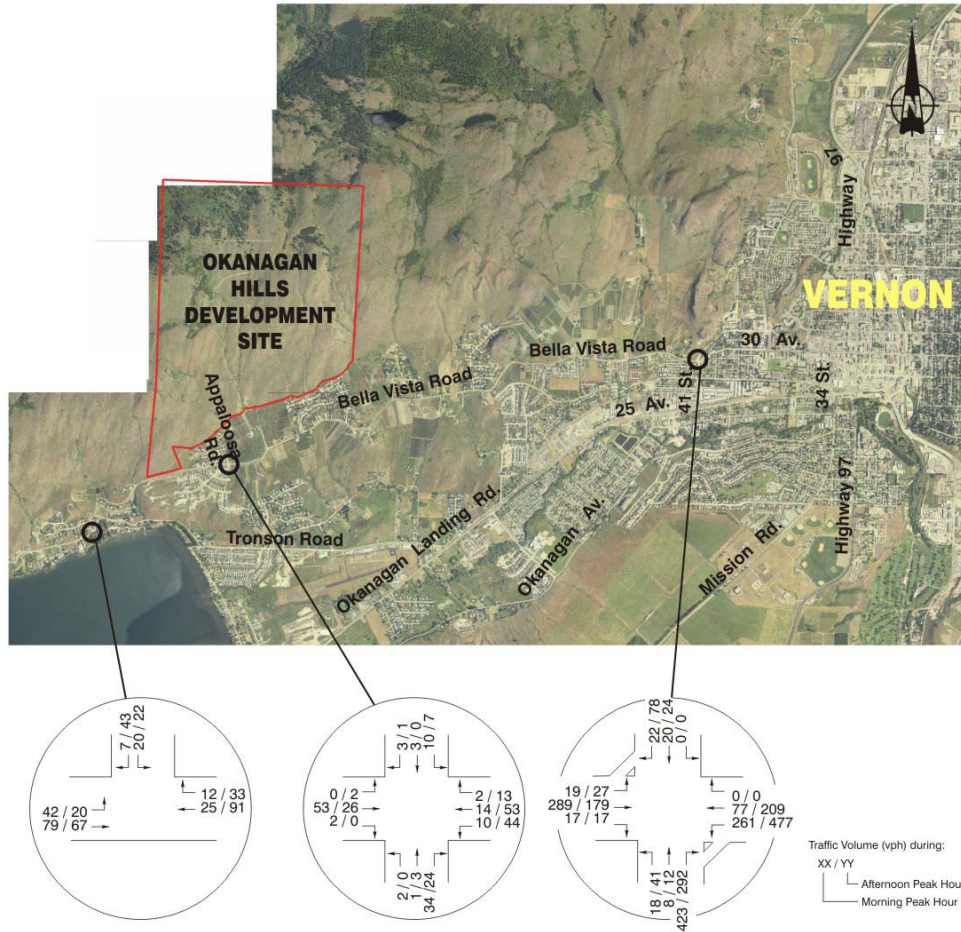
LANE CONFIGURATIONS



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APPENDIX B

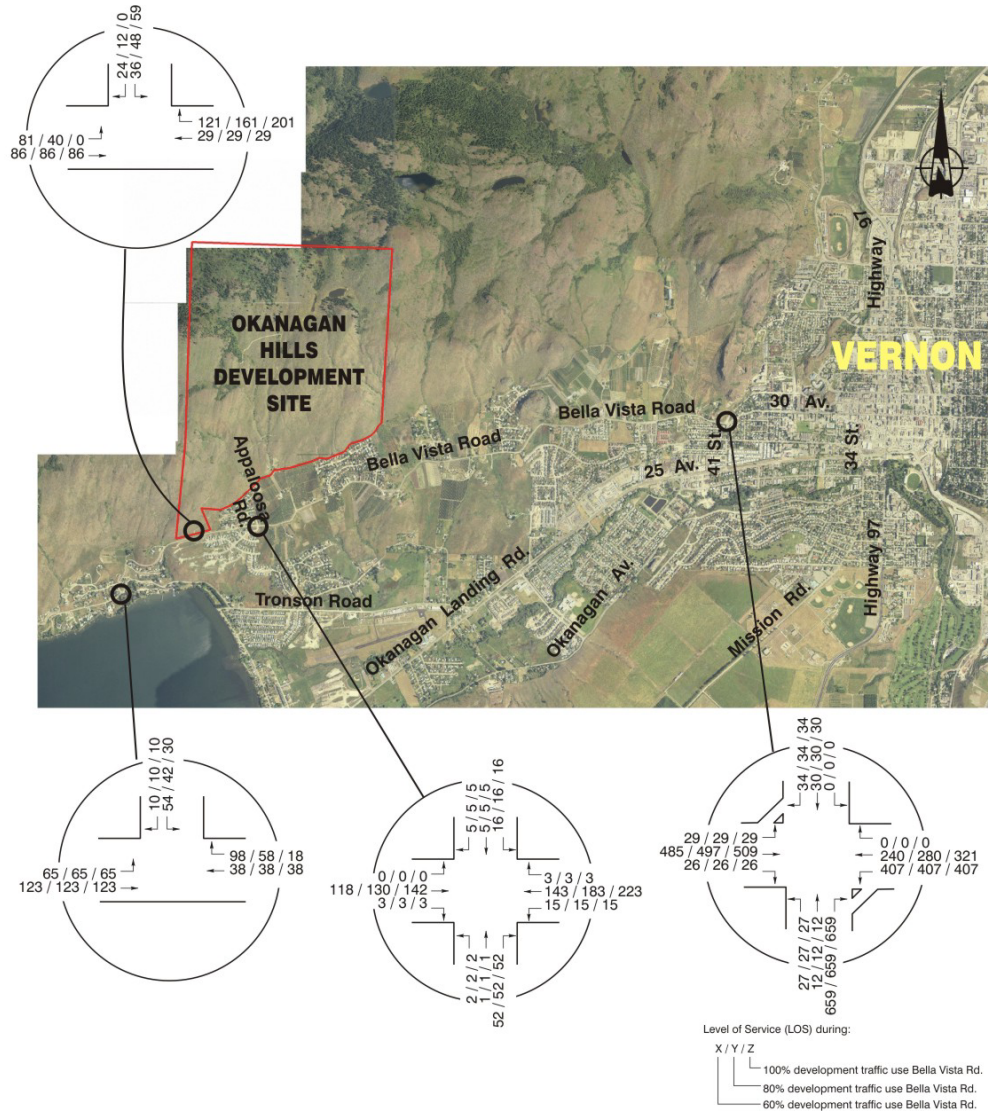
2003 TRAFFIC VOLUMES



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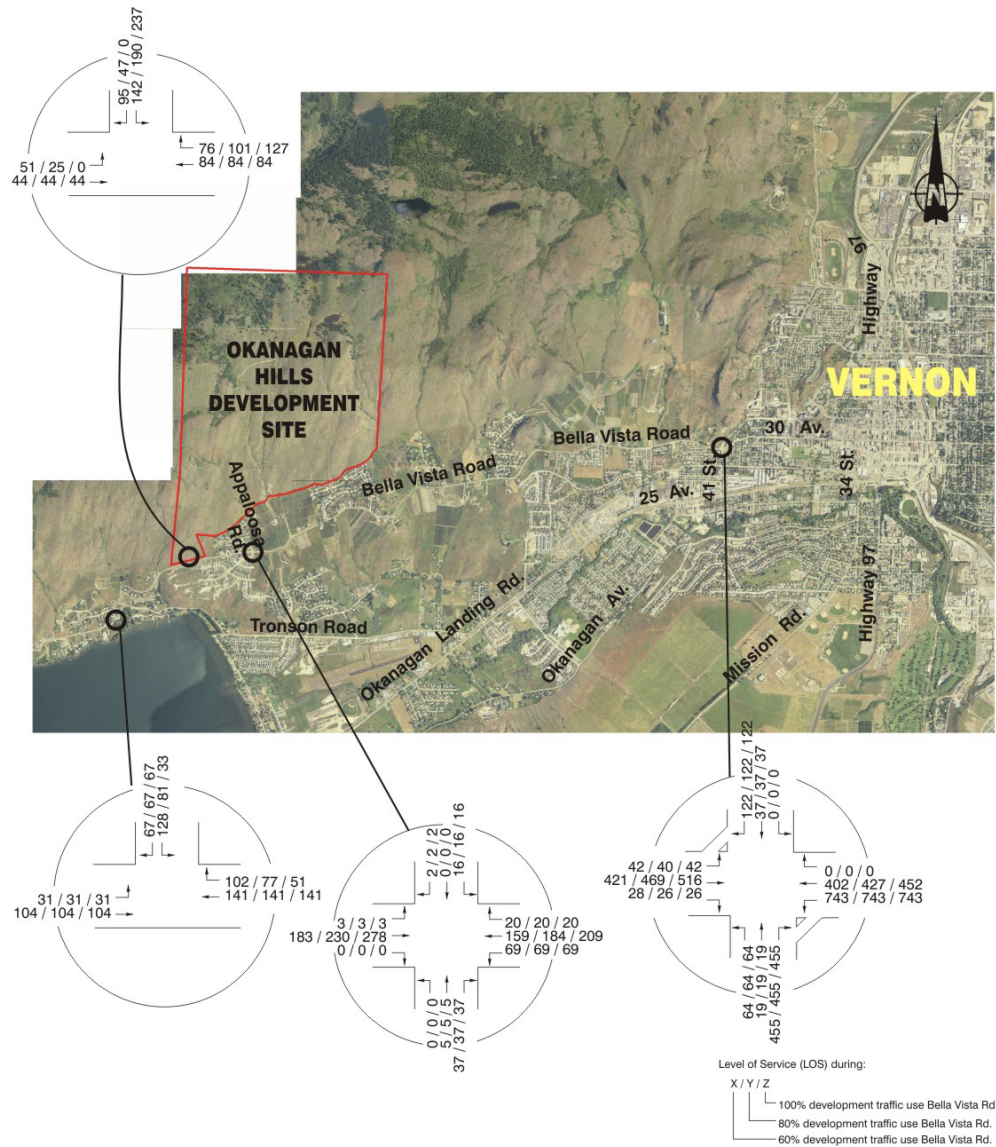
APPENDIX C

2018 COMBINED PEAK HOUR TRAFFIC VOLUMES



MORNING PEAK HOUR

APPENDIX C



AFTERNOON PEAK HOUR

APPENDIX D

PRINTOUTS FOR CAPACITY CALCULATIONS

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**TRAFFIC REVIEW FOR
THE PROPOSED OKANAGAN HILLS
NEIGHBOURHOOD PLAN
VERNON, BRITISH COLUMBIA**

**SUPPLEMENTARY REPORT
SENSITIVITY ANALYSIS
ON TRIP GENERATION**

Engineering and
Planning Consultants



**TRAFFIC REVIEW FOR
THE PROPOSED OKANAGAN HILLS
NEIGHBOURHOOD PLAN
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**SUPPLEMENTARY REPORT
SENSITIVITY ANALYSIS
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March 2004
7845

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EXECUTIVE SUMMARY

A Traffic Review report, *Traffic Review for the Proposed Okanagan Hills Neighbourhood Plan, Vernon, British Columbia*, was prepared in October 2003 by Hamilton Associates for the proposed Okanagan Hills development. As part of the approval process, the City of Vernon has requested a sensitivity analysis conducted on traffic generation. This report documents the findings of the sensitivity analysis and should be read in conjunction with the October 2003 report.

The original report assumes trip reduction rates because the development was similar to that of Predator Ridge Golf course. Because of the development's proximity to City centre, there are concerns that the development may attract more visitors from the City. The City has requested a sensitivity analysis on the trip generation and provided guidelines on the "revised reduction rates". To complete the sensitivity analysis, trips were generated without any reductions.

As summarized in TABLE 4.1, the intersection capacity performance of the intersections on Bella Vista at the Development Access, Appaloosa Road and Tronson Road are insensitive to various reduction rates.

The recommended improvements at the 41st Street and Bella Vista intersection will remain unchanged with the use of revised or no reduction rates. The intersection of 41st Street and Bella Vista will perform satisfactorily except the eastbound through movement. Towards the year 2018, base traffic and Okanagan Hills development traffic will cause the eastbound traffic at this intersection to operate at Level of Service E. One of the options is to provide two eastbound through lanes. The provision of an additional east bound lane would increase the levels of service and the intersection is anticipated to operate satisfactorily but the need is not immediate. The timing of the additional lane could be determined by monitoring traffic growth in the area.

The results of this analysis indicated that the conclusions and recommendations of the October 2003 traffic report are valid and robust to accommodate variations of trip generation.

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1.0 INTRODUCTION

1.1 Background

A Traffic Review report, *Traffic Review for the Proposed Okanagan Hills Neighbourhood Plan, Vernon, British Columbia*, was prepared in October 2003 by Hamilton Associates for the proposed Okanagan Hills development. As part of the approval process, the City of Vernon has requested a sensitivity analysis conducted on traffic generation. This report documents the findings of the sensitivity analysis and should be read in conjunction with the October 2003 report.

1.2 Study Objectives

The objective of this study is to review the sensitivity of intersection capacity performance using portions of and no reduction rates of trip generation. The original report assumes that 100 percent, 80 percent and 60 percent of the traffic generated by the development use Bella Vista Road. For the convenience of presentation and simplicity, the 80 percent distribution factor was used in this report. The reasons are that: there will be some traffic using Tronson Road; assuming the three distribution scenarios will triple the amount of analysis scenarios; and the analysis results are sufficiently robust to account for variations of the distribution factor. Some of the trip origins were adjusted as recommended by the City.

1.3 Study Parameters

This review was completed using the same methodology stated in the October 2003 report. The following parameters were used in this report:

- The land uses were updated.
- Intersection capacity performance for the four intersections were reviewed using the Institute of Transportation Engineers trip generation rates with:
 - Original trip reduction rates shown in the October 2003 report;
 - Revised reduction rates as suggested by the City; and
 - No reduction rates.
- 80 percent of development traffic will use Bella Vista Road and 20 percent will be on Tronson Road.
- The intersection of 41st Street and Bella Vista Road will be improved with a traffic signal.
- The horizon year for analysis is year 2018 with an annual compounded base traffic growth rate of 3 percent.

2.0 DEVELOPMENT TRAFFIC VOLUME FORECAST

2.1 Trip Generation by Golf Course Operation

The trips generated by the golf course operation are shown in TABLE 2.1.

TABLE 2.1 GOLF COURSE TRIP GENERATION

DESCRIPTION	AM PEAK HOUR	PM PEAK HOUR
ITE Rates	2.22 vehicles per hole	2.74 vehicles per hole
Adjustment Factor*	Less 50%/50%/ 0%	Less 50%/50%/ 0%
Vehicles per hour for 18 holes**	20/20/40	25/25/49
Origin Direction	30% Vernon & North 70% South	30% Vernon & North 70% South

* Sensitivity Analysis of three reduction rates:
(Original Reduction /Revised Reduction/No Reduction)

** Trips generated with the three reduction rates, respectively.

2.2 Trip Generation by Guest Cottages

Trips generated by golfers who were staying at cottages and lodges are shown in TABLE 2.2. The number of cottages was updated from 420 units to 550 units. Some of the cottages on the top of the slopes that are planned provide retail wineries with some retail, restaurant and tasting space. The number of seats of the restaurant or the exact sizes of the wineries is unknown at this time. In this analysis, a 100 seat quality restaurant is assumed in addition to the traffic generated by the cottages. It should be noted that restaurants and wine tasting outlets generate low traffic volumes in the morning peak hour and some traffic during the afternoon peak hour. Peak restaurant traffic usually occurs in the early evenings while wine tasting may be during lunch time or in the afternoon.

TABLE 2.2 COTTAGE TRIP GENERATION

DESCRIPTION	AM PEAK HOUR	PM PEAK HOUR
ITE Rates	0.16 vehicles per unit	0.26 vehicles per unit
Average Reduction Factor*	Less 40%/40%/ 0%	Less 40%/40%/ 0%
Vehicles per hour for 550 units***	53/53/88	86/86/143
Winery & Quality Restaurant Traffic**	2/2/3	13/20/26
Origin Direction	4% North, 26% Vernon, 70% South	4% North, 26% Vernon, 70% South

* Sensitivity Analysis of three reduction rates:

(Original Reduction /Revised Reduction/No Reduction)

** Trips generated with the three reduction rates, respectively.

2.3 Trip Generation by Residential Homes

Trips generated for residents are shown in TABLE 2.3. The number of residential units was updated from 780 units to 660 units.

TABLE 2.3 RESIDENTIAL HOMES TRIP GENERATION

DESCRIPTION	AM PEAK HOUR	PM PEAK HOUR
ITE Rates	0.16 vehicles per unit	0.26 vehicles per unit
Average Reduction Factor*	Less 40%/20%/0%	Less 40%/20%/0%
Vehicles per hour for 660 units**	63/85/106	103/137/172
Origin Direction	75% Vernon Area 15% South	75% Vernon Area 15% South

* Sensitivity Analysis of three reduction rates:

(Original Reduction /Revised Reduction/No Reduction)

** Trips generated with the three reduction rates, respectively.

2.4 Hotel and Conference Traffic Generation

A. Hotel Traffic

Traffic volumes generated by the hotel operation are shown in TABLE 2.4.

TABLE 2.4 HOTEL TRIP GENERATION

DESCRIPTION	AM PEAK HOUR	PM PEAK HOUR
ITE Rates	0.31 vehicles per unit	0.42 vehicles per unit
Average Reduction Factor*	Less 50%/25%/ 0%	Less 50%/25%/ 0%
Vehicles per hour for 150-room Hotel**	26/35/47	34/47/63
Origin Direction	25% Vernon & North 75% South	25% Vernon & North 75% South

* Sensitivity Analysis of three reduction rates:
(Original Reduction /Revised Reduction/No Reduction)

** Trips generated with the three reduction rates, respectively.

B. Conference Facility Traffic

The conference facility was updated from 400 persons to 300 persons. Traffic volumes generated by the conference facility are shown in TABLE 2.5. It is assumed that 25 percent of the conference participants will be staying at the hotel, and 15 percent at the cottages. The net increase in the number of participants is therefore 180. Of this net increase, 25 percent are assumed to arrive by air and to be picked up by shuttle buses.

The remaining number of participants arriving by car is estimated to be 135. Using a vehicle occupancy rate of 1.5 persons per vehicle, the number of vehicles arriving by the remaining 135 participants is 90. Of these 90 vehicles, 50 percent, or 45 vehicles, are assumed to arrive and leave during the morning and afternoon peak hours. The number of employees remains unchanged from the original report.

TABLE 2.5 CONFERENCE FACILITY TRAFFIC GENERATION SUMMARY

USE	AM PEAK HOUR	PM PEAK HOUR
Conference Facility 300 Persons	45 vehicles per hour	45 vehicles per hour
Conference Employee	15 vehicles per hour	15 vehicles per hour
Origin Distribution	25% Vernon & North 75% S. on Hwy 97	25% Vernon & North 75% S. on Hwy 97

2.5 Retail Development

A total of 50,000 square feet retail space is proposed to be developed. The retail space is planned to be visited by local residents, cottage guests and golfers. These generation rates could be reduced by 50 percent to account for the internal shopping trips by residents, cottage guests and golfers. The resulting trip generation for the retail component of the development is shown in TABLE 2.6.

TABLE 2.6 RETAIL SPACE TRIP GENERATION SUMMARY

DESCRIPTION	AM PEAK HOUR	PM PEAK HOUR
ITE Rates	1.03 vehicles per unit	3.74 vehicles per unit
Average Reduction Factor*	Less 50%/25%/0%	Less 50%/25%/0%
Vehicles per hour 50,000 sq ft Retail**	26/39/52	94/140/187
Origin Direction	40% Vernon & North 60% South	40% Vernon & North 60% South

* Sensitivity Analysis of three reduction rates:

(Original Reduction /Revised Reduction/No Reduction)

** Trips generated with the three reduction rates, respectively.

2.6 Development Traffic Generation Summary

The total development traffic volumes generated by the proposed development with three reduction rates are summarized in TABLE 2.7. The development is scheduled to be completed in 15 years.

TABLE 2.7 TOTAL TRAFFIC GENERATION SUMMARY
Vehicles per Hour

USE	MORNING PEAK HOUR	AFTERNOON PEAK HOUR
Hotel & Conference	86/95/107	95/107/123
Residents and Cottages	116/138/194	189/223/315
Winery and Restaurant	2/2/3	13/20/26
Golf	20/20/40	25/25/49
Retail Commercial	26/37/52	94/140/187
Combined Traffic Volume	250/292/396	416/515/700

3.0 COMBINED TRAFFIC PERFORMANCE REVIEW

The development is scheduled to be completed in 15 years. Current traffic volumes were assumed to grow at an annual compounded rate of 3 percent. The base traffic volumes for the year 2018 were therefore estimated by using this growth rate. The study findings concluded that combined traffic conditions for the year 2018 are acceptable. Findings for intermediate years are therefore not presented in this report.

The year 2018 base traffic volumes and intersection performance calculations are shown in APPENDIX A. The year 2018 combined base and development traffic with no reduction, revised reduction and original reduction (in October 2003 report) and the intersection capacity calculations are shown in APPENDIX B, APPENDIX C and APPENDIX D respectively. The intersection capacity performance for the four study intersections and four sensitivity analysis scenarios are summarized in TABLE 4.1.

**TABLE 4.1 SUMMARY OF YEAR 2018
INTERSECTION CAPACITY PERFORMANCE**

INTERSECTION W BELLA VISTA*	BASE CONDITION	ORIGINAL REDUCTION	REVISED REDUCTION	NO REDUCTION
Development Access**	A/A	B/B	B/C	B/C
Appaloosa Road**	A/B	B/C	B/C	B/C
Tronson Road**	B/B	B/B	B/B	B/B
41 st Street W Signal***	B/B (B/D)	B/C (C/D)	C/D (B/E)	C/D (D/E)
41 st Street W Signal****	A/B (B/C)	B/B (B/D)	B/B (B/C)	B/C (C/D)

* A/C represents morning and afternoon peak hour levels of service, respectively.

** Levels of Service represent left turn movement from minor road with STOP sign control.

*** Levels of service in () represent eastbound through movement with one lane.

**** Levels of service in () represent eastbound through movement with two lanes.

4.0 OVERVIEW

The original report assumes trip reduction rates because the development was similar to that of Predator Ridge Golf course. Because of the development's proximity to City centre, there are concerns that the development may attract more visitors from the City. The City has requested a sensitivity analysis on the trip generation and provided guidelines on the "revised reduction rates". To complete the sensitivity analysis, trips were generated without any reductions.

As summarized in TABLE 4.1, the intersection capacity performance of the intersections on Bella Vista at the Development Access, Appaloosa Road and Tronson Road are insensitive to various reduction rates.

The intersection of 41st Street and Bella Vista will perform satisfactorily except the eastbound through movement. Towards the year 2018, base traffic and Okanagan Hills development traffic will cause the eastbound traffic at this intersection to operate at Level of Service E. One of the options is to provide two eastbound through lanes sometime in the future when the need arises. The provision of an additional eastbound lane would increase the levels of service and the intersection is anticipated to operate satisfactorily. The traffic growth in the area should be monitored so that the timing of the additional eastbound lane could be determined.

The results of this analysis indicated that the conclusions and recommendations of the October 2003 traffic report are valid and robust to accommodate variations of trip generation.

APPENDIX A

**TRAFFIC VOLUMES AND CAPACITY PERFORMANCE
CALCULATIONS FOR YEAR 2018 BASE CONDITION
(NO DEVELOPMENT TRAFFIC)**

APPENDIX B

COMBINED 2018 BASE TRAFFIC AND DEVELOPMENT TRAFFIC WITH NO REDUCTION FACTORS

APPENDIX C
COMBINED 2018 BASE TRAFFIC AND DEVELOPMENT TRAFFIC
WITH REVISED REDUCTION FACTORS

APPENDIX D

**COMBINED 2018 BASE TRAFFIC AND DEVELOPMENT TRAFFIC
WITH ORIGINAL REDUCTION FACTORS
(AS SHOWN IN OCTOBER 2003 REPORT)**