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Date:	March 27, 2012
To:	Steve Black, P.Eng.
From:	Billy Kwok, P.Eng.
Project Number:	60239890
Subject:	**Whistle Bend Traffic Impact Analysis Update R1**

Distribution:

As input into the Whistle Bend Subdivision Plan, a traffic study was undertaken to assess the on-site and off-site roadway and intersection requirements to service the proposed land uses within the subdivision. The following is a summary of our work and findings.

Project Scope and Definition

The project is the development of the Whistle Bend Subdivision located approximately 10km north of the downtown core, bounded by the Yukon River to the north and east, Kwanlin Dun First Nation settlement lands to the southeast, McIntyre Creek and Range Road to the south and existing neighborhood of Porter Creek and Mountainview Drive to the west. This traffic study forecasts traffic demands from Whistle Bend and recommends on-site road facilities and off-site road improvements to support them. It includes:

- Background traffic forecasts;
- Trip generation and distribution for the various land uses within the study area, as well as various areas of growth within Whitehorse;
- On-site servicing requirements including the estimation of the anticipated capacity and Level of Service (LOS) of proposed roads and intersections along Casca Boulevard corridor, as well as its connections to Whistle Bend Way; and
- Off-site servicing requirements including the estimation of the anticipated capacity and LOS of proposed improvements to existing roads and intersections along Hickory-Mountainview-Copper-Quartz corridor, Wann Road, 12th Avenue, Range Road, Two Mile Hill Road, and the Alaska Highway.

The analysis typifies conditions at full build-out by 2031. Internal roads and land use information at the end of Phase 4 was based on the Whistle Bend Draft Plan Drawing by Morrison Hershfield (December 2, 2011). Internal roads and land use information for Phases 5 and 6 were based on the Whistle Bend Preliminary Site Plan (May 18, 2010).

On-site Servicing Study Area

The study area, as shown in Figure 1, is defined as those land uses within the Whistle Bend Subdivision boundary which access the main road network via Whistle Bend Way.

Figure 1: Study Area and Traffic Zones

Source: Whistle Bend Draft Plan Drawing (December 2, 2011)

Existing Traffic Expansion

- Existing through traffic on Whistle Bend Way was derived using historic traffic count data at the downstream intersection of Hickory Street and Wann Road and Range Road.
- An annual growth factor was not applied to existing through traffic on Whistle Bend Way for the following reasons:
  - Among all the proposed new developments within the City in the medium to long term, Whistle Bend will be the largest future growth area and traffic generator. Without the development in Whistle Bend, the overall background traffic growth is relatively small.
  - In addition, other future growth areas are at least 3 kilometres from Whistle Bend. This part of Whistle Bend Way is too remote to be part of the trip pattern for those areas.[1]

[1] *As per Porter Creek Bench Transport Network Impact Study (2008) and Alaska Highway Corridor Traffic Study (2011).*

Future Development Traffic

The lands within the study area were divided into six development phases including residential, commercial, schools, community, and recreation uses as illustrated in Figure 1. Phases 1 and 2 are mainly residential development expected to be fully occupied by 2015. Additional residential development is expected for Phases 3, 4, and 5. Phase 6 will be located at the heart of the subdivision and is considered the town center and will contain the majority of the subdivision's commercial development. The assumed land use types and input variables as obtained from project concept drawings are summarized in Tables 1 and 2 for residential and non-residential uses.

The residential trip generation for each phase was calculated based on the number of dwelling units (illustrated in Table 1) and the corresponding ITE trip generation equation for each land use.[2] Four trip generation equations for residential land uses were used in this analysis:

- Land Use 210 Single-Family Detached Housing
- Land Use 230 Residential Condominium/Townhouse
- Land Use 231 Low-Rise Residential Condominium/Townhouse
- Land Use 232 High-Rise Residential Condominium/Townhouse

Table 1: Residential Land Uses

Land Use Type	Density	ITE Land Use	Dwelling Units							AM Pk Hr Trips	PM Pk Hr Trips
			Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Full Build	Full Build	Full Build
Single Family	18units/ha	LU210	109	155	71	118	0	0	453	327	409
Townhouse	25units/ha	LU230	0	48	417	235	35	0	735	255	260
Multi Family - Low	40units/ha	LU231	126	91	267	70	92	0	647	519	504
Multi Family - High	80units/ha	LU232	325	56	535	141	184	0	1240	389	437
Housing Mix A	25units/ha	LU210	0	0	0	0	233	0	233	173	225
Housing Mix B	50units/ha	LU231	0	0	0	0	182	283	465	359	362
Mixed Use	35units/ha	LU231	0	0	20	6	42	107	175	104	137
Total			**560**	**350**	**1310**	**570**	**767**	**390**	**3947**	**2125**	**2335**

Information pertaining to Phases 5 and 6 is general in nature and subject to change. As a result, the number of units is based on a percentage basis for Housing Mix A and B and Mixed Use. The Housing Mix A (25 units/ha) concept is predominantly a mix of single family housing with a range of lot sizes from 300 m^2 to 700 m^2. The mix also includes duplexes, triplexes, fourplexes and townhouses integrated throughout the neighborhood. Housing Mix B (50 units/ha) will be higher in density and contain a mix of duplexes, triplexes, fourplexes, townhouses and apartments of up to 4 stories. Mixed use is a land use area where the ground floor is designated for commercial/business use with a second and/or third floor used for residential purposed.

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[2] *As per ITE 8th Edition Trip Generation.*

Trip generation for non-residential land uses was calculated using independent variables (illustrated in Table 2) and the corresponding ITE trip generation equation for said land use. These included:

- For Commercial land uses:
  - Land Use 814 Speciality Retail Center
  - Land Use 815 Free-Standing Discount Store

- For Community land uses:
  - Land Use 412 County Park
  - Land Use 495 Recreational Community Center
  - Land Use 560 Church
  - Land Use 565 Day Care Center

- For Active Recreation land uses:
  - Land Use 430 Golf Course

- For Schools land uses:
  - Land Use 520 Elementary School
  - Land Use 530 High School

- For Mixed Use land uses:
  - Land Use 710 General Office Building
  - Land Use 814 Speciality Retail Center

Table 2: Non-Residential Land Uses

Land Use Type	ITE Land Use	Variable	Input Variables							AM Pk Hr Trips	PM Pk Hr Trips
			Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Full Build	Full Build	Full Build
Commercial	LU814	KSF	0	0	0	0	0	176	176	241	444
	LU815	KSF	123	0	0	0	0	0	123	130	615
Community	LU565	Students	0	50	0	0	50	0	100	78	76
	LU560	KSF	0	36	0	0	60	0	96	54	38
	LU412	Acres	0	0	2	2	0	0	4	0	0
	LU495	KSF	0	0	0	139	0	0	139	225	202
Active Recreation	LU430	Acres	0	353	0	0	0	0	353	60	77
Schools	LU530	Students	0	0	0	500	0	0	500	210	65
	LU520	Students	0	0	0	250	0	250	500	186	75
Mixed Use	LU710	KSF	0	0	37	8	31	82	157	269	255
	LU814	KSF	0	0	37	8	31	82	157	215	399
Total										**1669**	**2245**

A representative development mix was assumed for the Mixed Use (Commercial) land uses:

- Land Use 710 General Office Building (50% of Mixed Use lands)
- Land Use 814 Speciality Retail Center (50% of Mixed Use lands)

These trip generation equations were selected with reference to the Whistle Bend Traffic Impact Assessment (2010). Their selection was based on the availability of matching or closely matched land uses in the ITE trip generation handbook for both peak hours, the reliability of the equations, and the availability of information to derive the input variables.

Trips generated following Full Build are a mix of residential and non-residential trips therefore, the following generation assumptions were made for the purpose of this study:

- 90% of all residential traffic generated at Full Build will be external trips while 10% will be internal
- trips generated and destined within the Whistle Bend development and using the internal road
- network;
- 100% of all elementary and community use trips will be internal trips;
- 75% of all high school trips will be external and 25% internal; and
- 75% of all commercial and mixed use commercial trips will be external and 25% internal.

Assuming full occupancy of all six development phases, the AM and PM peak hour generated traffic is summarized in Table 3.

Table 3: Trip Generation – Full Development

Phase	AM Peak Hour Trips Generated			PM Peak Hour Trips Generated		
	Total	Entering	Exiting	Total	Entering	Exiting
1	351	124	227	741	402	340
2	287	108	179	326	176	150
3	616	173	443	677	386	291
4	580	268	312	464	248	216
5	540	175	366	619	346	273
6	670	308	362	880	400	480
Total Trips	**3044**	**1156**	**1888**	**3707**	**1957**	**1750**

The total number of peak hour trips differs from the Whistle Bend Traffic Impact Assessment (2010) mainly due to the following:

1. Updated detailed plan for Phase 3-5;
2. Changes in internal trip assumptions; and
3. Assuming that the "specialty retail" floor space will generate 241 AM peak hour trips rather than the zero trip assumption made in the previous study.

Trip distribution was developed based on forecast peak hour directional split from the EMME transportation demand forecast model at the intersections of Whistle Bend Way and Casca Boulevard.[3] The majority of the trips generated by the development will travel in and out of the area

[3] *As per Alaska Highway Corridor Traffic Study (2011).*

via the southern part of Whistle Bend Way, with a nominal percentage of trips traveling via the northern part of Whistle Bend Way. Directional splits in the both peak hours were obtained from the model as illustrated in Table 4.

Table 4: Trip Distribution

	AM Peak Hour		PM Peak Hour	
Directional Split	**Inbound**	**Outbound**	**Inbound**	**Outbound**
Via northern part of Whistle Bend Way	30%	13%	13%	17%
Via southern part of Whistle Bend Way	70%	87%	87%	83%

Trip assignment was accomplished by first allocating trips in each traffic zone to loading points, i.e. locations where traffic gains access to the network. There are a total of 23 loading points, each representing an access point where traffic loads onto the local cross street that intersects with Casca Boulevard. A “catchment area” is established for each loading point so that trips from the traffic zone level can be distributed to the loading point level depending on the geographical size and the land uses within the “catchment area”. Two allocations were developed – one allocates trips that originate from or destined to Whistle Bend Way north and one allocates trips that originate from or destined to Whistle Bend Way south. The trips can then be assigned to the road network on the shortest distance path. This is accomplished by comparing the travel distance from each loading point to a common exit point on Whistle Bend Way, and vice versa.

Full Build Internal Road Base Network

The proposed on-site road network at the end of Phase 5 was based on Whistle Bend Draft Plan Drawing by Morrison Hershfield (December 2, 2011). The proposed on-site road network for Phases 6 was based on the Whistle Bend Preliminary Site Plan (May 18, 2010).

The development has two main access/egress points via Whistle Bend Way. The proposed basic road network identifies Casca Boulevard as a two-way arterial within a 30m right-of-way. As a starting point, Casca Boulevard was assumed to be a two-lane facility (one lane per direction), as this provides a more conservative approach to the provision of road capacity for vehicular movements only, without overbuild. If the single lanes are insufficient to handle the anticipated traffic demand, then additional laning could be accommodated within the existing RoW. All intersections on the Casca Boulevard corridor were analyzed as unsignalized intersections with left turn bays provided on all major approaches and stop controlled on the minor approaches (2WSC), except at the intersection of Casca Boulevard and Skookum Drive in which a single-lane roundabout was proposed. The two Casca Boulevard connections to Whistle Bend Way, as well as the intersection of Casca Boulevard and Skookum Drive, are single-lane roundabouts with single entry and exit lanes on all approaches. Peak hour traffic volumes at full build-out are illustrated in Figure 2 and 3.

Figure 2: AM Peak Hour Traffic Volumes – Full Build

Figure 3: PM Peak Hour Traffic Volumes – Full Build

Level of Service Definition

Level of Service (LOS) is a qualitative measure that describes the operating conditions of a transportation infrastructure. At an intersection, the LOS can be characterized for the entire intersection, each intersection approach, and each turning movement. It is also a surrogate measure of driver discomfort and fuel consumption. Six level of service are defined and given letter designations A through F, with LOS A representing the best range of operating conditions and LOS F the worst. LOS D or better are considered acceptable in urban areas.

Table 5: Intersection Level of Service Criteria

LOS	Signalized Intersection	Unsignalized Intersection
A	≤10 sec	≤10 sec
B	10-20 sec	10-15 sec
C	20-35 sec	15-25 sec
D	35-55 sec	25-35 sec
E	55-80 sec	35-50 sec
F	≥80 sec	≥50 sec

The delay experienced by motorists in a signalized intersection is affected by a number of factors related to geometrics, traffic, control, and incidents. The total delay is defined as the difference between the actual travel time and travel time that would result from ideal conditions. For signalized intersections, only the portion of the total delay associated with control is measured. This delay is referred to as control delay and includes the following: initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

LOS A describes operations with a control delay 10 seconds per vehicle or less. This level is typically assigned when most vehicles arrive during green signal and travel through the intersection without stopping. It is due to exceptional progression or short cycle lengths. All vehicles will clear the intersection during the first available green time.

LOS B describes operations with a control delay greater than 10 and up to 20 seconds per vehicle. More vehicles stop than for LOS A, causing higher levels of average delay. This level is typically assigned when progression is highly favorable or the cycle length is short. All vehicles will clear the intersection during the first available green time. The intersection of Two Mile Hill Road and Range Road is currently operating at LOS B in both peak hours.

LOS C describes operations with a control delay greater than 20 and up to 35 seconds per vehicle. This level is typically assigned when progression is favorable or the cycle length is moderate. The number of vehicles stopping is significant, though many vehicles still pass through without stopping. The majority of vehicles will clear the intersection during the first available green time. The intersection of Alaska Highway and Two Mile Hill Road and Hamilton Boulevard is currently operating at LOS C in both peak hours.

LOS D describes operations with a control delay greater than 35 and up to 55 seconds per vehicle. This level is typically assigned when progression is ineffective, the cycle length is long, or has a high volume-to-capacity ratio. Many vehicles stop, and the proportion of vehicles not stopping diminishes. Some vehicles may be delayed for a full cycle and will not clear the intersection during the first available green time.

LOS E describes operations with a control delay greater than 55 and up to 80 seconds per vehicle. This level is typically assigned when progression is unfavorable, the cycle length is long, or has a high volume-to-capacity ratio. Most vehicles will be delayed for a full cycle and will not clear the intersection during the first available green time.

LOS F describes operations with a control delay greater than 80 seconds per vehicle. This level is typically assigned when progression is very poor, the cycle length is long, and demand exceeds the capacity. All vehicles are delayed for one or more cycle length. Sustained operation at this LOS can quickly lead to network grid lock. This level is considered unacceptable to most drivers.

The two types of unsignalized intersections include two-way stop-controlled (TWSC) and all way stop-controlled (AWSC) intersections. The delay range for unsignalized intersections is different from those for signalized intersections primarily due to driver expectation. The expectation is that signalized intersections are designed to carry higher volumes of traffic and therefore higher levels of delay are acceptable. The unsignalized intersections are also associated with more uncertainty for users, as delays are less predictable than they are at signals, which can reduce users' delay tolerance.

LOS A describes operations with a very low control delay 10 seconds per vehicle or less. All drivers find freedom of operation. There is rarely more than one vehicle in queue.

LOS B describes operations with a control delay greater than 10 and up to 15 seconds per vehicle. Some drivers begin to consider the delay troublesome. Seldom is there more than one vehicle in queue.

LOS C describes operations with a control delay greater than 15 and up to 25 seconds per vehicle. Most drivers feel restricted, but tolerably so. There is often more than one vehicle in queue.

LOS D describes operations with a control delay greater than 25 and up to 35 seconds per vehicle. Drivers feel restricted. Most often, there is more than one vehicle in queue.

LOS E describes operations with a control delay greater than 35 and up to 50 seconds per vehicle. Drivers find delays approaching intolerable levels. There is frequently more than one vehicle in queue. This level denotes a state in which the demand is close or equal to the probable maximum number of vehicles that can be accommodated by the movement.

LOS F describes operations with a control delay in excess of 50 seconds per vehicle. It represents an intersection failure situation that is caused by geometric and/or operational constraints external to the intersection.

Analysis Criteria

The purpose of the traffic analysis is to determine the effect of the development on the adjacent street network in terms of performance, capacity, delay and required mitigation measures for post-development volumes. Traffic operations analysis software Synchro 7 was used for traffic analysis of signalized and unsignalized intersections based on the Highway Capacity Manual (HCM2000). In addition, traffic analysis of roundabouts followed procedures in the latest HCM2010.

Building upon the basic road network, any turning movement at a stop-controlled intersection that did not satisfy a performance threshold of Level-of-service (LOS) "D"[4] was considered for road or intersection improvements. This was an iterative process in which addition improvements were evaluated until all turning movements were LOS "D" or better, in the following improvement sequences:

1. Four-way stop-controlled (4WSC) or single-lane roundabout
2. Signalization
3. Signal optimization and coordination
4. Geometric Improvements

Building upon the basic road network, any turning movement at a single-lane roundabout that did not satisfy the threshold of LOS "D" was considered for roundabout improvements. The following improvement sequences were tested in an iterative process until all turning movements were LOS "D" or better:

1. Bypass lanes
2. Multilane roundabout

It should be noted that the improvements forming the recommended network are only based on the vehicle traffic operation analysis. Safety, transit, pedestrian and cyclists considerations were not comprehensively examined in this study and may require further improvements where appropriate.

Scenario Analyzed

Two scenarios were selected for analysis as follows:

- Scenario Full Build Basic: representing future traffic volumes (background plus development) on the proposed basic road network at full build-out.
- Scenario Full Build Recommended: representing future traffic volumes (background plus development) on the proposed road network with all recommended improvements in place at full build-out.

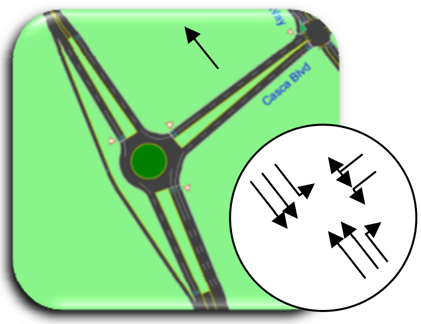
[4] *LOS "D" is equivalent to 35 seconds of delay at an unsignalized intersection and 55 seconds of delay at a signalized intersection.*

Full Build Traffic Analysis Results

HCM results for the two scenarios at full build-out are included in Appendix A and summarized below at each intersection. The descriptions below were arranged such that one would assume a travelling car along Casca Boulevard starting at the eastern entrance into the community, travelling north, loops back south, until it reaches Whistle Bend Way at the western entrance. Analysis results indicate the following:

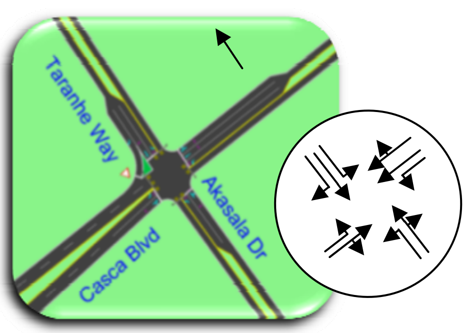
At Whistle Bend Way/Casca Boulevard (E):

- As a single-lane roundabout with single entry and exit lanes, all approaches operate at LOS “F” during both peak hours. This suggests the need for greater capacity to accommodate the heavy flow of traffic using this entrance.
- A multilane roundabout was examined with two-lane entry and exit lanes. Two bypass lanes are provided for the northbound right turn from Whistle Bend Way to Casca Boulevard, and for the southbound through along Whistle Bend Way. As a result, the Whistle Bend Way approaches experience LOS “B” or better, while the Casca Boulevard approach experience LOS “D” during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



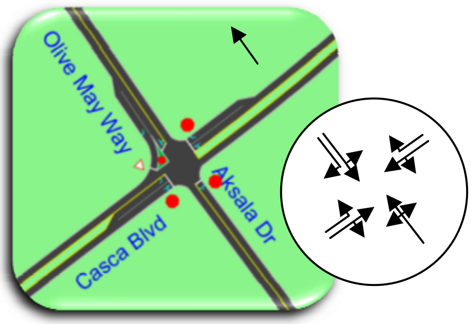
At Casca Boulevard/Taranhe Way/Aksala Drive:

- As a 2WSC intersection with basic laning, the northbound approach on Akaka Drive operates at LOS “F” during both peak hours.
- Traffic signals are examined together with the addition of a westbound through lane on Casca Boulevard and a channelized southbound right turn lane on Taranhe Way. As a result, the Casca Boulevard approaches experience LOS “B” or better, while the Taranhe Way/Akaka Drive approaches experience LOS “C” or better during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



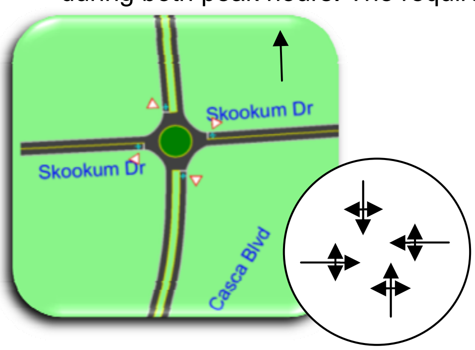
At Casca Boulevard/Olive May Way/Akaka Drive:

- As a 2WSC intersection with basic laning, the northbound approach on Akaka Drive operates at LOS “F” during both peak hours.
- A 4WSC intersection was examined together with the additional of a channelized southbound right turn lane on Olive May Way. A westbound right turn lane is provided on Casca Boulevard to facilitate the elementary school at the vicinity. As a result, the Casca Boulevard approaches experience LOS “B” or better, while the Olive May Way/Akaka Drive approaches experience LOS “A” during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



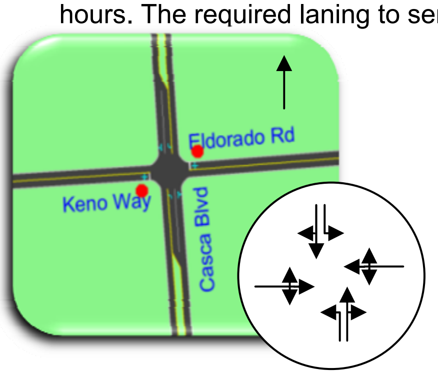
At Casca Boulevard/Skookum Drive:

- As a single-lane roundabout with single entry and exit lanes, all approaches operate at LOS “A” during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



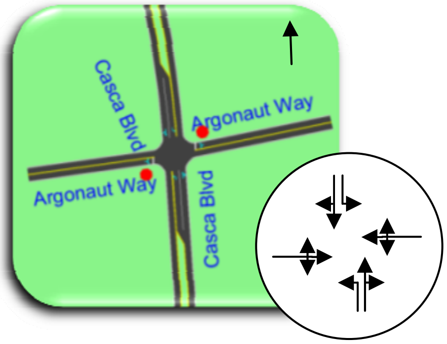
At Casca Boulevard/Keno Way/Eldorado Road:

- As a 2WSC intersection with basic laning, the Casca Boulevard approaches operate at LOS “A”, while the Keno Way/Eldorado Road approaches experience LOS “B” or better during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



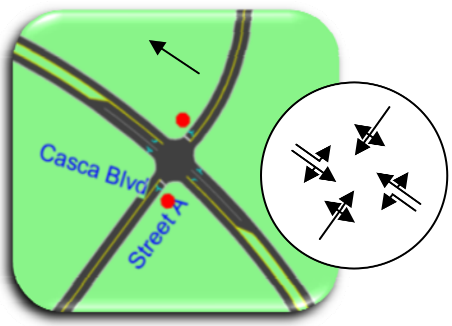
At Casca Boulevard/Argonaut Way:

- As a 2WSC intersection with basic laning, the Casca Boulevard approaches operate at LOS “A”, while the Argonaut Way approaches experience LOS “B” or better during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



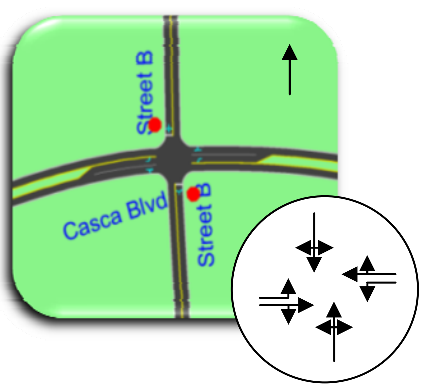
At Casca Boulevard/Street A:

- As a 2WSC intersection with basic laning, the Casca Boulevard approaches operate at LOS “A”, while the Street A approaches experience LOS “B” or better during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



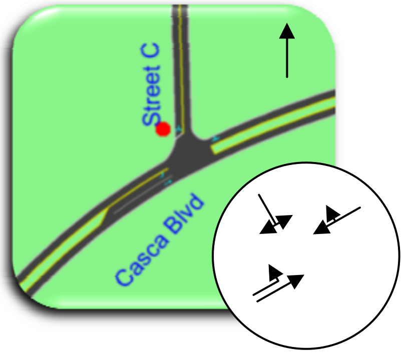
At Casca Boulevard/Street B:

- As a 2WSC intersection with basic laning, the Casca Boulevard approaches operate at LOS “A”, while the Street B approaches experience LOS “B” or better during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



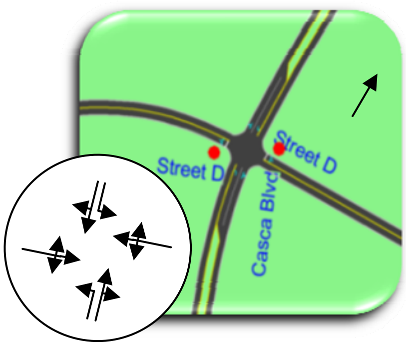
At Casca Boulevard/Street C:

- As a 1WSC intersection with basic laning, all approaches operate at LOS “A” during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



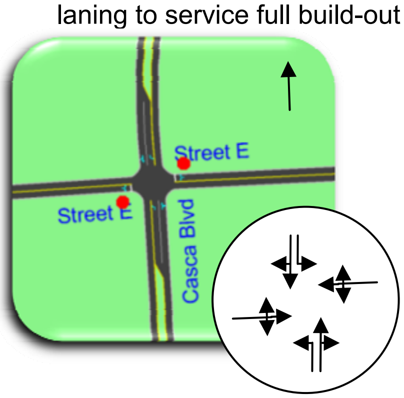
At Casca Boulevard/Street D:

- As a 2WSC intersection with basic laning, the Casca Boulevard approaches operate at LOS “A”, while the Street D approaches experience LOS “C” or better during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



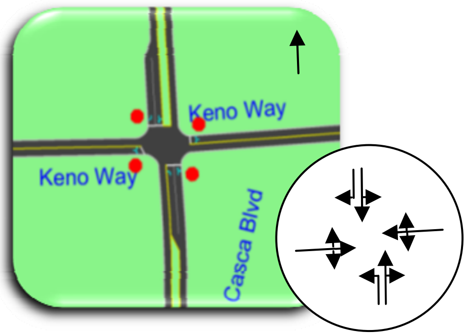
At Casca Boulevard/Street E:

- As a 2WSC intersection with basic laning, the Casca Boulevard approaches operate at LOS “A”, while the Street E approaches experience LOS “C” or better during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



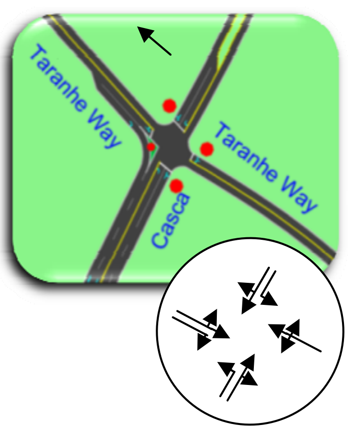
At Casca Boulevard/Keno Way (W):

- As a 2WSC intersection with basic laning, the Keno Way westbound approach operates at LOS “E” during both peak hours.
- A 4WSC intersection was examined. A southbound right turn lane is provided on Casca Boulevard to facilitate the high school at the vicinity. As a result, the Casca Boulevard approaches experience LOS “D” or better, while the Keno Way approaches experience LOS “B” or better during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



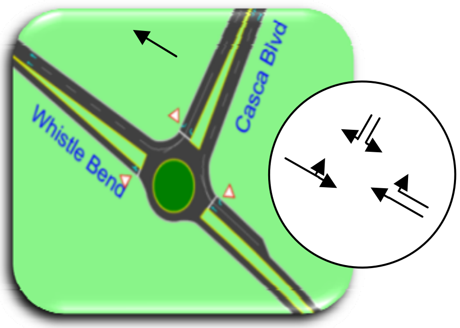
At Casca Boulevard/Taranhe Way (W):

- As a 2WSC intersection with basic laning, the northbound approach on Taranhe Way operates at LOS “F” during both peak hours.
- A 4WSC intersection was examined together with the addition of a channelized southbound right turn lane on Tarahe Way. As a result, the Casca approaches experience LOS “D”, while the Taranhe Way approaches experience LOS “B” during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



At Whistle Bend Way/Casca Boulevard (W):

- As a single-lane roundabout with single entry and exit lanes, all approaches operate at LOS “D” or better during both peak hour.
- After the addition of two bypass lanes for the northbound right turn from Whistle Bend Way to Casca Boulevard, and for the westbound right turn from Casca Boulevard to Whistle Bend Way, the Casca Boulevard westbound approach experiences LOS “B” or better, while the Whistle Bend Way southbound approach experiences LOS “D” or better during both peak hours. The required laning to service full build-out traffic is illustrated as follows:



Full Build Internal Road Network

Peak hour volumes and recommended laning along the study corridor at full build-out are illustrated in Figures 4 and 5.

Figure 4: Traffic Volumes and Laning – Full Build Recommended AM Peak Hour

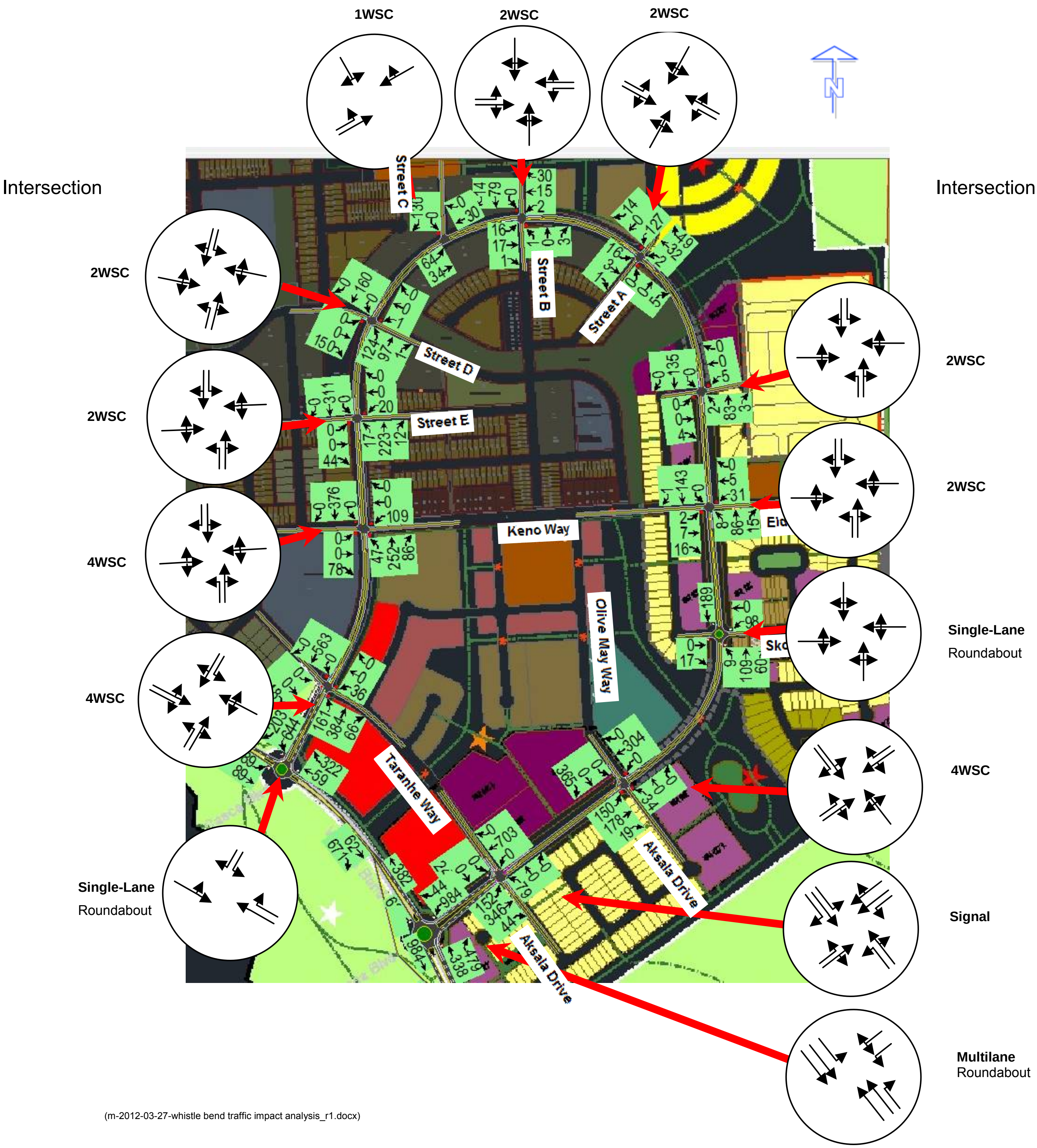
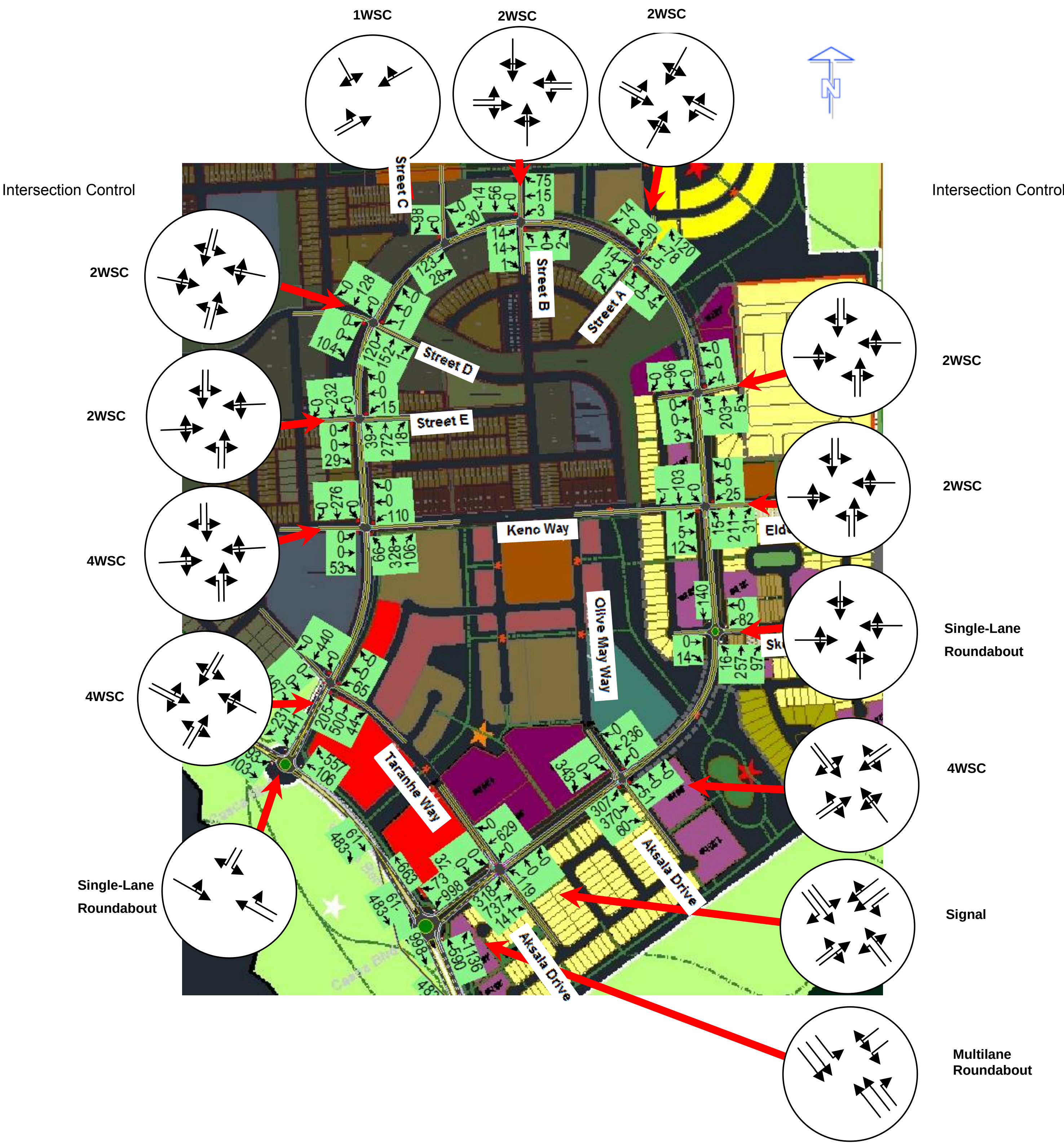


Figure 5: Traffic Volumes and Laning – Full Build Recommended PM Peak Hour



In general, the laning requirement for Casca Boulevard at full build-out is:

- Two lane per direction between Whistle Bend Way and Taranhe Way E
- One lane per direction between Taranhe Way E and Taranhe Way W
- Two lane per direction between Taranhe Way W and Whistle Bend Way

Laning and storage length requirements are summarized in Table 6 and those in the vicinity of the Whistle Bend Way entrances are illustrated in Figures 6 and 7.

Table 6: Laning and Storage Length Requirements

		Bypass Lanes		Turn Bays (m of storage)					
		Casca Blvd	WB Way	Casca Blvd			Cross Street		
Intersection	Control Type			1 LT	2 LT	1 RT	1 LT	2 LT	1 RT
Whistle Bend Way & Casca Blvd (E)	Multilane Roundabout		NBR, SBT						
Casca Blvd & Taranhe Way (E)	Signal			60		60		30	30
Casca Blvd & Olive May Way (E)	4WSC			30		30			30
Casca Blvd & Skookum Dr	Single-Lane Roundabout								
Casca Blvd & Keno Way (E)	2WSC				30				
Casca Blvd & Argonaut Way	2WSC				30				
Casca Blvd & Street A	2WSC				30				
Casca Blvd & Street B	2WSC				30				
Casca Blvd & Street C	1WSC			30					
Casca Blvd & Street D	2WSC				30				
Casca Blvd & Street E	2WSC				30				
Casca Blvd & Keno Way (W)	4WSC			30		30			
Casca Blvd & Taranhe Way (W)	4WSC				30				30
Whistle Bend Way & Casca Blvd (W)	Single-Lane Roundabout	WBR	NBR						

Figure 6: Laning at Whistle Bend Way and Casca Boulevard (E)

Figure 7: Laning at Whistle Bend Way and Casca Boulevard (W)

Safety

An elementary school is proposed to be located on the northern quadrant of the proposed Casca Boulevard and Olive May Way intersection. Signals are not required at full build-out to accommodate forecast traffic volumes. However, it may be desirable to install signals on pedestrian safety grounds.

A secondary school is proposed for the western quadrant of the proposed Casca Boulevard intersections at Keno Way W and Taranhe Way W. Signals are not required at full build-out to accommodate forecast traffic volumes. However, it may be desirable to install signals on pedestrian safety grounds.

Pedestrian actuated signals may also be considered at the following locations to promote pedestrian safety and other modes of transportation:

- On Casca Boulevard adjacent to transit stops.
- Near Town Square and nearby mixed used commercials.
- On Casca Boulevard at trail connections.

Transit Service Review

Bus service in the City of Whitehorse is provided by Whitehorse Transit for conventional transit services. Currently, Route 1 Riverdale North-Porter Creek Express and Route 4 Porter Creek-Crestview both run on Mountainview Drive and operate on 60-minute headways in the peak hours. To service the population in the Whistle Bend in the short term, route extension to the Skookum Drive roundabout should be considered. If that is the case, the roundabouts must be designed to allow for such turning movements to be made by a bus. In the long term, there should be consideration of a new bus route dedicated to Whistle Bend which runs on the entire Casca Boulevard corridor. To accommodate increasing transit demand, it is anticipated that this bus route will be a frequent service in the peak hour in contrast with current standards. This is an important and sustainable feature of the subdivision to promote and encourage public transit in the new development.

Summary

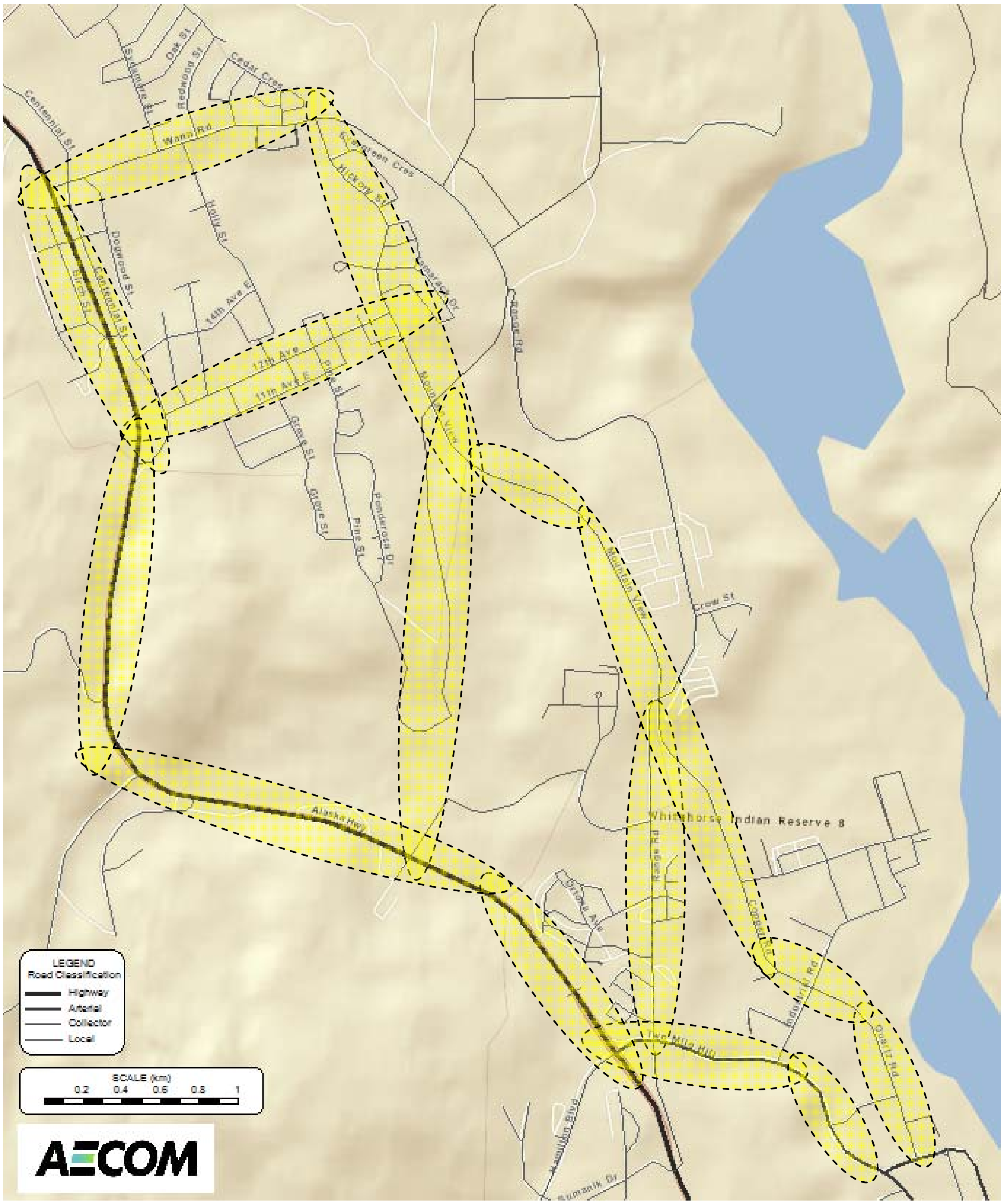
To assess the on-site impacts of the new development in Whistle Bend, two scenarios were developed typifying traffic conditions at full build-out. Key findings of the traffic analysis include:

- The full build-out Whistle Bend will generate 3,044 and 3,707 external vehicle trips during the AM and PM peak hours respectively.
- Analysis shows both single-lane roundabouts at the intersection of Whistle Bend Way and Casca Boulevard (W), and the intersection of Casca Boulevard and Skookum Drive operate well at full build-out.
- A multilane roundabout at the intersection of Whistle Bend Way and Casca Boulevard (E) will operate within the acceptable LOS of D.
- The installation of traffic signals is required at the intersection of Casca Boulevard and Taranhe Way/Akaka Drive.
- Laning requirement of Casca Boulevard at full build-out suggests:
    - Two lanes per direction between Whistle Bend Way and Taranhe Way E
    - One lane per direction between Taranhe Way E and Taranhe Way W
    - Two lanes per direction between Taranhe Way W and Whistle Bend Way.
- Detailed laning requirements under full build-out conditions are illustrated in Figures 4 to 7.
- Intersection operations at the Casca Boulevard corridor indicate that with all the recommended improvements in place, all intersections and all turning movements will operate within the acceptable LOS of “D” during both AM and PM peak hours under full build-out conditions.

Off-site Servicing Study Area

The study area, as shown in Figure 8, is defined as those roads and intersections that will be highly impacted by Whistle Bend generated traffic, mainly focused along Hickory-Mountainview-Copper-Quartz corridor, Wann Road, 12th Avenue, Whistle Bend Way extension to Alaska Highway, Range Road, Alaska Highway, and Two Mile Hill Road.

Figure 8: Study Area



Transportation Model Development

The Whitehorse Transportation Model, based on the EMME software package, was re-validated and updated in the recent Alaska Highway Corridor Traffic Study (2011). AECOM has made advancement in modelling traffic operations by introducing capacity and delay calculation algorithms into EMME based on the latest Highway Capacity Manual (HCM2010). This develops the capability to generate reliable forecasts of turning traffic volumes at major intersections for future land use and network scenarios. In combination with other analytical tools, the model can then be used to evaluate present and future transportation conditions in the City, which will identify future network infrastructure needs.

The model was developed using the following data inputs:

- Various relevant reports;
- Satellite photography and Street View;
- Traffic count data, traffic signal timing plans, and traffic signal warrants;
- Whitehorse road GIS shapefile;
- Whitehorse subdivision GIS shapefile;
- CAA Driving Cost 2010;
- Yukon Bureau of Statistics – Population, Employment, School Enrolment, Employment Payroll;
- Whitehorse Downtown Parking Management Plan;
- Tourism Yukon Situation Analysis;
- City of Whitehorse 2010 OCP; and
- Digital mapping, including graphics of recent planning initiatives.

Land Use and Demographics

The Whitehorse Transportation Model was re-validated to 2011 conditions using land use and demographic data primarily based on Yukon Bureau of Statistics (2010), supplemented by Federal Census (2006), forming a base year 2011 population of 23,600 people. The development of demographic and land use projections was based on iterative discussions with the City's Planning Department.

The Pop. 35,000 model used in this study represents approximately 48% increase in total population and is equivalent to medium (2.0%) growth in Whitehorse to the year 2031 as follows:

- City population has reached 35,000 with a corresponding 17,800 jobs. This horizon was developed by projecting an increase in population, employment and school enrolment based on an annual growth rate of 2.0% per annum for 20 years. Most of the new population will be located in Whistle Bend. The rest of the population will be distributed across public and non-public new areas, First Nation lands, as well as infill and redevelopment in the City's downtown and other residential areas.
- Whistle Bend development has reached Phase 5, with a population of 6,300 excluding Ta'an or Heiland properties. Land use and demographics has been updated to be more consistent with the detailed information provided for the on-site analysis, as well as assumptions about internal and external trips.

The Pop. 46,800 model used in this study represents approximately 98% increase in total population and is equivalent to high (3.5%) growth in Whitehorse to the year 2031 as follows:

- City population has reached 46,800 with a corresponding 23,900 jobs. This horizon was developed by projecting an increase in population, employment and school enrolment based on an annual growth rate of 3.5% per annum for 20 years. This scenario takes Whistle Bend to the full build-out stage and creates new communities of approximately 2,500 in Downtown, 2,000 people in the McLean Lake area, 2,000 people in the Lobird area, 1,500 people in the Porter Creek "D" area, and in other residential areas.
- Whistle Bend land use and demographics at full build-out has been updated to be more consistent with the detailed information provided for the on-site analysis, as well as assumptions about internal and external trips.

Pop. 46,800 Base Road Network

The proposed base road network includes these road improvement projects identified in the Pop. 46,800 Horizon Network of the Alaska Highway Corridor Traffic Study:

- Downgrade of Range Road Between Whistle Bend Way tie-in and Northland for Local or Emergency Access Only **(2-lane)**
- Whistle Bend Way Extension to Pine Street **(2-lane)**
- Pine Street Extension to Alaska Highway (**2-lane)**
- College Access Road Extension **(2-lane)**
- Whistle Bend Way **4-lane** Widening Between Casca Boulevard and Mountainview Drive
- Mountainview Drive **4-lane** Widening Between Range Road and Whistle Bend Way
- Mountainview Drive / Whistle Bend Way Signalization and Geometric Improvement
- Mountainview Drive Corridor Signalized Intersections Geometric Improvement
- Alaska Highway Twinning **(4-lane)** between:
  - Centennial and Kathleen
  - Fraser and Prospector
- Alaska Highway Northbound Passing Lanes between:
  - Lorne and Mt. Sima
  - Dawson/Castle and Cronkhite/Nansen
  - South Klondike and Salmon Trail
- Alaska Highway Southbound Passing Lanes between:
  - North Klondike and Cousins Airfield
  - Lorne and Mt. Sima
  - Dawson/Castle and Cronkhite/Nansen
- Alaska/Prospector/Pine Signalization and Geometric Improvement
- Alaska/Forestry Geometric Improvement
- Alaska/Two Mile Hill Northbound Overpass and Signal Optimization
- Alaska/Range Signalization and Geometric Improvement
- Alaska/Burns Geometric Improvement
- Alaska/Robert Service Way Geometric Improvement and Signal Optimization

It should be noted that some of the above improvements on the Alaska Highway may no longer be required as a result of McIntyre Creek Crossing alternatives and additional improvements along the Mountainview corridor identified in this study. These will be discussed in a later section.

Analysis Criteria

Innovations to EMME modeling techniques enable capacities and associated delays at all signalized and unsignalized intersections to be explicitly modeled. The procedure is developed to be capable of producing reliable traffic operations and levels of service results which closely resemble that from the latest HCM2010[5]. Building upon the basic road network, any turning movement at an intersection that did not satisfy a performance threshold of Level-of-service (LOS) “D” was considered for road or intersection improvements. This was an iterative process in which addition improvements were evaluated until all turning movements were LOS “D” or better, in the following improvement sequences:

1. Signalization
2. Signal optimization
3. Geometric Improvements and Signal optimization

It should be noted that the improvements forming the recommended network are only based on the vehicle traffic operation analysis. Safety, transit, pedestrian and cyclists considerations were not comprehensively examined in this study and may require further improvements where appropriate.

Scenario Analyzed

Four scenarios were selected for analysis as follows:

- Scenario Pop.46,800 With McIntyre Creek Crossing Basic: representing future traffic volumes on the proposed basic road network.
- Scenario Pop.46,800 With McIntyre Creek Crossing Recommended: representing future traffic volumes on the proposed road network, with corresponding improvements in place.
- Scenario Pop.46,800 No McIntyre Creek Crossing Basic: representing future traffic volumes on the proposed basic road network minus McIntyre Creek Crossing.
- Scenario Pop.46,800 No McIntyre Creek Crossing Recommended: representing future traffic volumes on the proposed road network minus McIntyre Creek Crossing, with corresponding improvements in place.

Pop. 46,800 With McIntyre Creek Crossing Network

Figure 9 illustrates the approximate location of each improvement element. Each improvement element is described below together with an illustration on the right when changes to lane geometries are involved:

[5] *The EMME method calculates capacity using exactly the same procedure as the HCM2010. However some parameters are generalized to reduce the number of inputs. These includes saturation flow adjustment factors such as lane widths, bus blockages, parking maneuvers, pedestrian crossings, which have very little impact on the capacity in a broad sense.*

1. Mountainview Drive-Copper Road-Quartz Road **4-lane** Widening Between Range Road and 2nd

4-lane widening of this corridor includes additional auxiliary lanes, where appropriate, at the various junctions with cross streets and local accesses. Separate bike lane, access management, and the elimination of on-street parking should be considered.

2. Whistle Bend Way/Range Geometric Improvement

Geometric laning will be modified as follows:

- Northbound – T, T, R*[6]
- Southbound – L* ,T, T
- Westbound – LR

3. Whistle Bend Way/Mountainview Geometric Improvement and Signal Optimization

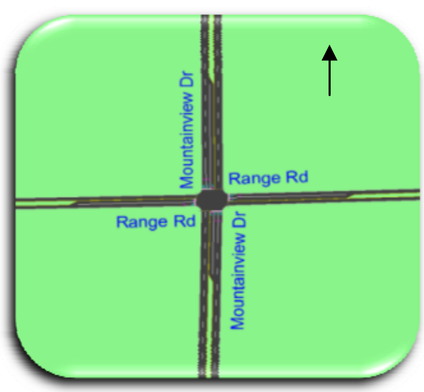
Geometric laning will be modified as follows:

- Northbound – T, R, R*
- Southbound – LT, TR*
- Eastbound – L*, TR
- Westbound – L*, L, TR

The signal would require eastbound and westbound advanced left turn phases. Results indicate that traffic operation for the southbound left turn improves to LOS "D" (53s/veh delay) and the westbound left turn improves to LOS "D" (50s/veh delay) in the AM peak hour.

4. Mountainview/Range Geometric Improvement and Signal Optimization

Geometric laning will be modified as follows:



- Northbound – L*, T, TR
- Southbound – L*, T, TR
- Eastbound – L*, TR
- Westbound – L*, TR

The signal would require an eastbound advanced left turn phase. Results indicate that traffic operation for the eastbound left turn improves to LOS "D" (42s/veh delay) and the westbound approach improves to LOS "D" (42s/veh delay) in

[6] *An asterisk beside a lane indicates that this lane is a turn bay and requires sufficient storage length.*

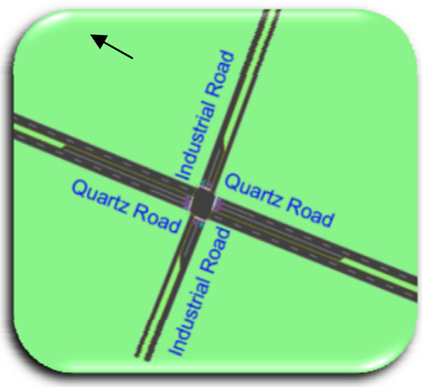
the AM peak hour.

5. Mountainview/Tlingit Geometric Improvement
Geometric laning will be modified as follows:

- Northbound – T, TR
- Southbound – L*, T, T
- Westbound – L, R*

Results indicate that traffic operation for the westbound approach improves to LOS “B” (17s/veh delay) in the PM peak hour.

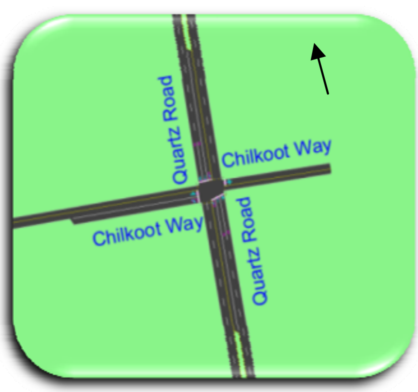
6. Quartz/Industrial Geometric Improvement and Signal Optimization
Geometric laning will be modified as follows:



- Northbound – L*, T, TR
- Southbound – L*, T, TR
- Eastbound – L*, TR
- Westbound – L*, TR

Results indicate that traffic operation for the eastbound left turn improves to LOS “D” (50s/veh delay) in the PM peak hour.

7. Quartz/Chilkoot Geometric Improvement and Signal Optimization
Geometric laning will be modified as follows:



- Northbound – L*, T, TR
- Southbound – L*, T, TR
- Eastbound – LT, R*
- Westbound – LTR

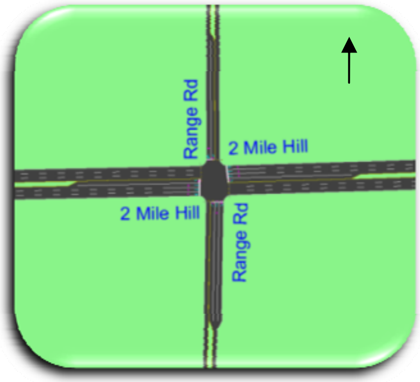
The signal would require a northbound advanced left turn phase. Results indicate that traffic operation for all turning movements improves to LOS “C” or better in both peak hours.

8. Quartz/2nd Signal Optimization

The signal would require a southbound advanced left turn phase. Results indicate that traffic operation for the eastbound left turn improves to LOS “D” (54s/veh delay) in both peak hours.

9. Range/Nijmegan Geometric Improvement
Forecast traffic volume warrants additional auxiliary lanes at the intersection.

10. Two Mile Hill/Range Geometric Improvement and Signal Optimization
Geometric laning will be modified as follows:



- Northbound – L*, T, R*
- Southbound – L*, TR
- Eastbound – L*, T, T, TR
- Westbound – L*, T, T, TR

The signal would require southbound, eastbound, and westbound advanced left turn phases. Results indicate that traffic operation for the westbound left turn improves to LOS "D" (52s/veh delay) in both peak hours.

11. Two Mile Hill/Industrial Signal Optimization

The signal would require southbound and eastbound advanced left turn phases. Results indicate that traffic operation for the southbound left turn improves to LOS "D" (54s/veh delay) in the PM peak hour.

12. Two Mile Hill/Chilkoot Signal Optimization

The signal would require a southbound advanced left turn phase. Results indicate that traffic operation for the westbound left turn improves to LOS "C" (34s/veh delay) in both peak hours.

13. 2nd/4th Signal Optimization

The signal would require a southbound advanced left turn phase. Results indicate that traffic operation for the southbound left turn improves to LOS "D" (49s/veh delay) in the AM peak hour.

The above improvements on the City roads will reduce forecast traffic volumes on the Alaska Highway especially between Prospector Road and Two Mile Hill Road. A review of the improvements on Alaska Highway was performed to understand if the initial improvements in the base network are still required. The indication is that the following improvement on the highway is no longer required in this scenario:

- Alaska/Forestry Geometric Improvement

Peak hour traffic volumes are illustrated in Figures 10 and 11.

Figure 9: Location of Improvements – Pop. 46,800 with McIntyre Creek Crossing

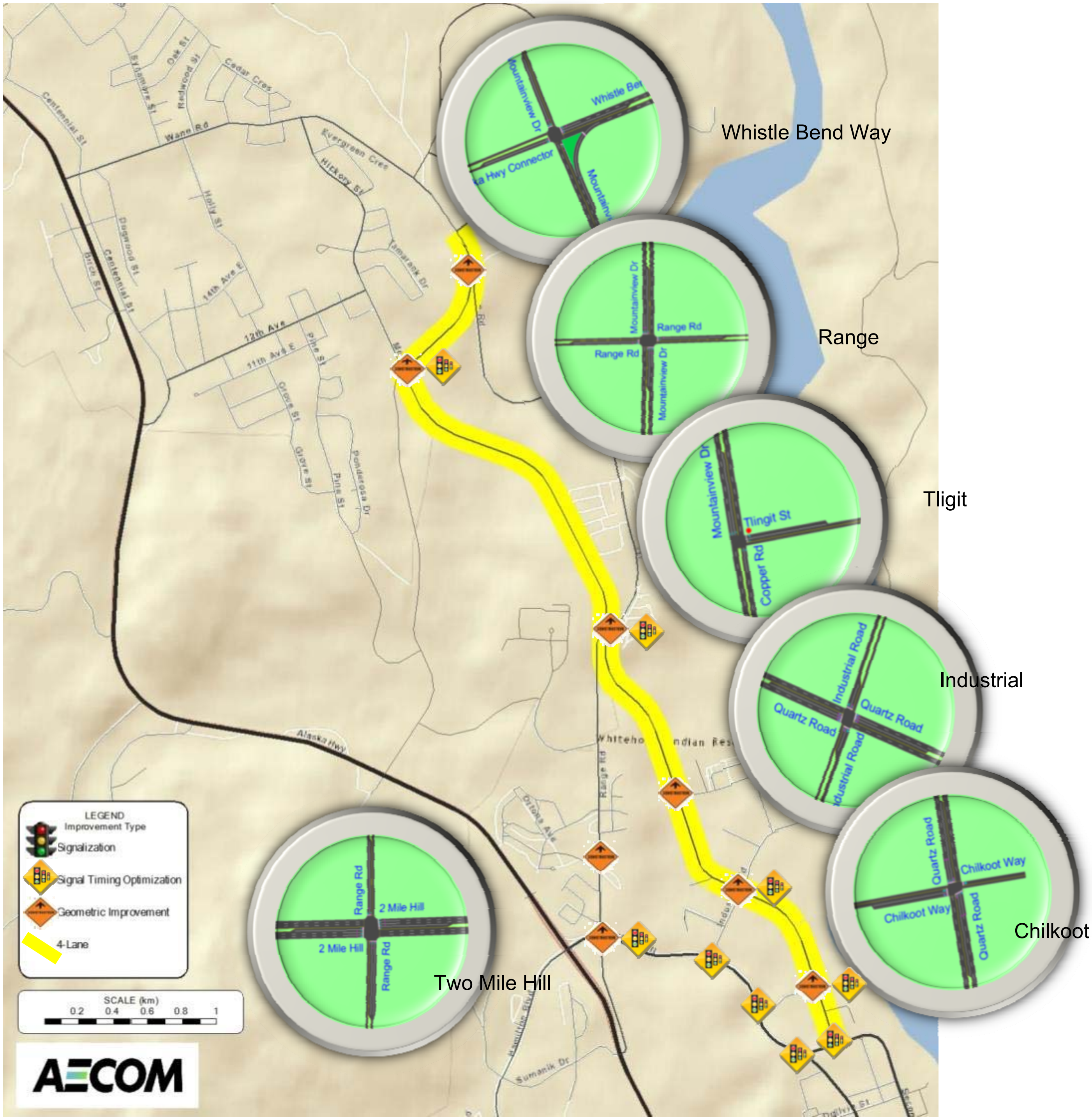
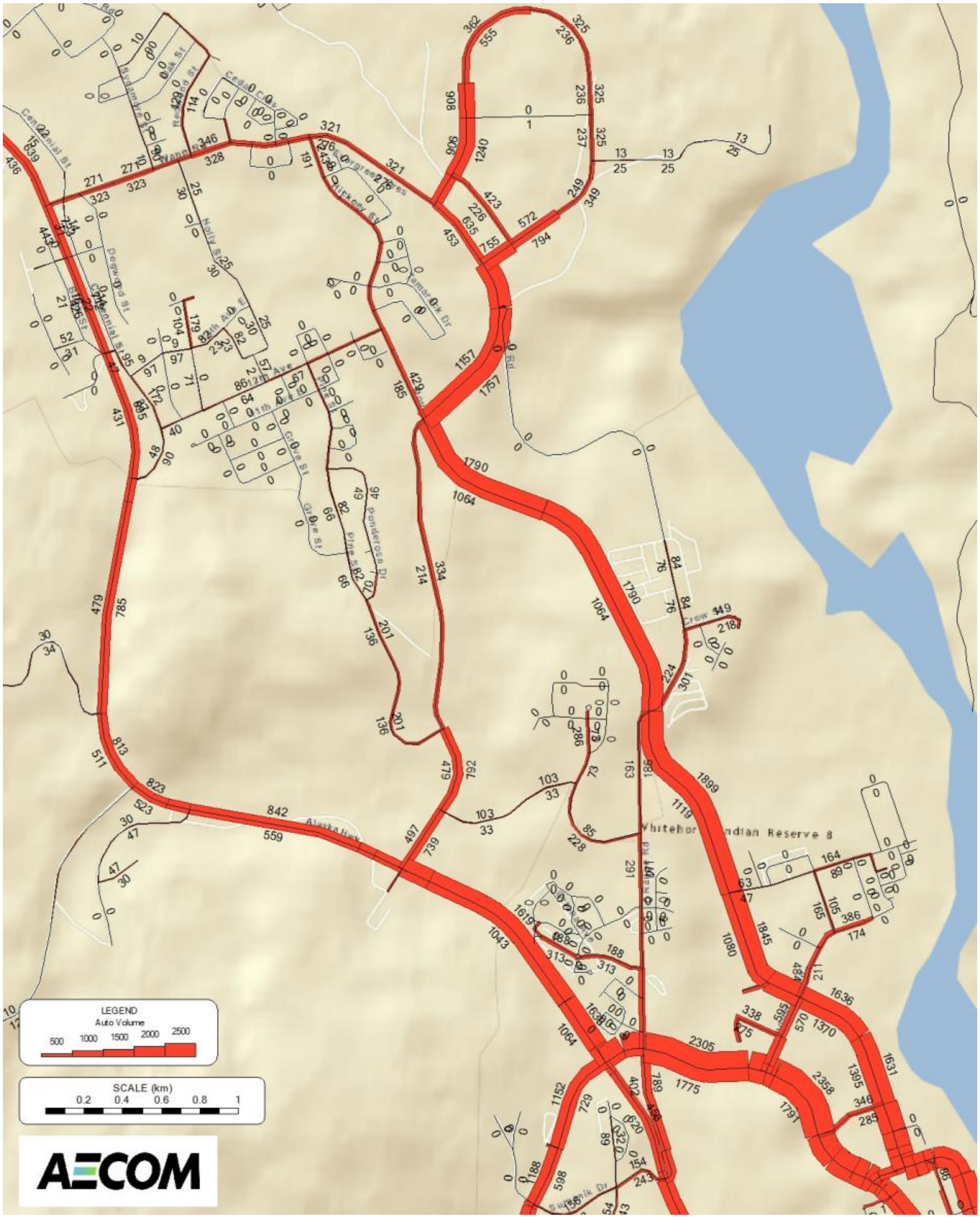


Figure 10: Traffic Volumes – Pop. 46,800 with McIntyre Creek Crossing Recommended AM Peak Hour

Figure 11: Traffic Volumes – Pop. 46,800 with McIntyre Creek Crossing Recommended PM Peak Hour



Pine Street Extension at the McIntyre Creek Crossing anticipates a two-way volume of around 1300vph in both peak hours, with close to 1100vph travelling southbound in the AM peak hour. The 4-lane Mountainview-Copper-Quartz corridor anticipates consistently in the range of 1500-1900vph in the peak hour direction. Comparatively low traffic volumes are shown on Wann Road, 12th Avenue, and Range Road.

Traffic operation conditions are demonstrated in Figure 12 and 13, detailed in Appendix B. The signalized intersections along the Mountainview-Copper-Quartz corridor and the Two Mile Hill corridor anticipate average intersection delays in the range of 20-30 seconds, with individual movement delays up to 55 seconds. Comparatively low delays are shown on Wann Road, 12th Avenue, and Range Road.

Travel time between Whistle Bend and downtown is anticipated to be around 15 minutes in the peak direction. Travel time between Porter Creek "D" and downtown is anticipated to be around 12 minutes in the peak direction.

Figure 12: Traffic Operation Conditions – Pop. 46,800 with McIntyre Creek Crossing Recommended AM Peak Hour

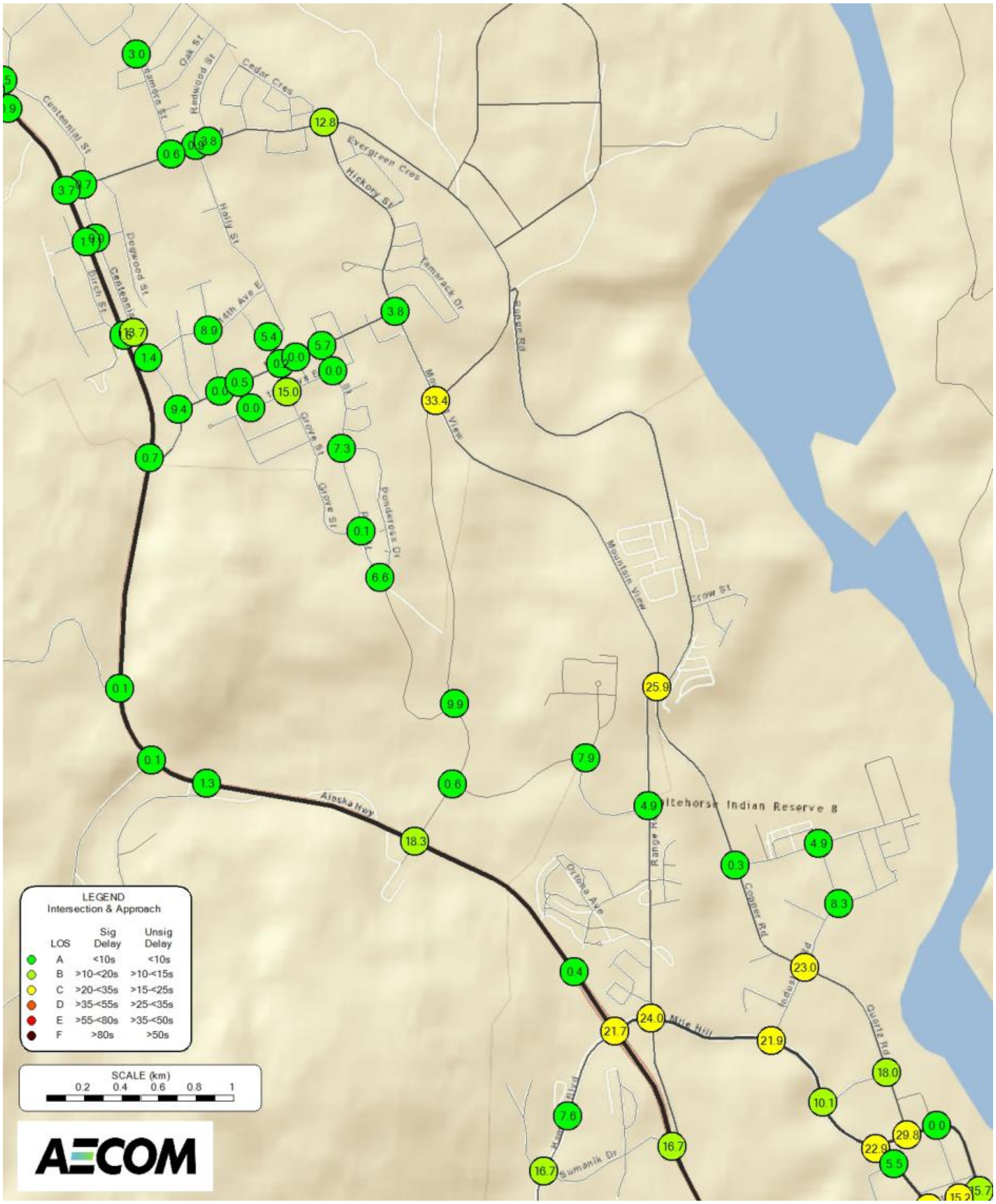
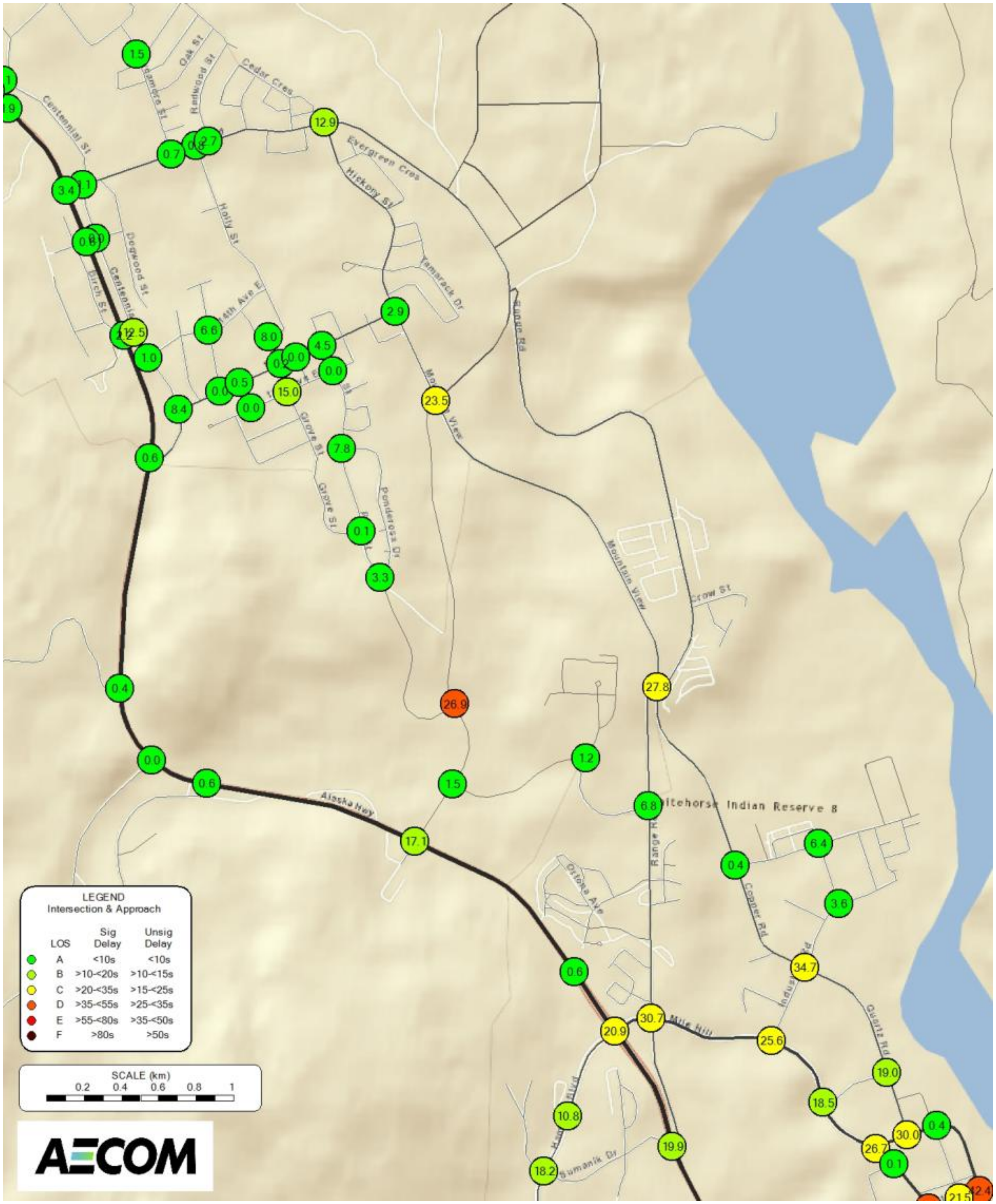


Figure 13: Traffic Operation Conditions – Pop. 46,800 with McIntyre Creek Crossing Recommended PM Peak Hour



Pop. 35,000 With McIntyre Creek Crossing Network

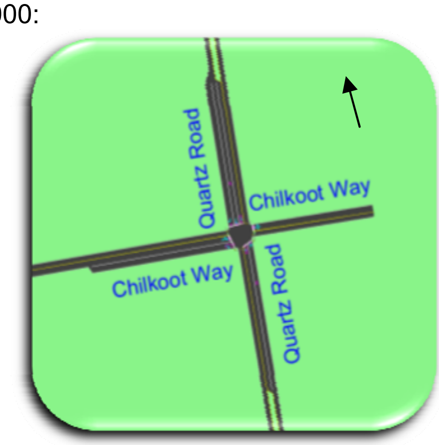
The medium growth network identifies how the above improvements may be phased in. Although the analysis was conducted with the same level of rigor, the information is not presented with the same level of detail. Figure 14 illustrates the approximate location of each improvement element. Each improvement element presented in the Pop. 46,800 With McIntyre Creek Crossing Network are described with the phasing strategy below together with an illustration on the right when lane geometries are different from the Pop. 46,800 network:

1. Mountainview Drive-Copper Road-Quartz Road **4-lane** Widening Between Range Road and 2nd
   - 4-lane widening up to Tlingit Street by Pop. 35,000
   - Auxiliary lanes required by Pop. 35,000
2. Whistle Bend Way/Range Geometric Improvement
   - Required by Pop. 35,000
3. Whistle Bend Way/Mountainview Geometric Improvement and Signal Optimization
   - Required by Pop. 35,000
4. Mountainview/Range Geometric Improvement and Signal Optimization
   - Required by Pop. 35,000
5. Mountainview/Tlingit Geometric Improvement
   - Required by Pop. 35,000
6. Quartz/Industrial Geometric Improvement and Signal Optimization
   - These geometric laning will be required by Pop. 35,000:

Northbound – LT, TR*
Southbound – LT, TR*
Eastbound – L*, TR
Westbound – L*, TR

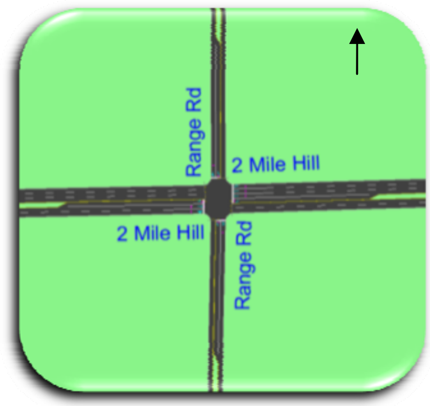
7. Quartz/Chilkoot Geometric Improvement and Signal Optimization
   - These geometric laning will be required by Pop. 35,000:

Northbound – L*, TR
Southbound – L*, T, R*
Eastbound – LT, R*
Westbound – LTR



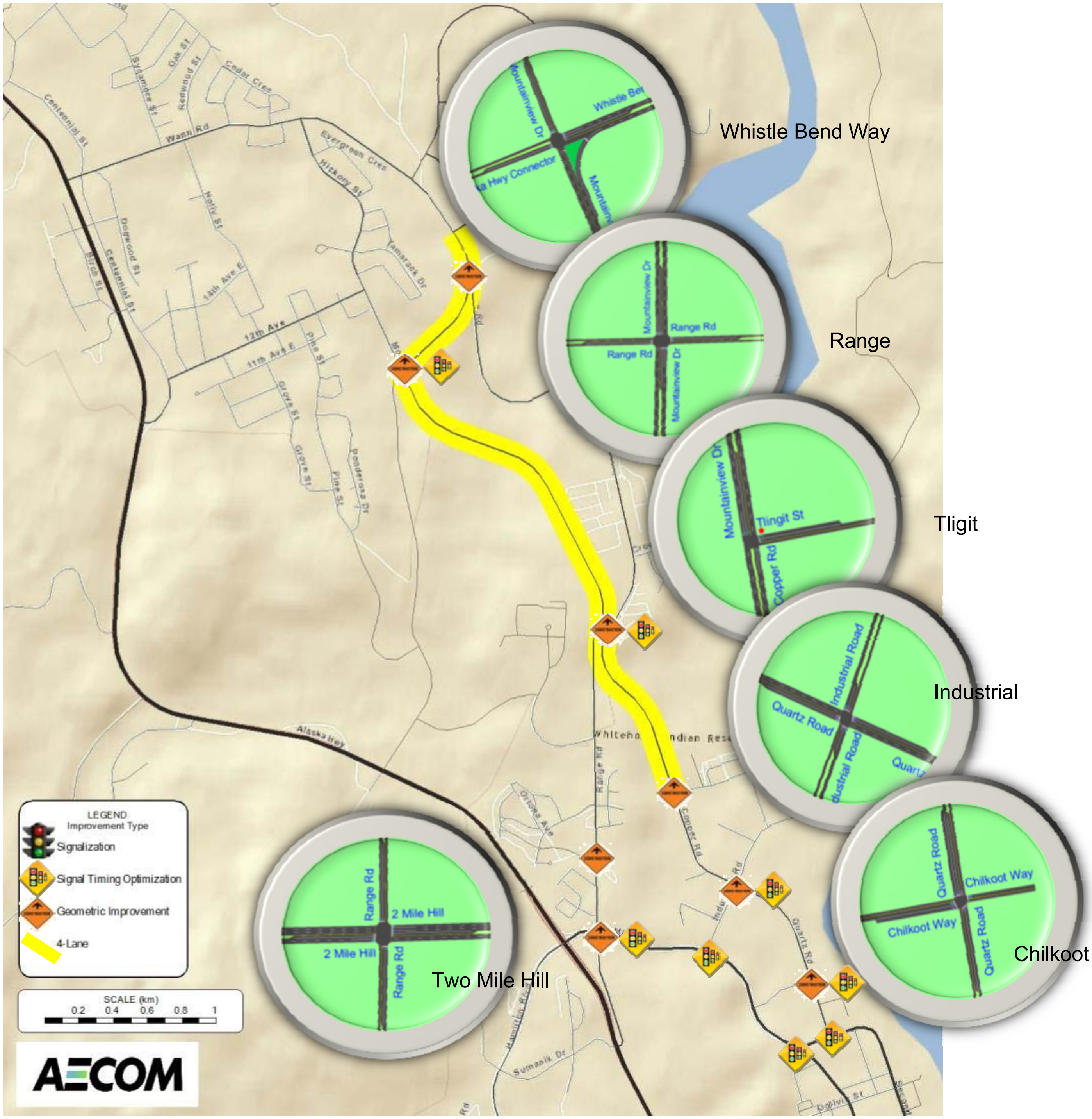
8. Quartz/2nd Signal Optimization
   - Required by Pop. 35,000
9. Range/Nijmegan Geometric Improvement
   - Required by Pop. 35,000
10. Two Mile Hill/Range Geometric Improvement and Signal Optimization
    - These geometric laning will be required by Pop. 35,000:

      Northbound – L*, TR
      Southbound – L*, TR
      Eastbound – L*, T, TR
      Westbound – L*, T, T, TR



11. Two Mile Hill/Industrial Signal Optimization
    - Required by Pop. 35,000
12. Two Mile Hill/Chilkoot Signal Optimization
    - Not required by Pop. 35,000
13. $2^{nd}/4^{th}$ Signal Optimization
    - Only PM peak hour required by Pop. 35,000

Figure 14: Location of Improvements – Pop. 35,000 with McIntyre Creek Crossing



Pop. 46,800 No McIntyre Creek Crossing Network

Figure 15 illustrates the approximate location of each element. Each improvement element is described below together with an illustration on the right when changes to lane geometries are involved:

1. Mountainview Drive-Copper Road-Quartz Road **4-lane** Widening Between Range Road and 2nd

4-lane widening of this corridor includes additional auxiliary lanes, where appropriate, at the various junctions with cross streets and local accesses. Separate bike lane, access management, and the elimination of on-street parking should be considered.

2. Whistle Bend Way/Range Geometric Improvement

Geometric laning will be modified as follows:

- Northbound – T, T, R*
- Southbound – L* ,T, T
- Westbound – LR

3. Whistle Bend Way/Mountainview Geometric Improvement and Signal Optimization

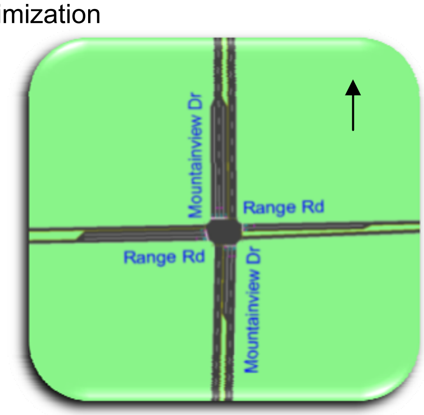
Geometric laning will be modified as follows:

- Northbound – L*, T, R, R*
- Southbound – LT, TR*
- Eastbound – L*, T, R*
- Westbound – L*, L, TR

The signal would require eastbound and westbound advanced left turn phases. Results indicate that traffic operation for the southbound left turn improves to LOS “D” (53s/veh delay) and the eastbound right turn improves to LOS “D” (53s/veh delay) in the AM peak hour.

4. Mountainview/Range Geometric Improvement and Signal Optimization

Geometric laning will be modified as follows:



- Northbound – L*, T, TR
- Southbound – L*, T, T, R*
- Eastbound – L*, L*, TR
- Westbound – L*, TR

The signal would require an eastbound advanced left turn phase. Results indicate that traffic operation for the northbound through and right turn improves to LOS “D” (52s/veh delay) in the PM peak hour.

5. Mountainview/Tlingit Geometric Improvement

Geometric laning will be modified as follows:

- Northbound – T, TR
- Southbound – L*, T, T
- Westbound – L, R*

Results indicate that traffic operation for the westbound approach improves to LOS “B” (17s/veh delay) in the PM peak hour.

6. Quartz/Industrial Geometric Improvement and Signal Optimization

- Northbound – L*, T, TR
- Southbound – L*, T, TR
- Eastbound – L*, TR
- Westbound – L*, TR

The signal would require a northbound advanced left turn phase. Results indicate that traffic operation for the southbound right turn improves LOS “D” (47s/veh delay) in the AM peak hour and the northbound left turn improves to LOS “D” (46s/veh delay) in the PM peak hour.

7. Quartz/Chilkoot Geometric Improvement and Signal Optimization

Geometric laning will be modified as follows:

- Northbound – L*, T, TR
- Southbound – L*, T, TR
- Eastbound – LT, R*
- Westbound – LTR

The signal would require a northbound advanced left turn phase. Results indicate that traffic operation for eastbound left turn improves to LOS “C” (34s/veh) in the AM peak hour and LOS “D” (37s/veh) in the PM peak hour.

8. Quartz/2nd Signal Optimization

The signal would require a southbound advanced left turn phase. Results indicate that traffic operation for the eastbound left turn improves to LOS “D” (53s/veh delay) in the PM peak hour.

9. Range/College Geometric Improvement
Forecast traffic volume warrants additional auxiliary lanes at the intersection.

10. Range/Normany North Geometric Improvement
Forecast traffic volume warrants additional auxiliary lanes at the intersection.

11. Range/Nijmegan Geometric Improvement
Forecast traffic volume warrants additional auxiliary lanes at the intersection.

12. Range/Falaise Geometric Improvement
Forecast traffic volume warrants additional auxiliary lanes at the intersection.

13. Two Mile Hill/Range Geometric Improvement and Signal Optimization
Geometric laning will be modified as follows:

- Northbound – L*, T, TR*
- Southbound – L*, L*, T, R*
- Eastbound – L*, T, T, TR
- Westbound – L*, T, T, T, TR*

The signal would require southbound, eastbound, and westbound advanced left turn phases. Results indicate that traffic operation for the northbound right turn, westbound left turn, eastbound through, and southbound left turn are just within the acceptable LOS "D" in the AM peak hour.

14. Two Mile Hill/Industrial Signal Optimization

The signal would require southbound and eastbound advanced left turn phases. Results indicate that traffic operation for the eastbound left turn and the westbound through improves to LOS "D" (53s/veh delay) in the PM peak hour.

15. Two Mile Hill/Chilkoot Signal Optimization

The signal would require a southbound advanced left turn phase. Results indicate that traffic operation for the westbound left turn improves to LOS "C" (35s/veh delay) in the PM peak hour.

16. 2nd/4th Signal Optimization

The signal would require a southbound advanced left turn phase. Results indicate that traffic operation for the westbound left turn improves to LOS "D" (51s/veh delay) in the AM peak hour.

17. Alaska Highway Twinning between Prospector and Centennial

The twinning of this highway segment includes additional acceleration and deceleration lanes, where appropriate, at the various junctions with cross streets and accesses.

18. Alaska/Centennial Signalization

Results indicate that traffic operation for the westbound approach improves to LOS “C” (30s/veh delay) in the PM peak hour.

The above improvements will reduce forecast traffic volumes on the Alaska Highway especially between Prospector Road and Two Mile Hill Road. A review of the improvements on Alaska Highway was performed to understand if the initial improvements in the base network are still required. The indication is that the following improvements on the highway are no longer required in this scenario:

- Alaska/Prospector/Pine Signalization and Geometric Improvement[7]
- Alaska/Forestry Geometric Improvement
- Alaska/Two Mile Hill Northbound Overpass and Signal Optimization

Peak hour traffic volumes are illustrated in Figures 16 and 17.

[7] *Although this is not required from the vehicle traffic perspective, transit use, safety concerns, pedestrian and cyclist access may be reasons to keep this improvement. This requires further discussions between YG and the City.*

Figure 15: Location of Improvements – Pop. 46,800 no McIntyre Creek Crossing

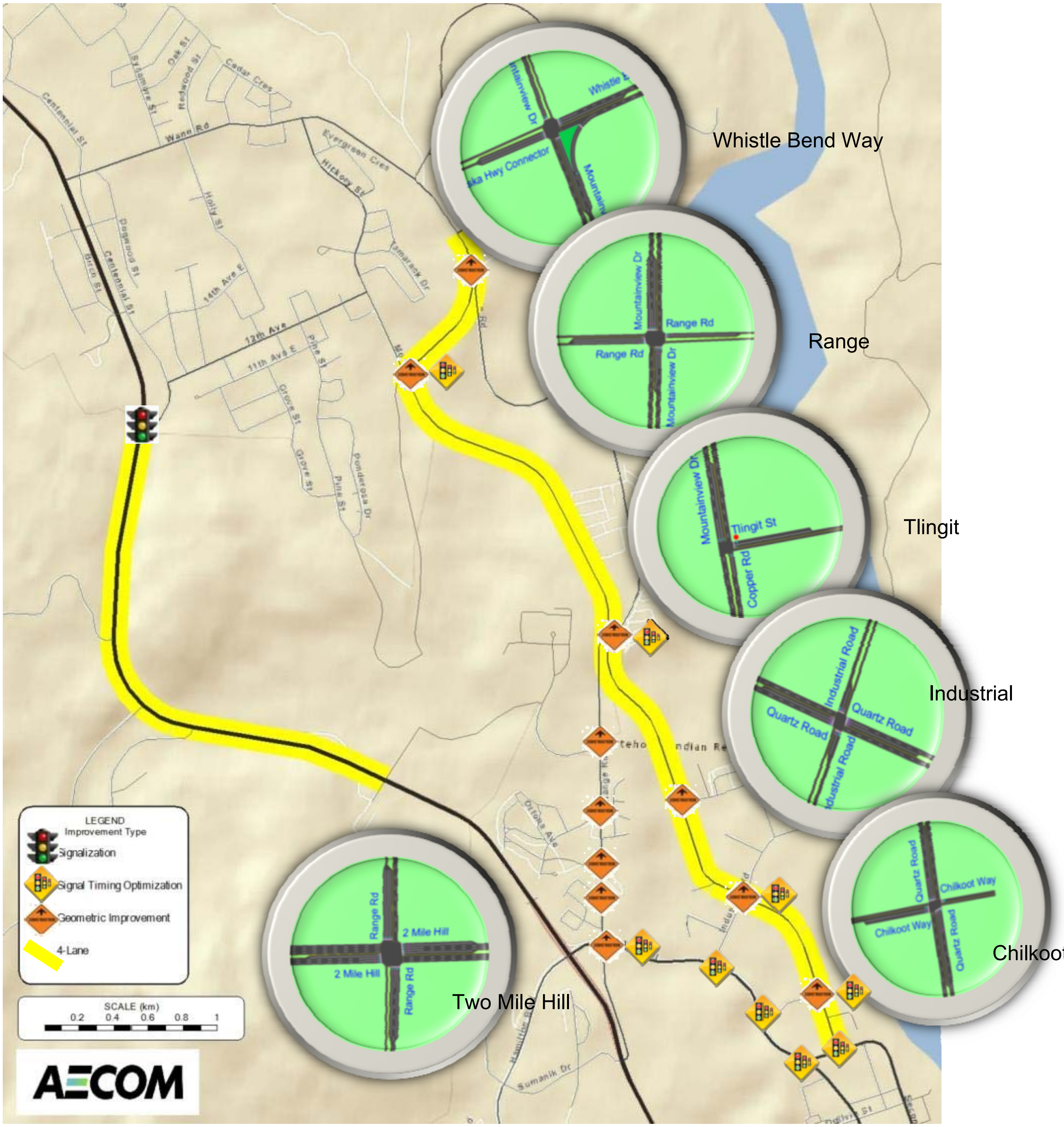


Figure 16: Traffic Volumes – Pop. 46,800 no McIntyre Creek Crossing Recommended AM Peak Hour

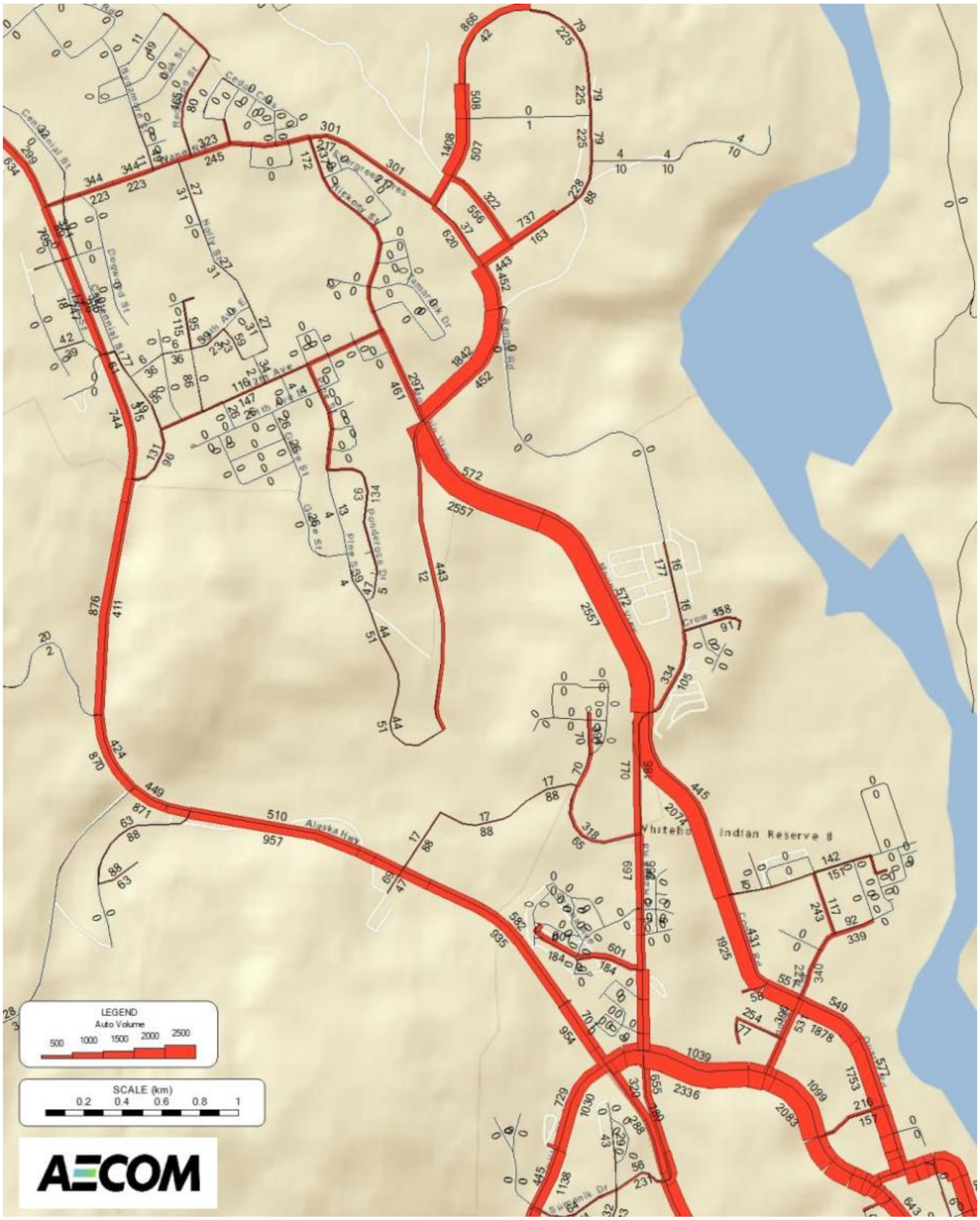


Figure 17: Traffic Volumes – Pop. 46,800 no McIntyre Creek Crossing Recommended PM Peak Hour

Without the McIntyre Creek Crossing, the 4-lane Mountainview Drive is anticipated to carry traffic in the range of 2200-2600vph in the peak hour direction. The 4-lane Copper Road and Quartz Road is anticipated to carry slightly less traffic in the range of 1700-2100vph in the peak hour direction. The 2-lane Range Road is expected to carry higher directional traffic in the range of 400-800vph south of Mountainview Drive during both peak hours. Comparatively low traffic volumes are shown on Wann Road and 12th Avenue.

Traffic operation conditions are demonstrated in Figure 18 and 19, detailed in Appendix B. The signalized intersections along the Mountainview-Copper-Quartz corridor, and the Two Mile Hill corridor anticipate average intersection delays in the range of 25-35 seconds, except at two intersections where the average intersection delays are around 40 seconds in the AM peak hour. Delays of individual movement may be as high as 55 seconds. Comparatively low delays are shown on Wann Road and 12th Avenue.

Travel time between Whistle Bend and downtown is anticipated to be around 15 minutes in the peak direction. Travel time between Porter Creek "D" and downtown is anticipated to be around 16 minutes in the peak direction.

Figure 18: Traffic Operation Conditions – Pop. 46,800 no McIntyre Creek Crossing Recommended AM Peak Hour

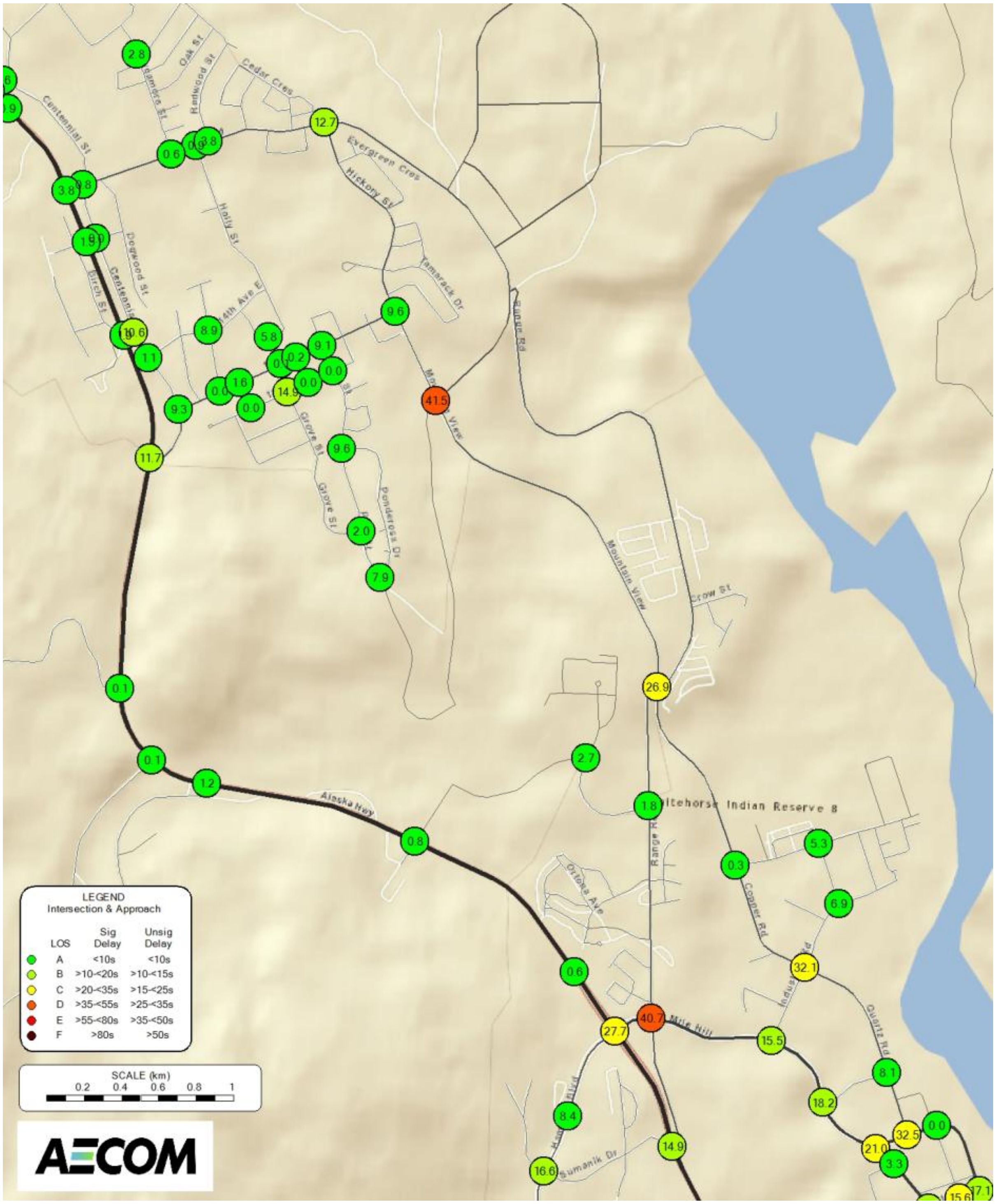
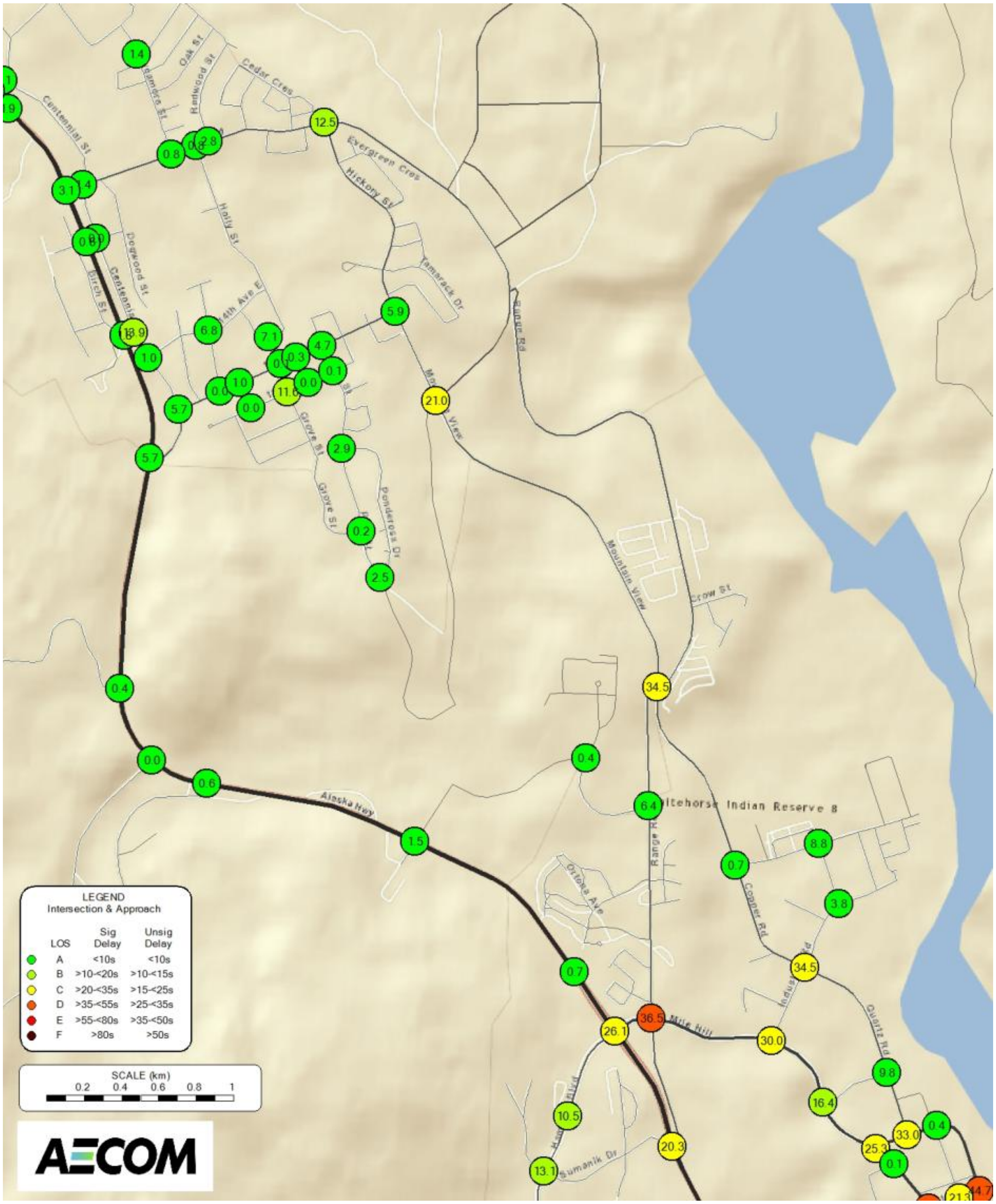


Figure 19: Traffic Operation Conditions – Pop. 46,800 no McIntyre Creek Crossing Recommended PM Peak Hour



Pop. 35,000 No McIntyre Creek Crossing Network

The medium growth network identifies how the above improvements may be phased in. Although the analysis was conducted with the same level of rigor, the information is not presented with the same level of detail. Figure 20 illustrates the approximate location of each improvement element. Each improvement element presented in the Pop. 46,800 No McIntyre Creek Crossing Network are described with the phasing strategy below together with an illustration on the right when lane geometries are different from the Pop. 46,800 network:

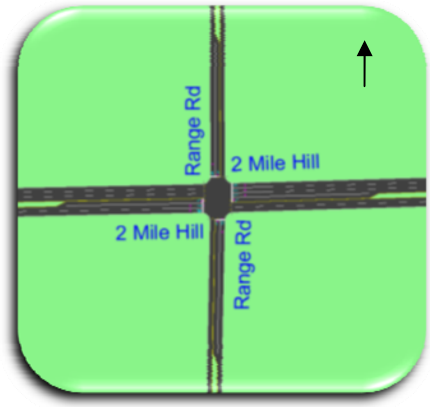
1. Mountainview Drive-Copper Road-Quartz Road **4-lane** Widening Between Range Road and 2nd
    - **4-lane** widening up to Walmart Access by Pop. 35,000
    - Auxiliary lanes required by Pop. 35,000
2. Whistle Bend Way/Range Geometric Improvement
    - Required by Pop. 35,000
3. Whistle Bend Way/Mountainview Geometric Improvement and Signal Optimization
    - Required by Pop. 35,000
4. Mountainview/Range Geometric Improvement and Signal Optimization
    - Required by Pop. 35,000
5. Mountainview/Tlingit Geometric Improvement
    - Not required by Pop. 35,000
6. Quartz/Industrial Geometric Improvement and Signal Optimization
    - Required by Pop. 35,000
7. Quartz/Chilkoot Geometric Improvement and Signal Optimization
    - These geometric laning will be required by Pop. 35,000:

    Northbound – L*, TR
    Southbound – L*, T, R*
    Eastbound – LT, R*
    Westbound – LTR

8. Quartz/2nd Signal Optimization
    - Required by Pop. 35,000
9. Range/College Geometric Improvement
    - Required by Pop. 35,000
10. Range/Normany North Geometric Improvement
    - Required by Pop. 35,000
11. Range/Nijmegan Geometric Improvement
    - Required by Pop. 35,000

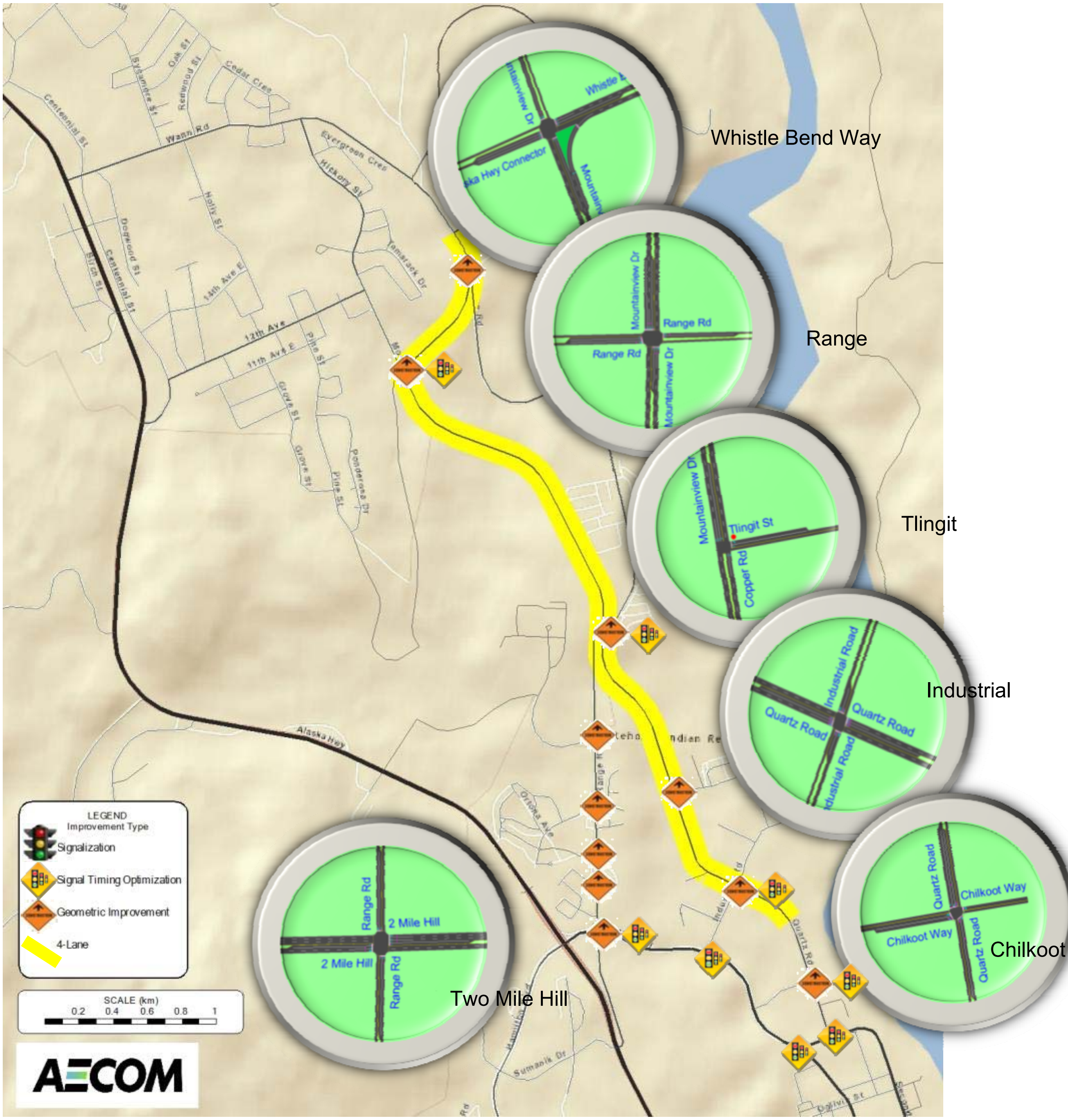
12. Range/Falaise Geometric Improvement
    - Required by Pop. 35,000
13. Two Mile Hill/Range Geometric Improvement and Signal Optimization
    - These geometric laning will be required by Pop. 35,000:

    Northbound – L*, TR
    Southbound – L*, TR
    Eastbound – L*, T, TR
    Westbound – L*, T, T, TR



14. Two Mile Hill/Industrial Signal Optimization
    - Required by Pop. 35,000
15. Two Mile Hill/Chilkoot Signal Optimization
    - Not required by Pop. 35,000
16. $2^{nd}/4^{th}$ Signal Optimization
    - Only PM peak hour required by Pop. 35,000
17. Alaska Highway Twinning between Prospector and Centennial
    - Not required by Pop. 35,000
18. Alaska/Centennial Signalization
    - Not required by Pop. 35,000

Figure 20: Location of Improvements – Pop. 35,000 no McIntyre Creek Crossing



Summary

To assess the off-site impacts of the new development in Whistle Bend, four scenarios were developed typifying traffic conditions when population reaches 46,800. Key findings of the traffic analysis comparing the required improvements with and without the proposed McIntyre Creek Crossing are summarized in Table 7.

Table 7: Pop. 46,800 McIntyre Creek Crossing Requirement Comparison

	with McIntyre Creek Crossing	Improvement Element	no McIntyre Creek Crossing
Whitehorse	Yes	McIntyre Creek Crossing	No
	Yes	Pine Street Extension to Alaska Highway	No
	Yes, same for both	Mountainview Dr-Copper Rd-Quartz Rd 4-lane to 2nd Ave	Yes, same for both
	Yes, same for both	Whistle Bend Way/Range Geometric Improvement	Yes, same for both
	Yes	Whistle Bend Way/Mountainview Geometric Improvement	Yes, additional NB turn bay and EB turn bay
	Yes	Mountainvew/Range Geometric Improvement	Yes, additional SB turn bay and EB turn bay
	Yes, same for both	Mountainview/Tlingit Geometric Improvement	Yes, same for both
	Yes, same for both	Quartz/Industrial Geometric Improvement	Yes, same for both
	Yes, same for both	Quartz/Chilkoot Geometric Improvement	Yes, same for both
	No	Range/College Geometric Improvement	Yes, additional NB turn bay and SB turn bay
	No	Range/Normandy N. Geometric Improvement	Yes, additional NB turn bay and SB turn bay
	Yes, same for both	Range/Nijmegan Geometric Improvement	Yes, same for both
	No	Range/Falaise Geometric Improvement	Yes, additional NB turn bay and SB turn bay
	Yes	Two Mile Hill/Range Geometric Improvement	Yes , 2 additional SB turn bays, additional NB through lane up to Normandy Rd, additional WB through lane up to Alaska Highway
Yukon	Yes	Alaska Highway Twinning	Yes, additional twinning between Prospector & Centennial
	No	Alaska/Centennial Signalization	Yes
	Yes	Alaska/Prospector Signalization	No[8]
	Yes, additional EB turn bay and 2 WB turn bays	Alaska/Prospector Geometric Improvement	No
	Yes, additional 2 lane overpass	Alaska/Two Mile Hill Geometric Improvement	Yes

* Optimize signal timings and phasing as appropriate at all intersections mentioned above

In general, the table shows that not building the proposed McIntyre Creek Crossing and the northbound overpass on Alaska Highway at Two Mile Hill Road can be justified, but at the expense of additional twinning on the Alaska Highway between Prospector Road and Centennial Street, higher traffic volumes on Range Road and the Mountiainview corridor resulting in additional road widening of turn bays approaching intersections.

Travel time between Whistle Bend and downtown is anticipated to be around 15 minutes in the peak direction and is comparable in both cases. Travel time between Porter Creek "D" and downtown is anticipated to be around 12 minutes in the peak direction with the McIntyre Creek Crossing, and 16 minutes in the peak direction without the McIntyre Creek Crossing.

With the recommended improvements to the 46,800 population threshold, the analysis of intersection operations along Hickory-Mountainview-Copper-Quartz corridor, Wann Road, 12th Avenue, Range Road, Alaska Highway, and Two Mile Hill Road indicates that all intersections and all turning movements will operate within the acceptable LOS of "D" during both AM and PM peak hours'. The majority of these improvements will be required before population reaches 35,000.

[8] *Subject to further discussion.*