CITY OF BLACK DIAMOND

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December 16, 2010

To whom it may concern:

Re: Reasons for and the use of the SE Green Valley Road Traffic Calming Study for Lawson Hill and Villages Master Planned Developments

The City has completed the Green Valley Road Traffic Calming study as required by condition No. 33(a) of Ordinance No. 10-946 approving the Master Planned Development ("MPD") for The Villages and Condition of Approval No. 29 of Ordinance No. 10-947 approving the Lawson Hills MPD. This study, completed by Parametrix for the City, includes, as required by these conditions, an assessment of traffic calming devices within the existing improved right-of-way and an analysis and recommended mitigation ensuring safety and compatibility of the various uses of the road.

Yarrow Bay, the Master Planned Developments applicant, will be setting up a committee with two representatives of the Green Valley Road Community and one representative of the City to consider the recommendations of the Green Valley Road Traffic Calming Study and determine what measures, if any, might be employed to further discourage MPD traffic from using the Green Valley Road. Copies of this study have now been forwarded to Yarrow Bay for their use with the Committee.

City staff will be incorporating the recommendations of this study into The Villages and Lawson Hills MPD Development Agreements, together with a description of the process and an estimate of the timing required for YarrowBay to seek permits from King County, should King County allow installation of the mitigation improvements, but subject to whatever is agreed to by the Green Valley Road Review Committee.

Sincerely,

Seth Boettcher
Public Works Director
City of Black Diamond

SE Green Valley Road – Traffic Calming Strategies

Prepared for
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November 29, 2010 | 554-3040-011

Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

Citation

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Parametrix

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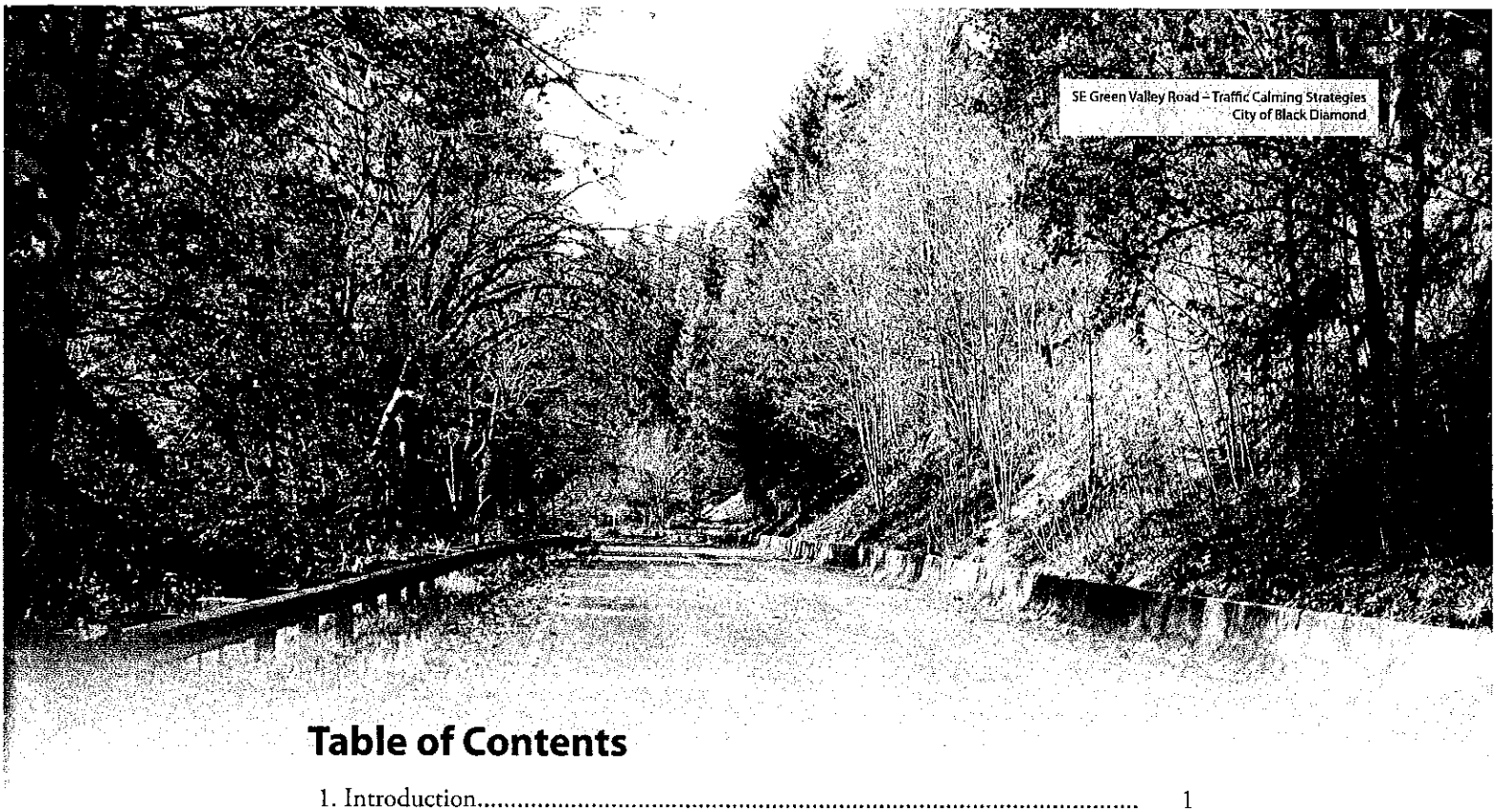

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Acronyms

City	City of Black Diamond
HCM	Highway Capacity Manual
LOS	level of service
MPDs	Master Planned Developments
vpd	vehicles per day
vph	vehicles per hour

1. Introduction

The City of Black Diamond (City) City Council approved the two Master Planned Developments (MPDs) known as The Villages and Lawson Hills under Ordinances 10-946 and 10-947, which included a list of conditions that must be met. The purpose of this study is to address Condition 33a, which states:

"The City shall commission a study, at the Applicant's expense, on how to limit MPD traffic from using Green Valley Road, and which shall include an assessment of traffic calming devices within the existing improved right-of-way. The study shall also include an analysis and recommended mitigation ensuring safety and compatibility of the various uses of the road. All reasonable measures identified in the study shall be incorporated into the Development Agreement together with a description of the process and timing required for the Applicant to seek permits from King County should King County allow installation of the improvements, and with a proviso that none or the measures need to be implemented if not agreed to by the Green Valley Road Review Committee."

To comply with this condition, this study:

- Identifies and evaluates the three primary and likely east-west routes between SR 18 and the vicinity of the two MPDs, and
- Describes and evaluates the likely effectiveness of various traffic calming measures to limit MPD traffic from using Green Valley Road.

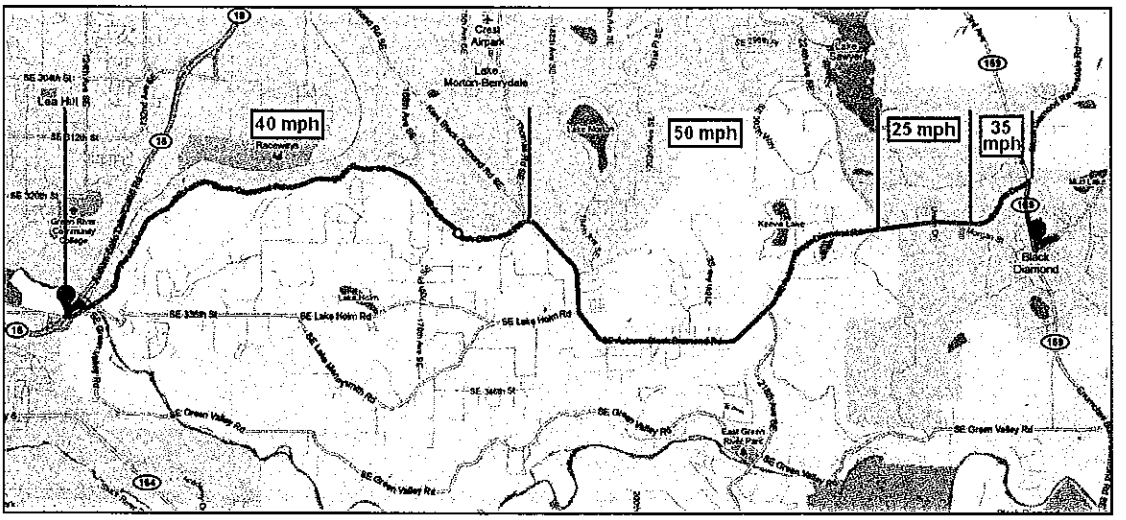
2. Primary East-West Routes

There are three primary east-west corridor routes that could be used to accommodate travel between SR 18 and the vicinity of the two MPDs. For the purposes of this study, SR 169 at Lawson Street is assumed to be the "mid point" of the two MPDs, from which commuters to and from the west would originate or be destined to. This location was selected as the mid point was because it is roughly in the middle of the two MPDs and their access points.

Auburn-Black Diamond Route

From the vicinity of the two MPDs (i.e., SR 169/Lawson Street), commuters could travel along SR 169, Roberts Drive, then continue along Auburn-Black Diamond Road to SR 18. This travel route is shown on Exhibit 1.

Exhibit 1. Auburn-Black Diamond Route



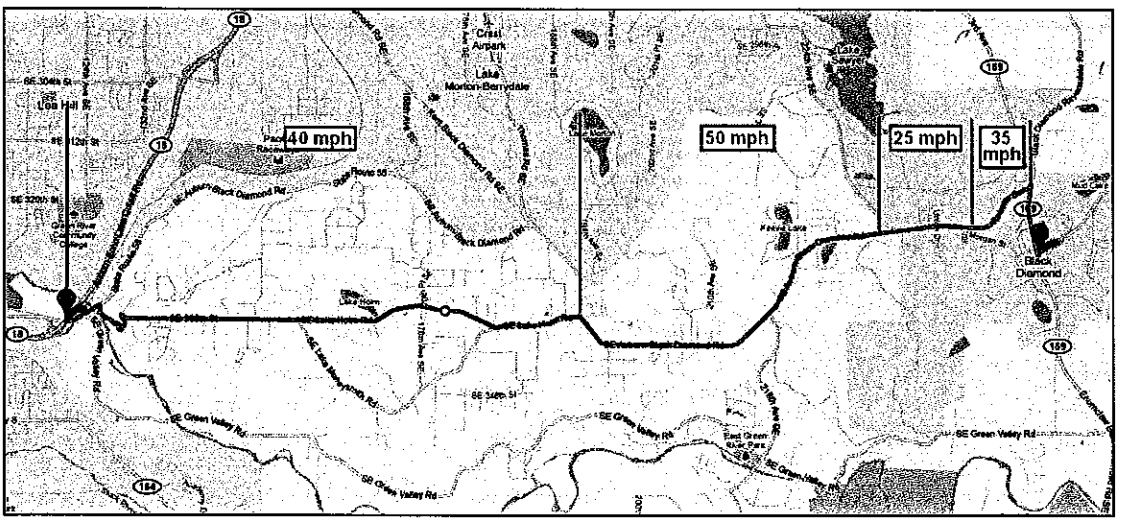
Source: Modified from Google Maps (Google 2010).

This route is also listed on the King County Bicycling Guidemap as a "Shared Roadway." From 148th Avenue SE to SR 18, Auburn-Black Diamond Road is listed as a "Caution Area."

Auburn-Black Diamond/Lake Holm Route

Starting at SR 169/Lawson Street, this route is similar to the Auburn-Black Diamond Route in that commuters could travel along SR 169, Roberts Drive, and Auburn-Black Diamond Road. However, the Auburn-Black Diamond/Lake Holm Route would then continue along SE Lake Holm Road, and back to SE Auburn-Black Diamond Road to reach SR 18. This travel route is shown on Exhibit 2.

Exhibit 2. Auburn-Black Diamond/Lake Holm Route



Source: Modified from Google Maps (Google 2010).

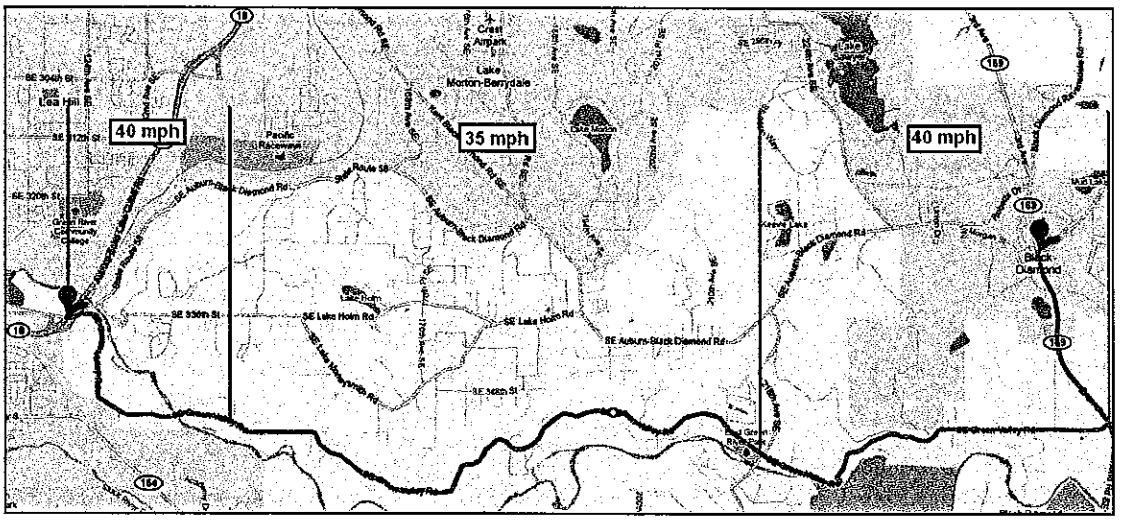
The Auburn-Black Diamond/Lake Holm Route is also identified on the King County Bicycling Guidemap as a "Shared Roadway." Two short segments along SE Lake Holm Road have steep

grades; one segment is about a 1/2 mile in length and located just west of 148th Avenue SE, and the other segment is also about a 1/2 mile in length and is just east of the traffic signal at Auburn-Black Diamond Road.

Green Valley Route

The third route option for travel between the vicinity of the MPDs and SR 18 extends along SR 169, SE Green Valley Road, and a short distance along SE Auburn-Black Diamond Road. This travel route is shown on Exhibit 3.

Exhibit 3. Green Valley Route



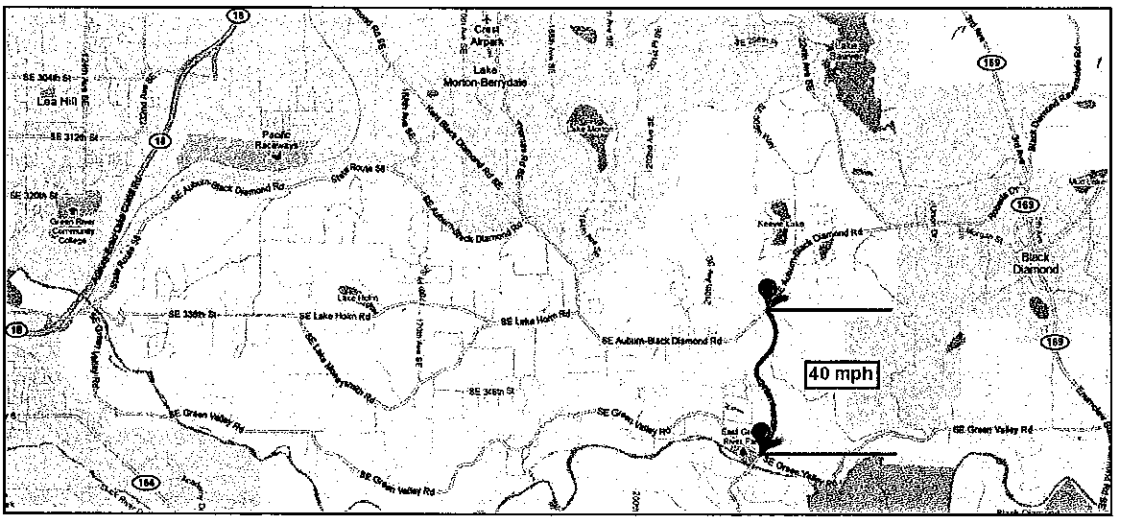
Source: Modified from Google Maps (Google 2010).

Similar to the other east-west routes, the Green Valley Route is also listed on the King County Bicycling Guidemap as a "Shared Roadway." A short segment, nearly a 1/2 mile long, is shown as having steep grades near the Flaming Geyser State Park.

218th Avenue SE Connection

This roadway is not an east-west corridor that could be used for travel between the MPDs and SR 18; however, 218th Avenue SE is a north-south roadway and could be used to travel between Auburn-Black Diamond Road and Green Valley Road. Exhibit 4 highlights 218th Avenue SE.

Exhibit 4. 218th Avenue SE Connection



Source: Modified from Google Maps (Google 2010).

This roadway is also listed on the on the King County Bicycling Guidemap as a "Shared Roadway." The length of this roadway, approximately 1.4 miles, has steep grades.

The use of 218th Avenue SE in conjunction with the other routes and its affects on travel time between the vicinity of the MPDs and SR 18 is described in Exhibit 7 below.

3. East-West Route Desirability

For the purposes of this study, the desirability of each east-west route is evaluated with respect to three factors:

- **Functional Classification** – is a categorization system that groups roadways based on their intended uses.
- **Roadway Characteristics** – are the various features of a roadway as well as its environmental context.
- **Operating Characteristics** – describes how little, or how much, congestion is experienced.

These three factors are independent, yet exhibit a great deal of overlap – collectively they dictate roadway-context-driver interaction and form the basis for route desirability and selection.

Functional Classifications

Section 2.02 of the King County 2007 Road Design and Construction Standards divides roadways into rural and urban roadways (King County 2007). Within the rural roadways category, King County provides seven functional classifications, three relevant classifications are quoted below.

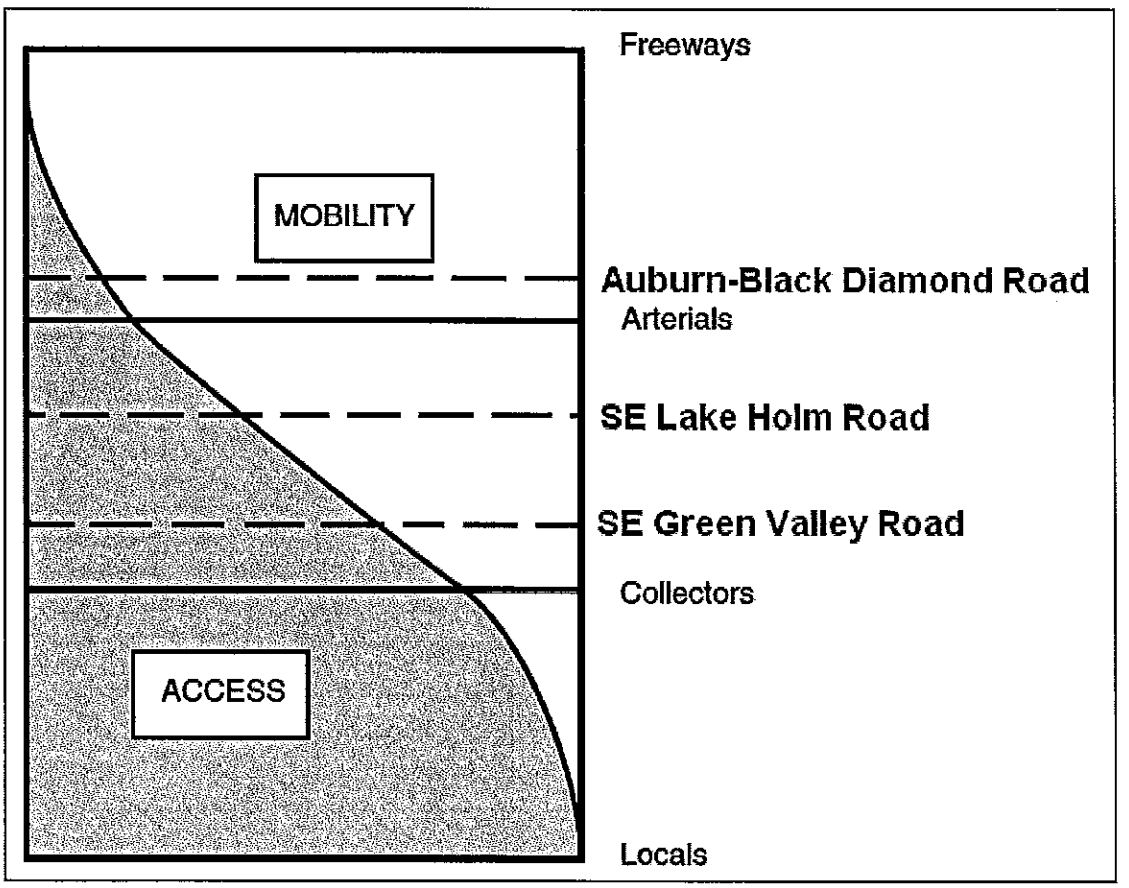
- **Rural Principal Arterial** – Rural principal arterials provide primary connections between rural areas and also distribute traffic between rural and urban areas. They provide the highest degree of mobility; therefore, direct access to abutting properties is very restricted. They generally serve major centers of activity, highest traffic volume corridors and intra-area travel between business districts, communities, and rural town centers.

- **Rural Minor Arterials** – Rural minor arterials interconnect with and augment the principal arterial system. They provide intra-community continuity connecting community centers and facilities. A rural minor arterial is typically a continuous road with a direct alignment. Access is partially restricted.
- **Rural Collector Arterial** – Rural collector arterials typically are intra-community roadways connecting cities or towns, residential neighborhoods and community centers and facilities. They provide connections between rural local roads and other roadways that are higher in the hierarchy of classification. Access is partially restricted.

The City's definitions for these classifications are very similar to King County's, and are found in their Comprehensive Plan (Black Diamond 2009).

According to both King County and the City, for the classifications described above, principal arterials are intended to primarily emphasize mobility, collector arterials are primarily intended to provide the most property access, and minor arterials are intended to balance mobility and access. The relationship between mobility and direct property access is graphically shown in Exhibit 5.

Exhibit 5. Relationship Between Functional Classification, Mobility, and Access



Note: Dotted lines showing the balance between mobility and access for the primary east-west routes are only conceptual.

Source: Modified from Exhibit 1-5 of A Policy On Geometric Design of Highways and Streets (AASHTO 2004).

Auburn-Black Diamond Route

This route begins with a short distance along SR 169, which is a State facility and is classified as an urban-principal arterial (U1) and is also classified as a Highway of Statewide Significance. Roberts Drive and Auburn-Black Diamond Road (east of Lake Sawyer Road SE) are within the City of Black Diamond and are classified as minor arterials. The remaining section of Auburn-Black Diamond Road is within King County jurisdiction and is classified as a principal arterial.

Auburn-Black Diamond Route/Lake Holm Route

This route is similar to the Auburn-Black Diamond Route, except the portion of the route along SE Lake Holm Road is under King County jurisdiction and is classified as a minor arterial.

Green Valley Route

All of SE Green Valley Road is within King County jurisdiction and is classified as a collector arterial.

218th Avenue SE Connection

This roadway is under King County jurisdiction and is classified as a minor arterial.

Summary of Functional Classifications

Based on the King County and City of Black Diamond functional classification systems, the Auburn-Black Diamond Route would serve as the best east-west route because the majority of this route is classified as a principal arterial, which emphasizes mobility over property access.

The Auburn-Black Diamond/Lake Holm Route would serve as the second best east-west route because approximately half of this route is classified as a principal arterial and the remaining portions are classified as minor arterials.

The Green Valley Route, according to its functional classification, would serve as the least desirable east-west route because the entire route is classified as a collector arterial, which is intended to emphasize property access over mobility to a greater degree compared the principal and minor arterial classifications associated with the Auburn-Black Diamond and Auburn-Black Diamond/Lake Holm Routes.

Roadway Characteristics

In addition to functional classification, other roadway characteristics are important to route selection because they provide context on how users interact with the roadway and environmental features along the roadway. Exhibit 6 provides a summary of roadway characteristics along representative portions of the three primary east-west routes and the 218th Avenue SE connection.

As shown in Exhibit 6, all three routes share some similar roadway characteristics, such as the number of lanes, lane widths, availability of turn pockets, and, to a lesser degree, paved shoulder widths. However, several differences exist that differentiate these routes, including:

- Both Auburn-Black Diamond and Auburn-Black Diamond/Lake Holm Routes have two stop-controlled approaches (a third stop for Lake Holm) and one signal, whereas the Green Valley Route does not have any controlled approaches.
- Travel speeds along the Auburn-Black Diamond and Auburn-Black Diamond/Lake Holm Routes tend to be higher compared to the Green Valley Route.

- The Green Valley Route has the most frequent horizontal curves with speed reduction signs and the Auburn-Black Diamond/Lake Holm Route has a similar, but lower, frequency of curves. In addition to the frequency of curves, both of these routes have locations with sharp curves that require substantial speed reductions. It is also important to note that the 14 signs with substantial speed reductions (25 – 30 mph below posted speeds) along the Auburn-Black Diamond/Lake Holm Route occur over a 1/2-mile section of SE Lake Holm Road, whereas most of the speed-reducing curves along the Green Valley Route are distributed throughout the corridor.

In addition to these differences in roadway characteristics, land uses abutting Auburn-Black Diamond Road and SE Lake Holm Road are primarily residential, whereas the majority of the Green Valley Route is located in a more agricultural setting. Frequent "Cattle" and "Farming Area Drive Carefully" signage along SE Green Valley Road indicates use of the roadway by slow-moving farming equipment and heavy machinery, which could deter commuter traffic.

Several areas along SE Green Valley Road also have very little horizontal clearance. Jersey barriers, river-rock privacy walls, dense vegetation and mature trees, and steep embankments on both sides of the road tend to narrow the corridor from 243rd Avenue SE to the Flaming Geyser State Park.

Exhibit 6. Typical Roadway Characteristics

Route	No. of Lanes	Lane Width	Paved Shoulders	Turn Pockets	Controlled Intersections	Posted Speed	Curves with Speed Reduction Signs
Auburn-Black Diamond Route	-1 lane in each direction	-10 ft	-0 - 4 ft along Roberts -4 - 6 ft along Auburn-Black Diamond -Discontinuous	-At 161st -At Lynch	-Stop at SR 169/Roberts -Stop at Auburn/Kent-Black Diamond/Thomas -Signal at Auburn-Black Diamond/Lake Holm	-25 - 35 mph between SR 169 and Lake Sawyer -50 mph between Lake Sawyer and Kent-Black Diamond -40 mph between Kent-Black Diamond and SR 18 -Weighted average 44.9 mph	- 7 @ -5 mph - 3 @ -10 mph - 1 @ -15 mph - 4 @ -20 mph - 0 @ -25 mph - 0 @ -30 mph **- Total 15**
Auburn-Black Diamond/Lake Holm Route	-1 lane in each direction	-10 ft	-0 - 4 ft along Roberts -4 - 6 ft along Auburn-Black Diamond -0 - 2 ft along Lake Holm -Discontinuous	-None	-Stop at SR 169/Roberts -Stop at Lake Holm/Lake Moneysmith -Stop at Lake Holm/Auburn-Black Diamond -Signal at Auburn-Black Diamond/Lake Holm	-25 - 35 mph between SR 169 and Lake Sawyer -50 mph between Lake Sawyer and Lake Holm -40 mph between Lake Holm and SR 18 -Weighted average 44.4 mph	- 8 @ -5 mph - 6 @ -10 mph - 0 @ -15 mph - 3 @ -20 mph - 10 @ -25 mph - 4 @ -30 mph **- Total 31**
Green Valley Route	-1 lane in each direction	-10 ft	-0 - 3 ft -Discontinuous	-None	-None	-40 mph between SR 169 and 218th -35 mph between 218th and 144th -40 mph between 144th and SR 18 -Weighted average 39.0 mph	- 16 @ -5 mph - 10 @ -10 mph - 6 @ -15 mph - 0 @ -20 mph - 3 @ -25 mph - 0 @ -30 mph **- Total 35**
218th Avenue Connection	-1 lane SB -1 to 2 lanes NB	-10 ft	-4 ft -Continuous	-None	-None	-40 mph	-None

In December 2009, the King County Road Services Division completed the Historic and Scenic Corridors Project, which identified the entire length of SE Green Valley Road as one of nine Heritage Corridors in King County (King County 2009). Heritage Corridors are roadways that provide a unique historical and cultural experience and have been deemed worthy of special attention to preserve its characteristics. The Historic and Scenic Corridors Project identifies several guiding principles with respect to road design and maintenance, vegetation management, and view shed preservation that should be taken into consideration.

Summary of Roadway Characteristics

The controlled intersections along the Auburn-Black Diamond and Auburn-Black Diamond/Lake Holm Routes are not as desirable compared to the uncontrolled intersections along the Green Valley Route. However, the slower posted speeds, frequency of curves with speed reductions, distribution of speed reductions along the corridor, and potential interference from agricultural equipment disfavor the Green Valley Route. Based on the collective roadway characteristics described above, the Auburn-Black Diamond and Auburn-Black Diamond/Lake Holm Routes are equal to or more desirable than the Green Valley Route.

Route Operating Characteristics

While functional classification and roadway characteristics play a role in route selection, route choice mostly depends on how well the roadway operates – roadway operations are largely determined by roadway capacity (supply) and traffic volumes (demand), and measured best by travel times.

Route Capacity

Roadway capacity is dependent on a variety of different parameters, such as the roadway characteristics described above, intersection spacing, driver behavior, traffic composition (i.e., the proportions of cars, medium trucks, and heavy trucks), and several other factors. As a result, roadway capacity is different for each roadway, different within each section of a single roadway, and can only be truly identified from field observation. Nonetheless, the capacity of a roadway can be generally identified and adequately captured within a range.

The Highway Capacity Manual (HCM) provides guidance on approximate traffic volumes that can be served for different roadways. According to the HCM, Class I roadways can be expected to serve approximately 930 vehicles per hour (vph) with little congestion (level of service [LOS] C) and up to 1,140 vph at capacity (LOS E) (TRB 2000). This range of service volumes could be low compared to all three of the east-west routes because the Class I roadways are assumed to have 0.8 traffic signals per mile and other roadway characteristics that lower the roadway capacity. However, this range could also be high because the HCM assumes a higher posted speed limit (50 mph) and a 50/50 directional distribution. If the differences between the HCM Class I roadways and east-west routes have a small net capacity difference, the HCM range is appropriate, and 10 percent of the daily traffic occurs during the peak hour (i.e., 0.10 k-factor), the daily roadway capacity is estimated to range from 18,600 vehicles per day (vpd) to 22,800 vpd (930 vph x 2 directions of travel ÷ 10 percent = 18,600 vpd; 1,140 vph x 2 directions of travel ÷ 10 percent = 22,800 vpd). A transportation plan for Georgetown, Texas also provided ranges of daily roadway capacity for different roadway types; for minor arterials the volume range was 12,500 vpd to 24,000 vpd, which is generally consistent with the HCM guidance (Wilbur Smith Associates 2003).

The capacity for the Auburn-Black Diamond Route is likely the highest due to the higher posted speed limits and least amount of horizontal curves, while the capacity for the Green Valley Route is likely the lowest for the same reasons. However, for the purposes of this analysis, the capacity for all three east-west routes is assumed to be within the same range described above.

Route Traffic Volumes

Traffic volumes for each of the primary east-west routes were based on the cumulative (i.e., both MPDs) PM peak hour forecasts provided in the Transportation Technical Report to the FEIS for each of the MPDs (Parametrix 2009). The cumulative PM peak hour traffic forecasts provided in the Transportation Technical Reports were converted to daily traffic volumes using the same method used for the HCM capacity (0.10 k-factor). The daily traffic forecasts are compared to the approximate roadway capacity estimated from the HCM in Exhibit 7.

Exhibit 7. Route Capacity and Forecasted Traffic Volumes

Route	Daily Capacity[1]	No Build 2035 Traffic Volumes[2]	Build 2035 Traffic Volumes[2]	Available Capacity
Auburn-Black Diamond east of 218th	18,600 - 22,800	5,510	14,420	4,180 – 8,380
Auburn-Black Diamond west of 218th	18,600 - 22,800	7,620	14,810	3,790 – 7,990
Green Valley east of 218th	18,600 - 22,800	940	2,810	15,790 – 19,990
Green Valley west of 218th	18,600 - 22,800	2,570	4,730	13,870 – 18,070

[1] *Source: (TRB 200)*
[2] *Source: (Parametrix 2009)*

Exhibit 7 shows that with the build out of both MPDs all east-west routes would still have available capacity in 2035.

Travel Times

Travel times were identified as the best means of characterizing east-west route operations and desirability because they account for the running time (i.e., free-flow travel time), internal congestion caused by vehicles turning into and out of side streets, and control delay (i.e., congestion at stop signs and signals).

Travel times along the primary east-west routes and the 218th Avenue SE connection were evaluated using two methods. The first method, the "theoretical travel time," utilized Google Maps (October 21, 2010 after 8:00 PM) to calculate the travel time based on the distance and speed limits provided by Google Maps. This theoretical travel time represents free flow conditions. The second method utilized floating car travel time surveys, or "observed travel times," that were collected by driving the routes during a time that was representative of PM peak hour conditions (Tuesday, October 26, 2010; 4:30-6:30 PM). Travel speeds were maintained at the posted speed limits, or up to 5 mph above the posted speed limit to replicate typical and reasonable driver behavior. This observed travel time accounts for congestion caused by vehicles turning into and out of side streets as well as control delay at stop signs and the signal.

In addition to the primary east-west routes, the 218th Avenue SE connection allows drivers to use a combination of routes. For example, a driver could start along the Auburn-Black Diamond and Lake Holm Routes by traveling north along SR 169 and west along Roberts Drive. Instead of continuing along Auburn-Black Diamond Road or SE Lake Holm, the driver could travel south along 218th Avenue SE, then use SE Green Valley Road to get to SR 18 ("Combination 1"). Similarly, a driver

could travel south along SR 169, west on SE Green Valley Road, and north along 218th Avenue SE, to access either Auburn-Black Diamond Road ("Combination 2") or SE Lake Holm ("Combination 3") to SR 18. Exhibit 8 summarizes the theoretical and observed travel times for the different primary east-west routes, as well as the different combinations of routes when using the 218th Avenue SE connection.

Exhibit 8. Existing Route Travel Times

Route	Distance (miles)	Theoretical Travel Time (min)			Observed Travel Time (min)		
		EB/NB	WB/SB	Average	EB/NB	WB/SB	Average
Auburn-Black Diamond Route	18,600 - 22,800	10.4	18.00	20.00	19.00	16.82	16.65
Auburn-Black Diamond/Lake Holm Route	18,600 - 22,800	9.4	19.00	19.00	19.00	16.65	16.87
Green Valley Route	18,600 - 22,800	12.5	23.00	22.00	22.50	20.60	20.43
218th Ave SE		1.4	2.00	2.00	2.00	1.95	1.90
Combination 1 *		11.7	23.00	23.00	23.00	20.11	19.90
Combination 2 *		13.9	24.00	25.00	24.50	21.21	20.98
Combination 3 *	18,600 - 22,800	12.9	25.00	25.00	25.00	20.83	20.87

Note: Distances and theoretical travel times are based on Google Maps after 8:00 PM (October 21, 2010) to avoid the effects of Google's congestion component (Google 2010).

** Estimated from travel times associated with the Auburn-Black Diamond and Auburn-Black Diamond/Lake Holm Routes and 218th Avenue SE.*

As shown in Exhibit 7, both the theoretical and observed travel times for the Auburn-Black Diamond and Auburn-Black Diamond/Lake Holm Routes were consistently lower compared to the Green Valley Route and the combination of routes using the 218th Avenue SE connection. The Auburn-Black Diamond and Auburn-Black Diamond/Lake Holm Routes were nearly 3 minutes shorter compared to the Green Valley Route, and over 4 minutes shorter than the Combination 2 Route.

Summary of Route Operating Characteristics

The HCM and research suggests that the east-west route capacity likely ranges between 18,600 vpd to 22,800 vpd. The capacity for the Green Valley Route is likely lower compared to the Auburn-Black Diamond and Auburn-Black Diamond/Lake Holm Routes as a result of lower speeds and more frequent horizontal curves that require speed reductions. However, for the purposes of this analysis, the capacities for all three east-west routes are assumed and likely to be within 18,600 vpd to 22,800 vpd.

Future 2035 forecasts suggest that all three primary east-west routes will continue to have available capacity after the complete construction and occupation of both MPDs.

Travel times were selected as the most appropriate gauge of route operating conditions because they account for running time, internal congestion due to turning movements, and control delay. Existing travel times indicate that the Auburn-Black Diamond Route has the shortest travel time and would therefore serve as the preferred east-west route.

It is likely that forecasted traffic volumes would increase internal congestion and control delay. However, given that all three routes are expected to have available capacity in the future year 2035, no traffic diversion from the preferred east-west route (Auburn-Black Diamond Route) is anticipated.

In the event that some diversion occurs, traffic volumes would likely divert to the Auburn-Black Diamond/Lake Holm Route first since this route is also expected to have available capacity and has the second shortest travel times.

4. Potential Traffic Calming Strategies

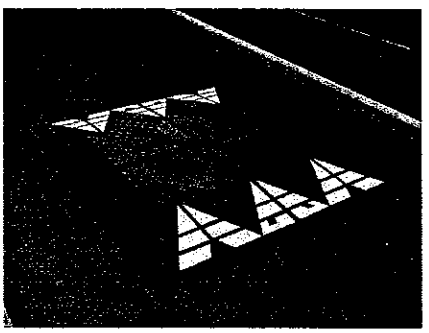
Traffic calming strategies are measures that primarily focus on reducing travel speeds, but depending on the type and extent implemented, can reduce traffic volumes as well. Traffic calming strategies evaluated as part of this study include:

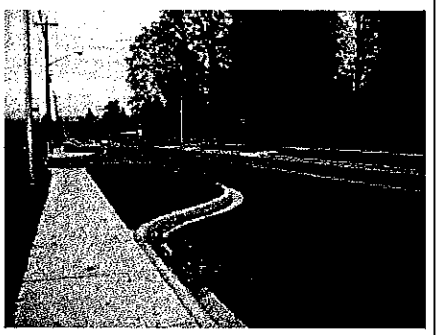
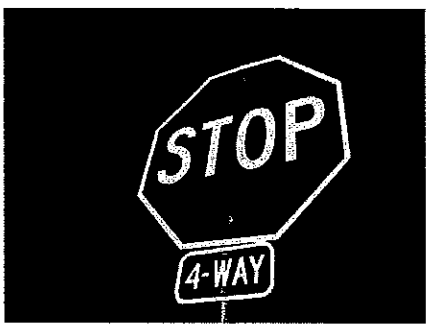
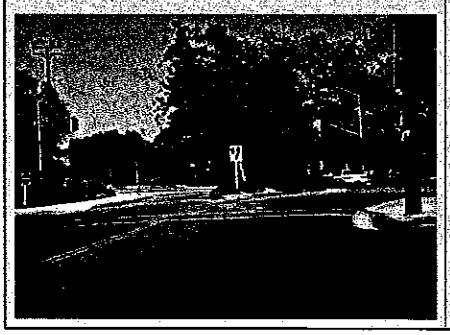
- Speed Limits – Reduced speed limits.
- Radar Speed Alert Signs – Solar powered variable message signs that provide driver feedback on speed.
- Speed Humps/Cushions/Tables – Intermittent raises in the pavement surface; curved 3-4 inches high and 7-14 feet long (humps), curved 3 inches high and 7 feet long (cushions), flat 3 inches high and 14-21 feet long (tables).
- Traffic Circles – Small traffic circles (not roundabouts) at intersections.
- Curb Extensions/Chokers – Reduced lane width, either with striping or curb extensions.
- Chicanes – Curb bulges or planters (usually 3) on alternating sides.
- Stop Signs/Signals – Stop sign or signal control on all approaches.
- Diverters – Raised centers medians that create directionally separate lanes of travel where drivers must sharply turn to avoid the median.
- Curb Bulb Outs – Curb extensions at intersections.
- Surface Treatments – Colored and/or textured surfaces that provide visual, auditory, and vibratory queues.

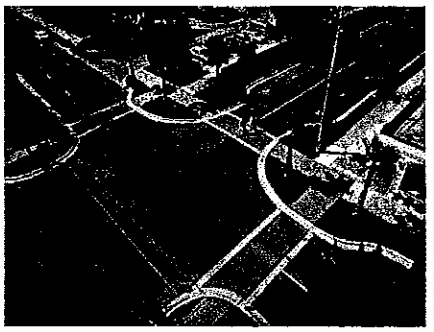
Evaluation Criteria

Based on research and professional engineering judgment, the traffic calming measures described above were evaluated with respect to their potential to reduce traffic volumes and/or travel speeds on Green Valley Road. Exhibit 9 summarizes the effectiveness of the aforementioned traffic calming strategies and identifies the ideal locations.

Exhibit 9. Evaluation of Traffic Calming Strategies

Traffic Calming Strategy	Ideal Locations	Reduces Volumes	Reduces Speeds
Speed Limits	SR 169 to 218th Ave; 218th Ave	Possible	Yes
Radar Speed Alert Signs	Along Green Valley; 218th Ave	No	Yes
Speed Humps/Cushions/Tables 	SR 169 to 244th Ave	Possible	Yes
Traffic Circles	257th Ave, 253rd Ave, 244th Ave	Possible	Yes

Traffic Calming Strategy	Ideal Locations	Reduces Volumes	Reduces Speeds
Curb Extensions/Chokers 	SR 169 to 244th Ave; 218th Ave	Possible	Yes
Chicanes	SR 169 to 244th Ave; 218th Ave	Possible	Yes
Stop Signs/Signals 	257th Ave, 253rd Ave, 244th Ave	Possible	Yes
Diverters 	257th Ave, 253rd Ave, 244th Ave	No	Yes

Traffic Calming Strategy	Ideal Locations	Reduces Volumes	Reduces Speeds
Curb Bulb Outs 	257th Ave, 253rd Ave, 244th Ave	No	Yes
Surface Treatments	SR 169 to 244th Ave; 218th Ave	No	Yes

Source: (Carman Hass-Klau, et al. 1992), (Savage et al. 1994), (Seattle 1996), (Noyes 1998).

The ideal locations identified were based on the type of traffic calming strategy, ability to minimize interconnectivity between Auburn-Black Diamond Road and SE Green Valley Road, and serve as a "gate" to deter through traffic from the MPDs while minimizing impacts to existing residents along SE Green Valley Road.

The potential to reduce traffic volumes along SE Green Valley Road would be dependent on the extent of implementation; more traffic calming strategies along more of SE Green Valley Road would reduce more traffic volumes as a result of increased travel times. However, increased implementation would also likely be opposed by residents along SE Green Valley Road.

All traffic calming strategies would likely reduce travel speeds where implemented.

As described above, the majority of the SE Green Valley Road corridor has agricultural land uses adjacent to the roadway and heavy machinery and farming equipment use portions of the roadway. These larger vehicles may be unable to use the roadway if some of the traffic calming strategies listed above narrow the roadway and/or introduce sharper turning radii, such as traffic circles, curb extension/chokers, chicanes, diverters, and curb bulb outs.

Other larger vehicles, such as school buses and fire trucks, may also be affected by strategies that tighten turning radii or narrow travel lane widths.

Summary of Traffic Calming Strategies

Traffic calming strategies are most effective at reducing travel speeds and have only a small potential to reduce traffic volumes. The probability to reduce traffic volumes increases with a greater extent of implementation.

Lowered posted speed limits, traffic circles, chokers, chicanes, and stop signs/signals would likely provide the greatest traffic volume reductions. Most of these strategies reduce the roadway width and/or introduce tighter turning radii, which increase travel times.

Strategies that are likely the most effective at discouraging MPD traffic would equally and adversely affect existing residents along SE Green Valley Road.

The ideal locations for implementation would be along the 218th Avenue SE connection and along SE Green Valley Road near SR 169 – these locations would create a "gate" to discourage MPD traffic and minimize adverse impacts to residents along SE Green Valley Road.

5. Conclusions

The following conclusions are drawn from this study:

East-West Route Desirability

- Based on functional classifications, the Auburn-Black Diamond and Auburn-Black Diamond/Lake Holm Routes provide better east-west routes because they are designed and intended to serve more long-distance trips (greater emphasis on mobility), compared to SE Green Valley Road, where direct property access is more important.
- Both the Auburn-Black Diamond and Auburn-Black Diamond/Lake Holm Routes have controlled intersections, which make these routes less desirable. However, these routes also have higher posted speed limits (44.4 to 44.9 weighted average mph) compared to the Green Valley Route (39.0 weighted average mph), and the Green Valley Route has over twice as many horizontal curves that require speed reductions compared to the Auburn-Black Diamond Route. Based on overall roadway characteristics, the Auburn-Black Diamond Route is the most desirable.
- In addition to lower posted speed limits and frequent horizontal curves, other existing roadway characteristics (e.g., Jersey barriers, river-rock privacy walls, dense vegetation and mature trees within the right-of-way, and steep embankments that narrow the corridor) along SE Green Valley Road suggest that this corridor, relative to the other two east-west routes, is already traffic calmed.
- Land uses adjacent to SE Green Valley Road and signage suggest usage by slow-moving farming equipment, which would likely deter commuter traffic.
- The Auburn-Black Diamond and Auburn-Black Diamond/Lake Holm Routes are shorter (9.4 to 10.4 miles) compared to the Green Valley Route (12.5 miles). The shorter distances and higher posted speed limits result in lower travel times along the Auburn-Black Diamond (16.74 minutes) and Auburn-Black Diamond/Lake Holm (16.76 minutes) Routes compared to the Green Valley Route (20.52 minutes).
- Future traffic volume forecasts inclusive of both MPDs are not expected to exceed the roadway capacity for any of the east-west routes and excess capacity for all three routes is expected. Accordingly, no diversion is expected to occur from the preferred east-west route (Auburn-Black Diamond Route). However, in the event that some diversion occurs, traffic volumes would likely divert to the Auburn-Black Diamond/Lake Holm Route since this route is also expected to have available capacity and has the second shortest travel times.

- These items individually and collectively suggest that the most desirable routes between the vicinity of the MPDs and SR 18 are along Auburn-Black Diamond Road and SE Lake Holm Road; not SE Green Valley Road.

Traffic Calming Strategies

- All traffic calming strategies would reduce travel speeds. The potential to reduce traffic volumes would be largely dependent on the extent of implementation.
- Traffic calming strategies most likely to deter MPD traffic from using SE Green Valley Road largely consist of strategies that narrow lanes and/or introduce tighter turning radii. These strategies could adversely affect existing roadway users such as farming equipment, school buses, and fire trucks.
- All traffic calming strategies that effectively reduce roadway usage by MPD traffic would equally and adversely affect existing residents along SE Green Valley Road.
- To minimize adverse effects to the existing SE Green Valley Road residents, the ideal locations for implementing traffic calming strategies would create a "gate" to minimize interconnectivity between the MPDs and SE Green Valley Road. These "gate" locations would be along 218th Avenue SE and along SE Green Valley Road near SR 169.
  - In addition to these considerations, any potential traffic calming strategies will need to be evaluated with respect to maintaining historical and cultural character of SE Green Valley Road's since this roadway is identified as one of nine Heritage Corridors in King County.

Next Steps

This study provides the necessary information required in Condition 33a of Ordinances 10-946 and 10-947 that approve The Villages and Lawson Hills MPDs.

SE Green Valley Road is under King County jurisdiction. It is the County's responsibility, alongside the Green Valley Road Review Committee, to review this study and any other necessary information to determine if traffic calming strategies along SE Green Valley Road are warranted, the preferred type of calming strategies, and the locations and extent of implementation.

6. References

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