

ISLAND CREST WAY

SAFETY RECOMMENDATIONS

CITY OF MERCER ISLAND

MARCH 2022



PREPARED FOR

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INTRODUCTION

The City of Mercer Island desires to evaluate and improve the operations and safety along a 1-mile segment of Island Crest Way between 90th Avenue SE and SE 68th Street. The study team analyzed existing safety conditions along the roadway and at intersections, providing safety and operational findings from data analysis and field assessment in the Safety Needs Identification Technical Memo and the Existing Traffic Operation Memo. The purpose of this memorandum is to provide recommendations to address transportation needs identified in the previous memos.

The team combined existing conditions observations; their experience implementing roadway safety solutions; and feedback from City staff, school district officials, and the public to identify potential safety treatments.

Limitations on Use

Under 23 U.S. Code Sections 148 and 409, safety data, reports, surveys, schedules, or lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.



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OVERVIEW OF SAFETY NEEDS

The study corridor is a two-way undivided road that spans approximately 1 mile from 90th Avenue SE to SE 68th Street, as shown in Figure 1. Through analysis of collision history and traffic operations data, field visits to the site, discussions with school district staff, and data reported from a public survey,¹ the study team identified the following safety needs along Island Crest Way:

- Between 2015 and 2020, there were 43 reported crashes along the study corridor, including three serious injury crashes.
- Based on feedback from an online survey, the two most common concerns along the corridor were bicyclist safety and lighting (85 comments about lighting alone).
- The 19 marked crosswalks on this corridor had 29 end points/ramps. Only four of these ramps meet current ADA accessibility standards.
- Vegetation covers signs and limits sight distance at several locations along the Island Crest Way corridor.
- At night, worn and faded pavement markings including edgeline striping, centerline striping, and crosswalks are difficult to see.
- Sign clutter for southbound motorists at SE 68th Street reduces the clarity of the message for these road users.
- The overhanging tree canopy affects sight distance and nighttime light coverage at the SE 68th Street intersection.
- The bike route crossing near SE 62nd Street has no pavement markings or signage for the northbound approach to warn vehicles of potential cyclists crossing the road.
- The SE 53rd Place intersection provides the only exit/entrance point for school buses to access the school parking lot. The community has raised concerns regarding the safety of the side street approaches turning onto Island Crest Way.
- The SE 68th Street intersection has experienced the highest frequency of collisions in the study area.

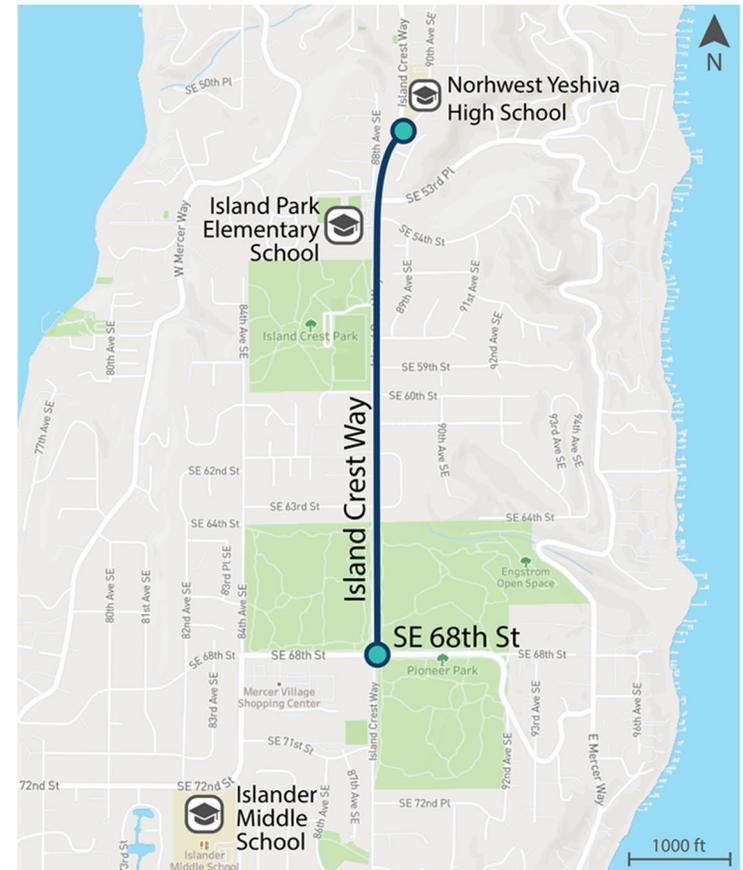


FIGURE 1. STUDY CORRIDOR MAP

¹ Public survey was posted on the City's "Let's Talk website from 12/3/21-1/3/22. 499 respondents provided feedback, 57% of whom travel along Island Crest Way daily.

ADDRESSING SAFETY NEEDS

During data analysis, the team identified collision patterns that may be addressed by proven safety treatments. For example, a predominant collision type at the all-way stop controlled intersection of Island Crest Way and SE 68th Street involved southbound vehicles. Enhancing signing, pavement marking, and lighting at the intersection could help prevent future collisions.

Along the study corridor, the team discovered that crashes involving driver inattention, distraction, and following too closely were predominant, often resulting in rear-end collisions when vehicles were stopped to turn left or to wait for pedestrians to cross Island Crest Way or the side street. If the following vehicle did not notice the need for the lead vehicle to stop, a rear-end crash occurred.

The on-site field assessment with Mercer Island staff and officials from Island Park Elementary School and the school district provided additional information to the study team. For example, northbound and southbound traffic often backs up near the school as drivers wait for crossing pedestrians at the pedestrian crossing and Rectangular Rapid Flashing Beacon (RRFB) near the south entrance. To address this issue, the study team identified a Pedestrian Hybrid Beacon (PHB) crossing as a potential countermeasure to improve pedestrian safety and reduce vehicle delay. A PHB signal is a special kind of pedestrian traffic signal placed overhead. It is designed to increase motorists' awareness of pedestrians crossing the road. Like an RRFB, it is activated by pedestrians pressing a button, but a PHB includes a red light for motorists, legally requiring them to stop.

To connect safety needs to potential solutions along Island Crest Way, the study team used their knowledge of applied best practices to recommend improvement types in four areas:

- **Short-term Corridor-wide** treatments are countermeasures the City could apply quickly and at a low cost to address overall corridor safety along Island Crest Way. Example: Clear vegetation covering signs along Island Crest Way and at side street Stop signs.
- **Short-term Hot Spot** recommendations are typically low-cost and applied at a specific location. Example: At SE 68th Street, improve the Stop signs by adding reflective post sleeves, adding ALL WAY plaques, and removing advertisements from the sign islands.
- **Long-term Corridor-wide** treatments will benefit the entire corridor, but require additional analysis, design, and resources to complete. Example: Improve the east-side sidewalk to a full multi-use path for pedestrians and bicyclists.
- **Long-term Hot Spot** improvements are expected to improve traffic safety and operations significantly at an individual location. Example: Replace the 4-way stop at Island Crest Way and 68th Street with a roundabout.

The following sections are organized with these improvement types in mind.

CORRIDOR-WIDE SAFETY TREATMENTS

Table 1 introduces recommended corridor-wide safety treatments, looking at both short-term and long-term solutions to improve safety along the entire Island Crest Way corridor from 90th Avenue SE to SE 68th Street.

TABLE 1. CORRIDOR-WIDE SAFETY TREATMENTS

IDENTIFIED SAFETY NEED	CORRIDOR-WIDE SAFETY TREATMENTS
<p>Lighting</p> <ul style="list-style-type: none"> ● 21% of crashes reported dark conditions with street lights on. ● Two street lights were not functioning at SE 58th Street entrance on the east side of Island Crest Way. ● No lighting provided at the trail entrance south of SE 62nd St. 	<p>Short-term</p> <ul style="list-style-type: none"> ● Upgrade existing luminaires to current standard (or confirm if completed). <p>Long-term</p> <ul style="list-style-type: none"> ● Conduct a corridor-wide assessment of lighting needs and implement lighting upgrades to meet standards.
<p>Active Transportation</p> <ul style="list-style-type: none"> ● 12% of crashes involved a bicyclist or pedestrian. ● There are no bike lanes on the road. ● There is no crosswalk or marked crossing south of SE 62nd Street where it leads to the bike trail. ● The informal path on the west side of Island Crest Way, just south of the Elementary School, is not easy to traverse for all pedestrians. ● Vegetation coverage impedes drivers' visibility of pedestrians and bicyclists, and pedestrians' and bicyclists' visibility of vehicles. 	<p>Short-term</p> <ul style="list-style-type: none"> ● Add crosswalk markings and restripe worn markings. ● Add reflective sleeves to all pedestrian crossing warning sign posts. ● Add left-mounted pedestrian crossing sign and diagonal-down arrow at each crossing. ● Trim vegetation near all pedestrian crossings to increase visibility. <p>Long-term</p> <ul style="list-style-type: none"> ● Assess lighting at each pedestrian crossing and add pedestrian-scale lighting at any deficient locations. ● Improve westside informal path to meet shared use path standards (e.g., path width and surface type).

IDENTIFIED SAFETY NEED	CORRIDOR-WIDE SAFETY TREATMENTS
	<ul style="list-style-type: none"> Widen the east side path to a minimum of 10 ft. standard to make it a designated shared use path.² <p><i>Assessment of current conditions revealed that shared use paths are the most reasonable method to address bicyclist needs along this section of the corridor.</i></p>
<p>Signage</p> <ul style="list-style-type: none"> Red/white object markers in the median are non-standard and not easy for motorists to see. Some side street Stop signs were not retroreflective in dark conditions, and some were covered by vegetation. 	<p>Short-term</p> <ul style="list-style-type: none"> Replace red/white median object markers with standard black/yellow markers. Evaluate retroreflectivity of all Stop signs and upgrade to high visibility retroreflective sheeting where needed. Trim vegetation to ensure sign visibility. Add retroreflective red post sleeves to all side street Stop sign posts. <p>Long-term</p> <ul style="list-style-type: none"> Evaluate the City’s sign inspection program and consider changes to practices and frequency. Review the appropriateness, placement, and retroreflectivity of all City-installed street signs.
<p>Roadway Shoulder and Fixed Objects</p> <ul style="list-style-type: none"> 14% of all reported crashes along Island Crest Way involved a vehicle departing the roadway and hitting a fixed object. Lack of paved shoulder along Island Crest Way. There are several unprotected fixed objects near the road, including fire hydrants and trees. Median trees close to the traveled way could be hit by motorists who depart their lane. 	<p>Short-term</p> <ul style="list-style-type: none"> Remove, relocate, or shield fixed objects near the roadway. <p>Long-term</p> <ul style="list-style-type: none"> Add 2-4 ft. paved shoulder to support motorists’ ability to return to the roadway if they run off the road. Conduct a tree condition assessment to determine long-term viability of existing trees along the shoulder and in the median. Consider removal or median trees or improve visibility of the median areas with improved delineation (curbs, raised median, etc.).

² WSDOT Design Manual M 22-01, Chapter 1515, Shared Use Paths. <https://cdn2.assets-servd.host/material-civet/production/images/documents/shared-use-path-design-manual.pdf>

IDENTIFIED SAFETY NEED	CORRIDOR-WIDE SAFETY TREATMENTS
<p>Intersection Sight Distance</p> <ul style="list-style-type: none"> ● 21% of crashes involved a vehicle entering at an angle, and another 5% included a left-turning vehicle. ● Limited sight distance for side street motorists due to excess vegetation, private buildings and fences, or geography. 	<p>Short-term</p> <ul style="list-style-type: none"> ● Trim vegetation within the sight distance triangles. ● Remove objects in City right-of-way that cause visual limitations and communicate with property owners about potential removal or modification of objects and vegetation on private property for the sake of roadway safety.
<p>Striping</p> <ul style="list-style-type: none"> ● 14% of crashes included a vehicle running off the road, and one additional collision was a head-on crash. ● Edgeline and centerline striping is difficult to see at night. ● Some raised pavement markers (RPMs) are missing. ● Marked crossings at SE 68th Street intersection and SE 63rd Street crossing are faded. 	<p>Short-term</p> <ul style="list-style-type: none"> ● Restripe edge lines. ● Add centerline pavement marking under the current raised pavement markers (RPMs). ● Identify and replace missing RPMs. ● Restripe the crosswalk markings at the SE 68th St intersection, and other marked crossings as needed. <p>Long-term</p> <ul style="list-style-type: none"> ● Replace current striping and raised pavement markers with profiled thermoplastic marking on centerline and edge lines.

HOT SPOT LOCATION TREATMENTS

This section introduces recommended safety countermeasures for hot spot locations along Island Crest Way. These intersections or other high-profile areas were identified by reviewing collision history, traffic operations, field conditions, and community survey responses.

SE 53rd Place

This residential intersection and school driveway serve school buses and staff. A horizontal curve to the north limits sight distance for side street drivers. Heavy north-south vehicle movements can make accessing Island Crest Way difficult for drivers and crossing problematic for pedestrians. There were three reported collisions at this intersection during the 6-year study period.

Short-term Treatments

- Install an advance intersection warning sign for southbound Island Crest Way drivers approaching SE 53rd Place.
- Add a marked crossing with advanced pedestrian warning signs (advance and at crosswalk) with Rectangular Rapid Flashing Beacons (RRFBs).
- Train additional school crossing guards to ensure availability each day at the school bus driveway for end-of-day departure.
- Trim vegetation to improve sight distance triangles.

Long-term Treatments

- Add a right turn lane for the westbound approach to allow vehicles to pass other cars waiting to turn left or travel through to the school (see figure to the right).

Before



After



Add Right Turn Lane at SE 53rd Place

Island Park Elementary School

A high volume of pedestrians, bicyclists, personal vehicles, and school buses enter and exit campus before and after school, and Island Crest Way is also a heavily-used commuter route during the morning and evening peak periods.

Short-term Treatments

- **School Speed Limit.** Reassess the time-of-day use of the School Zone Speed Limit of 20 mph to ensure it addresses student and family needs related to pedestrian and bicyclist activity.
- **Crossing Guard Availability.** Train additional crossing guards to ensure availability each day before and after school at the southside crossing. If a PHB is added (see below), the crossing guard can also help group students together to cross to minimize vehicle delay.

Long-term Treatments

- **Pedestrian Hybrid Beacon.** At the south pedestrian crossing (currently a Rectangular Rapid Flashing Beacon (RRFB)), a Pedestrian Hybrid Beacon could increase pedestrian safety while also providing additional gaps in pedestrian traffic to reduce motor vehicle delay during heavy pedestrian times of day (e.g., before and after school)
- **Long-term Site Planning.** Monitor Island Park Elementary School's future plans for expansion and coordinate student and family transportation safety during the planning stage.



Pedestrian Hybrid Beacon

SE 62nd Street and SE 63rd Street Pedestrian Crossing Improvements

Enhanced pedestrian crossings at these two locations were identified as needs during the safety review based on pedestrian usage and access to nearby facilities.

Short-term Treatments

- **Add SE 62nd Street Pedestrian Crossing.** Include pavement marking, warning signs, and a Rectangular Rapid Flashing Beacon (RRFB). Connect the eastside sidewalk to the Stevenson Property Trail to the west.
- **Add Rectangular Rapid Flashing Beacon (RRFB) to SE 63rd Street Pedestrian Crossing.** This provides additional warning to motorists of pedestrians on or near the roadway. It supports the transit stop on both sides of Island Crest Way at this location.



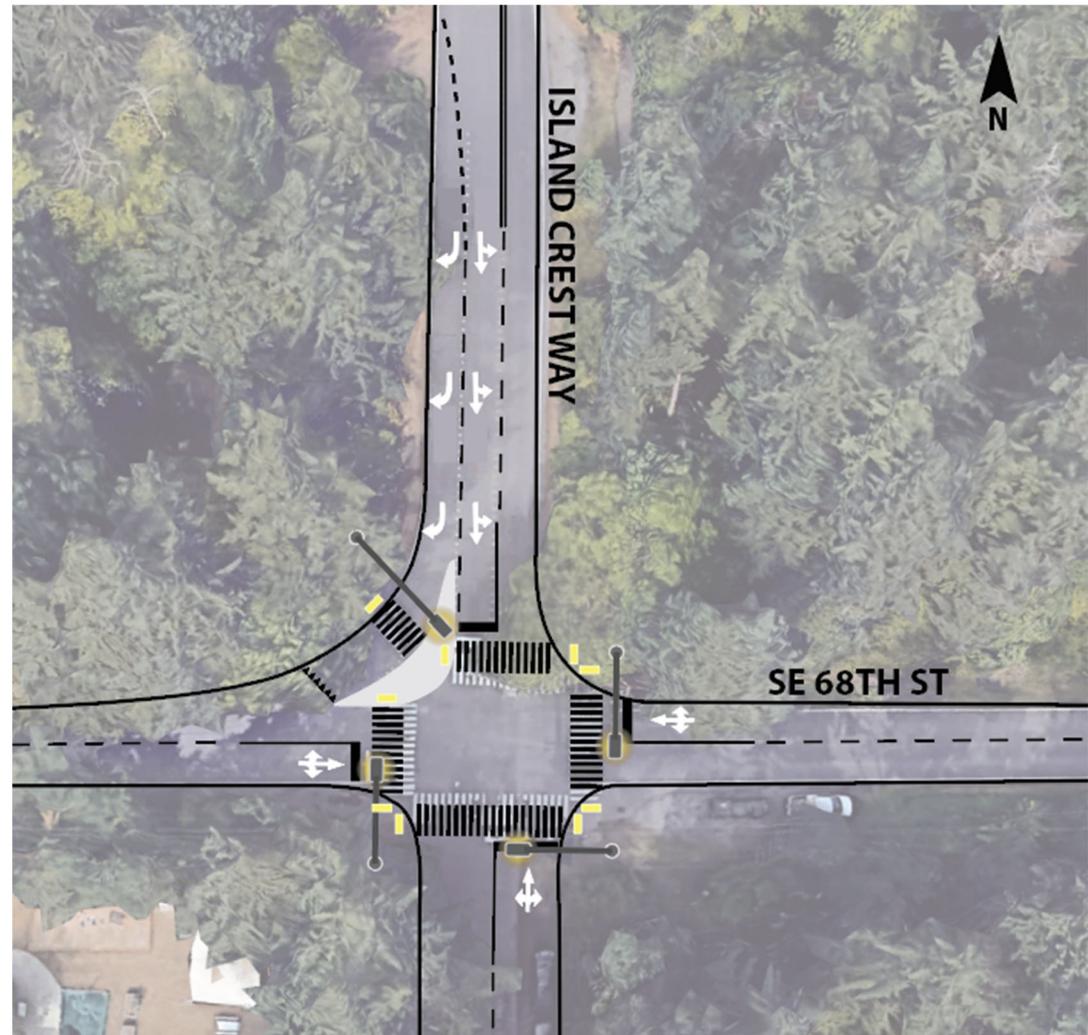
Rectangular Rapid Flashing Beacon (RRFB)

SE 68th Street Intersection

This location experiences a higher-than-expected frequency of collisions for a 4-way Stop-controlled intersection, including angle, pedestrian-involved, and bicyclist-involved collisions. Ten crashes occurred at the intersection during the 6-year study period.

Short-term Treatments

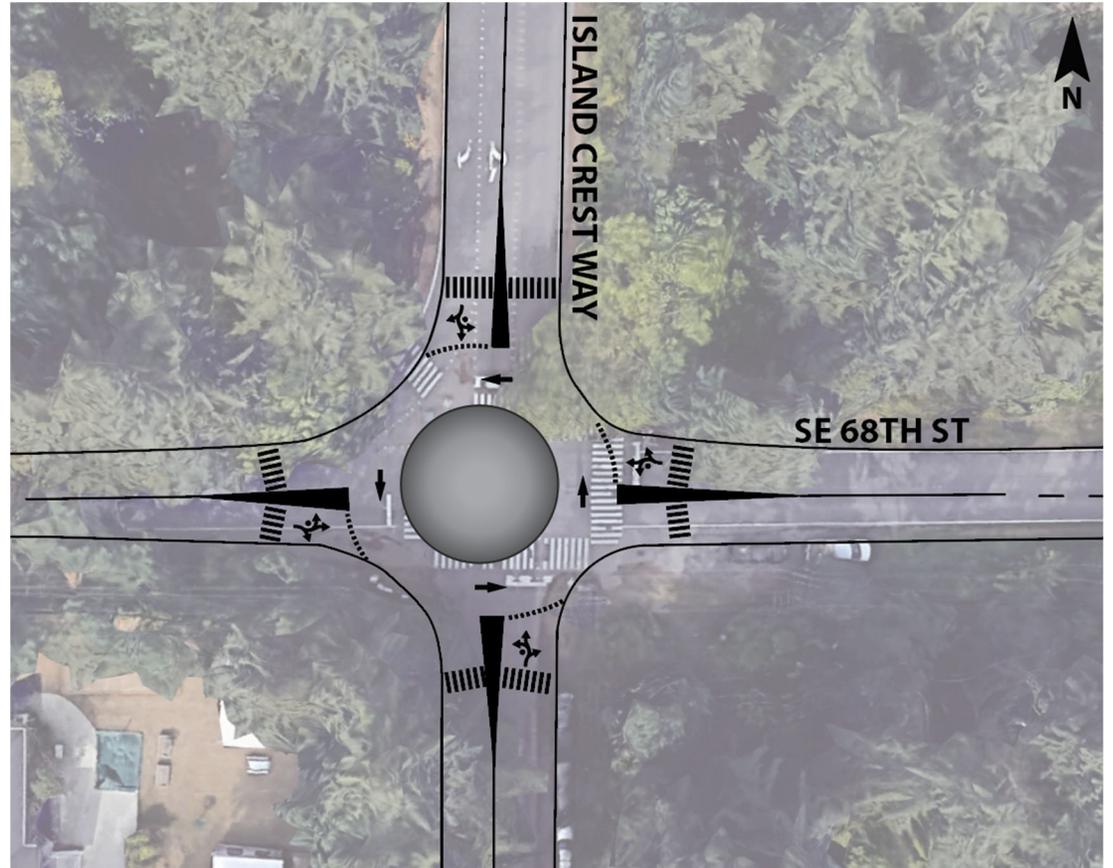
- **Signing**
 - For southbound Island Crest Way road users, repeat the Lane Use Control sign and move the Right Lane Must Turn Right sign further from the intersection to provide additional information.
 - Add red retroreflective post sleeves to all Stop sign posts.
 - Add ALL WAY plaque under each Stop sign.
 - Remove advertisements from the right-of-way (at least at the Stop sign islands).
- **Pavement Marking**
 - Southbound Island Crest Way: Restripe lane use control pavement marking.
 - Southbound Island Crest Way: Add dotted marking to clarify the right-turn lane drop.
- **Pedestrian Crossings**
 - Trim vegetation to provide a clearer view of pedestrians entering the intersection from the park.
 - Separate southbound Island Crest Way vehicle yield movements (yield to pedestrians first, then other vehicles) by adding space between the marked crosswalk and the Yield sign.
- **Lighting**
 - Upgrade lighting and trim vegetation that blocks lighting from reaching the road surface.



SE 68th Street: Potential Pavement Marking and Lighting Treatments

Long-term Treatments

- **Roundabout.** Consider a single-lane roundabout at the intersection to reduce collision frequency, improve traffic operations, and enhance aesthetics.



SE 68th Street: Potential Single-lane Roundabout

After identifying a list of treatments by location based on the process described above, the study team compared each treatment to the others to determine its impact to reduce crashes and its relative cost-effectiveness.

- **Countermeasures and Crash Reduction Factors:** The study team selected a representative Crash Reduction Factor (CRF) from the Highway Safety Manual, FHWA Crash Modification Factor Clearinghouse website, or other established peer-reviewed research. Each CRF is described further related to the severity of crash and/or type of crash it affects.
- **Treatment Type:** The team identified each treatment as Corridor-Wide or Hot Spot. Some countermeasures were other types (e.g., program, training).
- **Relative Project Cost:** The team provided a planning-level cost estimate for each countermeasure based on previous experience with safety treatment implementation at similar locations in the region. Actual costs may vary widely depending on detailed existing conditions and other related impacts.
- **Term:** The study team identified each as a short-term or long-term improvement based on resources required, potential right-of-way acquisition, and other feasibility criteria.
- **Next Step(s):** The team identified one or more next steps for the City to pursue each potential treatment.

Table 2 summarizes the potential safety projects identified along the study corridor related to these criteria. Projects are organized by Type, Cost, and Term.

TABLE 2. POTENTIAL SAFETY COUNTERMEASURES

COUNTERMEASURE	CRASH REDUCTION (Severity or Type)	HOT SPOT/ CORRIDOR-WIDE	COST	TERM	NEXT STEP(S)
Upgrade or Replace Existing Luminaires to Current Standard	N/A	Corridor-wide	\$10k/luminaire	Short Term	Continue current Public Works effort
Pedestrian Crossings: Reflective Post Sleeves, Left-mounted Warning Sign, Trim Vegetation	N/A	Corridor-wide	\$200/sign \$60/sleeve	Short Term	Secure signs and install with maintenance forces
Stop Sign Reflective Post Sleeves at Every Intersection	N/A	Corridor-wide	\$60/ sleeve	Short Term	Secure signs and install with maintenance forces
Replace Red/White Median Object Markers with Standard Black/Yellow	N/A	Corridor-wide	\$200/sign	Short Term	Secure signs and install with maintenance forces
Trim Vegetation to Improve Sight Distance at Intersections	48% reduced injury crashes	Corridor-wide	Staff time	Short Term	Assess each situation and, where appropriate, trim with maintenance forces
Refresh All Existing Pavement Marking	N/A	Corridor-wide	\$10k	Short Term	Complete per regular City schedule

COUNTERMEASURE	CRASH REDUCTION (Severity or Type)	HOT SPOT/ CORRIDOR-WIDE	COST	TERM	NEXT STEP(S)
Conduct a Corridor-wide Lighting Assessment and Implement Relevant Upgrades	38% reduced injury crashes at intersections. 52% dark crashes	Corridor-wide	\$50-100k assessment	Long Term	Seek grant funding
Add Centerline Pavement Marking Under RPMs	N/A	Corridor-wide	Standard contract	Long Term	Consider at next convenient time (e.g., RPM replacement)
Upgrade Pavement Markings (Profiled Thermoplastic)	21%reduced run-off-road and head-on crashes	Corridor-wide	\$30-40k (4 lines) installed	Long Term	Seek grant funding or budget as part of a capital project.
Remove, Relocate, or Shield Fixed Objects (Including Median Trees)	38% reduced crashes)	Corridor-wide	\$50-100k	Short Term Long Term	Conduct a tree condition assessment
Add 2 ft Paved Shoulder	5-13% reduced crashes)	Corridor-wide	\$\$1M	Long Term	Seek grant funding
SE 62nd Street: Install pedestrian crossing (signs, striping, RRFB)	40% reduced pedestrian-involved crashes	Hot Spot	\$200/sign \$25k/RRFB \$10k/ADA ramp	Short Term	Secure signs and equipment. Install per standard procedures.
SE 53rd Place: Advance Intersection Warning Signs (2 signs)	20-40% reduced crashes	Hot Spot	\$400	Short Term	Secure signs and install with maintenance forces.

COUNTERMEASURE	CRASH REDUCTION (Severity or Type)	HOT SPOT/ CORRIDOR-WIDE	COST	TERM	NEXT STEP(S)
SE 68th Street: Signing, Pavement Marking, Vegetation Clearing, Lighting Improvements	20-40% reduced crashes	Hot Spot	\$200/sign \$20k lighting \$10k vegetation clearing	Short Term	Conduct additional short-term and long-term analysis of solutions
Install Rectangular Rapid Flashing Beacon <ul style="list-style-type: none"> SE 63rd Street SE 53rd Place (with new crossing) 	47% reduced pedestrian-involved crashes	Hot Spot	\$25k/RRFB \$10k/ADA ramp	Short Term	Design improvements and solicit bids for construction.
West Side Shared Use Path Improvements	25% reduced bicyclist-involved crashes	Corridor-wide	\$250/linear ft	Long Term	Seek grant funding. Further study.
East Side Shared Use Path Improvements	25% reduced bicyclist-involved crashes	Corridor-wide	\$150/linear ft	Long Term	Seek grant funding. Further study.
SE 53rd Place: Add Right Turn Lane for Westbound Traffic (East Leg)	14-26% reduced crashes	Hot Spot	\$100-200k	Long Term	Seek grant funding
SE 68th Street: Install Roundabout	36% reduced crashes	Hot Spot	\$500k-2M	Long Term	Implement short-term treatments. Analyze roundabout feasibility

COUNTERMEASURE	CRASH REDUCTION (Severity or Type)	HOT SPOT/ CORRIDOR-WIDE	COST	TERM	NEXT STEP(S)
Island Park Elementary School: Pedestrian Hybrid Beacon (PHB) Crossing at South Driveway	69% reduced pedestrian-involved crashes	Hot Spot	\$50-100k	Long Term	Seek grant funding
Island Park Elementary School: School Zone Speed Limit Operational Time Frame Reassessment	N/A	Study	Staff time	Short Term	Meeting with School District to discuss operational time frame of the 20 mph School Zone Speed Limit.
Island Park Elementary School: Crossing Guard Training	N/A	Training	Staff time	Short Term	Recommend actions to the school
Island Park Elementary School: Future Site Planning	N/A	Study	TBD	Long Term	Participate in future school planning meetings if/when MI School District considers renovation/replacement
Evaluate Citywide Sign Inspection Program, Make Improvements, and Implement	N/A	Citywide Program	\$30-50k evaluation	Short Term	Assess operating procedures and current sign quality

Figure 3 displays the location of a subset of the potential safety projects in Table 2 along Island Crest Way.

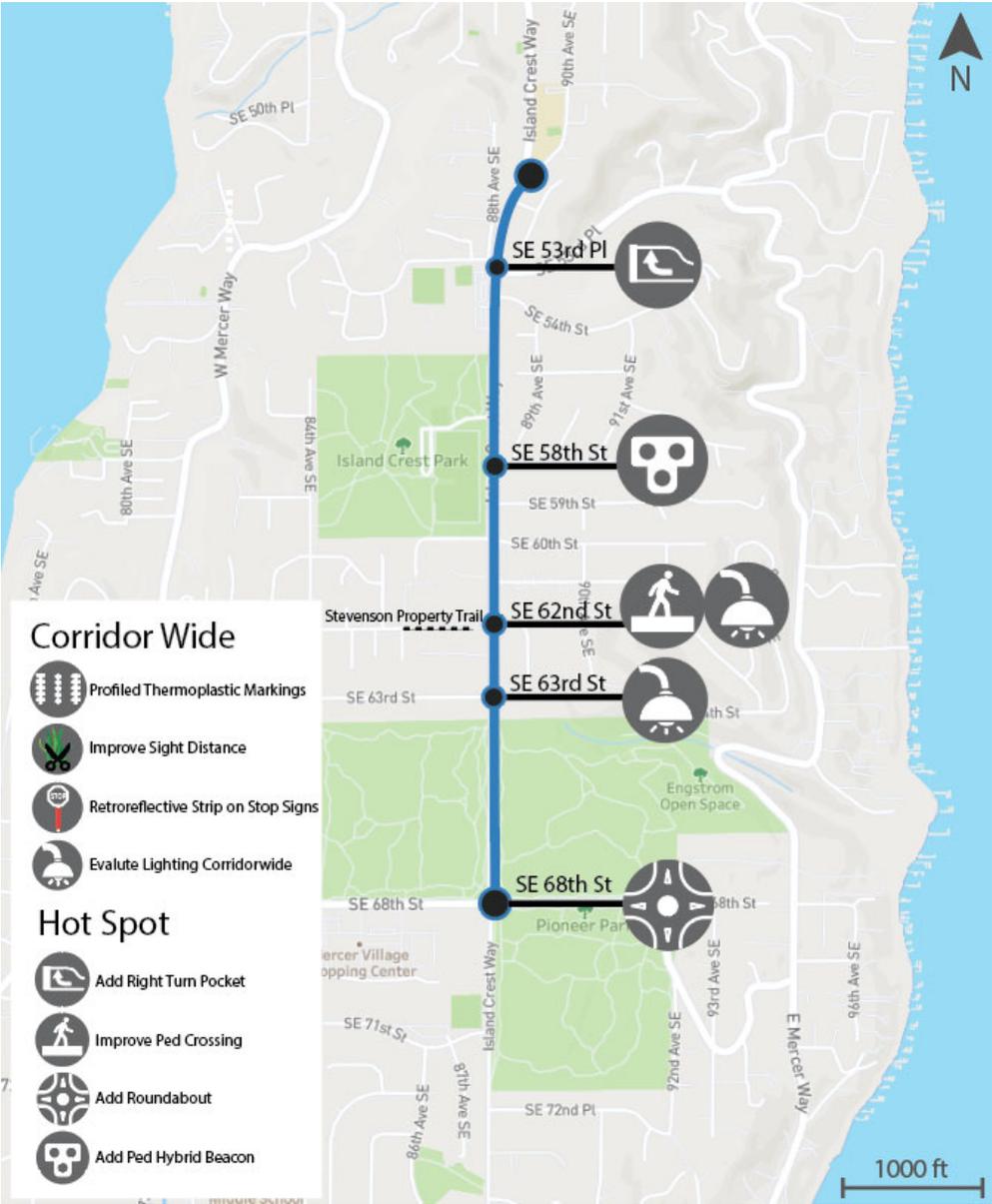


FIGURE 3. SUMMARY MAP OF POTENTIAL SAFETY PROJECTS

APPENDICES

APPENDIX A: SAFETY COUNTERMEASURE DESCRIPTIONS

APPENDIX B: SAFETY ANALYSIS REPORT

APPENDIX C: EXISTING TRAFFIC OPERATIONS ASSESSMENT

DESCRIPTION OF SAFETY COUNTERMEASURES

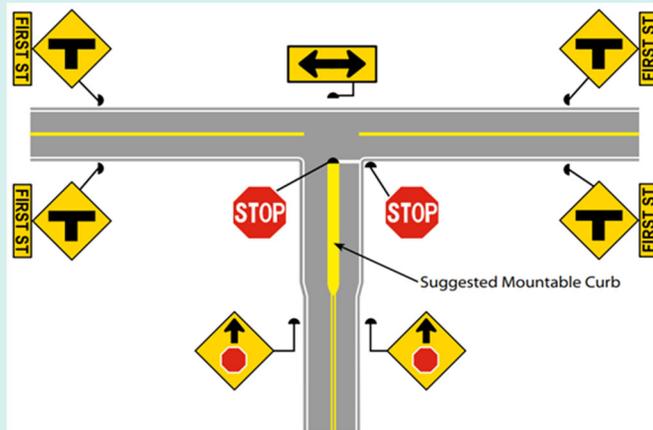
This section introduces recommended safety countermeasures, describes each treatment, and identifies potential location(s) for implementation.

Low-cost Intersection Safety Enhancements

Locations: Several unsignalized intersections.

Description: The set of low-cost countermeasures is designed to increase drivers' alertness to the presence of the intersection and reduce potential conflicts with other entering vehicles.

- Advanced Intersection Warning Signs, including oversized or doubled-up signs, and/or street name plaques.
- Stop Ahead Sign, including oversized or doubled-up signs.
- Oversized or doubled-up STOP signs.
- Painted or mountable curb on side street for supplemental STOP sign.



Retroreflective Post Sleeves

Locations: All unsignalized intersections.

Description: Retroreflective strips or sleeves can be added to stop sign posts to draw additional attention to drivers, particularly at night. In addition to providing a warning for approaching motorists on the side street, a wrapped post also indicates an upcoming intersection to mainline drivers.



Retroreflective Strips on Signposts^{3,4}

³ https://www.clrp.cornell.edu/q-a/030-retro_strips.html

⁴ <https://safety.fhwa.dot.gov/hcip/hrrr/manual/sec48.cfm#s48c>

Pedestrian Crossing and School Crossing Improvements

Locations: All current and proposed marked crosswalks.

Description: Add the following to standardize all pedestrian crossings.

- Post sleeves on each warning sign (advance warning and at the crosswalk)
- Add left-mounted Pedestrian Crossing or School Crossing signs and diagonal down arrow plaques
- Reapply any worn crosswalk pavement marking
- Trim vegetation for improved visibility
- Assess and improve lighting

BEFORE:



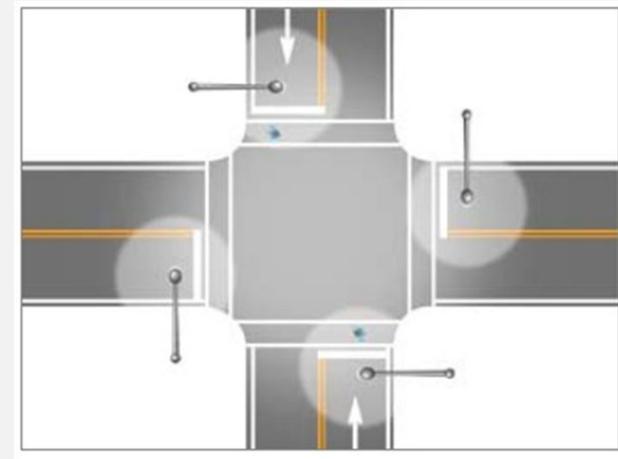
AFTER:



Intersection Lighting

Locations: Locations assessed to have lighting deficiencies.

Description: Installing sufficient intersection lighting can improve the ability for drivers to recognize that an intersection is being approached, navigate turning movements properly and recognize other vehicles and pedestrians in or entering the intersection.



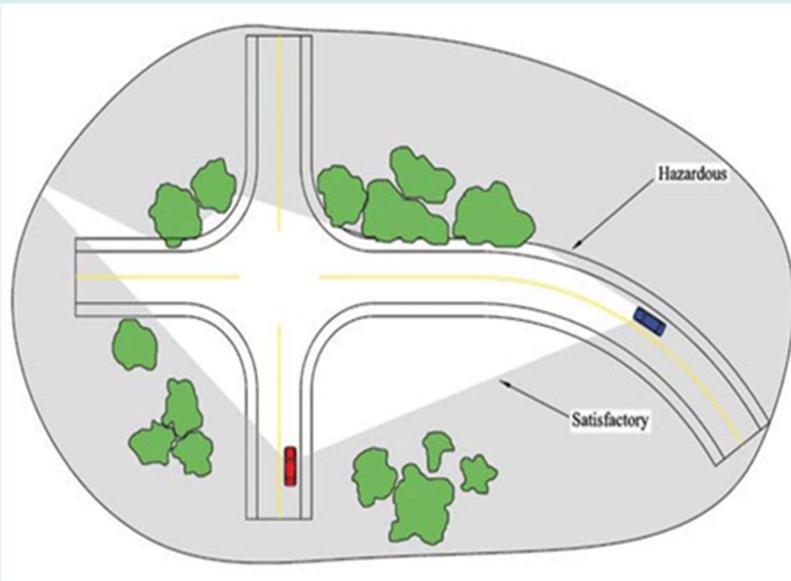
Typical intersection lighting design⁵

⁵ https://safety.fhwa.dot.gov/intersection/other_topics/fhwas09020/chap_4.cfm#s42

Clear sight distance triangle of vegetation and objects

Locations: All intersections and major driveways.

Description: Provide appropriate sight distance triangles for the minor approaches by clearing obstructions that might block an approaching driver's view of potentially conflicting vehicles. The sight distance for a stopped vehicle at an intersection should be enough for the vehicle to clearly see any conflicting vehicles approaching along the adjacent roadway and allow them to proceed through the intersection without conflict.



Pedestrian/Bicyclist Shared Use Path

Locations: Entire Island Crest Way Corridor.

Description: A shared use path provides a travel area separate from motorized traffic for bicyclists, pedestrians, skaters, wheelchair users, joggers, and other users. Shared use paths can provide a low-stress experience for a variety of users using the network for transportation or recreation.

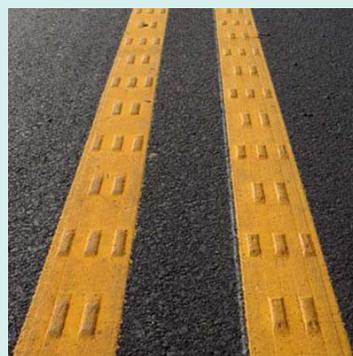


Profiled Thermoplastic Markings

Locations: Entire study corridor where feasible.

Description: Profiled thermoplastic markings provide enhanced retroreflectivity compared to normal paint strips along with better durability and less maintenance than raised pavement markers.

In addition, the noise and vibration produced by profiled (raised) thermoplastic markings alert drivers when they leave the traveled way.



Paved Shoulder

Locations: Recommend installing a paved shoulder throughout the entire study corridor on both sides.

Description: Paved shoulders can provide a clear recovery area for drivers who may leave their travel lane.⁶ Uniform shoulder width is not required for retrofit installation to provide a safety benefit.



⁶ https://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/chapter4/4_lane3showidth.cfm

Fixed Object Removal, Relocation, or Shielding

Locations: Entire study corridor where feasible.

Description: The AASHTO Roadside Design Guide provides a hierarchy of countermeasures to deal with roadside fixed objects.

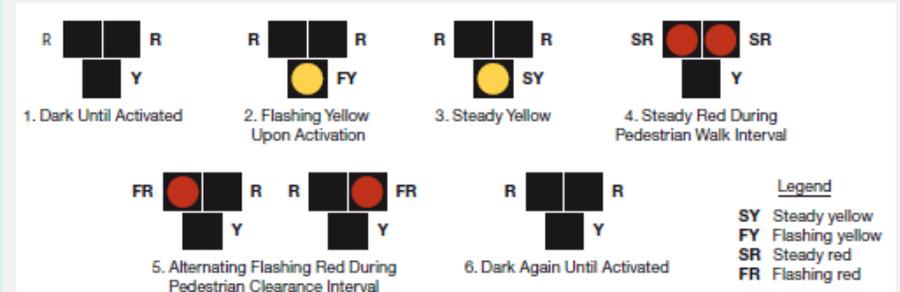
1. Remove the obstacle.
2. Redesign the obstacle so it can be safely traversed.
3. Relocate the obstacle to a point where it is less likely to be struck.
4. Reduce impact severity by using an appropriate breakaway device.
5. Shield the obstacle with a longitudinal traffic barrier designed for redirection or use a crash cushion.
6. Delineate the obstacle if the previous alternatives are not appropriate.



Pedestrian Hybrid Beacon (PHB)

Location: School pedestrian crossing at the south side of Island Park Elementary School.

Description: A pedestrian hybrid beacon (PHB) is a traffic control device designed to increase motorists' awareness of pedestrian crossings at uncontrolled marked crosswalk locations. A PHB is distinct from pre-timed traffic signals and constant flash warning beacons because it is only activated by pedestrians when needed. Because it is a traffic signal, it can be timed to support traffic flow and pedestrian safety.



Install Roundabout

Location: Island Crest Way and SE 68th Street

Description: Effective at intersections that have a high frequency of right-angle and left-turn type crashes, primarily at unsignalized intersections with moderate volumes.



Single-lane roundabout⁷

Rectangular Rapid Flashing Beacon (RRFB)

Locations: SE 53rd Place, SE 62nd Street, SE 63rd Street

Description: RRFBs enhance pedestrian conspicuity and increase driver awareness at uncontrolled, marked crosswalks. It is used to accompany a pedestrian warning sign.



⁷ <https://safety.fhwa.dot.gov/provencountermeasures/roundabouts.cfm>

Install Right Turn Lane

Location: Island Crest Way and SE 53rd Place

Description: While turn lanes provide measurable safety and operational benefits at many types of intersections, they are particularly helpful at two-way stop-controlled intersections. This eliminates delays for right turning vehicles waiting behind vehicles traveling in other directions. Depending on available pavement width, a right turn lane may be striped on the existing roadway, or additional pavement may be needed to accommodate the lane.



APPENDIX B: SAFETY ANALYSIS REPORT



ISLAND CREST WAY SAFETY ANALYSIS REPORT

CITY OF MERCER ISLAND

JANUARY 2022



SAFETY NEEDS ANALYSIS

DATE: January 20, 2022

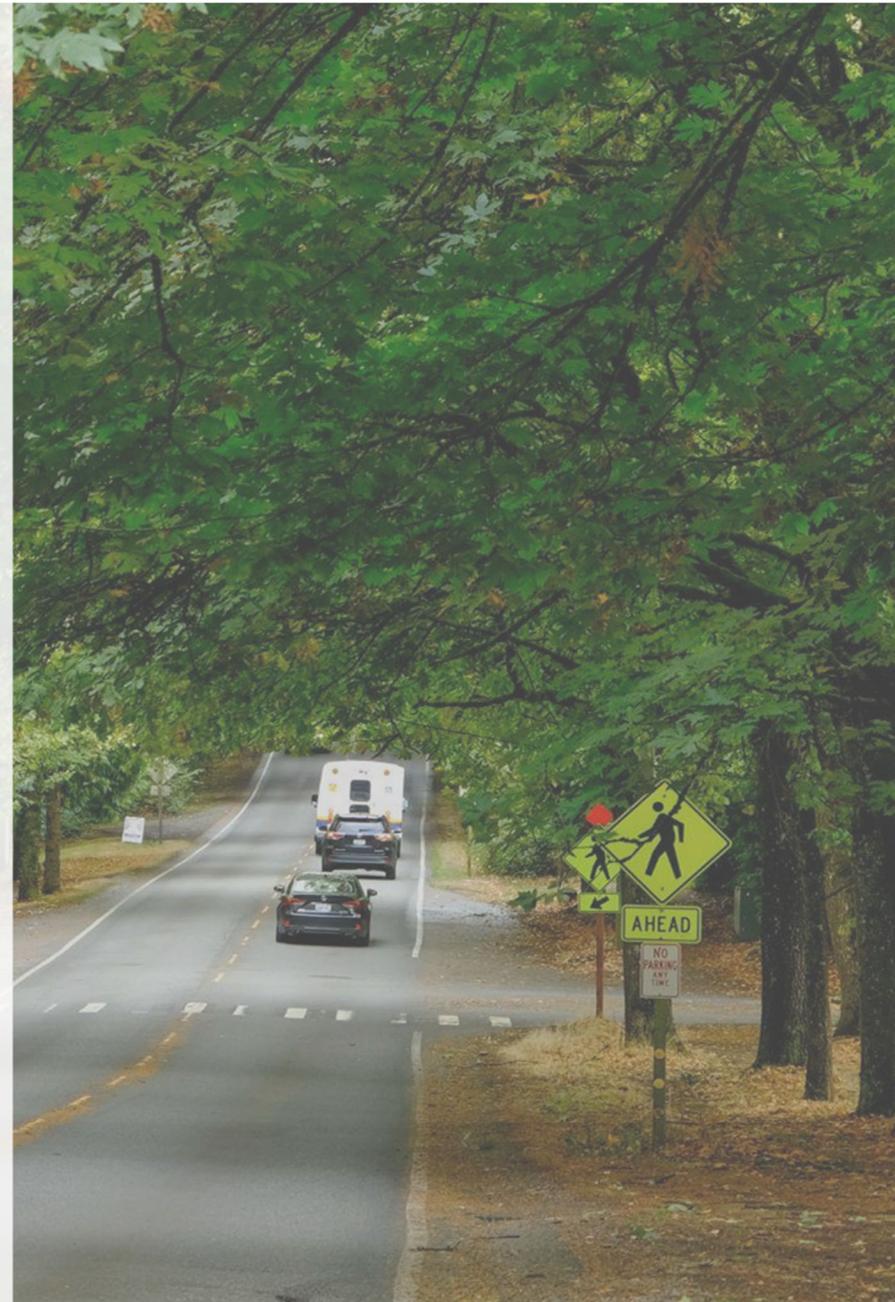
TO: Lia Klein, PE | City of Mercer Island

FROM: Brian Chandler, PE, PTOE, RSP_{2IB}, PMP | DKS
Veronica Sullivan, RSP₁ | DKS

SUBJECT: Mercer Island Crest Way Corridor Safety Analysis

INTRODUCTION

The City of Mercer Island is interested in improving the operations and safety along the corridor of Island Crest Way between 90th Ave SE and SE 68th St. To achieve this goal, the City initiated a corridor safety study along this corridor. The purpose of this memorandum is to evaluate the existing safety conditions along Island Crest Way and its intersections and identify potential safety issues. The following sections present findings of the team's comprehensive safety analysis, including an investigation of historical crash data, discussions with relevant stakeholders (e.g., school officials), and field observations.



STUDY AREA

The study corridor is a two-way undivided road that spans approximately 1 mile from 90th Avenue SE to SE 68th Street, as shown in Figure 1. There are no bicycle lanes on the roadway, however there is a paved shared use path on the east side of the road and a combination of paved and unpaved pathway on the west side of the road.

Based on the Mercer Island Comprehensive Plan,¹ the study corridor is designated as a secondary arterial. Secondary arterials connect with and augment principal arterials and generally have a higher degree of access to adjacent land, lower traffic volumes and lower travel speeds. Based on the narrow landscape configuration of Mercer Island, the roadway of Island Crest Way functions as one of the main north-south routes in the City while also providing direct access to several schools and other destinations (e.g., Island Crest Park, Pioneer Park, Islander Middle School, and the Mercer Village Shopping Center).

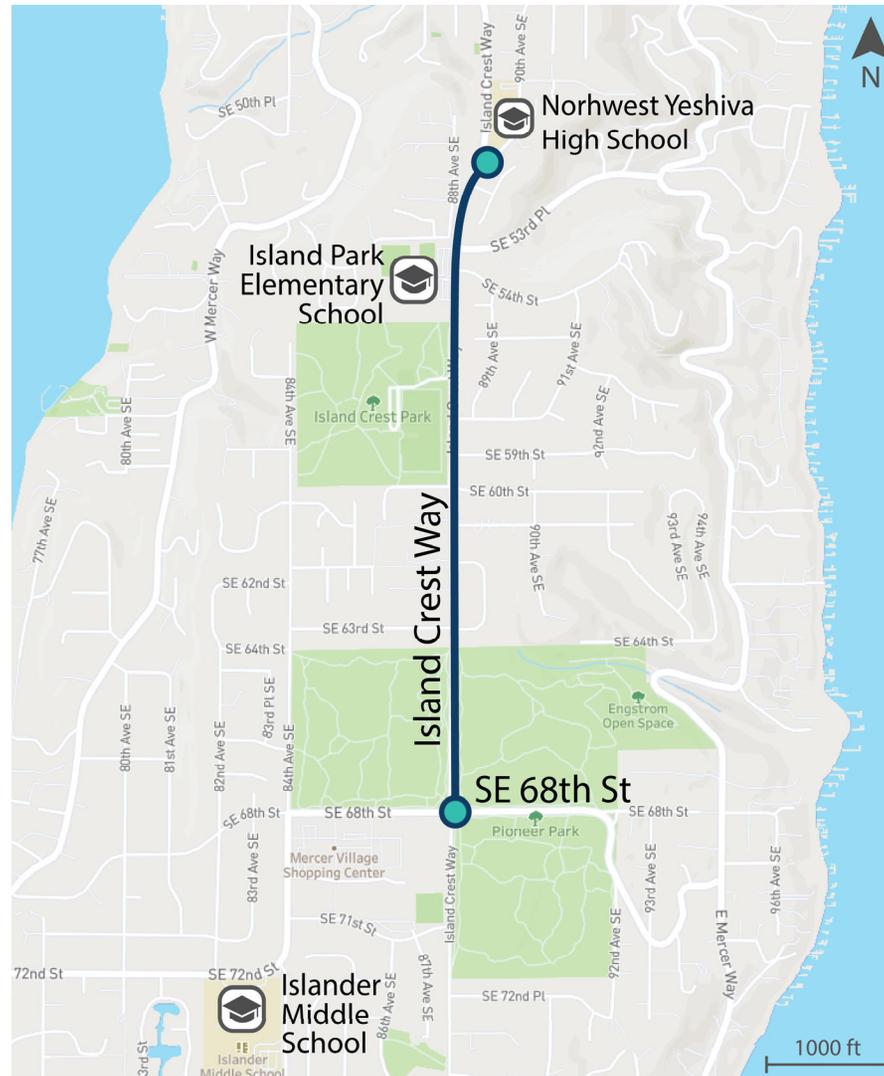


FIGURE 1. STUDY CORRIDOR MAP

¹ Mercer Island Comprehensive Plan. <https://www.mercerisland.gov/cpd/page/comprehensive-plan>

SITE CHARACTERISTICS

Table 1 below summarizes the roadway characteristics along Island Crest Way between 90th Ave SE and SE 68th St.

TABLE 1. ROADWAY CHARACTERISTICS SUMMARY

Attribute	
POSTED SPEED LIMIT	35mph 20mph School Zone
50TH PERCENTILE SPEED ²	37 mph
85TH PERCENTILE SPEED	40 mph
95TH PERCENTILE SPEED	43-44 mph
SEGMENT LENGTH	1 mile
AVERAGE LANE WIDTH	10-11 ft
AVERAGE SHOULDER WIDTH	Average 1 ft. paved shoulder
ROAD BUFFER	Grass buffer with no curbs
NUMBER OF ACCESS POINTS	20
Weekday AADT	15,000-16,000 vehicles per day
MEDIAN	Typically, none. Some small separation at locations with median trees
LIGHTING	Inconsistent street lighting
NUMBER OF CRASHES (2015-2020)	43
AVERAGE NUMBER OF CRASHES PER YEAR	7



² Speed at which 50% of surveyed vehicles traveled at or below. 85th and 95th percentile speeds are those speeds at which 85% and 95% of vehicles traveled at or below, respectively.

The study team retrieved collision data from the Washington State Department of Transportation (WSDOT) collision database from the past six years (2015-2020) along the study corridor (including intersection and non-intersection crashes). The team identified 43 crashes that occurred along the study corridor between 90th Avenue SE and SE 68th Street. Figure 2 presents collision frequency by severity. Overall, the total number of crashes along the study corridor fluctuated over the study period. The first three years averaged five crashes annually, while the final three years of the study averaged nine crashes per year. Regarding severity, two serious injury collisions occurred in 2018 and one serious injury collision occurred in 2020.

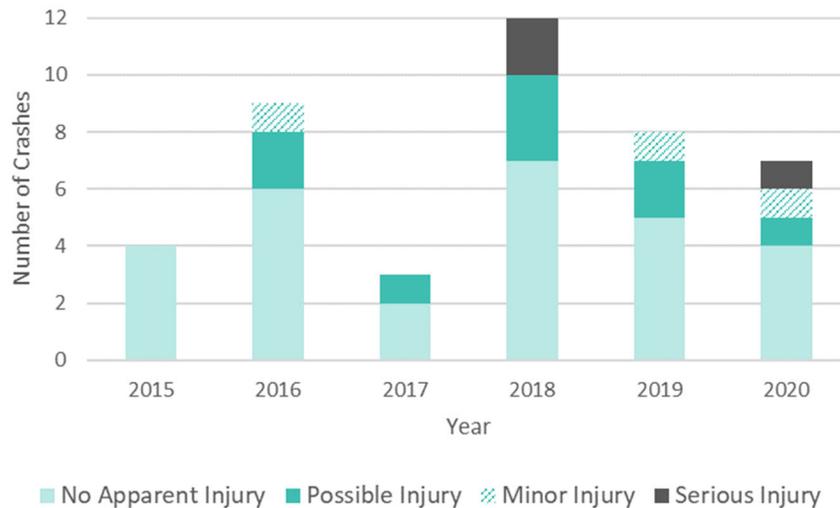


FIGURE 2. COLLISION FREQUENCY BY SEVERITY AND YEAR, 2015-2020

Figure 3 presents a heat map of the 43 recorded collisions, showing that corridor crashes tend to cluster around access points. In particular, the access points of SE 62nd Street, SE 63rd Street, and SE 68th Street intersection have experienced a higher frequency of crashes compared to other locations along the corridor. Figure 4 maps all the crashes along the corridor based on crash severity.

Serious Injury Crashes

- On February 17, 2018, at 5:30AM, a serious injury collision occurred just north of SE 53rd Place. The driver was traveling northbound while navigating the curve and ran off the road in wet road conditions, then hit a tree.
- A serious injury crash occurred at SE 63rd Street when a vehicle traveling southbound hit a pedestrian crossing the marked crosswalk at 6:40 PM on February 19, 2018. It was reported that this collision occurred in dark conditions with street lights on.
- Approximately 700 feet north of the SE 68th Street intersection, there was a serious injury crash involving a head-on collision that occurred at 8:24 PM on April 13, 2020.

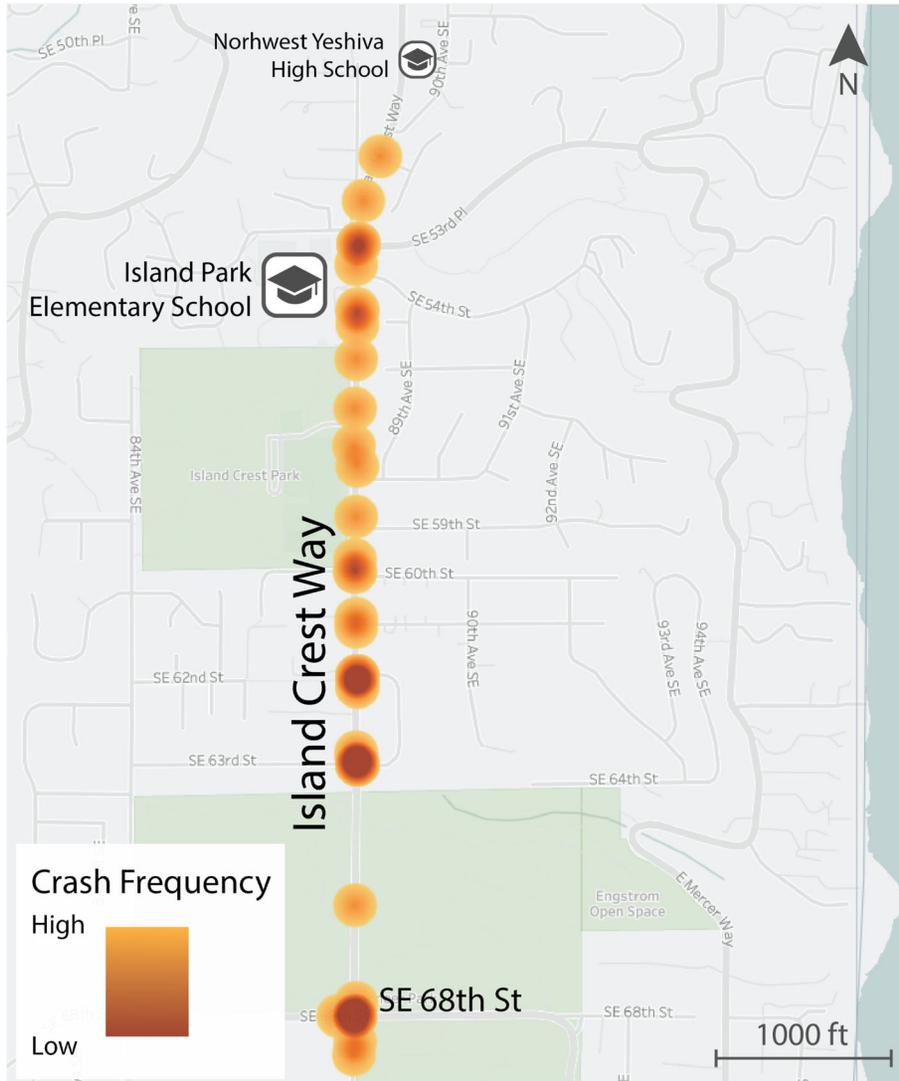


FIGURE 3. HEAT MAP OF CRASHES ALONG STUDY CORRIDOR, 2015-2020

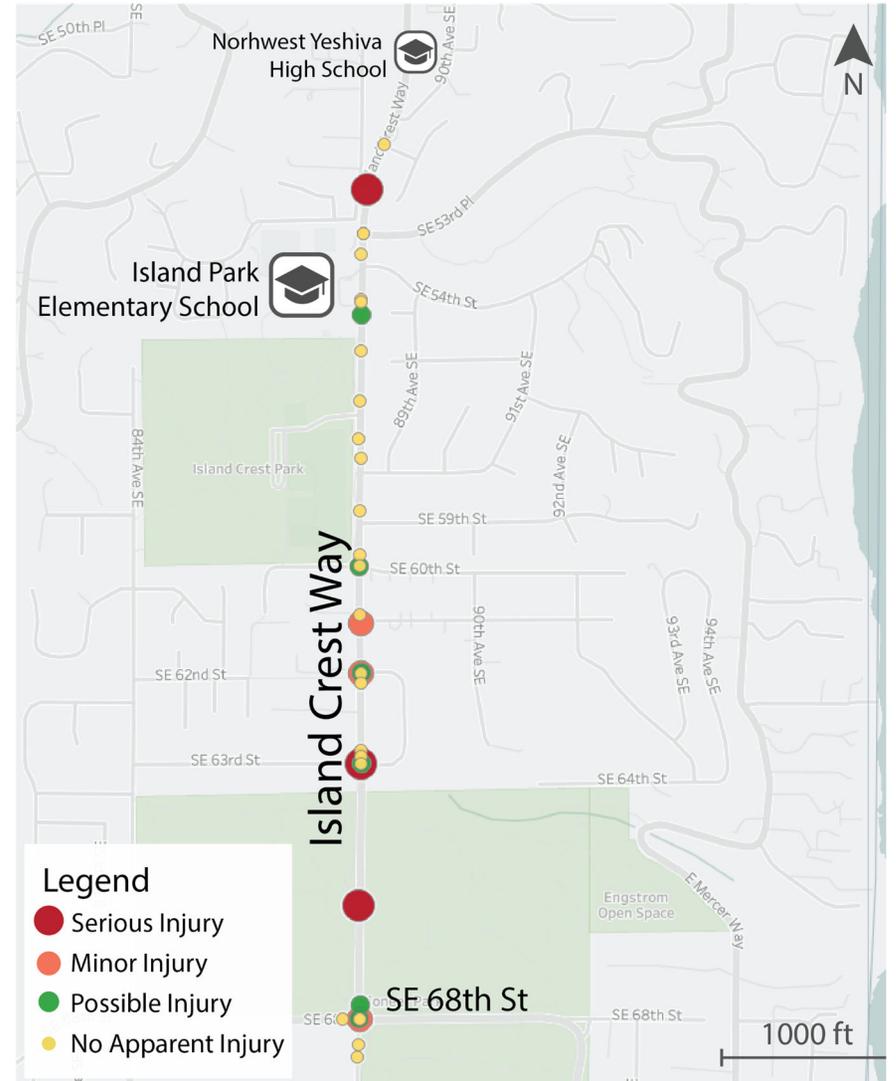


FIGURE 4. CRASH SEVERITY ALONG STUDY CORRIDOR, 2015-2020

CORRIDOR CRASH TYPES

As illustrated in Figure 5, the most common contributing circumstance was inattention (18%). As shown in Figure 6, the most common crash types along the study corridor are rear-end crashes (42%), followed by entering at angle³ (21%) and run off the road crashes (14%).⁴

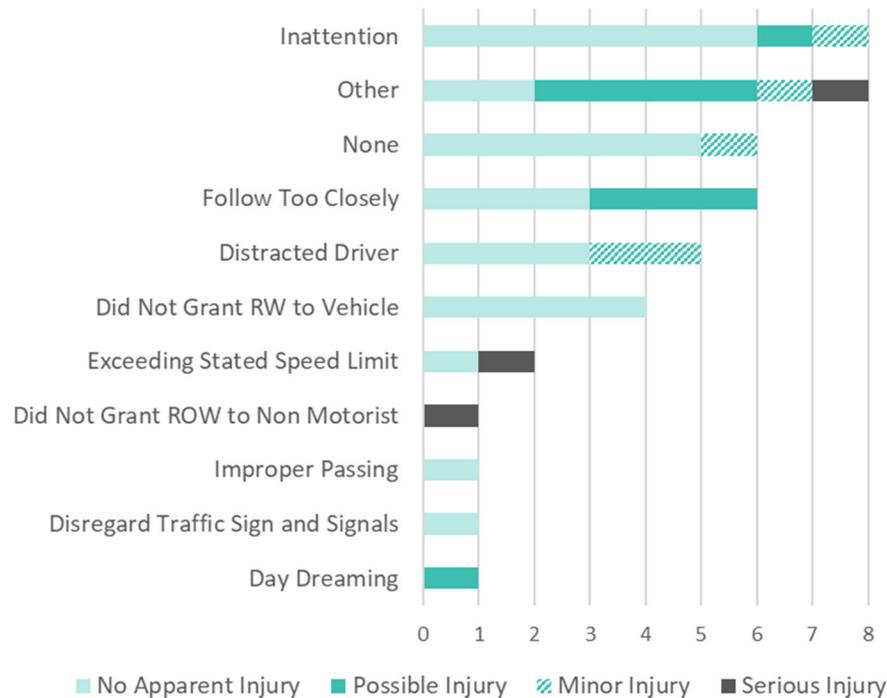


FIGURE 5. CONTRIBUTING CIRCUMSTANCES ALONG THE STUDY CORRIDOR, 2015-2020

Of the 74 motor vehicle drivers identified in crashes during the study period, 28 (38%) were 15-25 years-old and seven (9%) were 65 year-old or older.

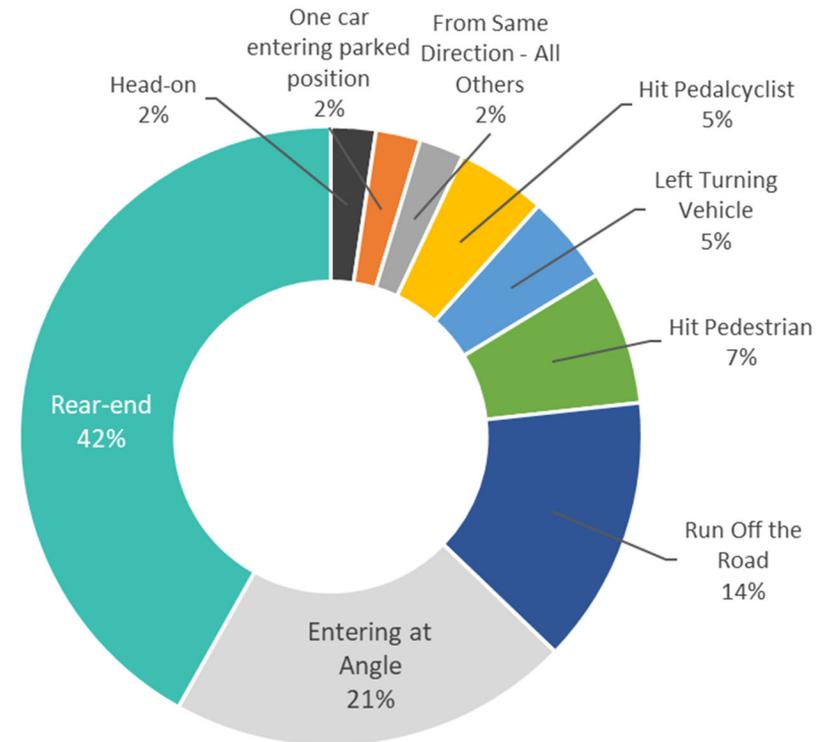


FIGURE 6. PROPORTION OF CRASH TYPES ALONG THE STUDY CORRIDOR, 2015-2020

³ Crashes where one vehicle struck another from an angle (often near-90-degrees).

⁴ "Other" in Figure 5 was marked by the reporting officer. Additional details are unavailable.

CRASH REPORT NARRATIVE AND DIAGRAM REVIEW

To understand some of the stories about the collisions on Island Crest Way, the study team reviewed law enforcement reports that included individual collision diagrams and narratives. This review resulted in the following findings:

- In many cases a non-traffic situation (a child left their jacket in the vehicle; a driver had recently had an argument with a family member) are recorded in the narrative and are directly related to the collision.
- Distraction is a common element in the collision narratives: adjusting vents, sunroof, etc.
- Tree hits were relatively common, and in each case the tree was very close to the roadway. There may be an opportunity to consider strategic tree removal or other mitigations.
- Drivers are not used to needing to stop along Island Crest Way, and as activity has increased, the need for drivers to stop for other road users (vehicles, bicyclists, pedestrians, etc.) has also increased. In particular, two actions are involved in the vast majority of rear-end collisions on the corridor: vehicles stopped to turn left onto a side street and vehicles stopped for crossing pedestrians.
 - Vehicle stopped to turn left onto a side street, most common at:
 - SE 53rd Place during school bus departure
 - Park entrance
 - SE 59th Street (Southbound Left Turn)
 - Vehicle stopped for crossing pedestrians
 - SE 63rd Street (Southbound vehicle)
 - Elementary School Pedestrian Crossing
- SE 68th Street: Two primary collision types.
 - Most vehicle-vehicle collisions involved a southbound vehicle that did not stop at the Stop sign.
 - Pedestrian-related collisions involved an eastbound left turning vehicle.

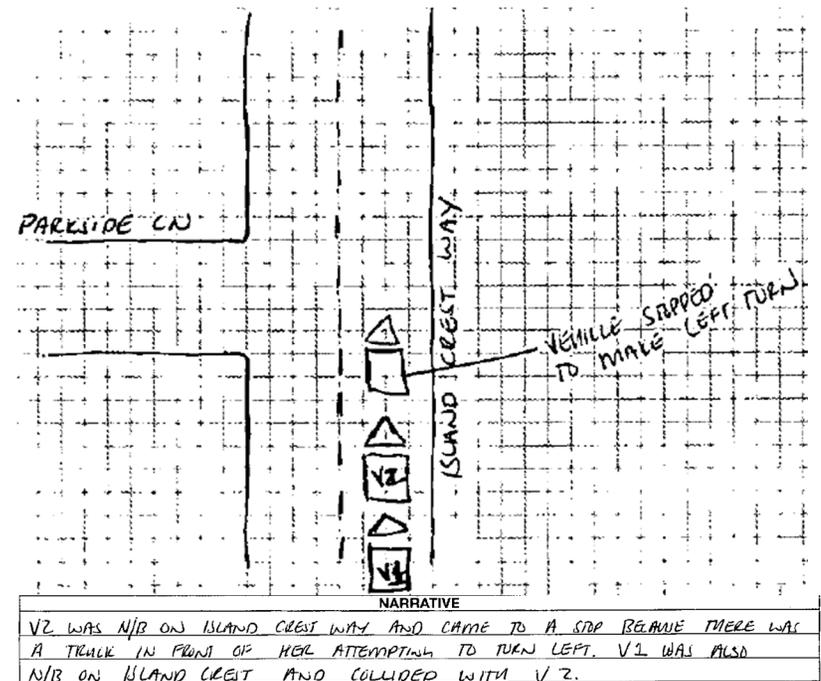


FIGURE 7. EXAMPLE DIAGRAM AND NARRATIVE FROM COLLISION REPORT

"I turn north onto ICW from SE 63rd and cars often are traveling above the speed limit, bikes are hidden and then cross the intersection at 63rd on the west side going north and south, and buses and trucks sometimes block the view making it impossible to see in order to turn north from SE 63rd."

- Survey Respondent, December 2021

LIGHTING CONDITIONS

During the study period, there were 15 crashes that occurred during non-daylight conditions. In particular, 21% of crashes reported dark conditions with street lights on, as shown in Figure 8. During the PM peak field visit, the study team observed the street lighting and noticed that two street lights were not functioning on both sides of SE 58th Street entrance on the east side of Island Crest Way, as shown in Figure 9.

Once the area gets dark, which is around 5 PM during the winter time, the areas without street lights have limited visibility, as shown in Figure 10. Without daylight, it can be difficult to see the edge line striping (which was not exhibiting retroreflectivity during the field review), centerline reflectors, and trees that border the roadway. As a pedestrian on the sidewalk or a cyclist sharing the road, it can be difficult for drivers to see them in the dark along this corridor.

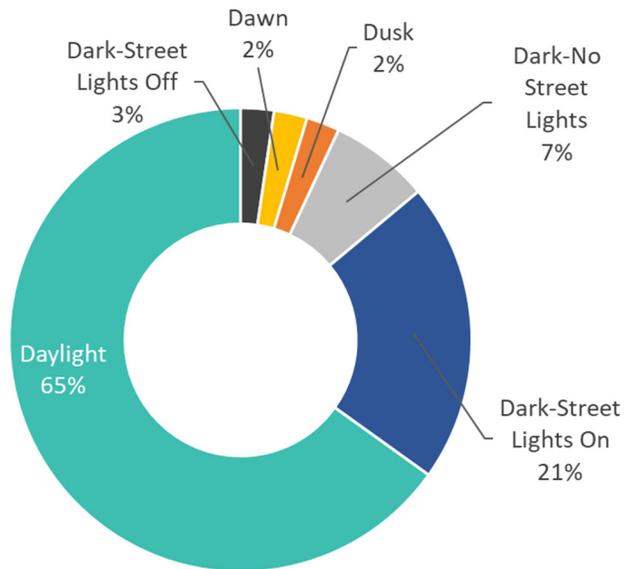


FIGURE 8. CRASH EVENT LIGHTING CONDITIONS, STUDY CORRIDOR, 2015-2020



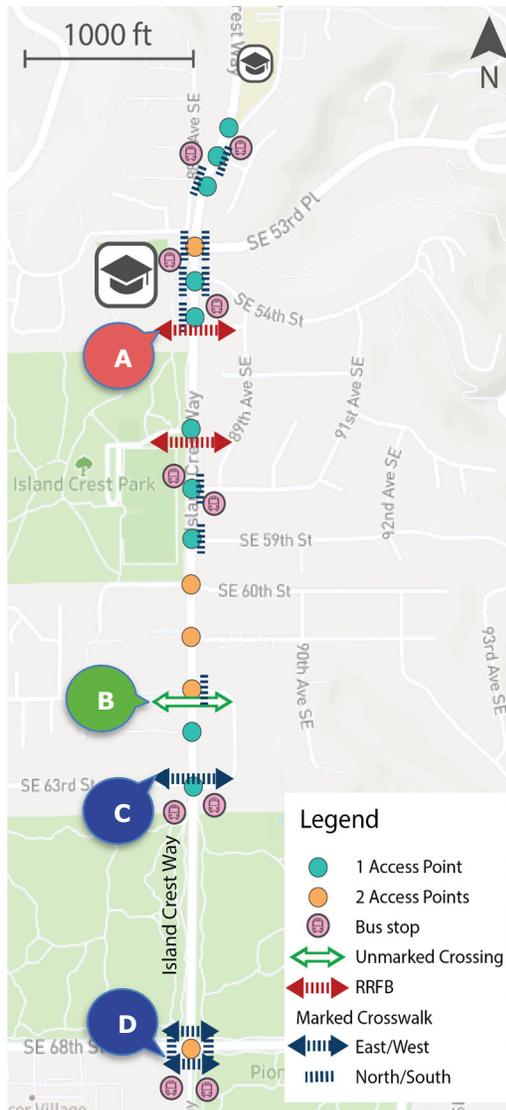
FIGURE 9. STREETLIGHTS OUT ON BOTH SIDES OF SE 58TH ST INTERSECTION (12/2/2021).



FIGURE 10. ISLAND CREST WAY AT NIGHT.

"This stretch is very dark. When driving, I'm cautious to watch for peds, especially during the dark months. I don't walk along here during the night at all." - Survey Respondent, December 2021

ACTIVE TRANSPORTATION NEEDS



During the study period, three pedestrian-involved and two bicyclist-involved collisions were recorded along the study corridor. Of these five collisions, one resulted in a possible injury, three in a minor injury, and one was a serious injury crash at the SE 63rd Street crosswalk in dark conditions.

The map on the left presents an inventory of access points, transit bus stops, marked crosswalks, and Rectangular Rapid Flashing Beacon (RRFB) locations along the study corridor. The bus stop locations are served by route Metro Transit Route 204 with a bus frequency of 30 minutes. Route 204 is operational Monday - Friday from 5:50 AM to 6:29 PM and Saturday 9:00 AM to 6:01 PM.⁵ There is one RRFB located at the southeast corner of the elementary school and approximately 700 feet south, there is another RRFB located at Island Crest Park. Both RRFB locations have a pedestrian warning sign on one side, facing the oncoming traffic, and are well lit.

Along the east side of the study corridor, there is a paved, shared use path approximately 6-8 foot wide with a buffered grass shoulder from the road. On the west side of Island Crest Way, there is a soft surface path that is used by pedestrians; however, it meanders and slopes around trees, vegetation, and driveways. The west side informal path is often used by adults who park on the shoulders of Island Crest Way and wait for the students during pick-up times. However, during wet road conditions, the unpaved path becomes uneven and muddy. Photo A on the next page shows the narrow, muddy path, just south of the Elementary School RRFB on the west side. During the afternoon pick-up time, the project team observed several pedestrians walking on the road, against opposing traffic, in order to avoid the muddy trail.

At SE 62nd Street, there is an access point to Stevenson Property Trail on the west side of Island Crest Way, as shown in Photo B in the next page. This bike route is a gravel pathway that leads to 84th Avenue SE and South Mercer Playfields. Based on the Mercer Island Bicycle Routes Map,⁶ Island Crest Way serves an important bicycle connection from 84th Avenue SE to 86th Avenue SE. However, cyclists are expected to use caution along Island Crest Way because of higher speeds and lack of shoulders or curb lanes.

⁵ Route 204 information: https://moovitapp.com/index/en/public_transit-line-204-Seattle_Tacoma_Bellevue_WA-522-5872-666053-0

⁶ Mercer Island Bicycle Route Map: https://www.mercerisland.gov/sites/default/files/fileattachments/community/page/23841/bicycle_map.pdf

Photos C and D provide visuals of the marked crossings at SE 63rd Street and SE 68th Street, respectively. The pavement striping has faded, and some stop bars could also be refreshed to improve visibility. Also, these crossings do not appear to be Americans with Disabilities Act (ADA) compliant with regard to ramp access. Lighting at each of the crosswalks needs to be evaluated. In particular, at the crosswalk at SE 63rd Street, there is insufficient lighting to provide visibility at nighttime.

A



Photo A: Informal path on the west side of Island Crest Way, just south of the Island Park Elementary School (facing northbound).

B



Photo B: Bike Route crossing south of SE 62nd Street (facing northbound). Existing street light on the east side. No lighting provided on the west side of Island Crest Way at this crossing.

C



Photo C: Marked crossing at SE 63rd Street with signing (facing southbound).

D



Photo D: Marked crossing at SE 68th Street intersection (facing northbound from southeast corner).

OTHER FIELD OBSERVATIONS

In addition to the topics listed above, the study team identified several other potential safety needs along the corridor:

Vegetation. At several locations along Island Crest Way and at intersections, vegetation blocked signs or limited intersection sight distance for road users.

Median Trees and Signing. A few locations along the corridor include trees in the median, which introduce fixed object near the traveled way. These same medians have non-standard red-and-white object markers to delineate the presence of trees.

Pavement Marking. In general, pavement marking is worn and needs to be re-marked along the edgeline and at crosswalks. Some centerline marking is only raised pavement markers with no striping underneath. When markers are non-reflective or missing, this causes gaps in delineation.



HOT SPOT ANALYSIS

The following section describes the existing conditions at key intersections based on lane configuration, traffic operations, crash data, and the project teams' field visit observations

ISLAND CREST ELEMENTARY SCHOOL

There are two schools near the study corridor. Northwest Yeshiva High School is located north of the study corridor on 90th Avenue SE, and Island Park Elementary School is located adjacent to the study corridor, just south of SE 53rd Place. Figure 11 shows typical operations of this area.

Island Park Elementary School is one of the priority locations along the study corridor since there is a high volume of pedestrians, bicycles, personal vehicles, and school buses entering and exiting the campus. The study team conducted both morning and afternoon peak field visits at Island Park Elementary School and spoke with school representatives about potential safety concerns and daily operations.

Island Park Elementary School has 67 staff who serve approximately 425 students. On a typical school day, the school doors open at 8:50 AM and school starts at 9:10 AM. Parents start to drop off their children around 8:05 AM. School buses start picking up students at 8:30 AM and the last bus arrives on campus at 9:05 AM.

Approximately 450 feet north and south of the school, there are school speed limit 20 mph flashing signs that turn on at 8:45 AM.⁷

For the PM peak, the typical school day ends at 3:45 PM. Parents begin waiting in the parking lot at approximately 3:30 PM and the parking lot generally becomes full by 3:40 PM. Other parents park on the unpaved shoulders along Island Crest Way south of the school. The parent parking lot generally clears within 10 minutes of student release. With the help of a flagger, school buses leave the separate parking lot at 3:55 PM at the intersection of SE 53rd Street.

One of the main crossings for the school is the RRFB controlled crosswalk located on the south end of Island Park Elementary School. This crossing is heavily used for students and faculty during the school drop-off and pick-up times and is assisted by a flagger.

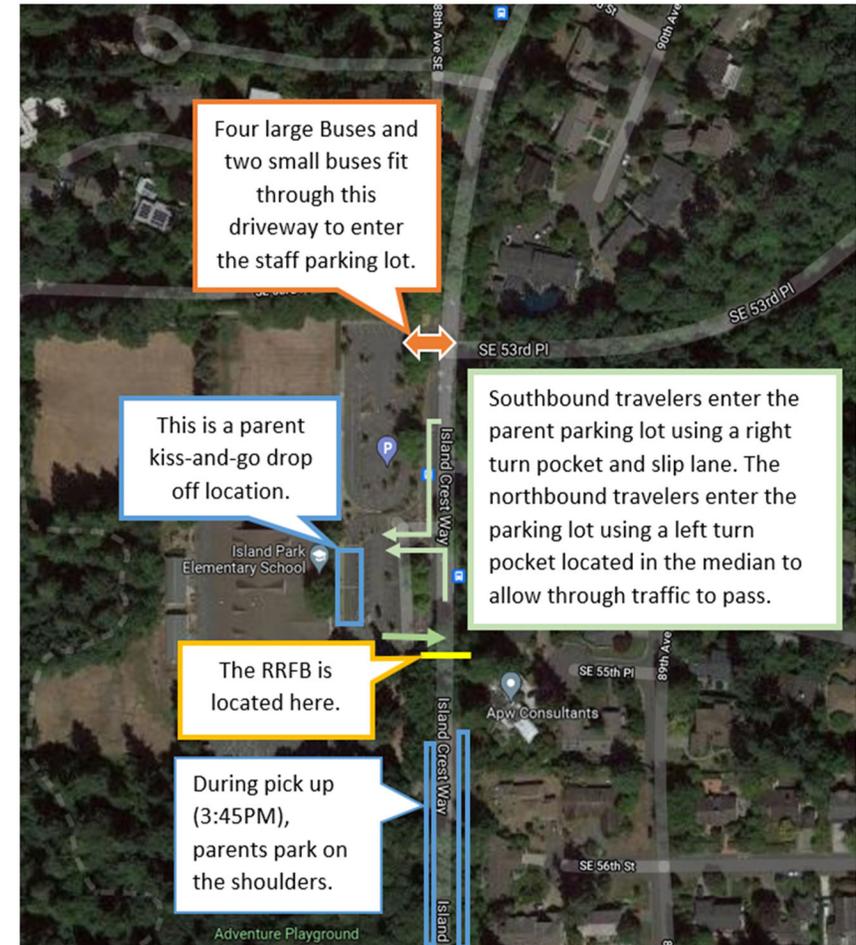


FIGURE 11. ISLAND PARK ELEMENTARY SCHOOL PARKING LOT OPERATIONS.

⁷ This is a recent change, as the school speed limit previously turned on earlier in both the AM drop-off and PM pick-up times.

SE 53RD PLACE

There are two main parking lots to access the school. The north parking lot serves the school staff and school buses. The only entry/exit point to the north staff parking lot is across from SE 53rd Place. The south parking lot serves as a drop-off and pick-up location for parents and guardians.

One of the main locations that the project team has heard concerns about is regarding the entry/exit driveway to the north parking lot, which operates as a two-way stop-controlled intersection. A horizontal curve just north of the intersection results in less-than-ideal sight distance for side street motorists as they look to the north. This is most evident for westbound left-turning drivers who are seeking a gap in northbound and southbound Island Crest Way traffic to make their movement.

In particular, during the PM pick-up time (3:45 PM), the school buses require assistance exiting the north parking lot. Currently, a flagger assists school buses by stopping northbound and southbound traffic to allow the buses to turn onto Island Crest Way. Without the assistance of the flagger, the constant through traffic makes it challenging for bus drivers to attempt to make a turn onto Island Crest Way.

Based on the traffic counts and field observations, there is pedestrian activity on both the east leg and west leg of this intersection. During the site visits, the project team observed pedestrians running across Island Crest Way to cross the street, but there is no marked crosswalk or pedestrian crossing warning signs at the intersection.

At the intersection of SE 53rd Place and Island Crest Way, there were three reported collisions during the study period, none of which resulted in an injury:

- In January 2016, a westbound vehicle from SE 53rd Place was making a left turn to southbound Island Crest Way and hit a car making an eastbound right turn from the school parking lot.
- In February 2018, a driver traveling northbound stopped for a flagger at 9:14 AM and a distracted driver rear-ended that vehicle.
- In March 2019, a collision involved a westbound vehicle from SE 53rd Place making a right turn and a vehicle traveling northbound on Island Crest Way.

"Once I'm on the road, it's fine, but it's so hard to merge into it, specifically the intersection at 53rd in front of Island Park Elementary." - Survey Respondent,



SE 68TH STREET

This four-way stop intersection is one of the most significant intersections along the study corridor, in terms of the number of crashes and daily activity. Over the six-year study period, approximately one in five collisions along the entire study corridor occurred at this intersection.

The crash diagram shown in Figure 14 illustrates the vehicle movements, severity, date, and time of all the crashes that occurred during the study period. There have been two pedestrian and bicycle crashes that involved an eastbound left-turning vehicle. Based on the pedestrian counts collected in 2018, pedestrian activity is present on all four legs, with the highest amount of pedestrian traffic crossing the north leg of the intersection. Also, the study team observed multiple runners during the PM peak field visit in December 2021 at this intersection.

The intersection provides access to three trail access points to Pioneer Park in the northeast, southeast, and northwest corners. Pioneer Park is one of the largest parks in Mercer Island and provides a large network of unpaved non-motorized trails. Furthermore, there is also a shopping plaza southwest of the intersection that includes a grocery store, restaurants, and a park-and-ride transit stop.

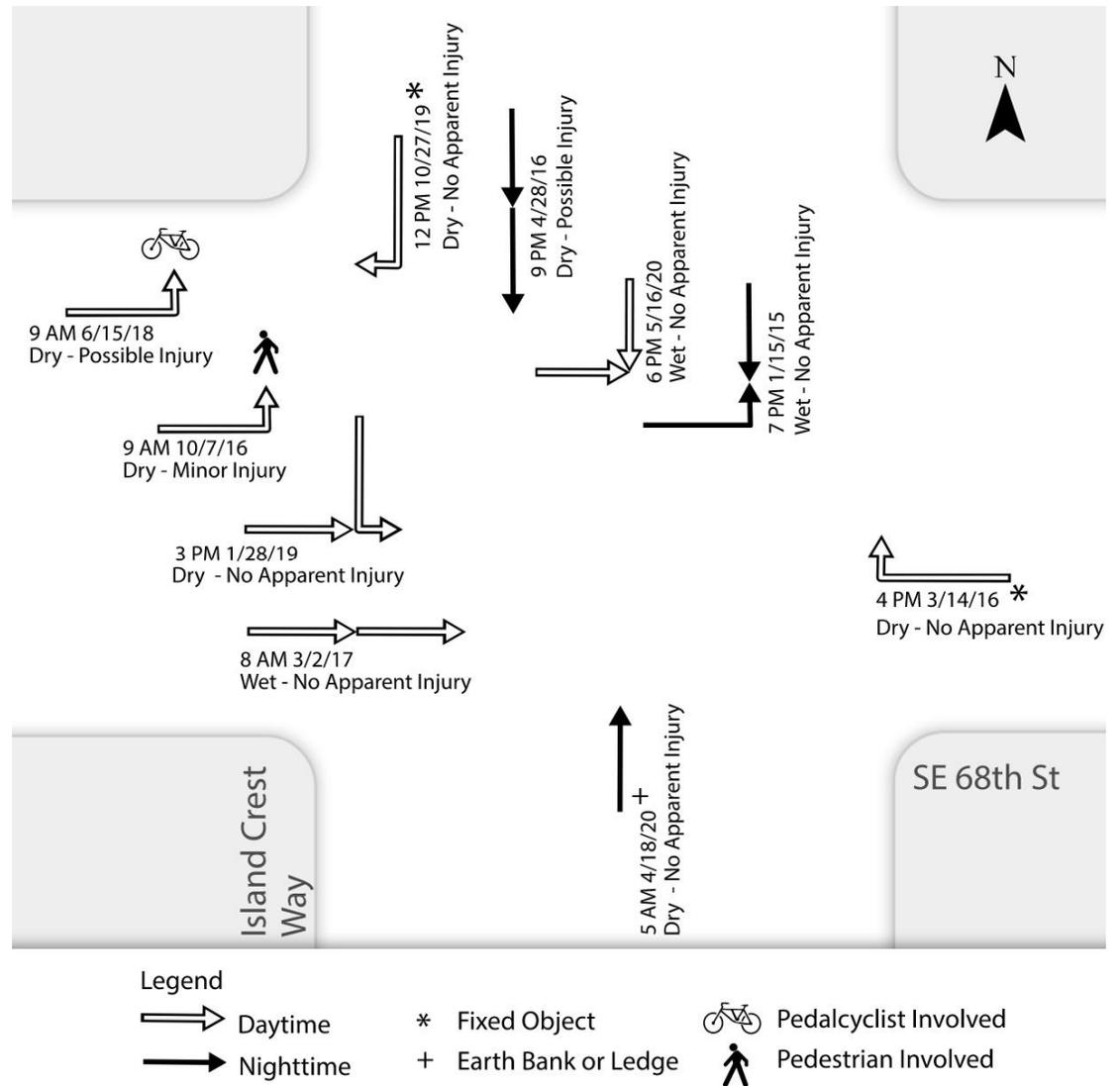


FIGURE 14: CRASH DIAGRAM FOR SE 68TH ST AND ISLAND CREST WAY INTERSECTION (2015-2020).

The project team conducted multiple site visits to the SE 68th St intersection. During the afternoon field visit, sunset began around 5:00 PM and the areas without streetlights have limited visibility. Although at the intersection there is sufficient lighting to illuminate the intersection, it is very dark leading up to the intersection for all approaches.

The southbound approach has a vertical grade approaching the intersection, making it difficult for drivers to know there is an intersection approaching. As shown in Figure 15, leading up to the intersection, there are multiple signs on the west side of the road, which are difficult to read as they are installed in close proximity to one another. Due to approach grade, faded edgeline pavement markings, and absence of curbs, drivers may have limited visibility approaching roadside objects.



FIGURE 15: SIGNAGE ON WEST SIDE, APPROACHING SOUTHBOUND OF SE 68TH ST INTERSECTION.

"In particular, the intersection of ICW and SE 68th is a choke point for cars and a tricky place to be a pedestrian." - Survey Respondent, December 2021



"Coming out of the NW quadrant of Pioneer Park and crossing over to the NE quadrant requires contending with cars who don't stop and take that corner at high speeds." - Survey Respondent, December 2021



PUBLIC INPUT

On December 2, 2021, the City of Mercer Island published an online survey on the "Let's Talk" website to solicit information from the public. To increase promotion of the website, the City of Mercer Island also provided flyers to students and staff at the Island Park Elementary School. The survey was closed on January 3, 2022, and results were retrieved for this analysis. In total, there were 499 survey responses, and the following figures provide a high-level summary of the results:



499

Respondents



57%

Travel along
Island Crest Way
EVERY DAY



9%

Walk along Island
Crest Way as a
common mode of
travel



86%

Drive along Island
Crest Way as a
common mode of
travel

REPRESENTATIVE RESPONDENT QUOTES

"You can't walk the entire route without having to cross Island Crest because [of the lack] of sidewalks."

"Riding a bike on the sidewalk is dangerous at intersections where cars come out too far toward Island Crest to see."

"When traveling by car I worry about the crosswalks, especially during the spring and summer with the foliage is heavy and it is difficult to spot pedestrians waiting to cross when the sidewalks are often hidden by the trees."

"This stretch of road is straight with well-marked lanes and drivers generally seem to be safely traveling down this road."

"First of all, it is too narrow, secondly, it is very dark during the night. I would like to see a walk/bike path where my kids can safely walk or bike on Island Crest Way all the way from south QFC to north QFC. Currently, they have to take an extra longer loop inside the neighborhood streets because it is not safe for them to ride on Island Crest Way."



64%

Of respondents feel safe travelling the study corridor



#1

Safety Concern is Bicyclist Safety



85+

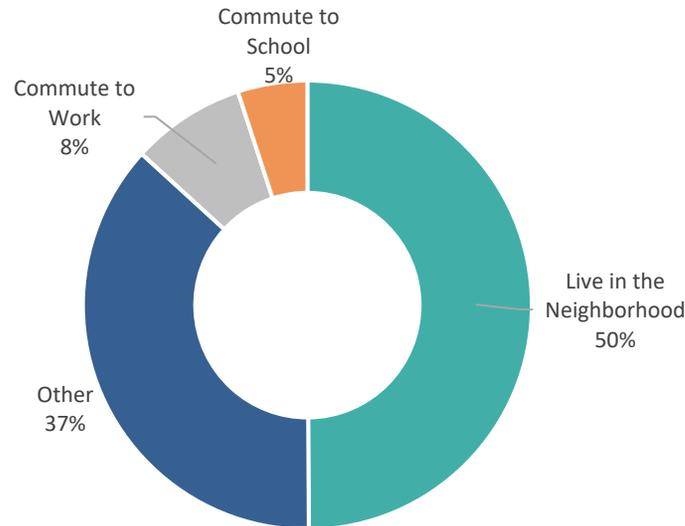
Comments about improving lighting along the corridor



13%

Of Respondents are a student or have a student attending Island Park Elementary School

WHY DO YOU PRIMARILY TRAVEL ALONG THIS STRETCH OF ISLAND CREST WAY?



OTHER RESPONDENT QUOTES

"Generally ok, but needs more lighting at night and have trees trimmed back."

"It would be good to have a lighted sign at the intersection of ICW & 63rd."

"Having lived 21 years (my entire life) in this neighborhood, the potential for a pedestrian vs. car collision is immense. I have almost been hit several times on my bike or while walking, and I've definitely had some near misses with pedestrians as a driver. It is my belief that this is caused due to poor sightlines, particularly when it is dark out, a lack of crosswalks, and a high-speed limit. "

NEXT STEPS

Following is a summary of identified needs along Island Crest Way.

- There are many crosswalks that are not ADA compliant and have poor lighting at night.
- Vegetation covers signs and limits sight distance at several locations along the Island Crest Way corridor and at intersections.
- During nighttime driving, it can be difficult to view the worn out edgeline striping, centerline pavement marking, and faded crosswalk markings.
- There is sign clutter and overhanging tree canopy that can potentially block the southbound approach at SE 68th Street intersection.
- Bike route crossing near SE 62nd Street has no pavement markings or signage for the northbound approach to warn vehicles of potential cyclists crossing the road.
- SE 53rd Place intersection provides the only exit/entrance point for school buses to access the school parking lot. There have been vocal concerns regarding the safety of the side street approaches turning onto Island Crest Way.
- The SE 68th Street intersection has experienced the highest frequency of collisions in the study section.
- Bicyclists and pedestrians expressed concerns about safely navigating the corridor.

The next tasks of this study are confirming the safety needs in this memo, identifying strategies to address these safety needs, and proposing a prioritized set of solutions, estimated relative costs and benefits, and potential funding sources to the City of Mercer Island.

APPENDIX C: EXISTING TRAFFIC OPERATIONS ASSESSMENT



EXISTING TRAFFIC OPERATIONS ASSESSMENT (FINAL)

DATE: January 7, 2022

TO: Lia Klein, PE | City of Mercer Island

FROM: Yilun Xu, PE | DKS
Brian Chandler, PE, PTOE, RSP_{21B}, PMP | DKS

SUBJECT: Mercer Island - Island Crest Way Corridor Traffic Operations 21212-000
Assessment

This memorandum documents the assessment of current traffic operations along Island Crest Way between 90th Avenue SE and SE 68th Street in Mercer Island, WA. The traffic operations analysis focuses on the intersections at SE 53rd Place, SE 54th Street, and SE 68th Street, and pedestrian crossing and parking lot access near Island Park Elementary School.

SITE OVERVIEW

The study corridor, Island Crest Way between 90th Avenue SE and SE 68th Street, is situated in the southern center of the City of Mercer Island, as shown by **Figure 1**.

The SE 53rd Place and SE 54th Street intersections are currently two-way stop controls, while the SE 68th Street intersection is an all-way stop control. The traffic operations assessment supports the Island Crest Way corridor safety analysis to identify existing traffic operation deficiencies and opportunities for further improvement.

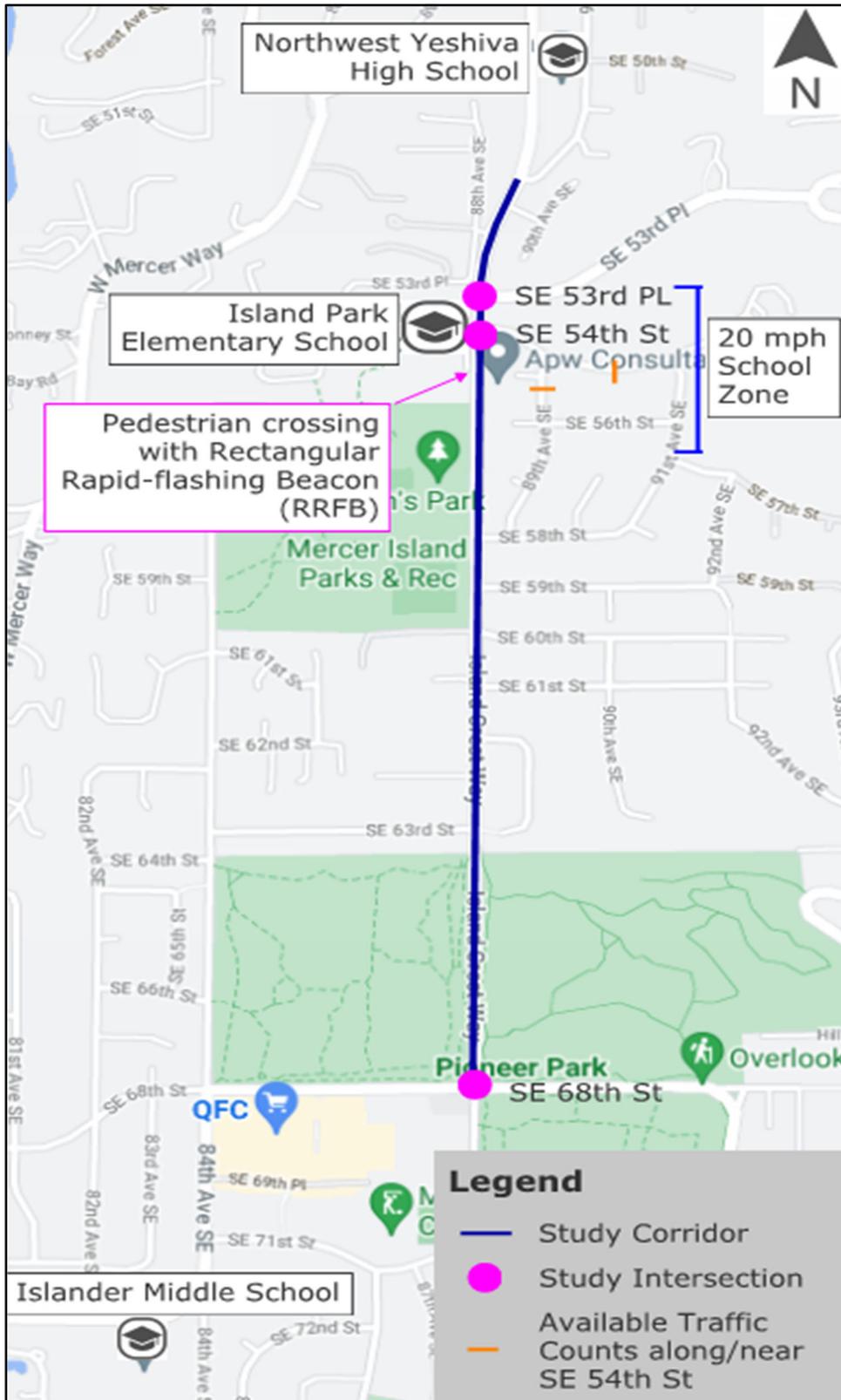


FIGURE 1: STUDY CORRIDOR AND STUDY INTERSECTIONS

OPERATIONS ASSESSMENT

The traffic operations assessment includes Synchro traffic models during the AM and PM peak hours (7:30 - 8:30 AM and 5:00 – 6:00 PM, respectively) at the three most congested study intersections (SE 53rd Place, SE 54th Street, and SE 68th Street). It also documents the traffic operations observations, particularly around the Island Park Elementary School, during the study team’s two site visits on Tuesday, November 16, 2021 (AM) and Thursday, December 2, 2021 (PM).

KEY STUDY INTERSECTIONS

The most recent Synchro models and traffic volumes for traffic operation analysis at the three study intersections were obtained from the City of Mercer Island. The turning movement counts at SE 53rd Place and SE 68th Street intersections were collected in 2018 (**Appendix A**).

Turning movement counts were not available for SE 54th Street, so the team developed a method to derive a reasonable estimate as follows:

1. Collected data from tube counts along SE 54th Street that were collected in 2010 (**Appendix A**).
2. Combined two additional tube counts along/near SE 54th Street (one on and one east of 89th Avenue SE, as shown in **Figure 1** above) to derive the approach volume of SE 54th Street at Island Crest Way.
3. Assigned turning movements in/out of SE 54th Street based on approach volume and general travel pattern.
4. To improve the accuracy of the derived turning movement counts, collected traffic volumes for southbound right-turn vehicles into the Island Park Elementary School parent parking lot at SE 54th Street during the AM peak site visit (PM peak hour volume at this movement was expected to be minimal).
5. Balanced traffic volumes at SE 53rd Place and SE 54th Street intersections in the Synchro models due to their close proximity.

No traffic volume growth has been assigned between data collection and current conditions, due to mostly residential land use and lack of recent redevelopment projects along the study corridor.

Delay, Level of Service (LOS), and 95th percentile queue lengths for the AM and PM peak hours are reported from the Synchro models using the Highway Capacity Manual (HCM) 6th Edition method and summarized in **Table 1** and **Table 2**, respectively. According to the HCM, the LOS for two-way stop intersections such as the SE 53rd Place and SE 54th Street intersections is reported based on the delay of the worst side-street approach, while that for all-way stop intersections such as SE 68th Street intersections is reported based on overall intersection delay. Detailed Synchro model outputs are documented in **Appendix B**.

TABLE 1: TRAFFIC OPERATIONS PERFORMANCE - AM PEAK HOUR

INTERSECTION	TRAFFIC CONTROL	WORST APPROACH DELAY (SEC/VEH) / LOS*		WORST 95TH %TILE QUEUE (VEH)
SE 53RD PL	Two-way Stop	84.5 / F (Westbound)		4.1 (westbound)
SE 54TH ST	Two-way Stop	43.4 / E (Westbound)		1.2 (Westbound)
INTERSECTION	TRAFFIC CONTROL	OVERALL DELAY / LOS	WORST APPROACH DELAY / LOS	WORST 95TH %TILE QUEUE (VEH)
SE 68TH ST	All-way Stop	48.2 / E	94.1 / F (eastbound)	16.7 (eastbound)

* LOS FOR TWO-WAY STOP CONTROLS IS REPORTED BASED ON THE WORST APPROACH DELAY.

TABLE 2: TRAFFIC OPERATIONS PERFORMANCE - PM PEAK HOUR

INTERSECTION	TRAFFIC CONTROL	WORST APPROACH DELAY (SEC/VEH) / LOS*		WORST 95TH %TILE QUEUE (VEH)
SE 53RD PL	Two-way Stop	77.6 / F (Westbound)		3.6 (westbound)
SE 54TH ST	Two-way Stop	39.2 / E (Westbound)		0.8 (Westbound)
INTERSECTION	TRAFFIC CONTROL	OVERALL DELAY / LOS	WORST APPROACH DELAY / LOS	WORST 95TH %TILE QUEUE (VEH)
SE 68TH ST	All-way Stop	18.1 / C	21.4 / C (eastbound)	5 (eastbound)

* LOS FOR TWO-WAY STOP CONTROLS IS REPORTED BASED ON THE WORST APPROACH DELAY.

The traffic operation analysis indicates that the congested study intersections do not meet the LOS standard of D as required by the City of Mercer Island Comprehensive Plan¹, with the exception of the SE 53rd Place intersection which is exempt from the LOS D standard until traffic volumes increase and signal warrants are met.

The analysis results also reveal that AM peak hour is more congested than the PM peak hour at the three study intersections, which is consistent with field visit observations and the fact that AM commuter traffic and AM school traffic occur at similar times along Island Crest Way. The long delays at the side-street at the SE 53rd Place and SE 54th Street intersections are due to heavy traffic along Island Crest Way during the peak hours, providing limited gaps for side-street vehicles to enter. At the westbound approach (the most delayed approach) of the SE 53rd Place intersection, the majority of delay results from the heavily delayed westbound left-turning and through vehicles. Right-turning vehicles could not pass them due to the single lane approach configuration.

¹ Comprehensive Plan. City of Mercer Island.

https://library.municode.com/wa/mercer_island/codes/comprehensive_plan?nodeId=MEISCOPL_4T_REL_IITRSYXICO_LESEST. September 30, 2021.

At the SE 68th Street intersection, the eastbound approach could be delayed by more than 90 seconds per vehicle during the AM peak hour with queues up to 17 vehicles (or approximately 340 feet assuming 20 feet per vehicle), contributing to the intersection overall delay. This delay and queuing are driven mostly by the heavy eastbound left-turn demand (over 400 vehicles/hour) in the AM peak hour. The LOS E for the AM peak hour at the SE 68th Street intersection is also worse than the LOS D shown in the City of Mercer Island Comprehensive Plan. This is due to a Peak Hour Factor (PHF) update in the latest model based on the recent traffic counts in **Appendix A**. A PHF is an adjustment factor in traffic analysis and modeling that addresses the traffic flow rate difference between the busiest 15 minutes and the peak hour.

SCHOOL TRAFFIC OBSERVATIONS

In addition to the AM and PM peak hours, congestion around the Island Park Elementary School (near the SE 53rd Place and SE 54th Street intersections) has also been reported during the school's morning drop-off and afternoon pick-up times. When school is in session, the daily schedule starts at 9:15 AM and ends at 3:45 PM, except for Wednesday's early dismissal at 2:05 PM.

There are two parking lots for the Island Park Elementary School. The one on the north (entry/exit at SE 53rd Place) is for staff parking and school bus drop-off and pickup. The one on the south, with entrance on the north end and exit on the south end and generally counterclockwise traffic flow, is used for parent drop-off, pickup, and short-term parking. Based on the site observations, parking lot operations appeared to be efficient and no significant backup inside the parking lot was identified beyond the expected queuing during after-school pickup.

As observed during the morning site visit on Tuesday, November 16, 2021, congestion around the Island Park Elementary School starts at around 8 AM when a pedestrian crossing with a Rectangular Rapid-flashing Beacon (RRFB) near the south side of the school starts to experience frequent crossing activities before the scheduled pick-up of the school bus heading south towards the Islander Middle School. This is also in the middle of the AM peak hour (7:30-8:30 AM) based on traffic volume, so northbound and southbound traffic queues up quickly along Island Crest Way. The queues were observed to be present until 8:15 AM.

Soon after the AM peak hour, at 8:45 AM, the 20 mph school zone sign was activated around the elementary school, where traffic speed was observed to be noticeably slower as a result. Around this same time, parents started to arrive at the south school parking lot to wait for the school door to open. Parent drop-off activities were observed to continue until 9:15 AM. During this time, school crossing guards are out at the RRFB pedestrian crossing to assist student crossings as well as the exiting traffic from the parking lot. Long northbound and southbound queues along Island Crest Way were observed until shortly after 9:15 AM due to the frequent crossing activities with RRFB activations and vehicles exiting the parking lot. Based on the field observation, the parking lot continued to clear and was never fully occupied, while several vehicles were also seen parking on the unpaved shoulder along the east side of Island Crest Way just south of the RRFB crossing to avoid the area congestion.

As observed during the afternoon site visit on Thursday, December 2, 2021, heavy northbound traffic along Island Crest Way started to build up at around 2:55 PM, shortly after Islander Middle School's release at 2:50 PM. The northbound school bus dropped off students on the east side of Island Crest Way near the RRFB crossing on the south side of the Island Park Elementary School at around 3:05 PM, adding to the northbound congestion. The congestion was observed to dissipate by 3:25 PM.

At the Island Park Elementary School, the parent pick-up parking lot became full at 3:30 PM and overflow parking started to appear along both shoulders of Island Crest Way south of the school. The 20 mph school zone sign was activated at 3:45 PM, yet pedestrian activities had been observed prior to its activation. Similar to the morning drop-off, crossing guards assisted parents' vehicles exiting the parking lot, and it was observed that the parking lot was empty by 3:55 PM.

OPERATING SPEEDS

In addition to the traffic operations issues revealed by the peak hour traffic models and school traffic observations, the prevailing travel speed (85th percentile speed), according to several speed studies from 2013 and 2014, was found to be around 40 mph, 5 mph above the speed limit. This was consistent with the field observations.

The 20 mph school zone speed limit at Island Park Elementary School had historically been used for a relatively long period before school start time (9:15 AM) and end time (3:45 PM). School officials shared that they recently reduced the duration of the 20 mph school speed limit (e.g., starting it closer to 8:45 AM instead of an earlier time), and in doing so have - at least anecdotally - noticed better traffic flow.

RECOMMENDED NEXT STEPS

It is recommended that the City of Mercer Island address the identified traffic operation deficiencies along the study corridor, especially where the traffic operation fails the City's LOS standards. It is also important to balance other corridor needs around safety, environment, school operations, etc. when assessing the most suitable traffic operational improvement as the next step.

APPENDICES

CONTENTS

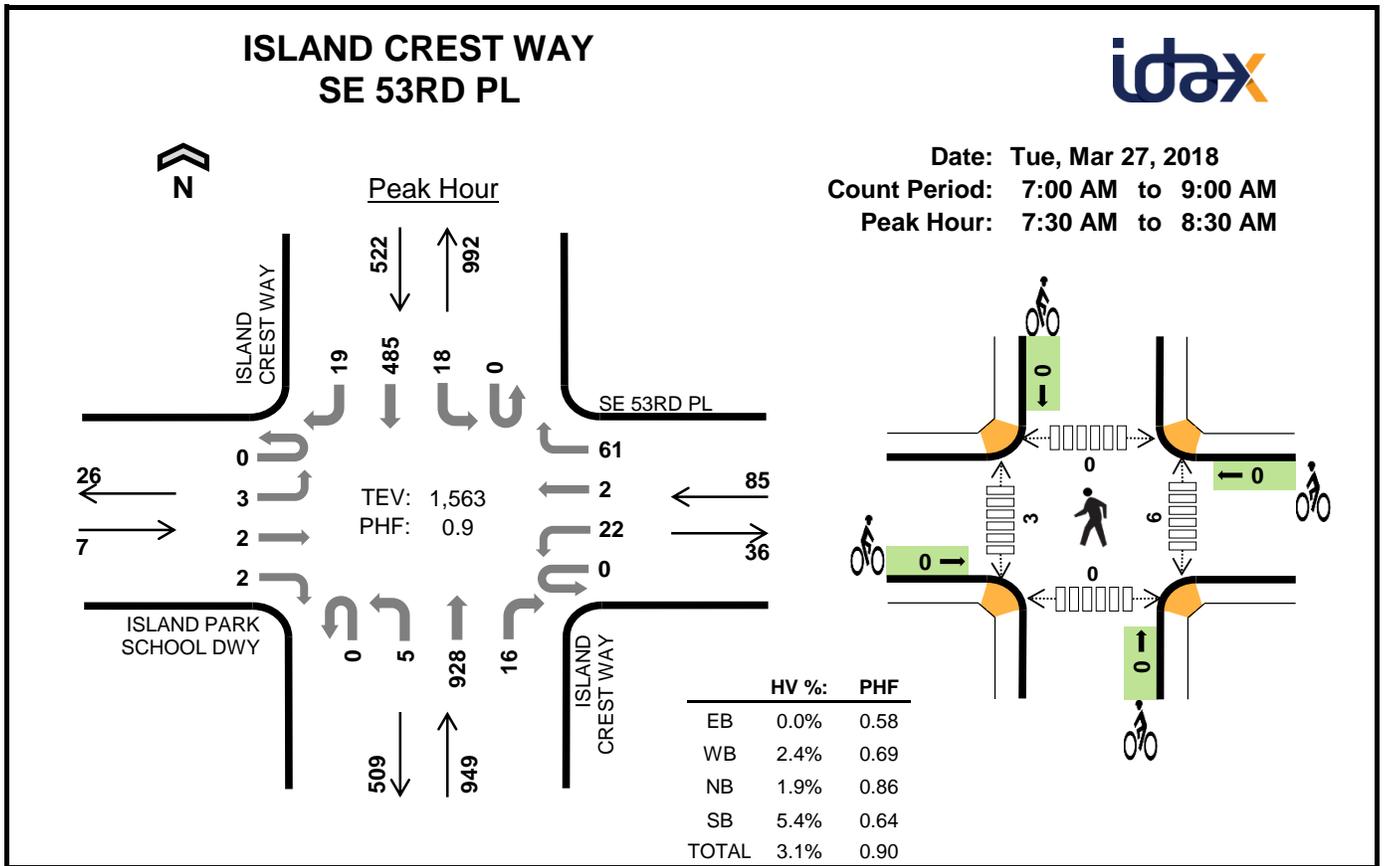
APPENDIX A: TRAFFIC VOLUME

APPENDIX B: DETAILED SYNCHRO OUTPUTS



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APPENDIX A TRAFFIC VOLUME

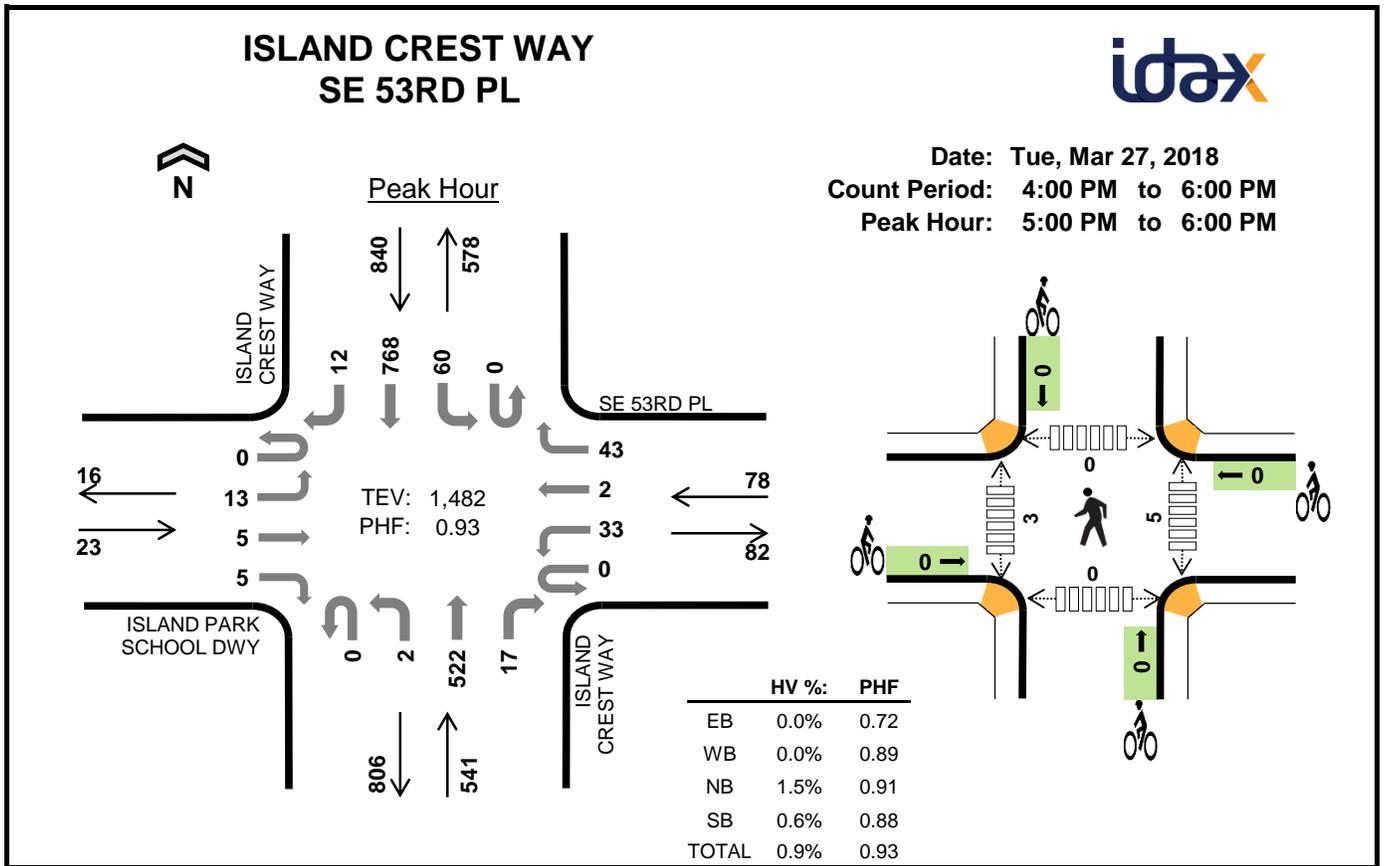


Two-Hour Count Summaries

Interval Start	ISLAND PARK SCHOOL DWY				SE 53RD PL				ISLAND CREST WAY				ISLAND CREST WAY				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	0	0	0	3	0	5	0	0	134	0	0	3	75	2	222	0
7:15 AM	0	1	0	0	0	2	1	9	0	0	172	0	0	0	88	1	274	0
7:30 AM	0	0	0	0	0	5	0	20	0	0	233	0	0	3	89	1	351	0
7:45 AM	0	0	0	1	0	2	1	28	0	2	272	2	0	4	120	4	436	1,283
8:00 AM	0	2	1	0	0	9	1	9	0	2	190	5	0	8	186	10	423	1,484
8:15 AM	0	1	1	1	0	6	0	4	0	1	233	9	0	3	90	4	353	1,563
8:30 AM	0	0	0	0	0	0	1	14	0	0	161	3	0	4	72	11	266	1,478
8:45 AM	0	2	1	0	0	4	2	9	0	2	142	5	0	5	99	7	278	1,320
Count Total	0	6	3	2	0	31	6	98	0	7	1,537	24	0	30	819	40	2,603	0
Peak Hour	0	3	2	2	0	22	2	61	0	5	928	16	0	18	485	19	1,563	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	0	0	3	6	9	0	0	0	0	0	0	0	1	0	1
7:15 AM	0	0	5	5	10	0	0	0	0	0	3	1	0	0	4
7:30 AM	0	0	3	5	8	0	0	0	0	0	1	0	0	0	1
7:45 AM	0	0	3	5	8	0	0	0	0	0	0	2	0	0	2
8:00 AM	0	2	7	13	22	0	0	0	0	0	3	1	0	0	4
8:15 AM	0	0	5	5	10	0	0	0	0	0	2	0	0	0	2
8:30 AM	0	0	5	7	12	0	0	0	0	0	1	1	0	0	2
8:45 AM	1	1	6	13	21	0	0	0	0	0	1	4	3	0	8
Count Total	1	3	37	59	100	0	0	0	0	0	11	9	4	0	24
Peak Hour	0	2	18	28	48	0	0	0	0	0	6	3	0	0	9

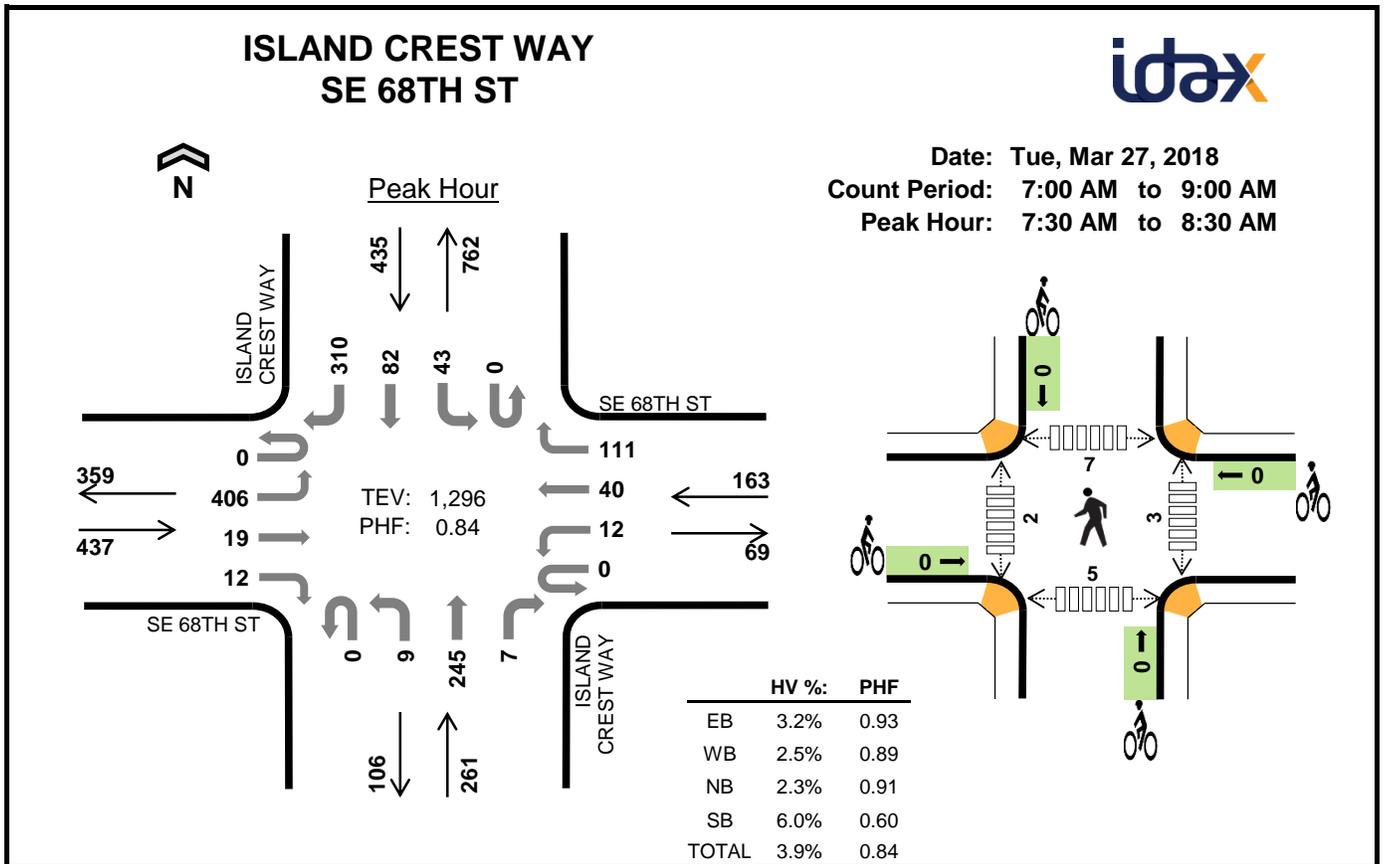


Two-Hour Count Summaries

Interval Start	ISLAND PARK SCHOOL DWY				SE 53RD PL				ISLAND CREST WAY				ISLAND CREST WAY				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	10	0	3	0	6	1	13	0	1	146	10	0	8	186	1	385	0
4:15 PM	0	7	2	0	0	9	2	13	0	0	136	6	0	11	162	4	352	0
4:30 PM	0	6	0	0	0	4	0	8	0	0	146	5	0	15	153	1	338	0
4:45 PM	0	3	0	2	0	8	0	7	0	0	135	9	0	11	198	3	376	1,451
5:00 PM	0	4	1	0	0	8	0	14	0	2	141	5	0	15	174	5	369	1,435
5:15 PM	0	3	1	4	0	7	1	8	0	0	136	2	0	13	174	3	352	1,435
5:30 PM	0	3	1	1	0	8	1	13	0	0	116	4	0	15	198	3	363	1,460
5:45 PM	0	3	2	0	0	10	0	8	0	0	129	6	0	17	222	1	398	1,482
Count Total	0	39	7	10	0	60	5	84	0	3	1,085	47	0	105	1,467	21	2,933	0
Peak Hour	0	13	5	5	0	33	2	43	0	2	522	17	0	60	768	12	1,482	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	0	1	5	2	8	0	0	0	0	0	11	2	0	0	13
4:15 PM	1	0	6	1	8	0	0	0	0	0	1	1	0	0	2
4:30 PM	0	1	4	4	9	0	0	0	0	0	3	0	0	0	3
4:45 PM	0	0	2	1	3	0	0	0	0	0	8	0	0	0	8
5:00 PM	0	0	3	2	5	0	0	0	0	0	3	2	0	0	5
5:15 PM	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1
5:30 PM	0	0	3	1	4	0	0	0	0	0	1	0	0	0	1
5:45 PM	0	0	2	1	3	0	0	0	0	0	0	1	0	0	1
Count Total	1	2	25	13	41	0	0	0	0	0	28	6	0	0	34
Peak Hour	0	0	8	5	13	0	0	0	0	0	5	3	0	0	8

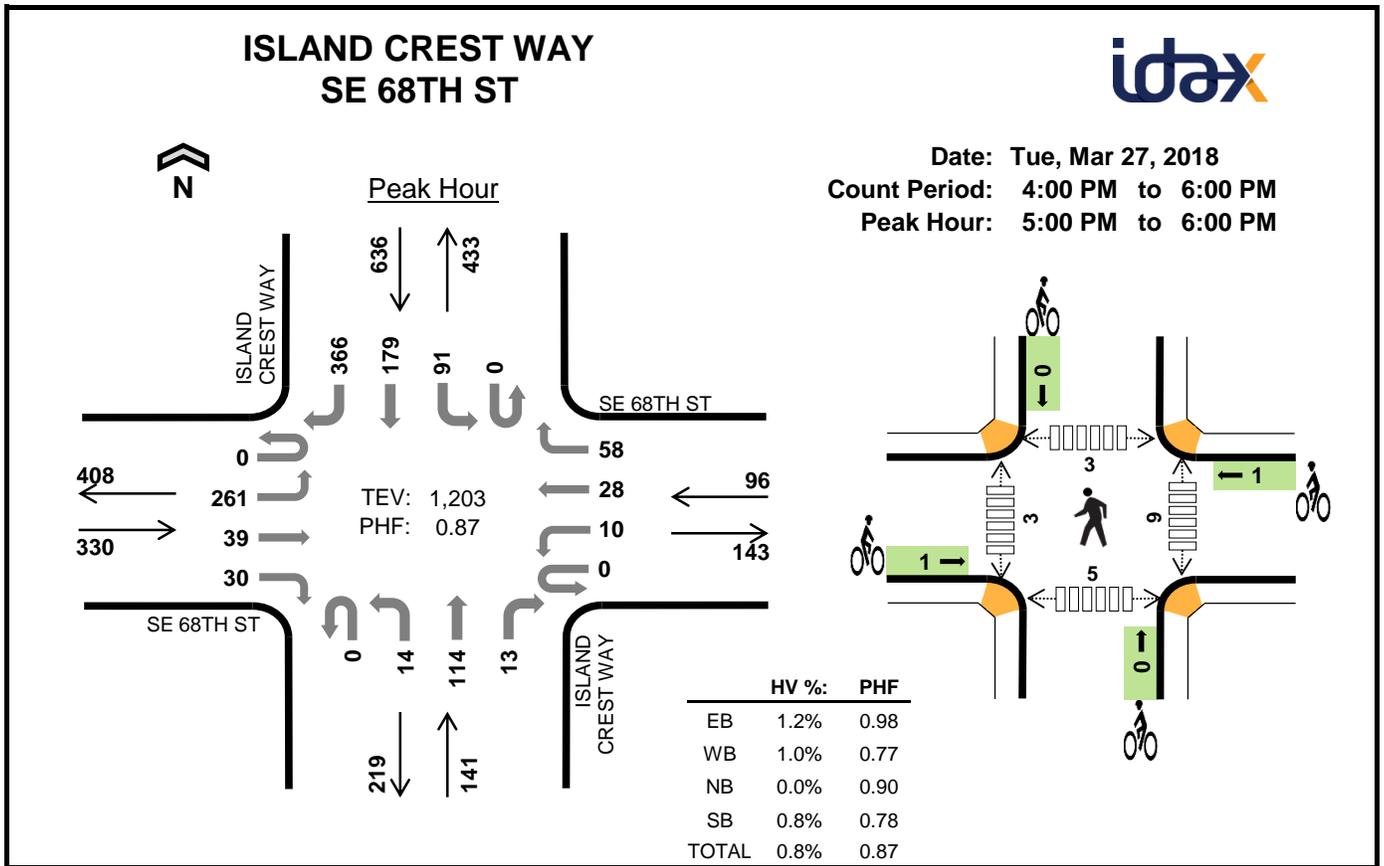


Two-Hour Count Summaries

Interval Start	SE 68TH ST Eastbound				SE 68TH ST Westbound				ISLAND CREST WAY Northbound				ISLAND CREST WAY Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	64	5	1	0	1	5	10	0	2	41	0	0	5	12	53	199	0
7:15 AM	0	73	5	0	0	0	3	22	0	0	46	2	0	9	14	54	228	0
7:30 AM	0	95	3	4	0	1	4	34	0	2	66	1	0	11	7	55	283	0
7:45 AM	0	104	4	1	0	2	4	34	0	1	70	0	0	6	18	64	308	1,018
8:00 AM	0	102	6	1	0	7	20	19	0	2	45	2	0	15	35	130	384	1,203
8:15 AM	0	105	6	6	0	2	12	24	0	4	64	4	0	11	22	61	321	1,296
8:30 AM	0	73	4	2	0	0	4	17	0	3	27	1	0	7	9	41	188	1,201
8:45 AM	0	50	6	5	0	5	7	15	0	3	32	2	0	6	17	45	193	1,086
Count Total	0	666	39	20	0	18	59	175	0	17	391	12	0	70	134	503	2,104	0
Peak Hour	0	406	19	12	0	12	40	111	0	9	245	7	0	43	82	310	1,296	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	5	0	0	8	13	0	0	0	0	0	0	0	1	0	1
7:15 AM	3	0	2	5	10	0	0	1	0	1	1	1	0	1	3
7:30 AM	2	2	0	5	9	0	0	0	0	0	0	2	3	1	6
7:45 AM	1	0	2	1	4	0	0	0	0	0	1	0	2	0	3
8:00 AM	7	2	2	18	29	0	0	0	0	0	1	0	2	3	6
8:15 AM	4	0	2	2	8	0	0	0	0	0	1	0	0	1	2
8:30 AM	5	1	1	7	14	0	0	0	0	0	0	0	1	0	1
8:45 AM	5	2	1	9	17	0	0	0	0	0	1	0	0	0	1
Count Total	32	7	10	55	104	0	0	1	0	1	5	3	9	6	23
Peak Hour	14	4	6	26	50	0	0	0	0	0	3	2	7	5	17



Two-Hour Count Summaries

Interval Start	SE 68TH ST Eastbound				SE 68TH ST Westbound				ISLAND CREST WAY Northbound				ISLAND CREST WAY Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	85	9	3	0	0	4	6	0	1	34	1	0	18	42	88	291	0
4:15 PM	0	81	12	6	0	3	10	22	0	4	27	1	0	22	26	90	304	0
4:30 PM	0	72	9	7	0	0	9	8	0	0	35	1	0	15	24	73	253	0
4:45 PM	0	69	11	6	0	8	5	20	0	5	29	0	0	22	49	100	324	1,172
5:00 PM	0	66	7	11	0	5	8	18	0	4	32	3	0	15	42	81	292	1,173
5:15 PM	0	66	11	5	0	1	5	18	0	5	31	3	0	28	31	74	278	1,147
5:30 PM	0	63	11	7	0	0	5	12	0	2	24	3	0	21	46	94	288	1,182
5:45 PM	0	66	10	7	0	4	10	10	0	3	27	4	0	27	60	117	345	1,203
Count Total	0	568	80	52	0	21	56	114	0	24	239	16	0	168	320	717	2,375	0
Peak Hour	0	261	39	30	0	10	28	58	0	14	114	13	0	91	179	366	1,203	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	4	0	0	3	7	0	0	0	0	0	3	0	0	2	5
4:15 PM	1	4	2	0	7	2	0	0	0	2	1	2	1	1	5
4:30 PM	0	0	0	4	4	0	0	0	0	0	7	1	1	7	16
4:45 PM	4	0	0	1	5	0	0	0	0	0	2	1	1	0	4
5:00 PM	1	0	0	2	3	0	0	0	0	0	2	2	1	1	6
5:15 PM	0	0	0	0	0	0	0	0	0	0	3	0	0	1	4
5:30 PM	3	0	0	1	4	1	0	0	0	1	2	0	0	2	4
5:45 PM	0	1	0	2	3	0	1	0	0	1	2	1	2	1	6
Count Total	13	5	2	13	33	3	1	0	0	4	22	7	6	15	50
Peak Hour	4	1	0	5	10	1	1	0	0	2	9	3	3	5	20

Start Time	08-Jul-13		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
12:00 AM	2	1	1	1	2	2	3	2	3	2	2	3	4	4	2	2
01:00	3	1	4	1	1	1	1	1	0	0	1	1	1	1	2	1
02:00	2	2	0	0	1	0	1	0	1	0	1	1	3	0	1	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
04:00	1	0	2	3	1	1	2	3	1	1	0	0	0	0	1	1
05:00	0	6	1	4	2	4	1	4	0	5	1	0	1	2	1	4
06:00	1	13	4	10	1	13	6	15	3	13	2	5	1	4	3	10
07:00	4	19	6	22	7	19	8	14	11	17	6	12	0	5	6	15
08:00	8	18	13	24	10	24	14	24	16	23	8	13	5	7	11	19
09:00	17	22	10	23	14	20	22	25	11	26	5	17	7	16	12	21
10:00	15	24	14	20	14	17	19	26	18	24	14	17	14	17	15	21
11:00	12	12	14	20	12	15	11	19	23	16	20	22	18	26	16	19
12:00 PM	15	20	16	19	14	15	16	22	19	33	18	21	16	15	16	21
01:00	22	22	8	19	8	13	12	18	18	26	16	13	18	17	15	18
02:00	21	20	19	14	20	14	15	15	32	24	17	16	20	17	21	17
03:00	23	26	25	13	19	22	26	23	26	29	15	11	20	24	22	21
04:00	18	12	18	18	15	13	37	17	13	15	22	21	29	15	22	16
05:00	28	13	20	17	26	15	20	13	22	15	15	6	18	17	21	14
06:00	19	15	24	16	23	18	22	13	27	14	13	14	13	14	20	15
07:00	16	12	24	10	15	8	22	14	11	10	16	9	12	10	17	10
08:00	17	11	16	8	19	9	19	10	14	2	10	14	20	8	16	9
09:00	16	16	21	8	10	9	11	13	7	9	6	4	12	11	12	10
10:00	9	1	4	8	6	5	7	3	7	4	5	4	9	8	7	5
11:00	3	4	8	3	5	2	5	3	3	2	15	4	4	2	6	3
Lane Day	272	290	272	281	245	259	300	297	286	310	228	228	246	241	265	272
Day	562		553		504		597		596		456		487		537	
AM Peak	09:00	10:00	10:00	08:00	09:00	08:00	09:00	10:00	11:00	09:00	11:00	11:00	11:00	11:00	11:00	09:00
Vol.	17	24	14	24	14	24	22	26	23	26	20	22	18	26	16	21
PM Peak	17:00	15:00	15:00	12:00	17:00	15:00	16:00	15:00	14:00	12:00	16:00	12:00	16:00	15:00	15:00	12:00
Vol.	28	26	25	19	26	22	37	23	32	33	22	21	29	24	22	21

Comb. Total	562		553		504		597		596		456		487		537	
ADT	Not Calculated															

TRAFFIC COUNT CONSULTANTS, INC.

Team@tc2inc.com

(425) 861-8866

Site Code: 03

Station ID:

MERCER ISLAND, WASHINGTON
 89TH AVE SE BETWEEN
 SE 56TH ST & CUL DE SAC (UN-NAMED)
 LOC# 03 S M10076

Latitude: -999' 0.000 South

Start Time	27-Sep-10		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
12:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
01:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	2	0	0	0	2	0	0	0	0	0	2	0	1	0
05:00	2	0	0	0	2	0	0	0	1	0	0	0	0	0	1	0
06:00	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
07:00	1	3	3	1	2	2	2	1	4	1	3	2	0	1	2	2
08:00	5	1	10	3	14	4	6	5	6	2	2	1	1	0	6	2
09:00	6	3	6	4	6	3	2	4	6	3	6	5	6	0	5	3
10:00	4	2	7	1	4	5	2	4	4	4	4	0	0	0	4	2
11:00	4	0	4	1	7	1	3	2	4	1	1	2	6	2	4	1
12:00 PM	2	4	7	2	4	3	2	1	5	2	2	1	2	4	3	2
01:00	9	2	5	5	2	1	9	4	2	7	5	3	3	3	5	4
02:00	9	11	5	2	2	1	4	2	5	6	2	3	1	5	4	4
03:00	5	6	14	8	9	8	6	6	12	6	4	5	3	4	8	6
04:00	8	2	7	6	6	5	7	5	6	7	2	4	7	4	6	5
05:00	7	3	5	8	13	3	6	7	8	2	9	7	6	3	8	5
06:00	6	3	4	2	5	8	7	7	1	5	8	5	3	1	5	4
07:00	1	0	5	5	9	6	6	4	2	5	2	1	3	3	4	3
08:00	1	2	2	0	1	1	2	0	1	2	6	3	0	2	2	1
09:00	0	2	0	1	1	2	1	3	2	0	1	1	0	0	1	1
10:00	0	1	1	0	0	2	0	1	3	3	1	1	2	0	1	1
11:00	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
Lane Day	70	45	87	49	87	55	68	56	72	56	60	44	46	34	70	46
	115		136		142		124		128		104		80		116	
AM Peak	09:00	07:00	08:00	09:00	08:00	10:00	08:00	08:00	08:00	10:00	09:00	09:00	09:00	11:00	08:00	09:00
Volume	6	3	10	4	14	5	6	5	6	4	6	5	6	2	6	3
PM Peak	13:00	14:00	15:00	15:00	17:00	15:00	13:00	17:00	15:00	13:00	17:00	17:00	16:00	14:00	15:00	15:00
Volume	9	11	14	8	13	8	9	7	12	7	9	7	7	5	8	6

Comb. Total	115	136	142	124	128	104	80	116
ADT	Not Calculated							

APPENDIX B DETAILED SYNCHRO OUTPUTS

Intersection												
Int Delay, s/veh	5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↘		↗	↘	
Traffic Vol, veh/h	3	2	2	22	2	61	5	928	16	18	485	19
Future Vol, veh/h	3	2	2	22	2	61	5	928	16	18	485	19
Conflicting Peds, #/hr	0	0	0	0	0	0	3	0	6	6	0	3
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	60	-	-	60	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	3	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	2	2	2	2	2	2	5	5	5
Mvmt Flow	3	2	2	24	2	68	6	1031	18	20	539	21

Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	1680	1660	553	1650	1661	1046	563	0	0	1055	0	0
Stage 1	593	593	-	1058	1058	-	-	-	-	-	-	-
Stage 2	1087	1067	-	592	603	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.72	7.12	6.52	4.12	-	-	4.15	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.72	6.12	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.72	6.12	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.518	4.018	3.318	2.218	-	-	2.245	-	-
Pot Cap-1 Maneuver	76	98	537	60	74	254	1008	-	-	649	-	-
Stage 1	496	497	-	228	253	-	-	-	-	-	-	-
Stage 2	264	301	-	446	442	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	53	94	536	57	71	253	1005	-	-	646	-	-
Mov Cap-2 Maneuver	53	94	-	57	71	-	-	-	-	-	-	-
Stage 1	492	481	-	225	250	-	-	-	-	-	-	-
Stage 2	190	298	-	428	427	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	51	84.5	0	0.4
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1005	-	-	86	130	646	-
HCM Lane V/C Ratio	0.006	-	-	0.09	0.726	0.031	-
HCM Control Delay (s)	8.6	-	-	51	84.5	10.8	-
HCM Lane LOS	A	-	-	F	F	B	-
HCM 95th %tile Q(veh)	0	-	-	0.3	4.1	0.1	-

Intersection												
Int Delay, s/veh	1.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↕			↕		↕	↕	↕
Traffic Vol, veh/h	0	0	0	13	0	25	0	924	11	7	493	9
Future Vol, veh/h	0	0	0	13	0	25	0	924	11	7	493	9
Conflicting Peds, #/hr	0	0	0	0	0	0	3	0	6	6	0	3
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	30	-	100
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	5	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	0	0	14	0	28	0	1027	12	8	548	10

Major/Minor	Minor1		Major1			Major2			
Conflicting Flow All	1603	1606	1039	-	0	0	1045	0	0
Stage 1	1039	1039	-	-	-	-	-	-	-
Stage 2	564	567	-	-	-	-	-	-	-
Critical Hdwy	7.43	7.53	6.73	-	-	-	4.13	-	-
Critical Hdwy Stg 1	6.43	6.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.43	6.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	-	-	-	2.227	-	-
Pot Cap-1 Maneuver	74	67	241	0	-	-	662	-	-
Stage 1	254	230	-	0	-	-	-	-	-
Stage 2	485	432	-	0	-	-	-	-	-
Platoon blocked, %									
Mov Cap-1 Maneuver	73	0	240	-	-	-	659	-	-
Mov Cap-2 Maneuver	73	0	-	-	-	-	-	-	-
Stage 1	253	0	-	-	-	-	-	-	-
Stage 2	479	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	43.4	0	0.1
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT	SBR
Capacity (veh/h)	-	-	135	659	-
HCM Lane V/C Ratio	-	-	0.313	0.012	-
HCM Control Delay (s)	-	-	43.4	10.5	-
HCM Lane LOS	-	-	E	B	-
HCM 95th %tile Q(veh)	-	-	1.2	0	-

Intersection	
Intersection Delay, s/veh	48.2
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	↕
Traffic Vol, veh/h	406	19	12	12	40	111	9	245	7	43	82	310
Future Vol, veh/h	406	19	12	12	40	111	9	245	7	43	82	310
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Heavy Vehicles, %	3	3	3	3	3	3	2	2	2	6	6	6
Mvmt Flow	483	23	14	14	48	132	11	292	8	51	98	369
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	1	1
HCM Control Delay	94.1	17.5	27.4	26.2
HCM LOS	F	C	D	D

Lane	NBLn1	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	3%	93%	7%	34%	0%
Vol Thru, %	94%	4%	25%	66%	0%
Vol Right, %	3%	3%	68%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	261	437	163	125	310
LT Vol	9	406	12	43	0
Through Vol	245	19	40	82	0
RT Vol	7	12	111	0	310
Lane Flow Rate	311	520	194	149	369
Geometry Grp	5	2	2	7	7
Degree of Util (X)	0.682	1.087	0.43	0.34	0.754
Departure Headway (Hd)	8.333	7.521	8.354	8.631	7.727
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	438	484	435	420	472
Service Time	6.333	5.586	6.354	6.331	5.427
HCM Lane V/C Ratio	0.71	1.074	0.446	0.355	0.782
HCM Control Delay	27.4	94.1	17.5	15.7	30.5
HCM Lane LOS	D	F	C	C	D
HCM 95th-tile Q	5	16.7	2.1	1.5	6.4

Intersection												
Int Delay, s/veh	5.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	13	5	5	33	2	43	2	522	17	60	768	12
Future Vol, veh/h	13	5	5	33	2	43	2	522	17	60	768	12
Conflicting Peds, #/hr	0	0	0	0	0	0	3	0	5	5	0	3
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	60	-	-	60	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	3	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	0	0	0	2	2	2	1	1	1
Mvmt Flow	14	5	5	35	2	46	2	561	18	65	826	13

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1564	1554	836	1547	1551	575	842	0	0	584	0	0
Stage 1	966	966	-	579	579	-	-	-	-	-	-	-
Stage 2	598	588	-	968	972	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.7	7.1	6.5	4.12	-	-	4.11	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.7	6.1	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.7	6.1	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.218	-	-	2.209	-	-
Pot Cap-1 Maneuver	92	114	370	73	89	497	794	-	-	996	-	-
Stage 1	309	336	-	458	458	-	-	-	-	-	-	-
Stage 2	492	499	-	262	284	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	77	106	369	65	82	495	792	-	-	992	-	-
Mov Cap-2 Maneuver	77	106	-	65	82	-	-	-	-	-	-	-
Stage 1	307	313	-	455	455	-	-	-	-	-	-	-
Stage 2	443	496	-	237	265	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	52.4		77.6		0		0.6	
HCM LOS	F		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	792	-	-	100	126	992	-
HCM Lane V/C Ratio	0.003	-	-	0.247	0.666	0.065	-
HCM Control Delay (s)	9.6	-	-	52.4	77.6	8.9	-
HCM Lane LOS	A	-	-	F	F	A	-
HCM 95th %tile Q(veh)	0	-	-	0.9	3.6	0.2	-

HCM 6th TWSC
 11: Island Crest Way & SE 54th St

12/06/2021

Intersection												
Int Delay, s/veh	0.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↕			↕		↕	↕	↕
Traffic Vol, veh/h	0	0	0	17	0	11	0	530	10	19	786	1
Future Vol, veh/h	0	0	0	17	0	11	0	530	10	19	786	1
Conflicting Peds, #/hr	0	0	0	0	0	0	3	0	5	5	0	3
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	Yield
Storage Length	-	-	-	-	-	-	-	-	-	30	-	100
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	5	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	1	1	1	1	1	1	1	1	1	1	1	1
Mvmt Flow	0	0	0	18	0	12	0	570	11	20	845	1

Major/Minor	Minor1		Major1			Major2			
Conflicting Flow All	1466	1469	581	-	0	0	586	0	0
Stage 1	581	581	-	-	-	-	-	-	-
Stage 2	885	888	-	-	-	-	-	-	-
Critical Hdwy	7.41	7.51	6.71	-	-	-	4.11	-	-
Critical Hdwy Stg 1	6.41	6.51	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.41	6.51	-	-	-	-	-	-	-
Follow-up Hdwy	3.509	4.009	3.309	-	-	-	2.209	-	-
Pot Cap-1 Maneuver	94	85	475	0	-	-	994	-	-
Stage 1	478	427	-	0	-	-	-	-	-
Stage 2	317	284	-	0	-	-	-	-	-
Platoon blocked, %									
Mov Cap-1 Maneuver	92	0	473	-	-	-	990	-	-
Mov Cap-2 Maneuver	92	0	-	-	-	-	-	-	-
Stage 1	476	0	-	-	-	-	-	-	-
Stage 2	311	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	39.2	0	0.2
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT	SBR
Capacity (veh/h)	-	-	135	990	-
HCM Lane V/C Ratio	-	-	0.223	0.021	-
HCM Control Delay (s)	-	-	39.2	8.7	-
HCM Lane LOS	-	-	E	A	-
HCM 95th %tile Q(veh)	-	-	0.8	0.1	-

Intersection	
Intersection Delay, s/veh	18.1
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	↕
Traffic Vol, veh/h	261	39	30	10	28	58	14	114	13	91	179	366
Future Vol, veh/h	261	39	30	10	28	58	14	114	13	91	179	366
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles, %	1	1	1	1	1	1	0	0	0	1	1	1
Mvmt Flow	300	45	34	11	32	67	16	131	15	105	206	421
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	1	1
HCM Control Delay	21.4	11.4	12.6	18.7
HCM LOS	C	B	B	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	10%	79%	10%	34%	0%
Vol Thru, %	81%	12%	29%	66%	0%
Vol Right, %	9%	9%	60%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	141	330	96	270	366
LT Vol	14	261	10	91	0
Through Vol	114	39	28	179	0
RT Vol	13	30	58	0	366
Lane Flow Rate	162	379	110	310	421
Geometry Grp	5	2	2	7	7
Degree of Util (X)	0.303	0.668	0.205	0.567	0.666
Departure Headway (Hd)	6.737	6.337	6.702	6.582	5.698
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	536	565	537	543	627
Service Time	4.744	4.427	4.713	4.379	3.494
HCM Lane V/C Ratio	0.302	0.671	0.205	0.571	0.671
HCM Control Delay	12.6	21.4	11.4	17.8	19.3
HCM Lane LOS	B	C	B	C	C
HCM 95th-tile Q	1.3	5	0.8	3.5	5