Fairbanks North Star Borough
High School & Circulation Plan

Federal Project No. NFHWY00844/0002(536)

Needs Analysis Report

DRAFT March 2025

West Valley (WVHS) and Hutchison (HHS) High Schools, Fairbanks, AK

Prepared For:
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Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ARRC	Alaska Railroad Corporation
ATMS	Alaska Traffic Manual Supplement (to the MUTCD)
CMAQ	Congestion Mitigation and Air Quality
CRP	Carbon Reduction Program
CTC	Career and Technical College (within HHS)
DEED	Alaska Department of Education and Early Development
DOT&PF	Alaska Department of Transportation and Public Facilities
FAST Planning	Fairbanks Area Surface Transportation (FAST) Planning, an MPO organization
FHWA	Federal Highway Association
FNSB	Fairbanks North Star Borough
HHS	Hutchison High School
ITE	Institute of Transportation Engineers
KE	Kinney Engineering
LED	Light emitting diode
LOS	Level of Service
MACS	Metropolitan Area Commuter System
MPO	Metropolitan Planning Organization
MUTCD	Manual on Uniform Traffic Control Devices
PGDHS	A Policy on Geometric Design of Highways and Streets
PHB (*HAWK*)	Pedestrian Hybrid Beacon (Older terminology referred to this as a “high intensity activated crosswalk” or HAWK)
PHF	Peak Hour Factor
SPED	Special Education Department (and designated busing)
TIP	Transportation Improvement Program (by FAST Planning)
TVCC	Tanana Valley Community College
UAF	University of Alaska Fairbanks
U-Park	University Park Building (now UAF)
v/c	Volume to capacity ratio
vph	Vehicles per hour
vphpl	Vehicles per hour per lane
WVHS	West Valley High School

Definition of Terms

Capacity: The maximum sustainable hourly flow rate under prevailing roadway, environmental, traffic, and control conditions. This is usually expressed in vehicles per hour (vph) or vehicles per hour per lane (vphpl). Capacity is identified at a threshold Level of Service transitioning into the worst flow conditions where the movement of traffic begins to break down into unsteady flow or even fall into "stop and go" conditions.

FAST Planning: Fairbanks Area Surface Transportation (FAST) Planning is the Metropolitan Planning Organization (MPO) for the urbanized areas of the Fairbanks North Star Borough (FNSB), including the cities of North Pole and Fairbanks.

Level of Service (LOS): LOS is a relative grading scale used to rank the operational performance of a facility for summary presentation to users and operating agencies. More detailed system performance measures are computed for various types of facilities; however, these measurements are typically bracketed and simplified into a scale of A (best conditions for individual users) to F (worst conditions). Choosing LOS A can result in excess capacity and high cost, high impact improvements. The transition from LOS E to LOS F is often called "capacity" or "overcapacity". Under these conditions, the cost of not making improvements can mean significant congestion and safety costs even without projects. Often, choosing LOS C or D in the most congested hours of the day will achieve optimal performance benefits within reasonably accepted construction and maintenance costs.

Peak Hour Factor (PHF): The PHF is a measure of traffic variability over a one-hour period calculated by dividing the total hourly flowrate by four times the peak 15-minute flowrate. PHF values can vary from 0.25 (all traffic for the hour arrives in the same 15-minute period) to 1.00 (traffic is spread evenly throughout the hour). High schools typically experience a high surge of traffic within a 15-minute period, resulting in PHF values in the 0.5 to 0.7 range.

Volume to Capacity Ratio (v/c): The v/c ratio is a measure of how much of the available capacity of a facility is being used, calculated by dividing the demand volume by the capacity of a facility. Capacity is determined by the number of lanes available for vehicles and the amount of "green" time available for moving forward. Signals and STOP signs introduce stopped time or "red" time which reduces capacity of an approach. Higher opposing traffic conflicts reduce availability of gaps for side street traffic, thus also reduces capacity of an approach. Values of v/c of 0.85 or less are an ideal design objective to better ensure additional capacity is available to serve traffic variations and incidents over time. Values of v/c higher than 0.85 can lead to unstable flow, no reserve capacity, and possible "stop and go" conditions.

Executive Summary

The Alaska Department of Transportation and Public Facilities (DOT&PF), in partnership with Fairbanks Area Surface Transportation (FAST) Planning, initiated this circulation study. The study purpose is to mitigate congestion and improve safety for the combined West Valley High School (WVHS) and Hutchison High School (HHS) campuses. This study is funded by FAST Planning's Carbon Reduction Program (CRP).

The goal is to improve safety and operations for all modes of transportation. These modes include buses, pick-up/drop-off traffic, student drivers, pedestrians, and bicyclists. Each of these user groups have specific travel routes and destination goals onsite. Strategies are also tested for the possibility to improve carbon reduction emissions, primarily measured as CO_2.

Initial site date facts were collected in the spring of 2024 through traffic counts and field observations. Pick-up and drop-off areas were seen to generate the highest conflict between travel modes and user groups. Based on concerns identified in this first stage, a Fall Demonstration Project was carried out in October of 2024. Temporary traffic control solutions tested changes constrained within the existing network. Changes included expanding west side passenger loading at WVHS, relocating bus loading to the back of the WVHS, expanding passenger loading storage at HHS, and relocating HHS parking lot departures to the back of HHS instead of to Geist Road. This information informed how much traffic rebalancing and relocation will and won't work successfully. This shaped the traffic proportions used to model new options presented in this report.

This Needs Analysis Report presents the best options to target congestion and safety risks on the high school's campus. Measurable congestion and safety factors are used to compare a menu of new project options to existing conditions. Queueing, delay, volume-to-capacity ratio, crash risk, pedestrian and bicyclist routing, and air quality are all tested for improvement.

Each options targets improving a specific area of campus to measure the potential benefits of that option. No single option solves the whole campus, but a combination of options could provide an areawide solution. In this way, this report is a menu of options. Features from one option could be combined with other options unless otherwise noted in the report. Performance measures can help identify a mix of options which may be desirable to agency stakeholders.

RESULTS REVEALED EARLY: Options conclusions are labeled early from the start of this report to expedite review. The outcomes of analysis in the end of the report are brought forward. School options findings have been labeled with one of three labels:

FINDINGS	
RECOMMENDED	Best options to improve onsite queues and delays, overall network congestion, or safety when compared to existing conditions. Key intersection bottlenecks of concern have v/c ratios improved by lowering below 0.8 or 80 percent.
CONSIDER	Adequate options which help to improve some congestion or safety concerns, but do not fully address targeted concerns. Some features of these options could be selected or modified as part of the recommended solution, but these are not the best options overall. Most key intersection bottlenecks have v/c ratios which have been lowered below 0.8 or 80 percent.
NOT RECOMMENDED	Poor options with low or worsening performance measured by queues, delays, or overall network congestion. Intersection bottleneck concerns remain unresolved and unstable with v/c ratios exceeding 0.8 or greater than 80 percent.

This report examines options for further advancement by transportation managers as listed on the next page:

OPTIONS MENU

Rehabilitation Options

3.1.1	**Turn lanes (extended and new turn lanes) (WVHS and HHS)**	**CONSIDER**
3.1.2	**Weaving lane (plus turn lanes) (WVHS and HHS)**	**CONSIDER**
3.1.3	Southbound right turn lane (from University Avenue) (HHS)	NOT RECOMMENDED
3.1.4	**Sandvik Signal at University Avenue (WVHS and HHS)**	**CONSIDER**

Reconstruction Options

3.2.1	**West Loop Dropoff/Pickup Conversion (WVHS)**	**RECOMMENDED**
3.2.2.	**Signal 2-Way Frontage (HHS)**	**CONSIDER**
3.2.3	Signal 1-way, Small Loop (HHS)	NOT RECOMMENDED
3.2.4	Signal, 1-way, Small Loop plus 2-way Parking (HHS)	NOT RECOMMENDED
3.2.5	Midblock STOP, Small Loop, No Signal (HHS)	NOT RECOMMENDED
3.2.6	**Signal, 1-way, Big Loop (HHS)**	**RECOMMENDED**
3.2.7	**Signal, 2-way, Big Loop (HHS)**	**RECOMMENDED**
3.2.8	Signal Shared - to both High Schools (WVHS and HHS)	NOT RECOMMENDED

Safety and Operations Options

3.3.1	a) Pedestrian Hybrid Beacon (WVHS & HHS)	CONSIDER
3.3.2	b) Fairbanks Street Curve Realignment and Sight Distance	CONSIDER
3.3.3	c) Pedestrian Visibility Lighting Replacement	RECOMMENDED
3.3.4	d) Pedestrian Crossing Retroreflective Signing	RECOMMENDED
3.3.5	e) Sidewalk Barrier Curb	CONSIDER
3.3.6	f) Signal Timing Adjustments	RECOMMENDED
3.3.7	g) No Left Turns from HHS Prohibition	RECOMMENDED
3.3.8	h) Commercial Access Consolidation	RECOMMENDED
3.3.9	i) Increased Bus Service	CONSIDER
3.3.10	j) Arctic Entry (HHS)	CONSIDER
3.3.10	k) Increased Plowing	CONSIDER

Options Considered but not Analyzed

3.4.1	a) Split-phased signal operations	NOT RECOMMENDED
3.4.2	b) HHS Back Lot Exit	NOT RECOMMENDED
3.4.3	c) HHS West Perimeter Road	NOT RECOMMENDED
3.4.4	U-Park Daycare Background Development	CONSIDER
3.4.5	Vary School Start/Stop Times	CONSIDER
3.4.6	WVHS Roundabout at Gradelle & Sandvik	NOT RECOMMENDED
3.4.7	Multilane Roundabout at University & Sandvik	NOT RECOMMENDED
3.4.8	Pedestrian Bridge replacement	NOT RECOMMENDED

1 Existing Conditions Reporting

1.1 Existing Conditions Input and Observation

The Existing Conditions Report was completed February 11, 2025. The report contains:

- past planning and projects
- stakeholder agency and public input
- school site facts, travel modes, and user groups served
- traffic counts and circulation routes
- traffic control devices and access to the campus
- pedestrian routes
- crash history and younger driver involvement
- maintenance and operations considerations
- existing levels of congestion

The key concerns identified in the Existing Conditions Report include:

- Safety of pedestrians crossing Geist Road without a pedestrian bridge
- Delay and queueing for motorists turning onto University Avenue from Sandvik Street
- Delay and queuing at pedestrian loading zones at both schools
- Vehicles queuing into Geist Road through lanes from Hutchison High School driveways

Key observations include:

- 2/3 of traffic demand during both peak periods is to and from the east.
- Buses arrive and depart in a short window of time, concentrating bus congestion
- Transit route options do not closely match school start and stop times
- Geist Road crash rates in front of the campus are higher than similar arterial locations
- Access point density along Geist Road is higher than recommended by design criteria
- Teen drivers are not involved in crashes at a higher rate than other drivers
- U-Park daycare development will further overwhelm Sandvik Street at peak times

Maps of existing concerns, traffic counts, pedestrian route reviews and benchmark congestion and safety findings are contained in the Existing Conditions Report. Updated benchmark performance measures and results for permanent options are documented in Chapter 4 of this report, Analysis of Options.

Figure 1. WVHS East Loop 2 Lane Pick-up Queues to Sandvik St

(Credit: FAST Planning)

Figure 2. WVHS PM dismissal queue at Fairbanks Street

1.2 Existing Conditions Analysis Methods

Performance measures for existing conditions were calculated as a benchmark for comparison to new improvement options. Detailed performance outputs for intersections and individual turning movements are attached in the Appendices.

Both Synchro and SimTraffic were used to determine network performance of existing conditions. The Highway Capacity Manual (Chapter 20) suggests traffic simulation as an

alternative tool for approximating two-way stop control intersection performance within an arterial network of signals. Given the complex mix of short links and frequent traffic stops controlling the FNSB campus, network performance was determined primarily through SimTraffic simulation. This tool better reflected queue and delay spillback internal to the campus along short links into upstream intersections. At the arterial approaches, Synchro better reported the poor performance of school access for turning movements entering arterials. Synchro uses HCM analysis methods instead of simulation. Synchro correlated well to observed congestion entering and exiting at arterials. In this report's performance maps, poor congestion at arterials is shown when the level-of-service drops to LOS D/E/F for each option considered.

Appendix D outlines the analysis steps used to study options performance in more detail.

1.3 Existing Conditions Performance Benchmarks

Existing conditions traffic counts were modeled to benchmark the campus network and adjacent arterial intersections. The model was calibrated to simulate observed congestion at pedestrian loading and unloading areas and pedestrian crossing areas on campus. This method was documented in the Existing Conditions Report.

The two peak 15-minute periods of highest school congestion modeled were:

- AM Arrival Peak (7:15-7:30 AM)
- PM Dismissal Peak (2:00-2:15 PM)

Existing conditions models have been calibrated further in this report in order to better reflect school bus staging at WVHS. Imposing an artificial "traffic signal" simulates how AM bus arrivals cycle through as they arrive in a small but steady stream, with time for unloading students under a "red light". Buses then depart steadily to the Fairbanks and Geist traffic signal to make a left turn. PM dismissal bus staging via a similar "red light" is used to hold buses onsite for up to 10 minutes in order to fill the staging lanes. Then buses are discharged to reflect the singular large surge into the southbound left turn lane of the Fairbanks and Geist signal.

Modeling results show how maximum queues and delays begin at each school's main entrance and spill back into the network. Main entrances are where pedestrian and vehicle conflicts are highest and require slow movement and frequent stops for all users.

Table 1 shows updated benchmark performance results for existing conditions. Network total measures include network delay, average delay per vehicle, vehicle miles of travel, and carbon emissions. Intersection and turning movements are tested for volume-to-capacity ratio, queueing, and individual delays. The longest lines of traffic queue and delay at each of the school's main entrances are listed.

Pedestrian delay is not a benchmark problem at the school entrance and parking lot crossings, because pedestrians have priority. Motorists typically yield at very low speeds. Pedestrians are not delayed when crossing with due care.

Pedestrian delay at Geist Road was reviewed in the Existing Conditions Report and found to be a top concern. Pedestrian service across Geist Road is addressed in this report by examining the level of service provided by midblock signal options or a pedestrian hybrid beacon (PHB).

PERFORMANCE: Table 1 shows benchmark performance results for the existing conditions. Figure 3 maps the level-of-service (LOS) and queues of concern for existing conditions. Both represent the AM arrival and PM dismissal peak 15-minute periods.

Top concerns include:

- WVHS long traffic queues into Sandvik Street
- WVHS long traffic delays at the main entrance
- HHS long traffic queues into the site and onto Geist Road
- HHS long traffic delays at the main entrance
- Unstable v/c ratios at the main entrance of both schools
- Unstable v/c ratio at the Fairbanks Street southbound left turns
- Unstable v/c ratio at the Sandvik Street stop approach to University Avenue
- Multiple locations of LOS F for turning movements in the AM and PM periods
- Pedestrian routing and safety is unimproved
- Pedestrian crossing of Geist Road unimproved

Table 1. Performance Measure Benchmarks for Existing Conditions

Existing Conditions

Performance Measure	AM	PM
Average network delay per vehicle (sec)	68.2 s	64.0 s
Network vehicle miles of travel (VMT)	709 mi	775 mi
Total network traffic delay (hours)	24.3 hr	28.5 hr
Network Carbon emitted (grams CO2)	20656 g	23942 g
WVHS peak queue (vehicles) / (feet)	28 veh <= 700 ft	24 veh <= 600 ft
WVHS Dropoff/Pickup delay per vehicle (sec)	200 s	180 s
Queue: WVHS risk of vehicles backing out onto Sandvik Street or Geist Rod?	Yes	Yes
HHS peak queue (vehicles)	20 veh <=500 ft	18 veh <=450 ft
HHS Dropoff/Pickup delay per vehicle (sec)	70 s	205 s
Queue: HHS risk of vehicles backing out onto Geist Road? Intersection or Turning Movement Level-of-Service (LOS) for school movements (shown on performance maps)	Yes LOS D/E/F	Yes LOS D/E/F
Is the volume-to-capacity (v/c) ratio becoming unstable at >= 0.8 for school related turns at intersections?	Yes WVHS main entrance SB LTs at Fairbanks & Geist	Yes WVHS main entrance SB LTs at Fairbanks & Geist EB Sandvik & University HHS SB at Geist Rd
Is pedestrian route safety and operations improved?	No	No
Is pedestrian crossing of Geist Road improved?	No	No

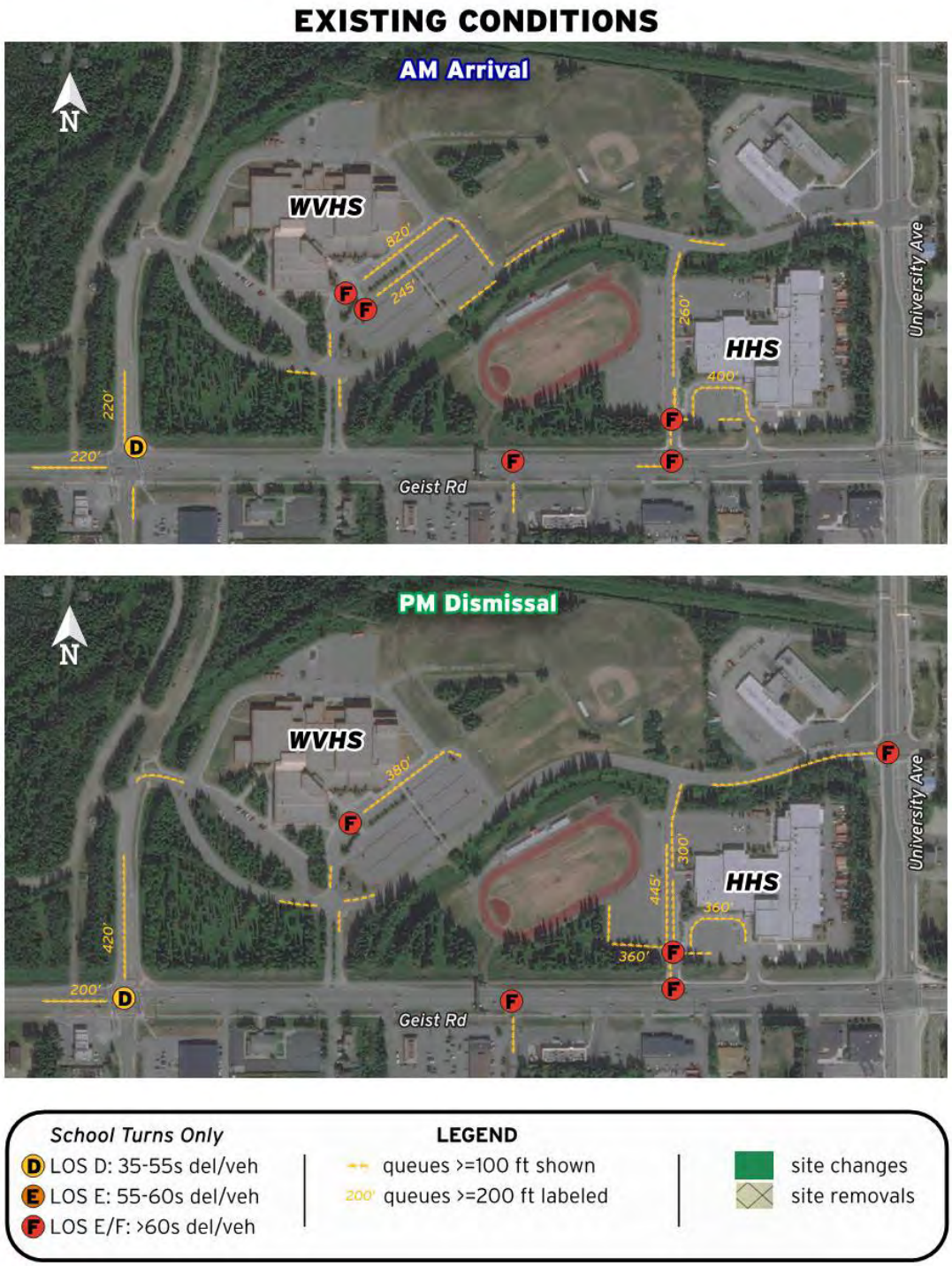


Figure 3. Existing Conditions Performance Map

2 Fall Demonstration Project – Lessons Learned

The potential to make significant long-term improvements was first tested using work zone traffic control devices and flaggers for one week, October 14 to 18, 2024. The first snowfall occurred during this week. Draft Fall Demonstration Project results were submitted to DOT&PF on January 29, 2025.

The goal was to indicate whether major traffic routing changes are feasible and how effective changes could be, even when constrained within the existing site layout. The demonstration changes included:

1. Shifting WVHS bus loading to the back of school, doubling the student drop-off/pick-up zones available in front of the school by adding a west loop.
2. Dedicating the front of HHS to drop-off and pick-up and using senior parking for queueing vehicles onsite.
3. Closing HHS parking lot dismissal access out to Geist Road and routing parking lot departure traffic to Sandvik Street and University Avenue. Pick-up and drop-off routing was given increased u-turn storage onsite but was not closed.

Implementation cost was about $25,000, or less than one-half a percent of the likely cost of a design and capital project upgrade for campus roads of this size.

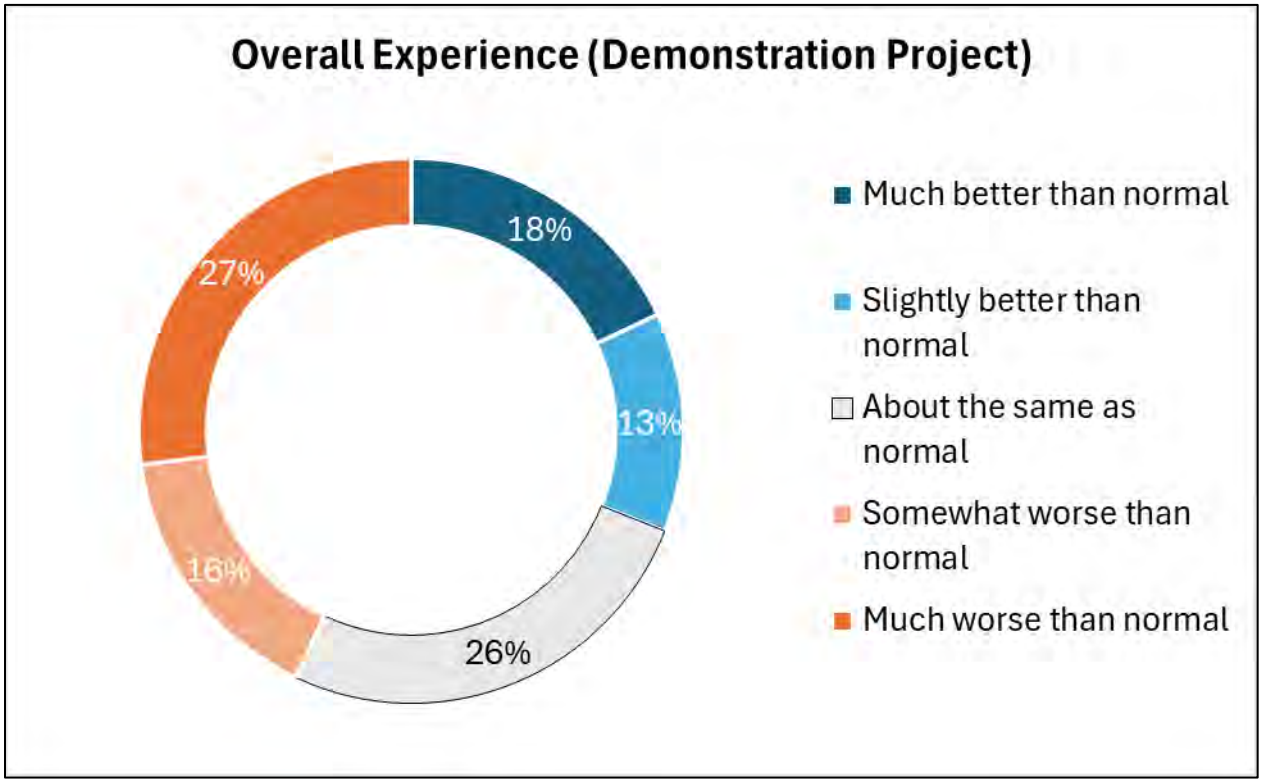
Public outreach through school administrators, call lists, and notices posted on the project website were issued ahead of the event.

The project team conducted a public survey from October 14, 2024 to November 30, 2024 to collect feedback about the demonstration project. The survey was available on the project website and a link to the survey was sent to stakeholder groups for West Valley High School and Hutchison High Schools which included students, school faculty and staff, parents of students, bus drivers, and facility maintenance staff for both high schools. 196 people responded to the survey, over half of whom (55%) were a parent or guardian that dropped students off at either West Valley High School or Hutchison High School, roughly 25% were students, 17% were school faculty or staff, and one survey respondent was a bus driver.

57% of respondents said that their overall experience during the project was either somewhat better, much better, or mostly the same. Figure 4 shows the overall user experience of the fall demonstration project as reported by survey respondents.Figure 4 shows the overall user experience reported during the fall demonstration project.

Survey responses are consistent with observations made by staff at different locations onsite. Improvements and problems reflect locations where each user group and trip purpose was affected. Adding winter storm conditions and darkness, new changes were difficult for users to

adjust to in a short period. Counts show many users fell back to previous passenger loading patterns in the afternoons and later in the week.



SOURCE: Question 15, Public Survey, Fall Demonstration Project

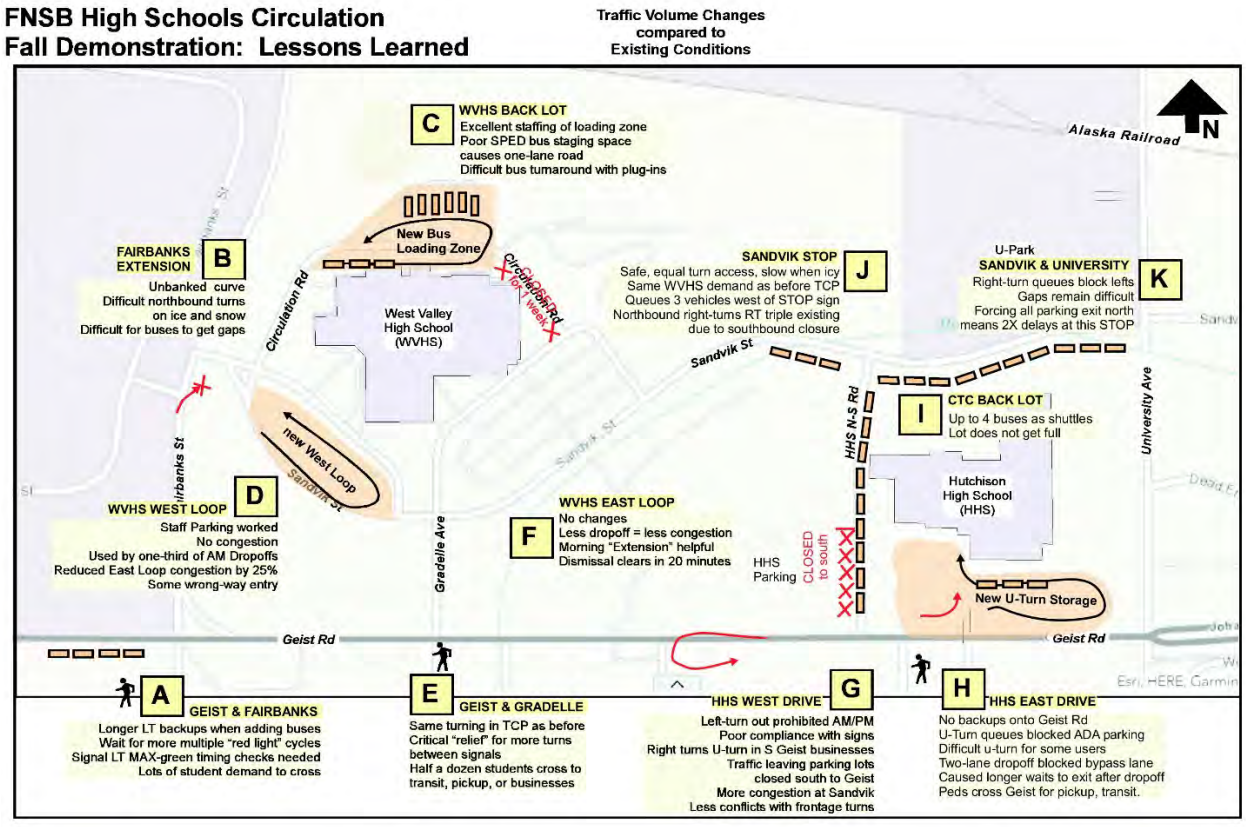
Figure 4. Survey Response to Overall Experience during Demonstration Project

Lessons learned are listed below and illustrated in Figure 5:

- Moving campus traffic internally helps one area but moves problems to other areas.
  - The WVHS west loop temporary curbside loading zone was effective at reducing congestion at the east loop curbside loading zone by 25 to 30 percent of demand.
  - Restricting HHS parking lot access so that students couldn't directly access Geist Road improved drop-off, pick-up mobility but worsened congestion on the Sandvik Street route to University Avenue.
- Most school congestion occurs to the east where all access is STOP controlled. (The only traffic signal is west of campus).
- Increased onsite storage at HHS prevented queue spillover to Geist Road.
- HHS is located on a signalized corner but has no nearby access to a signal.
- Peak school traffic is high enough to look beyond internal changes and consider external changes, including new access to dilute and decrease congestion, and new travel times or travel modes for users.

- Bus staging at the back of WVHS is feasible. Significant staging area and entrance changes would be needed to accommodate the high volume of students using the buses.

Full documentation of the temporary traffic control plan testing process, costs, methods and public input are contained in the Fall Demonstration Project Summary report submitted to DOTPF January 29, 2025. Incorporating lessons learned from these field findings while removing onsite constraints allows this Needs Analysis Report to consider more extensive options to improve congestion bottlenecks.



SOURCE: Fall Demonstration Project Summary Report, January 2025

Figure 5. Fall Demonstration Project Lessons Learned

Figure 6. PM Dismissal Northbound curbside pickup at HHS (looking south) during Fall Demonstration Project

Figure 7. PM Dismissal Northbound pick-up at HHS (looking north) during Fall Demonstration Project

3 Future Options for Congestion and Safety Mitigation

Future options for campus access and circulation improvements were developed along three categories:

- Rehabilitation – maximizing use of the existing campus layout with low-cost improvements.
- Reconstruction – make major changes to the campus layout for best results at a higher cost of improvements.
- Safety and Operations – further upgrades to optimize multimodal safety. These can be independent or part of rehabilitation or reconstruction choices.

Based on spring and fall 2024 data collection and field observations of various user groups, options were developed to reduce conflict between user groups. Reducing overlapping routes and conflicting turns improves safety and congestion. This can be done by diluting the concentration of users through creating more access and circulation options around the campus.

3.1 Rehabilitation Options

"Rehabilitation Options" are meant to be low cost or cost-effective improvements which extend the service life of the existing campus layout and improve safety using the existing network.

Rehabilitation options were developed from stakeholder and public input, and from traffic observations in the spring of 2024 and during the Fall Demonstration Project of October 2024. These options were considered in order of lower impact and cost to higher impact and cost, including:

3.1.1 Turn lanes (extended and new turn lanes) (WVHS and HHS) CONSIDER
3.1.2 Weaving lane (plus turn lanes) (WVHS and HHS) CONSIDER
3.1.3 Southbound right turn lane (from University Avenue) (HHS) NOT RECOMMENDED
3.1.4 Sandvik Signal at University Avenue (WVHS and HHS) CONSIDER

None of the rehabilitation options are in the RECOMMENDED category as a best option for the FNSB campus; however, selected features from these options can be considered further to improve performance. They may be better options when combined with reconstruction options reviewed in the next section. This report recommends reconstruction options over rehabilitation options.

3.1.1 Turn Lanes - Extended and New Turn Lanes – CONSIDER

DESCRIPTION: One option frequently suggested has been to build or extend turn lanes along existing roads at existing driveways and intersections.

PURPOSE: The purpose is to store low speed or stopped queueing traffic to prevent blocking through lanes and other traffic.

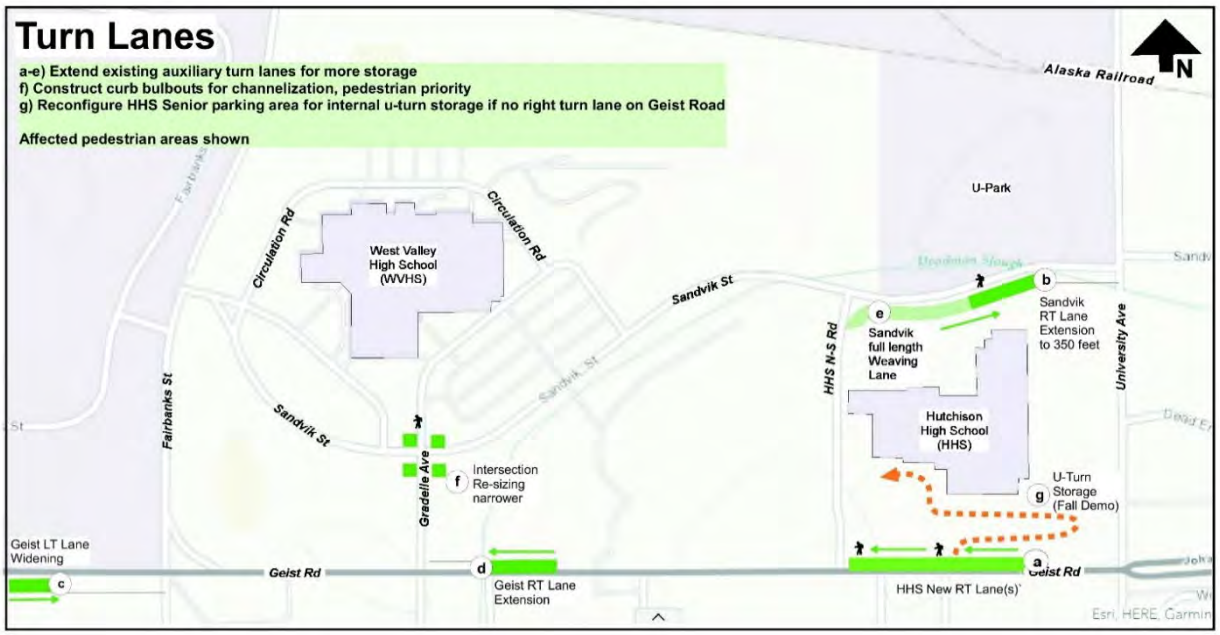


Figure 8. Extended Turn Lane Options

Figure 9. 24-10-16 WED 2:22 PM Sandvik eastbound queues in front of U-Park

BACKGROUND: Not all turn lanes have to be upgraded. This option considers a variety of traffic backup locations for improvement to see how much benefit would occur if all locations were upgraded. A selection of one or more locations may be more desirable to Stakeholder agencies. The turn lane locations corresponding to concept Figure 8 are:

a) **HHS Driveways on Geist Road, New right turn lanes – CONSIDER:** Consider westbound right turn lanes for one or both HHS driveways from Geist Road to provide right turn storage outside of through lanes.
b) **Sandvik Street and University Avenue, eastbound right turn lane extension – CONSIDER:** Consider a longer right turn lane eastbound on Sandvik Street approaching University Avenue to provide additional storage and allow left turning traffic to bypass the right turn queues at University Avenue.
c) **Fairbanks Street and Geist Road, eastbound left turn lane lengthening - CONSIDER:** Consider lengthening the eastbound left turn lane approaching the traffic signal, which would require some widening of Geist Road**.** Eastbound left turn demand is high enough to routinely exceed the 160-feet of storage, backing into the tapered "neutral" area where Geist Road narrows. Even though most passenger vehicle traffic is from the east, 8 to 10 buses arrive from the west nearly simultaneously, around 7:10 to 7:15 AM. Most buses are 40 feet long, taking up the same space as two or more vehicles, with slower startup times so that the green signal phase is insufficient for left turning buses.
d) **Gradelle Street and Geist Road, right turn lane extension – CONSIDER:** Consider a longer westbound right turn lane for to provide additional storage**.** While the current westbound right turn storage is adequate for observed queues, significant events could quickly fill the right turn lane and back into Geist Road. Note that queues of this length are not expected to occur on a weekly basis.
e) **Gradelle Street and Sandvik Street, intersection narrowing - CONSIDER**: Consider narrowing intersection corners to better channelize turning traffic, increase pedestrian refuge space, and shorten pedestrian conflict areas. The current intersection width and large radii leads to occasional utilization by vehicles as two lanes approaching or departing each leg of the intersection, mostly on the north leg.

Figure 10. 24-10-16 WED 2:14:33 PM Moving congestion at Sandvik St and Gradelle Avenue All-Way Stop

PERFORMANCE: Figure 11 maps the level-of-service (LOS) and queues of concern for existing conditions during the AM arrival and PM dismissal peak 15-minute periods. Traffic queues and delays along existing internal routes worsen, and LOS F remains for turning movements at campus bottlenecks, the same as for existing conditions. Traffic queues are slightly improved on Sandvik Street and congestion improves along Geist Road but does not eliminate the bottleneck. Simulation suggests turn lanes improve access onto the site and increase congestion at internal bottlenecks. Turn lanes exiting the campus help with storage but not delays. The primary desirability of some turn lanes is to prevent blockage of adjacent through lane traffic on Geist Road at two locations, eastbound left turns into limited storage at the Fairbanks Street and Geist Road signal, and westbound right turns into the campus.

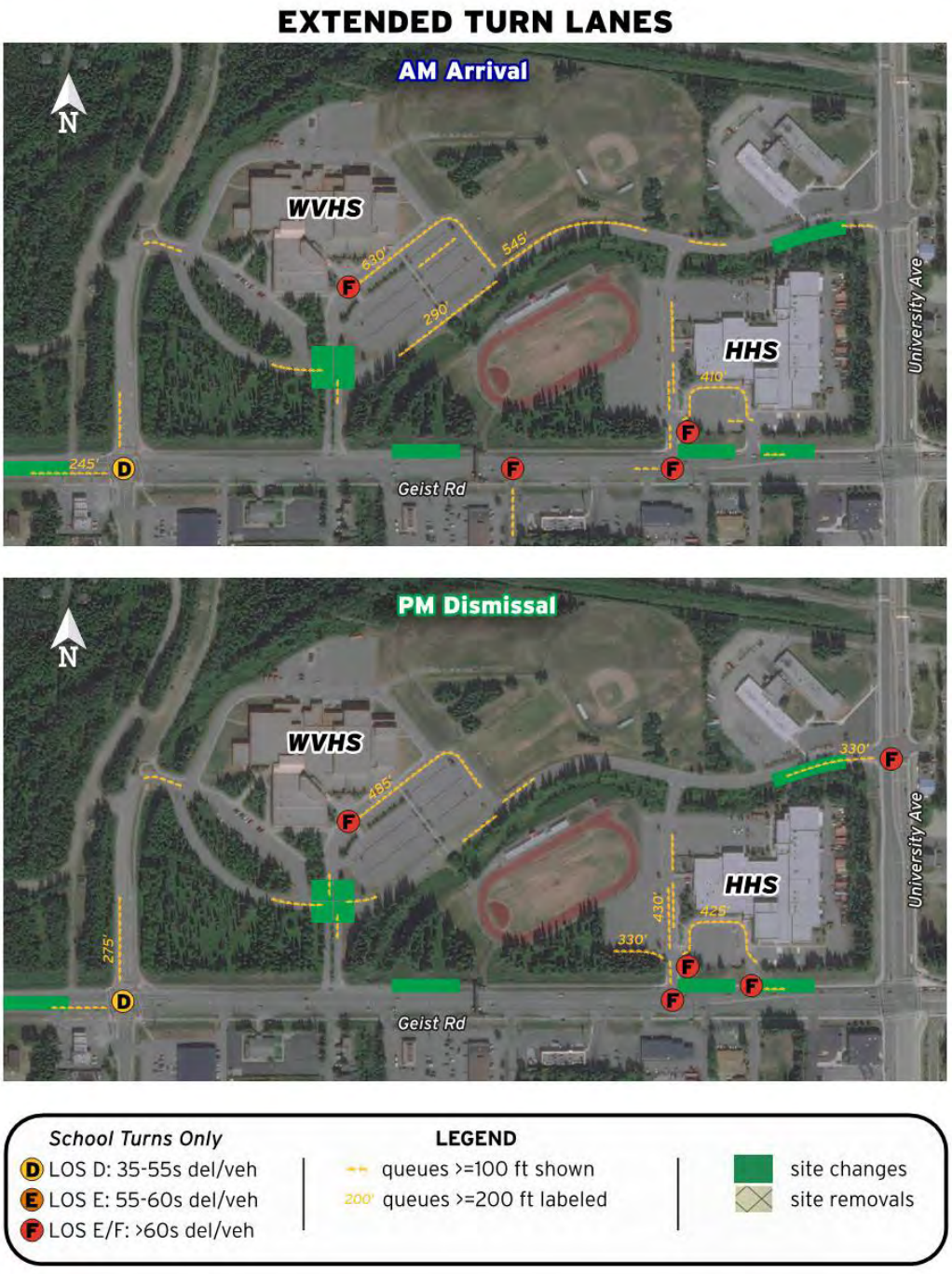


Figure 11. Extended Turn Lanes Performance Map

3.1.2 Sandvik Street, Weaving Lane plus Extended and New Turn Lanes – CONSIDER

DESCRIPTION: This option is intended to test the same network of extended turn lanes and add a longer weaving lane continuously along Sandvik Street between the HHS north-south access road and University Avenue.

PURPOSE: The purpose is to not only create more storage for departing queues, but to give a priority to HHS traffic over WVHS traffic heading to University Avenue, to see if we can balance out dismissal delays more evenly between the two high schools.

BACKGROUND: Based on the congestion observed at the existing all-way stop, WVHS and HHS traffic exiting the site during dismissal properly take turns on each leg. However, because WVHS has more options for departure via Gradelle Street and Fairbanks Street, WVHS congestion dissipates in half the time it takes for HHS traffic to clear. Adding a longer weaving lane could allow for a free right turn from HHS and a higher priority to exit the HHS campus. This requires WVHS traffic to use the weaving lane after stopping and accept secondary courtesy gaps to merge into right turn queues at University Avenue. Instead of equal priority, this option offers an HHS priority to HHS as the more congested school and lowers the priority of WVHS. This can also have the effect of encouraging WVHS traffic to use alternative routes.

PERFORMANCE: Figure 12 maps the level-of-service (LOS) and queues of concern for extending and adding auxiliary turn lanes, along with a weaving lane from HHS along Sandvik Street to University Avenue, during the AM arrival and PM dismissal peak 15-minute periods. No significant changes over the previous turn lane extension option or existing conditions were found. In concept, this option would help give HHS priority over WVHS to the east but would not significantly improve delays at University Avenue.

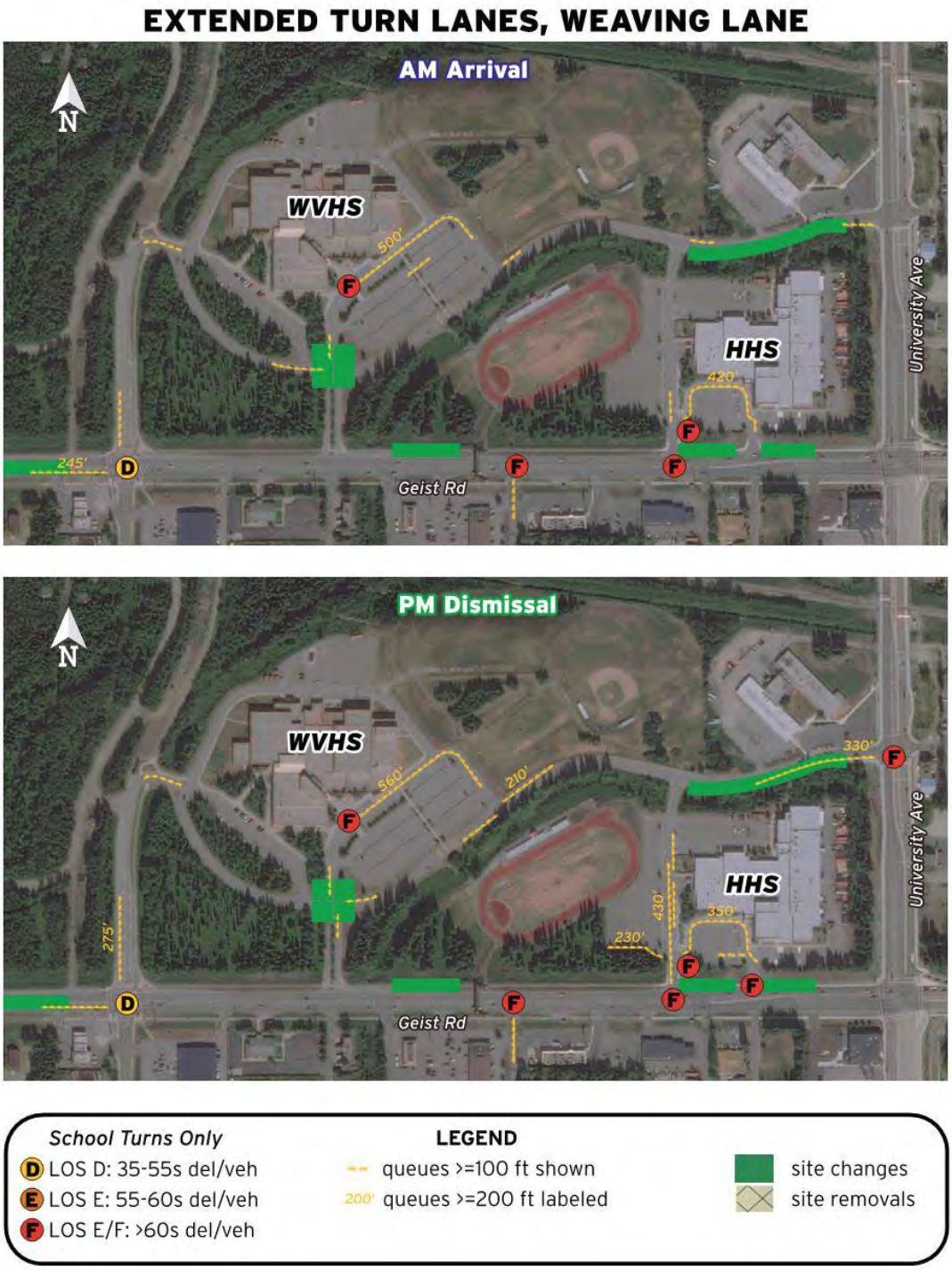


Figure 12. Extended Turn Lanes Plus Weaving Lane Performance Map

3.1.3 University Avenue Southbound Right Turn Lane to HHS – NOT RECOMMENDED

DESCRIPTION: This option was suggested by HHS safety staff. Could a southbound right turn lane directly into the senior parking area allow for quick access and reduce the load on Geist Road frontage areas?

PURPOSE: The purpose is to get into HHS quickly and reduce Geist Road traffic conflicts.

Figure 13. University Avenue Southbound Right Turn Lane into HHS Option

PERFORMANCE: Figure 14 maps the level-of-service (LOS) and queues of concern for an added southbound right turn lane or a right turn lane "split" on University Avenue during the AM arrival and PM dismissal peak 15-minute periods. No significant improvements were found over existing conditions. Other concerns are explored further in the next Section 4 Analysis of Options.

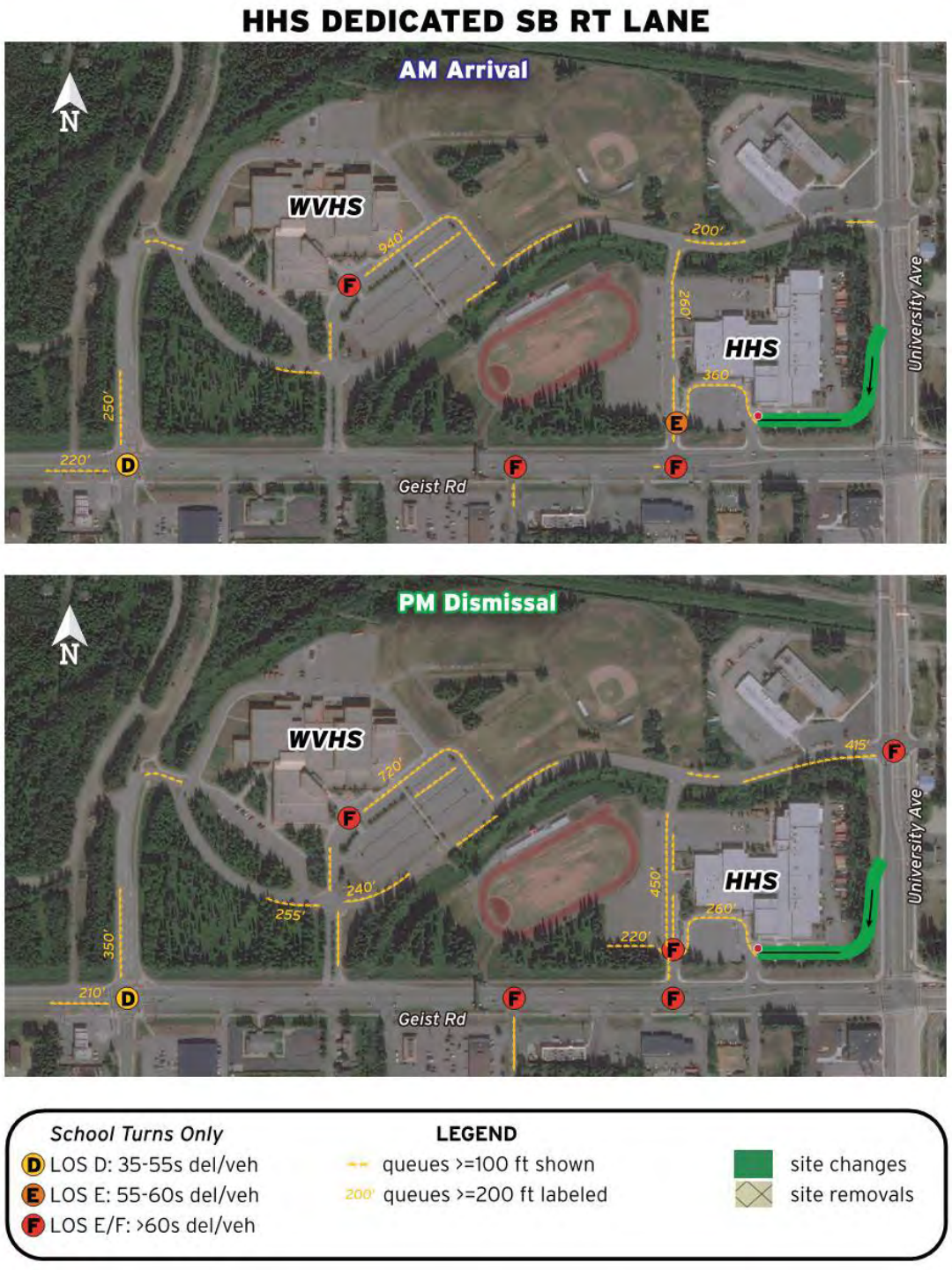


Figure 14. HHS Dedicated Southbound Right Turn Lane Performance Map

3.1.4 Sandvik Signal – Sandvik Street at University Avenue – CONSIDER

DESCRIPTION: One of the last locations dissipate when traffic is exiting the campus is at Sandvik Street and University Avenue. This option would build full traffic signal control at the intersection, removing the Pedestrian Hybrid Beacon. Pedestrian crosswalks would be provided with the full signal.

PURPOSE: This option is intended to reduce queueing and delays on Sandvik Street at University Avenue.

BACKGROUND: This option was explored in the absence of other alternatives selected for the campus. A traffic signal is a "million dollar" investment that will increase impacts to arterial traffic all day long and require annual maintenance staffing and costs. Therefore, selection of this option requires considering whether the benefits during short school traffic peaks outweigh the disbenefits of operation and impacts for all users the rest of the day.

Figure 15. Signal at Sandvik and University Option

RAILROAD COORDINATION: Another complication of signal design at this location would require further modeling of increased queues to the north of Sandvik Street. There is 425 feet of queue storage between Sandvik Street and the Alaska Railroad. Federal Code (23 CFR 646.214(b)) requires detailed design review to mitigate and prevent vehicles queueing near or onto the railroad tracks. This signal option could require also upgrading the railroad crossing with another signal, doubling arterial impacts. The Alaska Railroad Corporation would be a required stakeholder agency with approval authority when reviewing and considering this option.

Figure 16. Alaska Railroad crossing north of Sandvik Street and University Avenue

PERFORMANCE: Figure 17 maps the level-of-service (LOS) and queues of concern for a Sandvik Street signal during the AM arrival and PM dismissal peak 15-minute periods. Short peak congestion on Sandvik Street is reduced by half or more with a full signal during the PM dismissal period. The AM arrival period does not benefit significantly. LOS F remains at all the other campus bottlenecks. While this option helps at one location, there are other reconstruction options with more benefit to the rest of the campus.

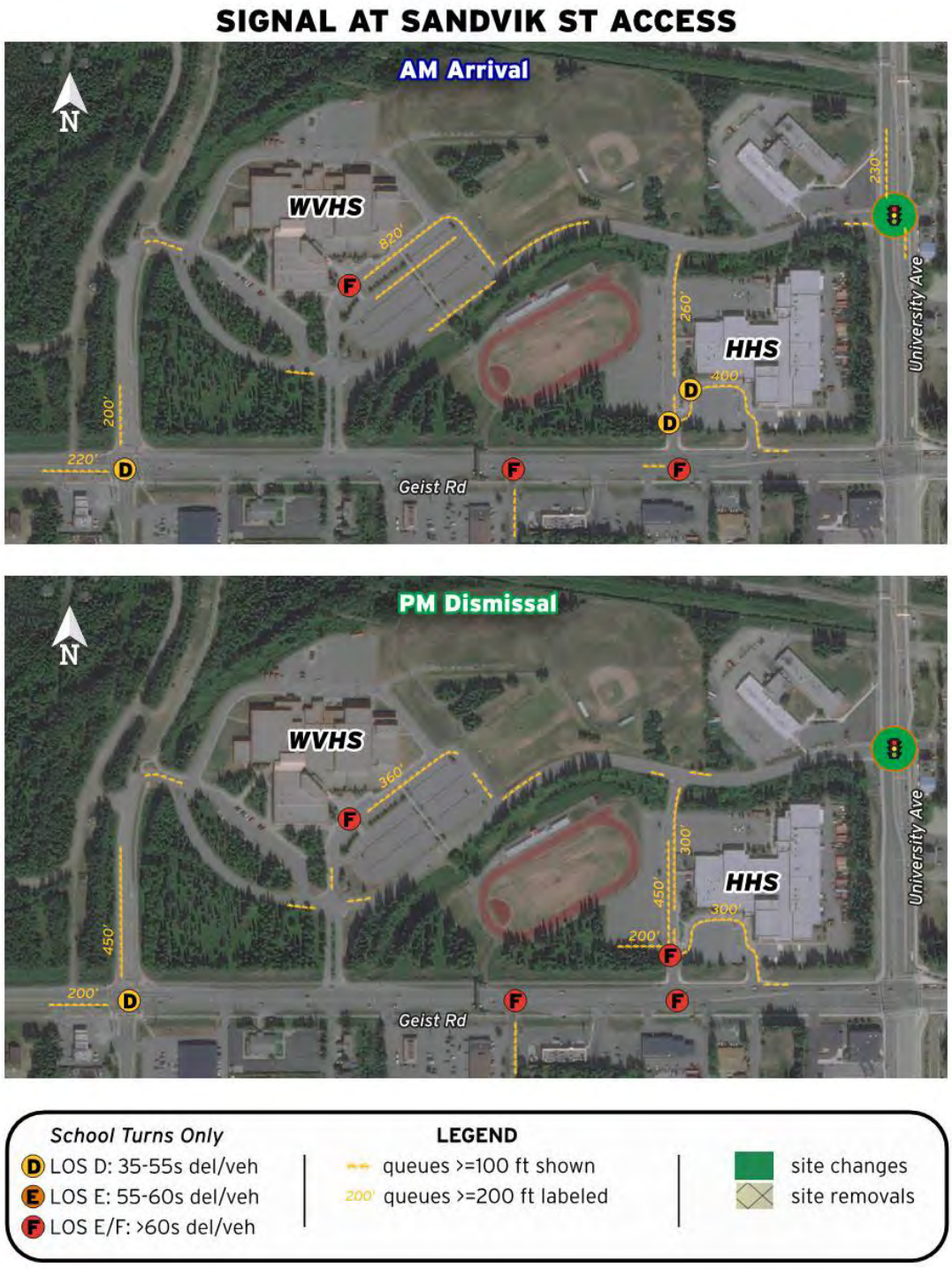


Figure 17. Sandvik & University Signal Performance Map

3.2 Reconstruction Options

"Reconstruction Options" involve realignment or construction of new roadways, parking lots, and possibly closing some driveways. The intent is to maximize congestion reduction and campus safety with less constrained options. Levels of service or the capacity of access and circulation are expected to be changed and improved.

Reconstruction options were developed from stakeholder and public input, and from traffic observations in the spring of 2024 and during the Fall Demonstration Project of October 2024. These options were considered in order of impact and cost, including:

3.2.1	**West Loop Dropoff/Pickup Conversion (WVHS)**	**RECOMMENDED**
3.2.2	**Signal 2-Way Frontage (HHS)**	**CONSIDER**
3.2.3	Signal 1-way, Small Loop (HHS)	NOT RECOMMENDED
3.2.4	Signal, 1-way, Small Loop plus 2-way Parking (HHS)	NOT RECOMMENDED
3.2.5	Midblock STOP, Small Loop, No Signal (HHS)	NOT RECOMMENDED
3.2.6	**Signal, 1-way, Big Loop (HHS)**	**RECOMMENDED**
3.2.7	**Signal, 2-way, Big Loop (HHS)**	**RECOMMENDED**
3.2.8	Signal Shared - to both High Schools (WVHS and HHS)	NOT RECOMMENDED

Option 3.2.1 is an improvement at WVHS. The remaining reconstruction options involve installing a new signal on Geist Road at Rebecca Street to serve HHS or both HHS and WVHS. Option variations start with minimal changes in the HHS circulation network and work towards more and more changes internal to the site.

3.2.1 West Loop, Drop-off/Pickup Zone Conversion (WVHS) – RECOMMENDED:

DESCRIPTION: This option converts the west side of WVHS to add a new west side loading zone and relocates bus staging to the back of the school. Staff parking is relocated to new locations in front of the school.

PURPOSE: This option reduces traffic at the WVHS top congestion and safety conflict point at east side of WVHS by up to one-third. This main entrance is where drop-off, pick-up, visitor parking, and pedestrians all overlap.

BACKGROUND: The Fall Demonstration Project showed this option can redistribute and reduce congestion by tapping into the west side entrance to WVHS. This option doubles the curbside drop-off and pick-up area available to parents and students.

Converting the west side of the high school requires minor reconfiguration of traffic in front of WVHS, and rehabilitation of the back parking lot for bus use. Faculty and staff parking can be relocated within any of the three lots: back lot, west lot, or east lot, or some combination. In this example, staff is divided amongst the front two lots. With this option, buses and demand from

the west enter and exit the campus via the Fairbanks Street signal, increasing eastbound left turn demand and congestion at the traffic signal.

In addition to circulation improvements, improvements would be needed to the student entry and exit via the back doorways and loading areas of WVHS. During the Fall Demonstration Project, concerns revealed this area has narrower access doorways than the front of the school; air intakes and lighting are not designed for high volume points of entry; and dumpsters constricted bus circulation and back lot access. Thus, in addition to site circulation improvements, this west loop conversion option could require building improvements for access.

Lessons learned from the Fall Demonstration Project show this option flowed well in the morning and was utilized enough to significantly reduce the load on the existing east loop drop-off. However, reduced existing signal green time for eastbound left turns combined with increased bus demand was found to worsen queues at the signal. The existing eastbound left turn lane is short at 160 feet of storage and could be longer to serve peak demand. Under a reconstruction option, signal detection would be improved and timing increased for the new traffic flows. Eastbound left turn lane extension and widening is needed as a part of this option.

This option is modified from the Fall Demonstration Project to include realignment of the existing west side circulation road to the back lot using more of the Fairbanks Street Extension. Extending the Fairbanks Street Extension removes internal stops for busing and creates a priority entry and exit for buses. Sandvik Street retains stop sign control the same as under existing conditions. The back lot would need to be renovated to better align buses for staging.

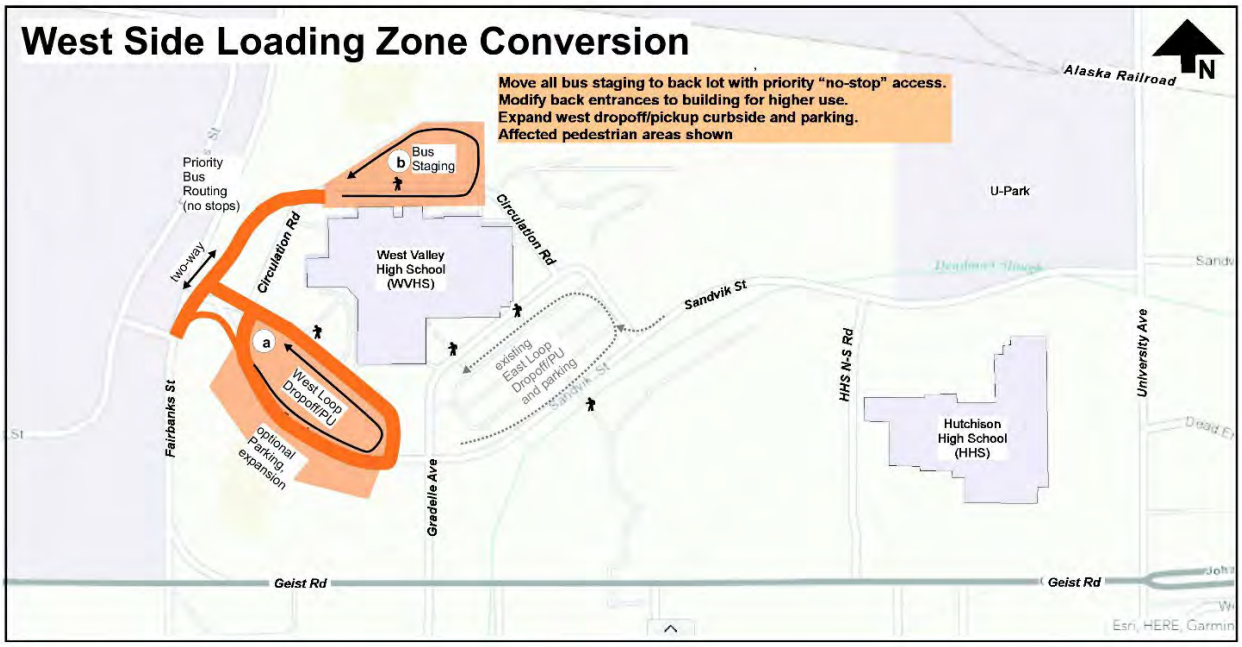


Figure 18. West Loop Drop-off/Pick-up Zone Conversion Option (WVHS)

Figure 19. 24-10-16 WED 7:45 AM West Loop existing major entrance

Figure 20. 24-10-16 WED 7:13 AM West Loop Dropoff under light but steady moving traffic in morning

Figure 21. 24-10-16 WED AM Arrival Buses Queueing to get to WVHS Back Lot for Dropoff

Figure 22. 24-10-16 WED 1:58 PM Dismissal SPED Bus curbside staging and narrow bypass

Figure 23. 24-10-16 WED 1:57 PM Back Lot SPED Bus Queues (left) and temporary bus loading zone staging

PERFORMANCE: Figure 24 maps the level-of-service (LOS) and queues of concern for creating a new west loop drop-off and pick-up area with back lot bus staging during the AM arrival and PM dismissal peak 15-minute periods. Congestion and delay can be greatly reduced by one-half to two-thirds within the east loop parking and passenger loading areas of WVHS. Bus priority can be ensured by removing stop controls to and from the WVHS bus loading zones. However, congestion and delay are increased at the Fairbanks and Geist signal which would require changes to signal timing and eastbound left turn storage to accommodate demand increases. Overall, in Section 4, this option provides the greatest congestion and delay benefits to WVHS compared to any other options. Combining this option with signal timing changes such as longer green times for school turning movements could ensure volume-to-capacity ratios don't near or exceed 0.8.

RELATED OPTIONS: Split phase signal timing is reviewed later in this report as another lower cost option to ensure school green times match demand. That option is not recommended above other options available at this time.

An alternative to this option, that could work similarly to this one, would be to expand the area on the west lot that is currently serving only buses to serve student drop-off and pick-up, as well. This could provide more space for parent drop-off while still keeping bus operations separate from other uses. Keeping the bus area on the south-west side of the school would eliminate the need for facility upgrades associated with this option. This method of parallel, dual use passenger car and bus loading zones is often used at airport pick-up and drop-off areas.

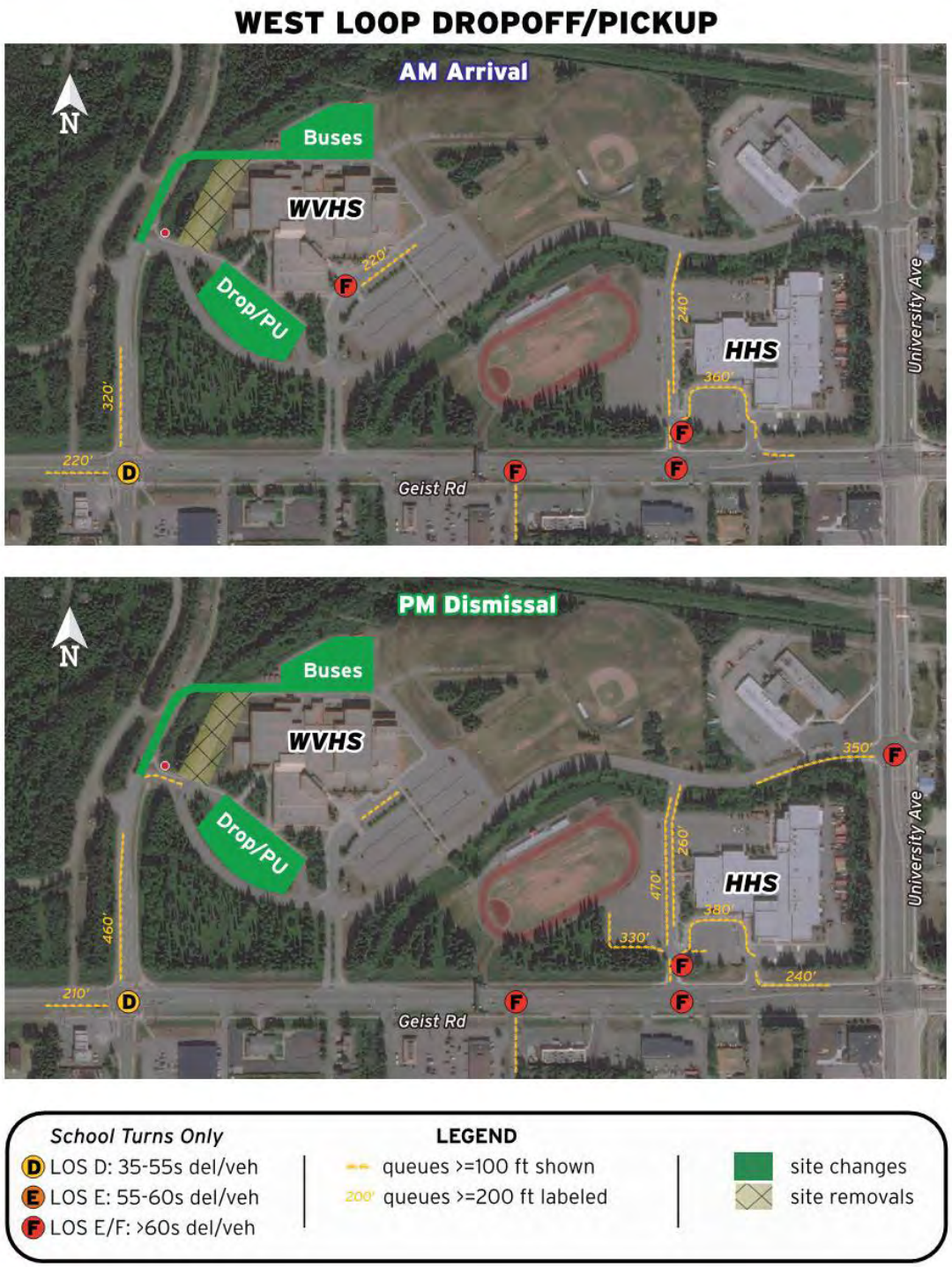


Figure 24. West Loop Drop-off/Pick-up and Back Lot Bus Staging Performance Map

3.2.2 Midblock Signal, 2-way Frontage (HHS) – CONSIDER

DESCRIPTION: This option would construct new signalized access on Geist Road at Rebecca Street. A two-way frontage road would connect to the front of HHS only. Existing HHS driveways onto Geist Road would be closed, although there is the potential for the east driveway to remain open.

PURPOSE: The purpose of this option is to solve the top congestion and safety conflict point at HHS located at the west driveway by relocating this access to a new traffic signal connected by a traditional two-way frontage road.

BACKGROUND: This option begins one of several reconstruction variations which uses a new traffic signal on Geist Road at Rebecca Street. All user group conflicts are concentrated where the frontage road intersects with north-south campus circulation. This internal intersection and the segment 100 feet to the north is where curbside drop-off, pick-up, visitors, parking pedestrians, and senior parking are the main overlapping user groups. In addition, some traffic is bound for both WVHS and HHHS in this conflict area. Due to the short storage distance between HHS frontage and Geist Road under existing conditions, there is a frequent and recurring risk of school traffic backing onto Geist Road.

The Fall Demonstration Project showed the potential to reduce this congestion by separating senior parking and west side parking traffic from the curbside drop-off and pick-up zones. The demonstration also showed reducing access to Geist Road (by not allowing access to Geist Road from the parking lot) increased congestion to Sandvik Street. Departing HHS traffic was delayed two times longer than WVHS traffic when forced to exit HHS to Sandvik Street to the north. These exit results were undesirable; therefore, access to Geist Road from the parking areas is considered critical in future options.

A new traffic signal was considered during this peak period because the high school is a peak generator. HHS does not have direct access to a signal while WVHS does (at Fairbanks Street). The recommended location is at Rebecca Street, evenly spaced ¼ mile between existing arterial traffic signals. This location offers more uniform control of Geist Road signal progression to maximize Geist Road green times. Commercial access and service on the south side of Geist Road would have to be consolidated around this signal. West Valley Plaza Mall, McDonalds, and other businesses peak traffic would benefit by using internal circulation routes to get to a potential signal. Without consolidation of south side business access, left turns to and from the commercial area under existing conditions is shown to be congested and an increasing safety risk.

This new signal location is near the original pedestrian overcrossing that was recently removed. A signal would provide crossing opportunities for pedestrian traffic, connected to both high schools by pedestrian pathways.

This signal option offers an improved access alternative with greater storage length, further from the existing points of turning conflicts on campus. Two versions were evaluated. This option was first evaluated with closure of both existing driveways to HHS. Both driveways are within the "functional area" for University Avenue and Geist Road traffic signal. The functional area is an undesirable location for driveway turns because this introduces more conflicts and multiple visibility-based decision points ahead of the main traffic signal. At arterial traffic speeds, it is more desirable for motorists to focus on the traffic signal conflicts within the functional area. It is undesirable to have to watch for multiple conflict points at the same time.

Due to the high demand for the HHS main entrance access, this option was also evaluated by keepng the existing east driveway open. This would be a one-way driveway where traffic is prohibited from returning to Geist Road.

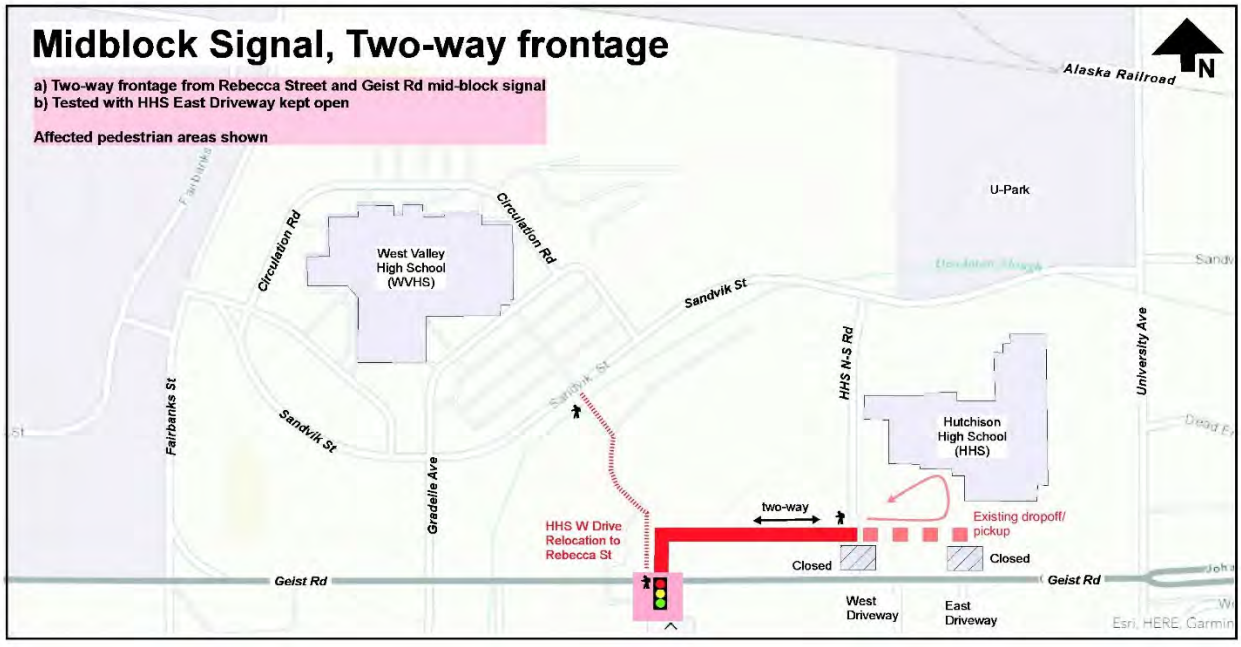


Figure 25. Signal, Midblock, Two-way frontage option (HHS)

PERFORMANCE: Figure 26 maps the level-of-service (LOS) and queues of concern for a new midblock signal on Geist Road with two-way frontage to HHS during the AM arrival and PM dismissal peak 15-minute periods. This was also modeled with the east HHS driveway kept open and found to worsen congestion in front of HHS. The east driveway model performance map is not shown here but is included in the appendices. A new signal significantly improves Geist Road and University Avenue level-of-service over existing conditions. Volume-to-capacity ratios (v/c) at Geist Road is reduced to one-fourth of existing congestion. Sandvik at University Avenue is improved by about one-third but still nears v/c just below 0.8. Internal congestion at the HHS frontage road remains LOS F but is improved with more internal queue storage.

RELATED OPTIONS: Instead of a signal, the new driveway/Rebecca Street could be under two-way stop control. Drivers from the high school would experience more delay than with a signal, but vehicle operations on campus would still be improved. However, two-way stop control would provide no benefits to pedestrians desiring to cross Geist Road.

Figure 26. Midblock Signal at Rebecca Street, Two-way Frontage, Performance Map

3.2.3 Signal, 1-way, Small Loop (HHS) – NOT RECOMMENDED

DESCRIPTION: A signal with one way frontage to the all-way stop and curbside secondary drop-off area was tested with a short one-way loop as a return to the signal. Driveways to allow parking are possible but not shown.

PURPOSE: This option is intended to test whether a one-way loop using the existing roads west of HHS can improve congestion with minimal changes to the rest of the campus. This option contrasts with the previous option by splitting internal frontage test for improved circulation.

BACKGROUND: Traffic flow would be the same in concept as a large traffic circle with stops along the route. The main entrance, visitor parking area, and senior parking would retain their existing uses and allow for drop-off and pickup as existed before. This option would require reconstruction of the southwest parking area to allow for these movements. This option was also tested for the impacts of keeping the east driveway open as a one-way exit from Geist Road.

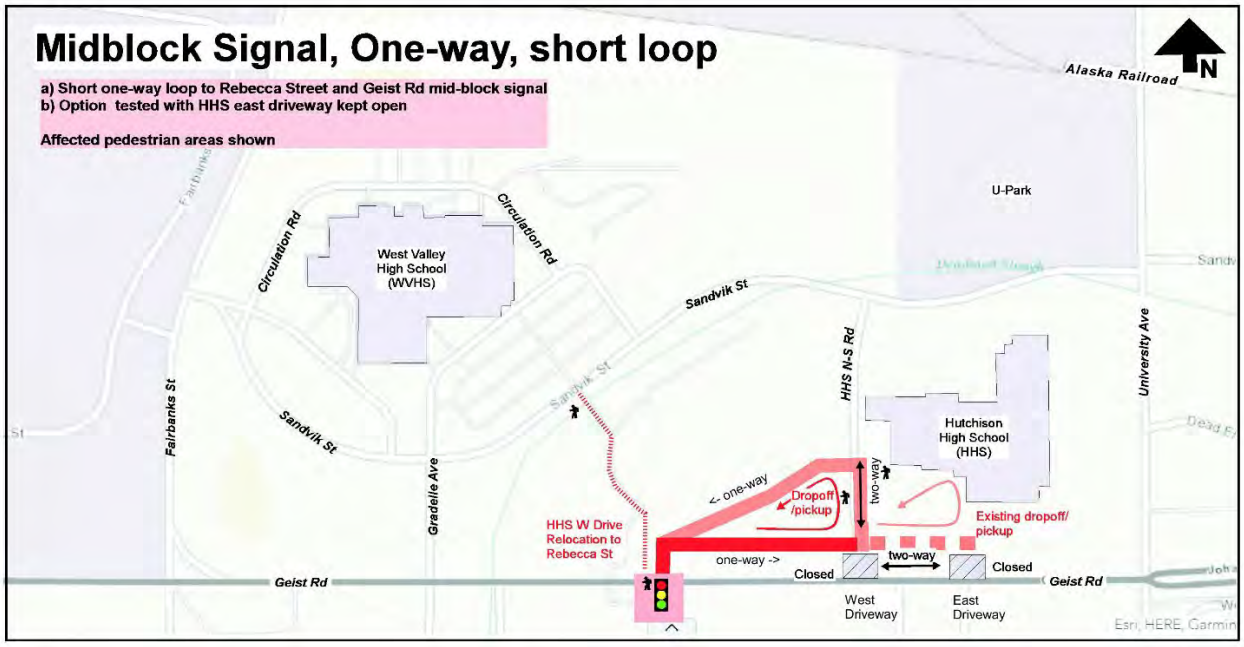


Figure 27. Signal, Midblock, one-way short frontage loop option (HHS)

PERFORMANCE: Figure 28 maps level-of-service (LOS) and queues of concern for a new midblock signal on Geist Road using a short one-way loop to and from HHS during the AM arrival and PM dismissal peak 15-minute periods. This was also modeled with the east HHS driveway kept open and found to worsen congestion in front of HHS. The east driveway model performance map is not shown here but is included in the appendices. This option resulted in greater bottlenecks along the north-south sculpture road and discouraged full utilization of the existing main entrance area. Traffic queues went all the way to the signal. Sandvik Street was inadvertently improved through undesirable internal congestion metering at the frontage road.

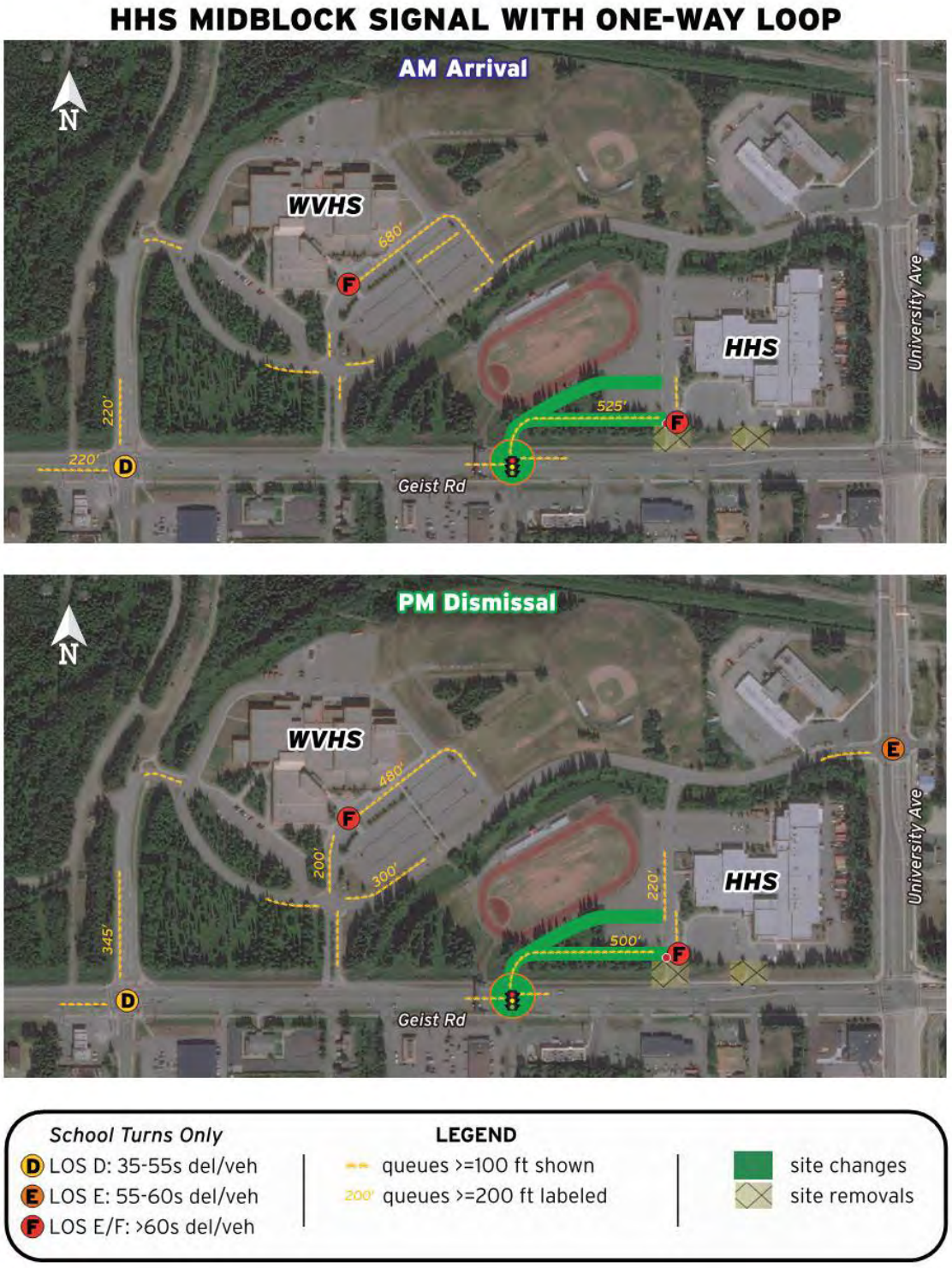


Figure 28. Midblock Signal, Short One-way Frontage Loop Performance Map

3.2.4 Signal, 1-way Small Loop, with 2-way Parking, (HHS) – NOT RECOMMENDED

DESCRIPTION: This option provides a one-way road from the signal to the drop-off/pick-up area, and a second two-way road to allow direct access between the parking lot access and the traffic signal.

PURPOSE: The purpose of this option is to see if flow is further improved by allowing entering traffic to access the parking area more directly, diluting conflicting movements.

BACKGROUND: Previous frontage and loop concepts bottleneck at the HHS north-south road and force all parking vehicles to travel through high pedestrian conflict zones. This variation creates a direct two-way route to the HHS west side parking lots which removes more vehicles from pedestrian conflict zones.

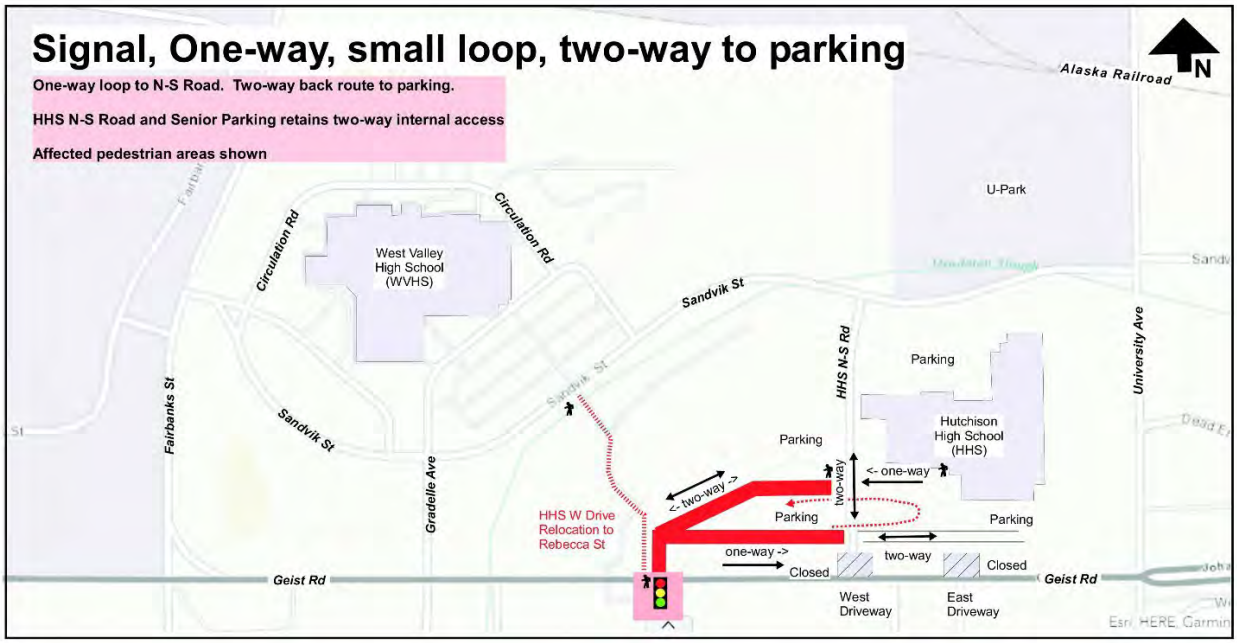


Figure 29. Signal, one-way to drop-off/pick-up, two-way to back parking option

PERFORMANCE: Figure 30 maps the level-of-service (LOS) and queues of concern for a new midblock signal on Geist Road with a short one-way loop to HHS and a two-way parking access during the AM arrival and PM dismissal peak 15-minute periods. This option performs better in terms of overall LOS and queues than previous loops but still risks long queues at the frontage road and main entrance, backing nearly to the signal. Sandvik Street at University Avenue is improved by one-half to two-thirds, same as previous options.

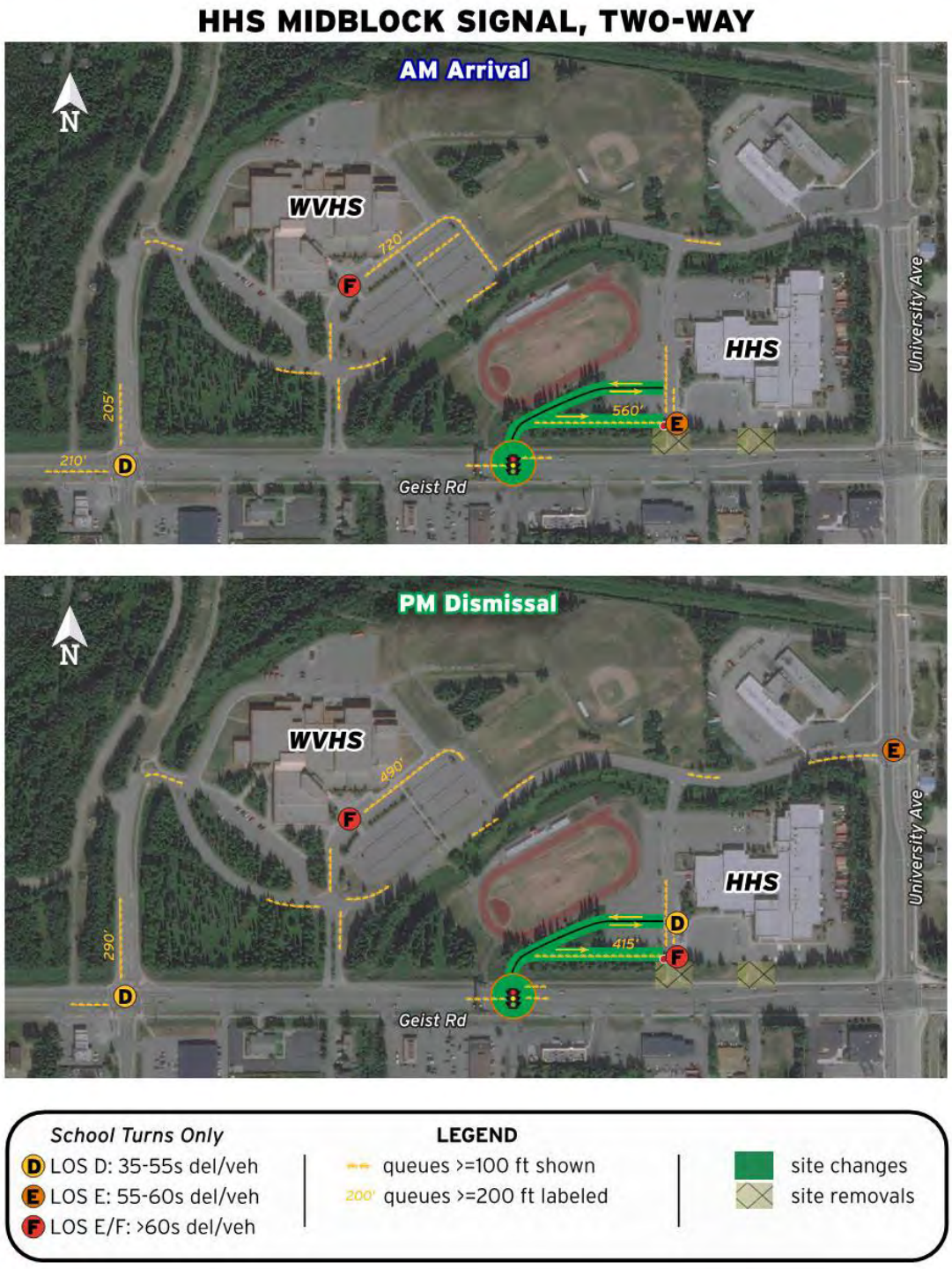


Figure 30. Midblock Signal, One-way Frontage, Two-way Parking Performance Map

3.2.5 Midblock STOP, 1-way, Small Loop (HHS) – NOT RECOMMENDED:

DESCRIPTION: The short loop of traffic from a new midblock access on Geist Road was also tested without a traffic signal. STOP sign control is used on the side streets to test congestion if Geist Road were to remain free flowing.

PURPOSE: The goal of this option is to see if Geist Road impacts can be minimized while increasing storage and departure options for HHS to and from Geist Road.

BACKGROUND:

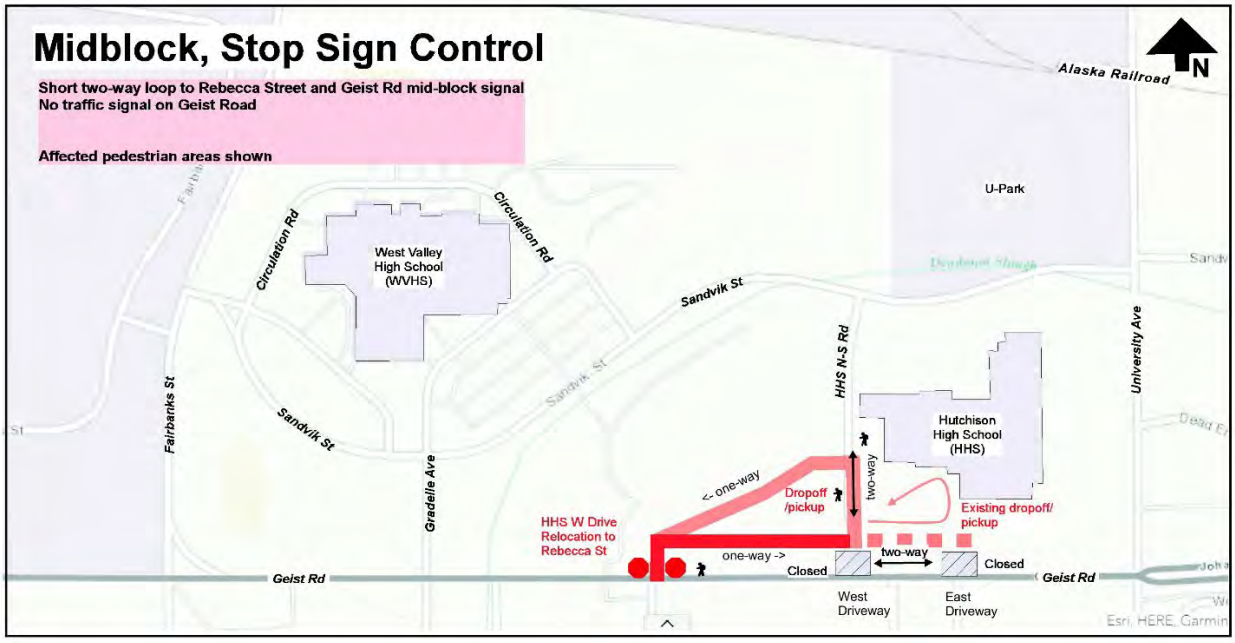


Figure 31. HHS Relocated Stop Controlled Access to Geist Road option

PERFORMANCE: Figure 32 maps the level-of-service (LOS) and queues of concern by testing new midblock access on Geist Road as a STOP sign controlled side street. This includes a short one-way loop to HHS during the AM arrival and PM dismissal peak 15-minute periods. STOP sign control was inadequate to improve high school congestion and turning movements beyond existing conditions. Conditions at Geist Road are much worse under STOP sign control. STOP sign control more than doubled congestion onto the campus with v/c ratios at 2.85 or higher for stop-controlled traffic. All remaining options explored at this location continue to examine signal control.

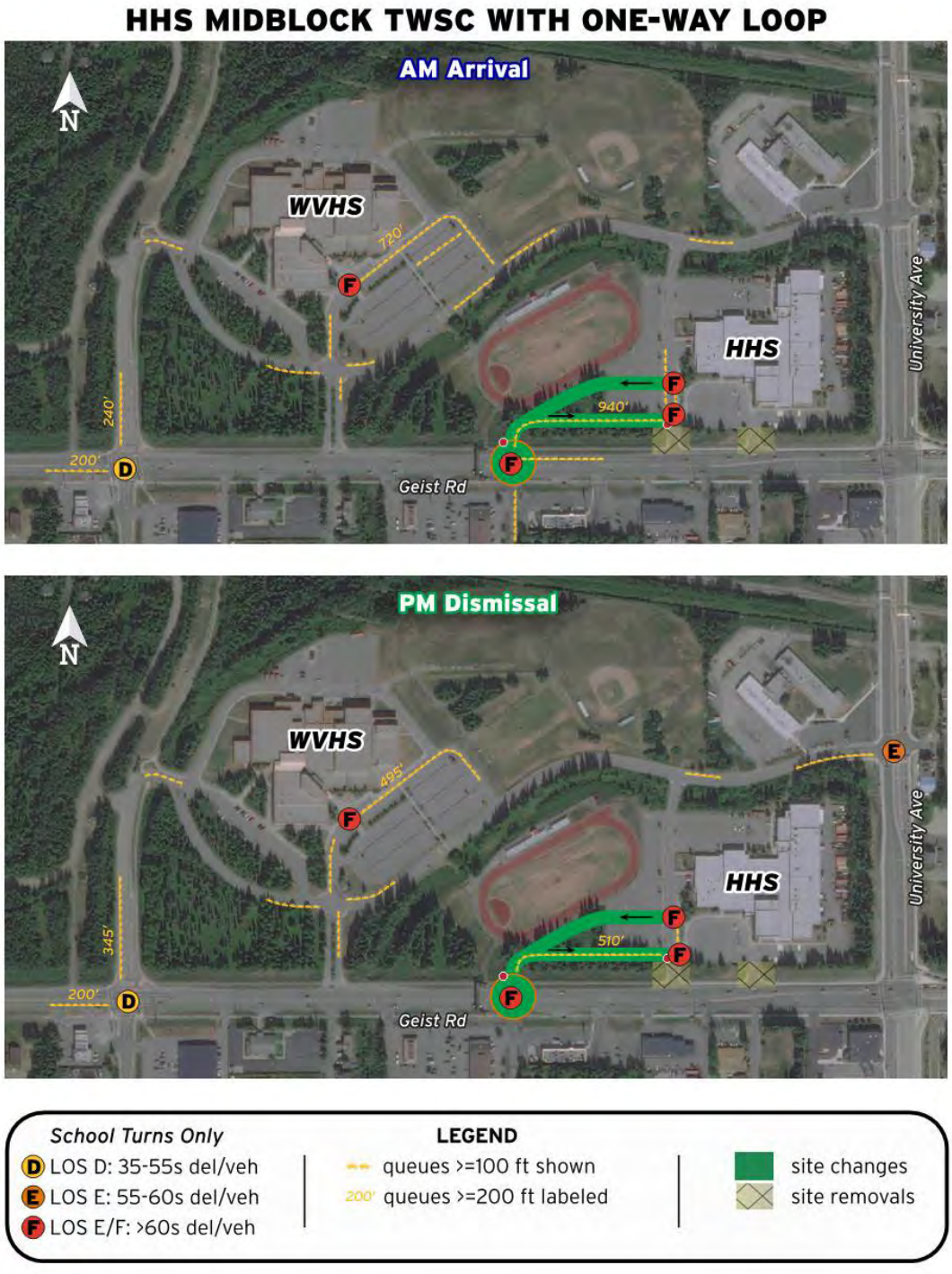


Figure 32. Midblock Two-Way STOP Controlled Performance Map

3.2.6 Signal, 1-way Big Loop (HHS) – RECOMMENDED

DESCRIPTION: A midblock signalized HHS access to Geist Road was increased to use a full-sized one-way loop to the main entrance.

PURPOSE: The intent of this option is to further reduce queues on the frontage road compared to short loops. This option provides longer vehicle queue storage.

BACKGROUND: This option is similar to the WVHS main entrance circulation in the way two lanes are used counterclockwise from the location of the original east driveway to the HHS north-south road. This multilane drop-off exists at HHS to serve curbside parking and allow bypass vehicles in the left lane. Any multilane drop-off use along the south frontage would require lane reconfiguration and an additional crosswalk to the HHS north-south frontage road.

This option would minimize parking within the loop area to cut-through traffic and to user groups that minimize conflict. Staff and visitors would be more desirable than student parking. This is because those groups arrive earlier or later than most peak period travel. Senior parking is a smaller group that was left unchanged and still parks east of the loop.

Figure 33. Signal, Midblock, one-way long frontage loop option (HHS)

PERFORMANCE: Figure 34 maps the level-of-service (LOS) and queues of concern for a new midblock signal on Geist Road with a full one-way loop in front of HHS during the AM arrival and PM dismissal peak 15-minute periods. LOS, queues, and delays improved for HHS. Sandvik Street congestion at University Avenue was reduced by one-third, just below v/c of 0.8.

RELATED OPTIONS: Instead of a signal, the new driveway/Rebecca Street could be under two-way stop control. This would still provide additional storage for vehicles entering the campus and picking up/dropping off. However, drivers leaving campus would experience similar or worse delays and queues compared to existing. Additionally, two-way stop control would provide no benefits to pedestrians desiring to cross Geist Road.

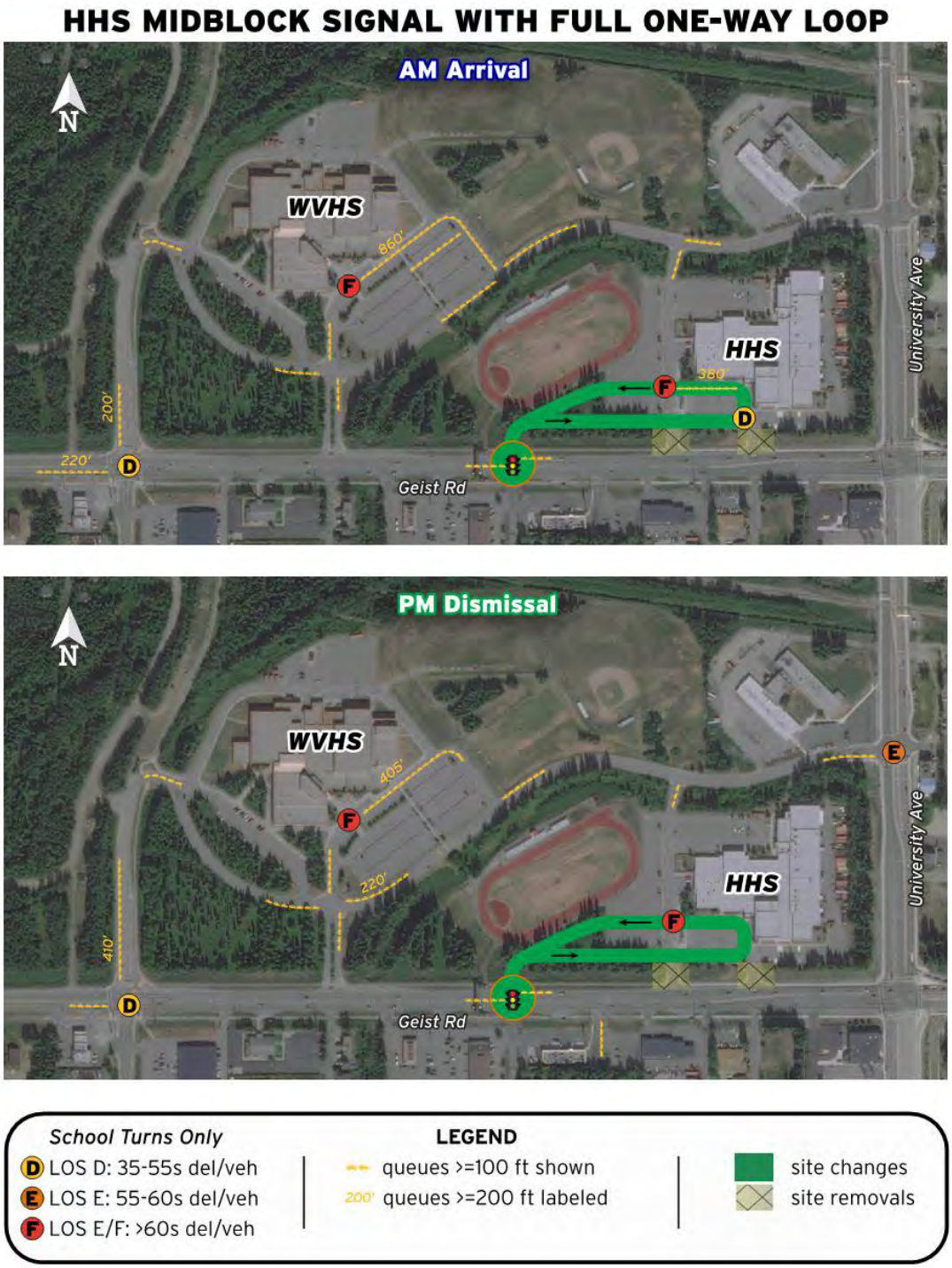


Figure 34. Midblock Signal with Full One-way Loop Performance Map

3.2.7 Signal, 2-way Big Loop (HHS) – RECOMMENDED

DESCRIPTION: This option tests the full-size loop option from a midblock signalized HHS access to Geist Road, by using two-way flow instead of one-way flow.

PURPOSE: The purpose is to allow movements in all directions and see if this can still function in a two-way configuration as well as a full-size one-way loop.

BACKGROUND: A larger two-way loop expands on the two-way frontage road concept, and then provides a second parallel two way, east-west route through the parking area to the west and back to the signal. The advantage of this routing is that it allows parking traffic to use the northern route away from pedestrian conflict areas. Low speed parking access internal to the loop could be made available, where internal pedestrian conflicts would be minimal. Drop-off and pick-up traffic can be widened to two lanes inbound to provide more curbside storage than existing conditions.

Existing driveways were closed under this option. Senior parking was retained. Departing traffic was not required to use the one-way route through the main entrance but can instead travel the two-way frontage back to a stop-controlled intersection west of the parking areas and then turn left to the signal.

This option would minimize parking within the loop area to user groups that minimize conflict. Staff and visitors would be more desirable than student parking. This is because those groups arrive earlier or later than most peak period travel.

Figure 35. Signal, Midblock, two-way short frontage loop option (HHS)

PERFORMANCE: Figure 36 maps the level-of-service (LOS) and queues of concern for a new midblock signal on Geist Road with a full two-way loop in front of HHS during the AM arrival and PM dismissal peak 15-minute periods. This option performs as well as a full-size one-way loop. LOS, queues, and delays improved for HHS. Sandvik Street congestion at University Avenue was reduced by one-third, just below v/c of 0.8.

RELATED OPTIONS: Instead of a signal, the new driveway/Rebecca Street could be under two-way stop control. This would still provide additional storage for vehicles entering the campus and picking up/dropping off. However, drivers leaving campus would experience similar or worse delays and queues compared to existing. Additionally, two-way stop control would provide no benefits to pedestrians desiring to cross Geist Road.

Figure 36. Midblock Signal with Full Two-way Loop Performance Map

3.2.8 Signal Shared - to both High Schools – NOT RECOMMENDED

DESCRIPTION: This concept examines the impacts of adding access for WVHS to a midblock signal using two-way frontage roads.

PURPOSE: While the signal and frontage roads are of greater benefit to HHS, the purpose of this option is to explore including direct access for WVHS user groups and how it may alter on-campus traffic flows.

BACKGROUND: This option provides insight into the effects of providing access to a Rebecca Street signal that serves both high schools.

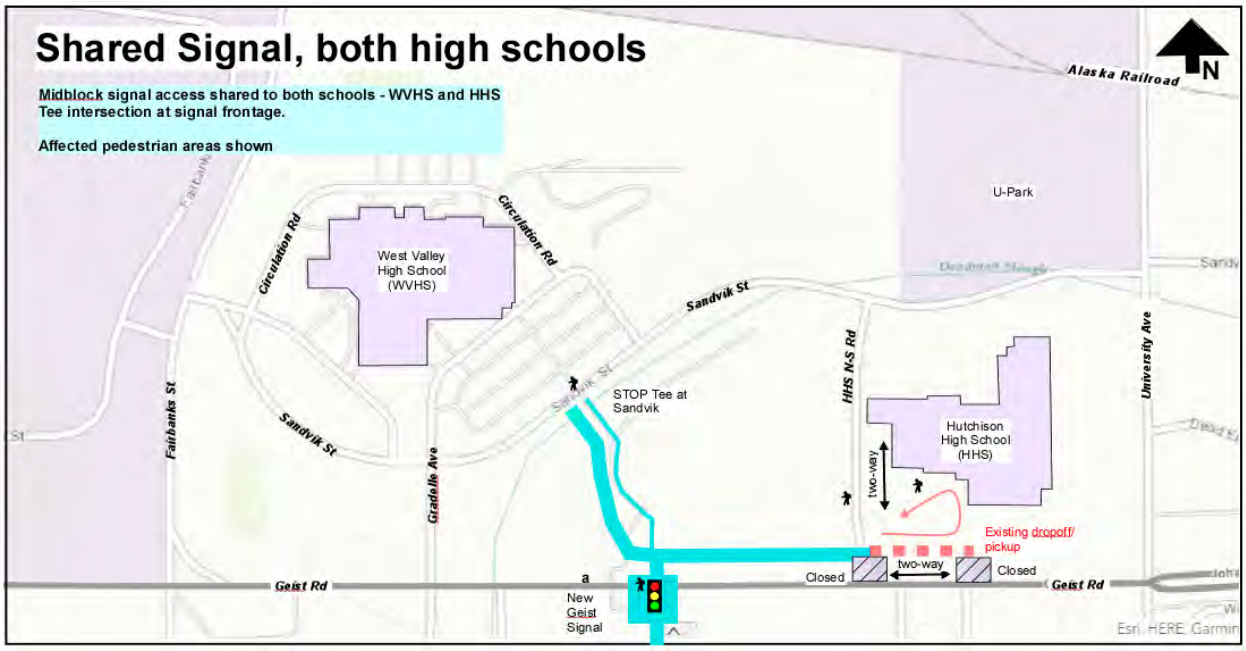


Figure 37. Shared Signal to both High School option

PERFORMANCE: Figure 38 maps the level-of-service (LOS) and queues of concern for a new midblock signal on Geist Road with a tee frontage intersection and two-way roads to both high schools during the AM arrival and PM dismissal peak 15-minute periods. The frontage tee intersection becomes a congested and unstable intersection when it serves both high schools. WVHS right turns have easier access priority and further delay HHS traffic. Sandvik Street at University Avenue benefits from this new diversion of traffic from both schools. However, HHS stop-controlled traffic on the frontage road experience volume-to-capacity ratios exceeding 1.5, leading to long queues and delays back to HHS under LOS F conditions. The impacts and concerns with a shared access frontage road intersection are explored further in Section 4.3 of this report, Volume-to-Capacity Ratio.

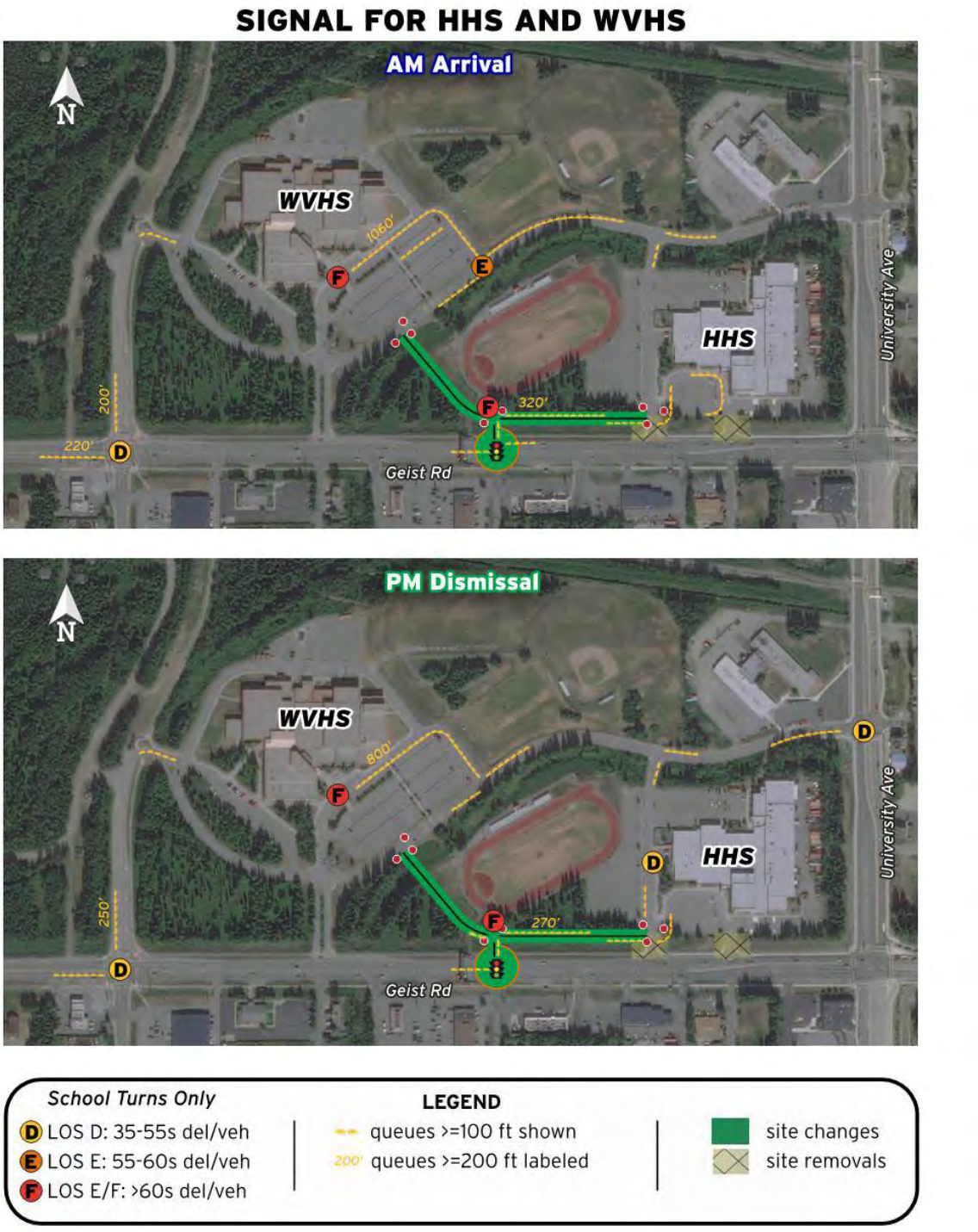


Figure 38. Midblock Signal Shared by WVHS and HHS Performance Map

3.3 Safety and Operations Options

Additional options can improve safety and operations without requiring reconstruction. Various rehabilitation options to improve conditions can be considered. While they may not have a calculable impact on congestion, these options can improve visibility and reduce conflicts, so they can be expected to have some qualitative impact on improving congestion.

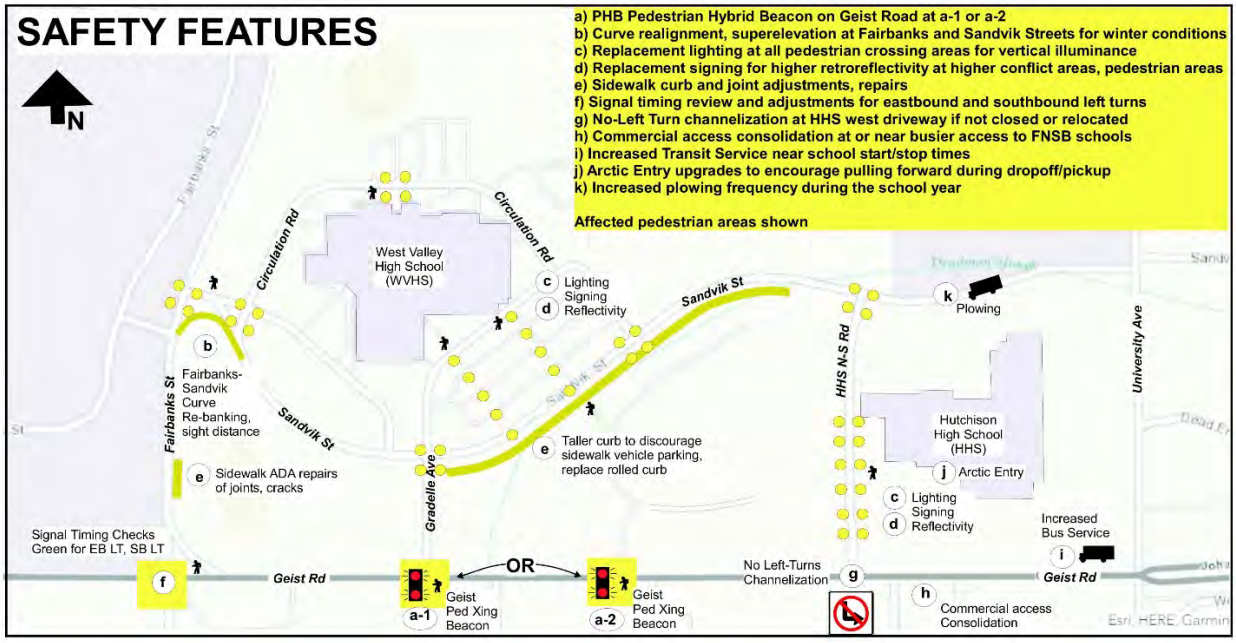


Figure 39. Safety and Operational Improvement Options

The letter in front of each option refer to the locations identified in Figure 39.

3.3.1	**(a) Pedestrian Hybrid Beacon (WVHS & HHS)**	**CONSIDER**
3.3.2	**(b) Fairbanks Street Curve Realignment and Sight Distance**	**CONSIDER**
3.3.3	**(c) Pedestrian Visibility Lighting Replacement**	**RECOMMENDED**
3.3.4	**(d) Pedestrian Crossing Retroreflective Signing**	**RECOMMENDED**
3.3.5	**(e) Sidewalk Barrier Curb**	**CONSIDER**
3.3.6	**(f) Signal Timing Adjustments**	**RECOMMENDED**
3.3.7	**(g) No Left Turns from HHS Prohibition**	**RECOMMENDED**
3.3.8	**(h) Commercial Access Consolidation**	**RECOMMENDED**
3.3.9	**(i) Increased Bus Service**	**CONSIDER**
3.3.10	**(j) Arctic Entry at HHS**	**CONSIDER**

3.3.1 (a) Pedestrian Hybrid Beacon (WVHS & HHS) – CONSIDER

DESCRIPTION: This option would install a Pedestrian Hybrid Beacon (PHB) at either Gradelle Street or Rebecca Street on Geist Road to serve pedestrian and bicyclist crossings.

PURPOSE: The purpose is to improve crossing opportunities for non-motorized use using positive traffic control for a full width crossing of Geist Road.

BACKGROUND: If there are no other signal and access changes along Geist Road selected for vehicular modes, one option is to consider a Pedestrian Hybrid Beacon for pedestrians and bicyclist crossings. This device would be the same as the one already built on University Avenue at Sandvik Street. The PHB would rest in dark mode and only control Geist Road traffic when non-motorized users activate it for service. The location of a PHB would either be at or near Gradelle Street where the existing break in fencing is used by some pedestrians to cross, or a PHB could be located midblock at or near the original pedestrian overcrossing.

Use of a PHB or full traffic signal is a strategy FHWA would consider effective towards reducing carbon emissions, primarily because it allows for travel mode shift from automobile use to walking or transit service. This option was tested in this study at a demand level of about 10 pedestrians over a peak 15-minute period. Beacon red time was cycled as a pretimed device used once every 3 minutes during peak periods. A 3-minute cycle length corresponds to about the same maximum cycle length and waiting time for pedestrians at the existing adjacent traffic signals. These assumptions fit within current signal progression and adjacent wait times. This helps simulate impacts to peak Geist Road traffic on a regular basis.

Figure 40. Pedestrian Hybrid Beacon example (on University Avenue at Sandvik Street)

PERFORMANCE: Figure 41 maps the level-of-service (LOS) and queues of concern for a new midblock Pedestrian Hybrid Beacon (PHB) on Geist Road HHS during the AM arrival and PM dismissal peak 15-minute periods. No onsite improvements are found, and no significant LOS, queue, or delays impacts occur on Geist Road. Pedestrian movements are improved.

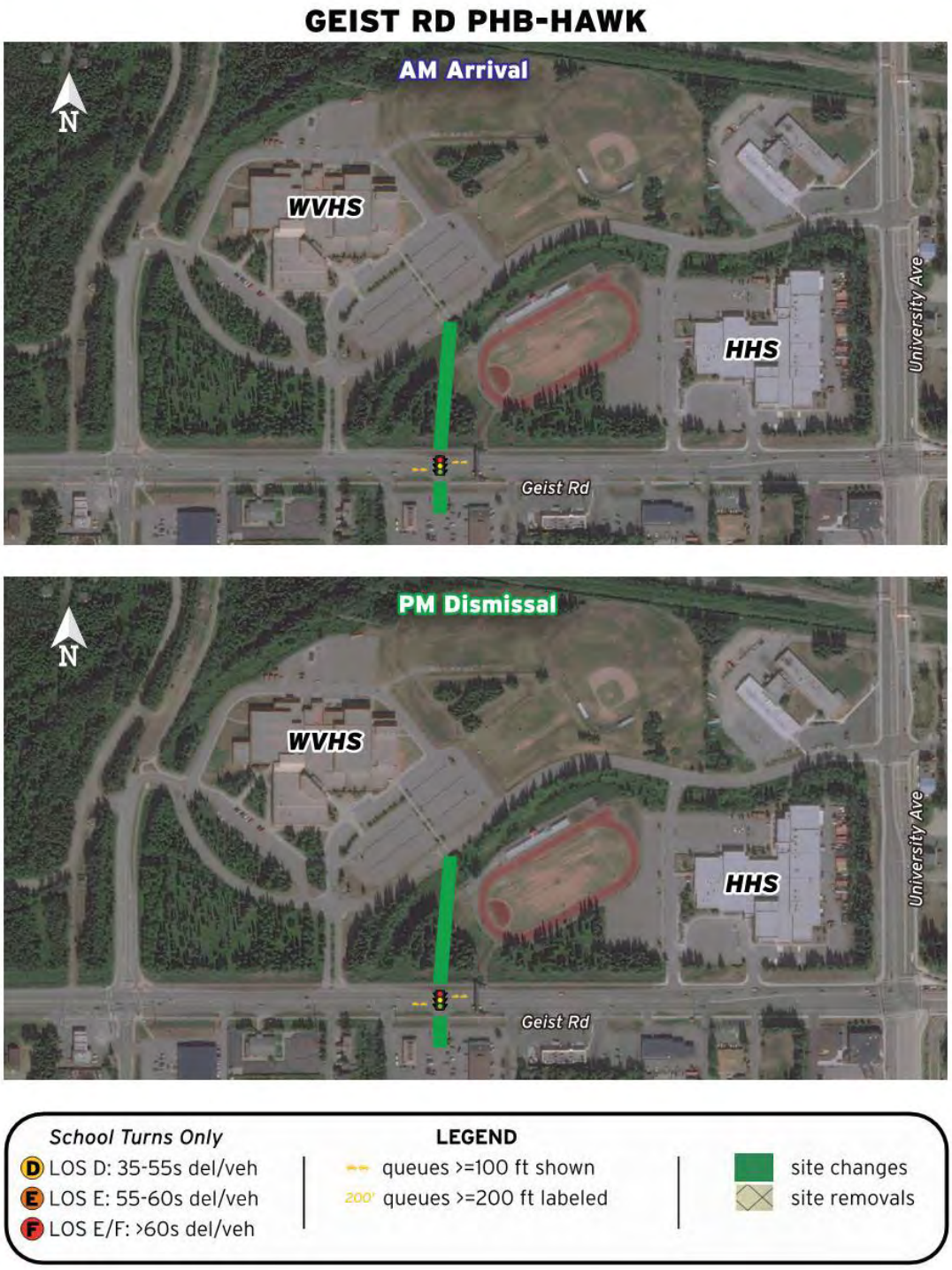


Figure 41. PHB/HAWK on Geist Road Performance Map

3.3.2 b) Fairbanks Street Curve Realignment and Sight Distance - CONSIDER

DESCRIPTION: This option realigns the “driveway” curve at northbound Fairbanks Street onto eastbound Sandvik Street.

PURPOSE: The purpose is to improve curve safety at low speeds under snow and ice conditions.

BACKGROUND: Fall Demonstration Project observations under snow and ice conditions revealed how difficult this northbound curve can be to navigate under extreme very icy conditions. Difficulty appears to be primarily due a lower level of superelevation. This Sandvik Street connection appears to be a remnant of an original side street alignment from a time when Fairbanks Street was a through route. This is now a free right turn movement since Fairbanks Street is closed beyond Sandvik Street. Reconstructing this curve could provide a small superelevation increase to assist drivers negotiating the turn during the worst of snow and ice conditions. Additionally, sight distance concerns at the northbound Sandvik Street STOP sign could be addressed through adjustments to vegetation and signing during curve upgrades.

Figure 42. 24-10-16 WED 7:28 AM Fairbanks Street Northbound to Sandvik Street under freezing rain, first snow

3.3.3 (c) Pedestrian Visibility Lighting Replacement - RECOMMENDED

DESCRIPTION: New LED lighting systems would be designed throughout the campus, with a focus at high conflict areas.

PURPOSE: The purpose of new LED lighting is to improve visibility for all users at high pedestrian-vehicle conflict areas.

BACKGROUND: Lighting placement on-campus was reviewed in relation to high conflict areas, especially marked pedestrian crosswalks. To meet current design standards, lighting would be upgraded with new pole placement at or near crosswalks. New poles, mounting height increases, and vertical illuminance design standards could help increase pedestrian visibility during winter darkness. LED upgrades are a strategy for energy savings and carbon reduction.

3.3.4 (d) Pedestrian Crossing Retroreflective Signing - RECOMMENDED

DESCRIPTION: New high-grade signing would be designed for high conflict areas.

PURPOSE: The purpose of new signing is to improve sign visibility during darkness for all users at high pedestrian-vehicle conflict areas, primarily marked crosswalks.

BACKGROUND: Signing placement for high conflict areas was reviewed on campus at marked pedestrian crosswalks. Under current design standards, height to base of sign panels would require taller posts to make signs more visible and unobstructed by parked vehicles. Sign retroreflectivity testing in Alaska indicates sign sheeting older than 15-20 years in age is not as visible as new signing. New sign sheeting rated as Type 9 or Type 11 are exceptional at improving nighttime visibility. Type 11 excels under low beam headlights.

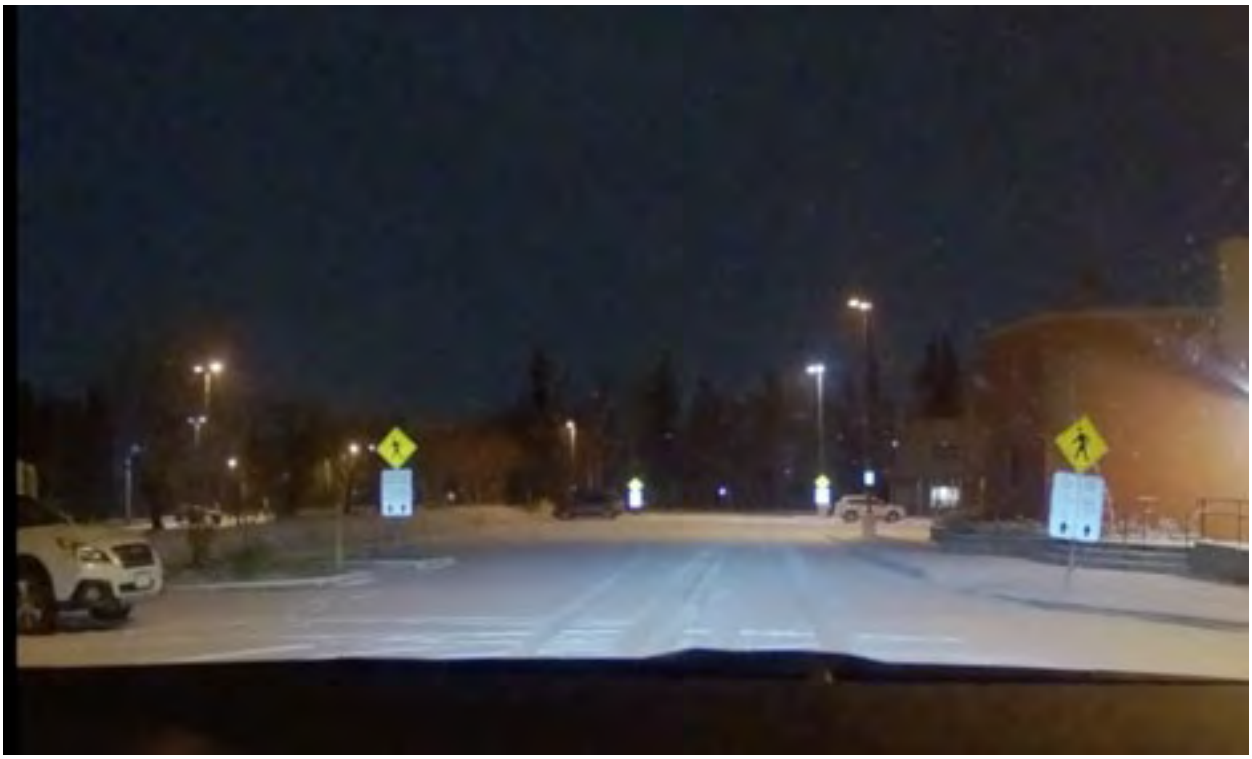


Figure 43. 24-10-16 WED 6:43 AM East and West Main Entrances (2) for Dropoff WVHS westbound

Figure 44. 24-10-16 WED 7:50 AM WVHS Southeast side Student Parking Lot not full, northern aisles

Figure 45. Pedestrian warning signs in parking lot mounted lower than SUV vehicles

3.3.5 (e) Sidewalk Barrier Curb - CONSIDER

DESCRIPTION: This option would rebuild curbing along Sandvik Street and campus roads near high pedestrian use and passenger loading areas. Isolated sidewalk improvements can also repair or replace locations not meeting accessibility standards.

PURPOSE: The purpose is to reduce conflict between roadway vehicles and sidewalk users.

BACKGROUND: Some of the public noted concerns for the lack of a positive buffer between motorist and sidewalk users. Current rolled curb along Sandvik Street makes it easier for motorists to partially park upon the sidewalk during drop-off or pick-up periods. This may not be intentional, as rolled curb becomes harder to distinguish under snow buildup conditions. A standardized or vertical 6-inch barrier curb would provide more positive definition between the sidewalk and the vehicle lanes. This will be more of a barrier during snow plowing operations as well. Before installing barrier curb, plowing equipment capabilities and the potential need for delineators at or near the face of curb should be considered.

Figure 46. 24-10-16 WED 2:00 PM Curbside Pickup on Sandvik St, parallel parking, same vehicles, looking east

Figure 47. Walk auditors

3.3.6 (f) Signal Timing Adjustments – RECOMMENDED

DESCRIPTION: This operational option would have DOT&PF staff review and upgrade signal timing settings and add detection devices as needed.

PURPOSE: The purpose is to efficiently allocate green time to adjust to peak traffic demand and reduce congestion of peak movements. This could improve eastbound Geist Road left turns at Fairbanks Street in the morning period.

BACKGROUND: During the Fall Demonstration Project, eastbound left turn queues at Fairbanks Street and Geist Road were longer than expected, and green timing to serve the left turn movement was observed to be less than what was programmed and expected. DOT&PF has since field checked the site to ensure vehicle detection is working and green time extensions are occurring. With changes in site circulation, signal timing adjustments will be needed, especially if more buses enter the campus at the Fairbanks signal.

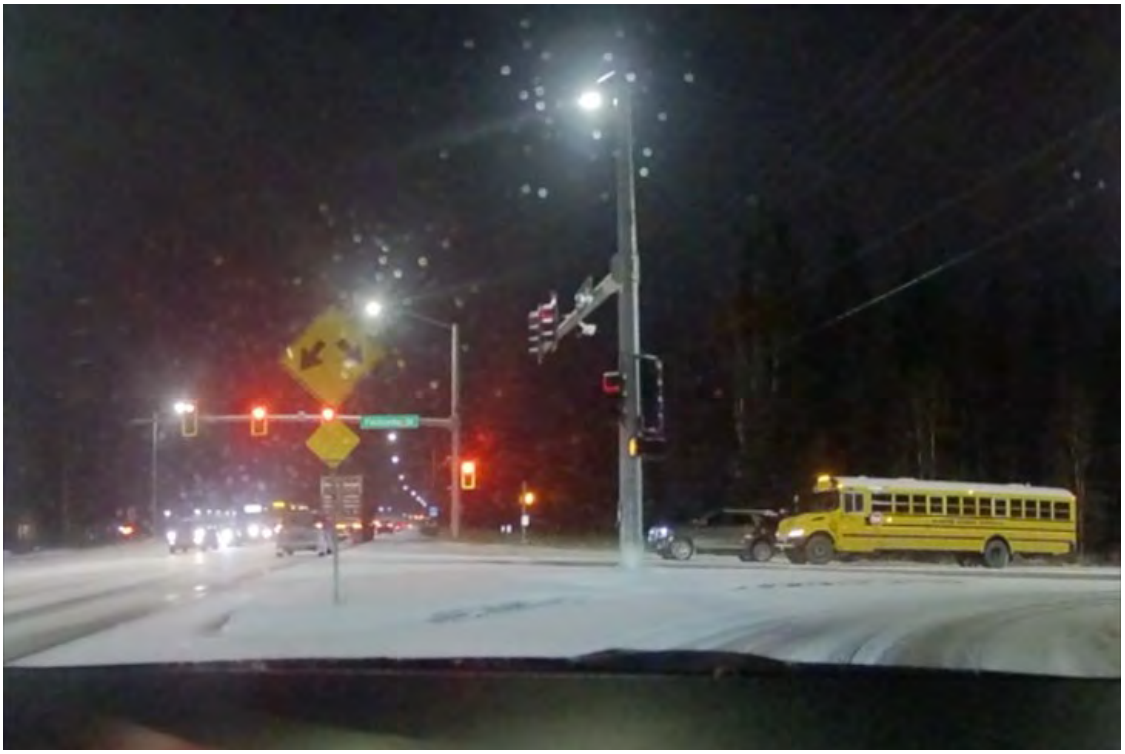


Figure 48. 24-10-16 WED 7:25 AM Eastbound Left Turn queueing (opposite) looking west on Geist Road

3.3.7 (g) No Left Turns from HHS west driveway onto Geist Road – RECOMMENDED

The Fall Demonstration Project demonstrated reductions in left turn conflicts were possible with prohibition of left turns onto Geist Road. While left turns onto Geist Road are currently prohibited at specific times, many drivers are observed ignoring this prohibition and turning when they can. Clear channelization curb similar to that installed at the Gradelle Street

intersection would improve compliance if this option were selected. If this driveway is not closed, then this option is recommended in conjunction with other improvements that offer left turn alternatives elsewhere onsite. Eliminating left turns onto Geist Road from the west driveway removes higher risk conflicting movements within the functional area of the University Avenue and Geist Road traffic signal.

Figure 49. 24-10-15 TUE 2:31 PM No Left Turn signs in afternoon at West Drive and Geist Road

3.3.8 (h) Commercial Access Consolidation – RECOMMENDED

DESCRIPTION: This option would consolidate some commercial driveways spaced along the south side of Geist Road. Some commercial driveways could be aligned with new school access.

PURPOSE: The purpose is to improve decision making and safety by reducing conflicts along Geist Road in the vicinity of school access points to “one decision at a time”.

BACKGROUND: Commercial access spacing is less than the stopping sight distance between each driveway. As commercial access becomes busier and each approach is in use more often, this leads to more than one decision at a time faced by oncoming motorists. When higher volume driveways are separated by stopping sight distance, the motorist’s decision tasks become easier. In the event a new midblock signal, new access, or PHB is selected, some commercial driveways will conflict with the functional area for those new intersection choices. Commercial driveways within the functional area should be closed to all movements or to left turns onto Geist Road. Instead consolidated commercial access at a better location could be shared by adjacent properties away from any new intersection functional area.

3.3.9 (i) Expanded Bus Service - CONSIDER

DESCRIPTION: This option would provide earlier morning public transit service ahead of high school start times.

PURPOSE: The purpose of expanded bus service is to increase options for non-vehicular school travel in order to reduce vehicular congestion.

BACKGROUND: An alternative to infrastructure rehabilitation or reconstruction is to improve access to these schools by public busing. Consider whether MACS Transit schedules could be timed to serve school start and stop times. Consider if adequate demand is possible to support this service sufficiently to adjust bus schedules.

3.3.10 (j) Arctic Entry (HHS) - CONSIDER

DESCRIPTION: This option would encourage the use of the curbside at the main entrance of HHS towards the west end of the drop-off and-pick-up lanes.

PURPOSE: The purpose of modifying the primary entrance to HHS is to encourage passenger loading to move forward and more fully utilize available curb space.

BACKGROUND: Unlike WVHS and the other entrance points to HHS, the main entrance into the HHS building is near the start of the passenger loading zone. Input from the stakeholders and the public, as well as onsite observations, demonstrate motorists tend to stop at or near the main doors to HHS rather than pull forward. As traffic peaks, nearly half of the curbside loading area downstream of the doorways tends to be underutilized. The result is traffic queues begin at or near the main entrance. From that point, queues are more likely to fill internal storage and back out to Geist Road than they would if traffic pulled forward.

Options to address this include education, encouragement, and notices asking drivers to pull forward before letting passengers out of the vehicle. Modifying the building entrance could be another option. An arctic entry which provides more shelter towards the front of the drop-off/pick-up zone could encourage drivers to pull forward during winter darkness and colder weather.

3.3.11 k) Increased Plowing

During the Demonstration Project, snow plowing was critical for both walking and driving through the site. Survey respondents noted that there were some students walking in the road where sidewalks were not plowed and that, in general, travel through the site can be difficult if roads are not plowed wide enough. Recurring snow and ice maintenance make walking and biking more feasible and also benefit vehicle safety.

3.4 Other Options Considered – Not Analyzed Further

Figure 50 presents several options that were considered but either didn't have sufficient merit to analyze further or were outside of the scope of this study.

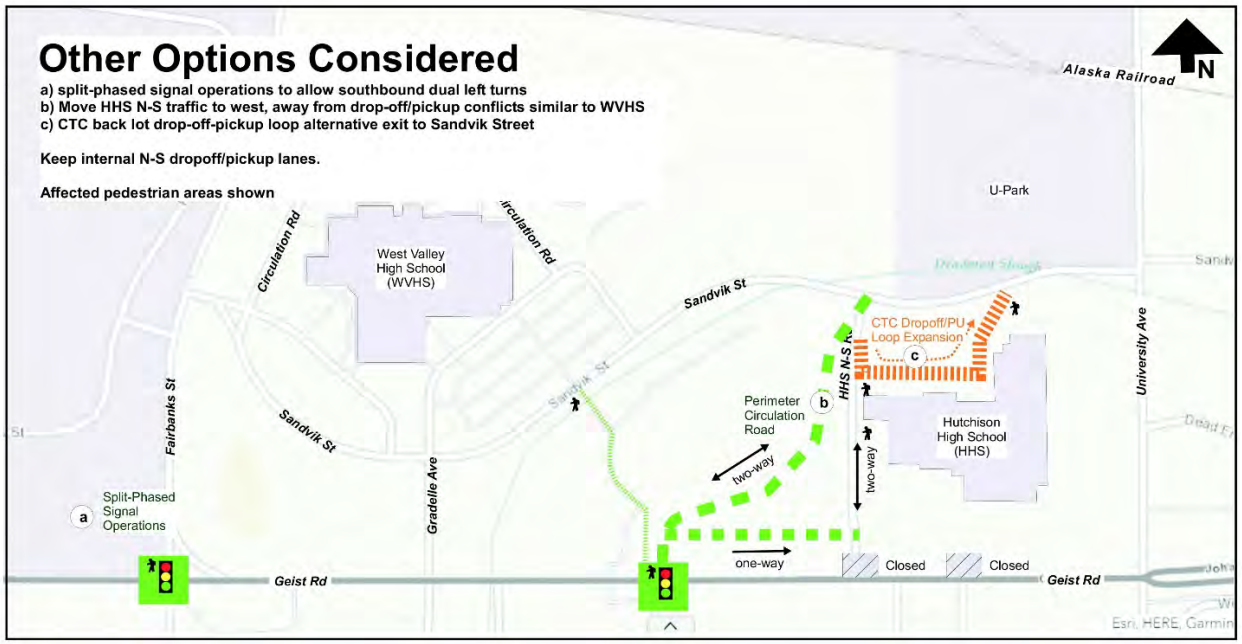


Figure 50. Options considered but not analyzed

The letter in front of each option refers to the locations identified in Figure 50.

3.4.1	(a) Split-phased signal operations	NOT RECOMMENDED
3.4.2	(b) HHS Back Lot Exit	NOT RECOMMENDED
3.4.3	(c) HHS West Perimeter Road	NOT RECOMMENDED
3.4.4	**U-Park Daycare Background Development**	**CONSIDER**
3.4.5	**Vary School Start/Stop Times**	**CONSIDER**
3.4.6	WVHS Roundabout at Gradelle and Sandvik	NOT RECOMMENDED
3.4.7	Multilane Roundabout at University and Sandvik	NOT RECOMMENDED
3.4.8	Pedestrian Bridge Replacement	NOT RECOMMENDED

3.4.1 (a) Split-phased signal operations – NOT RECOMMENDED

During the initial phase of this study, the potential for split-phased signal operations was considered for Fairbanks Street and Geist Road. Southbound Fairbanks Street has lane widths available which could allow dual left turns during peak conditions by converting signing, striping, and overhead signal indications. Dual left turns were considered in this study as a potential mitigation of long queues into the school site.

Dual lefts could be installed without reconstructing the approach lanes if the southbound left, through, and right turn lanes were converted to a southbound left, through/left, and right turn lanes. This would require the signal to be operated as “split-phased,” where southbound and northbound movements can no longer operate simultaneously. Running northbound and then southbound separately requires “two steps” to cycle through side streets each time instead of running both directions at the same time. This can mean longer waits on Geist Road during the rest of the day, even when there is very low traffic on Fairbanks Street.

Because long queues on Fairbanks Street from WVHS are very short duration of five minutes or less, and usually dissipate within one or two signal cycles, this option is not recommended. Southbound congestion occurs primarily due to the mass departure of all buses at once during PM dismissal, holding up other vehicles on campus. Buses are quickly served by the current signal timing. Any need for split-phasing is over in five minutes or less.

Section 4.4 shows southbound left turns operate at a high volume-to-capacity ratio (v/c) during short school arrival and dismissal periods. With existing v/c ratios at or above 0.8 or 80 percent, southbound left turn signal timing and capacity is a concern. This report finds that even with all solutions options tested, v/c ratios remain at or near 0.74 or about 74 percent for southbound left turns. Signal timing and detection operational changes should still be considered before taking the more drastic measure of split-phasing. Signal timing changes in general could avoid the all-day impacts of split phase operations.

Currently, all options do not worsen southbound left turn congestion. If congestion worsens, split-phasing is a lower cost “rehabilitation” type of option. Split-phasing can be considered in the future if needed without impacts to right-of-way or widening of Geist Road.

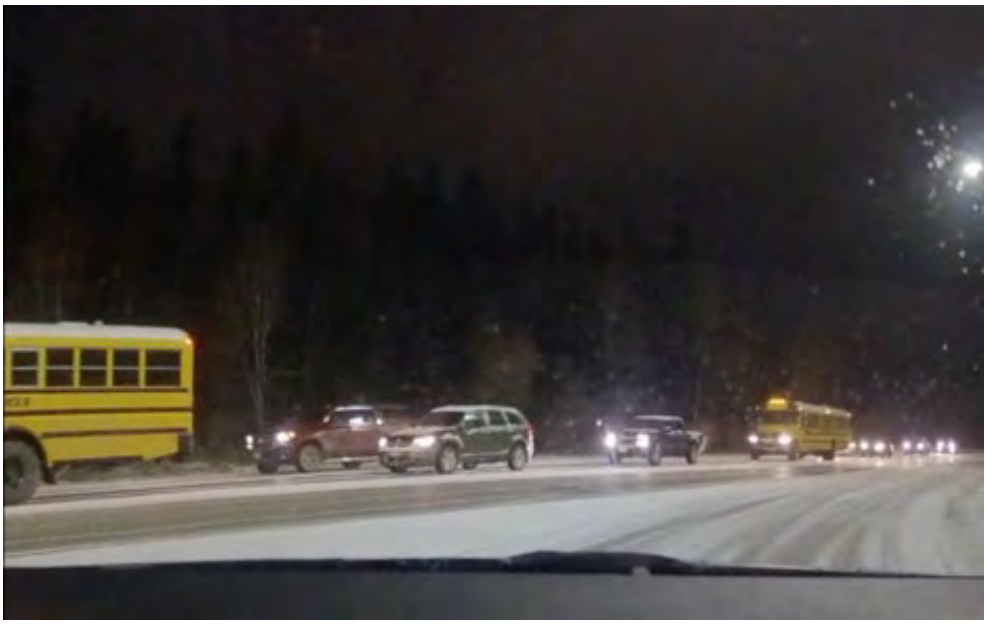


Figure 51. 24-10-16 WED 7:25 AM Southbound Maximum Queues looking north (first snowfall)

3.4.2 (b) HHS Back Lot Exit – NOT RECOMMENDED

The HHS HIT/CTC back lot can be "boxed in" by congestion. One option for providing another way out of this lot is to re-purpose the pathway across Deadman's Slough to Sandvik Street. This connection could be upgraded to a one-way exit from the CTC lot, with a lane and a pathway. This option is not recommended primarily because it reduces the nonmotorized pathway buffer from vehicles, and because it puts departing traffic in the middle of eastbound queues which need to keep moving to University Avenue. This location is also complicated by future U-Park daycare growth.

3.4.3 (c) HHS West Perimeter Road – NOT RECOMMENDED

Borrowing from the relatively smooth operations at WVHS, it can be seen how parking traffic is kept outside of the drop-off and pick-up loop where pedestrian conflicts are higher. Instead, most WVHS parking traffic can travel Sandvik Street and via internal parking lot roads on the perimeter and avoid pedestrians near the building main entries.

Similarly, moving the HHS north-south road to the west perimeter of the HHS parking areas could remove more parking vehicles from conflicting with pedestrians to and from HHS major entry points on the north and south sides of the building. The existing central HHS north-south road can then be downsized to prioritize a longer drop-off and pick-up use zone, with a greater width of sidewalk refuge for pedestrian use in all directions.

Though the principle of perimeter parking access is appealing as seen at WVHS, the HHS property is not wide enough to facilitate moving the main north-south road to the west while

retaining the north-south lanes for passenger loading, not without losing many parking spaces. For this reason, this option is not recommended.

3.4.4 U-Park Daycare Background Development – CONSIDER

The University Park building currently housing the UAF Career and Technical College (CTC) is accessed by two midblock driveways onto Sandvik Street. These driveways enter Sandvik Street within the area of congested peak queuing for WVHS and HHS. Thus, exiting U-Park onto Sandvik Street is difficult during these periods, unless other motorists offer courtesy gaps. Currently, there are minimal conflicts with U-Park during high school peaks, otherwise U-Park traffic would significantly add to congestion on Sandvik Street.

The U-Park building is currently being renovated to be used for a daycare facility. The level of traffic increase associated with this change in use is high enough that a Traffic Impact Assessment (TIA) should be completed, focused on the future needs of this building and site. Site circulation planning also appears necessary.

Improvements to the U-Park facility are not in the scope of this study; however, additional onsite circulation options for U-Park daycare could reduce conflicts on Sandvik Street. Similar to the next section, consideration of daycare start and stop times outside of the current high school peak 15-minute periods could also have an impact on congestion.

Figure 52. U-Park TIA Needs

3.4.5 Vary School Start/Stop Times – NOT RECOMMENDED

Before considering infrastructure changes, another option to reduce conflicts is to change the start and stop times of conflicting users. This is similar to how teachers arrive earlier and leave later than students and can be seen as reducing conflicts within the peak 15-minute student arrival and dismissal period. Visitors also arrive and depart outside of peak 15-minute periods. Another successful example of this option already in place, is how the two high schools allow for "extension" or delayed start times for student's class schedules. "Extension" was observed to have significant benefits onsite as students trickled in past the peak 15-minute period when congestion was essentially over with.

Expanding on the proven use of alternating arrivals and departures could greatly reduce conflicts. The biggest option would be to start HHS and WVHS at different times, more than 15 minutes apart. However, because these are both high schools with the same grade levels, and parents have students at both schools, this option was not considered further. This option would be difficult to model without input and interest from the community and school district.

Figure 53. 24-10-13 SUN 1:41 PM U-Park Building access to midblock Sandvik St (2 driveways)

3.4.6 WVHS Roundabout at Gradelle and Sandvik – NOT RECOMMENDED

A single lane roundabout was briefly considered at the Gradelle Avenue and Sandvik Street all-way stop. While the intersection is wide, it is not large enough for an efficient single lane roundabout diameter. A small diameter roundabout risks difficulty for motorists accepting gaps. Close proximity to internal parking lot and loading zone intersections risks queues backing into

the roundabout. Existing bus departure queues have been observed to briefly back into this intersection. Queuing into the roundabout gridlocks movement. By remaining an all-way stop, the intersection can remain clear. A roundabout was not found to offer any significant congestion and safety benefits over existing conditions.

3.4.7 Multilane Roundabout at University and Sandvik – NOT RECOMMENDED

A multilane roundabout at University Avenue and Sandvik Street was briefly considered. The benefits of a multilane roundabout would be that it can continue to serve high volume University Avenue traffic while enabling entry of Sandvik Street left turns more easily by converting them to right turns. However, this option was dismissed for several reasons. Pedestrian crossing on the south leg would have to remain signalized, affecting roundabout operations. The large footprint for a multilane roundabout diameter greatly impacted adjacent properties. As this report shows, other options are available with less right of way and operational impacts.

3.4.8 Pedestrian Bridge Replacement – NOT RECOMMENDED

As noted in the Safe Routes to School Guide[1], "The location selected for any bridge or tunnel is an important factor in its effectiveness. Like all pedestrian crossings, any facility that is inconvenient or requires an indirect path will simply not be used. The effectiveness of a grade-separated crossing depends on its perceived ease of use by the users. Pedestrians will weigh the perceived safety benefit of using the bridge versus the extra effort and time it will require when making a decision about where to cross. **Often it is best to redesign the crossing or modify the traffic control at the at-grade crossing instead of building an over- or underpass**." (emphasis added)

[1] See http://guide.saferoutesinfo.org/engineering/pedestrian_and_bicycle_bridges_and_tunnels.cfm

4 Performance Comparison and Consideration of Options

This section shows the performance measures of improvement options. More detailed data outputs are attached in the Appendices.

As stated earlier, both Synchro and SimTraffic were used to determine the network and intersection performance of future options. This report shows the worst locations in the school campus network using both of these tools and compares options using equal assumptions across the network. The result is a "relative" comparison of the most significant campus bottlenecks. Four of the top bottlenecks are tested and confirmed further in Section 4.3 Volume-to-Capacity Ratio (v/c) Checks.

4.1 Congestion Performance Indicators at the Network Level

Rehabilitation and reconstruction options are compared at the network level in the following charts, including performance of arterials adjacent to the high school campus. Network performance is measured during the highest peak 15-minute periods of the AM Arrival and PM Dismissal hours and are not averaged out over the rest of the hour. Because most motorists arrive and depart the campus over a 20- to 30-minute period, measuring and modeling the peak 15-minutes more closely demonstrates congestion and delay occurring during the worst part of school attendance times. The half hour either side of this peak period experiences much lower traffic.

Network performance was measured using four indicators:

1) Average delay per vehicle (seconds per vehicle)
2) Total Network Delay (hours)
3) Vehicle Miles of Travel (VMT)
4) Carbon Emissions CO2 (grams)

Delay was reduced under two options:

3.1.2 Sandvik Street, Weaving Lane plus Extended and New Turn Lanes (HHS) – **CONSIDER**
3.1.3 University Avenue Southbound Right Turn Lane to HHS – NOT RECOMMENDED
3.2.1 West Loop Drop-off/Pickup Zone Conversion (WVHS) – **RECOMMENDED**

Delays became greater under two options:

3.2.3 Signal, 1-way, Small Loop (HHS) – NOT RECOMMENDED
3.2.5 Midblock STOP, 1-way, Small Loop – NOT RECOMMENDED

Other variations of a midblock signal which include retaining the east driveway at HHS have a higher risk of queueing spillover onto Geist Road and are not recommended in this report.

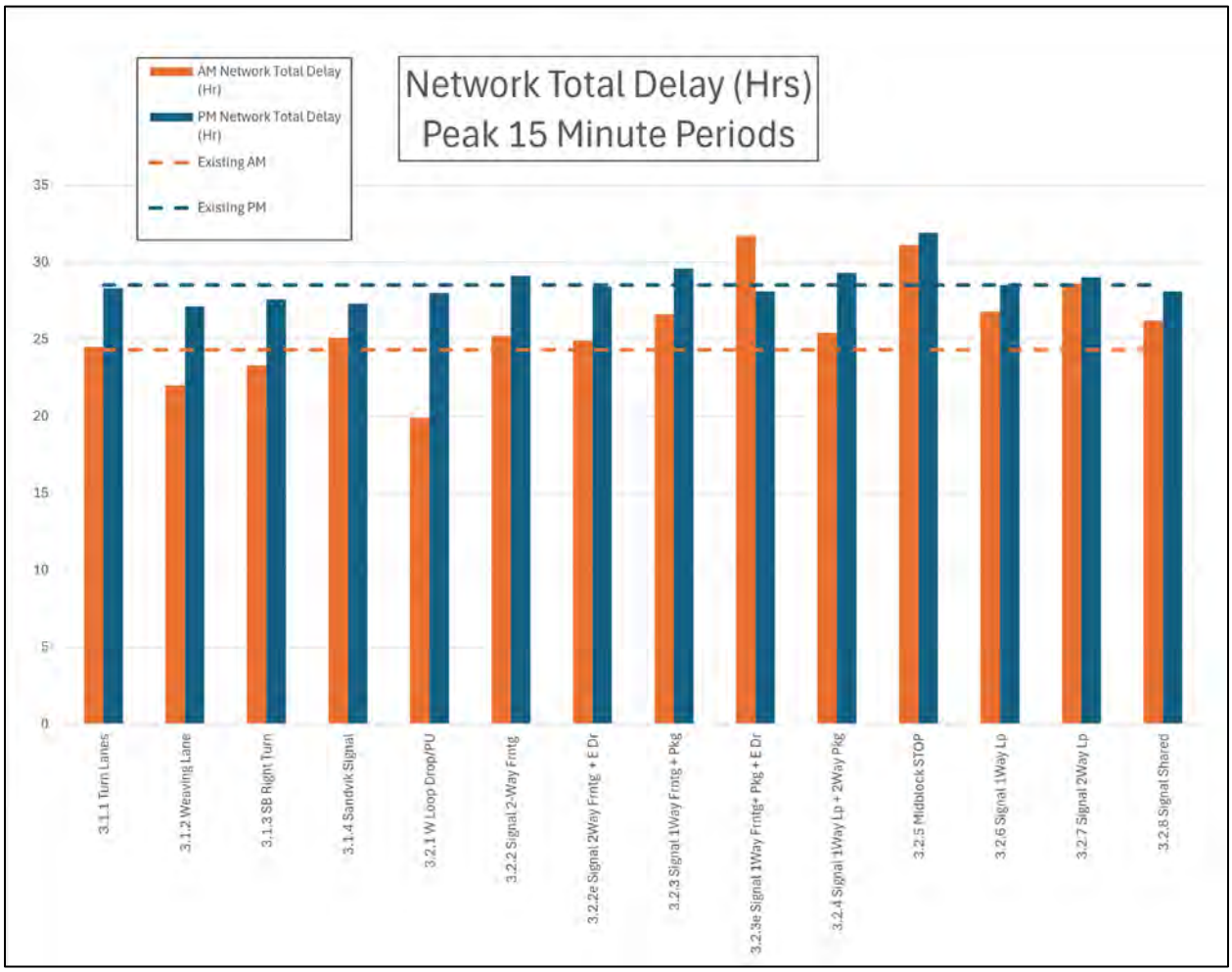


Figure 54. Comparison of Total Network Delay across Options

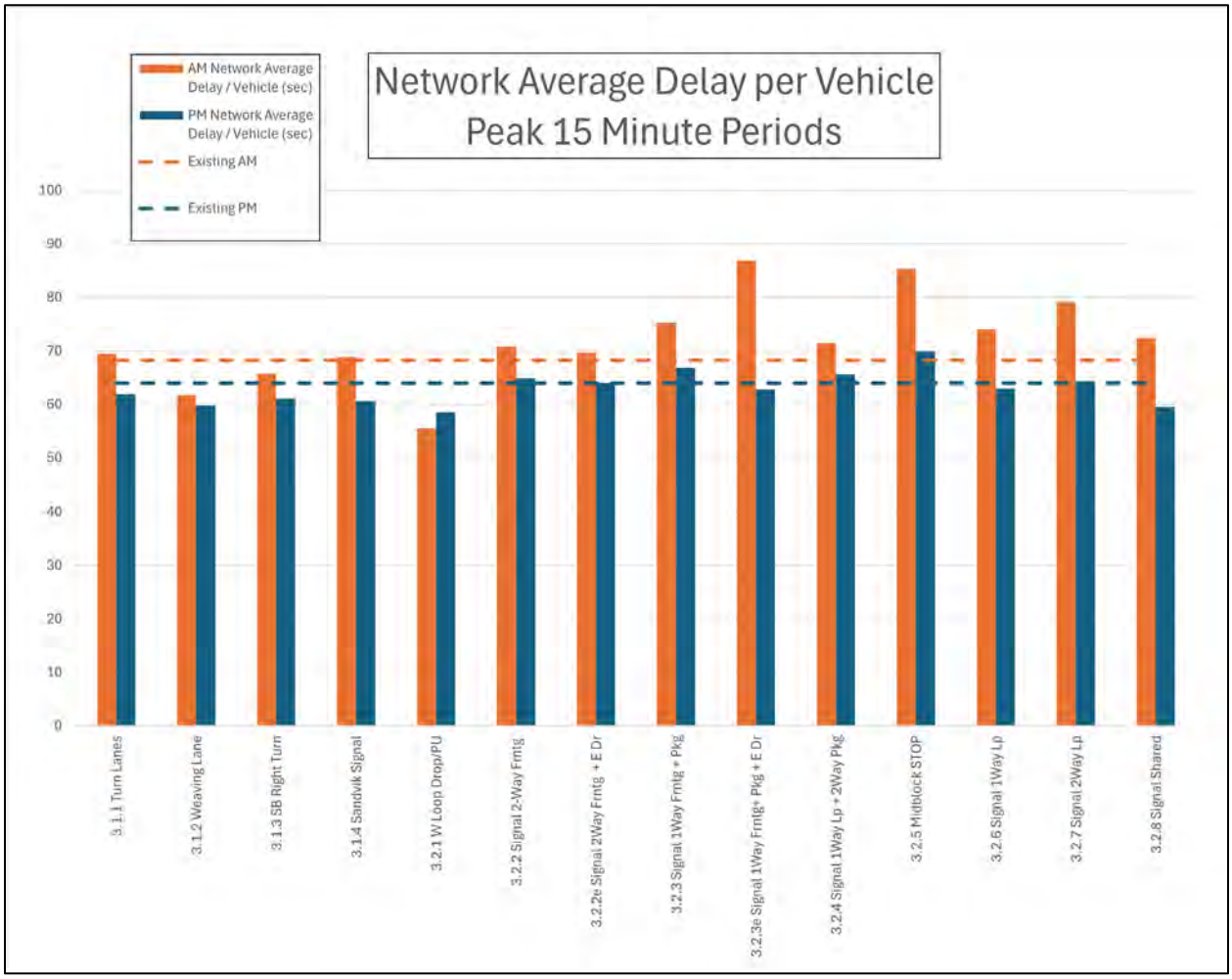


Figure 55. Comparison of Average Delay per Vehicle across Options

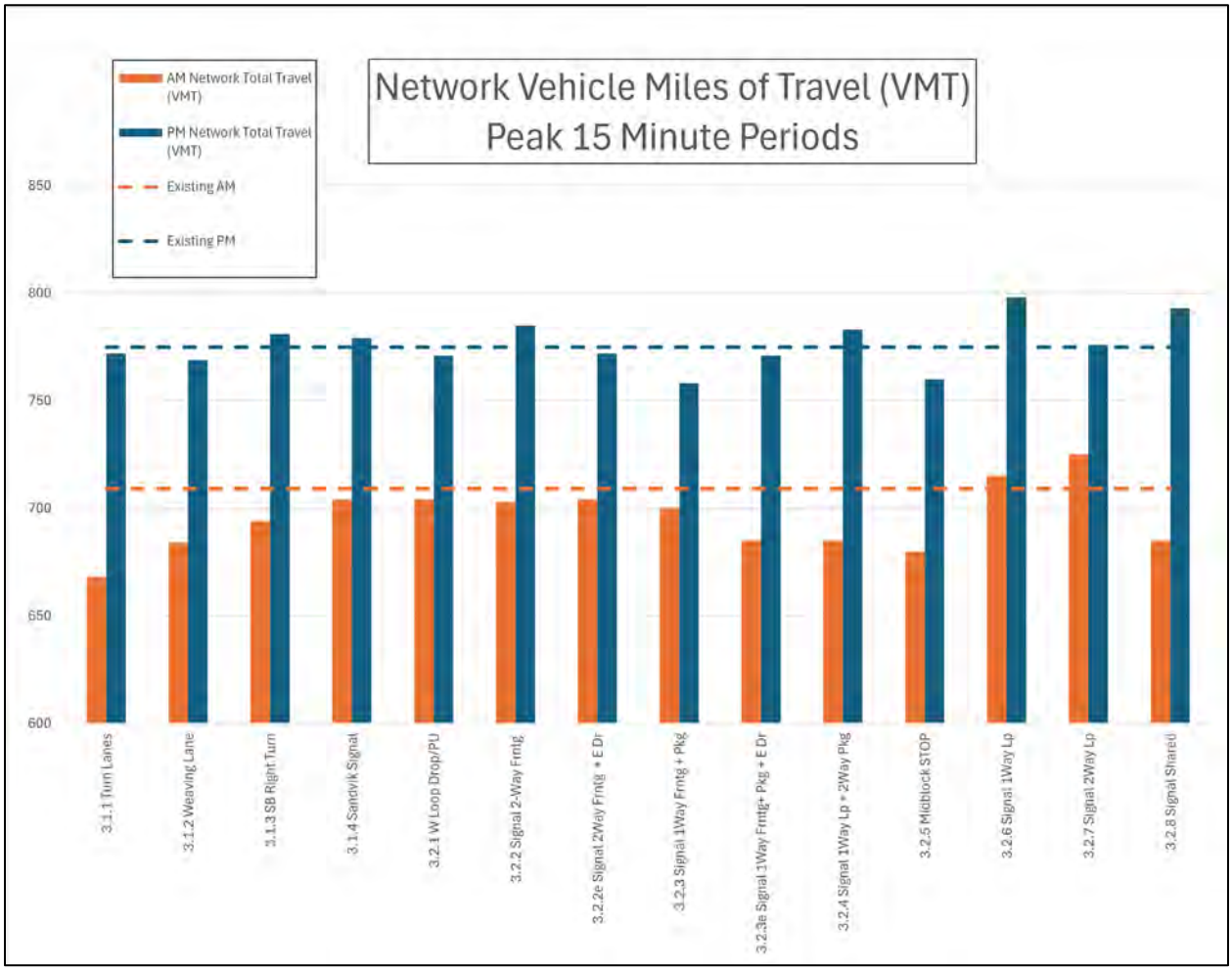


Figure 56. Comparison of Vehicle Miles of Travel across Options

Vehicle Miles of Travel (VMT) worsens during the AM period under one option:

3.2.6, Signal, 1-way, Big Loop (HHS) - **RECOMMENDED**

This option is retained because it is shown to improve other conditions.

Carbon emissions at the network level are not significantly changed between options. Conversely, carbon emissions are not significantly worsened either. The majority of emissions

are from higher volume non-school related traffic on the arterials. Three options increase carbon emissions by small amounts at the network level:

3.1.3 University Avenue Southbound Right Turn Lane to HHS University Avenue Southbound Right Turn Lane to HHS (HHS) – NOT RECOMMENDED
3.2.6 Signal, 1-way, Big Loop (HHS) - **RECOMMENDED**
3.3.1 Pedestrian Hybrid Beacon on Geist Road - **CONSIDER**

Carbon emission increase as more vehicles are moving versus idling. These results can occur counter to mitigating congestion in the form of queues and delays. While these three options do not significantly change network delays over existing conditions, small increases in emissions are evident due to more acceleration and movement.

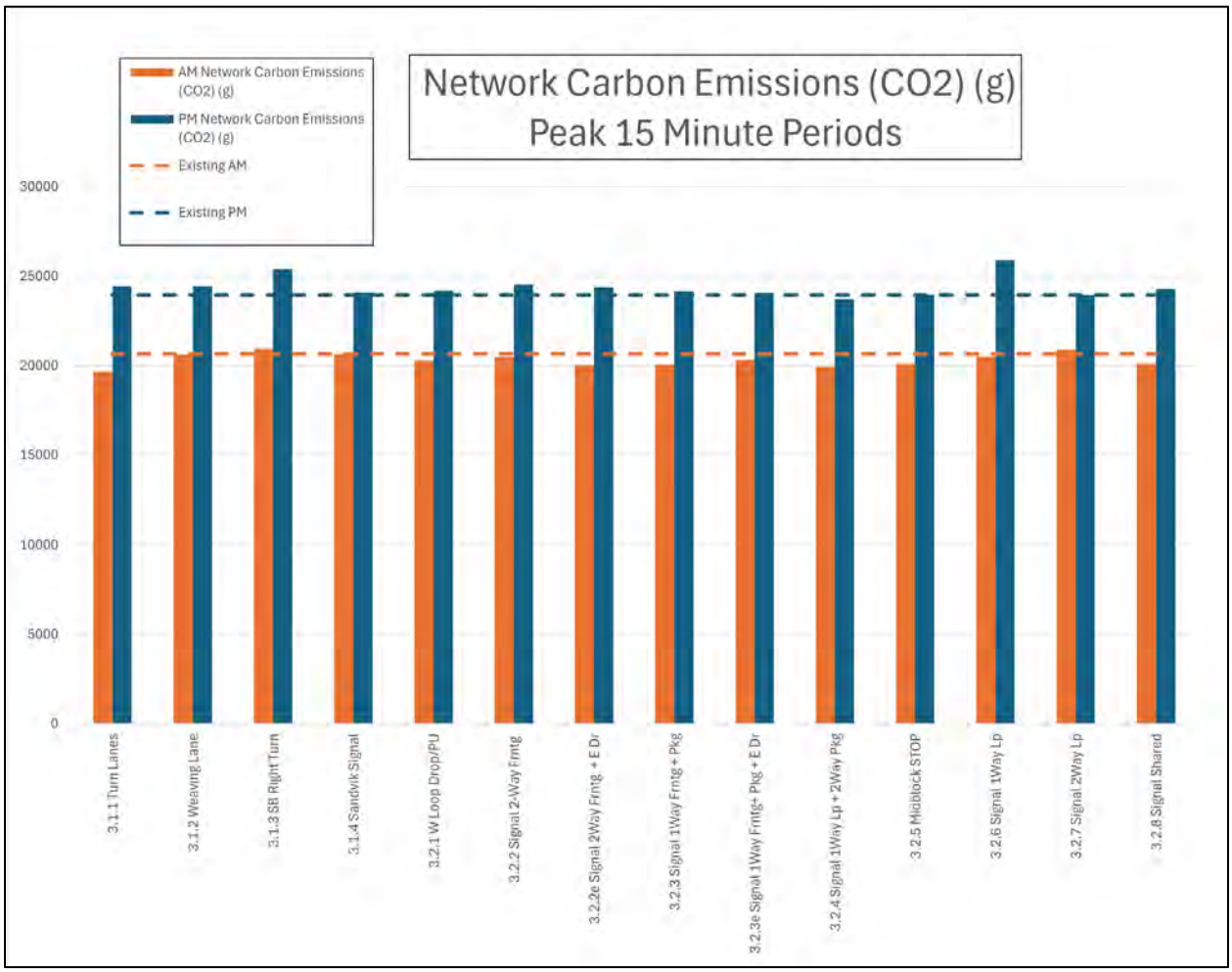


Figure 57. Comparison of Carbon Emissions across Options

4.2 Congestion Performance Indicators internal to Campus

Each option modeled shows the change to the most significant queues and delays which occur at each school entrance. Charting results indicates which options improve congestion at high school entrances during both AM arrival and PM dismissal periods.

4.2.1 WVHS West Valley High School Main Entrance

Figure 58 and Figure 59 show the two options directly linked to WVHS noticeably reduce WVHS queues and delays, more so in the PM dismissal period:

3.1.4 Sandvik Signal at University Avenue – **CONSIDER** - by improving operations during short peaks out at University Avenue, WVHS main entrance dismissal is shorter. AM traffic is not improved but worsened.

3.2.1 West Loop Drop-off/Pickup Conversion (WVHS) - **RECOMMENDED** – by removing demand directly from the east WVHS loop.

Other options tested may have some effect but do not show significant changes to WVHS queues because they are not directly changing WVHS circulation. Other options focus on HHS circulation. When these options help HHS, this can mean faster arrivals at WVHS and some variation in queues and delays for WVHS.

Improving turn lanes around the campus does not help both AM arrival and PM dismissal periods equally. From KE team experience, full length auxiliary lanes on the main arterial can have the unintended consequence of increasing speeds of adjacent lanes and increasing arrival rates at the downstream destination, in this case the school's main entrance. The traffic models appear to show this effect is occurring. Sometimes traffic calming is desirable by using shorter turn lanes to manage speeds and meter traffic. This is not to imply having no turn lane is better, as no turn lanes can lead to greater speed differentials and increasing safety and congestion risks.

While emissions are not significantly changed at the total network level, air quality at or near entrances are improved when queues and delays are reduced.

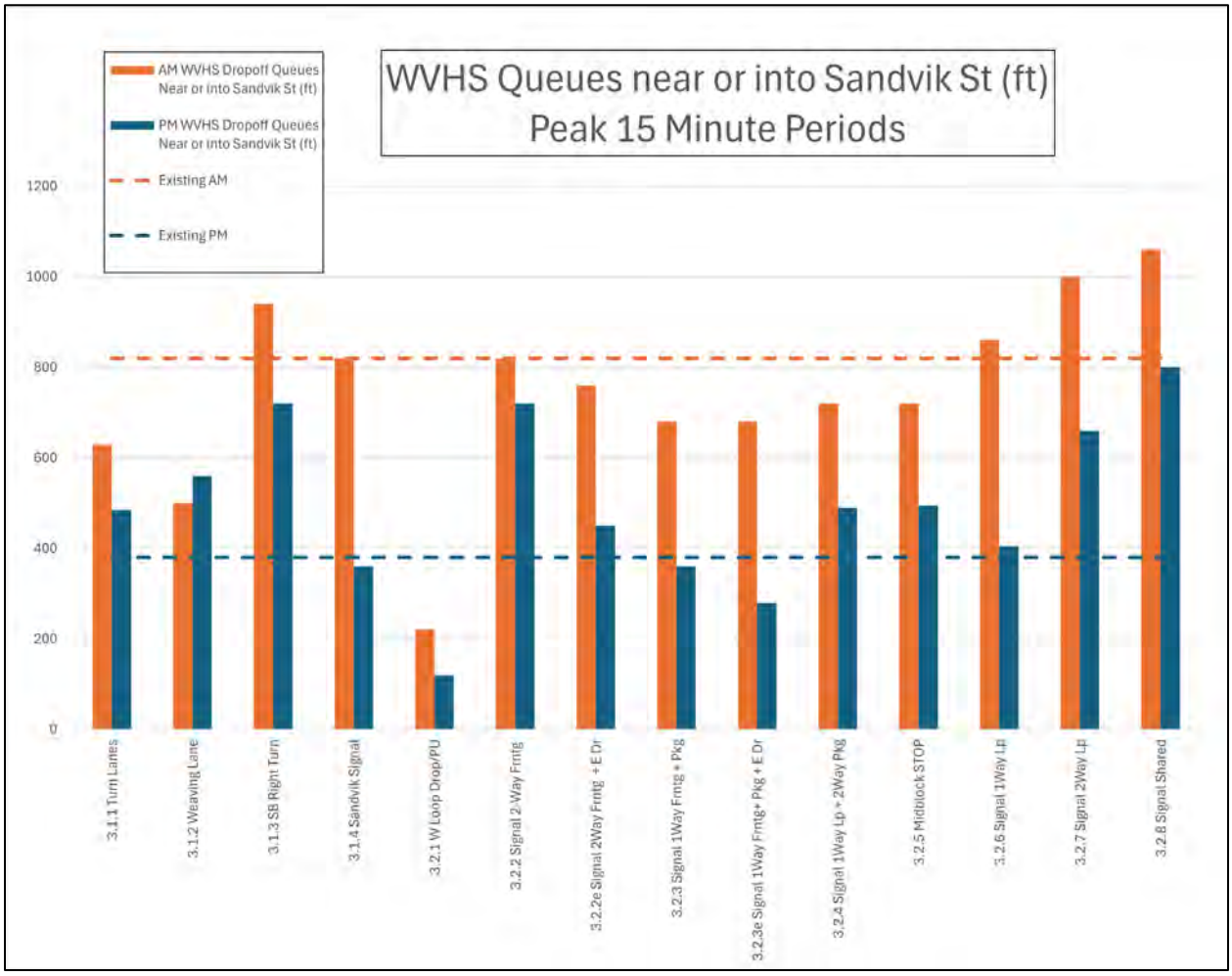


Figure 58. WVHS Queues near or into Sandvik St across Options

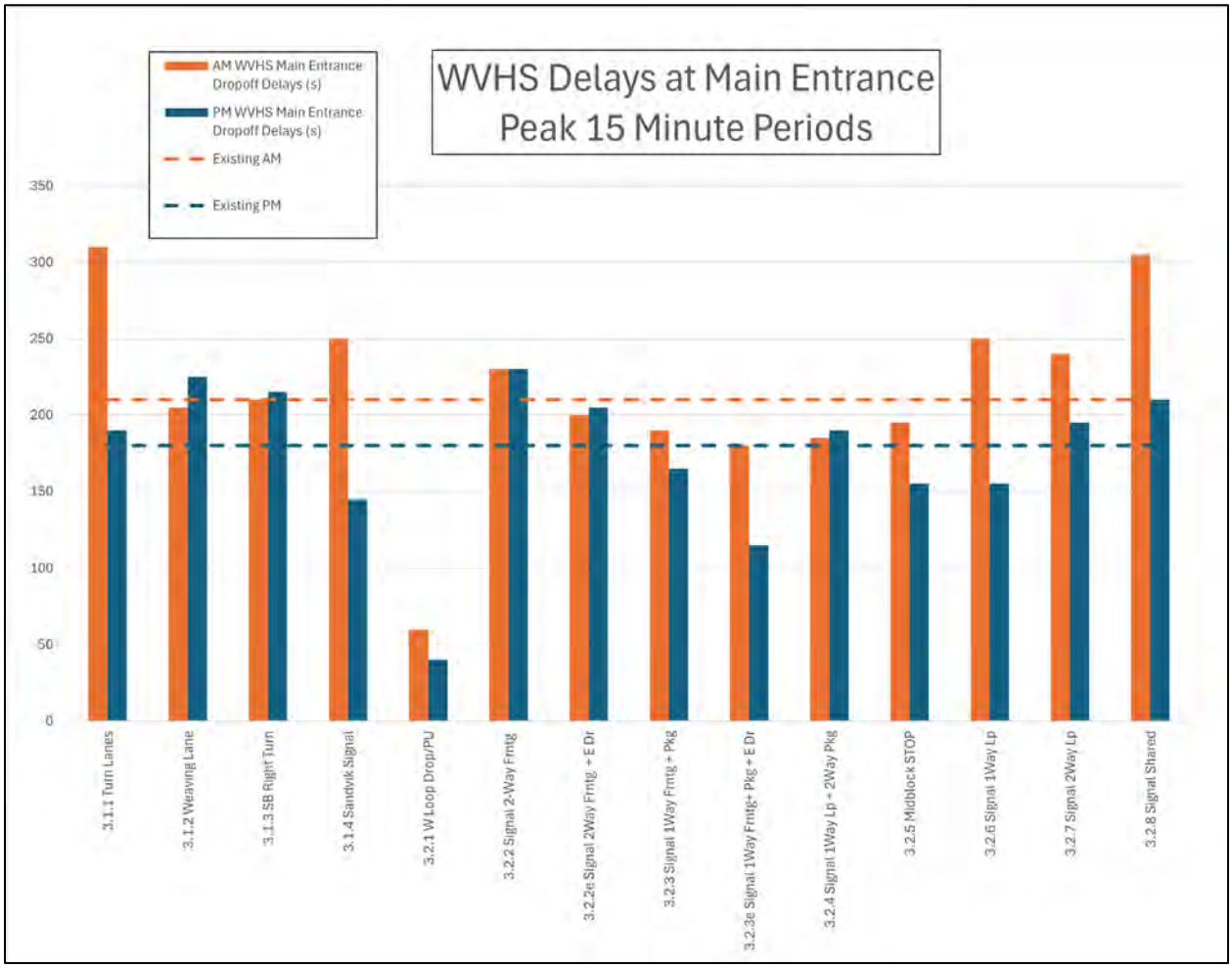


Figure 59. WHVS Delays at Main Entrance across Options

4.2.2 HHS Hutchison High School Frontage, Main Entrance

Figure 60 and Figure 61 show more of the signal options which link directly to reduce queues and delays at HHS. It is critical to find the options that prevent queueing onto Geist Road. Those options which help both queues and delays include:

3.1.4 Sandvik Signal at University Avenue – **CONSIDER**
3.2.2 Signal, 2-way Frontage (HHS) – **CONSIDER**
3.2.6 Signal, 1-way Big Loop (HHS) – **RECOMMENDED**
3.1.1 and 3.1.2 Turn Lanes – **CONSIDER** - improving turn lanes onto campus appears to worsen both periods with more downstream effect at HHS than at WVHS. As stated for WVHS, full length auxiliary lanes can have the unintended consequence of increasing speeds of adjacent lanes and increasing arrival rates at the downstream destination, in this case the school's main entrance. The traffic models appear to show this effect is occurring. Sometimes traffic calming is desirable by using shorter turn lanes to manage speeds and meter traffic. This is not to imply having no turn lane is better, as no turn lanes can lead to greater speed differentials and increasing safety and congestion risks.

Other options appear to worsen HHS congestion as follows:

3.1.3 Southbound right turn lane (from University Avenue) – **NOT RECOMMENDED** While this option provides quick access to HHS, it also increases conflicting traffic from the east at the driveway frontage to HHS drop-off, pick-up. The east driveway frontage intersection risk of queuing and backups onto Geist Road remains unsolved.
3.2.1 West Loop Drop-off/Pickup Conversion (WVHS) – **RECOMMENDED** - for modeling where WVHS is the only improved area, this shows how downstream efficiency for WVHS leads to increased delays for HHS to wait to get to Sandvik Street. Similar to the Fall Demonstration Project, HHS experienced more dismissal delay than WVHS. This indicates a West Loop Conversion is of less value as an isolated solution to WVHS only and instead is of more benefit if combined with improvements to HHS.
3.2.3 Signal 1-way, Small Loop (HHS) – **NOT RECOMMENDED**. This is to the north-south road only (sculpture island drop-off/pick-up area). While these don't significantly affect WVHS, HHS does not benefit from emphasizing this short north-south area as the destination for loading and unloading.
3.2.5 Midblock STOP, Small Loop, No Signal – **NOT RECOMMENDED**. While not as significant to the network or WVHS congestion measurements, HHS congestion deteriorates under this option.
3.2.7 Signal, 2-way, Big Loop (HHS) - **RECOMMENDED**. While the queues are longer than existing, they have adequate internal storage and are not risking queuing onto Geist Road. In addition, mixing in internal parking access increases conflicts and delays measured for

motorists. This option removes significant pedestrian loading/unloading conflicts not quantified in the simulation results.

While emissions are not significantly changed at the total network level, air quality at or near entrances are improved when queues and delays are reduced.

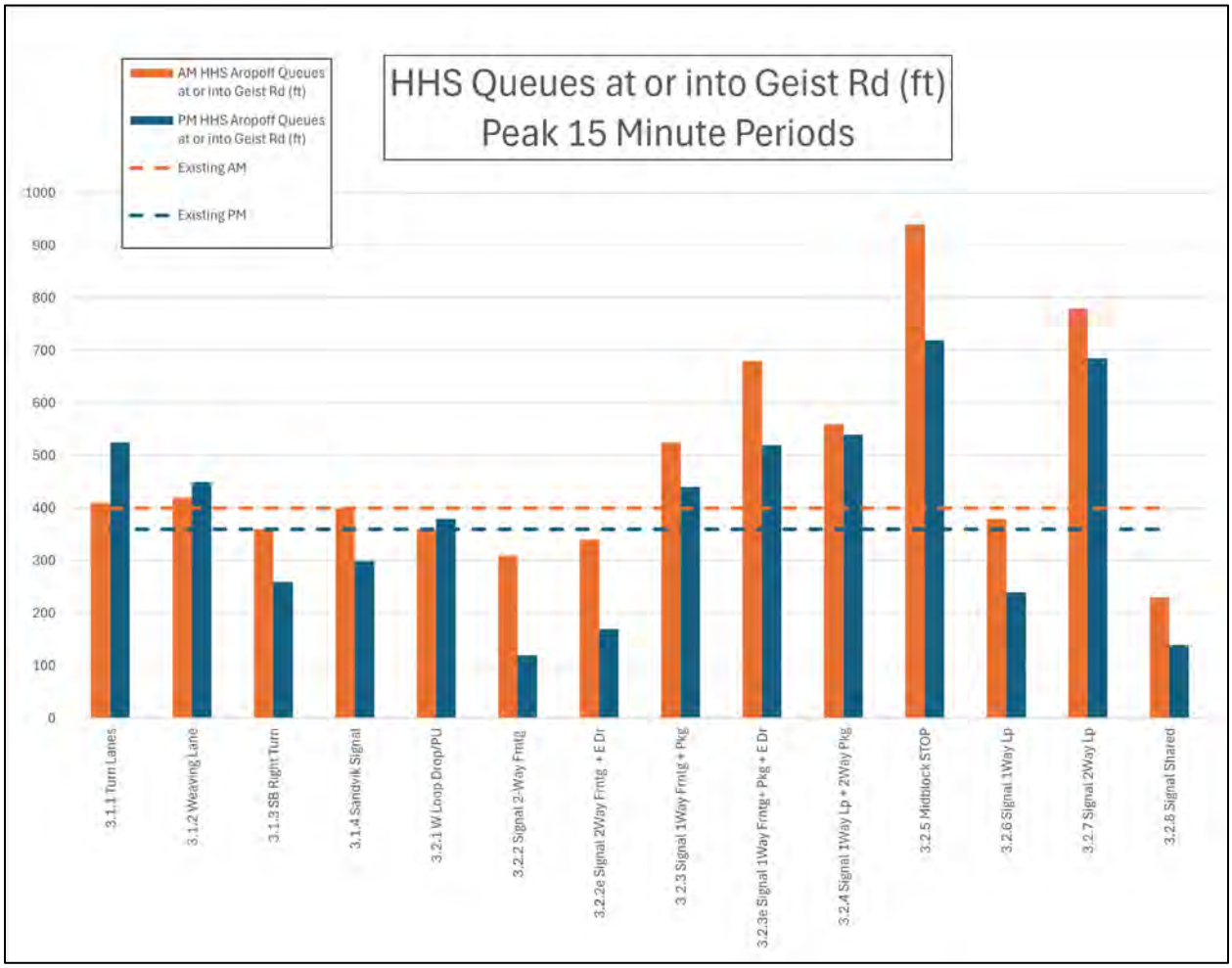


Figure 60. HHS Queues at or onto Geist Road across Options

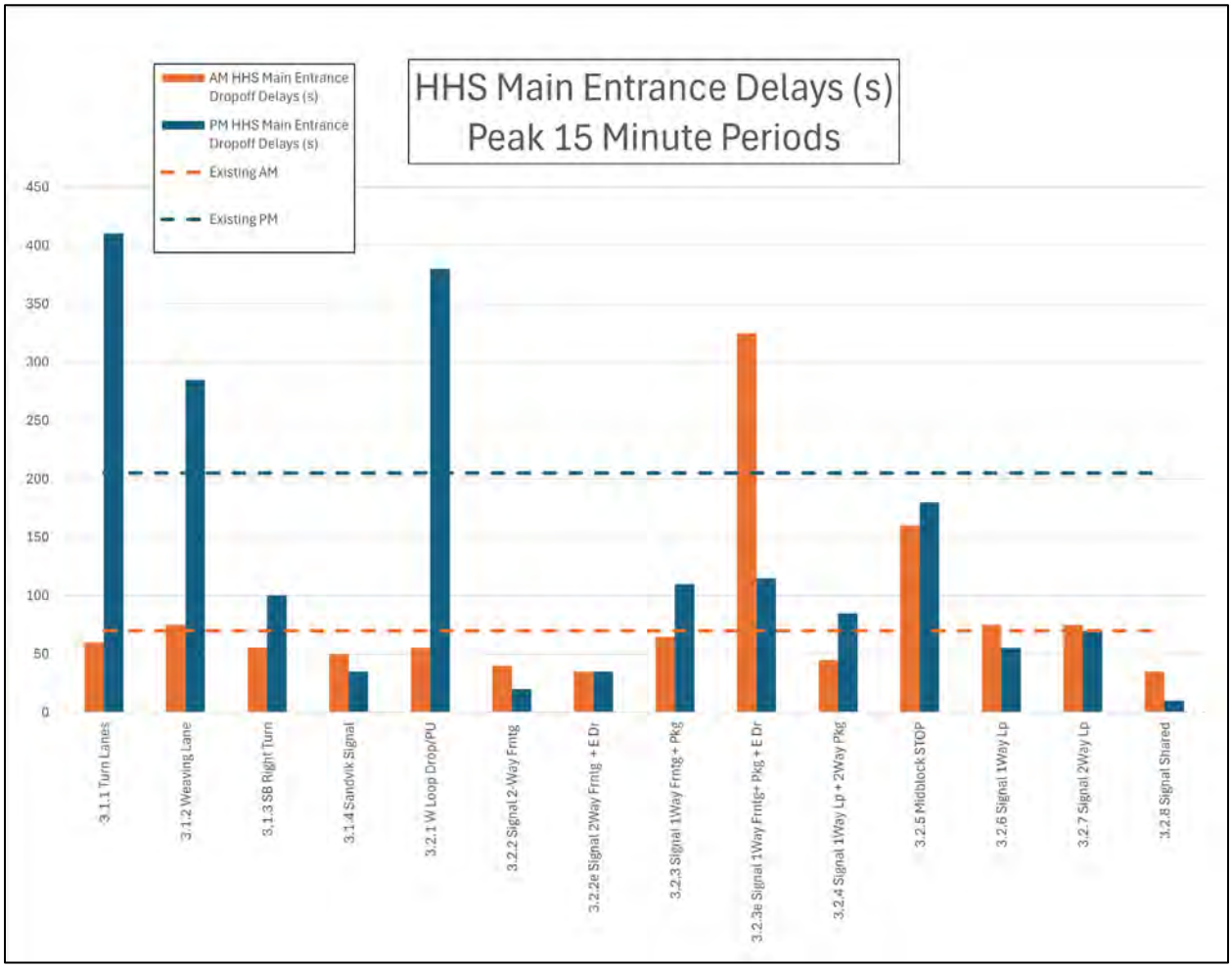


Figure 61. HHS Entrance Delays across Options

4.3 Volume-to-Capacity Ratio (v/c) Checks

Best options for consideration or recommendation were confirmed by checking volume-to-capacity ratio (v/c) results for turning movements in each option simulated. This report checked school traffic when v/c ratios for individual turning movements were found to be at 0.8 or higher. When turning demand approaches 80 percent or more of capacity, this was flagged by this project as a generally understood threshold of concern.[2] At or above this value, traffic capacity can be volatile, leading to stop and go traffic, longer queues and queue spillover, and long potentially intolerable delays measured in minutes, not seconds.

Four key intersections show v/c greater than or equal to 0.8 under existing conditions. As shown Figure 62, high v/c ratios are indicated at the top three intersections of concern for the FNSB campus. Turning movement conflicts at these locations initiate the most congestion during peak periods by holding up other movements and cascading upstream in the form of long queues and long delays. These top three locations are:

a) West Valley High School Main Entrance pedestrian crosswalk
b) West Valley High School at Fairbanks Street, southbound left turns onto Geist Road
c) Hutchison High School southbound left turns onto Geist Road
d) Both high schools, eastbound left turns from Sandvik Street onto University Avenue

[2] FHWA Traffic Signal Timing Manual, Chapter 3.3.5 Volume-to-capacity ratio. Movements or lane groups with volume-to-capacity ratios less than 0.85 are considered undersaturated and typically have sufficient capacity and stable operations. For movements or lane groups with a volume-to-capacity ratio of 0.85 to 1.00, traffic flow becomes less stable due to natural cycle-to-cycle variations in traffic flow.

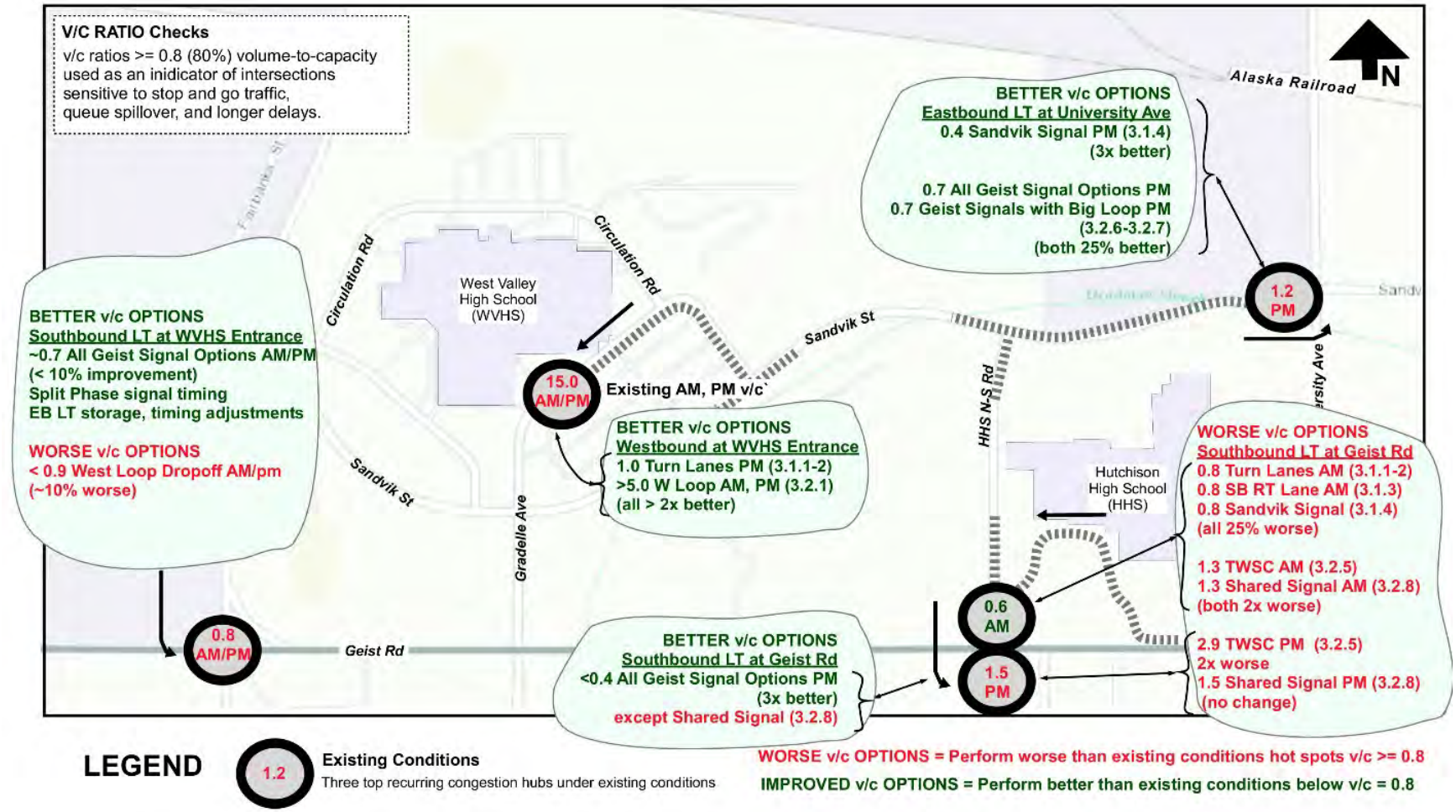


Figure 62. Locations with v/c ratios of concern for existing conditions and analysis options

V/C ratio checks confirm options previously found to improve network performance or internal queues and delays also improve these three sites with high v/c ratios significantly. The beneficial options are:

3.2.1 West Loop Drop-off/Pickup Conversion (WVHS) – **RECOMMENDED**
3.2.2 Signal 2-Way Frontage (HHS) **– CONSIDER**
3.2.6 Signal, 1-way, Big Loop (HHS) – **RECOMMENDED**
3.2.7 Signal, 2-way, Big Loop (HHS) **– RECOMMENDED**

Several options worsen v/c ratios at one or more of the critical locations shown in Figure 62. While these options are helpful in some locations of the network, they also can lead to instability and congestion in other locations. For this reason, these options should be considered only in conjunction with other options rather than as standalone improvements:

3.1.1 Turn lanes (extended and new turn lanes) (WVHS and HHS) - **CONSIDER**
3.1.2 Weaving lane (plus turn lanes) (WVHS and HHS) – **CONSIDER**
3.1.4 Sandvik Signal at University Avenue (WVHS and HHS) – **CONSIDER**

Two options are not recommended after reviewing v/c ratios under this option.

3.1.3 Southbound right turn lane (from University Avenue) (HHS) – NOT RECOMMENDED
3.2.8 Shared Signal - to both high schools (WVHS and HHS) – NOT RECOMMENDED

Option 3.1.3, a southbound right turn lane to HHS increases conflicting movements with opposing traffic at the entry to the drop-off and pick-up lanes and is modeled to worsen v/c ratios at the HHS west driveway onto Geist Road. A southbound right turn lane is not found to improve v/c ratios at critical intersections that load up when departing back onto Geist Road in the AM peak period. Thus, a southbound right turn is not really helpful without considering other options as well. In addition, southbound exit to HHS is more difficult to make clear to all drivers intending to turn right onto Geist Road, not HHS. There is a risk of not meeting expectations of all drivers and not being able to provide clear direction. This lane would not be in the snowplowing route for mainline plows and would require local equipment to enter the main roadway and plow a ramp to a driveway. For these reasons, a southbound right turn lane is not recommended.

Option 3.2.8, a shared signal to both high schools was modeled as an offset tee frontage road intersection from Geist Road. This is shown as Option A in Figure 63. When this is a closely spaced offset tee intersection, Geist Road traffic must free flow onto campus, while HHS and WVHS traffic must stop. This ends up giving HHS the most difficult delay, waiting at STOP

sign to turn left, while WVHS traffic has an easier time turning right, dominating traffic entering back onto Geist Road. For this reason, version A of this option, as shown below, results in high v/c ratios of 1.5 for HHS left turns. For this reason, Option 3.2.8 does not improve traffic over existing conditions, even with a signal.

Two other configurations are possible ways to improve v/c ratios for HHS dismissal but were not analyzed due to risks with each option.

Option B would try to channelize WVHS traffic to stop equally alongside HHS. Courtesy gaps or taking turns would be more likely under Option B than Option A.

Option C moves WVHS to the east under STOP control. HHS could free flow to Geist Road under this option and gain priority and not reach v/c of 0.8 or higher. This option increases the risk Geist Road traffic having more difficulty turning left towards WVHS.

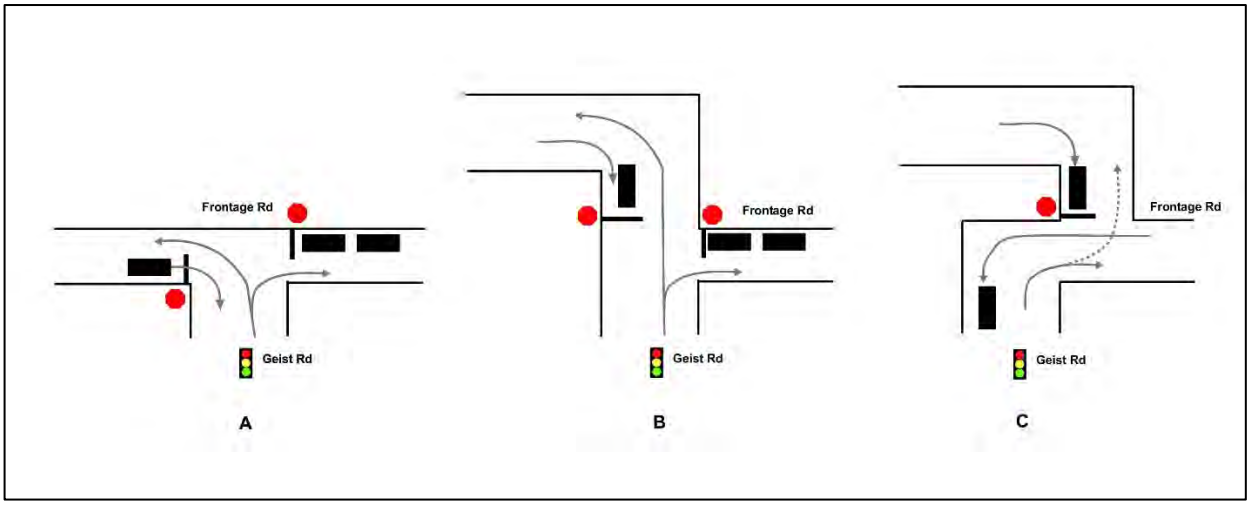


Figure 63. Offset tee model options for a midblock signal on Geist Road

4.4 Carbon Reduction Program Consideration

As found in Section 4.2, carbon emissions at the network level are not significantly improved through all the vehicular circulation changes modeled. Fortunately, carbon emissions at the network level are not significantly worsened either. Most network emissions are generated by higher volume, non-school related traffic moving along the arterials.

However, three options can be considered as beneficial strategies towards carbon reduction. These were described in Section 3.3 Safety and Operations.

3.3.1 Pedestrian Hybrid Beacon (WVHS & HHS) - Along with efforts to improve sidewalks, facilitate walking school bus teams, or increase walking route radii without busing, this option could increase local pedestrian use. By changing modes of travel, reducing any vehicular travel to the school helps reduce carbon emissions.

3.3.3 Pedestrian Visibility Lighting Replacement - Improved lighting at crosswalks and throughout the campus can improve safety and reduce energy consumption. By reducing energy consumption, new LED lighting designs can help reduce carbon emissions. If more lighting is needed on campus, LED lighting can provide more fixtures at the same energy levels as before, without increasing carbon emissions.

3.3.9 Increased Bus Service - Provides more mode choice options to students and school workers. Considering this option is another way to meet the carbon reduction intent.

5 Needs Analysis Options Menu - Summary

Appendix A provides a menu table with the options in this report. These tables show averaged output values of how the AM arrival and the PM Dismissal periods perform at the network level in terms of queue, delay, and emissions, as well as the risk that site queues will extend to block Sandvik Street or Geist Road through lanes. The far-right columns indicate whether options improve volume-to-capacity ratios at bottlenecks and pedestrian routing. The last column reflects whether the option should be considered further given the cumulative results, matching the recommendations in this report listed in the next Section 5 and the Executive Summary.

In the Options Menu, each column is shaded to reflect the best results in green, average results as faded or clear, and the worst results in red.

The name of each option is shaded to match the cumulative results for that option:

Green – RECOMMENDED
White – CONSIDER
Grey – NOT RECOMMENDED

Based on the analysis and observations in this report, the options for transportation managers to consider further are listed on the next page as follows:

OPTIONS MENU

Rehabilitation Options

3.1.1	**Turn lanes (extended and new turn lanes) (WVHS and HHS)**	**CONSIDER**
3.1.2	**Weaving lane (plus turn lanes) (WVHS and HHS)**	**CONSIDER**
3.1.3	Southbound right turn lane (from University Avenue) (HHS)	NOT RECOMMENDED
3.1.4	**Sandvik Signal at University Avenue (WVHS and HHS)**	**CONSIDER**

Reconstruction Options

3.2.1	**West Loop Dropoff/Pickup Conversion (WVHS)**	**RECOMMENDED**
3.2.2.	**Signal 2-Way Frontage (HHS)**	**CONSIDER**
3.2.3	Signal 1-way, Small Loop (HHS)	NOT RECOMMENDED
3.2.4	Signal, 1-way, Small Loop plus 2-way Parking (HHS)	NOT RECOMMENDED
3.2.5	Midblock STOP, Small Loop, No Signal (HHS)	NOT RECOMMENDED
3.2.6	**Signal, 1-way, Big Loop (HHS)**	**RECOMMENDED**
3.2.7	**Signal, 2-way, Big Loop (HHS)**	**RECOMMENDED**
3.2.8	Signal Shared - to both High Schools (WVHS and HHS)	NOT RECOMMENDED

Safety and Operations Options

3.3.1	a) Pedestrian Hybrid Beacon (WVHS & HHS)	CONSIDER
3.3.2	b) Fairbanks Street Curve Realignment and Sight Distance	CONSIDER
3.3.3	c) Pedestrian Visibility Lighting Replacement	RECOMMENDED
3.3.4	d) Pedestrian Crossing Retroreflective Signing	RECOMMENDED
3.3.5	e) Sidewalk Barrier Curb	CONSIDER
3.3.6	f) Signal Timing Adjustments	RECOMMENDED
3.3.7	g) No Left Turns from HHS Prohibition	RECOMMENDED
3.3.8	h) Commercial Access Consolidation	RECOMMENDED
3.3.9	i) Increased Bus Service	CONSIDER
3.3.10	j) Arctic Entry (HHS)	CONSIDER
3.3.10	k) Increased Plowing	CONSIDER

Options Considered but not Analyzed

3.4.1	a) Split-phased signal operations	NOT RECOMMENDED
3.4.2	b) HHS Back Lot Exit	NOT RECOMMENDED
3.4.3	c) HHS West Perimeter Road	NOT RECOMMENDED
3.4.4	U-Park Daycare Background Development	CONSIDER
3.4.5	Vary School Start/Stop Times	CONSIDER
3.4.6	WVHS Roundabout at Gradelle & Sandvik	NOT RECOMMENDED
3.4.7	Multilane Roundabout at University & Sandvik	NOT RECOMMENDED
3.4.8	Pedestrian Bridge replacement	NOT RECOMMENDED

References

FAST Planning Carbon Reduction Program (CRP) at https://fastplanning.us/cmaq/

FHWA Carbon Reduction Program (CRP) funding intent and example strategies at https://www.fhwa.dot.gov/environment/crp/

Appendix A: Options List and Performance Indicators Table

Fairbanks North Star Borough

High School & Circulation Plan

Federal Project No. NFHWY00844/0002(536)

Final Summary Table
Comparison of Solutions
AM Arrival, Peak 15 Minutes

Option Colors:

Grey - NOT RECOMMENDED

Green - Recommended

White - Consider Further

Data Colors:

Red – Worst value out of all presented options

Green – Best value out of all presented options

FNSB High School Circulation Options: AM Arrival PEAK

Option Number	Option Heading	Purpose	AM Network Average Delay / Vehicle (sec)	AM Network Total Travel (VMT)	AM Network Total Delay (Hr)	AM Network Carbon Emissions (CO2) (g)	AM WVHS Dropoff Queues Near or into Sandvik St (ft)	AM WVHS Main Entrance Dropoff Delays (s)	AM HHS Aropoff Queues at or into Geist Rd (ft)	AM HHS Main Entrance Dropoff Delays (s)	AM WVHS Risk of Internal Spillover onto Sandvik St?	AM WVHS Spillover on Geist & Fbks Signal out of EB LT Bay	AM HHS Storage Risk Spillover onto Geist Rd?	Reduces bottlenecks where v/c is > 0.8?	Addresses Geist Ped Xing?	Improves Ped Routes?	A Carbon Reduction Strategy?	AM Consider Further?	Comments
3.0.0.X	**3.0.0 EXISTING**	Measured for performance as a benchmark for analysis of options for future needs.	68.2	709	24.3	20656	820	210	400	70	Yes		Yes					No	- Backs onto Geist Rd. - High overlapping conflicts in front of both schools. - Fall Demo showed more than half of nearly 200 responders want to see imrpovements thorugh FAST Planning.
3.1.1.3R	**3.1.1 Turn Lanes**	Stores low speed / stopped queueing traffic and prevents blocking through lanes or other traffic.	69.5	668	24.5	19666	630	310	410	60	Yes		Yes	Yes				Choose Lanes	- Improves v/c by 10 percent at Sandvk to University. v/c still > 0.8 ' - LOS at bottlenecks remain at F
3.1.2.3R	**3.1.2 Weaving Lane**	Creates more storage for departing queues and gives a priority to HHS traffic over WVHS traffic heading to University Avenue, to balance delays between the two high schools.	61.7	684	22	20630	500	205	420	75	Yes		Yes	Yes				Choose Lanes	- Improves v/c by 10 percent at Sandvk to University. Still exceeds 0.8 - HHS has more priority on Sandvk Street '- LOS at bottlenecks ramin at F
3.1.3.3R	**3.1.3 SB Right Turn**	Grants access to HHS quickly and removes traffic from Geist Road conflicts.	65.7	694	23.3	20943	940	210	360	55	Yes		Yes					No	- Higher carbon emissions. - Could ceate turning confusion for University Avenue users. - Adds conflict to the senior parking lot. - The solution would only serve a small number of vehicles.
3.1.4.3R	**3.1.4 Sandvik Signal**	Reduces queueing and delays at Sandvik Street and University Avenue without affecting the rest of the campus.	68.8	704	25.1	20645	820	250	400	50	Yes			Yes				Yes	- Not critical if Geist midblock signal options selected '- Removes v/c bottleneck at this location
3.2.1.4R	**3.2.1 W Loop Drop/PU**	Reduces traffic at the top congestion and safety conflict point at WVHS. This is at the main entrance where drop-off, pick-up, visitors, parking pedestrians are the main overlapping user groups.	55.5	704	19.9	20271	220	60	360	55		Yes	Yes	Yes		Yes		Yes	- Fall Demo in AM shows this can reduce east side congestion. - Bus delays solved with higher priortity entry/exit option - 1/3 of vehicle demand is removed from the east side of school '-Improves Sandvik bottleneck by 10 percent, Worsens SB Fairbnks v/c without signal timing changes
3.2.2.4R	**3.2.2 Signal 2-Way Frntg**	Solves the top congestion and safety conflict point at HHS at the west driveway by relocating access to a new traffic signal connected by a traditional two-way frontage road.	70.8	703	25.2	20471	820	230	310	40	Yes			Yes	Yes	Yes		Yes	- No driveways onto Geist Road, remove both '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent '-Internal congestion remains at LOS F frontage stop area
3.2.2e.4R	**3.2.2e Signal 2Way Frntg + E Dr**	New intersection west of HHS increases storage and assists left turns in and out, with East HHS Driveway from Geist Rd	69.6	704	24.9	20017	760	200	340	35	Yes		Yes	Yes	Yes	Yes		No	- East driveways onto Geist Road '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent '-Long queues back to signal, bottlenecks at sculpture dropoff
3.2.3.4R	**3.2.3 Signal 1Way Frntg + Pkg**	Tests whether a one-way loop using the existing roads west of HHS can improve congestion with minimal changes to the rest of the campus.	75.3	700	26.6	20046	680	190	525	65	Yes			Yes	Yes	Yes		No	- No driveways onto Geist Road '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent '-Long frontage road queues back to signal a risk
3.2.3e.4R	**3.2.3e Signal 1Way Frntg+ Pkg + E Dr**	New intersection west of HHS increases storage and assists left turns in and out, with East HHS driveway from Geist Rd. Short Dropoff Loop east of school.	86.9	685	31.7	20313	680	180	680	325	Yes		Yes	Yes	Yes	Yes		No	- East driveways onto Geist Road '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent '-Long frontage road queues back to signal a risk '-East drive worsens internal congestion
3.2.4.4R	**3.2.4 Signal 1Way Lp + 2Way Pkg**	Determines if we can improve one-way flow further by removing traffic from having to go through drop-off and pick-up areas unnecessarily, and dilute conflicting movements.	71.4	685	25.4	19918	720	185	560	45	Yes			Yes	Yes	Yes		No	- Moves the most possible non-dropoff/nonpickup traffic external to pedestrian loading zones. '- No driveways onto Geist Road '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent. Long frontage queues.
3.2.5.4R	**3.2.5 Midblock STOP**	Determines if Geist Road impacts can be minimized while increasing storage and departure options for HHS to and from Geist Road.	85.3	680	31.1	20116	720	195	940	160	Yes		Yes					No	-Worsens Geist Road STOP congstion and v/c by 3 times

FNSB High School Circulation Options: AM Arrival PEAK

Option Number	Option Heading	Purpose	AM Network Average Delay / Vehicle (sec)	AM Network Total Travel (VMT)	AM Network Total Delay (Hr)	AM Network Carbon Emissions (CO2) (g)	AM WVHS Dropoff Queues Near or into Sandvik St (ft)	AM WVHS Main Entrance Dropoff Delays (s)	AM HHS Aropoff Queues at or into Geist Rd (ft)	AM HHS Main Entrance Dropoff Delays (s)	AM WVHS Risk of Internal Spillover onto Sandvik St?	AM WVHS Spillover on Geist & Fbks Signal out of EB LT Bay	AM HHS Storage Risk Spillover onto Geist Rd?	Reduces bottlenecks where v/c is > 0.8?	Addresses Geist Ped Xing?	Improves Ped Routes?	A Carbon Reduction Strategy?	AM Consider Further?	Comments
3.2.6.4R	**3.2.6 Signal 1Way Lp**	Further reduces queues on the frontage road compared to short loops. Provides longer possible vehicular queue storage.	74.0	715.0	26.8	20515	860	250	380	75	Yes			Yes	Yes	Yes		Yes	- No driveways onto Geist Road '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent
3.2.7.4R	**3.2.7 Signal 2Way Lp**	Allows driving in all directions and determines if this can still function in a two-way configuration as well as a one-way flow pattern.	79.1	725	28.6	20905	1000	240	780	75	Yes			Yes	Yes	Yes		Yes	- No driveways onto Geist Road '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent
3.2.8.4R	**3.2.8 Signal Shared**	Explores the impacts of more direct access to WVHS user groups and how it may alter on-campus traffic flows.	72.5	685	26.2	20120	1060	305	230	35	Yes				Yes	Yes		No	- More WVHS conflicts with HHS turns = frontage v/c > 1.5 - More internal dogleg left turns to WVHS increases queues.
3.3.1	**3.3.1 PHB/HAWK**	Improves crossing opportunities with positive traffic control for the full width crossing of Geist Road.	68.9	683	24.2	20499	N/A	N/A	N/A	N/A	Yes		Yes		Yes	Yes	Yes	Yes	- Stand alone option. - Not recommended in combination with midblock access solutions at Rebecca Street and Geist Road.
3.3.2	**3.3.2 Fairbanks Curve**	Improves curve safety at low speeds under snow and ice conditions.	Not modeled															Yes	
3.3.3	3.3.3 LED Ped Lighting	New LED lighting improves visibility for all users at high pedestrian-vehicle conflict areas.	Not modeled													Yes	Yes	Yes	- Improved visibility improves safety and standards upgrades, not as much towards congestion. - Explore costs, benefits
3.3.4	3.3.4 Signing Retro	New signing improves sign visibility during darkness for all users at high pedestrian-vehicle conflict areas.	Not modeled													Yes		Yes	- Improved visibility improves safety and standards upgrades, not as much towards congestion. - Explore costs, benefits
3.3.5	3.3.5 Barrier Curb	Reduces conflict between roadway vehicles and sidewalk users.	Not modeled													Yes		yes	
3.3.6	3.3.6 Signal Timing Adjustments	Efficiently allocates green time to peak traffic demand and reduce congestion of peak movements, especially eastbound Geist Road at Fairbanks Street in the morning period.	Modeled with existing timing parameters. Field observatsions were less.								Yes							Yes	
3.3.7	3.3.7 Prohibit LT's	Reshapes driveways to encourage no left turn conflicts out of HHS, in addition to clearer signing	Not modeled, Field tested during Fall Demo October 2024															Yes	- Compliance with signs alone was insufficient. - Requires channelization. - Could work better with alternative route options.
3.3.8	Consolidate opposing Commercial Access	Improves decision making and safety by reducing conflicts along Geist Road in the vicinity of school access points.	Not modeled													Yes		Yes	- New Geist access options should consider restricting or relocating left turns from opposing commercial access where driveway spacing creates multiple decisions in a short space.
3.3.9	3.3.9 Increased Bus Service	Increased bus service increases options for non-vehicular school access in order to reduce congestion.	Not modeled													Yes	Yes	Yes	-Service options may be limited by funding sources

FNSB High School Circulation Options: AM Arrival PEAK

Option Number	Option Heading	Purpose	AM Network Average Delay / Vehicle (sec)	AM Network Total Travel (VMT)	AM Network Total Delay (Hr)	AM Network Carbon Emissions (CO2) (g)	AM WVHS Dropoff Queues Near or into Sandvik St (ft)	AM WVHS Main Entrance Dropoff Delays (s)	AM HHS Aropoff Queues at or into Geist Rd (ft)	AM HHS Main Entrance Dropoff Delays (s)	AM WVHS Risk of Internal Spillover onto Sandvik St?	AM WVHS Spillover on Geist & FBks Signal out of EB LT Bay	AM HHS Storage Risk Spillover onto Geist Rd?	Reduces bottlenecks where v/c is > 0.8?	Addresses Geist Ped Xing?	Improves Ped Routes?	A Carbon Reduction Strategy?	AM Consider Further?	Comments
3.3.10	3.3.10 Artic Entry HHS	Increases the drop off / pick up area, to encourage users to pull forward and keep vehicle queues moving.	Not modeled												Yes		Yes		
3.4.1	3.4.1 Split-Phased Signal Operations	Reconfigure existing southbound lanes and signal heads for dual left turns usign a shared through and left turn lane	Not modeled														No		- Increases delays to Geist Road during rest of day
3.4.2	3.4.2 CTC Driveway	Open back parking lot access to another way in and out	Not modeled														No		- Added conflict to Sandvik Street could worsen queues.
3.4.3	3.4.3 HHS West Perimeter Route	Move parking and circulation west of HHS north-south road. Create north-south pedestrian zone with less conflict similar to WVHS	Not modeled														No		- Inadequate space to the west of HHS to have both roads
3.4.4	3.4.4 U-Park Daycare Background Development	New onsite circulation plan to minimize Sandvik Street conflicts	Not modeled														Yes		- Poor intersection location for higher volume passenger drop-off and pick-up zone. Traffic Impact Analysis (TIA) recommended.
3.4.5	3.4.5 Vary School Start/Stop Times	Reduce conflicts by separating school start/stop times between WVHS or HHS or U-Park Daycare	Not modeled														No		- WVHS and HHS share students and passenger pickup. May be an option for U-Park Daycare
3.4.6	3.4.6 Roundabout WVHS	Less stopping at intersection. May mean less ped gaps and less downstream gaps	Not modeled														No		- At Gradelle Street, or HHS N-S Road - Does not reduce congestion or low speed conflicts. - Risk of "gridlocking" roundabout. - All-way Stop control provides clearer use of courtesy gaps or "taking turns".
3.4.7	3.4.7 Roundabout University	Less stopping at intersection, more yielding and entry, retaining ped xing device. Lower risk of ARRC queueing than a full signal. More congestion, delays to University Ave most of day	Not modeled														No		
3.4.8	Pedestrian Bridge Replacement	Improved pedestrian crossing opportunities to cross Geist Road	Not modeled											Yes	No	No	No		

Fairbanks North Star Borough

High School & Circulation Plan

Federal Project No. NFHWY00844/0002(536)

Final Summary Table
Comparison of Solutions
PM Dismissal, Peak 15 Minutes

Option Colors:

Grey - NOT RECOMMENDED

Green - Recommended

White - Consider Further

Data Colors:

Red – Worst value out of all presented options

Green – Best value out of all presented options

FNSB High School Circulation Options: PM Dismissal PEAK

Option Number	Option Heading	Purpose	PM Network Average Delay / Vehicle (sec)	PM Network Total Travel (VMT)	PM Network Total Delay (Hr)	PM Network Carbon Emissions (CO2) (g)	PM WVHS Dropoff Queues Near or into Sandvik St (ft)	PM WVHS Main Entrance Dropoff Delays (s)	PM HHS Aropoff Queues at or into Geist Rd (ft)	PM HHS Main Entrance Dropoff Delays (s)	PM WVHS Risk of Internal Spillover onto Sandvik St?	PM WVHS Spillover on Geist & FbkS Signal out of EB LT Bay	PM HHS Storage Risk Spillover onto Geist Rd?	Reduces bottlenecks where v/c is > 0.8?	Addresses Geist Ped Xing?	Improves Ped Routes?	A Carbon Reduction Strategy?	PM Consider Further?	Comments
3.0.0.X	**3.0.0 EXISTING**	Measured for performance as a benchmark for analysis of options for future needs	64	775	28.5	23942	380	180	360	205	Yes		Yes					No	- Backs onto Geist Rd. - High overlapping conflicts in front of both schools. - Fall Demo showed more than half of nearly 200 responders want to see imrpovements thorugh FAST Planning.
3.1.1.3R	**3.1.1 Turn Lanes**	Stores low speed / stopped queueing traffic and prevents blocking through lanes or other traffic.	61.9	772	28.3	24434	485	190	525	410	Yes		Yes	Yes				Choose Lanes	- Improves v/c by 10 percent at Sandvk to University. v/c still > 0.8 ' - LOS at bottlenecks remain at F
3.1.2.3R	**3.1.2 Weaving Lane**	Creates more storage for departing queues and gives a priority to HHS traffic over WVHS traffic heading to University Avenue, to balance delays between the two high schools.	59.8	769	27.1	24434	560	225	450	285	Yes		Yes	Yes				Choose Lanes	- Improves v/c by 10 percent at Sandvk to University. Still exceeds 0.8 - HHS has more priority on Sandvk Street '- LOS at bottlenecks ramin at F
3.1.3.3R	**3.1.3 SB Right Turn**	Grants access to HHS quickly and removes traffic from Geist Road conflicts.	61.1	781	27.6	25401	720	215	260	100	Yes							No	- Higher carbon emissions. - Could ceate turning confusion for University Avenue users. - Adds conflict to the senior parking lot. - The solution would only serve a small number of vehicles.
3.1.4.3R	**3.1.4 Sandvik Signal**	Reduces queueing and delays at Sandvik Street and University Avenue without affecting the rest of the campus.	60.6	779	27.3	24088	360	145	300	35	No			Yes				Yes	- Not critical if Geist midblock signal options selected '- Removes v/c bottleneck at this location
3.2.1.4R	**3.2.1 W Loop Drop/PU**	Reduces traffic at the top congestion and safety conflict point at WVHS. This is at the main entrance where drop-off, pick-up, visitors, parking pedestrians are the main overlapping user groups.	58.5	771	28	24183	120	40	380	380	No	Yes	Yes	Yes		Yes		Yes	- Fall Demo in AM shows this can reduce east side congestion. - Bus delays solved with higher priortity entry/exit option - 1/3 of vehicle demand is removed from the east side of school '-Improves Sandvik bottleneck by 10 percent, Worsens SB Fairbnks v/c without signal timing changes
3.2.2.4R	**3.2.2 Signal 2-Way Frntg**	Solves the top congestion and safety conflict point at HHS at the west driveway by relocating access to a new traffic signal connected by a traditional two-way frontage road.	64.9	785	29.1	24553	720	230	120	20	Yes		No	Yes	Yes	Yes		Yes	- No driveways onto Geist Road, remove both '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent '-Internal congestion remains at LOS F frontage stop area
3.2.2e.4R	**3.2.2e Signal 2Way Frntg + E Dr**	New intersection west of HHS increases storage and assists left turns in and out, with East HHS Driveway from Geist Rd	64.0	772	28.4	24372	450	205	170	35	Yes		Yes	Yes	Yes	Yes		No	- East driveways onto Geist Road '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent '-Long queues back to signal, bottlenecks at sculpture dropoff
3.2.3.4R	**3.2.3 Signal 1Way Frntg + Pkg**	Tests whether a one-way loop using the existing roads west of HHS can improve congestion with minimal changes to the rest of the campus.	66.8	758	29.6	24156	360	165	440	110	Yes			Yes	Yes	Yes		No	- No driveways onto Geist Road '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent '-Long frontage road queues back to signal a risk
3.2.3e.4R	**3.2.3e Signal 1Way Frntg+ Pkg + E Dr**	New intersection west of HHS increases storage and assists left turns in and out, with East HHS driveway from Geist Rd. Short Dropoff Loop east of school.	62.8	771	28.1	24078	280	115	520	115	Yes		Yes	Yes	Yes	Yes		No	- East driveways onto Geist Road '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent '-Long frontage road queues back to signal a risk '-East drive worsens internal congestion
3.2.4.4R	**3.2.4 Signal 1Way Lp + 2Way Pkg**	Determines if we can improve one-way flow further by removing traffic from having to go through drop-off and pick-up areas unnecessarily, and dilute conflicting movements.	65.6	783	29.3	23714	490	190	540	85	Yes		No	Yes	Yes	Yes		No	- Moves the most possible non-dropoff/nonpickup traffic external to pedestrian loading zones. '- No driveways onto Geist Road '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent. Long frontage queues.
3.2.5.4R	**3.2.5 Midblock STOP**	Determines if Geist Road impacts can be minimized while increasing storage and departure options for HHS to and from Geist Road.	69.9	760	31.9	23965	495	155	720	180	Yes		Yes					No	-Worsens Geist Road STOP congstion and v/c by 3 times

FNSB High School Circulation Options: PM Dismissal PEAK

Option Number	Option Heading	Purpose	PM Network Average Delay / Vehicle (sec)	PM Network Total Travel (VMT)	PM Network Total Delay (Hr)	PM Network Carbon Emissions (CO2) (g)	PM WVHS Dropoff Queues Near or into Sandvik St (ft)	PM WVHS Main Entrance Dropoff Delays (s)	PM HHS Aropoff Queues at or into Geist Rd (ft)	PM HHS Main Entrance Dropoff Delays (s)	PM WVHS Risk of Internal Spillover onto Sandvik St?	PM WVHS Spillover on Geist & Fbks Signal out of EB LT Bay	PM HHS Storage Risk Spillover onto Geist Rd?	Reduces bottlenecks where v/c is > 0.8?	Addresses Geist Ped Xing?	Improves Ped Routes?	A Carbon Reduction Strategy?	PM Consider Further?	Comments
3.2.6.4R	**3.2.6 Signal 1Way Lp**	Further reduces queues on the frontage road compared to short loops. Provides longer possible vehicular queue storage.	62.9	798	28.5	25897	405	155	240	55	Yes		No	Yes	Yes	Yes		Yes	- No driveways onto Geist Road '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent
3.2.7.4R	**3.2.7 Signal 2Way Lp**	Allows driving in all directions and determines if this can still function in a two-way configuration as well as a one-way flow pattern.	64.3	776	29.0	23949	660	195	685	70	Yes		No	Yes	Yes	Yes		Yes	- No driveways onto Geist Road '-Resolves Geist Road v/c for HHS and reduces Sandvik v/c at Univeristy by more than 25 percent
3.2.8.4R	**3.2.8 Signal Shared**	Explores the impacts of more direct access to WVHS user groups and how it may alter on-campus traffic flows.	59.5	793	28.1	24301	800	210	140	10	Yes		No		Yes	Yes		No	- More WVHS conflicts with HHS turns = frontage v/c > 1.5 - More internal dogleg left turns to WVHS increases queues.
3.3.1	**3.3.1 PHB/HAWK**	Improves crossing opportunities with positive traffic control for the full width crossing of Geist Road.	66.6	778	30.7	25478	N/A	N/A	N/A	N/A	Yes		Yes		Yes	Yes	Yes	Yes	- Stand alone option. - Not recommended in combination with midblock access solutions at Rebecca Street and Geist Road.
3.3.2	**3.3.2 Fairbanks Curve**	Improves curve safety at low speeds under snow and ice conditions.	Not modeled															Yes	
3.3.3	3.3.3 LED Ped Lighting	New LED lighting improves visibility for all users at high pedestrian-vehicle conflict areas.	Not modeled													Yes	Yes	Yes	- Improved visibility improves safety and standards upgrades, not as much towards congestion. - Explore costs, benefits
3.3.4	3.3.4 Signing Retro	New signing improves sign visibility during darkness for all users at high pedestrian-vehicle conflict areas.	Not modeled													Yes		Yes	- Improved visibility improves safety and standards upgrades, not as much towards congestion. - Explore costs, benefits
3.3.5	3.3.5 Barrier Curb	Reduces conflict between roadway vehicles and sidewalk users.	Not modeled													Yes		Yes	
3.3.6	3.3.6 Signal Timing Adjustments	Efficiently allocates green time to peak traffic demand and reduce congestion of peak movements, especially eastbound Geist Road at Fairbanks Street in the morning period.	Modeled with existing timing parameters. Field observatsions were less.															Yes	
3.3.7	3.3.7 Prohibit LT's	Reshapes driveways to encourage no left turn conflicts out of HHS, in addition to clearer signing	Not modeled, Field tested during Fall Demo October 2024															Yes	- Compliance with signs alone was insufficient. - Requires channelization. - Could work better with alternative route options.
3.3.8	Consolidate opposing Commercial Access	Improves decision making and safety by reducing conflicts along Geist Road in the vicinity of school access points.	Not modeled													Yes		Yes	- New Geist access options should consider restricting or relocating left turns from opposing commercial access where driveway spacing creates multiple decisions in a short space.
3.3.9	3.3.9 Increased Bus Service	Increased bus service increases options for non-vehicular school access in order to reduce congestion.	Not modeled													Yes	Yes	Yes	-Service options may be limited by funding sources

FNSB High School Circulation Options: PM Dismissal PEAK

Option Number	Option Heading	Purpose	PM Network Average Delay / Vehicle (sec)	PM Network Total Travel (VMT)	PM Network Total Delay (Hr)	PM Network Carbon Emissions (CO2) (g)	PM WVHS Dropoff Queues Near or into Sandvik St (ft)	PM WVHS Main Entrance Dropoff Delays (s)	PM HHS Aropoff Queues at or into Geist Rd (ft)	PM HHS Main Entrance Dropoff Delays (s)	PM WVHS Risk of Internal Spillover onto Sandvik St?	PM WVHS Spillover on Geist & Fbks Signal out of EB LT Bay	PM HHS Storage Risk Spillover onto Geist Rd?	Reduces bottlenecks where v/c is > 0.8?	Addresses Geist Ped Xing?	Improves Ped Routes?	A Carbon Reduction Strategy?	PM Consider Further?	Comments
3.3.10	3.3.10 Artic Entry HHS	Increases the drop off / pick up area, to encourage users to pull forward and keep vehicle queues moving.	Not modeled												Yes		Yes		
3.4.1	3.4.1 Split-Phased Signal Operations	Reconfigure existing southbound lanes and signal heads for dual left turns usign a shared through and left turn lane	Not modeled														No		- Increases delays to Geist Road during rest of day
3.4.2	3.4.2 CTC Driveway	Open back parking lot access to another way in and out	Not modeled														No		- Added conflict to Sandvik Street could worsen queues.
3.4.3	3.4.3 HHS West Perimeter Route	Move parking and circulation west of HHS north-south road. Create north-south pedestrian zone with less conflict similar to WVHS	Not modeled														No		- Inadequate space to the west of HHS to have both roads
3.4.4	3.4.4 U-Park Daycare Background Development	New onsite circulation plan to minimize Sandvik Street conflicts	Not modeled														Yes		- Poor intersection location for higher volume passenger drop-off and pick-up zone. Traffic Impact Analysis (TIA) recommended.
3.4.5	3.4.5 Vary School Start/Stop Times	Reduce conflicts by separating school start/stop times between WVHS or HHS or U-Park Daycare	Not modeled														No		- WVHS and HHS share students and passenger pickup. May be an option for U-Park Daycare
3.4.6	3.4.6 Roundabout WVHS	Less stopping at intersection. May mean less ped gaps and less downstream gaps	Not modeled														No		- At Gradelle Street, or HHS N-S Road - Does not reduce congestion or low speed conflicts. - Risk of "gridlocking" roundabout. - All-way Stop control provides clearer use of courtesy gaps or "taking turns".
3.4.7	3.4.7 Roundabout University	Less stopping at intersection, more yielding and entry, retaining ped xing device. Lower risk of ARRC queueing than a full signal.	Not modeled														No		
3.4.8	Pedestrian Bridge Replacement	Improved pedestrian crossing opportunities to cross Geist Road	Not modeled											Yes	No	No	No		

Appendix B: Performance Maps for Each Option

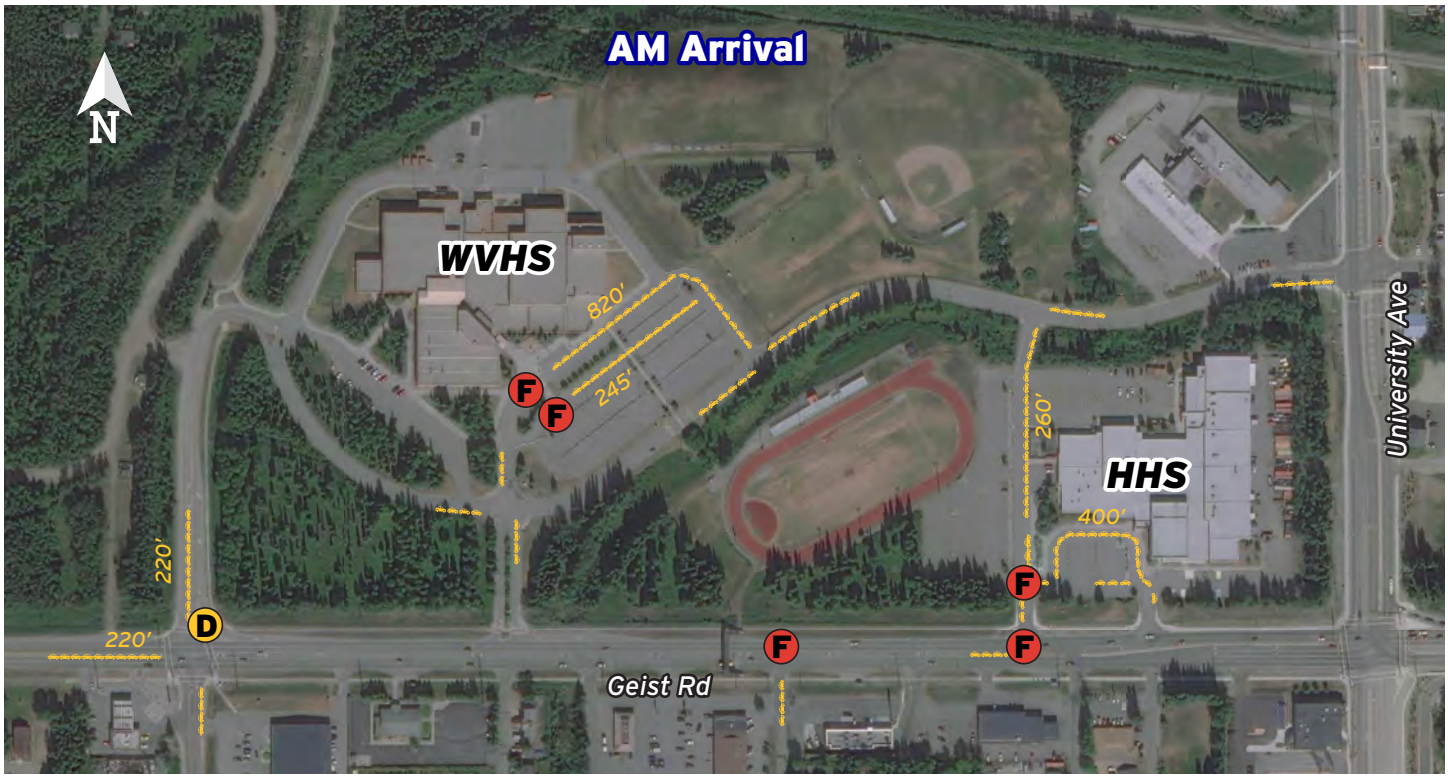
Fairbanks North Star Borough

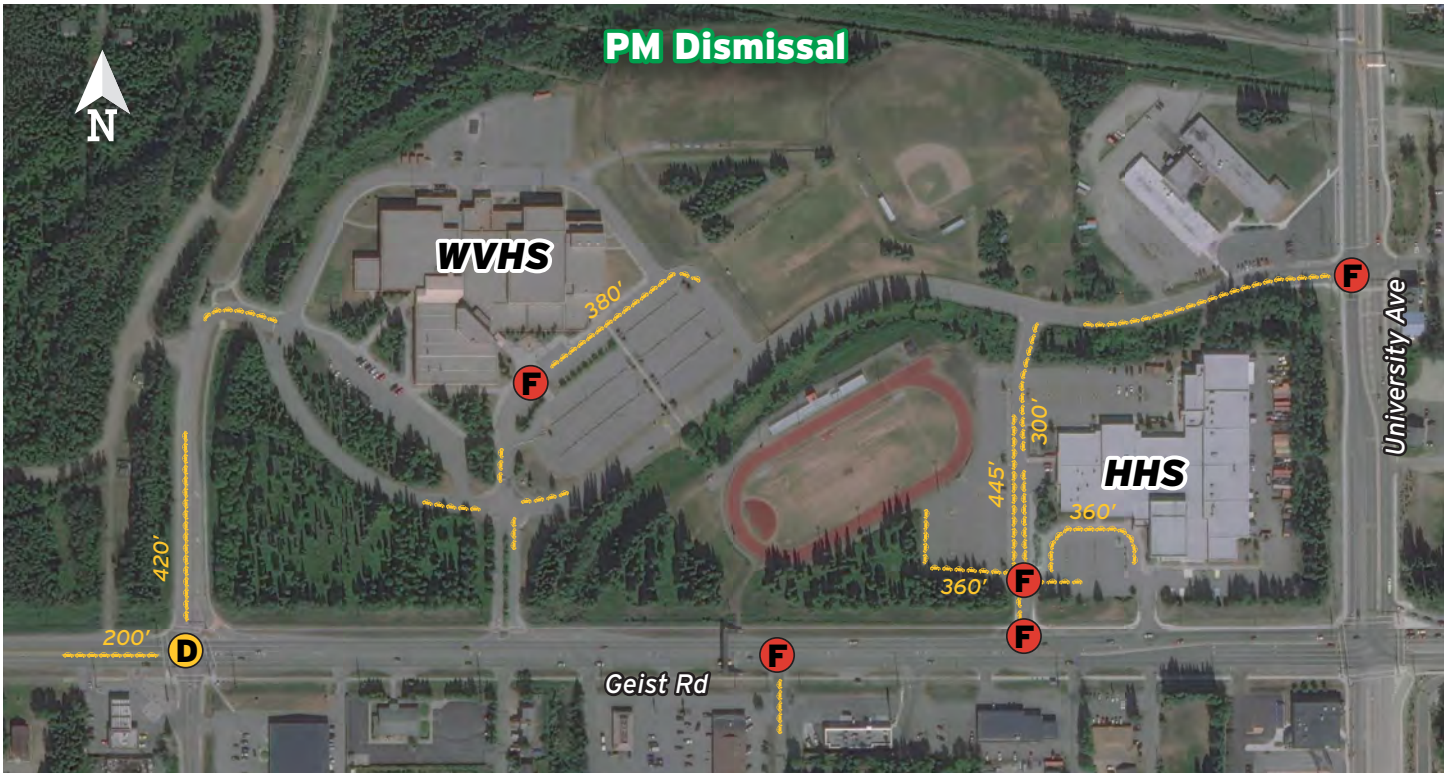
High School & Circulation Plan

Federal Project No. NFHWY00844/0002(536)

Performance Figures for All Options
AM Arrival & PM Dismissal,
Peak 15 Minute Periods

EXISTING CONDITIONS





School Turns Only

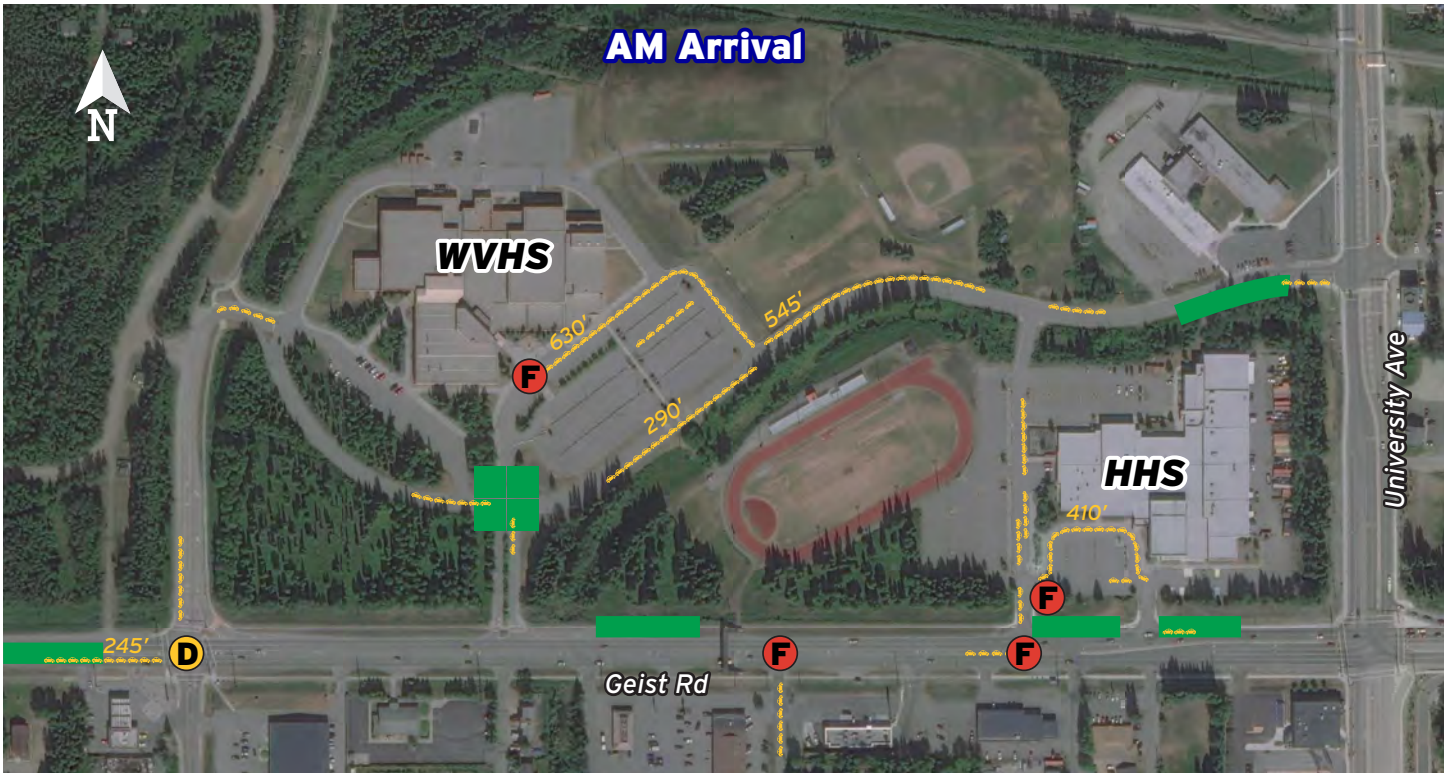
- D LOS D: 35-55s del/veh
- E LOS E: 55-60s del/veh
- F LOS E/F: >60s del/veh

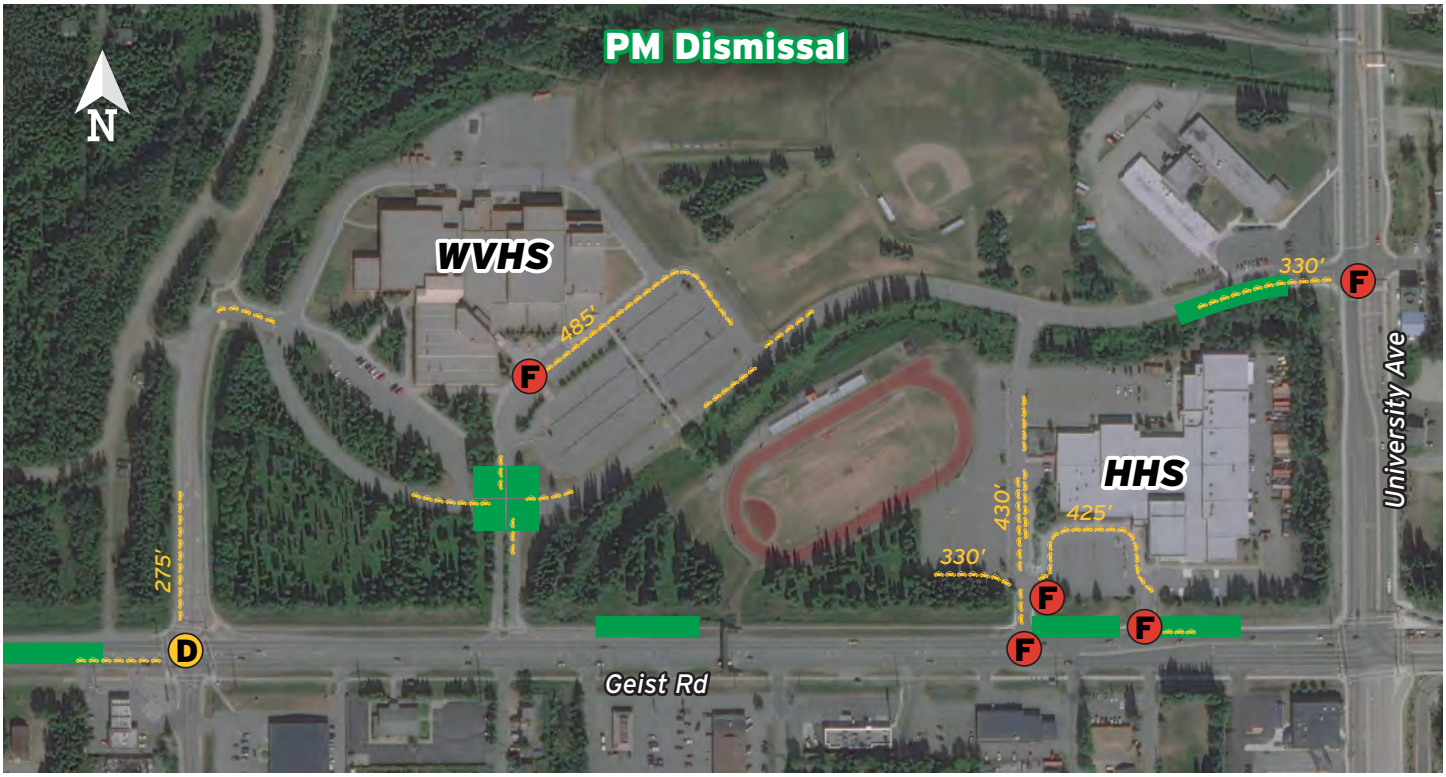
LEGEND

- queues >=100 ft shown
- 200' queues >=200 ft labeled

- site changes
- site removals

EXTENDED TURN LANES





School Turns Only

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LEGEND

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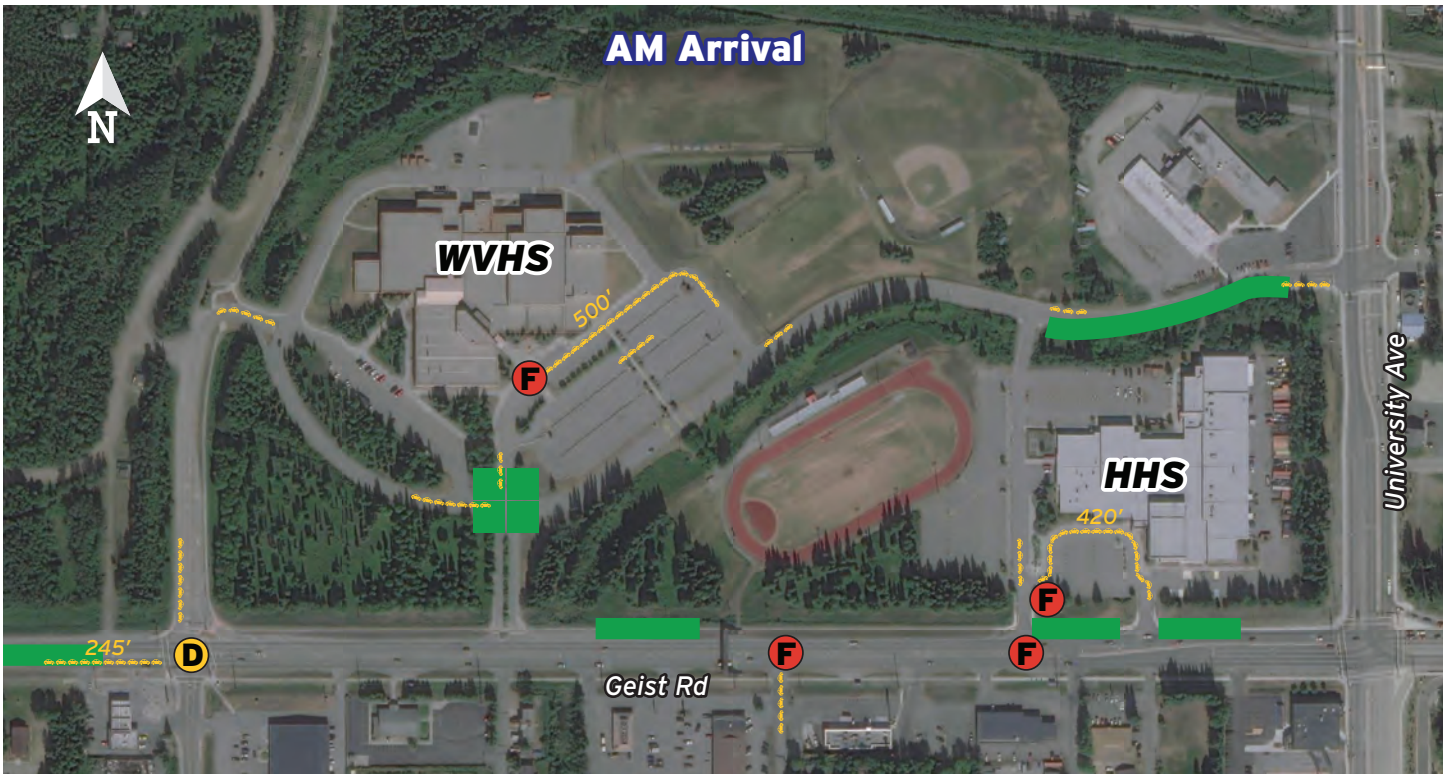
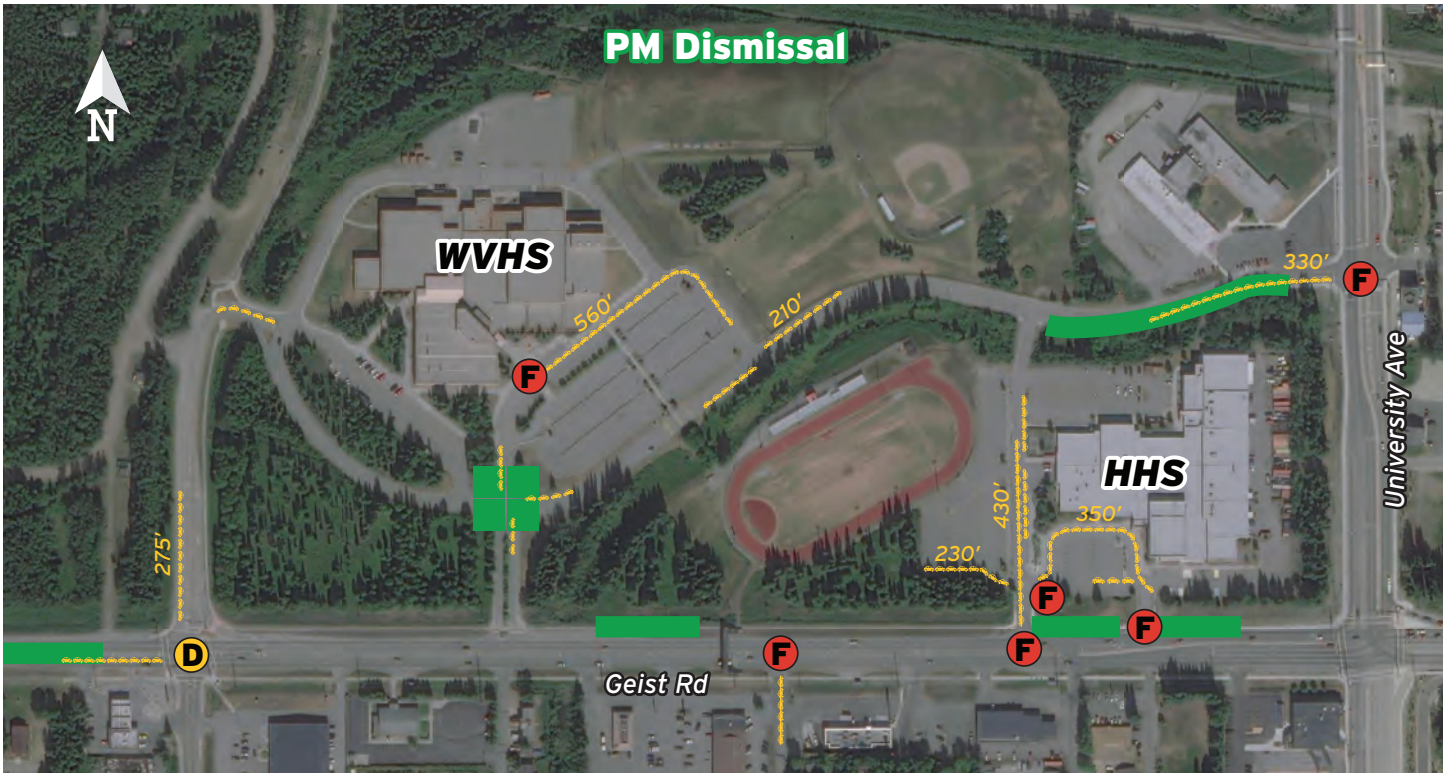
- site changes
- site removals

EXTENDED TURN LANES, WEAVING LANE





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LEGEND

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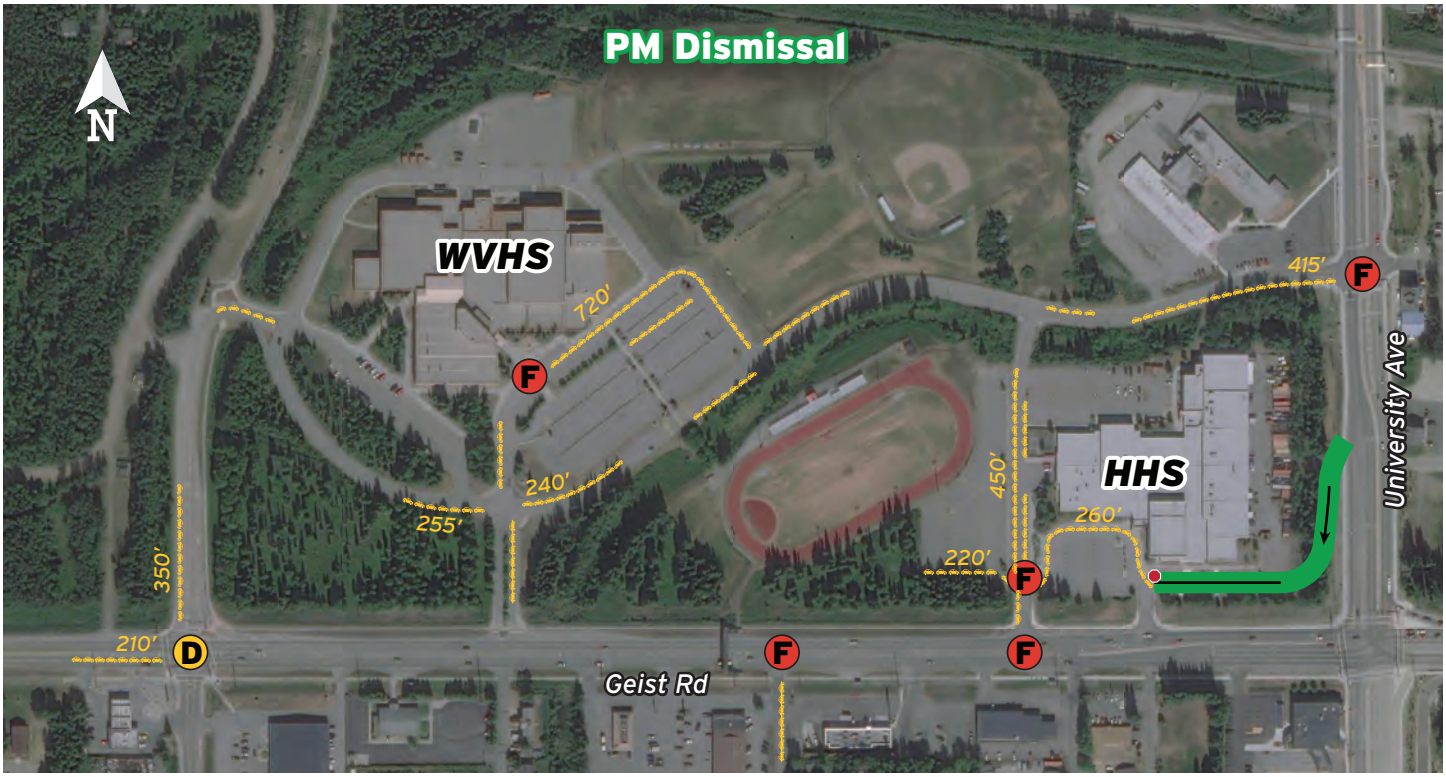
- site removals

HHS DEDICATED SB RT LANE



School Turns Only

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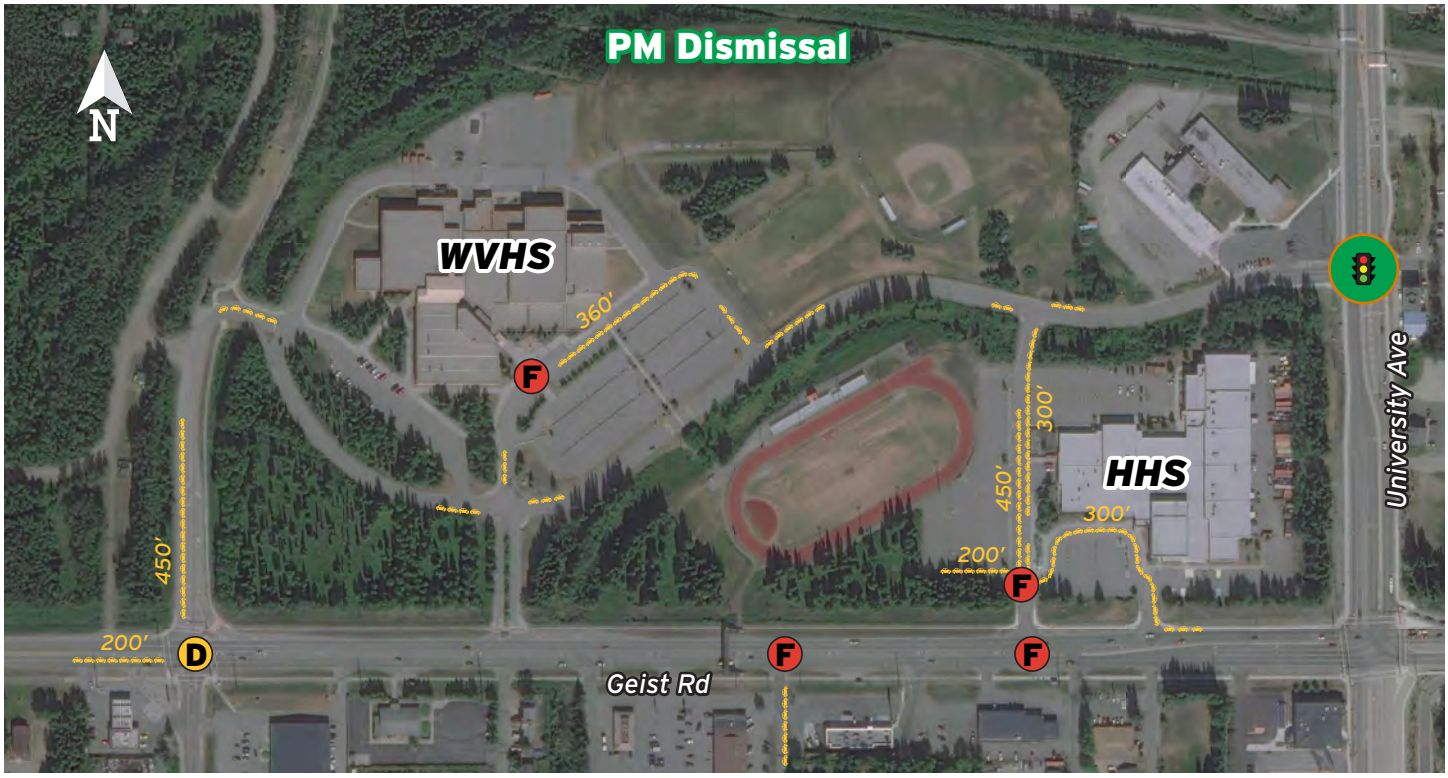
- F LOS E/F: >60s del/veh

LEGEND

- queues >=100 ft shown
- 200' queues >=200 ft labeled

- site changes
- site removals

SIGNAL AT SANDVIK ST ACCESS



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- F LOS E/F: >60s del/veh

LEGEND

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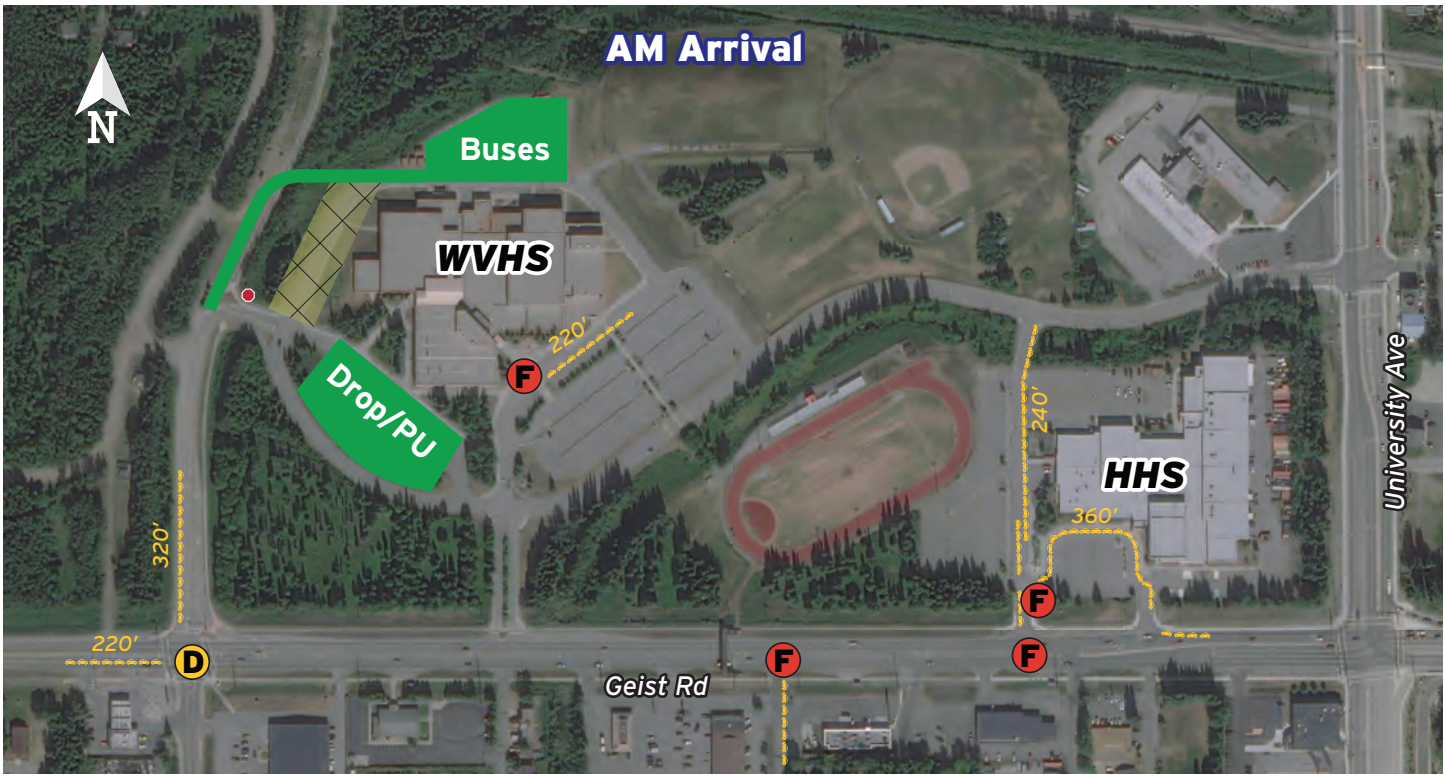
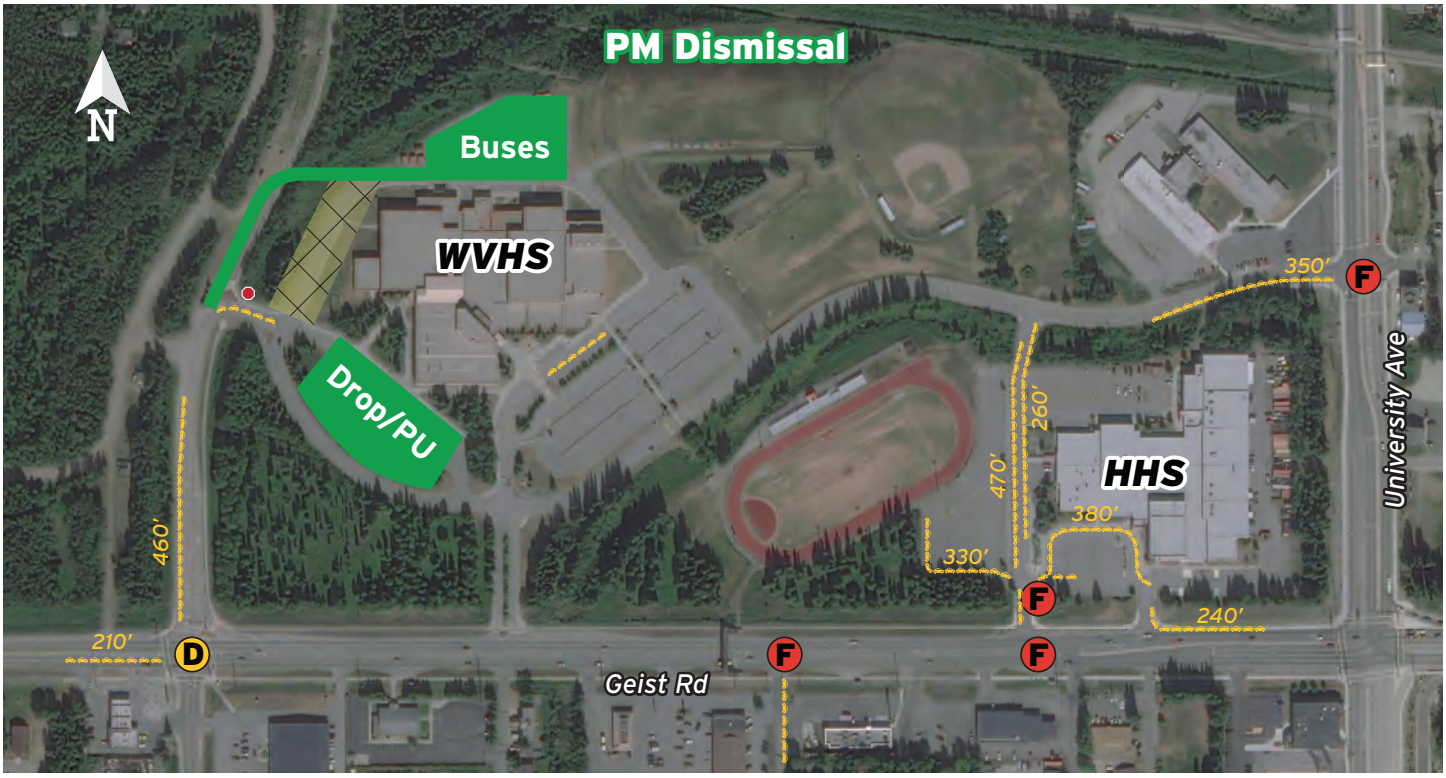
- 200' queues >=200 ft labeled

- site changes
- site removals

WEST LOOP DROPOFF/PICKUP





School Turns Only

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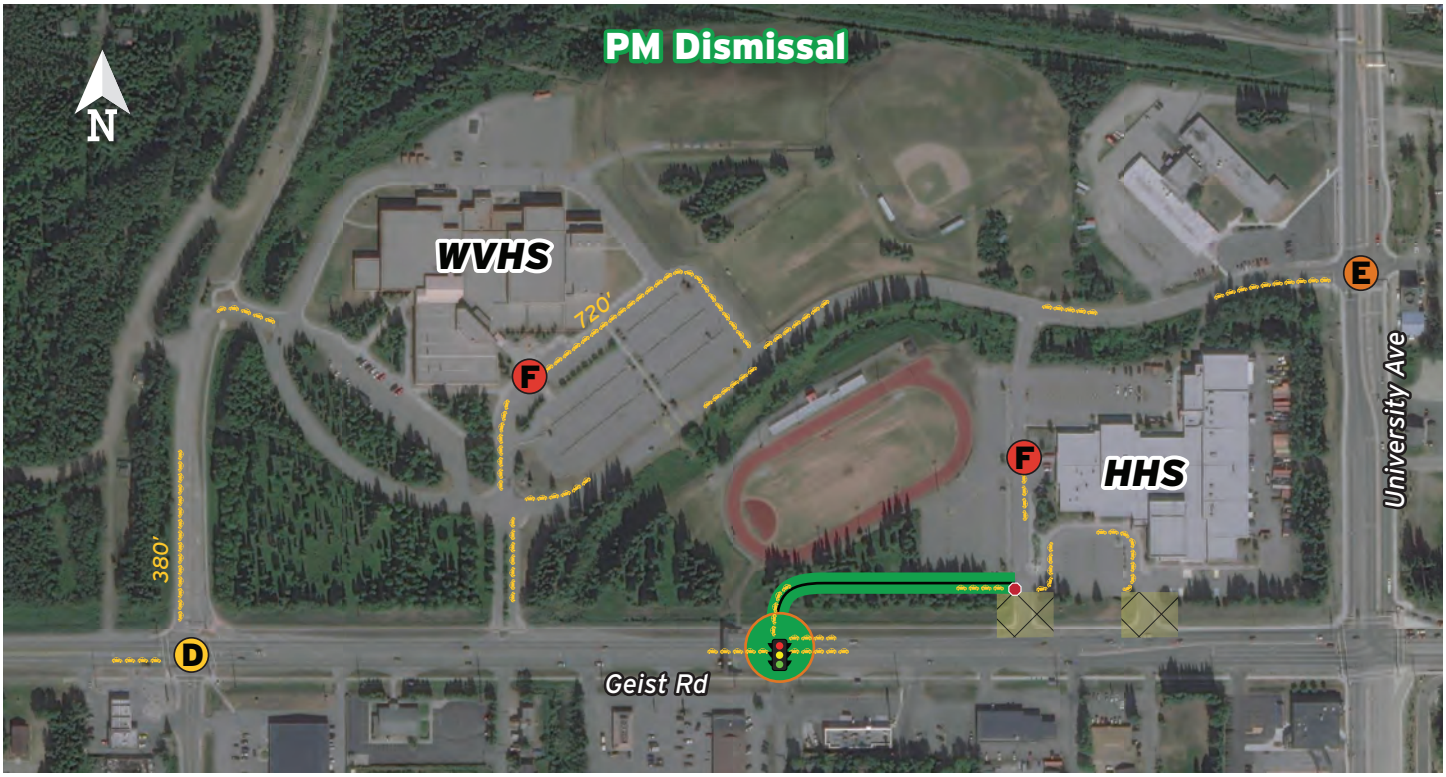
- E LOS E: 55-60s del/veh
- F LOS E/F: >60s del/veh

LEGEND

- queues >=100 ft shown
- 200' queues >=200 ft labeled
- site changes
- site removals

HHS MIDBLOCK SIGNAL AT REBECCA ST



School Turns Only

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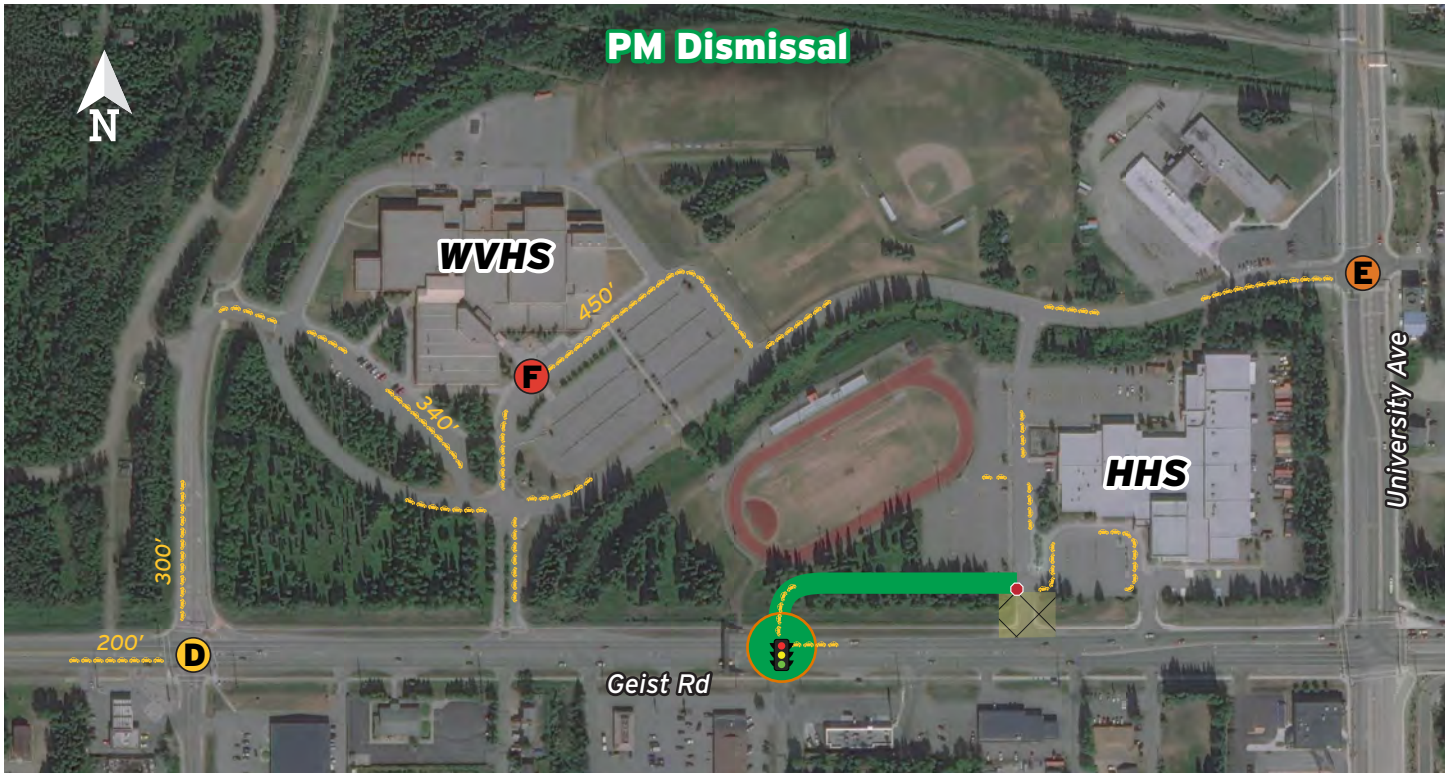
- E LOS E: 55-60s del/veh
- F LOS E/F: >60s del/veh

LEGEND

- queues >=100 ft shown
- 200' queues >=200 ft labeled

- site changes
- site removals

HHS MIDBLOCK SIGNAL WITH E ENTRANCE



School Turns Only

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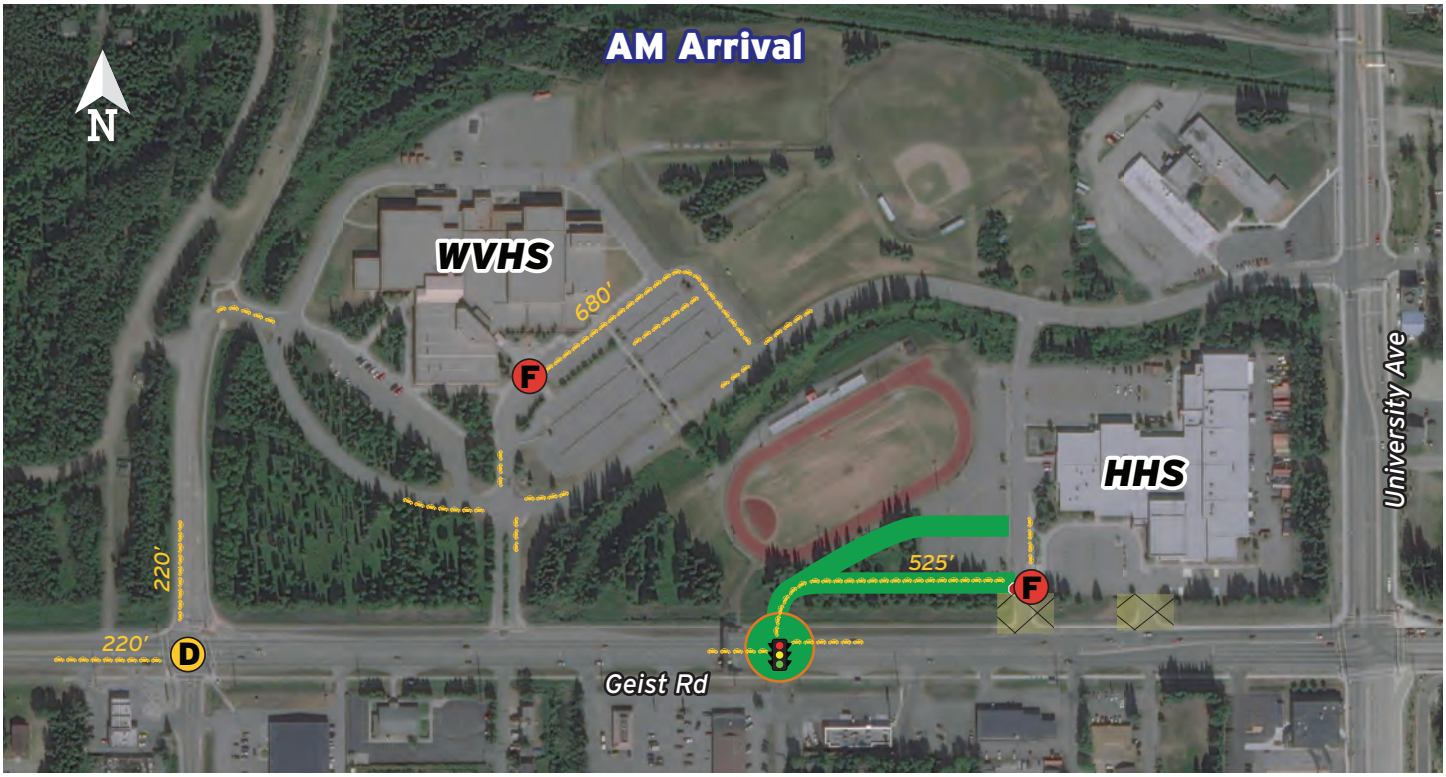
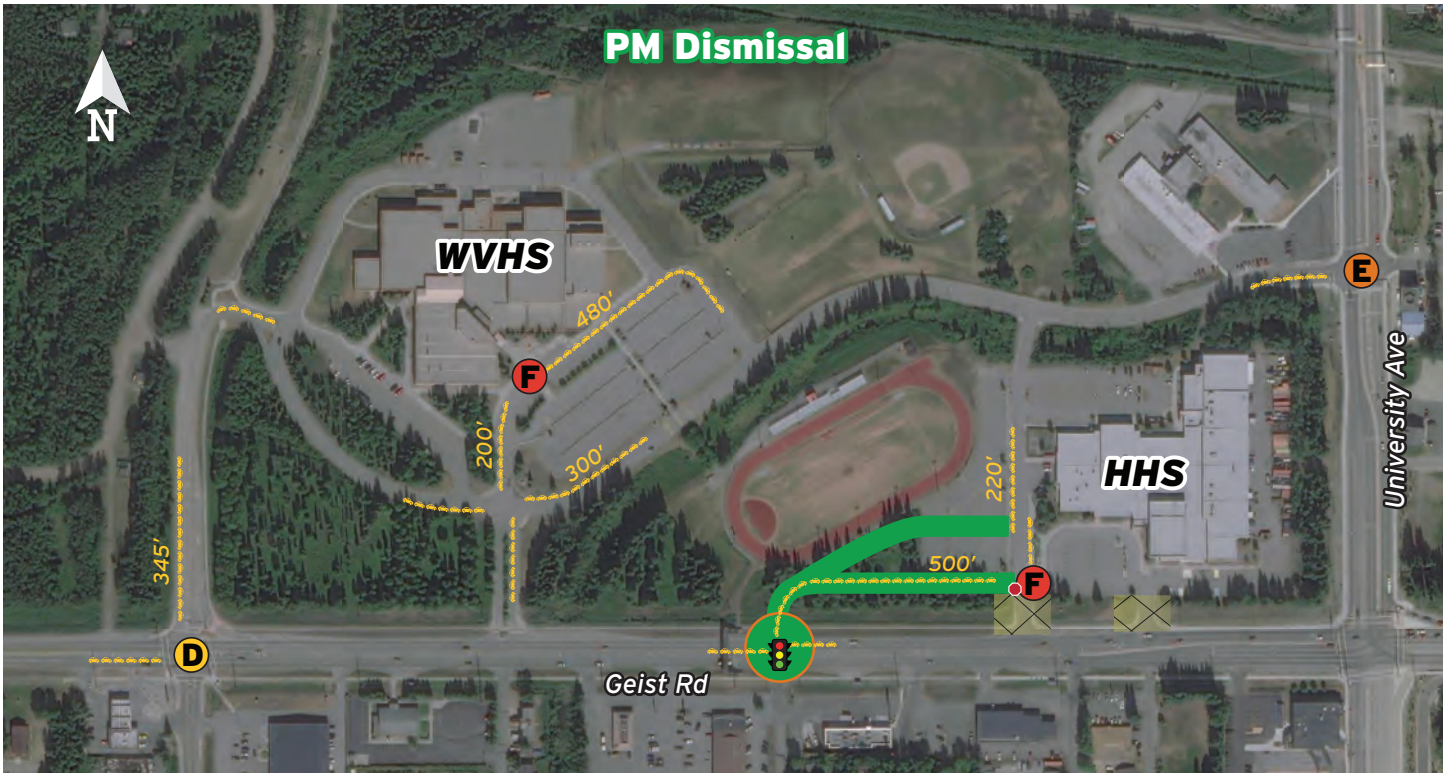
- E LOS E: 55-60s del/veh
- F LOS E/F: >60s del/veh

LEGEND

- queues >=100 ft shown
- 200' queues >=200 ft labeled
- site changes
- site removals

HHS MIDBLOCK SIGNAL WITH ONE-WAY LOOP





School Turns Only

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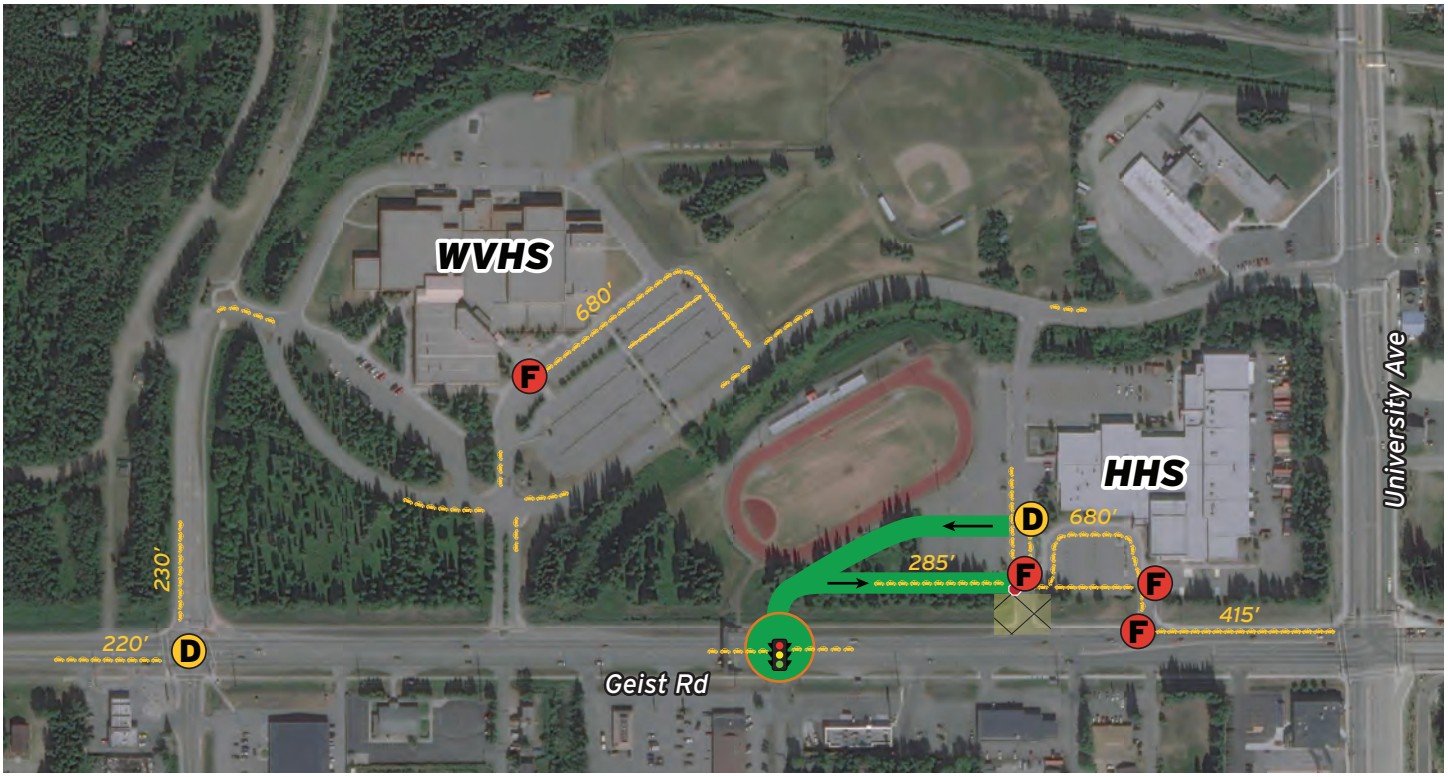
- E LOS E: 55-60s del/veh
- F LOS E/F: >60s del/veh

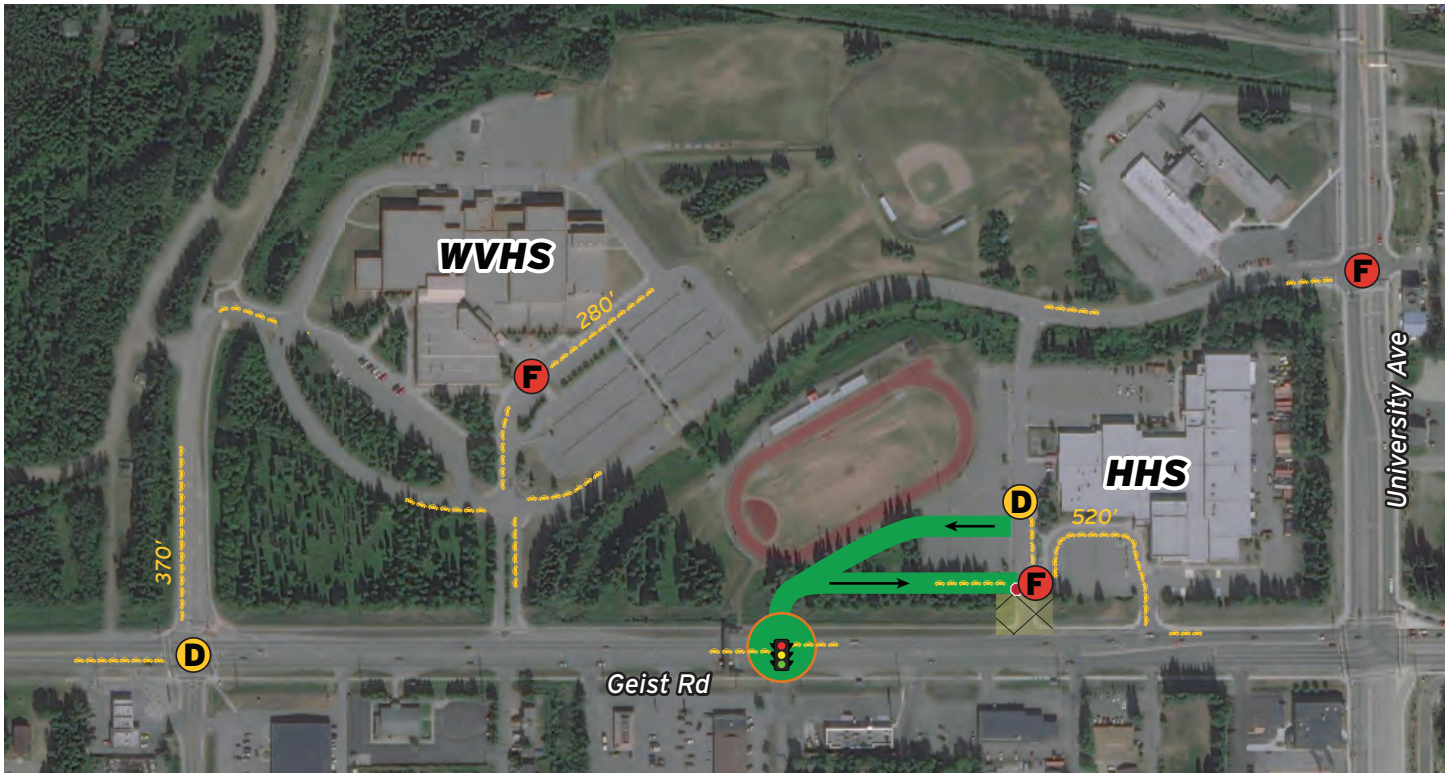
LEGEND

- queues >=100 ft shown
- 200' queues >=200 ft labeled

- site changes
- site removals

HHS MIDBLOCK SIGNAL, ONE-WAY LP, E ENTR





School Turns Only

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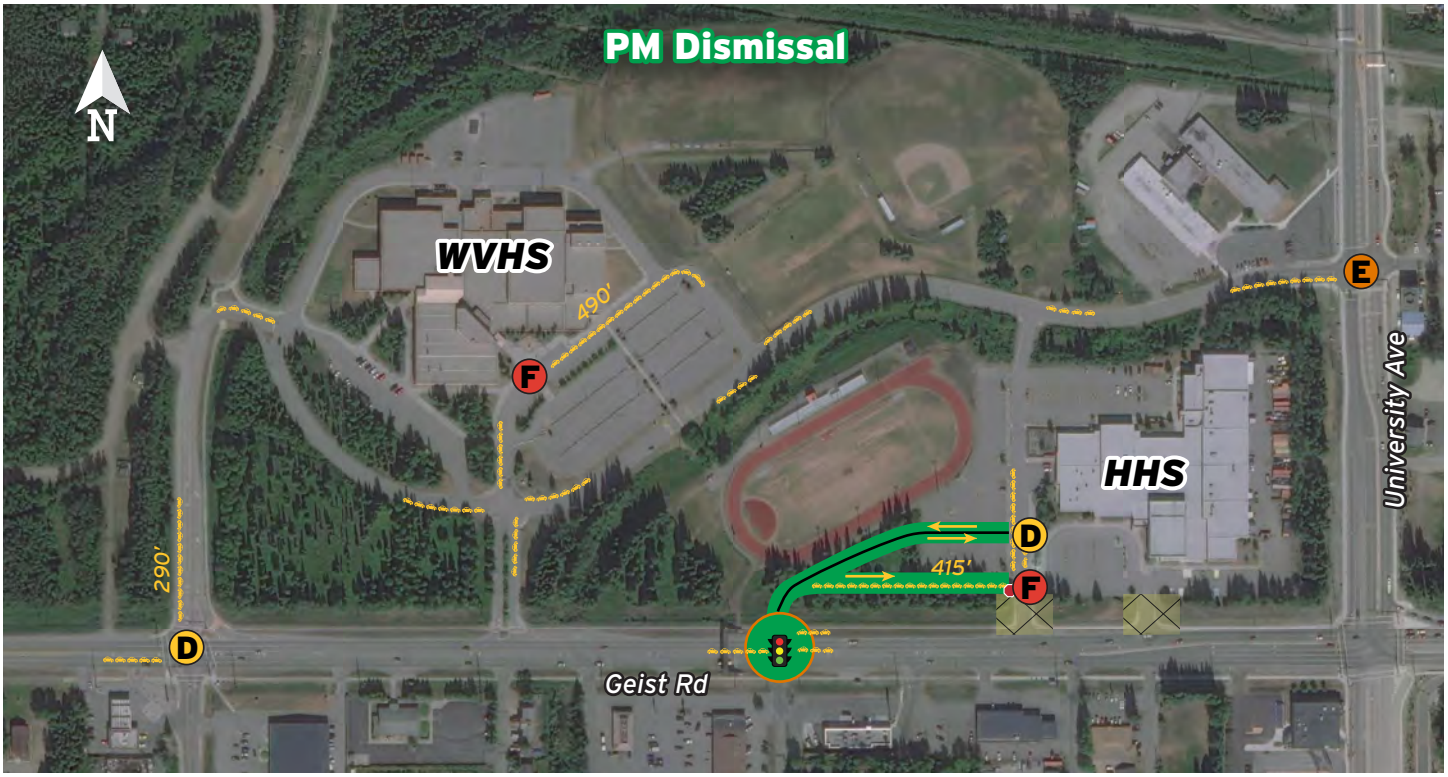
- F LOS E/F: >60s del/veh

LEGEND

- queues >=100 ft shown
- 200' queues >=200 ft labeled

- site changes
- site removals

HHS MIDBLOCK SIGNAL, TWO-WAY



School Turns Only

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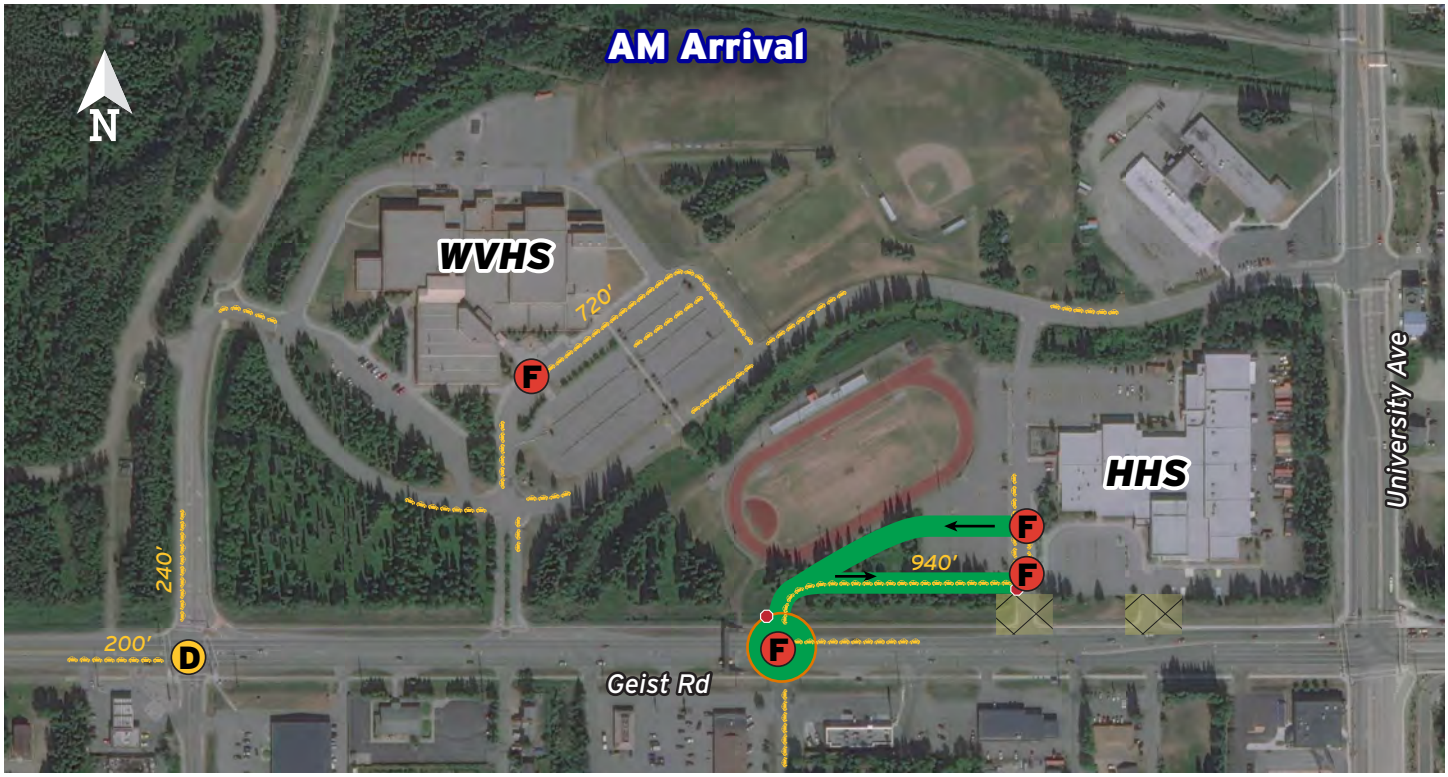
- E LOS E: 55-60s del/veh
- F LOS E/F: >60s del/veh

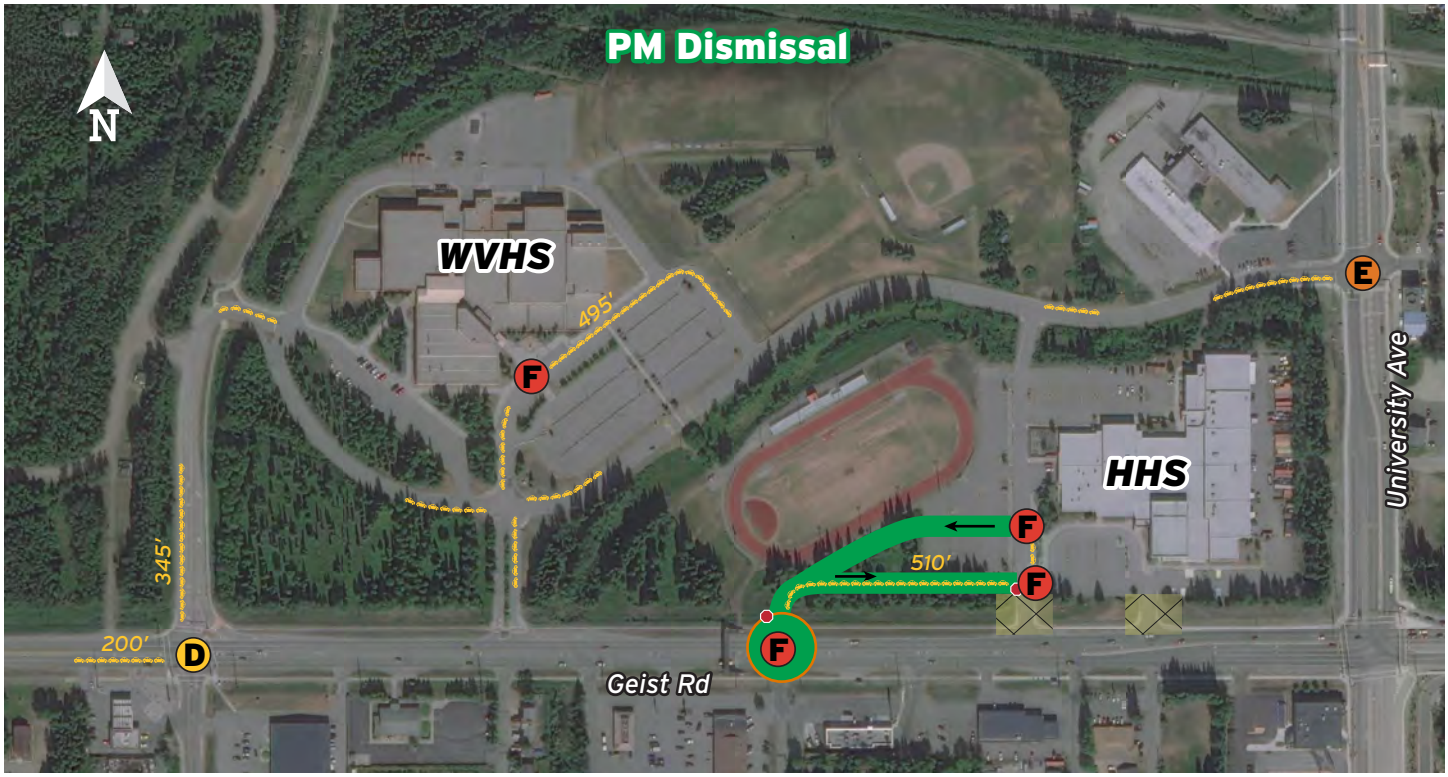
LEGEND

- queues >=100 ft shown
- 200' queues >=200 ft labeled

- site changes
- site removals

HHS MIDBLOCK TWSC WITH ONE-WAY LOOP





School Turns Only

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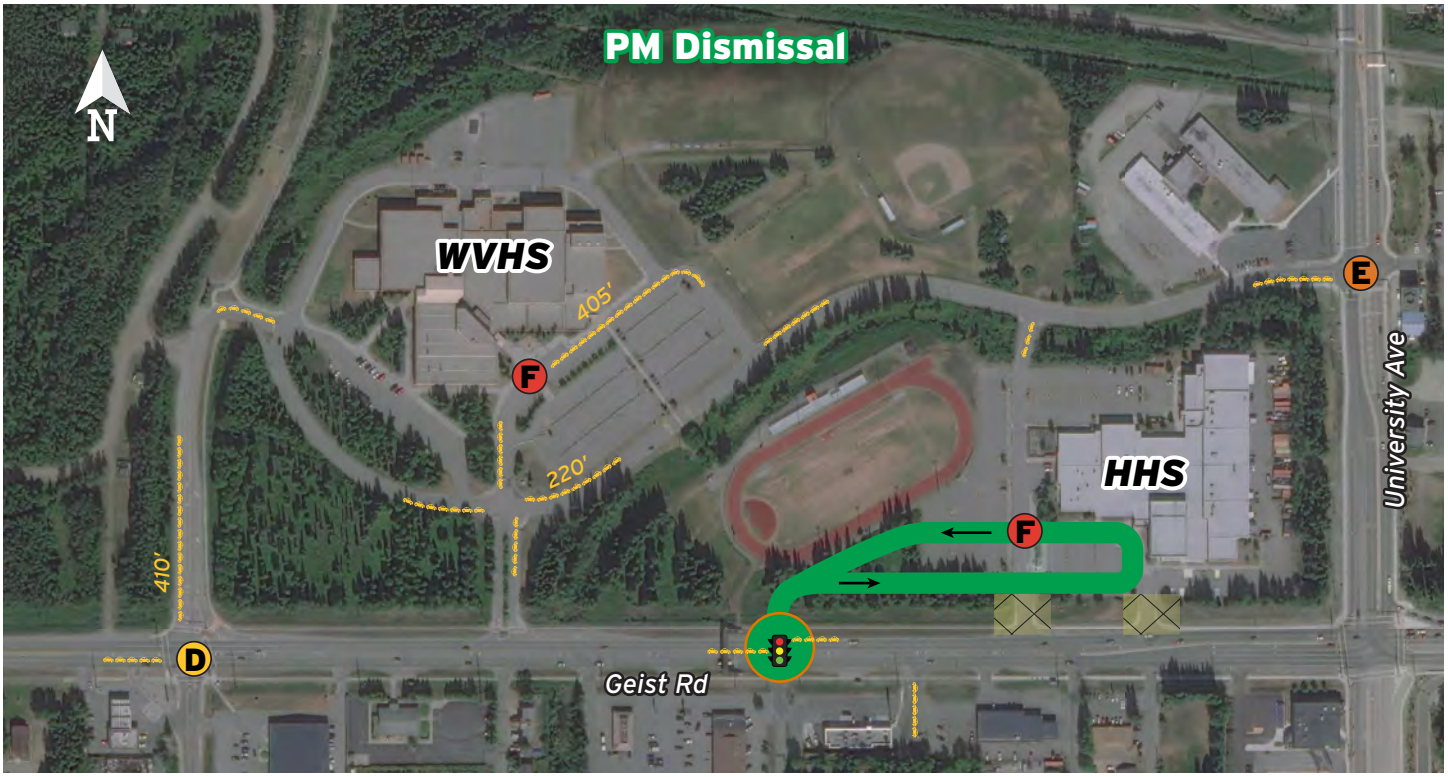
- F LOS E/F: >60s del/veh

LEGEND

- queues >=100 ft shown
- 200' queues >=200 ft labeled

- site changes
- site removals

HHS MIDBLOCK SIGNAL WITH FULL ONE-WAY LOOP



School Turns Only

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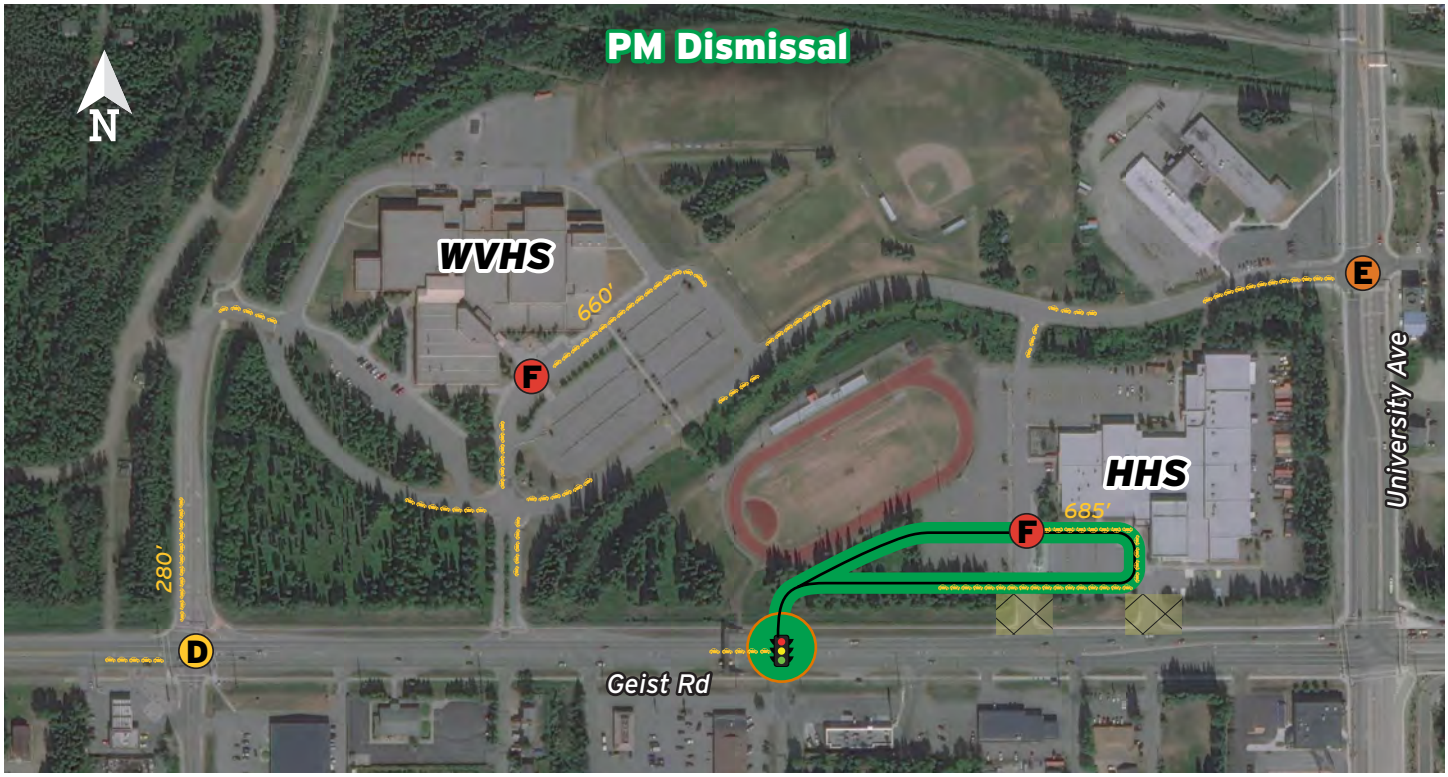
- F LOS E/F: >60s del/veh

LEGEND

- queues >=100 ft shown
- 200' queues >=200 ft labeled

- site changes
- site removals

HHS MIDBLOCK SIGNAL WITH FULL TWO-WAY LOOP



School Turns Only

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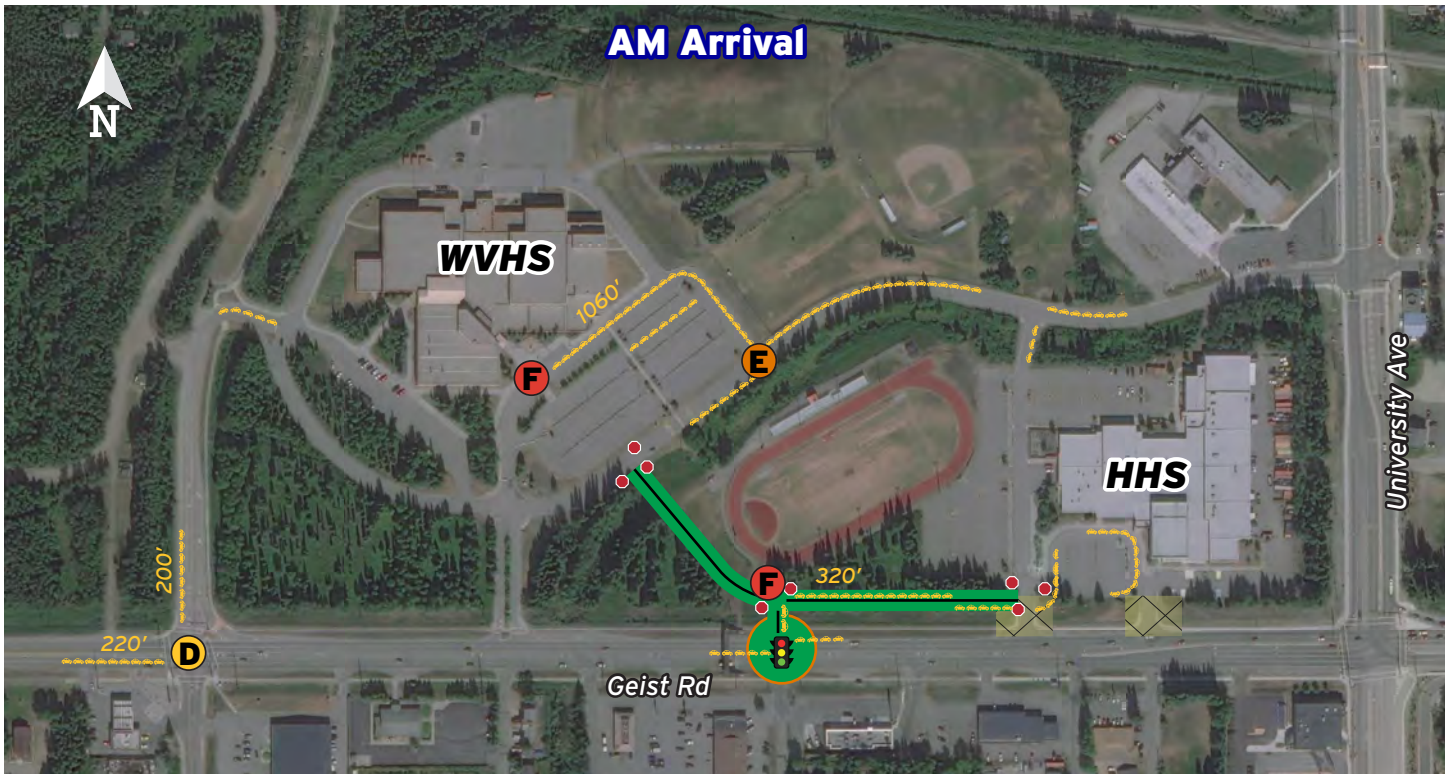
- F LOS E/F: >60s del/veh

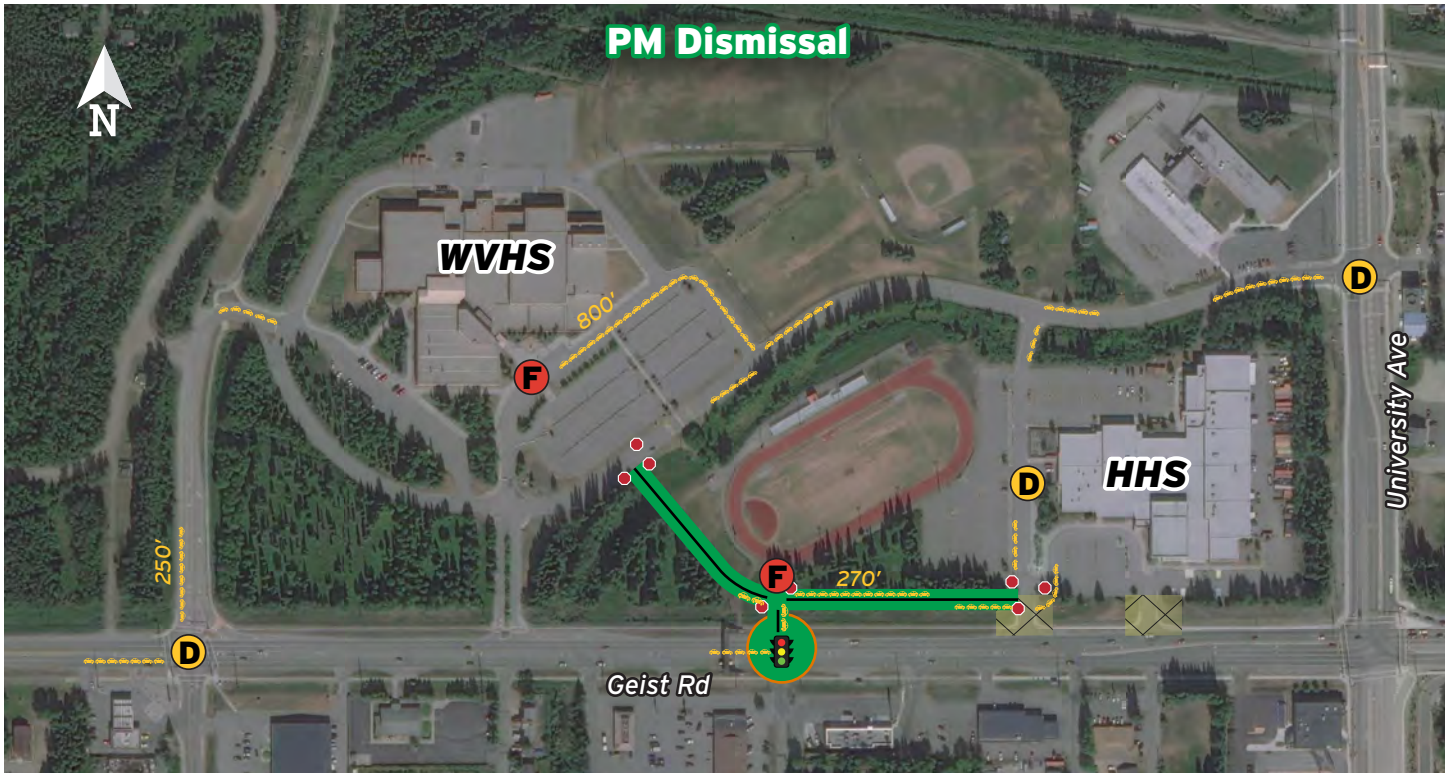
LEGEND

- queues >=100 ft shown
- 200' queues >=200 ft labeled

- site changes
- site removals

SIGNAL FOR HHS AND WVHS





School Turns Only

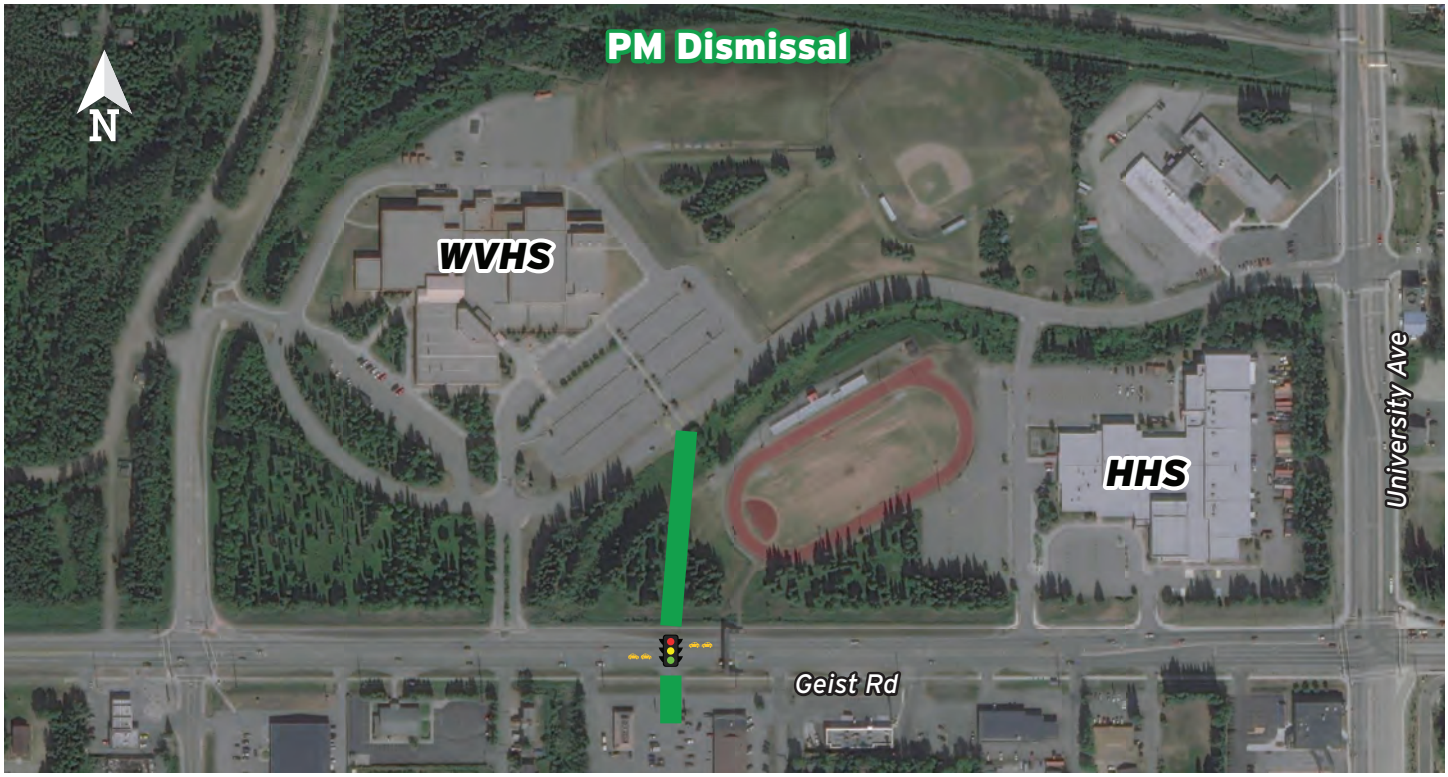
- D LOS D: 35-55s del/veh
- E LOS E: 55-60s del/veh
- F LOS E/F: >60s del/veh

LEGEND

- queues >=100 ft shown
- 200' queues >=200 ft labeled

- site changes
- site removals

GEIST RD PHB-HAWK



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Appendix C: Simulation Results by Turning Movements

(see attached)

Appendix D: Needs Analysis Methodology

Needs Analysis Options Development Procedure

1. Collected traffic counts from DOT&PF signal counts and from KE field observations, see Figure 1 below.
    a. DOT&PF signal counts:
        i. Geist & Fairbanks
        ii. University & Sandvik
        iii. University & Geist
    b. Kinney Field Counts:
        i. Geist & Wilcox
        ii. Geist & Rebecca
        iii. Geist & Ginko
        iv. Geist & HHS W Driveway
        v. Geist & HHS E Driveway
        vi. Geist & Gradelle
        vii. Sanvik & Gradelle
        viii. Gradelle & WVHS Student Parking Lot
        ix. Sandvik & WVHS Staff Parking Lot
        x. Sandvik & WVHS Pick up/Drop off Lane
        xi. Sandvik & HHS Driveway

Figure 1: Map of Count Locations

2. Combined traffic volumes for the whole study area.
    a. Determined the peak hour factor (PHF) for each intersection during AM Arrival (6:45-7:45 AM) and PM Dismissal hours (1:45-2:45 PM) of the morning and afternoon.
        i. It was discovered that the PM peak commuter hour (5:00-6:00 PM) time had little to no traffic to gather and analyze within the school network.
    b. Placed school peak 1-hour turning movements for all intersections into one spreadsheet to be viewed together.
    c. Balanced volumes by adding/subtracting small increments of vehicles so there are no missing vehicles from intersection to intersection.
3. Built a model of existing conditions in Synchro 11 and simulated performance results as a network in SimTraffic.
    a. Built the study area in Synchro using satellite imagery.
    b. Adjusted speeds, signal timing, lane settings, road geometry, and more to reflect existing conditions as best as possible.
        i. Uniform or average peak hour factors were applied to the network on campus and on arterials to eliminate dropping of vehicles between intersections (ghosting). The network of intersections is dense enough there are few reasons to drop vehicle counts between intersections. While raw turning movement counts are balanced – variable PHF values increases the number of vehicles dropped between intersections. It is especially critical to unify PHF values when moving various user groups around campus during solutions modeling in order to prevent these same simulation errors.
    c. The balanced network volumes were added to the Synchro model.
    d. Traffic was simulated using the SimTraffic tool in Synchro
        i. Simulations for hourly vehicular volumes were performed for peak 15-minute periods to more closely reflect congestion during those periods when the most traffic in the school network arrives within a 15-minute period. Uniform PHF values ensured peak vehicular traffic was modeled.
        ii. Simulation was performed for the AM and dismissal peak 15 minute periods.
            1. Buses and pedestrian counts within the 15 minute period were multiplied “as-if” they occurred over an hour at the same rate. This is because Synchro does not apply a PHF which simulates school concentrations of these users in a 15 minute period. Instead, Syncrho spreads these vehicles over the hour. This way Synchro and SimTraffic more accurately simulate queueing at drop off and pick up areas.
        iii. To account for the “random seeding” of the simulation tool, 5 different simulations were run; and an average of the 5 was used for analysis.
4. Simulation reports were created to determine benchmark performance measures for existing conditions. (This is the baseline to be compared to when considering new solutions)
    a. Queueing reports – Determined the expected length in feet of vehicle backups at each intersection.

b. Delay reports – Determined the amount of time a vehicle is expected to wait at an intersection.
c. Network reports – Determined how the network, as a whole, is performing with performance measures such as:
    i. Total emissions
    ii. Total stops
    iii. Total delays
    iv. Total distance traveled
    v. Average delay per vehicle
    vi. v/c ratios of turning movements at campus intersections
d. The "Existing Conditions Report" addresses all information about the current state of the project area.

5. Fall Demonstration Project: Developed potential solutions that are easy to implement and test for a short time on a low budget, constrained to the onsite circulation space available (roads and parking areas). This work tested feasibility of moving user groups around the campus to reduce conflicts – through the use of work zone traffic control measures. Cones, drums, signs, and flaggers performed this work for one week in October 2024 at a cost of about $25,000.
    a. Made minor changes to:
        i. Road access
        ii. Routes for certain user groups (mostly buses, drop-off/pick-up traffic)
        iii. Permitted movements
        iv. Parking locations
    b. Used public outreach to inform the public of the changes being made.
    c. Used a contractor to issue a traffic control plan with flaggers and signage.
        i. See Figure 2 on page 6 and Figure 3 on page 7 for reference.
    d. Implemented site changes for 1 week to test if the solutions are applicable.
        i. Kinney engineering observed and took traffic counts within the network area to identify the effects of the temporary site changes.
        ii. Winter conditions occurred, including a first snowfall under darkness, testing the limits of traffic routing.
    e. Sent out survey to receive public input on each change.
    f. Made conclusions based on spot traffic counts and field observations by staff onsite about the effectiveness of each site change.
        i. These conclusions helped with
            1. Shaping the type of solutions that would be tested in Synchro.
            2. Recommendations of the viability of each solution.
            3. Understanding how the public responds to certain site changes.
            4. Identifying the main problems occurring within the network area.
    g. The "Lessons Learned Memo" addresses all information associated with the Fall Demonstration Project.
6. Developed and tested new solutions using Synchro.
    a. Identified user groups for each high school and assigned volumes to each group.
        i. User groups:

1. Buses
2. Staff
3. Students parking
4. Senior students in specialized parking areas
5. CTC Students
6. Drop-off and Pick -up volumes in passenger loading zones (Parents)
7. Geist Road and University Avenue traffic levels external to school traffic

ii. Made assumptions about the route that each user group might take relevant to their destination or relocated destination (parking, entrnaces, loading zones, east versus west travel from existing conditions).
    1. Isolated each individual group and their turning movements so that they can be adjusted for each solution.

b. Brainstormed solutions to fit the problems observed in the existing conditions performance reports, stakeholders' input, public survey, and the Fall Demonstration Project.
    i. Left turn difficulty onto Geist → Signalized intersection
    ii. Geist Pedestrian crossing difficulty → Signalized intersection / PHB/HAWK
    iii. User group conflicts → Provide new routes to parking lots
    iv. Backups on Geist Road → Add storage length for queueing cars at HHS
    v. Drop-off queues at WVHS → Add additional drop-off locations
    vi. Congestion on Sandvik → Add better routes for HHS and WVHS.
c. Simulated solutions and variations on driveway access for those alternatives.
    i. Created spreadsheets to reallocate volumes for each user group based on their respective solutions.
    ii. Copied the existing Sychro model and made changes to it to reflect the proposed solution.
    iii. Adjusted Synchro settings, edited pedestrian volumes if they were relocated to new loading zones, and added the adjusted other user group volumes to match the new solution Sycnchro model.
    iv. Simulation was performed for the AM arrival and PM dismissal peak15.-minute periods
d. Created Synchro performance reports for each alternative to match the result outputs for the existing conditions.

7. Compared proposed solutions to the existing conditions.
    a. Created large queueing, delay, and network tables that listed all the turning movement performance output for each new options alongside the existing output for each intersection.
        i. Conditionally formatted the tables to identify areas of concern, or solutions that improve or worsen the existing conditions.
        ii. Used segment length to determine if queues should be stacking at particular intersections. Formulated queueing data to sum up adjacent intersections queues when minimum segment length was reached.

    b. Created figures to visually represent the impacts of each solution, which can also be viewed alongside existing performance figures.
        i. Each figure highlights only the area with the highest delays and queues of concern, or approximately LOS E/F rated. Generally delays longer than 60 seconds and queues more than 100 feet or 4-5 vehicles long are listed
    c. Created a checklist of the main problems and noted if each solution addresses them or not.
    d. After evaluating the tables, figures, and checklists; each of the solutions were determined as "consider further" or "not recommended".
        i. The "Needs Analysis Report" addresses these recommendations and results.
8. The solutions were presented to the stakeholders.
    a. The benefits and downsides of each solution are reviewed.
    b. Stakeholders helped determine the value of each solution, and which solutions are the most attractive.
9. The final proposed solution recommendations are made. A "Final Recommendations and Implementation Plan" will summarize best options make recommendations and list a potential implementation plan for agencies to consider.

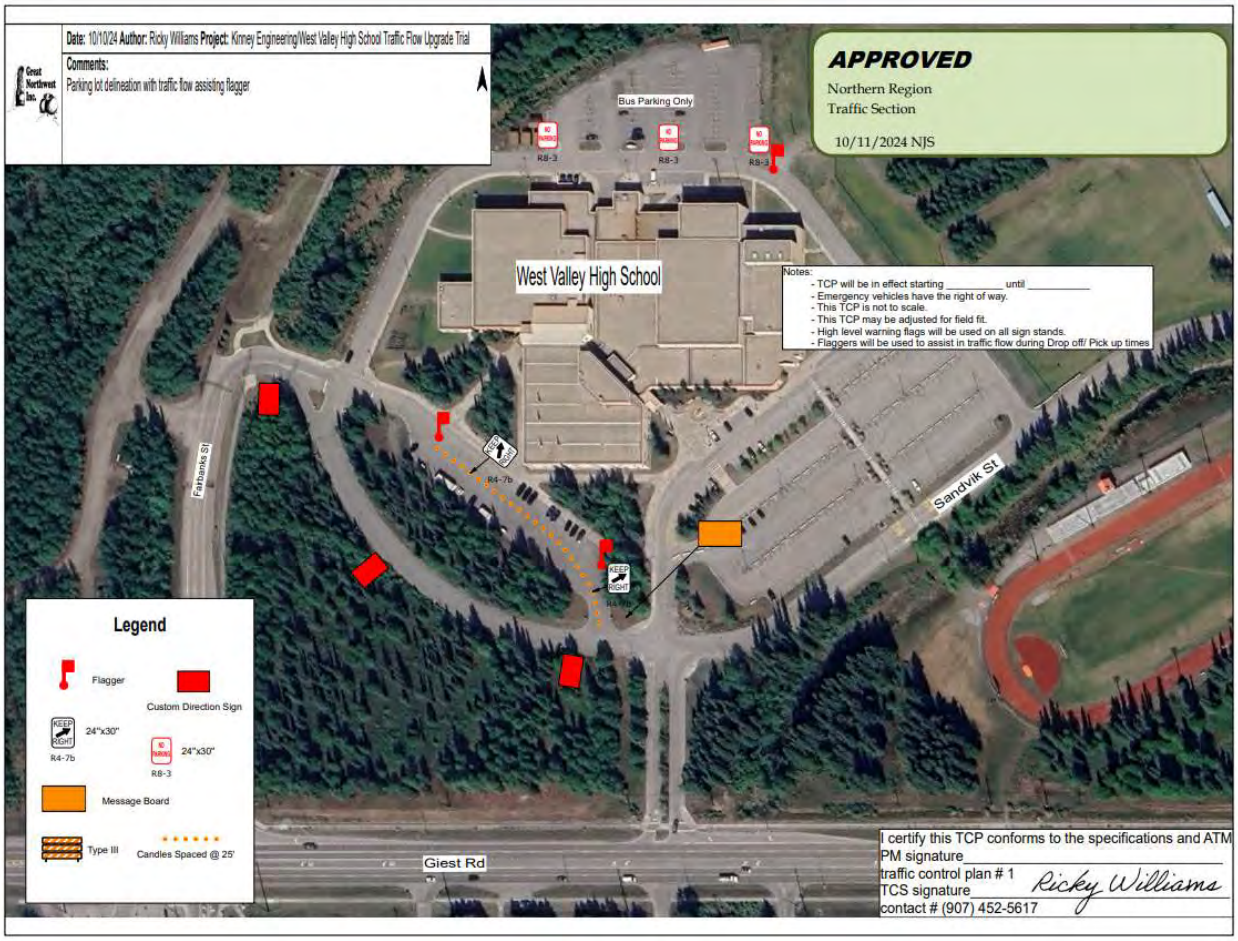

Figure 2: AM TCP Approved

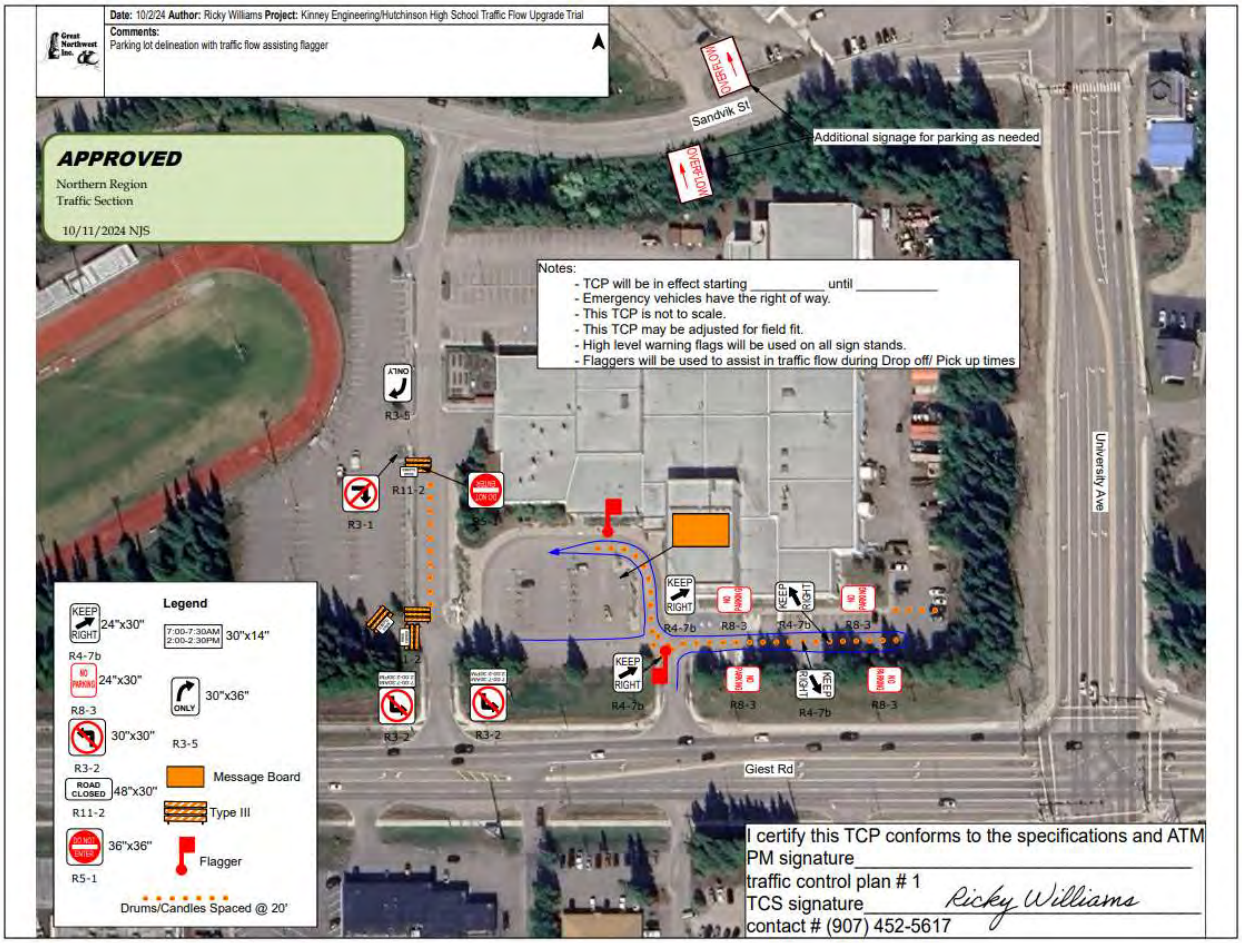

Figure 3: PM TCP Approved