

Appendix A

Key Features and Characteristics to Option Alignments and Engineering Design Considerations

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A.1 Supplemental Design Characteristics for Options A, B, and C

Following are key features and characteristics to supplement the Option A alignment description:

- The alignment is partially grade-separated with an operating speed of 35 miles per hour (mph) from Winters House to SE 6th Street; 20-mph design speed curves are proposed at the SE 6th Street at-grade crossing from the east side to the west side of 112th Avenue SE.
- A bridge for the rail track is proposed to cross over an existing culvert just south of the SE 15th Street and 112th Avenue SE intersection.
- Due to the existing poor soils condition, a section of the light rail guideway is supported by a trestle structure; the supported section is from SE 15th Street to SE 6th Street.
- Substantial elevation change of the existing roadway grade and consequential utility work is needed to match the light rail transit at-grade crossing profile at SE 8th Street. Relocating utilities to a utility corridor at the parking lot south of SE 8th Street and placing roadway pavement on pile-supported embankment is proposed to address poor soil conditions.
- Left-turn lanes on both northbound and southbound traffic on 112th Avenue SE will be added at the intersection of SE 6th Street and 112th Avenue SE. Exclusive right-turn lanes on northbound traffic will be added at the intersections of SE 15th Street and SE 8th Street.
- A 1.2-acre-foot storm drainage vault located at approximately SE 8th Street.
- Double cross-over track is located along the east side of 112th Avenue SE, north of the SE 8th Street and 112th Avenue SE intersection.
- A traction power substation (TPSS) is located near SE 1st Place.

Following are key features and characteristics to supplement the Option B alignment description:

- The alignment is grade-separated from the roadway with a rail transit design speed of 45 mph from Winters House to East Main Station.
- One straddlebent for the elevated guideway is assumed over the 112th Avenue SE southbound lanes to meet horizontal stopping sight distance for the southbound vehicles traveling at 35 mph.
- A double cross-over track is located in front of the south portion of Surrey Downs Park.
- The trench along the west side of 112th Avenue SE would be watertight, with struts every 30 feet assuming the wall height is 15 feet or higher; a second diagonal strut every 30 feet is

assumed when the west guideway wall is higher than 15 feet when measured from the first strut.

- A 1.2-acre-foot storm drainage vault located at approximately SE 8th Street.
- A deep-bore storm drainage pipe at SE 6th Street is assumed at the low point of the trench guideway to accommodate runoff discharge and connection to the existing storm drainage system.
- The TPSS and hammerhead at SE 1st Place shifts west (when compared with Option A) to maintain a 300-foot clear line-of-sight from the north pedestrian track crossing at East Main Station for the westbound light rail train operator when entering the station.

Following are key features and characteristics to supplement the Option C alignment description:

- Light rail transit operating speed of up to 40 mph is proposed at the intersection of 112th Avenue SE and SE 15th Street when light rail crosses from east side onto west side of 112th Avenue
- There is a signalized at-grade crossing through the intersection of SE 15th Street. Vehicle gates will be installed at the intersection since the light rail speed exceeds 35 mph through the intersection.
- A bridge for the rail track is proposed to cross over an existing culvert just south of the SE 15th Street and 112th Avenue SE intersection.
- Left-turn lanes on both northbound and southbound traffic on 112th Avenue SE will be added at the intersection of SE 15th Street and 112th Avenue SE. No roadway widening on 112th Avenue SE will be needed; a portion of the existing median on 112th Avenue SE at the intersection or 112th and 15th will be removed to accommodate left-turn pockets.
- Bellefield Park Drive will be realigned.
- A 1.2-acre-foot storm drainage vault located at approximately SE 8th Street.
- A double cross-over track is located in front of the south portion of Surrey Downs Park.
- Vehicle gates on each side of the tracks will be installed to control eastbound traffic from SE 6th Street (the realigned SE 4th Street) and westbound traffic movement onto SE 6th Street (the realigned SE 4th Street section) from 112th Avenue SE.
- Left-turn lanes on both northbound and southbound traffic on 112th Avenue SE will be added at the intersection of SE 6th Street and 112th Avenue SE. An exclusive right-turn lane on southbound traffic will be added at the intersection.
- The TPSS and hammerhead at SE 1st Place shifts west (when compared to Option A) to maintain a 300-foot clear line-of-sight from the north pedestrian track crossing at East Main Station for the westbound light rail train operator when entering the station.

A.2 Engineering Design Considerations

Key engineering design considerations used to develop the alternative route designs along 112th Avenue SE from the wye intersection at Bellevue Way to Main Street included soil conditions, roadway reconstruction, number of grade crossings, crossing locations, operating speed of light rail trains, and construction schedule.

A.2.1 Soil Condition

In general, the soil condition along the east side of 112th Avenue SE from the wye intersection at Bellevue Way to SE 8th Street is considered to be poor due to its shared soil characteristics with the Mercer Slough. Soil conditions are anticipated to improve with an alignment shift to the west. Option A runs along the east side of 112th Avenue SE from the wye intersection to SE 6th Street before crossing at-grade to the west side through the SE 6th intersection. Significant ground improvements such as stone columns, overexcavation and replacement with granular material, and auger cast piles are expected to improve the subsurface condition under the trackway and the reprofiled roadways along the east side of 112th Ave SE. For Options B and C, the trackway crosses from the east to west side of 112th Avenue SE just south of SE 15th Street. The soil condition on the west side of 112th Avenue SE is more stable, requiring limited or no soil remediation when compared with the subsurface on the east side. Ground improvements from the wye to SE 15th Street are anticipated, but the extent will be less than for Option A.

A.2.2 Roadway Reconstruction

For at-grade crossings, flat cross-slopes across the trackway are required; typical roadway cross-slope, however, normally has a 2-percent crown. Major grading and roadway reconstruction is required for both the cross street and at the intersection to achieve a smooth transition for vehicle traffic.

In Option A, the 112th Avenue SE eastside-running trackway crosses SE 15th and SE 8th Streets. Major roadway reconstruction is proposed at these intersections. SE 8th Street will have significant roadway reconstruction due to the subsurface condition. The resulting reprofiled roadway will impact existing underground utilities, necessitating relocation. When the trackway crosses from the east to the west side of 112th Avenue SE at SE 6th Street (and realigned SE 4th Street) intersection, major grading at the intersection and on SE 6th Street is anticipated.

In Option B, the trackway crosses from the east to the west side of 112th Avenue SE south of SE 15th Street with an elevated guideway, making the crossing grade-separated. The impact to roadway reconstruction for this alternative is the least among the three options. Reconstruction work is expected to be limited to where the guideway crosses underneath SE 4th Street. A lidded structure will be constructed over the track at SE 4th Street to maintain access to the Surrey Downs neighborhood.

In Option C, the trackway crosses from the east side to the west side of 112th Avenue SE beginning south of SE 15th Street and through the intersection. The impact at the SE 15th Street intersection is greater than that of Option A, which crosses at the SE 6th Street intersection, due to the longer length of the track crossing at the intersection of SE 15th Street. However, the crossing at SE 8th Street has been eliminated in Option C. This option also proposes roadway realignment of SE 4th Street onto the SE 6th intersection similar to Option A.

A.2.3 Number of Grade Crossings and Crossing Locations

When a light rail train crosses an intersection or cross street, considerations for evaluating operation safety at the intersection include automatic vehicle gates, pedestrian gates, train bells, and bicycles crossing the trackway. Automatic vehicle gates and pedestrian gates with audible warning devices (e.g., bells) are typical safety control devices where light rail train at-grade roadway crossings occur. Using gates increases stopping and waiting time at the intersection,

thereby reducing the intersection vehicle capacity. Consequently, for at-grade crossings, traffic and noise impacts are anticipated. Design consideration for bicycles at crossings involves positioning the bicycles perpendicular to the track if possible in order to minimize the potential of a bicycle wheel being trapped in the gap next to rail.

In Option A, there are three at-grade crossing locations: SE 15th Street, SE 8th Street, and SE 6th Street (and realigned SE 4th Street) intersections. Automatic vehicle gates are proposed at both SE 15th and SE 8th Streets. To relieve traffic traveling northbound on 112th Avenue SE while trains are crossing the street, exclusive right-turn pockets for both SE 15th and SE 8th Streets in the northbound direction are proposed. No automated vehicle and pedestrian gates are proposed at the SE 6th Street at-grade intersection crossing due to the lower operating speed of 20 mph precipitated by design geometry restrictions.

The major movement at the 112th Avenue SE and SE 8th Street intersection is the southbound left turn to Interstate 405 (I-405). For Option A, the at-grade crossing at SE 6th Street will impact the southbound movement along 112th Avenue SE to I-405 via SE 8th Street. In Option B, the light rail is a fully grade-separated alignment with no at-grade crossings; no increased traffic impacts and bell noise impacts are anticipated on 112th Avenue SE at the crossings. In Option C, there are two at-grade crossing locations: SE 15th and SE 6th Street intersections. At both locations, automated vehicle gates and related bells are anticipated. Crossing at SE 15th Street can eliminate impacts to the southbound movement at 112th Avenue SE and SE 8th Street.

A.2.4 Light Rail Train Operating Speed

In general, it is desirable for trains to operate at a speed of 55 mph along a grade-separated corridor if feasible. Where the train operates within a roadway, the speed should match the design speed of the parallel street traffic. In Option A, the train is operating adjacent to 112th Avenue SE and crossing from the east to west side at the SE 6th Street intersection. The train operates at a speed of 20 mph when it crosses the intersection due to geometry restrictions. Option B is a fully grade-separated alignment. The train can be operated at a speed of 45 mph from the Winters House to East Main Station. It would not have any physical constraints to slow down the speed of the train operation. Option C is very similar to Option A. The train operates adjacent to 112th Avenue SE. Unlike Option A, when the train crosses an intersection, the train can operate at a speed of 40 mph at the SE 15th Street intersection.

A.2.5 Construction Duration and Schedule

The construction schedule is based on the complexity of the construction and the associated typical production rates. Construction delay is also defined as construction risks, resulting in extra expenses and/or schedule delay primarily due to potential geotechnical issues. In general, at-grade and elevated construction will have a lower risk than retained cut and fill. However, the construction duration for Option A is relatively longer due to the complex construction work associated with ground improvements, utility relocations, and roadway reconstruction. Option B is expected to have the second longest construction duration due to the combination of elevated guideway and retained cut guideway. Option C is expected to have the shortest construction duration when compared with Options A and B because Option C is mostly at-grade and has less need for soil/ground improvements than Option A and less retaining wall construction than Option B.