

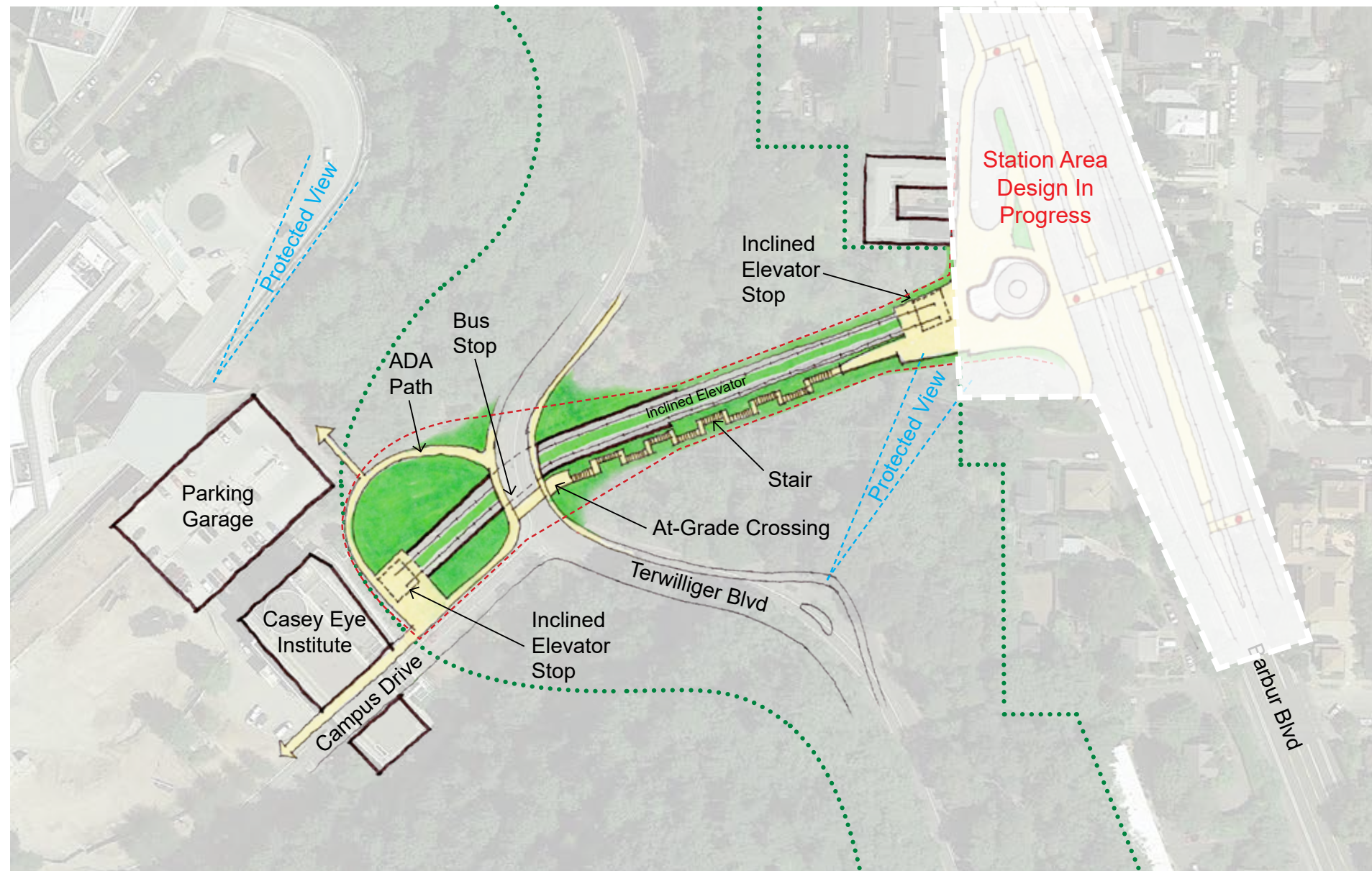
APRIL 10, 2019

Marquam Hill Connector

Options & Draft Evaluation

Green Ribbon Committee

Option 1: Inclined Elevators

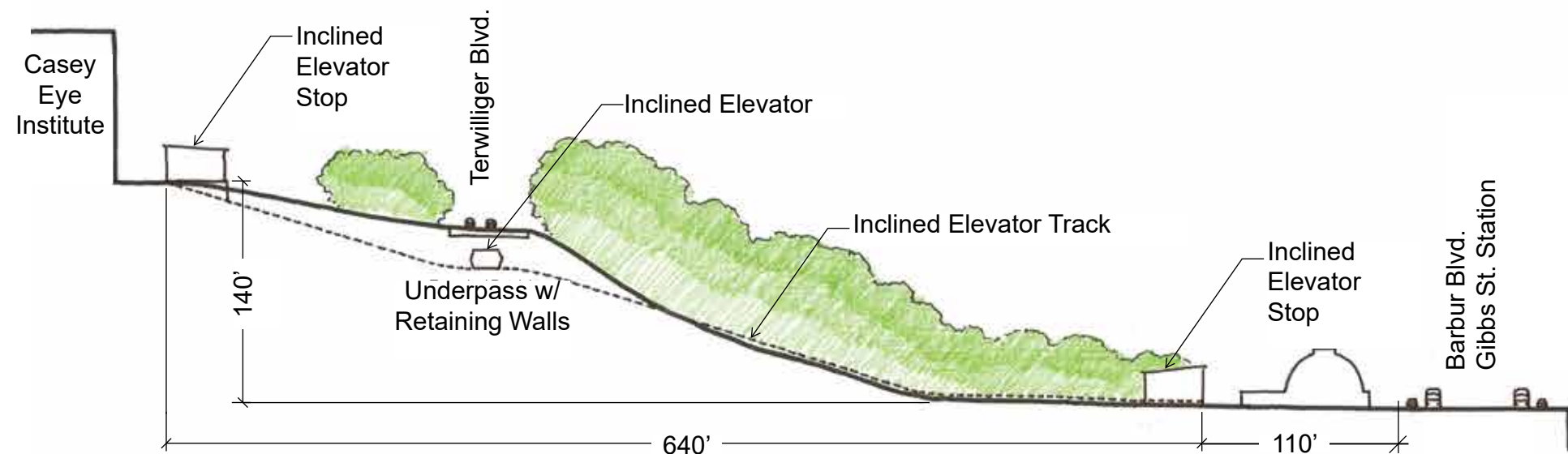
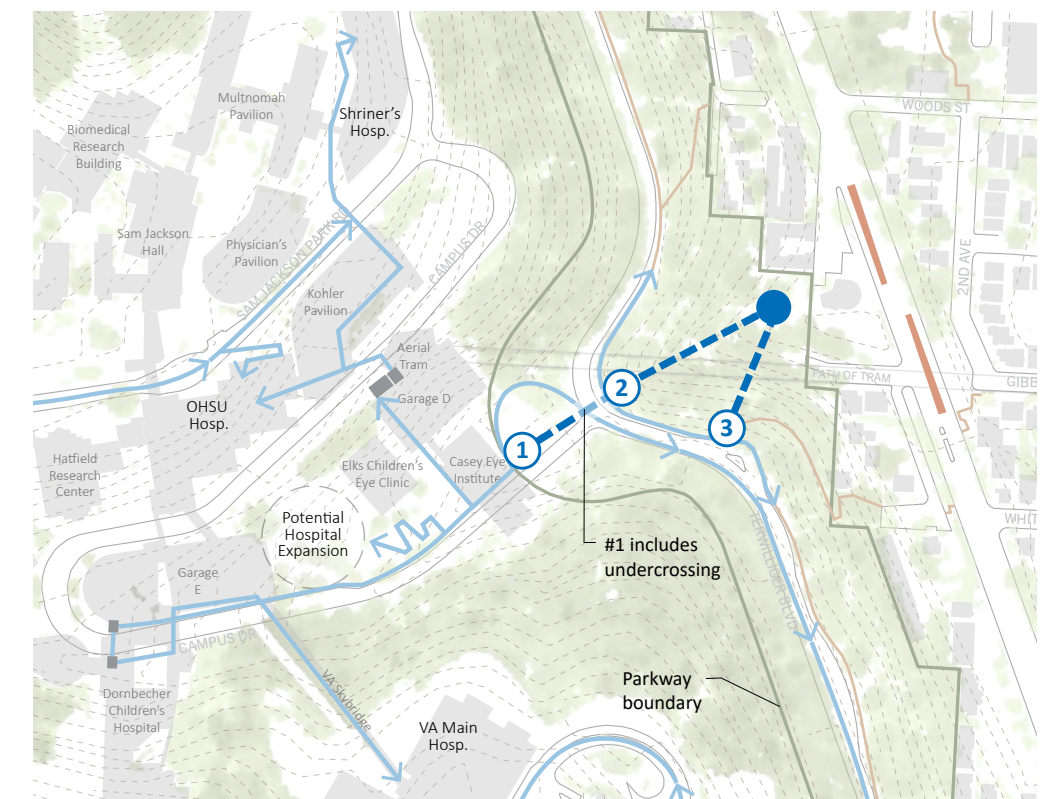


Estimated Average Travel Time from Gibbs Station during AM Peak (Minutes)

Destination:	Ambulatory Person	Person using Manual Wheelchair
OHSU Hospital	11	14
VA Medical Center Hospital	12*	14*
Shriners Hospital	14	22*
OHSU Hospital Expansion	6	11

* Includes bus trip

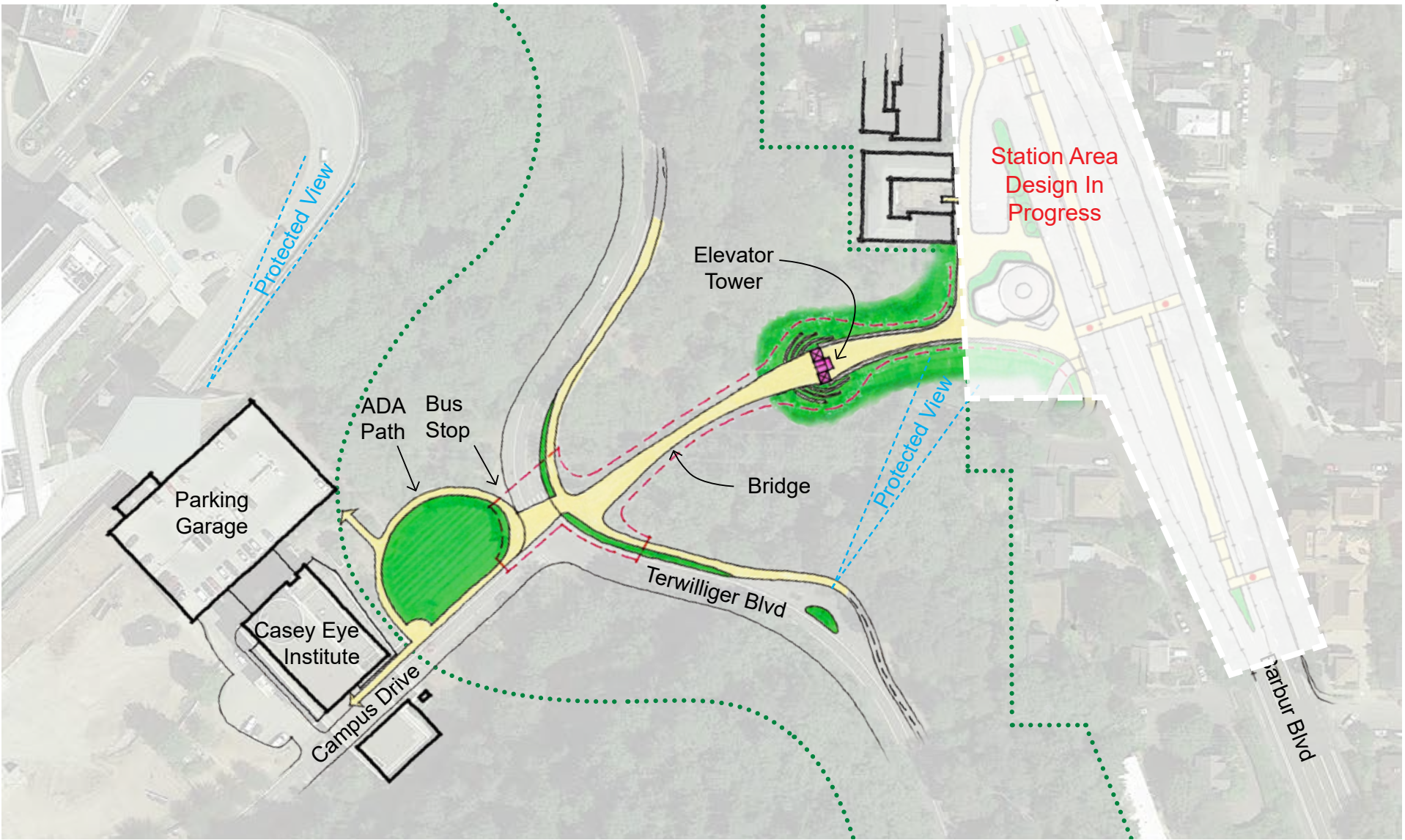
Other Potential Alignments



Option 1 Draft Evaluation

Category	Draft Evaluation	Opportunities	Challenges	Additional Notes
Access		- Direct access to OHSU lower campus - Direct access to recreational destinations - Connection to bus, shortens time to VA Hospital - Weather protection provided in inclined elevator cabins & at stops - Overcomes vertical & horizontal distances, minimizes physical effort to cross Parkway	- Indirect access to OHSU upper/east campus, may require additional improvements - Physical effort for connections uphill from landing at edge of Parkway	From landing point, destinations may be uphill to OHSU lower & upper campuses, or downhill to Parkway & bus stop
Safety		- Users are highly visible from surroundings with limited areas of seclusion or isolation - Sized for pedestrian volumes at peak times* - Relatively easy to monitor & secure	Safety considerations for at-grade crossing at Terwilliger for stair users	Assumes 2 inclined elevators (40 people/car), independently operating
Context		- Protects existing properties - Protects existing viewpoints	- Mechanical & boarding structures will be visible within surroundings - Changes the use of the park land in trackway footprint - May impact existing utilities, depending on alignment	Other potential alignments have different visual impacts
Environmental		Relatively small construction footprint outside of trackway	- Clearing for trackway causes permanent tree impacts - Disruption to Terwilliger Blvd during construction of undercrossing - Security lighting & fencing may impact wildlife	- Construction footprint 50-60ft (includes 20-30ft trackway & 10-12ft stairway) - Other potential alignments do not include undercrossing at Terwilliger
Operational		- Buildable with durable & resilient materials* - Redundancy with multiple elevators & stairs* - Elevators operate independently - May be expanded with future growth with proper planning	- Maintenance of incline track & traction system - Elevators will have maintenance/out of service time that temporarily impairs capacity* - May require an attendant - May have limited hours - May require a user fee	- No precedent for this system in Portland, many operational issues require further study - There are autonomous & staffed examples worldwide
Budget/ Schedule		- May be attainable within project budget, would benefit from funding partnerships - Relatively straight forward construction type	Risks associated with a system/technology that has no precedent in the TriMet system	Approximate capital cost: \$35-45 million
Experience		- Unique new transit system for Portland, likely to be an attraction - Inclined elevator/funicular interpretive opportunity - Includes stairway to allow for choice of access and experience	Unfamiliar mode for many people, will require user orientation	

Option 2: Bridge + Elevators

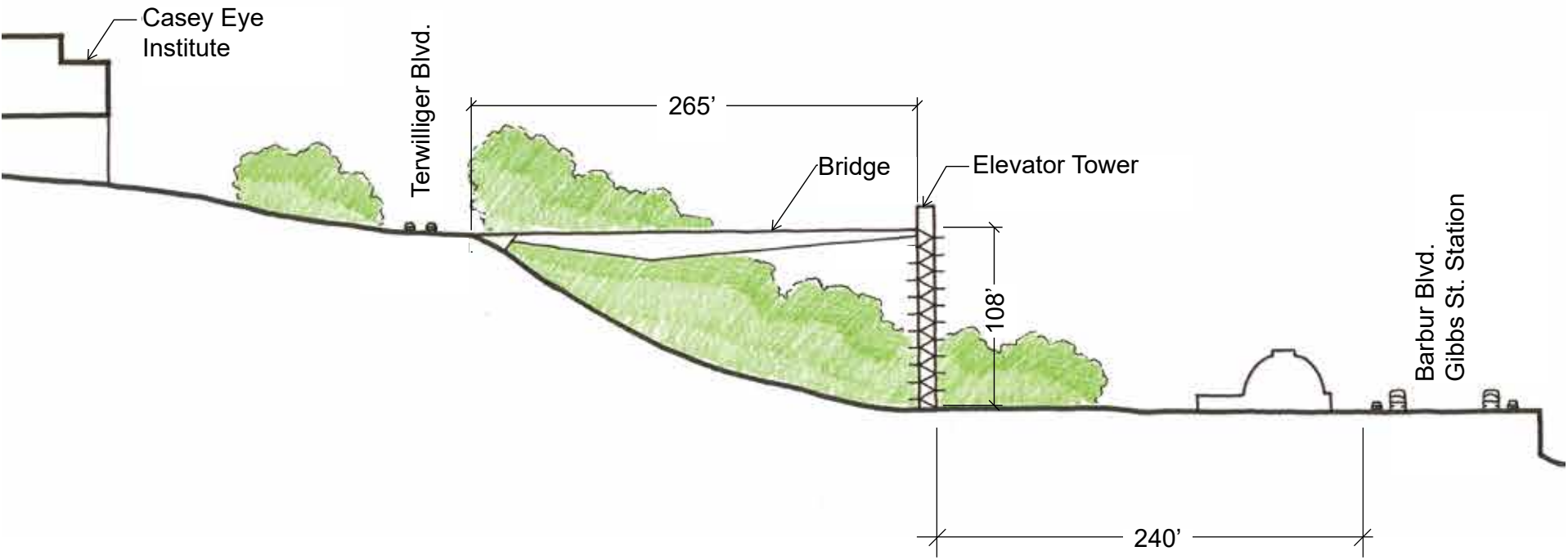
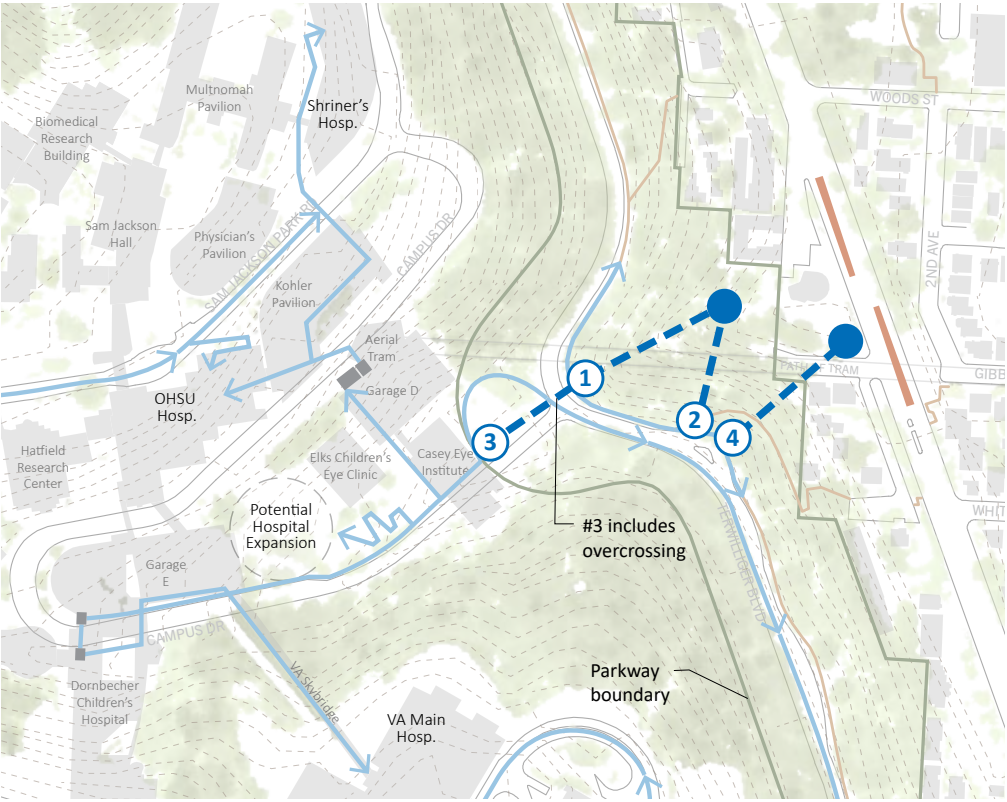


Estimated Average Travel Time from Gibbs Station during AM Peak (Minutes)

Destination:	Ambulatory Person	Person using Manual Wheelchair
OHSU Hospital	12	21*
VA Medical Center Hospital	11*	14*
Shriners Hospital	14	22*
OHSU Hospital Expansion	7	15

* Includes bus trip

Other Potential Alignments



Option 2 Draft Evaluation

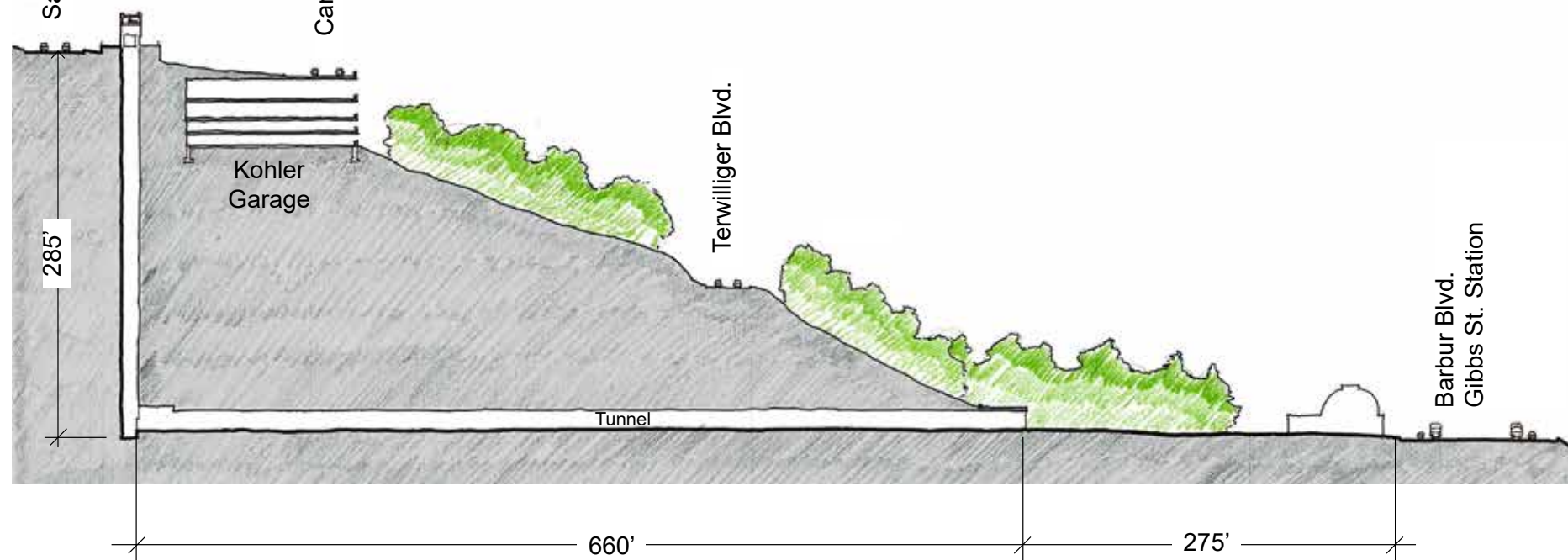
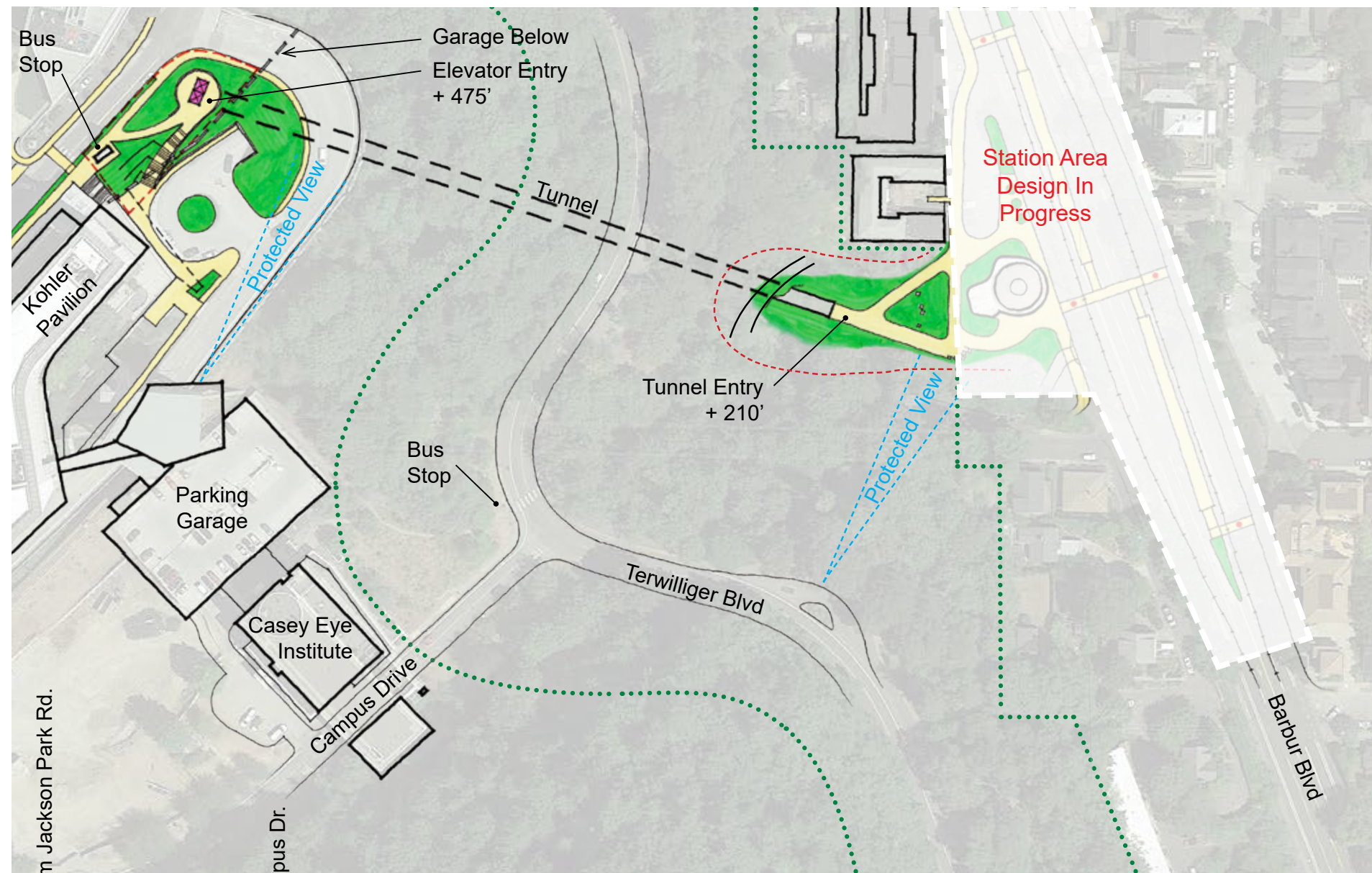
Category	Draft Evaluation	Opportunities	Challenges	Additional Notes
Access		- Direct access to OHSU lower campus - Direct access to recreational destinations - Bus route shortens time to VA Hospital	- Indirect access to OHSU upper/east campus, may require additional improvements - Physical effort for connections uphill from landing - Weather protection not inherent to type, may be added	From Terwilliger, destinations may be uphill to OHSU lower & upper campuses, or accessible via bus stop
Safety		- Users are highly visible from surroundings with limited areas of seclusion or isolation - Sized for pedestrian volumes at peak times* - Relatively easy to monitor & secure	Safety considerations for at-grade crossing at Terwilliger	Assumes 2 elevators (39 people/car), high speed, similar to Washington Park MAX station elevators
Context		- Protects existing properties - Protects existing viewpoints - Flexibility in alignment to respond to context	- Bridge & elevator structures likely visible from surrounding views - May impact the use of the park land in bridge footprint - May impact existing utilities, depending on alignment	Visibility of structure can vary with alignment, placement is constrained by protected view points
Environmental		- Opportunity for replanting/habitat restoration post-construction (permanent footprint is smaller than construction footprint) - Relatively low disruption to surroundings during construction	- Construction footprint will include tree impacts - Security lighting may impact wildlife	Construction footprint 40-50ft along bridge alignment, including access road during construction
Operational		- Buildable with durable & resilient materials* - Redundancy with multiple elevators & stairs* - May be expanded with future growth with proper planning - Relatively simple & predictable maintenance - Likely to operate 24/7 - Likely to be free to use	- Elevators will have maintenance/out of service time that temporarily impairs capacity* - Addition of supplemental shuttle service at Terwilliger would increase operations costs	Current precedents in Portland are free to use & operate 24/7
Budget/ Schedule		- May be attainable within project budget, would benefit from funding partnerships - Relatively easy construction type - Relatively low risk, familiar construction method & equipment		Approximate capital cost: \$15-25 million
Experience		- Canopy walk & views may be an attraction - Unique bridge design opportunity & context for Portland - Terwilliger Parkway interpretive opportunity		

Option 3: Tunnel + Elevators

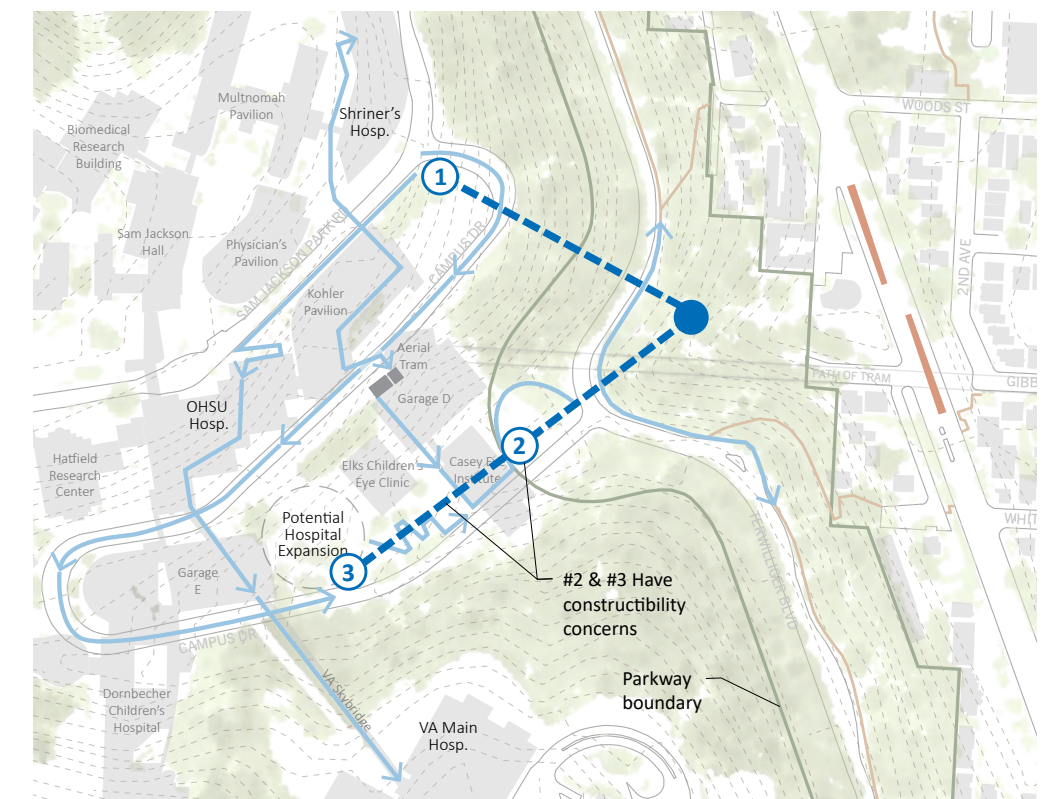
Estimated Average Travel Time from Gibbs Station during AM Peak (Minutes)

Destination:	Ambulatory Person	Person using Manual Wheelchair
OHSU Hospital	9	17
VA Medical Center Hospital	13	26
Shriners Hospital	7	14
OHSU Hospital Expansion	11*	16*

* Includes bus trip



Other Potential Alignments



Option 3 Draft Evaluation

Category	Draft Evaluation	Opportunities	Challenges	Additional Notes
Access		- Direct access to OHSU upper/east campus - Weather protection is inherent	- Indirect access to OHSU lower campus & VA Hospital, may require additional improvements - Indirect access to recreational destinations - Physical effort for long walk underground (660 ft/3+ city blocks), moving walkway may be incorporated	From elevator shaft, destinations may be along Sam Jackson Park Rd to upper campus, or downhill to lower campus & Parkway
Safety		- Minimizes conflicts among modes - Sized for pedestrian volumes at peak times*	- Users have low visibility from surrounding area - Will require monitoring equipment and/or staff for security	Assumes 2 elevators (39 people/car), high speed, similar to Washington Park MAX station elevators
Context		- Protects existing properties - Protects existing viewpoints - Minimizes visual impacts on surroundings - Maintains use & identity of Terwilliger Parkway		Tunnel portal & elevator are visible structures, presence may be minimized depending on alignment
Environmental		- Tree impacts limited to portal & shaft construction areas - Construction footprint isolated to portal & shaft construction areas	- Drainage from tunnel will need to be managed - Monitoring for noise & vibration impacts to surroundings necessary during construction - Debris hauling will impact adjacent roadways during construction	Construction constraints may limit elevator shaft location options to area NE of Kohler Pavilion
Operational		- Buildable with durable & resilient materials* - Redundancy with multiple elevators & stairs*	- Maintenance of tunnel liner, drainage & ventilations systems - Elevators will have maintenance/out of service time that temporarily impairs capacity* - Relatively difficult to expand with future growth - May require an attendant - May have limited hours - May require a user fee	No precedent for a pedestrian tunnel of this scale in Portland, operational issues require further study
Budget/ Schedule			- Very high cost - Very high risk of cost & schedule overruns - Difficult construction type - Requires funding partnerships	Approximate capital cost: \$55-125 million
Experience		Geologic/historic interpretive opportunity	- Difficult to overcome underground experience - Less likely to be a local attraction - No interaction with Parkway	

* Typical of all options