Summary of Burnside Bridge – Eastbank Esplanade Ramp Connections

Purpose of Project Study

Project background. The EQRB project will fully replace the existing bridge with a seismically resilient new bridge. Initial bridge cost estimates ($800-960M) and failure of Get Moving 2020 necessitated the cost reductions identified in the SDEIS. City staff have worked cooperatively with the County on the range of cost reduction measures, but the City staff feel strongly that a ramp connection from the bridge to the Eastbank Esplanade is the right solution for this connection. Safety, accessibility, reliability, policy, capacity, and maintenance issues factor into City position. Stairs do not provide an ADA accessible route and public elevators are not a full-time ADA solution given the poor reliability.

The Burnside Bridge carries Portland's highest classifications for bicycling (Major City Bikeway) and walking (Major City Walkway). According to Portland's Transportation System Plan (TSP) Major City Bikeways "should be designed to accommodate large volumes of bicyclists, [and] to maximize their comfort…." We are directed by the TSP to "build the highest quality bikeway facilities". "Where conditions warrant and where practical, Major City Bikeways should have separated facilities for bicycles and pedestrians." Major City Walkways "are intended to provide safe, convenient, and attractive pedestrian access….[with] wide sidewalk on both sides, and a pedestrian realm that can accommodate high volumes of pedestrian activity." (From *PedPDX: Portland's Citywide Pedestrian Plan*). The Burnside Bridge is also classified as a "Civic Main Street" and should be able to accommodate high levels of pedestrian use. (*Portland Pedestrian Design Guide*).

The Eastbank Esplanade is both a Major City Walkway and a Major City Bikeway. Given that both the Burnside Bridge and the Eastbank Esplanade are designated with Portland's highest classifications for walking and biking, the connection between them should be of the same caliber.

The County has determined that providing a stairway connection will meet the purpose and need of the EQRB project. As this solution does not align with City policy, the City has contracted with a consultant to study ramp connection concepts.

Separately, the Human Access Project (HAP) developed a ramp concept that would connect to the south side of the new bridge and also provide water access at several points along the Esplanade. The consultant scope also includes a feasibility and cost analysis of the HAP concept.

Analysis of HAP Concept

The HAP Concept includes a linear north-south oriented riverbank ramp and stairs from the south side of the bridge to the Eastbank Esplanade in addition to several access points for "toes in the water".

The site of the HAP ramp concept is comprised of highly liquefiable soils and extensive ground improvement would be necessary for the construction of this expansive concept. Costs are

identified at the end of this summary, however the HAP Ramp Concept, largely due to the size of its large infrastructure improvement footprint, is determined to be cost prohibitive.
A secondary concern is that by providing access from only the south side of the bridge, it would be necessary to implement a signalized crossing on the bridge to provide a safe crossing for pedestrians and bicyclists. Adding a signalized crossing on the bridge is undesirable from both a traffic perspective and a safety perspective since vehicles are unlikely to be expecting the signal and it would be in close proximity to the lift signal and pedestrians and bicyclists may not be willing to wait for the signal and cross against it.

The water accesses have been costed separately and could be included with design and implementation of the other ramp options presented.

Draft Burnside Bridge Ramp Connector Concept Report Summary

Each alternative provides opportunity to be mixed and matched with each other, however there are geotechnical constraints that suggest a more compact structure south of the bridge and feasibility for other options north of the bridge. The City does prefer the design flexibility of an asymmetrical solution.

As noted in the draft findings provided by the consultant, environmental permitting will be a significant aspect that would be advantageous to combine into the permitting of the EQRB project. The County has not embraced this approach and has instead been making efforts to minimize their environmentally permitted area.

Next Steps
City review of the concepts is underway. Key considerations include constructability; maintenance; aesthetics; user safety, experience and comfort.

Preliminary Information that follows is provided by consultants KPFF and GRI:

Geotechnical Conditions

The site is mantled with a variable thickness of artificial fill underlain by recent alluvium consisting of silt and sand, which was deposited by the Willamette River. Review of subsurface information in the area indicates the alluvial sands and silts are underlain by gravels consisting of both alluvial gravels and the Troutdale Formation. The sand soils at the site below the groundwater are highly susceptible to seismically induced liquefaction and will experience post shaking reconsolidation settlement. The near surface fill soils and silts will likely experience limited cyclic degradation and will largely act as a non-liquefied crust overlying the liquefiable materials.

In riverfront areas, liquefaction can also cause large lateral spreading deformations of the riverbank, which may extend hundreds of feet into the upland areas. Review of recently completed numerical modeling for the EQRB project indicate lateral deformations on the order of 8 feet will likely occur on the eastern bank of the Willamette River near the Burnside bridge following the 1,000 year and median level Mw 9 events.

The magnitude and extent of this liquefaction induced soil movement, and the subsequent lateral loading applied to foundations, varies from the south to north side of the bridge, with the north side of the bridge applying significantly less lateral loading on the foundations.

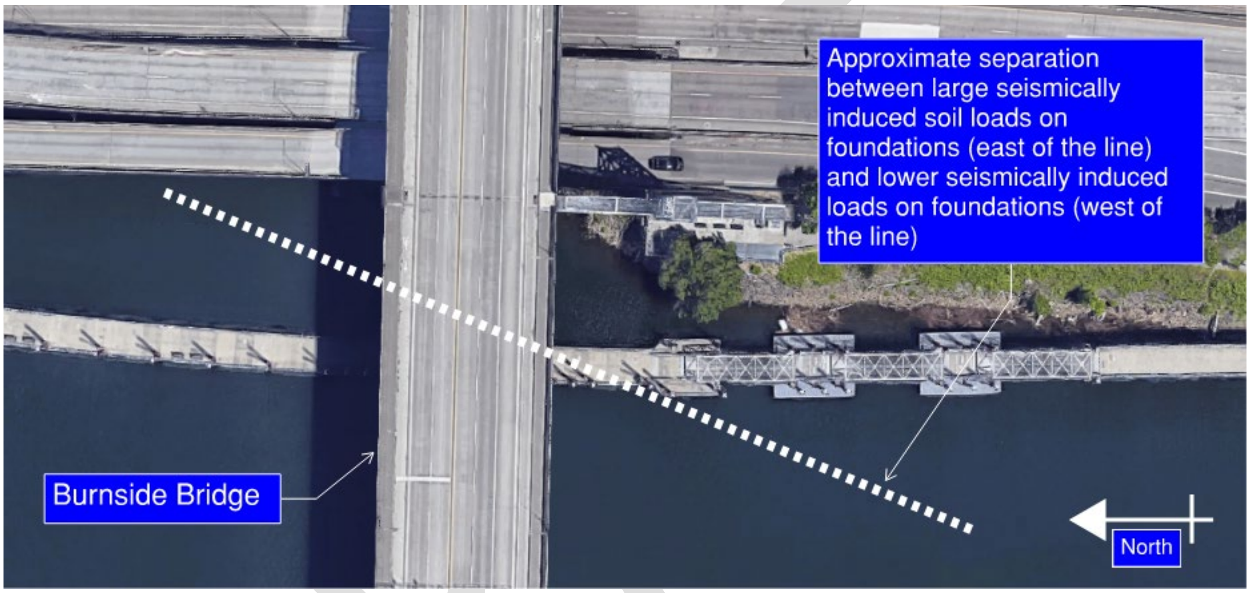

Figure 2: Plan at Existing Bridge Showing Approximate Location of Liquifiable Soils

Foundation Options

South of EQRB

The underlying soils on the south side of the bridge are expected to experience liquefaction in a large seismic event, causing several feet of lateral movement of the underlying soils towards the river. This liquefaction will impose significant lateral loads against the foundations as the soil pushes towards the river. The effect of this liquefaction is greatest on the riverbank south of the bridge and reduces substantially to the west of the existing esplanade alignment. Steel pipe piles are often used to support structures on deep foundations, However, the magnitude of lateral forces applied to the foundation by the soils make the use of this foundation type impractical.

Large diameter concrete shafts can provide the strength and stiffness to resist the lateral forces from the liquifiable soils and we anticipate 10-foot diameter shafts to be adequate to support the new connector structure south of EQRB.

Ground improvement (by jet grouting for example) could provide a soil buttress east of the structure to resist the soil loads and allow more conventional foundation systems such as steel pipe piles or smaller diameter concrete shafts. However, the constraints of the river to the west and the freeways to the east place significant restrictions on where the ground improvement could be installed from, dramatically increasing the cost. It is anticipated that ground improvement on the south side of the bridge could exceed $20 million, making this option impractical from a cost perspective.

North of EQRB

The underlying soils on the north side of the bridge are expected to experience liquefaction to a significantly smaller extent to that described above for the south side of the bridge. These reduced lateral forces from liquefaction permit the use of 48-inch diameter steel pipe piles on the north side of EQRB.

Concrete drilled shafts may also be used in this location.

Superstructure Options

Concrete Framing

Concrete framing, while typically more durable than steel framing, presents numerous challenges at this location:

- The seismic mass of a concrete structure is significantly higher that other structure types,
- increasing the demand on foundations and the resulting cost of the foundations.
- A concrete structure would be deeper than a steel structure, requiring the alignment of the walkway to be elongated to avoid reduced clearance where the structure crosses over itself.
- Forming and pouring concrete over the river will require significant containment to protect the river.

Steel Framing

- Steel framing can be constructed from shop fabricated elements, reducing working time in the river and adjacent to the freeway's ramps.
- Shallower steel structure will reduce clearance conflicts and visual impacts of structure.

Aesthetic Considerations

The EQRB is expected to be either a cable stayed bridge or arch, with a height of more than 100 feet above the roadway. This presents a significant visual element immediately adjacent to the new connector.

Due to the scale of the bridge compared to the connector, designs that appear as independent structures from the bridge and do not compete with it from an aesthetic perspective are preferred.

Civil Design, Stormwater, and Permitting Considerations

The radii on the proposed alignment will serve to reduce bicycle speeds. However, close attention will need to be paid during design to implement additional features (signage and striping) to help control bicycle speeds through the project area.

Based on the assumption that the proposed walkway will include concrete decking we anticipate that the project will be responsible for providing water quality treatment for the new structure. This could be accommodated with implementation of a vegetated planter or planters that would likely be sized at approximately 2% of the contributing impervious area. If vegetated treatment is not feasible due to limited upland areas and proximity to the river, storm water treatment might include treatment through a manufactured filter system. A case could also be made for a Special Circumstance which might allow pay the fee-in-lieu since pollutant loads are low for the bike and pedestrian use of the pathway.

Environmental permitting is expected to be a considerable task for this project, due to its footprint within the Willamette River. Consideration should be given to combining the permitting of the connector with the permitting for the EQRB, which is expected to include a significant portion of the footprint of the connector.

Alignment Concepts

A variety of concepts for vertical access from the Eastbank Esplanade to the bridge deck on both the north and south sides of the new Burnside Bridge are shown on the following pages. For concepts 1, 2, and 3, any concept on the north side can be paired with a concept shown on the south side (mix and match). Concept 4 is an example of unified ramp concept where the north ramp is integrated into the south helix ramp that connects to the Eastbank Esplanade.

Alignment Concept 1

This concept provides a direct path from the bridge along the riverbank to connect the bridge to the esplanade. It also demonstrates the scale of the length of connector pathway required to meet ADA limits on deck slope. Two options for this direct approach are shown in Figure 3 below.

Advantages

- Most direct travel route
- Avoids crossover points

Disadvantages

- Long footprint along the riverbank
- Fewer opportunities to manage bicycle and skateboard speeds

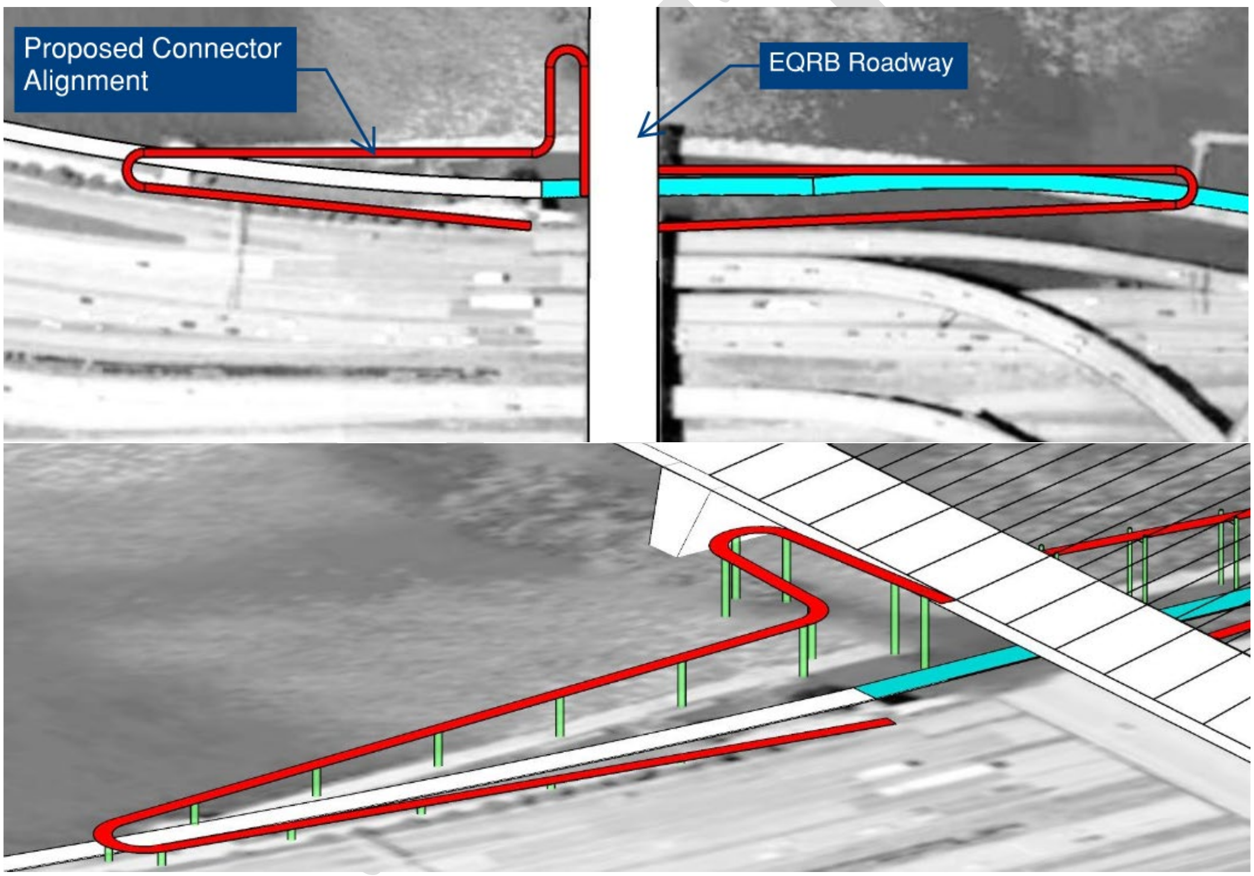

Figure 3: Alignment Concept 1

Alignment Concept 2

This approach uses meanders to gain travel distance within a more compact footprint while providing a more enjoyable experience. It also provides opportunities to slow bicycles and skateboards through the use of curves and out-of-path travel features. Two options for this approach are shown in Figure 4 below.

Advantages

- Mimics experience of the existing esplanade walking between pile supported structures
- Reduced footprint
- Reduces bicycle and skateboard speeds (curved portion)

Disadvantages

- Less efficient use of structure
- May be challenging to manage bicycle and skateboard speeds (more linear option)

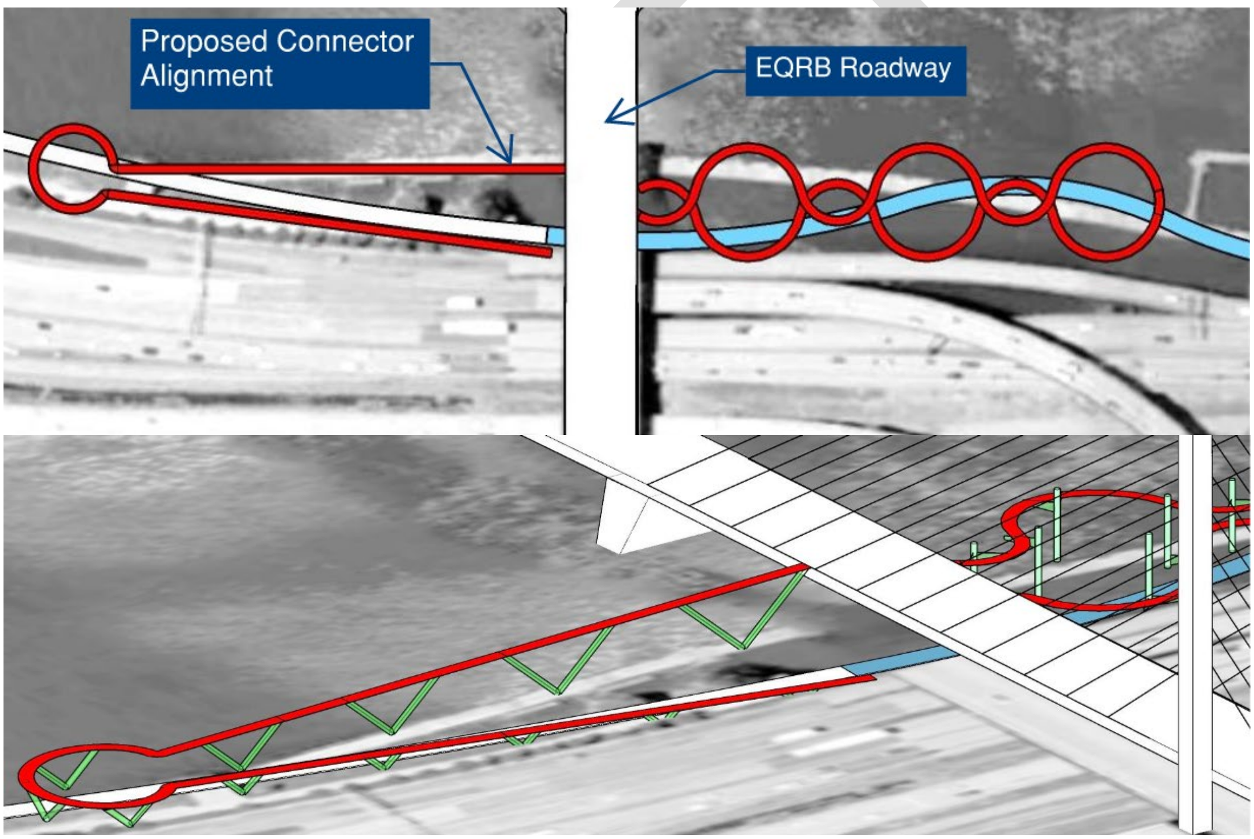

Figure 4: Alignment Concept 2

Alignment Concept 3

This approach provides a compact footprint with tightly radiused alignments to limit bicycle and skateboard speeds and reduce foundation footprint. Widened sections would also be included for resting/refuge. Two options for this approach are shown in Figure 5.

Advantages

- Fewer columns and foundations
- Compact footprint reduces location of foundations in challenging soil conditions.
- Tighter corners will help manage bicycle and skateboard speeds

Disadvantages

- Tighter alignment and less experience of walking along the river

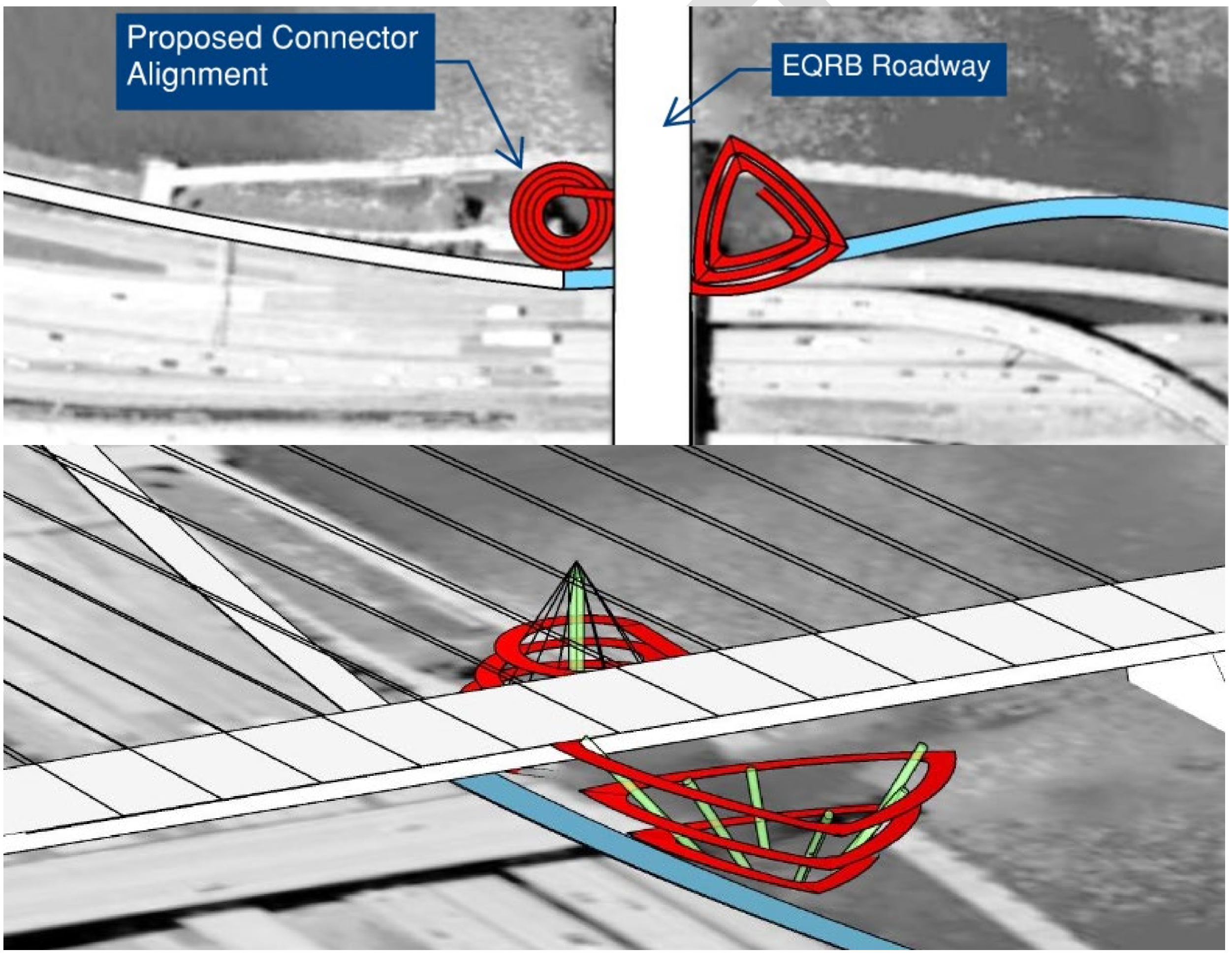

Figure 5: Alignment Concept 3

Alignment Concept 4

This concept incorporates an asymmetric structure that provides access from both the north and south sides of the bridge walkways and merges them under the bridge to touch down at the esplanade on a single walkway. This section could be flipped to place the helix on the north side so less structure is constructed within the zone of highly liquefiable soils.

Advantages

- Balances reduced footprint while maintaining longer walkways along river
- One structure merges near bridge
- Asymmetric design does not complete visually with the EQRB

Disadvantages

- Requires users to cross under bridge on walkway

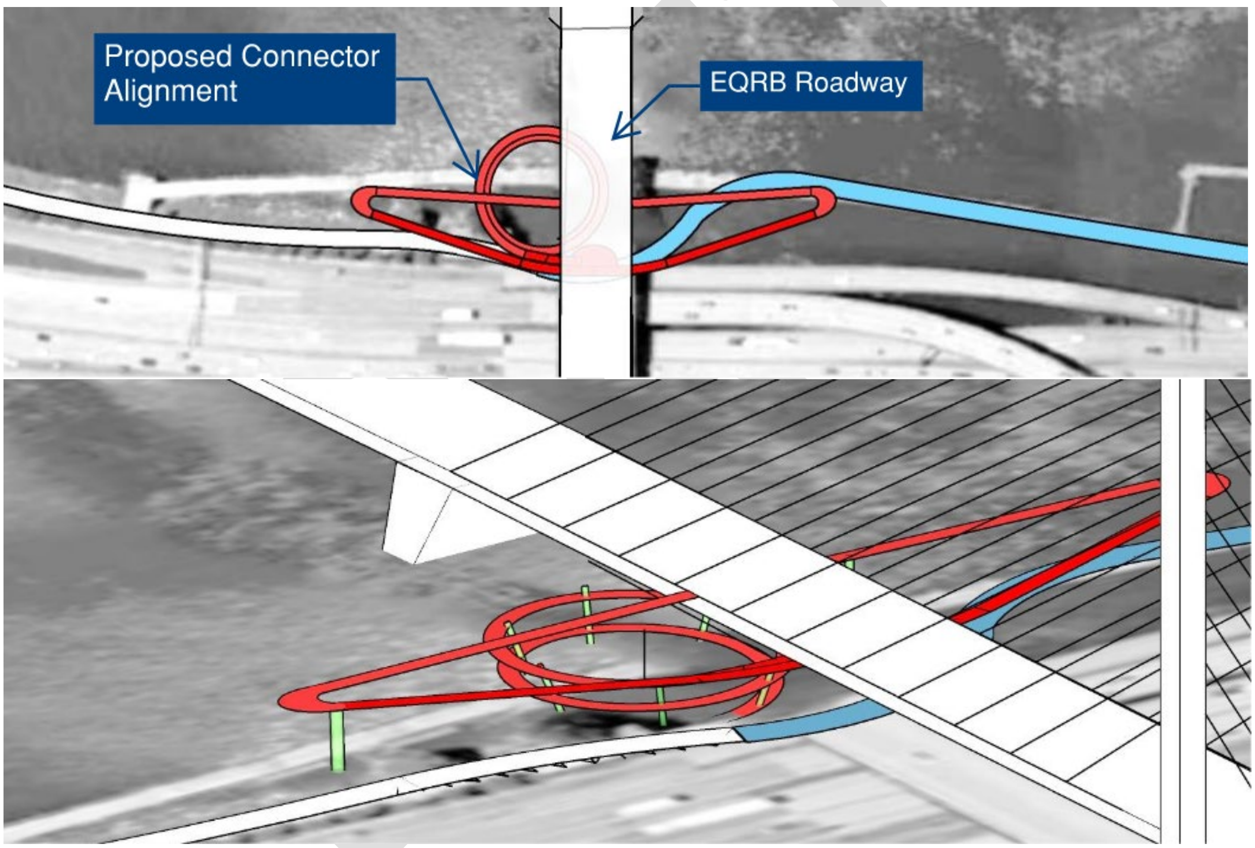

Figure 6: Alignment Concept 4

Exhibit A

Preliminary Cost Estimates

Costs shown below include a 40% contingency for unknowns and 30% for preliminary and construction engineering. Cost analysis is still in progress. Information to date is provided below.

Ribbon shown in Concept 2	$34.7M
Basket shown in Concept 3	$47.0M
HAP Ramp Concept	$140.1M
HAP “Toes in the Water” Concept	$8.7M