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***Draft** Technical Memorandum*

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To: Jay Lyman, David Evans and Associates

From: Connie Kratovil

Subject: ODOT Contract No. 16902- I-5 Trade Corridor Study Phase II
Conceptual Engineering for Option Package 8: New Western Arterial Corridor

GENERAL FUNCTIONAL DESCRIPTION

This Option Package would provide a new arterial connection between US 30 in Oregon and Mill Plain Blvd. in Washington. The new arterial would provide an alternate route for freight traffic between Portland industrial areas, the Port of Portland and the Port of Vancouver, and would also function as an "overflow" facility for commuter traffic on I-5.

Schematic drawings of a new western arterial corridor is shown in **Figures 8-1 and 8-2** at the end of this memo.

TECHNICAL DESCRIPTION OF OPTION

General Description

The arterial alignment would start in Vancouver near Mill Plain Blvd., continue south to cross the Columbia River and Slough, and then extend along North Portland Road. Just north of Columbia Blvd., the arterial would transition to a grade-separated structure above the existing BNSF rail lines to a point just north of the Willamette River. From there, the arterial would cross the Willamette River on a new bridge to US 30.

Access to/from the arterial and adjacent street system would be limited to Mill Plain Blvd., Hayden Island, Marine Drive, Columbia Blvd., Lombard Street, and US 30. In concept, the arterial would have four lanes (two in each direction) and include bicycle lanes, sidewalks and turn lanes at intersections. The design speed of the new facility is 50 mph.

Bridges over the Columbia River and Slough could be used jointly by arterial traffic and Amtrak passenger rail, whereas the bridge over the Willamette River would probably not accommodate joint-use auto/rail. Opportunities to design joint-use auto/rail bridges will be further considered for the Columbia River and Columbia Slough crossings.

No changes to existing I-5 interchange configurations/operations is assumed under this option package.

Structures

Beginning on the south end of the alignment at US 30, a new structure would be required to cross over the top of US 30, which would include ramps connecting Hwy 30 to and from the new arterial. The alignment would remain elevated and cross the Willamette River just east of the existing Burlington Northern Rail Bridge. The new high span structure crossing the Willamette River would provide 160 feet of vertical clearance above the river.

The alignment would then become a viaduct over the top of the existing rail line through the "cut" in North Portland. The viaduct would be approximately 4,300 feet in length and due to the span length of the crossbeams, two rail track lines would be relocated to the west. A retaining wall would be built to accommodate the new track alignment. A proposed signalized intersection at Lombard Ave. would provide access for local traffic, and the existing Willamette Blvd. and Lombard Ave. overpasses would need to be replaced. The new arterial would have vertical clearance below the structures, but the superstructures would be in conflict.

The alignment would shift away from the rail alignment at Fessenden where the "cut" becomes more shallow and vertical clearance over the railroad is lost. A new structure would be added just west of the existing Fessenden railroad overpass structure. In addition, the Columbia Blvd. overpass would be rebuilt. This alternative would provide for a signalized intersection at Columbia Blvd., which would be a main truck route access point to the arterial. The arterial would then follow the North Portland Road alignment to 1,500 feet south of Marine Drive. On this portion of the alignment, two existing structures would be reconstructed (Railroad overpass and Columbia Slough overpass) to accommodate the widened road, however the existing railroad overpasses would remain.

Continuing north, the alignment would shift to the west to allow for a connection to Marine Drive and to start the vertical climb over the North Portland Harbor. The Marine Drive connection would be another signalized intersection and provide another main truck access point to the arterial. The arterial would cross the North Portland Harbor and provide a connection with Hayden Island. The proposed structure over North Portland Harbor would have 83 feet of vertical clearance above the water. A new signalized intersection at Hayden Island would provide another access point for freight traffic to the Port of Portland and other industrial facilities.

The arterial would then cross the Columbia River on a low/mid level lift-span structure. Once across the river, the arterial would remain elevated on a viaduct over the top of existing railroad spur lines and local roads in Vancouver. The arterial would terminate at a signalized "T" intersection at Mill Plain Blvd. just west of the new Mill Plain structure.

Construction Considerations

- *Superstructure Type* - The superstructure section could be broken into two sections, water crossing and land crossing.
  For the *water crossings* (Columbia River, Portland Harbor, Willamette River) the superstructure could be an above Deck Truss or Bow String Arch type with a vertical lift span at the main river navigation channel. The cross section would have a constant deck thickness with the trusses or arch ribs follow the truss lines of the existing bridges. This structure type would fit with the existing BNSF Bridge of have the main structural element above deck allowing the new bridge profile to be as tight as possible to the control river vertical clearance requirements. Alternatively, a concrete segmental bridge type could follow the same pier spacing, but utilizing a bascule lift span over the main channel. This

bridge type would require a slight higher profile because the main structural elements are below the deck surface.
For *land crossing* the superstructure could be a concrete girder type bridge. The column spacing would not need to be as far apart as for the water crossing, thus a typical highway girder and structure depth could be assumed for a majority of the alignment.

- *Column Type* - The river pier columns could match the type and spacing of the existing BNSF Bridges for either a matching truss, Bow String Arch Bridge or concrete segmental types. For a concrete segmental the pier could be made up by a twin wall pier arrangement, which gives sufficient flexibility for final service conditions and provides the required stability for balanced cantilever construction. These walls will be 20 feet long and 2 feet 6 inches thick and set apart 26 feet, or 13 feet from the centerline of the pier to each wall. The truss and bow string arch the pier could be similar to the existing sizes.
  Land Piers would be conventional concrete piers. Given the width of this proposed structure, they could be made of up multi-columns (4 min.) with circular sections 4 to 5 feet in diameter.

- *Foundations* - The two end transition piers are on land at the riverbanks, and the interior piers are all in the river. For the river piers, a footing plan size of approximately 32 X 52 for the Truss and Bow String Arch option and 54 X 56 feet for the Concrete Segmental could be required. Deep foundation elements may be either driven piles or drilled shafts. Larger diameter drilled shafts may be preferable to limit the construction impacts of noise and vibration normally associated with driven piles. Land based foundations would be on more typical size 15' x 15' with driven pile foundations.

- *Construction Procedures* - The river piers may be constructed by conventional methods using cofferdams. This features braced sheet piling walls, driven piles, underwater tremie concrete pours, and extensive pumping of the water inside the cofferdam to allow construction of the remainder of the pier footing and columns in the dry. This foundation type features footings that are founded below the river bottom. Because contractors assume a high risk with this type of foundation construction, costs are generally high for the cofferdams.

  The river piers may also be constructed as water level foundations. This foundation makes use of a precast concrete lost footing form. The form has a bottom and four sides approximately 15' high. The bottom has holes for piling or in this case, large diameter drilled shafts. The drilled shafts are installed with permanent casings from the water level down below the bottom of the river. The precast footing form is lifted and placed over the top of the shaft casings and supported by hangers from the casings. Underwater tremie concrete is placed in the bottom of the form to allow pumping out the water to construct the remainder of the footing in the dry. However, in this configuration, the bottom of footing is at a much higher elevation, requiring a smaller tremie pour due to the reduced hydrostatic head. This type of foundation is generally less costly, because the contractor risk is lowered.

  The Truss or Bow String Arch superstructure construction would be fabricated off site, and finished spans barged to the site and lifted into position. A concrete deck would then be poured in place after the finished Truss or Bow Sting Arches are all in place.

  The Concrete Segmental would be constructed of either precast concrete units or cast-in-place concrete units. Both methods could be constructed from conventional overhead travelers and employ balance cantilever construction methods. These methods would eliminate the need for formwork to be place across the river (refer to *Major River Crossing Finding Report, May 1995, Section 6.2 " Bridge Superstructure"*). These methods were employed for the Glenn Jackson.

Land Based Bridges could use a combination of precast girder elements combined with cast-in-place decks. Formwork and Falsework would be required to construct pier areas and the deck would be constructed by deck forms attached directly to the precast girders.

Deviations from Standards

The new facility would have a 50-mph design speed. The horizontal, crest and sag vertical curves meet the design standards for a 50-mph design facility, except for the north end of the arterial. The design speed of the last 1,500 feet of the arterial would be reduced to 30 mph due to both the vertical and horizontal alignments. A lower design speed is typically allowed at intersections.

Another deviation from standards would be the flat grade of the existing North Portland Road. The minimum grade typically allowed is 0.5%, however the existing grade is as flat as 0.07%. This portion of the roadway would need further refinement if this alternative is carried forward.

ROW Impacts

This alternative would require 57 acres of new Right of Way. This includes approximately 12 acres of Right of Way on existing railroad property. In addition, 34 commercial buildings would be demolished on 26 different parcels. The new facility would only displace one residential property.

In addition, seven water quality treatment sites would need to be located near or adjacent to the new roadway. Approximately 6.2 acres would be needed for these facilities (for cost estimating purposes, it is assumed that this would be commercial property).

COSTS

West Arterial Road – U.S. 30 to Mill Plain Extension	
Right of Way	$ 95,080,467
Utility Relocations	39,000,000
Excavation	1,301,230
Surfacing	6,638,075
Roadside Development	27,300,000
Traffic Services	11,175,600
Structures	479,088,824
Mobilization	45,160,320
Contingencies	195,092,582
Engineering and Administration	201,189,226
Total	$1,101,027,000

I-5 Transportation and Trade corridor Partnership
Draft Costs by Option Package
October 16, 2001

Costs by Option Package	Unique Costs	Park and Ride Lots	Baseline Road Costs	Baseline Transit Costs	Rose Quarter Widening	Delta Park to Lombard	Vancouver Interchange Modifications	Add North Ramps to Columbia	No Bridge - Access to Hayden island through Marine Drive	LRT only Columbia River Bridge	4-lane supplemental Bridge	6-lane supplemental Bridge	10-lane supplemental Bridge	4-lane supplemental Tunnel	Total
Baseline					$300	$41	$93								$434
West Arterial	$947				$300	$41	$93								$1,381
3 Lanes (with a 4-lane Bridge)		$52			$300	$41	$93				$596				$1,083
Add a 4th Lane (with 6 lane bridge)	$465	$52			$300							$940			$1,757
Add a 4th Lane (with 10 lane bridge)	$465	$52			$300								$1,117		$1,933
Add a 4th Lane (with 4 lane tunnel)	$465	$52			$300									$807	$1,624
Light Rail Loop/3 lane [1, 2]	$1,082				$300	$41	$93			$140	$596				$2,252
Light Rail Loop/add a 4th lane [1,2]	$1,546				$300					$140		$940			$2,926

notes:
1. Assume separate LRT bridge
2. Park and Ride facilities inclused in "Unique costs"

I-5 Transportation and Trade corridor Partnership
Draft Costs by Decision Point
October 16, 2001

Costs by Decision Point	Unique Costs	Park and Ride	Baseline Road Costs	Baseline Transit Costs	Rose Quarter Widening	Delta Park to Lombard	Vancouver Interchange Modifications	Add North Ramps to Columbia	No Bridge - Access to Hayden island through Marine Drive	Total
Baseline					$300	$41	$93	$111	$76	$621
West Arterial	$947									$947
3 Lanes (with a 4-lane Bridge)	$596	$52			$300	$41	$93	$111		$1,193
Add a 4th Lane (with 6 lane bridge)	$1,405	$52			$300					$1,757
Light Rail Loop [1]	$1,222									$1,222
Express Bus - Short [2]	$199	$52				$41				$292
Express Bus- long [3]	$351	$52								$403
LRT only Columbia River Bridge	$140									$140
4-lane Supplemental Bridge (Victory to Mill Plain)	$596									$596
6-lane Supplemental Bridge (Victory to Mill Plain)	$940									$940
10-lane Supplemental Bridge (Victory to Mill Plain)	$1,117									$1,117
4-lane Supplemental Tunnel (Victory to Mill Plain)	$807									$807

Notes: 1. Park and Ride facilities included in "Unique costs"
2. Assume cost is 1/3 of 3-lane option
3. Assume cost is 1/4 of 4-lane option