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MEMORANDUM

DATE: January 23, 2001
TO: Jay Lyman
FROM: Ryan LeProwse, EIT
Mike Baker, PE
SUBJECT: **I-5 Oregon Freeway/Interchange operations-Lessons Learned**
PROJECT: PORTLAND VANCOUVER I-5 TRANSPORTATION AND TRADE PARTNERSHIP
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BACKGROUND

This memorandum describes I-5 freeway operations under 2020 Baseline conditions and under build alternative conditions based on work conducted by DEA over the last several months. This information is intended to help guide the ongoing refinement of conceptual designs to address known transportation operations issues and public input.

INITIAL CONCEPTS

We know from previous work that the level of capacity increase across the Columbia River and the manner in which access is balanced across existing and supplemental bridges affect corridor operations. To better understand how a decision to increase Columbia River Bridge affects corridor traffic operations, the consultant team initially analyzed four bridge alternatives as listed below.

- **New Four-Lane Supplemental Bridge:** Under this variation, a new four-lane bridge would supplement the existing I-5 Columbia River bridges for a total of 10 lanes of river crossing capacity. The supplemental bridge would operate one general purpose and one HOV lane per direction. Existing Hayden Island access would be moved from the I-5 mainline to the new supplemental bridge, resulting in increased bridge capacity at the existing bridgehead. In addition to Hayden Island, access to/from the supplemental bridge is provided for Mill Plain, Vancouver City Center, and Victory Boulevard. This bridge variation was modeled upon a three through lane corridor.
 - **New Six-Lane Supplemental Bridge:** Under this variation, a new six-lane bridge would supplement the existing I-5 Columbia River bridges for a total of 12 lanes of river crossing capacity. The supplemental bridge would operate two general-purpose lanes and one HOV lane per direction. In the northbound direction, traffic would access the new bridge just north of the Marine Drive off-ramp and merge back into the I-5 mainline just north of the SR 14 on-ramp. In the southbound direction, traffic would access the new bridge just north of the Mill Plain on-ramp and merge back into the I-5 mainline just south of the Interstate Avenue off-ramp. Access to/from SR 14 to the new bridge would only be provided for HOV vehicles. Access to Marine Drive, Hayden
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Island, SR 14, Vancouver City Center, and Mill Plain/4th Plain would be provided via the existing I-5 mainline. This bridge variation was modeled upon a four through lane corridor.

- **New 10-Lane Replacement Bridge:** Under this variation, a new 10-lane bridge would replace the existing I-5 Columbia River Bridges that provide only six lanes of river crossing capacity. The new bridge would operate three general-purpose lanes and one HOV lane for through traffic and one auxiliary ramp lane between Hayden Island and SR 14 per direction. Local access to and from the new bridge would be similar to today's access. This bridge variation was modeled upon a four through lane corridor.
- **New Four-Lane Supplemental Tunnel:** Under this variation, a new four-lane tunnel would supplement the existing I-5 Columbia River bridges for a total of 10 lanes of river crossing capacity. The supplemental tunnel would operate one general purpose and one HOV lane per direction. In the northbound direction, traffic would enter the tunnel just north of the Marine Drive off-ramp and merge back into the I-5 mainline just north of the Mill Plain/4th Plain off-ramp. In the southbound direction, traffic would enter the tunnel just south of the Vancouver City center off-ramp and merge back into the I-5 mainline just south of the Interstate Avenue off-ramp. No intermediate tunnel access would be provided in either direction. This bridge variation was modeled upon a four through lane corridor.

TASK FORCE DIRECTION

Preliminary recommendations from the Governors' Task Force specify that further refinement of the corridor alternatives will need to include the following:

- A corridor-wide capacity increase to four lanes per direction is not recommended, however the need for capacity increases between Columbia Blvd. and SR 500 is recognized
- New transit and vehicle capacity should be constructed across the Columbia River in the I-5 Corridor and should be provided on a joint-use supplemental bridge that is parallel to the existing bridges.
- In total (existing and new bridges), there should be no more than 3 through lanes and two auxiliary lanes of capacity in each direction (5 in each direction) across the Columbia River in the I-5 corridor.
- The transit system will include an LRT loop system, but will maintain current express bus service along the I-5 and I-205 corridors between Clark County and Downtown Portland.
- I-5 should be widened to three through lanes in each direction between the Delta Park and Lombard Interchanges in Oregon.
- The Columbia Blvd. interchange in Oregon should be made into a full interchange.

Of the initial corridor concepts evaluated, the new four-lane supplemental bridge best meets the Task Force direction and will therefore serve as the base for subsequent refinement and traffic operations evaluation. Freeway modifications through the Rose Quarter are not being considered at this time, but will be analyzed through a future study.

PRELIMINARY FINDINGS

DEA prepared a November 2001 memorandum titled *Preliminary Traffic Operations of I-5 River Crossing Alternatives* describing each of the four river crossing concepts identified previously. The remainder of this section is devoted to discussing operations associated with a new four-lane supplemental bridge option only. The discussion includes overall findings and specific findings associated with key I-5 interchanges between Portland Blvd. and Hayden Island.

Overall

1. A review of forecast 2020 Baseline and Build conditions indicates that over half the traffic crossing between Oregon and Washington in the I-5 corridor begins or ends its trip between the SR 500 interchange in Vancouver and the Columbia Blvd. interchange in Portland.

New Four-Lane Supplemental Bridge

Northbound

- Increased Columbia River crossing capacity improves corridor accessibility and therefore enables higher traffic demands to be served. Increased demands along the mainline and along SR 500 result in the formation of a bottleneck at the Mill Plain on-ramp to SR 500 off-ramp weave section.
- The bottleneck results in peak hour queues extending near or beyond Victory Boulevard.
- Traffic demands are such that adding one more lane of mainline capacity within the weave section could alleviate the bottleneck. Alternatively, braiding the Mill Plain on-ramp so that it enters the mainline north of SR 500 off-ramp, similar to the 4th Plain on-ramp braid, would eliminate the weave as well as the bottleneck in this location. If this ramp modification was completed, it is expected that a third mainline general purpose lane would be required up to 78th Street to accommodate on-ramp demands from Mill Plain, 4th Plain, 39th Street, and Main Street.
- Removal of the existing Hayden Island interchange from the I-5 mainline to the new supplemental bridge will increase existing mainline bridge capacity to approximately 6000 vehicles per hour (vph).
- Increased demands throughout the corridor cause the existing I-5 Bridge and the new four-lane supplemental bridge to operate near capacity.
- Even at increased meter rates relative to today, on-ramps at Interstate Avenue, Marine Drive, and Mill Plain would operate with long delays due to ramp metering. In some cases, queues are expected to spill over onto arterial roadways unless ramp meter rates are increased to serve demand.

Southbound

- Increased demands along the mainline and SR 500 on-ramp result in the formation of a bottleneck at the SR 500 on-ramp to 4th Plain/Mill Plain off-ramp weave section.
- Capacity increases in the SR 500 weave section would move the bottleneck north to the 39th off-ramp vicinity.
- Traffic demands within the SR 500/I-5 junction are high enough that the bottleneck would not be eliminated by simply adding one more lane of mainline capacity to diffuse traffic flow in this area.

- The downstream metering affect of the SR 500 bottleneck eliminates the existing I-5 Columbia River bridge bottleneck and improves the ability of traffic to enter the freeway south of the bottleneck from 4th Plain, Mill Plain, and SR 14.
- Removal of the existing Hayden Island interchange from the I-5 mainline to the new four-lane supplemental bridge will increase existing mainline bridge capacity to approximately 6000 vehicles per hour (vph).
- Increased bridge capacity in concert with corridor ramp metering and an upstream bottleneck at the SR 500 weave section should allow the existing I-5 Columbia River bridge and the new four-lane supplemental bridge to operate under capacity.
- The SR 14 on-ramp would operate over capacity with long delays due to ramp metering. The SR 500 on-ramp, although not modeled under ramp meter control, is expected to experience long queues and associated delays.

Hayden Island Access from New Supplemental Bridge

As evaluated thus far, under a four-lane supplemental bridge option, access to Hayden Island was shifted from the existing mainline to the new supplemental bridge. This results in improved mainline traffic flow through elimination of the Marine Drive/Hayden Island weave section. Moving Hayden Island access to the new bridge supports more balanced local versus through trip use of the existing and supplemental bridges.

Hayden Island Access from Marine Drive (No-Build Scenario)

As a spot improvement associated with no increased river crossing capacity, the consultant team evaluated the potential to eliminate the existing I-5/Hayden Island interchange by routing Hayden Island traffic through the Marine Drive interchange. As studied, access to and from Hayden Island via Marine Drive interchange would be on a new bridge between Marine Drive and Hayden Island. Preliminary traffic results associated with this modification lead to the following findings:

- This option is not expected to work as a standalone project or as part of a scenario that involves new river crossing capacity.
- Northbound on-ramp demands exceed ramp meter capacity by 700 vph resulting in long queues through ramp terminals.
- Northbound traffic leaving the freeway at Marine Drive is not substantial enough to reduce mainline demands to a level that would accommodate merging traffic from the modified on-ramp. The result is that the existing Hayden Island on-ramp bottleneck would move south to the Marine Drive on-ramp.
- Removal of the existing I-5/Hayden Island interchange would eliminate the existing weave section between Marine Drive and Hayden Island but resulting friction from the new two-lane merge section would operate in a similar manner.
- Any northbound freeway capacity increase resulting from elimination of the Hayden Island interchange will likely be lost to the friction caused by increased merging conflicts.
- Without any capacity enhancements, the Marine Drive interchange is expected to operate over capacity in 2020 and could not accommodate the diversion of Hayden Island traffic. To do so would require major

reconstruction of the interchange to avoid impacts to heavy volumes of freight traffic and other vehicles accessing I-5 at Marine Drive.

- Requires out of direction travel for trucks and autos traveling between Clark County and Hayden Island. Columbia Blvd.

The Governors' Task Force recommends modifying the Columbia Blvd. interchange to provide a southbound off-ramp and northbound on-ramp to improve truck freight access to Columbia Corridor and reduce truck traffic in North Portland neighborhoods. Preliminary traffic results relative to 2020 Baseline associated with this modification under a four-lane supplemental bridge concept include the following:

- Reduces truck traffic on Interstate and Denver (south of Argyle) by over 70% during peak periods.
- Reduces total traffic on Interstate and Denver (south of Argyle) by approximately 40% during peak periods.
- Increases truck and total traffic on Columbia Boulevard by 500-600 vehicles per hour west of I-5 (a 30 to 50 % increase over Baseline).
- During the morning peak, reduces total traffic on the Marine Drive northbound on-ramp by over 30%, and reduces truck traffic by approximately 20%, thus improving operations at a highly congested interchange.
- Requires modifications to the Delta Park/Victory interchange, including capacity increases and signalization of northbound and southbound ramp terminals.
- Reconfigured southbound on-ramp merge from Columbia Boulevard operates acceptably:
 - * Existing ramp has a rising grade of six percent and enables heavy trucks to attain speed of only 25 mph when entering the freeway.
 - * Proposed ramp would have a four- percent grade and a 1,400-foot long acceleration lane parallel to the third freeway lane. Ramp would enable trucks to attain a speed of 45 mph within the acceleration lane before entering freeway.
 - * The new on-ramp merge would operate at level-of-service "C-D" during peak periods, indicating generally smooth merging conditions.

Issues

1. Perhaps the key issue will be balancing the local access versus through trip use of the freeway. Primary methods to be considered to achieve the desired balance include geometric modifications (e.g., ramp braiding, new arterial roads), ramp metering, and access consolidation.
2. We learned from analyzing a 10-lane replacement bridge option that maintaining Hayden Island access as it exists today, even with increased river crossing capacity, leads to a continued bottleneck situation at the Columbia River. Alternative Hayden Island access options need to be considered.

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