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AND ASSOCIATES INC.

MEMORANDUM

DATE: November 8, 2001

TO: Deb Wallace

FROM: Jay Lyman, PE
Mike Baker, PE

SUBJECT: **Traffic Operations Related to Vancouver Ramp Improvements**

PROJECT: Portland/Vancouver I-5 Transportation and Trade Partnership

PROJECT NO: ODOT0000-00364

COPIES:

BACKGROUND

The Portland/Vancouver I-5 Transportation and Trade Partnership Study is considering a number of corridor options to address existing and long-term mobility issues along the I-5 corridor from the I-84 junction in Portland, Oregon to the I-205 junction north of Vancouver, Washington. The options have been conceptually designed and modeled to support preliminary transportation operations analysis with a range of Columbia River Bridge crossing variations.

As currently designed, each potential new river crossing concept along I-5 incorporates a system of freeway ramp modifications in Clark County between the Columbia River and SR 500. The ramp improvements were designed to address existing or anticipated future traffic operations issues associated with how and where freeway access occurs. The consultant team was asked to conduct a preliminary assessment of the future ramp modifications and assess key traffic operations impacts with and without such modifications.

APPROACH

Two key decisions that will drive long-term traffic operations along I-5 in Vancouver include the following: (1) whether to increase freeway capacity across the Columbia River, and (2) whether to modify existing access to and from the freeway. As a basis of comparison, 2020 Baseline conditions without changes to existing bridge capacity or Vancouver ramps was analyzed. To better understand how a decision to increase Columbia River Bridge capacity drives a decision to modify ramps, the consultant team considered scenarios with increased bridge capacity with and without conceptual Vancouver ramp modifications. The following future year 2020 options were considered:

- Baseline
- New supplemental 4-lane arterial bridge without Vancouver ramp modifications
- New supplemental 4-lane arterial bridge with Vancouver ramp modifications

SUMMARY OF KEY FINDINGS

- Adding more lanes across the Columbia River on a new supplemental four-lane bridge would increase directional traffic-carrying capacity by about 70 percent, substantially improving corridor accessibility and reducing the duration of peak periods and the effects of bottlenecks, including vehicle back-ups.

- However, provision of additional capacity across the Columbia River, without modifying I-5's southbound ramp junctions in Vancouver, would exacerbate southbound vehicular weaving, merging and diverging along I-5 in Vancouver north of 4th Plain. In addition, while the southbound Columbia River Bridge bottleneck would be minimized or eliminated, a new bottleneck would result at the SR 500 merge point. This bottleneck could be more severe than that experienced at the Bridge under Baseline conditions. During peak periods, however, the bottleneck would enable smoother southbound traffic flows between 4th Plain and the Columbia River Bridge.

- With southbound ramp improvements in Vancouver (as currently conceptualized), SR 500 would still pose a southbound bottleneck, but it would be substantially less severe compared to a scenario with no ramp improvements. With further design, it may be possible to mitigate this potential bottleneck (e.g., re-configured lanes, ramp metering, etc.). Ramp modifications, including braiding of on- and off-ramps and reconfiguring ramp junctions, would eliminate southbound weaving areas and decrease the potential for traffic conflicts as corridor capacity is increased. In addition, travel times would improve both along southbound I-5, and to off-ramps such as Mill Plain and Fourth Plain. Traffic safety would improve substantially.

- In the northbound direction, provision of additional capacity across the Columbia River, without modifying I-5's northbound ramp junctions in Vancouver, would exacerbate northbound vehicular weaving, merging and diverging along I-5 in Vancouver. While the Columbia River Bridge's bottleneck would be minimized or eliminated, a new pinch point would result within and adjacent to the Mill Plain/Fourth Plain on-ramp to SR 500 off-ramp weaving area. This bottleneck could be more severe than that experienced at the Bridge under Baseline conditions. During peak periods, however, the bottleneck would enable smoother northbound traffic flows north of SR 500.

- With northbound ramp improvements in Vancouver (as currently conceptualized), the above weaving area remains a bottleneck but would be less severe, resulting in substantially reduced congestion. Further refinement to current ramp modifications, including braiding on- and off-ramps and reconfiguring ramp junctions, would eliminate northbound weaving areas and decrease the potential for traffic conflicts as capacity is increased. In addition, travel times would improve both along northbound I-5, and to off-ramps such as Fourth Plain. Traffic safety would improve substantially.

- With added capacity across the Columbia River and ramp improvements within Vancouver, the duration of the peak periods would decrease substantially. While peak period traffic flow would improve, non-peak traffic operations would benefit as well due to the reduction in complex weaving areas and the elimination or reduction of traffic conflict areas.

DISCUSSION OF FINDINGS

Directional peak hour findings are based on traffic modeling using the Freeway Queuing (FREQ) traffic model.

SOUTHBOUND I-5 MORNING PEAK CONDITIONS

Baseline:

- Under year 2020 Baseline conditions, the I-5 Bridge continues to operate as a bottleneck creating vehicular queues extending beyond SR 500 that hinder the ability of drivers to maneuver along the corridor.

Increased Bridge Capacity Without Vancouver Ramp Modifications:

- Increased Columbia River crossing capacity (approximately 70 percent) improves corridor accessibility and therefore enables higher traffic demands to be served relative to Baseline. Increased demands along the mainline and along SR 500 result in the formation of a bottleneck at the SR 500 on-ramp junction.

- Relative to the bottleneck that occurs at the Columbia River Bridge under Baseline conditions, the SR 500 bottleneck would be similar or somewhat **more** severe for traffic north of SR 500. However, less traffic would be affected since the bottleneck would be further north in the corridor.

- An SR 500 bottleneck meters traffic flow south to the Columbia River and eliminates the I-5 Bridge bottleneck. It also improves the ability of traffic to enter the freeway south of the bottleneck from 4th Plain, Mill Plain, and SR 14 supporting level of service D operations at the 4th Plain on-ramp weave.

- 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.

Increased Bridge Capacity With Vancouver Ramp Modifications:

- Increased demands along the mainline and along SR 500 result in the formation of a bottleneck at the SR 500 on-ramp junction. The downstream metering affect of this bottleneck eliminates the I-5 Bridge bottleneck and improves the ability of traffic to enter the freeway south of the bottleneck from 4th Plain, Mill Plain, and SR 14 supporting level of service D operations at the 4th Plain on-ramp weave.

- Relative to the bottleneck that occurs at the Columbia River Bridge under Baseline conditions, the SR 500 bottleneck would be similar or somewhat **less** severe for traffic north of SR 500. However, less traffic would be affected since the bottleneck would be further north in the corridor.

- 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.

- Ramp modifications result in eliminating the existing Mill Plain on-ramp to SR 14 off-ramp weave and the associated traffic conflicts associated with these maneuvers.
- Relocating the Mill Plain/4th Plain off-ramp to a location north of the SR 500 on-ramp provides the following operational benefits:

    1. Improves travel times for traffic destined to Mill Plain and 4th Plain by allowing trips to exit the freeway (and congestion) sooner.
    2. Reduces (approximately 15 percent) mainline traffic flow through the SR 500 bottleneck by exiting Mill Plain and 4th Plain traffic north of the bottleneck.
    3. Reduced traffic flow through the bottleneck reduces the magnitude of queuing and the period of congestion caused by the bottleneck. It further reduces the number of potential conflicts, which supports improved safety.
    4. Eliminates the existing Mill Plain on-ramp to SR 14 off-ramp weave and the associated traffic conflicts associated with these maneuvers.
    5. Lengthens the existing 4th Plain on-ramp to Mill plain off-ramp weave section, supporting improved traffic flow through this section.

NORTHBOUND I-5 EVENING PEAK CONDITIONS

Baseline:

- Under year 2020 Baseline conditions, the I-5 Bridge continues to operate as a bottleneck creating queues beyond the Columbia Slough that hinder the ability of drivers to maneuver along the corridor.
- The I-5 Bridge meters traffic flow from Portland into Vancouver. Because traffic is constrained by the bridge, the three weave sections between the Columbia river and SR 500 in Vancouver are estimated to operate at level of service D or better.

Increased Bridge Capacity Without Vancouver Ramp Modifications:

- Increased traffic demand throughout the corridor cause the existing I-5 Bridge and the new 4-lane supplemental Bridge to operate near capacity.
- Increased Columbia River crossing capacity (approximately 70 percent) improves corridor accessibility and therefore enables higher traffic demands to be served relative to Baseline. Increased demands along the mainline and along SR 500 result in the formation of a bottleneck at the compound Mill Plain/4th Plain on-ramp to SR 500 off-ramp weave section.

- Relative to the bottleneck that occurs at the Columbia River Bridge under Baseline conditions, the SR 500 bottleneck would be similar or somewhat **more** severe with peak hour queues extending beyond the Columbia Slough in Portland.

- The downstream metering affect of the bottleneck improves traffic operations north of the bottleneck.

- 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 freeway north of SR 500 would eliminate the weave and eliminate the bottleneck in this location. If this ramp modification was completed, it is expected that a third mainline general purpose lane would be needed up to 78th Street to accommodate on-ramp demands from Mill Plain, 4th Plain, and 39th Street (note that this option as modeled included the conversion of one of the existing three lanes to HOV).

Increased Bridge Capacity With Vancouver Ramp Modifications:

- Increased demands throughout the corridor cause the existing I-5 Bridge and the new 4-lane supplemental Bridge to operate near capacity.

- Increased traffic 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. However, reconfiguring the 4th Plain/SR 500 weave section reduces the traffic flows through this bottleneck, resulting in expected reductions in duration and intensity of congestion.

- Relative to the bottleneck that occurs at the Columbia River Bridge under Baseline conditions, the SR 500 bottleneck would be similar or somewhat **more** severe **but less** severe than a scenario without ramp modifications. Peak hour queues are estimated to extend beyond the Columbia Slough in Portland.

- 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 freeway north of SR 500 would eliminate the weave and eliminate the bottleneck in this location. If this ramp modification was completed, it is expected that a third mainline general purpose lane would be needed up to 78th Street to accommodate on-ramp demands from Mill Plain, 4th Plain, and 39th Street.

- As conceptually designed, relocating the 4th Plain on-ramp north of SR 500 provides the following benefits:

    1. Improves travel times for 4th Plain on-ramp traffic by allowing trips to enter the freeway north of (or after) the bottleneck.
    2. Reduces mainline traffic flow (approximately 10 percent) through the Mill Plain to SR 500 weave bottleneck by shifting 4th Plain on-ramp traffic north of the bottleneck.

3. Reduced traffic flow through the bottleneck reduces the magnitude of queuing and the period of congestion caused by the bottleneck. It further reduces the number of potential conflicts, which supports improved safety.
4. Eliminates part of the existing compound weave section (4th Plain on-ramp to SR 500 weave section) and the associated traffic conflicts associated with these maneuvers.
5. Freeway entrance operations for 4th Plain on-ramp traffic improved by relocating the on-ramp outside of the existing weave section.

Initials: MJBA

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