

# **BUS ON SHOULDER FEASIBILITY STUDY:**

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## **Final Report – Study Recommendations**

Prepared for: Southwest Washington Regional Transportation Council

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**SR-14 WESTBOUND**

While both minimal and low cost options were developed for Westbound SR-14 from I-205 to 164th, the low cost option is recommended. Compared to the minimal cost options, it offers improved bus movement and reliability with minor restriping that:

- Restripes shoulder at the east end of SR-14 to allow buses to stay out of the traffic lane and move directly onto the shoulder from the bus only onramp from 164th Avenue.
- Extends westbound BOS approximately 1,000 feet to the west by restriping collector / distributor road shoulder between the I-205 NB exit and the entrance ramps to westbound SR-14.

**SR-14 EASTBOUND**

A minimal cost option from I-205 to 164th is recommended for SR-14 eastbound.

**STUDY TEAM OBSERVATIONS**

WSDOT and C-TRAN have cooperated on a thorough examination of SR-14 from I-205 to 164<sup>th</sup> and identified it as an excellent location for a BOS pilot project. The SR-14 concept:

- Has no intermediate interchanges
- Has suitable freeway shoulders
- Has an existing WB bus only on-ramp at 164<sup>th</sup>
- Serves as a queue jump to I-205 SB
- A pilot project evaluation will provide performance measurement and allow proof of concept for consideration of other corridors

The agencies are collaborating on the development of a letter of understanding for operating rules and shoulder maintenance as well as the required design analysis documentation for pilot project approval and implementation. An SR-14 pilot project can also provide insight to how BOS operation could apply to other freeway corridors in the bi-state region.

**I-205 SOUTHBOUND**

There are some geometric constraints on segments of I-205 southbound where shoulders are less than 10 feet or dual lane ramps prevent BOS operations. This limits recommended BOS operations to only portions of I-205. The identified BOS corridor on I-205 southbound is from SR-14 to I-84 and consists of the following segments:

**RECOMMENDED**

- Segment 1, SR-14 entrance to 1,000 feet before Airport Way

**NOT RECOMMENDED AT THIS TIME - SUBJECT TO FURTHER REVIEW**

- Segment 2, Airport Way Exit to Airport Way eastbound entrance
- Segment 3, I-84 eastbound exit to I-84 westbound entrance
- Segment 4, I-84- westbound entrance to I-84 westbound exit

**I-205 NORTHBOUND**

Geometric constraints and programmed construction of northbound auxiliary lanes from I-84 EB and WB to Killingsworth limit opportunities for BOS in the northbound direction to the following segment.

**RECOMMENDED**

- Segment 1, Airport Way Entrance to 1,000 feet before SR-14 Exit

### STUDY TEAM OBSERVATIONS

The northbound and southbound segments that cross the Glenn Jackson Bridge are straightforward sections for the implementation of BOS; there are no intermediate interchanges and there are adequate freeway shoulders for the full length of the bridge. Southbound segments 2, 3 and 4 meet technical criteria established to identify feasible BOS sections. However, they are located in a more complex portion of I-205 with multiple interchanges and several two lane onramps where buses would have to leave and get back on the shoulder. While many regions have successfully operated non-continuous BOS segments with similar characteristics, the three southbound segments may need further examination of operational and safety issues as well as a more detailed policy review on the question of BOS service in the corridor.

There are currently no BOS corridors in the Portland region. The BOS Feasibility Study Report documents operational guidelines, technical criteria, safety factors, and transit benefits to guide the future consideration of other freeway corridors for BOS operations

## **ADDITIONAL ANALYSIS**

### **TRAVEL TIME**

While the recommended segments on I-205 have a benefit to travel time and reliability and show additional promise as congestion in the corridor increases, BOS use is not available on I-84 west of I-205 because of constrained ROW. It should be noted, that commuter buses on I-205 will frequently reroute by using Sandy Boulevard and other parallel facilities into downtown Portland during times of heavy congestion in the I-205/I-84 corridor.

A more detailed examination of bus travel times between Fisher's Landing and downtown Portland should be conducted to better understand the tradeoffs between transit travel time to downtown via I-205/I-84 or I-205/Sandy, which is one of the alternate routes used by C-TRAN. This analysis would help guide decision-makers on the full range of routing options for commuter transit travel to Portland.

### **I-5 BOS SCAN ASSESSMENT FINDINGS**

A high level assessment of BOS was conducted of I-5 southbound from 99<sup>th</sup> Street to the Interstate Bridge and is documented in Appendix A. The assessment focused on geometric opportunities and constraints and AM peak period travel speeds to determine the adequacy of southbound I-5 for possible BOS operations. The scan assessment found that implementing BOS on southbound I-5 would likely require investment levels beyond simple signing and striping. The following segments were identified for further feasibility evaluation. It should be noted that the corridor could accommodate improvements to either an outside or inside shoulder, but not both.

### OUTSIDE (RIGHT) SHOULDER

- Segment A: 99th St. to 78th St.
- Segment B: Main St. to 39th St.

These segments would require restriping of the existing lanes to widen the outside (right) shoulder to 11.5 feet due to the adjacent barrier and over the longer term strengthening of the shoulder to increase the depth to a minimum of 7 inches.

### INSIDE (LEFT) SHOULDER

- Segment C: 99th St. to SR-14

This segment would require widening and strengthening of the shoulder, along with restriping of the existing lanes to provide an inside (left) shoulder of 11.5 feet due to the adjacent barrier.

## POLICY FRAMEWORK

### WASHINGTON

The legal framework is already established in the State of Washington for BOS operations and this legal framework covers the SR-14 corridor. This authorization is derived from RCW 47.52.025 (Additional Powers - Controlling use of limited access facilities - High occupancy vehicle lanes - Definition) and RCW 46 61.165 (High Occupancy Vehicles lanes - Definition)

### OREGON

Oregon does not have comparable language in the Oregon Revised Statutes (ORS) that expressly permits designation of a shoulder as a BOS lane. However, the legal framework does exist for ODOT to designate exclusive use of lanes for buses. It would first require ODOT support at the region and headquarters levels. If ODOT is interested in pursuing BOS, there are several possible pathways to proceed.

The Oregon Transportation Commission has broad authority to control operations of state highways, including use of shoulders. ODOT and the OTC should examine and make a determination whether a modification to allow use of the shoulder by transit vehicles may occur under Oregon Transportation Commission authority. If ODOT wanted to establish express legal authority for BOS, it could do so through: 1) an Oregon Administrative Rule or by amending the Oregon Revised Statute (ORS), which would require legislative action.

## POTENTIAL NEAR TERM I-205 BOS EXTENSIONS

The following segments could accommodate BOS with additional investments beyond the Minimal or Low Cost investments evaluated by the Feasibility Study and were therefore outside the scope of this study. Although they are not recommended, they are included here because they would offer improved reliability and travel time for transit if BOS expansion in the corridor were to be considered.

### I-205 (18TH STREET TO MILL PLAIN)

The shoulder is 10 feet wide; however, there is a barrier immediately adjacent to the shoulder for the majority of the segment length and bus on shoulder operations adjacent to a barrier require a minimum 11.5-foot-wide shoulder. As a result, the shoulder will need to be widened to accommodate BOS in this segment. With only one bus route (Route 177) using this segment of the corridor, along with heavy congestion on the 18<sup>th</sup> Street on-ramp limiting the reliability of the bus route, investment in BOS in this segment is not recommended as part of this initial feasibility evaluation.

### SR-14 LOOP RAMP TO I-205 SOUTH

The cost of this segment to accommodate BOS was outside the scope of this study, however, the loop ramp from SR-14 Westbound to I-205 Southbound is congested during the AM peak period and buses would benefit from BOS on shoulder operations on the ramp to connect the recommended Westbound SR-14 BOS segment with Segment 1 of the recommended Southbound I-205 BOS across the Glenn Jackson Bridge.

The existing ramp would require widening to provide adequate shoulder width BOS operations. Given the relatively tight horizontal and vertical curvature of the ramp, the shoulder would have to be more than 10 feet to provide adequate site distance and accommodate the wide path of long buses traversing the loop ramp.

**PROGRAMMED SR-14 IMPROVEMENT**

Since the completion of the BOS Study, new funding has become available to expand SR-14 from 2 to 3 travel lanes in each direction between I-205 and 164<sup>th</sup> Avenue. Design of SR-14 improvement is programmed to occur over the next 2 years with construction in 2019 to 2021. SR-14 project design should be considered that accommodates the WB transit on ramp at 164<sup>th</sup>, the future/ongoing operation for transit use of the freeway shoulder on SR-14, the transition of BOS from SR-14 to the SB loop ramp to I-205 and widening of the ramp to accommodate use of ramp shoulder for transit vehicles. This would allow a continuous BOS lane from 164<sup>th</sup> on SR-14 west to the Airport Way Exit on I-205 south.