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**TECHNICAL APPENDIX ADDITION**  
**(LOS CALCULATION AT THORPE AND MEADOWLANE IMP)**  
**March 18, 2022**

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**YEAR 2021**

**LEVEL OF SERVICE CALCULATIONS**

**AM & PM EXISTING CONDITIONS**

**(J-TURN AT THORPE & SR 195)**

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| Intersection             |        |      |                |      |        |      |        |      |      |      |      |      |
|--------------------------|--------|------|----------------|------|--------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 0.9    |      |                |      |        |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT  | EBR            | WBL  | WBT    | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Lane Configurations      |        |      | ↗              |      |        | ↗    |        | ↗↗   | ↗    |      | ↗↗   | ↗    |
| Traffic Vol, veh/h       | 0      | 0    | 165            | 0    | 0      | 41   | 0      | 1557 | 147  | 0    | 546  | 64   |
| Future Vol, veh/h        | 0      | 0    | 165            | 0    | 0      | 41   | 0      | 1557 | 147  | 0    | 546  | 64   |
| Conflicting Peds, #/hr   | 0      | 0    | 0              | 0    | 0      | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Stop   | Stop | Stop           | Stop | Stop   | Stop | Free   | Free | Free | Free | Free | Free |
| RT Channelized           | -      | -    | None           | -    | -      | Free | -      | -    | None | -    | -    | Free |
| Storage Length           | -      | -    | 0              | -    | -      | 0    | -      | -    | 25   | -    | -    | 0    |
| Veh in Median Storage, # | -      | 0    | -              | -    | 0      | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0    | -              | -    | 0      | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 85     | 85   | 85             | 85   | 85     | 85   | 85     | 85   | 85   | 85   | 85   | 85   |
| Heavy Vehicles, %        | 0      | 0    | 3              | 0    | 0      | 5    | 0      | 2    | 2    | 0    | 12   | 12   |
| Mvmt Flow                | 0      | 0    | 194            | 0    | 0      | 48   | 0      | 1832 | 173  | 0    | 642  | 75   |
| Major/Minor              | Minor2 |      | Minor1         |      | Major1 |      | Major2 |      |      |      |      |      |
| Conflicting Flow All     | -      | -    | 321            | -    | -      | -    | 0      | 0    | -    | -    | -    | 0    |
| Stage 1                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy            | -      | -    | 6.96           | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 1      | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 2      | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Follow-up Hdwy           | -      | -    | 3.33           | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Pot Cap-1 Maneuver       | 0      | 0    | 672            | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 1                  | 0      | 0    | -              | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 2                  | 0      | 0    | -              | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Platoon blocked, %       | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-1 Maneuver       | -      | -    | 672            | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-2 Maneuver       | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 1                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Approach                 | EB     |      | WB             |      | NB     |      | SB     |      |      |      |      |      |
| HCM Control Delay, s     | 12.5   |      | 0              |      | 0      |      | 0      |      |      |      |      |      |
| HCM LOS                  | B      |      | A              |      |        |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBT    |      | NBR EBLn1WBLn1 |      | SBT    |      |        |      |      |      |      |      |
| Capacity (veh/h)         | -      |      | 672            |      | -      |      |        |      |      |      |      |      |
| HCM Lane V/C Ratio       | -      |      | 0.289          |      | -      |      |        |      |      |      |      |      |
| HCM Control Delay (s)    | -      |      | 12.5           |      | 0      |      |        |      |      |      |      |      |
| HCM Lane LOS             | -      |      | B              |      | A      |      |        |      |      |      |      |      |
| HCM 95th %tile Q(veh)    | -      |      | 1.2            |      | -      |      |        |      |      |      |      |      |

| Intersection             |        |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
|--------------------------|--------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 0.2    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Movement                 | EBL    | EBR                                                                               | NBL                                                                               | NBT                                                                               | SBT                                                                               | SBR  |
| Lane Configurations      |        |  |  |  |  |      |
| Traffic Vol, veh/h       | 0      | 60                                                                                | 60                                                                                | 1538                                                                              | 550                                                                               | 0    |
| Future Vol, veh/h        | 0      | 60                                                                                | 60                                                                                | 1538                                                                              | 550                                                                               | 0    |
| Conflicting Peds, #/hr   | 0      | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0    |
| Sign Control             | Stop   | Stop                                                                              | Free                                                                              | Free                                                                              | Free                                                                              | Free |
| RT Channelized           | -      | Free                                                                              | -                                                                                 | None                                                                              | -                                                                                 | None |
| Storage Length           | -      | 0                                                                                 | 600                                                                               | -                                                                                 | -                                                                                 | -    |
| Veh in Median Storage, # | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Grade, %                 | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Peak Hour Factor         | 92     | 92                                                                                | 92                                                                                | 92                                                                                | 92                                                                                | 92   |
| Heavy Vehicles, %        | 0      | 5                                                                                 | 5                                                                                 | 2                                                                                 | 12                                                                                | 0    |
| Mvmt Flow                | 0      | 65                                                                                | 65                                                                                | 1672                                                                              | 598                                                                               | 0    |
| Major/Minor              | Minor2 | Major1                                                                            |                                                                                   | Major2                                                                            |                                                                                   |      |
| Conflicting Flow All     | -      | -                                                                                 | 598                                                                               | 0                                                                                 | -                                                                                 | 0    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy            | -      | -                                                                                 | 4.2                                                                               | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 1      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 2      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Follow-up Hdwy           | -      | -                                                                                 | 2.25                                                                              | -                                                                                 | -                                                                                 | -    |
| Pot Cap-1 Maneuver       | 0      | 0                                                                                 | 954                                                                               | -                                                                                 | -                                                                                 | 0    |
| Stage 1                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Stage 2                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Platoon blocked, %       |        |                                                                                   |                                                                                   | -                                                                                 | -                                                                                 |      |
| Mov Cap-1 Maneuver       | -      | -                                                                                 | 954                                                                               | -                                                                                 | -                                                                                 | -    |
| Mov Cap-2 Maneuver       | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Approach                 | EB     | NB                                                                                |                                                                                   | SB                                                                                |                                                                                   |      |
| HCM Control Delay, s     | 0      | 0.3                                                                               |                                                                                   | 0                                                                                 |                                                                                   |      |
| HCM LOS                  | A      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Minor Lane/Major Mvmt    | NBL    | NBT                                                                               | EBLn1                                                                             | SBT                                                                               |                                                                                   |      |
| Capacity (veh/h)         | 954    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.068  | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Control Delay (s)    | 9.1    | -                                                                                 | 0                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane LOS             | A      | -                                                                                 | A                                                                                 | -                                                                                 |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 0.2    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |



# HCS7 Freeway Merge Report

## Project Information

|                     |                                      |               |                  |
|---------------------|--------------------------------------|---------------|------------------|
| Analyst             | Whipple Consulting Engineers         | Date          | 03/05/2021       |
| Agency              | WSDOT                                | Analysis Year | 2021 AM Existing |
| Jurisdiction        | WSDOT                                | Time Analyzed | AM               |
| Project Description | 20-2564 Latah Glen - Thorpe N<br>MUT | Units         | U.S. Customary   |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 900                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 550   | 60    |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 12.00 | 5.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.893 | 0.952 |
| Flow Rate (vi),pc/h                   | 669   | 69    |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.16  | 0.03  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.257 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.2  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 669   | Ramp Junction Speed (S), mi/h                 | 43.2  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 738   | Average Density (D), pc/mi/ln                 | 8.5   |
| Level of Service (LOS)                       | A     | Density in Ramp Influence Area (DR), pc/mi/ln | 5.6   |

| Intersection             |          |                                                                                   |                                                                                   |        |                                                                                   |                                                                                   |
|--------------------------|----------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Int Delay, s/veh         | 1.1      |                                                                                   |                                                                                   |        |                                                                                   |                                                                                   |
| Movement                 | WBL      | WBR                                                                               | NBT                                                                               | NBR    | SBL                                                                               | SBT                                                                               |
| Lane Configurations      |          |  |  |        |  |  |
| Traffic Vol, veh/h       | 0        | 124                                                                               | 1580                                                                              | 0      | 124                                                                               | 587                                                                               |
| Future Vol, veh/h        | 0        | 124                                                                               | 1580                                                                              | 0      | 124                                                                               | 587                                                                               |
| Conflicting Peds, #/hr   | 0        | 0                                                                                 | 0                                                                                 | 0      | 0                                                                                 | 0                                                                                 |
| Sign Control             | Stop     | Stop                                                                              | Free                                                                              | Free   | Free                                                                              | Free                                                                              |
| RT Channelized           | -        | Free                                                                              | -                                                                                 | None   | -                                                                                 | None                                                                              |
| Storage Length           | -        | 0                                                                                 | -                                                                                 | -      | 600                                                                               | -                                                                                 |
| Veh in Median Storage, # | 0        | -                                                                                 | 0                                                                                 | -      | -                                                                                 | 0                                                                                 |
| Grade, %                 | 0        | -                                                                                 | 0                                                                                 | -      | -                                                                                 | 0                                                                                 |
| Peak Hour Factor         | 92       | 92                                                                                | 92                                                                                | 92     | 92                                                                                | 92                                                                                |
| Heavy Vehicles, %        | 0        | 3                                                                                 | 2                                                                                 | 0      | 3                                                                                 | 12                                                                                |
| Mvmt Flow                | 0        | 135                                                                               | 1717                                                                              | 0      | 135                                                                               | 638                                                                               |
| Major/Minor              | Minor1   | Major1                                                                            |                                                                                   | Major2 |                                                                                   |                                                                                   |
| Conflicting Flow All     | -        | -                                                                                 | 0                                                                                 | -      | 1717                                                                              | 0                                                                                 |
| Stage 1                  | -        | -                                                                                 | -                                                                                 | -      | -                                                                                 | -                                                                                 |
| Stage 2                  | -        | -                                                                                 | -                                                                                 | -      | -                                                                                 | -                                                                                 |
| Critical Hdwy            | -        | -                                                                                 | -                                                                                 | -      | 4.16                                                                              | -                                                                                 |
| Critical Hdwy Stg 1      | -        | -                                                                                 | -                                                                                 | -      | -                                                                                 | -                                                                                 |
| Critical Hdwy Stg 2      | -        | -                                                                                 | -                                                                                 | -      | -                                                                                 | -                                                                                 |
| Follow-up Hdwy           | -        | -                                                                                 | -                                                                                 | -      | 2.23                                                                              | -                                                                                 |
| Pot Cap-1 Maneuver       | 0        | 0                                                                                 | -                                                                                 | 0      | 361                                                                               | -                                                                                 |
| Stage 1                  | 0        | 0                                                                                 | -                                                                                 | 0      | -                                                                                 | -                                                                                 |
| Stage 2                  | 0        | 0                                                                                 | -                                                                                 | 0      | -                                                                                 | -                                                                                 |
| Platoon blocked, %       |          |                                                                                   | -                                                                                 |        |                                                                                   | -                                                                                 |
| Mov Cap-1 Maneuver       | -        | -                                                                                 | -                                                                                 | -      | 361                                                                               | -                                                                                 |
| Mov Cap-2 Maneuver       | -        | -                                                                                 | -                                                                                 | -      | -                                                                                 | -                                                                                 |
| Stage 1                  | -        | -                                                                                 | -                                                                                 | -      | -                                                                                 | -                                                                                 |
| Stage 2                  | -        | -                                                                                 | -                                                                                 | -      | -                                                                                 | -                                                                                 |
| Approach                 | WB       | NB                                                                                |                                                                                   | SB     |                                                                                   |                                                                                   |
| HCM Control Delay, s     | 0        | 0                                                                                 |                                                                                   | 3.6    |                                                                                   |                                                                                   |
| HCM LOS                  | A        |                                                                                   |                                                                                   |        |                                                                                   |                                                                                   |
| Minor Lane/Major Mvmt    | NBTWBLn1 |                                                                                   | SBL                                                                               | SBT    |                                                                                   |                                                                                   |
| Capacity (veh/h)         | -        |                                                                                   | 361                                                                               | -      |                                                                                   |                                                                                   |
| HCM Lane V/C Ratio       | -        |                                                                                   | 0.373                                                                             | -      |                                                                                   |                                                                                   |
| HCM Control Delay (s)    | -        |                                                                                   | 20.8                                                                              | -      |                                                                                   |                                                                                   |
| HCM Lane LOS             | -        |                                                                                   | A                                                                                 | C      |                                                                                   |                                                                                   |
| HCM 95th %tile Q(veh)    | -        |                                                                                   | 1.7                                                                               | -      |                                                                                   |                                                                                   |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                    |               |                  |
|---------------------|------------------------------------|---------------|------------------|
| Analyst             | Whipple Consulting Engineers       | Date          | 03/05/2021       |
| Agency              | WSDOT                              | Analysis Year | 2021 AM Existing |
| Jurisdiction        | WSDOT                              | Time Analyzed | AM               |
| Project Description | 20-2564 Latah Glen - Thorpe S. MUT | Units         | U.S. Customary   |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 500                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 1580  | 124   |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 2.00  | 3.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.980 | 0.971 |
| Flow Rate (vi),pc/h                   | 1752  | 139   |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.42  | 0.07  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.307 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.1  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 1752  | Ramp Junction Speed (S), mi/h                 | 43.1  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 1891  | Average Density (D), pc/mi/ln                 | 21.9  |
| Level of Service (LOS)                       | B     | Density in Ramp Influence Area (DR), pc/mi/ln | 17.1  |

| Intersection             |        |      |                |      |        |      |        |      |      |      |      |      |
|--------------------------|--------|------|----------------|------|--------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 0.8    |      |                |      |        |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT  | EBR            | WBL  | WBT    | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Lane Configurations      |        |      | ↗              |      |        | ↗    |        | ↗↗   | ↗    |      | ↗↗   | ↗    |
| Traffic Vol, veh/h       | 0      | 0    | 96             | 0    | 0      | 69   | 0      | 699  | 107  | 0    | 1400 | 136  |
| Future Vol, veh/h        | 0      | 0    | 96             | 0    | 0      | 69   | 0      | 699  | 107  | 0    | 1400 | 136  |
| Conflicting Peds, #/hr   | 0      | 0    | 0              | 0    | 0      | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Stop   | Stop | Stop           | Stop | Stop   | Stop | Free   | Free | Free | Free | Free | Free |
| RT Channelized           | -      | -    | None           | -    | -      | Free | -      | -    | None | -    | -    | Free |
| Storage Length           | -      | -    | 0              | -    | -      | 0    | -      | -    | 25   | -    | -    | 0    |
| Veh in Median Storage, # | -      | 0    | -              | -    | 0      | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0    | -              | -    | 0      | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 93     | 93   | 93             | 93   | 93     | 93   | 93     | 93   | 93   | 93   | 93   | 93   |
| Heavy Vehicles, %        | 2      | 2    | 2              | 2    | 2      | 2    | 2      | 4    | 4    | 2    | 2    | 2    |
| Mvmt Flow                | 0      | 0    | 103            | 0    | 0      | 74   | 0      | 752  | 115  | 0    | 1505 | 146  |
| Major/Minor              | Minor2 |      | Minor1         |      | Major1 |      | Major2 |      |      |      |      |      |
| Conflicting Flow All     | -      | -    | 753            | -    | -      | -    | 0      | 0    | -    | -    | -    | 0    |
| Stage 1                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy            | -      | -    | 6.94           | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 1      | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 2      | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Follow-up Hdwy           | -      | -    | 3.32           | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Pot Cap-1 Maneuver       | 0      | 0    | 352            | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 1                  | 0      | 0    | -              | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 2                  | 0      | 0    | -              | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Platoon blocked, %       | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-1 Maneuver       | -      | -    | 352            | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-2 Maneuver       | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 1                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Approach                 | EB     |      | WB             |      | NB     |      | SB     |      |      |      |      |      |
| HCM Control Delay, s     | 19.4   |      | 0              |      | 0      |      | 0      |      |      |      |      |      |
| HCM LOS                  | C      |      | A              |      |        |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBT    |      | NBR EBLn1WBLn1 |      | SBT    |      |        |      |      |      |      |      |
| Capacity (veh/h)         | -      |      | 352            |      | -      |      |        |      |      |      |      |      |
| HCM Lane V/C Ratio       | -      |      | 0.293          |      | -      |      |        |      |      |      |      |      |
| HCM Control Delay (s)    | -      |      | 19.4           |      | 0      |      |        |      |      |      |      |      |
| HCM Lane LOS             | -      |      | C              |      | A      |      |        |      |      |      |      |      |
| HCM 95th %tile Q(veh)    | -      |      | 1.2            |      | -      |      |        |      |      |      |      |      |

| Intersection             |        |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
|--------------------------|--------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 0.8    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Movement                 | EBL    | EBR                                                                               | NBL                                                                               | NBT                                                                               | SBT                                                                               | SBR  |
| Lane Configurations      |        |  |  |  |  |      |
| Traffic Vol, veh/h       | 0      | 106                                                                               | 106                                                                               | 661                                                                               | 1430                                                                              | 0    |
| Future Vol, veh/h        | 0      | 106                                                                               | 106                                                                               | 661                                                                               | 1430                                                                              | 0    |
| Conflicting Peds, #/hr   | 0      | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0    |
| Sign Control             | Stop   | Stop                                                                              | Free                                                                              | Free                                                                              | Free                                                                              | Free |
| RT Channelized           | -      | Free                                                                              | -                                                                                 | None                                                                              | -                                                                                 | None |
| Storage Length           | -      | 0                                                                                 | 600                                                                               | -                                                                                 | -                                                                                 | -    |
| Veh in Median Storage, # | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Grade, %                 | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Peak Hour Factor         | 92     | 92                                                                                | 92                                                                                | 92                                                                                | 92                                                                                | 92   |
| Heavy Vehicles, %        | 2      | 2                                                                                 | 2                                                                                 | 4                                                                                 | 2                                                                                 | 2    |
| Mvmt Flow                | 0      | 115                                                                               | 115                                                                               | 718                                                                               | 1554                                                                              | 0    |
| Major/Minor              | Minor2 | Major1                                                                            |                                                                                   | Major2                                                                            |                                                                                   |      |
| Conflicting Flow All     | -      | -                                                                                 | 1554                                                                              | 0                                                                                 | -                                                                                 | 0    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy            | -      | -                                                                                 | 4.14                                                                              | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 1      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 2      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Follow-up Hdwy           | -      | -                                                                                 | 2.22                                                                              | -                                                                                 | -                                                                                 | -    |
| Pot Cap-1 Maneuver       | 0      | 0                                                                                 | 422                                                                               | -                                                                                 | -                                                                                 | 0    |
| Stage 1                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Stage 2                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Platoon blocked, %       |        |                                                                                   |                                                                                   | -                                                                                 | -                                                                                 |      |
| Mov Cap-1 Maneuver       | -      | -                                                                                 | 422                                                                               | -                                                                                 | -                                                                                 | -    |
| Mov Cap-2 Maneuver       | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Approach                 | EB     | NB                                                                                |                                                                                   | SB                                                                                |                                                                                   |      |
| HCM Control Delay, s     | 0      | 2.3                                                                               |                                                                                   | 0                                                                                 |                                                                                   |      |
| HCM LOS                  | A      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Minor Lane/Major Mvmt    | NBL    | NBT                                                                               | EBLn1                                                                             | SBT                                                                               |                                                                                   |      |
| Capacity (veh/h)         | 422    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.273  | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Control Delay (s)    | 16.7   | -                                                                                 | 0                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane LOS             | C      | -                                                                                 | A                                                                                 | -                                                                                 |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 1.1    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                      |               |                  |
|---------------------|--------------------------------------|---------------|------------------|
| Analyst             | Whipple Consulting Engineers         | Date          | 03/05/2021       |
| Agency              | WSDOT                                | Analysis Year | 2021 PM Existing |
| Jurisdiction        | WSDOT                                | Time Analyzed | PM               |
| Project Description | 20-2564 Latah Glen - Thorpe N<br>MUT | Units         | U.S. Customary   |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 900                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 1430  | 106   |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 2.00  | 2.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fhv) | 0.980 | 0.980 |
| Flow Rate (vi),pc/h                   | 1586  | 118   |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.38  | 0.06  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.270 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (vOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.2  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 1586  | Ramp Junction Speed (S), mi/h                 | 43.2  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 1704  | Average Density (D), pc/mi/ln                 | 19.7  |
| Level of Service (LOS)                       | B     | Density in Ramp Influence Area (DR), pc/mi/ln | 13.1  |

| Intersection             |          |        |       |        |      |      |
|--------------------------|----------|--------|-------|--------|------|------|
| Int Delay, s/veh         | 0.3      |        |       |        |      |      |
| Movement                 | WBL      | WBR    | NBT   | NBR    | SBL  | SBT  |
| Lane Configurations      |          | ↗      | ↗↗    |        | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0        | 81     | 724   | 0      | 81   | 1415 |
| Future Vol, veh/h        | 0        | 81     | 724   | 0      | 81   | 1415 |
| Conflicting Peds, #/hr   | 0        | 0      | 0     | 0      | 0    | 0    |
| Sign Control             | Stop     | Stop   | Free  | Free   | Free | Free |
| RT Channelized           | -        | Free   | -     | None   | -    | None |
| Storage Length           | -        | 0      | -     | -      | 600  | -    |
| Veh in Median Storage, # | 0        | -      | 0     | -      | -    | 0    |
| Grade, %                 | 0        | -      | 0     | -      | -    | 0    |
| Peak Hour Factor         | 92       | 92     | 92    | 92     | 92   | 92   |
| Heavy Vehicles, %        | 0        | 2      | 4     | 0      | 2    | 2    |
| Mvmt Flow                | 0        | 88     | 787   | 0      | 88   | 1538 |
| Major/Minor              | Minor1   | Major1 |       | Major2 |      |      |
| Conflicting Flow All     | -        | -      | 0     | -      | 787  | 0    |
| Stage 1                  | -        | -      | -     | -      | -    | -    |
| Stage 2                  | -        | -      | -     | -      | -    | -    |
| Critical Hdwy            | -        | -      | -     | -      | 4.14 | -    |
| Critical Hdwy Stg 1      | -        | -      | -     | -      | -    | -    |
| Critical Hdwy Stg 2      | -        | -      | -     | -      | -    | -    |
| Follow-up Hdwy           | -        | -      | -     | -      | 2.22 | -    |
| Pot Cap-1 Maneuver       | 0        | 0      | -     | 0      | 828  | -    |
| Stage 1                  | 0        | 0      | -     | 0      | -    | -    |
| Stage 2                  | 0        | 0      | -     | 0      | -    | -    |
| Platoon blocked, %       |          |        | -     |        |      | -    |
| Mov Cap-1 Maneuver       | -        | -      | -     | -      | 828  | -    |
| Mov Cap-2 Maneuver       | -        | -      | -     | -      | -    | -    |
| Stage 1                  | -        | -      | -     | -      | -    | -    |
| Stage 2                  | -        | -      | -     | -      | -    | -    |
| Approach                 | WB       | NB     |       | SB     |      |      |
| HCM Control Delay, s     | 0        | 0      |       | 0.5    |      |      |
| HCM LOS                  | A        |        |       |        |      |      |
| Minor Lane/Major Mvmt    | NBTWBLn1 |        | SBL   | SBT    |      |      |
| Capacity (veh/h)         | -        |        | 828   | -      |      |      |
| HCM Lane V/C Ratio       | -        |        | 0.106 | -      |      |      |
| HCM Control Delay (s)    | -        |        | 0     | 9.9    |      |      |
| HCM Lane LOS             | -        |        | A     | A      |      |      |
| HCM 95th %tile Q(veh)    | -        |        | 0.4   | -      |      |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                    |               |                  |
|---------------------|------------------------------------|---------------|------------------|
| Analyst             | Whipple Consulting Engineers       | Date          | 03/05/2021       |
| Agency              | WSDOT                              | Analysis Year | 2021 PM Existing |
| Jurisdiction        | WSDOT                              | Time Analyzed | PM               |
| Project Description | 20-2564 Latah Glen - Thorpe S. MUT | Units         | U.S. Customary   |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 500                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 724   | 81    |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 4.00  | 2.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.962 | 0.980 |
| Flow Rate (vi),pc/h                   | 818   | 90    |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.20  | 0.05  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.291 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.1  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 818   | Ramp Junction Speed (S), mi/h                 | 43.1  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 908   | Average Density (D), pc/mi/ln                 | 10.5  |
| Level of Service (LOS)                       | A     | Density in Ramp Influence Area (DR), pc/mi/ln | 9.5   |



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**YEAR 2026**

**LEVEL OF SERVICE CALCULATIONS**

**AM & PM WITH BACKGROUND GROWTH RATE**

**(J-TURN AT THORPE & SR 195 AND MEADOWLANE IMP)**

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| Intersection             |        |      |                |      |        |      |        |      |      |      |      |      |
|--------------------------|--------|------|----------------|------|--------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 0.9    |      |                |      |        |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT  | EBR            | WBL  | WBT    | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Lane Configurations      |        |      | ↗              |      |        | ↗    |        | ↗↗   | ↗    |      | ↗↗   | ↗    |
| Traffic Vol, veh/h       | 0      | 0    | 173            | 0    | 0      | 43   | 0      | 1636 | 155  | 0    | 574  | 67   |
| Future Vol, veh/h        | 0      | 0    | 173            | 0    | 0      | 43   | 0      | 1636 | 155  | 0    | 574  | 67   |
| Conflicting Peds, #/hr   | 0      | 0    | 0              | 0    | 0      | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Stop   | Stop | Stop           | Stop | Stop   | Stop | Free   | Free | Free | Free | Free | Free |
| RT Channelized           | -      | -    | None           | -    | -      | Free | -      | -    | None | -    | -    | Free |
| Storage Length           | -      | -    | 0              | -    | -      | 0    | -      | -    | 25   | -    | -    | 0    |
| Veh in Median Storage, # | -      | 0    | -              | -    | 0      | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0    | -              | -    | 0      | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 85     | 85   | 85             | 85   | 85     | 85   | 85     | 85   | 85   | 85   | 85   | 85   |
| Heavy Vehicles, %        | 0      | 0    | 3              | 0    | 0      | 5    | 0      | 2    | 2    | 0    | 12   | 12   |
| Mvmt Flow                | 0      | 0    | 204            | 0    | 0      | 51   | 0      | 1925 | 182  | 0    | 675  | 79   |
| Major/Minor              | Minor2 |      | Minor1         |      | Major1 |      | Major2 |      |      |      |      |      |
| Conflicting Flow All     | -      | -    | 338            | -    | -      | -    | 0      | 0    | -    | -    | -    | 0    |
| Stage 1                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy            | -      | -    | 6.96           | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 1      | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 2      | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Follow-up Hdwy           | -      | -    | 3.33           | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Pot Cap-1 Maneuver       | 0      | 0    | 655            | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 1                  | 0      | 0    | -              | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 2                  | 0      | 0    | -              | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Platoon blocked, %       | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-1 Maneuver       | -      | -    | 655            | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-2 Maneuver       | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 1                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Approach                 | EB     |      | WB             |      | NB     |      | SB     |      |      |      |      |      |
| HCM Control Delay, s     | 13     |      | 0              |      | 0      |      | 0      |      |      |      |      |      |
| HCM LOS                  | B      |      | A              |      |        |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBT    |      | NBR EBLn1WBLn1 |      | SBT    |      |        |      |      |      |      |      |
| Capacity (veh/h)         | -      | -    | 655            | -    | -      |      |        |      |      |      |      |      |
| HCM Lane V/C Ratio       | -      | -    | 0.311          | -    | -      |      |        |      |      |      |      |      |
| HCM Control Delay (s)    | -      | -    | 13             | 0    | -      |      |        |      |      |      |      |      |
| HCM Lane LOS             | -      | -    | B              | A    | -      |      |        |      |      |      |      |      |
| HCM 95th %tile Q(veh)    | -      | -    | 1.3            | -    | -      |      |        |      |      |      |      |      |

| Intersection             |        |        |       |        |      |      |
|--------------------------|--------|--------|-------|--------|------|------|
| Int Delay, s/veh         | 0.2    |        |       |        |      |      |
| Movement                 | EBL    | EBR    | NBL   | NBT    | SBT  | SBR  |
| Lane Configurations      |        | ↗      | ↘     | ↗↗     | ↘↘   |      |
| Traffic Vol, veh/h       | 0      | 63     | 63    | 1617   | 578  | 0    |
| Future Vol, veh/h        | 0      | 63     | 63    | 1617   | 578  | 0    |
| Conflicting Peds, #/hr   | 0      | 0      | 0     | 0      | 0    | 0    |
| Sign Control             | Stop   | Stop   | Free  | Free   | Free | Free |
| RT Channelized           | -      | Free   | -     | None   | -    | None |
| Storage Length           | -      | 0      | 600   | -      | -    | -    |
| Veh in Median Storage, # | 0      | -      | -     | 0      | 0    | -    |
| Grade, %                 | 0      | -      | -     | 0      | 0    | -    |
| Peak Hour Factor         | 92     | 92     | 92    | 92     | 92   | 92   |
| Heavy Vehicles, %        | 0      | 5      | 5     | 2      | 12   | 0    |
| Mvmt Flow                | 0      | 68     | 68    | 1758   | 628  | 0    |
| Major/Minor              | Minor2 | Major1 |       | Major2 |      |      |
| Conflicting Flow All     | -      | -      | 628   | 0      | -    | 0    |
| Stage 1                  | -      | -      | -     | -      | -    | -    |
| Stage 2                  | -      | -      | -     | -      | -    | -    |
| Critical Hdwy            | -      | -      | 4.2   | -      | -    | -    |
| Critical Hdwy Stg 1      | -      | -      | -     | -      | -    | -    |
| Critical Hdwy Stg 2      | -      | -      | -     | -      | -    | -    |
| Follow-up Hdwy           | -      | -      | 2.25  | -      | -    | -    |
| Pot Cap-1 Maneuver       | 0      | 0      | 930   | -      | -    | 0    |
| Stage 1                  | 0      | 0      | -     | -      | -    | 0    |
| Stage 2                  | 0      | 0      | -     | -      | -    | 0    |
| Platoon blocked, %       |        |        |       | -      | -    |      |
| Mov Cap-1 Maneuver       | -      | -      | 930   | -      | -    | -    |
| Mov Cap-2 Maneuver       | -      | -      | -     | -      | -    | -    |
| Stage 1                  | -      | -      | -     | -      | -    | -    |
| Stage 2                  | -      | -      | -     | -      | -    | -    |
| Approach                 | EB     | NB     |       | SB     |      |      |
| HCM Control Delay, s     | 0      | 0.3    |       | 0      |      |      |
| HCM LOS                  | A      |        |       |        |      |      |
| Minor Lane/Major Mvmt    | NBL    | NBT    | EBLn1 | SBT    |      |      |
| Capacity (veh/h)         | 930    | -      | -     | -      |      |      |
| HCM Lane V/C Ratio       | 0.074  | -      | -     | -      |      |      |
| HCM Control Delay (s)    | 9.2    | -      | 0     | -      |      |      |
| HCM Lane LOS             | A      | -      | A     | -      |      |      |
| HCM 95th %tile Q(veh)    | 0.2    | -      | -     | -      |      |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                      |               |                 |
|---------------------|--------------------------------------|---------------|-----------------|
| Analyst             | Whipple Consulting Engineers         | Date          | 03/05/2021      |
| Agency              | WSDOT                                | Analysis Year | 2026 AM w BK GR |
| Jurisdiction        | WSDOT                                | Time Analyzed | AM              |
| Project Description | 20-2564 Latah Glen - Thorpe N<br>MUT | Units         | U.S. Customary  |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 900                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 578   | 63    |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 12.00 | 5.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.893 | 0.952 |
| Flow Rate (vi),pc/h                   | 704   | 72    |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.17  | 0.04  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.257 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (vOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.2  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 704   | Ramp Junction Speed (S), mi/h                 | 43.2  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 776   | Average Density (D), pc/mi/ln                 | 9.0   |
| Level of Service (LOS)                       | A     | Density in Ramp Influence Area (DR), pc/mi/ln | 5.9   |

| Intersection             |          |        |       |        |      |      |
|--------------------------|----------|--------|-------|--------|------|------|
| Int Delay, s/veh         | 1.3      |        |       |        |      |      |
| Movement                 | WBL      | WBR    | NBT   | NBR    | SBL  | SBT  |
| Lane Configurations      |          | ↗      | ↗↗    |        | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0        | 130    | 1661  | 0      | 130  | 617  |
| Future Vol, veh/h        | 0        | 130    | 1661  | 0      | 130  | 617  |
| Conflicting Peds, #/hr   | 0        | 0      | 0     | 0      | 0    | 0    |
| Sign Control             | Stop     | Stop   | Free  | Free   | Free | Free |
| RT Channelized           | -        | Free   | -     | None   | -    | None |
| Storage Length           | -        | 0      | -     | -      | 600  | -    |
| Veh in Median Storage, # | 0        | -      | 0     | -      | -    | 0    |
| Grade, %                 | 0        | -      | 0     | -      | -    | 0    |
| Peak Hour Factor         | 92       | 92     | 92    | 92     | 92   | 92   |
| Heavy Vehicles, %        | 0        | 3      | 2     | 0      | 3    | 12   |
| Mvmt Flow                | 0        | 141    | 1805  | 0      | 141  | 671  |
| Major/Minor              | Minor1   | Major1 |       | Major2 |      |      |
| Conflicting Flow All     | -        | -      | 0     | -      | 1805 | 0    |
| Stage 1                  | -        | -      | -     | -      | -    | -    |
| Stage 2                  | -        | -      | -     | -      | -    | -    |
| Critical Hdwy            | -        | -      | -     | -      | 4.16 | -    |
| Critical Hdwy Stg 1      | -        | -      | -     | -      | -    | -    |
| Critical Hdwy Stg 2      | -        | -      | -     | -      | -    | -    |
| Follow-up Hdwy           | -        | -      | -     | -      | 2.23 | -    |
| Pot Cap-1 Maneuver       | 0        | 0      | -     | 0      | 333  | -    |
| Stage 1                  | 0        | 0      | -     | 0      | -    | -    |
| Stage 2                  | 0        | 0      | -     | 0      | -    | -    |
| Platoon blocked, %       |          |        | -     |        |      | -    |
| Mov Cap-1 Maneuver       | -        | -      | -     | -      | 333  | -    |
| Mov Cap-2 Maneuver       | -        | -      | -     | -      | -    | -    |
| Stage 1                  | -        | -      | -     | -      | -    | -    |
| Stage 2                  | -        | -      | -     | -      | -    | -    |
| Approach                 | WB       | NB     |       | SB     |      |      |
| HCM Control Delay, s     | 0        | 0      |       | 4.1    |      |      |
| HCM LOS                  | A        |        |       |        |      |      |
| Minor Lane/Major Mvmt    | NBTWBLn1 |        | SBL   | SBT    |      |      |
| Capacity (veh/h)         | -        |        | 333   | -      |      |      |
| HCM Lane V/C Ratio       | -        |        | 0.424 | -      |      |      |
| HCM Control Delay (s)    | -        |        | 23.5  | -      |      |      |
| HCM Lane LOS             | -        |        | A     | C      |      |      |
| HCM 95th %tile Q(veh)    | -        |        | 2     | -      |      |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                    |               |                 |
|---------------------|------------------------------------|---------------|-----------------|
| Analyst             | Whipple Consulting Engineers       | Date          | 03/05/2021      |
| Agency              | WSDOT                              | Analysis Year | 2026 AM w BK GR |
| Jurisdiction        | WSDOT                              | Time Analyzed | AM              |
| Project Description | 20-2564 Latah Glen - Thorpe S. MUT | Units         | U.S. Customary  |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 500                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 1661  | 130   |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 2.00  | 3.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.980 | 0.971 |
| Flow Rate (vi),pc/h                   | 1842  | 146   |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.44  | 0.07  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.309 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.1  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 1842  | Ramp Junction Speed (S), mi/h                 | 43.1  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 1988  | Average Density (D), pc/mi/ln                 | 23.1  |
| Level of Service (LOS)                       | B     | Density in Ramp Influence Area (DR), pc/mi/ln | 17.9  |

| Intersection             |        |          |       |        |      |      |
|--------------------------|--------|----------|-------|--------|------|------|
| Int Delay, s/veh         | 0.2    |          |       |        |      |      |
| Movement                 | WBL    | WBR      | NBT   | NBR    | SBL  | SBT  |
| Lane Configurations      |        | ↗        | ↗↗    | ↗      | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0      | 19       | 1144  | 4      | 12   | 594  |
| Future Vol, veh/h        | 0      | 19       | 1144  | 4      | 12   | 594  |
| Conflicting Peds, #/hr   | 0      | 0        | 0     | 0      | 0    | 0    |
| Sign Control             | Stop   | Stop     | Free  | Free   | Free | Free |
| RT Channelized           | -      | Stop     | -     | None   | -    | None |
| Storage Length           | -      | 0        | -     | 25     | 200  | -    |
| Veh in Median Storage, # | 1      | -        | 0     | -      | -    | 0    |
| Grade, %                 | 0      | -        | 0     | -      | -    | 0    |
| Peak Hour Factor         | 92     | 92       | 92    | 92     | 92   | 92   |
| Heavy Vehicles, %        | 17     | 17       | 2     | 2      | 9    | 9    |
| Mvmt Flow                | 0      | 21       | 1243  | 4      | 13   | 646  |
| Major/Minor              | Minor1 | Major1   |       | Major2 |      |      |
| Conflicting Flow All     | -      | 622      | 0     | 0      | 1247 | 0    |
| Stage 1                  | -      | -        | -     | -      | -    | -    |
| Stage 2                  | -      | -        | -     | -      | -    | -    |
| Critical Hdwy            | -      | 7.24     | -     | -      | 4.28 | -    |
| Critical Hdwy Stg 1      | -      | -        | -     | -      | -    | -    |
| Critical Hdwy Stg 2      | -      | -        | -     | -      | -    | -    |
| Follow-up Hdwy           | -      | 3.47     | -     | -      | 2.29 | -    |
| Pot Cap-1 Maneuver       | 0      | 395      | -     | -      | 517  | -    |
| Stage 1                  | 0      | -        | -     | -      | -    | -    |
| Stage 2                  | 0      | -        | -     | -      | -    | -    |
| Platoon blocked, %       | -      | -        | -     | -      | -    | -    |
| Mov Cap-1 Maneuver       | -      | 395      | -     | -      | 517  | -    |
| Mov Cap-2 Maneuver       | -      | -        | -     | -      | -    | -    |
| Stage 1                  | -      | -        | -     | -      | -    | -    |
| Stage 2                  | -      | -        | -     | -      | -    | -    |
| Approach                 | WB     | NB       |       | SB     |      |      |
| HCM Control Delay, s     | 14.6   | 0        |       | 0.2    |      |      |
| HCM LOS                  | B      |          |       |        |      |      |
| Minor Lane/Major Mvmt    | NBT    | NBRWBLn1 | SBL   | SBT    |      |      |
| Capacity (veh/h)         | -      | -        | 395   | 517    | -    |      |
| HCM Lane V/C Ratio       | -      | -        | 0.052 | 0.025  | -    |      |
| HCM Control Delay (s)    | -      | -        | 14.6  | 12.1   | -    |      |
| HCM Lane LOS             | -      | -        | B     | B      | -    |      |
| HCM 95th %tile Q(veh)    | -      | -        | 0.2   | 0.1    | -    |      |

| Intersection             |        |        |       |        |      |      |
|--------------------------|--------|--------|-------|--------|------|------|
| Int Delay, s/veh         | 0.5    |        |       |        |      |      |
| Movement                 | EBL    | EBR    | NBL   | NBT    | SBT  | SBR  |
| Lane Configurations      |        | ↗      | ↘     | ↗↘     | ↗↘   |      |
| Traffic Vol, veh/h       | 0      | 93     | 93    | 1071   | 515  | 0    |
| Future Vol, veh/h        | 0      | 93     | 93    | 1071   | 515  | 0    |
| Conflicting Peds, #/hr   | 0      | 0      | 0     | 0      | 0    | 0    |
| Sign Control             | Stop   | Stop   | Free  | Free   | Free | Free |
| RT Channelized           | -      | Free   | -     | None   | -    | None |
| Storage Length           | -      | 0      | 250   | -      | -    | -    |
| Veh in Median Storage, # | 0      | -      | -     | 0      | 0    | -    |
| Grade, %                 | 0      | -      | -     | 0      | 0    | -    |
| Peak Hour Factor         | 92     | 92     | 92    | 92     | 92   | 92   |
| Heavy Vehicles, %        | 2      | 2      | 2     | 2      | 9    | 9    |
| Mvmt Flow                | 0      | 101    | 101   | 1164   | 560  | 0    |
| Major/Minor              | Minor2 | Major1 |       | Major2 |      |      |
| Conflicting Flow All     | -      | -      | 560   | 0      | -    | 0    |
| Stage 1                  | -      | -      | -     | -      | -    | -    |
| Stage 2                  | -      | -      | -     | -      | -    | -    |
| Critical Hdwy            | -      | -      | 4.14  | -      | -    | -    |
| Critical Hdwy Stg 1      | -      | -      | -     | -      | -    | -    |
| Critical Hdwy Stg 2      | -      | -      | -     | -      | -    | -    |
| Follow-up Hdwy           | -      | -      | 2.22  | -      | -    | -    |
| Pot Cap-1 Maneuver       | 0      | 0      | 1007  | -      | -    | 0    |
| Stage 1                  | 0      | 0      | -     | -      | -    | 0    |
| Stage 2                  | 0      | 0      | -     | -      | -    | 0    |
| Platoon blocked, %       | -      | -      | -     | -      | -    | -    |
| Mov Cap-1 Maneuver       | -      | -      | 1007  | -      | -    | -    |
| Mov Cap-2 Maneuver       | -      | -      | -     | -      | -    | -    |
| Stage 1                  | -      | -      | -     | -      | -    | -    |
| Stage 2                  | -      | -      | -     | -      | -    | -    |
| Approach                 | EB     | NB     |       | SB     |      |      |
| HCM Control Delay, s     | 0      | 0.7    |       | 0      |      |      |
| HCM LOS                  | A      |        |       |        |      |      |
| Minor Lane/Major Mvmt    | NBL    | NBT    | EBLn1 | SBT    |      |      |
| Capacity (veh/h)         | 1007   | -      | -     | -      |      |      |
| HCM Lane V/C Ratio       | 0.1    | -      | -     | -      |      |      |
| HCM Control Delay (s)    | 9      | -      | 0     | -      |      |      |
| HCM Lane LOS             | A      | -      | A     | -      |      |      |
| HCM 95th %tile Q(veh)    | 0.3    | -      | -     | -      |      |      |



# HCS7 Freeway Merge Report

## Project Information

|                     |                                       |               |                 |
|---------------------|---------------------------------------|---------------|-----------------|
| Analyst             | Whipple Consulting Engineers          | Date          | 03/05/2021      |
| Agency              | WSDOT                                 | Analysis Year | 2026 AM w BK GR |
| Jurisdiction        | WSDOT                                 | Time Analyzed | AM              |
| Project Description | 20-2564 Latah Glen - Meadowlane N MUT | Units         | U.S. Customary  |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 500                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 515   | 93    |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 9.00  | 2.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.917 | 0.980 |
| Flow Rate (vi),pc/h                   | 610   | 103   |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.16  | 0.05  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.289 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.1  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 610   | Ramp Junction Speed (S), mi/h                 | 43.1  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 713   | Average Density (D), pc/mi/ln                 | 8.3   |
| Level of Service (LOS)                       | A     | Density in Ramp Influence Area (DR), pc/mi/ln | 7.9   |

| Intersection             |                                                                                   |                                                                                   |      |       |                                                                                   |      |
|--------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|-------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 5.6                                                                               |                                                                                   |      |       |                                                                                   |      |
| Movement                 | EBL                                                                               | EBR                                                                               | NBL  | NBT   | SBT                                                                               | SBR  |
| Lane Configurations      |  |  |      |       |  |      |
| Traffic Vol, veh/h       | 197                                                                               | 100                                                                               | 0    | 0     | 495                                                                               | 0    |
| Future Vol, veh/h        | 197                                                                               | 100                                                                               | 0    | 0     | 495                                                                               | 0    |
| Conflicting Peds, #/hr   | 0                                                                                 | 0                                                                                 | 0    | 0     | 0                                                                                 | 0    |
| Sign Control             | Stop                                                                              | Stop                                                                              | Free | Free  | Free                                                                              | Free |
| RT Channelized           | -                                                                                 | None                                                                              | -    | None  | -                                                                                 | None |
| Storage Length           | 0                                                                                 | 0                                                                                 | -    | -     | -                                                                                 | -    |
| Veh in Median Storage, # | 2                                                                                 | -                                                                                 | -    | 16979 | 0                                                                                 | -    |
| Grade, %                 | 0                                                                                 | -                                                                                 | -    | 0     | 0                                                                                 | -    |
| Peak Hour Factor         | 92                                                                                | 92                                                                                | 92   | 92    | 92                                                                                | 92   |
| Heavy Vehicles, %        | 3                                                                                 | 3                                                                                 | 2    | 2     | 9                                                                                 | 9    |
| Mvmt Flow                | 214                                                                               | 109                                                                               | 0    | 0     | 538                                                                               | 0    |

| Major/Minor          | Minor2 |      | Major2 |   |
|----------------------|--------|------|--------|---|
| Conflicting Flow All | 538    | 269  | -      | 0 |
| Stage 1              | 538    | -    | -      | - |
| Stage 2              | 0      | -    | -      | - |
| Critical Hdwy        | 6.86   | 6.96 | -      | - |
| Critical Hdwy Stg 1  | 5.86   | -    | -      | - |
| Critical Hdwy Stg 2  | -      | -    | -      | - |
| Follow-up Hdwy       | 3.53   | 3.33 | -      | - |
| Pot Cap-1 Maneuver   | 471    | 726  | -      | 0 |
| Stage 1              | 547    | -    | -      | 0 |
| Stage 2              | -      | -    | -      | 0 |
| Platoon blocked, %   |        |      | -      |   |
| Mov Cap-1 Maneuver   | 471    | 726  | -      | - |
| Mov Cap-2 Maneuver   | 517    | -    | -      | - |
| Stage 1              | 547    | -    | -      | - |
| Stage 2              | -      | -    | -      | - |

| Approach             | EB   | SB |
|----------------------|------|----|
| HCM Control Delay, s | 14.8 | 0  |
| HCM LOS              | B    |    |

| Minor Lane/Major Mvmt | EBLn1 | EBLn2 | SBT |
|-----------------------|-------|-------|-----|
| Capacity (veh/h)      | 517   | 726   | -   |
| HCM Lane V/C Ratio    | 0.414 | 0.15  | -   |
| HCM Control Delay (s) | 16.8  | 10.8  | -   |
| HCM Lane LOS          | C     | B     | -   |
| HCM 95th %tile Q(veh) | 2     | 0.5   | -   |

| Intersection             |        |          |      |        |      |      |
|--------------------------|--------|----------|------|--------|------|------|
| Int Delay, s/veh         | 7.7    |          |      |        |      |      |
| Movement                 | WBL    | WBR      | NBT  | NBR    | SBL  | SBT  |
| Lane Configurations      |        | ↗        | ↗↗   | ↗      | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0      | 459      | 417  | 91     | 204  | 303  |
| Future Vol, veh/h        | 0      | 459      | 417  | 91     | 204  | 303  |
| Conflicting Peds, #/hr   | 0      | 0        | 0    | 0      | 0    | 0    |
| Sign Control             | Stop   | Stop     | Free | Free   | Free | Free |
| RT Channelized           | -      | None     | -    | None   | -    | None |
| Storage Length           | -      | -        | -    | 25     | 350  | -    |
| Veh in Median Storage, # | 1      | -        | 0    | -      | -    | 0    |
| Grade, %                 | 0      | -        | 0    | -      | -    | 0    |
| Peak Hour Factor         | 86     | 86       | 86   | 86     | 86   | 86   |
| Heavy Vehicles, %        | 2      | 2        | 2    | 2      | 9    | 9    |
| Mvmt Flow                | 0      | 534      | 485  | 106    | 237  | 352  |
| Major/Minor              | Minor1 | Major1   |      | Major2 |      |      |
| Conflicting Flow All     | -      | 243      | 0    | 0      | 591  | 0    |
| Stage 1                  | -      | -        | -    | -      | -    | -    |
| Stage 2                  | -      | -        | -    | -      | -    | -    |
| Critical Hdwy            | -      | 6.94     | -    | -      | 4.28 | -    |
| Critical Hdwy Stg 1      | -      | -        | -    | -      | -    | -    |
| Critical Hdwy Stg 2      | -      | -        | -    | -      | -    | -    |
| Follow-up Hdwy           | -      | 3.32     | -    | -      | 2.29 | -    |
| Pot Cap-1 Maneuver       | 0      | 758      | -    | -      | 934  | -    |
| Stage 1                  | 0      | -        | -    | -      | -    | -    |
| Stage 2                  | 0      | -        | -    | -      | -    | -    |
| Platoon blocked, %       | -      | -        | -    | -      | -    | -    |
| Mov Cap-1 Maneuver       | -      | 758      | -    | -      | 934  | -    |
| Mov Cap-2 Maneuver       | -      | -        | -    | -      | -    | -    |
| Stage 1                  | -      | -        | -    | -      | -    | -    |
| Stage 2                  | -      | -        | -    | -      | -    | -    |
| Approach                 | WB     | NB       |      | SB     |      |      |
| HCM Control Delay, s     | 20.2   | 0        |      | 4.1    |      |      |
| HCM LOS                  | C      |          |      |        |      |      |
| Minor Lane/Major Mvmt    | NBT    | NBRWBLn1 |      | SBL    | SBT  |      |
| Capacity (veh/h)         | -      | 758      |      | 934    | -    |      |
| HCM Lane V/C Ratio       | -      | 0.704    |      | 0.254  | -    |      |
| HCM Control Delay (s)    | -      | 20.2     |      | 10.2   | -    |      |
| HCM Lane LOS             | -      | C        |      | B      | -    |      |
| HCM 95th %tile Q(veh)    | -      | 5.9      |      | 1      | -    |      |

| Intersection             |        |      |                |      |        |      |        |      |      |      |      |      |
|--------------------------|--------|------|----------------|------|--------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 0.9    |      |                |      |        |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT  | EBR            | WBL  | WBT    | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Lane Configurations      |        |      | ↗              |      |        | ↗    |        | ↗↗   | ↗    |      | ↗↗   | ↗    |
| Traffic Vol, veh/h       | 0      | 0    | 101            | 0    | 0      | 73   | 0      | 734  | 113  | 0    | 1472 | 143  |
| Future Vol, veh/h        | 0      | 0    | 101            | 0    | 0      | 73   | 0      | 734  | 113  | 0    | 1472 | 143  |
| Conflicting Peds, #/hr   | 0      | 0    | 0              | 0    | 0      | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Stop   | Stop | Stop           | Stop | Stop   | Stop | Free   | Free | Free | Free | Free | Free |
| RT Channelized           | -      | -    | None           | -    | -      | Free | -      | -    | None | -    | -    | Free |
| Storage Length           | -      | -    | 0              | -    | -      | 0    | -      | -    | 25   | -    | -    | 0    |
| Veh in Median Storage, # | -      | 0    | -              | -    | 0      | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0    | -              | -    | 0      | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 93     | 93   | 93             | 93   | 93     | 93   | 93     | 93   | 93   | 93   | 93   | 93   |
| Heavy Vehicles, %        | 2      | 2    | 2              | 2    | 2      | 2    | 2      | 4    | 4    | 2    | 2    | 2    |
| Mvmt Flow                | 0      | 0    | 109            | 0    | 0      | 78   | 0      | 789  | 122  | 0    | 1583 | 154  |
| Major/Minor              | Minor2 |      | Minor1         |      | Major1 |      | Major2 |      |      |      |      |      |
| Conflicting Flow All     | -      | -    | 792            | -    | -      | -    | 0      | 0    | -    | -    | -    | 0    |
| Stage 1                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy            | -      | -    | 6.94           | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 1      | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 2      | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Follow-up Hdwy           | -      | -    | 3.32           | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Pot Cap-1 Maneuver       | 0      | 0    | 332            | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 1                  | 0      | 0    | -              | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 2                  | 0      | 0    | -              | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Platoon blocked, %       | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-1 Maneuver       | -      | -    | 332            | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-2 Maneuver       | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 1                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Approach                 | EB     |      | WB             |      | NB     |      | SB     |      |      |      |      |      |
| HCM Control Delay, s     | 21     |      | 0              |      | 0      |      | 0      |      |      |      |      |      |
| HCM LOS                  | C      |      | A              |      |        |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBT    |      | NBR EBLn1WBLn1 |      | SBT    |      |        |      |      |      |      |      |
| Capacity (veh/h)         | -      |      | 332            |      | -      |      |        |      |      |      |      |      |
| HCM Lane V/C Ratio       | -      |      | 0.327          |      | -      |      |        |      |      |      |      |      |
| HCM Control Delay (s)    | -      |      | 21             |      | 0      |      |        |      |      |      |      |      |
| HCM Lane LOS             | -      |      | C              |      | A      |      |        |      |      |      |      |      |
| HCM 95th %tile Q(veh)    | -      |      | 1.4            |      | -      |      |        |      |      |      |      |      |

| Intersection             |        |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
|--------------------------|--------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 0.9    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Movement                 | EBL    | EBR                                                                               | NBL                                                                               | NBT                                                                               | SBT                                                                               | SBR  |
| Lane Configurations      |        |  |  |  |  |      |
| Traffic Vol, veh/h       | 0      | 112                                                                               | 112                                                                               | 695                                                                               | 1503                                                                              | 0    |
| Future Vol, veh/h        | 0      | 112                                                                               | 112                                                                               | 695                                                                               | 1503                                                                              | 0    |
| Conflicting Peds, #/hr   | 0      | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0    |
| Sign Control             | Stop   | Stop                                                                              | Free                                                                              | Free                                                                              | Free                                                                              | Free |
| RT Channelized           | -      | Free                                                                              | -                                                                                 | None                                                                              | -                                                                                 | None |
| Storage Length           | -      | 0                                                                                 | 600                                                                               | -                                                                                 | -                                                                                 | -    |
| Veh in Median Storage, # | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Grade, %                 | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Peak Hour Factor         | 92     | 92                                                                                | 92                                                                                | 92                                                                                | 92                                                                                | 92   |
| Heavy Vehicles, %        | 2      | 2                                                                                 | 2                                                                                 | 4                                                                                 | 2                                                                                 | 2    |
| Mvmt Flow                | 0      | 122                                                                               | 122                                                                               | 755                                                                               | 1634                                                                              | 0    |
| Major/Minor              | Minor2 | Major1                                                                            |                                                                                   | Major2                                                                            |                                                                                   |      |
| Conflicting Flow All     | -      | -                                                                                 | 1634                                                                              | 0                                                                                 | -                                                                                 | 0    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy            | -      | -                                                                                 | 4.14                                                                              | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 1      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 2      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Follow-up Hdwy           | -      | -                                                                                 | 2.22                                                                              | -                                                                                 | -                                                                                 | -    |
| Pot Cap-1 Maneuver       | 0      | 0                                                                                 | 393                                                                               | -                                                                                 | -                                                                                 | 0    |
| Stage 1                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Stage 2                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Platoon blocked, %       |        |                                                                                   |                                                                                   | -                                                                                 | -                                                                                 |      |
| Mov Cap-1 Maneuver       | -      | -                                                                                 | 393                                                                               | -                                                                                 | -                                                                                 | -    |
| Mov Cap-2 Maneuver       | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Approach                 | EB     | NB                                                                                |                                                                                   | SB                                                                                |                                                                                   |      |
| HCM Control Delay, s     | 0      | 2.5                                                                               |                                                                                   | 0                                                                                 |                                                                                   |      |
| HCM LOS                  | A      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Minor Lane/Major Mvmt    | NBL    | NBT                                                                               | EBLn1                                                                             | SBT                                                                               |                                                                                   |      |
| Capacity (veh/h)         | 393    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.31   | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Control Delay (s)    | 18.2   | -                                                                                 | 0                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane LOS             | C      | -                                                                                 | A                                                                                 | -                                                                                 |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 1.3    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                      |               |                 |
|---------------------|--------------------------------------|---------------|-----------------|
| Analyst             | Whipple Consulting Engineers         | Date          | 03/05/2021      |
| Agency              | WSDOT                                | Analysis Year | 2026 PM w BK GR |
| Jurisdiction        | WSDOT                                | Time Analyzed | PM              |
| Project Description | 20-2564 Latah Glen - Thorpe N<br>MUT | Units         | U.S. Customary  |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 900                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 1503  | 112   |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 2.00  | 2.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.980 | 0.980 |
| Flow Rate (vi),pc/h                   | 1667  | 124   |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.40  | 0.06  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.272 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (vOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.2  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 1667  | Ramp Junction Speed (S), mi/h                 | 43.2  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 1791  | Average Density (D), pc/mi/ln                 | 20.7  |
| Level of Service (LOS)                       | B     | Density in Ramp Influence Area (DR), pc/mi/ln | 13.8  |

| Intersection             |          |        |        |      |      |      |
|--------------------------|----------|--------|--------|------|------|------|
| Int Delay, s/veh         | 0.4      |        |        |      |      |      |
| Movement                 | WBL      | WBR    | NBT    | NBR  | SBL  | SBT  |
| Lane Configurations      |          | ↗      | ↗↗     |      | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0        | 86     | 761    | 0    | 86   | 1487 |
| Future Vol, veh/h        | 0        | 86     | 761    | 0    | 86   | 1487 |
| Conflicting Peds, #/hr   | 0        | 0      | 0      | 0    | 0    | 0    |
| Sign Control             | Stop     | Stop   | Free   | Free | Free | Free |
| RT Channelized           | -        | Free   | -      | None | -    | None |
| Storage Length           | -        | 0      | -      | -    | 600  | -    |
| Veh in Median Storage, # | 0        | -      | 0      | -    | -    | 0    |
| Grade, %                 | 0        | -      | 0      | -    | -    | 0    |
| Peak Hour Factor         | 92       | 92     | 92     | 92   | 92   | 92   |
| Heavy Vehicles, %        | 0        | 2      | 4      | 0    | 2    | 2    |
| Mvmt Flow                | 0        | 93     | 827    | 0    | 93   | 1616 |
| Major/Minor              | Minor1   | Major1 | Major2 |      |      |      |
| Conflicting Flow All     | -        | -      | 0      | -    | 827  | 0    |
| Stage 1                  | -        | -      | -      | -    | -    | -    |
| Stage 2                  | -        | -      | -      | -    | -    | -    |
| Critical Hdwy            | -        | -      | -      | -    | 4.14 | -    |
| Critical Hdwy Stg 1      | -        | -      | -      | -    | -    | -    |
| Critical Hdwy Stg 2      | -        | -      | -      | -    | -    | -    |
| Follow-up Hdwy           | -        | -      | -      | -    | 2.22 | -    |
| Pot Cap-1 Maneuver       | 0        | 0      | -      | 0    | 800  | -    |
| Stage 1                  | 0        | 0      | -      | 0    | -    | -    |
| Stage 2                  | 0        | 0      | -      | 0    | -    | -    |
| Platoon blocked, %       | -        | -      | -      | -    | -    | -    |
| Mov Cap-1 Maneuver       | -        | -      | -      | -    | 800  | -    |
| Mov Cap-2 Maneuver       | -        | -      | -      | -    | -    | -    |
| Stage 1                  | -        | -      | -      | -    | -    | -    |
| Stage 2                  | -        | -      | -      | -    | -    | -    |
| Approach                 | WB       | NB     |        | SB   |      |      |
| HCM Control Delay, s     | 0        | 0      |        | 0.6  |      |      |
| HCM LOS                  | A        |        |        |      |      |      |
| Minor Lane/Major Mvmt    | NBTWBLn1 |        | SBL    | SBT  |      |      |
| Capacity (veh/h)         | -        |        | 800    | -    |      |      |
| HCM Lane V/C Ratio       | -        |        | 0.117  | -    |      |      |
| HCM Control Delay (s)    | -        |        | 10.1   | -    |      |      |
| HCM Lane LOS             | -        |        | A      | B    |      |      |
| HCM 95th %tile Q(veh)    | -        |        | 0.4    | -    |      |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                    |               |                 |
|---------------------|------------------------------------|---------------|-----------------|
| Analyst             | Whipple Consulting Engineers       | Date          | 03/05/2021      |
| Agency              | WSDOT                              | Analysis Year | 2026 PM w BK GR |
| Jurisdiction        | WSDOT                              | Time Analyzed | PM              |
| Project Description | 20-2564 Latah Glen - Thorpe S. MUT | Units         | U.S. Customary  |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 500                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 761   | 86    |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 4.00  | 2.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.962 | 0.980 |
| Flow Rate (vi),pc/h                   | 860   | 95    |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.21  | 0.05  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.291 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (vOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.1  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 860   | Ramp Junction Speed (S), mi/h                 | 43.1  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 955   | Average Density (D), pc/mi/ln                 | 11.1  |
| Level of Service (LOS)                       | A     | Density in Ramp Influence Area (DR), pc/mi/ln | 9.8   |



| Intersection             |        |          |        |      |      |      |
|--------------------------|--------|----------|--------|------|------|------|
| Int Delay, s/veh         | 0.3    |          |        |      |      |      |
| Movement                 | WBL    | WBR      | NBT    | NBR  | SBL  | SBT  |
| Lane Configurations      |        | ↗        | ↗↗     | ↗    | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0      | 29       | 758    | 4    | 21   | 1211 |
| Future Vol, veh/h        | 0      | 29       | 758    | 4    | 21   | 1211 |
| Conflicting Peds, #/hr   | 0      | 0        | 0      | 0    | 0    | 0    |
| Sign Control             | Stop   | Stop     | Free   | Free | Free | Free |
| RT Channelized           | -      | Stop     | -      | None | -    | None |
| Storage Length           | -      | 0        | -      | 25   | 200  | -    |
| Veh in Median Storage, # | 1      | -        | 0      | -    | -    | 0    |
| Grade, %                 | 0      | -        | 0      | -    | -    | 0    |
| Peak Hour Factor         | 92     | 92       | 92     | 92   | 92   | 92   |
| Heavy Vehicles, %        | 17     | 17       | 2      | 2    | 9    | 9    |
| Mvmt Flow                | 0      | 32       | 824    | 4    | 23   | 1316 |
| Major/Minor              | Minor1 | Major1   | Major2 |      |      |      |
| Conflicting Flow All     | -      | 412      | 0      | 0    | 828  | 0    |
| Stage 1                  | -      | -        | -      | -    | -    | -    |
| Stage 2                  | -      | -        | -      | -    | -    | -    |
| Critical Hdwy            | -      | 7.24     | -      | -    | 4.28 | -    |
| Critical Hdwy Stg 1      | -      | -        | -      | -    | -    | -    |
| Critical Hdwy Stg 2      | -      | -        | -      | -    | -    | -    |
| Follow-up Hdwy           | -      | 3.47     | -      | -    | 2.29 | -    |
| Pot Cap-1 Maneuver       | 0      | 549      | -      | -    | 756  | -    |
| Stage 1                  | 0      | -        | -      | -    | -    | -    |
| Stage 2                  | 0      | -        | -      | -    | -    | -    |
| Platoon blocked, %       | -      | -        | -      | -    | -    | -    |
| Mov Cap-1 Maneuver       | -      | 549      | -      | -    | 756  | -    |
| Mov Cap-2 Maneuver       | -      | -        | -      | -    | -    | -    |
| Stage 1                  | -      | -        | -      | -    | -    | -    |
| Stage 2                  | -      | -        | -      | -    | -    | -    |
| Approach                 | WB     | NB       | SB     |      |      |      |
| HCM Control Delay, s     | 12     | 0        | 0.2    |      |      |      |
| HCM LOS                  | B      |          |        |      |      |      |
| Minor Lane/Major Mvmt    | NBT    | NBRWBLn1 | SBL    | SBT  |      |      |
| Capacity (veh/h)         | -      | -        | 549    | 756  | -    |      |
| HCM Lane V/C Ratio       | -      | -        | 0.057  | 0.03 | -    |      |
| HCM Control Delay (s)    | -      | -        | 12     | 9.9  | -    |      |
| HCM Lane LOS             | -      | -        | B      | A    | -    |      |
| HCM 95th %tile Q(veh)    | -      | -        | 0.2    | 0.1  | -    |      |

| Intersection             |        |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
|--------------------------|--------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 0.8    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Movement                 | EBL    | EBR                                                                               | NBL                                                                               | NBT                                                                               | SBT                                                                               | SBR  |
| Lane Configurations      |        |  |  |  |  |      |
| Traffic Vol, veh/h       | 0      | 110                                                                               | 110                                                                               | 584                                                                               | 1035                                                                              | 0    |
| Future Vol, veh/h        | 0      | 110                                                                               | 110                                                                               | 584                                                                               | 1035                                                                              | 0    |
| Conflicting Peds, #/hr   | 0      | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0    |
| Sign Control             | Stop   | Stop                                                                              | Free                                                                              | Free                                                                              | Free                                                                              | Free |
| RT Channelized           | -      | Free                                                                              | -                                                                                 | None                                                                              | -                                                                                 | None |
| Storage Length           | -      | 0                                                                                 | 250                                                                               | -                                                                                 | -                                                                                 | -    |
| Veh in Median Storage, # | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Grade, %                 | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Peak Hour Factor         | 92     | 92                                                                                | 92                                                                                | 92                                                                                | 92                                                                                | 92   |
| Heavy Vehicles, %        | 2      | 2                                                                                 | 5                                                                                 | 5                                                                                 | 2                                                                                 | 2    |
| Mvmt Flow                | 0      | 120                                                                               | 120                                                                               | 635                                                                               | 1125                                                                              | 0    |
| Major/Minor              | Minor2 | Major1                                                                            |                                                                                   | Major2                                                                            |                                                                                   |      |
| Conflicting Flow All     | -      | -                                                                                 | 1125                                                                              | 0                                                                                 | -                                                                                 | 0    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy            | -      | -                                                                                 | 4.2                                                                               | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 1      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 2      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Follow-up Hdwy           | -      | -                                                                                 | 2.25                                                                              | -                                                                                 | -                                                                                 | -    |
| Pot Cap-1 Maneuver       | 0      | 0                                                                                 | 600                                                                               | -                                                                                 | -                                                                                 | 0    |
| Stage 1                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Stage 2                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Platoon blocked, %       |        |                                                                                   |                                                                                   | -                                                                                 | -                                                                                 |      |
| Mov Cap-1 Maneuver       | -      | -                                                                                 | 600                                                                               | -                                                                                 | -                                                                                 | -    |
| Mov Cap-2 Maneuver       | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Approach                 | EB     | NB                                                                                |                                                                                   | SB                                                                                |                                                                                   |      |
| HCM Control Delay, s     | 0      | 2                                                                                 |                                                                                   | 0                                                                                 |                                                                                   |      |
| HCM LOS                  | A      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Minor Lane/Major Mvmt    | NBL    | NBT                                                                               | EBLn1                                                                             | SBT                                                                               |                                                                                   |      |
| Capacity (veh/h)         | 600    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.199  | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Control Delay (s)    | 12.5   | -                                                                                 | 0                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane LOS             | B      | -                                                                                 | A                                                                                 | -                                                                                 |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 0.7    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                       |               |                 |
|---------------------|---------------------------------------|---------------|-----------------|
| Analyst             | Whipple Consulting Engineers          | Date          | 03/05/2021      |
| Agency              | WSDOT                                 | Analysis Year | 2026 PM w BK GR |
| Jurisdiction        | WSDOT                                 | Time Analyzed | PM              |
| Project Description | 20-2564 Latah Glen - Meadowlane N MUT | Units         | U.S. Customary  |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 500                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 1035  | 110   |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 2.00  | 5.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fhv) | 0.980 | 0.952 |
| Flow Rate (vi),pc/h                   | 1148  | 126   |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.28  | 0.06  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.295 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.1  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 1148  | Ramp Junction Speed (S), mi/h                 | 43.1  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 1274  | Average Density (D), pc/mi/ln                 | 14.8  |
| Level of Service (LOS)                       | B     | Density in Ramp Influence Area (DR), pc/mi/ln | 12.3  |

| Intersection             |                                                                                   |                                                                                   |        |       |                                                                                   |      |
|--------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------|-------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 1.8                                                                               |                                                                                   |        |       |                                                                                   |      |
| Movement                 | EBL                                                                               | EBR                                                                               | NBL    | NBT   | SBT                                                                               | SBR  |
| Lane Configurations      |  |  |        |       |  |      |
| Traffic Vol, veh/h       | 56                                                                                | 57                                                                                | 0      | 0     | 946                                                                               | 0    |
| Future Vol, veh/h        | 56                                                                                | 57                                                                                | 0      | 0     | 946                                                                               | 0    |
| Conflicting Peds, #/hr   | 0                                                                                 | 0                                                                                 | 0      | 0     | 0                                                                                 | 0    |
| Sign Control             | Stop                                                                              | Stop                                                                              | Free   | Free  | Free                                                                              | Free |
| RT Channelized           | -                                                                                 | None                                                                              | -      | None  | -                                                                                 | None |
| Storage Length           | 0                                                                                 | 0                                                                                 | -      | -     | -                                                                                 | -    |
| Veh in Median Storage, # | 2                                                                                 | -                                                                                 | -      | 16979 | 0                                                                                 | -    |
| Grade, %                 | 0                                                                                 | -                                                                                 | -      | 0     | 0                                                                                 | -    |
| Peak Hour Factor         | 92                                                                                | 92                                                                                | 92     | 92    | 92                                                                                | 92   |
| Heavy Vehicles, %        | 3                                                                                 | 3                                                                                 | 2      | 2     | 9                                                                                 | 9    |
| Mvmt Flow                | 61                                                                                | 62                                                                                | 0      | 0     | 1028                                                                              | 0    |
|                          |                                                                                   |                                                                                   |        |       |                                                                                   |      |
| Major/Minor              | Minor2                                                                            |                                                                                   | Major2 |       |                                                                                   |      |
| Conflicting Flow All     | 1028                                                                              | 514                                                                               |        |       | -                                                                                 | 0    |
| Stage 1                  | 1028                                                                              | -                                                                                 |        |       | -                                                                                 | -    |
| Stage 2                  | 0                                                                                 | -                                                                                 |        |       | -                                                                                 | -    |
| Critical Hdwy            | 6.86                                                                              | 6.96                                                                              |        |       | -                                                                                 | -    |
| Critical Hdwy Stg 1      | 5.86                                                                              | -                                                                                 |        |       | -                                                                                 | -    |
| Critical Hdwy Stg 2      | -                                                                                 | -                                                                                 |        |       | -                                                                                 | -    |
| Follow-up Hdwy           | 3.53                                                                              | 3.33                                                                              |        |       | -                                                                                 | -    |
| Pot Cap-1 Maneuver       | 228                                                                               | 503                                                                               |        |       | -                                                                                 | 0    |
| Stage 1                  | 304                                                                               | -                                                                                 |        |       | -                                                                                 | 0    |
| Stage 2                  | -                                                                                 | -                                                                                 |        |       | -                                                                                 | 0    |
| Platoon blocked, %       |                                                                                   |                                                                                   |        |       | -                                                                                 |      |
| Mov Cap-1 Maneuver       | 228                                                                               | 503                                                                               |        |       | -                                                                                 | -    |
| Mov Cap-2 Maneuver       | 278                                                                               | -                                                                                 |        |       | -                                                                                 | -    |
| Stage 1                  | 304                                                                               | -                                                                                 |        |       | -                                                                                 | -    |
| Stage 2                  | -                                                                                 | -                                                                                 |        |       | -                                                                                 | -    |
|                          |                                                                                   |                                                                                   |        |       |                                                                                   |      |
| Approach                 | EB                                                                                |                                                                                   | SB     |       |                                                                                   |      |
| HCM Control Delay, s     | 17.3                                                                              |                                                                                   | 0      |       |                                                                                   |      |
| HCM LOS                  | C                                                                                 |                                                                                   |        |       |                                                                                   |      |
|                          |                                                                                   |                                                                                   |        |       |                                                                                   |      |
| Minor Lane/Major Mvmt    | EBLn1                                                                             | EBLn2                                                                             | SBT    |       |                                                                                   |      |
| Capacity (veh/h)         | 278                                                                               | 503                                                                               | -      |       |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.219                                                                             | 0.123                                                                             | -      |       |                                                                                   |      |
| HCM Control Delay (s)    | 21.5                                                                              | 13.2                                                                              | -      |       |                                                                                   |      |
| HCM Lane LOS             | C                                                                                 | B                                                                                 | -      |       |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 0.8                                                                               | 0.4                                                                               | -      |       |                                                                                   |      |

| Intersection             |        |          |        |       |      |      |
|--------------------------|--------|----------|--------|-------|------|------|
| Int Delay, s/veh         | 5.3    |          |        |       |      |      |
| Movement                 | WBL    | WBR      | NBT    | NBR   | SBL  | SBT  |
| Lane Configurations      |        | ↗        | ↗↗     | ↗     | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0      | 390      | 241    | 57    | 425  | 529  |
| Future Vol, veh/h        | 0      | 390      | 241    | 57    | 425  | 529  |
| Conflicting Peds, #/hr   | 0      | 0        | 0      | 0     | 0    | 0    |
| Sign Control             | Stop   | Stop     | Free   | Free  | Free | Free |
| RT Channelized           | -      | None     | -      | None  | -    | None |
| Storage Length           | -      | -        | -      | 25    | 350  | -    |
| Veh in Median Storage, # | 1      | -        | 0      | -     | -    | 0    |
| Grade, %                 | 0      | -        | 0      | -     | -    | 0    |
| Peak Hour Factor         | 97     | 97       | 97     | 97    | 97   | 97   |
| Heavy Vehicles, %        | 2      | 2        | 5      | 5     | 2    | 2    |
| Mvmt Flow                | 0      | 402      | 248    | 59    | 438  | 545  |
| Major/Minor              | Minor1 | Major1   | Major2 |       |      |      |
| Conflicting Flow All     | -      | 124      | 0      | 0     | 307  | 0    |
| Stage 1                  | -      | -        | -      | -     | -    | -    |
| Stage 2                  | -      | -        | -      | -     | -    | -    |
| Critical Hdwy            | -      | 6.94     | -      | -     | 4.14 | -    |
| Critical Hdwy Stg 1      | -      | -        | -      | -     | -    | -    |
| Critical Hdwy Stg 2      | -      | -        | -      | -     | -    | -    |
| Follow-up Hdwy           | -      | 3.32     | -      | -     | 2.22 | -    |
| Pot Cap-1 Maneuver       | 0      | 904      | -      | -     | 1250 | -    |
| Stage 1                  | 0      | -        | -      | -     | -    | -    |
| Stage 2                  | 0      | -        | -      | -     | -    | -    |
| Platoon blocked, %       | -      | -        | -      | -     | -    | -    |
| Mov Cap-1 Maneuver       | -      | 904      | -      | -     | 1250 | -    |
| Mov Cap-2 Maneuver       | -      | -        | -      | -     | -    | -    |
| Stage 1                  | -      | -        | -      | -     | -    | -    |
| Stage 2                  | -      | -        | -      | -     | -    | -    |
| Approach                 | WB     | NB       | SB     |       |      |      |
| HCM Control Delay, s     | 12.1   | 0        | 4.2    |       |      |      |
| HCM LOS                  | B      |          |        |       |      |      |
| Minor Lane/Major Mvmt    | NBT    | NBRWBLn1 | SBL    | SBT   |      |      |
| Capacity (veh/h)         | -      | -        | 904    | 1250  | -    |      |
| HCM Lane V/C Ratio       | -      | -        | 0.445  | 0.351 | -    |      |
| HCM Control Delay (s)    | -      | -        | 12.1   | 9.4   | -    |      |
| HCM Lane LOS             | -      | -        | B      | A     | -    |      |
| HCM 95th %tile Q(veh)    | -      | -        | 2.3    | 1.6   | -    |      |

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**YEAR 2026**

**LEVEL OF SERVICE CALCULATIONS**

**AM & PM WITH BACKGROUND PROJECTS**

**(J-TURN AT THORPE & SR 195 AND MEADOWLANE IMP)**

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| Intersection             |        |      |        |      |            |      |        |      |      |      |      |      |
|--------------------------|--------|------|--------|------|------------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 0.9    |      |        |      |            |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT  | EBR    | WBL  | WBT        | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Lane Configurations      |        |      | ↗      |      |            | ↗    |        | ↗↗   | ↗    |      | ↗↗   | ↗    |
| Traffic Vol, veh/h       | 0      | 0    | 175    | 0    | 0          | 45   | 0      | 1753 | 163  | 0    | 614  | 71   |
| Future Vol, veh/h        | 0      | 0    | 175    | 0    | 0          | 45   | 0      | 1753 | 163  | 0    | 614  | 71   |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0          | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Stop   | Stop | Stop   | Stop | Stop       | Stop | Free   | Free | Free | Free | Free | Free |
| RT Channelized           | -      | -    | None   | -    | -          | Free | -      | -    | None | -    | -    | Free |
| Storage Length           | -      | -    | 0      | -    | -          | 0    | -      | -    | 25   | -    | -    | 0    |
| Veh in Median Storage, # | -      | 0    | -      | -    | 0          | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0    | -      | -    | 0          | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 85     | 85   | 85     | 85   | 85         | 85   | 85     | 85   | 85   | 85   | 85   | 85   |
| Heavy Vehicles, %        | 0      | 0    | 3      | 0    | 0          | 5    | 0      | 2    | 2    | 0    | 12   | 12   |
| Mvmt Flow                | 0      | 0    | 206    | 0    | 0          | 53   | 0      | 2062 | 192  | 0    | 722  | 84   |
| Major/Minor              | Minor2 |      | Minor1 |      | Major1     |      | Major2 |      |      |      |      |      |
| Conflicting Flow All     | -      | -    | 361    | -    | -          | -    | 0      | 0    | -    | -    | -    | 0    |
| Stage 1                  | -      | -    | -      | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -      | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy            | -      | -    | 6.96   | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| Follow-up Hdwy           | -      | -    | 3.33   | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| Pot Cap-1 Maneuver       | 0      | 0    | 633    | 0    | 0          | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 1                  | 0      | 0    | -      | 0    | 0          | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 2                  | 0      | 0    | -      | 0    | 0          | 0    | 0      | -    | -    | 0    | -    | 0    |
| Platoon blocked, %       | -      | -    | -      | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-1 Maneuver       | -      | -    | 633    | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| Stage 1                  | -      | -    | -      | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -      | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| Approach                 | EB     |      | WB     |      | NB         |      | SB     |      |      |      |      |      |
| HCM Control Delay, s     | 13.4   |      | 0      |      | 0          |      | 0      |      |      |      |      |      |
| HCM LOS                  | B      |      | A      |      |            |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBT    |      | NBR    |      | EBLn1WBLn1 |      | SBT    |      |      |      |      |      |
| Capacity (veh/h)         | -      | -    | 633    | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| HCM Lane V/C Ratio       | -      | -    | 0.325  | -    | -          | -    | -      | -    | -    | -    | -    | -    |
| HCM Control Delay (s)    | -      | -    | 13.4   | 0    | -          | -    | -      | -    | -    | -    | -    | -    |
| HCM Lane LOS             | -      | -    | B      | A    | -          | -    | -      | -    | -    | -    | -    | -    |
| HCM 95th %tile Q(veh)    | -      | -    | 1.4    | -    | -          | -    | -      | -    | -    | -    | -    | -    |

| Intersection             |        |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
|--------------------------|--------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 0.3    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Movement                 | EBL    | EBR                                                                               | NBL                                                                               | NBT                                                                               | SBT                                                                               | SBR  |
| Lane Configurations      |        |  |  |  |  |      |
| Traffic Vol, veh/h       | 0      | 69                                                                                | 69                                                                                | 1730                                                                              | 616                                                                               | 0    |
| Future Vol, veh/h        | 0      | 69                                                                                | 69                                                                                | 1730                                                                              | 616                                                                               | 0    |
| Conflicting Peds, #/hr   | 0      | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0    |
| Sign Control             | Stop   | Stop                                                                              | Free                                                                              | Free                                                                              | Free                                                                              | Free |
| RT Channelized           | -      | Free                                                                              | -                                                                                 | None                                                                              | -                                                                                 | None |
| Storage Length           | -      | 0                                                                                 | 600                                                                               | -                                                                                 | -                                                                                 | -    |
| Veh in Median Storage, # | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Grade, %                 | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Peak Hour Factor         | 92     | 92                                                                                | 92                                                                                | 92                                                                                | 92                                                                                | 92   |
| Heavy Vehicles, %        | 0      | 5                                                                                 | 5                                                                                 | 2                                                                                 | 12                                                                                | 0    |
| Mvmt Flow                | 0      | 75                                                                                | 75                                                                                | 1880                                                                              | 670                                                                               | 0    |
| Major/Minor              | Minor2 | Major1                                                                            |                                                                                   | Major2                                                                            |                                                                                   |      |
| Conflicting Flow All     | -      | -                                                                                 | 670                                                                               | 0                                                                                 | -                                                                                 | 0    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy            | -      | -                                                                                 | 4.2                                                                               | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 1      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 2      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Follow-up Hdwy           | -      | -                                                                                 | 2.25                                                                              | -                                                                                 | -                                                                                 | -    |
| Pot Cap-1 Maneuver       | 0      | 0                                                                                 | 896                                                                               | -                                                                                 | -                                                                                 | 0    |
| Stage 1                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Stage 2                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Platoon blocked, %       |        |                                                                                   |                                                                                   | -                                                                                 | -                                                                                 |      |
| Mov Cap-1 Maneuver       | -      | -                                                                                 | 896                                                                               | -                                                                                 | -                                                                                 | -    |
| Mov Cap-2 Maneuver       | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Approach                 | EB     | NB                                                                                |                                                                                   | SB                                                                                |                                                                                   |      |
| HCM Control Delay, s     | 0      | 0.4                                                                               |                                                                                   | 0                                                                                 |                                                                                   |      |
| HCM LOS                  | A      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Minor Lane/Major Mvmt    | NBL    | NBT                                                                               | EBLn1                                                                             | SBT                                                                               |                                                                                   |      |
| Capacity (veh/h)         | 896    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.084  | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Control Delay (s)    | 9.4    | -                                                                                 | 0                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane LOS             | A      | -                                                                                 | A                                                                                 | -                                                                                 |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 0.3    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |



# HCS7 Freeway Merge Report

## Project Information

|                     |                                   |               |                    |
|---------------------|-----------------------------------|---------------|--------------------|
| Analyst             | Whipple Consulting Engineers      | Date          | 03/05/2021         |
| Agency              | WSDOT                             | Analysis Year | 2026 AM w BK Proj. |
| Jurisdiction        | WSDOT                             | Time Analyzed | AM                 |
| Project Description | 20-2564 Latah Glen - Thorpe N MUT | Units         | U.S. Customary     |

## Geometric Data

|                                                  | Freeway | Ramp                 |
|--------------------------------------------------|---------|----------------------|
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 900                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 616   | 69    |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 12.00 | 5.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.893 | 0.952 |
| Flow Rate (vi),pc/h                   | 750   | 79    |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.18  | 0.04  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.258 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.2  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 750   | Ramp Junction Speed (S), mi/h                 | 43.2  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 829   | Average Density (D), pc/mi/ln                 | 9.6   |
| Level of Service (LOS)                       | A     | Density in Ramp Influence Area (DR), pc/mi/ln | 6.3   |

| Intersection             |          |        |       |        |      |      |
|--------------------------|----------|--------|-------|--------|------|------|
| Int Delay, s/veh         | 1.4      |        |       |        |      |      |
| Movement                 | WBL      | WBR    | NBT   | NBR    | SBL  | SBT  |
| Lane Configurations      |          | ↗      | ↗↗    |        | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0        | 130    | 1786  | 0      | 130  | 659  |
| Future Vol, veh/h        | 0        | 130    | 1786  | 0      | 130  | 659  |
| Conflicting Peds, #/hr   | 0        | 0      | 0     | 0      | 0    | 0    |
| Sign Control             | Stop     | Stop   | Free  | Free   | Free | Free |
| RT Channelized           | -        | Free   | -     | None   | -    | None |
| Storage Length           | -        | 0      | -     | -      | 600  | -    |
| Veh in Median Storage, # | 0        | -      | 0     | -      | -    | 0    |
| Grade, %                 | 0        | -      | 0     | -      | -    | 0    |
| Peak Hour Factor         | 92       | 92     | 92    | 92     | 92   | 92   |
| Heavy Vehicles, %        | 0        | 3      | 2     | 0      | 3    | 12   |
| Mvmt Flow                | 0        | 141    | 1941  | 0      | 141  | 716  |
| Major/Minor              | Minor1   | Major1 |       | Major2 |      |      |
| Conflicting Flow All     | -        | -      | 0     | -      | 1941 | 0    |
| Stage 1                  | -        | -      | -     | -      | -    | -    |
| Stage 2                  | -        | -      | -     | -      | -    | -    |
| Critical Hdwy            | -        | -      | -     | -      | 4.16 | -    |
| Critical Hdwy Stg 1      | -        | -      | -     | -      | -    | -    |
| Critical Hdwy Stg 2      | -        | -      | -     | -      | -    | -    |
| Follow-up Hdwy           | -        | -      | -     | -      | 2.23 | -    |
| Pot Cap-1 Maneuver       | 0        | 0      | -     | 0      | 295  | -    |
| Stage 1                  | 0        | 0      | -     | 0      | -    | -    |
| Stage 2                  | 0        | 0      | -     | 0      | -    | -    |
| Platoon blocked, %       |          |        | -     |        |      | -    |
| Mov Cap-1 Maneuver       | -        | -      | -     | -      | 295  | -    |
| Mov Cap-2 Maneuver       | -        | -      | -     | -      | -    | -    |
| Stage 1                  | -        | -      | -     | -      | -    | -    |
| Stage 2                  | -        | -      | -     | -      | -    | -    |
| Approach                 | WB       | NB     |       | SB     |      |      |
| HCM Control Delay, s     | 0        | 0      |       | 4.6    |      |      |
| HCM LOS                  | A        |        |       |        |      |      |
| Minor Lane/Major Mvmt    | NBTWBLn1 |        | SBL   | SBT    |      |      |
| Capacity (veh/h)         | -        |        | 295   | -      |      |      |
| HCM Lane V/C Ratio       | -        |        | 0.479 | -      |      |      |
| HCM Control Delay (s)    | -        |        | 0     | 27.9   |      |      |
| HCM Lane LOS             | -        |        | A     | D      |      |      |
| HCM 95th %tile Q(veh)    | -        |        | 2.4   | -      |      |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                    |               |                    |
|---------------------|------------------------------------|---------------|--------------------|
| Analyst             | Whipple Consulting Engineers       | Date          | 03/05/2021         |
| Agency              | WSDOT                              | Analysis Year | 2026 AM w BK Proj. |
| Jurisdiction        | WSDOT                              | Time Analyzed | AM                 |
| Project Description | 20-2564 Latah Glen - Thorpe S. MUT | Units         | U.S. Customary     |

## Geometric Data

|                                                  | Freeway | Ramp                 |
|--------------------------------------------------|---------|----------------------|
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 500                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 1786  | 130   |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 2.00  | 3.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.980 | 0.971 |
| Flow Rate (vi),pc/h                   | 1981  | 146   |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.47  | 0.07  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.314 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.1  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 1981  | Ramp Junction Speed (S), mi/h                 | 43.1  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 2127  | Average Density (D), pc/mi/ln                 | 24.7  |
| Level of Service (LOS)                       | B     | Density in Ramp Influence Area (DR), pc/mi/ln | 18.9  |

| Intersection             |        |          |      |        |      |      |
|--------------------------|--------|----------|------|--------|------|------|
| Int Delay, s/veh         | 0.2    |          |      |        |      |      |
| Movement                 | WBL    | WBR      | NBT  | NBR    | SBL  | SBT  |
| Lane Configurations      |        | ↗        | ↗↗   | ↗      | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0      | 19       | 1258 | 4      | 12   | 640  |
| Future Vol, veh/h        | 0      | 19       | 1258 | 4      | 12   | 640  |
| Conflicting Peds, #/hr   | 0      | 0        | 0    | 0      | 0    | 0    |
| Sign Control             | Stop   | Stop     | Free | Free   | Free | Free |
| RT Channelized           | -      | Stop     | -    | None   | -    | None |
| Storage Length           | -      | 0        | -    | 25     | 200  | -    |
| Veh in Median Storage, # | 1      | -        | 0    | -      | -    | 0    |
| Grade, %                 | 0      | -        | 0    | -      | -    | 0    |
| Peak Hour Factor         | 92     | 92       | 92   | 92     | 92   | 92   |
| Heavy Vehicles, %        | 17     | 17       | 2    | 2      | 9    | 9    |
| Mvmt Flow                | 0      | 21       | 1367 | 4      | 13   | 696  |
| Major/Minor              | Minor1 | Major1   |      | Major2 |      |      |
| Conflicting Flow All     | -      | 684      | 0    | 0      | 1371 | 0    |
| Stage 1                  | -      | -        | -    | -      | -    | -    |
| Stage 2                  | -      | -        | -    | -      | -    | -    |
| Critical Hdwy            | -      | 7.24     | -    | -      | 4.28 | -    |
| Critical Hdwy Stg 1      | -      | -        | -    | -      | -    | -    |
| Critical Hdwy Stg 2      | -      | -        | -    | -      | -    | -    |
| Follow-up Hdwy           | -      | 3.47     | -    | -      | 2.29 | -    |
| Pot Cap-1 Maneuver       | 0      | 358      | -    | -      | 462  | -    |
| Stage 1                  | 0      | -        | -    | -      | -    | -    |
| Stage 2                  | 0      | -        | -    | -      | -    | -    |
| Platoon blocked, %       | -      | -        | -    | -      | -    | -    |
| Mov Cap-1 Maneuver       | -      | 358      | -    | -      | 462  | -    |
| Mov Cap-2 Maneuver       | -      | -        | -    | -      | -    | -    |
| Stage 1                  | -      | -        | -    | -      | -    | -    |
| Stage 2                  | -      | -        | -    | -      | -    | -    |
| Approach                 | WB     | NB       |      | SB     |      |      |
| HCM Control Delay, s     | 15.7   | 0        |      | 0.2    |      |      |
| HCM LOS                  | C      |          |      |        |      |      |
| Minor Lane/Major Mvmt    | NBT    | NBRWBLn1 |      | SBL    | SBT  |      |
| Capacity (veh/h)         | -      | - 358    |      | 462    | -    |      |
| HCM Lane V/C Ratio       | -      | - 0.058  |      | 0.028  | -    |      |
| HCM Control Delay (s)    | -      | - 15.7   |      | 13     | -    |      |
| HCM Lane LOS             | -      | - C      |      | B      | -    |      |
| HCM 95th %tile Q(veh)    | -      | - 0.2    |      | 0.1    | -    |      |

| Intersection             |        |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
|--------------------------|--------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 0.6    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Movement                 | EBL    | EBR                                                                               | NBL                                                                               | NBT                                                                               | SBT                                                                               | SBR  |
| Lane Configurations      |        |  |  |  |  |      |
| Traffic Vol, veh/h       | 0      | 105                                                                               | 105                                                                               | 1173                                                                              | 549                                                                               | 0    |
| Future Vol, veh/h        | 0      | 105                                                                               | 105                                                                               | 1173                                                                              | 549                                                                               | 0    |
| Conflicting Peds, #/hr   | 0      | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0    |
| Sign Control             | Stop   | Stop                                                                              | Free                                                                              | Free                                                                              | Free                                                                              | Free |
| RT Channelized           | -      | Free                                                                              | -                                                                                 | None                                                                              | -                                                                                 | None |
| Storage Length           | -      | 0                                                                                 | 250                                                                               | -                                                                                 | -                                                                                 | -    |
| Veh in Median Storage, # | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Grade, %                 | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Peak Hour Factor         | 92     | 92                                                                                | 92                                                                                | 92                                                                                | 92                                                                                | 92   |
| Heavy Vehicles, %        | 2      | 2                                                                                 | 2                                                                                 | 2                                                                                 | 9                                                                                 | 9    |
| Mvmt Flow                | 0      | 114                                                                               | 114                                                                               | 1275                                                                              | 597                                                                               | 0    |
| Major/Minor              | Minor2 | Major1                                                                            |                                                                                   | Major2                                                                            |                                                                                   |      |
| Conflicting Flow All     | -      | -                                                                                 | 597                                                                               | 0                                                                                 | -                                                                                 | 0    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy            | -      | -                                                                                 | 4.14                                                                              | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 1      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 2      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Follow-up Hdwy           | -      | -                                                                                 | 2.22                                                                              | -                                                                                 | -                                                                                 | -    |
| Pot Cap-1 Maneuver       | 0      | 0                                                                                 | 976                                                                               | -                                                                                 | -                                                                                 | 0    |
| Stage 1                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Stage 2                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Platoon blocked, %       |        |                                                                                   |                                                                                   | -                                                                                 | -                                                                                 |      |
| Mov Cap-1 Maneuver       | -      | -                                                                                 | 976                                                                               | -                                                                                 | -                                                                                 | -    |
| Mov Cap-2 Maneuver       | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Approach                 | EB     | NB                                                                                |                                                                                   | SB                                                                                |                                                                                   |      |
| HCM Control Delay, s     | 0      | 0.8                                                                               |                                                                                   | 0                                                                                 |                                                                                   |      |
| HCM LOS                  | A      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Minor Lane/Major Mvmt    | NBL    | NBT                                                                               | EBLn1                                                                             | SBT                                                                               |                                                                                   |      |
| Capacity (veh/h)         | 976    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.117  | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Control Delay (s)    | 9.2    | -                                                                                 | 0                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane LOS             | A      | -                                                                                 | A                                                                                 | -                                                                                 |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 0.4    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                       |               |                    |
|---------------------|---------------------------------------|---------------|--------------------|
| Analyst             | Whipple Consulting Engineers          | Date          | 03/05/2021         |
| Agency              | WSDOT                                 | Analysis Year | 2026 AM w BK Proj. |
| Jurisdiction        | WSDOT                                 | Time Analyzed | AM                 |
| Project Description | 20-2564 Latah Glen - Meadowlane N MUT | Units         | U.S. Customary     |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 500                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 549   | 105   |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 9.00  | 2.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.917 | 0.980 |
| Flow Rate (vi),pc/h                   | 651   | 116   |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.17  | 0.06  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.289 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.1  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 651   | Ramp Junction Speed (S), mi/h                 | 43.1  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 767   | Average Density (D), pc/mi/ln                 | 8.9   |
| Level of Service (LOS)                       | A     | Density in Ramp Influence Area (DR), pc/mi/ln | 8.3   |

| Intersection             |                                                                                   |                                                                                   |        |       |                                                                                   |                                                                                   |
|--------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------|-------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Int Delay, s/veh         | 6.9                                                                               |                                                                                   |        |       |                                                                                   |                                                                                   |
| Movement                 | EBL                                                                               | EBR                                                                               | NBL    | NBT   | SBT                                                                               | SBR                                                                               |
| Lane Configurations      |  |  |        |       |  |  |
| Traffic Vol, veh/h       | 238                                                                               | 124                                                                               | 0      | 0     | 519                                                                               | 0                                                                                 |
| Future Vol, veh/h        | 238                                                                               | 124                                                                               | 0      | 0     | 519                                                                               | 0                                                                                 |
| Conflicting Peds, #/hr   | 0                                                                                 | 0                                                                                 | 0      | 0     | 0                                                                                 | 0                                                                                 |
| Sign Control             | Stop                                                                              | Stop                                                                              | Free   | Free  | Free                                                                              | Free                                                                              |
| RT Channelized           | -                                                                                 | None                                                                              | -      | None  | -                                                                                 | None                                                                              |
| Storage Length           | 0                                                                                 | 0                                                                                 | -      | -     | -                                                                                 | -                                                                                 |
| Veh in Median Storage, # | 2                                                                                 | -                                                                                 | -      | 16979 | 0                                                                                 | -                                                                                 |
| Grade, %                 | 0                                                                                 | -                                                                                 | -      | 0     | 0                                                                                 | -                                                                                 |
| Peak Hour Factor         | 92                                                                                | 92                                                                                | 92     | 92    | 92                                                                                | 92                                                                                |
| Heavy Vehicles, %        | 3                                                                                 | 3                                                                                 | 2      | 2     | 9                                                                                 | 9                                                                                 |
| Mvmt Flow                | 259                                                                               | 135                                                                               | 0      | 0     | 564                                                                               | 0                                                                                 |
| Major/Minor              | Minor2                                                                            |                                                                                   | Major2 |       |                                                                                   |                                                                                   |
| Conflicting Flow All     | 564                                                                               | 282                                                                               |        |       |                                                                                   |                                                                                   |
| Stage 1                  | 564                                                                               | -                                                                                 |        |       |                                                                                   |                                                                                   |
| Stage 2                  | 0                                                                                 | -                                                                                 |        |       |                                                                                   |                                                                                   |
| Critical Hdwy            | 6.86                                                                              | 6.96                                                                              |        |       |                                                                                   |                                                                                   |
| Critical Hdwy Stg 1      | 5.86                                                                              | -                                                                                 |        |       |                                                                                   |                                                                                   |
| Critical Hdwy Stg 2      | -                                                                                 | -                                                                                 |        |       |                                                                                   |                                                                                   |
| Follow-up Hdwy           | 3.53                                                                              | 3.33                                                                              |        |       |                                                                                   |                                                                                   |
| Pot Cap-1 Maneuver       | 453                                                                               | 712                                                                               |        |       |                                                                                   |                                                                                   |
| Stage 1                  | 530                                                                               | -                                                                                 |        |       |                                                                                   |                                                                                   |
| Stage 2                  | -                                                                                 | -                                                                                 |        |       |                                                                                   |                                                                                   |
| Platoon blocked, %       |                                                                                   |                                                                                   |        |       |                                                                                   |                                                                                   |
| Mov Cap-1 Maneuver       | 453                                                                               | 712                                                                               |        |       |                                                                                   |                                                                                   |
| Mov Cap-2 Maneuver       | 501                                                                               | -                                                                                 |        |       |                                                                                   |                                                                                   |
| Stage 1                  | 530                                                                               | -                                                                                 |        |       |                                                                                   |                                                                                   |
| Stage 2                  | -                                                                                 | -                                                                                 |        |       |                                                                                   |                                                                                   |
| Approach                 | EB                                                                                |                                                                                   | SB     |       |                                                                                   |                                                                                   |
| HCM Control Delay, s     | 16.7                                                                              |                                                                                   | 0      |       |                                                                                   |                                                                                   |
| HCM LOS                  | C                                                                                 |                                                                                   |        |       |                                                                                   |                                                                                   |
| Minor Lane/Major Mvmt    | EBLn1                                                                             | EBLn2                                                                             | SBT    |       |                                                                                   |                                                                                   |
| Capacity (veh/h)         | 501                                                                               | 712                                                                               |        |       |                                                                                   |                                                                                   |
| HCM Lane V/C Ratio       | 0.516                                                                             | 0.189                                                                             |        |       |                                                                                   |                                                                                   |
| HCM Control Delay (s)    | 19.6                                                                              | 11.2                                                                              |        |       |                                                                                   |                                                                                   |
| HCM Lane LOS             | C                                                                                 | B                                                                                 |        |       |                                                                                   |                                                                                   |
| HCM 95th %tile Q(veh)    | 2.9                                                                               | 0.7                                                                               |        |       |                                                                                   |                                                                                   |

| Intersection             |        |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |
|--------------------------|--------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Int Delay, s/veh         | 8.4    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |
| Movement                 | WBL    | WBR                                                                               | NBT                                                                               | NBR                                                                               | SBL                                                                               | SBT                                                                               |
| Lane Configurations      |        |  |  |  |  |  |
| Traffic Vol, veh/h       | 0      | 468                                                                               | 481                                                                               | 102                                                                               | 216                                                                               | 339                                                                               |
| Future Vol, veh/h        | 0      | 468                                                                               | 481                                                                               | 102                                                                               | 216                                                                               | 339                                                                               |
| Conflicting Peds, #/hr   | 0      | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 |
| Sign Control             | Stop   | Stop                                                                              | Free                                                                              | Free                                                                              | Free                                                                              | Free                                                                              |
| RT Channelized           | -      | None                                                                              | -                                                                                 | None                                                                              | -                                                                                 | None                                                                              |
| Storage Length           | -      | -                                                                                 | -                                                                                 | 25                                                                                | 350                                                                               | -                                                                                 |
| Veh in Median Storage, # | 1      | -                                                                                 | 0                                                                                 | -                                                                                 | -                                                                                 | 0                                                                                 |
| Grade, %                 | 0      | -                                                                                 | 0                                                                                 | -                                                                                 | -                                                                                 | 0                                                                                 |
| Peak Hour Factor         | 86     | 86                                                                                | 86                                                                                | 86                                                                                | 86                                                                                | 86                                                                                |
| Heavy Vehicles, %        | 2      | 2                                                                                 | 2                                                                                 | 2                                                                                 | 9                                                                                 | 9                                                                                 |
| Mvmt Flow                | 0      | 544                                                                               | 559                                                                               | 119                                                                               | 251                                                                               | 394                                                                               |
| Major/Minor              | Minor1 | Major1                                                                            |                                                                                   | Major2                                                                            |                                                                                   |                                                                                   |
| Conflicting Flow All     | -      | 280                                                                               | 0                                                                                 | 0                                                                                 | 678                                                                               | 0                                                                                 |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 |
| Critical Hdwy            | -      | 6.94                                                                              | -                                                                                 | -                                                                                 | 4.28                                                                              | -                                                                                 |
| Critical Hdwy Stg 1      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 |
| Critical Hdwy Stg 2      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 |
| Follow-up Hdwy           | -      | 3.32                                                                              | -                                                                                 | -                                                                                 | 2.29                                                                              | -                                                                                 |
| Pot Cap-1 Maneuver       | 0      | 717                                                                               | -                                                                                 | -                                                                                 | 864                                                                               | -                                                                                 |
| Stage 1                  | 0      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 |
| Stage 2                  | 0      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 |
| Platoon blocked, %       | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 |
| Mov Cap-1 Maneuver       | -      | 717                                                                               | -                                                                                 | -                                                                                 | 864                                                                               | -                                                                                 |
| Mov Cap-2 Maneuver       | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 |
| Approach                 | WB     | NB                                                                                |                                                                                   | SB                                                                                |                                                                                   |                                                                                   |
| HCM Control Delay, s     | 24     | 0                                                                                 |                                                                                   | 4.2                                                                               |                                                                                   |                                                                                   |
| HCM LOS                  | C      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |
| Minor Lane/Major Mvmt    | NBT    | NBRWBLn1                                                                          | SBL                                                                               | SBT                                                                               |                                                                                   |                                                                                   |
| Capacity (veh/h)         | -      | -                                                                                 | 717                                                                               | 864                                                                               | -                                                                                 |                                                                                   |
| HCM Lane V/C Ratio       | -      | -                                                                                 | 0.759                                                                             | 0.291                                                                             | -                                                                                 |                                                                                   |
| HCM Control Delay (s)    | -      | -                                                                                 | 24                                                                                | 10.9                                                                              | -                                                                                 |                                                                                   |
| HCM Lane LOS             | -      | -                                                                                 | C                                                                                 | B                                                                                 | -                                                                                 |                                                                                   |
| HCM 95th %tile Q(veh)    | -      | -                                                                                 | 7.1                                                                               | 1.2                                                                               | -                                                                                 |                                                                                   |



| Intersection             |        |      |                |      |        |      |        |      |      |      |      |      |
|--------------------------|--------|------|----------------|------|--------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 1      |      |                |      |        |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT  | EBR            | WBL  | WBT    | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Lane Configurations      |        |      | ↗              |      |        | ↗    |        | ↗↗   | ↗    |      | ↗↗   | ↗    |
| Traffic Vol, veh/h       | 0      | 0    | 106            | 0    | 0      | 81   | 0      | 812  | 118  | 0    | 1607 | 145  |
| Future Vol, veh/h        | 0      | 0    | 106            | 0    | 0      | 81   | 0      | 812  | 118  | 0    | 1607 | 145  |
| Conflicting Peds, #/hr   | 0      | 0    | 0              | 0    | 0      | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Stop   | Stop | Stop           | Stop | Stop   | Stop | Free   | Free | Free | Free | Free | Free |
| RT Channelized           | -      | -    | None           | -    | -      | Free | -      | -    | None | -    | -    | Free |
| Storage Length           | -      | -    | 0              | -    | -      | 0    | -      | -    | 25   | -    | -    | 0    |
| Veh in Median Storage, # | -      | 0    | -              | -    | 0      | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0    | -              | -    | 0      | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 93     | 93   | 93             | 93   | 93     | 93   | 93     | 93   | 93   | 93   | 93   | 93   |
| Heavy Vehicles, %        | 2      | 2    | 2              | 2    | 2      | 2    | 2      | 4    | 4    | 2    | 2    | 2    |
| Mvmt Flow                | 0      | 0    | 114            | 0    | 0      | 87   | 0      | 873  | 127  | 0    | 1728 | 156  |
| Major/Minor              | Minor2 |      | Minor1         |      | Major1 |      | Major2 |      |      |      |      |      |
| Conflicting Flow All     | -      | -    | 864            | -    | -      | -    | 0      | 0    | -    | -    | -    | 0    |
| Stage 1                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy            | -      | -    | 6.94           | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 1      | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 2      | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Follow-up Hdwy           | -      | -    | 3.32           | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Pot Cap-1 Maneuver       | 0      | 0    | 297            | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 1                  | 0      | 0    | -              | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 2                  | 0      | 0    | -              | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Platoon blocked, %       | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-1 Maneuver       | -      | -    | 297            | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-2 Maneuver       | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 1                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Approach                 | EB     |      | WB             |      | NB     |      | SB     |      |      |      |      |      |
| HCM Control Delay, s     | 24.5   |      | 0              |      | 0      |      | 0      |      |      |      |      |      |
| HCM LOS                  | C      |      | A              |      |        |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBT    |      | NBR EBLn1WBLn1 |      | SBT    |      |        |      |      |      |      |      |
| Capacity (veh/h)         | -      |      | 297            |      | -      |      |        |      |      |      |      |      |
| HCM Lane V/C Ratio       | -      |      | 0.384          |      | -      |      |        |      |      |      |      |      |
| HCM Control Delay (s)    | -      |      | 24.5           |      | 0      |      |        |      |      |      |      |      |
| HCM Lane LOS             | -      |      | C              |      | A      |      |        |      |      |      |      |      |
| HCM 95th %tile Q(veh)    | -      |      | 1.7            |      | -      |      |        |      |      |      |      |      |

| Intersection             |        |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
|--------------------------|--------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 1.1    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Movement                 | EBL    | EBR                                                                               | NBL                                                                               | NBT                                                                               | SBT                                                                               | SBR  |
| Lane Configurations      |        |  |  |  |  |      |
| Traffic Vol, veh/h       | 0      | 122                                                                               | 122                                                                               | 771                                                                               | 1630                                                                              | 0    |
| Future Vol, veh/h        | 0      | 122                                                                               | 122                                                                               | 771                                                                               | 1630                                                                              | 0    |
| Conflicting Peds, #/hr   | 0      | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0    |
| Sign Control             | Stop   | Stop                                                                              | Free                                                                              | Free                                                                              | Free                                                                              | Free |
| RT Channelized           | -      | Free                                                                              | -                                                                                 | None                                                                              | -                                                                                 | None |
| Storage Length           | -      | 0                                                                                 | 600                                                                               | -                                                                                 | -                                                                                 | -    |
| Veh in Median Storage, # | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Grade, %                 | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Peak Hour Factor         | 92     | 92                                                                                | 92                                                                                | 92                                                                                | 92                                                                                | 92   |
| Heavy Vehicles, %        | 2      | 2                                                                                 | 2                                                                                 | 4                                                                                 | 2                                                                                 | 2    |
| Mvmt Flow                | 0      | 133                                                                               | 133                                                                               | 838                                                                               | 1772                                                                              | 0    |
| Major/Minor              | Minor2 | Major1                                                                            |                                                                                   | Major2                                                                            |                                                                                   |      |
| Conflicting Flow All     | -      | -                                                                                 | 1772                                                                              | 0                                                                                 | -                                                                                 | 0    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy            | -      | -                                                                                 | 4.14                                                                              | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 1      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 2      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Follow-up Hdwy           | -      | -                                                                                 | 2.22                                                                              | -                                                                                 | -                                                                                 | -    |
| Pot Cap-1 Maneuver       | 0      | 0                                                                                 | 347                                                                               | -                                                                                 | -                                                                                 | 0    |
| Stage 1                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Stage 2                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Platoon blocked, %       |        |                                                                                   |                                                                                   | -                                                                                 | -                                                                                 |      |
| Mov Cap-1 Maneuver       | -      | -                                                                                 | 347                                                                               | -                                                                                 | -                                                                                 | -    |
| Mov Cap-2 Maneuver       | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Approach                 | EB     | NB                                                                                |                                                                                   | SB                                                                                |                                                                                   |      |
| HCM Control Delay, s     | 0      | 3                                                                                 |                                                                                   | 0                                                                                 |                                                                                   |      |
| HCM LOS                  | A      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Minor Lane/Major Mvmt    | NBL    | NBT                                                                               | EBLn1                                                                             | SBT                                                                               |                                                                                   |      |
| Capacity (veh/h)         | 347    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.382  | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Control Delay (s)    | 21.6   | -                                                                                 | 0                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane LOS             | C      | -                                                                                 | A                                                                                 | -                                                                                 |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 1.7    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                      |               |                    |
|---------------------|--------------------------------------|---------------|--------------------|
| Analyst             | Whipple Consulting Engineers         | Date          | 03/05/2021         |
| Agency              | WSDOT                                | Analysis Year | 2026 PM w BK Proj. |
| Jurisdiction        | WSDOT                                | Time Analyzed | PM                 |
| Project Description | 20-2564 Latah Glen - Thorpe N<br>MUT | Units         | U.S. Customary     |

## Geometric Data

|                                                  | Freeway | Ramp                 |
|--------------------------------------------------|---------|----------------------|
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 900                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 1630  | 122   |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 2.00  | 2.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.980 | 0.980 |
| Flow Rate (vi),pc/h                   | 1808  | 135   |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.43  | 0.07  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.276 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.2  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 1808  | Ramp Junction Speed (S), mi/h                 | 43.2  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 1943  | Average Density (D), pc/mi/ln                 | 22.5  |
| Level of Service (LOS)                       | B     | Density in Ramp Influence Area (DR), pc/mi/ln | 15.0  |

| Intersection             |          |        |        |      |      |      |
|--------------------------|----------|--------|--------|------|------|------|
| Int Delay, s/veh         | 0.3      |        |        |      |      |      |
| Movement                 | WBL      | WBR    | NBT    | NBR  | SBL  | SBT  |
| Lane Configurations      |          | ↗      | ↗↗     |      | ↘    | ↗↗   |
| Traffic Vol, veh/h       | 0        | 86     | 844    | 0    | 86   | 1627 |
| Future Vol, veh/h        | 0        | 86     | 844    | 0    | 86   | 1627 |
| Conflicting Peds, #/hr   | 0        | 0      | 0      | 0    | 0    | 0    |
| Sign Control             | Stop     | Stop   | Free   | Free | Free | Free |
| RT Channelized           | -        | Free   | -      | None | -    | None |
| Storage Length           | -        | 0      | -      | -    | 600  | -    |
| Veh in Median Storage, # | 0        | -      | 0      | -    | -    | 0    |
| Grade, %                 | 0        | -      | 0      | -    | -    | 0    |
| Peak Hour Factor         | 92       | 92     | 92     | 92   | 92   | 92   |
| Heavy Vehicles, %        | 0        | 2      | 4      | 0    | 2    | 2    |
| Mvmt Flow                | 0        | 93     | 917    | 0    | 93   | 1768 |
| Major/Minor              | Minor1   | Major1 | Major2 |      |      |      |
| Conflicting Flow All     | -        | -      | 0      | -    | 917  | 0    |
| Stage 1                  | -        | -      | -      | -    | -    | -    |
| Stage 2                  | -        | -      | -      | -    | -    | -    |
| Critical Hdwy            | -        | -      | -      | -    | 4.14 | -    |
| Critical Hdwy Stg 1      | -        | -      | -      | -    | -    | -    |
| Critical Hdwy Stg 2      | -        | -      | -      | -    | -    | -    |
| Follow-up Hdwy           | -        | -      | -      | -    | 2.22 | -    |
| Pot Cap-1 Maneuver       | 0        | 0      | -      | 0    | 740  | -    |
| Stage 1                  | 0        | 0      | -      | 0    | -    | -    |
| Stage 2                  | 0        | 0      | -      | 0    | -    | -    |
| Platoon blocked, %       |          |        | -      |      |      | -    |
| Mov Cap-1 Maneuver       | -        | -      | -      | -    | 740  | -    |
| Mov Cap-2 Maneuver       | -        | -      | -      | -    | -    | -    |
| Stage 1                  | -        | -      | -      | -    | -    | -    |
| Stage 2                  | -        | -      | -      | -    | -    | -    |
| Approach                 | WB       | NB     | SB     |      |      |      |
| HCM Control Delay, s     | 0        | 0      | 0.5    |      |      |      |
| HCM LOS                  | A        |        |        |      |      |      |
| Minor Lane/Major Mvmt    | NBTWBLn1 | SBL    | SBT    |      |      |      |
| Capacity (veh/h)         | -        | -      | 740    | -    |      |      |
| HCM Lane V/C Ratio       | -        | -      | 0.126  | -    |      |      |
| HCM Control Delay (s)    | -        | 0      | 10.6   | -    |      |      |
| HCM Lane LOS             | -        | A      | B      | -    |      |      |
| HCM 95th %tile Q(veh)    | -        | -      | 0.4    | -    |      |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                    |               |                    |
|---------------------|------------------------------------|---------------|--------------------|
| Analyst             | Whipple Consulting Engineers       | Date          | 03/05/2021         |
| Agency              | WSDOT                              | Analysis Year | 2026 PM w BK Proj. |
| Jurisdiction        | WSDOT                              | Time Analyzed | PM                 |
| Project Description | 20-2564 Latah Glen - Thorpe S. MUT | Units         | U.S. Customary     |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 500                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 844   | 86    |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 4.00  | 2.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.962 | 0.980 |
| Flow Rate (vi),pc/h                   | 954   | 95    |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.23  | 0.05  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.292 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (vOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.1  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 954   | Ramp Junction Speed (S), mi/h                 | 43.1  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 1049  | Average Density (D), pc/mi/ln                 | 12.2  |
| Level of Service (LOS)                       | B     | Density in Ramp Influence Area (DR), pc/mi/ln | 10.6  |

| Intersection             |        |          |        |       |      |      |
|--------------------------|--------|----------|--------|-------|------|------|
| Int Delay, s/veh         | 0.3    |          |        |       |      |      |
| Movement                 | WBL    | WBR      | NBT    | NBR   | SBL  | SBT  |
| Lane Configurations      |        | ↗        | ↗↗     | ↗     | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0      | 29       | 863    | 4     | 21   | 1364 |
| Future Vol, veh/h        | 0      | 29       | 863    | 4     | 21   | 1364 |
| Conflicting Peds, #/hr   | 0      | 0        | 0      | 0     | 0    | 0    |
| Sign Control             | Stop   | Stop     | Free   | Free  | Free | Free |
| RT Channelized           | -      | Stop     | -      | None  | -    | None |
| Storage Length           | -      | 0        | -      | 25    | 200  | -    |
| Veh in Median Storage, # | 1      | -        | 0      | -     | -    | 0    |
| Grade, %                 | 0      | -        | 0      | -     | -    | 0    |
| Peak Hour Factor         | 92     | 92       | 92     | 92    | 92   | 92   |
| Heavy Vehicles, %        | 17     | 17       | 2      | 2     | 9    | 9    |
| Mvmt Flow                | 0      | 32       | 938    | 4     | 23   | 1483 |
| Major/Minor              | Minor1 | Major1   | Major2 |       |      |      |
| Conflicting Flow All     | -      | 469      | 0      | 0     | 942  | 0    |
| Stage 1                  | -      | -        | -      | -     | -    | -    |
| Stage 2                  | -      | -        | -      | -     | -    | -    |
| Critical Hdwy            | -      | 7.24     | -      | -     | 4.28 | -    |
| Critical Hdwy Stg 1      | -      | -        | -      | -     | -    | -    |
| Critical Hdwy Stg 2      | -      | -        | -      | -     | -    | -    |
| Follow-up Hdwy           | -      | 3.47     | -      | -     | 2.29 | -    |
| Pot Cap-1 Maneuver       | 0      | 502      | -      | -     | 682  | -    |
| Stage 1                  | 0      | -        | -      | -     | -    | -    |
| Stage 2                  | 0      | -        | -      | -     | -    | -    |
| Platoon blocked, %       | -      | -        | -      | -     | -    | -    |
| Mov Cap-1 Maneuver       | -      | 502      | -      | -     | 682  | -    |
| Mov Cap-2 Maneuver       | -      | -        | -      | -     | -    | -    |
| Stage 1                  | -      | -        | -      | -     | -    | -    |
| Stage 2                  | -      | -        | -      | -     | -    | -    |
| Approach                 | WB     | NB       | SB     |       |      |      |
| HCM Control Delay, s     | 12.7   | 0        | 0.2    |       |      |      |
| HCM LOS                  | B      |          |        |       |      |      |
| Minor Lane/Major Mvmt    | NBT    | NBRWBLn1 | SBL    | SBT   |      |      |
| Capacity (veh/h)         | -      | -        | 502    | 682   | -    |      |
| HCM Lane V/C Ratio       | -      | -        | 0.063  | 0.033 | -    |      |
| HCM Control Delay (s)    | -      | -        | 12.7   | 10.5  | -    |      |
| HCM Lane LOS             | -      | -        | B      | B     | -    |      |
| HCM 95th %tile Q(veh)    | -      | -        | 0.2    | 0.1   | -    |      |

| Intersection             |        |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
|--------------------------|--------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 1      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Movement                 | EBL    | EBR                                                                               | NBL                                                                               | NBT                                                                               | SBT                                                                               | SBR  |
| Lane Configurations      |        |  |  |  |  |      |
| Traffic Vol, veh/h       | 0      | 136                                                                               | 136                                                                               | 650                                                                               | 1149                                                                              | 0    |
| Future Vol, veh/h        | 0      | 136                                                                               | 136                                                                               | 650                                                                               | 1149                                                                              | 0    |
| Conflicting Peds, #/hr   | 0      | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0    |
| Sign Control             | Stop   | Stop                                                                              | Free                                                                              | Free                                                                              | Free                                                                              | Free |
| RT Channelized           | -      | Free                                                                              | -                                                                                 | None                                                                              | -                                                                                 | None |
| Storage Length           | -      | 0                                                                                 | 250                                                                               | -                                                                                 | -                                                                                 | -    |
| Veh in Median Storage, # | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Grade, %                 | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Peak Hour Factor         | 92     | 92                                                                                | 92                                                                                | 92                                                                                | 92                                                                                | 92   |
| Heavy Vehicles, %        | 2      | 2                                                                                 | 5                                                                                 | 5                                                                                 | 2                                                                                 | 2    |
| Mvmt Flow                | 0      | 148                                                                               | 148                                                                               | 707                                                                               | 1249                                                                              | 0    |
| Major/Minor              | Minor2 | Major1                                                                            |                                                                                   | Major2                                                                            |                                                                                   |      |
| Conflicting Flow All     | -      | -                                                                                 | 1249                                                                              | 0                                                                                 | -                                                                                 | 0    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy            | -      | -                                                                                 | 4.2                                                                               | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 1      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 2      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Follow-up Hdwy           | -      | -                                                                                 | 2.25                                                                              | -                                                                                 | -                                                                                 | -    |
| Pot Cap-1 Maneuver       | 0      | 0                                                                                 | 537                                                                               | -                                                                                 | -                                                                                 | 0    |
| Stage 1                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Stage 2                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Platoon blocked, %       |        |                                                                                   |                                                                                   | -                                                                                 | -                                                                                 |      |
| Mov Cap-1 Maneuver       | -      | -                                                                                 | 537                                                                               | -                                                                                 | -                                                                                 | -    |
| Mov Cap-2 Maneuver       | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Approach                 | EB     | NB                                                                                |                                                                                   | SB                                                                                |                                                                                   |      |
| HCM Control Delay, s     | 0      | 2.5                                                                               |                                                                                   | 0                                                                                 |                                                                                   |      |
| HCM LOS                  | A      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Minor Lane/Major Mvmt    | NBL    | NBT                                                                               | EBLn1                                                                             | SBT                                                                               |                                                                                   |      |
| Capacity (veh/h)         | 537    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.275  | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Control Delay (s)    | 14.2   | -                                                                                 | 0                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane LOS             | B      | -                                                                                 | A                                                                                 | -                                                                                 |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 1.1    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                       |               |                    |
|---------------------|---------------------------------------|---------------|--------------------|
| Analyst             | Whipple Consulting Engineers          | Date          | 03/05/2021         |
| Agency              | WSDOT                                 | Analysis Year | 2026 PM w BK Proj. |
| Jurisdiction        | WSDOT                                 | Time Analyzed | PM                 |
| Project Description | 20-2564 Latah Glen - Meadowlane N MUT | Units         | U.S. Customary     |

## Geometric Data

|                                                  | Freeway | Ramp                 |
|--------------------------------------------------|---------|----------------------|
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 500                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 1149  | 136   |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 2.00  | 5.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.980 | 0.952 |
| Flow Rate (vi),pc/h                   | 1274  | 155   |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.32  | 0.08  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.297 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.1  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 1274  | Ramp Junction Speed (S), mi/h                 | 43.1  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 1429  | Average Density (D), pc/mi/ln                 | 16.6  |
| Level of Service (LOS)                       | B     | Density in Ramp Influence Area (DR), pc/mi/ln | 13.5  |



| Intersection             |                                                                                   |                                                                                   |        |       |                                                                                   |      |
|--------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------|-------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 2.8                                                                               |                                                                                   |        |       |                                                                                   |      |
| Movement                 | EBL                                                                               | EBR                                                                               | NBL    | NBT   | SBT                                                                               | SBR  |
| Lane Configurations      |  |  |        |       |  |      |
| Traffic Vol, veh/h       | 81                                                                                | 74                                                                                | 0      | 0     | 1027                                                                              | 0    |
| Future Vol, veh/h        | 81                                                                                | 74                                                                                | 0      | 0     | 1027                                                                              | 0    |
| Conflicting Peds, #/hr   | 0                                                                                 | 0                                                                                 | 0      | 0     | 0                                                                                 | 0    |
| Sign Control             | Stop                                                                              | Stop                                                                              | Free   | Free  | Free                                                                              | Free |
| RT Channelized           | -                                                                                 | None                                                                              | -      | None  | -                                                                                 | None |
| Storage Length           | 0                                                                                 | 0                                                                                 | -      | -     | -                                                                                 | -    |
| Veh in Median Storage, # | 2                                                                                 | -                                                                                 | -      | 16979 | 0                                                                                 | -    |
| Grade, %                 | 0                                                                                 | -                                                                                 | -      | 0     | 0                                                                                 | -    |
| Peak Hour Factor         | 92                                                                                | 92                                                                                | 92     | 92    | 92                                                                                | 92   |
| Heavy Vehicles, %        | 3                                                                                 | 3                                                                                 | 2      | 2     | 9                                                                                 | 9    |
| Mvmt Flow                | 88                                                                                | 80                                                                                | 0      | 0     | 1116                                                                              | 0    |
|                          |                                                                                   |                                                                                   |        |       |                                                                                   |      |
| Major/Minor              | Minor2                                                                            |                                                                                   | Major2 |       |                                                                                   |      |
| Conflicting Flow All     | 1116                                                                              | 558                                                                               |        |       | -                                                                                 | 0    |
| Stage 1                  | 1116                                                                              | -                                                                                 |        |       | -                                                                                 | -    |
| Stage 2                  | 0                                                                                 | -                                                                                 |        |       | -                                                                                 | -    |
| Critical Hdwy            | 6.86                                                                              | 6.96                                                                              |        |       | -                                                                                 | -    |
| Critical Hdwy Stg 1      | 5.86                                                                              | -                                                                                 |        |       | -                                                                                 | -    |
| Critical Hdwy Stg 2      | -                                                                                 | -                                                                                 |        |       | -                                                                                 | -    |
| Follow-up Hdwy           | 3.53                                                                              | 3.33                                                                              |        |       | -                                                                                 | -    |
| Pot Cap-1 Maneuver       | 200                                                                               | 471                                                                               |        |       | -                                                                                 | 0    |
| Stage 1                  | 273                                                                               | -                                                                                 |        |       | -                                                                                 | 0    |
| Stage 2                  | -                                                                                 | -                                                                                 |        |       | -                                                                                 | 0    |
| Platoon blocked, %       |                                                                                   |                                                                                   |        |       | -                                                                                 |      |
| Mov Cap-1 Maneuver       | 200                                                                               | 471                                                                               |        |       | -                                                                                 | -    |
| Mov Cap-2 Maneuver       | 247                                                                               | -                                                                                 |        |       | -                                                                                 | -    |
| Stage 1                  | 273                                                                               | -                                                                                 |        |       | -                                                                                 | -    |
| Stage 2                  | -                                                                                 | -                                                                                 |        |       | -                                                                                 | -    |
|                          |                                                                                   |                                                                                   |        |       |                                                                                   |      |
|                          |                                                                                   |                                                                                   |        |       |                                                                                   |      |
| Approach                 | EB                                                                                |                                                                                   | SB     |       |                                                                                   |      |
| HCM Control Delay, s     | 21.1                                                                              |                                                                                   | 0      |       |                                                                                   |      |
| HCM LOS                  | C                                                                                 |                                                                                   |        |       |                                                                                   |      |
|                          |                                                                                   |                                                                                   |        |       |                                                                                   |      |
|                          |                                                                                   |                                                                                   |        |       |                                                                                   |      |
| Minor Lane/Major Mvmt    | EBLn1                                                                             | EBLn2                                                                             | SBT    |       |                                                                                   |      |
| Capacity (veh/h)         | 247                                                                               | 471                                                                               | -      |       |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.356                                                                             | 0.171                                                                             | -      |       |                                                                                   |      |
| HCM Control Delay (s)    | 27.4                                                                              | 14.2                                                                              | -      |       |                                                                                   |      |
| HCM Lane LOS             | D                                                                                 | B                                                                                 | -      |       |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 1.5                                                                               | 0.6                                                                               | -      |       |                                                                                   |      |

| Intersection             |        |          |       |        |      |      |
|--------------------------|--------|----------|-------|--------|------|------|
| Int Delay, s/veh         | 5.3    |          |       |        |      |      |
| Movement                 | WBL    | WBR      | NBT   | NBR    | SBL  | SBT  |
| Lane Configurations      |        | ↗        | ↗↗    | ↗      | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0      | 416      | 295   | 64     | 434  | 618  |
| Future Vol, veh/h        | 0      | 416      | 295   | 64     | 434  | 618  |
| Conflicting Peds, #/hr   | 0      | 0        | 0     | 0      | 0    | 0    |
| Sign Control             | Stop   | Stop     | Free  | Free   | Free | Free |
| RT Channelized           | -      | None     | -     | None   | -    | None |
| Storage Length           | -      | -        | -     | 25     | 350  | -    |
| Veh in Median Storage, # | 1      | -        | 0     | -      | -    | 0    |
| Grade, %                 | 0      | -        | 0     | -      | -    | 0    |
| Peak Hour Factor         | 97     | 97       | 97    | 97     | 97   | 97   |
| Heavy Vehicles, %        | 2      | 2        | 5     | 5      | 2    | 2    |
| Mvmt Flow                | 0      | 429      | 304   | 66     | 447  | 637  |
| Major/Minor              | Minor1 | Major1   |       | Major2 |      |      |
| Conflicting Flow All     | -      | 152      | 0     | 0      | 370  | 0    |
| Stage 1                  | -      | -        | -     | -      | -    | -    |
| Stage 2                  | -      | -        | -     | -      | -    | -    |
| Critical Hdwy            | -      | 6.94     | -     | -      | 4.14 | -    |
| Critical Hdwy Stg 1      | -      | -        | -     | -      | -    | -    |
| Critical Hdwy Stg 2      | -      | -        | -     | -      | -    | -    |
| Follow-up Hdwy           | -      | 3.32     | -     | -      | 2.22 | -    |
| Pot Cap-1 Maneuver       | 0      | 867      | -     | -      | 1185 | -    |
| Stage 1                  | 0      | -        | -     | -      | -    | -    |
| Stage 2                  | 0      | -        | -     | -      | -    | -    |
| Platoon blocked, %       | -      | -        | -     | -      | -    | -    |
| Mov Cap-1 Maneuver       | -      | 867      | -     | -      | 1185 | -    |
| Mov Cap-2 Maneuver       | -      | -        | -     | -      | -    | -    |
| Stage 1                  | -      | -        | -     | -      | -    | -    |
| Stage 2                  | -      | -        | -     | -      | -    | -    |
| Approach                 | WB     | NB       |       | SB     |      |      |
| HCM Control Delay, s     | 13.1   | 0        |       | 4.1    |      |      |
| HCM LOS                  | B      |          |       |        |      |      |
| Minor Lane/Major Mvmt    | NBT    | NBRWBLn1 | SBL   | SBT    |      |      |
| Capacity (veh/h)         | -      | -        | 867   | 1185   | -    |      |
| HCM Lane V/C Ratio       | -      | -        | 0.495 | 0.378  | -    |      |
| HCM Control Delay (s)    | -      | -        | 13.1  | 9.9    | -    |      |
| HCM Lane LOS             | -      | -        | B     | A      | -    |      |
| HCM 95th %tile Q(veh)    | -      | -        | 2.8   | 1.8    | -    |      |

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**YEAR 2026**

**LEVEL OF SERVICE CALCULATIONS**

**AM & PM WITH BACKGROUND PROJECTS AND PROJECT  
(J-TURN AT THORPE & SR 195 AND MEADOWLANE IMP)**

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| Intersection             |        |      |                |      |        |      |        |      |      |      |      |      |
|--------------------------|--------|------|----------------|------|--------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 0.9    |      |                |      |        |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT  | EBR            | WBL  | WBT    | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Lane Configurations      |        |      | ↗              |      |        | ↗    |        | ↗↗   | ↗    |      | ↗↗   | ↗    |
| Traffic Vol, veh/h       | 0      | 0    | 175            | 0    | 0      | 47   | 0      | 1767 | 168  | 0    | 624  | 71   |
| Future Vol, veh/h        | 0      | 0    | 175            | 0    | 0      | 47   | 0      | 1767 | 168  | 0    | 624  | 71   |
| Conflicting Peds, #/hr   | 0      | 0    | 0              | 0    | 0      | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Stop   | Stop | Stop           | Stop | Stop   | Stop | Free   | Free | Free | Free | Free | Free |
| RT Channelized           | -      | -    | None           | -    | -      | Free | -      | -    | None | -    | -    | Free |
| Storage Length           | -      | -    | 0              | -    | -      | 0    | -      | -    | 25   | -    | -    | 0    |
| Veh in Median Storage, # | -      | 0    | -              | -    | 0      | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0    | -              | -    | 0      | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 85     | 85   | 85             | 85   | 85     | 85   | 85     | 85   | 85   | 85   | 85   | 85   |
| Heavy Vehicles, %        | 0      | 0    | 3              | 0    | 0      | 5    | 0      | 2    | 2    | 0    | 12   | 12   |
| Mvmt Flow                | 0      | 0    | 206            | 0    | 0      | 55   | 0      | 2079 | 198  | 0    | 734  | 84   |
| Major/Minor              | Minor2 |      | Minor1         |      | Major1 |      | Major2 |      |      |      |      |      |
| Conflicting Flow All     | -      | -    | 367            | -    | -      | -    | 0      | 0    | -    | -    | -    | 0    |
| Stage 1                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy            | -      | -    | 6.96           | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 1      | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Critical Hdwy Stg 2      | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Follow-up Hdwy           | -      | -    | 3.33           | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Pot Cap-1 Maneuver       | 0      | 0    | 627            | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 1                  | 0      | 0    | -              | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Stage 2                  | 0      | 0    | -              | 0    | 0      | 0    | 0      | -    | -    | 0    | -    | 0    |
| Platoon blocked, %       | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-1 Maneuver       | -      | -    | 627            | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Mov Cap-2 Maneuver       | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 1                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Stage 2                  | -      | -    | -              | -    | -      | -    | -      | -    | -    | -    | -    | -    |
| Approach                 | EB     |      | WB             |      | NB     |      | SB     |      |      |      |      |      |
| HCM Control Delay, s     | 13.5   |      | 0              |      | 0      |      | 0      |      |      |      |      |      |
| HCM LOS                  | B      |      | A              |      |        |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBT    |      | NBR EBLn1WBLn1 |      | SBT    |      |        |      |      |      |      |      |
| Capacity (veh/h)         | -      | -    | 627            | -    | -      |      |        |      |      |      |      |      |
| HCM Lane V/C Ratio       | -      | -    | 0.328          | -    | -      |      |        |      |      |      |      |      |
| HCM Control Delay (s)    | -      | -    | 13.5           | 0    | -      |      |        |      |      |      |      |      |
| HCM Lane LOS             | -      | -    | B              | A    | -      |      |        |      |      |      |      |      |
| HCM 95th %tile Q(veh)    | -      | -    | 1.4            | -    | -      |      |        |      |      |      |      |      |

| Intersection             |        |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
|--------------------------|--------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 0.3    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Movement                 | EBL    | EBR                                                                               | NBL                                                                               | NBT                                                                               | SBT                                                                               | SBR  |
| Lane Configurations      |        |  |  |  |  |      |
| Traffic Vol, veh/h       | 0      | 71                                                                                | 71                                                                                | 1744                                                                              | 624                                                                               | 0    |
| Future Vol, veh/h        | 0      | 71                                                                                | 71                                                                                | 1744                                                                              | 624                                                                               | 0    |
| Conflicting Peds, #/hr   | 0      | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0    |
| Sign Control             | Stop   | Stop                                                                              | Free                                                                              | Free                                                                              | Free                                                                              | Free |
| RT Channelized           | -      | Free                                                                              | -                                                                                 | None                                                                              | -                                                                                 | None |
| Storage Length           | -      | 0                                                                                 | 600                                                                               | -                                                                                 | -                                                                                 | -    |
| Veh in Median Storage, # | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Grade, %                 | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Peak Hour Factor         | 92     | 92                                                                                | 92                                                                                | 92                                                                                | 92                                                                                | 92   |
| Heavy Vehicles, %        | 0      | 5                                                                                 | 5                                                                                 | 2                                                                                 | 12                                                                                | 0    |
| Mvmt Flow                | 0      | 77                                                                                | 77                                                                                | 1896                                                                              | 678                                                                               | 0    |
| Major/Minor              | Minor2 | Major1                                                                            |                                                                                   | Major2                                                                            |                                                                                   |      |
| Conflicting Flow All     | -      | -                                                                                 | 678                                                                               | 0                                                                                 | -                                                                                 | 0    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy            | -      | -                                                                                 | 4.2                                                                               | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 1      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 2      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Follow-up Hdwy           | -      | -                                                                                 | 2.25                                                                              | -                                                                                 | -                                                                                 | -    |
| Pot Cap-1 Maneuver       | 0      | 0                                                                                 | 890                                                                               | -                                                                                 | -                                                                                 | 0    |
| Stage 1                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Stage 2                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Platoon blocked, %       |        |                                                                                   |                                                                                   | -                                                                                 | -                                                                                 |      |
| Mov Cap-1 Maneuver       | -      | -                                                                                 | 890                                                                               | -                                                                                 | -                                                                                 | -    |
| Mov Cap-2 Maneuver       | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Approach                 | EB     | NB                                                                                |                                                                                   | SB                                                                                |                                                                                   |      |
| HCM Control Delay, s     | 0      | 0.4                                                                               |                                                                                   | 0                                                                                 |                                                                                   |      |
| HCM LOS                  | A      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Minor Lane/Major Mvmt    | NBL    | NBT                                                                               | EBLn1                                                                             | SBT                                                                               |                                                                                   |      |
| Capacity (veh/h)         | 890    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.087  | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Control Delay (s)    | 9.4    | -                                                                                 | 0                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane LOS             | A      | -                                                                                 | A                                                                                 | -                                                                                 |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 0.3    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                   |               |                 |
|---------------------|-----------------------------------|---------------|-----------------|
| Analyst             | Whipple Consulting Engineers      | Date          | 03/05/2021      |
| Agency              | WSDOT                             | Analysis Year | 2026 AM w Proj. |
| Jurisdiction        | WSDOT                             | Time Analyzed | AM              |
| Project Description | 20-2564 Latah Glen - Thorpe N MUT | Units         | U.S. Customary  |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 900                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 624   | 71    |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 12.00 | 5.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.893 | 0.952 |
| Flow Rate (vi),pc/h                   | 760   | 81    |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.19  | 0.04  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.258 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.2  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 760   | Ramp Junction Speed (S), mi/h                 | 43.2  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 841   | Average Density (D), pc/mi/ln                 | 9.7   |
| Level of Service (LOS)                       | A     | Density in Ramp Influence Area (DR), pc/mi/ln | 6.4   |

| Intersection             |          |        |        |      |      |      |
|--------------------------|----------|--------|--------|------|------|------|
| Int Delay, s/veh         | 1.4      |        |        |      |      |      |
| Movement                 | WBL      | WBR    | NBT    | NBR  | SBL  | SBT  |
| Lane Configurations      |          | ↗      | ↗↗     |      | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0        | 130    | 1805   | 0    | 130  | 669  |
| Future Vol, veh/h        | 0        | 130    | 1805   | 0    | 130  | 669  |
| Conflicting Peds, #/hr   | 0        | 0      | 0      | 0    | 0    | 0    |
| Sign Control             | Stop     | Stop   | Free   | Free | Free | Free |
| RT Channelized           | -        | Free   | -      | None | -    | None |
| Storage Length           | -        | 0      | -      | -    | 600  | -    |
| Veh in Median Storage, # | 0        | -      | 0      | -    | -    | 0    |
| Grade, %                 | 0        | -      | 0      | -    | -    | 0    |
| Peak Hour Factor         | 92       | 92     | 92     | 92   | 92   | 92   |
| Heavy Vehicles, %        | 0        | 3      | 2      | 0    | 3    | 12   |
| Mvmt Flow                | 0        | 141    | 1962   | 0    | 141  | 727  |
| Major/Minor              | Minor1   | Major1 | Major2 |      |      |      |
| Conflicting Flow All     | -        | -      | 0      | -    | 1962 | 0    |
| Stage 1                  | -        | -      | -      | -    | -    | -    |
| Stage 2                  | -        | -      | -      | -    | -    | -    |
| Critical Hdwy            | -        | -      | -      | -    | 4.16 | -    |
| Critical Hdwy Stg 1      | -        | -      | -      | -    | -    | -    |
| Critical Hdwy Stg 2      | -        | -      | -      | -    | -    | -    |
| Follow-up Hdwy           | -        | -      | -      | -    | 2.23 | -    |
| Pot Cap-1 Maneuver       | 0        | 0      | -      | 0    | 289  | -    |
| Stage 1                  | 0        | 0      | -      | 0    | -    | -    |
| Stage 2                  | 0        | 0      | -      | 0    | -    | -    |
| Platoon blocked, %       |          |        | -      |      |      | -    |
| Mov Cap-1 Maneuver       | -        | -      | -      | -    | 289  | -    |
| Mov Cap-2 Maneuver       | -        | -      | -      | -    | -    | -    |
| Stage 1                  | -        | -      | -      | -    | -    | -    |
| Stage 2                  | -        | -      | -      | -    | -    | -    |
| Approach                 | WB       | NB     | SB     |      |      |      |
| HCM Control Delay, s     | 0        | 0      | 4.7    |      |      |      |
| HCM LOS                  | A        |        |        |      |      |      |
| Minor Lane/Major Mvmt    | NBTWBLn1 | SBL    | SBT    |      |      |      |
| Capacity (veh/h)         | -        | -      | 289    | -    |      |      |
| HCM Lane V/C Ratio       | -        | -      | 0.489  | -    |      |      |
| HCM Control Delay (s)    | -        | 0      | 28.8   | -    |      |      |
| HCM Lane LOS             | -        | A      | D      | -    |      |      |
| HCM 95th %tile Q(veh)    | -        | -      | 2.5    | -    |      |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                    |               |                 |
|---------------------|------------------------------------|---------------|-----------------|
| Analyst             | Whipple Consulting Engineers       | Date          | 03/05/2021      |
| Agency              | WSDOT                              | Analysis Year | 2026 AM w Proj. |
| Jurisdiction        | WSDOT                              | Time Analyzed | AM              |
| Project Description | 20-2564 Latah Glen - Thorpe S. MUT | Units         | U.S. Customary  |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 500                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 1805  | 130   |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 2.00  | 3.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.980 | 0.971 |
| Flow Rate (vi),pc/h                   | 2002  | 146   |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.48  | 0.07  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.314 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.1  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 2002  | Ramp Junction Speed (S), mi/h                 | 43.1  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 2148  | Average Density (D), pc/mi/ln                 | 24.9  |
| Level of Service (LOS)                       | B     | Density in Ramp Influence Area (DR), pc/mi/ln | 19.1  |



| Intersection             |        |          |       |        |      |      |
|--------------------------|--------|----------|-------|--------|------|------|
| Int Delay, s/veh         | 0.2    |          |       |        |      |      |
| Movement                 | WBL    | WBR      | NBT   | NBR    | SBL  | SBT  |
| Lane Configurations      |        | ↗        | ↗↗    | ↗      | ↗    | ↗↗   |
| Traffic Vol, veh/h       | 0      | 19       | 1260  | 4      | 12   | 644  |
| Future Vol, veh/h        | 0      | 19       | 1260  | 4      | 12   | 644  |
| Conflicting Peds, #/hr   | 0      | 0        | 0     | 0      | 0    | 0    |
| Sign Control             | Stop   | Stop     | Free  | Free   | Free | Free |
| RT Channelized           | -      | Stop     | -     | None   | -    | None |
| Storage Length           | -      | 0        | -     | 25     | 200  | -    |
| Veh in Median Storage, # | 1      | -        | 0     | -      | -    | 0    |
| Grade, %                 | 0      | -        | 0     | -      | -    | 0    |
| Peak Hour Factor         | 92     | 92       | 92    | 92     | 92   | 92   |
| Heavy Vehicles, %        | 17     | 17       | 2     | 2      | 9    | 9    |
| Mvmt Flow                | 0      | 21       | 1370  | 4      | 13   | 700  |
| Major/Minor              | Minor1 | Major1   |       | Major2 |      |      |
| Conflicting Flow All     | -      | 685      | 0     | 0      | 1374 | 0    |
| Stage 1                  | -      | -        | -     | -      | -    | -    |
| Stage 2                  | -      | -        | -     | -      | -    | -    |
| Critical Hdwy            | -      | 7.24     | -     | -      | 4.28 | -    |
| Critical Hdwy Stg 1      | -      | -        | -     | -      | -    | -    |
| Critical Hdwy Stg 2      | -      | -        | -     | -      | -    | -    |
| Follow-up Hdwy           | -      | 3.47     | -     | -      | 2.29 | -    |
| Pot Cap-1 Maneuver       | 0      | 357      | -     | -      | 460  | -    |
| Stage 1                  | 0      | -        | -     | -      | -    | -    |
| Stage 2                  | 0      | -        | -     | -      | -    | -    |
| Platoon blocked, %       | -      | -        | -     | -      | -    | -    |
| Mov Cap-1 Maneuver       | -      | 357      | -     | -      | 460  | -    |
| Mov Cap-2 Maneuver       | -      | -        | -     | -      | -    | -    |
| Stage 1                  | -      | -        | -     | -      | -    | -    |
| Stage 2                  | -      | -        | -     | -      | -    | -    |
| Approach                 | WB     | NB       |       | SB     |      |      |
| HCM Control Delay, s     | 15.7   | 0        |       | 0.2    |      |      |
| HCM LOS                  | C      |          |       |        |      |      |
| Minor Lane/Major Mvmt    | NBT    | NBRWBLn1 | SBL   | SBT    |      |      |
| Capacity (veh/h)         | -      | -        | 357   | 460    | -    |      |
| HCM Lane V/C Ratio       | -      | -        | 0.058 | 0.028  | -    |      |
| HCM Control Delay (s)    | -      | -        | 15.7  | 13.1   | -    |      |
| HCM Lane LOS             | -      | -        | C     | B      | -    |      |
| HCM 95th %tile Q(veh)    | -      | -        | 0.2   | 0.1    | -    |      |

| Intersection             |        |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
|--------------------------|--------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 0.6    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Movement                 | EBL    | EBR                                                                               | NBL                                                                               | NBT                                                                               | SBT                                                                               | SBR  |
| Lane Configurations      |        |  |  |  |  |      |
| Traffic Vol, veh/h       | 0      | 105                                                                               | 105                                                                               | 1175                                                                              | 553                                                                               | 0    |
| Future Vol, veh/h        | 0      | 105                                                                               | 105                                                                               | 1175                                                                              | 553                                                                               | 0    |
| Conflicting Peds, #/hr   | 0      | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0    |
| Sign Control             | Stop   | Stop                                                                              | Free                                                                              | Free                                                                              | Free                                                                              | Free |
| RT Channelized           | -      | Free                                                                              | -                                                                                 | None                                                                              | -                                                                                 | None |
| Storage Length           | -      | 0                                                                                 | 250                                                                               | -                                                                                 | -                                                                                 | -    |
| Veh in Median Storage, # | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Grade, %                 | 0      | -                                                                                 | -                                                                                 | 0                                                                                 | 0                                                                                 | -    |
| Peak Hour Factor         | 92     | 92                                                                                | 92                                                                                | 92                                                                                | 92                                                                                | 92   |
| Heavy Vehicles, %        | 2      | 2                                                                                 | 2                                                                                 | 2                                                                                 | 9                                                                                 | 9    |
| Mvmt Flow                | 0      | 114                                                                               | 114                                                                               | 1277                                                                              | 601                                                                               | 0    |
| Major/Minor              | Minor2 | Major1                                                                            |                                                                                   | Major2                                                                            |                                                                                   |      |
| Conflicting Flow All     | -      | -                                                                                 | 601                                                                               | 0                                                                                 | -                                                                                 | 0    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy            | -      | -                                                                                 | 4.14                                                                              | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 1      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Critical Hdwy Stg 2      | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Follow-up Hdwy           | -      | -                                                                                 | 2.22                                                                              | -                                                                                 | -                                                                                 | -    |
| Pot Cap-1 Maneuver       | 0      | 0                                                                                 | 972                                                                               | -                                                                                 | -                                                                                 | 0    |
| Stage 1                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Stage 2                  | 0      | 0                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | 0    |
| Platoon blocked, %       |        |                                                                                   |                                                                                   | -                                                                                 | -                                                                                 |      |
| Mov Cap-1 Maneuver       | -      | -                                                                                 | 972                                                                               | -                                                                                 | -                                                                                 | -    |
| Mov Cap-2 Maneuver       | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 1                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Stage 2                  | -      | -                                                                                 | -                                                                                 | -                                                                                 | -                                                                                 | -    |
| Approach                 | EB     | NB                                                                                |                                                                                   | SB                                                                                |                                                                                   |      |
| HCM Control Delay, s     | 0      | 0.8                                                                               |                                                                                   | 0                                                                                 |                                                                                   |      |
| HCM LOS                  | A      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |      |
| Minor Lane/Major Mvmt    | NBL    | NBT                                                                               | EBLn1                                                                             | SBT                                                                               |                                                                                   |      |
| Capacity (veh/h)         | 972    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.117  | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Control Delay (s)    | 9.2    | -                                                                                 | 0                                                                                 | -                                                                                 |                                                                                   |      |
| HCM Lane LOS             | A      | -                                                                                 | A                                                                                 | -                                                                                 |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 0.4    | -                                                                                 | -                                                                                 | -                                                                                 |                                                                                   |      |

# HCS7 Freeway Merge Report

## Project Information

|                     |                                       |               |                 |
|---------------------|---------------------------------------|---------------|-----------------|
| Analyst             | Whipple Consulting Engineers          | Date          | 03/05/2021      |
| Agency              | WSDOT                                 | Analysis Year | 2026 AM w Proj. |
| Jurisdiction        | WSDOT                                 | Time Analyzed | AM              |
| Project Description | 20-2564 Latah Glen - Meadowlane N MUT | Units         | U.S. Customary  |

## Geometric Data

|                                                  |         |                      |
|--------------------------------------------------|---------|----------------------|
|                                                  | Freeway | Ramp                 |
| Number of Lanes (N), ln                          | 2       | 1                    |
| Free-Flow Speed (FFS), mi/h                      | 43.6    | 40.0                 |
| Segment Length (L) / Acceleration Length (LA),ft | 1500    | 500                  |
| Terrain Type                                     | Level   | Level                |
| Percent Grade, %                                 | -       | -                    |
| Segment Type / Ramp Type                         | Freeway | Right-Sided One-Lane |

## Adjustment Factors

|                                        |                    |                    |
|----------------------------------------|--------------------|--------------------|
| Driver Population                      | All Familiar       | All Familiar       |
| Weather Type                           | Non-Severe Weather | Non-Severe Weather |
| Incident Type                          | No Incident        | -                  |
| Final Speed Adjustment Factor (SAF)    | 1.000              | 1.000              |
| Final Capacity Adjustment Factor (CAF) | 1.000              | 1.000              |
| Demand Adjustment Factor (DAF)         | 1.000              | 1.000              |

## Demand and Capacity

|                                       |       |       |
|---------------------------------------|-------|-------|
| Demand Volume (Vi)                    | 553   | 105   |
| Peak Hour Factor (PHF)                | 0.92  | 0.92  |
| Total Trucks, %                       | 9.00  | 2.00  |
| Single-Unit Trucks (SUT), %           | -     | -     |
| Tractor-Trailers (TT), %              | -     | -     |
| Heavy Vehicle Adjustment Factor (fHV) | 0.917 | 0.980 |
| Flow Rate (vi),pc/h                   | 655   | 116   |
| Capacity (c), pc/h                    | 4500  | 2000  |
| Volume-to-Capacity Ratio (v/c)        | 0.17  | 0.06  |

## Speed and Density

|                                              |       |                                               |       |
|----------------------------------------------|-------|-----------------------------------------------|-------|
| Upstream Equilibrium Distance (LEQ), ft      | -     | Number of Outer Lanes on Freeway (NO)         | 0     |
| Distance to Upstream Ramp (LUP), ft          | -     | Speed Index (MS)                              | 0.289 |
| Downstream Equilibrium Distance (LEQ), ft    | -     | Flow Outer Lanes (VOA), pc/h/ln               | -     |
| Distance to Downstream Ramp (LDOWN), ft      | -     | On-Ramp Influence Area Speed (SR), mi/h       | 43.1  |
| Prop. Freeway Vehicles in Lane 1 and 2 (PFM) | 1.000 | Outer Lanes Freeway Speed (SO), mi/h          | 43.6  |
| Flow in Lanes 1 and 2 (v12), pc/h            | 655   | Ramp Junction Speed (S), mi/h                 | 43.1  |
| Flow Entering Ramp-Infl. Area (vR12), pc/h   | 771   | Average Density (D), pc/mi/ln                 | 8.9   |
| Level of Service (LOS)                       | A     | Density in Ramp Influence Area (DR), pc/mi/ln | 8.4   |

| Intersection             |                                                                                   |                                                                                   |        |       |                                                                                   |      |
|--------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------|-------|-----------------------------------------------------------------------------------|------|
| Int Delay, s/veh         | 6.9                                                                               |                                                                                   |        |       |                                                                                   |      |
| Movement                 | EBL                                                                               | EBR                                                                               | NBL    | NBT   | SBT                                                                               | SBR  |
| Lane Configurations      |  |  |        |       |  |      |
| Traffic Vol, veh/h       | 238                                                                               | 124                                                                               | 0      | 0     | 523                                                                               | 0    |
| Future Vol, veh/h        | 238                                                                               | 124                                                                               | 0      | 0     | 523                                                                               | 0    |
| Conflicting Peds, #/hr   | 0                                                                                 | 0                                                                                 | 0      | 0     | 0                                                                                 | 0    |
| Sign Control             | Stop                                                                              | Stop                                                                              | Free   | Free  | Free                                                                              | Free |
| RT Channelized           | -                                                                                 | None                                                                              | -      | None  | -                                                                                 | None |
| Storage Length           | 0                                                                                 | 0                                                                                 | -      | -     | -                                                                                 | -    |
| Veh in Median Storage, # | 2                                                                                 | -                                                                                 | -      | 16979 | 0                                                                                 | -    |
| Grade, %                 | 0                                                                                 | -                                                                                 | -      | 0     | 0                                                                                 | -    |
| Peak Hour Factor         | 92                                                                                | 92                                                                                | 92     | 92    | 92                                                                                | 92   |
| Heavy Vehicles, %        | 3                                                                                 | 3                                                                                 | 2      | 2     | 9                                                                                 | 9    |
| Mvmt Flow                | 259                                                                               | 135                                                                               | 0      | 0     | 568                                                                               | 0    |
| Major/Minor              | Minor2                                                                            |                                                                                   | Major2 |       |                                                                                   |      |
| Conflicting Flow All     | 568                                                                               | 284                                                                               |        |       |                                                                                   |      |
| Stage 1                  | 568                                                                               | -                                                                                 |        |       |                                                                                   |      |
| Stage 2                  | 0                                                                                 | -                                                                                 |        |       |                                                                                   |      |
| Critical Hdwy            | 6.86                                                                              | 6.96                                                                              |        |       |                                                                                   |      |
| Critical Hdwy Stg 1      | 5.86                                                                              | -                                                                                 |        |       |                                                                                   |      |
| Critical Hdwy Stg 2      | -                                                                                 | -                                                                                 |        |       |                                                                                   |      |
| Follow-up Hdwy           | 3.53                                                                              | 3.33                                                                              |        |       |                                                                                   |      |
| Pot Cap-1 Maneuver       | 451                                                                               | 710                                                                               |        |       |                                                                                   |      |
| Stage 1                  | 528                                                                               | -                                                                                 |        |       |                                                                                   |      |
| Stage 2                  | -                                                                                 | -                                                                                 |        |       |                                                                                   |      |
| Platoon blocked, %       |                                                                                   |                                                                                   |        |       |                                                                                   |      |
| Mov Cap-1 Maneuver       | 451                                                                               | 710                                                                               |        |       |                                                                                   |      |
| Mov Cap-2 Maneuver       | 499                                                                               | -                                                                                 |        |       |                                                                                   |      |
| Stage 1                  | 528                                                                               | -                                                                                 |        |       |                                                                                   |      |
| Stage 2                  | -                                                                                 | -                                                                                 |        |       |                                                                                   |      |
| Approach                 | EB                                                                                |                                                                                   | SB     |       |                                                                                   |      |
| HCM Control Delay, s     | 16.8                                                                              |                                                                                   | 0      |       |                                                                                   |      |
| HCM LOS                  | C                                                                                 |                                                                                   |        |       |                                                                                   |      |
| Minor Lane/Major Mvmt    | EBLn1                                                                             | EBLn2                                                                             | SBT    |       |                                                                                   |      |
| Capacity (veh/h)         | 499                                                                               | 710                                                                               |        |       |                                                                                   |      |
| HCM Lane V/C Ratio       | 0.518                                                                             | 0.19                                                                              |        |       |                                                                                   |      |
| HCM Control Delay (s)    | 19.7                                                                              | 11.3                                                                              |        |       |                                                                                   |      |
| HCM Lane LOS             | C                                                                                 | B                                                                                 |        |       |                                                                                   |      |
| HCM 95th %tile Q(veh)    | 2.9                                                                               | 0.7                                                                               |        |       |                                                                                   |      |