Attachment 1

# Preliminary Analysis of Speed Limit Changes in Eastern Oregon

## Final Report

by

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# 1 INTRODUCTION

This report is the third in a series of reports examining issues in Oregon related to changes in posted speed limits. In 2004, a comprehensive report, "*Impacts and Issues Related to Proposed Changes in Oregon's Interstate Speed Limits*[1]," was prepared. An update to the most important literature in the report was updated in 2017's "*Update to Issues Report for Interstate Speed Changes*[2]." Readers are referred to these reports for a review of the scientific literature related to changing speed limits (focused on interstates).

This report is the summary of a preliminary analysis of the speed and crash performance changes for Oregon highways and interstates where speed limits were increased by the Oregon legislature effective March 1, 2016. This action raised speed maximum speed limits for cars and trucks on approximately 1,400 miles of highways and interstates in Eastern Oregon. Posted speed limits were increased to 70 mph (cars) and 65 mph (trucks) and 65 mph (cars) and 55 mph (trucks). The corridors (starting from (2) to match the numbering in Section 1 in ORS 811.111) are listed below and shown in Figure 1-1:

- 2) Interstate 84 beginning at the eastern city limit of The Dalles and ending at the Idaho state line
    - Sixty-five miles per hour for trucks; (b) Seventy miles per hour for all other vehicles.
- 3) State Highway 95 beginning at the Idaho state line and ending at the Nevada state line
    - Sixty-five miles per hour for trucks; (b) Seventy miles per hour for all other vehicles.
- (4) State Highway 20 beginning in Bend and ending in Ontario
    - Sixty miles per hour for trucks; (b) Sixty-five miles per hour for all other vehicles.
- (5) State Highway 197 beginning in The Dalles and ending at its intersection with State Highway 97 and the portion of State Highway 97 beginning at its intersection with State Highway 197 and ending at the California state line
    - Sixty miles per hour for trucks; (b) Sixty-five miles per hour for all other vehicles.
- (6) State Highway 31 beginning in Valley Falls and ending in La Pine
    - Sixty miles per hour for trucks; (b) Sixty-five miles per hour for all other vehicles.
- (7) State Highway 78 beginning in Burns Junction and ending in Burns
    - Sixty miles per hour for trucks; (b) Sixty-five miles per hour for all other vehicles.
- (8) State Highway 395 beginning in Burns and ending in John Day
    - Sixty miles per hour for trucks; (b) Sixty-five miles per hour for all other vehicles.
- (9) State Highway 395 beginning in Riley and ending at the California state line
    - Sixty miles per hour for trucks; (b) Sixty-five miles per hour for all other vehicles.
- (10) Oregon Route 205 beginning in Burns and ending in Frenchglen
    - Sixty miles per hour for trucks; (b) Sixty-five miles per hour for all other vehicles.
- (11) State Highway 26 beginning in John Day and ending in Vale
    - Sixty miles per hour for trucks; (b) Sixty-five miles per hour for all other vehicles.
- (12) Interstate 82 beginning at the Washington state line and ending at its intersection with Interstate 84
    - Sixty-five miles per hour for trucks; (b) Seventy miles per hour for all other vehicles.

[1] Download at https://works.bepress.com/christopher_monsere/2/
[2] Download at https://works.bepress.com/christopher_monsere/80/

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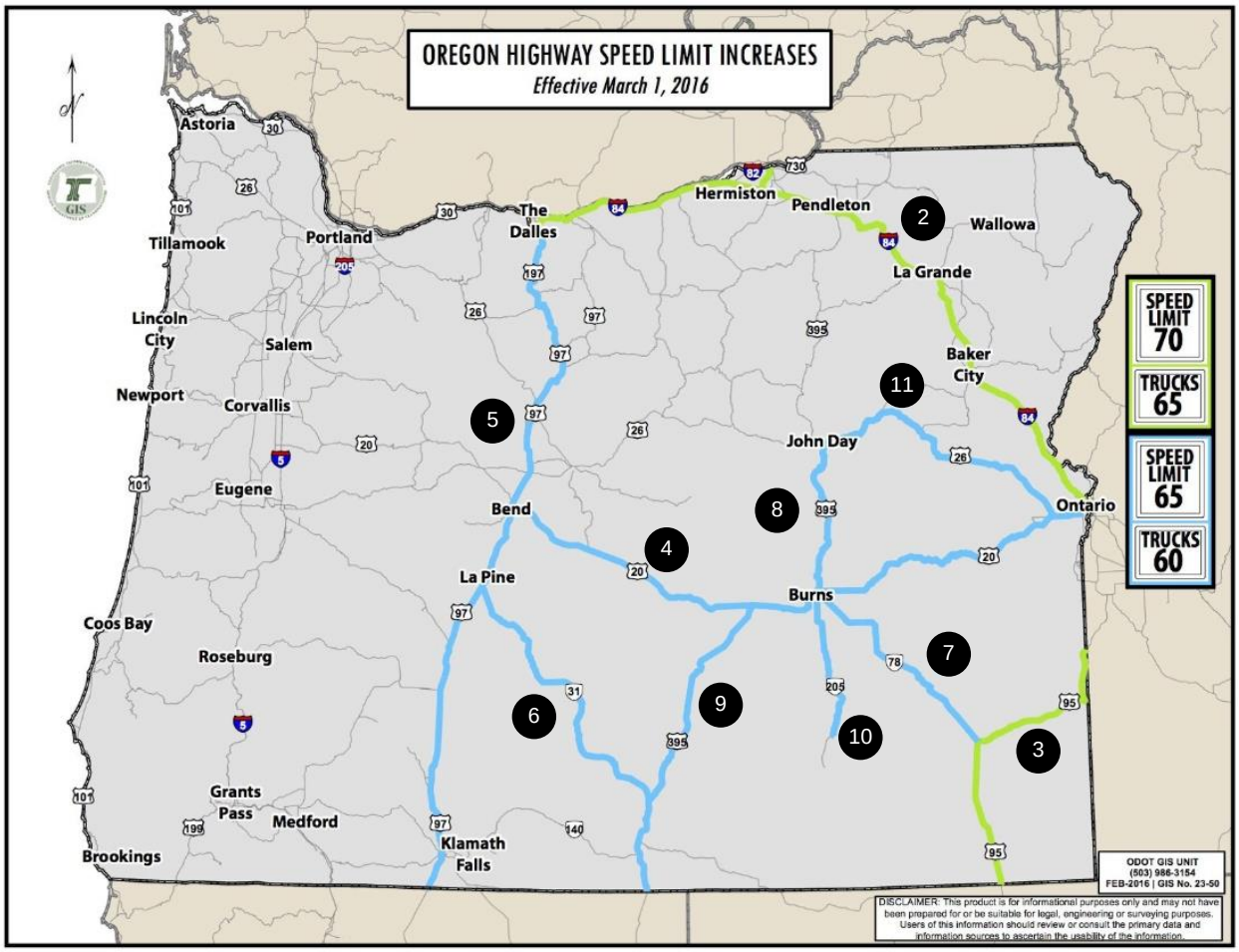



**Figure 1-1 Map of Corridors of Speed Change**

Following an engineering analysis, ODOT lowered speeds to 55 mph for vehicles / 55 mph for trucks in the following sections of the increased speed limit corridors:

- US 97 – Dover Lane to Lower Bridge -- MP 98.6 to 115 (Madras to Terrebonne)
- US 20 – Dalton Street to Dodds Road -- MP 3.17 to 9.19 (east of Bend)
- US 97 – 6th Street to Masten Road -- MP 168.8 to 169.87 (south of LaPine)
- US 20 Hawley Loop to Olds Ferry-Ontario -- MP 246.84 to 258.20 (Vale to Cairo)

# 2 DATA AND METHODS

The preliminary analysis compares the changes in speed, volume and safety performance for the sections of highway where the speed limits were increased. To provide a benchmark for comparison of the corridors where the speeds were increased, a set of highways were chosen where the speeds were not changed as control sections and the same analysis was conducted. Approximately 12 months of crash data were available at the time of this report after the speed change was enacted (through the first two months of 2017). The early 2017 data are considered preliminary and subject to change. More data are available for the speed analysis covering January 2015 through March 2018.

## 2.1 Speed and Volume Data from ATR stations

The Oregon DOT maintains a robust network of permanent traffic counting stations. These stations continuously record vehicle presence and speed and, depending on the type of station, vehicle axle counts so that vehicle classifications can be done. Not all of the stations provide speed records. PSU selected ATR stations that reported speed on the sections of highways where the speed limits were increased and on a set of highways sections that could be used as control sections. ODOT provided monthly summary files for theses ATRs from January 2015 to March 2018. Figure 1-1 shows a sample of the ATR monthly summary reports. In compiling the data, ODOT staff noted any irregularities in the data for possible issues with construction, data power outages or other issues. These notes are included in the Appendix.

The ATR report includes the counts of vehicles observed by hour of the day in each speed bin and a total count of vehicles for the month. The monthly speed reports average all directions, lanes and vehicle type (automobiles and trucks). Since trucks have lower speed limits and some stations have a high percentage of truck traffic, the ATR speed data might be biased/weighted with lower speed trucks.

To compile the data, PSU wrote a script to extract the total vehicle counts in each speed bin by month from over 400 monthly data files (the “Grand Total” row in the figure). The ATR monthly reports have a known bug that the average speed reported on the report is not accurate (always reads 68.6 mph).

**Speed Grand Totals (Direction: Combined)**
**Transportation Development Division**

| | | | |
|---|---|---|---|
| Site Number | 9003 | Date | 1/1/2017-1/31/2017 |
| Site Name | Lava Butte (09-003) | Highway # | 004 |
| County | Deschutes | City | Bend |
| Mile Point | 142.41 | Location | 0.17 mile south of China Ha |

| MPH | | Hourly Averages | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Total** | **0-40** | **40-45** | **45-50** | **50-55** | **55-60** | **60-65** | **65-70** | **70-75** | **75-77** | **77-80** | **80-85** | **85-90** | **90+** |
| **0:00** | 98 | 11 | 12 | 19 | 25 | 19 | 8 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| **1:00** | 68 | 9 | 9 | 12 | 17 | 13 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| **2:00** | 61 | 8 | 7 | 11 | 16 | 11 | 6 | 2 | 0 | 0 | 0 | 0 | | |
| **3:00** | 72 | 8 | 10 | 13 | 17 | 13 | 7 | 3 | 1 | 0 | 0 | 0 | 0 | |
| **4:00** | 128 | 12 | 17 | 24 | 34 | 23 | 12 | 5 | 1 | 0 | 0 | 0 | 0 | |
| **5:00** | 259 | 20 | 36 | 49 | 68 | 48 | 25 | 11 | 2 | 0 | 0 | 0 | | |
| **6:00** | 603 | 55 | 87 | 116 | 165 | 114 | 47 | 16 | 3 | 0 | 0 | 0 | 0 | 0 |
| **7:00** | 993 | 74 | 124 | 172 | 269 | 204 | 100 | 42 | 7 | 1 | 0 | 0 | 0 | 0 |
| **8:00** | 975 | 67 | 100 | 161 | 264 | 216 | 113 | 45 | 8 | 1 | 0 | 0 | 0 | 0 |
| **9:00** | 1022 | 70 | 112 | 167 | 273 | 221 | 118 | 49 | 9 | 1 | 1 | 1 | 0 | 0 |
| **10:00** | 1120 | 95 | 112 | 164 | 276 | 252 | 146 | 61 | 12 | 1 | 1 | 0 | 0 | 0 |
| **11:00** | 1231 | 102 | 116 | 164 | 290 | 282 | 177 | 81 | 16 | 2 | 1 | 0 | 0 | |
| **12:00** | 1240 | 94 | 109 | 153 | 294 | 296 | 188 | 84 | 18 | 2 | 1 | 1 | 0 | 0 |
| **13:00** | 1261 | 72 | 100 | 150 | 298 | 323 | 203 | 90 | 21 | 2 | 1 | 1 | 0 | 0 |
| **14:00** | 1292 | 84 | 90 | 148 | 304 | 330 | 211 | 98 | 22 | 2 | 2 | 1 | 0 | 0 |
| **15:00** | 1412 | 94 | 105 | 163 | 319 | 352 | 235 | 114 | 25 | 3 | 1 | 1 | 0 | 0 |
| **16:00** | 1464 | 122 | 119 | 182 | 329 | 353 | 228 | 106 | 21 | 2 | 1 | 1 | 0 | 0 |
| **17:00** | 1350 | 151 | 151 | 215 | 326 | 275 | 153 | 64 | 12 | 1 | 1 | 1 | 0 | 0 |
| **18:00** | 925 | 94 | 120 | 171 | 242 | 172 | 86 | 33 | 6 | 1 | 0 | 0 | 0 | 0 |
| **19:00** | 606 | 57 | 77 | 112 | 158 | 118 | 57 | 22 | 5 | 0 | 0 | 0 | | 0 |
| **20:00** | 468 | 41 | 54 | 87 | 127 | 92 | 45 | 18 | 4 | 0 | 0 | 0 | | 0 |
| **21:00** | 356 | 32 | 43 | 68 | 96 | 68 | 34 | 12 | 3 | 0 | 0 | 0 | 0 | 0 |
| **22:00** | 235 | 20 | 30 | 47 | 63 | 43 | 22 | 8 | 2 | 0 | 0 | 0 | 0 | 0 |
| **23:00** | 160 | 18 | 21 | 30 | 40 | 28 | 15 | 6 | 2 | 0 | 0 | 0 | 0 | 0 |
| **ADT** | 17399 | 1410 | 1761 | 2598 | 4310 | 3866 | 2241 | 975 | 202 | 19 | 10 | 7 | 0 | 0 |
| **Grand Tot** | 539546 | 43593 | 54652 | 80607 | 133534 | 119831 | 69502 | 30130 | 6310 | 630 | 376 | 263 | 57 | 61 |
| **% of Total** | | 8.08% | 10.13% | 14.94% | 24.75% | 22.21% | 12.88% | 5.58% | 1.17% | 0.12% | 0.07% | 0.05% | 0.01% | 0.01% |

| **Percentile Speeds** | 10% | 15% | 50% | 85% | 90% |
|---|---|---|---|---|---|
| (mph) | 40.9 | 43.4 | 53.4 | 61.9 | 63.8 |

| **10 mph Pace Speed** | 50 - 60 |
|---|---|
| Number in Pace | 253365 |
| % of Total | 47.00% |

| | |
|---|---|
| **Average Speed (mph)** | 68.6 |
| **Minimum Speed (mph)** | 20 |
| **Maximum Speed (mph)** | 145 |

| **Speeds Exceeded** | 45 mph | 55 mph | 65 mph |
|---|---|---|---|
| % of Total | 81.80% | 42.10% | 7.00% |
| Count | 441301 | 227160 | 37827 |

**Figure 2-1 Sample ATR Station Report, Lave Butte January 2017**

The data ATR files contained two types of speed bins as shown in Table 2-1. To calculate the estimated monthly average speed for each ATR, the number of vehicles in the speed bin ($n_{bin}$) was multiplied by the speed bins' midpoint assumed speed ($s_{bin}$). These calculations were summed for all bins and then divided by the total number of vehicles ($n_{total}$) to obtain an estimated monthly average speed as in the following equation:

$$Estimated\ Average\ Speed = \frac{\sum_{i=0}^{bin} n_{\ bin}(s_{bin})}{n_{total}}$$

**Table 2-1 Bin Speeds Used for Calculating Average Speed**

| Bin | Midpt Speed $s_{bin}$ | Bin | Midpt Speed $s_{bin}$ |
|---|---|---|---|
| 0-40 | 35 | 0-20 | 18.0 |
| 40-45 | 42.5 | 20-25 | 22.5 |
| 45-50 | 47.5 | 25-30 | 27.5 |
| 50-55 | 52.5 | 30-35 | 32.5 |
| 55-60 | 57.5 | 35-40 | 37.5 |
| 60-65 | 62.5 | 40-45 | 42.5 |
| 65-70 | 67.5 | 45-50 | 47.5 |
| 70-75 | 72.5 | 50-55 | 52.5 |
| 75-77 | 77.5 | 55-60 | 57.5 |
| 77-80 | 78 | 60-65 | 62.5 |
| 80-85 | 82.5 | 65-70 | 67.5 |
| 85-90 | 87.5 | 70-75 | 72.5 |
| 90+ | 92 | 75+ | 77.5 |

### 2.1.1 Control Locations

A total of 17 ATR locations were chosen as control locations. Table 2-2 shows the ATRs that were selected and current speed at the station, the location, the current AADT and the percentage of trucks in the traffic. Figure 2-2 includes a map of the stations by ATR number. Control locations are shown as black rectangles. Stations were chosen on I-84 west of The Dalles at Rowena (33-001) and Cascade Locks (14-004) as well as I-5 at Wilsonville (03-011), North Albany (22-016) and Lake Creek (22-016) for comparison to the interstate speed change segments on I-84 east of The Dalles to Idaho and I-82. The remaining control stations include most of the speed reporting ATRs in Eastern Oregon on highways where the speeds were not increased. A further set of locations was chosen on highways that most closely resemble the primary highways where speeds were increased, including OR-58 near Oakridge (20-107), US-26 near Rhododendron (03-006), and US-20 near Black Butte (09-014). In addition, two stations were selected on US-97 in 45 mph speed zones to explore the effect of any carryover speeds in Madras (16-002) and North Redmond (09-023) from the increase in speeds on US-97.

**Table 2-2 ATR in Control Segments**

| ATR | Name | Speed | Location | MP | AADT | Pct Trucks |
|---|---|---|---|---|---|---|
| 01-001 | North Powder | 55 | LA GRANDE-BAKER HWY. NO. 66 | 37.7 | 860 | 26.9 |
| 03-006 | Rhododendron | 55 | MT. HOOD HWY. NO. 26 | 46.38 | 10,100 | 16.3 |
| 03-011 | Wilsonville | 65 | PACIFIC HWY. NO. 1 | 281.2 | 95,300 | 9.49 |
| 09-003 | Lava Butte | 55 | THE DALLES-CALIFORNIA HWY. NO. 4 | 142.41 | 25,100 | 7.59 |
| 09-014 | Sisters | 55 | SANTIAM HWY. NO. 16 | 93.12 | 9,100 | 22.84 |
| 09-023 | North Redmond | 45 | THE DALLES-CALIFORNIA HWY. NO. 4 | 119.09 | 22,400 | 14.66 |
| 11-007 | Shutler | 55 | JOHN DAY HWY. NO. 5 | 6.81 | 690 | 43.93 |
| 12-003 | Dayville | 55 | JOHN DAY HWY. NO. 5 | 131.4 | 960 | 29.1 |
| 14-004 | Cascade Locks | 65 | COLUMBIA RIVER HWY. NO. 2 | 45.53 | 24,200 | 31.45 |
| 15-013 | Shady Cove | 55 | CRATER LAKE HWY. NO. 22 | 15.46 | 8,400 | 10.44 |
| 16-002 | Madras | 45 | THE DALLES-CALIFORNIA HWY. NO. 4 | 97.11 | 14,700 | 19.45 |
| 20-005 | Noti | 55 | FLORENCE-EUGENE HWY. NO. 62 | 43.86 | 6,400 | 17.34 |
| 20-017 | Oakridge | 55 | WILLAMETTE HWY. NO. 18 | 37.36 | 3,100 | 43.54 |
| 22-005 | North Albany | 65 | PACIFIC HWY. NO. 1 | 234.8 | 66,600 | 23.65 |
| 22-016 | Lake Creek | 65 | PACIFIC HWY. NO. 1 | 214.56 | 41,700 | 23.65 |
| 25-007 | Lexington | 55 | HEPPNER HWY. NO. 52 | 37.83 | 1,400 | 18.08 |
| 30-021 | Milton | 55 | OREGON-WASHINGTON HWY. NO. 8 | 34.46 | 15,400 | 6.3 |
| 33-001 | Rowena | 65 | COLUMBIA RIVER HWY. NO. 2 | 75.93 | 23,400 | 25.27 |

### 2.1.2 Increased Speed Limit Segments

A total of 17 ATR locations were chosen to measure the speed change locations. Table 2-3 shows the ATRs that were selected (Figure 2-2). Speed increase locations are shown as pink circles. The table shows the current speed at the station, the location, the current AADT and the percentage of trucks. A total of six stations were selected on I-84 (01-013 at South Baker, 23-016 at Huntington, 25-008 at Boardman Junction, 28-002 at Rufus, 30-004 at Pendleton, and 31-007 at North La Grande) and one station on I-82 (30-025 at Umatilla Bridge) where the speeds were increased to 70 mph. No ATRs were located on US-95, a two-lane highway where speeds were increased to 70 mph. Four stations were located on US-97 at 09-020 Redmond, 18-019 at Midland, 18-022 at Modoc Point, and 33-005 at Dufur). The remaining stations are in the two-lane highway sections where speeds were increased to 65 mph.

**Table 2-3 ATR Locations in Increased Speed Limit Sections**

| ATR | Name | Speed | Location | MP | AADT | Pct Trucks |
|---|---|---|---|---|---|---|
| 01-013 | South Baker | 70 | OLD OREGON TRAIL NO. 6 | 309.02 | 9,900 | 40.63 |
| 09-005 | Pilot Butte | 65 | CENTRAL OREGON HWY. NO. 7 | 6.28 | 3,000 | 26.53 |
| 09-020 | Redmond | 65 | THE DALLES-CALIFORNIA HWY. NO. 4 | 124.39 | 33,700 | 10.21 |
| 12-009 | Prairie City[2] | 65 | JOHN DAY HWY. NO. 5 | 175.79 | 930 | 26.72 |
| 13-001 | Burns | 65 | JOHN DAY-BURNS HWY. NO. 48 | 66.3 | 510 | 30.81 |
| 13-007 | Steens | 65 | STEENS HWY. NO. 442 | 1.7 | 1,600 | 30.12 |
| 18-019 | Midland | 65 | THE DALLES-CALIFORNIA HWY. NO. 4 | 289.44 | 4,300 | 40.01 |
| 18-022 | Modoc Point | 65 | THE DALLES-CALIFORNIA HWY. NO. 4 | 254.3 | 6,300 | 30.25 |
| 19-008 | New Pine Creek[2] | 65 | FREMONT HWY. NO. 19 | 157.43 | 860 | 28.77 |
| 23-006 | Cairo Junction[2] | 65 | CENTRAL OREGON HWY. NO. 7 | 257.86 | 5,300 | 19.68 |
| 23-016 | Huntington | 70 | OLD OREGON TRAIL NO. 6 | 353.47 | 10,400 | 40.63 |
| 25-008 | Boardman Jct | 70 | OLD OREGON TRAIL NO. 6 | 168.55 | 16,900 | 25.96 |
| 28-002 | Rufus | 70 | COLUMBIA RIVER HWY. NO. 2 | 109.51 | 13,000 | 33.71 |
| 30-004 | Pendleton | 70 | OLD OREGON TRAIL NO. 6 | 203.34 | 16,600 | 32.34 |
| 30-025 | Umatilla Bridge[1] | 70 | McNARY HWY. NO. 70 | 0.58 | 21,700 | 25.13 |
| 31-007 | North La Grande | 70 | OLD OREGON TRAIL NO. 6 | 260.12 | 10,100 | 48.49 |
| 33-005 | Dufur | 65 | THE DALLES-CALIFORNIA HWY. NO. 4 | 10.3 | 2,800 | 15.26 |

[1] Construction and outages required the station be removed from analysis
[2] Stations are in location where speeds where speeds are lower

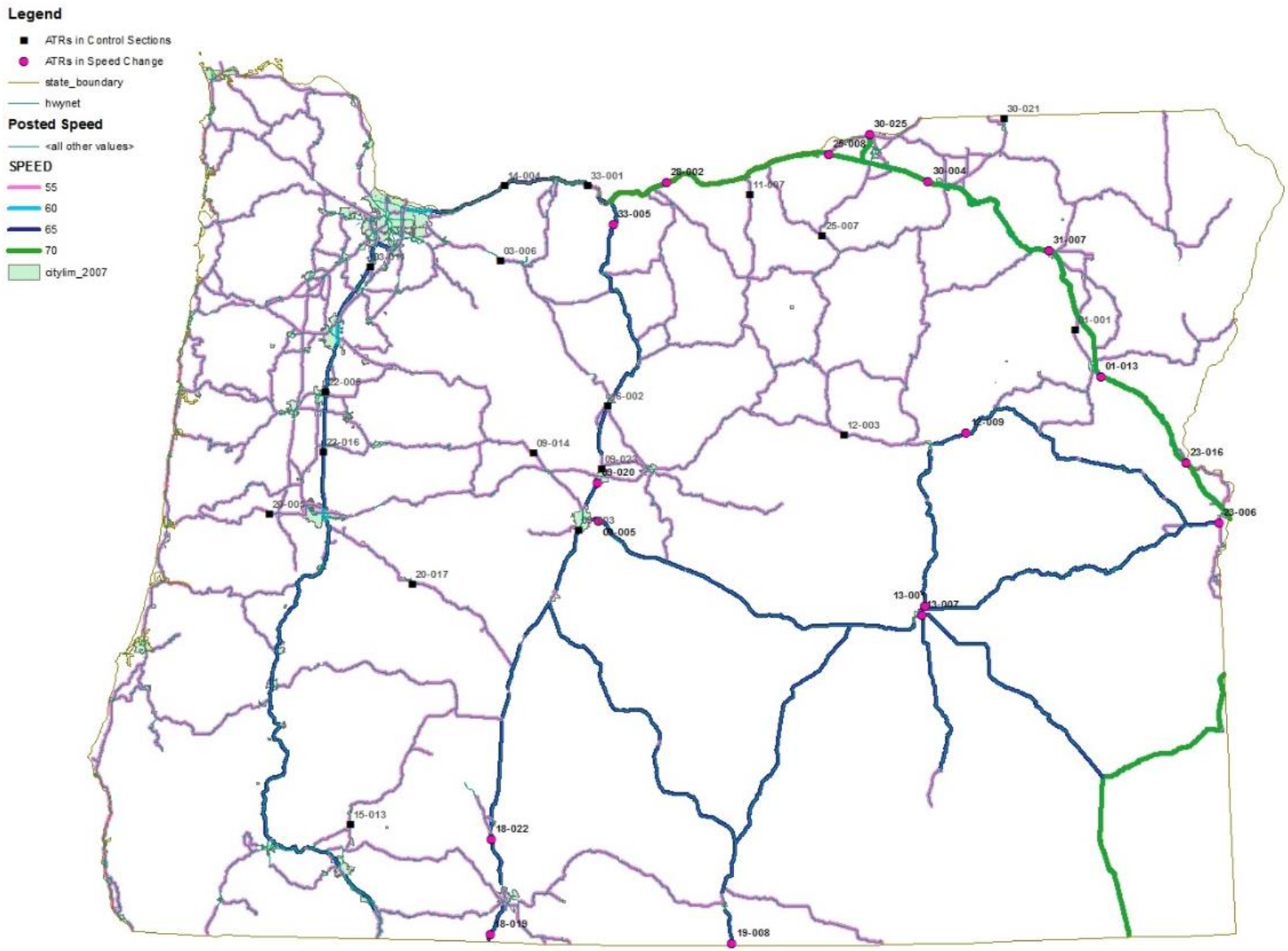



**Figure 2-2 Map of ATR Locations Used in Speed Analysis**

## 2.2 HERE Speed Data Assessment

One task in this analysis was to assess the validity and potential use of HERE probe data in locations where ATRs are not present for future analysis. PSU requested from ODOT HERE data in locations represented by the ATR stations. The HERE data consists of two files, one for automobiles (i.e., passenger vehicles) and one for heavy vehicles (i.e., a truck with a gross vehicle weight rating of greater than 10,000 pounds). The analysis of these probe speed records is included in Appendix B.

## 2.3 Crash Performance

Crashes were queried from historical DECODE databases that are provided to PSU as part of the annual distribution of crash data by ODOT's Crash Analysis and Reporting Unit. A query was constructed to extract all crashes that occurred on the mainline (ramps and connections were excluded) between the mileposts for each of the segments identified in Table 2-4 and Table 2-5. These crash records were analyzed for total, fatal and injury A crashes, and proportions of crash types. Truck-involved crashes were defined as those where a truck was one of the vehicles involved in the crash. These include vehicle type 2 - truck tractor with no trailers (bobtail); type 4 - truck tractor with trailer/mobile home in tow; and type 5 - truck with non-detachable bed, panel, etc. Starting in 2016, PDO crashes did not record vehicle type.

It should be noted that in the DECODE snapshots that are released annually it is possible that there are small differences between the official 10-year database maintained by ODOT, as errors are sometimes corrected in the master file after the publication of the annual snapshot. However, it is expected that these differences are minor. The most recent data for 2017 was also provided to PSU for January and February. These data are considered preliminary by ODOT (unofficial) and are subject to change.

### 2.3.1 Control Segments

To compare crash trends to highways without a speed change, a set of control highway segments was selected. Using the ODOT Speed Limit GIS layer, the sections of highway where the speeds were not changed. Sections of lower posted speed limits through cities, towns or congested areas were excluded. A total of 691.17 miles of highway was selected for comparison. For the interstates, segment 1 on I-84 from east of Portland to The Dalles and segment 11 on I-5 from Wilsonville to the north of Eugene were selected. It is worth noting that the interstate speed limits were raised to 60 mph for trucks in late 2017 which is not explicitly accounted for in the speed analysis. To the extent possible, sections were selected based on their representation as higher-volume, higher-speed, two-lane highways such as US-26 (segment 3), US-20 (segment 6), OR-58 (segment 5), and OR-126 (segments 7 and 10). The remaining sections were selected as the best comparison in Eastern Oregon where speeds were not increased such as OR-19 (segment 8), OR-3 (segment 9), and OR-140 (segment 12). Because these Eastern Oregon highways were not selected by the legislature for increased speeds, it is clear that they are not necessarily an ideal comparison but best represent the lower-volume speed change highways.

**Table 2-4 Control Segments for Crash Analysis**

| Control Segment | Route | Trks[1] | Pass | Highway | Hwy | BMP | EMP | Length |
|---|---|---|---|---|---|---|---|---|
| C-1 | I-84 | 55 | 65 | COLUMBIA RIVER | 002 | 18.25 | 87 | 68.75 |
| C-2 | OR-11 | 55 | 55 | OREGON-WASHINGTON | 008 | 17.8 | 26.59 | 8.79 |
| | OR-11 | 55 | 55 | OREGON-WASHINGTON | 008 | 0.52 | 16.15 | 15.63 |
| C-3 | US-26 | 55 | 55 | OCHOCO | 041 | 20.75 | 65.68 | 44.93 |
| | US-26 | 55 | 55 | OCHOCO | 041 | 66.88 | 98.36 | 31.48 |
| | US-26 | 55 | 55 | JOHN DAY | 005 | 123.98 | 160.28 | 36.3 |
| C-4 | US-26 | 55 | 55 | WARM SPRINGS | 053 | 72 | 102.83 | 30.83 |
| | US-26 | 55 | 55 | WARM SPRINGS | 053 | 105.64 | 115.81 | 10.17 |
| C-5 | OR-58 | 55 | 55 | WILLAMETTE | 018 | 5.8 | 33.94 | 28.14 |
| | OR-58 | 55 | 55 | WILLAMETTE | 018 | 36.49 | 86.45 | 49.96 |
| C-6 | US-20 | 55 | 55 | SANTIAM | 016 | 88.2 | 99.53 | 11.33 |
| | US-20 | 55 | 55 | MCKENZIE-BEND | 017 | 0.37 | 14.47 | 14.1 |
| C-7 | OR-126 | 55 | 55 | MCKENZIE | 015 | 93.38 | 110.14 | 16.76 |
| C-8 | OR-19 | 55 | 55 | JOHN DAY | 005 | 1.3 | 37.5 | 36.2 |
| | OR-19 | 55 | 55 | JOHN DAY | 005 | 36.68 | 57.58 | 20.9 |
| | OR-19 | 55 | 55 | JOHN DAY | 005 | 59.64 | 91.68 | 32.04 |
| C-9 | OR-3 | 55 | 55 | ENTERPRISE-LEWISTON | 011 | 0 | 42.42 | 42.42 |
| C-10 | OR-126 | 55 | 55 | BELTLINE | 069 | 0 | 2.28 | 2.28 |
| | OR-126 | 55 | 55 | FLORENCE-EUGENE | 062 | 47.04 | 52.69 | 5.65 |
| | OR-126 | 55 | 55 | FLORENCE-EUGENE | 062 | 32.8 | 46.76 | 13.96 |
| C-11 | I-5 | 55 | 65 | PACIFIC | 001 | 260.85 | 288.6 | 27.75 |
| | I-5 | 55 | 65 | PACIFIC | 001 | 196 | 251 | 55 |
| C-12 | OR-140 | 55 | 55 | KLAMATH FALLS-LAKEVIEW | 020 | 5.64 | 40.53 | 34.89 |
| | OR-140 | 55 | 55 | KLAMATH FALLS-LAKEVIEW | 020 | 41.33 | 53.17 | 11.84 |
| | OR-140 | 55 | 55 | KLAMATH FALLS-LAKEVIEW | 020 | 54.18 | 95.25 | 41.07 |

[1] Interstate speed limits were raised to 60 mph for trucks on C-1 and C-11 in late 2017

### 2.3.2 Increased Speed Limit Segments

Using the ODOT Speed Limit GIS layer, the sections of highway where the speed change was enacted was constructed. Sections of lower posted speed limits through cities, towns or congested areas were excluded. The segments for analysis were constructed to match the 12 segments identified in ORS 811.11 segments described in the introduction. Table 2-5 shows the highways that were analyzed. A total of 1,426.5 miles of highway were queried for crash performance.

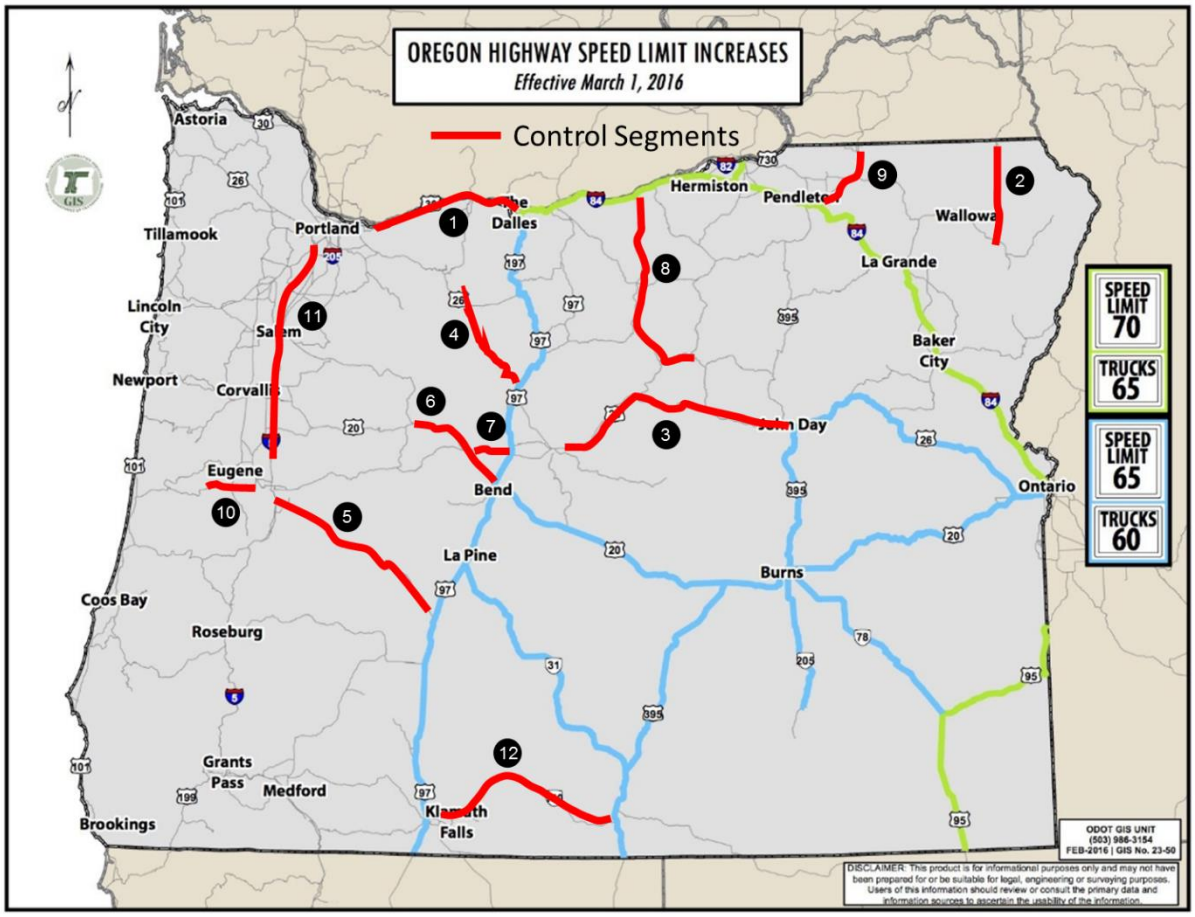



**Figure 2-3 Map of Segments Used for Control in Crash Analysis**

**Table 2-5 Increased Speed Limit Segments for Crash Analysis**

| ORS Segment | Route | Trks | Pass | Highway | Hwy | BMP | EMP | Length |
|---|---|---|---|---|---|---|---|---|
| 2 | I-84 | 65 | 70 | COLUMBIA RIVER | 002 | 87 | 167.58 | 80.58 |
| | I-84 | 65 | 70 | OLD OREGON TRAIL | 006 | 167.73 | 378.01 | 210.28 |
| 3 | US-95 | 65 | 70 | I.O.N. | 456 | 0 | 19.44 | 19.44 |
| | US-95 | 65 | 70 | I.O.N. | 456 | 21.64 | 117.65 | 96.01 |
| 12 | I-82 | 65 | 70 | MCNARY | 070 | 0 | 10.78 | 10.78 |
| 4 | US-20 | 60 | 65 | CENTRAL OREGON | 007 | 3.17 | 42.5 | 39.33 |
| | US-20 | 60 | 65 | CENTRAL OREGON | 007 | 43 | 127.7 | 84.7 |
| | US-20 | 60 | 65 | CENTRAL OREGON | 007 | 132.72 | 245.48 | 112.76 |
| | US-26/20 | 60 | 65 | CENTRAL OREGON | 007 | 246.79 | 258.2 | 11.41 |
| 5 | US-197 | 60 | 65 | THE DALLES-CALIFORNIA | 004 | 2.32 | 42.9 | 40.58 |
| | US-197/97 | 60 | 65 | THE DALLES-CALIFORNIA | 004 | 46.35 | 89.4 | 43.05 |
| | US-97 | 60 | 65 | THE DALLES-CALIFORNIA | 004 | 98.6 | 114.9 | 16.3 |
| | US-97 | 60 | 65 | THE DALLES-CALIFORNIA | 004 | 124.4 | 133.32 | 8.92 |
| | US-97 | 60 | 65 | THE DALLES-CALIFORNIA | 004 | 142.52 | 164.19 | 21.67 |
| | US-97 | 60 | 65 | THE DALLES-CALIFORNIA | 004 | 168.8 | 183.8 | 15 |
| | US-97 | 60 | 65 | THE DALLES-CALIFORNIA | 004 | 187.14 | 202.45 | 15.31 |
| | US-97 | 60 | 65 | THE DALLES-CALIFORNIA | 004 | 204.23 | 209.05 | 4.82 |
| | US-97 | 60 | 65 | THE DALLES-CALIFORNIA | 004 | 209.41 | 270.5 | 61.09 |
| | US-97 | 60 | 65 | THE DALLES-CALIFORNIA | 004 | 279.04 | 291.73 | 12.69 |
| 6 | OR-31 | 60 | 65 | FREMONT | 019 | 0 | 46.58 | 46.58 |
| | OR-31 | 60 | 65 | FREMONT | 019 | 48.11 | 68.74 | 20.63 |
| | OR-31 | 60 | 65 | FREMONT | 019 | 70.5 | 97.98 | 27.48 |
| | OR-31 | 60 | 65 | FREMONT | 019 | 99.09 | 120.43 | 21.34 |
| 7 | OR-78 | 60 | 65 | STEENS | 442 | 0.9 | 91.6 | 90.7 |
| 8 | US-395 | 60 | 65 | JOHN DAY-BURNS | 048 | 2.72 | 24.55 | 21.83 |
| | US-395 | 60 | 65 | JOHN DAY-BURNS | 048 | 29.58 | 35.42 | 5.84 |
| 9 | US-395 | 60 | 65 | FREMONT | 019 | 120.57 | 139.68 | 19.11 |
| | US-395 | 60 | 65 | FREMONT | 019 | 145.7 | 157.24 | 11.54 |
| | US-395 | 60 | 65 | LAKEVIEW BURNS | 049 | 0.01 | 90.02 | 90.01 |
| 10 | OR-205 | 60 | 65 | FRENCH GLEN | 440 | 0 | 57.83 | 57.83 |
| 11 | US-26 | 60 | 65 | JOHN DAY | 005 | 163.69 | 174.51 | 10.82 |
| | US-26 | 60 | 65 | JOHN DAY | 005 | 176.04 | 211.47 | 35.43 |
| | US-26 | 60 | 65 | JOHN DAY | 005 | 213.15 | 230.55 | 17.4 |
| | US-26 | 60 | 65 | JOHN DAY | 005 | 231.33 | 253.73 | 22.4 |
| | US-26 | 60 | 65 | JOHN DAY | 005 | 255.09 | 266.26 | 11.17 |
| | US-26 | 60 | 65 | JOHN DAY | 005 | 267.34 | 277.44 | 10.1 |

### 2.3.3 Speed Reductions Segments

Following an engineering analysis, ODOT lowered speeds to 55 mph for vehicles and 55 mph for trucks in the following sections of the increased speed limit corridors. Table 2-6 shows the description of these sections where crashes were extracted.

**Table 2-6 Speed Reduction Segments**

| Segment | Route | Trks | Pass | Highway | Hwy | BMP | EMP | Length |
|---|---|---|---|---|---|---|---|---|
| 13 | US-97 | 55 | 55 | THE DALLES-CALIFORNIA | 004 | 168.8 | 169.87 | 1.07 |
| 14 | US-97 | 55 | 55 | THE DALLES-CALIFORNIA | 004 | 98.6 | 115 | 16.4 |
| 15 | US-20 | 55 | 55 | CENTRAL OREGON | 007 | 3.17 | 9.19 | 6.02 |
| 16 | US-20 | 55 | 55 | CENTRAL OREGON | 007 | 248.84 | 258.2 | 9.36 |

# 3 PRELIMINARY ANALYSIS

The preliminary analysis compares the changes in speed, volume and safety performance for the control sections of highway and in the sections where the speed was changed.

## 3.1 Estimated Speed Change (ATR)

The estimated average speed and the percentage of vehicles exceeding 65 mph, 75 mph and 85 mph were tabulated for each of the ATRs in the control segments and increased speed segments. They were grouped by the posted speed for cars at the ATR location in the tables. The speed data were compared for two time periods. First, all months where speed data were available from January 2015 to March 2018 were compared. For the pre-period, these months included January 2015 to February 2016. The post-period (April 2016 to March 2018) excluded the month where the speed change was enacted. The differences between the pre- and post-average speeds are tabulated in the "Delta" column (in mph) for each ATR. To explore if there was a seasonal influence of the speed increase, the winter months of December, January and February of the same pre- and post-periods were compared. A similar analysis was conducted for the months of May to October but, in the interest of space, are not shown in this report. Results of this analysis were consistent with the results of the entire sample.

To statistically compare the mean speeds, two tests were conducted for the entire sample: 1) a t-test assuming unequal variance and 2) a paired t-test. The p-values of each test are reported in the tables. For the t-test of means, the null hypothesis ($H_o$) is that the means are equal. If the p-value is less than the selected confidence of the test ($95^{th}$ percentile = 0.05), then the null is rejected and it can be concluded that mean speeds are different. A paired t-test was conducted for a subset of the data. The paired test compares the differences between matched samples (e.g., speeds in January before and speeds in January after). The null hypothesis is that the true mean difference between the paired samples is zero. When the p-values in this test are less than the selected confidence of the test ($95^{th}$ percentile = 0.05), it can be concluded that the difference of paired mean speeds is not zero (i.e., a change in speed). For both tests, p-values indicating a statistically significant difference in speeds are shaded grey.

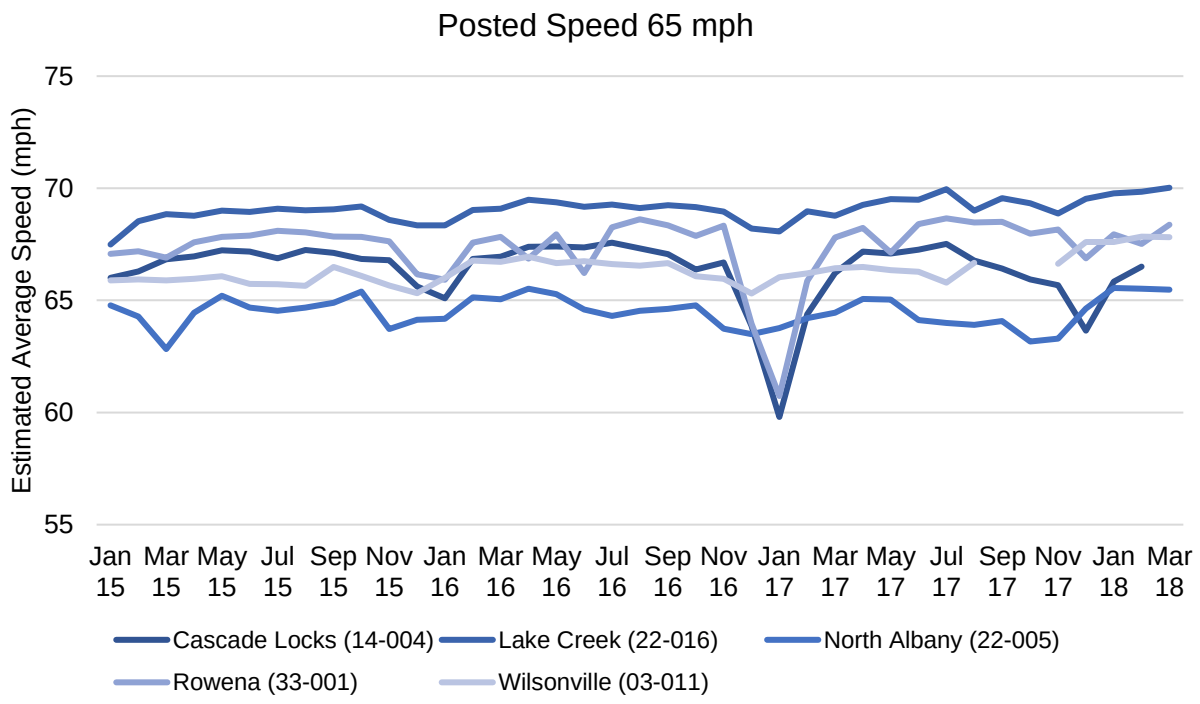
### 3.1.1 Estimated Change in Average Speed

#### *3.1.1.1 Control Segments*

Table 3-1 summarizes the analysis for the control sections. Figure 3-1 shows the monthly average plots for all ATRs in the analysis. As shown in the average summary for each group, the mean speed at these selected stations has not significantly changed. Only a few stations have statistically different speeds. The average speed change for the entire sample is less than 1 mph with the exception of two stations, Dayville and Lava Butte. While the Lava Butte station is in the section of US-97 where the speed was not changed, it is very near to the boundary where the posted speed was increased to 65 mph. The increase at this station in average speed indicates some carryover effect of the increased speed limits in adjacent sections. The 45-mph group, however, is also on US-97 and does not show this increase, though they are in more "urban" areas then the Lava Butte station. The winter observations show primarily a decrease in average speed.

**Table 3-1 Estimated Average Monthly Speed (mph) for Control Sections, ATR**

| Speed Group and ATR | | January 2015- March 2018, excluding March 2016 | | | | | December to February Only, 2015-18 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Pre** | **Post** | **Delta** | **Means, p-value** | **Paired, p-value** | **Pre** | **Post** | **Delta** | **Means, p-value** |
| 45 | Madras (16-002) | 46.0 | 45.6 | -0.5 | 0.02 | 0.21 | 46.6 | 45.4 | -1.2 | 0.03 |
| | North Redmond (09-023) | 56.9 | 57.4 | 0.6 | 0.15 | 0.45 | 56.5 | 55.8 | -0.7 | 0.46 |
| | **Average** | | | **0.0** | | | | | **-0.9** | |
| 55 | Dayville (12-003) | 51.1 | 49.5 | -1.6 | 0.00 | 0.00 | 51.2 | 48.0 | -3.3 | 0.00 |
| | Lava Butte (09-003) | 57.9 | 59.2 | 1.3 | 0.04 | 0.03 | 56.8 | 57.1 | 0.3 | 0.38 |
| | Lexington (25-007) | 59.6 | 59.6 | 0.0 | 0.92 | 0.51 | 59.1 | 58.2 | -0.9 | 0.27 |
| | Milton (30-021) | 54.5 | 54.6 | 0.1 | 0.73 | 0.92 | 54.3 | 53.0 | -1.3 | 0.10 |
| | North Powder (01-001) | 59.5 | 59.8 | 0.2 | 0.64 | 0.99 | 59.0 | 57.6 | -1.4 | 0.29 |
| | Noti (20-005) | 60.0 | 60.6 | 0.7 | 0.01 | 0.00 | 59.8 | 60.4 | 0.6 | 0.10 |
| | Oakridge (20-017) | 56.3 | 56.5 | 0.2 | 0.22 | 0.30 | 56.5 | 55.9 | -0.6 | 0.23 |
| | Rhododendron (03-006) | 53.2 | 52.6 | -0.6 | 0.44 | 0.37 | 52.0 | 48.9 | -3.1 | 0.11 |
| | Shady Cove (15-013) | 59.9 | 60.4 | 0.5 | 0.01 | 0.02 | 59.5 | 59.7 | 0.2 | 0.51 |
| | Shutler (11-007) | 56.7 | 56.8 | 0.1 | 0.70 | 0.54 | 56.2 | 55.1 | -1.1 | 0.25 |
| | Sisters (09-014) | 57.7 | 58.1 | 0.4 | 0.59 | 0.89 | 56.7 | 55.2 | -1.5 | 0.46 |
| | **Average** | | | **0.1** | | | | | **-1.1** | |
| 65 | Cascade Locks (14-004) | 66.6 | 66.1 | -0.5 | 0.24 | 0.06 | 66.0 | 64.0 | -2.0 | 0.10 |
| | Lake Creek (22-016) | 68.7 | 69.2 | 0.5 | 0.00 | 0.00 | 68.3 | 69.1 | 0.7 | 0.11 |
| | North Albany (22-005) | 64.5 | 64.5 | 0.0 | 0.90 | 0.27 | 64.5 | 64.5 | 0.0 | 0.95 |
| | Rowena (33-001) | 67.4 | 67.4 | 0.0 | 0.96 | 0.65 | 66.8 | 65.5 | -1.3 | 0.30 |
| | Wilsonville (03-011) | 65.9 | 66.6 | 0.7 | 0.00 | 0.01 | 66.0 | 66.8 | 0.8 | 0.15 |
| | **Average** | | | **0.1** | | | | | **-0.4** | |



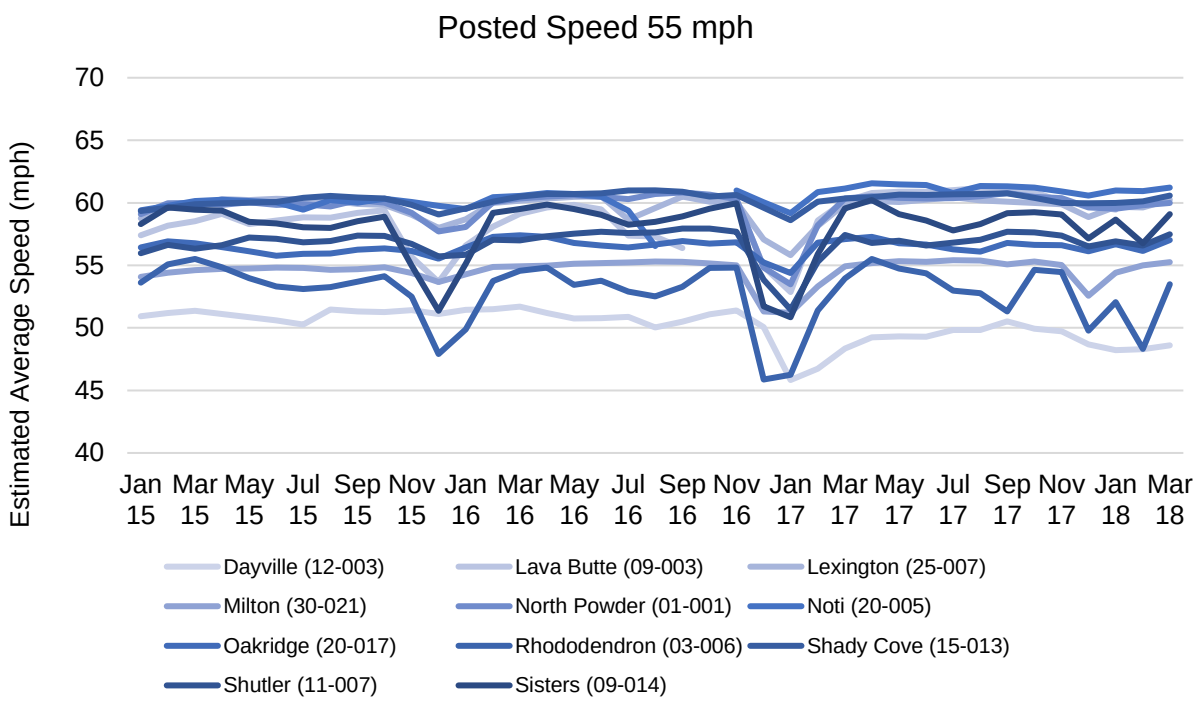




**Figure 3-1 Average Monthly Speed Plots, Control Segments**

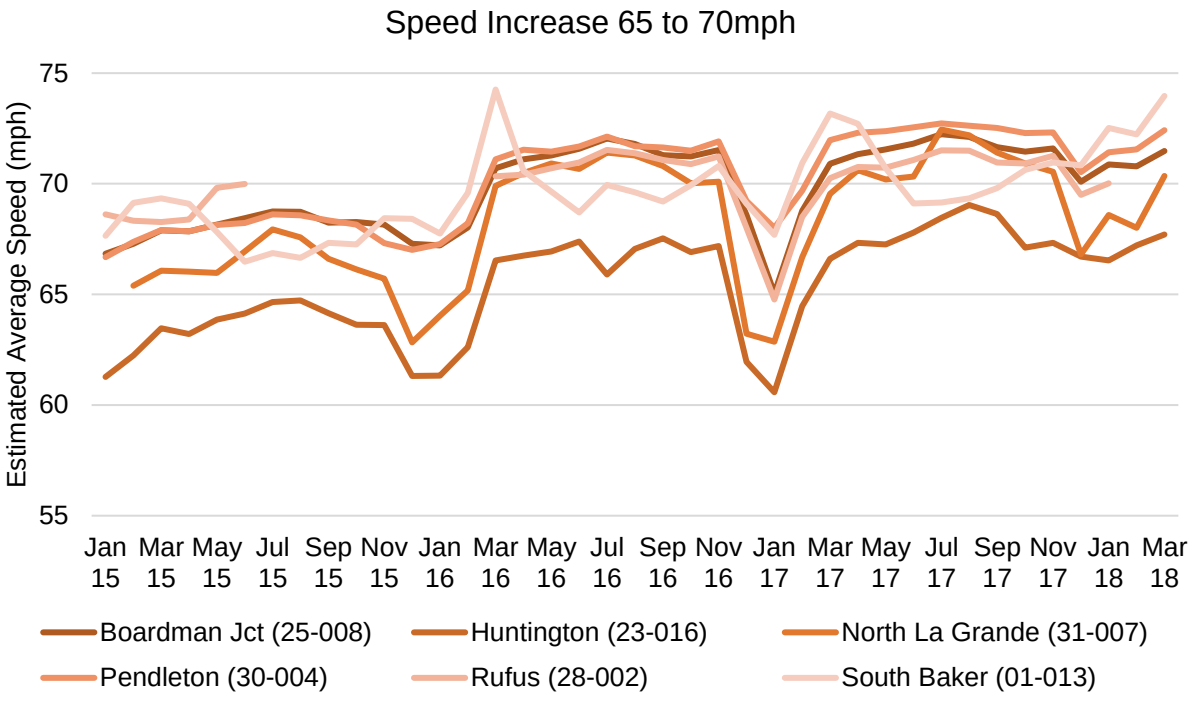
#### *3.1.1.2 Increased Speed Limit Segments*

Table 3-2 summarizes the analysis for the increased speed limit sections. Figure 3-2 shows the monthly average speed for ATRs in the segments with speed limit changes. Figure 3-3 and Figure 3-4 show bar plots of the pre- and post-average speeds for these ATRs. As shown in the average summary for each group, the mean speed at these stations has increased approximately 3 mph. Nearly all of these changes are statistically significant.

There are some anomalies to note in the speed increase ATR data. The large increase in the Cairo Junction station is influenced by problems with the station in the pre-month periods. The New Pine Creek and Prairie City ATR are placed in locations where speeds are lower than the other stations. Here, the increased speed limits have not resulted in observed increases in average speeds. Also, Umatilla Bridge ATR on I-82 was originally selected as an ATR but it was clear from the data that construction and lane closures had impacted the station reporting significantly and it was removed from the analysis.

**Table 3-2 Estimated Average Monthly Speed (mph) from ATR, Speed Limit Change Sections**

| Speed Group and ATR | | January 2015- March 2018, excluding March 2016 | | | | | December to February Only, 2015-18 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Pre** | **Post** | **Delta** | **Means, p-value** | **Paired, p-value** | **Pre** | **Post** | **Delta** | **Means, p-value** |
| 65 | Burns (13-001) | 61.3 | 62.9 | 1.6 | 0.01 | 0.27 | 60.0 | 60.5 | 0.4 | 0.80 |
| | Cairo Junction (23-006) | 46.8 | 54.3 | 7.5 | 0.00 | 0.00 | 49.6 | 52.1 | 2.5 | 0.42 |
| | Dufur (33-005) | 60.9 | 64.4 | 3.6 | 0.00 | 0.01 | 60.7 | 62.6 | 1.9 | 0.19 |
| | Midland (18-019) | 59.5 | 64.5 | 5.0 | 0.00 | 0.00 | 59.0 | 64.0 | 5.0 | 0.00 |
| | Modoc Point (18-022) | 61.9 | 64.9 | 3.1 | 0.00 | 0.00 | 61.0 | 63.3 | 2.3 | 0.47 |
| | New Pine Creek (19-008) | 49.2 | 48.8 | -0.3 | 0.24 | 0.17 | 48.5 | 48.4 | -0.1 | 0.84 |
| | Pilot Butte (09-005) | 60.3 | 61.3 | 0.9 | 0.08 | 0.28 | 60.1 | 59.1 | -1.0 | 0.53 |
| | Prairie City (12-009) | 46.5 | 46.6 | 0.1 | 0.74 | 0.86 | 46.4 | 45.6 | -0.8 | 0.22 |
| | Redmond (09-020) | 59.9 | 62.9 | 3.0 | 0.00 | 0.00 | 59.1 | 61.0 | 1.9 | 0.20 |
| | Steens (13-007) | 52.3 | 54.3 | 2.0 | 0.00 | 0.03 | 51.0 | 53.1 | 2.1 | 0.25 |
| | **Average** | | | **2.6** | | | | | **1.4** | |
| 70 | Boardman Jct (25-008) | 67.9 | 70.9 | 3.0 | 0.00 | 0.00 | 67.3 | 69.0 | 1.7 | 0.12 |
| | Huntington (23-016) | 63.2 | 66.7 | 3.5 | 0.00 | 0.00 | 61.8 | 64.6 | 2.8 | 0.05 |
| | North La Grande (31-007) | 65.9 | 69.6 | 3.7 | 0.00 | 0.00 | 64.4 | 66.0 | 1.7 | 0.32 |
| | Pendleton (30-004) | 67.8 | 71.6 | 3.8 | 0.00 | 0.00 | 67.3 | 70.1 | 2.8 | 0.00 |
| | Rufus (28-002) | 68.9 | 70.4 | 1.5 | 0.01 | 0.65 | 68.5 | 68.2 | -0.3 | 0.19 |
| | South Baker (01-013) | 68.0 | 70.5 | 2.5 | 0.00 | 0.00 | 68.5 | 70.6 | 2.0 | 0.05 |
| | **Average** | | | **3.0** | | | | | **1.8** | |



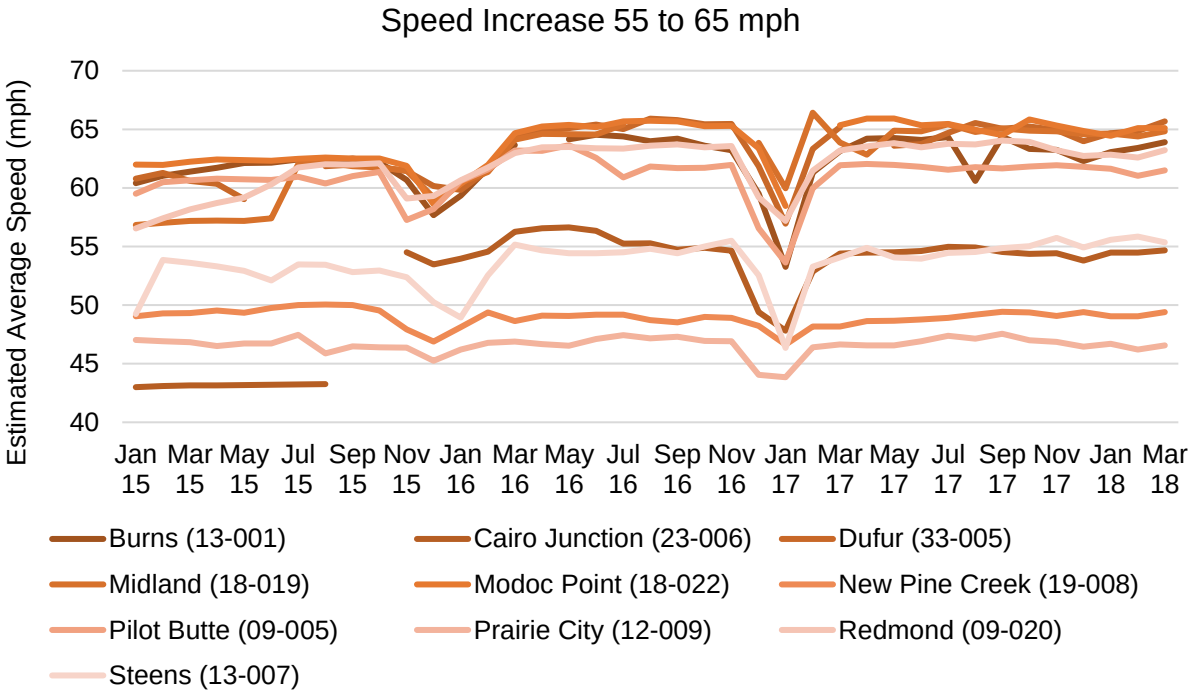




**Figure 3-2 Average Monthly Speed Plots, Increased Speed Limit Segments**

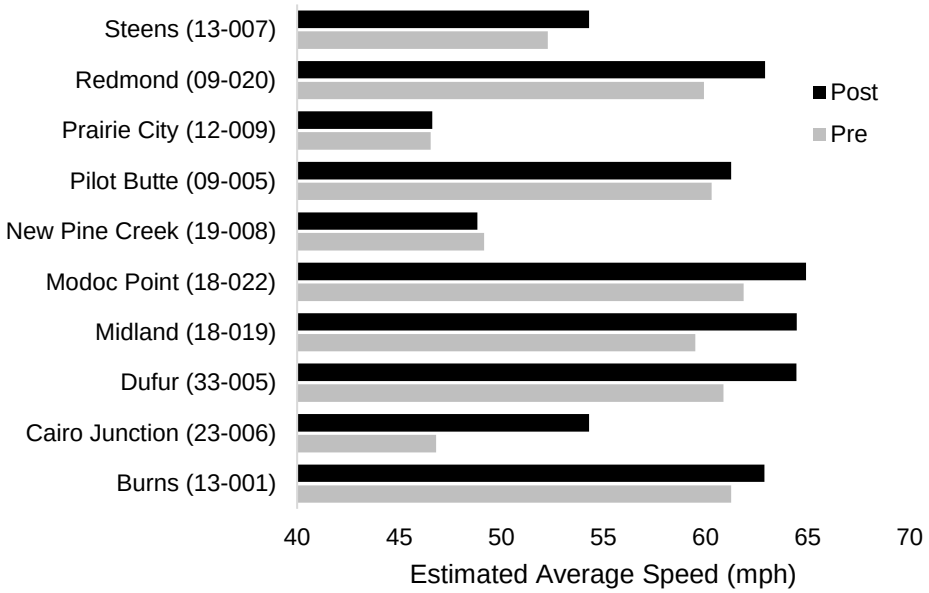



**Figure 3-3 ATRs with Speed Increase from 55 to 65 mph**

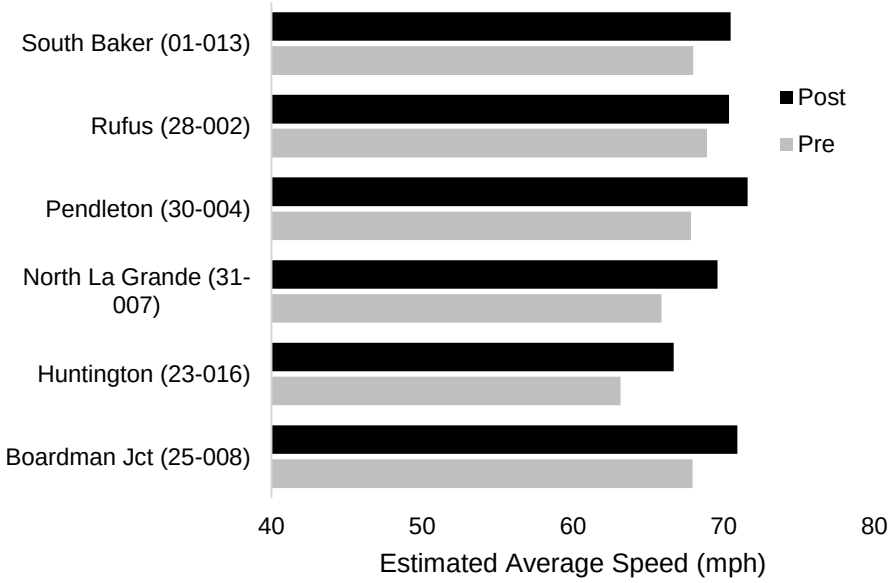



**Figure 3-4 ATRs with Speed Increase to 65 to 70 mph**

### 3.1.2 Average Percentage of Vehicles per Month Exceeding Speeds

#### *3.1.2.1 Control Segments*

Table 3-3 displays the results of the analysis for the percentage of vehicles exceeding 65 mph. There is variation in the results, reflecting the locations and context of the ATR stations. In the 45-mph group, very few vehicles exceed 65 mph at the Madras section (0.1%) while 8% of the observed vehicles at North Redmond are above this speed. The North Redmond station saw a 1.9% increase in the average values and this increase was statistically significant. For the 55-mph group, on average, there was a 2% increase in vehicles traveling faster than 65 mph. There were large statistically significant increases at Lava Butte and Noti. For the 65-mph group most vehicles were and continue to exceed 65 mph and only a 0.8% increase on average was observed.

**Table 3-3 Average Percentage of Vehicles Exceeding 65 mph for Control Sections, ATR**

| Speed Group and ATR | | January 2015- March 2018, excluding March 2016 | | | | | December to February Only, 2015-18 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Pre** | **Post** | **Delta** | **Means, p-value** | **Paired, p-value** | **Pre** | **Post** | **Delta** | **Means, p-value** |
| 45 | Madras (16-002) | 0.1 | 0.1 | 0.0 | 0.70 | 0.79 | 0.2 | 0.1 | 0.0 | 0.07 |
| | North Redmond (09-023) | 7.0 | 8.9 | 1.9 | 0.00 | 0.00 | 6.2 | 6.5 | 0.3 | 0.76 |
| | **Average** | | | **0.9** | | | | | **0.2** | |
| 55 | Dayville (12-003) | 1.8 | 1.8 | 0.0 | 0.77 | 0.53 | 1.9 | 1.5 | -0.4 | 0.07 |
| | Lava Butte (09-003) | 13.3 | 19.9 | 6.6 | 0.00 | 0.00 | 10.1 | 14.9 | 4.8 | 0.55 |
| | Lexington (25-007) | 15.9 | 16.1 | 0.2 | 0.81 | 0.21 | 14.1 | 13.3 | -0.8 | 0.58 |
| | Milton (30-021) | 1.3 | 1.8 | 0.5 | 0.00 | 0.00 | 1.2 | 1.3 | 0.1 | 0.69 |
| | North Powder (01-001) | 14.3 | 16.7 | 2.5 | 0.00 | 0.02 | 13.4 | 13.1 | -0.3 | 0.89 |
| | Noti (20-005) | 13.3 | 18.5 | 5.3 | 0.00 | 0.00 | 12.7 | 18.8 | 6.1 | 0.00 |
| | Oakridge (20-017) | 5.1 | 5.7 | 0.6 | 0.03 | 0.05 | 5.1 | 4.7 | -0.4 | 0.53 |
| | Rhododendron (03-006) | 3.1 | 3.0 | -0.1 | 0.80 | 0.81 | 2.7 | 1.5 | -1.2 | 0.13 |
| | Shady Cove (15-013) | 15.3 | 18.3 | 3.0 | 0.00 | 0.00 | 13.6 | 15.7 | 2.1 | 0.04 |
| | Shutler (11-007) | 10.0 | 10.9 | 0.9 | 0.12 | 0.38 | 8.5 | 7.9 | -0.6 | 0.50 |
| | Sisters (09-014) | 8.6 | 10.7 | 2.1 | 0.03 | 0.12 | 8.1 | 7.4 | -0.8 | 0.75 |
| | **Average** | | | **2.0** | | | | | **0.8** | |
| 65 | Cascade Locks (14-004) | 65.7 | 63.2 | -2.6 | 0.17 | 0.03 | 62.1 | 53.7 | -8.5 | 0.05 |
| | Lake Creek (22-016) | 72.6 | 73.6 | 1.0 | 0.12 | 0.29 | 70.7 | 72.7 | 1.9 | 0.25 |
| | North Albany (22-005) | 51.9 | 52.0 | 0.2 | 0.88 | 0.44 | 51.4 | 51.3 | -0.1 | 0.97 |
| | Rowena (33-001) | 67.6 | 67.7 | 0.1 | 0.97 | 0.62 | 64.3 | 59.3 | -5.0 | 0.35 |
| | Wilsonville (03-011) | 60.8 | 66.0 | 5.2 | 0.00 | 0.00 | 59.8 | 65.2 | 5.4 | 0.08 |
| | **Average** | | | **0.8** | | | | | **-1.2** | |

Table 3-4 displays the results of the analysis for the percent of vehicles exceeding 75 mph. Obviously very few vehicles exceed 75 mph in the 45-mph group. In the 55-mph stations, less than 2% of vehicles were observed at this speed and there was little change (except at Lava Butte and Noti). In the 65-mph group, there was more variation in the observed increases including large increases at Lake Creek and Rowena ATRs. On average, a 1.7% increase was observed in the percentage of vehicles exceeding 75 mph.

**Table 3-4 Average Percentage of Vehicles Exceeding 75 mph for Control Sections, ATR**

| Speed Group and ATR | | January 2015- March 2018, excluding March 2016 | | | | | December to February Only, 2015-18 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Pre** | **Post** | **Delta** | **Means, p-value** | **Paired, p-value** | **Pre** | **Post** | **Delta** | **Means, p-value** |
| 45 | Madras (16-002) | 0.0 | 0.0 | 0.0 | 0.11 | 0.77 | 0.0 | 0.0 | 0.0 | 0.68 |
| | North Redmond (09-023) | 0.2 | 0.3 | 0.1 | 0.00 | 0.00 | 0.2 | 0.2 | 0.0 | 0.46 |
| | **Average** | | | **0.0** | | | | | **0.0** | |
| 55 | Dayville (12-003) | - | 0.1 | - | - | - | | 0.1 | 0.1 | 0.01 |
| | Lava Butte (09-003) | 0.5 | 1.1 | 0.5 | 0.00 | 0.00 | 0.4 | 0.7 | 0.3 | 0.32 |
| | Lexington (25-007) | 1.2 | 1.2 | 0.0 | 0.90 | 0.18 | 1.0 | 0.9 | -0.1 | 0.49 |
| | Milton (30-021) | 0.1 | 0.1 | 0.0 | 0.00 | 0.00 | 0.1 | 0.1 | 0.0 | 0.53 |
| | North Powder (01-001) | 1.1 | 1.4 | 0.3 | 0.00 | 0.01 | 0.9 | 0.9 | 0.0 | 0.89 |
| | Noti (20-005) | 0.9 | 1.4 | 0.5 | 0.00 | 0.00 | 0.8 | 1.3 | 0.5 | 0.00 |
| | Oakridge (20-017) | 0.1 | 0.2 | 0.0 | 0.01 | 0.01 | 0.1 | 0.1 | 0.0 | 0.53 |
| | Rhododendron (03-006) | 0.2 | 0.1 | 0.0 | 0.67 | 0.61 | 0.1 | 0.1 | -0.1 | 0.09 |
| | Shady Cove (15-013) | 1.1 | 1.6 | 0.4 | 0.00 | 0.00 | 0.9 | 1.2 | 0.3 | 0.01 |
| | Shutler (11-007) | 0.8 | 0.9 | 0.2 | 0.02 | 0.03 | 0.6 | 0.6 | 0.1 | 0.48 |
| | Sisters (09-014) | 0.3 | 0.4 | 0.1 | 0.00 | 0.02 | 0.2 | 0.2 | 0.0 | 0.95 |
| | **Average** | | | **0.2** | | | | | **0.1** | |
| 65 | Cascade Locks (14-004) | 8.9 | 9.1 | 0.2 | 0.76 | 0.28 | 8.3 | 6.5 | -1.8 | 0.10 |
| | Lake Creek (22-016) | 14.7 | 18.2 | 3.5 | 0.00 | 0.00 | 13.5 | 17.1 | 3.7 | 0.02 |
| | North Albany (22-005) | 5.0 | 5.7 | 0.8 | 0.02 | 0.05 | 4.6 | 5.2 | 0.6 | 0.27 |
| | Rowena (33-001) | 8.3 | 10.2 | 1.9 | 0.00 | 0.01 | 6.9 | 7.3 | 0.4 | 0.71 |
| | Wilsonville (03-011) | 4.9 | 7.3 | 2.4 | 0.00 | 0.00 | 4.7 | 7.4 | 2.7 | 0.03 |
| | **Average** | | | **1.7** | | | | | **1.1** | |

Table 3-5 displays the results of the analysis for the percentage of vehicles exceeding 85 mph. Very few vehicles exceed 85 mph in the 45-mph group or the 55-mph stations. In the 65-mph group, more vehicles were observed exceeding 85 mph. On average, there was a 0.1% increase in the percentage of vehicles exceeding 85 mph.

**Table 3-5 Average Percentage of Vehicles Exceeding 85 mph for Control Sections, ATR**

| Speed Group and ATR | | January 2015- March 2018, excluding March 2016 | | | | | December to February Only, 2015-18 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Pre | Post | Delta | Means, p-value | Paired, p-value | Pre | Post | Delta | Means, p-value |
| 45 | Madras (16-002) | 0.0 | 0.0 | 0.0 | 0.17 | 0.51 | 0.0 | 0.0 | 0.0 | 0.73 |
| | North Redmond (09-023) | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 | 0.85 |
| | **Average** | | | **0.0** | | | | | **0.0** | |
| 55 | Dayville (12-003) | - | - | - | - | - | - | - | - | - |
| | Lava Butte (09-003) | 0.1 | 0.1 | 0.0 | 0.00 | 0.00 | 0.0 | 0.1 | 0.0 | 0.79 |
| | Lexington (25-007) | 0.1 | 0.1 | 0.0 | 0.56 | 0.64 | 0.1 | 0.1 | 0.0 | 0.43 |
| | Milton (30-021) | 0.0 | 0.0 | 0.0 | 0.11 | 0.02 | 0.0 | 0.0 | 0.0 | 0.52 |
| | North Powder (01-001) | 0.1 | 0.2 | 0.0 | 0.09 | 0.44 | 0.1 | 0.1 | 0.0 | 0.97 |
| | Noti (20-005) | 0.1 | 0.2 | 0.0 | 0.00 | 0.00 | 0.1 | 0.1 | 0.0 | 0.01 |
| | Oakridge (20-017) | 0.0 | 0.0 | 0.0 | 0.22 | 0.21 | 0.0 | 0.0 | 0.0 | 0.95 |
| | Rhododendron (03-006) | 0.0 | 0.0 | 0.0 | 0.11 | 0.13 | 0.0 | 0.0 | 0.0 | 0.15 |
| | Shady Cove (15-013) | 0.1 | 0.2 | 0.0 | 0.00 | 0.00 | 0.1 | 0.1 | 0.0 | 0.08 |
| | Shutler (11-007) | 0.1 | 0.1 | 0.0 | 0.21 | 0.24 | 0.1 | 0.1 | 0.0 | 0.51 |
| | Sisters (09-014) | 0.0 | 0.0 | 0.0 | 0.06 | 0.09 | 0.0 | 0.0 | 0.0 | 0.56 |
| | **Average** | | | **0.0** | | | | | **0.0** | |
| 65 | Cascade Locks (14-004) | 0.3 | 0.3 | 0.0 | 0.92 | 0.10 | 0.3 | 0.2 | 0.0 | 0.53 |
| | Lake Creek (22-016) | 0.5 | 0.7 | 0.2 | 0.00 | 0.00 | 0.4 | 0.6 | 0.2 | 0.01 |
| | North Albany (22-005) | 0.2 | 0.2 | 0.0 | 0.00 | 0.01 | 0.1 | 0.2 | 0.0 | 0.17 |
| | Rowena (33-001) | 0.3 | 0.3 | 0.1 | 0.08 | 0.03 | 0.2 | 0.2 | 0.0 | 0.97 |
| | Wilsonville (03-011) | 0.3 | 0.4 | 0.1 | 0.01 | 0.11 | 0.2 | 0.3 | 0.1 | 0.03 |
| | **Average** | | | **0.1** | | | | | **0.1** | |

#### *3.1.2.2 Increased Speed Limit Segments*

As expected (since the average speeds increased) the observed data show increases in the percentage of vehicles exceeding 65, 75 and 85 mph. These changes are important observations since the small changes in average speeds measured in mph do not completely illuminate the changes in the speed distributions. Table 3-6, Table 3-7 and Table 3-8 provide the results.

For the sections of highway where the maximum posted speed limit increased from 55 mph to 65 mph for cars, the percentage of vehicles exceeding 65 mph increased, on average, 13.4%, the percentage exceeding 75 mph increased 1.9% and the percentage exceeding 85 mph increased 0.3%. Nearly all of these increases were statistically significant. Similarly, for the sections of highway that increased from 65 mph to 70 mph, the percentage of vehicles exceeding 65 mph increased, on average, 15.5%, the percentage exceeding 75 mph increased 12% and the percentage exceeding 85 mph increased 0.9%. Nearly all of these increases were statistically significant. At two stations on I-84, over 3% of the total vehicles observed since the speed increase was enacted were traveling faster than 85 mph (15 miles per hour over the speed limit).

**Table 3-6 Average Percentage of Vehicles Exceeding 65 mph for Speed Change Sections, ATR**

| Speed Group and ATR | | January 2015- March 2018, excluding March 2016 | | | | | December to February Only, 2015-18 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Pre | Post | Delta | Means, p-value | Paired, p-value | Pre | Post | Delta | Means, p-value |
| 65 | Burns (13-001) | 29.9 | 43.0 | 13.2 | 0.00 | 0.00 | 25.8 | 33.7 | 7.9 | 0.20 |
| | Cairo Junction (23-006) | 0.5 | 2.8 | 2.3 | 0.00 | 0.00 | 0.8 | 1.3 | 0.4 | 0.32 |
| | Dufur (33-005) | 20.0 | 50.2 | 30.2 | 0.00 | 0.00 | 18.9 | 42.3 | 23.4 | 0.00 |
| | Midland (18-019) | 15.9 | 46.5 | 30.5 | 0.00 | 0.00 | 14.5 | 45.1 | 30.6 | 0.00 |
| | Modoc Point (18-022) | 23.6 | 50.6 | 27.0 | 0.00 | 0.00 | 20.5 | 44.3 | 23.8 | 0.12 |
| | New Pine Creek (19-008) | 2.0 | 2.3 | 0.2 | 0.06 | 0.29 | 1.7 | 2.3 | 0.6 | 0.04 |
| | Pilot Butte (09-005) | 20.8 | 28.0 | 7.3 | 0.00 | 0.00 | 19.8 | 21.9 | 2.1 | 0.61 |
| | Prairie City (12-009) | 0.6 | 0.8 | 0.1 | 0.02 | 0.06 | 0.6 | 0.6 | 0.0 | 0.98 |
| | Redmond (09-020) | 24.0 | 39.2 | 15.2 | 0.00 | 0.00 | 21.3 | 31.3 | 10.0 | 0.04 |
| | Steens (13-007) | 25.4 | 33.3 | 7.9 | 0.00 | 0.01 | 21.5 | 28.8 | 7.3 | 0.16 |
| | **Average** | | | **13.4** | | | | | **10.6** | |
| 70 | Boardman Jct (25-008) | 69.9 | 81.9 | 12.0 | 0.00 | 0.00 | 66.4 | 73.9 | 7.5 | 0.13 |
| | Huntington (23-016) | 47.3 | 62.6 | 15.3 | 0.00 | 0.00 | 40.0 | 52.6 | 12.7 | 0.04 |
| | North La Grande (31-007) | 52.4 | 73.3 | 20.9 | 0.00 | 0.00 | 44.9 | 59.8 | 15.0 | 0.06 |
| | Pendleton (30-004) | 69.3 | 87.2 | 17.8 | 0.00 | 0.00 | 66.2 | 81.1 | 15.0 | 0.00 |
| | Rufus (28-002) | 69.4 | 79.8 | 10.5 | 0.00 | 0.19 | 66.4 | 70.4 | 4.0 | 0.15 |
| | South Baker (01-013) | 62.4 | 78.8 | 16.4 | 0.00 | 0.00 | 63.5 | 79.3 | 15.8 | 0.00 |
| | **Average** | | | **15.5** | | | | | **11.7** | |

**Table 3-7 Average Percentage of Vehicles Exceeding 75 mph for Speed Change Sections, ATR**

| Speed Group and ATR | | January 2015- March 2018, excluding March 2016 | | | | | December to February Only, 2015-18 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Pre | Post | Delta | Means, p-value | Paired, p-value | Pre | Post | Delta | Means, p-value |
| 65 | Burns (13-001) | 3.2 | 4.9 | 1.6 | 0.00 | 0.00 | 2.6 | 3.5 | 1.0 | 0.21 |
| | Cairo Junction (23-006) | | | | | | | | | |
| | Dufur (33-005) | 1.8 | 3.7 | 1.9 | 0.00 | 0.00 | 1.5 | 2.8 | 1.3 | 0.01 |
| | Midland (18-019) | 1.3 | 6.9 | 5.6 | 0.00 | 0.01 | 1.0 | 8.5 | 7.4 | 0.08 |
| | Modoc Point (18-022) | 1.4 | 4.7 | 3.3 | 0.00 | 0.00 | 1.2 | 4.4 | 3.2 | 0.06 |
| | New Pine Creek (19-008) | 0.2 | 0.2 | 0.0 | 0.80 | 0.99 | 0.1 | 0.1 | 0.0 | 0.44 |
| | Pilot Butte (09-005) | 1.3 | 1.8 | 0.5 | 0.00 | 0.00 | 1.3 | 1.3 | 0.1 | 0.76 |
| | Prairie City (12-009) | 0.0 | 0.0 | 0.0 | 0.54 | 0.70 | 0.0 | 0.0 | 0.0 | 0.37 |
| | Redmond (09-020) | 0.5 | 1.7 | 1.2 | 0.00 | 0.00 | 0.4 | 1.2 | 0.8 | 0.02 |
| | Steens (13-007) | 3.7 | 6.3 | 2.6 | 0.00 | 0.00 | 2.9 | 5.0 | 2.1 | 0.07 |
| | **Average** | | | **1.9** | | | | | **1.8** | |
| 70 | Boardman Jct (25-008) | 10.9 | 26.9 | 15.9 | 0.00 | 0.00 | 9.3 | 20.1 | 10.8 | 0.00 |
| | Huntington (23-016) | 4.2 | 12.7 | 8.5 | 0.00 | 0.00 | 3.4 | 9.5 | 6.1 | 0.01 |
| | North La Grande (31-007) | 10.9 | 23.5 | 12.6 | 0.00 | 0.00 | 6.8 | 12.8 | 6.0 | 0.01 |
| | Pendleton (30-004) | 8.8 | 28.3 | 19.5 | 0.00 | 0.00 | 7.6 | 23.3 | 15.7 | 0.00 |
| | Rufus (28-002) | 16.9 | 24.1 | 7.1 | 0.00 | 0.13 | 15.3 | 17.1 | 1.9 | 0.13 |
| | South Baker (01-013) | 17.5 | 25.8 | 8.3 | 0.00 | 0.00 | 20.7 | 28.0 | 7.3 | 0.01 |
| | **Average** | | | **12.0** | | | | | **8.0** | |

**Table 3-8 Average Percentage of Vehicles Exceeding 85 mph for Speed Change Sections, ATR**

| Speed Group and ATR | | January 2015- March 2018, excluding March 2016 | | | | | December to February Only, 2015-18 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Pre | Post | Delta | Means, p-value | Paired, p-value | Pre | Post | Delta | Means, p-value |
| 65 | Burns (13-001) | 0.3 | 0.4 | 0.1 | 0.00 | 0.00 | 0.2 | 0.3 | 0.1 | 0.12 |
| | Cairo Junction (23-006) | - | - | - | - | - | - | - | - | - |
| | Dufur (33-005) | 0.2 | 0.3 | 0.1 | 0.00 | 0.02 | 0.2 | 0.2 | 0.1 | 0.18 |
| | Midland (18-019) | 0.1 | 1.8 | 1.7 | 0.03 | 0.03 | 0.1 | 2.7 | 2.6 | 0.20 |
| | Modoc Point (18-022) | 0.1 | 0.3 | 0.2 | 0.00 | 0.00 | 0.1 | 0.4 | 0.3 | 0.13 |
| | New Pine Creek (19-008) | 0.0 | 0.0 | 0.0 | 0.76 | 0.60 | 0.0 | 0.0 | 0.0 | 0.50 |
| | Pilot Butte (09-005) | 0.1 | 0.1 | 0.0 | 0.83 | 0.64 | 0.1 | 0.1 | 0.0 | 0.20 |
| | Prairie City (12-009) | - | - | - | - | - | - | - | - | - |
| | Redmond (09-020) | 0.0 | 0.1 | 0.0 | 0.00 | 0.00 | 0.0 | 0.1 | 0.0 | 0.04 |
| | Steens (13-007) | - | - | - | - | - | - | - | - | - |
| | **Average** | | | **0.3** | | | | | **0.4** | |
| 70 | Boardman Jct (25-008) | 0.5 | 1.1 | 0.6 | 0.00 | 0.00 | 0.5 | 0.7 | 0.3 | 0.01 |
| | Huntington (23-016) | 0.2 | 0.6 | 0.3 | 0.00 | 0.00 | 0.2 | 0.4 | 0.2 | 0.02 |
| | North La Grande (31-007) | 0.7 | 3.6 | 2.9 | 0.00 | 0.00 | 0.3 | 0.6 | 0.3 | 0.01 |
| | Pendleton (30-004) | 0.4 | 1.0 | 0.6 | 0.00 | 0.00 | 0.3 | 0.7 | 0.4 | 0.00 |
| | Rufus (28-002) | 0.8 | 1.0 | 0.2 | 0.02 | 0.34 | 0.7 | 0.7 | 0.0 | 0.21 |
| | South Baker (01-013) | 2.2 | 3.2 | 1.1 | 0.07 | 0.01 | 3.4 | 5.5 | 2.1 | 0.02 |
| | **Average** | | | **0.9** | | | | | **0.6** | |

## 3.2 Estimated Volume Change (ATR)

An important consideration in crash performance analysis is to consider changes in volume. All else being equal in highway geometry, drivers, vehicles, weather, and other contributing factors (and this is almost never true) an increase in volume would increase the number of observed crashes. Using the same data from the ATR stations, an analysis of the total monthly volumes observed was conducted. The data in the tables are expressed in 100,000s of vehicles. For the table, the index column shows the post-average volume divided by the pre-average volume. An value of 1.1 would be interpreted as a 10% increase in the traffic.

### 3.2.1 Control Segments

Table 3-9 shows the results of the volume analysis for the control sections. For all groups, the general trend is that there were more vehicles observed in the post-period. For the 45-mph and 55-mph group, the average index value was 1.1. For the 65-mph group, there was no increase observed (index=1.0). For the winter weather periods, the index values average 1.0 for all groups.

**Table 3-9 Estimated Average Monthly Volume (in 100,000) for Control Sections, ATR**

| Speed Group and ATR | | January 2015- March 2018, excluding March 2016 | | | | | December to February Only, 2015-18 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Pre | Post | Index | Means, p-value | Paired, p-value | Pre | Post | Index | Means, p-value |
| 45 | Madras (16-002) | 4.1 | 4.4 | 1.1 | 0.27 | 0.00 | 3.5 | 3.5 | 1.0 | 0.99 |
| | North Redmond (09-023) | 6.3 | 6.9 | 1.1 | 0.03 | 0.00 | 5.4 | 5.6 | 1.0 | 0.33 |
| | **Average** | | | **1.1** | | | | | **1.0** | |
| 55 | Dayville (12-003) | 0.2 | 0.3 | 1.1 | 0.28 | 0.18 | 0.2 | 0.1 | 0.9 | 0.61 |
| | Lava Butte (09-003) | 7.2 | 7.5 | 1.0 | 0.65 | 0.00 | 5.8 | 6.2 | 1.1 | 0.55 |
| | Lexington (25-007) | 0.4 | 0.4 | 1.0 | 0.73 | 0.53 | 0.4 | 0.4 | 1.0 | 0.57 |
| | Milton (30-021) | 4.5 | 4.6 | 1.0 | 0.17 | 0.10 | 4.1 | 4.0 | 1.0 | 0.22 |
| | North Powder (01-001) | 0.2 | 0.3 | 1.1 | 0.27 | 0.36 | 0.2 | 0.2 | 0.9 | 0.17 |
| | Noti (20-005) | 1.9 | 1.9 | 1.0 | 0.89 | 0.05 | 1.6 | 1.6 | 1.0 | 0.73 |
| | Oakridge (20-017) | 0.8 | 0.9 | 1.1 | 0.30 | 0.01 | 0.6 | 0.6 | 1.0 | 0.98 |
| | Rhododendron (03-006) | 2.6 | 3.1 | 1.2 | 0.05 | 0.01 | 2.4 | 3.0 | 1.2 | 0.31 |
| | Shady Cove (15-013) | 2.4 | 2.6 | 1.1 | 0.06 | 0.00 | 2.0 | 2.1 | 1.0 | 0.25 |
| | Shutler (11-007) | 0.2 | 0.2 | 1.1 | 0.00 | 0.00 | 0.2 | 0.2 | 1.0 | 0.43 |
| | Sisters (09-014) | 2.6 | 2.7 | 1.1 | 0.59 | 0.97 | 1.8 | 1.7 | 1.0 | 0.31 |
| | **Average** | | | **1.1** | | | | | **1.0** | |
| 65 | Cascade Locks (14-004) | 6.6 | 6.9 | 1.1 | 0.58 | 0.80 | 5.4 | 4.1 | 0.8 | 0.11 |
| | Lake Creek (22-016) | 12.0 | 12.8 | 1.1 | 0.12 | 0.00 | 10.5 | 10.8 | 1.0 | 0.44 |
| | North Albany (22-005) | 19.4 | 19.8 | 1.0 | 0.72 | 0.68 | 17.5 | 18.1 | 1.0 | 0.32 |
| | Rowena (33-001) | 6.6 | 7.1 | 1.1 | 0.29 | 0.13 | 5.4 | 5.3 | 1.0 | 0.73 |
| | Wilsonville (03-011) | 27.6 | 28.2 | 1.0 | 0.61 | 0.49 | 25.1 | 25.9 | 1.0 | 0.41 |
| | **Average** | | | **1.0** | | | | | **1.0** | |

### 3.2.2 Increased Speed Limit Segments

Table 3-10 shows the results of the volume analysis for the increased speed sections. For all groups, the general trend is that there were more vehicles observed in the post-period. For the 55-mph group, the average index value was 1.2. There were some observed issues with the Cairo Junction station in the pre-period which resulted in a higher index value (1.8). Removing this station, the 65-mph group would have a similar volume change index as the control sections in the 55-mph group (1.1). For the 70-mph group, there was an increase observed (index=1.1) which was more than the control sections in the 65-mph group. However, for the two I-84 stations in the control group, the index value was also 1.1. For the winter weather periods, the index values average 1.0 for all groups.

**Table 3-10 Estimated Average Monthly Volume (in 100,000) for Speed Limit Change Sections, ATR**

| Speed Group and ATR | | January 2015- March 2018, excluding March 2016 | | | | | December to February Only, 2015-18 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Pre | Post | Index | Means, p-value | Paired, p-value | Pre | Post | Index | Means, p-value |
| 65 | Burns (13-001) | 0.1 | 0.2 | 1.1 | 0.30 | 0.32 | 0.10 | 0.09 | 0.9 | 0.08 |
| | Cairo Junction (23-006) | 0.9 | 1.6 | 1.8 | 0.00 | 0.00 | 0.90 | 1.26 | 1.4 | 0.13 |
| | Dufur (33-005) | 0.7 | 0.9 | 1.2 | 0.01 | 0.03 | 0.65 | 0.65 | 1.0 | 0.99 |
| | Midland (18-019) | 1.1 | 1.1 | 1.0 | 0.86 | 0.85 | 0.84 | 0.90 | 1.1 | 0.39 |
| | Modoc Point (18-022) | 1.8 | 1.9 | 1.1 | 0.45 | 0.34 | 1.34 | 1.04 | 0.8 | 0.17 |
| | New Pine Creek (19-008) | 0.3 | 0.3 | 1.1 | 0.54 | 0.69 | 0.19 | 0.18 | 1.0 | 0.61 |
| | Pilot Butte (09-005) | 0.8 | 0.9 | 1.1 | 0.10 | 0.01 | 0.64 | 0.63 | 1.0 | 0.81 |
| | Prairie City (12-009) | 0.3 | 0.3 | 1.1 | 0.30 | 0.05 | 0.16 | 0.17 | 1.1 | 0.42 |
| | Redmond (09-020) | 9.3 | 10.4 | 1.1 | 0.00 | 0.00 | 8.51 | 8.89 | 1.0 | 0.26 |
| | Steens (13-007) | 0.4 | 0.5 | 1.1 | 0.11 | 0.00 | 0.38 | 0.39 | 1.0 | 0.85 |
| | **Average** | | | **1.2** | | | | | **1.0** | |
| 70 | Boardman Jct (25-008) | 4.7 | 5.2 | 1.1 | 0.09 | 0.00 | 3.76 | 3.86 | 1.0 | 0.60 |
| | Huntington (23-016) | 2.8 | 3.2 | 1.1 | 0.13 | 0.37 | 2.18 | 2.34 | 1.1 | 0.26 |
| | North La Grande (31-007) | 2.8 | 3.1 | 1.1 | 0.31 | 0.00 | 2.15 | 2.14 | 1.0 | 0.39 |
| | Pendleton (30-004) | 4.7 | 5.1 | 1.1 | 0.17 | 0.03 | 3.88 | 3.80 | 1.0 | 0.67 |
| | Rufus (28-002) | 3.4 | 3.8 | 1.1 | 0.27 | 0.46 | 2.52 | 2.56 | 1.0 | 0.18 |
| | South Baker (01-013) | 2.7 | 3.0 | 1.1 | 0.16 | 0.01 | 2.08 | 2.13 | 1.0 | 0.64 |
| | **Average** | | | **1.1** | | | | | **1.0** | |

## 3.3 Preliminary Crash Analysis

Due to the lag in crash data, only 12 months of after crash data were available (March 2016 to February 2017) for analysis at the time of this report. The first two months of 2017 are not official and are considered preliminary and subject to change. While it would generally be good practice to exclude March 2016 from the analysis as the month the speed change occurred, we have elected to keep the month of data due to the limited data. In establishing the change in safety performance, the state of the practice would be to conduct an empirical Bayes before-after analysis developing models to control for the change in volumes. In this preliminary analysis, a simplified approach is taken with the expectation that when more data becomes available a more rigorous comparison will be made.

For each of the control or speed increase segments, the crash data was aggregated to monthly crash counts of total, fatal and injury A crashes. So that periods are equal in months, the following are the durations in the tables that follow:

- 2013-2014 – March 2013 to February 2014
- 2014-2015 – March 2014 to February 2015
- 2015-2016 – March 2015 to February 2016
- Post – March 2016 to February 2017

The three-year average of these crash counts is presented in the tables. The post column is the 1 year count of crashes after the speed limit changes (March 2016 to February 2017). The "Delta" column is the difference in counts between the post- and the three-year average. Negative counts are a decrease in crashes. Two index values are calculated. The "Index, 3-yr Avg" column divides the post counts by the three-year average. For each group of segments, a subtotal row is calculated for all counts and the same index calculations are done. A total row is also calculated, adding the two subtotal rows and performing the same index calculations. An index less than 1 is a decrease in crash counts and an index greater than 1.0 is an increase. The overall trend in the Oregon is that reported crashes have been increasing. Averaging the three-year prior count may dampen this trend, so an index is also created that compares the post- to only the immediately previous period (2015-2016). Unlike the prior analysis, no statistical tests are performed reflecting the preliminary nature of the analysis.

### 3.3.1 Total Crashes

Total crash counts are analyzed for control, increased speed limit and the speed reduction segments. As a reminder, these crashes include mainline crashes within the milepost boundaries for each segment presented previously in Table 2-4, Table 2-5 and Table 2-6.

#### *3.3.1.1 Control Segments*

Table 3-11 summarizes the results of the crash performance in the control sections. For the 65-mph group of freeway sections, the index for the three-year period is 1.20. An estimated 159 more total crashes were observed. For the 55-mph group selected for comparison, the overall crash counts increased, with an index of 1.05 (less than the volume index change of 1.1). Figure 3-5 presents a plot of the crash counts for all of the control segments by year and posted speed.

**Table 3-11 Total Crashes, Before-to-After, Control Segments**

| Seg | Route | 2013-2014 | 2014-2015 | 2015-2016 | 3-year Avg | Post | Delta | Index, 3-yr Avg | Index, Prior Yr |
|---|---|---|---|---|---|---|---|---|---|
| 1 | I-84 | 198 | 231 | 229 | 219 | 203 | -16 | 0.93 | 0.89 |
| 11 | I-5 | 503 | 534 | 697 | 578 | 753 | 175 | 1.30 | 1.08 |
| **65 mph subtotal** | | **701** | **765** | **926** | **797** | **956** | **159** | **1.20** | **1.03** |
| 2 | OR-11 | 20 | 29 | 17 | 22 | 30 | 8 | 1.36 | 1.76 |
| 3 | US-26 | 31 | 35 | 63 | 43 | 51 | 8 | 1.19 | 0.81 |
| 4 | US-26 | 18 | 32 | 47 | 32 | 26 | -6 | 0.80 | 0.55 |
| 5 | OR-58 | 79 | 95 | 90 | 88 | 104 | 16 | 1.18 | 1.16 |
| 6 | US-20 | 53 | 48 | 66 | 56 | 48 | -8 | 0.86 | 0.73 |
| 7 | OR-126 | 27 | 36 | 31 | 31 | 33 | 2 | 1.05 | 1.06 |
| 8 | OR-19 | 11 | 16 | 11 | 13 | 10 | -3 | 0.79 | 0.91 |
| 9 | OR-3 | 5 | 10 | 4 | 6 | 5 | -1 | 0.79 | 1.25 |
| 10 | OR-126 | 70 | 53 | 76 | 66 | 73 | 7 | 1.10 | 0.96 |
| 12 | OR-140 | 58 | 46 | 54 | 53 | 52 | -1 | 0.99 | 0.96 |
| **55 mph subtotal** | | **372** | **400** | **459** | **410** | **432** | **22** | **1.05** | **0.94** |
| **Total** | | **1,073** | **1,165** | **1,385** | **1,208** | **1,388** | **180** | **1.15** | **1.00** |

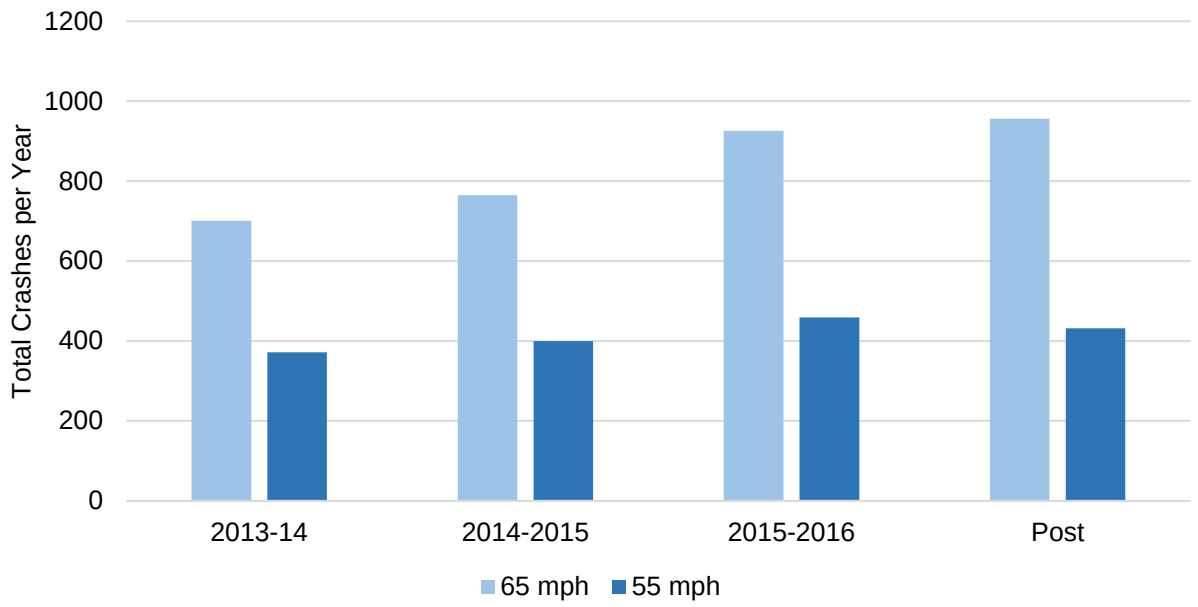



**Figure 3-5 Total Crashes by Year and Posted Speed Group, All Control Segments**

#### *3.3.1.2 Increased Speed Limit Segments*

Table 3-12 summarizes the results of the crash performance in the sections where the speed limits were increased for total crashes. Figure 3-5 presents a plot of the crash counts for all of the control segments by year and posted speed. For the sections of highway that were increased to 70 mph, the index calculated for the counts of crashes of all segments in the group is 1.75. This is much larger than the index calculated for the volume change (1.1) or the control sections (1.2). An estimated 382 more total crashes were observed in this group in the one-year period after the speed change. The majority of the increased crashes are from I-84, as it the longest and highest-volume roadway in the table. For the group of sections of highways that were increased from 55 mph to 65 mph, the overall crash counts increased, with an index of 1.43 (more than the volume index change of 1.2).

**Table 3-12 Total Crashes, Before-to-After, Increased Speed Limit Segments**

| Seg | Route | 2013-2014 | 2014-2015 | 2015-2016 | 3-year Avg | Post | Delta | Index, 3-yr Avg | Index, Prior Yr |
|---|---|---|---|---|---|---|---|---|---|
| 2 | I-84 | 424 | 473 | 466 | 454 | 785 | 331 | 1.73 | 1.68 |
| 3 | US-95 | 23 | 41 | 46 | 37 | 68 | 31 | 1.85 | 1.48 |
| 12 | I-82 | 12 | 22 | 20 | 18 | 38 | 20 | 2.11 | 1.90 |
| **70 mph Subtotal** | | **459** | **536** | **532** | **509** | **891** | **382** | **1.75** | **1.67** |
| 4 | US-26/ US-20 | 106 | 119 | 139 | 121 | 174 | 53 | 1.43 | 1.25 |
| 5 | US-97 | 261 | 287 | 366 | 305 | 435 | 130 | 1.43 | 1.19 |
| 6 | OR-31 | 14 | 28 | 29 | 24 | 44 | 20 | 1.86 | 1.52 |
| 7 | OR-78 | 6 | 17 | 12 | 12 | 21 | 9 | 1.80 | 1.75 |
| 8 | US-395 | 10 | 5 | 5 | 7 | 9 | 2 | 1.35 | 1.80 |
| 9 | US-395 | 20 | 12 | 18 | 17 | 33 | 16 | 1.98 | 1.83 |
| 10 | OR-205 | 9 | 8 | 5 | 7 | 6 | -1 | 0.82 | 1.20 |
| 11 | US-26 | 24 | 32 | 30 | 29 | 22 | -7 | 0.77 | 0.73 |
| **65 mph Subtotal** | | **450** | **508** | **604** | **521** | **744** | **223** | **1.43** | **1.23** |
| **Total** | | **909** | **1,044** | **1,136** | **1,030** | **1,635** | **605** | **1.59** | **1.44** |

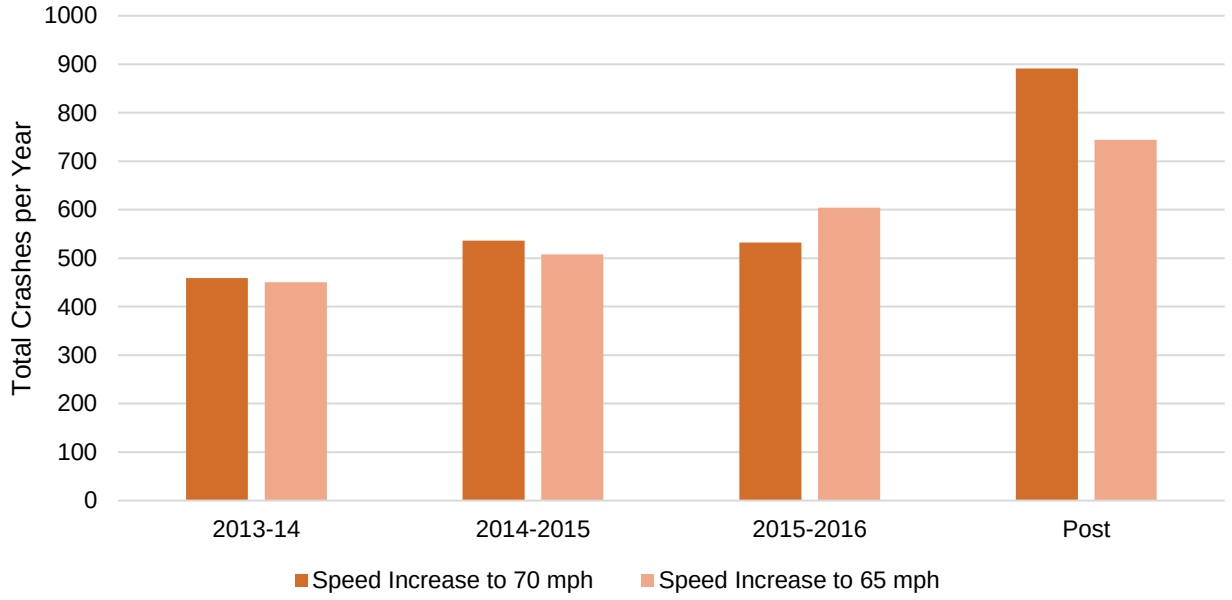



**Figure 3-6 Total Crashes by Year by Posted Speed, Increased Speed Limit Segments**

#### *3.3.1.3 Temporary Speed Reduction Segments*

Table 3-13 shows the results of the crash counts in the speed reduction sections. These sections are short and there are fewer crashes to analyze. For the sections of highways that were kept at 55 mph rather than raised to 65 mph, the overall crash counts increased slightly. The index change for this group was 1.09 (less than the volume index change of 1.2).

**Table 3-13 Total Crashes, Before-to-After, Speed Reduction Segments**

| Seg | Route | 2013-2014 | 2014-2015 | 2015-2016 | 3-year Avg | Post | Delta | Index, 3-yr Avg | Index Prior |
|---|---|---|---|---|---|---|---|---|---|
| 13 | US-97 | 7 | 4 | 4 | 5 | 3 | -2 | 0.60 | 0.75 |
| 14 | US-97 | 28 | 41 | 24 | 31 | 32 | 1 | 1.03 | 1.33 |
| 15 | US-20 | 11 | 17 | 8 | 12 | 13 | 1 | 1.08 | 1.63 |
| 16 | US-20 | 14 | 13 | 22 | 16 | 22 | 6 | 1.35 | 1.00 |
| **Total** | | **60** | **75** | **58** | **64** | **70** | **6** | **1.09** | **1.21** |

### 3.3.2 Fatal and Injury A Crashes

Fatal and injury A (severe) crash counts are analyzed for control, increased speed limits and the speed reduction segments. As a reminder, these crashes include mainline crashes within the milepost boundaries for each segment presented previously in Table 2-4, Table 2-5 and Table 2-6.

#### *3.3.2.1 Control Segments*

Table 3-14 summarizes the results of the crash performance in the control sections. For the group of 65-mph freeway sections, the index for the three-year average calculation is 1.37 (more than in the index for total crashes and more than the volume index of 1.0). An estimated seven more fatal and injury crashes were observed. For the 55-mph group selected for comparison, the fatal and injury A crash counts also increased, with an index of 1.21 (more than the volume index change of 1.1). Figure 3-7 presents a plot of the crash counts for all of the control segments by year and posted speed.

**Table 3-14 Fatal and Injury A Crashes, Before-to-After, Control Segments**

| Seg | Route | 2013-2014 | 2014-2015 | 2015-2016 | 3-year Avg | Post | Delta | Index, 3-yr Avg | Index Prior |
|---|---|---|---|---|---|---|---|---|---|
| 1 | I-84 | 6 | 4 | 4 | 5 | 7 | 2 | 1.50 | 1.75 |
| 11 | I-5 | 12 | 17 | 14 | 14 | 19 | 5 | 1.33 | 1.36 |
| **65 mph subtotal** | | **18** | **21** | **18** | **19** | **26** | **7** | **1.37** | **1.44** |
| 2 | OR-11 | 1 | 5 | 0 | 2 | 2 | 0 | 1.00 | - |
| 3 | US-26 | 2 | 2 | 5 | 3 | 3 | 0 | 1.00 | 0.60 |
| 4 | US-26 | 1 | 4 | 4 | 3 | 2 | -1 | 0.67 | 0.50 |
| 5 | OR-58 | 8 | 5 | 7 | 7 | 11 | 4 | 1.65 | 1.57 |
| 6 | US-20 | 4 | 3 | 6 | 4 | 5 | 1 | 1.15 | 0.83 |
| 7 | OR-126 | 2 | 3 | 0 | 2 | 4 | 2 | 2.40 | - |
| 8 | OR-19 | 1 | 2 | 0 | 1 | 3 | 2 | 3.00 | - |
| 9 | OR-3 | 2 | 1 | 1 | 1 | 0 | -1 | 0.00 | 0.00 |
| 10 | OR-126 | 9 | 4 | 7 | 7 | 5 | -2 | 0.75 | 0.71 |
| 12 | OR-140 | 6 | 3 | 1 | 3 | 5 | 2 | 1.50 | 5.00 |
| **55 mph subtotal** | | **36** | **32** | **31** | **33** | **40** | **7** | **1.21** | **1.29** |
| **Total** | | **54** | **53** | **49** | **52** | **66** | **14** | **1.27** | **1.35** |

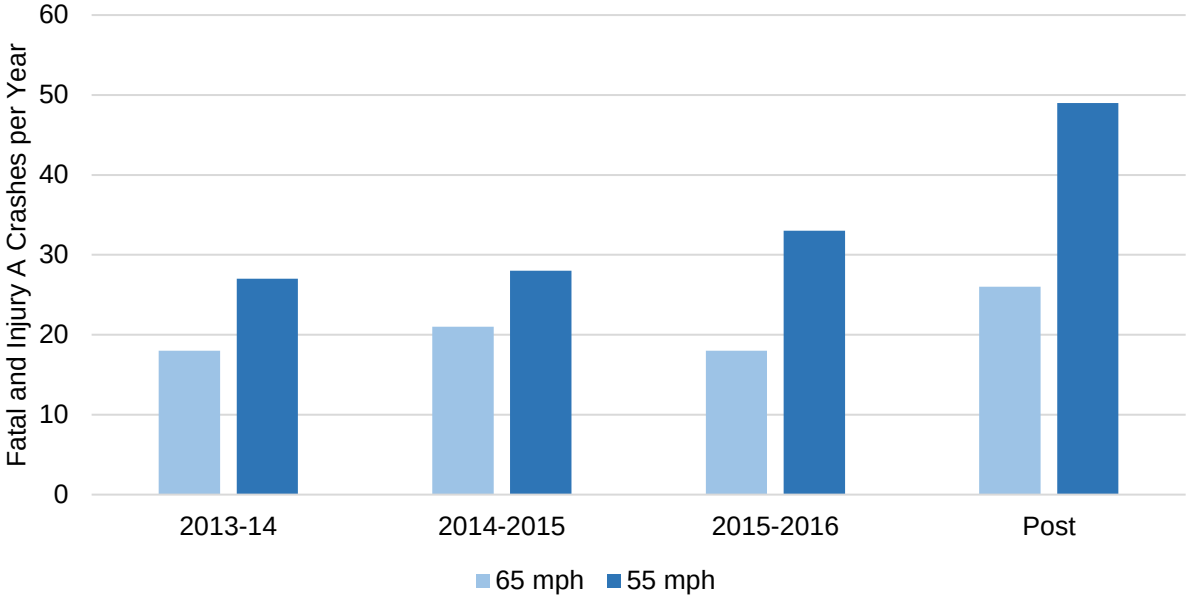



**Figure 3-7 Fatal and Injury A Crashes per Year by Posted Speed, All Control Segments**

*3.3.2.2 Increased Speed Limit Segments*

Table 3-16 summarizes the results of the crash performance in the sections where the speed limits were increased for fatal and injury A crashes. For the 70-mph freeway sections, the index for the group for three-year period is 1.36 (more than in the index for total crashes and more than the volume index of 1.1) but the same as the index change for the control sections (1.37). An estimated nine more fatal and injury crashes were observed. For the sections where the speed was increased from 55 mph to 65 mph, the fatal and injury A crash counts also increased, with an index of 1.67 (more than the volume index change of 1.2) and more than the control group (1.21). Figure 3-8 presents a plot of the crash counts for all of the increased speed segments by year and posted speed.

**Table 3-15 Fatal and Injury Crashes, Before-to-After, Increased Speed Segments**

| Seg | Route | 2013-2014 | 2014-2015 | 2015-2016 | 3-year Avg | Post | Delta | Index, 3-yr Avg | Index, Prior Yr |
|---|---|---|---|---|---|---|---|---|---|
| 2 | I-84 | 14 | 24 | 22 | 20 | 26 | 6 | 1.30 | 1.18 |
| 3 | US-95 | 4 | 5 | 3 | 4 | 4 | 0 | 1.00 | 1.33 |
| 12 | I-82 | 0 | 3 | 0 | 1 | 4 | 3 | 4.00 | - |
| **70 mph Subtotal** | | **18** | **32** | **25** | **25** | **34** | **9** | **1.36** | **1.36** |
| 4 | US-26/ US-20 | 11 | 7 | 6 | 8 | 10 | 2 | 1.25 | 1.67 |
| 5 | US-97 | 11 | 15 | 23 | 16 | 32 | 16 | 1.96 | 1.39 |
| 6 | OR-31 | 1 | 2 | 0 | 1 | 1 | 0 | 1.00 | - |
| 7 | OR-78 | 0 | 1 | 1 | 1 | 3 | 2 | 4.50 | 3.00 |
| 8 | US-395 | 1 | 0 | 0 | 0 | 1 | 1 | 3.00 | - |
| 9 | US-395 | 1 | 1 | 1 | 1 | 0 | -1 | 0.00 | 0.00 |
| 10 | OR-205 | 2 | 0 | 0 | 1 | 1 | 0 | 1.50 | - |
| 11 | US-26 | 0 | 2 | 2 | 1 | 1 | 0 | 0.75 | 0.50 |
| **65 mph Subtotal** | | **27** | **28** | **33** | **29** | **49** | **20** | **1.67** | **1.48** |
| **Total** | | **45** | **60** | **58** | **54** | **83** | **29** | **1.53** | **1.43** |

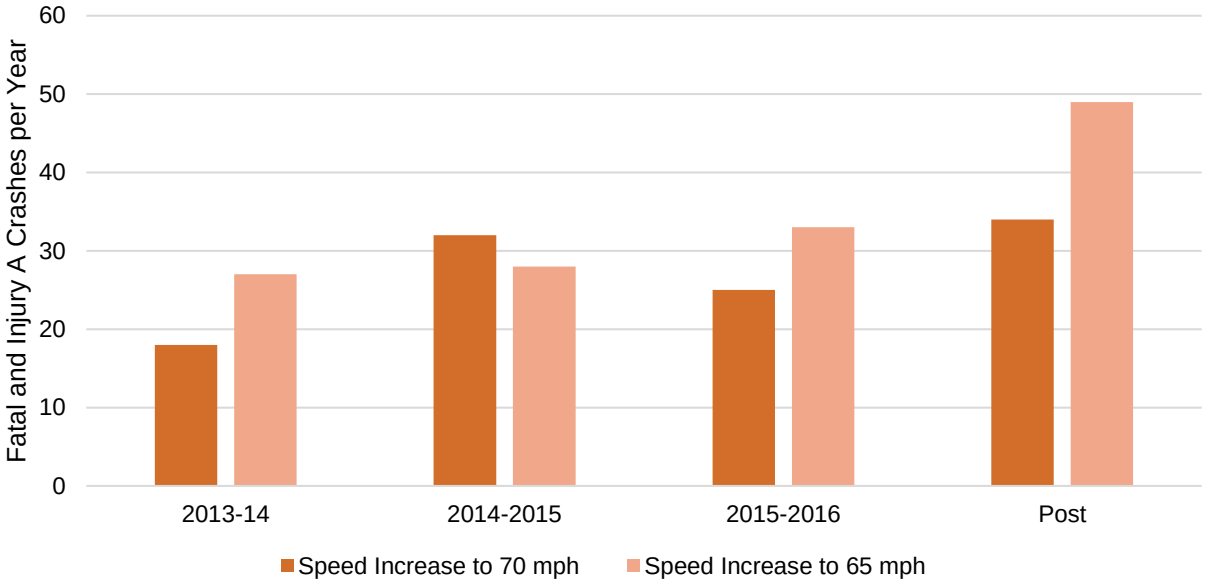



**Figure 3-8 Fatal and Injury A Crashes per Year by Posted Speed, All Increased Speed Sections**

#### *3.3.2.3 Temporary Speed Reduction Segments*

Table 3-16 shows the fatal and injury crash change on the speed reduction sections. The overall counts are low so it is difficult to draw conclusions. The US-97 location averages one crash per year and in the after period had seven crashes. Further research on the crash performance of this section may be warranted.

**Table 3-16 Fatal and Injury A Crashes, Before-to-After, Speed Reduction Segments**

| Seg | Route | 2013-2014 | 2014-2015 | 2015-2016 | 3-year Avg | Post | Delta | Index, 3-yr Avg | Index Prior |
|---|---|---|---|---|---|---|---|---|---|
| 13 | US-97 | 0 | 0 | 0 | 0 | 0 | 0 | - | - |
| 14 | US-97 | 0 | 0 | 1 | 0.3 | 7 | 7 | 21.00 | 7.00 |
| 15 | US-20 | 1 | 2 | 0 | 1 | 1 | 0 | 1.00 | - |
| 16 | US-20 | 4 | 2 | 0 | 2 | 0 | -2 | 0.00 | - |
| **Total** | | **5** | **4** | **1** | **3** | **8** | **5** | **2.40** | **8.00** |

### 3.3.3 Total Truck-Involved Crashes

Total truck-involved crash counts are analyzed for control, increased speed limit and the speed reduction segments. As a reminder, these crashes include mainline crashes within the milepost boundaries for each segment presented previously in Table 2-4, Table 2-5 and Table 2-6.

#### *3.3.3.1 Control Segments*

Table 3-17 summarizes the results of the crash performance in the control sections. For the group of 60-mph freeway sections, the index for the three-year period is 1.02. An estimated two more total truck-involved crashes were observed. For the 55-mph group selected for comparison, the overall crash counts decreased, with an index of 0.83. Figure 3-9 presents a plot of the truck-involved crash counts by year and posted speed for all of the control segments.

**Table 3-17 Total Truck-Involved Crashes, Before-to-After, Control Segments**

| Seg | Route | 2013-2014 | 2014-2015 | 2015-2016 | 3-year Avg | Post | Delta | Index, 3-yr Avg | Index, Prior Yr |
|---|---|---|---|---|---|---|---|---|---|
| 1 | I-84 | 33 | 58 | 41 | 44 | 35 | -9 | 0.80 | 0.85 |
| 11 | I-5 | 66 | 57 | 76 | 66 | 77 | 11 | 1.16 | 1.01 |
| **60 mph subtotal** | | **99** | **115** | **117** | **110** | **112** | **2** | **1.02** | **0.96** |
| 2 | OR-11 | 0 | 4 | 1 | 2 | 2 | 0 | 1.20 | 2.00 |
| 3 | US-26 | 3 | 1 | 2 | 2 | 1 | -1 | 0.50 | 0.50 |
| 4 | US-26 | 1 | 4 | 13 | 6 | 3 | -3 | 0.50 | 0.23 |
| 5 | OR-58 | 18 | 22 | 12 | 17 | 15 | -2 | 0.87 | 1.25 |
| 6 | US-20 | 1 | 3 | 3 | 2 | 2 | 0 | 0.86 | 0.67 |
| 7 | OR-126 | 1 | 0 | 3 | 1 | 4 | 3 | 3.00 | 1.33 |
| 8 | OR-19 | 0 | 0 | 0 | 0 | 0 | 0 | - | - |
| 9 | OR-3 | 0 | 1 | 0 | 0 | 0 | 0 | 0.00 | - |
| 10 | OR-126 | 6 | 1 | 3 | 3 | 2 | -1 | 0.60 | 0.67 |
| 12 | OR-140 | 7 | 4 | 1 | 4 | 3 | -1 | 0.75 | 3.00 |
| **55 mph subtotal** | | **37** | **40** | **38** | **38** | **32** | **-6** | **0.83** | **0.84** |
| **Total** | | **136** | **155** | **155** | **149** | **144** | **-5** | **0.97** | **0.93** |

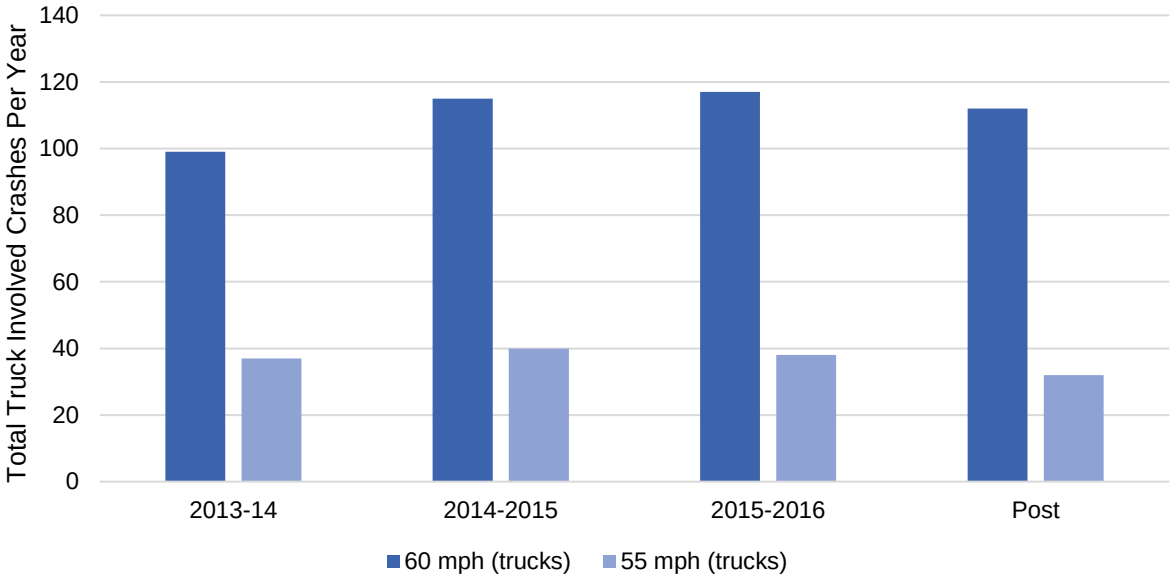



**Figure 3-9 Total Truck-Involved Crashes by Year by Posted Speed, All Control Segments**

*3.3.3.2 Increased Speed Limit Segments*

Table 3-18 summarizes the results of the crash performance analysis in the sections where the speed limits were increased for truck-involved crashes. Figure 3-10 presents a plot of the crash counts by year and posted speed for all of the control segments. For the sections of highway increased to 65 mph for trucks, the index for these segments for the three-year period is 2.00. This is much larger than the index calculated for the volume change (1.1) or the control sections (1.2). An estimated 140 more total truck-involved crashes were observed in this group in the one-year period after the speed change. The majority of the increased counts are from I-84, as it the longest and highest-volume roadway in the table. For the sections of highways that were increased from 55 mph to 60 mph for trucks, the overall crash counts increased, with an average index of 1.51 (more than the volume index change of 1.2).

**Table 3-18 Total Truck-Involved Crashes, Before-to-After, Increased Speed Segments**

| Seg | Route | 2013-2014 | 2014-2015 | 2015-2016 | 3-year Avg | Post | Delta | Index, 3-yr Avg | Index, Prior Yr |
|---|---|---|---|---|---|---|---|---|---|
| 2 | I-84 | 128 | 115 | 131 | 125 | 249 | 124 | 2.00 | 1.90 |
| 3 | US-95 | 4 | 11 | 14 | 10 | 21 | 11 | 2.17 | 1.50 |
| 12 | I-82 | 4 | 6 | 5 | 5 | 9 | 4 | 1.80 | 1.80 |
| **65 mph trucks subtotal** | | **136** | **132** | **150** | **139** | **279** | **140** | **2.00** | **1.86** |
| 4 | US-26/ US-20 | 25 | 14 | 13 | 17 | 25 | 8 | 1.44 | 1.92 |
| 5 | US-97 | 42 | 48 | 67 | 52 | 80 | 28 | 1.53 | 1.19 |
| 6 | OR-31 | 1 | 4 | 2 | 2 | 3 | 1 | 1.29 | 1.50 |
| 7 | OR-78 | 1 | 2 | 2 | 2 | 4 | 2 | 2.40 | 2.00 |
| 8 | US-395 | 2 | 0 | 0 | 1 | 0 | -1 | 0.00 | - |
| 9 | US-395 | 2 | 0 | 1 | 1 | 3 | 2 | 3.00 | 3.00 |
| 10 | OR-205 | 0 | 1 | 0 | 0 | 0 | 0 | 0.00 | - |
| 11 | US-26 | 2 | 3 | 4 | 3 | 1 | -2 | 0.33 | 0.25 |
| **60 mph trucks subtotal** | | **75** | **72** | **89** | **79** | **116** | **37** | **1.47** | **1.30** |
| **Total** | | **211** | **204** | **239** | **218** | **395** | **177** | **1.81** | **1.65** |

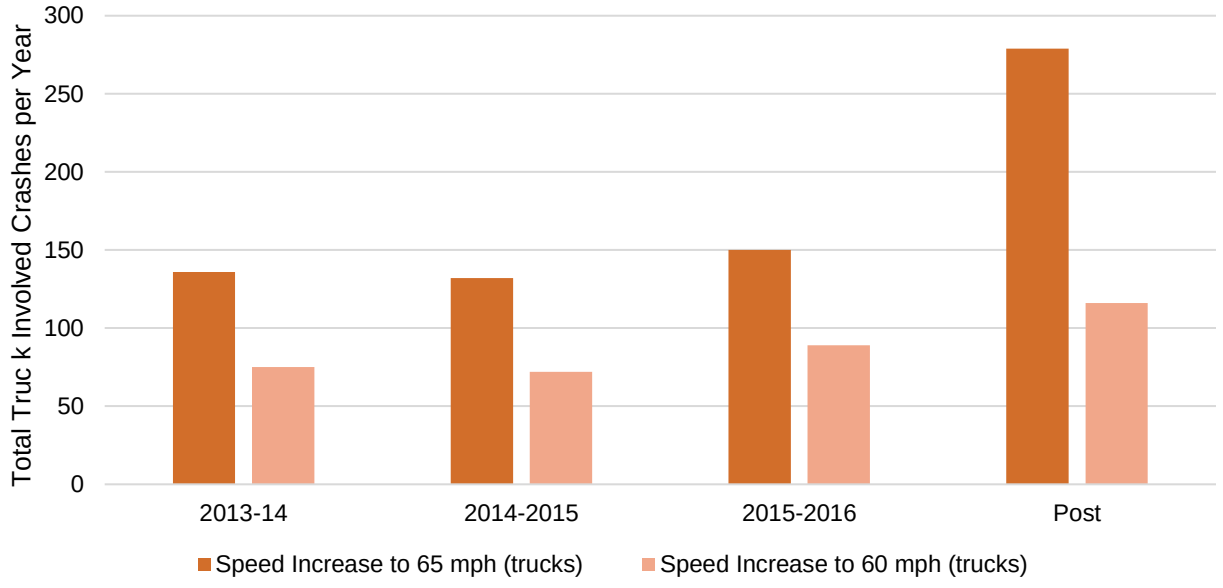



**Figure 3-10 Total Truck-Involved Crashes by Year and Posted Speed Limit, Increased Speed Limit Segments**

#### *3.3.3.3 Temporary Speed Reduction Segments*

Table 3-19 shows the results of the crash counts in the speed reduction sections. These sections are short and there are fewer crash counts for analysis. For the sections of highways that were kept at 55 mph rather than raised to 65 mph, the overall truck-involved crash counts decreased, but with an index of 0.78 (less than the volume index change of 1.2).

**Table 3-19 Total Truck-Involved Crashes, Before-to-After, Speed Reduction Segments**

| Seg | Route | 2013-2014 | 2014-2015 | 2015-2016 | 3-year Avg | Post | Delta | Index, 3-yr Avg | Index Prior |
|---|---|---|---|---|---|---|---|---|---|
| 13 | US-97 | 2 | 0 | 0 | 1 | 1 | 0 | 1.50 | - |
| 14 | US-97 | 3 | 8 | 3 | 5 | 5 | 0 | 1.07 | 1.67 |
| 15 | US-20 | 0 | 2 | 2 | 1 | 1 | 0 | 0.75 | 0.50 |
| 16 | US-20 | 4 | 2 | 1 | 2 | 0 | -2 | 0.00 | 0.00 |
| **Total** | | **9** | **12** | **6** | **9** | **7** | **-2** | **0.78** | **1.17** |

### 3.3.4 Fatal and Injury A Truck-Involved Crashes

Fatal and injury A (severe) truck-involved crash counts are analyzed for control, increased speed limit and the speed reduction segments. As a reminder, these crashes include mainline crashes within the milepost boundaries for each segment presented previously in Table 2-4, Table 2-5 and Table 2-6.

#### *3.3.4.1 Control Segments*

Table 3-20 summarizes the results of the crash performance in the control sections. For the 60-mph (trucks) freeway group, the index for the three-year period is 1.67 (more than in the index for total crashes and more than the volume index of 1.0). An estimated two more fatal and injury A crashes were observed. For the 55-mph group selected for comparison, the fatal and injury A crash counts decreased, with an index of 0.69 (more than the volume index change of 1.1). However, for both of these categories the crash counts are small and many changes on individual segments could not be calculated to do zero counts (shown with "-" in the tables). Figure 3-11 presents a plot of the fatal and injury A truck-involved crash counts for all of the control segments by year.

**Table 3-20 Fatal and Injury A Truck-Involved Crashes, Before-to-After, Control Segments**

| Seg | Route | 2013-2014 | 2014-2015 | 2015-2016 | 3-year Avg | Post | Delta | Index, 3-yr Avg | Index Prior |
|---|---|---|---|---|---|---|---|---|---|
| 1 | I-84 | 1 | 0 | 0 | 0 | 2 | 2 | 6.00 | - |
| 11 | I-5 | 5 | 2 | 1 | 3 | 3 | 0 | 1.13 | 3.00 |
| **60 mph (trucks) subtotal** | | **6** | **2** | **1** | **3** | **5** | **2** | **1.67** | **5.00** |
| 2 | OR-11 | 0 | 1 | 0 | 0 | 0 | 0 | 0.00 | |
| 3 | US-26 | 0 | 0 | 0 | 0 | 0 | 0 | - | - |
| 4 | US-26 | 0 | 1 | 1 | 1 | 0 | -1 | 0.00 | 0.00 |
| 5 | OR-58 | 3 | 2 | 0 | 2 | 2 | 0 | 1.20 | - |
| 6 | US-20 | 0 | 0 | 0 | 0 | 1 | 1 | - | - |
| 7 | OR-126 | 0 | 0 | 0 | 0 | 0 | 0 | - | |
| 8 | OR-19 | 0 | 0 | 0 | 0 | 0 | 0 | - | |
| 9 | OR-3 | 2 | 0 | 1 | 1 | 0 | -1 | 0.00 | 0.00 |
| 10 | OR-126 | 1 | 0 | 0 | 0 | 0 | 0 | 0.00 | - |
| 12 | OR-140 | 1 | 0 | 0 | 0 | 0 | 0 | 0.00 | - |
| **55 mph (trucks) subtotal** | | **7** | **4** | **2** | **4** | **3** | **-1** | **0.69** | **1.50** |
| **Total** | | **13** | **6** | **3** | **7** | **8** | **1** | **1.09** | **2.67** |

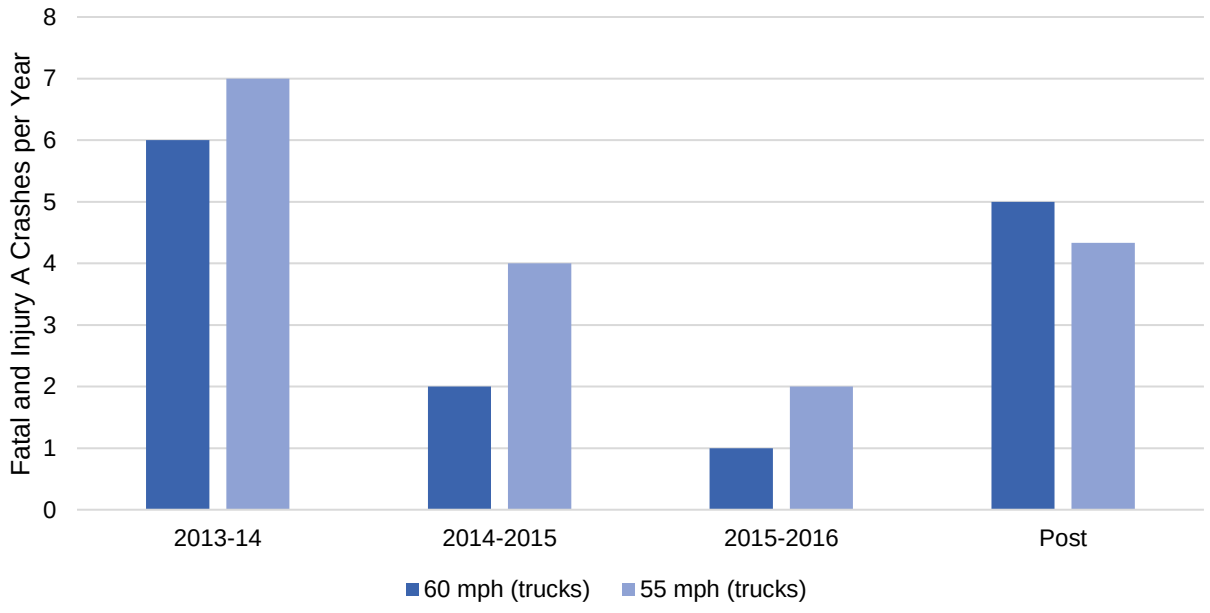



**Figure 3-11 Fatal and Injury A Truck-Involved Crashes by Year and Posted Speed, All Control Segments**

#### *3.3.4.2 Increased Speed Limit Segments*

Table 3-21 summarizes the results of the crash performance in the sections where the speed limits were increased for truck-involved fatal and injury A crashes. For the 65-mph (truck) freeway sections, the index for the group for three-year period is 1.29. An estimated four more fatal and injury crashes were observed. For the sections where the speed was increased from 55 mph to 60 mph for trucks, the fatal and injury A crash counts also increased, with an index of 1.60. Figure 3-12 presents a plot of the fatal and injury A truck-involved crash counts for the increased speed limit sections.

**Table 3-21 Fatal and Injury A Truck Involved Crashes, Before-to-After, Increased Speed Segments**

| Seg | Route | 2013-2014 | 2014-2015 | 2015-2016 | 3-year Avg | Post | Delta | Index, 3-yr Avg | Index, Prior Yr |
|---|---|---|---|---|---|---|---|---|---|
| 2 | I-84 | 3 | 9 | 6 | 6 | 8 | 2 | 1.33 | 1.33 |
| 3 | US-95 | 1 | 1 | 1 | 1 | 0 | -1 | 0.00 | 0.00 |
| 12 | I-82 | 0 | 0 | 0 | 0 | 1 | 1 | - | - |
| **65 trucks mph subtotal** | | **4** | **10** | **7** | **7** | **9** | **2** | **1.29** | **1.29** |
| 4 | US-26/ US-20 | 5 | 0 | 0 | 2 | 3 | 1 | 1.80 | - |
| 5 | US-97 | 1 | 4 | 5 | 3 | 5 | 2 | 1.50 | 1.00 |
| 6 | OR-31 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 7 | OR-78 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 8 | US-395 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 9 | US-395 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 10 | OR-205 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 11 | US-26 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| **60 mph trucks subtotal** | | **6** | **4** | **5** | **5** | **8** | **3** | **1.60** | **1.60** |
| **Total** | | **10** | **14** | **12** | **12** | **17** | **5** | **1.42** | **1.42** |

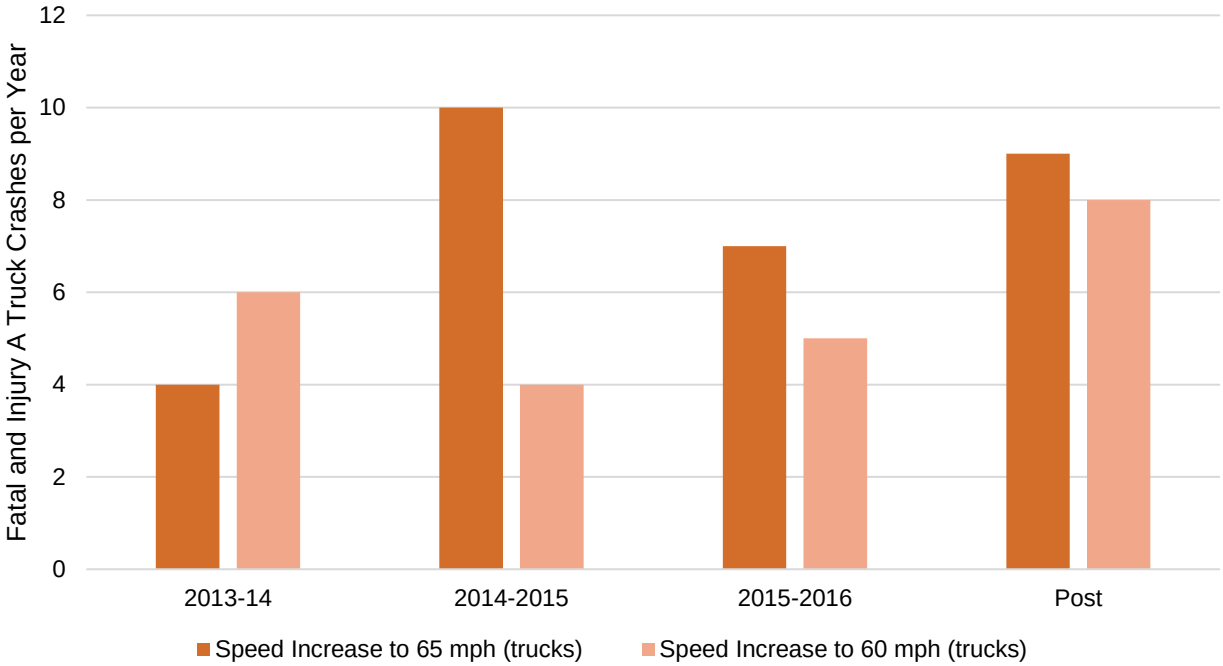



**Figure 3-12 Fatal and Injury A Truck-Involved Crashes by Year and Posted Speed, All Increased Speed Sections**

*3.3.4.3 Temporary Speed Reduction Segments*

Table 3-22 shows the fatal and injury truck-involved crash change on the temporary speed reduction sections. The overall counts are low so it is difficult to draw conclusions. The US-97 location averages one crash per year and in the after period had two truck-involved crashes.

**Table 3-22 Fatal and Injury A Crashes, Before-to-After, Speed Reduction Segments**

| Seg | Route | 2013-2014 | 2014-2015 | 2015-2016 | 3-year Avg | Post | Delta | Index, 3-yr Avg | Index Prior |
|---|---|---|---|---|---|---|---|---|---|
| 13 | US-97 | 0 | 0 | 0 | 0 | 0 | 0 | - | - |
| 14 | US-97 | 0 | 0 | 0 | 0 | 2 | 2 | - | - |
| 15 | US-20 | 0 | 0 | 0 | 0 | 0 | 0 | - | - |
| 16 | US-20 | 4 | 0 | 0 | 1 | 0 | -1 | 0.00 | - |
| **Total** | | 4 | 0 | 0 | 1 | 2 | 1 | 1.50 | - |

### 3.3.5 Crash Proportions (All Vehicles)

The crash counts by type were calculated for each of the highway sections in the before-and-after time periods for the control, increased speed and speed reduction segments. For this section, the control and speed reduction segments are presented together.

#### *3.3.5.1 Control and Speed Reduction Segments*

Table 3-23 shows the results of the proportions analysis. Nearly all of the rear-end crashes (~400) occur on the I-5 control section, which somewhat skews the proportion comparisons. There is little shift in the crash proportions from the before-to-after periods.

**Table 3-23 Proportions of Crash by Type, Control and Speed Reduction Segments**

| | ANGL | BACK | FIX | HEAD | NCOL | OTH | PED | REAR | SS-M | SS-O | TURN | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Before | 13 | 0 | 467 | 27 | 50 | 143 | 8 | 507 | 14 | 173 | 41 | 1443 |
| After | 9 | 3 | 440 | 18 | 51 | 99 | 6 | 578 | 23 | 174 | 57 | 1458 |
| Before % | 0.9% | 0.0% | 32.4% | 1.9% | 3.5% | 9.9% | 0.6% | 35.1% | 1.0% | 12.0% | 2.8% | 100% |
| After % | 0.6% | 0.2% | 30.2% | 1.2% | 3.5% | 6.8% | 0.4% | 39.6% | 1.6% | 11.9% | 3.9% | 100% |
| Delta | -0.3% | -0.2% | 2.2% | 0.6% | 0.0% | 3.1% | 0.1% | -4.5% | -0.6% | 0.1% | -1.1% | |

#### *3.3.5.2 Increased Speed Limit Segments*

Table 3-24 shows the results of the proportions analysis on the increased speed sections. The distribution of approximately 53% of the crashes being fixed or non-collision is expected on the primary rural highways. There is little shift in the crash proportions from the before-to-after periods with the exception of a 6% increase in the percentage of fixed collisions in the after period.

**Table 3-24 Proportions of Crash by Type, Increased Speed Segments**

| | ANGL | BACK | FIX | HEAD | NCOL | OTH | PED | REAR | SS-M | SS-O | TURN | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Before | 6 | 1 | 421 | 39 | 172 | 203 | 4 | 122 | 35 | 69 | 32 | 1104 |
| After | 13 | 1 | 699 | 25 | 240 | 205 | 3 | 188 | 44 | 127 | 40 | 1585 |
| Before % | 0.5% | 0.1% | 38.1% | 3.5% | 15.6% | 18.4% | 0.4% | 11.1% | 3.2% | 6.3% | 2.9% | 100% |
| After % | 0.8% | 0.1% | 44.1% | 1.6% | 15.1% | 12.9% | 0.2% | 11.9% | 2.8% | 8.0% | 2.5% | 100% |
| Delta | 0.3% | 0.0% | 6.0% | -2.0% | -0.4% | -5.5% | -0.2% | 0.8% | -0.4% | 1.8% | -0.4% | |

# 4 SUMMARY

The preliminary analysis compares the changes in speed, volume and safety performance for the sections of highway where the speed was changed and in selected control locations. Twelve months of crash data were available at the time of this report after the speed change was enacted (through the first two months of 2017). The early 2017 data are considered preliminary and subject to change. More data were available for the speed analysis covering January 2015 through March of 2018. To provide a benchmark for comparison of the corridors where the speeds were increased, a set of highways was chosen where the speeds were not changed. Key findings from the analysis are summarized in Table 4-1 and presented graphically in Figure 4-1. The table shows the data on changes in average speed and the percent of vehicles exceeding 65 mph, 75 mph, and 85 mph for the control and the speed change segments. For the monthly volumes and the observed crash data, the table presents an index value. The index column is the division of the post volume or crash counts by the prior three-year average. An index of 1.0 indicates no change. Indexes less than 1 represent a decrease in crash or volume counts and an index greater than 1.0 is an increase.

**Table 4-1 Summary of Preliminary Analysis**

| Speed Change Segment Group | | Change in | | | | Index (*Delta in Crashes per Year*) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Avg. Speed (mph)** | **Percent > 65 mph** | **Percent > 75 mph** | **Percent > 85 mph** | **Total Monthly Volume** | **Total Crashes (All)** | **Fatal & Inj. A Crashes (All)** | **Total Crashes (Trucks)** | **Fatal & Inj. A Crashes (Trucks)** |
| SPEED LIMIT 70 / TRUCKS 65 | **Control** | 0.1 | 0.8 | 1.7 | 0.0 | 1.0 | 1.20<br>*+159* | 1.37<br>*+7* | 1.02<br>*+2* | 1.67<br>*+2* |
| | **Speed Change** | 3.0 | 15.5 | 12.0 | 0.9 | 1.1 | 1.75<br>*+382* | 1.36<br>*+9* | 2.00<br>*+140* | 1.29<br>*+2* |
| *Direction of Change* | | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | – | ↑ | ↓ |
| Preliminary Observation: | | Increase in speeds and shift in more vehicles traveling faster | | | | | Increase in total and total truck-involved crashes. No apparent change in fatal and injury A crashes. A possible decrease in truck-involved fatal injury A crashes | | | |
| SPEED LIMIT 65 / TRUCKS 60 | **Control** | 0.1 | 2.0 | 0.2 | 0.1 | 1.1 | 1.05<br>*+22* | 1.21<br>*+7* | 0.83<br>*-6* | 0.69<br>*-1* |
| | **Speed Change** | 2.6 | 13.4 | 1.9 | 0.3 | 1.2 | 1.43<br>*+223* | 1.67<br>*+20* | 1.47<br>*+37* | 1.60<br>*+3* |
| *Direction of Change* | | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ |
| Preliminary Observation: | | Increase in speeds and shift in more vehicles traveling faster | | | | | Increase in total, fatal and injury A crashes, truck involved, and truck involved fatal and injury A crashes. | | | |

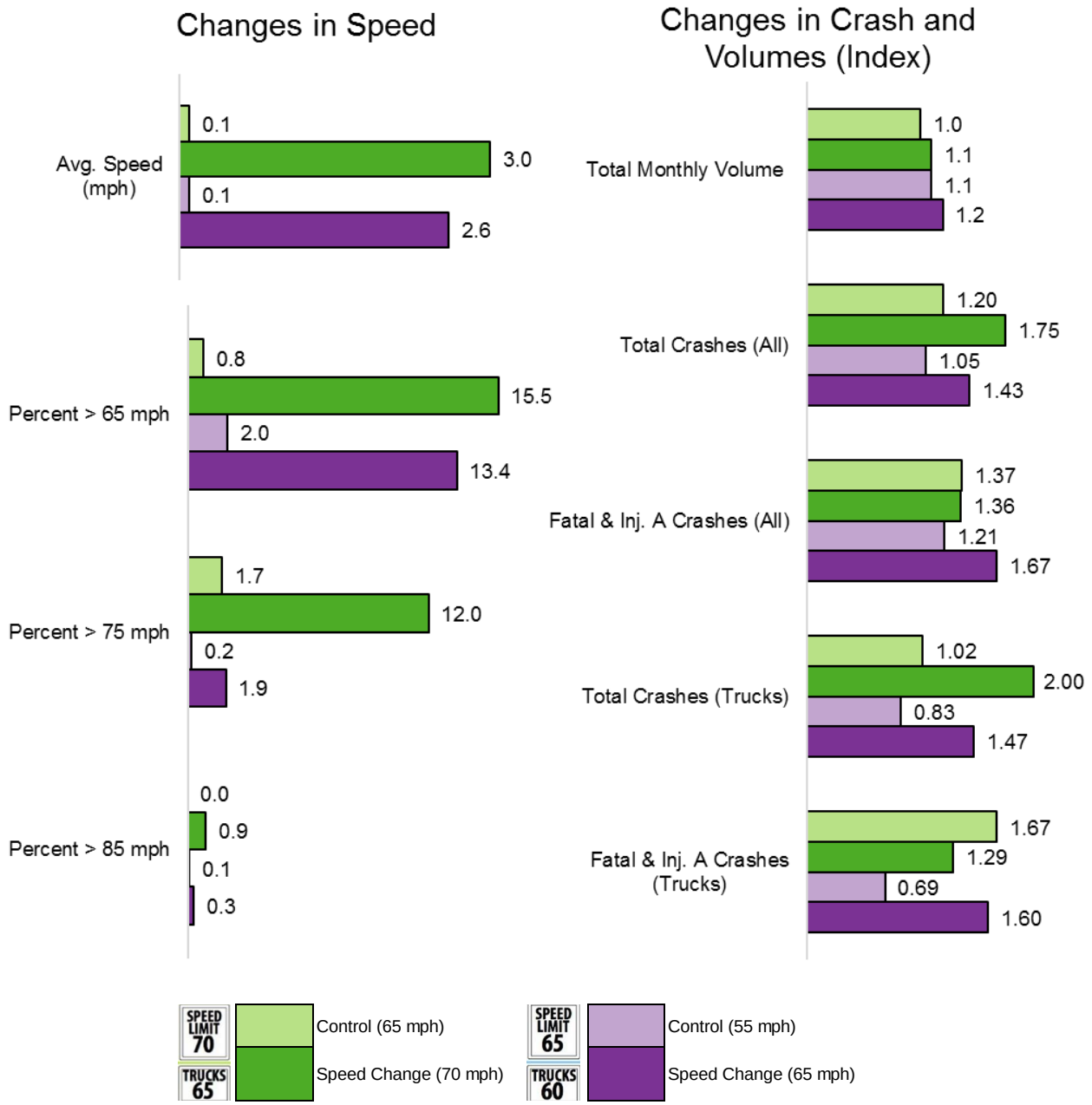



**Figure 4-1 Summary Charts of Preliminary Analysis Metrics**

It is clear from the analysis of the ATR speed data (and the HERE data in the Appendix) that speeds have increased on the highways where the posted speed limits were increased. The data show that both the average and percentage of vehicles exceeding 65, 75 and 85 mph have increased. The average speeds have increased approximately 3 mph and these changes are statistically significant. Overall, with a 5-mph increase in the posted speeds, the literature suggests that when the posted speed limits are increased, the average speed typically increases by something less than the mph increase which is consistent with this analysis. More importantly, the percentage of very fast vehicles (e.g., over 85 mph) has also increased. A large increase in vehicles traveling at very high speeds (i.e., more than 15 mph above the posted speed limit) are a concern since these are the vehicles typically associated with worse crash outcomes. The increases 1) in the stopping distance, 2) in the required detection distance to make reactions in time for collision avoidance, and 3) the kinetic energy in these vehicles all are known physical effects that contribute to increased crashes and severity for vehicles traveling at higher speeds. The speed ATR data also finds some evidence of carryover (higher) speeds in the sections where speed limits were not increased but this needs further exploration.

The preliminary crash analysis finds that the total crashes have increased at a rate higher than both the traffic volume and the crash performance change on control sections than the control sections might suggest. This increase was observed both on the interstates where speeds were increased to 70 mph and the network of rural two-lane highways where speeds were increased from 55 mph to 65 mph. Fatal and injury A crashes did not appear to increase more than the control sections for the interstate speed changes, but did increase for the 55 mph to 65 mph increase sections. Based on the one year trend, there were an additional 20 fatal and severe injury A crashes in these mostly two-lane highway sections. In the literature summarized in the previous reports, it was found that raising speed limits is associated with an increase in the number of crashes, fatalities and serious injuries. These preliminary findings of the analysis are consistent with other related research and analysis that have found increased crash frequency and severity with increased speed limits.

The preliminary crash analysis finds that the total truck-involved crashes have increased at a rate higher than both the total traffic volume and the truck-related crash performance change on the control sections. On the sections where the speed limit was raised to 65 mph for trucks (primarily the interstates), truck-involved crashes more than doubled (an index of 2.00). On the sections where the speed limit was increased to 60 mph for trucks, crashes also increased more than the truck-involved crashes on the control sections. There are fewer fatal and injury A crashes that involve trucks. On the 65-mph segments the increase was similar to the control sections. On the 55-mph segments, the increase was more than the control sections.

In the temporary speed reduction segments, the total crashes increased but at the same rate as the increase in the traffic volumes. The total truck-involved crashes decreased. However, the fatal and injury A crashes, for all vehicles and for truck-involved crashes increased. These segments are short and the crash counts are much smaller than the other categories which makes the index calculation more sensitive. Nonetheless, it appears that crash changes (increases or decreases) were not observed in the temporary speed reduction segments.

Overall, the preliminary trend in crash performance on the sections of highways where the speed limits were increased warrant continued monitoring. A longer time series with additional crash data will improve the analysis.

## 4.1 Limitations

ATR speed data is limited to the point of the station. Presently, much of the rural network outside of I-84 and US-97 is not well covered. Also, the high percentage of truck traffic at the speed change ATRs could be influencing the overall speed increase and might be heavily weighted by the heavy trucks. There are also some missing data and errors in the analyzed sample. This preliminary analysis did not explore truck speeds except for the analysis in the Appendix of the HERE data. Speed limit differentials, especially on two-lane sections of highway, have the potential to create additional interaction and conflict opportunities between vehicles in the traffic stream. The HERE data does show, similar to the ATR data, that average speeds increased for trucks on all of the speed limit change segments by about 3 mph (see page 66 in Appendix). The 90$^{th}$ percentiles of the truck speeds also increased by about 3 mph while the auto 90$^{th}$ percentile speeds increased by less than 1 mph. Future work will make use of the HERE data in additional analysis, including exploring changes in speed variability.

The methods used for crash performance analysis are generally categorized as before-after methods and cross-sectional methods. The before-after methods are generally preferred and of those methods, the empirical Bayes before-after study is considered the state of the practice and is a preferred approach. Development of these functions was outside the scope of this project. In this preliminary analysis, a simplified approach is taken with the expectation that when more data becomes available a more rigorous analysis will be conducted. The control segments were chosen to improve the interpretations of the change in crash performance. In addition, nearly all of the higher-volume highways were affected by the speed change requiring the use of control sections in Eastern Oregon and, thus, the index change analysis is not completely matched. The crash data are preliminary and are only for one year in the post period. The one year includes the winter months of January and February 2017 which tend to have significantly more crashes in Eastern Oregon. While not shown in the report, the analysis was conducted in only the months of March to October and the crash performance results were essentially unchanged (though this analysis has less than a full year for comparison).

# 5 APPENDIX

## A: ATR Data Summary

| | | | |
|---|---|---|---|
| 01-001 | North Powder | 8/2017 | Affected by eclipse? |
| 01-013 | South Baker | 1/2015 | Major truck wreck on the 17th. |
| 01-013 | South Baker | 1/2016 | Wreck on the 28th and 29th. |
| 01-013 | South Baker | 3/2016 | One day deleted? |
| 01-013 | South Baker | 3/2016 | Data for the 15th incomplete, deleted. |
| 01-013 | South Baker | 8/2017 | Higher volumes due to eclipse. |
| 03-006 | Rhododendron | 1/2015 | Wreck took out equipment. |
| 03-006 | Rhododendron | 3/2015 | 12-hour closure after explosion one day. |
| 03-006 | Rhododendron | 9/2017 | Higher volumes due to fire closure on I-84. |
| 03-011 | Wilsonville | 7/2017 | Night paving. |
| 03-011 | Wilsonville | 8/2017 | Much lower volume. Loops cut? Night paving. |
| 03-011 | Wilsonville | 9/2017 | No data this month. |
| 03-011 | Wilsonville | 10/2017 | No data this month. |
| 03-011 | Wilsonville | 11/2017 | Partial month? |
| 09-003 | Lava Butte | 5/2015 | Higher volumes due to nearby county road closure? |
| 09-003 | Lava Butte | 6/2015 | Higher volumes due to nearby county road closure? |
| 09-003 | Lava Butte | 7/2015 | Higher volumes due to nearby county road closure? |
| 09-003 | Lava Butte | 9/2016 | Partial month? |
| 09-003 | Lava Butte | 10/2016 | No data |
| 09-003 | Lava Butte | 11/2016 | Partial month? |
| 09-020 | Redmond | 11/2017 | No power on the 29th and 30th. |
| 09-020 | Redmond | 12/2017 | No power on the 1st through the 5th. |
| 12-003 | Dayville | 2/2017 | Partial month? |
| 12-003 | Dayville | 3/2017 | Partial month? |
| 13-001 | Burns | 4/2016 | No data this month. |
| 13-001 | Burns | 5/2016 | 1st and 2nd deleted. Inaccurate data. |
| 13-007 | Steens | 1/2016 | Increased traffic due to Wildlife Refuge takeover. |
| 14-004 | Cascade Locks | 5/2015 | Partial month? |
| 14-004 | Cascade Locks | 9/2017 | Volume low due to Eagle Creek Fire and road closures. Road closures for rock blasting on I-84 throughout the month. |
| 14-004 | Cascade Locks | 11/2017 | Damaged loops? |
| 14-004 | Cascade Locks | 12/2017 | Damaged loops? |
| 14-004 | Cascade Locks | 1/2018 | Damaged loops? |
| 14-004 | Cascade Locks | 2/2018 | Damaged loops? Partial data. |
| 14-004 | Cascade Locks | 3/2018 | No data |
| 15-013 | Shady Cove | 10/2015 | Two partial days deleted. |
| 16-002 | Madras | 4/2016 | Partial month? |
| 16-002 | Madras | 5/2016 | Partial month? |
| 16-002 | Madras | 6/2016 | Partial month. |
| 18-019 | Midland | 7/2015 | Recorder moved to mp 289.44 this month. Was 291.73. |
| 18-019 | Midland | 7/2016 | I do not think this recorder ran a full month. SLR |
| 18-019 | Midland | 8/2016 | No speed data this month. |
| 18-019 | Midland | 9/2016 | No speed data this month. |
| 18-019 | Midland | 10/2016 | Half a month? |
| 18-019 | Midland | 11/2016 | No speed data found. |
| 18-019 | Midland | 12/2016 | Half a month? |

| | | | |
|---|---|---|---|
| 18-019 | Midland | 3/2017 | Partial month? |
| 18-019 | Midland | 4/2017 | Partial data? |
| 18-019 | Midland | 5/2017 | Partial data? |
| 18-019 | Midland | 8/2017 | Higher volumes due to eclipse. |
| 18-022 | Modoc Point | 2/2017 | No speed data this month? |
| 18-022 | Modoc Point | 7/2017 | Incident caused mid-day slow-downs for 3 days. |
| 19-008 | New Pine Creek | 8/2017 | ADT high due to eclipse on Aug. 21 |
| 20-005 | Noti | 8/2016 | Most of the month missing? |
| 20-005 | Noti | 9/2016 | No data this month. |
| 20-005 | Noti | 10/2016 | No data this month. |
| 20-005 | Noti | 11/2016 | Partial month? |
| 22-005 | North Albany | 10/2017 | Construction. Loops severed, then restored. Total traffic counts low relative to other months. |
| 23-006 | Cairo Jct. | 10/2015 | Speeds might be wrong until loops are tuned. |
| 23-006 | Cairo Jct. | 11/2015 | Speeds might be wrong until loops are tuned. |
| 23-006 | Cairo Jct. | 1/2016 | Speeds might be wrong until loops are tuned. |
| 23-006 | Cairo Jct. | 2/2016 | Speeds might be wrong until loops are tuned. |
| 23-006 | Cairo Jct. | 3/2016 | Speeds might be wrong until loops are tuned. |
| 23-006 | Cairo Jct. | 4/2016 | Speeds might be wrong until loops are tuned. |
| 23-006 | Cairo Jct. | 5/2016 | Speeds might be wrong until loops are tuned. |
| 23-006 | Cairo Jct. | 6/2016 | Speeds might be wrong until loops are tuned. |
| 23-016 | Huntington | 5/2017 | Half a month? |
| 23-016 | Huntington | 10/2017 | Two days missing? |
| 25-007 | Lexington | 9/2017 | Lower ADT due to fire on I-84 detour. |
| 28-002 | Rufus | 1/2015 | Two low volume days. Construction near Biggs. |
| 28-002 | Rufus | 7/2015 | No data |
| 28-002 | Rufus | 8/2015 | No data |
| 28-002 | Rufus | 9/2015 | No data |
| 28-002 | Rufus | 10/2015 | No data |
| 28-002 | Rufus | 11/2015 | No data |
| 28-002 | Rufus | 12/2015 | No data |
| 28-002 | Rufus | 1/2016 | No data |
| 28-002 | Rufus | 2/2016 | No data |
| 28-002 | Rufus | 3/2016 | At least the first two days are missing. |
| 28-002 | Rufus | 10/2016 | Partial month? |
| 28-002 | Rufus | 11/2016 | Partial month? |
| 28-002 | Rufus | 8/2017 | Affected by eclipse? |
| 28-002 | Rufus | 9/2017 | Ten days deleted? |
| 28-002 | Rufus | 11/2017 | Eastbound slow lane closed at night for two weeks. |
| 28-002 | Rufus | 2/2018 | No data |
| 28-002 | Rufus | 3/2018 | No data |
| 30-004 | Pendleton | 8/2017 | Affected by eclipse? |
| 30-004 | Pendleton | 2/2018 | Two days of snow. |
| 30-021 | Milton | 12/2016 | Three days with low volumes due to "icy cold". |
| 30-021 | Milton | 1/2017 | Nine days with low volumes due to "bad weather". |
| 30-021 | Milton | 8/2017 | Affected by eclipse? |
| 30-021 | Milton | 12/2017 | Unable to retrieve the data for one day. |
| 30-025 | Umatilla Bridge | 5/2017 | Bad loop. Effects not conspicuous to me. SLR |
| 30-025 | Umatilla Bridge | 7/2017 | Construction in area with lane restrictions. |
| 30-025 | Umatilla Bridge | 8/2017 | Affected by eclipse? |
| 30-025 | Umatilla Bridge | 9/2017 | Construction in area with lane restrictions. |

| | | | |
|---|---|---|---|
| 30-025 | Umatilla Bridge | 10/2017 | Construction in area with lane restrictions. |
| 31-007 | N. La Grande | 1/2015 | No data.  Power off most days. |
| 31-007 | N. La Grande | 4/2015 | One day of construction w/lane restrictions. |
| 31-007 | N. La Grande | 12/2015 | Five scattered days of road closures (snow). |
| 31-007 | N. La Grande | 1/2016 | Two days w/wrecks on snow and ice. |
| 31-007 | N. La Grande | 5/2016 | No power for nine days. |
| 31-007 | N. La Grande | 7/2016 | Two days low volumes (w/normal looking speeds) because of fire related closure on I-84 at mp ?. |
| 31-007 | N. La Grande | 1/2017 | Eleven days of tough weather reduced volumes. |
| 31-007 | N. La Grande | 8/2017 | Affected by eclipse? |
| 31-007 | N. La Grande | 2/2018 | Two days snow. |
| 33-001 | Rowena | 6/2016 | Construction in area. |
| 33-001 | Rowena | 12/2016 | Four days with low volumes due to "icy cold". |
| 33-001 | Rowena | 1/2017 | Thirteen days with low volumes due to "bad weather". |
| 33-001 | Rowena | 8/2017 | Affected by eclipse? |
| 33-001 | Rowena | 2/2018 | Two days of snow. |
| 33-001 | Rowena | 3/2018 | Eleven days deleted due to construction. |
| 33-005 | Dufur | 6/2015 | No data |
| 33-005 | Dufur | 7/2015 | No data |
| 33-005 | Dufur | 8/2017 | Affected by eclipse? |
| 33-005 | Dufur | 9/2017 | Volumes increased because of Eagle Creek Fire on I-84. |

# APPENDIX B: Assessment of HERE Data

To assess the validity and potential use of HERE data in locations where ATRs are not present, the provided HERE data that overlaps with the ATR segments were analyzed. The obtained HERE data consists of two files, one for automobiles (i.e., passenger vehicles) and one for heavy-vehicles (i.e., a truck with a gross vehicle weight rating of greater than 10,000 pounds). In addition, a file for linking HERE data locations to ATR locations was provided. Within the automobile and truck datasets are the same 14 variables, in which the variables and corresponding definitions are shown in Table B1.

**Table B1: Variable and Variable Definitions in HERE Data**

| Variable | Definition |
|---|---|
| LINK-DIR | Unique value used to link the HERE data locations to the ATR locations. |
| DATE-TIME | Provides date (MM/DD/YEAR) at 5-minute intervals. |
| EPOCH-5MIN | Counter between 0 and 287 to count the 5-minute time intervals of a day. |
| LENGTH | Length of HERE segment, measured in meters. |
| MEAN | Mean speed over a 5-minute interval along a HERE segment, measured in km/hr. |
| STDDEV | Standard deviation of measured speed over a 5-minute interval along a HERE segment, measured in km/hr. |
| MIN | Minimum recorded speed over a 5-mintute interval along a HERE segment, measured in km/hr. |
| MAX | Maximum recorded speed over a 5-mintute interval along a HERE segment, measured in km/hr. |
| CONFIDENCE | Measure of real data used for the 5-minute interval aggregation. 40 indicates all real data, while anything less indicated some level of historical data has been integrated during the aggregation. |
| PCT-15 | 15th percentile speed, measured in km/hr. |
| PCT-50 | 50th percentile speed, measured in km/hr. |
| PCT-85 | 85th percentile speed, measured in km/hr. |
| PCT-90 | 90th percentile speed, measured in km/hr. |
| PCT-95 | 95th percentile speed, measured in km/hr. |

Being that the HERE used for analysis consists of data from March, 2015, to March, 2018, there are millions of observations for both the automobile and heavy-vehicle datasets. As such, the data must be mined in a software that can handle such a large number of observations. For this assessment, an R script in the R-Studio platform is used.

To begin the data mining process, data is aggregated by month. Upon aggregating the data by month, each month for each year is again filtered to represent only observations at a given HERE segment corresponding to an ATR location. As stated in Table B1, this is accomplished using LINK-DIR, a unique value in each dataset (HERE and ATR). The result after this process is a month of data for a HERE location associated with a specific ATR. With data from March, 2015, to March, 2018, 37 datasets (one for each month) are generated and used to calculate mean speeds and 90th percentile speeds. During this monthly aggregation process, however, several HERE segments are found to not be associated with ATRs. ATR locations with no HERE data are shown in Table B2. In addition to the locations listed in Table B2, two ATR locations have missing data for heavy-vehicles. For a summary of missing data in regards to heavy-vehicles, refer to Table B3.

**Table B2: ATR Locations With No HERE Data**

| Speed Increase Category | ATR Location | Availability of HERE Data |
|---|---|---|
| 55 mi/hr Control Locations (Automobiles and Heavy-Vehicles) | Lexington (25-007) | No HERE Data |
| | Rhododendron (03-006) | No HERE Data |
| | Shady Cove (15-013) | No HERE Data |
| | Sisters (09-014) | No HERE Data |
| Increase of 55 mi/hr to 65 mi/hr for Automobiles | Cairo Junction (23-006) | No HERE Data |
| | New Pine Creek (19-008) | No HERE Data |
| | Pilot Butte (09-005) | No HERE Data |
| | Redmond (09-020) | No HERE Data |
| | Steens (13-007) | No HERE Data |
| Increase of 55 mi/hr to 60 mi/hr for Heavy-Vehicles | Cairo Junction (23-006) | No HERE Data |
| | New Pine Creek (19-008) | No HERE Data |
| | Pilot Butte (09-005) | No HERE Data |
| | Redmond (09-020) | No HERE Data |
| | Steens (13-007) | No HERE Data |
| Increase of 65 mi/hr to 70 mi/hr for Automobiles | Boardman Junction (25-008) | No HERE Data |
| Increase of 60 mi/hr to 65 mi/hr for Heavy-Vehicles | Boardman Junction (25-008) | No HERE Data |

**Table B3: Summary of Missing Data in Heavy-Vehicle HERE Data**

| ATR Location | Description of Missing Data |
|---|---|
| Prairie City (12-009) | Missing heavy-vehicle data for the following months:<br>• May, 2015<br>• September, 2015<br>• January, 2016<br>• February, 2017<br>• July, 2017 |
| Lake Creek (22-016) | No heavy-vehicle data before March, 2016 (i.e., no data before the speed increase). In addition, only 11 months of data after March, 2016, are available. |

The final steps are to calculate average monthly speeds for each month of data and the average change in speed/90the percentile speed pre- and post-speed increase. Based on Table B2 and Table B3, specific months and ATR locations are not considered for analysis. To determine average monthly speeds, in miles per hour (mi/hr), speeds are multiplied by 0.621371 and averaged over the entire month. For example, if a month has 60 speed observations, the speeds are summed and divided by 60 to create a monthly speed average. Referring to the same example for determining 90th percentile speeds, the 90th percentile speed of the 60 speed observations is calculated and used as the 90th percentile speed for that month. Plots of average speeds by month are shown in Figure B1 to B8.

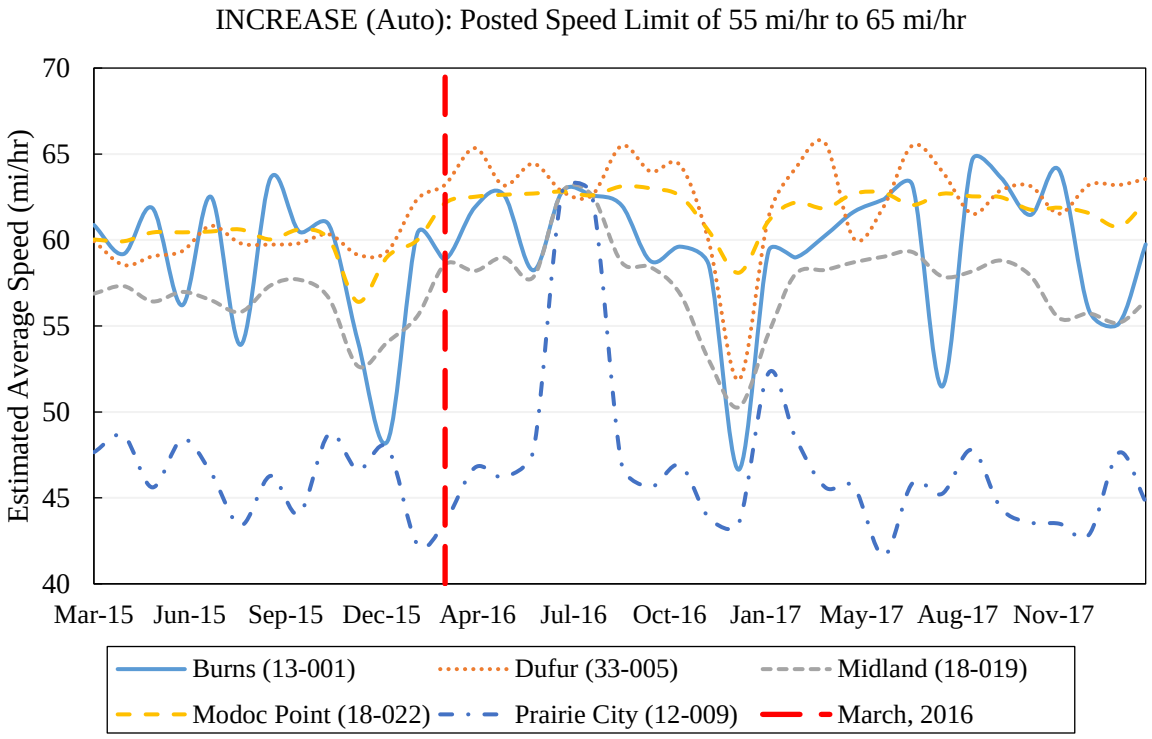
Pertaining to average change in speed and 90th percentile speed, average speeds and 90th percentile speeds are determined pre- and post-speed increase. Then, the change in these values is used to calculate

an average change in mean speed and average 90th percentile speed. Plots and average changes in the considered metrics are shown in Figure B9 to B16.

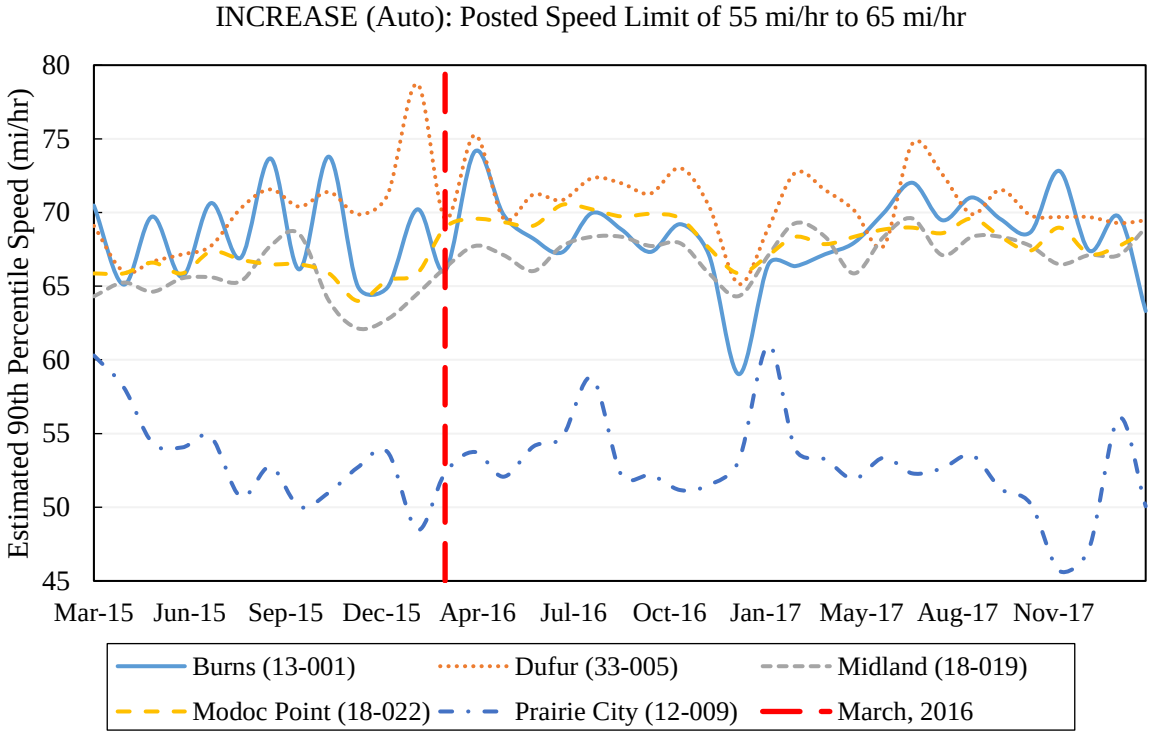
Finally, a summary of the analysis for the average and 90th percentile speeds are shown in Table B4. The overall results are consistent with the ATR speed data: small or no changes observed in the control segments and increased speeds in the sections were the posted speed was increased. The HERE data shows this was consistent for both autos and trucks.

**Table B4: Summary of Speed Changes on Control and Speed Increase Segments**

| Speed Increase Category | Segment | Average Speed Increase (mi/hr) | | Average 90th Percentile Speed Increase (mi/hr) | |
|---|---|---|---|---|---|
| | | Autos | | | |
| 70 mi/hr | Control | -0.1 | ↓ | -0.2 | ↓ |
| | Speed Increase | 3.0 | ↑ | 2.1 | ↑ |
| 65 mi/hr | Control | 0.5 | ↑ | 0.4 | ↑ |
| | Speed Increase | 1.7 | ↑ | 1.0 | ↑ |
| | | Trucks | | | |
| 65 mi/hr | Control | -0.2 | ↓ | -1.1 | ↓ |
| | Speed Increase | 4.0 | ↑ | 3.7 | ↑ |
| 60 mi/hr | Control | 0.9 | ↑ | 0.5 | ↑ |
| | Speed Increase | 2.8 | ↑ | 3.3 | ↑ |

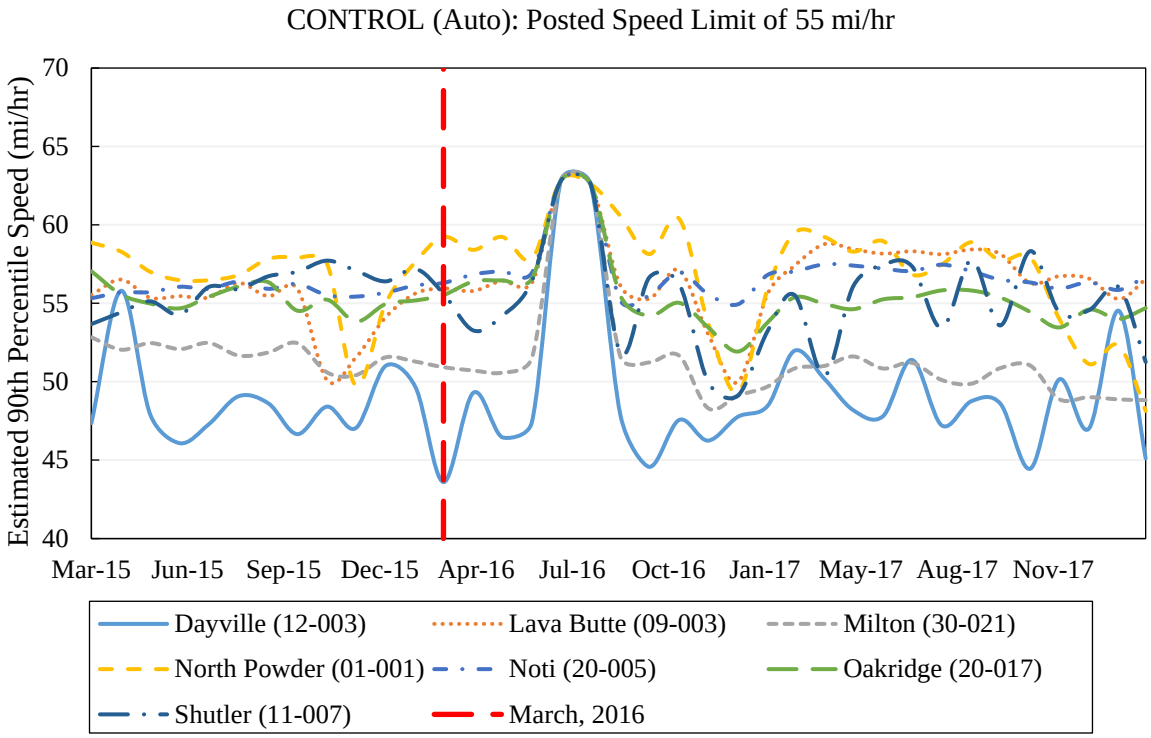



**(a)**

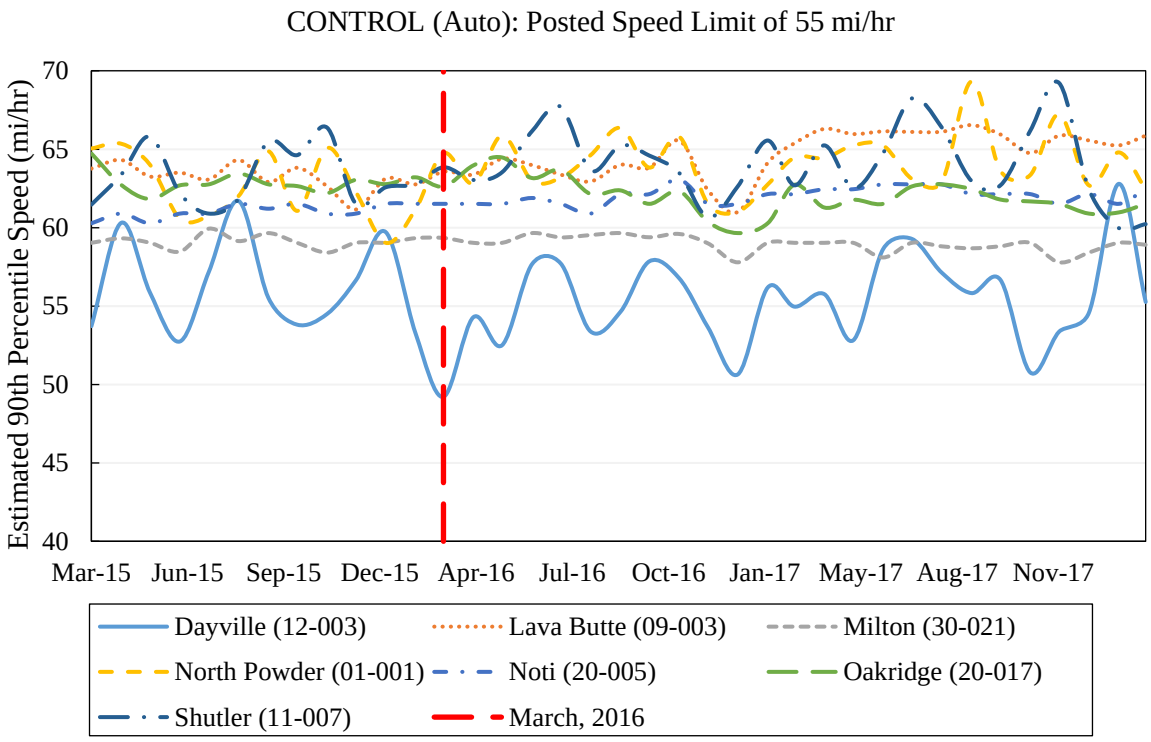



**(b)**

**Figure B1: (a) Average Auto Speeds and (b) Average Auto 90th Percentile Speeds for Speed Limit Increase of 55 mi/hr to 65 mi/hr**

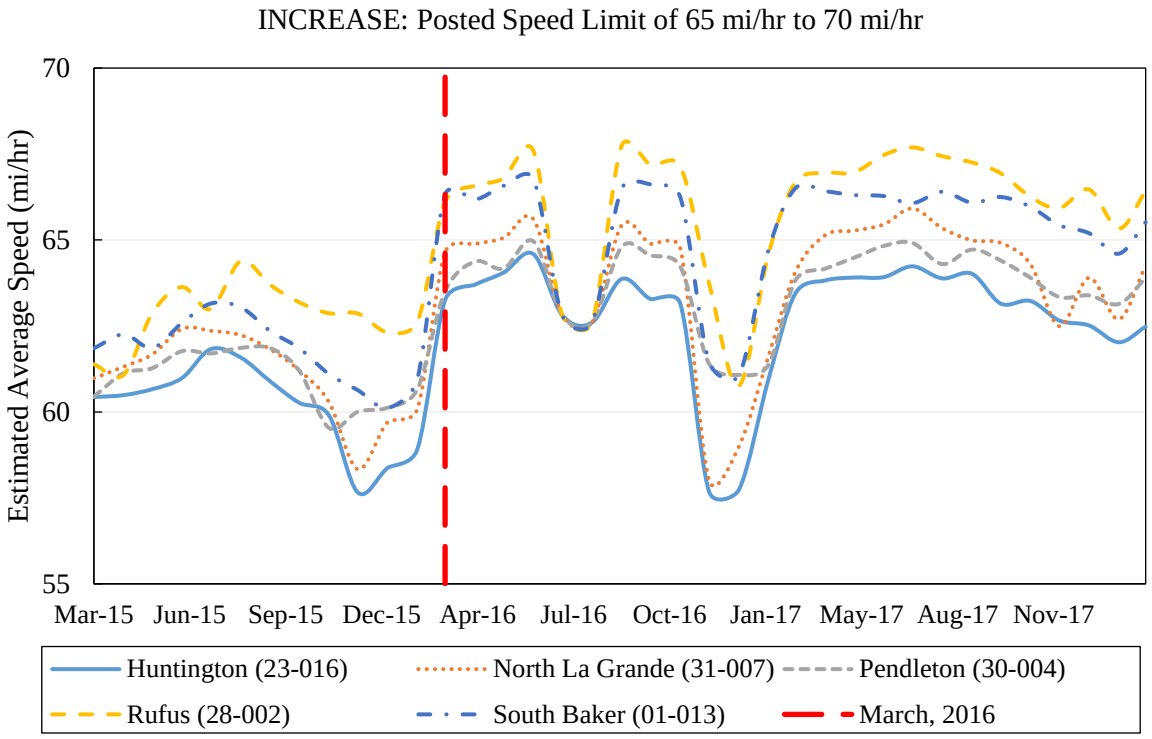



**(a)**

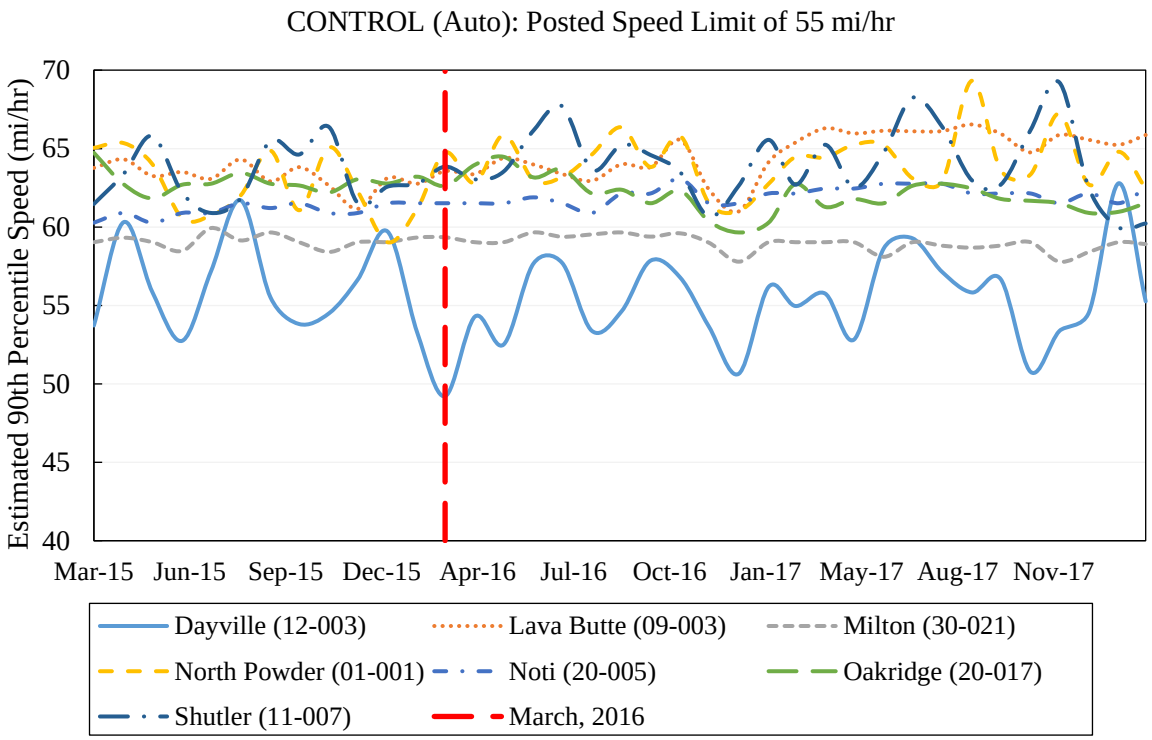



**(b)**

**Figure B2: (a) Average Auto Speeds and (b) Average Auto 90th Percentile Speeds for Control Locations of 55 mi/hr**

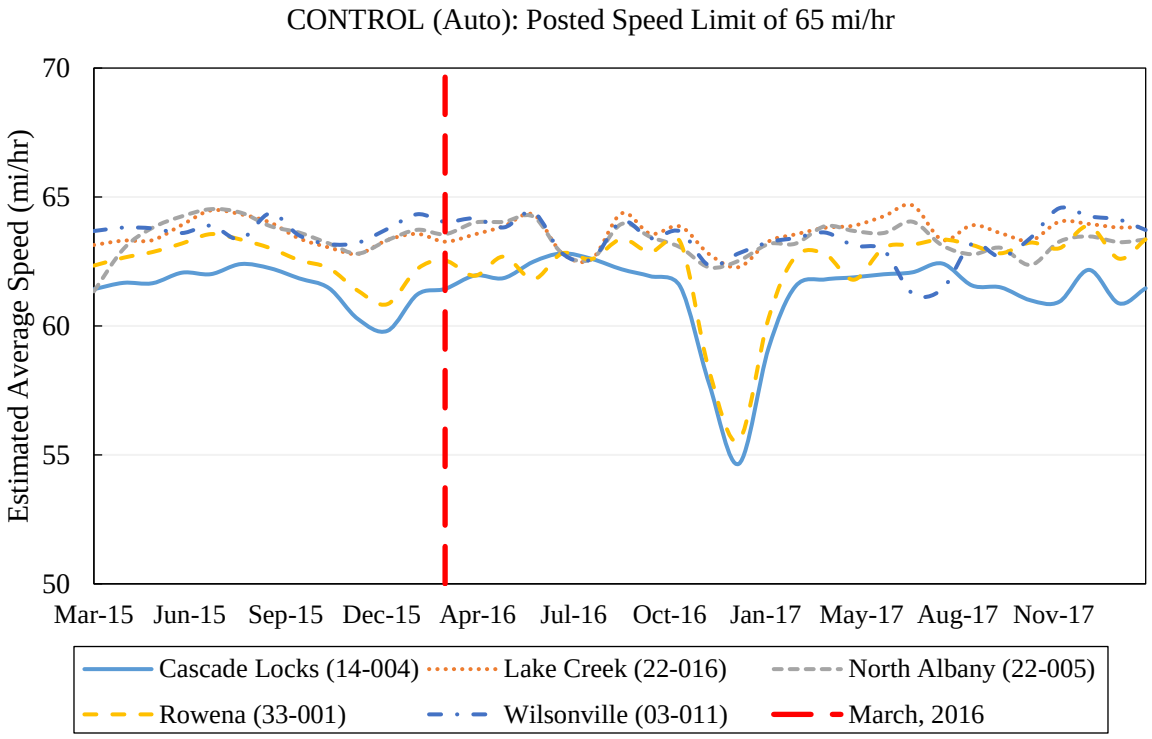



**(a)**

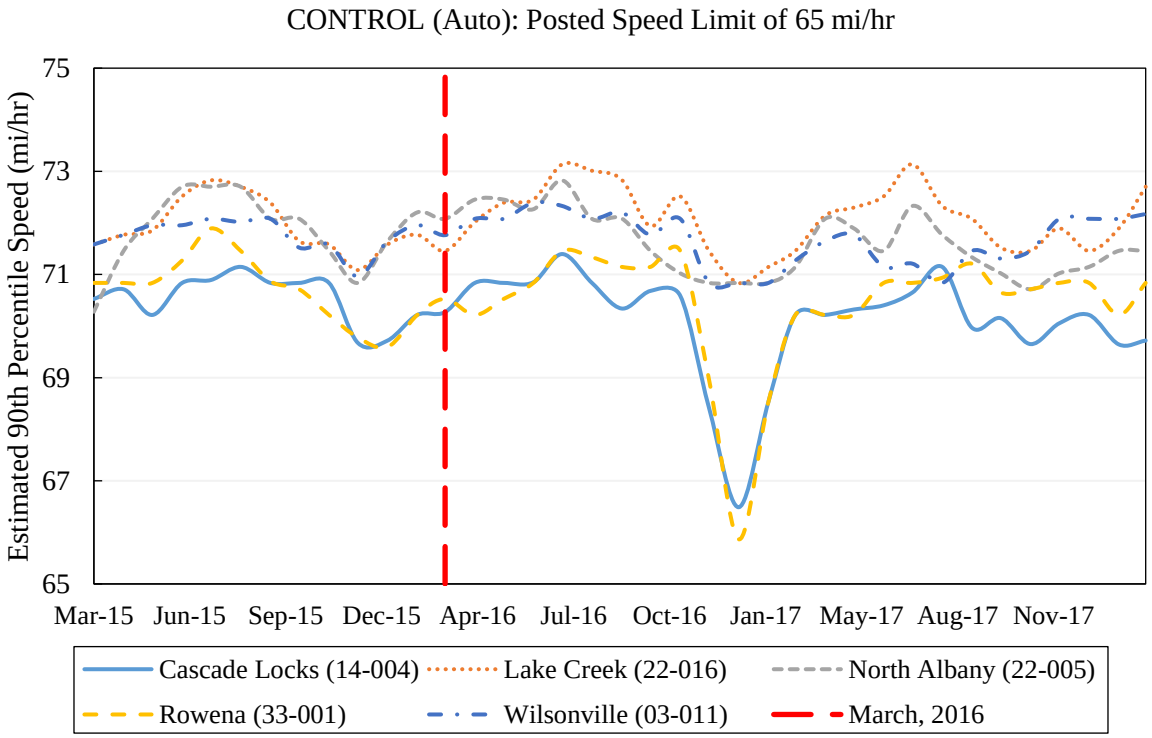



**(b)**

**Figure B3: (a) Average Auto Speeds and (b) Average Auto 90th Percentile Speeds for Speed Limit Increase of 65 mi/hr to 70 mi/hr**

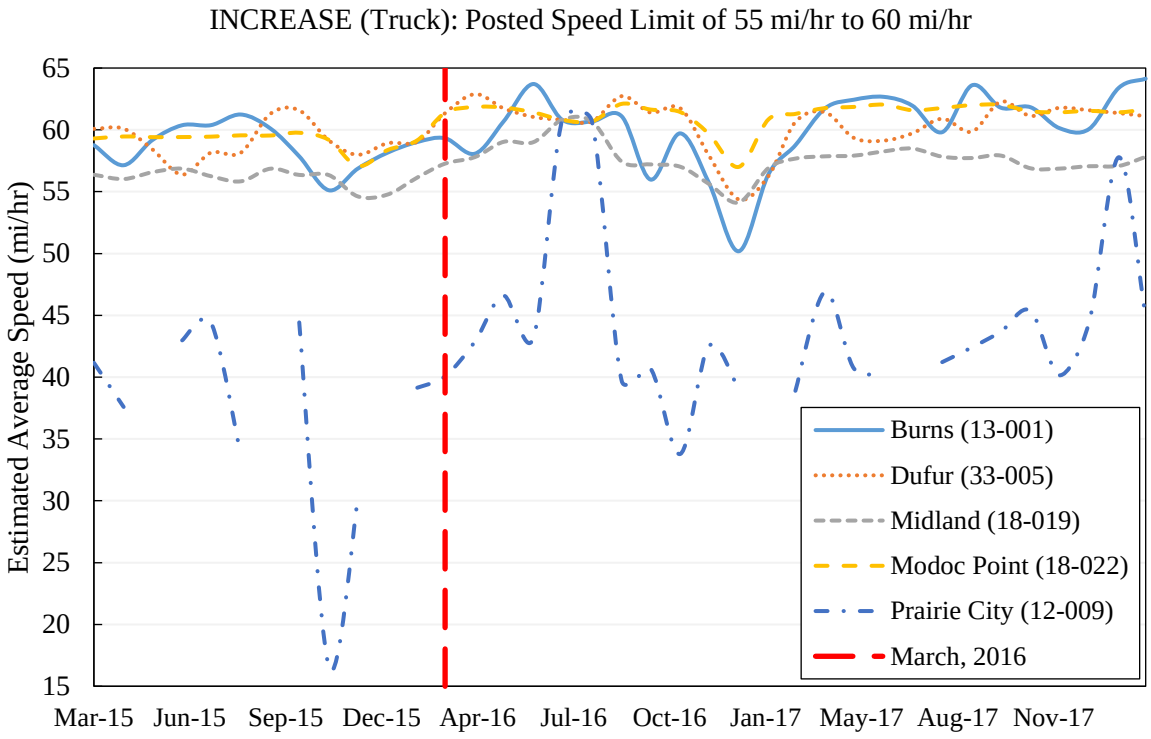



**(a)**

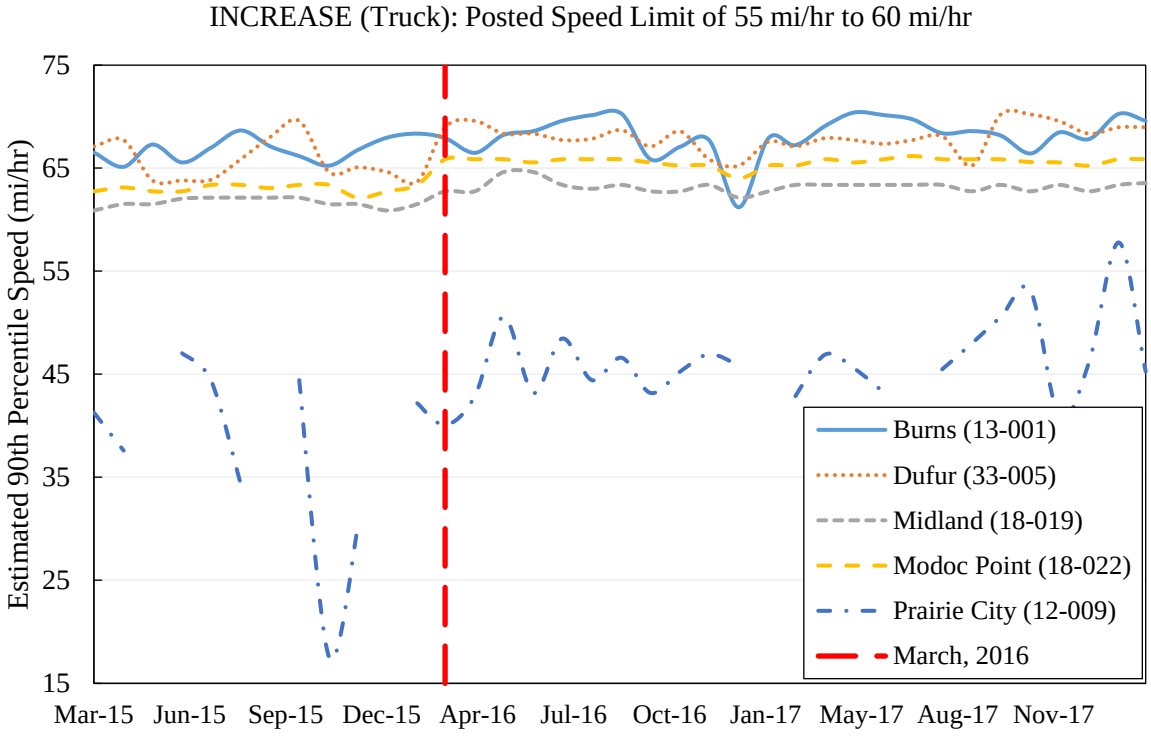



**(b)**

**Figure B4: (a) Average Auto Speeds and (b) Average Auto 90th Percentile Speeds for Control Locations of 65 mi/hr**

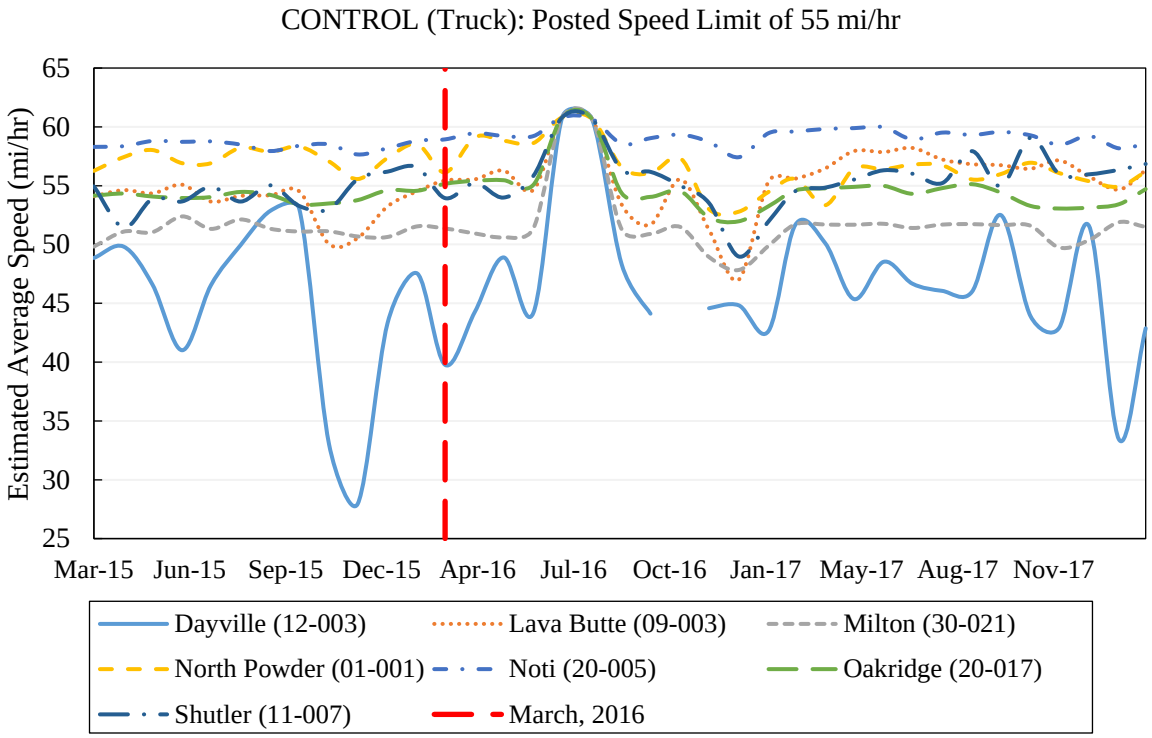



**(a)**

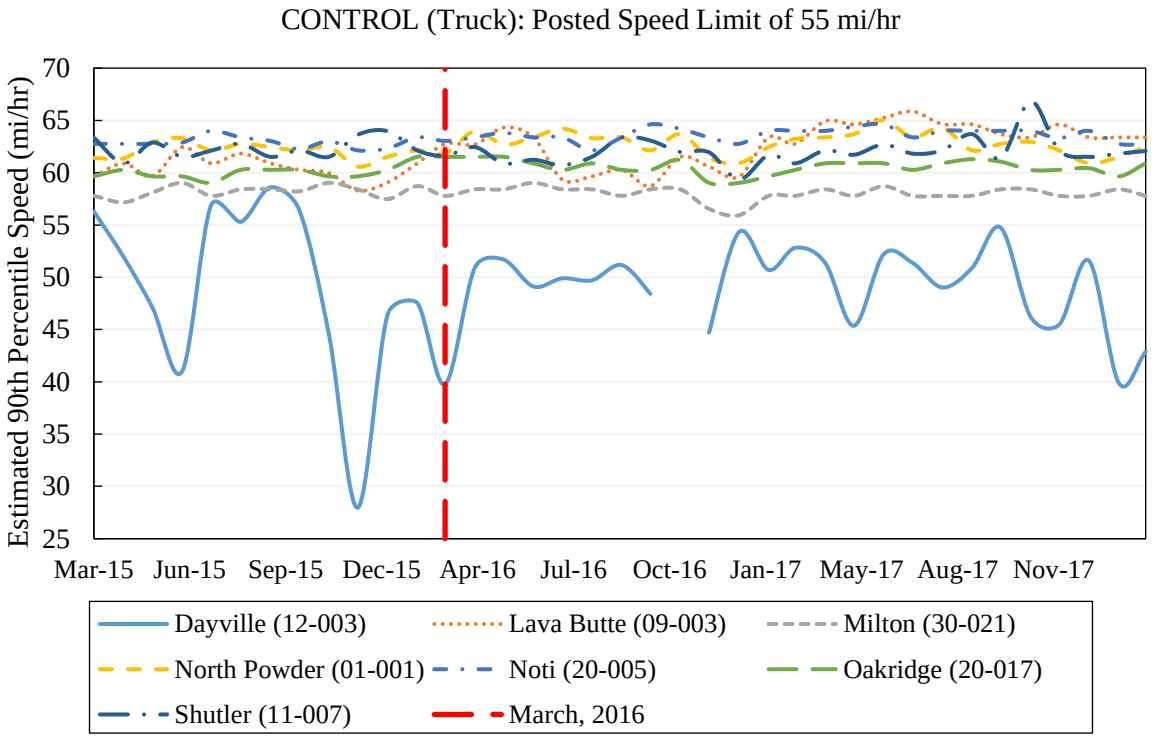



**(b)**

**Figure B5: (a) Average Truck Speeds and (b) Average Truck 90th Percentile Speeds for Speed Limit Increase of 55 mi/hr to 60 mi/hr**

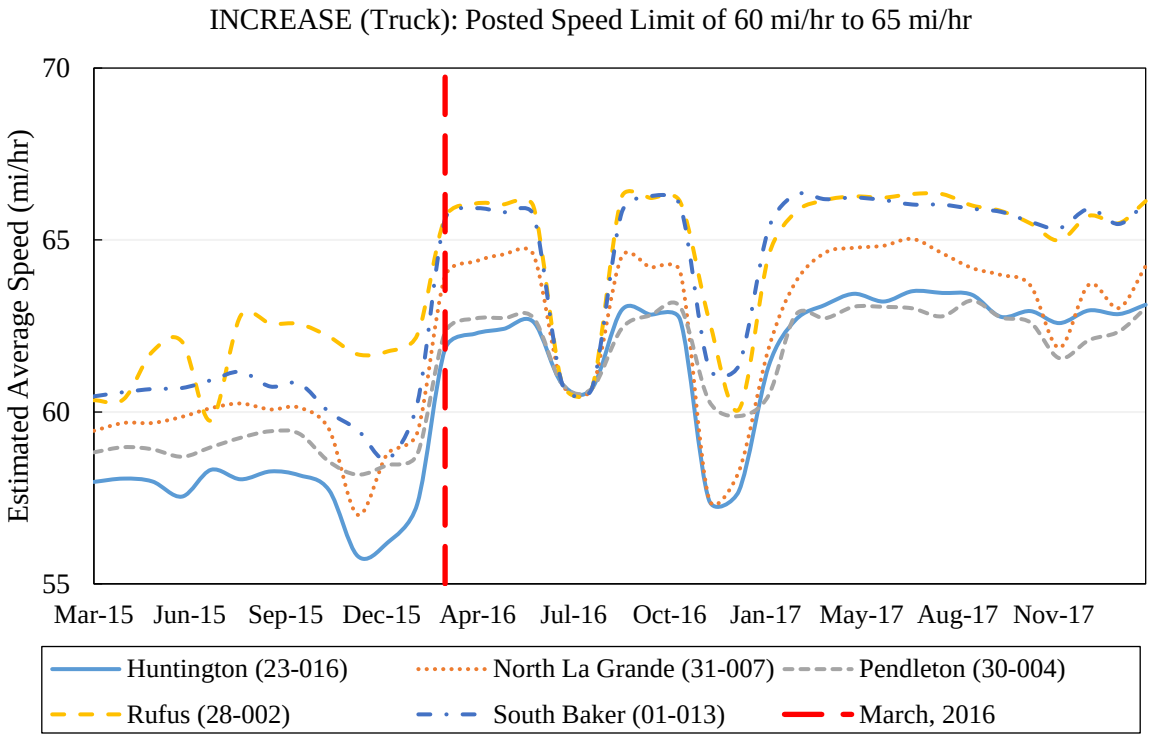



**(a)**

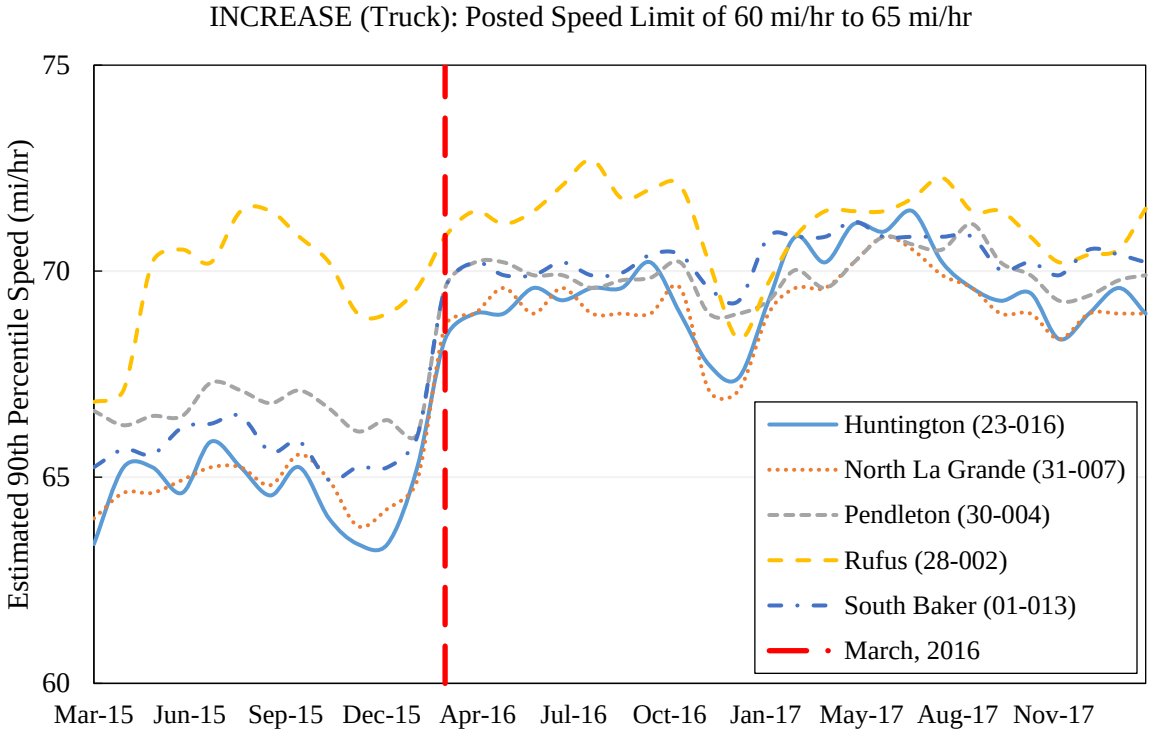



**(b)**

**Figure B6: (a) Average Truck Speeds and (b) Average Truck 90th Percentile Speeds for Control Locations of 55 mi/hr**

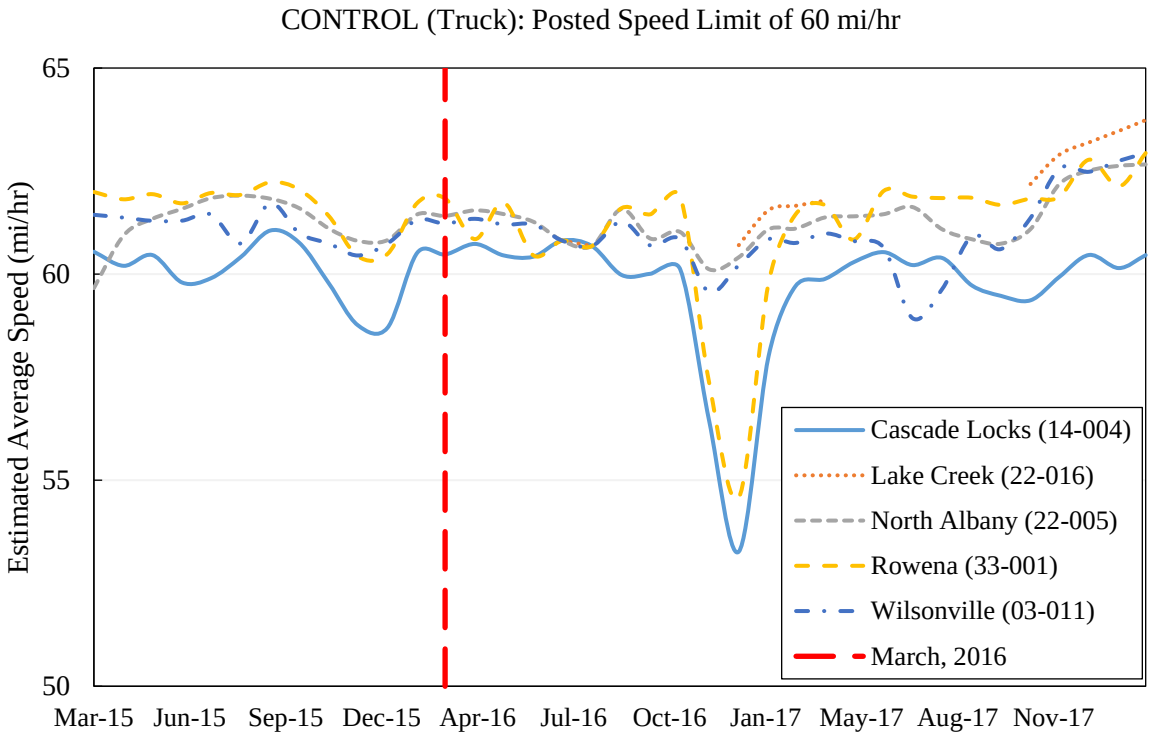



**(a)**

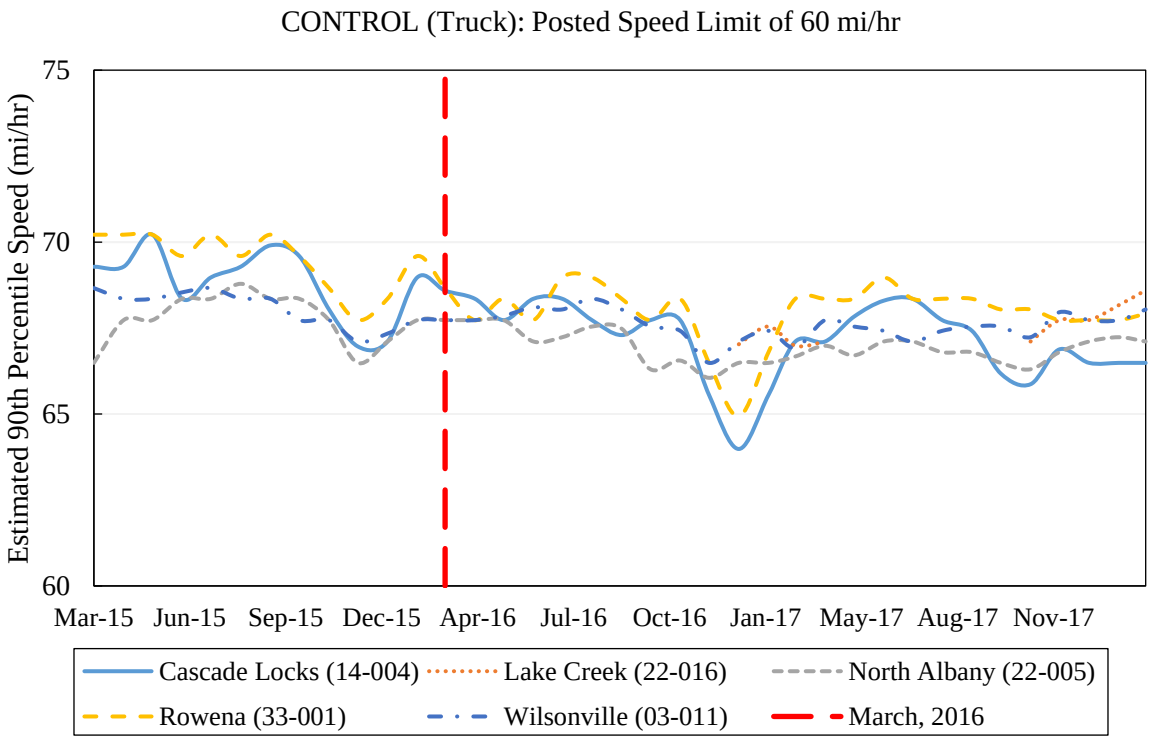



**(b)**

**Figure B7: (a) Average Truck Speeds and (b) Average Truck 90th Percentile Speeds for Speed Limit Increase of 60 mi/hr to 65 mi/hr**




**(a)**




**(b)**

**Figure B8: (a) Average Truck Speeds and (b) Average Truck 90th Percentile Speeds for Control Locations of 60 mi/hr**

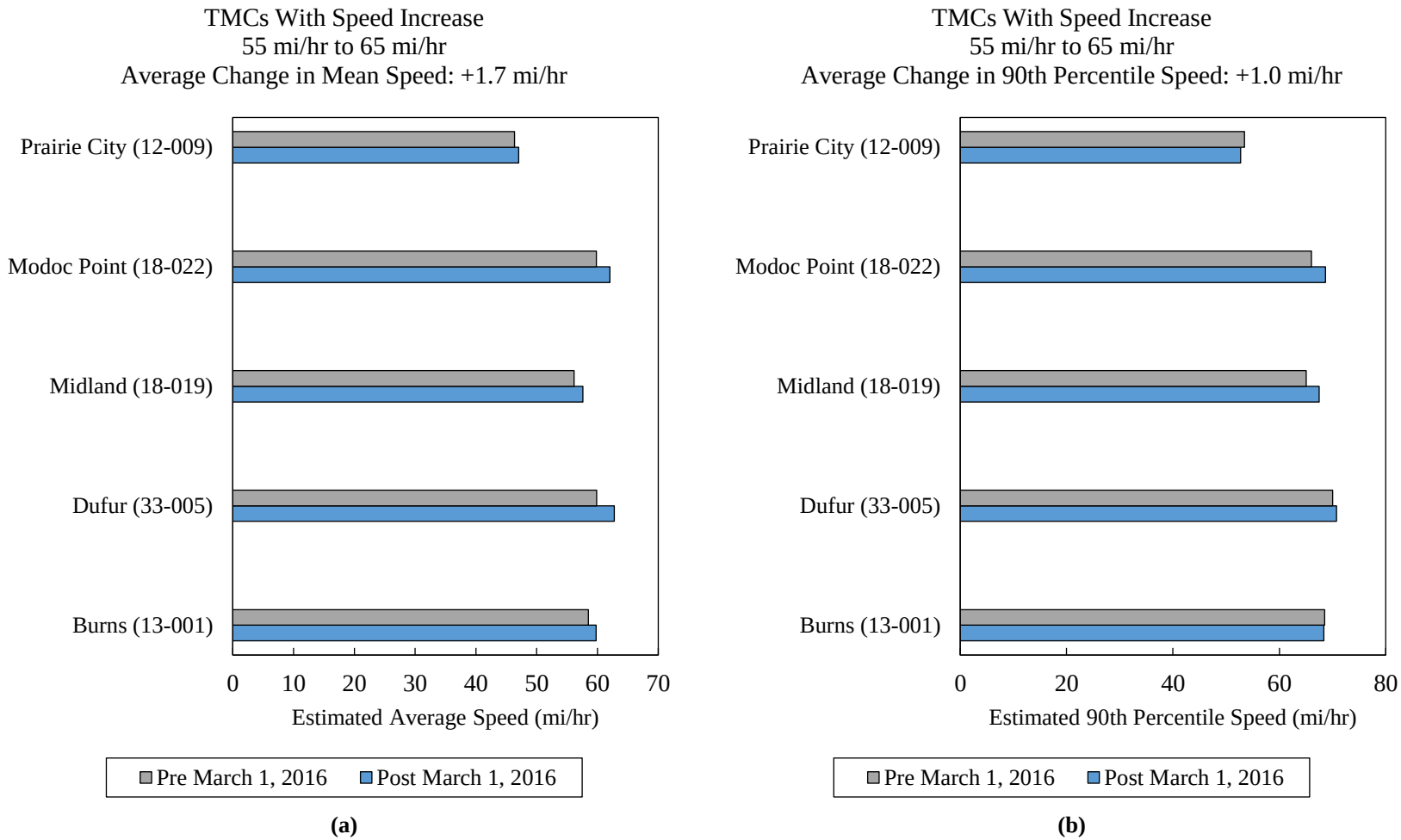



**Figure B9: (a) Average Auto Speeds and (b) Average Auto 90th Percentile Speeds for Speed Limit Increase of 55 mi/hr to 65 mi/hr Pre- and Post-March 1, 2016**

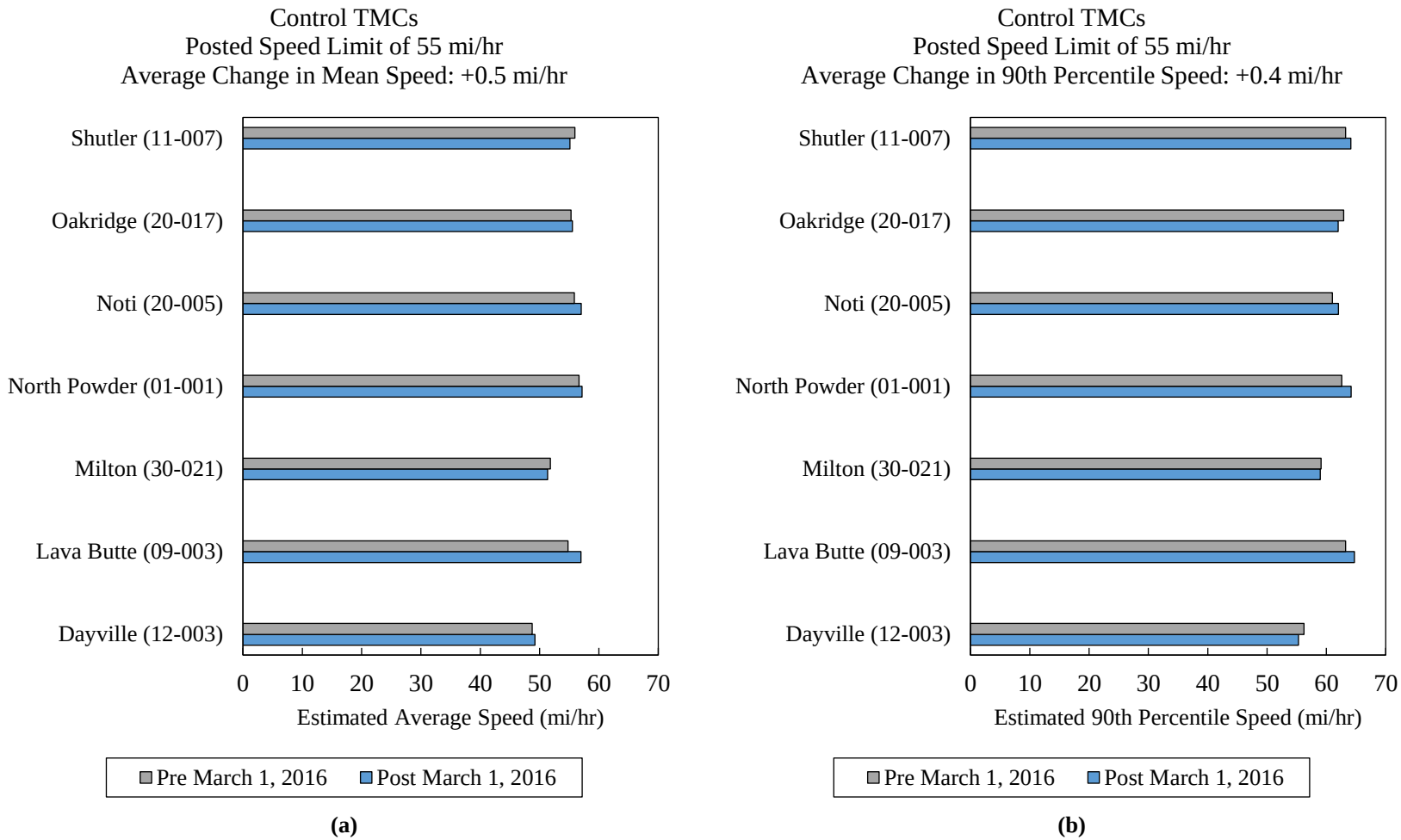



**Figure B10: (a) Average Auto Speeds and (b) Average Auto 90th Percentile Speeds for Control Locations of 55 mi/hr Pre- and Post-March 1, 2016**

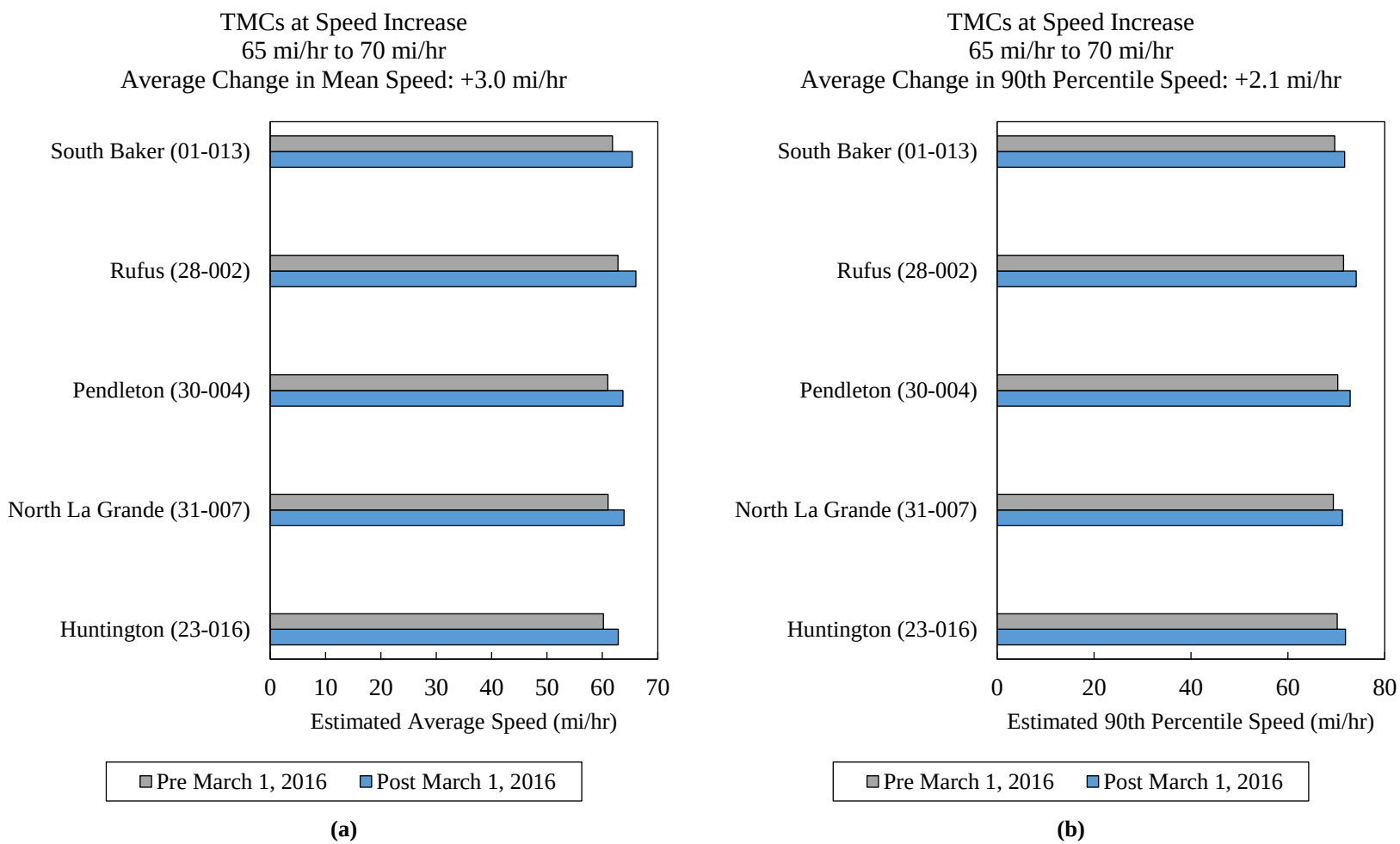



**Figure B11: (a) Average Auto Speeds and (b) Average Auto 90th Percentile Speeds for Speed Limit Increase of 65 mi/hr to 70 mi/hr Pre- and Post-March 1, 2016**

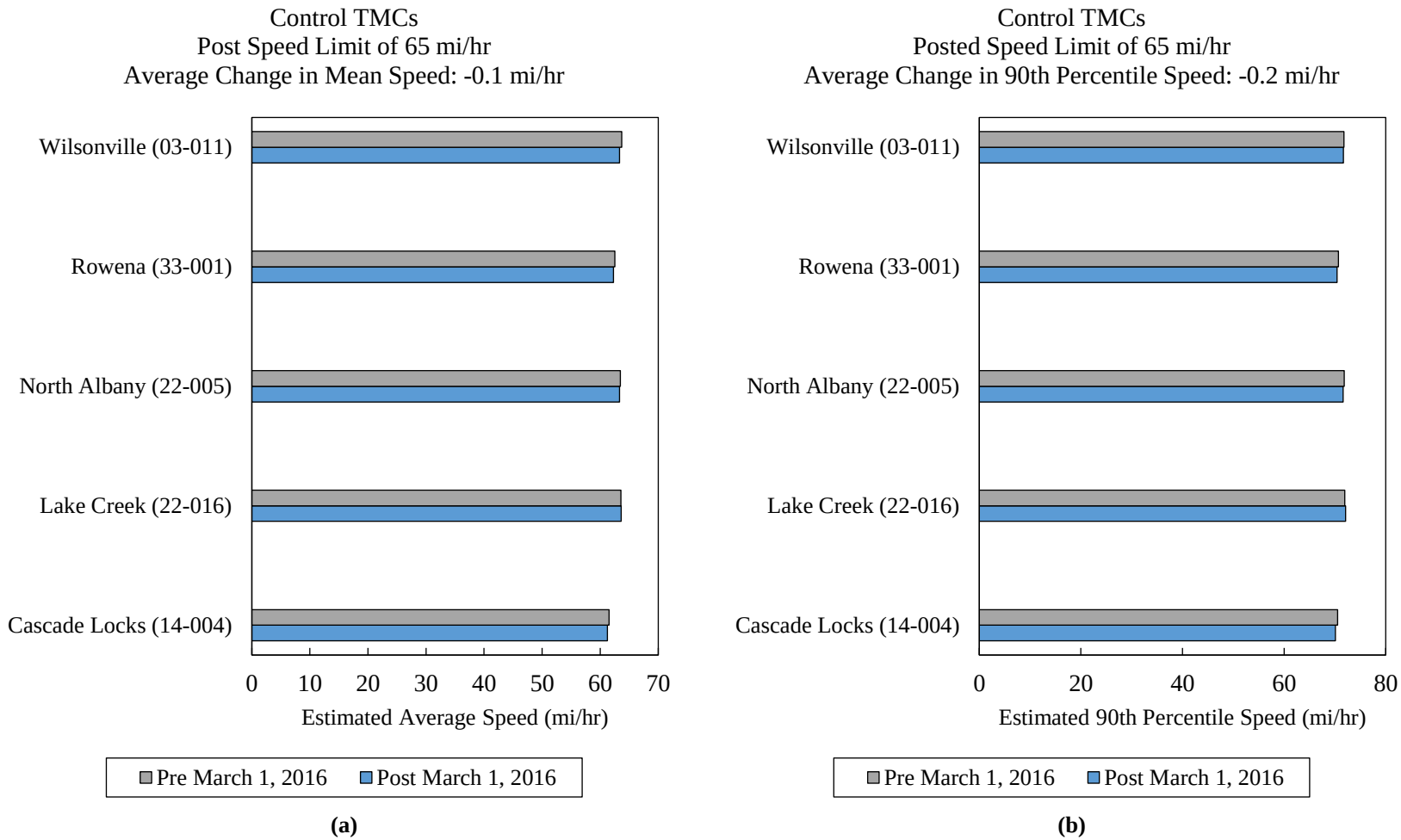



**Figure B12: (a) Average Auto Speeds and (b) Average Auto 90th Percentile Speeds for Control Locations of 65 mi/hr Pre- and Post-March 1, 2016**

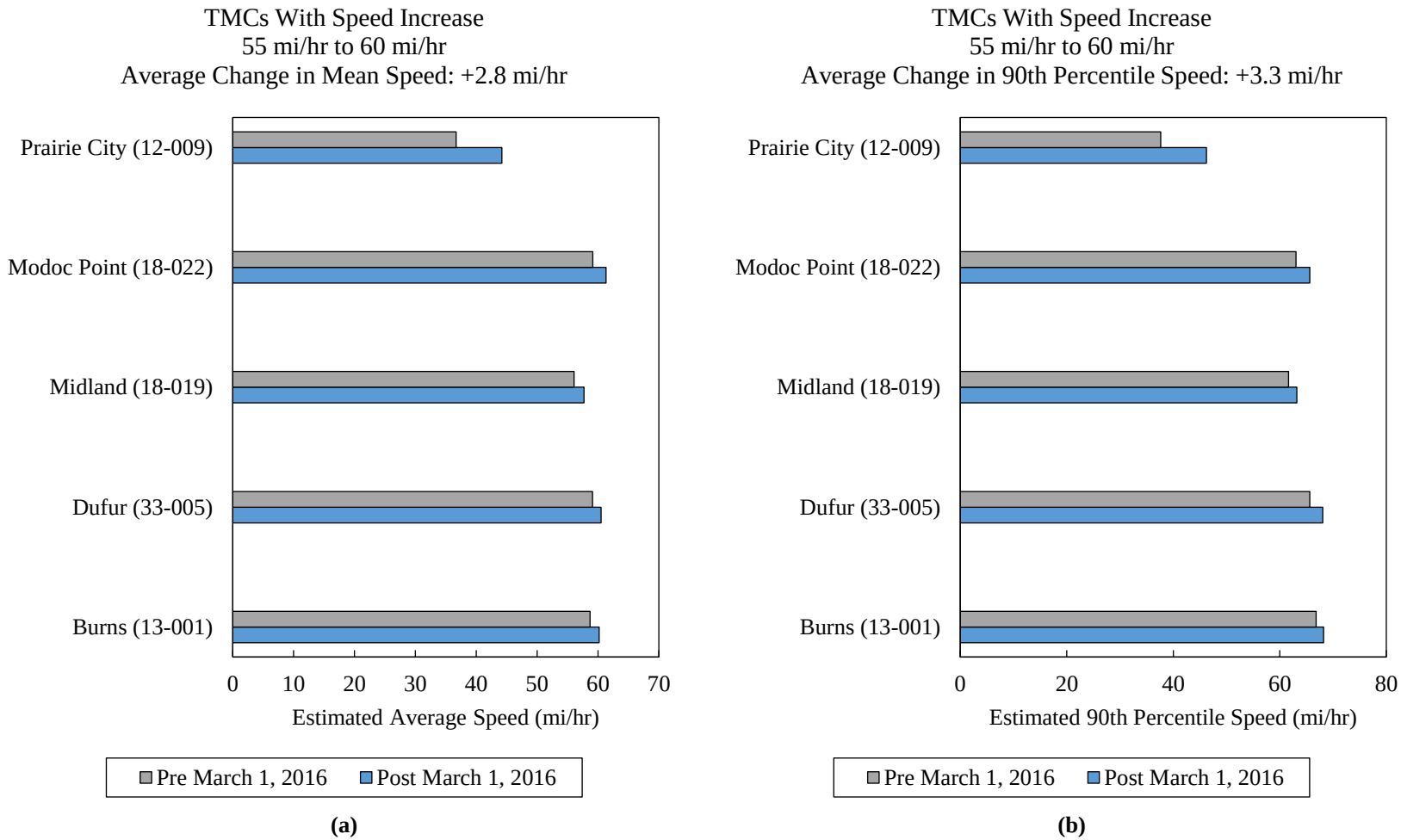



**Figure B13: (a) Average Truck Speeds and (b) Average Truck 90th Percentile Speeds for Speed Limit Increase of 55 mi/hr to 60 mi/hr Pre- and Post-March 1, 2016**

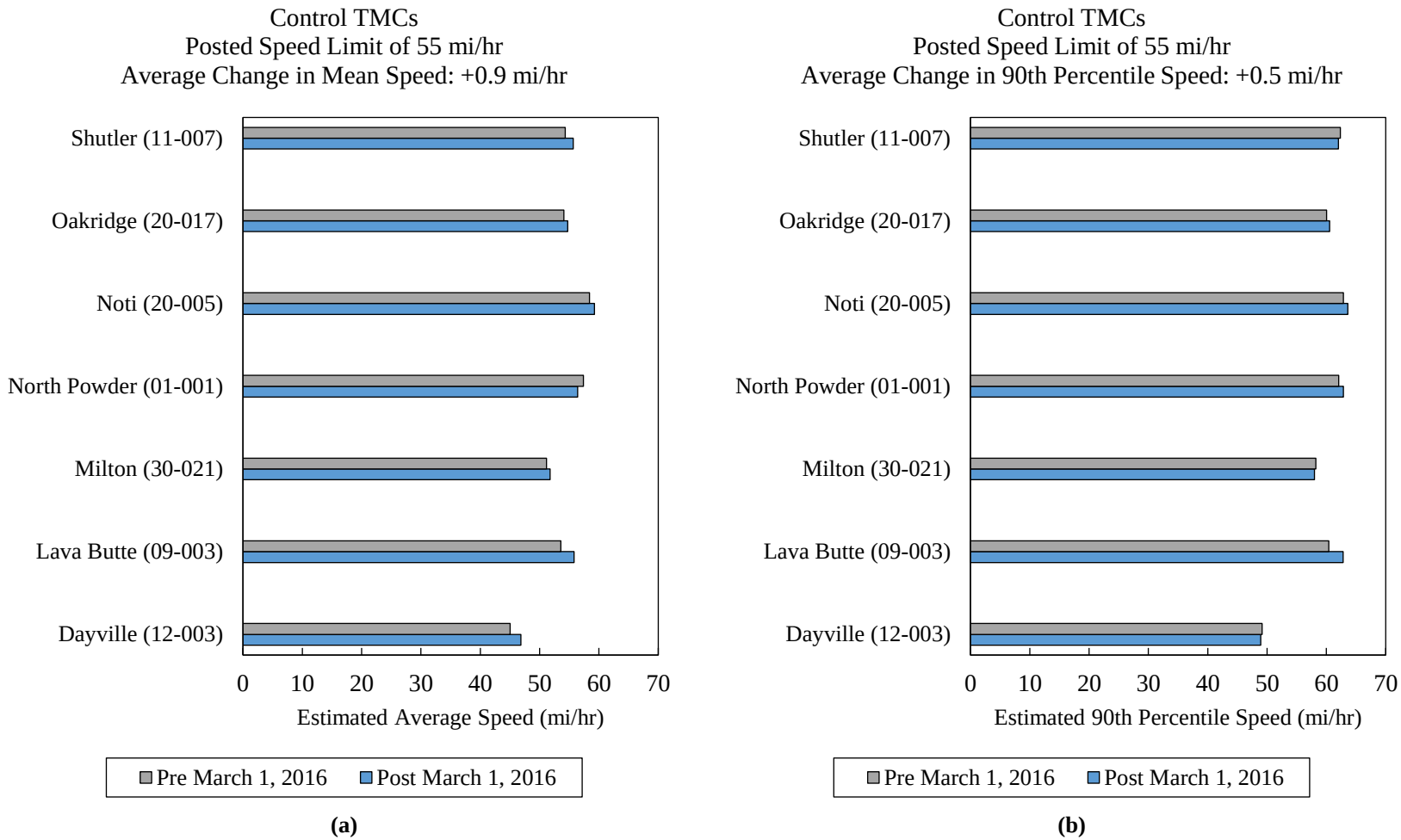



**Figure B14: (a) Average Truck Speeds and (b) Average Truck 90th Percentile Speeds for Control Locations of 55 mi/hr Pre- and Post-March 1, 2016**

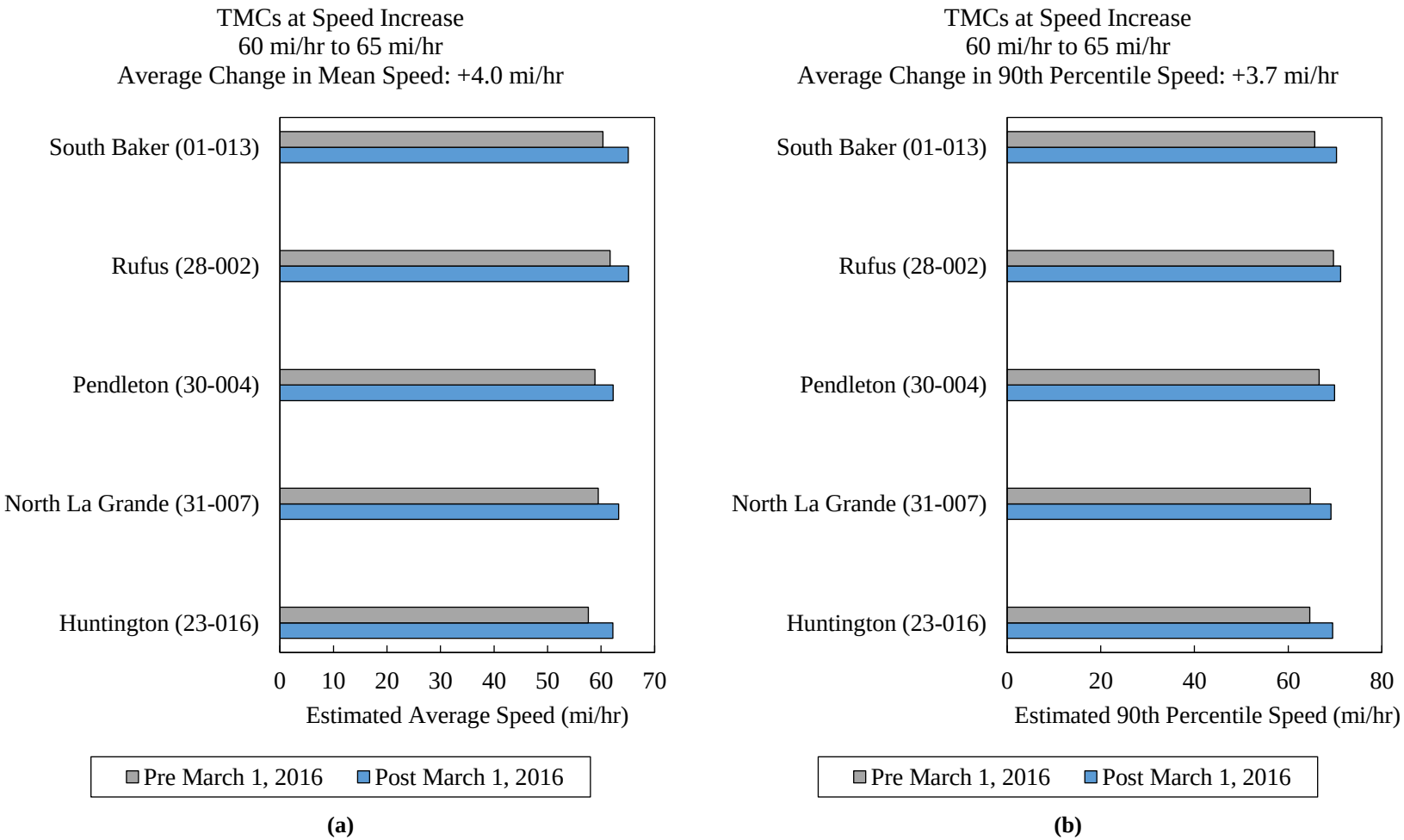
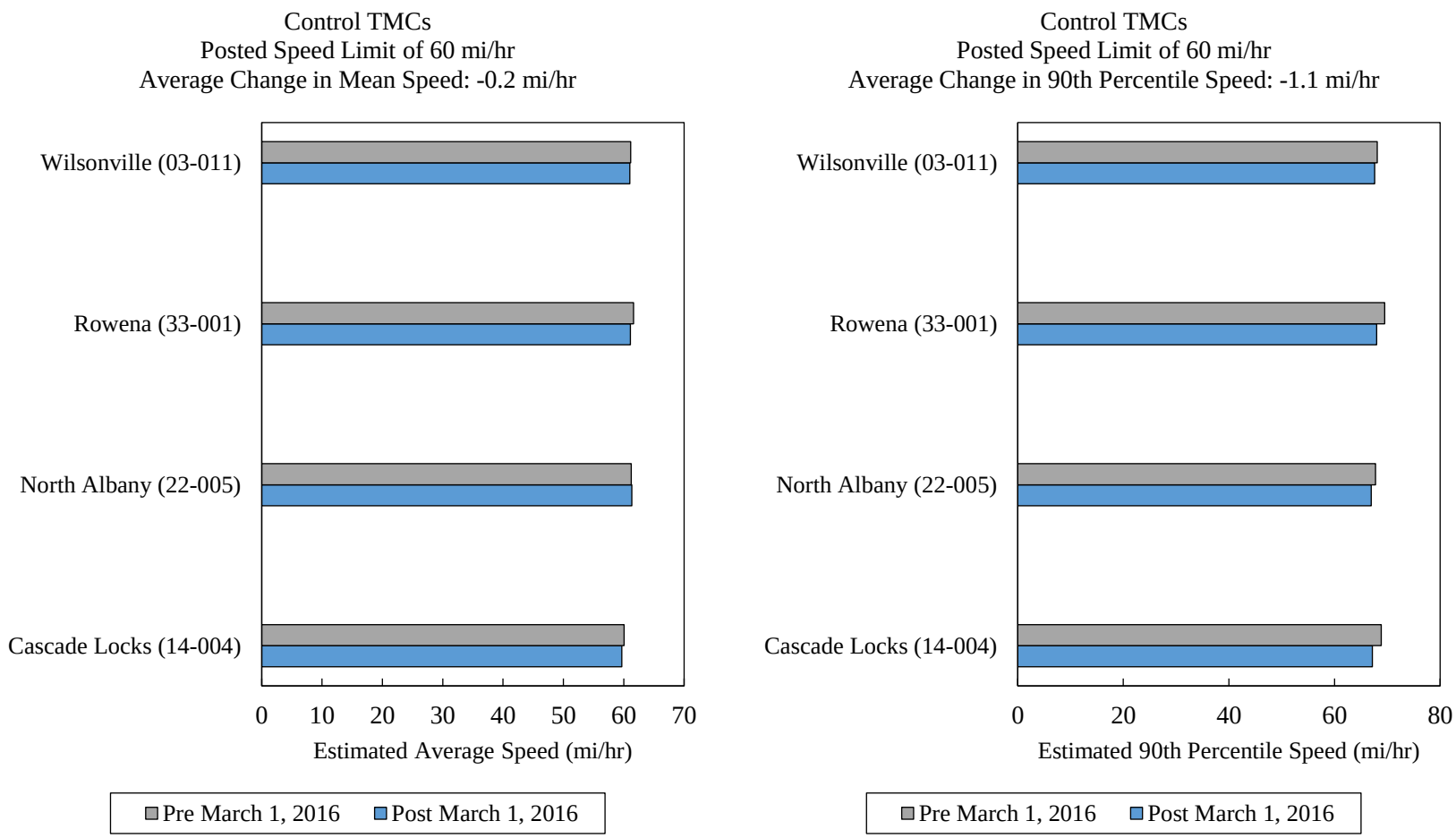



**Figure B15: (a) Average Truck Speeds and (b) Average Truck 90th Percentile Speeds for Speed Limit Increase of 60 mi/hr to 65 mi/hr Pre- and Post-March 1, 2016**




**(a)** **(b)**

**Figure B16: (a) Average Truck Speeds and (b) Average Truck 90th Percentile Speeds for Control Locations of 60 mi/hr Pre- and Post-March 1, 2016**