



**NATIONAL TRANSPORTATION SAFETY BOARD  
OFFICE OF HIGHWAY SAFETY  
WASHINGTON, D.C.**

**HIGHWAY FACTORS GROUP CHAIRMAN'S  
FACTUAL REPORT**

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**A. CRASH INFORMATION**

Location: Eastbound Interstate 84 (I-84) near mile post 47, in Boise, Ada County, Idaho

Vehicle #1: 2019 Volvo truck in combination with a 2015 Great Dane semi-trailer

Operator #1: Krujex Freight Transport Corporation

Vehicle #2: 2008 Jeep Wrangler, private operator

Vehicle #3: 2003 Volvo truck in combination with a 2008 Great Dane semi-trailer

Operator #3: Zhuk Expres LLC

Vehicle #4: 2010 Ford Focus, private operator

Vehicle #5: 2014 Ford F-150, private operator

Vehicle #6: 2006 Ford Fusion, private operator

Vehicle #7: 2015 Ford Escape, private operator

Date: June 16, 2018

Time: Approximately 11:32 p.m. Mountain Standard Time (MST)

Fatalities: 2 Jeep Passengers, 1 Jeep Driver and 1 2019 Volvo Driver

NTSB #: **HWY18FH015**

**B. HIGHWAY FACTORS GROUP**

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### **C. CRASH SUMMARY**

For a summary of the crash, refer to the *Crash Summary Report* (or *Factual Report of the Investigation*, depending on investigation type) in the docket for this investigation.

### **D. DETAILS OF THE HIGHWAY FACTORS INVESTIGATION**

The highway group obtained information related to the design, operation, and maintenance of the highway environment to establish a foundation for evaluating whether the condition, design, or operation of the traffic facility contributed to or caused this crash. Prefatory data was obtained giving a general description of the highway location. Highway information including traffic counts and accident history were obtained from the Idaho Transportation Department (ITD) and particular focus was placed on reviewing the information ITD uses to make policy decisions regarding Traffic Management Plans (TMP's), temporary traffic control plans for the Temporary Traffic Control Zone (TTC) that existed at the time of the crash, and other special provisions of the construction contracts used to prevent end of queue crashes involving heavy trucks. Also, guidance from the Federal Highway Administration's Manual on Uniform Traffic Control Devices (FHWA) (MUTCD) was documented. Finally, information on nationwide statistics involving work zones and heavy trucks was obtained.

## 1. Prefatory Data

The crash occurred in Boise, Idaho on the eastbound side of I-84 near milepost 47.007 and Station No. 2475+26.<sup>1</sup> The crash occurred in the advance-warning area of an active work zone. The project resulting in the work zone included diamond grinding of concrete pavement, resealing concrete pavement joints, repairing concrete pavement cracks, and repairing pavement spalls.<sup>2</sup> The project limits were at Milepost (MP) 48.320 and Station No. 2549+00.00 to MP 51.30 and Station No. 2710+00.00. The general highway configuration is a controlled access highway with four east and four westbound lanes divided by a 32-inch tall concrete median barrier.<sup>3</sup> Additional there were two interchanges in the project area with entrance and exit ramps bringing the total to as 7 lanes in each direction near the interchanges. Both the east and westbound segments are comprised of four 12-foot-wide lanes delineated by 12-foot-long solid white pavement stripes at 38-foot intervals. The 12-foot-wide median shoulder is delineated from the #1 lane by a solid yellow pavement stripe. The right-hand or #4 lane is delineated from the 12-foot-wide right-hand shoulder by a solid white pavement stripe.<sup>4</sup> See Figures 1 and 2 for detail on the accident area.

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<sup>1</sup> Station number describe official dimensional locations of features within a project.

<sup>2</sup> See Federal Aid Project No. A019(289), I-84 Five-Mile Road to Orchard Road & Ramps. Approximate beginning Milepost (MP) 48.320 and highway Station No. 2549+00.00 to approximate ending point at MP 51.3 and Station No. 2710+00.00

<sup>3</sup> 32-inch high, New Jersey style concrete median barriers are cast in place and meet Test level-four of NCHRP 350.

<sup>4</sup> The lane numbering convention follows the same practice used by the Idaho State Police, however, the numbering convention is the opposite on Idaho Transportation Department (ITD) and its contractors documents on this project with the right-hand lane numbered as number 1 and increasing to 4 for the left-hand lane.

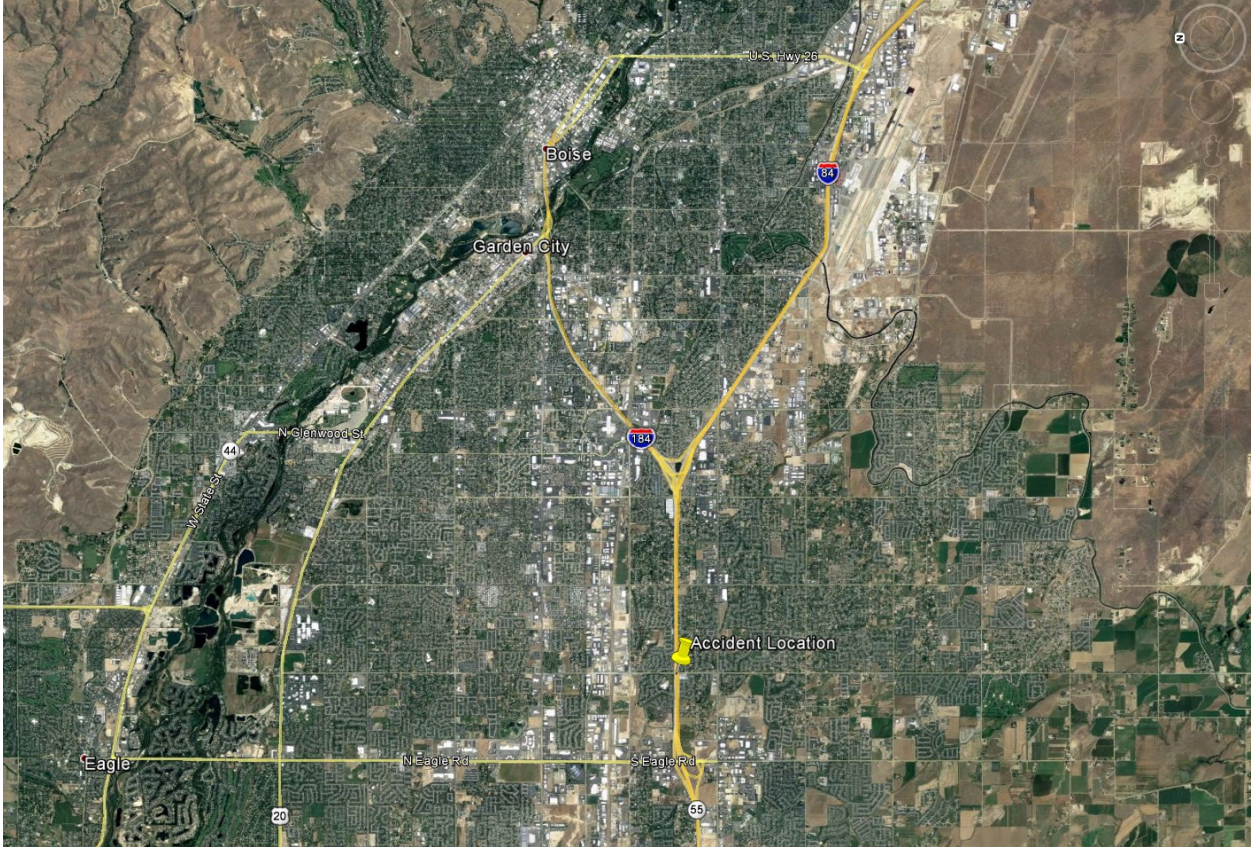


Figure1, Accident location Boise, Idaho

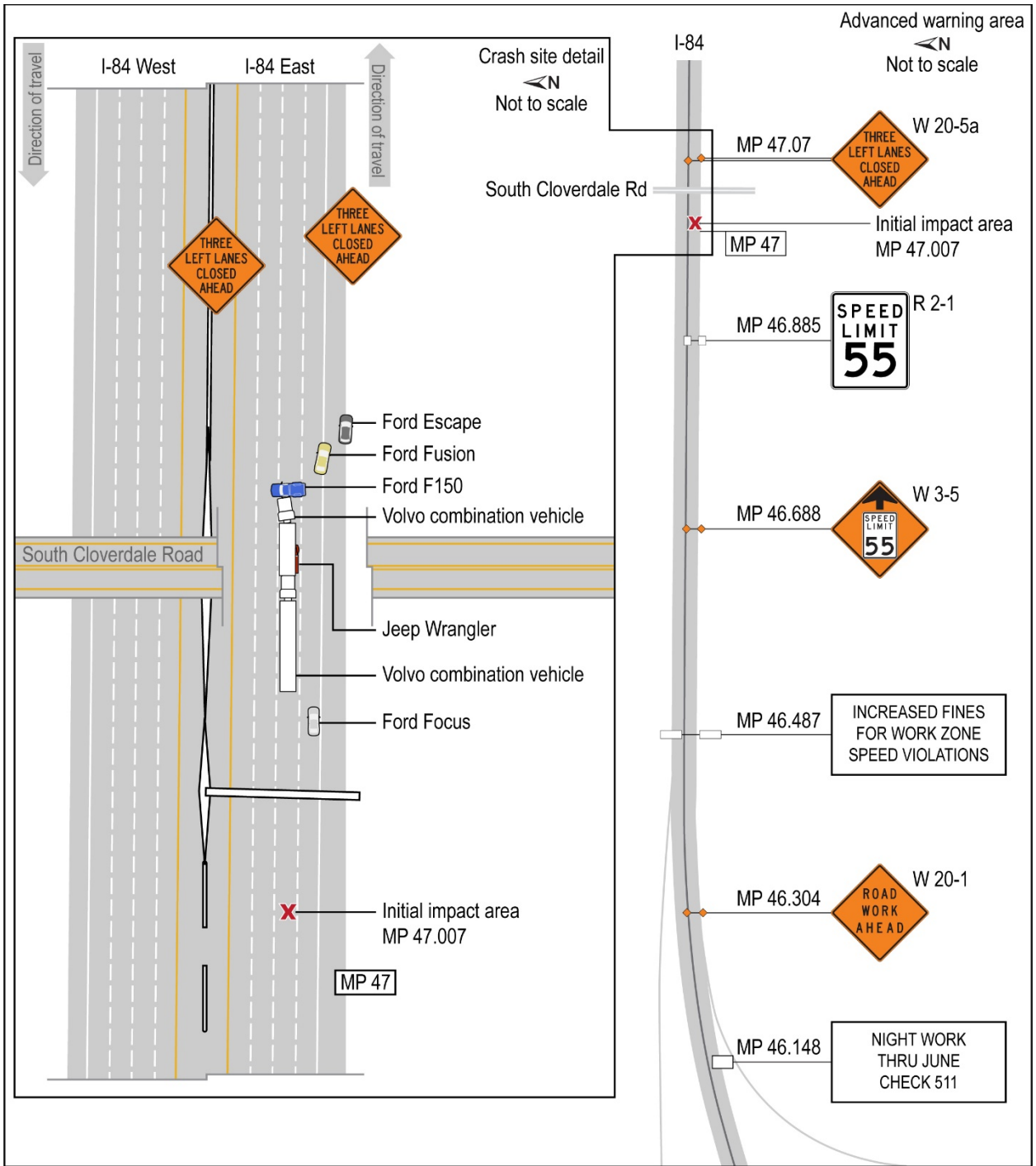


Figure 2 – Advance Warning Area of Work Zone with Crash Site Detail



## 2. Traffic Metrics

The average Daily Traffic (ADT) for I-84 in 2017 was 85, 270 vehicles per day. Heavy truck traffic was 7,280 trucks per day or 8.5% of the total ADT. The 20-year design ADT was for 136,170 vehicles a day with 15,280 truck per day or approximately 11%. The general posted speed limit for I-84 was 65 mph and that was reduced to 55 mph for the work zone. The 85<sup>th</sup> speed percentile was 73 mph.<sup>5</sup> Also, Automatic Traffic Recorders (ATR's) positioned in the transition area of this work zone indicated the speed of traffic had slowed to approximately 18 mph near the time of the collision and resulted in a stop and go queue situation.

## 3. Accident History

There were Seven fatal work zone crashes statewide in Idaho in the preceding five-year-period 2012-2016. See Table 1 below for details. The most common harmful event for work zone crashes was a rear-end collision involving multiple vehicles.<sup>6</sup> Work zone inspector diaries from ITD indicated that one other accident occurred on 6/21/2018 in this work zone when a truck tractor semitrailer and a Toyota passenger car collided.<sup>7</sup> See Table 1 for Idaho statewide work zone crash statistics. Additionally, The accident history for a six-mile-long segment of I-84 that encompassed 3 miles on each side of this crash showed that between July 2015-July 2018 two other fatal crashes occurred that were not related to work zones.

**Table 1 Crashes in Idaho Work Zones 2012-2016**

	Crashes in Work Zones: 2012-2016					Change 2015-2016	Avg. Change 2012-2015
	2012	2013	2014	2015	2016		
Work Zone Crashes	342	332	407	444	324	-27.0%	9.6%
Fatalities	1	3	1	2	0	-100.0%	77.8%
Serious Injuries	23	12	34	27	19	-29.6%	38.3%
Visible Injuries	34	50	108	95	59	-37.9%	50.3%
Possible Injuries	104	109	204	222	96	-56.8%	33.6%
% All Crashes	1.5%	1.5%	1.8%	1.8%	1.3%	-30.8%	7.1%
Workers Injured	1	1	0	1	0	-100.0%	0.0%

<sup>5</sup> See Highway Attachment, “Engineering and Traffic Investigation study for I-84 from MP 24.24-MP 59.0, February 1, 2018.”

<sup>6</sup> See Idaho Traffic Crashes 2017 by Idaho Transportation Department Office of Highway Safety, Table 46 and comments on page 67.

<sup>7</sup> See Highway Attachment, “ITD Work Zone Inspector Diaries”

#### **4. Work Zone Oversight**

The Federal Highway Administration (FHWA) exercises oversight of Federal-aid project work zones through guidance found in 23 CFR Part 630 Subpart J, “Traffic Safety in Highway and Street Work Zones.” Subpart J was re-titled “Work Zone Safety and Mobility in October 2007 in response to federal rulemaking in 2004. (See 69 FR54562 , Published September 9, 2004, for more information.)

The key components of the update rule included the following:

1. Development and implementation of an overall, agency-level work zone safety and mobility policy to institutionalize work zone processes and procedures.
2. Development of agency-level processes and procedures to support policy implementation, including procedures for work zone impact assessments, analyzing work zone data, training, and process reviews.
3. Development of procedures to assess and manage work zone impacts of individual Projects.

The Idaho Transportation Department (ITD) published a Work Zone Safety and Mobility Manual Which indicated that ITD policies, processes, and procedures were following the FHWA requirements.

#### **5. Idaho Transportation Department Work Zone Oversight**

The Idaho Department of Transportation (ITD) classified this work zone project as a significant project requiring the development of a Transportation Management Plan (TMP). The TMP included a traffic control plan and an impact analysis along with a Public Information component where information about the work zone was updated on ITD’s 511 call system.<sup>8</sup> ITD contracted with Parametrix, a traffic engineering firm, to develop a construction staging and traffic control plan along with special provisions requiring nighttime work and limiting lane closures.<sup>9</sup> The construction work times were limited to 10 pm until 5 am on weekday nights, 10 pm until 7am on Friday nights, and 10 pm until 9am on Saturday nights through Sunday mornings. Parametrix used the Highway Capacity Manual 2010 for capacity evaluations and determined that the capacity of I-84 in this area was 1,450 vehicles per lane per hour and, required that two lanes be maintained open in the eastbound and westbound directions on sections that had four existing through lanes, such as, the accident location.<sup>10</sup> These special provisions and traffic control plan were provided to the contractor in the contract documents.

The special provisions also provided for the contractor to change the staging plans and traffic control plan if the existing plans did not follow the contractors intended operational plan. However, any proposed changes in the traffic control plans and special provisions required written plans by a licensed engineer in Idaho be submitted to ITD 14 days in advance of any intended

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<sup>8</sup> See Highway Attachment , “ Idaho Transportation Department Work Zone Safety and Mobility Program January 2012.”

<sup>9</sup> See Highway Attachment , “Traffic Control Plan and Special Contract Provisions”

<sup>10</sup> See Highway Attachment, “Traffic Control Design e-mail from March 7, 2017 detailing rationale for estimating lane capacity and requirement for two lanes to be open in 4-lane sections of I-84.”

changes and the existing plans would remain in place unless ITD approved any submitted changes. No changes were submitted by the contractor.

## **6. Pre-Construction Conference Meeting**

A pre-construction conference meeting was held on July 26, 2017. ITD personnel, the contractor Penhall company and the traffic control subcontractor Specialty Construction Supply Company attended the meeting.<sup>11</sup> No Law Enforcement personnel were invited. The meeting lasted 1 hour and 54 minutes. Agenda discussions included the following items:

1. Contractor Award date of June 20<sup>th</sup>, 2017
2. Expected work days (75)
3. Expected contract completion date November 19<sup>th</sup>
4. Protocol for extending work days due to winter-weather
5. Construction sequencing decisions (grinding fast lanes in each direction simultaneously followed by grinding slow lanes and ramps)
6. Special provision limiting lane closures to two lanes in 4-lanes sections (42-minute mark in recording)
7. Any requirements to terminate lane closures if traffic gets backed up - none
8. Any law enforcement component provided for – none
9. Use of black paint as well as white for temporary lane line markings (Create greater visibility)
10. Noise, environmental protection, safety and lighting.

Specific information about the traffic control plan and special provisions requiring nighttime work was discussed. Penhall had a question regarding what to do if traffic was backed up. They asked about any special provisions similar to the East coast where contractors would be required to terminate a lane closure if the traffic backed up. ITD indicated that they had accounted for the traffic and did not expect anything like that to occur. ITD indicated that if severe congestion did occur, they would probably be notified by the State Highway Patrol.

In fact, on Thursday night June 15, 2017, the Idaho State police were notified of traffic congestion and signage problems in the work zone. ISP Sergeant Beckner who was in the area

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<sup>11</sup> See Highway Attachment, “Pre-Construction Conference Agenda with Sign-in Sheet and Audio Recorded Minutes.”



attending to a disabled vehicle answered the Dispatch interrogative with the statement that the zone was signed.

## **7. ITD Work Zone Inspector and Sub-contractor Traffic Control Manager Diaries**

The work was expected to take 75 days and be completed early in the Fall. However, poor weather set in and the project had to be terminated and begin again in the Summer of 2018. ITD provided Construction Diary sheets dated from 9/7/2017 through 10/28/2017 that were completed by ITD work zone inspector David Van Lydegraph, indicating that most of the grinding had been completed in the westbound and eastbound lanes of I-84. ITD also provided diaries prepared by work zone inspectors Blaine Schwendiman and J. Mensinger. The Traffic Control Maintenance Diary prepared for ITD by the Traffic Control Manager was also provided to the NTSB

On May 31, 2018, ITD and Penhall company had another pre-construction conference meeting before re-starting the project. No minutes were kept at this meeting. Bruce Kidd from Penhall attended the meeting and Bryon Breen the Resident Engineer for ITD were present. No personnel from the traffic control sub-contractor were at the second meeting. Penhall indicated that at this meeting they had requested to be allowed to close a third lane during joint sealing operations. The resident engineer told the NTSB that he recalled that item coming up in the meeting but was not sure how it was resolved other than no written requests were submitted as required by the special provisions to the contract. His clarified comment was that he had specifically told the contractor that a written request was required to change the traffic control plan.

## **8. Special Provisions for a Traffic Control Manager**

Section 105.04 of the ITD Standard Specifications for Construction 2012 provides for the coordination of contract documents and specifies that contract Special Provisions govern over all of specifications, supplemental specifications and project plans. Special Provision S626-30A details the required performance of a Traffic Control Manager. Special provision S626-30A was required in this contract and provides the following:

**Description:** This work shall be performed in accordance with 105.14-D. Maintenance of Traffic and shall consist of furnishing an experienced Traffic Control Manager (TCM) for resolution of traffic control conflicts, continuous monitoring of the traffic flow through a work zone setup and determine any potential improvements to the traffic control operations and phasing in accordance with the approved traffic control plans.

**Construction Requirements:** The TCM will be ATSSA certified with a minimum of 5 years of work zone traffic control experience to maintain, monitor, and manage traffic control. Evidence of the required certification, qualifications, and experience shall be submitted for approval to the engineer.

The TCM shall have access to direct all equipment, materials, and manpower needed to install and maintain traffic control and handle traffic related situations and coordinate for the completion of the items in this contract.

The TCM shall be available within 30 minutes after notification of an emergency, prepared to positively respond to repair the work zone traffic control or to provide alternate traffic arrangement. Where reasonable to expect potential problems, emergency plans shall be prepared in advance.

The TCM shall maintain a daily diary and document the design and approval of all work zones and any changes in configuration to an established work zone, and direction from coordinating with the Prime Contractor. The TCM shall make daily entries in the diary of all traffic control pay items, personnel used in traffic control operations and unusual occurrences involving the traveling public. A copy of the day's diary entries shall be submitted to the Engineer by 10:00 am the following workday.

Each daily record provided by the TCM will count as a single day of TCM to be measured for payment. Daily records shall be prepared and certified by the TCM and approved.

## **9. Work Zone Operation with Multiple Lane Closures at The Time of the Crash**

On August 17, 2018, NTSB staff met with ITD, Penhall, and Specialty Construction Supply to try and determine why the special provisions of the contract requiring two of the four eastbound I-84 lanes to remain open was not followed. Mason Garling, the traffic control supervisor for Specialty Construction Supply, stated that when they began the final stage of the construction to replace the pavement seals in the I-84 eastbound lanes on Thursday June 14, 2018, that he was told by Penhall to use the same three-lane closure that he had previously used in the westbound lanes in September and October of 2017. Bruce Kidd, the superintendent for Penhall indicated that in the second pre-construction conference on May 31, 2018, he had brought this matter up to Byron Breen, the ITD Resident Engineer. Byron Breen indicated the conversation did occur but that no minutes were recorded of the meeting and he could not remember the exact details of the conversation. He later related that he had specifically told Penhall that a written request to change the plan had to be submitted. He added that no written request to change the traffic control plan was ever submitted as required.

The work zone construction diaries by ITD provided the following information:

1. Blaine Schwendiman, the ITD work zone inspector noted that he drove through the TTC and verified that it appeared to be in place correctly. (Thursday June 14, 2018)
2. Schwendiman noted that traffic appeared to have merge hesitations and had issues the first few hours, but after 12:00 am traffic volumes reduced and flowed without interruption.
3. On Friday June 15, only two lanes were closed, and no traffic problems were noted.
4. On Saturday night June 16, the night of the accident, Schwendiman noted that TTC set-up began about 9:30 pm and three lanes were again closed to remove/replace seals in the pavement. He indicated he drove through the Temporary Traffic Control (TTC) and it appeared to be set up correctly with three arrow boards. He indicated that traffic

had issues with the lane closure merges and there was a lot of stop and go traffic happening. About 11:30 pm the accident occurred.

5. Traffic Control Maintenance Diaries by the Traffic Control Manager and his staff showed that a change to close three lanes was made by Penhall. The daily record was never questioned to determine if ITD had approved the change. The diaries show that three lanes were closed on the following dates:

June 10-12

June 15-16

At the time of the accident Diamond Drilling and Sawing, a sub-contractor to Penhall company was working in the eastbound lanes and Penhall company was working in the westbound lanes. Temporary Traffic Control was provided by Specialty construction Supply Company. The impact occurred in lane number 3 with lane 4 as the right-hand lane. Lanes 1-3 were closed ahead, and only lane 4 was open after the merges were complete.

At the request of the NTSB ITD obtained information about the traffic demand on I-84 in the one-hour period before the accident from 10:30 pm until 11:30 pm. ITD indicated that traffic was comprised of 1,277 vehicles in all lanes in the hour before the crash. Using the Highway Capacity Manual (HCM-2010) approach, the total was multiplied by a factor of 1.048 to convert the estimated truck traffic into passenger vehicle equivalents. This yielded a traffic demand of 1,338 passenger vehicle equivalents per lane per hour (PVE/PL/PH). These numbers indicate that theoretically with only one lane open the roadway was at 92 percent capacity based on the estimated capacity of 1,450 PVE/PL/PH determined by Parametrix, using procedures found in HCM 2010.<sup>12</sup> Figures 3 and 4 below show excerpts from the Automatic Traffic Recorder that detail the volumes and speeds in the time preceding the crash.

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<sup>12</sup> See Highway Attachment, ITD June 2018 email detailing roadway demand capacity ratios and Automatic Traffic Recorder (ATR) Counts

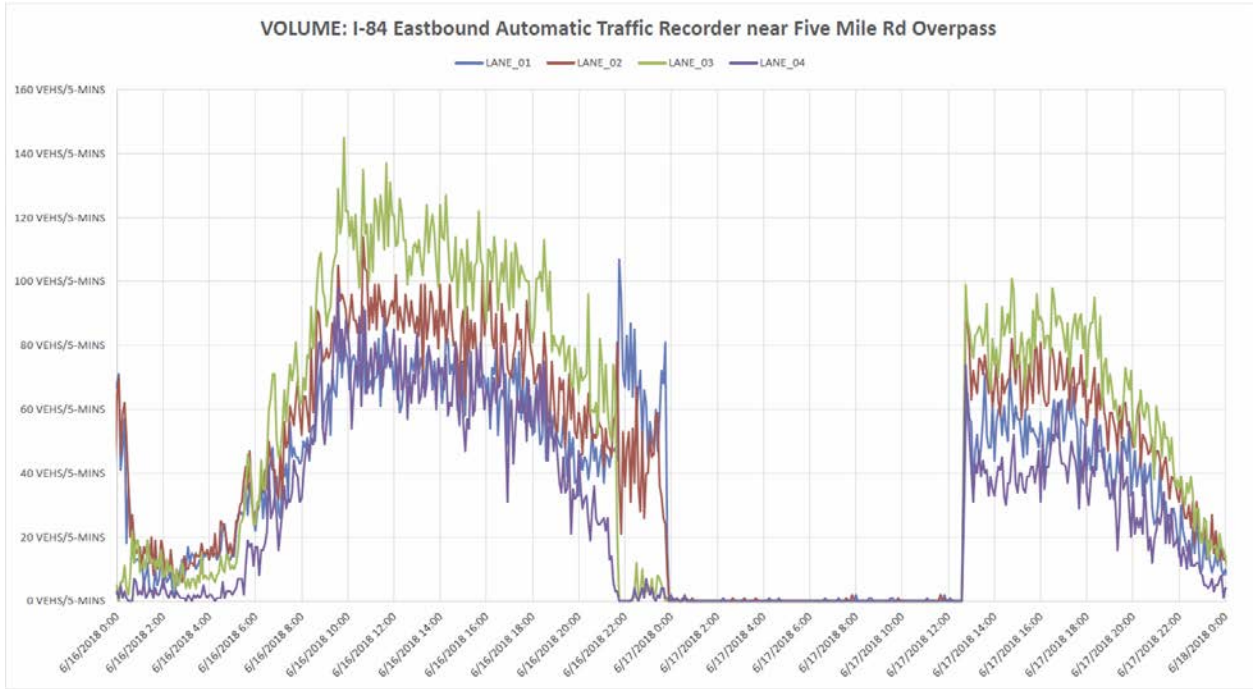


Figure 3 Showing details from the ATR on the traffic volumes

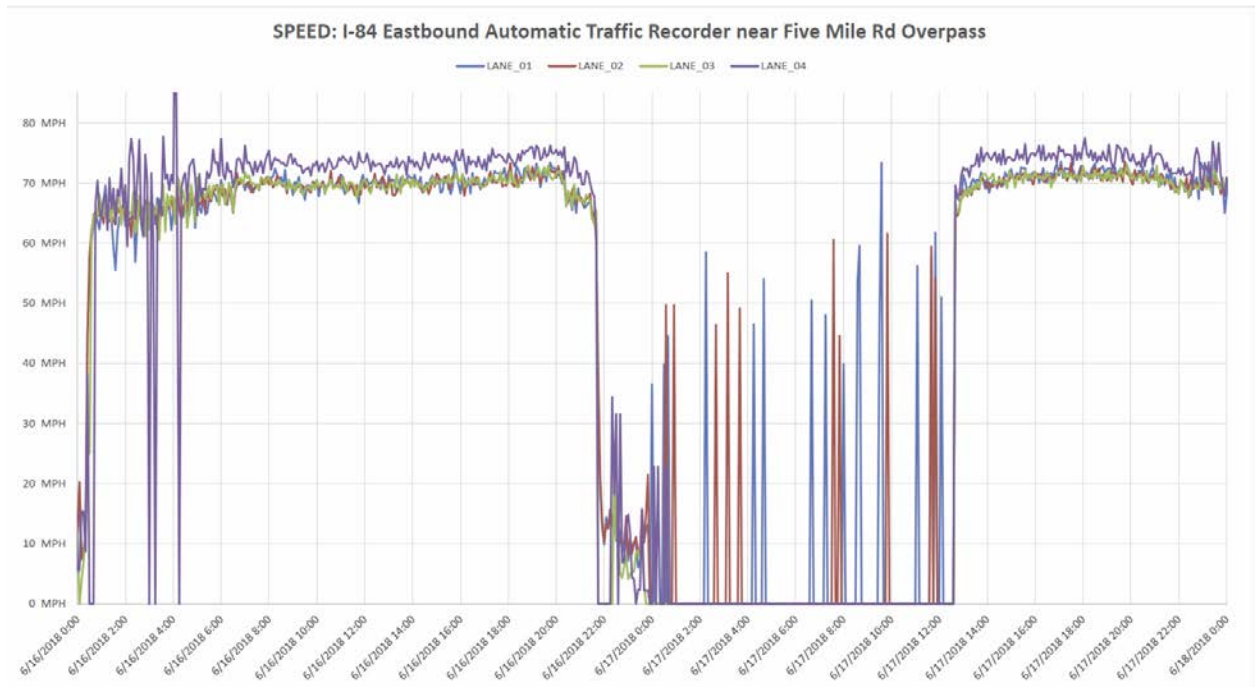


Figure 4 Showing traffic speeds before the crash

## 10. Work Zone Traffic Control Devices

Six work zone and accident site detail sheets were prepared by ITD from measurements supplied by the Idaho State Police, Specialty Construction Supply Company, and ITD measurements.<sup>13</sup> See figures 5 and 6 for graphics of the work zone traffic control. The figures indicate the following dimensional information:

1. The distance from the Portable changeable Message Sign (PCMS), which was the first traffic control device in the work zone, to the impact area was approximately .859 miles or 4,535 feet.
2. The distance from the Road Work Ahead Sign (MUTCD designation 20-1 at MP 46.304 to the impact area at MP 47.007 was .703 miles or 3,711 feet.
3. Next there were warning signs to let motorists know the speed limit changed to 55 mph ahead.

<sup>13</sup> See Highway Attachment, ITD Detail Drawings of Work Zone Advance Warning Area, Transition Area with Work Area and Accident Site

4. The regulatory speed reduction to 55 mph was at MP 46.885, .122 miles or 644 feet from the impact area where the traffic was stopped.

5. The first signs warning that the “Three left Lanes Closed Ahead”, were at MP 47.073 or 349 feet past where the impact occurred.

6. The next warning signs were located 980 feet past the “Three Left Lanes closed Ahead”. They were 48-inch square W4-2 signs warning that the lane was closing.

7. 1,000 feet after that the first arrow board and taper began. The first taper closing the left-hand or number 1 lanes was 900 feet long. (minimum distance required is 660 feet or 12 feet wide lane by 55 mph speed zone = 660 feet.

8. At the end of the taper was another 1000-foot-long break with lane reduction warnings signs (W4-2) followed by another arrow board and 650-foot-long taper.

9. After the number 2 lane was closed there was another 1000-foot-long break with W4-2 signs warning of another lane reduction that was followed by another arrow board and 650-foot-long taper.

10. After the number two lanes was closed there were orange drums at 55-foot intervals keeping traffic in the right-hand lane.

11. The one-mile long work area began 800 feet after the three left hand lanes were closed.

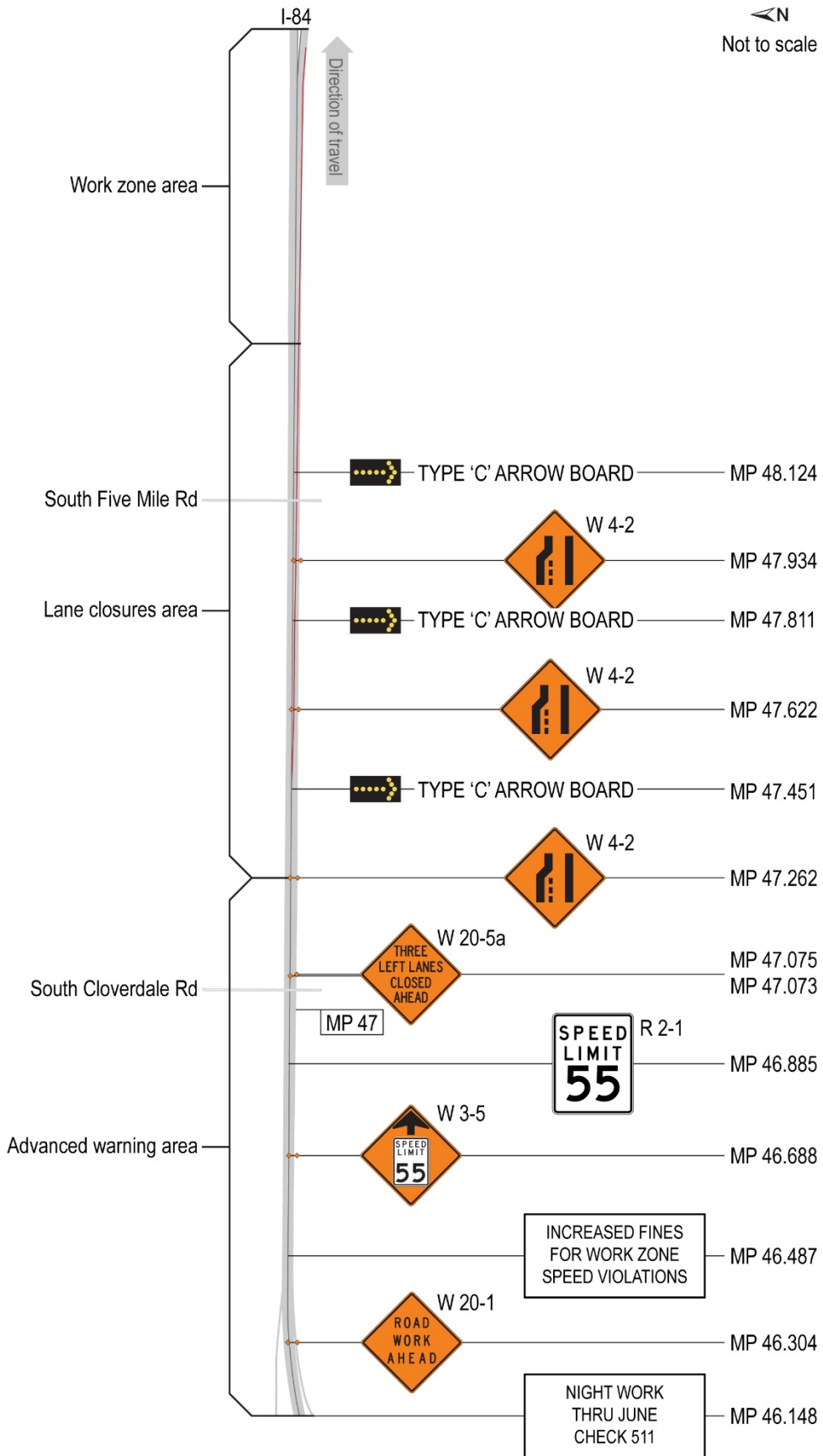




Figure 5 Work Zone Warning Signs Before the Crash location at Cloverdale Road Overpass at Milepost 47.007

I-84 Eastbound

⬅ N  
Not to scale

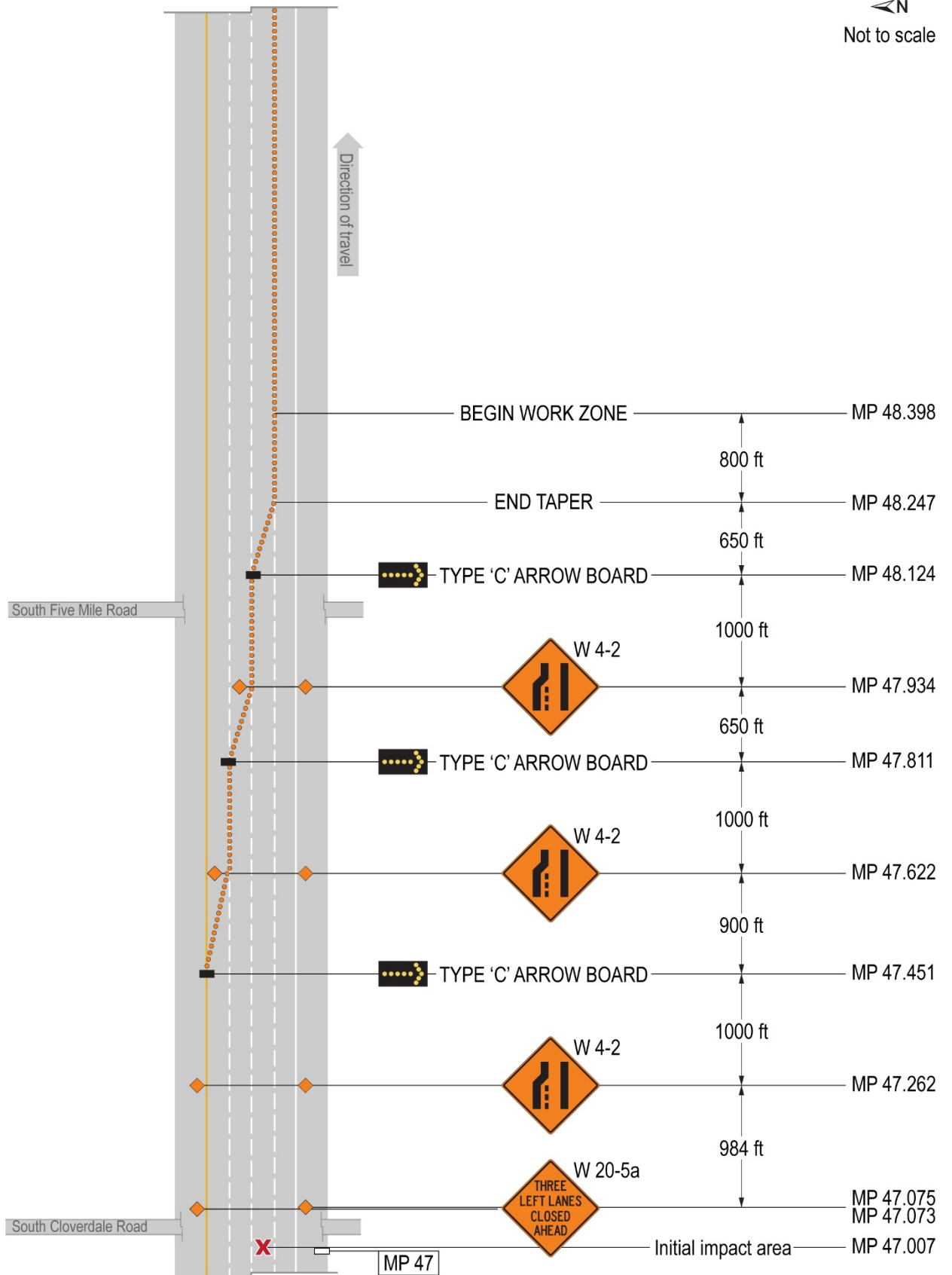


Figure 6- Transition area after the Impact Area

## 11. MUTCD Work Zone Traffic Control Device Guidance

Section 6C.04, Advance Warning Area in the FHWA Manual Uniform Traffic Control Devices (MUTCD), provides guidance on sign placement for advance warning before a Temporary Traffic Control Zone. The guidance indicates that typical distances for placement of advance warning signs on freeways and expressways should be longer because drivers are conditioned to uninterrupted flow. “Therefore, the advance warning sign placement should extend on these facilities as far as ½ mile or more.” In this work zone accident, the ITD warning signs from the initial PCMS sign to the end of the third taper were 2.1 miles. The distance from the beginning of the first taper back to the PCMS was 1.3 miles.

The transition area of a temporary traffic control zone is that section of highway where road users are redirected out of their normal path. Transition areas normally involve the use of tapers. Tapers are created by using a series of channelization devices or pavement markings to move traffic out of the normal path. The appropriate taper length is should be determined using the criteria shown in MUTCD table 6C-3 and 6C-4. Table 6C-4 provides formulas for determining taper length. In a speed zone of 45 mph or greater the length of the taper is expressed by  $L=WS$  where L is the taper length and W is the width of the offset and S is the posted speed limit or the anticipated operation speed. This expression indicates that the minimum taper length should have been 660 feet for channeling traffic out of a 12-foot-wide lane in the 55-mph work zone. However, in this accident the initial 900-foot taper length exceeded this minimum requirement. The second and third tapers met the minimum required taper length.

The Federal Highway Administration (FHWA) and the American Traffic Safety Services Association, (ATSSA) recommend using longer tapers to help smooth traffic flow at merge locations.<sup>14</sup>

Section 6G.14 of the 2009 MUTCD, “Work Within the Traveled Way of a Freeway or Expressway”, addresses lane closures and multiple lane closures on high-speed freeways and expressways. The standard requires that an arrow board shall be used when a freeway lane is closed. Also, when more than one lane is closed, a separate arrow board shall be used for each closed lane. Examples of proper placement of traffic control devices are given in Typical Application (TA 37). Comparison of TA 37 in the MUTCD and the Standard Drawing for a multiple right lane closure for the NJTA (Traffic Protection (TP3) showed that the NJTA complied with and exceeded the MUTCD standards and guidance for color, sign wording, retro- reflectivity, dimensions, advance warning and placement. See figure 7 for MUTCD TA-37.

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<sup>14</sup> Treating Potential Back-of-Queue Safety Hazards, American Traffic Safety Services Association, FHWA Grant No.DTFH61-06-G00004

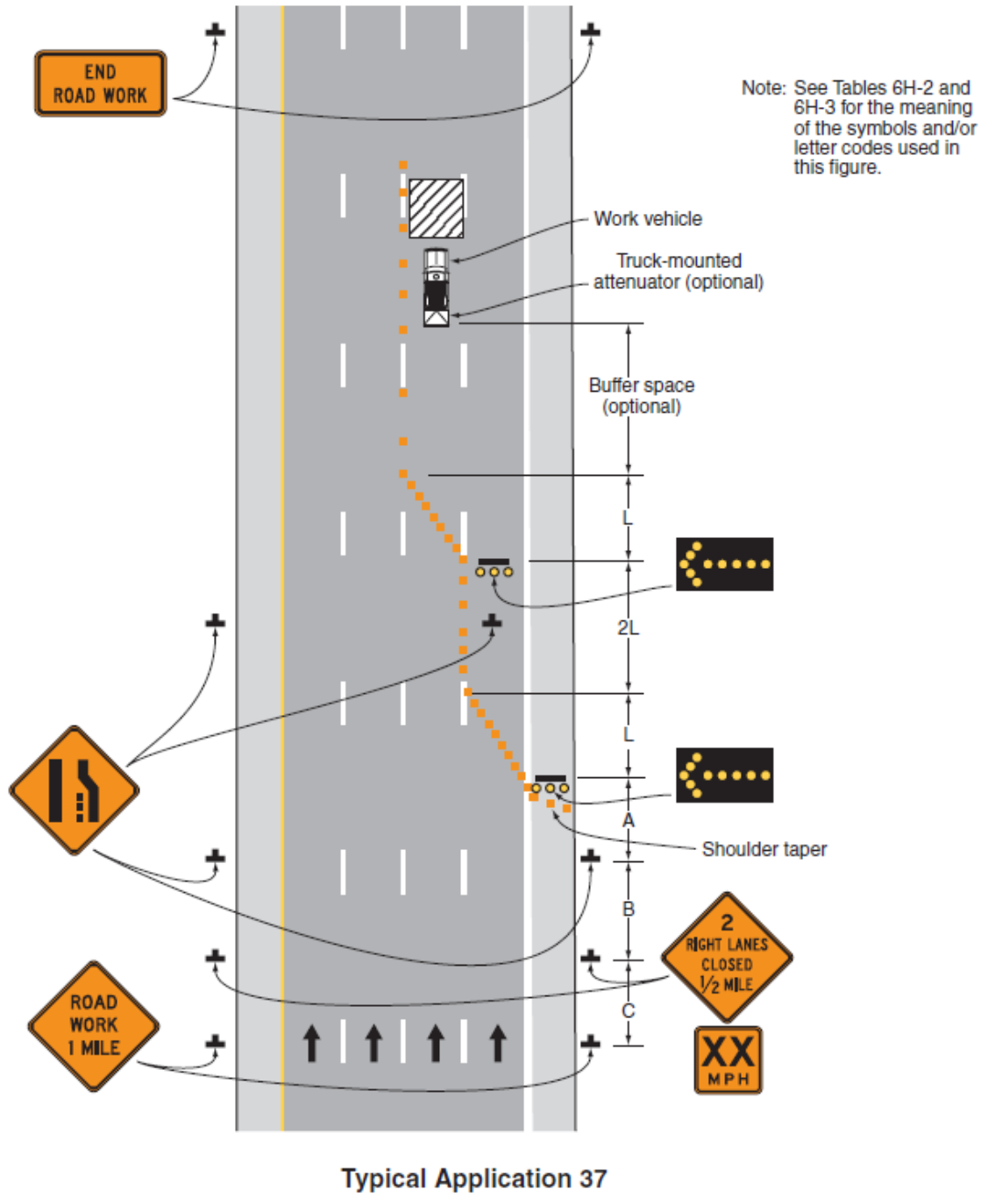


Figure 7 MUTCD Typical Application 37 for Freeway Multiple Lane Closures

Section 6G.19 of the MUTCD provides for special consideration of temporary traffic control during nighttime hours. The following guidance is provided:

“Considering the safety issues inherent to night work, consideration should be given to enhancing traffic controls (see Section 6G.04) to provide added visibility and driver guidance, and increased protection for workers.”

Section 6G04, Modifications to Fulfill Special Needs, provides guidance on devices that may be added to supplement the devices provided in typical applications. “When conditions are more complex, typical applications should be modified by giving particular attention to the provisions set forth in Chapter 6B<sup>15</sup> and by incorporating appropriate devices and practices from the following list:”

#### Additional Devices

1. Signs
  2. Arrow Boards
  3. More channelizing devices at closer spacing
  4. Temporary raised pavement markers
  5. High-level warning devices
  6. Portable changeable message signs
  7. Temporary traffic control signals
  8. Temporary traffic barriers
  9. Crash cushions
  10. Screens
  11. Rumble strips
  12. More delineation
- B. Upgrading of devices:
1. A full complement of standard pavement markings

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<sup>15</sup> Section 6B.01 provides detailed information about the seven fundamental principles of temporary traffic control pages 549-550, 2009 edition Manual on Uniform Traffic Control Devices for Streets and Highways

2. Brighter and/or wider pavement markings
  3. Larger and/or brighter signs
  4. Channelizing devices with greater conspicuity
  5. Temporary traffic control barriers instead of channelizing devices
- C. Improved geometrics at detours or crossovers
- D. Increased distances

In this accident, a stop and go queue developed and extended from the end of the third taper back to MP 47.007, a distance of 1.24 miles or approximately 6547 feet.

## **12. Research Related to the Scope of Work Zone Accidents**

FHWA amended 23 CFR Part 630 subpart J in 2004 with a requirement for the states to institute the changes by 2007. Therefore, accident statistics for the six-year-period 2007-2012 were listed to look at the general scope of the problem, then the problem of truck accidents in work zones will be highlighted by showing a list of fatal truck crashes in work zones, and then a listing of fatal accidents in work zones for the 50 states will be provided. First, a list of work zone fatalities that occurred in the previous six-year-period will be shown listing the numbers for the years 2001-2006.<sup>16</sup>

2001- 1,026 work zone fatalities

2002 – 1,186 work zone fatalities

2003 – 1,095 work zone fatalities

2004 – 1,063 work zone fatalities

2005 – 1,058 work zone fatalities

2006 – 1,004 work zone fatalities

The following list provides the number of fatalities from motor vehicle crashes in work zones for each of the years 2007-2012, which includes all types of vehicles.

2007 – 831

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<sup>16</sup> All data was sourced from [www.workzonesafety.org/crash\\_data/workzone-fatalities](http://www.workzonesafety.org/crash_data/workzone-fatalities) accessed on December 16, 2014

2008 – 716

2009 – 680

2010 – 586

2011 – 590

2012 – 609

The next list shows the number of large trucks involved in fatal and injury work zone crashes for the period 2003-2007.<sup>17</sup>

2003 – 196 fatal work zone crashes, 2003 – 3,000 injury work zone crashes

2004 – 225 fatal work zone crashes, 2004 – 4,000 injury work zone crashes

2005 – 235 fatal work zone crashes, 2005 – 4,000 injury work zone crashes

2006 – 216 fatal work zone crashes, 2006 – 2,000 injury work zone crashes

2007 – 174 fatal work zone crashes, 2007 – 2,000 injury work zone crashes

Additional research showed that on average there were 213 fatalities per year for the period 1996-2000 that involved heavy trucks in work zones. Twenty-four percent of work zone fatalities that occurred in 2000 involved large trucks in the crash (264 out of 1,093). In 1999, 868 fatalities resulted from motor vehicle crashes in work zones. Twenty six percent of these fatalities resulted from crashes involving large trucks. In November 2014, the Federal Motor Carrier Safety Administration (FMCSA) published more recent data regarding heavy trucks in fatal work zone crashes.<sup>18</sup> The analysis of FARS Data indicated that 23.6 percent of fatal work zone crashes for the five-year-period 2008-2012 involved at least one heavy truck. Other highlights of the study showed that large truck fatal crashes in work zones are more like to involve three or more vehicles. In 2012, 32.6 percent of large truck fatal crashes in work zones involved three or more vehicles, while 16.0 percent of fatal large truck crashes in general involved three or more vehicles. Another highlighted fact in the report showed that the majority of large truck fatal crashes in work zones involved large trucks in transport, and most are rear-ended. In 2012, 56.2 percent of large trucks in work zone fatal crashes were rear-ended.

Statistics on fatal work zone crashes between 2013 and 2017 showed that heavy trucks were involved in 29 percent of fatal work zone crashes.<sup>19</sup>

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<sup>17</sup> Large Truck and Bus Crash Facts 2007, Federal Motor Carrier Safety Administration

<sup>18</sup> Analysis Brief, “Work Zone Fatal Crashes Involving Large Trucks, 2012”, Federal Motor Carrier Safety Administration, Washington, D.C. November 2014

<sup>19</sup> NHTSA and FMCSA Trucks and Bus Fact Books 2013-2017



### 13. Scene Information

There were tire friction marks and scrapes on the pavement leading from the initial impact between the 2019 Volvo truck tractor semi-trailer combination unit and the 2009 Jeep Wrangler and 2003 Volvo Truck tractor semi-trailer combination unit. Both combination unit were fully loaded with produce. The Jeep was pushed from a stopped position in the number 2 lane approximately 184.8 feet from impact to final rest position.

#### E. DOCKET MATERIAL

The following attachments and photographs are included in the docket for this investigation:

##### LIST OF ATTACHMENTS

Highway Attachment – Engineering and Traffic Study for I-84 from MP 24.24 to MP 59.0,

February 1, 2018

Highway Attachment – ITD Work Zone Construction Diaries and TCM Diaries

Highway Attachment – ITD Work Zone Safety and Mobility Guidebook

Highway Attachment – Temporary Traffic Control Plan, Standard Specifications for Maintenance of Traffic, and Special Contract Provisions

Highway Attachment – Traffic Control Design e-mail from March 7, 2017 Detailing Rationale for Estimating Lane Capacity and the Requirement to Maintain Two Lanes Open in 4-lane Sections of I-84

Highway Attachment – Pre-Construction Conference Agenda with Sign-in Sheets and Minutes Recorded on MP-4 Audio

Highway Attachment – ITD June 2018 e-mail Detailing Roadway Demand-Capacity Ratios and Automatic Traffic Recorder Volumes

Highway Attachment – ITD Detail Sheets of Work Zone Advance Warning, Transition Area with Work Area, and Crash Site Detail

##### LIST OF PHOTOGRAPHS

Highway Photo 1 - View of Eastbound I-84 with wreckage behind the tow truck in the number 2 lane where the impact occurred. **Highway photos 1-8 are provided courtesy of the Idaho State Police**

Highway Photo 2 - Eastbound view of produce from both semi-trailers spilled in the impact lane.

Highway Photo 3 – Additional view of cargo spilled in the impact lane with a view of the damage to the striking semi-trailer.

Highway Photo 4 – View of extensive crushing damage to the red Jeep Wrangler

Highway Photo 5 – Right side view showing the extensive rear and front crushing damage to the Jeep.

Highway Photo 6 – Closer view of the frontal damage to the Jeep

Highway Photo 7 – View of extensive frontal crush to the 2019 Volvo truck tractor

Highway Photo 8 – View of the truck tractor and Jeep after they were pulled apart by tow trucks.

Highway Photo 9 – View of tire friction marks and scrape marks in the number 2 lane. Also note the damage to the bottom of the overhead sign. Photos were taken from the Cloverdale Road overpass

Highway Photo 10 – Additional view of tire marks and scrapes in the impact lane.

Highway Photo 11 – View of tire marks and pavement scrapes leading to a burned area on the concrete impact lane.

Highway Photo 12 – Additional view looking west in the I-84 eastbound lanes from the Cloverdale overpass. Tire marks and scrapes begin west of the shadow on the pavement formed by the sunlight on the overhead highway sign.

Highway Photo 13 - Eastbound view of I-84 looking east from the Cloverdale overpass. The two, “Left Three Lanes Closed” signs are visible on the shoulders of the highway.

**END OF REPORT**

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David S. Rayburn  
Senior Highway Accident Investigator (Highway Factors)