

## 2.3 Crash Data and Safety Analysis

Crash data was obtained from the Connecticut Department of Transportation (CTDOT) for the approximately 2.88 mile section of I-84 in Hartford from the West Hartford town line (Milepost 59.30) to the downtown Hartford platform (Trumbull Street and Main Street over I-84, Milepost 62.18). The data covers the 35 month period from January 31, 2009 to December 31, 2011 and includes all crashes that resulted in a death, injury or where the damage to the property of one individual was \$1,000 or more. Crashes occurring on the I-84 mainline, I-84 interchange ramps, and I-84 interchange ramp terminal intersections are analyzed separately within this section. Having not yet defined the preferred alternative, the impacts of the I-84 Hartford Project on the local street network cannot be determined.

### 2.3.1 I-84 Mainline

During this period, a total of 1,832 crashes were reported on this segment of I-84, including 2 fatalities and 423 crashes that resulted in 611 injuries. This translates to an average rate of 1.72 crashes per day. A review of the overall corridor crash data shows that approximately 77 percent of reported crashes resulted in property damage alone, while the remaining 23 percent involved an injury or a fatality. It is clear that the frequency of crashes on the corridor contributes to significant non-recurring traffic delays within the Project Study Corridor. The lack of proper shoulders and substandard roadway geometry, as identified in Section 2.5: Roadway Geometry Review, further add to the delay as vehicles involved in crashes are unable to pulloff the travel lanes and instead effectively close the travel lane until the crash-site is cleared.

The rate at which crashes occur is measured relative to the length and amount of traffic carried by the segment in question. An analysis was conducted to determine the number of crashes per 100 million vehicle miles traveled on each section of the corridor, as well as for the corridor overall. In total, the overall crash rate was 452 crashes per 100 million vehicle miles traveled (HMVMT). Directionally, crashes occur at a higher rate in the eastbound direction (553 crashes per HMVMT) than in the westbound direction (359 crashes per HMVMT). These rates are comparably higher than the 2009 average crash rate of 314.2 crashes per HMVMT for all State roads in Connecticut. Table 2-14, following, summarizes the crashes and crash rates by section of highway for I-84 in the eastbound direction while Table 2-15, following, summarizes the crashes in the westbound direction. Crash rates by segment are illustrated Figure 2-28, page 2-75.

**Table 2-14: I-84 Eastbound Mainline Crash Summary**

<b>Segment From</b>	<b>Segment To</b>	<b>Crashes</b>	<b>Crash Rate per 100 Million Veh. Miles</b>	<b>Fatalities</b>	<b>Injuries</b>	<b>Percent Crashes w/ Injuries</b>
Interchange 44 on-ramp	Interchange 45 on-ramp	34	122	0	15	32.4%
Interchange 45 on-ramp	Interchange 46 off-ramp	157	396	0	46	21.7%
Interchange 46 off-ramp	Interchange 46 on-ramp	113	364	0	50	29.2%
Interchange 46 on-ramp	Interchange 47 on-ramp	31	205	0	12	12.9%
Interchange 47 on-ramp	Interchange 48 off-ramp	241	1,149	0	74	23.7%
Interchange 48 off-ramp	Interchange 48 on-ramp	104	578	0	38	23.1%
Interchange 48 on-ramp	Interchange 49 off-ramp	157	739	0	33	18.5%
Interchange 49 off-ramp	Interchange 50 off-ramp	149	1,119	0	42	22.8%
Interchange 50 off-ramp	Interchange 51 off-ramp	90	1,247	1	30	30.0%
<b>I-84 Eastbound Total</b>		<b>1,076</b>	<b>553</b>	<b>1</b>	<b>340</b>	<b>23.5%</b>

**Table 2-15: I-84 Westbound Mainline Crash Summary**

<b>Segment From</b>	<b>Segment To</b>	<b>Crashes</b>	<b>Crash Rate per 100 Million Veh. Miles</b>	<b>Fatalities</b>	<b>Injuries</b>	<b>Percent Crashes w/ Injuries</b>
Interchange 51/52 on-ramps	Interchange 50 on-ramp	15	167	0	7	33.3%
Interchange 50 on-ramp	Interchange 49 on-ramp	95	589	0	39	16.8%
Interchange 49 on-ramp	Interchange 48 off-ramp	127	1,280	0	45	26.0%
Interchange 48 off-ramp	Interchange 48 on-ramp	102	409	0	32	22.5%
Interchange 48 on-ramp	Interchange 47 off-ramp	130	476	0	57	27.7%
Interchange 47 off-ramp	Interchange 46 off-ramp	103	409	0	26	20.4%
Interchange 46 off-ramp	Interchange 46 on-ramp	68	301.1	1	38	26.5%

**Table 2-15 (ctd.): I-84 Westbound Mainline Crash Summary**

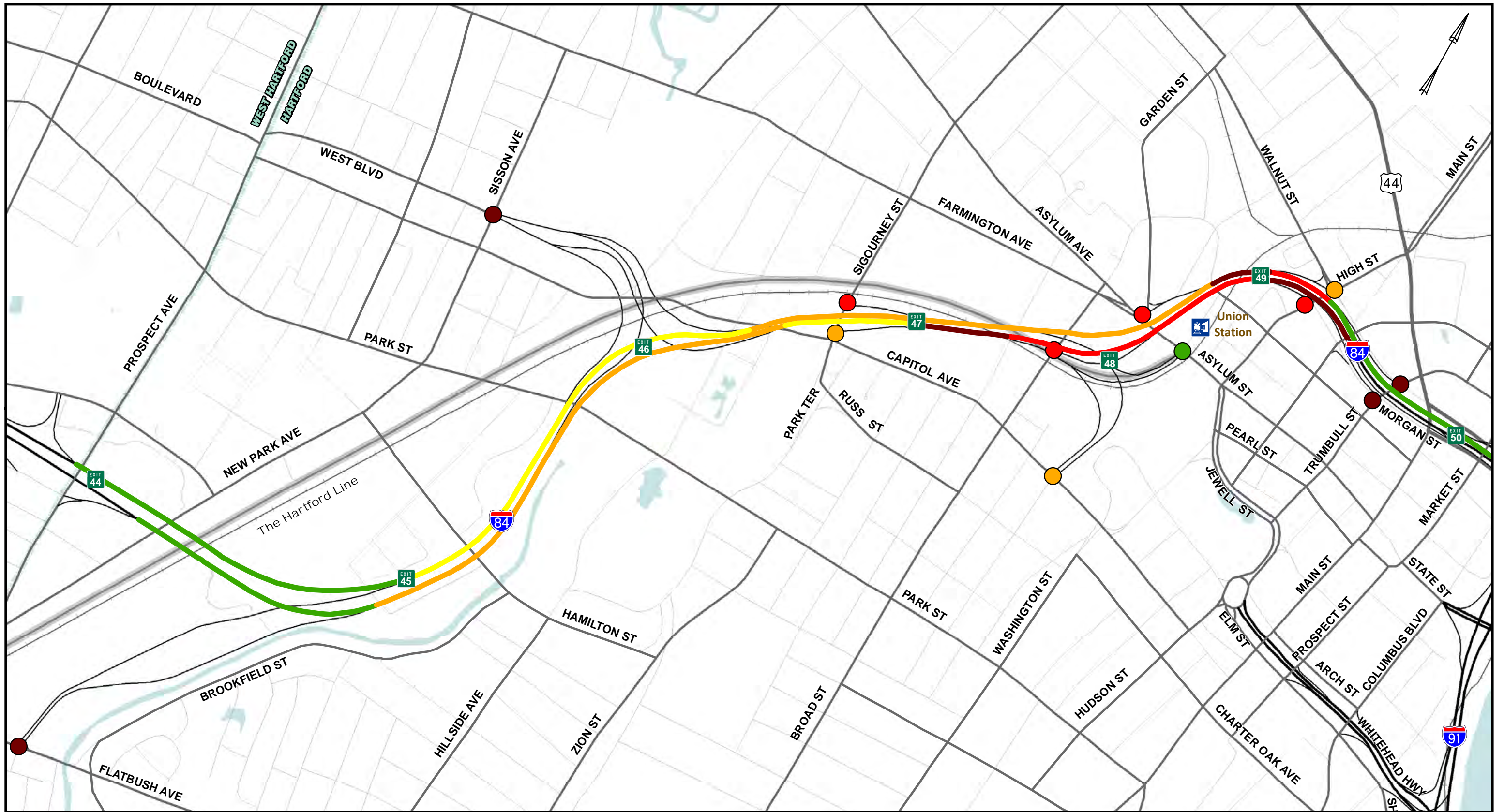
<b>Segment From</b>	<b>Segment To</b>	<b>Crashes</b>	<b>Crash Rate per 100 Million Veh. Miles</b>	<b>Fatalities</b>	<b>Injuries</b>	<b>Percent Crashes w/ Injuries</b>
Interchange 46 on-ramp	Interchange 45 off-ramp	71	206.8	0	20	16.9%
Interchange 45 off-ramp	West Hartford Town Line	45	109.7	0	7	13.3%
<b>I-84 Westbound Average</b>		<b>756</b>	<b>359</b>	<b>1</b>	<b>271</b>	<b>22.5%</b>
<b>I-84 Total Both Directions</b>		<b>1,832</b>	<b>452</b>	<b>2</b>	<b>611</b>	<b>23.1%</b>

Four sections of I-84 in Hartford have been identified as having exceptionally high crash rates:

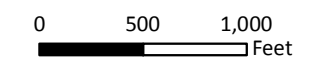
- The I-84 westbound segment between the Interchange 49 on-ramp (High Street) and the Interchange 48 off-ramp. 1,280 crashes per HMVMT occurred on this 0.11 mile segment.
- The I-84 eastbound segment between the Interchange 50 off-ramp (Trumbull Street) and the Interchange 51 off-ramp (I-91 Northbound). 1,247 crashes per HMVMT occurred on this 0.09 mile segment.
- The I-84 eastbound segment between the Interchange 47 on-ramp (Sigourney Street) and the Interchange 48 off-ramp (Capitol Avenue/Asylum Street). 1,149 crashes per HMVMT occurred on this 0.25 mile segment.
- The I-84 eastbound segment between the Interchange 49 off-ramp (High Street) and the Interchange 50 off-ramp (Trumbull Street). 1,119 crashes per HMVMT occurred on this 0.16 mile segment.

The crash data provided by CTDOT also includes information regarding the severity and type of crashes that occurred along this segment of I-84. The data indicates that approximately 0.6 percent of the crashes resulted in an incapacitating injury; approximately 6 percent resulted in a non-incapacitating but evident injury and approximately 17 percent with possible injuries. Approximately 50 percent of the crashes on the corridor were identified as rear-end collisions; 26 percent were sideswipe – same direction collisions; and 17 percent were fixed object collisions. The high rate of rear-end crashes suggests that congestion may adversely influence safety on the corridor. Crashes on mainline I-84 are illustrated by type in Figure 2-29, page 2-76.

A review of the contributing factors for crashes within the segment indicates that approximately 44 percent of the crashes were caused by vehicles following too close. 21 percent were caused by an improper lane change, 12 percent were due to driver losing control, and 8 percent were due to speeds too fast for conditions. In addition, it was found that 3 percent of the crashes were caused by failure to grant the right of way, 1.8 percent were due to violation of traffic control, 1.6 percent were caused by driving under the influence, 1.4 percent were caused by an animal or foreign object in the road, and 1.0 percent were caused by slippery surface conditions. The remaining contributing factors were either unknown or for a variety of other reasons. The contributing factors for I-84 mainline crashes



<b>LEGEND</b>	<b>Ramp Intersection Crash Rate</b> (per 1,000,000 Entering Vehicles)	<b>I-84 Mainline Crash Rate</b> (per 100,000,000 VMT)	Railroad	I-84 Exit #
	0.10	109.7 - 200.0	CTfastrak	Union Station
	0.11 - 0.25	200.1 - 315.0	Town/City Limit	Water
	0.26 - 0.50	315.1 - 500.0		
	0.51 - 0.75	500.1 - 750.0		
	0.76 - 1.00+	750.1 - 1000+		

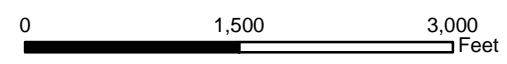


Sources of Data: City of Hartford, ESRI  
<http://www.ctfastrak.com/>

<b>The I-84 Hartford Project</b>		
<b>I-84 Crash Rates</b>		
Date: 7/17/2015	Drawn By: TranSystems	Figure No: 2-28



- LEGEND**
- Accident Types
- Rear End
  - Fixed Object
  - Right Angle
  - Turning
  - Sideswipe
  - Other



Sources of Data: DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Get Mapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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**I-84 Mainline Crash Type Map**

Date: 7/17/2015	Drawn By: Parsons Brinckerhoff	Figure: 2-29
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### 2.3.2 I-84 Interchange Ramps

Crash data for I-84 interchange ramps between Interchange 45 (Flatbush Avenue) and the western half of Interchange 50 (Trumbull Street) was also obtained from CTDOT for the same January 31, 2009 to December 31, 2011 timeframe. Table 2-16, following, and Table 2-17, page 2-79, document the number and severity of crashes for eastbound and westbound interchange ramps. The ramp with the highest crash total was found to be the Interchange 48B eastbound off-ramp (Capitol Avenue) with 49 crashes. The next highest crash ramp locations were the I-84 Interchange 48B westbound on-ramp (Capitol Avenue) and the Interchange 48 westbound off-ramp (Asylum Avenue). These ramps experienced 41 crashes each. None of the interchange ramp crashes involved fatalities but 104 injuries were recorded during this time period. Interchange ramp crash types are illustrated on Figure 2-31 and Figure 2-32, pages 2-82 and 2-83.

**Table 2-16: I-84 Eastbound Interchange Ramps Crash Summary**

<b>Interchange Ramp</b>	<b>From</b>	<b>To</b>	<b>Crash Total/Severity</b>
Interchange 45 On-Ramp	Flatbush Avenue	I-84	7 Crashes, 0 Fatalities, 1 Injury
Interchange 46 Off-Ramp	I-84	Sisson Avenue	18 Crashes, 0 Fatalities, 10 Injuries
Interchange 46 On-Ramp	Sisson Avenue	I-84	3 Crashes, 0 Fatalities, 1 Injury
Interchange 47 On-Ramp	I-84	Sigourney Street	13 Crashes, 0 Fatalities, 1 Injury
Interchange 48A Off-Ramp	I-84	Asylum Street	9 Crashes, 0 Fatalities, 7 Injuries
Interchange 48B Off-Ramp	I-84	Capitol Avenue	49 Crashes, 0 Fatalities, 26 Injuries
Interchange 48 On-Ramp	Broad Street	I-84	Data Not Provided
Interchange 49 Off-Ramp	I-84	High Street	27 Crashes, 0 Fatalities, 9 Injuries
Interchange 50 Off-Ramp	I-84	Trumbull Street	16 Crashes, 0 Fatalities, 9 Injuries

**Table 2-17: I-84 Westbound Interchange Ramps Crash Summary**

<b>Interchange Ramp</b>	<b>From</b>	<b>To</b>	<b>Crash Total/Severity</b>
Interchange 50 On-Ramp	Chapel St. North	I-84	3 Crashes, 0 Fatalities, 1 Injuries
Interchange 49 On-Ramp	High Street	I-84	14 Crashes, 0 Fatalities, 6 Injuries
Interchange 48 Off-Ramp	I-84	Asylum Avenue	41 Crashes, 0 Fatalities, 14 Injuries
Interchange 48A On-Ramp	Asylum Street	I-84	No Data Provided
Interchange 48B On-Ramp	Capitol Avenue	I-84	41 Crashes, 0 Fatalities, 1 Injury
Interchange 47 Off-Ramp	I-84	Sigourney Street	Data Not Provided
Interchange 46 Off-Ramp	I-84	Sisson Avenue	20 Crashes, 0 Fatalities, 11 Injuries
Interchange 46 On-Ramp	Sisson Avenue	I-84	14 Crashes, 0 Fatalities, 5 Injuries
Interchange 45 Off-Ramp	I-84	Flatbush Avenue	14 Crashes, 0 Fatalities, 2 Injuries

### 2.3.3 I-84 Interchange Ramp Terminal Intersections

Crash data was also obtained for the ramp terminal intersections. The crash data corresponds to the period from January 1, 2009 to December 31, 2011. Intersection crash rates are determined relative to the number of vehicles entering the intersection, expressed as crashes per million entering vehicles. An analysis of these intersections indicates that the ramp terminal intersections experience crashes at rates of between 0.11 and 1.32 crashes per million entering vehicles. These rates are in line with rates for major intersections in urban areas in Connecticut. Table 2-18, following, summarizes the crashes reported at the intersections and provides the crash rates for each. Figure 2-31 and Figure 2-32, pages 2-82 and 2-83 illustrate the ramp terminal intersection crash rates.

Two intersections had crash rates exceeding 1.00 crashes per million entering vehicles: the Interchange 45 Ramps at Flatbush Avenue and the Interchange 46 Ramps at Sisson Avenue/West Boulevard. However, despite the high number of crashes, each intersection exhibited a low rate of injury crashes: 22 percent and 32 percent, respectively.

The intersection of the Interchange 50 eastbound off-ramp and Trumbull Street/Chapel Street South experienced a crash rate of 0.97 crashes per million entering vehicles. None of the 18 crashes reported at this intersection involved a fatality but 56 percent of the crashes reported resulted in injuries. The intersection of the Interchange 50 westbound on-ramp and Trumbull Street/Chapel Street North experienced 13 crashes, with a corresponding crash rate of 0.87 vehicles per million entering vehicles. There were no fatalities and 31 percent of the crashes involved injuries.

The intersections of the Interchange 49 westbound on-ramp and High Street/Chapel Street North and the Interchange 48A ramps and Asylum Street/Spruce Street had relatively high rates of crashes involving injuries (57 percent and 50 percent, respectively) but low crash rates overall.



**Table 2-18: I-84 Interchange Ramp Terminal Intersections Crash Summary**

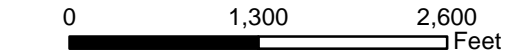
<b>Intersection</b>	<b>No. of Crashes</b>	<b>Crashes per Million Entering Veh.</b>	<b>Fatalities</b>	<b>Injuries</b>	<b>Percent with Injuries</b>
Interchange 45 Ramps at Flatbush Avenue	36	1.23	0	11	22.2%
Interchange 46 Ramps at Sisson Avenue/West Boulevard	44	1.32	0	23	31.8%
Interchange 47 Eastbound On-Ramp at Sigourney Street	8	0.34	0	1	12.5%
Interchange 47 Westbound Off-Ramp at Sigourney Street	16	0.71	0	7	43.8%
Interchange 48 Eastbound On-Ramp at Broad Street	13	0.63	0	6	46.2%
Interchange 48B Ramps at Capitol Avenue/Oak Street	6	0.26	0	1	16.7%
Interchange 48A Ramps at Asylum Street/Spruce Street	2	0.11	0	1	50.0%
Interchange 48 Westbound Off-Ramp at Asylum Street/Spring Street	14	0.51	0	7	42.9%
Interchange 49 Eastbound Off-Ramp at High Street/Chapel Street South	6	0.53	0	2	33.4%
Interchange 49 Westbound On-Ramp at High Street/Chapel Street North	3	0.43	0	5	57.1%
Interchange 50 Eastbound Off-Ramp at Trumbull Street/Chapel Street South	18	0.97	0	16	55.6%
Interchange 50 Westbound On-Ramp at Trumbull Street/Chapel Street North	13	0.87	0	8	30.8%



**LEGEND**

Accident Types

- Rear End
- Fixed Object
- Right Angle
- Turning
- Sideswipe
- Other



Sources of Data: ESRI, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstop, and the GIS User community

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**I-84 Interchange Ramp and Terminal Intersection Crashes Map, West End**

Date: 7/17/2015	Drawn By: Parsons Brinckerhoff	Figure 2-31
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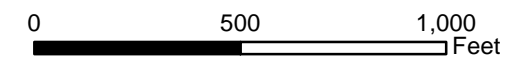
Accident Types

- Rear End
- Fixed Object
- Right Angle
- Turning
- Sideswipe
- Other

LEGEND

 The I-84 Hartford Project

I-84 Interchange Ramp and Terminal Intersection Crashes Map, East End



Sources of Data: ESRI, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstop, and the GIS User community

Date: 7/17/2015

Drawn By:  
Parsons Brinckerhoff

Figure: 2-32