

Road Safety Audit Report

US 20 Road Safety Audit

Albany-Corvallis Highway No.31

Benton County, Oregon

Independence Highway (M.P. 6.41)

Granger Avenue (M.P. 5.63)

Prepared For:

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April, 2012

DKS ASSOCIATES

Road Safety Audit

US 20 (Albany-Corvallis Highway No. 31)

at Independence Highway and Granger Avenue, Benton County





Audit Dates: March 19-20, 2012

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Notwithstanding any other provision of law, reports, surveys, schedules, lists or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway-highway crossings, pursuant to sections 130, 144 and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists or data.

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Road Safety Audit
US 20 (Albany-Corvallis Highway No. 31)
at Independence Highway and Granger Avenue, Benton County



Road Safety Audit Summary

A Road Safety Audit (RSA) was conducted by an interdisciplinary team for the US 20 Albany-Corvallis Highway No. 31 (US 20) intersections at Independence Highway and Granger Avenue to assess the roadway's safety performance and suggest potential improvement options. Both intersections were top 5 percentile Safety Priority Index System (SPIS) sites in 2011, and have been within the top 5 or 10 percentile of SPIS sites since 2006. Between 2004 and 2006, left turn crashes at both locations accounted for approximately one-half to three-quarters of all crashes recorded. A Statewide Transportation Improvement Program safety project rebuilt the left and right turn lanes to current standards in 2007, and added new signage and flashing warning beacons. Table 1 shows that the number of crashes increased in the three year period after 2007 when compared to the number of crashes recorded in the previous three year period before 2007. For the period from 2008 to 2010, the percent of crashes related to turning vehicles increased to over 90 percent at Independence Highway and to nearly 75 percent at Granger Avenue. The local community has been vocal about safety concerns for both locations.

Table 1: Intersection Left Turn Crash History

Intersection	Crash Type	2004	2008
		to 2006	to 2010
Independence Highway	Crashes	15	16
	Left Turn Crashes	8	15
Granger Avenue	Crashes	8	29
	Left Turn Crashes	6	21

Source: ODOT

The RSA was conducted on the 19th and 20th of March, 2012 and the findings were presented to the Oregon Department of Transportation (ODOT) on the 5th of April, 2012. The RSA Team observed that there were several issues related to driver behavior, intersection geometry, operations, the adjacent railroad and enforcement that were contributing factors to the high number of collisions. Based on the investigation, the team was able to develop several suggested improvement options for each of the identified issue areas. Through further study, the issues and suggested improvements were ranked and prioritized.

The most pressing issue discovered by the RSA Team was the large number of left turning crashes that had been recorded at both intersections since the installation of improvements by ODOT in 2007. Through the RSA investigation process, the RSA Team was able to determine that the most likely factors contributing to this high number of crashes included:

- ◆ **Driver Behavior:** Road rage, impatient drivers, failure to stop for the stop sign and illegal left turns were behaviors the RSA Team witnessed and associated with the high number of crashes at these locations.
- ◆ **Operations:** High traffic volumes, limited gaps and high side street delay were seen as contributing factors by the RSA Team to many of the observed driver behaviors.
- ◆ **Geometry:** Due to the configuration of the right turn lanes on US 20, vehicles turning onto Independence Highway or Granger Avenue block the view of oncoming traffic for vehicles trying to enter US 20 from the side street. This situation was also seen by the RSA Team as a significant contributing factor to the left turning crashes at these locations.

Any one of these factors by themselves would not likely lead to an increase in crash frequency. However, the RSA Team has found that the likely explanation for the increase in crashes at the US 20 intersections at Independence Highway and Granger Avenue was the combination of all three.

RSA Process

RSAs are conducted by an interdisciplinary team to assess a roadway’s safety performance and suggest potential improvement options. RSAs help improve road safety by identifying present and future safety issues, as well as promoting awareness of safe design, operational and maintenance practices. RSAs also support consideration of multimodal approaches to safety, and include human factors in safety needs assessment and solution development.

Figure 1 shows the eight major steps for conducting an RSA. Based on public comment and SPIS listing, ODOT Region 2 identified the US 20 intersections of Independence Highway and Granger Avenue as RSA candidates. ODOT then selected a consultant-led team to take the RSA through core steps, which included: a start-up meeting, field investigation, RSA analysis, presentation of findings and preparation of this report.

RSA Team Selection

The RSA Team was selected by ODOT and consisted of the specialists listed in Table 2. The team conducted a RSA of US 20 at the intersections of Independence Highway and Granger Avenue between the 19th and the 20th of March, 2012. Table 3 lists the RSA schedule details.



RSA Start-Up Meeting

The RSA start-up meeting was held in ODOT’s Region 2 Maintenance Building on March 19th, 2012 in Albany, Oregon. In addition to the RSA Team, stakeholders

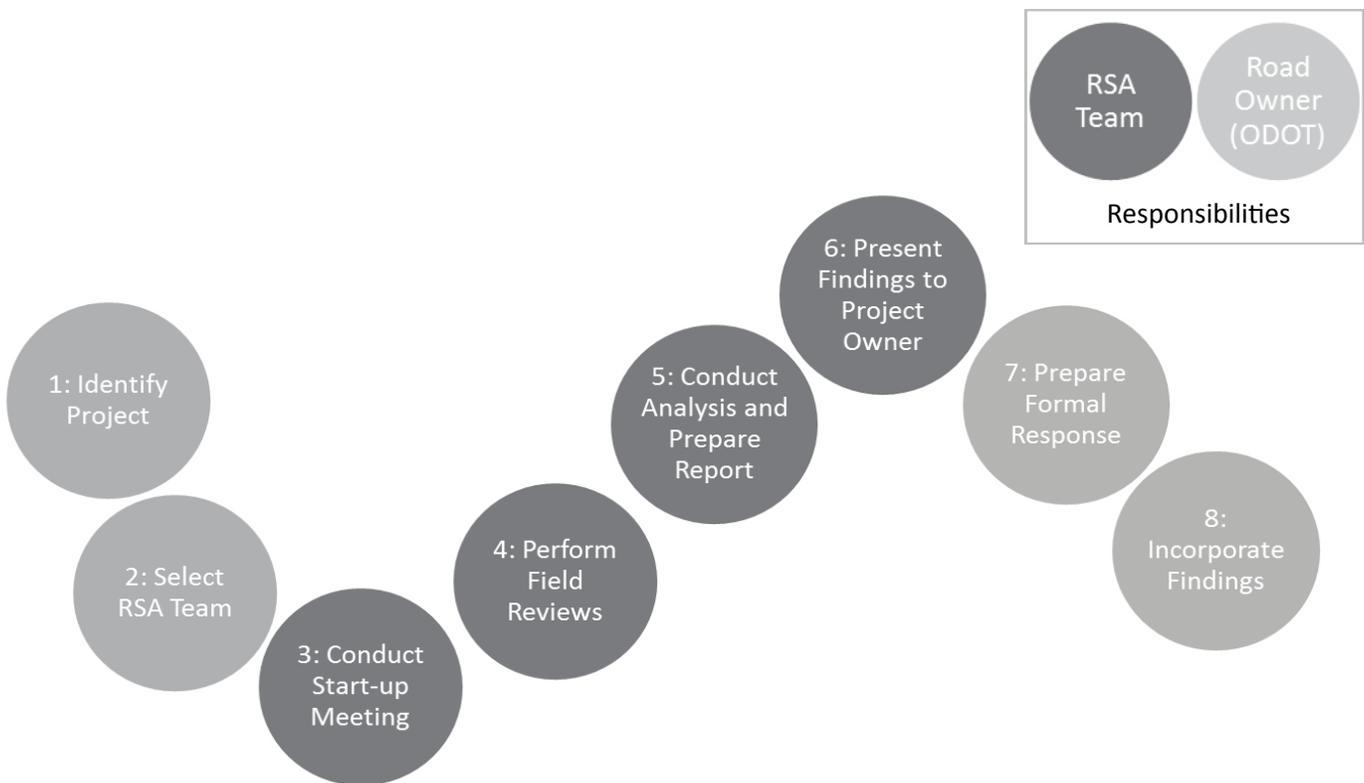


Figure 1: Road Safety Audit Steps

Table 2: Road Safety Audit Team

Name	Agency	Specialty
Scott Mansur, P.E., PTOE	DKS Associates	RSA Team Leader – Transportation Planning, Engineering, Safety and Operations
Michael Tomasini, P.E., PTOE	DKS Associates	Transportation Planning, Engineering, Safety and Operations
Amanda Westmoreland	ODOT	Traffic Safety & Project Resource/Coordinator
Wade Coatney	ODOT	Roadway Design
David Stearns	ODOT	Striping Maintenance
Anne Holder	ODOT	Traffic Safety/Human Factors
Dave Hacek	ODOT	Sign Crew Coordinator
Laurel Byer, P.E.	Benton County	County Engineer
Ron Keil, P.E.	OSU	OSU Engineering Professor and User

Table 3: Road Safety Audit Schedule

Monday March 19, 2012	
9:00 am to 10:30 am	Pre Audit Meeting/RSA Team Training
10:30 am to 12:30 pm	Field Conditions Observations
12:30 pm to 1:30 pm	Lunch
1:30 pm to 3:00 pm	Debrief/Break
3:00 pm to 4:00 pm	Field Conditions Observations
4:00 pm to 5:30 pm	Peak Hour Observations
5:30 pm to 6:30 pm	Dinner
6:30 pm to 9:00 pm	Evening Observations
Tuesday March 20, 2012	
7:00 am to 9:00 am	Morning Peak Hour Observations
9:00 am to 12:00 pm	Review Field Notes, Technical Information, and Debrief
12:00 am to 1:30 pm	Lunch
1:30 pm to 3:30 pm	Document Issues Observed, Trends, Factors
3:30 pm to 5:00 pm	Brainstorm Suggested Mitigations
Wednesday March 21, 2012	
9:00 am to 12:00 pm	Conduct Audit Analysis and Prepare Findings Presentation
12:00 pm to 1:00 pm	Lunch
1:00 pm to 3:00 pm	Conduct Audit Analysis and Prepare Findings Presentation
3:00 pm to 5:00 pm	Presentation to ODOT (Canceled due to Snow)
Thursday April 5, 2012	
3:00 pm to 5:00 pm	Presentation to ODOT and Stakeholders

in attendance included representatives from ODOT Area Management, ODOT Region 2 Traffic, the Oregon Highway Patrol, Benton County Sheriff's Office, Oregon State University, Albany school districts, the local Area Council on Transportation and two neighborhood groups. The RSA Team and Stakeholders were given a presentation to inform them of the existing site conditions, including: surrounding land uses, motor vehicle volumes, crash records, speed survey results and previous intersection improvement efforts. The RSA Team was then given additional RSA training before heading out to the field to investigate the two intersections.

RSA Field Investigation

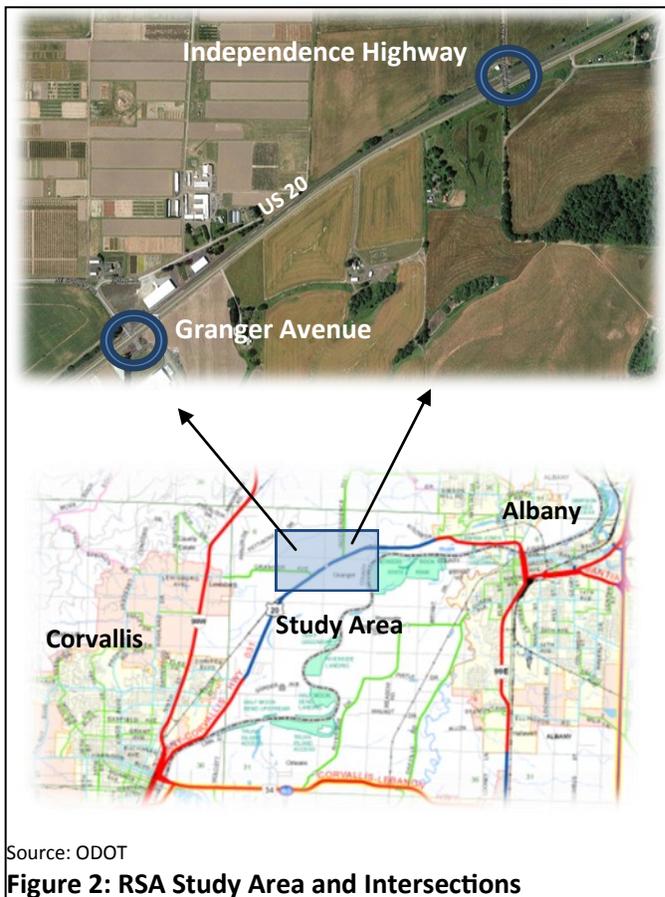
The RSA Team observed and investigated the two intersections during peak and off-peak hours under various lighting and weather conditions on the 19th and 20th of March, 2012. Observations focused on the roadway and roadside environment, existing roadway geometry, motor vehicle operations, driver behaviors and the adjacent railroad. Figure 2 shows the locations of the RSA intersections on US 20, which are about three-quarters of a mile apart.

RSA Analysis

The RSA Team identified and categorized observations and safety issues based on a qualitative risk scale. This risk scale was based on the probability of a potential crash and its associated severity. Table 4 shows a matrix of the risk scale based on FHWA crash prioritization methodology for crash frequency and crash severity.

Crash Frequency: Indicates the potential for how often a crash could occur.

- ◆ **High:** Five or more crashes per year
- ◆ **Medium:** One to five crashes per year
- ◆ **Low:** One crash every six years



Source: ODOT

Figure 2: RSA Study Area and Intersections

- ◆ **Rare:** Less than one crash every six years

Crash Severity: Indicates the potential for the outcome of a crash.

- ◆ **High:** Fatality or debilitating injury crash
- ◆ **Medium:** Non-debilitating injury crash, but medical assistance is required
- ◆ **Low:** Non-debilitating injury crash without need for medical assistance
- ◆ **Negligible:** property damage only type crashes

Table 4: Crash Prioritization Matrix

FHWA Crash Prioritization Risk Category		Severity			
		Negligible	Low	Medium	High
Crash Frequency Category	Frequent	C	D	E	F
	Occasional	B	C	D	E
	Infrequent	A	B	C	D
	Rare	A	A	B	C

This table assigns a letter score between A and F based on the potential combinations of crash frequency and crash severity. A score of “F” indicates that there would be a high probability of frequent and severe crashes - a poor situation that should be addressed with top priority. Conversely, a score of “A” indicates that the probability of a crash would be rare to infrequent and that the severity of the crash would be negligible to low.

The RSA Team investigated options for improving safety issues identified while in the field. These improvement options included potential enforcement, education and engineering solutions. One of three order of magnitude cost categories was assigned to the suggested solution by the RSA Team. These cost categories included:

- ◆ **Low:** Maintenance staff assignments or low-cost improvements
- ◆ **Medium:** Minor to moderate new construction
- ◆ **High:** Significant new construction.

RSA Presentation

Upon completion of the RSA field investigation on the 20th of March, the RSA Team compiled all of the observations and improvement options into a presentation for the RSA Stakeholders. This presentation had been scheduled for the 21st of March, but it was canceled due to a snow storm event and was postponed until the 5th of April. The RSA observations and suggestions were generally well received by the RSA Stakeholders in attendance for the presentation. Stakeholder feedback at the presentation indicated that many of the suggestions were consistent with their ideas and expectations.

RSA Area Background

The RSA area background data investigated included

roadway characteristics, surrounding land use, motor vehicle traffic volumes and crash history.

Roadway Intersection Characteristics

The two intersections investigated in this RSA were US 20/Independence Highway and US 20/Granger Avenue. Both intersections are 3-legged, rural intersections with stop control on the side street, intersection warning signage and a flashing warning beacon. This segment of US 20 maintains two travel lanes and is classified by ODOT as a regional highway. The posted speed limit is 55 mph, but 85th percentile speeds ranged from 58 mph to 60 mph along the corridor.

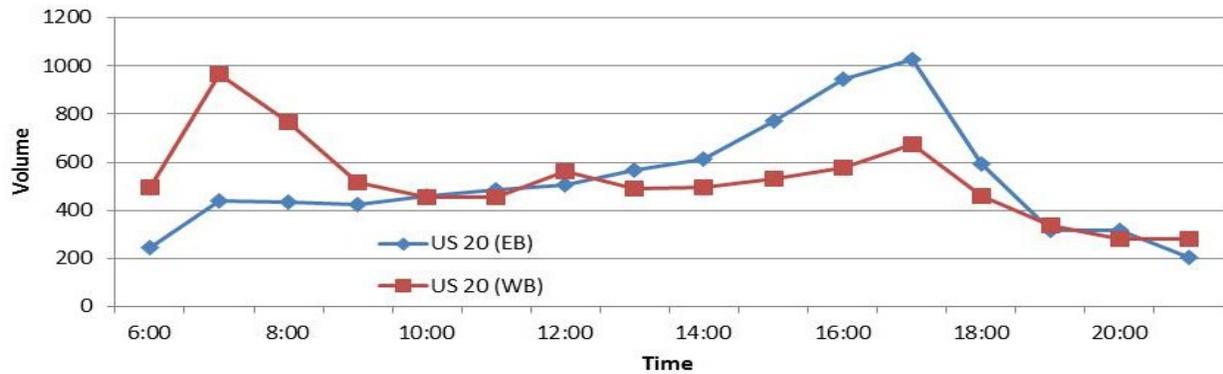
Surrounding Land Uses

Surrounding rural land uses within the study area include sparsely developed residential housing, recreation, research and agriculture. This route also serves commuters between Albany and Corvallis .



Motor Vehicle Traffic Volume

The RSA study portion of US 20 carries approximately 14,000 vehicles per day. Truck traffic makes up about 1-3% of traffic on US 20, 12% of traffic on Independence Highway, and about 1% of traffic on Granger Avenue. The large number of trucks on Independence Highway is due to a waste transfer station north of



Source: ODOT

Figure 3: US 20 Mainline Volumes

Highway 20. Figure 3 shows the daily profile for east-bound and westbound traffic on US 20 between Independence Highway and Granger Avenue. This figure shows the commuter nature of the area traffic with distinct morning (7:00 to 8:00 a.m.) and evening (4:00 to 5:00 p.m.) peak hours. Traffic predominately moves from Albany to Corvallis in the morning and returns to Albany in the evening.

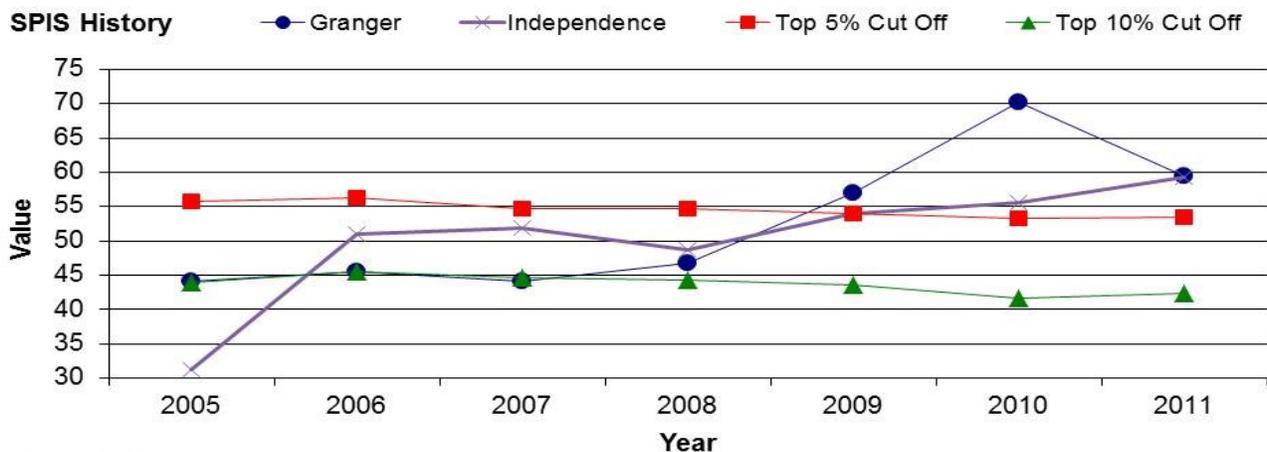
values on a yearly basis for state highway segments based on an indexing formula to identify potentially hazardous locations for further investigation. The SPIS score is calculated using the most recent full three years of available data and considers crash frequency, crash rate and crash severity. Figure 4 shows the statewide top 5 percentile and top 10 percentile values and the SPIS values for the US 20 intersections at Independence Highway and at Granger Avenue.

Crash History

Both intersections were top 5 percentile Safety Priority Index System (SPIS) sites in 2011, and have been within the top 5 percentile or 10 percentile of statewide SPIS sites since 2006. ODOT calculates SPIS

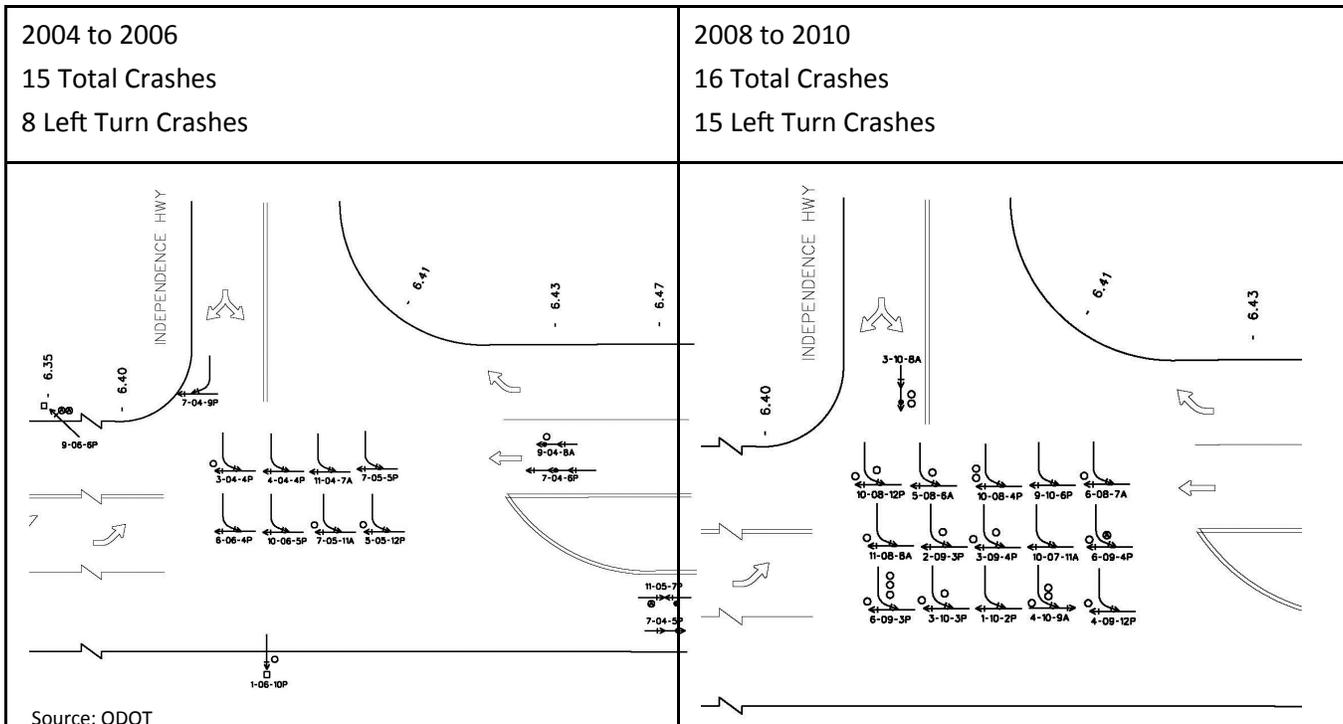
Independence Highway

The five-year crash history (2006 to 2010) at the US 20/Independence Highway intersection included a total of 23 Total Crashes with the following characteristics:



Source: ODOT

Figure 4: SPIS History – Independence Highway and Granger Avenue



LEGEND

- Person Killed
- ◀ Ped. Killed
- Person inj.
- ◀ Ped. inj.
- ◀ Property Damage Only
- ◀ Collision - Rear-end
- ◀ Collision - Head-on
- ◀ Collision - Sideswipe
- ★ Awaiting Left Turn
- Path of Pedestrian
- ← Path of Vehicle
- Path of Animal
- ← Vehicle Moving
- ◀ Vehicle Stopped
- ↔ Vehicle Backing
- ◻ Properly Parked
- ◻ Improperly Parked
- ↺ Vehicle Overturned
- ↺ Vehicle Skidded



US 20 at Independence Highway Facing East

Figure 5: Crash Diagram – Independence Highway

- ◆ 2 Debilitating Injury Crashes (9%)
- ◆ 7 Property Damage Only (PDO) Crashes (30%)
- ◆ 20 Turning Movement Crashes (87%)
- ◆ 14 Occurred between 12:00 and 6:00 p.m. (61%)
- ◆ 18 Occurred during the daylight conditions (78%)
- ◆ 16 Occurred under dry conditions (70%)

The patterns of crashes indicate that high traffic volume and limited gap availability may be more of a contributing factor than roadside hazards or environmental factors. To better understand the crash patterns, ODOT created crash diagrams using data

from 2004 to 2006 and from 2008 to 2010 (See Figure 5). Data from 2007 was excluded from the crash diagram because a Statewide Transportation Improvement Program safety project rebuilt the left and right turn lanes to current standards in 2007 and added new signage and flashing warning beacons.

The crash diagrams put together by ODOT revealed that most every type of crash had been eliminated after the 2007 improvements, with the exception of the left turn crashes, which have since doubled.

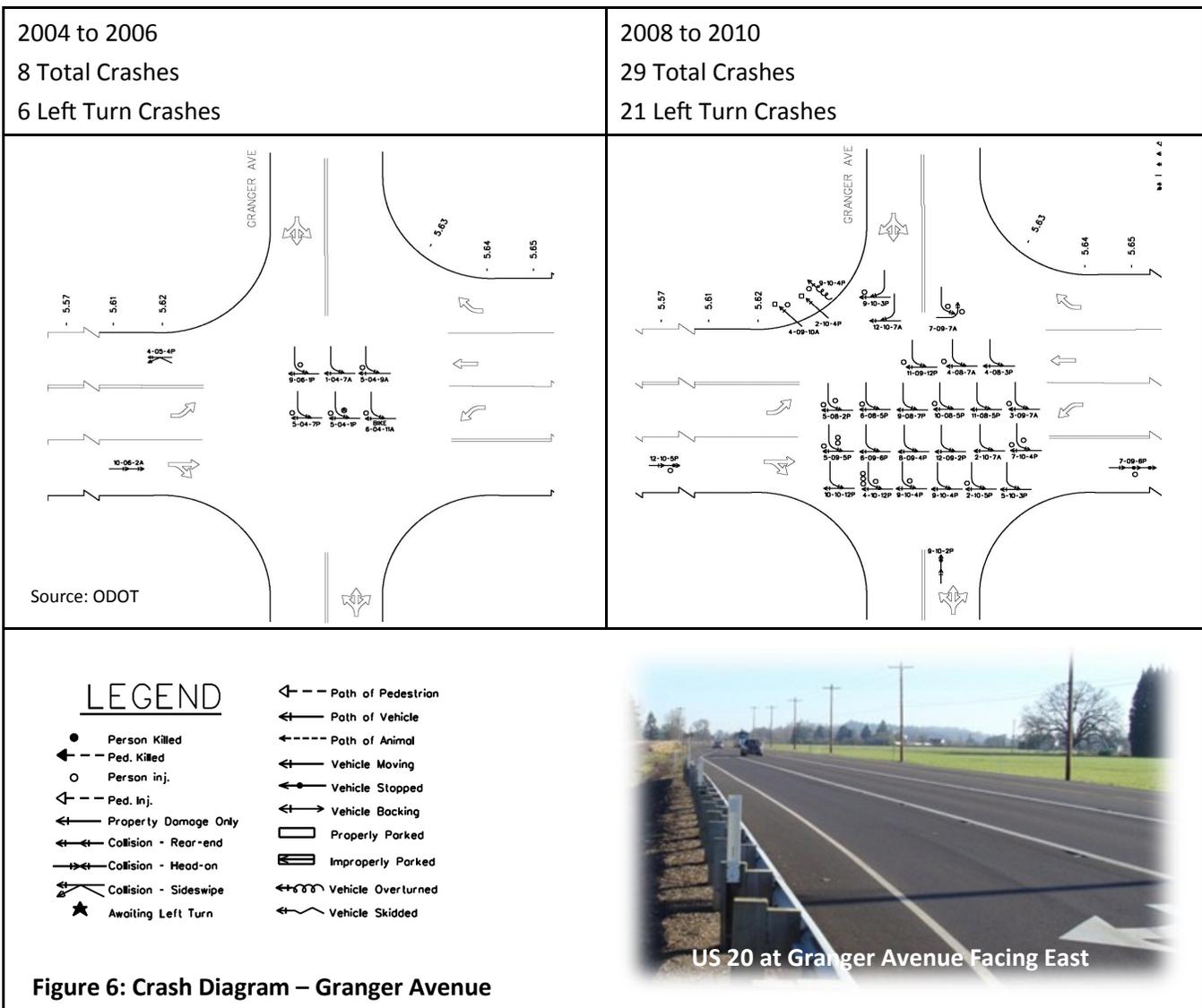


Figure 6: Crash Diagram – Granger Avenue

Granger Avenue

The five-year crash history (2006 to 2010) at the US 20/Granger Avenue intersection included a total of 41 Total Crashes with the following characteristics:

- ◆ 1 Debilitating Injury Crash (2%)
- ◆ 17 PDO Crashes (41%)
- ◆ 29 Turning Movement Crashes (71%)
- ◆ 25 Occurred between 12:00 and 6:00 p.m. (61%)
- ◆ 36 Occurred during the daylight conditions (88%)
- ◆ 29 Occurred under dry conditions (71%)

Similar to the patterns observed at Independence Highway, these patterns of crashes indicate that high traffic volume and limited gap availability may be more of a contributing factor than roadside hazards or environmental factors.

Figure 6 shows the crash diagrams created by ODOT using data from 2004 to 2006 and from 2008 to 2010. Data from 2007 was excluded from the crash diagram because a Statewide Transportation Improvement Program safety project rebuilt the left and right turn lanes to current standards in 2007.

As with the intersection at Independence Highway, the crash diagrams put together by ODOT revealed that left turning crashes more than tripled after the improvements were installed in 2007. Unlike at Independence Highway, other types of crashes increased at Granger Avenue in addition to the left turning crashes.

Road Safety Audit Team Findings Summary

The RSA Team made observations relating to the following categories:

- ◆ Environmental Observations
- ◆ Road User Observations
- ◆ Driver Behavior Observations
- ◆ Geometric Issues
- ◆ Operational Issues
- ◆ Railroad Issues
- ◆ Enforcement Issues

Environmental Observations

The RSA Team observed the roadside and roadway environments and determined that there were no significant factors that could potentially contribute to the increase in crashes at either location. The visual fields were clear of trees and other visual clutter. Street lights were not provided at either location, due to the rural nature of the surrounding land uses. This was not seen as an issue, since the majority of the crashes occur during the day and the non-provision of lighting fits within the surrounding environment.

Road User Observations

The RSA Team observed several different user types at both intersections. While the majority of users

were passenger vehicles, garbage trucks were frequently observed using Independence Highway to access the nearby dump. Additionally, large trucks, buses (school and transit) and emergency vehicles were observed to turn into and out of both locations. Bicycle and pedestrian activity was low during the observation periods on the 19th and 20th of March, potentially due to the weather.



Driver Behavior Observations

Several different types of driver behavior were observed by the RSA Team, including:

- ◆ Road Rage
- ◆ Impatient Drivers
- ◆ Disregard for Stop Signs
- ◆ Distracted Drivers



While these behaviors may not be the exact cause for the crashes recorded at these two locations, they could potentially be contributing factors. These types of behaviors could be a result of high traffic volumes, congestion and associated long driver delays (2 to 5 minutes) when trying to access the highway. A look

into the crash records revealed that the majority of the crashes involved local drivers. None of the crashes documented alcohol or speeding as contributing factors. The combination of the observations and the recorded crash documentation hints at a correlation between driver behavior and congestion as being contributing factors to the crashes at both locations.

Geometric Issues

Four geometric issues were identified by the RSA Team:

- ◆ Narrow Shoulder Width at Independence Highway
- ◆ Limited Storage Between Railroad and Highway on Side Street
- ◆ Right Turning Highway Vehicles Blocking View of Side Street Traffic
- ◆ No Pedestrian/Bicycle Facilities

Of the four issues listed above, the RSA Team believes that the single greatest geometric issue associated with the increase in left turn crashes at both locations was the installation of the right turn lanes on US 20. This is due to the fact that a high volume of vehicles turning onto the side street block the view of oncoming traffic for drivers waiting to enter US 20 from Independence Highway or Granger Avenue.



Operational Issues

The core of operational issues observed by the RSA Team was congestion-related. These issues included:

- ◆ Large Platoons of Vehicles (30+) on US 20 Create Infrequent Gaps for Side Street Traffic
- ◆ Long Queues (10+ Vehicles) and Delays (2 to 5 Minutes) for Side Street Traffic during Peak Hours
- ◆ Long Train Delay (6 to 7 Minutes) and Resulting Queues (5 Vehicles from US 20 at Granger Avenue)
- ◆ Local Traffic Diverts to North Albany Road and Springhill Drive due to Congestion

High traffic volumes, few gaps and high side street delay likely contribute to the impatient driver behaviors mentioned previously. Delay for the left turning vehicles onto US 20 was observed to be much greater than for the right turning vehicles, because the left turning vehicles need to look for gaps in both directions of traffic. The majority of crashes at both loca-





tions were recorded to be collisions between left turning movements onto US 20 and westbound through movements.

Rail Issues

The RSA Team observed four rail related issues, including:

- ◆ Limited Storage between Highway and Railroad on Independence Highway and Granger Road
- ◆ Steep Approach Road Grades from US 20
- ◆ Stop Bar for Railroad set back from Crossing Arm
- ◆ Vehicles Stopping on Railroad Tracks

While there have not been any train/motor vehicle crashes recorded since 2004, the potential for these types of crashes does exist due to the issues listed above. In particular, the frequently observed driver behavior of stopping on or near the tracks (within the



area of the gates) could be a contributing factor for future train/motor vehicle crashes.

Enforcement

During the observation period the RSA Team perceived a lack of enforcement on US 20 at Independence Highway and at Granger Avenue due to the frequency of drivers failing to stop at the stop sign before proceeding onto the highway. Additionally, the practice of illegal left turns was of concern to the team. Two types of illegal left turns were observed by the project team. At the Independence Highway intersection, vehicles were observed to be using the solid striped median as a staging area for making a two stage left turn. At Granger Avenue, drivers were observed to use the westbound left turn lane as an acceleration lane to merge into traffic on US 20.

RSA Issue and Suggestion Prioritization

The full list of issues and improvement suggestions has been included in the appendix to this document. Since several of the suggested improvements would cover one or more of the issues identified by the RSA Team, several of the issues were combined. This allowed for a simpler method to summarize the issues, rank the suggestions and prioritize using the risk scale identified previously. The RSA Team identified and ranked the following six core issues:

1. Left Turn Crashes (Rank "F")
2. Driver Behavior (Rank "D")
3. Vehicles Queuing on Railroad Tracks (Rank "C")
4. No Bicycle or Pedestrian Facilities (Rank "C")
5. Railroad Grades and Markings (Rank "A")
6. Narrow Shoulders (Rank "A")

Issue #1: Left Turn Crashes

The left turn crashes at both Independence Highway and at Granger Avenue were seen by

Severity	High
Frequency	Frequent
Rank	F

the RSA Team as being the highest priority issue. The issue was ranked as having “High” potential frequency and severity, which gave it a rank of “F.” Potential improvement suggestions and their associated costs have been listed below in ascending order by cost.

Low Cost Suggestions

- ◆ Convert (restripe) Median/Left Turn Lane to Continuous Left Turn Lane to Allow Refuge Zone for Left Turning Vehicles
- ◆ Add Buffer Between Right Turn and Through Lanes to Improve Sight Distance for Left Turning Vehicles entering US 20 from the Side Street



**US 20 at Independence Highway
Continuous Left Turn Lane**

Medium Cost Suggestions

- ◆ Construct a Median Acceleration Lane for Left Turns onto US 20 from Granger Avenue
- ◆ Intelligent Transportation System Solutions to Warn Motorists on US 20 of the Presence of Oncoming Traffic from Independence Highway and Granger Road



**US 20 at Granger Avenue
Continuous Left Turn Lane**

- ◆ Restrict Turn Movements (Right In-Right Out Only) and Provide Turn Around Points West of Granger Avenue for Left Turning Traffic to Eliminate the Left Turning Conflict

High Cost Suggestions

- ◆ Install a Roundabout or Signal at Granger Avenue, Close the US 20 intersection with Independence Highway and Construct a three quarter mile Frontage Road to Connect Granger Avenue and Independence Highway
- ◆ Install a Traffic Signal at Independence, Close the US 20 Intersection at Granger Avenue and construct a three quarter mile Frontage Road to Connect Independence Highway to Granger Avenue

Issue #2: Driver Behavior

Severity	Medium
Frequency	Occasional
Rank	D

Driver behaviors were identified by the RSA

Team as a potential contributing factor in the crashes recorded at both locations. Driver behaviors, such as impatience, disregard for stop signs, distracted driv-

ing and road rage were observed for the left and right turning vehicles entering US 20 from the side streets. Because driver behavior was only one of several factors contributing to crashes at the intersections, the potential severity was identified as “Medium” and the frequency was “Occasional”, which equated to a ranking of “D.” Improvement suggestions related to driver behavior have been listed below and sorted by costs.

Low Cost Suggestions

- ◆ Increased Targeted Enforcement of Rolling Stops and Distracted Driving
- ◆ Construct Enforcement Pads near Intersections for Police use
- ◆ Provide Overtime Enforcement Funding

Medium Cost Suggestions

- ◆ ITS Solution to Warn Motorists on Independence Highway and Granger Road about Oncoming Traffic on US 20
- ◆ Construct a Median Acceleration Lane for Left Turns onto US 20
- ◆ Restrict Turn Movements (Right In-Right Out Only) and Provide Turn Around Points West of Granger Avenue for Left Turning Traffic to Eliminate the Left Turning Conflict



US 20 at Granger Avenue Acceleration Lane for Left Turns onto US 20

High Cost Suggestions

- ◆ Install a Roundabout or Signal at Granger Avenue, Close the US 20 intersection with Independence Highway and Construct a three quarter mile Frontage Road to Connect Granger Avenue and Independence Highway
- ◆ Install a Traffic Signal at Independence, Close the US 20 Intersection at Granger Avenue and construct a three quarter mile Frontage Road to Connect Independence Highway to Granger Avenue

Issue #3: Vehicles Queuing on Tracks

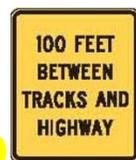
The queuing of vehicles on the railroad tracks, while being a subset of driver behavior, was ob-

Severity	High
Frequency	Rare
Rank	C

served frequently by the RSA Team and considered to be an issue. The RSA Team ranked this issue “C,” since potential severity of a train/motor vehicle crash would be “High” but the frequency would be “Rare.” Improvement suggestions and their associated costs have been listed below and sorted by cost.

Low Cost Suggestion

- ◆ Install MUTCD W10-11A Sign “XX FEET BETWEEN TRACKS AND HIGHWAY” to Inform Drivers of the Limited Storage



W10-11a

Medium Cost Suggestions

- ◆ Construct Left and Right Turn Lanes for Side Street Approach to Separate out the Left- and Right-Turning Vehicles
- ◆ Widen Shoulder on US 20 on provide a Refuge Area for Vehicles that Can’t find a Gap to Enter US 20 during Train Events
- ◆ ITS Active Warning Sign that Illuminates when Vehicles stop on Tracks.



US 20 at Granger Avenue Widen Shoulder

High Cost Suggestion

- ◆ Install a Traffic Signal with Railroad Interconnect and Advanced Warning to Improve Side Street Delay and to Eliminate the Need for Vehicles to Queue between the Railroad Track and the Highway

Issue #4: No Bicycle or Pedestrian Facilities

Low bicycle and pedestrian activity was observed by the RSA Team during the field investigations.

Severity	High
Frequency	Rare
Rank	C

The lack of bicycle and pedestrian facilities was not seen as a contributing factor in the crashes that have been recorded at either intersection. This issue was ranked as a “C” because the potential frequency of a crash would be “Rare” but the severity of a crash would be “High.”

High Cost Suggestion

- ◆ Construct Separate Bicycle and Pedestrian Facilities Parallel to US 20 as Part of a Regional Pedestrian and Bicycle Plan

Issue #5 Railroad Grades and Markings

The RSA Team identified steep railroad approach grades at both intersections and a Railroad stop

Severity	Low
Frequency	Rare
Rank	A

bar set further back than normal at Granger Avenue. While steeper grades and a setback stop bar are not ideal, neither of these issues were viewed by the RSA Team as being a contributor to the crashes occurring at either intersection. The RSA Team ranked the issue as an “A,” since the potential severity of a crash that could result identified issues would be “Negligible” and “Rare.”

Low Cost Suggestion

- ◆ Restripe the Granger Avenue Railroad Crossing Stop Bar to be One Foot from the Crossing Arm

High Cost Suggestion

- ◆ Raise US 20 at Independence Highway and Granger Avenue to Match Highway Grade to Railroad Grade (To Meet Standard Approach Grades)

Issue #6: Narrow Shoulder Width

Narrow shoulders were observed by the RSA Team for eastbound traffic on US 20 at the intersection with Independence Highway. The presence of narrow shoulders at this location was not considered by the RSA

Severity	Low
Frequency	Rare
Rank	A

Team to be a contributing factor to the current crash pattern. This issue was ranked as “A,” because the potential crash frequency would be “Rare” and severity would be “Low.”

Medium Cost Suggestion

- ◆ Widen the Shoulder on the Eastbound side of US 20 within the vicinity of Independence Highway ■