Road Safety Audit
Public Report

I-80 Mercer County – Mile Markers 0 to 15

Submitted November 2020 to:
PennDOT District 1-0

pennsylvania
DEPARTMENT OF TRANSPORTATION

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Appendices

- Photos throughout report are provided via Google Earth, Google Maps, and Google Street View

Background

PennDOT District 1 is planning to Let three (3) rehabilitation/repaving projects along the I-80 corridor amongst Mile Marker 0 through Mile Marker 15. This location has also been notorious for sudden inclement weather. Two (2) noteworthy crashes occurred during inclement weather in 2019, one resulting in a double fatal and the other resulting in an extended interstate shutdown. The District conducted this Road Safety Audit (RSA) to take a proactive approach in finding problematic conditions that exist in the corridor and review potential mitigations prior to the rehabilitation/repaving Let dates.

According to the Federal Highway Administration (FHWA),

A Road Safety Audit (RSA) is the formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users. The FHWA works with State and local jurisdictions and Tribal Governments to integrate RSAs into the project development process for new roads and intersections, and also encourages RSAs on existing roads and intersections.

The aim of an RSA is to answer the following questions:

- *What elements of the road may present a safety concern: to what extent, to which road users, and under what circumstances?*

  The RSA team reviewed crash cluster locations to identify safety concerns.

- *What opportunities exist to eliminate or mitigate identified safety concerns?*

  PennDOT District 1 will review concerns and potential mitigations identified in this report to incorporate into future projects.

Road Safety Audit Process

As outlined in the FHWA Road Safety Audit Guidelines, there are eight (8) standard steps in the RSA process. The FHWA's definition of the steps and how they were applied to this study are described below. Due to the COVID-19 pandemic, all meetings were held virtually. The field observations were conducted by RSA team members who drove the corridor separately, prior to the pre-audit meeting.

Step 1: Identify project or road in-service to be audited.

The objective of this step is to identify the project or existing road to be audited and to set the parameters for the RSA.

The audit can be conducted on projects in the pre-construction stages, whether at the planning, preliminary, or final design stages. Audits can also be performed on a project during the construction phase or prior to opening to the public. Post-construction audits can also be performed, whether on a road that has recently been opened to traffic or one that has been in service for a longer period of time. PennDOT District 1-0 selected I-80 between Mile Marker 0.0 (Ohio-Pennsylvania state line) and Mile Marker 15 (Interchange at SR 19) as the subject of a Road Safety Audit of the existing road that will be undergoing significant investment in the near future.

Step 2: Select RSA team.

The objective of selecting an audit team is to choose an independent, qualified, and multidisciplinary team of experts who can successfully conduct a road safety audit.

The RSA team was selected by PennDOT District 1-0 in coordination with Michael Baker International, Inc. (Michael Baker) to comprise of a team of individuals knowledgeable in both the current operations of I-80 and of potential engineering deficiencies and challenges with implementation. A list of the RSA team members is included in the **Road Safety Audit Findings and Recommendations** section of this report.

Step 3: Conduct a pre-audit meeting to review project information. ***(Day 1 Presentation – Morning)***

The objective of the pre-audit meeting is to set the context for the RSA by bringing together the project owner, the design team, and the audit team to discuss its scope and review all information available.

A pre-audit meeting was conducted virtually, due to the COVID-19 Pandemic, on September 17, 2020 via Skype. Michael Baker discussed the RSA process and presented an overview of the I-80 corridor to the participants. A copy of the presentation from the pre-audit meeting is included in ~~**Appendix D**~~ **REDACTED**.

The morning portion of the meeting focused on crash cluster locations throughout the study corridor which were provided by Michael Baker. This consisted of sharing crash data, skid test results, and field observations. The afternoon portion of the meeting consisted of the RSA team viewing recorded videos of the driven corridor provided by PennDOT District 1-0.

Step 4: Perform field observations under various conditions. ***(Day 1 Presentation – Afternoon)***

The objective of conducting a project data review is to gain insight into the project or existing road, to prepare for the field visit, and to identify preliminary areas of safety concern. The field visit is used to gain further insight into the project or existing road, and to further verify/identify safety concerns.

Due to the COVID-19 Pandemic, traditional field observations as a group were not feasible. Therefore, the RSA team used the afternoon of the Day 1 Presentation to view the recorded videos of the corridor traveling in both eastbound and westbound directions under daytime and nighttime conditions. These videos were played for the group and paused at key locations to allow for discussion. Google Maps and Google Street View was also used to assist in these discussions. Team members were also encouraged to drive the corridor prior to the pre-audit meeting.

Step 5: Conduct audit analysis and prepare report of findings.

The objective of conducting RSA analysis and preparing the RSA report is to succinctly report the findings of the audit team through identification and prioritization of safety issues. Suggestions should then be made for reducing the degree of risk.

Following the Day 1 presentation, the RSA team's input was noted, compiled and consolidated to prepare a follow up presentation describing the issues that were identified and potential mitigation measures that could be implemented. This report is a summary of that presentation and follow up discussions.

Step 6: Present audit findings to Project Owner/Design Team. ***(Day 2 Presentation)***

The objective of presenting audit findings to the project owner and design team is to report orally the key findings of the audit as presented in the audit report.

The findings of the RSA were presented virtually on September 21, 2020 via Skype. This report is a summary of the findings and presentation. A copy of the presentation is included in ~~**Appendix E**~~ **REDACTED**.

Following the RSA presentations, Matt Stewart (Mercer County Regional Planning Commission), Greg Maser (PennDOT PM) and Leon Jeziorski (Michael Baker PM) shared the findings and potential mitigations with Ohio planners and ODOT engineers.

Following the RSA presentations, Greg Maser (PennDOT PM) and Leon Jeziorski (Michael Baker PM) had correspondence via phone and email with Mercer County PSP and Shenango Township and Mercer East End Fire Chiefs to share findings and gather additional input from emergency responders.

Greg Maser presented these findings to the MPO Coordinating Committee November 11, 2020.

Step 7: Project Owner/Design Team prepares formal response.

The objective of responding to the audit report is for the project owner and the design team to document their response to the findings of the audit report.

This step is to be conducted by PennDOT following receipt of this report. Formal responses should be maintained with the project files for this RSA.

Step 8: Incorporate findings into the project when appropriate.

The objective of the final step is to incorporate findings into the project when appropriate and to ensure that the RSA process is a learning experience for all parties.

This step is to be completed by PennDOT during routine maintenances and/or during future investments in the corridor.

Overview of the Study Area

The study area for this RSA is Interstate 80 between Mile Marker 0.0 (Ohio-Pennsylvania State Line) and Mile Marker 15 (Interchange at SR 19). This section of interstate lies in Mercer county, Pennsylvania and is classified as a Rural Interstate. The posted speed limit of the study area is 70 MPH. The average daily traffic volume is approximately 26,500 veh/day, with 47% of those classified as trucks. Detailed traffic information from the PennDOT Internet Traffic Monitoring System (iTMS) can be found in ~~**Appendix B**~~ **REDACTED**. The corridor includes two (2) interchanges, being I-80 with US-19 as well as I-80 with I-376. There is also a welcome center/rest area located on eastbound I-80 near East of the OH-PA border.

Location Map (also included in ~~**Appendix A**~~ **REDACTED**)

Review of Crash Data

Crash data compiled from the PennDOT Crash Data and Retrieval Tool (CDART) was reviewed and plotted for the study corridor. Using the crash data and the crash cluster tool within CDART, locations of reoccurring crashes were identified. A summary of the crash data is included in ~~**Appendix C**~~ **REDACTED.**

During the 5-year period from 2014 to 2018 there were 281 reportable crashes within the corridor. Of these crashes, there were 10 that resulted in serious injuries and 3 that resulted in fatalities. The most common types of crashes were "hit fixed object" (53%) and "non-collision" (18%), both indicating vehicles that are leaving the roadway. The full list included in **Figure 1**.

Figure 1
Crashes by Collision Type

	CRASHES	PCT
HIT FIX OBJ	149	53%
NON COLL	50	18%
REAR END	38	14%
UNKNOWN	16	6%
ANGLE	14	5%
SAME DIR SS	13	5%
HEAD ON	1	0%
TOTAL	281	100%

Many of the crash clusters captured in this report confirm that inclement weather, horizontal curvature and a less than ideal tire/pavement interaction are all contributing factors to crashes. Weather conditions are a principle contribution to crashes in which 52% of crashes occurred in wet, snowy or slushy conditions as shown in **Figure 2**. This is above the expected value of approximately 25% of crashes occurring in these conditions.

Two other crash trends that stand out in this corridor lay within the time of day crashes occur and time of year crashes occur. Typically, crash numbers rise and fall with the peaks and off-peaks of vehicular volumes. In this corridor, more crashes occur at off-peak times such as nighttime hours and winter months as displayed in **Figure 3** and **Figure 4**.

In addition to the crashes captured in this data there were two noteworthy crashes in 2019, one of which resulted in a double fatality and the other resulted in an extended closure of the interstate.

Figure 2

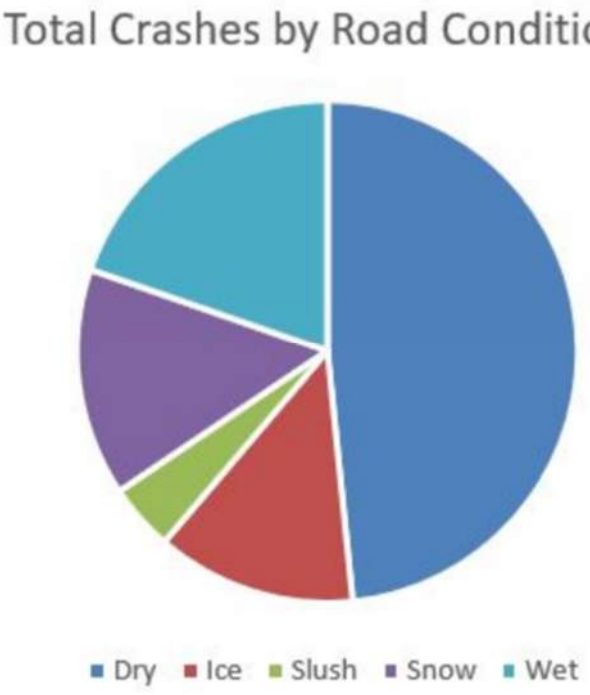


Figure 3

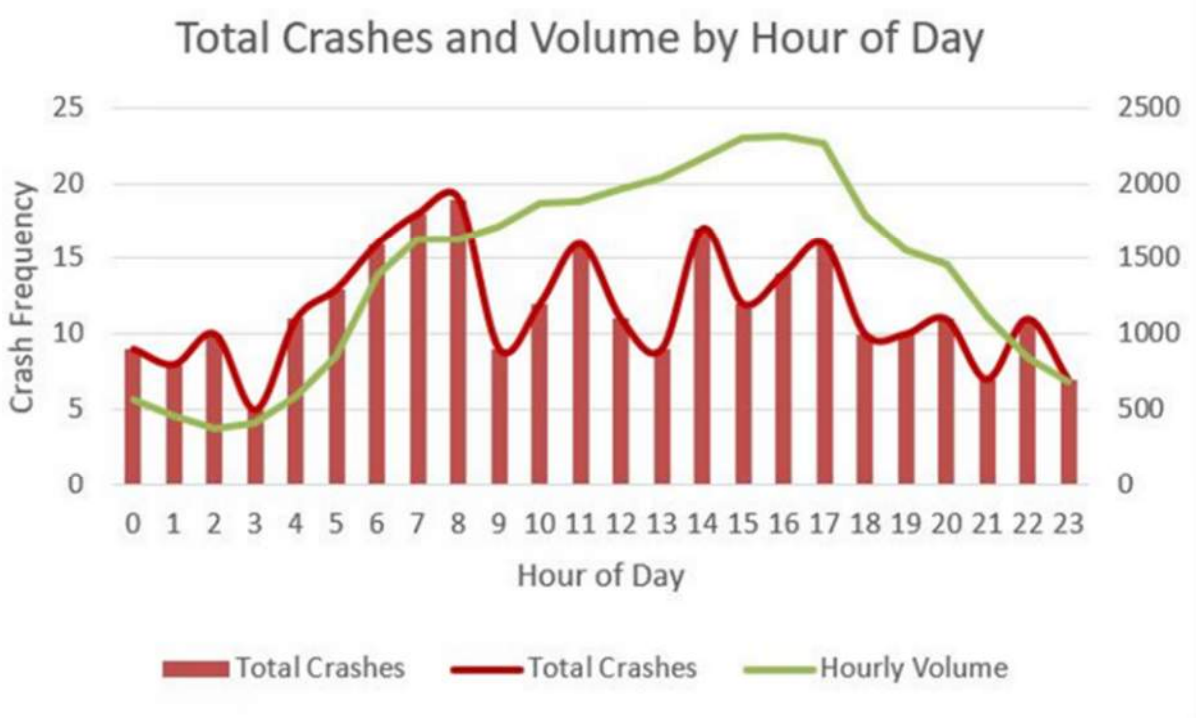
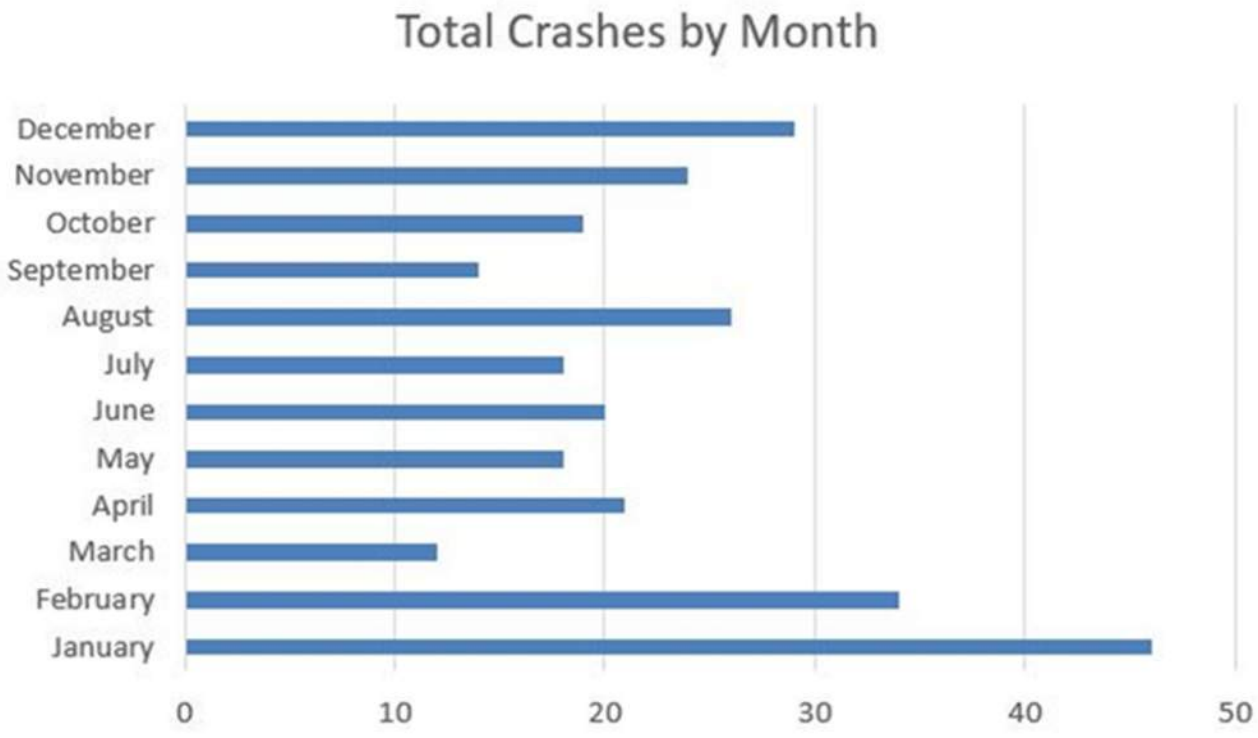


Figure 4



Comparable Corridor Crash Statistics

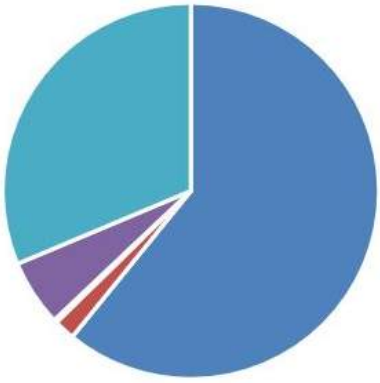
The crash statistics of the study corridor were compared with crash statistics along similar I-80 segments on either side of the study corridor in Trumbull County, Ohio and Jefferson County, Pennsylvania. The statistics were reviewed over the same five-year period to capture similar weather conditions. These crash statistics allow for a comparison of crash rates among the corridors. The findings are summarized in **Figure 5**.

As defined by the Federal Highway Administration, the crash rate describes the number of crashes in a given period as compared to the traffic volume (or exposure) to crashes. Crash rates are calculated by dividing the total number of crashes at a given roadway section over a specified time period by the average traffic volumes. Crash rates are reported as crashes per million vehicle miles traveled.

The corridor of I-80 in Trumbull County, Ohio was selected as a comparable corridor due to it being adjacent to the study corridor. This corridor's average daily traffic (ADT) of 32,000 vehicles per day (veh/day) and is similar to the study corridor having an ADT of 26,000 veh/day. The crash rate of 50.0 crashes per million vehicle miles travels on this this corridor is higher compared to the study corridor crash rate of 19.7 crashes per million vehicle miles. This difference can be contributed to Ohio including non-reportable crashes in their data for crash totals whereas Pennsylvania does not include non-reportable crashes in their data for crash totals. However, the crashes occurring on dry pavement conditions is more in line with expected trends near 70% as compared to that with the study corridor having dry condition crashes just below 50%.

The corridor of I-80 in Jefferson County, Pennsylvania was selected as the other comparable corridor due to it having similar horizontal geometries and profile grades. This corridor's average daily traffic (ADT) of 25,000 vehicles per day (veh/day) is similar to that of the study corridor. The crash rate of 20.4 crashes per million vehicle miles is also close to the study corridor. The crash data from Jefferson County, Pennsylvania also matches the expected trend with approximately 70% of crashes occurring on dry pavement.

Figure 5 – Crash Statistics and Distribution of Crashes by Road Conditions

I-80 Study Corridor Mercer County, PA Length: 15 miles Crash Rate: 19.7 ADT: 26,000 veh/day	I-80 Comparable Corridor Jefferson County, PA Length: 15 miles Crash Rate: 20.4 ADT: 25,000 veh/day	I-80 Comparable Corridor Trumbull County, OH Length: 12.3 miles Crash Rate: 50.0 ADT 32,000 veh/day
		

Road Safety Audit Team

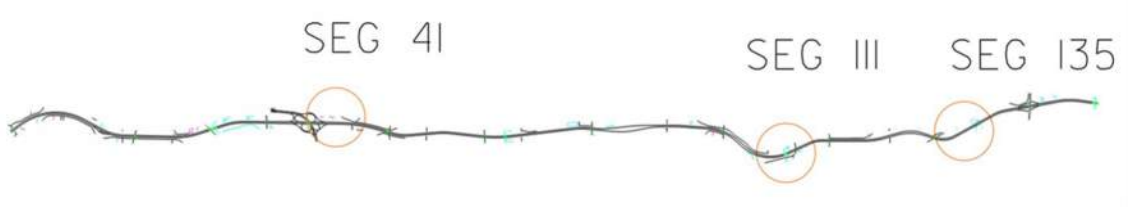
The following table lists the parties invited to participate in the RSA and the level to which they were able to participate.

RSA Team Member	Organization	Events Attended
Brian Barnhizer	Mercer County Regional Planning Commission	✓ Day 1 Presentation ✓ Day 2 Presentation
Matt Stewart	Mercer County Regional Planning Commission	✓ Day 1 Presentation ✓ Day 2 Presentation
Melissa Noble	Mercer County Deputy Director, E9-1-1 Services	✓ Unable to Attend
Dan Gracenin	Mercer County Regional Planning Commission	✓ Unable to Attend
Frank Jannetti	Mercer County Director, Department of Public Safety	✓ Unable to Attend
Sgt Ian Elliot	Mercer County Pennsylvania State Police	✓ Unable to Attend
Cpl Matt Wilcox	Mercer County Pennsylvania State Police	✓ Unable to Attend
Cpl Mark Hoehn	Mercer County Pennsylvania State Police	✓ Phone Call with PSP
Cpl Timothy Repp	Mercer County Pennsylvania State Police	✓ Communicated via email
Chief Bill Finley	East End Fire Department	✓ Phone Call with Fire Chiefs
Chief Justin Barnes	Shenango Township Fire Department	✓ Phone Call with Fire Chiefs
Darrell Chapman	PennDOT – Mercer County Manager	✓ Day 1 Presentation
Zach Miles	PennDOT – Assistant Mercer County Manager	✓ Day 1 Presentation ✓ Day 2 Presentation
Brian Bowen	PennDOT District 1	✓ Day 1 Presentation ✓ Day 2 Presentation
Christopher May	PennDOT District 1	✓ Day 1 Presentation ✓ Day 2 Presentation
Brian Smith	PennDOT District 1	✓ Day 1 Presentation ✓ Day 2 Presentation
Tom McClelland	PennDOT District 1	✓ Day 1 Presentation ✓ Day 2 Presentation
Gregory Maser	PennDOT District 1 – PM	✓ Day 1 Presentation ✓ Day 2 Presentation ✓ Phone Call with PSP ✓ Phone Call with Fire Chiefs
Steven Stuart	Michael Baker International	✓ Day 1 Presentation ✓ Day 2 Presentation
Zachary Cinq-Mars	Michael Baker International	✓ Day 1 Presentation ✓ Day 2 Presentation
Leon Jeziorski	Michael Baker International	✓ Day 1 Presentation ✓ Day 2 Presentation ✓ Phone Call with PSP ✓ Phone Call with Fire Chiefs

Road Safety Audit Findings and Recommendations

This RSA focused on substantive safety to identify problematic locations within the study corridor. Michael Baker then presented these locations to the RSA team where team members used their observations and their experience to verify corridor issues. With a concurrence on the likely contributing factors to crashes, the team collaborated and brainstormed potential safety mitigation opportunities.

I-80 Crash Clusters Westbound



I-80 Crash Clusters Eastbound

The following pages assess the crash cluster locations identified above. Existing conditions are reviewed followed by a table that identifies the issues discovered by the RSA team, potential mitigation opportunities, a qualitative level of effort estimate to implement these opportunities, and the qualitative potential safety benefit of implementation. The level of effort is assigned ratings of Low, Medium and High. This rating system considered general cost and time to implement the mitigation. The potential safety benefit is also assigned ratings of Low, Medium and High. This rating system considered crash modification factors (CMFs) provided to potential mitigations by the Federal Highway Administration. CMFs are determined empirically by comparing crash rates in a given corridor from before and after a mitigation opportunity is implemented. These CMFs are compiled nationally and are applied to corridors based on the road type, road surface conditions the prominent crash type that is potentially being mitigated. The CMF is a quantitative measure of mitigation effectiveness, however because the level of effort is evaluated qualitatively the RSA team chose to evaluate the potential safety benefit in the same way.

I-80 Westbound – Segment 41 Near MM 4

This location travels at a downhill grade of approximately 4%. The pavement surface consists of concrete pavement along the horizontal curve followed by asphalt pavement throughout the interchange. The concrete pavement at this location has skid test results below target value. The deceleration lane for the exit ramp is longer than required and leads to a tight horizontal curve. The deceleration lane length with the downhill grade may contribute to higher speeds. The common type of crash in this location is run- off-the-road type crash due to inclement weather and/or excessive speed. Additionally, this segment was the location of the crash involving extended I-80 shutdown November 12, 2019 (Tuesday @ 3:15 pm).

Issue	Mitigation Opportunity	Level of Effort	Potential Safety Benefit
Concrete pavement skid test results below target value. Location includes run off the road crashes.	Apply high friction surface treatment (HFST).	Low	High
	Apply new pavement surface.	High	High
Possible deceleration lane too long leading to excessive speeds.	Shorten deceleration lane via pavement markings.	Low	Low
	Shorten deceleration lane via full depth reconstruction.	High	Low
	Change ground mount advisory speed sign (30 mph) 600’ advance of curve to overhead advisory speed sign (25 mph) with W1-13R Truck Rollover Right Curve Sign.	Medium	Medium

I-80 Eastbound, Segment 104 Near MM 11

This location travels at a downhill grade of approximately 4%. The pavement surface consists of concrete pavement having skid test results below target value. The horizontal curve has a radius of 3274 feet with a superelevation of 4.6% (from I-80 as-built plans ~~**Appendix G**~~ **REDACTED**). This is less than the design standard of 5.8% for the radius at 70 MPH. The common type of crash in this location is the run-off-the-road type crash due to inclement weather and/or excessive speed. There was one fatal crash in wet conditions due to a driver traveling the wrong direction along the interstate.

Issue	Mitigation Opportunity	Level of Effort	Potential Safety Benefit
Concrete pavement skid test results below target value.	Apply high friction surface treatment (HFST).	Low	High
Horizontal curve superelevation does not meet design criteria for posted speed limit.	Add oversized chevron signs.	Low	Low
	Add advisory speed plaques.	Low	Low
	Apply new pavement surface.	High	High
	Increase horizontal curve superelevation.	High	High

I-80 Eastbound, Segment 110 Near MM 11.5

This location travels at an uphill grade of approximately 3%. The pavement surface consists of asphalt pavement having skid test results at or above target value. The horizontal curve has a radius of 3274 feet with a superelevation of 4.6% (from I-80 as-built plans ~~**Appendix G**~~ **REDACTED**). This is less than the design standard of 5.8% for the radius at 70 MPH. The common type of crash in this location is the run-off-the-road type crash due to inclement weather and/or excessive speed.

Issue	Mitigation Opportunity	Level of Effort	Potential Safety Benefit
Shoulder narrows over bridge with evidence of vehicles rubbing barrier and adjacent guide rail.	Increase shoulder width over bridge.	High	High
Horizontal curve superelevation does not meet design criteria for posted speed limit.	Apply high friction surface treatment (HFST).	Low	High
	Add large chevron signs.	Low	Low
	Add speed advisory plaques.	Low	Low
	New pavement surface with increased superelevation.	High	High

I-80 Westbound, Segment 111 Near MM 11.5

This location travels at a downhill grade of approximately 3.8%. The pavement surface consists of asphalt pavement having skid test results at or above target value. The horizontal curve has a radius of 2090 feet with a superelevation of 3.8% (from I-80 as-built plans ~~**Appendix G**~~ **REDACTED**). This is less than the design standard of 7.8% for the radius at 70 MPH. The common type of crash in this location is the run-off-the-road type crash due to inclement weather and/or excessive speed.

Issue	Mitigation Opportunity	Level of Effort	Potential Safety Benefit
Horizontal curve superelevation does not meet design criteria for posted speed limit.	Apply high friction surface treatment (HFST).	Low	High
	Add large chevron signs.	Low	Low
	Add speed advisory plaques.	Low	Low
	New pavement surface with increased superelevation.	High	High

I-80 Eastbound, Segment 114 Near MM 12

This location also known as the "Rock Area" travels at an uphill grade of approximately 3.4%. The pavement surface consists of concrete pavement having skid test results below target value. The horizontal curve has a radius of 1910 feet with a superelevation of 7.8% (from I-80 as-built plans ~~**Appendix G**~~ **REDACTED**). This is less than the design standard of 8% for the radius at 70 MPH. Delineation is also missing along the outside of the horizontal curve. This location has refreeze issues due to the shade provided by the rock cut, bridge overhead and vegetation. The common type of crash in this location is the run-off-the-road type crash due to inclement weather and/or excessive speed. Secondary crashes are also an occurrence at this location.

Issue	Mitigation Opportunity	Level of Effort	Potential Safety Benefit
Concrete pavement skid test results below target value.	Apply high friction surface treatment (HFST).	Low	High
Horizontal curve superelevation does not meet design criteria for posted speed limit.	Add large chevron signs.	Low	Low
	Add speed advisory plaques.	Low	Low
	New pavement surface with increased superelevation.	High	High
No delineation on outside curve within median.	Add delineation to outside curve within median.	Low	Medium
Refreeze issues due to shade and high wind.	Pave unofficial turnaround prior to horizontal curve for maintenance vehicles.	Medium	Medium
	Trim/cut down trees within right-of-way.	Medium	Low
	Add ITS pavement sensors to better inform maintenance crews when pavement requires de-icing treatment.	Medium	Medium

I-80 Eastbound, Segment 130 Near MM 13.5

This location has a pavement surface consisting of asphalt within horizontal curve. The pavement surface changes to concrete coming out of horizontal curve into the tangent section. The concrete pavement surface consists of skid test results below target value. The horizontal curve has a radius of 1910 feet with a superelevation of 7.8% (from I-80 as-built plans ~~**Appendix G**~~ **REDACTED**). This is less than the design standard of 8% for the radius at 70 MPH. The common type of crash in this location is the run-off-the-road type crash due to inclement weather and/or excessive speed. The change in pavement surface friction coming out of the curve is unexpected by drivers and is a contributing factor to the crash cluster. The raised brush covered slope in the median also prevents drivers from seeing the crashes outside of the horizontal curve creating a hazard for drivers and emergency responders. Secondary crashes are also an occurrence at this location. Additionally, this segment was the location of the crash involving a double fatal February 10, 2019 (Sunday @ 6:30 pm)

Issue	Mitigation Opportunity	Level of Effort	Potential Safety Benefit
Concrete pavement skid test results below target value.	Apply high friction surface treatment (HFST).	Low	High
Horizontal curve superelevation does not meet design criteria for posted speed limit.	Add large chevron signs.	Low	Low
	Add speed advisory plaques.	Low	Low
	New pavement surface with increased superelevation.	High	High
Reduced line of sight from withing horizontal curve to outside of horizontal curve.	Clear brush in median.	Medium	High
	Consider regrading median with further investigation.	High	High

I-80 Westbound, Segment 135 Near MM 13.5

This location has a pavement surface consisting of concrete pavement having skid test results below target value. The horizontal curve has a radius of 1910 feet with a superelevation of 7.8% (from I-80 as-built plans ~~**Appendix G**~~ **REDACTED**). This is less than the design standard of 8% for the radius at 70 MPH. Delineation is also missing along the outside of the horizontal curve. The common type of crash in this location is the run-off-the-road type crash due to inclement weather and/or excessive speed. One crash was caused by sun glare in this location.

Issue	Apply high friction surface treatment (HFST).	Level of Effort	Potential Safety Benefit
Concrete pavement skid test results below target value.	Apply high friction surface treatment (HFST).	Low	High
Horizontal curve superelevation does not meet design criteria for posted speed limit.	Add large chevron signs.	Low	Low
	Add speed advisory plaques.	Low	Low
	New pavement surface with increased superelevation.	High	High
No delineation on outside curve within median.	Add delineation to outside curve within median.	Low	Medium

I-80 Eastbound, Segment 140 Near MM 14

This location has a pavement surface consisting of concrete pavement having skid test results below target value. The horizontal curve has a radius of 3125 feet with a superelevation of 5.2% (from I-80 as-built plans ~~**Appendix G**~~ **REDACTED**). This is less than the design standard of 6% for the radius at 70 MPH. Delineation is also missing along the outside of the horizontal curve. The exit 15 sign and deceleration lane are hidden around crest vertical curve and within brush on inside horizontal curve. Additionally, the exit ramp deceleration lane appears to be part of horizontal curve. The common type of crash in this location is the run-off-the-road type crash due to inclement weather and/or excessive speed.

Issue	Mitigation Opportunity	Level of Effort	Potential Safety Benefit
Concrete pavement skid test results below target value.	Apply high friction surface treatment (HFST).	Low	High
Horizontal curve superelevation does not meet design criteria for posted speed limit.	Add large chevron signs.	Low	Low
	Add speed advisory plaques.	Low	Low
	New pavement surface with increased superelevation.	High	High
No delineation on outside curve within median.	Add delineation to outside curve within median.	Low	Medium
Exit 15 sign and deceleration lane hidden around crest vertical curve and within brush on inside horizontal curve.	Clear brush along inside horizontal curve.	Medium	High
Exit ramp deceleration lane appears to be part of horizontal curve.	Extend dotted extension line on exit ramp to guide vehicles of separation between travel lane and deceleration lane.	Low	Medium
	Add ½ mile exit guide sign.	Medium	Medium

I-80 Study Corridor-wide Observations

Figure 6 – Overall Study Corridor Crash Clusters and Noteworthy Crashes

The I-80 study corridor is characterized by a freeway that has many horizontal curves and changes in vertical grades. The pavement surface varies among segments between asphalt and concrete. The subsurface of the asphalt pavement structure is deteriorating. The surface of the concrete pavement has locations with skid test results below the target value. The horizontal curves throughout the corridor has superelevation that does not meet the value required for the posted speed of 70 mph. The speed limit changed from 65 mph to 70 mph in May 2016. The existing superelevation has been identified from the I-80 As-built Plans in ~~**Appendix G**~~ **REDACTED** and will need to be field verified. As a result, the District is looking to generate three (3) repaving/rehabilitation projects spanning roughly 5-mile sections within the 15-mile study corridor. The I-80 section of Mile Marker 0 through Mile Marker 5 is currently in design. Short term mitigation opportunities might be ideal in high crash locations if the Let dates occur in the distant future.

Additionally, the study corridor is notorious for sudden inclement weather that sees snow squalls and refreeze areas. Snow, rain, sleet and ice make up more than half of the contributing factors to crashes. Most of the crash clusters occurred in the eastern side of the study corridor as circled in **Figure 6** above**.** Two noteworthy crashes occurred during inclement weather in 2019, one resulting in a double fatal and the other resulting in an extended interstate shutdown as shown in the stars in **Figure 6**.

The table on the following page identifies the overall corridor issues discovered by the RSA team, potential mitigation opportunities, a qualitative level of effort estimate to implement these opportunities, and the qualitative potential safety benefit of implementation.

Issue	Mitigation Opportunity	Level of Effort	Potential Safety Benefit
Horizontal curve superelevation does not meet criteria for posted speed limit. Speed limit changed from 65 mph to 70 mph May 2016.	Flattening horizontal curves or improving superelevation is considered the ultimate solution for reducing crashes in a horizontal curve. The superelevation can be increased within the existing roadway geometries to meet the posted speed limit design criteria.	High	High
Pavement surface changes between asphalt and concrete. Concrete pavement skid test results below target value.	Apply high friction surface treatment (HFST).	Low	High
	Apply new pavement surface.	High	High
Median delineation missing in large sections throughout the corridor.	Incorporate Median Delineation through the horizontal curves in the study corridor.	Low	High
Guide rail delineation missing in some locations.	Replace missing guiderail delineators.	Low	Medium
Mile marker signage currently posted on the mile location.	Incorporate mile marker signage every 1/10- or 2/10-mile locations.	Low	Medium
Crashes occur during inclement weather at a higher rate than national averages. Most crash clusters occur in the eastern portion of the study corridor within a series of horizontal and vertical curves.	Improve weather monitoring and identification. Improve response access.	High	High
	Add additional DMS Boards. Incorporate large signage posted in the median and outside spaces to alert drivers of change in roadway geometries.	Medium	High
	Incorporate an adjustable speed limit corridor.	High	High