

Meeting Summary

Date: September 13, 2024

29 Road Interchange at I-70, NEPA/1601 Project

Meeting Name: TAC Meeting #12A

Meeting Date: July 8, 2024

Invitees:

Invitee	Organization	Attended?	Invitee	Organization	Attended?
Kevin King	Mesa County	X	Melanie Bishop	FHU	X
Scott Mai	Mesa County	X	Gaurav Vasisht	FHU	X
Daniel Larkin	Mesa County	X	Paul Brown	FHU	X
Eric Mocko	Grand Junction	X	Cady Dawson	FHU	X
Trent Prall	Grand Junction	X	Alex Pulley	FHU	X
David Thornton	Grand Junction	X	Amanda Cushing	FHU	X
Chung Tran	FHWA	X	Mark Bunnell	CDOT	X
Ajin Hu	FHWA	X	Rob Beck	CDOT	X
Dean Bressler	RTPO	X	Zane Znamenacek	CDOT	X
Rachel Peterson	RTPO	X	Dave Cesark	CDOT	X
Dana Brosig	RTPO	X	Troy Halouska	CDOT	X
Jason Smith	CDOT	X	Jen Klaetsch	CDOT	X

Note: Not all details that were included in the presentation are shown in this summary, but comments and discussion brought up during the presentation are included; discussion is denoted as [blue](#) text. Meeting materials can be found at the end of this meeting summary.

Meeting Summary

Meeting Goal

Review the proposed I-70 safety mitigation measures through a review of the traffic safety comments received following the System Level Study (SLS) report review by the TAC members.

Agenda

Screening Process Flowchart Review

- ▶ Level 1 and 2 screenings are complete, and we are currently advancing Level 3 screening, which will be documented in the 1601 SLS and eventually the IAR.
- ▶ The current plan is to present the project to the Transportation Commission during the July 2024 workshop for an August 2024 vote.
- ▶ The Project's Purpose and Need was reviewed.

Purpose and Need:

- ▶ The purpose of the project is to enhance the eastern Grand Valley transportation network between I-70 Business Loop East Interchange and Horizon Drive Interchange to:
 - ▶ Improve local and regional connectivity, and
 - ▶ Provide enhanced access to planned land use surrounding I-70 in Grand Junction, Colorado.

Question: Has the Purpose and Need been approved by the FHWA Regional Engineer and the FHWA Environmental Manager.

Response: Yes. Additionally, the Regional Engineer at that time was Jeff Bellen.

Question: Has the SLS Methods and Assumption document been approved?

Response: Yes. It was approved on February 25, 2022.

ACTION ITEM: Send the Methods and Assumption to Ajin as well as a link to the Social Pinpoint webpage.

Review comments on Highway Safety Software (HSS) analysis

The traffic study area consists of:

- ▶ I-70 from west of the Horizon Drive interchange to east of the I-70B/Clifton interchange

The Preferred Alternative introduces a new interchange on I-70 with auxiliary lanes in both directions; therefore, there is potential for an increase in predicted crashes due to the addition of a new access point (i.e., added conflict points. Additionally, there is a curve just east of the Horizon Drive interchange where a safety issue has been identified and mitigations installed. CDOT and FHWA have expressed concerns that with the introduction of an interchange, there will be an inherent “weaving” behavior which may increase the potential for crashes at that curve.

Based on a review the Highway Safety Manual with regards to weaving areas, a freeway segment that is 4,500 feet or more in length and includes weaving movements should be analyzed using an auxiliary lane. Based on the current design, the length of freeway between the proposed 29 Road interchange ramps and the Horizon Drive ramps is greater than 4,500 feet. Thus, this area has been analyzed with an auxiliary lane. This revision is included in the analysis shown in the meeting materials.

Provide an update to the HSS Evaluation

I-70 Freeway facility (Mainline, Horizon Drive, 29 Road interchange) predictive crashes

- ▶ **No Action:** 112.70 crashes
- ▶ **Preferred Alternative:** 128.22 crashes

29 Road Corridor:

- ▶ **No Action:** 7.53 crashes
- ▶ **Preferred Alternative:** 44.26 crashes

Question: Regarding the weaving definition: The statement was that the area is not a weaving section because it exceeds that minimum length of 4,500 feet, correct?

Meeting Summary

Response: It is not a weaving section because it's over the 4,500-foot HSM threshold, and because it's over the 3,000-foot HCM operational threshold. The HCM does allow for weaves that are longer than 3,000 feet, but the project's operational analysis shows that this is an on ramp followed by an off ramp.

Question: Are we essentially removing the weaving issue?

Response: Yes, that's what our analysis has shown.

Statement: A "weaving" maneuver is still anticipated even if it doesn't meet the definition. It's the weaving maneuver that will occur on a tight curve.

Response: The area will have typical lane changes occurring in it. Regarding the weaving element, weaving would need to occur in a confined distance to be considered different than a typical lane change.

Additional Response: Based on the software tools that are available, those tools have said that this area is not going to function in the way that a weaving area normally functions and that they it will essentially function as an add lane followed by a drop lane.

Statement: It will still require drivers to make lane changes on a tight curve. Some will change lanes to the right, some to the left, but that's still does not address the issue of a lane change.

Response: Addressing all safety concerns was not a part of the need of the project; however, we're trying to create the safest facility possible. As previously stated, introducing a new access point will always create more conflict points.

Question: I'm thinking about the existing accident history at 29 and Patterson and I recall there being 50 or more accidents just in the last five years. So, how does the current accident history relate with the no action? Is it calibrated?

Response: In the SLS we have summarized existing conditions at the 29 Road and Patterson Road intersection, and it did have a significant number of crashes; however, we don't have that data for this meeting.

The HSS analysis is a predictive analysis (e.g., future) and based on safety performance functions; however, it is not directly calibrated to that specific intersection. We will also

Meeting Summary

evaluate the design to be sure that the intersection functions both operationally and from a safety perspective. But it's somewhat outside of the focus of the SLS and the IAR.

Question: What about upstream and downstream interchanges along I-70 including the freeway to the west of Horizon Drive and to the east of I-70B/Clifton?

Response: We have reviewed the I-70 freeway mainline through the Horizon Drive interchange, which is the first interchange to the west, as well as the Clifton/I-70B interchange, which is the first interchange to the east. This meets the requirements of both the 1601 process and the FHWA IAR process of considering one interchange on either side.

The predicted number of crashes for that section of I-70 freeway mainline is 89 for the No Action and 92 crashes for the Preferred Alternative because it is looking at approximately 12 miles of I-70, including the adjacent interchanges.

Review of the Preferred Alternative predictive crashes

- ▶ **No Action:** Not applicable
- ▶ **With the Auxiliary Lane:** 6.17 crashes
- ▶ **Without the Auxiliary Lane:** 6.82 crashes

The safety performance improves when there's greater interchange spacing.

Provide an update on the supplemental Level of Service of Safety (LOSS) analysis

What is Level Service of Safety?

LOSS compares a segment of observed crash frequency and severity to frequencies and severities predicted by safety performance functions.

What is a safety performance function?

It is a statistical model used to estimate average crash frequency for a specific facility type.

Meeting Summary

Results of the LOSS throughout the traffic study area after the cable rail was installed:

- ▶ Total crashes:
 - ▶▶ Before cable rail: LOSS III
 - ▶▶ After cable rail: LOSS II
- ▶ Severity of crashes:
 - ▶▶ Before cable rail: LOSS III
 - ▶▶ After cable rail: LOSS III

Results of the predicted LOSS throughout the traffic study area with and without the 29 Road Interchange:

- ▶ Total crashes:
 - ▶▶ Without 29 Road interchange: LOSS II
 - ▶▶ With 29 Road interchange: LOSS I
- ▶ Severity of crashes:
 - ▶▶ Without 29 Road interchange: LOSS II
 - ▶▶ With 29 Road interchange: LOSS II

Review conclusions

- ▶ The addition of the cable rail improved LOSS for existing conditions.
- ▶ The addition of the 29 Road interchange will further improve LOSS.

Proposed mitigations:

- ▶ Curve warning signage including flashing beacons
- ▶ Further speed limit reductions
- ▶ Widening the inside shoulder
- ▶ A two-lane off-ramp at Horizon Drive
- ▶ Lane guidance signage

A new interchange may have potential for improved driver attention.

Meeting Summary

Open Discussion

Statement: A signing plan must be submitted as part of the IAR.

Response: Understood.

Statement: Safety analysis should be conducted for the area between 29 Road and Horizon Drive rather than the 12-mile corridor.

Response: We are following the methods and assumptions document and depicting the entire 12 miles (i.e., the traffic study area). However, there was a request from CDOT for FHU to show the LOSS information between 29 Road and Horizon Drive as well.

ACTION ITEM: FHU will prepare the LOSS information between 29 Road and Horizon Drive.

Statement: Crashes are still occurring on the curve; however, with the addition of the cable rail, rather than being head-on collisions, the cars are hitting a fixed object which also has a less severe crash type to it, but the crashes are still occurring.

Statement: I would say that the number of crashes may have slightly been reduced because of a reduction in speed from 75 mph to 70 mph; however, my concern is that this project is going to introduce lane changes on that curve.

Response: There are design considerations in which we can avoid lane changes through lane balancing at the off-ramp in which a driver within the right lane of the 29 Road interchange would not be required to change their lanes to achieve the exit at Horizon Drive.

Question: Will the westbound Horizon Drive exit be a two-lane off-ramp?

Response: it is something to be considered as well as other geometrical designs that are recommended in the Green Book.

Question: Are we planning a two-lane exit at Horizon Drive?

Response: We will need to review the concepts.

Post-meeting follow-up: A two-lane exit at Horizon Drive has not yet been designed, but this will be included in the SLS recommendations.

Meeting Summary

Statement: So that will eliminate moving from what would be considered the middle lane to the right lane, but those vehicles that have entered from the 29 Road interchange must move one lane to the left to continue past Horizon Drive. Drivers will have to make that lane change on the curve which must be addressed.

Response: Drivers will have to make that lane change on the curve; however, we are addressing the lane change at the curve by suggesting that speed limits be reduced and adding flashing beacon warning signs.

Response: There might be an occasional lane change at the curve; however, we can create a signing plan to inform drivers are aware of this sharp curve, which I think is lacking right now, and could certainly be improved.

Statement: CDOT feels like this specific issue is not explicitly addressed in the SLS as it should be as it may be the biggest hazard due to the interchange. A two-lane exit is a good idea.

Response: It has been a concern for the project team since the very beginning. We are looking at the interchange configuration and how we can improve it. However, without the interchange, there are improvements that could happen such as widening the inside shoulder.

Statement: In response to the speed limit reduction, CDOT is not opposed to reduced speed limits; however, we also do not want potentially substandard improvements for westbound traffic. If a speed limit reduction is considered, we may need to look at more than installing a sign.

Response: There are certain things motorists just don't pay attention to and we must be very careful how we maintain motorist attentiveness and motorist compliance in this area.

Response: We should have an aggressive signing strategy and warning strategy.

Question: What is the design speed of the curve?

Response: We don't have the original design plans, but I think the design speed that we've estimated is somewhere in the mid-60s.

Meeting Summary

Statement: During peak periods, simply signing the roadway may not be enough due to the proposed increase in volume, especially at the curve. That is the concern that I don't feel has been adequately addressed.

Question: What additional analysis do you feel is necessary to adequately address your concerns?

Response: Additional analysis is not needed. What is the proposed mitigation to address the issue? We have discussed speed limit reductions and possible signing. It is my opinion that is not going to do it. I have proposed a potential mitigation that this team hasn't talked about since I first mentioned it. It is up to the consultant to come up with the mitigation that addresses this safety concern.

Question: What was the proposed mitigation?

Response: Braided ramps were proposed in which a lane change is not required.

Statement: The braided ramps were evaluated, and it was cost prohibitive. Probable construction costs (2040 dollars) are as follows¹:

- Braided ramps: \$45.6 million²
- C/D road: \$31.3 million³
- Auxiliary lane: \$7.4 million

This information was included in TAC #10 meeting summary. A braided ramp would not be a good use of public funds.

Question: What is the other mitigation that has been proposed?

¹ All cost estimates are based on 2023 CDOT cost data and show a 2% inflation factor to a 2040 build year.

² The braided ramp will require a retaining wall at the 29 Road interchange for the Horizon Drive exit. Requires a bridge and retaining walls under the 29 Road ramp. Requires a new bridge over the Highline Canal to the Horizon Drive ramp. Requires additional ROW purchase, including a corner of the Airport ROW. 29 Road on ramp traffic will not be able to access Horizon Drive (design speed is set at 55 MPH).

³ Requires widening the existing bridge (or a new structure) over the Highline Canal. Assumed to be two lanes to accommodate the "weaving" between the 29 Road and Horizon Drive traffic (design speed is 55 MPH). Allows for 29 Road traffic to Horizon Drive.

Meeting Summary

ACTION ITEM: In addition to addressing safety in the revised SLS, FHU will develop a “toolkit” of proposed mitigations to address safety and share with the TAC members.

Question: Will the other comments from the SLS be addressed?

Response: A comment matrix will be submitted along with the revised SLS.

Decisions Made

None at this time.

Action Items

- ▶ Send the Methods and Assumption to Ajin at FHWA as well as a link to the Social Pinpoint webpage so she can review the previously presented project materials.
- ▶ FHU will prepare the LOSS information between 29 Road and Horizon Drive.
- ▶ In addition to addressing safety in the revised SLS, FHU will develop a “toolkit” of proposed mitigations to address safety and share with the TAC members.

Next Steps

- ▶ Address the action items listed above.
- ▶ Submit the revised draft of the SLS to the TAC members.
- ▶ Following the meeting, it was determined that the team would plan for a Transportation Commission workshop in September with a Transportation Commission vote in October to provide ample time for review of the revised SLS.

I-70 Interchange in Grand Junction – TAC Meeting #12

July 8, 2024

Agenda

- ▶ Welcome and Introductions
- ▶ Screening Process Flowchart
- ▶ Review—Need and Benefit of New Interchange
- ▶ I-70 Traffic Mitigation Evaluation
- ▶ TDM Strategies
- ▶ Summary of Public Meeting Results
- ▶ Next Steps / SLS Submittal
- ▶ Schedule

Meeting Goal:

Review proposed I-70 safety mitigation measures



PRE-1601



1601/NEPA

**CURRENT PROCESS****GOAL:**

Is there a need for an interchange?

DETERMINATION OF NEED● **Traffic**

- Straight Model Results
- Freeway Analysis
- Select Limits/Select Grades
- Safety

● **Analysis Tools**

- MPO Model
- HCS (Freeway)

COMPLETED**LEVEL 1****SCREENING GOAL:**

29 Road or 30 Road?

EFFECTIVENESS & IMPACTS● **Traffic**

- Interchange Spacing
- Arterial Volume Changes
- Freeway LOS
- Activity Centers
- Land Use

● **Park-n-Ride/TDM**

- Roadway Plans
- Connectivity
- Planning History
- Activity Centers

● **Impacts**

- Community Context
- Access/Driveways
- Airport
- Historic
- Previous Public Involvement
- Planning History

● **Analysis Tools**

- MPO Model
- HCS (Freeway LOS)

**LEVEL 2****SCREENING GOAL:**Identify and Select Alignment and Interchange Configuration & Key Project Elements *(see next page for details)***IMPACTS**● **Traffic**

- Interchange Type (DDI, SPUI, Diamond)

● **Environmental**

- Noise
- Connectivity
- Air Quality
- Historic
- Air Quality

● **Roadway**

- 29 Road

● **Analysis Tools**

- Field Data
- CAP-X
- Crash Modification Factors (CMFs)

COMPLETED**LEVEL 3 ANALYSIS & REFINEMENT GOAL:**

CDOT 1601 Approval (including SLS) & FHWA IAR Approval

PREFERRED ALTERNATIVE EVALUATION● **Traffic**

- Operations
- Queuing
- Upstream/Downstream Interchange Effects
- Arterial Improvements

● **Safety**

- Safety Performance Functions (SPFs)

● **Multimodal**

- Accessibility

● **Guide Signing**

- Conceptual Plan

SUPPORTING ELEMENTS● **Traffic**

- I-70 Auxiliary Lane
- 29 Road
- Patterson Road

● **TDM**

- Park-n-Rides
- Bike Lanes
- Mobility Hubs

● **Environmental**

- Mitigation Commitments

● **Analysis Tools**

- Field Data
- Synchro / Rodel (arterials)
- HCS (Freeway)

- Level of Service (LOS)
- Diverging Diamond Interchange (DDI)
- Single-Point Urban Interchange (SPUI)

Review

Need for and
Benefit of New
Interchange

Project Purpose

The purpose of the project is to enhance the eastern Grand Valley transportation network between I -70 Business Loop East Interchange and Horizon Drive Interchange to:

1. Improve local and regional connectivity, and
2. Provide enhanced access to planned land use surrounding I-70 in Grand Junction, Colorado.

Need:
***Improved
Connectivity***

Improved local and regional connectivity is needed to:

- Address limited regional transportation network connectivity with access to/from I-70 between I-70 Business and Horizon Drive interchanges
- Extend the functional longevity of the existing transportation system connecting to I-70

**Need:
Improved
Access**

Improved access to I-70 is needed to:

- Provide transportation infrastructure needed to accommodate planned land use surrounding I-70, and specifically, the future Matchett Park and its associated recreation center
- Provide transportation infrastructure needed to accommodate projected and regional traffic demands

I-70 Traffic Analysis Update

Traffic Review:

What did we hear at TAC #11 & Review of SLS?

- ▶ Requests for VMT and VHT data
 - ▶ Responded to in Meeting Minutes
- ▶ Safety concerns due to creation of an I-70 weaving segment
 - ▶ New auxiliary lanes (both directions) between 29 Road and Horizon Drive

Traffic Safety Agenda

- ▶ CDOT Comments on HSS Analysis
- ▶ HSS Evaluation Updates
- ▶ Supplemental LOSS Analysis
- ▶ Conclusions

Base HSS Analysis

- ▶ Modeled I-70 from west of Horizon to east of I-70B / Clifton
 - ▶ Consistent with SLS Study Area
 - ▶ No-Action and Build Scenarios
- ▶ Build Alternative increases predicted crashes
 - ▶ Build Alternative includes auxiliary lanes
 - ▶ HSM dictates that auxiliary lanes longer than 4,500 feet should be analyzed, which is consistent with Build Alternative
 - ▶ This is not considered weaving in HSS.
- ▶ Reviewed by CDOT team
 - ▶ Reviewer concluded that “the HSS files reviewed were largely complete and accurate given the limitations of the HSM methodology.”
 - ▶ FHU incorporated consistency changes noted by reviewer

Additional HSS Updates

- ▶ Inconsistent use of Rural and Urban Models
 - ▶ SLS analysis and reviewer comments both mixed models
 - ▶ Updated all HSS analyses to Urban model
- ▶ Refined analysis elements
 - ▶ Freeway (including ramps and merge /diverge /weave)
 - ▶ Interchange ramp terminals (Horizon Dr, 29 Road)
 - ▶ 29 Road (between Patterson and G Road)
 - ▶ Can be combined to obtain broader picture
 - ▶ Overcomes roundabout limitation of freeway module

Refined HSS Outputs

Element	No Action	Preferred Alternative
I-70 Freeway Mainline <i>freeway segments, speed change lanes, ramp segments</i>	89.24	91.88
Horizon Drive Interchange <i>ramp segments, ramp terminal intersections</i>	25.18	24.38
29 Road Interchange <i>ramp segments, ramp terminal intersections</i>	-	15.67
I-70 Freeway Facility Total	112.70	128.22
29 Road Corridor (Patterson to G Road) <i>arterial segments, intersections</i>	7.53	28.97
29 Road Corridor (G Road to N Frontage) <i>arterial segments, ramp terminal intersections</i>	-	15.29
29 Road Arterial Facility Total	7.53	44.26

HSS Auxiliary Lane Analysis

- ▶ Ran Build scenario with and without auxiliary lane
 - ▶ Predicted crashes between Horizon and 29 Road:
 - ▶ Without Auxiliary Lane: 6.82 crashes per year
 - ▶ With Auxiliary Lane: 6.17 crashes per year
- ▶ The addition of an auxiliary lane improves safety
 - ▶ Result is consistent with CMFs in the FHWA Clearinghouse

▼ Countermeasure: Provide an auxiliary lane between an entrance ramp and exit ramp

Compare	CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
☐	0.8	20	★★★★☆	All	All	Not specified	RAY ET AL., 2010	- CMF is function of ramp spac...[READ MORE]
☐	0.77	23	★★★★☆	All	K (fatal),A (serious injury),B (minor injury),C (possible injury)	Not specified	RAY ET AL., 2010	- CMF is function of ramp spac...[READ MORE]
☐	0.8	20	★★★★☆	Single vehicle	All	Not specified	RAY ET AL., 2010	- CMF is function of ramp spac...[READ MORE]
☐	0.76	24	★★★★☆	Angle,Rear end,Sideswipe	All	Not specified	RAY ET AL., 2010	- CMF is function of ramp spac...[READ MORE]

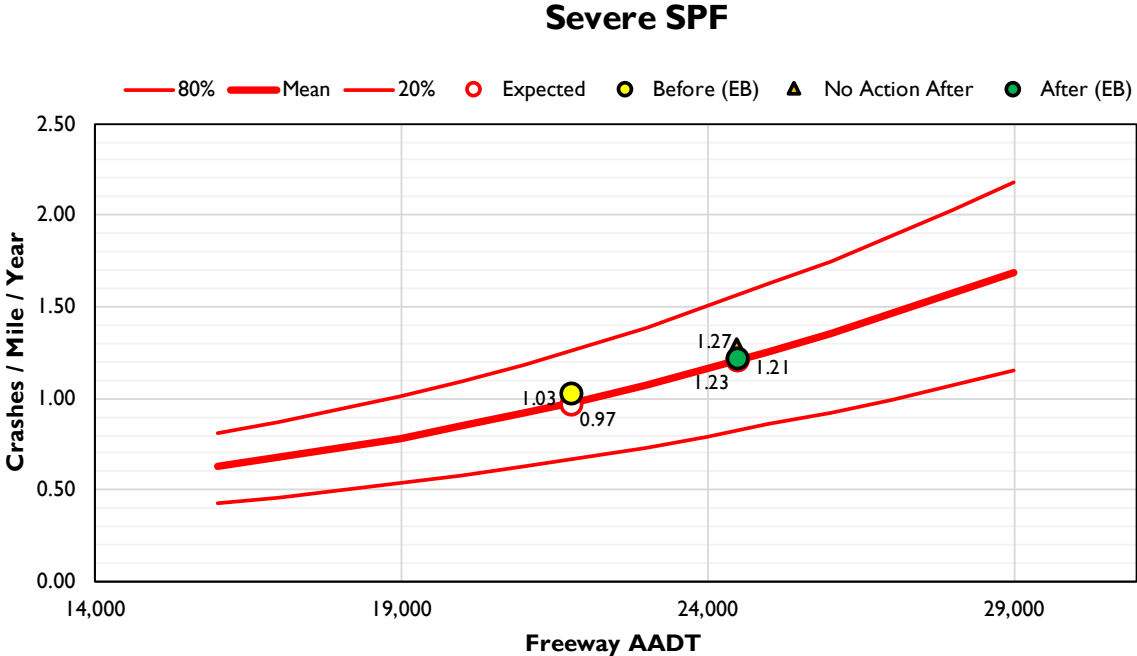
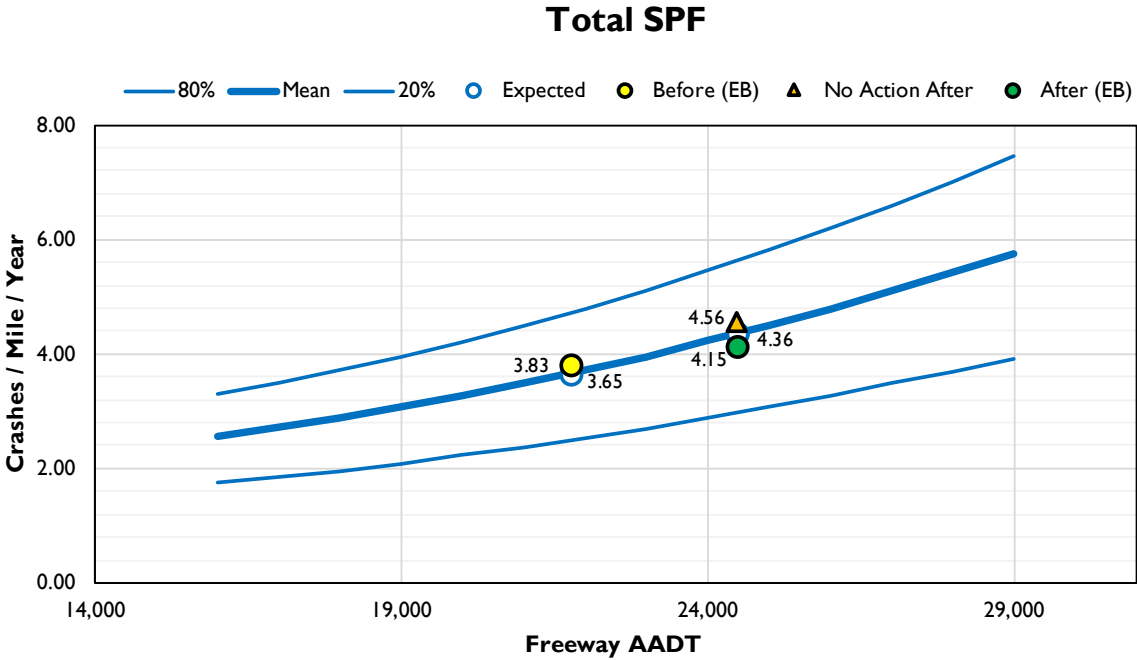
LOSS Background

- ▶ What is Level of Service of Safety (LOSS)?
 - ▶ The LOSS method compares a roadway segment's observed crash frequency and severity to the crash frequencies and severities predicted by Safety Performance Functions (SPFs)
 - ▶ SPFs are statistical models used to estimate the average crash frequency for a specific facility type
 - ▶ LOSS provides information only on the magnitude of the safety problem; it does not specify the reason for the problem
- ▶ How is it different from the HSS Analysis?
 - ▶ The HSS analysis predicts the number of crashes in a future scenario
 - ▶ The LOSS analysis compares existing or expected crash frequencies to data compiled across similar facilities

Existing Conditions LOSS Results: Study Area

- ▶ Inputs:
 - ▶ Colorado 4-lane urban freeway SPF
 - ▶ Crashes from before and after CDOT improvements
- ▶ Results:
 - ▶ Total Crashes:
 - ▶ Before: LOSS III
 - ▶ After: LOSS II
 - ▶ Severe Crashes:
 - ▶ Before: LOSS III
 - ▶ After: LOSS III

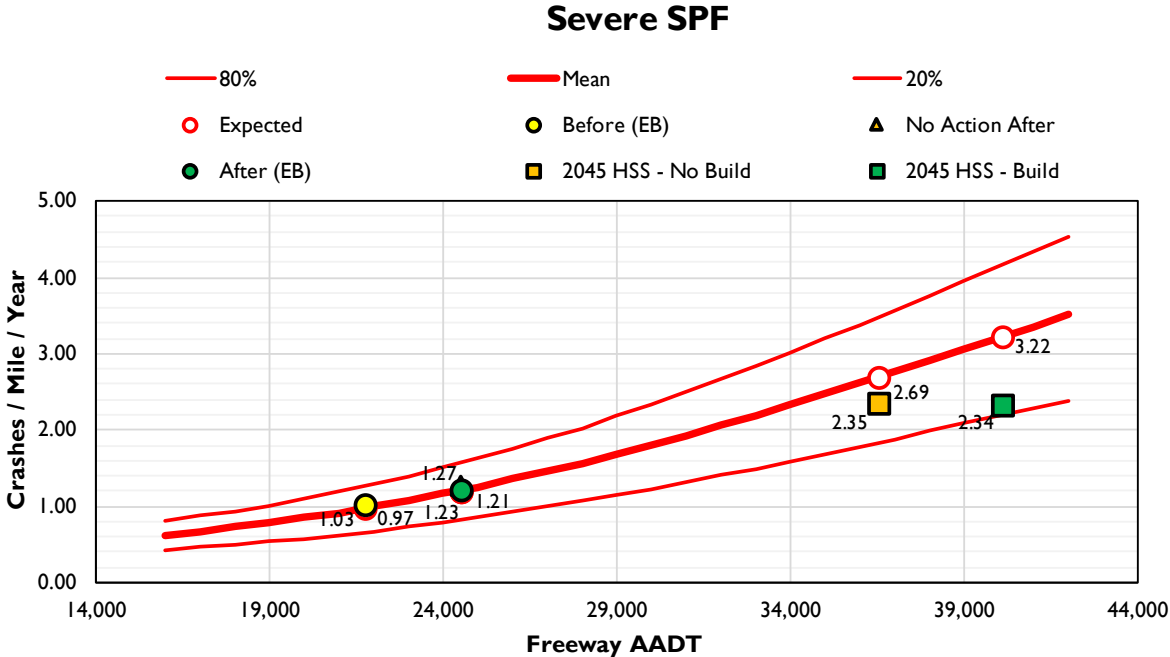
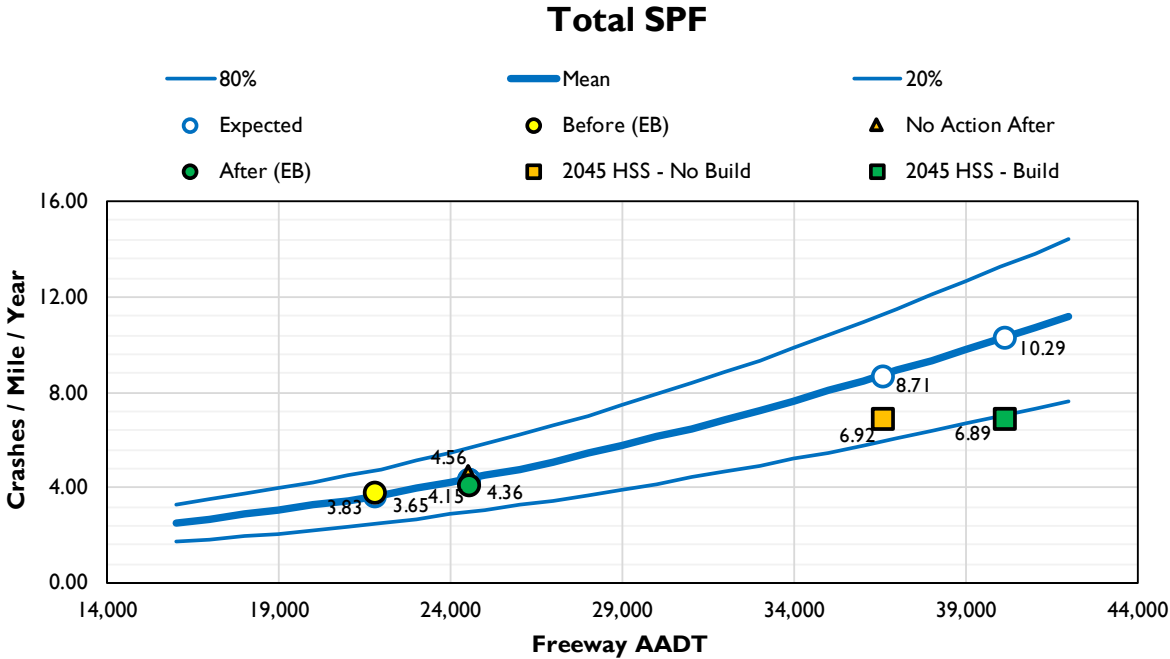
Existing
Conditions
LOSS
Results:
Study Area



Future Conditions LOSS Results: Study Area

- ▶ Inputs:
 - ▶ Same SPFs, same existing conditions data.
 - ▶ Predicted crashes from HSS for No-Action and Build.
- ▶ Results:
 - ▶ Total Crashes:
 - ▶ No Build: LOSS II
 - ▶ Build: LOSS I
 - ▶ Severe Crashes:
 - ▶ No Build: LOSS II
 - ▶ Build: LOSS II

Future Conditions LOSS Results: Study Area



LOSS Conclusions

- ▶ CDOT project resulted in improvements in LOSS for existing conditions.
- ▶ The 29 Road Interchange project would further improve LOSS
 - ▶ The project provides a LOSS I facility with a low potential for crash reduction.

Additional Mitigations

- ▶ The new interchange may increase attentiveness for westbound drivers
 - ▶ Potential for improved driver compliance
- ▶ Mitigations
 - ▶ Analysis includes additional curve warning signage
 - ▶ Would only reduce crashes between 29 Rd and Horizon Dr
 - ▶ Also Considering:
 - ▶ Further speed limit reductions

Next Steps

Overall Project & Decisions

- ▶ Submit System Level Study to CDOT Transportation Commission
 - ▶ Including TDM strategies
- ▶ CDOT Transportation Commission Presentation/Vote
 - ▶ August/September
- ▶ Prepare Interstate Access Request
- ▶ Complete NEPA Analysis/Design
 - ▶ RS/TC Determination (Air Quality / Environmental Justice)
 - ▶ Fall 2024

Schedule

▶ July / August

- ▶ Advance Conceptual Design (Interchange / 29 Road corridor)
- ▶ Submit SLS Documentation to Transportation Commission
- ▶ TDM Analysis approval
- ▶ Traffic Analysis—29 Road / Patterson intersection; safety
- ▶ Continue moving NEPA documentation forward

▶ August / September

- ▶ Advance conceptual design (Patterson Road and 29 Road intersection)
- ▶ CDOT TC Workshop (TC Vote in September)
- ▶ Initial review of NEPA Documentation

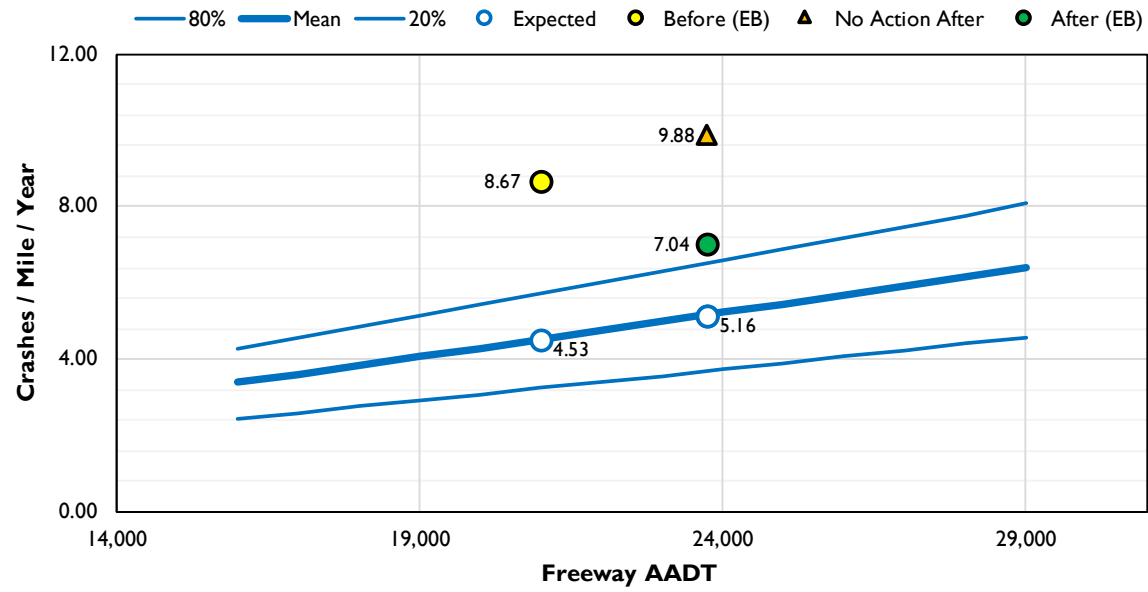
Thanks!

Existing Conditions LOSS Results: I-70 Curve

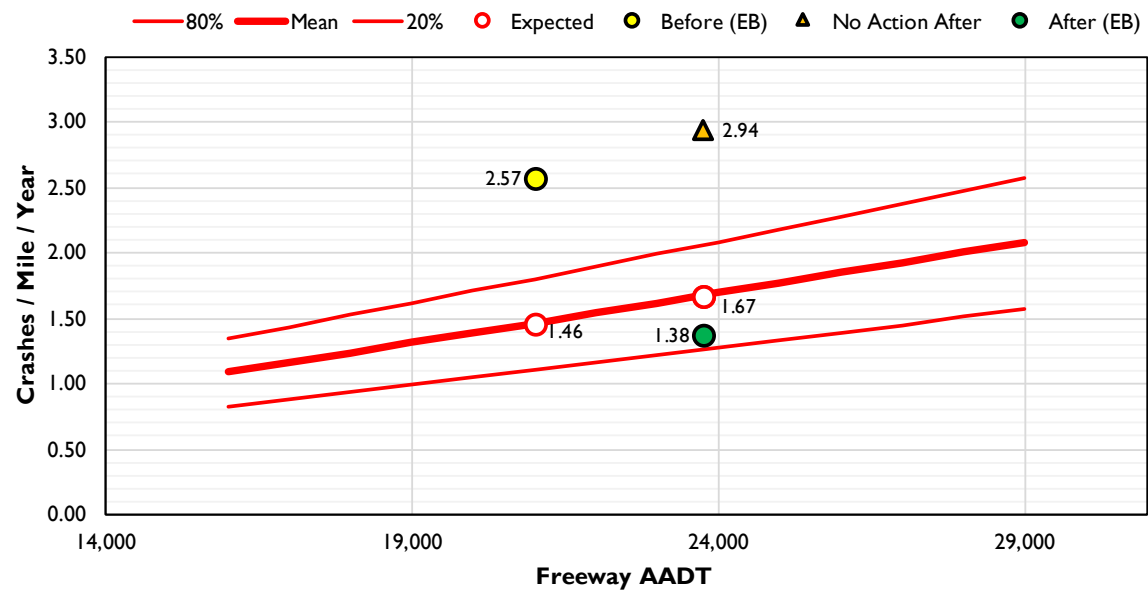
- ▶ Inputs:
 - ▶ Colorado 4-lane urban freeway SPF
 - ▶ Crashes from before (2014-2018) and after (2019-2022) CDOT improvements
- ▶ Results:
 - ▶ Total Crashes:
 - ▶ Before: LOSS IV
 - ▶ After: LOSS IV
 - ▶ Severe Crashes:
 - ▶ Before: LOSS IV
 - ▶ After: LOSS II

Existing Conditions LOSS Results: I-70 Curve

Total SPF



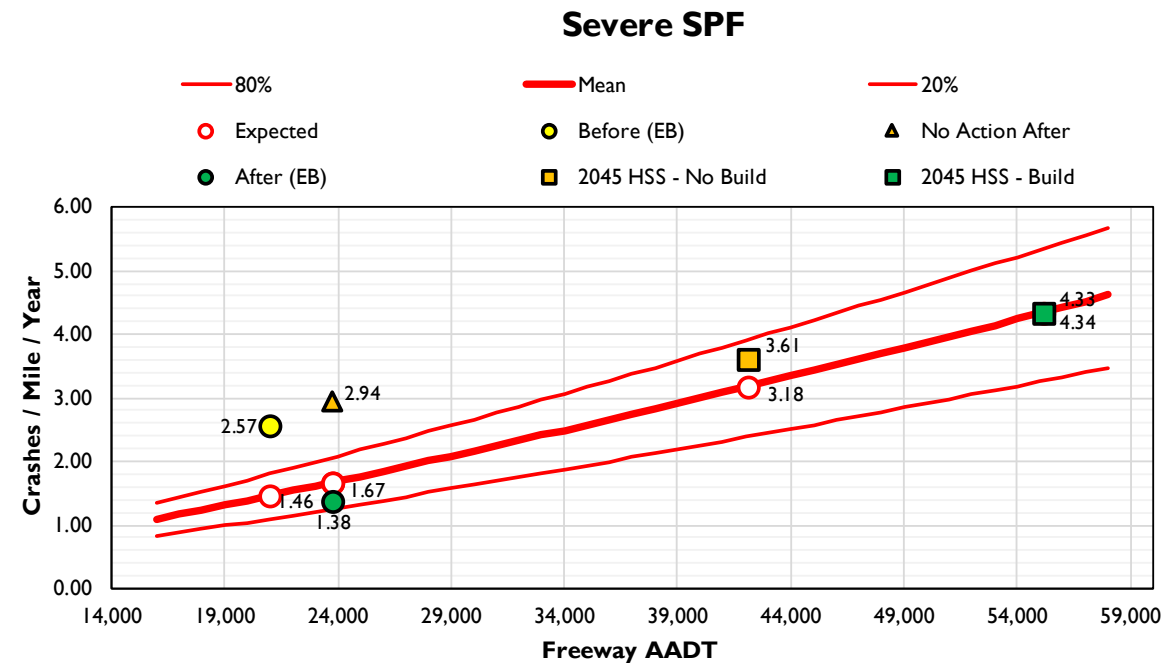
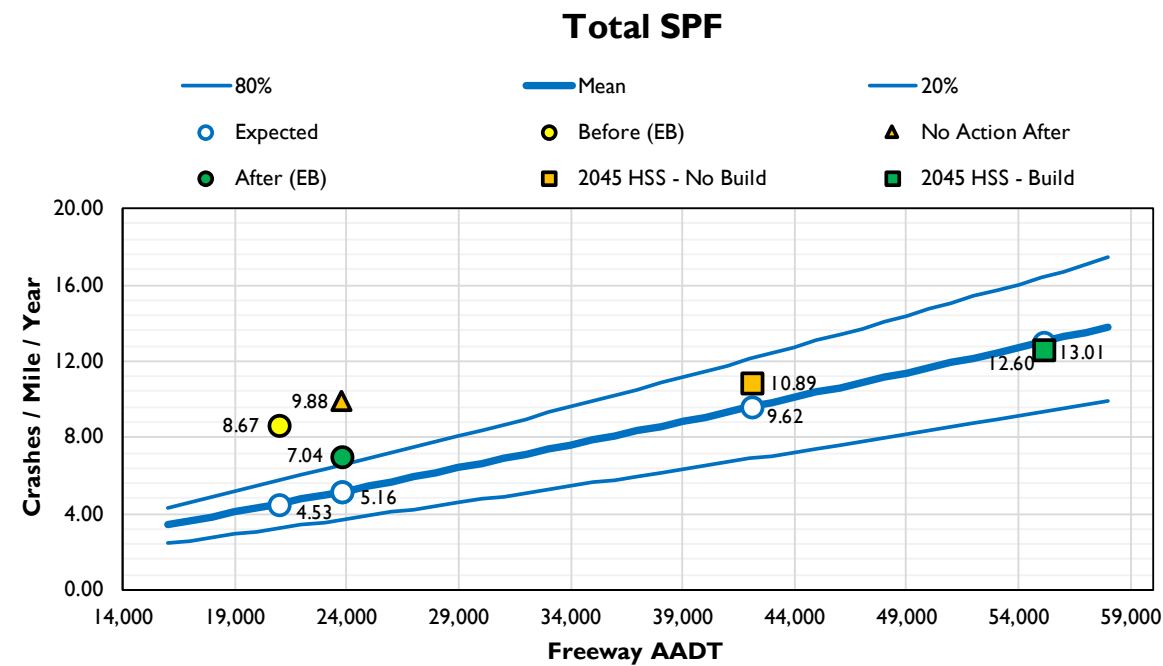
Severe SPF



Future Conditions LOSS Results: I-70 Curve

- ▶ Inputs:
 - ▶ Same SPFs, same existing conditions data.
 - ▶ Predicted Crashes from HSS for No-Action and Build.
- ▶ Results:
 - ▶ Total Crashes:
 - ▶ No Build: LOSS III
 - ▶ Build: LOSS II
 - ▶ Severe Crashes:
 - ▶ No Build: LOSS III
 - ▶ Build: LOSS II

Future
Conditions
LOSS
Results:
I-70 Curve





MEMORANDUM

TO:	Project File
FROM:	Melanie Bishop, Paul Brown
DATE:	March 22, 2024
SUBJECT:	Predictive Safety Analysis (Revised July 2, 2024) 29 Road Interchange at I-70 (FHU Project Number 121072-01)

This safety assessment uses Highway Safety Software (HSS) to determine the predicted crash frequency on the I-70 freeway facility and the 29 Road arterial within the project limits. HSS implements the Predictive Method found in the *Highway Safety Manual* (HSM, 2010), which applies national Safety Performance Functions (SPFs), to predict crashes based on location-specific roadway characteristics and associated Crash Modification Factors (CMFs), to estimate the potential effects of design alternatives. HSS result reports are attached.

Review comments provided by CDOT on June 13, 2024 were addressed in the safety analysis and updated results are documented in this revised memo.

Freeway Analysis

A freeway facility consists of freeway segments, and possibly, one or more interchanges. Safety prediction procedures for freeway facilities are further defined in the HSM supplement (2014) and in NCHRP Project 17-45, *Safety Prediction Methodology and Analysis Tool for Freeways and Interchanges* (2012).

The I-70 freeway facility evaluated for this study is comprised of the following section types:

- ▶ Freeway segment: a freeway segment is a section of roadway where there are no interruptions to the flow of traffic and have similar traffic demands and geometric characteristics.
- ▶ Freeway speed change lane: a speed change lane is the section of the roadway located (a) between the marked gore and taper points of a ramp merge or diverge area, and (b) on the same side of the freeway as the merge or diverge area.
- ▶ Ramp Segment: there are two types of ramps which include an entrance ramp and an exit ramp. An entrance ramp is a merge from a cross road to a freeway. An exit ramp is a diverge from a freeway to a cross road.
- ▶ Interchange ramp terminal: an interchange ramp terminal is a junction with a surface street to serve vehicles entering or exiting a freeway.

Segmentation of the freeway facility was performed based on roadway characteristics and changes in the roadway cross section. Detailed data was collected for each section type for use in the predictive model calibration, including:

- ▶ Geometric data includes lane width, shoulder type, median type, horizontal curvature, traffic control, etc. Measurements were collected from aerial photography and using web-based mapping tools.
- ▶ Traffic volume data was obtained from data sources including the Mesa County Regional Travel Demand Model, traffic counts collected for use in this project, and the CDOT traffic count database.

Analysis of the 2045 No Action scenario assumes the 29 Road interchange project is not built. The 2045 Preferred Alternative scenario includes the 29 Road interchange and assumes 2-lane roundabout ramp terminal intersections, an auxiliary lane between the Horizon Drive interchange and the 29 Road interchange, and curve warning signage.

Predictive analysis results are presented in Table 1 and Table 2 below for each scenario by freeway section type. The analysis results indicate the predicted crash frequency for the 2045 No Action scenario is 112.71 total crashes and the 2045 Preferred Alternative scenario predicted crash frequency is 126.71 total predicted crashes. The 2045 Preferred Alternative scenario predicted crash frequency is 12% higher than the 2045 No Action scenario.

The 29 Road interchange on I-70 and the associated additional lane change intensity is expected to increase the predicted crash frequency in the 2045 Preferred Alternative scenario.

**Table 1. Predicted Crash Frequency Summary by Section Type
(Freeway)**

Section Type	2045 No Action	2045 Preferred Alternative
Freeway Segment	78.20	74.32
Speed Change Lane	5.58	9.00
Ramp Segment	5.46	6.95
Ramp Terminals	23.47	36.43
Total	112.71	126.71

The analysis results indicate an average of 30% fatal/injury predicted crashes and 70% property damage only predicted crashes for the No Action scenario, and 29% fatal/injury and 71% property damage only for the Preferred Alternative scenario.

**Table 2. Predicted Crash Frequency Summary by Severity
(Freeway)**

Severity	2045 No Action	2045 Preferred Alternative
Fatal/Injury	34.12	36.47
Property Damage Only	78.59	90.24
Total	112.71	126.71

Detailed results for each scenario are presented in Table 3 and Table 4 below:

**Table 3. Predicted Crash Frequency
(2045 No Action - Freeway)**

Facility Type	Section Type	Location	Predicted Crashes
Freeway		24 Road to Horizon Drive	25.49

March 22, 2024

Predictive Safety Analysis

Page 4

Facility Type	Section Type	Location	Predicted Crashes
	Freeway Segment	Horizon Drive Interchange	2.13
		Horizon Drive to Speed Change	5.33
		Speed Change to Clifton	30.26
		Clifton Interchange	1.24
		Clifton to Palisade	13.74
	Speed Change Lane	Eastbound Horizon Diverge	0.49
		Eastbound Horizon Merge	0.86
		Eastbound Clifton Diverge	0.99
		Eastbound Clifton Merge	0.62
		Westbound Horizon Diverge	0.67
		Westbound Horizon Merge	0.80
		Westbound Clifton Diverge	0.28
		Westbound Clifton Merge	0.87
Ramp	Ramp Segment	Eastbound Horizon Diverge	0.37
		Eastbound Horizon Merge	0.44
		Eastbound Clifton Diverge	1.15
		Eastbound Clifton Merge	0.39
		Westbound Horizon Diverge	0.43
		Westbound Horizon Merge	0.46
		Westbound Clifton Diverge	0.74
		Westbound Clifton Merge	1.48
	Ramp Terminal	Eastbound Horizon	10.64
		Westbound Horizon	9.67

Table 4. Predicted Crash Frequency
(2045 Preferred Alternative - Freeway)

Facility Type	Section Type	Location	Predicted Crashes
Freeway	Freeway Segment	24 Road to Horizon Drive	29.65
		Horizon Drive Interchange	2.88
		Horizon Drive to 29 Road	7.69
		29 Road Interchange	2.45
		29 Road to Clifton	19.64
		Clifton Interchange	1.09
		Clifton to Palisade	12.45
	Speed Change Lane	Eastbound Horizon Diverge	0.56
		Eastbound Horizon Merge	1.24
		Eastbound 29 Diverge	0.82
		Eastbound 29 Merge	0.50
		Eastbound Clifton Diverge	0.84
		Eastbound Clifton Merge	0.55
		Westbound Horizon Diverge	0.87
		Westbound Horizon Merge	1.12
		Westbound 29 Diverge	0.53
		Westbound 29 Merge	1.03
		Westbound Clifton Diverge	0.25
		Westbound Clifton Merge	0.70
Ramp	Ramp Segment	Eastbound Horizon Diverge	0.33
		Eastbound Horizon Merge	0.55
		Eastbound 29 Diverge	0.62
		Eastbound 29 Merge	0.13
		Eastbound Clifton Diverge	0.99
		Eastbound Clifton Merge	0.40

Facility Type	Section Type	Location	Predicted Crashes
		Westbound Horizon Diverge	0.53
		Westbound Horizon Merge	0.41
		Westbound 29 Diverge	0.10
		Westbound 29 Merge	0.96
		Westbound Clifton Diverge	0.73
		Westbound Clifton Merge	1.22
	Ramp Terminal	Eastbound Horizon	9.85
		Westbound Horizon	9.76
		Eastbound 29	7.76
		Westbound 29	4.13

Arterial Analysis

An arterial facility consists of intersections and the roadway segments between intersections. An arterial facility can be comprised of the following section types:

- ▶ Intersection by stop control type
- ▶ Segment by number of lanes, divided or undivided

Segmentation of the arterial facility was more straight forward than freeway facilities. Segments were inputted as two-lane undivided in the 2045 No Action scenario and four-lane divided in the 2045 Preferred Alternatives scenario. The 29 Road and F ½ Road intersection was inputted as a four approach stop in the 2045 No Action scenario and a roundabout in the 2045 Preferred Alternative scenario. All other intersections were assumed to be the same between scenarios.

Predictive analysis results are presented in Table 5 and Table 6 below for each scenario by arterial section type. The analysis results indicate the predicted crash frequency for the 2045 No Action scenario is 7.53 total crashes and the 2045 Preferred Alternative scenario predicted crash frequency is 43.04 total crashes. The 2045 Preferred Alternative scenario predicted crash frequency is 472% higher than the 2045 No Action scenario.

The additional thru lanes and increased traffic volumes on 29 Road are expected to increase the predicted crash frequency associated with the 2045 Preferred Alternative.

**Table 5. Predicted Crash Frequency Summary by Section Type
(Arterial)**

Section Type	2045 No Action	2045 Preferred Alternative
Segment	0.68	5.54
Intersection	6.85	37.50
Total	7.53	43.04

The analysis results indicate an average of 35% fatal/injury predicted crashes and 65% property damage only predicted crashes for the No Action scenario. In the Preferred Alternative scenario, fatal/injury crashes reduce to 25% and property damage only crashes increase to 75%.

**Table 6. Predicted Crash Frequency Summary by Severity
(Arterial)**

Severity	2045 No Action	2045 Preferred Alternative
Fatal/Injury	2.66	10.61
Property Damage Only	4.88	32.43
Total	7.53	43.04

Detailed results for each scenario are presented in Table 7 and Table 8 below:

**Table 7. Predicted Crash Frequency
(2045 No Action - Arterial)**

Facility Type	Section Type	Location	Predicted Crashes
Intersection	Four Approach Signal	Patterson Rd	4.49
	Four Approach Stop	Bonito Ave	0.62
		Music Ave	0.62

Facility Type	Section Type	Location	Predicted Crashes
		F ½ Rd	0.72
		Brodict Way	0.26
	Three Approach Stop	G Rd	0.14
Segment	Two-Lane Undivided	Patterson Rd to Bonito Ave	0.23
		Bonito Ave to Music Ave	0.16
		Music Ave to F ½ Rd	0.15
		F ½ Rd to Brodict Way	0.04
		Brodict Way to G Rd	0.05
		G Rd to North Frontage Rd	0.04

**Table 8. Predicted Crash Frequency
(2045 Preferred Alternative - Arterial)**

Facility Type	Section Type	Location	Predicted Crashes
Intersection	Four Approach Signal	Patterson Rd	7.82
	Four Approach Stop	Bonito Ave	1.32
		Music Ave	1.32
	Roundabout	F ½ Rd	9.29
	Four Approach Stop	Brodict Way	1.76
	Three Approach Stop	G Rd	2.13
	Roundabout	I-70 Eastbound Ramp	8.92
	Roundabout	I-70 Westbound Ramp	4.95
Segment	Four-Lane Divided	Patterson Rd to Bonito Ave	1.14
		Bonito Ave to Music Ave	0.67
		Music Ave to F ½ Rd	0.79
		F ½ Rd to Brodict Way	0.69
		Brodict Way to G Rd	0.83

Facility Type	Section Type	Location	Predicted Crashes
		G Rd to I-70 Eastbound Ramp	1.25
		I-70 EB Ramp to I-70 WB Ramp	0.12
		I-70 WB Ramp to N Frontage Rd	0.06