

Road Safety Audit Report

Dell Range Boulevard from Powderhouse Road to College Drive & Prairie Avenue from Powderhouse Road to Dell Range Boulevard

prepared for:



Cheyenne Metropolitan Planning Organization
2101 O'Neil Avenue, Room 205,
Cheyenne, WY 82001

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Dell Range Boulevard from Powderhouse Road to College Drive & Prairie Avenue from Powderhouse Road to Dell Range Boulevard

Field Review Date: April 23 to 24, 2013

Participants:

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Project Characteristics:

Audit Type: Existing Road
Adjacent Land Use: Suburban; Commercial
Posted Speed Limit: 35 on Prairie Avenue and 40 MPH on Dell Range Boulevard
Opposite Flow Separation: Divided by Two-Way Left-Turn Lane (Dell Range Boulevard) or Raised Median (Prairie Avenue)
Service Function (Urban): Arterial
Terrain: Flat
Climatic Conditions: Sunny, Cold



Background

The study area is a highly-traversed commercial corridor that is a primary destination for shopping and dining. Commercial giants such as Walmart, Sam's Club, Kmart and Target are housed along this corridor along with Cheyenne's Frontier Mall. Other numerous retail establishments dot the entire stretch of the corridor. Commercial property fronts the western section between Powderhouse Drive and Converse Avenue. Near Converse Avenue and east, the intensity of commercial activity reduces slightly. Several special flood hazard areas exist along Dell Range Boulevard. Development on the north side of Dell Range Boulevard is constrained by the Dry Creek Channel. Recent flood control improvements restrict the flood waters to the channel; however, it still carries a significant amount of water. The south side is dedicated to recreational uses. This is changing with the construction of Menards in the southeast corner of the Dell Range Boulevard/Windmill Road intersection. East of Converse Avenue, strip commercial developments front the north side of the corridor.

The Dell Range Boulevard corridor feels unsafe and uncomfortable for modes of travel other than automobiles and poses a barrier for bicyclists and pedestrians. The greenway system runs parallel to the corridor, however there is no good way to go across the corridor at intersections to access the various businesses. The sidewalk along the corridor is attached in most places and exposed to high volumes and high speed traffic. The Bicycle Advisory Committee has determined that providing a bike lane on Dell Range Boulevard for the near term is too dangerous. Instead, providing opportunities for safe crossing of the corridor and access to businesses are more critical in the short term. However, long term solutions should be identified for safe mobility of all modes that can be incorporated during potential reconstruction of this corridor, if and when possible in the future.

The Dell Range Boulevard Corridor is one of the most heavily used roads in Wyoming. It is also perceived to be unsafe by most drivers. Data supports that Dell Range Boulevard does have higher crash frequency in comparison to other areas in the city. Per the 2010 Annual Crash Report for Cheyenne, the crash rate for the Dell Range Boulevard/Converse Avenue intersection was highest in 2010 and during the ten years from 2001 to 2010. Three of the five intersections with the highest frequency of crashes were within this stretch of Dell Range Boulevard. Also, the Stillwater Avenue/Dell Range Boulevard intersection was ranked as having the fifth highest number of fatal and incapacitating crashes from 2001 to 2010.

Project Scope and Objectives

The purpose of this Road Safety Audit is to evaluate safety issues and other areas of concern along the segment of Dell Range Boulevard between Powderhouse Road and North College Drive, as well as along Prairie Avenue.

Specific Roadway components and issues to be studied include:

- Areas of concern for vehicular safety, and pinch points for capacity and congestion.
- Pedestrian crossing opportunities and safety considerations, with an emphasis on business access.
- Opportunities to improve motor vehicle and pedestrian connectivity between adjacent businesses.
- Scenarios to improve bicycle accommodation along parallel corridors, including better connectivity between the Storey Avenue/Converse Avenue and Dry Creek Greenways.



Schedule

The RSA team generally adhered to the following schedule during the week the audit was conducted.

Tuesday, April 23, 2013 – Room 307

9:00 – 10:30 am RSA Training
10:30 – 11:15 am Project Objectives Overview (MPO)
11:15 – noon RSA Team Materials Review
Noon – 1:30 pm Travel to Corridor + Lunch
1:30 – 6:00 pm Field Review + PM Peak Observation
7:30 – 8:30 pm Night Field Review

Wednesday, April 24, 2013 – Dell Range Boulevard Corridor

7:00 – noon Observe AM Peak + Continue Field Review
Noon – 1:30 pm Lunch
1:30 – 4:30 pm Complete Field Review

Thursday, April 25, 2013 – Room 307

9:00 – noon RSA Team Analysis + Initial Report Preparation
Noon – 1:30 pm Lunch
1:30 – 5:00 pm RSA Team Analysis + Initial Report Preparation

Friday, April 26, 2013 – Room 307

8:00 – 10:00 am Post Audit Briefing Preparation
10:00 – noon Post Audit Briefing



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SUMMARY OF SAFETY ISSUES AND SUGGESTIONS

The RSA Team identified and categorized intersection and corridor segment safety issues based on a qualitative risk scale. For the purposes of this RSA, risk is defined as a function of exposure, probability, and consequence. Exposure reflects the number of users (vehicles, pedestrians, or bicyclists) potentially influenced by the issue. Probability reflects the likelihood of a crash influenced by the identified issue and can be quantified by the crash history. The consequence reflects the severity of a crash, if one occurs.

The qualitative risk rating of safety issues identified along Dell Range Boulevard and Prairie Avenue within the study segments are assigned relative to other issues observed. Category III issues have potentially the greatest risk compared to the other observed issues; they are associated with higher frequency and higher severity potential than other issues. Category I issues indicate the least risk compared to the other observed issues; they are associated with low crash severity and low crash frequency potential. Category II issues indicate higher risk than some issues and lower risk relative to other observed safety issues.

Where an issue was identified as Category II or III, an explanation is provided to support the categorization; no explanation is provided for Category I issues.

The RSA Team identified 4 Category III issues and 15 Category II issues. A brief summary of these issues and the RSA Team's suggestions for addressing these issues are provided in Table 1. Many Category I issues are identified and summarized at the conclusion of the report.



Table 1 Summary of Category II and III Issues and Suggestions

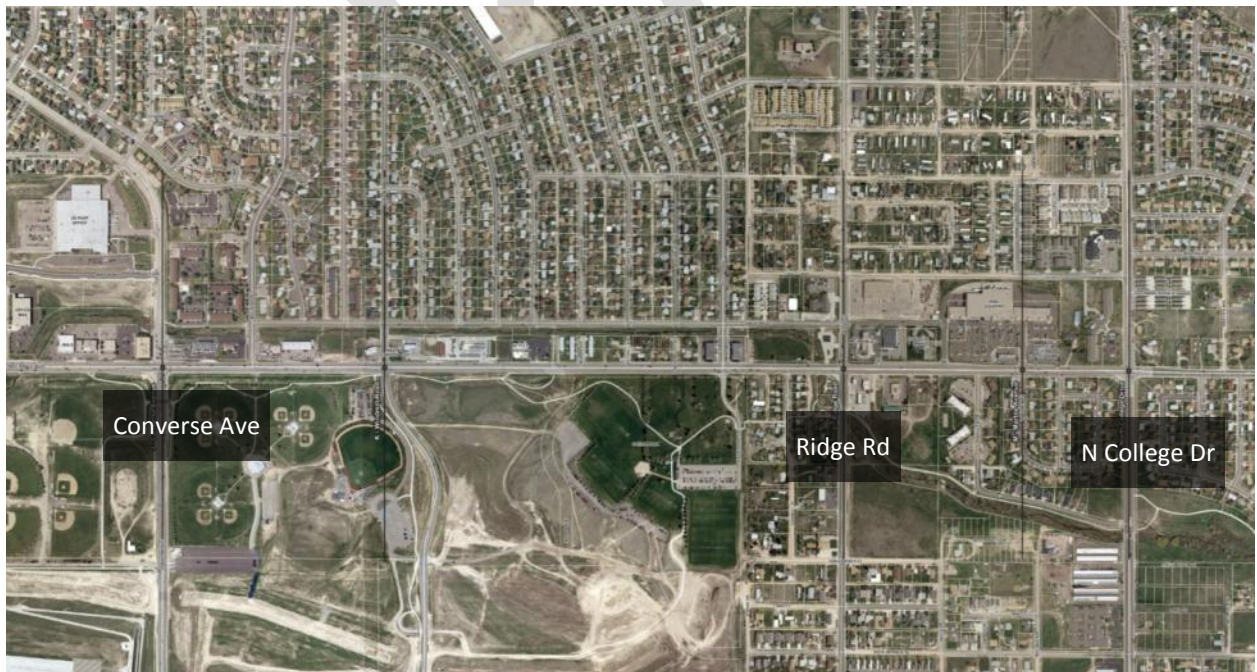
Issue	Location	Risk Classification	Suggestion
East-west connectivity north of Dell Range Boulevard	Entire Dell Range Boulevard Corridor	Category III	Provide additional east-west collector roadway connections within ½ mile north of Dell Range Boulevard, from Powderhouse Road to Converse Avenue.
Existing median two-way left-turn lane	Entire Dell Range Boulevard Corridor	Category III	Consider changing the existing two-way left turn lane to provide raised median access control. Consider strategically located u-turn bulb outs at full or directional intersections.
East-west left-turn crashes	Dell Range Boulevard/Converse Avenue	Category III	Consider making the EB and WB left turn signalized movements protected only.
Angle crashes at intersection	Dell Range Boulevard/Converse Avenue	Category III	Consider increasing the all-red clearance interval to 2 seconds for all movements.
Travel speed	Entire Dell Range Boulevard Corridor	Category II	Conduct a speed study to document existing 85 th percentile travel speed. Reduce posted speed limit to 35 mph, if supported by speed study.
Red light running	Entire Dell Range Boulevard Corridor	Category II	Check yellow clearance intervals as compared to the WYDOT procedure. Enhance the ability for law enforcement to enforce red-light running. This could include white or blue lights directly wired into the red signal lens illuminating at the same time as the red signal.
Signalized left-turn phase sequences	Entire Dell Range Boulevard Corridor	Category II	Consider providing leading protected left-turn phasing to promote consistency along the corridor, minimize potential for driver error, and minimize potential conflicts with pedestrians.
Accessible pedestrian facilities	Entire Dell Range Boulevard Corridor	Category II	As part of other improvements to the overall corridor, pedestrian facilities can be updated to meet ADA requirements.
No crosswalk provided on west leg of intersection	Dell Range Boulevard/Stillwater Avenue (W)	Category II	Stripe crosswalk on west leg and provide pedestrian signal equipment in NW and SW corners of intersection.
Offset intersection	Dell Range Boulevard/Rue Terre	Category II	Mount sign "KEEP RIGHT" on signal pole in north approach median facing northbound through lane approach.
No crosswalk provided on east leg of intersection	Dell Range Boulevard/Rue Terre	Category II	Stripe crosswalk on east leg and provide pedestrian signal equipment in NE and SE corners of intersection.
No crosswalk on north leg of intersection	Dell Range Boulevard/Converse Avenue	Category II	Stripe crosswalk on north leg and provide pedestrian signal equipment in NW and NE corners of intersection.
Pedestrian signal in NE corner not operative	Dell Range Boulevard/Converse Avenue	Category II	Repair pedestrian signal in the NE corner.
Left-turn crashes	Dell Range Boulevard/Mountain Road	Category II	Consider restricting access to right-in and right-out only.
Dry Creek box culvert needs rail	Dell Range Boulevard: Darnell Place to Ridge Road	Category II	Consider adding a pedestrian rail or guardrail on the top of the box culvert.
Northbound left-turn capacity	Dell Range Boulevard/College Way	Category II	Provide more green time for northbound left-turn or construct dual left-turn lanes.
Excess pavement width	Entire Prairie Avenue Corridor	Category II	Restripe corridor to include buffered bike lanes, as part of a corridor-wide bike connectivity plan. If feasible, implement road diet to reduce curb-to-curb width in widest segments. Provide striping channelization in open areas of shoulder to direct vehicles into travel lane.
Lane channelization	Prairie Avenue/Frontier Mall Drive	Category II	Short-term: realign eastbound approach to provide short tangent section that aligns drivers into their respective lanes on the downstream side of intersection. Long-term: reconstruct median and curb to improve channelization and provide consistent cross-section on east and west legs.
Intersection skew	Prairie Avenue/Frontier Mall Drive	Category II	Re-align Frontier Mall Drive approaches to intersect Prairie Avenue closer to 90-degrees (reduce skew).



DELL RANGE BOULEVARD CORRIDOR: POWDERHOUSE ROAD TO COLLEGE DRIVE



Dell Range Boulevard: Powderhouse Road to Converse Avenue



Dell Range Boulevard: Converse Avenue to College Drive



Dell Range Boulevard - Entire Corridor

Issue: East-west Connectivity North of Dell Range Boulevard



Exhibit 1 General Area North of Dell Range Boulevard

Description of Safety Issue:

Existing daily traffic volumes on Dell Range Boulevard between Prairie Avenue and Converse Avenue average 29,000 vehicles/day. To accommodate future growth on the corridor, additional through lanes may be required resulting in six travel lanes. Additional lanes will reduce delay at intersections and increase capacity for motorized vehicles. However, additional lanes make non-motorized travel more difficult by increasing pedestrian crossing distance at intersections.

An alternative to increasing the number of lanes (and overall width) on Dell Range Boulevard is to provide alternative parallel routes. Due to existing congestion on Dell Range Boulevard, drivers use alternative routes to avoid using Dell Range Boulevard for east-west travel. This is evident by the number of vehicles that cut through the back of the Kmart property to travel between Prairie Avenue and Rue Terre. However, there are no connections for east-west travel between Prairie Avenue and Converse Avenue within 0.5 miles of Dell Range Boulevard.

Function	Classification	Reasoning
Exposure	Category III	ADT of 29,000 veh/day
Probability	Category III	Corridor history
Consequence	Category II	History of low severity crashes, but potential for increased severity in future
Overall	Category III	-

Suggestion for Improvement:

Provide additional east-west collector roadway connections within ½ mile north of Dell Range Boulevard,



from Powderhouse Road to Converse Avenue.

Issue: Travel Speed



Exhibit 2 Posted Speed Limit Sign

Description of Safety Issue:

In order to reach the posted speed limit of 40 mph between signalized intersections, drivers must accelerate rapidly. Given the limited distances between signals (many are spaced less than 1,000 feet apart), most drivers cannot obtain the posted speed before decelerating at a downstream signal.

At each point of access to the corridor, drivers turning onto and off of the corridor are accelerating and decelerating, which leads to inconsistent travel speeds. Speed inconsistency can be associated with increased potential for rear-end crashes. Approximately 65 percent of all crashes on the corridor have been rear-end crashes from 2007 through 2011.

At 40 mph, 155 feet is required for stopping sight distance. By reducing posted speed to 35 mph, the required stopping distance is 115 feet for passenger cars. The difference in stopping distance between 40 and 35 mph is similar for trucks, although they require greater distances at both speeds.

Function	Classification	Reasoning
Exposure	Category II	Speed varies by lane
Probability	Category III	Speed is a contributing factor in most crashes
Consequence	Category II	Potential for rear-end crash
Overall	Category II	-

Suggestion for Improvement:

Conduct a speed study to document existing 85th percentile travel speed. Reduce posted speed limit to 35 mph, if supported by speed study.



Issue: Existing Median Two-Way Left-Turn Lane



Exhibit 3 Existing Two-Way Left-Turn Lane



Exhibit 4 Pedestrian Crossing Through Existing Two-Way Left-Turn Lane

Description of Safety Issue:

The existing cross-section includes a 12-foot wide, two-way left-turn lane. Over the study period multiple angle and turn crashes have been reported throughout the corridor. Enhancement of access management could reduce the number of conflict points along the corridor and reduce the number of crashes. The *Highway Safety Manual* (HSM) provides crash prediction models based on empirical studies showing five-lane roadways have approximately twice the number of crashes compared to four-lane divided urban roadways when the corridor carries approximately 30,000 vehicles/day. The addition of a median also provides better refuge for pedestrians crossing along the corridor.

The addition of a raised median would increase the number of u-turn movements and u-turn bulb outs would be needed to accommodate these movements.

Function	Classification	Reasoning
Exposure	Category III	Every driver is exposed to multiple conflicts
Probability	Category III	Existing left-turn and angle crashes
Consequence	Category III	Typically angle and left-turn crashes are injury producing crashes
<i>Overall</i>	<i>Category III</i>	-

Suggestion for Improvement:

Consider changing the existing two-way left turn lane to provide raised median access control. Consider strategically located u-turn bulb outs at full intersections. These could have the dual use of being future bus bays for transit operations along the corridor. The RSA Team discussed the potential of narrowing the through lanes to 11-ft and providing a 16-ft median within the existing 60-ft of pavement.



Issue: Red Light Running



Exhibit 5 Vehicle Entering Intersection on Red Signal

Description of Safety Issue:

The RSA team observed multiple drivers entering the intersection after the red indication had occurred. Over the study period, 203 angle crashes have been reported at signalized intersections. The proportion of those angle crashes that involved a red-light running vehicle are not identified in the crash data, but red-light running is a contributing factor in angle crashes. The RSA team measured the yellow clearance intervals to be 3- to 3.5-seconds at some intersections. Most locations have a one second all red interval.

Function	Classification	Reasoning
Exposure	Category II	RSA team observed this behavior at multiple locations
Probability	Category II	Angle crashes at intersections
Consequence	Category III	Angle crashes typically have injuries
<i>Overall</i>	<i>Category II</i>	-

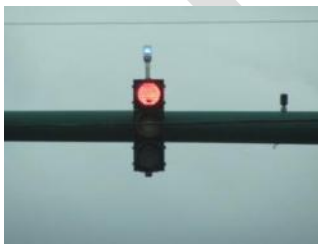


Exhibit 6 Example of Blue Light Mounted Above Signal Head

Suggestion for Improvement:

Check yellow clearance intervals as compared to the WYDOT procedure. Enhance the ability for law enforcement to enforce red light running. This could include white or blue lights directly wired into the red lens signal illuminating at the same time as the red signal (See example in Exhibit 6). Law enforcement can see the signal turn red from behind and pull over a driver. Also, law enforcement needs locations to safely monitor drivers for enforcement.



Issue: Signalized Left-Turn Phase Sequences

Description of Safety Issue:

Existing signal timing provides inconsistent use of left-turn phase sequences along the corridor. At some signals the east-west protected left-turn phase occurs before the permitted phase, but at other signals the protected phase “lags” behind the permitted phase. There are three potential issues associated with left-turn signal phasing: 1) inconsistency violates driver expectations and can increase driver error, 2) providing a leading protected left-turn phase reduces the demand during the permitted phase and reduces the potential for driver error during the permitted phase, and 3) permitted left-turns may increase potential conflicts between pedestrians in the crosswalk. These issues may have contributed to the 203 angle crashes reported at signals within the study corridor.

Allowing variations in the phasing sequence throughout a corridor is a common strategy for improving signal coordination and reducing delay, but inconsistent left-turn phasing may increase driver error. Drivers accustomed to one left-turn phasing sequence may assume other signals on the corridor have the same phase sequence.

When the protected left-turn phase “leads” and is followed by the permitted left-turn (See Exhibit 7), more vehicles proceed through the intersection during the protected phase and additional vehicles can proceed on the permitted phase if there is a gap in oncoming traffic. The protected left-turn phase follows (or “lags”) the permitted phase at many of the signals on Dell Range Boulevard, which increases the number of vehicles that are exposed to making an error when making the left turn against the flow of oncoming traffic.

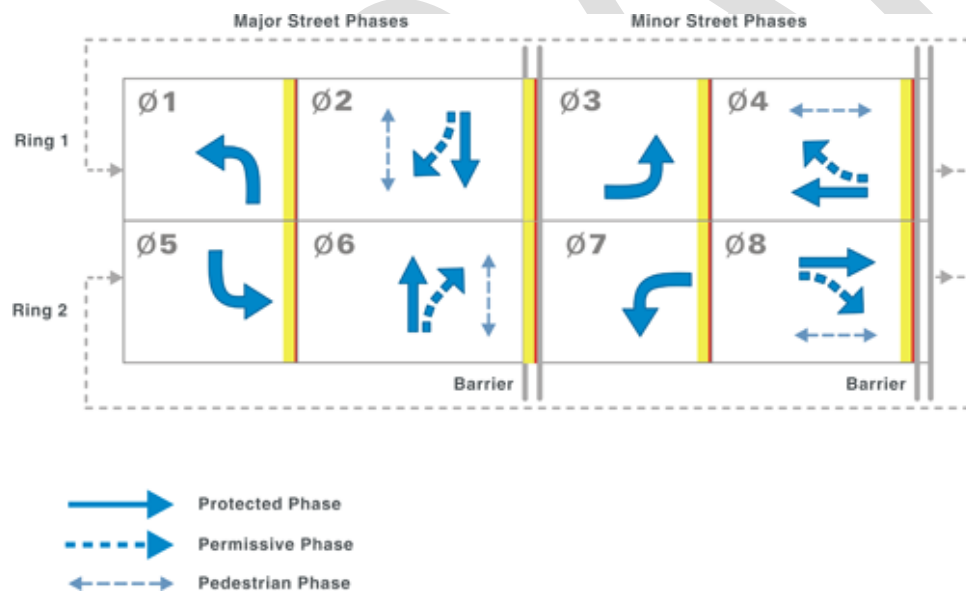


Exhibit 7 Example Ring-and-Barrier Diagram Showing Protected Lead-Lag Left Turns (source: FHWA Signal Timing Guide)

A recent study indicates that relatively few (4-9 percent) of left-turn drivers turning during a permitted phase look for pedestrians in the conflicting crosswalk. Most drivers in this situation are only watching for



a gap in oncoming traffic.¹ This trend provides additional incentive to provide protected left-turn phasing for a majority of left-turn vehicles through a leading protected left-turn phase.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category II	Permissive phase introduces potential for human error.
Consequence	Category III	Contributes to left-turn and angle crashes
<i>Overall</i>	<i>Category II</i>	-

Suggestion for Improvement:

Consider providing leading protected left-turn phasing to promote consistency along the corridor, minimize potential for driver error, and minimize potential conflicts with pedestrians.

Issue: Countdown Pedestrian Signals



Exhibit 8 **Example of Pedestrian Countdown Signal at Ridge Road**



Exhibit 9 **Example of Pedestrian Push Button and Sign**

¹ Hurwitz, D. and Monsere. *Pedestrian Safety at Signalized Intersections Operating the Flashing Yellow Arrow*. OTREC. April 2013.



Exhibit 10 Example of Pedestrian Signal Equipment Variation along Dell Range Boulevard Corridor



Description of Safety Issue:

The newer signals at Moran Avenue and Ridge Road have countdown signals on all approaches. The other signalized intersections have the older style pedestrian signal indications without countdown (See Exhibit 10). The RSA team also noted many of the pedestrian push button detectors and the pedestrian actuation signs are aged and some are not legible.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Upgrade the other signalized intersections with countdown pedestrian signals and upgrade the pedestrian push button detectors and pedestrian actuation signs for all signalized crosswalks as part of the overall corridor improvement project.

Issue: Pedestrian Walk Times



Exhibit 11 Pedestrian Signal

Description of Safety Issue:

The RSA team measured the Walk signal time to typically be 5 seconds and the Flashing Do Not Walk signal time to be 12 seconds for crossing Dell Range Boulevard. This roadway is typically 60 feet wide. The 2009 MUTCD (Section 4E.06) notes the pedestrian Flashing Do Not Walk time should be established "at a walking speed of 3.5 feet per second to at least the far side of the traveled way." This would require approximately 17 seconds of Flashing Do Not Walk time. The 2009 MUTCD also notes the Walk interval time should be a minimum of 7 seconds.



Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Consider increasing the Flashing Do Not Walk time for the Dell Range Boulevard crosswalks to provide for a 3.5 feet per second walking speed and the Walk interval time to be a minimum of 7 seconds. This could be done as part of an overall corridor retiming project done with the previous speed limit reduction consideration.

Issue: Accessible Pedestrian Facilities



Exhibit 12 Pedestrian Push Button in NE Corner of Dell Range/Converse Intersection

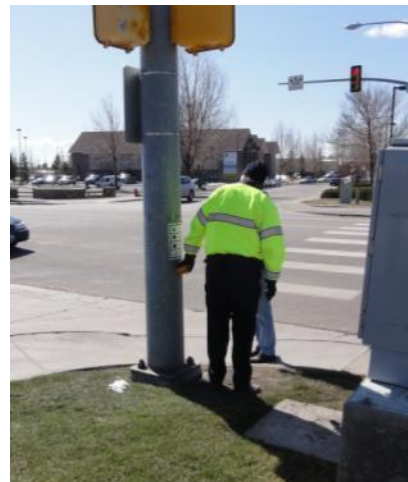


Exhibit 13 Pedestrian Push Button in NW Corner of Dell Range/Rue Terre Intersection

Description of Safety Issue:

Multiple design elements do not meet ADA requirements. Observed design elements that do not meet ADA requirements include:

- Clear width of pedestrian ramps and sidewalks less than 4 feet in many locations. Width limited by signal poles or other obstructions located in pedestrian path
- Slope of pedestrian ramps exceed maximum of 8.3 percent
- Cross-slope of sidewalk exceeds 2 percent at driveways
- Lack of truncated domes or tactile surface on pedestrian ramps
- Pedestrian ramps not aligned with crosswalk
- Inaccessible pedestrian push button locations (i.e. back of signal pole, or hard surface not provided up to base of button)



Function	Classification	Reasoning
Exposure	Category I	
Probability	Category II	Issues noted frequently throughout corridor
Consequence	Category III	Vulnerable user
<i>Overall</i>	<i>Category II</i>	-

Suggestion for Improvement:

As part of other improvements to the overall corridor, pedestrian facilities can be updated to meet ADA requirements.

Dell Range Boulevard/Powderhouse Road

Issue: Southbound Channelization Sign – Poor Retro-Reflectivity



Exhibit 14 Southbound Approach at Powderhouse Road/Dell Range Boulevard Intersection

Description of Safety Issue:

The post-mounted channelization sign has poor retro-reflectivity and is difficult to see at night.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Replace sign.



Issue: SB Right Turn Lane



Exhibit 15 Southbound Right-Turn Lane at Dell Range Boulevard/Powderhouse Road

Description of Safety Issue:

The southbound right turn to westbound Dell Range Boulevard has a separate lane with a large radius to enter Dell Range Boulevard. There is no acceleration lane or taper at Dell Range Boulevard. This turning movement is currently controlled by a yield sign. The right-turn volumes are relatively low being highest in the PM peak at 77 vehicles per hour (VPH). The corresponding through movement is also low at 54 VPH. There is no crash history for this movement.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Consider combining the right turn and through movements to make the right turn movement to be under signal control and eliminate the merge. This would remove the free right turn movement and island.

Powderhouse Road to Stillwater Avenue (W)

No issues identified.



Dell Range Boulevard/Stillwater Avenue (W)

Issue: Narrow Sidewalk Width in SE Corner



Exhibit 16 Sidewalk in SE Corner of Intersection

Description of Safety Issue:

Sidewalk width in SE corner is less than 4 feet.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category II	Vulnerable User
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Widen sidewalk to provide minimum clear width of 4 feet.



Issue: Signal Pole Located in Pedestrian Path



**Exhibit 17 Pedestrian Path in Northeast
Corner of Dell Range/Stillwater
Avenue Intersection**

Description of Safety Issue:

Existing pedestrian path through the splitter island in the northeast corner of the intersection is limited to 3.5 feet width due to signal pole obstruction.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category II	Vulnerable User
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Realign concrete curb to provide minimum clear width of 4 feet.



Issue: No Pedestrian Crossing on West Leg



Exhibit 18 Looking South on West Leg of Intersection

Description of Safety Issue:

Pedestrian crossing prohibited with signage and no crosswalk provided on west leg of intersection.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category II	Pedestrians are not likely to travel out of direction to cross Dell Range
Consequence	Category II	Vulnerable users
<i>Overall</i>	<i>Category II</i>	-

Suggestion for Improvement:

- Stripe crosswalk on west leg.
- Install pedestrian signal heads and pedestrian push buttons in NW and SW corners of intersection.



Issue: Inaccessible Pedestrian Push Button



Exhibit 19 Existing Pedestrian Push Button in SE Corner of Intersection

Description of Safety Issue:

Push button in SE corner is located behind curb on a soft surface. The current location does not meet ADA Guidelines.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category II	Vulnerable user
Overall	Category I	-

Suggestion for Improvement:

Provide hard surface access to the pedestrian push buttons, extend the push button off the existing pole or relocate the push buttons to a separate pole having hard surface access.



Issue: Cracked Sidewalk in SW Corner



Exhibit 20 Cracked Sidewalk in SW Corner Looking South



Exhibit 21 Cracked Sidewalk in SW Corner Looking North

Description of Safety Issue:

The concrete sidewalk in the southwest corner of the intersection is cracked making it difficult for a person in a wheelchair to traverse.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Replace this section of concrete sidewalk.



Stillwater Avenue (W) to Driftwood Drive

Issue: Cracked Sidewalk



Exhibit 22 Cracked Asphalt Sidewalk – South Side



Exhibit 23 Pot Hole in Asphalt Sidewalk

Description of Safety Issue:

Asphalt sidewalk has pot hole and cracking allowing for water to pond. Similar conditions were seen in two other locations in this segment. This can make it difficult for wheelchair and visually impaired persons to traverse.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Replace these sections of the sidewalk.



Dell Range Boulevard/Driftwood Drive

Issue: Intersection Volume May Not Warrant Signal



**Exhibit 24 Looking West from the Northeast
Corner at Driftwood**

Description of Safety Issue:

The volume counts for the north-south approaches are generally less than 100 VPH for the five hours counted. These volumes may not meet signal warrants. The removal of the signal may reduce potential for rear-end crashes on east-west approaches.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Conduct signal warrant study to determine if the signal should be removed.



Issue: No Overhead Signal for NB Approach



Exhibit 25 Looking North from Northbound Approach

Description of Safety Issue:

The northbound approach has two side mounted signals, but no overhead signal. Table 4D-1 of the MUTCD requires a minimum of one overhead signal where there is through traffic.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Add an overhead signal face for the NB approach



Issue: Pedestrian Push Buttons Accessibility



Exhibit 26 Pedestrian Push Button in SE Corner of Intersection

Description of Safety Issue:

The pedestrian push buttons are on the mast arm support pole located in the SE corner behind a curb with a grassy strip. There is no hard surface access to the push button.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Provide hard surface access to the pedestrian push buttons, extend the push button off the existing pole or relocate the push buttons to a separate pole having hard surface access.



Issue: Sidewalk Width in SW Corner



Exhibit 27 Sidewalk Between Signal Pole and Curb



Exhibit 28 Intersection SW Corner

Description of Safety Issue:

The sidewalk width is reduced to less than 4-ft for the short section between the signal pole and the curb at the back of sidewalk. This minimum should be 4-ft for traversing by a wheelchair.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Widen sidewalk.



Issue: Sidewalk Width in SE and NE Corners



Exhibit 29 Sidewalk in SE Corner



Exhibit 30 Sidewalk in NE Corner

Description of Safety Issue:

Sidewalk width is 3'-6" from back of curb to the face of the curb at the back of sidewalk. This minimum should be 4-ft for traversing by a wheelchair.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Widen sidewalk.

Driftwood Drive to Frontier Mall Drive

No Issues Identified.



Dell Range Boulevard/Frontier Mall Drive

Issue: Sidewalk Width Near Signal Pole – SW Corner



Exhibit 31 Sidewalk Width Near Signal Pole is 3'-6"



Exhibit 32 Sidewalk Width Near Signal Pole is 3'-6"

Description of Safety Issue:

Sidewalk width is 3'-6" from back of curb to the face of the signal pole foundation. This minimum should be 4-ft for traversing by a wheelchair.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

When intersection is reconstructed, relocate signal pole to provide proper sidewalk width.



Issue: Dirt Blocking Sidewalk



Exhibit 33 Dirt Blocking Sidewalk – SW Corner



Exhibit 34 Dirt Blocking Sidewalk – SW Corner

Description of Safety Issue:

Dirt has spilled into the sidewalk reducing the effective width to less than 4-ft and creating a potential tripping hazard for pedestrians.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Have maintenance crews remove the dirt.



Issue: Accessible Ramp Slopes



Exhibit 35 **Slope of Pedestrian Ramp in SW Corner**



Exhibit 36 **Slope of Pedestrian Ramp in SW Corner**

Description of Safety Issue:

The pedestrian ramp in the southwest corner has slopes measuring between 8% and 12%. It also does not have detectable warning devices/truncated domes.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Upgrade ramp to provide slopes less than 8.3% and detectable warning devices/truncated domes.



Issue: Westbound Right-Turn Lane Width



Exhibit 37 Looking Westbound from North Sidewalk



Exhibit 38 Google Maps Aerial Photo of Westbound Right-Turn Lane

Description of Safety Issue:

Westbound right-turn lane is less than 8 feet wide. The City's design standard is 12 feet lane width. Narrow lane width can accommodate passenger cars, but large trucks will not be able to store in the lane without partially blocking the outside through lane.

The westbound right-turn volumes do not exceed 150 vehicles/hour in the midday or p.m. peak periods.



Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

In the short-term, consider striping diagonal markings that slant away from the flow of traffic in the narrow turn lane to indicate that the lane is not adequate to accommodate all sizes of turning vehicles. In the long-term, when redevelopment of adjacent parcel occurs, widen the turn lane to accommodate truck widths and turning paths, consistent with City design standards. See Section 3B.24 of the Manual on Uniform Traffic Control Devices for reference to the striping suggestion.

Frontier Mall Drive to Stillwater Avenue (E)

No issues identified.

Dell Range Boulevard/Stillwater Avenue (E)

Issue: Sidewalk Width and Slope – SW corner



Exhibit 39 Sidewalk in SW Corner



Exhibit 40 Sidewalk in SW Corner

Description of Safety Issue:

The sidewalk in the southwest corner is 3-ft wide at the accessible pedestrian ramp and slopes to the ramp measure to be 10%. Both the width and slope can make it difficult for a person in a wheelchair to traverse. It also does not have detectable warning devices/truncated domes.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-



Suggestion for Improvement:

Upgrade ramp to provide slopes less than 8.3%, a minimum of 4-ft width and detectable warning devices/truncated domes.

Issue: Accessible Pedestrian Ramp Sloped Toward ROW Line



Exhibit 41 Accessible Pedestrian Ramp in SW Corner (from south)



Exhibit 42 Accessible Pedestrian Ramp in SW Corner (from east)

Description of Safety Issue:

This ramp is nearly flat with a slight slope toward the right-of-way (ROW) line. There are two apparent issues with this ramp:

1. Drainage can pond on the sidewalk after a rainfall event blocking the sidewalk; and,
2. The flatness of the radius allows vehicles to travel over the sidewalk, as seen from the tire marks in the photos above. This poses a risk to pedestrians.

It also does not have detectable warning devices/truncated domes.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Upgrade ramp to provide appropriate slopes and detectable warning devices/truncated domes.



Stillwater Avenue (E) to Prairie Avenue/ Bluegrass Circle (W)

Issue: Water Ponding on Asphalt Sidewalk



Exhibit 43 South Asphalt Sidewalk



Exhibit 44 Water Ponding on Sidewalk

Description of Safety Issue:

Water was ponded in a depression in the sidewalk that is difficult for a visually impaired or disabled person to traverse or avoid.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Repair sidewalk to remove depression and drain to street.



Dell Range Boulevard/Prairie Avenue/ Bluegrass Circle (W)

Issue: Low Reflectivity on Southbound Approach Signage



**Exhibit 45 Southbound Approach –
Channelization Sign between
Signal Heads**



**Exhibit 46 Southbound Approach –
Channelization Sign between
Signal Heads**

Description of Safety Issue:

The lane channelization sign mounted to the mast arm between the signals has poor retro-reflectivity and is difficult to see at night. Further, the brilliance of the two LED signal heads makes the sign difficult to see at night.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Replace the sign with a ground-mounted sign in advance of the intersection.



Issue: Inaccessible Pedestrian Push Button



Exhibit 47 SW Corner – Pedestrian Push Buttons



Exhibit 48 SW Corner – Pedestrian Push Buttons

Description of Safety Issue:

The southwest corner pedestrian push buttons do not have hard surface accessibility. This could make it difficult for a physically impaired person to access.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Provide hard surface access to the pedestrian push buttons, extend the push button off the existing pole or relocate the push buttons to a separate pole having hard surface access.



Issue: South Approach - Crosswalk



Exhibit 49 Looking East from South Sidewalk



Exhibit 50 Looking West from North Sidewalk

Description of Safety Issue:

The north and south approaches provide pedestrian signals for crossing, but do not provide either a painted crosswalk for pedestrians or a stop bar to guide vehicles to stop.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Add pedestrian crosswalk pavement markings.

Prairie Avenue/ Bluegrass Circle (W) to Rue Terre

No Issues Noted.



Dell Range Boulevard/Rue Terre

Issue: Offset Intersection



Exhibit 51 Looking North from Northbound Approach

Description of Safety Issue:

Northbound approach aligns with drainage ditch on north side of Dell Range Boulevard. No guidance to avoid signal pole and ditch.

Function	Classification	Reasoning
Exposure	Category II	Moderate volume on approach
Probability	Category I	
Consequence	Category II	Head-on or off-road crash potential
<i>Overall</i>	<i>Category II</i>	-

Suggestion for Improvement:

Mount sign "Keep Right" on signal pole or separate post in north approach median facing northbound through lane approach.



Issue: Railing Bent by Truck



Exhibit 52 North Sidewalk Looking West

Description of Safety Issue:

Southbound left-turn vehicle snagged railing and bent it into the sidewalk. It is ineffective in shielding pedestrians from the drop-off to the north.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category II	Vulnerable users
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Replace or repair railing.



Issue: Missing Crosswalk on East Leg



Exhibit 53 Looking North from SE Corner



Exhibit 54 Looking South from NE Corner

Description of Safety Issue:

Pedestrian crossing prohibited with signage and no crosswalk provided on east leg of intersection.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category II	Users not likely to travel out of direction to use crosswalk
Consequence	Category II	Vulnerable users
Overall	Category II	-

Suggestion for Improvement:

- Stripe crosswalk on east leg
- Install pedestrian signal heads and pedestrian push buttons in NE and SE corners of intersection.



Issue: Inaccessible Pedestrian Push Button



Exhibit 55 NW Corner – Pedestrian Push Button Accessibility

Description of Safety Issue:

The northwest corner pedestrian push buttons do not have hard surface accessibility. This could make it difficult for a physically impaired person to access.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Provide hard surface access to the pedestrian push buttons, extend the push button off the existing pole or relocate the push buttons to a separate pole having hard surface access.



Issue: Poor Sign Retro-Reflectivity



Exhibit 56 Low Reflectivity of Channelization Sign Mounted to Mast Arm Signal Pole

Description of Safety Issue:

The channelization sign has minimal retro-reflectivity.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Replace sign.



Rue Terre to Bluegrass Circle (E)/Fire Station

Issue: Enbankment narrows sidewalk



Exhibit 57 North Side Looking East



Exhibit 58 At EB Right Turn Lane Taper to Rue Terre

Description of Safety Issue:

The embankment of the adjacent property is encroaching onto the sidewalk narrowing the traversable width to be less than 4-ft. This can make it difficult for persons in wheelchairs to traverse.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Have maintenance crews remove grass and dirt from the sidewalk. Due to the slope of the embankment, a toe wall or curbing may be needed at the back of sidewalk to prevent continual maintenance.



Issue: Sidewalk/Driveway Surface Condition



Exhibit 59 Driveway/Sidewalk north side



Exhibit 60 Driveway/Sidewalk west of Fire Station

Description of Safety Issue:

The driveway serving a dirt road to the north and behind the fire station also serves as a sidewalk. This driveway/sidewalk has become cracked and is ponding water. The joints have become uneven. Crossing this area as a pedestrian could be difficult especially if in a wheelchair.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Repair cracked concrete driveway/sidewalk. Consider extending driveway paving to the north to minimize the dirt getting onto the sidewalk.



Dell Range Boulevard/Bluegrass Circle (E)

Issue: Crosswalk on South Leg



Exhibit 61 South Approach From SW Corner

Description of Safety Issue:

No crosswalk striping or stop bar provided on south leg.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Stripe crosswalk for east-west crossing of the south leg of intersection (Bluegrass Circle)



Issue: Sidewalk curb lip to Fire Station driveway



Exhibit 62 Northwest Side of Fire Station Driveway

Description of Safety Issue:

The sidewalk terminates into the Fire Station driveway with a curb having an approximate 1" lip between the sidewalk and the driveway. This can be difficult for a person in a wheelchair to traverse.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Remove the lip in the curb between the sidewalk and the driveway.

Bluegrass Circle (E) to Walmart

No issues



Dell Range Boulevard/Walmart Access

Issue: Inaccessible Pedestrian Ramp



Exhibit 63 Northwest Corner Pedestrian Ramps



Exhibit 64 Northwest Corner Pedestrian Ramps

Description of Safety Issue:

The handicapped ramps have a curb between the roadway and the ramp. There is an approximate one inch lip between the back of curb and the ramp. This can be difficult for a person in a wheelchair to traverse. Further, some slopes to the handicapped ramp measured 10 percent exceeding the maximum of 8.3 percent. This pedestrian ramp also does not have detectable warning devices/truncated domes.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Upgrade ramp to remove the lip between the ramp and curb, provide slopes not exceeding the 8.3% maximum and provide detectable warning devices/truncated domes.



Issue: STOP Pavement Markings SB Approach



Exhibit 65 Looking South from North Approach

Description of Safety Issue:

The three lanes of the SB approach all have STOP pavement markings. These conflict with the signal indications and should be removed.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Remove STOP pavement markings.



Issue: Crosswalk on South Leg



Exhibit 66 Looking West from SE Corner of Intersection

Description of Safety Issue:

No crosswalk striping provided on south leg.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Stripe crosswalk for east-west crossing of the south leg of intersection.

Walmart Access to Grandview Avenue

No issues



Dell Range Boulevard/Grandview Avenue

Issue: Wal-Mart Westbound Queue Blocks Intersection



Exhibit 67 Google Earth Aerial of Grandview Avenue Area

Description of Safety Issue:

Grandview Avenue is a full, unsignalized intersection approximately 400 feet east of the signalized Wal-Mart entrance. It is also served by Mason Way to the north having access to the Wal-Mart entrance to the west and Converse Avenue to the east. The full access to and from this intersection is frequently blocked by queuing traffic at the Wal-Mart intersection during the mid-day and PM peak hour. Crash data shows eight SB LT crashes with WB vehicles.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Limit access at this intersection to right-in and right-out.



Grandview Avenue to Converse Avenue

Issue: North Side Sidewalk Drop-Off



Exhibit 68 North side – sidewalk drop-off at box culvert – west of culvert



Exhibit 69 North side – sidewalk drop-off at box culvert – east of culvert

Description of Safety Issue:

The sidewalk is protected from a drop-off in the immediate area of the box culvert by a chain link fence. However erosion of the soil has extended beyond the east and west limits of the fence. There is an unprotected drop-off of 4" to 6". Further, the fence has started to pull away from the posts.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Extend the limits of the fence and repair fence.



Dell Range Boulevard/Converse Avenue

Issue: East-West Left Turn Crashes



Exhibit 70 Eastbound Left-turn Vehicle

Exhibit 71 Crash Diagram for 2010-2011

Description of Safety Issue:

There have been 39 left turn crashes with 20 being injury crashes over the past five years. A majority of these crashes have been for the WB LT – 27 crashes. The WB LT movement is the higher volume of the two. Further, EB traffic has a good opportunity to be at or higher than the 40 MPH speed limit with no side friction in the EB direction. Both movements have the flashing yellow initially followed by a protected green turn signal. The protected green turn time is 15 seconds.

Function	Classification	Reasoning
Exposure	Category III	Highest volume intersection in Wyoming
Probability	Category III	High proportion of left-turn crashes in last 4 years
Consequence	Category II	Moderate to severe crashes have occurred
<i>Overall</i>	<i>Category III</i>	-

Suggestion for Improvement:

Consider making the EB and WB left turn movements protected only.



Issue: Angle crashes at intersection



Exhibit 72 Looking North from South Leg of Intersection

Description of Safety Issue:

The southbound movement has had 13 angle crashes over the past five years. This movement is the lag part of a lead/lag signal operation. The all-red clearance interval at this intersection is 1 second for all movements.

Function	Classification	Reasoning
Exposure	Category III	Highest volume intersection in Wyoming
Probability	Category III	High proportion of angle crashes in last 4 years
Consequence	Category II	Moderate to severe crashes have occurred
<i>Overall</i>	<i>Category III</i>	-

Suggestion for Improvement:

Consider increasing the all red time to 2 seconds for all movements.



Issue: North approach crosswalk



**Exhibit 73 Looking at North Crosswalk from
NE Corner**

Description of Safety Issue:

The crosswalk on the north approach no longer has any pavement markings.

Function	Classification	Reasoning
Exposure	Category II	High volume at intersection
Probability	Category I	
Consequence	Category II	Vulnerable user
<i>Overall</i>	<i>Category II</i>	-

Suggestion for Improvement:

Repaint crosswalk.



Issue: Pedestrian Signal Not Operative



Exhibit 74 Signal Pole in NE Corner

Description of Safety Issue:

The pedestrian signal in the NE corner is not operative.

Function	Classification	Reasoning
Exposure	Category II	High volume at intersection
Probability	Category I	
Consequence	Category II	Vulnerable user
<i>Overall</i>	<i>Category II</i>	-

Suggestion for Improvement:

Repair



Issue: Corner Turn Radii – NE and NW corners



Exhibit 75 Looking East at Intersection from NW Corner

Description of Safety Issue:

Turn radius in the NE corner of the intersection is small, prompting trucks to use the through lane to make the westbound right-turn movement. The US Postal Service and other businesses to the north induce heavy truck traffic at this intersection.

Function	Classification	Reasoning
Exposure	Category 1	
Probability	Category 1	
Consequence	Category 1	
<i>Overall</i>	<i>Category 1</i>	-

Suggestion for Improvement:

Enhance the turn radius of the NE corner.



Issue: Northwest Corner Pedestrian Ramp Slopes



Exhibit 76 Northwest Corner Pedestrian Ramp

Exhibit 77 Northwest Corner Pedestrian Ramp

Description of Safety Issue:

The northwest corner handicapped ramp has some slopes being 9 to 10 percent. These exceed the maximum of 8.3% for a disabled or elderly person to safely traverse. It also does not have detectable warning devices/truncated domes.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Upgrade pedestrian ramp to provide slopes of 8.3% or less and provide detectable warning devices/truncated domes for all users.

Converse Avenue to Mountain Road

No issues identified.



Dell Range Boulevard/Mountain Road

Issue: Left-Turn Movements at Mountain Road



Exhibit 78 General Area around Mountain Road

Description of Safety Issue:

Mountain Road has full, unsignalized access to Dell Range Boulevard. The RSA team observed westbound traffic queuing from Converse Avenue to east of Mountain Road in the mid-afternoon. The approximate 625-foot spacing between intersections also limits the deceleration and queue storage for the westbound left turn to Converse Avenue. This intersection has had a fatal crash involving an eastbound left-turn vehicle and three other injury crashes involving left-turns to/from Mountain Road. Left turns from Mountain Road to eastbound Dell Range Boulevard frequently required a two stage movement into the center two-way left-turn lane. As shown in Exhibit 78, there are alternatives in the existing street network for traffic to use to access Mountain Road, including Converse Ave or Windmill Road.



Function	Classification	Reasoning
Exposure	Category II	Daily queues from Converse Ave past Mountain Road.
Probability	Category I	Low frequency relative to other intersections
Consequence	Category II	One fatal crash at this location.
<i>Overall</i>	<i>Category II</i>	-

Suggestion for Improvement:

Consider making access to Mountain Road to be right-in and right-out.

Mountain Road to Windmill Road

No issues identified.

Dell Range Boulevard/Windmill Road

Issue: Signal Pole Located in Pedestrian Path



Exhibit 79 Signal Pole in NW Corner of Intersection

Description of Safety Issue:

The signal pole and foundation intrudes into the sidewalk. The distance from the back of curb to the foundation is 3-ft. This limits the ability of a person in a wheelchair to traverse this area.



Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

When the intersection is reconstructed, relocate the signal pole to provide a minimum of 4-ft clearance from the back curb.

Issue: Pedestrian Push Button Inoperative

Description of Safety Issue:

Pedestrian push button in SW corner is inoperative.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Replace or repair.



Issue: No Crosswalk Striping on North Leg



Exhibit 80 North Leg of Intersection from NW Corner

Description of Safety Issue:

No striping where pedestrian signals exist on north leg of intersection.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Stripe Crosswalk



Windmill Road to Moran Avenue

Issue: Curb Higher than Sidewalk



Exhibit 81 North Side Sidewalk



Exhibit 82 North Side Sidewalk

Description of Safety Issue:

The sidewalk in front of the “New Concept – Optical & Eyecare” has the curb higher than the sidewalk. In some locations, this separation was over 1”. This can cause pedestrians to trip.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Repair sidewalk to match back of curb.



Dell Range Boulevard/Moran Avenue

Issue: Inaccessible Push Button



Exhibit 83 Inaccessible Pedestrian Push Button in NW Corner – Looking East



Exhibit 84 Inaccessible Pedestrian Push Button in NW Corner – Looking West

Description of Safety Issue:

Push button in northwest corner is located approximately 20 feet from pedestrian ramp for east-west crossing on north leg of intersection.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Relocate pedestrian push button to a location within 10 feet of the pedestrian ramp and mount in a location accessible to all users.



Issue: Sidewalk Width Limited to 3 feet



Exhibit 85 Fire Hydrant Limiting Clear Sidewalk Width

Description of Safety Issue:

Sidewalk in northwest corner is 3 feet wide where fire hydrant limits width.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Relocate fire hydrant or construct sidewalk around the back side of the hydrant to provide a pathway with 4-foot clear width.



Issue: Cross Slope of Moran Avenue



Exhibit 86 Looking East from NW Corner at Moran Avenue

Description of Safety Issue:

On north leg of intersection, the pedestrian crossing of Moran Avenue has a cross-slope that exceeds ADA guideline of 2 percent.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Reconstruct Moran Avenue approach to provide 2 percent or less cross-slope within pedestrian crossing.



Moran Avenue to Hilltop Avenue/Friendship Circle

Issue: Cross Slope at Public Streets



Exhibit 87 Looking East at Driveway Cross-Slope at Greybull Avenue



Exhibit 88 Looking West at Driveway Cross-Slope at Sagebrush Avenue

Description of Safety Issue:

On north side of Dell Range Boulevard, the crossings at Greybull Avenue and Sagebrush Avenue have cross-slopes exceeding ADA guideline of 2 percent.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Reconstruct sidewalk to reduce cross slope to less than 2 percent.



Dell Range Boulevard/Hilltop Avenue/Friendship Circle

Issue: No Pavement Markings on Southbound Approach



Exhibit 89 Hilltop Avenue looking south



Exhibit 90 Looking east at Hilltop Avenue north approach

Description of Safety Issue:

There are no visible pavement markings at the Hilltop Avenue north approach at night. The pavement is approximately 55-ft wide with parking allowed on both sides. It is difficult to determine proper lane alignment at night.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Provide pavement markings for the north approach.



Issue: No Left Turn Sign Not Effective



Exhibit 91 Looking Northbound at Friendship Circle

Description of Safety Issue:

Drivers were observed making a northbound left-turn from Friendship Circle although a “No Left-turn” sign is posted below the stop sign.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category II	Right-angle Crashes
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Consider a raised median or increase law enforcement of the turn restriction.



Hilltop Avenue to Darnell Place

Issue: Low Reflectivity Speed Limit Signs



Exhibit 92Speed Limit sign



Exhibit 93Panel to change speed limit

Description of Safety Issue:

Several speed limit signs on Dell Range Boulevard in the westbound direction between Greybull Avenue and Ridge Road have panels riveted for the "40" on the sign. These panels have poor retro-reflectivity.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Replace signs

Dell Range Boulevard/Darnell Place

No issues identified.



Darnell Place to Ridge Road

Issue: Sidewalk Cross-Slope



Exhibit 94 Sidewalk Slope on South Side of Dell Range Boulevard

Description of Safety Issue:

Multiple driveways with cross-slope of greater than 2 percent on south side of Dell Range Boulevard, exceeding ADA guidelines.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Reconstruct sidewalk through driveways.



Issue: Dry Creek Box Culvert



Exhibit 95 North Side Box Culvert



Exhibit 96 South Side Box Culvert

Description of Safety Issue:

The edge of the box culvert has an approximate 5 ft drop off and is not protected on the north or south sides of Dell Range Boulevard. It sits 7 and 8 feet from the back of sidewalk on the north and south sides of the road, respectively.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category III	Fall into creek
<i>Overall</i>	<i>Category II</i>	-

Suggestion for Improvement:

Consider adding a pedestrian rail or guardrail on the top of the box culvert.



Dell Range Boulevard/Ridge Road

Issue: No Crosswalks on North and South Approaches



Exhibit 97 Looking West at South Approach

Description of Safety Issue:

No crosswalks are striped on north and south approaches.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Stripe Crosswalk

Issue: Short Clearance Intervals

Description of Safety Issue:

North and south approach signal phases have 3 seconds of yellow time.



Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Consider extending yellow time for all movements.

Issue: Southbound Right Turn Only sign



Exhibit 98 Southbound Ridge Road at Dell Range Blvd

Description of Safety Issue:

Sign has poor retro-reflectivity.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Replace sign.



Ridge Road to Marble Avenue

Issue: Sidewalk Cross-Slope



Exhibit 99 Sidewalk Slope on South Side of Dell Range Boulevard

Description of Safety Issue:

Multiple driveways on south side of Dell Range Boulevard have the sidewalk as part of the driveway with a cross-slope of greater than 2 percent exceeding ADA guidelines.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Reconstruct sidewalk through driveways.



Dell Range Boulevard/Marble Avenue

Issue: Extended RT lane from King Soopers Entrance to McDonalds Entrance



Exhibit 100 Looking East at McDonalds Entrance

Description of Safety Issue:

The right turn lane beginning to the east of the King Soopers entrance ending at the McDonalds entrance is approximately 700 feet. There are no pavement markings or signage indicating this lane to be right turn only.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Provide pavement markings and signage indicating a right-turn only lane for westbound traffic.



Marble Avenue to College Drive

Issue: Queue Conflicts at Boysen Avenue



Exhibit 101 Dell Range Boulevard from Marble Avenue to College Drive

Description of Safety Issue:

Dell Range Boulevard at College Drive drops and adds a lane in the eastbound and westbound directions respectively. In the PM peak hour, the RSA team observed the eastbound queue at College Avenue to back through the Marble Avenue signal a distance of approximately 725 ft. The queue blocks the full, unsignalized intersection of Boysen Avenue. The residential subdivision has access to Dell Range Boulevard at both Boysen Avenue and the signal at Marble Avenue.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
Overall	Category I	-

Suggestion for Improvement:

Consider changing the access to Boysen Avenue to be right-in and right-out.



Dell Range Boulevard/College Drive

Issue: Northbound Left-turn Capacity



Exhibit 102 Looking South at Northbound Left-turn Lane Queue

Description of Safety Issue:

16 of 26 angle crashes from 2007 through 2011 involved northbound left-turn vehicles. During the weekday p.m. peak hour, the northbound left-turn volume is the second highest volume movement (highest volume is eastbound through). During peak periods this movement queues for several hundred feet. When long queues persist, drivers are more likely to traverse intersection on yellow or run the red.

Function	Classification	Reasoning
Exposure	Category III	Second highest movement at intersection
Probability	Category II	Queues regularly back >300 feet
Consequence	Category II	Angle or turning crash potential
<i>Overall</i>	<i>Category II</i>	-

Suggestion for Improvement:

Provide more green time for northbound left-turn or construct dual left-turn lanes.



Issue: Pedestrian Signal Push Button Inoperative



Exhibit 103 Looking North on West Leg

Description of Safety Issue:

Pedestrian signal pushbuttons in SW and NW corners do not activate the pedestrian crossing phase for the west leg.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category II	Vulnerable user
Overall	Category I	-

Suggestion for Improvement:

Repair or replace pedestrian signal pushbuttons in SW and NW corners of intersection.



Issue: Curb Radius Too Small



Exhibit 104 Curb in SE Corner

Description of Safety Issue:

Northbound right-turning trucks have tracked over the curb in the SE corner of the intersection and curb is in disrepair.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Reconstruct SE corner curb and increase curb radius.



Issue: Westbound Lane Striping Missing



Exhibit 105 Looking West Toward College Drive

Description of Safety Issue:

Lane striping is worn and not visible between lanes on westbound approach.

Function	Classification	Reasoning
Exposure	Category II	High-volume intersection
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Restripe lane lines on east approach.



PRAIRIE AVENUE CORRIDOR: POWDERHOUSE ROAD TO DELL RANGE BOULEVARD

Prairie Avenue – Entire Corridor

Issue: Excess Pavement Width



**Exhibit 106 West of Frontier Mall Drive
Looking East**



**Exhibit 107 Eastbound Lanes Looking East
Near Frontier Mall Entrance
(West)**

Description of Safety Issue:

Wide shoulders are confused for travel lanes, particularly when turning right from a minor street onto Prairie Avenue. Near Frontier Mall Drive the full width of asphalt pavement is 103 feet.

Excess travel lane and shoulder width increases crossing time for minor-street vehicles turning onto or crossing Prairie Avenue. Increased crossing time requires increased minor-street approach stopping sight distance.

Function	Classification	Reasoning
Exposure	Category II	Moderate volume
Probability	Category I	
Consequence	Category II	Low for autos, high for pedestrians and bikes
<i>Overall</i>	<i>Category II</i>	-

Suggestion for Improvement:

- Restripe corridor to include buffered bike lanes, as part of a corridor-wide bike connectivity plan.
- If feasible, implement road diet to reduce curb-to-curb width in widest segments.
- Provide striping channelization in open areas of shoulder to direct vehicles into travel lane.



Issue: Curb Higher Than Sidewalk



Exhibit 108 South Side of Prairie Ave West of Transit Stop



Exhibit 109 South Side of Prairie Ave East of Lowes Access

Description of Safety Issue:

There are multiple locations along the corridor where the curb is higher than the sidewalk by as much as 1" to 2". This can create a tripping situation for persons stepping off the curb.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

As part of other improvements along the corridor, raise the sidewalk to the elevation to match the back of curb.

Prairie Avenue/Powderhouse Road

No issues identified.



Powderhouse Road to Lowes Access

Issue: Missing Sidewalk Segment



Exhibit 110 Looking East on North Side of Prairie Avenue

Description of Safety Issue:

No sidewalk is provided on the north side of Prairie Avenue between the Lowes access west to the Point Frontier development.

Function	Classification	Reasoning
Exposure	Category I	Sidewalk provided on south side
Probability	Category I	Requires pedestrians to cross Prairie to stay on sidewalk
Consequence	Category II	Vulnerable user
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

As these vacant parcels north and east of Prairie Avenue develop, construct sidewalk on north side of Prairie Avenue from Lowes access west to the Point Frontier development.



Issue: Pedestrian Access to Transit Stop



Exhibit 111 Worn pathway across median



Exhibit 112 Sidewalk and transit stop on south side of Prairie Avenue

Description of Safety Issue:

There is a transit stop on the south side of Prairie Avenue and apartments on the north side. There is an identified worn pedestrian foot path across the median of Prairie Avenue. There is not a handicapped ramp at the transit stop nor provisions for handicapped accessibility across the median.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Provide accessible pedestrian ramps with hard surface connections at the sidewalk and across the median.



Prairie Avenue/Lowes Access

Issue: Street Name Sign Missing



Exhibit 113 Looking North from the South Approach at Lowes Access

Description of Safety Issue:

Street name signs are not provided on signal mast arm to indicate Prairie Avenue for drivers on the north and south approaches.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Install street name signs on south and north approach signal mast arms, consistent with those provided at adjacent signalized intersections on Prairie Avenue.



Issue: Painted Crosswalk into Median



Exhibit 114 West Approach Crosswalk



Exhibit 115 Median at West Approach Crosswalk

Description of Safety Issue:

The west approach has a painted crosswalk crossing a raised median with 6" curb. There are no ramps or hard surface extending the crosswalk through the median. An elderly or disabled person would likely need to walk around the median nose when using the crosswalk.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

Provide accessible ramps with a connecting hard surface extending the crosswalk through the median.



Prairie Avenue/Frontier Mall Drive

Issue: Eastbound Lane Channelization



Exhibit 116 Eastbound Approach at Frontier Mall Drive



Exhibit 117 Google Maps Aerial Photo at the Frontier Mall Drive/Prairie Avenue Intersection

Description of Safety Issue:

Lane alignment at the Frontier Mall Drive intersection results in vehicle path conflicts when travelling at posted speed limit. Vehicles in the outside through travel lane on the eastbound approach may end up to the inside travel lane on the downstream side of the intersection.



Southbound left-turn vehicles turning into the inside eastbound lane may conflict with eastbound through vehicles, even if eastbound through vehicles start in the outside lane upstream of the intersection. Potential for side-swipe or rear-end type crashes.

Function	Classification	Reasoning
Exposure	Category II	Moderate eastbound volume
Probability	Category II	9 of 11 crashes in study period are angle or left-turn crashes
Consequence	Category I	
<i>Overall</i>	<i>Category II</i>	-

Suggestion for Improvement:

In the near-term consider adding lane line extensions through the intersection (see Exhibit 118) and/or realigning eastbound approach to provide short tangent section aligning drivers into their respective lanes on the downstream side of intersection. In the long-term consider reconstructing median and curb to reinforce the approach alignment.

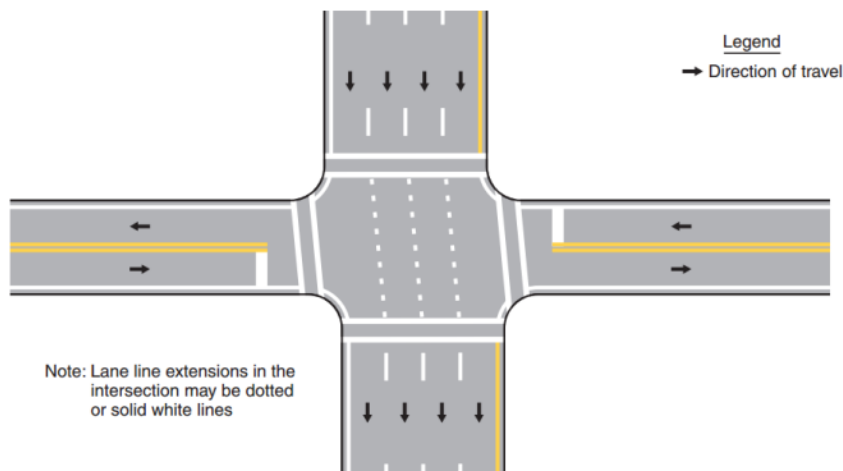


Exhibit 118 Example of Lane Line Extensions through Intersection (from MUTCD, Figure 3B-13)



Issue: Intersection geometry



Exhibit 119 Westbound Lanes at Frontier Mall Drive

Description of Safety Issue:

Intersection skew and transition of cross-section from divided to undivided (see Exhibit 119) results in wide paved area and long crossing distance.

9 crashes out of 11 reported during the study period resulted in angle or left-turn crashes. Northbound and southbound left-turns require greater gaps in major street traffic due to wide roadway.

Major-street vehicles arrive randomly due to limited access control upstream.

Function	Classification	Reasoning
Exposure	Category I	Low turning volume
Probability	Category III	Every turning movement is negatively impacted by existing geometry
Consequence	Category II	Left-turn, angle crash types
<i>Overall</i>	<i>Category II</i>	-

Suggestion for Improvement:

Suggestions include improving intersection horizontal geometry (reduce skew), reducing roadway width to reduce crossing distance, and restriping east-west lane alignment through intersection.



Frontier Mall Drive to Dell Range Boulevard

Issue: Access Management



Exhibit 120 PETCO driveway – View to left limited w/curve and parked vehicles



Exhibit 121 Multiple driveways on Prairie Avenue north of Dell Range Blvd.

Description of Safety Issue:

Horizontal curvature and multiple access points within 800 feet from Dell Range Boulevard increase



potential for turning movement and rear-end crashes. Parking and horizontal curvature along the east side of PETCO limits sight distance for drivers attempting to exit the parking lot.

Function	Classification	Reasoning
Exposure	Category I	
Probability	Category I	
Consequence	Category I	
<i>Overall</i>	<i>Category I</i>	-

Suggestion for Improvement:

To address the issues identified above, consider one or more of the following:

- providing additional cross-parcel connections;
- closing or restricting turning movements at existing access points on west side of Prairie Avenue between Kmart access and Dell Range Boulevard;
- restricting Wendy's access to right-in-right-out, if new connection can be made to Kmart parking lot; and,
- if driveway access to PETCO is kept, consider not allowing parking immediately east of the store and north of the driveway (this involves six parking spaces).

SUMMARY OF RECOMMENDATIONS

A summary of issues and suggestions is provided in Table 2.

APPENDIX

- A - Crash Diagrams
- B - Volume Data
- C - Crash Data



Table 2 Summary of Issues and Suggestions

Issue	Location	Risk Classification	Suggestion
East-west connectivity north of Dell Range Boulevard	Entire Dell Range Boulevard Corridor	Category III	Provide additional east-west collector roadway connections within ½ mile north of Dell Range Boulevard, from Powderhouse Road to Converse Avenue.
Existing median two-way left-turn lane	Entire Dell Range Boulevard Corridor	Category III	Consider changing the existing two-way left turn lane to provide raised median access control. Consider strategically located u-turn bulb outs at full or directional intersections.
East-west left-turn crashes	Dell Range Boulevard/Converse Avenue	Category III	Consider making the EB and WB left turn signalized movements protected only.
Angle crashes at intersection	Dell Range Boulevard/Converse Avenue	Category III	Consider increasing the all-red clearance interval to 2 seconds for all movements.
Travel speed	Entire Dell Range Boulevard Corridor	Category II	Conduct a speed study to document existing 85 th percentile travel speed. Reduce posted speed limit to 35 mph, if supported by speed study.
Red light running	Entire Dell Range Boulevard Corridor	Category II	Check yellow clearance intervals as compared to the WYDOT procedure. Enhance the ability for law enforcement to enforce red-light running. This could include white or blue lights directly wired into the red signal lens illuminating at the same time as the red signal.
Signalized left-turn phase sequences	Entire Dell Range Boulevard Corridor	Category II	Consider providing leading protected left-turn phasing to promote consistency along the corridor, minimize potential for driver error, and minimize potential conflicts with pedestrians.
Accessible pedestrian facilities	Entire Dell Range Boulevard Corridor	Category II	As part of other improvements to the overall corridor, pedestrian facilities can be updated to meet ADA requirements.
No crosswalk provided on west leg of intersection	Dell Range Boulevard/Stillwater Avenue (W)	Category II	Stripe crosswalk on west leg and provide pedestrian signal equipment in NW and SW corners of intersection.
Offset intersection	Dell Range Boulevard/Rue Terre	Category II	Mount sign "KEEP RIGHT" on signal pole in north approach median facing northbound through lane approach.
No crosswalk provided on east leg of intersection	Dell Range Boulevard/Rue Terre	Category II	Stripe crosswalk on east leg and provide pedestrian signal equipment in NE and SE corners of intersection.
No crosswalk on north leg of intersection	Dell Range Boulevard/Converse Avenue	Category II	Stripe crosswalk on north leg and provide pedestrian signal equipment in NW and NE corners of intersection.
Pedestrian signal in NE corner not operative	Dell Range Boulevard/Converse Avenue	Category II	Repair pedestrian signal in the NE corner.
Left-turn crashes	Dell Range Boulevard/Mountain Road	Category II	Consider restricting access to right-in and right-out only.
Dry Creek box culvert needs rail	Dell Range Boulevard: Darnell Place to Ridge Road	Category II	Consider adding a pedestrian rail or guardrail on the top of the box culvert.
Northbound left-turn capacity	Dell Range Boulevard/College Way	Category II	Provide more green time for northbound left-turn or construct dual left-turn lanes.
Excess pavement width	Entire Prairie Avenue Corridor	Category II	Restripe corridor to include buffered bike lanes, as part of a corridor-wide bike connectivity plan. If feasible, implement road diet to reduce curb-to-curb width in widest segments. Provide striping channelization in open areas of shoulder to direct vehicles into travel lane.
Lane channelization	Prairie Avenue/Frontier Mall Drive	Category II	Short-term: realign eastbound approach to provide short tangent section that aligns drivers into their respective lanes on the downstream side of intersection. Long-term: reconstruct median and curb to improve channelization and provide consistent cross-section on east and west legs.
Intersection skew	Prairie Avenue/Frontier Mall Drive	Category II	Re-align Frontier Mall Drive approaches to intersect Prairie Avenue closer to 90-degrees (reduce skew).



Issue	Location	Risk Classification	Suggestion
Countdown pedestrian signals	Entire Dell Range Boulevard Corridor	Category I	Upgrade the other signalized intersections with countdown pedestrian signals and upgrade the pedestrian push button detectors and pedestrian actuation signs for all signalized crosswalks as part of the overall corridor improvement project.
Pedestrian walk times	Entire Dell Range Boulevard Corridor	Category I	Consider increasing the Flashing Do Not Walk time for the Dell Range Boulevard crosswalks to provide for walking speed at 3.5 feet per second and a minimum of 7 second walk interval. This could be done as part of an overall corridor retiming project done with the previous speed limit reduction consideration.
Southbound channelization sign – poor retro-reflectivity	Dell Range Boulevard/Powderhouse Road	Category I	Replace sign.
SB right turn lane	Dell Range Boulevard/Powderhouse Road	Category I	Consider combining the right turn and through movements to make the right turn movement to be under signal control and eliminate the merge.
Narrow sidewalk width in SE corner	Powderhouse Road to Stillwater Avenue (W)	Category I	Widen sidewalk to provide minimum clear width of 4 feet.
Signal pole located in pedestrian path	Powderhouse Road to Stillwater Avenue (W)	Category I	Realign concrete curb to provide minimum clear width of 4 feet.
Inaccessible pedestrian push button	Powderhouse Road to Stillwater Avenue (W)	Category I	Provide hard surface access to the pedestrian push buttons, extend the push button off the existing pole or relocate the push buttons to a separate pole having hard surface access.
Cracked sidewalk in SW corner	Powderhouse Road to Stillwater Avenue (W)	Category I	Replace section of concrete sidewalk.
Cracked sidewalk in south	Stillwater Avenue (W) to Driftwood Drive	Category I	Replace section of concrete sidewalk.
Intersection volumes may not warrant signal	Dell Range Boulevard/Driftwood Drive	Category I	Conduct signal warrant study to determine if the signal should be removed.
No overhead signal for NB approach	Dell Range Boulevard/Driftwood Drive	Category I	Add an overhead signal face for the NB approach.
Inaccessible pedestrian push button	Dell Range Boulevard/Driftwood Drive	Category I	Provide hard surface access to the pedestrian push buttons, extend the push button off the existing pole or relocate the push buttons to a separate pole having hard surface access.
Sidewalk width in SW corner	Dell Range Boulevard/Driftwood Drive	Category I	Widen sidewalk
Sidewalk width in SW corner – near signal pole	Dell Range Boulevard/Frontier Mall Drive	Category I	When intersection is reconstructed, relocate signal pole to provide proper sidewalk width.
Dirt blocks sidewalk	Dell Range Boulevard/Frontier Mall Drive	Category I	Have maintenance crews remove the dirt.
Pedestrian ramp slope	Dell Range Boulevard/Frontier Mall Drive	Category I	Upgrade ramp to provide slopes less than 8.3% and detectable warning devices/truncated domes.
Narrow westbound right-turn lane	Dell Range Boulevard/Frontier Mall Drive	Category I	Short-term: consider striping diagonal markings in the narrow turn lane to indicate that the lane is not adequate to accommodate all sizes of turning vehicles. Long-term: when redevelopment of adjacent parcel occurs, widen the turn lane to accommodate truck widths and turning paths, consistent with City design standards. See Section 3B.24 of the Manual on Uniform Traffic Control Devices for reference to the striping suggestion.
Sidewalk width and slope – SW corner	Dell Range Boulevard/Frontier Mall Drive	Category I	Upgrade ramp to provide slopes less than 8.3%, a minimum of 4-ft width and detectable warning devices/truncated domes.



Issue	Location	Risk Classification	Suggestion
Accessible pedestrian ramp sloped toward ROW line	Dell Range Boulevard/Frontier Mall Drive	Category I	Upgrade ramp to provide appropriate slopes and detectable warning devices/truncated domes.
Water ponding on asphalt sidewalk	Stillwater Avenue (E) to Prairie Avenue/Bluegrass Circle (W)	Category I	Repair sidewalk to remove depression and drain to street.
Low reflectivity on southbound approach signage	Dell Range Boulevard/Prairie Avenue/Bluegrass Circle (W)	Category I	Replace the sign with a ground mounted sign in advance of the intersection.
Inaccessible pedestrian push button	Dell Range Boulevard/Prairie Avenue/Bluegrass Circle (W)	Category I	Provide hard surface access to the pedestrian push buttons, extend the push button off the existing pole or relocate the push buttons to a separate pole having hard surface access.
South approach crosswalk	Dell Range Boulevard/Prairie Avenue/Bluegrass Circle (W)	Category I	Add pedestrian crosswalk pavement markings.
Bend Railing on sidewalk	Dell Range Boulevard/Rue Terre	Category I	Replace or repair railing.
Inaccessible pedestrian push button	Dell Range Boulevard/Rue Terre	Category I	Provide hard surface access to the pedestrian push buttons, extend the push button off the existing pole or relocate the push buttons to a separate pole having hard surface access.
Low reflectivity on southbound approach signage	Dell Range Boulevard/Rue Terre	Category I	Replace channelization sign on southbound approach.
Enbankment narrows sidewalk	Rue Terre to Bluegrass Circle (E)/Fire Station	Category I	Have maintenance crews remove grass and dirt from the sidewalk. Consider toe wall or curbing at the back of sidewalk to prevent continual maintenance.
Sidewalk/driveway surface condition	Rue Terre to Bluegrass Circle (E)/Fire Station	Category I	Repair cracked concrete driveway/sidewalk. Consider extending driveway paving to the north to minimize the dirt getting onto the sidewalk.
Crosswalk on south leg	Dell Range Boulevard/Bluegrass Circle (E)	Category I	Stripe crosswalk for east-west crossing of the south leg of intersection (Bluegrass Circle).
Sidewalk curb lip to fire station driveway	Dell Range Boulevard/Bluegrass Circle (E)	Category I	Remove the lip in the curb between the sidewalk and the driveway.
Inaccessible pedestrian ramp	Dell Range Boulevard/Walmart Access	Category I	Upgrade ramp to remove the lip between the ramp and curb, provide slopes not exceeding the 8.3% maximum and provide detectable warning devices/truncated domes.
STOP pavement markings SB approach	Dell Range Boulevard/Walmart Access	Category I	Remove STOP pavement markings.
Crosswalk on south leg	Dell Range Boulevard/Walmart Access	Category I	Stripe crosswalk for east-west crossing of the south leg of intersection.
Wal-Mart Westbound Queue Blocks Intersection	Dell Range Boulevard/Grandview Avenue	Category I	Limit access at this intersection to right-in and right-out.
North Side Sidewalk Drop-Off	Grandview Avenue to Converse Avenue	Category I	Extend the limits of the fence and repair fence.
North approach crosswalk	Dell Range Boulevard/Converse Avenue	Category I	Restripe crosswalk.
Pedestrian signal not operative	Dell Range Boulevard/Converse Avenue	Category I	Repair inoperative pedestrian signal in NE corner.
Corner turn radii – NE and NW corners	Dell Range Boulevard/Converse Avenue	Category I	Enhance the turn radius of the NE corner.
Northwest corner pedestrian ramp slopes	Dell Range Boulevard/Converse Avenue	Category I	Upgrade pedestrian ramp to provide slopes of 8.3% or less and provide detectable warning Category I devices/truncated domes for all users.



Issue	Location	Risk Classification	Suggestion
Signal pole located in pedestrian path	Dell Range Boulevard/Windmill Road	Category I	When the intersection is reconstructed, relocate the signal pole to provide a minimum of 4-ft clearance from the back curb.
Pedestrian push button inoperative	Dell Range Boulevard/Windmill Road	Category I	Replace or repair.
No crosswalk striping on north leg	Dell Range Boulevard/Windmill Road	Category I	Stripe crosswalk.
Curb higher than sidewalk	Windmill Road to Moran Avenue	Category I	Repair sidewalk to match back of curb.
Inaccessible push button	Dell Range Boulevard/Moran Avenue	Category I	Relocate pedestrian push button to a location within 10 feet of the pedestrian ramp and mount in a location accessible to all users.
Sidewalk width limited to 3 feet	Dell Range Boulevard/Moran Avenue	Category I	Relocate fire hydrant or construct sidewalk around the back side of the hydrant to provide a pathway with 4-foot clear width.
Cross slope of moran avenue	Dell Range Boulevard/Moran Avenue	Category I	Reconstruct Moran Avenue approach to provide 2 percent or less cross-slope within pedestrian crossing.
Cross slope at public streets	Moran Avenue to Hilltop Avenue/Friendship Circle	Category I	Reconstruct sidewalk to reduce cross slope to less than 2 percent.
No pavement markings on southbound approach	Dell Range Boulevard/Hilltop Avenue/Friendship Circle	Category I	Provide pavement markings for the north approach.
No left turn sign not effective	Dell Range Boulevard/Hilltop Avenue/Friendship Circle	Category I	Consider a raised median or increase law enforcement of the turn restriction.
Low reflectivity speed limit signs	Hilltop Avenue to Darnell Place	Category I	Replace signs.
Sidewalk cross-slope	Darnell Place to Ridge Road	Category I	Reconstruct sidewalk through driveways.
No crosswalks on north and south approaches	Dell Range Boulevard/Ridge Road	Category I	Stripe Crosswalk.
Short clearance intervals	Dell Range Boulevard/Ridge Road	Category I	Consider extending yellow time for all movements.
Southbound right turn only sign	Dell Range Boulevard/Ridge Road	Category I	Replace sign.
Sidewalk cross-slope	Ridge Road to Marble Avenue	Category I	Reconstruct sidewalk through driveways.
Extended RT lane from King Soopers entrance to McDonalds entrance	Dell Range Boulevard/Marble Avenue	Category I	Provide pavement markings and signage indicating a right-turn only lane for westbound traffic.
Queue conflicts at Boysen Avenue	Marble Avenue to College Drive	Category I	Consider changing the access to Boysen Avenue to be right-in and right-out.
Pedestrian signal push button inoperative	Dell Range Boulevard/College Drive	Category I	Repair or replace pedestrian signal pushbuttons in SW and NW corners of intersection.
Curb radius too small	Dell Range Boulevard/College Drive	Category I	Reconstruct SE corner curb and increase curb radius.
Westbound lane striping missing	Dell Range Boulevard/College Drive	Category I	Restripe lane lines on east approach.
Curb higher than sidewalk	Prairie Avenue – Entire Corridor	Category I	As part of other improvements along the corridor, raise the sidewalk to the elevation to match the back of curb.



Issue	Location	Risk Classification	Suggestion
Missing sidewalk segment	Powderhouse Road to Lowes Access	Category I	As these vacant parcels north and east of Prairie Avenue develop, construct sidewalk on north side of Prairie Avenue from Lowes access west to the Point Frontier development.
Pedestrian access to transit stop	Powderhouse Road to Lowes Access	Category I	Provide accessible pedestrian ramps with hard surface connections at the sidewalk and across the median. Provide accessible pedestrian ramps with hard surface connections at the sidewalk and across the median.
Street name sign missing	Prairie Avenue/Lowes Access	Category I	Install street name signs on south and north approach signal mast arms, consistent with those provided at adjacent signalized intersections on Prairie Avenue.
Painted crosswalk into median	Prairie Avenue/Lowes Access	Category I	Provide accessible ramps with a connecting hard surface extending the crosswalk through the median.
Access Management	Frontier Mall Drive to Dell Range Boulevard	Category I	To address the issues identified above, consider one or more of the following: 1) providing additional cross-parcel connections; 2) closing or restricting turning movements at existing access points on west side of Prairie Avenue between Kmart access and Dell Range Boulevard; 3) restricting Wendy's access to right-in-right-out, if new connection can be made to Kmart parking lot; and, 4) if driveway access to PETCO is kept, consider not allowing parking immediately east of the store and north of the driveway (this involves six parking spaces).

Appendix A – Crash Diagrams

Appendix B – Traffic Volumes

Appendix C – Crash Data