Dell Range Boulevard Corridor Study

Powderhouse Road to College Drive

Prepared for:

Cheyenne Metropolitan Planning Organization

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AYRES ASSOCIATES

CHEYENNE MPO

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(Powderhouse Road to College Drive)

Cheyenne, WY

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Study Background

Study Area

The 2.5-mile long traffic study corridor shown in Figure 1 is located along Dell Range Boulevard between Powderhouse Road and North College Drive and includes the 0.8 mile segment of Prairie Avenue from its intersection with Powderhouse Road to Dell Range Boulevard. Land use in this corridor is mainly commercial with a large number of shopping and dining establishments at the west end of the corridor. The major traffic generators include Walmart, Sam's Club, Kmart, Target and Cheyenne's Frontier Mall.

Figure 1: Dell Range Boulevard Corridor Study Area

Project Purpose

The purpose of this study is to evaluate the existing and future traffic operating conditions and safety along the Dell Range Boulevard corridor between Powderhouse Road and North College Drive and to identify improvements to maintain acceptable traffic safety and operating conditions through the year 2040. The following is a list of objectives identified in the Dell Range Boulevard Corridor Study:

- Improve safety and efficiency of all corridor users
- Review access control to locate areas where it can be improved
- Identify improved and safer intersection designs
- Identify strategies to improve Level of Service (LOS)
- Identify short-term and long-term improvements

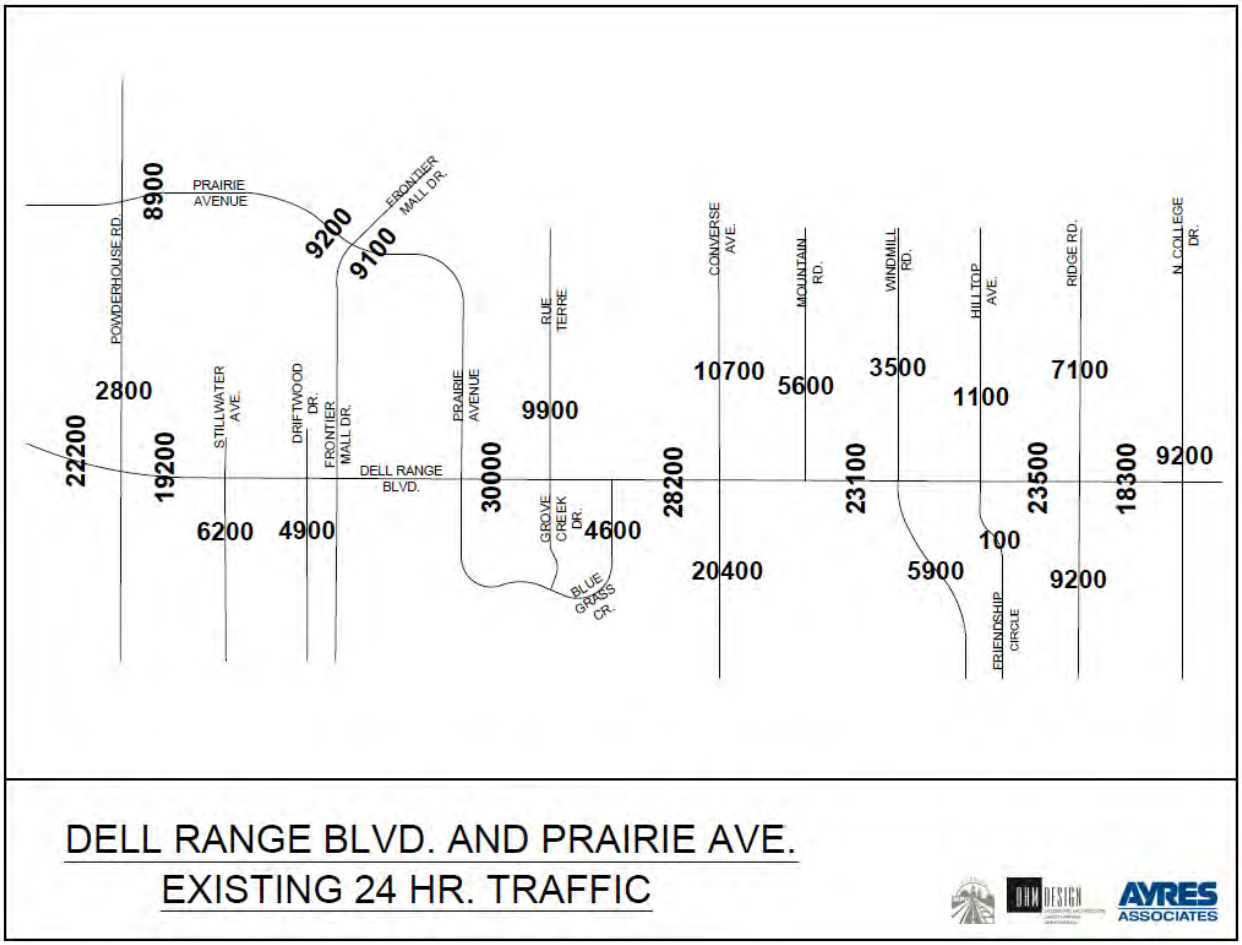
This report is organized to describe existing traffic volume patterns and safety conditions, existing traffic operation, future traffic growth and operation, long-term transportation system improvements, pedestrian enhancements, and Prairie Avenue improvements.

Existing Traffic

Traffic Volume Patterns

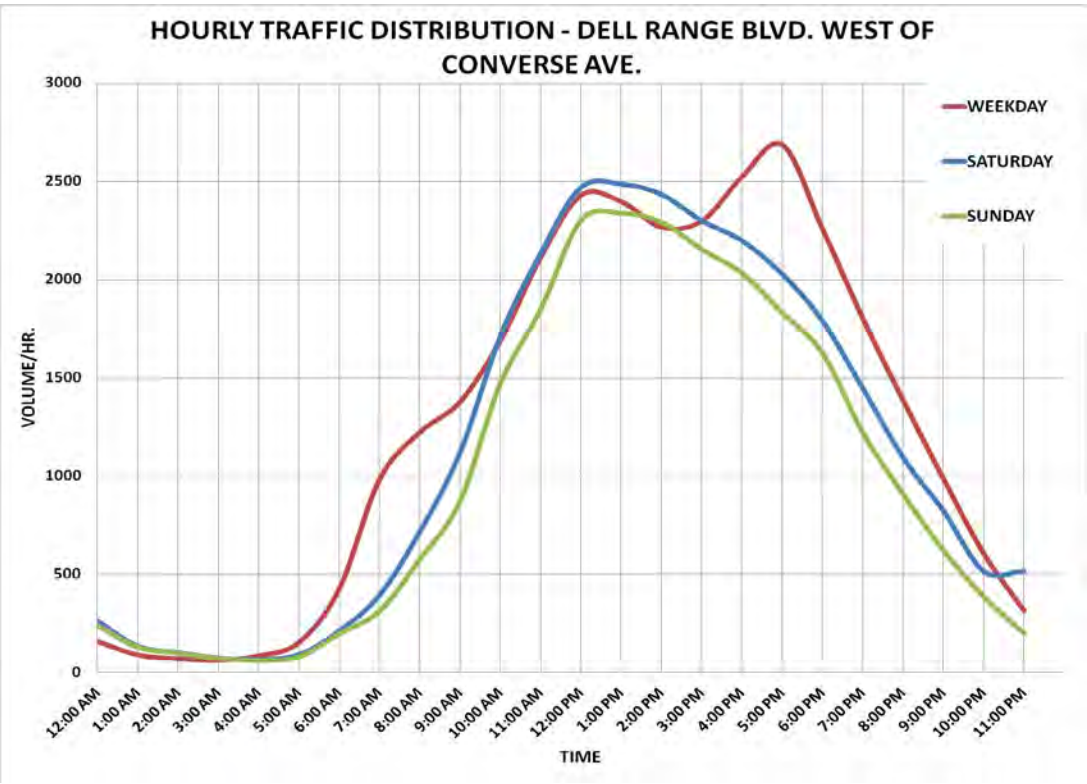
Annual average daily traffic (AADT) on Dell Range Boulevard ranges between 18,300 to 30,000 vehicles per day (vpd) as shown on Figure 2. The highest AADT is between Frontier Mall Drive and Rue Terre (middle of the corridor) with the lowest AADT occurring on the east end of the corridor between Ridge Road and North College Drive. The intersection of Dell Range Boulevard and Converse Avenue has the highest volume of traffic with 41,200 vpd entering the intersection.

Figure 2: Existing 24-Hour Daily Traffic Volumes on Dell Range Boulevard



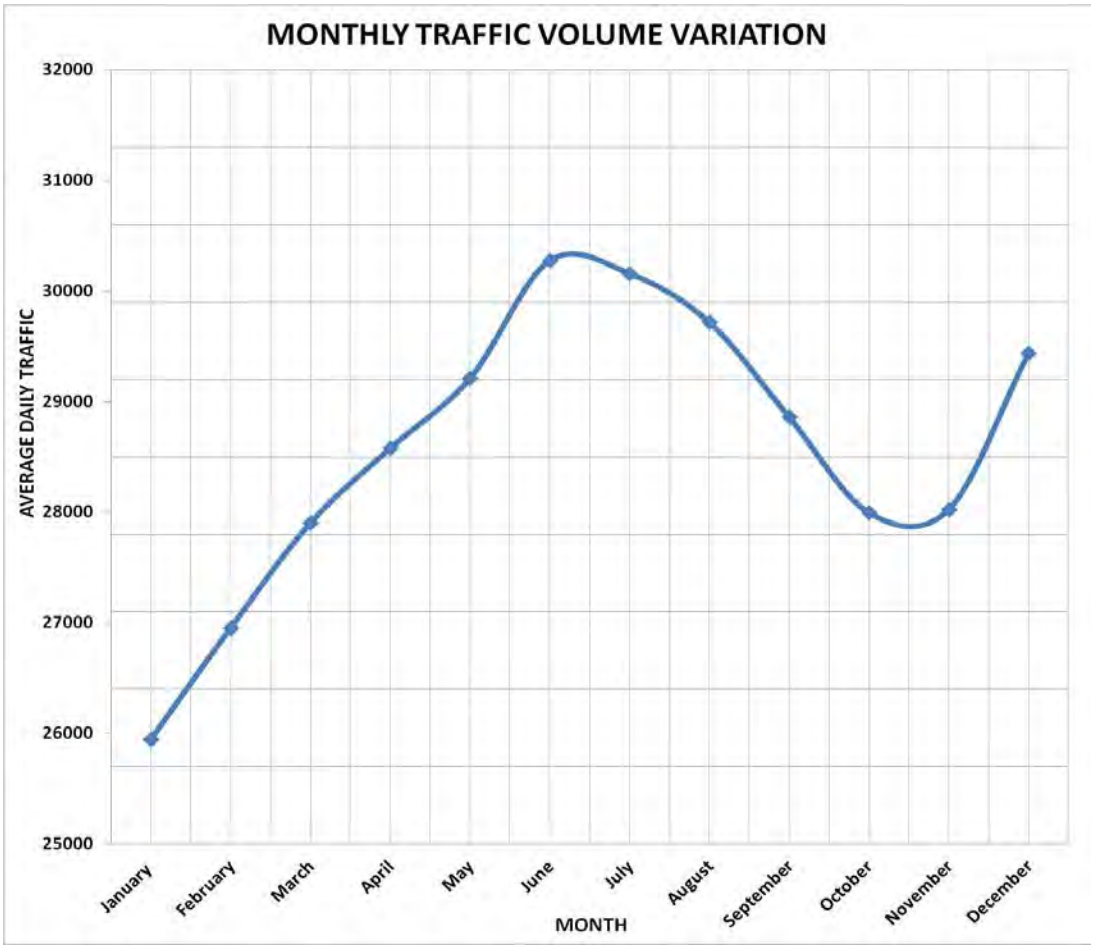
The hourly distribution of traffic on Dell Range Boulevard gradually increases throughout the day, with a midday peak of about 2,300 to 2,500 vehicles per hour (vph) during the noon to 1:00 PM time period, as shown on Figure 3. On Mondays through Fridays, traffic will continue to increase to a maximum of 2,700 vph during the 5:00 to 6:00 PM commuter peak hour. In comparison, traffic levels on typical Saturdays and Sundays slowly decrease after the noon peak hour shopping time period.

Figure 3: Typical Hourly Traffic Distribution Pattern on Dell Range Boulevard



Dell Range Boulevard experiences the highest daily volumes during the summer months of June, July, and August, and again in December, during the holiday shopping season, as shown on Figure 4.

Figure 4: Monthly Traffic Variation on Dell Range Boulevard



Detailed existing traffic volume data will be available in the 'Dell Range Boulevard Traffic Operation Supplement'.

Traffic Safety

Existing Conditions

Traffic crash data along Dell Range Boulevard between Powderhouse Road to College Drive and Prairie Avenue between Dell Range Boulevard to Powderhouse Road was reviewed over a 5-year time period between 2007 and 2011. A total of 700 crashes occurred during this time period. Of the 700 crashes reported, 510 (72%) were property damage only, 189 (27%) were injury related, and one fatality reported in 2011, as summarized in Table 1.

Table 1: Historic Crash Frequency on Dell Range Boulevard and Prairie Avenue

Historic Crash Frequency on Dell Range Blvd. and Prairie Ave.				
YEAR	**PDO**	**INJURY**	**FATALITY**	**TOTAL**
2007	121	43	0	164
2008	104	32	0	136
2009	85	45	0	130
2010	103	31	0	134
2011	97	38	1	136
TOTAL	**510**	**189**	**1**	**700**

The most common collision patterns along Dell Range Boulevard involved rear-end crashes, right-angle crashes, and angle crashes. There were 344 rear-end crashes reported (49%), 114 right-angle crashes (16%), and 101 angle crashes (14%). Other crash types exhibited along the corridor included head-on, side swipe – same direction, fixed object, side swipe – opposite direction, left-turn, and pedestrian crashes, as summarized in Table 2.

Table 2: Historic Crash Patterns on Dell Range Boulevard and Prairie Ave

Historic Crash Patterns on Dell Range Blvd and Prairie Ave		
CRASH TYPE	**TOTAL**	**Percentage**
REAR-END	344	49%
RIGHT ANGLE	114	16%
ANGLE	101	14%
OTHER/UNKNOWN	76	11%
HEAD-ON	21	3%
SIDE SWIPE - SAME	20	3%
FIXED	13	2%
SIDE SWIPE - OPPOSITE	6	1%
LEFT TURN	3	0%
PEDESTRIAN	2	0%
TOTAL	**700**	**100%**

There were several intersections with Dell Range Boulevard that reported more than 50 crashes during the 5-year time period on Dell Range Boulevard. The intersection of Converse Avenue experienced 148 crashes, College Drive had 71 crashes, Ridge Road had 69 crashes, Rue Terre had 68 crashes, and Bluegrass Circle had 50 crashes, as summarized in Table 3.

Table 3: High Intersection Crash Locations

High Intersection Crash Locations	
INTERSECTION WITH DELL RANGE BLVD.	**TOTAL # OF CRASHES**
CONVERSE AVE.	148
COLLEGE DR.	71
RIDGE RD.	69
RUE TERRE	68
BLUEGRASS CIR.	50
FRONTIER MALL DR.	36
PRAIRIE AVE.	36
WINDMILL RD.	35
STILLWATER AVE.	33
MARBLE AVE.	22
GRANDVIEW AVE.	21
POWDERHOUSE RD.	20
WALMART ACCESS	19
MOUNTAIN RD.	17
DRIFTWOOD DR.	15
HILLTOP AVE.	6
BOYSEN AVE.	4
DARRELL PL.	3
PARKVIEW DR.	2
INTERSECTION WITH PRAIRIE AVE.	**TOTAL # OF CRASHES**
FRONTIER MALL DR.	11
LOWES ACCESS	7
POWDERHOUSE RD.	7
TOTAL	**700**

Road Safety Audit

A Road Safety Audit (RSA) was completed for Dell Range Boulevard from Powderhouse Road to College Drive and along Prairie Avenue from Powderhouse Road to Dell Range Boulevard. An RSA is the formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users *(Federal Highway Administration).*The RSA Team identified and categorized intersection and corridor safety issues based on a qualitative risk scale with the following three categories:

1. Category III: Issues have potentially the greatest risk compared to other observed issues; they are associated with higher frequency and higher severity potential than other issues.
2. Category II: Issues indicate higher risk than some issues and lower risk relative to other observed safety issues.
3. Category I: Issues indicate the least risk compared to other observed issues; they are associated with low crash severity and low crash frequency potential.

(Information taken from the Road Safety Audit Report completed in June 2013)

The RSA Team identified suggestions for improving the issues at each intersection and ranked them by category. They identified 4 Category III issues, 15 Category II issues and 66 Category I issues. The majority of the issues are pedestrian related with regard to inaccessible

pedestrian push buttons, cracked sidewalks, narrow pedestrian paths, obstructed pedestrian paths, crosswalk markings, sidewalk cross slopes, and slopes at pedestrian ramps. Other issues include left-turn crashes, narrow lane widths, minimal sign reflectivity, signal timings, turn lanes, and signing.

The high priority improvements identified in the RSA involved:

- Provide additional east-west collector roadway connections within 12/2 mile north of Dell Range Boulevard between Powderhouse Road and Converse Avenue
- Change the existing two-way left turn lane to a raised median with strategically located u-turn bulb-outs at Dell Range Boulevard intersections
- Modify east and westbound left turn signalized intersection movements to protected only operation
- Increase the 'all-red' traffic signal clearance interval to 2 seconds for all movements

The following Table 4 identifies the issues, location, risk category, and improvement suggestions for the Category III and II locations:

Table 4: Summary of Category III and II Issues and Suggestions

Summary of Category II and Category III Issues and Suggestions			
Issue	**Location**	**Risk Category**	**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 85th 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 Drive	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).

Existing Traffic Operation

Traffic Operating Conditions

The following section summarizes average weekday midday and evening peak hour traffic operating conditions at the following 12 signalized intersections with Dell Range Boulevard between Powderhouse Road and College Drive.

1. Powderhouse Road
2. Stillwater Avenue
3. Driftwood Drive
4. Frontier Mall Drive
5. Prairie Avenue
6. Rue Terre
7. Walmart Drive
8. Converse Avenue
9. Windmill Road
10. Ridge Road
11. Marble Avenue
12. College Drive

The midday peak hour occurs from 12:00 to 1:00 PM, with the evening peak hour occurring during the 4:30 to 5:30 PM time period. The summary identifies existing operations, corridor operation with adjusted signal timings, and corridor operation with geometric improvements at select intersections, in addition to the signal timing adjustments.

Level-of-Service (LOS) Description

Intersection operation is typically evaluated on its Level of Service (LOS) during peak traffic volume conditions. This report summarizes the intersection operation using the LOS and 95th percentile queue length as the two measures of effectiveness (MOE's). The LOS in this report references the alphabetical ranking system of 'A' through 'F' and is graded according to the average amount of delay per vehicle. In this report, movements operating at LOS 'E' or worse are highlighted as unacceptable operational levels. Below is a description for the Level of Service for traffic entering an intersection.

Table 5: Level-of-Service Description

Level of Service (LOS)				
ALPHA LOS	NUMERIC LOS	SIGNALIZED DELAY (seconds/vehicle)	UNSIGNALIZED DELAY (seconds/vehicle)	DESCRIPTION
A	1.01 to 2.00	< 10	< 10	No Congestion, Minimal Delay
B	2.01 to 3.00	> 10 to 20	> 10 to 15	No Congestion
C	3.01 to 4.00	> 20 to 35	> 15 to 25	Minimal Congestion
D	4.01 to 5.00	> 35 to 55	> 25 to 35	Moderate Congestion
E	5.01 to 6.00	> 55 to 80	> 35 to 50	Severe Congestion
F	> 6.00	> 80	> 50	Extreme Congestion

The 95th percentile queue length represents the maximum distance that vehicles are expected to back-up at the study intersections. The operations analysis summarized in this report uses Synchro 8.0 software and the Highway Capacity Manual (HCM) 2000 outputs for LOS.

Existing and Short-Term Improvements

Midday and Evening Peak Hour Traffic Operating Conditions Summary

Table 6 and Table 7 summarize 2012 (existing) traffic operation during the weekday midday and evening peak hours. Existing corridor traffic operation, pedestrian enhancements and safety improvements include the following signal timing recommendations at all study intersections:

1. Pedestrian 'walk' times increased to 4 seconds to 7 seconds.
2. Pedestrian 'flashing don't walk' times increased to reflect pedestrian walking speed change from 4.0 ft/sec to 3.5 ft/sec.
3. Pedestrian walk times include yellow clearance interval.
4. Actuated pedestrian push buttons located at all crossings.

In addition to the above intersection signal timing changes, the following corridor operation analysis modifications are recommended:

1. Traffic signal progression coordination was created using an "actuated-coordinated" system.
2. Two coordinated signal systems were developed:
    a. Powderhouse Road to Walmart Drive – 90 second cycle length
    b. Converse Avenue to College Drive – 100 second cycle length during midday peak hour and 110 second cycle length during evening peak hour (The existing full corridor operates on a 100 second cycle length)

The analysis was conducted with the traffic signal operation recommendations described above, with eastbound and westbound left turns operating under permissive/protected lagging left-turn phasing for all intersections except at the Converse and College Drive intersections.

Table 6: 2012 Weekday Midday Peak Hour Traffic Operation

	2012 Existing		2012 Timing Adjustments		2012 Geometric Changes + Timing Adjustments	
Intersection	**Intersection LOS (Delay)**	**Number of Movements at LOS 'E' or 'F'**	**Intersection LOS (Delay)**	**Number of Movements at LOS 'E' or 'F'**	**Intersection LOS (Delay)**	**Number of Movements at LOS 'E' or 'F'**
Powderhouse Road	B (13.6)	0	B (11.6)	0	N/A	N/A
Stillwater Avenue	A (8.7)	0	A (9.3)	0	N/A	N/A
Driftwood Drive	A (6.9)	2	B (10.2)	2	N/A	N/A
Frontier Mall Drive	A (9.5)	0	A (9.3)	0	N/A	N/A
Prairie Avenue	C (20.4)	0	C (24.4)	0	N/A	N/A
Rue Terre	B (14.0)	0	A (9.7)	0	N/A	N/A
Walmart Drive	B (16.1)	0	C (20.4)	0	N/A	N/A
Converse Avenue	C (30.7)	0	D (36.4)	2	D (37.4)	0
Windmill Road	B (19.8)	0	B (11.3)	0	N/A	N/A
Ridge Road	C (20.7)	0	B (19.6)	0	N/A	N/A
Marble Avenue	B (14.8)	0	A (9.2)	0	N/A	N/A
College Drive	C (22.6)	0	D (37.9)	0	D (35.6)	0
Corridor Statistics	**EB**	**WB**	**EB**	**WB**	**EB**	**WB**
Total Stops	4,942	4,732	4,048	3,885	4,062	3,765
Average Speed (mph)	26	25	26	25	26	26
Signal Progression Bandwidth (sec):						
Powderhouse to Walmart	0	0	0	3	0	3
Converse to College	0	0	4	0	0	0

Table 7: 2012 Weekday Evening Peak Hour Traffic Operation

	2012 Existing		2012 Timing Adjustments		2012 Geometric Changes + Timing Adjustments	
Intersection	Intersection LOS (Delay)	Number of Movements at LOS 'E' or 'F'	Intersection LOS (Delay)	Number of Movements at LOS 'E' or 'F'	Intersection LOS (Delay)	Number of Movements at LOS 'E' or 'F'
Powderhouse Road	B (17.6)	1	B (14.5)	0	N/A	N/A
Stillwater Avenue	B (10.1)	0	B (15.1)	0	N/A	N/A
Driftwood Drive	A (6.4)	2	A (5.9)	0	N/A	N/A
Frontier Mall Drive	B (15.2)	0	A (9.3)	0	N/A	N/A
Prairie Avenue	C (29.3)	1	C (28.3)	0	N/A	N/A
Rue Terre	B (14.3)	1	B (14.2)	0	N/A	N/A
Walmart Drive	C (24.8)	1	C (20.7)	1	N/A	N/A
Converse Avenue	D (50.4)	4	D (50.6)	3	D (38.3)	0
Windmill Road	B (13.3)	0	B (15.1)	0	N/A	N/A
Ridge Road	C (28.9)	0	C (24.3)	2	N/A	N/A
Marble Avenue	C (20.8)	0	B (16.1)	0	N/A	N/A
College Drive	E (69.9)	6	E (60.2)	2	D (48.6)	2
Corridor Statistics	**EB**	**WB**	**EB**	**WB**	**EB**	**WB**
Total Stops	6,934	5,223	6,704	4,700	6,730	4,675
Average Speed (mph)	23	22	23	22	23	24
Signal Progression Bandwidth (sec):						
Powderhouse to Walmart	0	0	0	0	0	0
Converse to College	0	0	0	0	0	0

Note: Detailed intersection summary tables and capacity computer worksheets are included in the *Dell Range Corridor Study Technical Supplement*

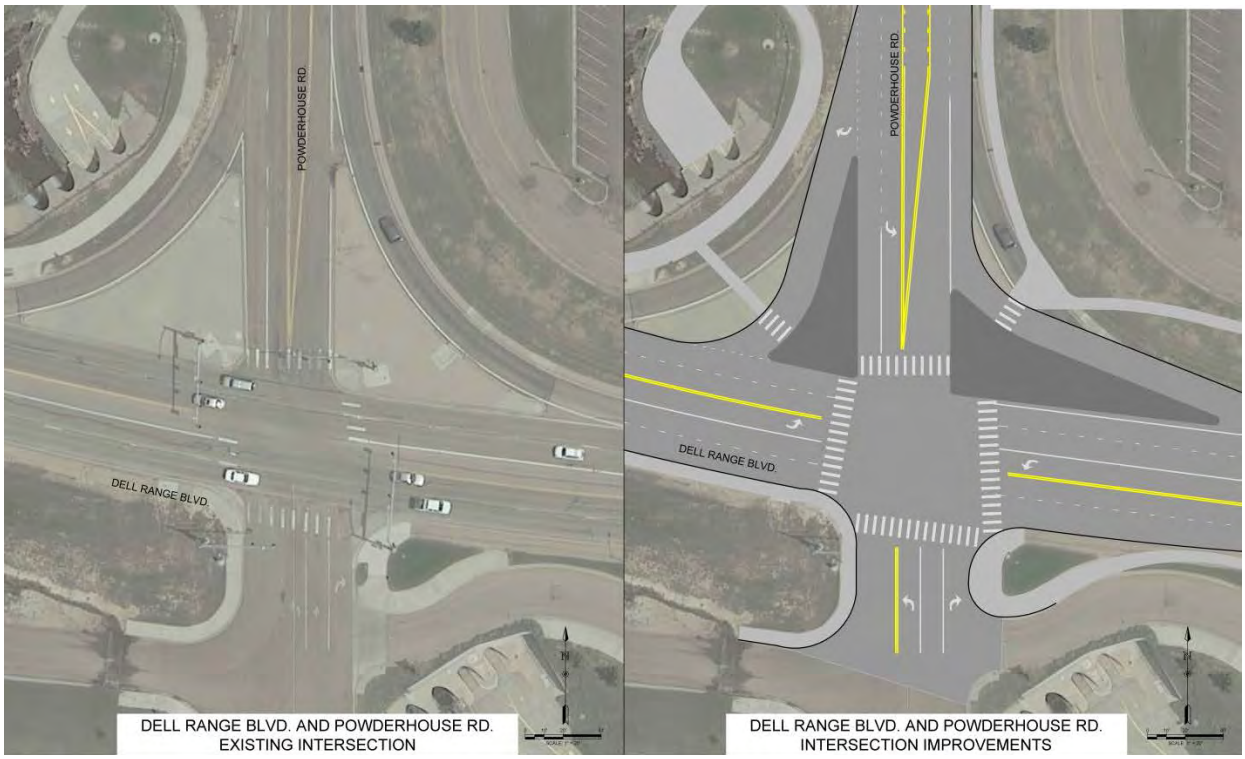
A comparison of traffic operation data shown in Table 6 and Table 7 indicates that the weekday evening peak hour experiences a significantly lower traffic level of service, with a total of two traffic movements operating at LOS 'E' or 'F' during the midday peak hour, compared to a total of 16 movements during the evening peak hour. With geometric and signal timing improvements, the number of traffic movements operating at LOS 'E' and 'F' are reduced to five during the evening peak hour. Included at the bottom of the tables are summary statistics related to the number of vehicles required to stop at the 12 Dell Range Boulevard study intersections. In total, there are 9,674 vehicles that stop at the study intersections under existing midday traffic conditions, compared to 12,157 vehicles that stop during the evening peak hour. With intersection geometric and timing improvements, the number of midday stop vehicles is reduced by 19%, to 7,827 vehicles and the number of evening peak hour stopped vehicles is reduced by 6%, to 11,405 vehicles. The tables also identify the average peak period traffic speed on the study segment of Dell Range Boulevard. During the weekday midday time period, the average speed on Dell Range Boulevard is 25 to 26 mph, while the evening peak hour speeds decrease slightly to 22 to 24 mph, due to traffic congestion documented by the increased number of traffic movements operating at LOS 'E' and 'F' conditions.

The following section of this report describes traffic operation at each study intersection for existing traffic volumes with and without intersection geometric and signal timing improvements.

1. **Powderhouse Road Intersection**

The existing intersection of Dell Range Boulevard and Powderhouse Road operates with all movements at LOS 'D' or better, with the exception of the southbound left-turn lane during the evening peak hour. This movement is expected to remain at LOS 'D' or better with the recommended signal timing adjustments. In addition to signal timing improvements, it is also recommended to reconstruct the southbound to westbound and the westbound to northbound high speed channelized right turn lanes, as shown on Figure 5, to enhance intersection pedestrian and traffic safety and tame traffic speeds on Dell Range Boulevard. The estimated cost of this improvement is $1,330,000.

Figure 5: Powderhouse Road Intersection Improvements



2. Stillwater Avenue Intersection

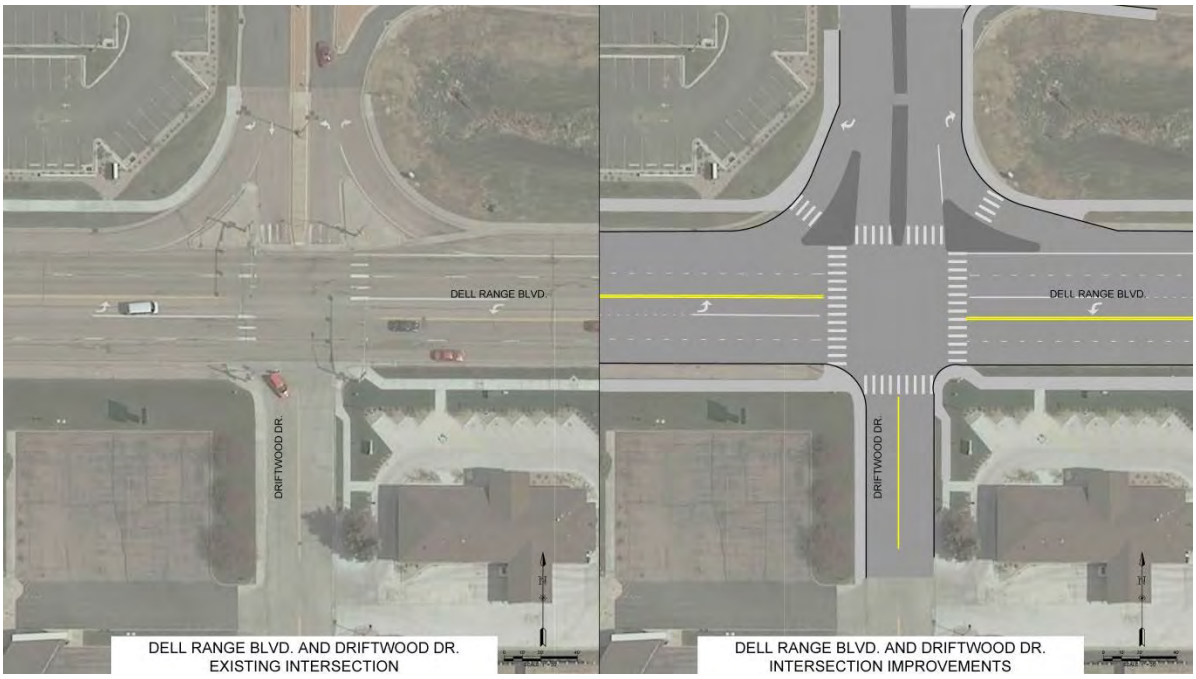
The existing intersection of Dell Range Boulevard and Stillwater Avenue currently operates will all movements at LOS 'D' or better. This operation level is expected to continue with the recommended signal timing adjustments. In addition to signal timing improvements it is also recommended to reconstruct the southbound to westbound and the westbound to northbound high speed channelized right turn lane, as shown on Figure 6, to enhance intersection pedestrian and traffic safety and tame traffic speeds on Dell Range Boulevard. The estimated cost of this improvement is $1,220,000.

Figure 6: Stillwater Avenue Intersection Improvements

3. Driftwood Drive Intersection

The existing intersection of Dell Range Boulevard and Driftwood Drive operates with the southbound shared through/left-turn lane at LOS 'E' during the midday peak hour and LOS 'F' during the evening peak hour. This operational issue is addressed by the recommended signal timing adjustments during the evening peak hour, but the LOS 'E' operation is expected to continue during the midday peak hour. In addition to signal timing adjustments, it is also recommended to reconstruct the westbound to northbound and southbound to westbound high speed channelized right turn lanes, as shown on Figure 7, to enhance intersection pedestrian and traffic safety and tame traffic speeds on Dell Range Boulevard. The estimated cost of this improvement is $490,000.

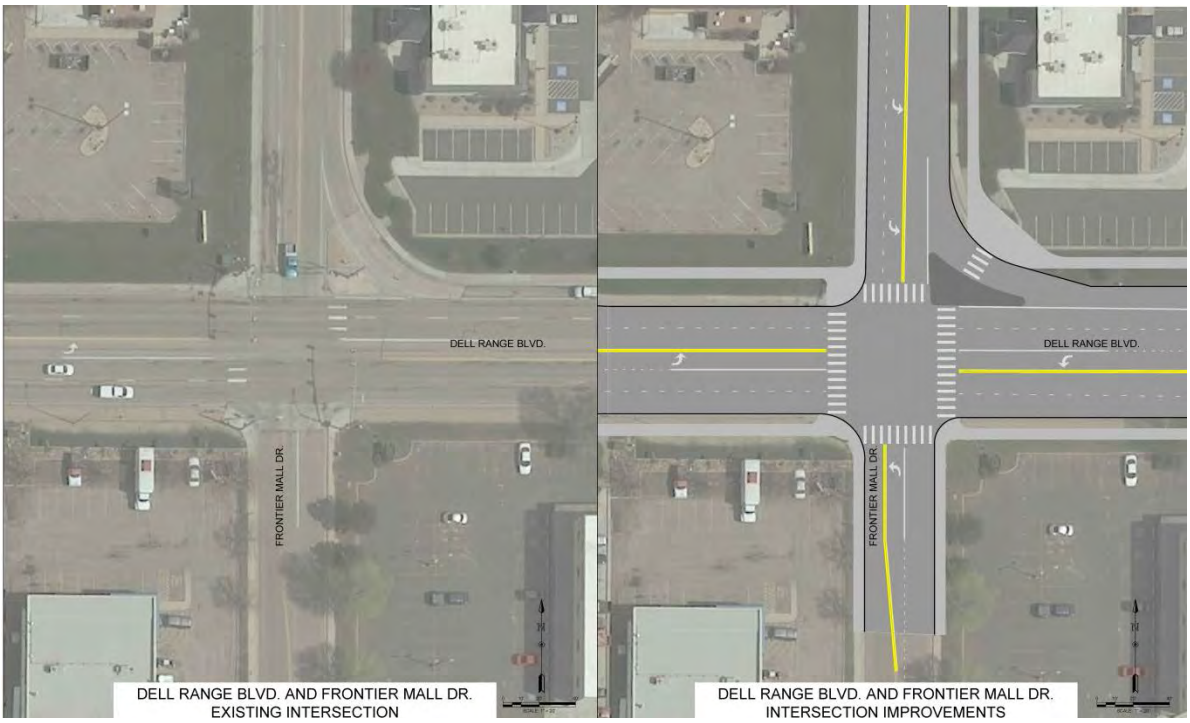
Figure 7: Driftwood Drive Intersection Improvements



4. Frontier Mall Drive

The existing intersection of Dell Range Boulevard and Frontier Mall Drive operates with all movements at LOS 'D' or better. This operation level is expected to continue with the recommended signal timing adjustments. In addition to signal timing adjustments, it is also recommended to reconstruct the westbound to northbound high speed channelized right turn lane, as shown on Figure 8, to enhance intersection pedestrian and traffic safety and tame traffic speeds on Dell Range Boulevard. The estimated cost of this improvement is $220,000.

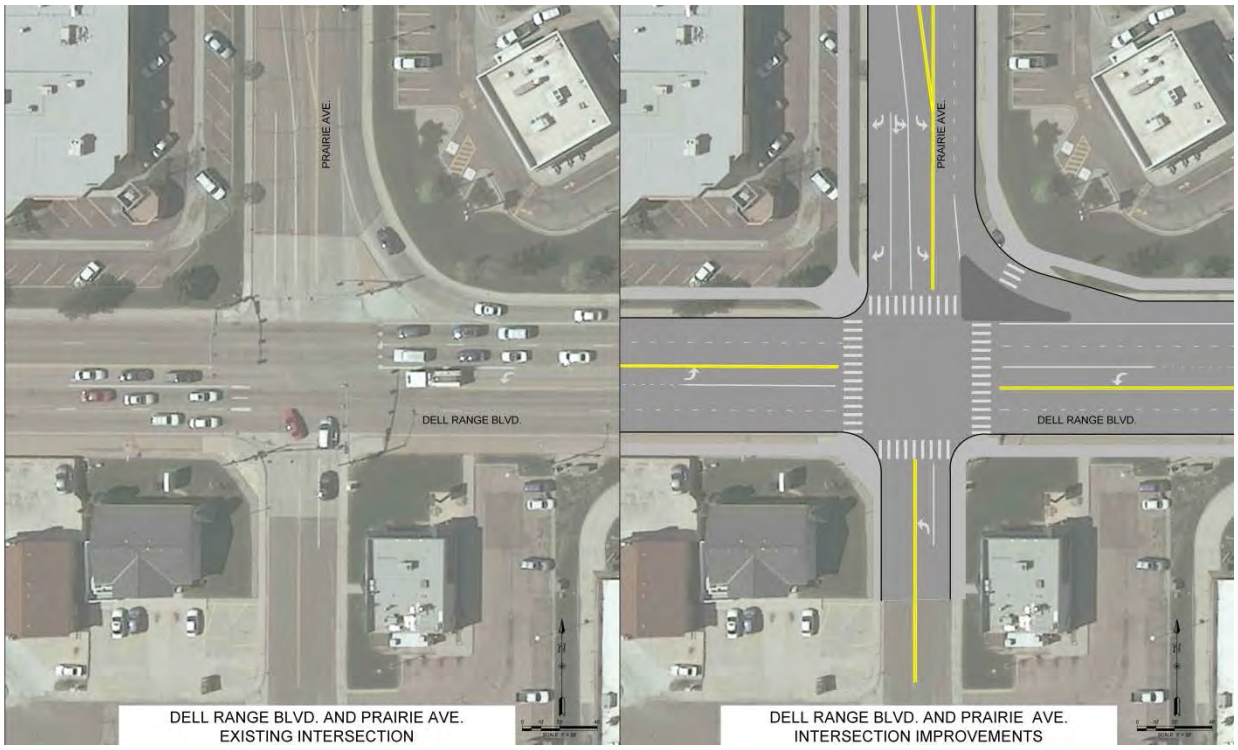
Figure 8: Frontier Mall Drive Intersection Improvements



5. Prairie Avenue Intersection

The existing intersection of Dell Range Boulevard and Prairie Avenue operates with all movements at LOS 'D' or better, with the exception of the northbound left-turn movement during the evening peak hour. This movement is expected to remain at LOS 'D' or better with the recommended signal timing adjustments. In addition to signal timing improvements, it is also recommended to reconstruct the westbound to northbound high speed channelized right turn lanes, as shown on Figure 9, to enhance intersection pedestrian and traffic safety and tame traffic speeds on Dell Range Boulevard. The estimated cost of this improvement is $1,120,000.

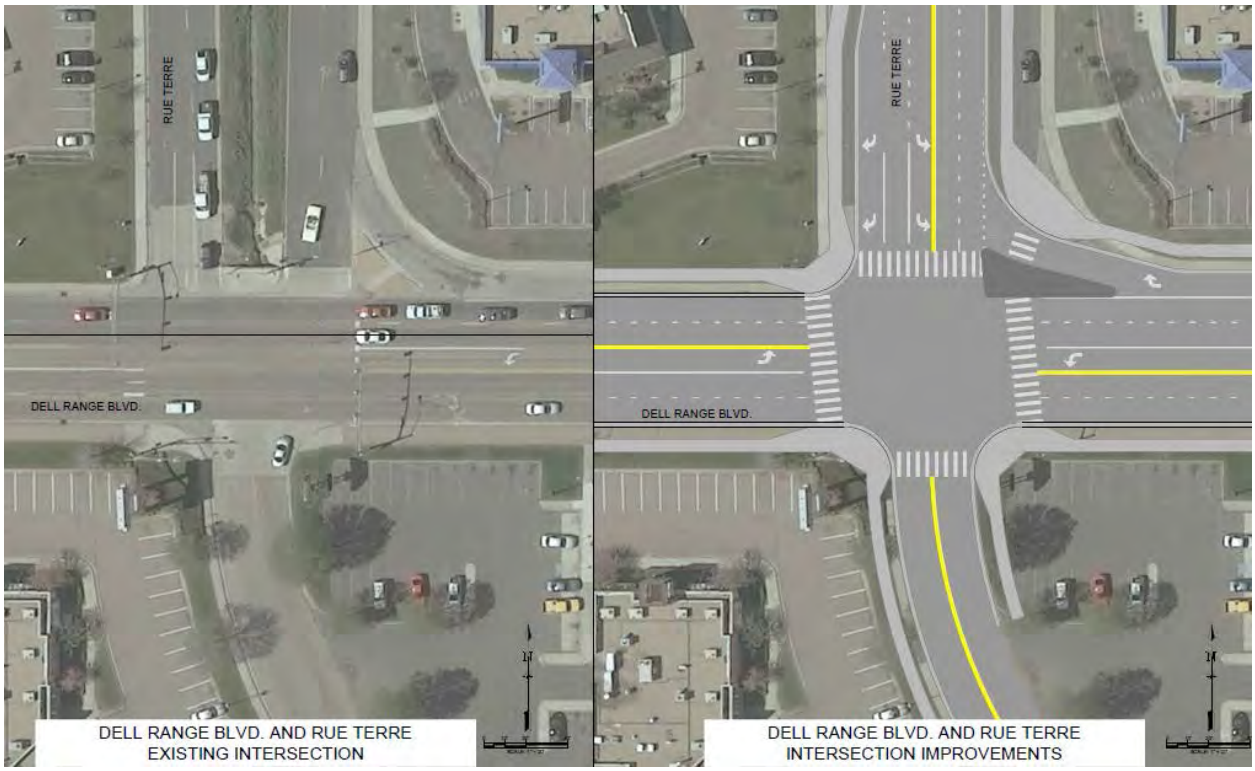
Figure 9: Prairie Avenue Intersection Improvements



6. Rue Terre Intersection

The existing intersection of Dell Range Boulevard and Rue Terre operates with all movements at LOS 'D' or better, with the exception of the southbound left-turn movement during the evening peak hour. This movement is expected to remain at LOS 'D' or better with the recommended signal timing adjustments. In addition to signal timing improvements it is also recommended to reconstruct the north leg of the intersection to improve how it aligns with the south leg by removing the median. It is also recommended to reconstruct the westbound to northbound high speed channelized right turn lane, as shown on Figure 10, to enhance intersection and traffic safety and tame traffic speeds on Dell Range Boulevard. The estimated cost of this improvement is $1,870,000.

Figure 10: Rue Terre Intersection Improvements



7. Walmart Drive Intersection

The existing intersection of Dell Range Boulevard and Walmart Drive operates with all movements at LOS 'D' or better with the exception of the westbound right-turn movement during the evening peak hour. This movement is expected to remain at LOS 'D' or better with the recommended signal timing adjustments, but the timing changes will cause the northbound left-turn movement to drop to LOS 'E' during the evening peak hour. The timing changes include the adjustment of the existing southbound permissive left-turn phasing for dual left-turn lanes to protected left-turn phasing only for enhanced pedestrian and traffic safety. It is also recommended to reconstruct the existing high speed westbound to northbound channelized right turn lane to enhance intersection pedestrian and traffic safety and tame traffic speeds on Dell Range Boulevard as shown in Figure 11. The estimated cost of this improvement is $960,000.

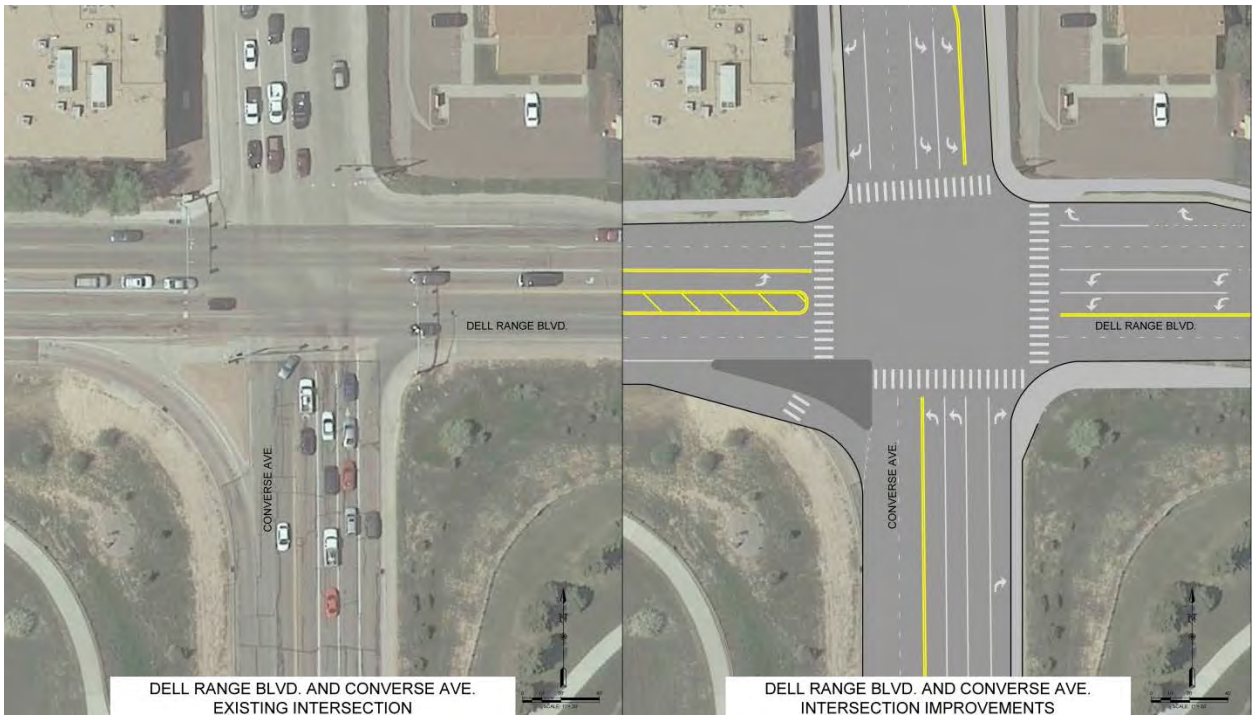
Figure 11: Walmart Drive Intersection Improvements

8. Converse Avenue Intersection

The existing intersection of Dell Range Boulevard and Converse Avenue operates with all movements at LOS 'D' or better during the midday peak hour, but with several movements at LOS 'E' or worse during the evening peak hour. These movements include the northbound left-turn, through, and right-turn movements, as well as the southbound left-turn movement. The recommended signal timing adjustments result in the westbound left-turn, northbound through, and southbound left-turn movements operating at LOS 'E' or worse during the evening peak hour and the eastbound and westbound left-turn movements at LOS 'E' or worse during the midday peak hour.

Consideration was given to the addition of a left-turn lane on the westbound and southbound approaches for additional capacity, as shown in Figure 12. With these additional lanes, the intersection can be expected to operate with all movements at LOS 'D' or better during the midday and evening peak hours. In addition to signal timing improvements it is also recommended to reconstruct the eastbound to southbound high speed channelized right turn lanes, as shown on Figure 12, to enhance intersection pedestrian and traffic safety and tame traffic speeds on Dell Range Boulevard. The estimated cost of this improvement is $2,250,000.

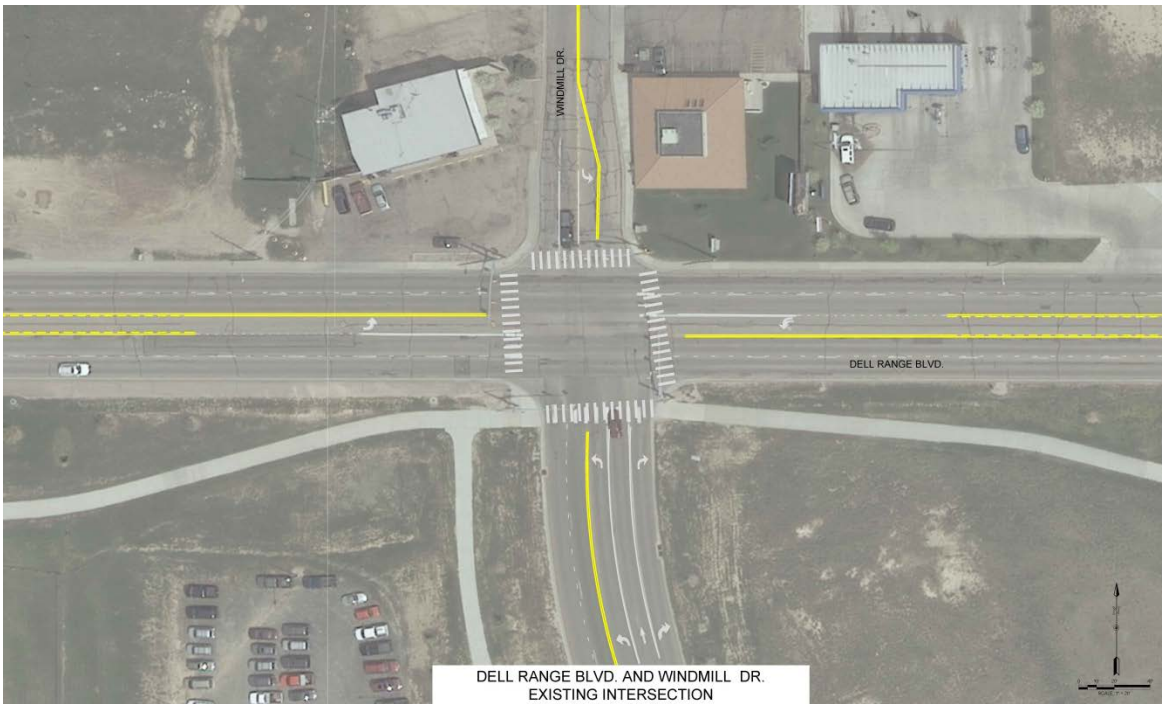
Figure 12: Converse Avenue Intersection Improvements



9. Windmill Road Intersection

The existing intersection of Dell Range Boulevard and Windmill Road operates with all movements at LOS 'D' or better. This operation level is expected to continue with the recommended signal timing adjustments. Figure 13 shows the existing condition at the Windmill Road intersection with enhanced pavement markings. There is minimal cost associated with this set of intersection enhancements.

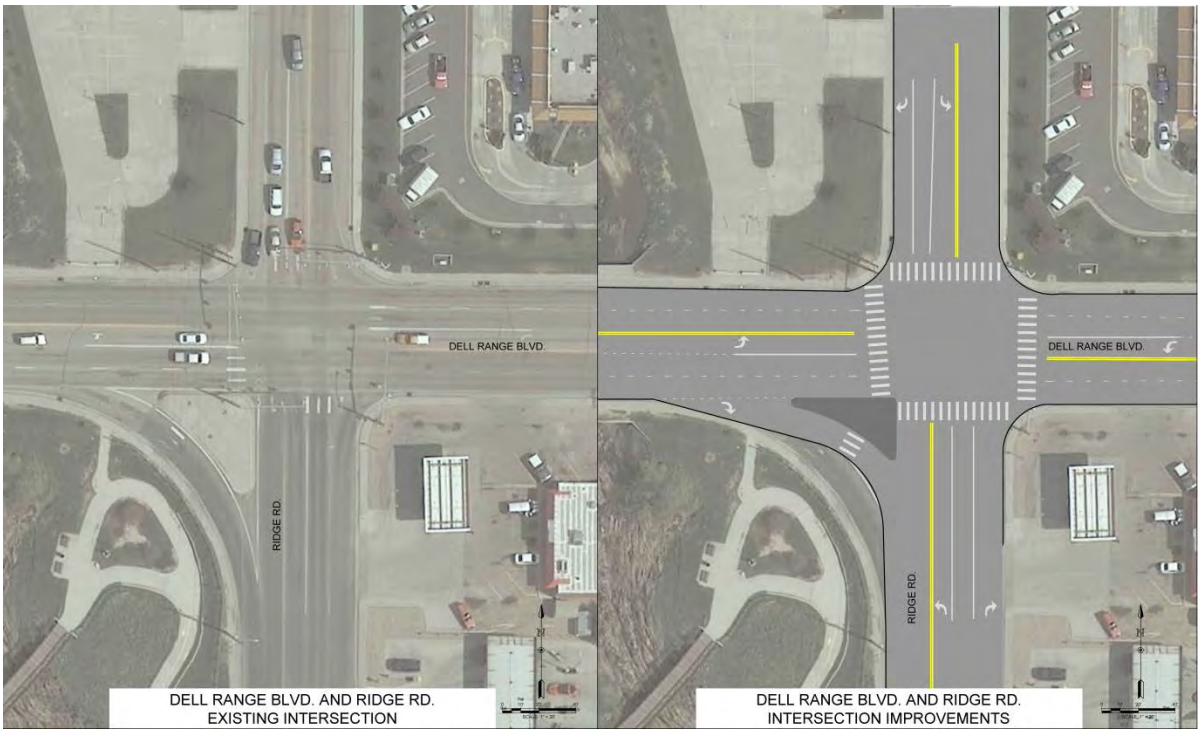
Figure 13: Windmill Road Intersection Improvements



10. Ridge Road Intersection

The existing intersection of Dell Range Boulevard and Ridge Road operates with all movements at LOS 'D' or better. The recommended signal timing adjustments are expected to cause the northbound through and southbound left-turn movements to drop to LOS 'E'. In addition to signal timing adjustments it is also recommended to reconstruct the eastbound to southbound high speed channelized right turn lane, as shown on Figure 14, to enhance intersection pedestrian and traffic safety and tame traffic speeds on Dell Range Boulevard. The estimated cost of this improvement is $230,000.

Figure 14: Ridge Road Intersection Improvements



11. Marble Avenue Intersection

The existing intersection of Dell Range Boulevard and Marble Avenue operates with all movements at LOS 'D' or better. This operation level is expected to continue with the recommended signal timing adjustments. Figure 15 shows the existing condition at the Windmill Road intersection with enhanced pavement markings. There is minimal cost associated with this set of intersection enhancements.

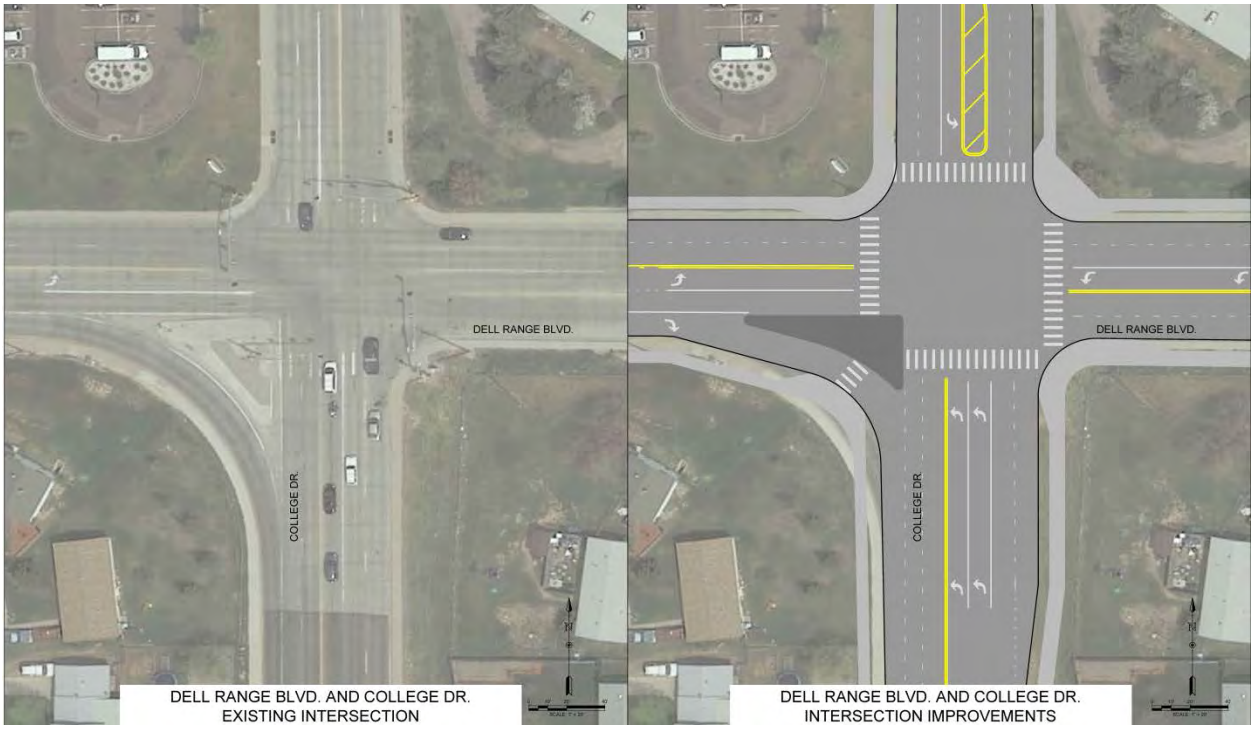
Figure 15: Marble Avenue Intersection Improvements

12. College Drive Intersection

The existing intersection of Dell Range Boulevard and College Drive operates with all movements at LOS 'D' or better during the midday peak hour and with several movements at LOS 'E' or worse during the evening peak hour. These movements include the eastbound through and right-turn lanes, the westbound left-turn and the shared through/right-turn movements, and the northbound left-turn movement. The recommended signal timing adjustments are expected to improve several of the movements during the evening peak hour, leaving only the westbound and northbound left-turn lanes at LOS 'F'.

Consideration was given to the addition of a left-turn lane in the northbound direction for additional capacity, as shown in Figure 16. With this additional lane, the northbound left-turn movement is expected to improve from LOS 'F' to LOS 'E' during the evening peak hour, with the westbound left-turn movement still at LOS 'F'. In addition to signal timing improvements, it is also recommended to reconstruct the eastbound to southbound high speed channelized right turn lanes, as shown on Figure 16, to enhance intersection pedestrian and traffic safety and tame traffic speeds on Dell Range Boulevard. The estimated cost of this improvement is $2,080,000.

Figure 16: College Drive Intersection Improvements



Additional details concerning traffic operation at each intersection are included in the *'Dell Range Boulevard Traffic Operation Supplement'* to this report.

Dell Range Boulevard Corridor Traffic Operation

There are two options to reducing the number of stopped vehicles, reduce average vehicle delays and travel speeds in the Dell Range Boulevard study corridor. The first option is to adjust intersection signal timings and cycle lengths coordinated with time-based controllers. This can be done at a relatively short time period at minimal cost. The second option is to install an adaptive traffic signal system that provides traffic detection for all intersection movements controlled by a 'Master' computer. This option is more expensive and will require a detailed implementation analysis for each intersection along the corridor. The following report section describes each of these traffic signal coordination improvements.

Traffic Progression

Intersection traffic signal coordination is recommended to improve traffic operations and decrease the probability of rear-end collisions at the study intersections. It is proposed that the study corridor provide one coordinated signal system from Powderhouse Road to Walmart Drive and a second coordinated system from Converse Avenue to College Drive. This split system is a result of a need for longer cycle lengths on the east end of the corridor due to intersection spacing and recommended timing adjustments. The initial progression analysis attempted to provide a maximized corridor bandwidth for the predominant direction of travel at the expense of traffic in the off-peak direction. It was realized that intersection delay could be reduced by improving coordination between adjacent intersections with consideration for both directions of travel. Therefore, a corridor-long progression bandwidth is not provided, but instead the progression model is designed to improve vehicle arrivals pattern between adjacent intersections in both directions of travel on Dell Range Boulevard.

The existing corridor currently operates with an estimated number of total stop vehicles of 9,674 during the midday peak hour and 12,157 stop vehicles during the evening peak hour. With the recommended signal timing changes the number of stop vehicles is expected to decrease to a midday peak hour total of 7,933 stop vehicles (an 18% reduction) and an evening peak hour total of 11,404 stop vehicles (a 6% reduction). These numbers are expected to remain relatively unchanged with the recommended lane additions at Converse Avenue and College Drive.

The average speed along the existing corridor in the eastbound and westbound directions is estimated at 26 mph and 25 mph, respectively, during the midday peak hour and 23 mph and 22 mph, respectively, during the evening peak hour. These average speeds are expected to remain unchanged with the signal timing adjustments. With the recommended turn lane additions, the westbound direction is expected to see an increase in corridor average speeds during the midday and evening peak hours to 26 mph and 24 mph, respectively.

The reduction in the number of stopped vehicles in the Dell Range Corridor and improvement in corridor travel speeds can be accomplished by providing progressive intersection signal coordination with a minimal cost from signal timing adjustments, offsets and coordination with time-based traffic signal controllers. This recommendation can be implemented in a relatively short time period.

Adaptive Traffic Signal Control System

An adaptive signal system reacts in real time to variations in traffic demand at all intersection approaches in a corridor by adjusting red, yellow and green light timings to accommodate changing traffic patterns and ease traffic congestion. The main benefits of adaptive signal control technology over conventional signal system progression systems are that it can:

- Continuously distribute green light time equitably for all traffic movements
- Improve travel time reliability by progressively moving vehicles through green traffic lights
- Reduce congestion by creating smoother traffic flow patterns
- Prolong the effectiveness of traffic signal timing operation

Case studies have documented that adaptive traffic signal control systems have been shown to:

- Reduce corridor crashes by 15-30%
- Reduce the number of stopped vehicles by 47-88%
- Reduce travel delays by 51-81%
- Reduce air pollution by 14-30%

It is recommended that a detailed implementation request be prepared to seek cost estimates for implementing an adaptive traffic control system in the Dell Range Boulevard corridor as a near-term improvement to maximize corridor capacity and safety.

Future Traffic

Traffic Growth

Future year 2040 traffic volumes along Dell Range Boulevard were projected based on a statistical analysis of historic traffic volume trends through both exponential and linear regression to identify potential increases. The regression analysis results were compared to traffic projections developed by the Cheyenne Metropolitan Planning Organization (MPO) land use/transportation demand model. Traffic was projected exponentially at a rate of 2.0% east of Powderhouse Road as shown in Figure 17 and at a rate of 1.5% east of Converse Avenue as shown in Figure 18 based on historic growth rates over the 14-year time period between 1998 and 2012. Traffic east of Powderhouse Road is expected to increase from 26,500 vpd in 2012 to 46,000 vpd in 2040 with traffic east of Converse Avenue expected to increase from 30,500 vpd in 2012 to 49,000 vpd in 2040 using the exponential method. Traffic projected linearly resulted in slightly lower traffic volumes when compared to the exponential projections. Traffic east of Powderhouse Road is expected to increase from 26,500 vpd in 2012 to 41,000 vpd in 2040 and traffic east of Converse Avenue is expected to increase from 30,500 vpd in 2012 to 41,000 vpd in 2040. In comparison, the MPO year 2040 land use/transportation demand model indicates traffic on Dell Ranger Boulevard east of Powderhouse Road will increase to 40,200 vpd.

Figure 17: Dell Range Blvd Historic and Projected Daily Traffic West of Converse Ave

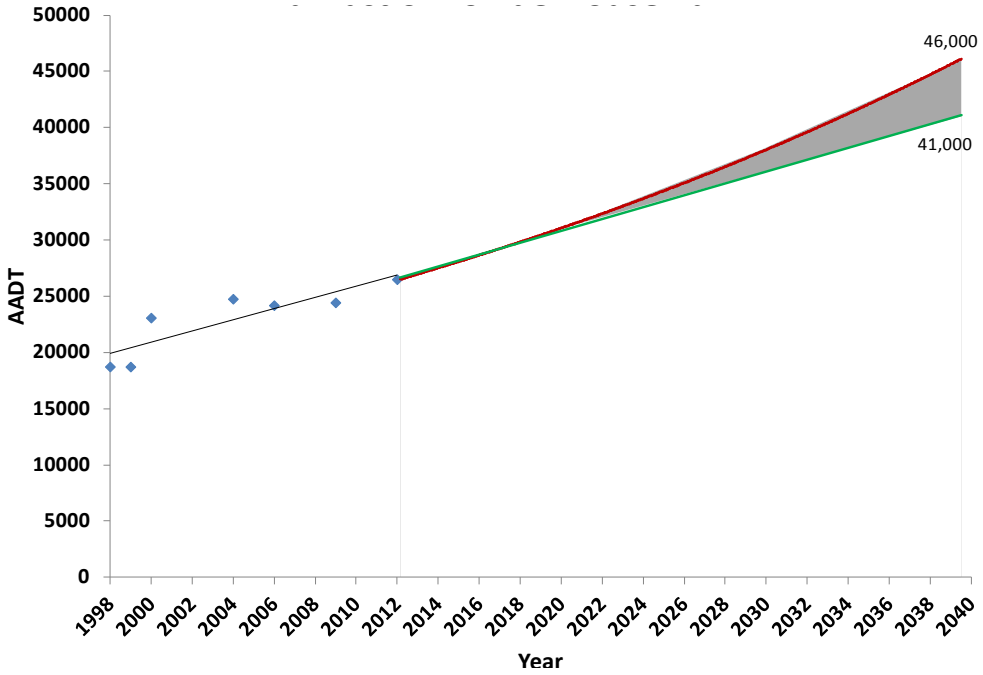
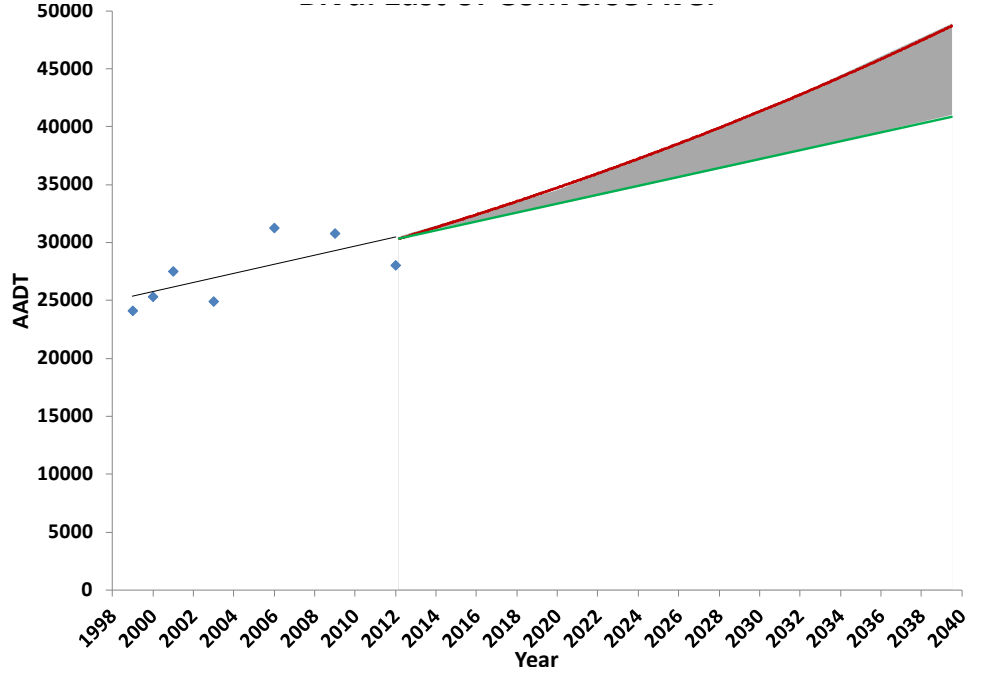
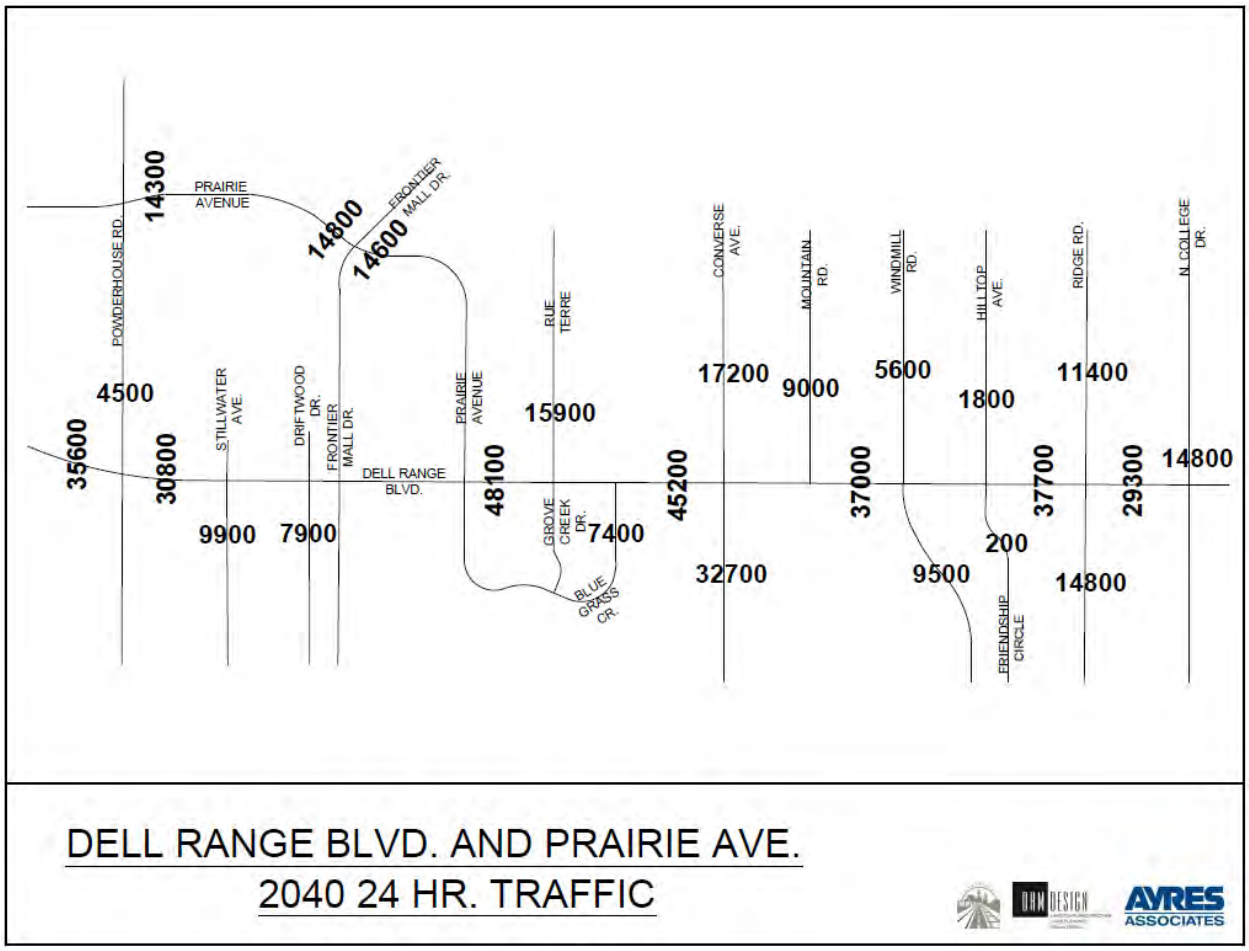


Figure 18: Dell Range Blvd Historic and Projected Daily Traffic East of Converse Ave



Based on the above traffic projection estimates it is expected that the Dell Range Boulevard corridor traffic demand will increase by the year 2040 to the 24-hour daily traffic volumes shown in Figure 19.

Figure 19: Dell Range Blvd Year 2040 Projected Average Weekly Traffic Demand



Future Traffic Operation – Signal Timing Modifications & Short-Term Geometric Improvements

A traffic analysis was completed for the projected year 2040 traffic volumes on Dell Range Boulevard between Powderhouse Road and College Drive with both the traffic signal timing and intersection geometric improvements that were previously identified for existing traffic operating conditions. The existing 4-lane cross-section with a two-way center left turn lane is designed to carry approximately 25,000 vpd at acceptable operating conditions. The existing volumes on Dell Range Boulevard are at 30,000 vpd, which is reflected in selected peak hour traffic movements operating at LOS 'E' and 'F'. The year 2040 traffic volume of 40,000 to 49,000 vpd on Dell Range Boulevard during the evening peak hour is expected to greatly exceed existing roadway capacity resulting in increased congestion, stopped vehicles, and average lower travel speeds. An analysis was not conducted for the midday peak traffic period as the evening peak hour operated significantly worse under existing conditions. Table 8 provides a summary of expected year 2040 intersection traffic level of service and corridor traffic operation statistics.

Table 8: 2040 Weekday Evening Peak Hour Traffic Operation

	2040 Geometric Changes + Timing Adjustments	
Intersection	**Intersection LOS (Delay)**	**Number of Movements at LOS 'E' or 'F'**
Powderhouse Road	E (79.1)	3
Stillwater Avenue	C (28.5)	2
Driftwood Drive	B (12.0)	2
Frontier Mall Drive	B (20.6)	1
Prairie Avenue	F (175.5)	4
Rue Terre	F (103.7)	3
Walmart Drive	F (271.6)	5
Converse Avenue	F (177.4)	8
Windmill Road	E (64.9)	3
Ridge Road	E (72.0)	8
Marble Avenue	E (13.0)	1
College Drive	F (178.6)	10

Corridor Statistics	**EB**	**WB**
Total Stops	13,026	9,799
Average Speed (mph)	5	10
Signal Progression Bandwidth (sec):		
Powderhouse to Walmart	0	0
Converse to College	0	0

In the year 2040, with the signal timing adjustments and lane additions at Converse Avenue and College Drive, all study intersections within the Dell Range Boulevard corridor are expected to operate with at least one movement at LOS ‘E’ or worse. In 2040, the total number of traffic movements operating at LOS ‘E’ or ‘F’ is 50, compared to 5 movements in the year 2012. Four of the twelve study intersections are expected to operate with an overall intersection LOS ‘E’ and five intersections at LOS ‘F’. As also shown on Figure 8, the total number of stopped vehicles is projected to increase by 100% from 11,405 vehicles in 2012 to 22,826 vehicles in the year 2040. In addition to the increased number of stopped vehicles, average traffic speeds can be expected to range between 5 to 10 mph in the year 2040, compared to 23 to 24 mph in 2012.

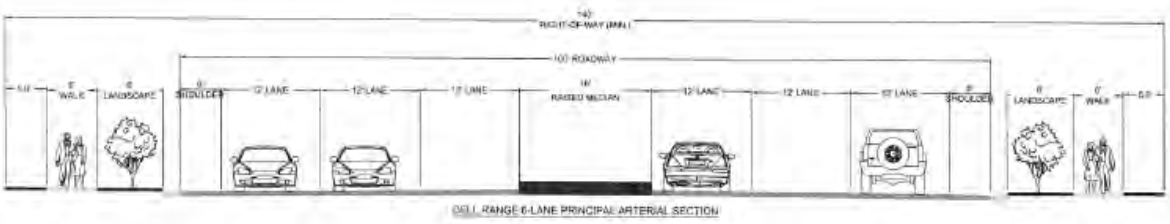
Long-Term Improvement Alternatives

There are three basic solutions to managing traffic growth on the study segment of Dell Range Boulevard. These solutions involve: 1) Increase corridor roadway traffic capacity; 2) Construct a complete street grid network; and 3) Limit area land use development.

1. Increase Corridor Roadway Capacity:

The first option to alleviate future roadway congestion and improve overall traffic operating conditions on Dell Range Boulevard, the roadway would need to be reconstructed as a 6-lane divided roadway as shown on Figure 20. The design capacity of a 6-lane divided roadway is 35,000 vpd with a maximum capacity of approximately 44,000 vpd. Initial analysis indicates that in addition to providing a 6-lane cross-section on Dell Range Boulevard, the Converse Avenue and College Drive intersections would require triple left turn lane improvements to operate above LOS 'E' during peak evening traffic periods. Widening the existing cross-section to 6-lanes would have a very high impact on local businesses within the corridor. The existing roadway right-of-way on Dell Range Boulevard is 102 feet. A 6-lane roadway, as shown in Figure 20 requires a right-of way width of 140 feet. Construction of 6-lanes on Dell Range Boulevard would require the purchase of additional right-of-way, removal of parking stalls at selected business fronting on Dell Range Boulevard and potentially require some businesses to relocate. The estimated cost of this improvement is $20,290,000. A detailed map of the right-of way impacts of widening Dell Range Boulevard to 6-lanes is attached as an Appendix to the report.

Figure 20: Dell Range Blvd 6-Lane Cross Section



2. Complete Street Network Grid

The second option is to provide area street network connectivity to reduce the need for traffic to utilize Dell Range Boulevard as their only access to existing and future corridor development. Storey Boulevard is the closet major east-west roadway located 1-mile north of Dell Range Boulevard which limits its ability to provide traffic relief to future traffic demands on Dell Range Boulevard. A collector street extension between Powderhouse Road and Converse Avenue with continuous north-south street connections between Dell Range Boulevard and Storey Boulevard has the ability to provide traffic relief for Dell Range Boulevard traffic demand as well as provide access to new development proposed for the undeveloped land between Prairie Avenue and Storey Boulevard. Existing residential development limits the ability to extend a new east-west collector roadway midway between Dell Range Boulevard and Storey Boulevard.

The Cheyenne Metropolitan Planning Organization (MPO) conducted a special land-use/transportation demand analysis for the undeveloped area located north of Dell Range Boulevard from Prairie Avenue to Storey Boulevard between Powderhouse Road and Converse Avenue. According to the Cheyenne Metropolitan Planning Organization, this area is planned for a mixed use of residential, office and commercial development. Traffic generated by this future development has the potential to increase traffic demand for Dell Range Boulevard. It is important that the new development area include a system of east-west and north-south collector street connections to Powderhouse Road, College Drive and Storey Boulevard to relieve traffic demand on Dell Range Boulevard.

The Regional land use/transportation demand model complete street network for the corridor area north of Dell Range Boulevard between Converse Avenue and Powderhouse Road is shown on Figure 21.

Dell Range Boulevard Traffic: The MPO model indicates that year 2040 traffic volumes with a complete street network will result in a maximum future traffic demand on Dell Range Boulevard of 37,000 vpd. This is a reduction of 3,000 vpd from the MPO initial year 2040 projection of 40,000 vpd.

Figure 21: Complete Street Network

Section 20 Street System Design: UNDER PREPARATION

3. Limit Future Development

The final option to managing traffic growth on the study segment of Dell Range Boulevard is to limit the amount and type of future development in the undeveloped areas adjacent to the Dell Range Boulevard corridor. As previously described, traffic growth is directly related to the number of trips generated by new development or redevelopment of existing land uses. Much of the land located north of Dell Range Boulevard is currently undeveloped. Zoning changes to limit the type of development in the area north of Dell Range Boulevard could reduce traffic growth on Dell Range Boulevard. Examples of high evening peak hour traffic generating land uses include office and restaurant development with retail/commercial developments being high generators of Saturday traffic activity. Examples of low traffic generator development categories include agriculture, light manufacturing, residential, hospitals, churches, parks, schools and automobile dealerships.

Based on the negative property impacts and cost of reconstructing Dell Range Boulevard to a 6-lane divided roadway it is recommended to pursue implementing a complete street grid network in Section 20 north of Prairie Avenue along with limiting the number of high peak hour traffic generators in the undeveloped lands of Section 20.

Pedestrian System Enhancements

The *On-Street Bicycle Plan and Greenway Plan Update* (2012) discusses the need for a connection across Dell Range Boulevard between two sections of existing greenway: the northern portion of the Converse Greenway to Dutcher Fields and existing greenways on the south side of Dell Range Boulevard. Connecting these greenway segments will require pedestrians and bicyclists to cross Dell Range Boulevard. The *On-Street Bicycle Plan and Greenway Plan Update* identifies the preferred alignment of the greenway as a route on the west side of Converse Avenue with an at-grade crossing of Dell Range Boulevard shown as Option 1 on Figure 22.

Figure 22: Greenway Plan for Dell Range Blvd Crossing at Converse Ave – Option 1

This location creates a high pedestrian/traffic conflict area. For an at-grade greenway crossing at this location, consideration should be given to the construction of a pedestrian refuge island on Dell Range Boulevard due to the wide crossing width of Dell Range Boulevard. Under this option it is also recommended that the existing high speed eastbound to southbound channelized right turn lanes be reconstructed as previously shown in the Intersection Improvement Figures above. Finally, a pedestrian crossing at this location with traffic signal timing modifications that include an advance pedestrian 'Walk' time, adjustment of the pedestrian walk time to 3.5 feet per second and installation of pedestrian countdown timers with pedestrian actuated signals is recommended. The estimated cost of this improvement is $630,000. The benefits of this at-grade crossing are the cost savings over a grade-separated crossing and the connectivity to existing sidewalks along Dell Range Boulevard. However, a grade-separated crossing provides a safer alternative for greenway users.

The safest option for crossing this multi-lane arterial roadway is a grade-separated structure. However, grade-separated structures require significant capital investment. An alternative to a grade separated structure (bridge) is to construct an underpass of Dell Range Boulevard. Both

Figure 23 (Option 2) and Figure 24 (Option 3) show a future underpass located east of the existing multi-cell box culvert for the Dry Creek crossing of Dell Range Boulevard. This location was chosen because it allows the greenway to take advantage of the existing topography near Dry Creek, requiring less earthmoving associated with construction of the underpass. Option 2 requires a pedestrian bridge over Dry Creek north of Dell Range Boulevard at an estimated cost of $940,000, whereas Option 3 requires an extension to the existing box culvert that would widen the sidewalk along Dell Range Boulevard, on top of the culvert to accommodate the greenway width at an estimated cost of $832,000. This is an attractive option because it allows the greenway path to be connected to the existing sidewalk along Dell Range Boulevard; this connection has been requested by greenway users in many greenway public input meetings. A new underpass is suggested for the structure, rather than widening the existing structure. The existing structure is not tall enough to be used as a pedestrian box culvert. Placing the new culvert alongside the existing culvert would make it difficult to keep the culvert dry. The new structure would be placed to the east of the existing box culvert, keeping the new structure out of the riverine environment of Dry Creek. Additionally, the existing structure is placed at a skew, which increases the pedestrian crossing underpass distance. A new structure would be placed perpendicular to the roadway, shortening the length of the box culvert and reducing construction costs.

Figure 23: Greenway Underpass Option 2

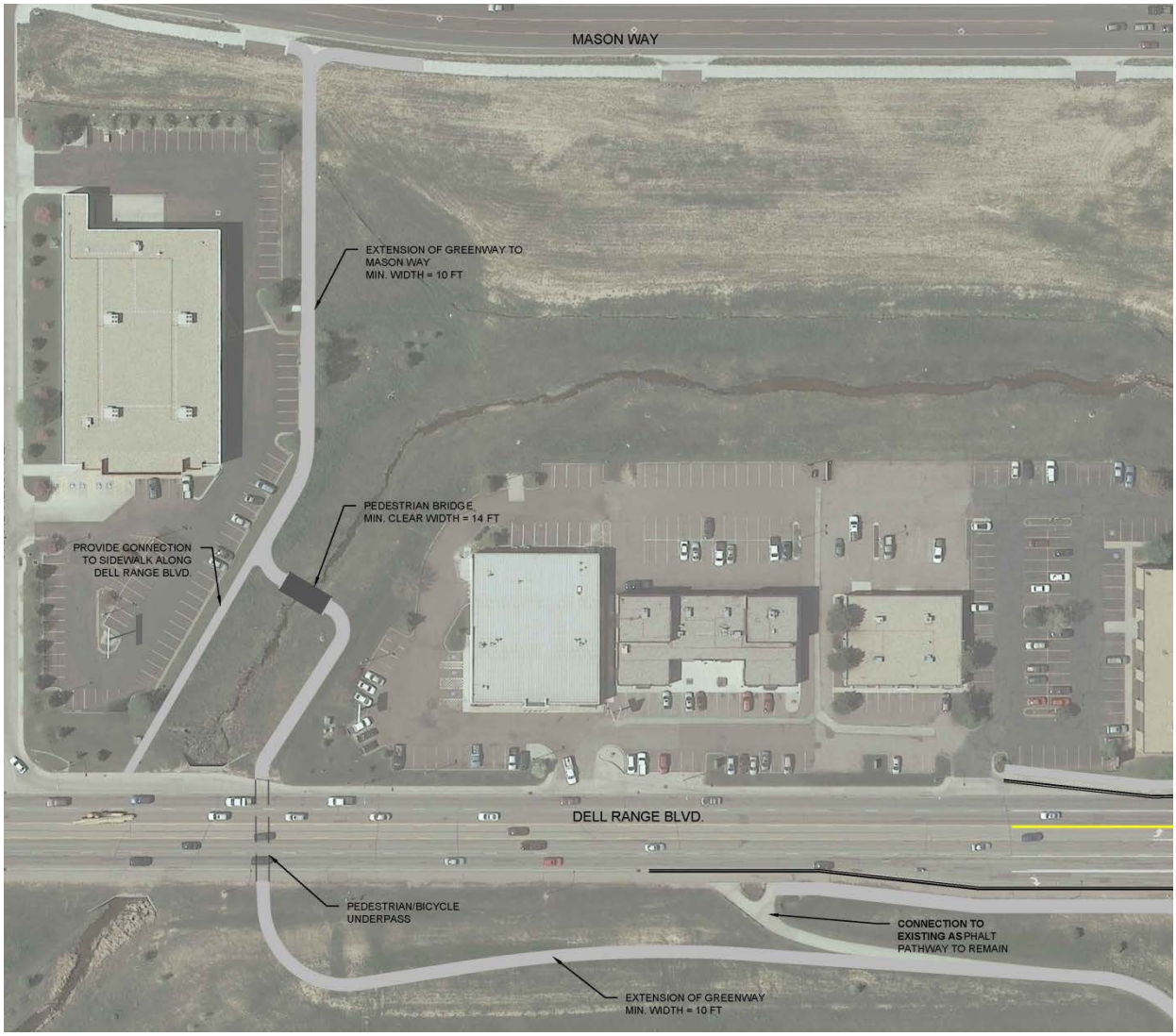
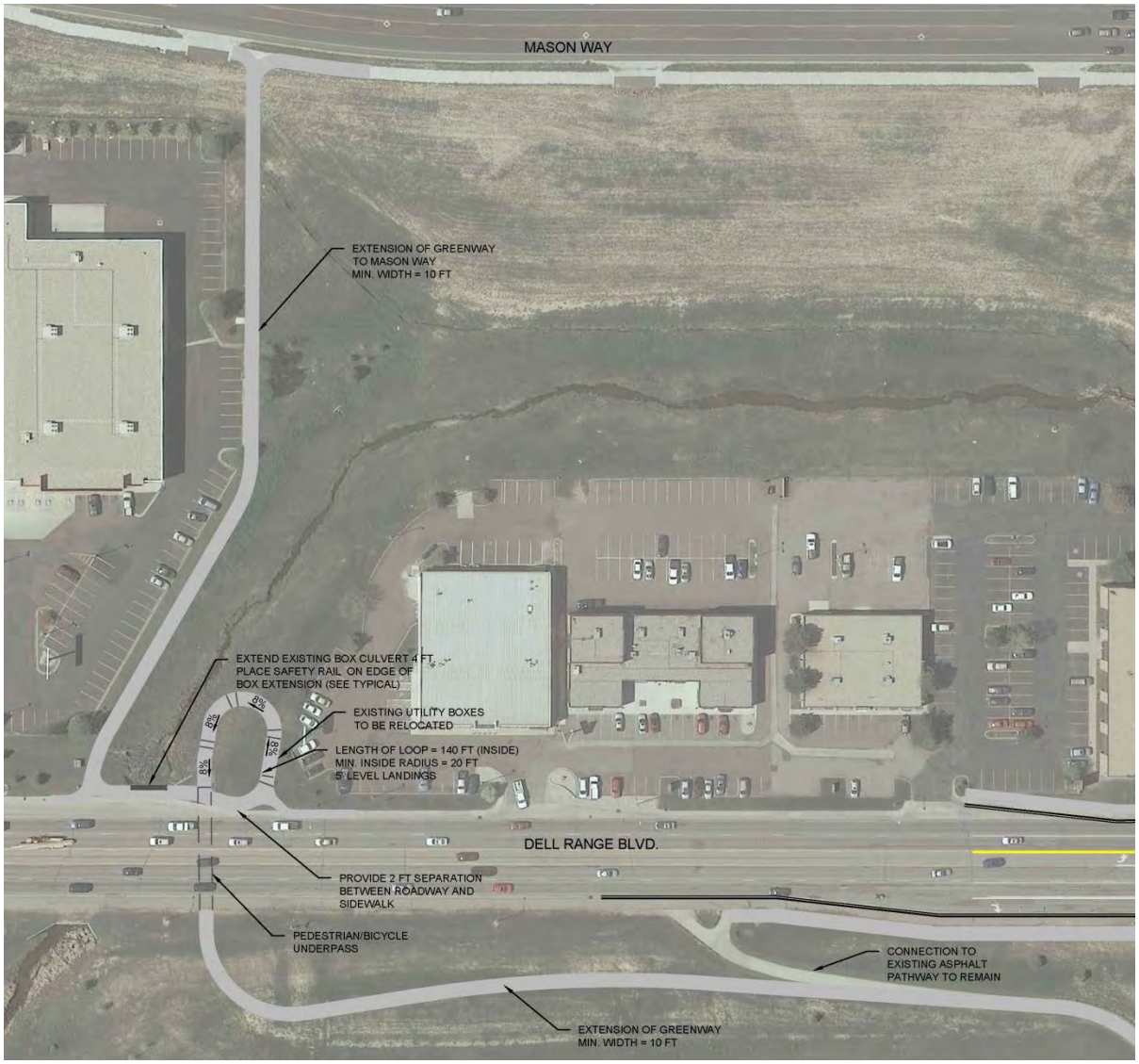


Figure 24: Greenway Underpass Option 3



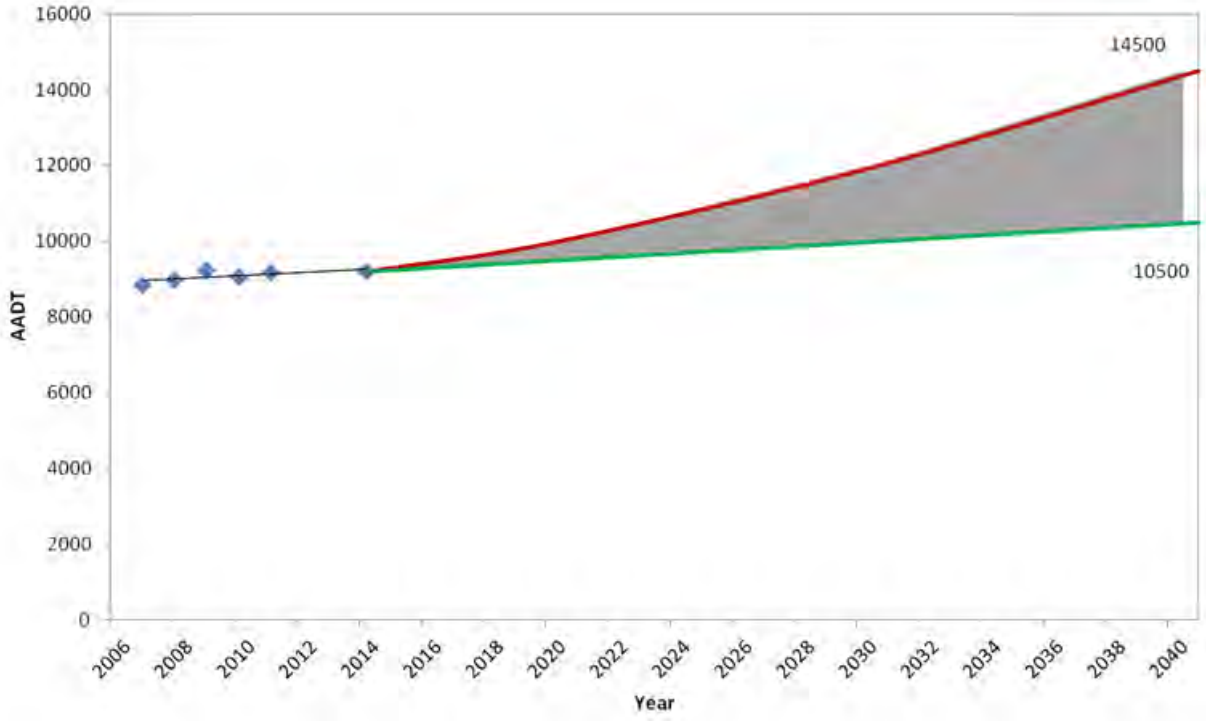
Based on the three Greenway path options for crossing Dell Range Boulevard in the vicinity of Converse Avenue it is recommended to construct Option 2.as providing the safest pedestrian and bicycle crossing of Dell Range Boulevard.

Prairie Avenue Improvement Alternatives

Prairie Avenue is classified as a minor arterial street with an average existing weekday traffic volume of that ranges between 9,200 to 9,500 vpd. As shown on Figure 25, daily traffic levels on Prairie Avenue have been relatively level over the past 7 years. Daily traffic volumes on Prairie Avenue are projected in this study to increase to a range of 10,500 to 14,800 vpd by the year 2040, as shown on Figure 25. This is projection is consistent with the Cheyenne Metropolitan Planning Commission land use/transportation demand model projections based on a Section 20 development pattern with minimal arterial or connector street improvements north

of Prairie Avenue. Section 20 is located north of Prairie Avenue to Story Boulevard between Powderhouse Road and Converse Avenue.

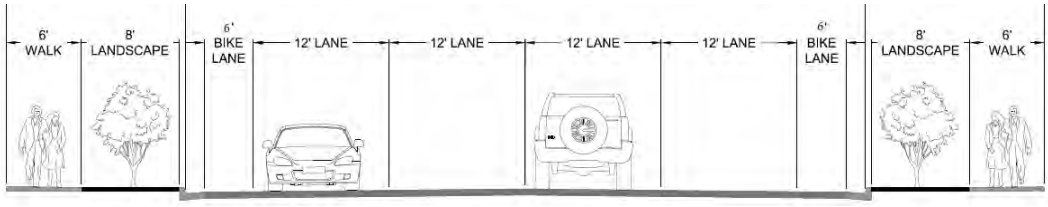
Figure 25: Prairie Ave Historic and Projected Daily Traffic West of Frontier Mall Dr



The existing roadway has a total of four travel lanes (two lanes in each direction) with wide shoulders and a median on a 120 foot right-of-way. The median serves as a storm water drainage channel beginning east of Powderhouse Road, carrying through to Frontier Mall Drive. South of Frontier Mall Drive, the roadway width of Prairie Avenue narrows, with the median replaced by a two-way center left-turn lane. Several improvement alternatives have been considered for Prairie Avenue and are summarized below.

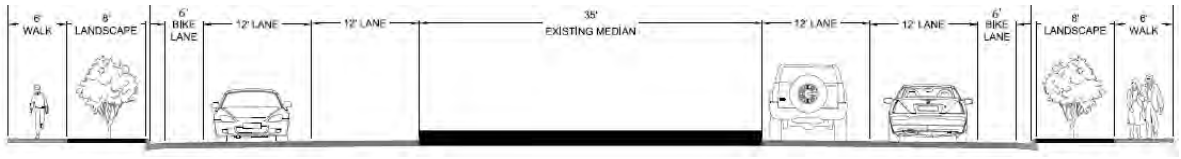
1. 4-Lane Roadway without a Median
   Under this alternative, the existing median on Prairie Avenue is eliminated and replaced with a yellow centerline pavement marking. The four 12-foot wide travel lanes are maintained. A five foot wide bike lane is added in each direction, along with an eight foot wide landscape buffer area and six foot wide sidewalks, as shown on Figure 26. The total right-of-way required for the alternative is 100 feet. The traffic design capacity of this alternative is 17,000 vpd. East of Frontier Mall Drive the roadway is narrowed to maintain the existing two-way center left turn lane with the addition of bike lanes and sidewalks within the existing right-of-way. This alternative would also require construction of a storm sewer system to pipe the water conveyed by the median ditch. This design alternative maintains the existing four traffic lanes on Prairie Avenue which is considered to be overbuilt based on existing and future traffic volumes projections. This condition can encourage traffic speeding conditions and increase access management traffic safety conflicts on Prairie Avenue. The estimated cost of this alternative is $4,990,000.

Figure 26: Typical 4-Lane Cross Section for Prairie Ave without a Median



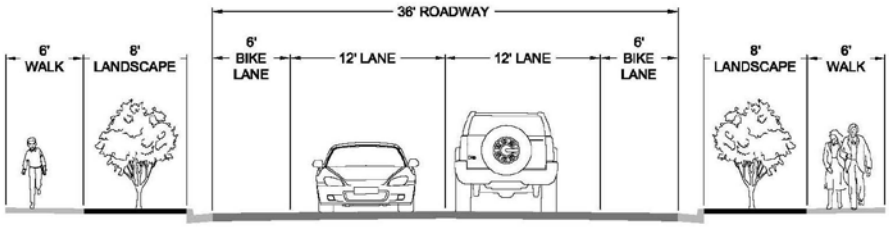
2. 4-Lane Roadway with a Median
   Under this Alternative, the existing Prairie Avenue median is maintained with the four 12-foot wide travel lanes with a traffic design capacity of 25,000 vpd. Similar to Alternative 1 described above this alternative also includes five foot wide bike lanes in each direction, along with an eight foot wide landscape buffer area and six foot wide sidewalks, as shown on Figure 27. The total right-of-way required for the alternative is 140 feet. This design provides both bicycle and pedestrian facilities within the existing right-of-way. East of Frontier Mall Drive, the existing Prairie Avenue two-way center left-turn lane is replaced with a median. Similar to the above design alternative, this alternative by maintaining the existing four traffic lanes which is not justified based on existing and future traffic projections and can encourage traffic speeding on Prairie Avenue. The estimated cost of this alternative is $5,930,000.

Figure 27: Typical 4-Lane Cross Section for Prairie Ave with a Median



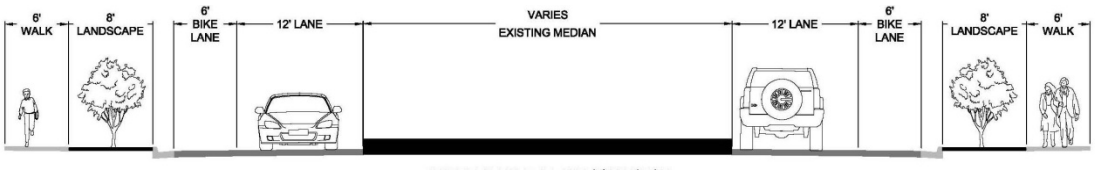
3. 2-Lane Roadway without a Median
   This Alternative reduces the number of traffic lanes on Prairie Avenue to one lane in each direction, with a five foot bike lane, eight foot landscape buffer band and six foot sidewalks, as shown on Figure 28. The total right-of-way required for the alternative is 75 feet. Under this alternative, Prairie Avenue is shifted north of the existing median resulting in longer driveway connections from businesses located south of Prairie Avenue. This alternative does not maintain the current access control and several right turn in right turn out driveways requiring reconfiguration. The traffic design capacity of this alternative is 13,000 vpd. The estimated cost of this alternative is $3,440,000.

Figure 28: Typical 2-Lane Cross Section for Prairie Ave without a Median



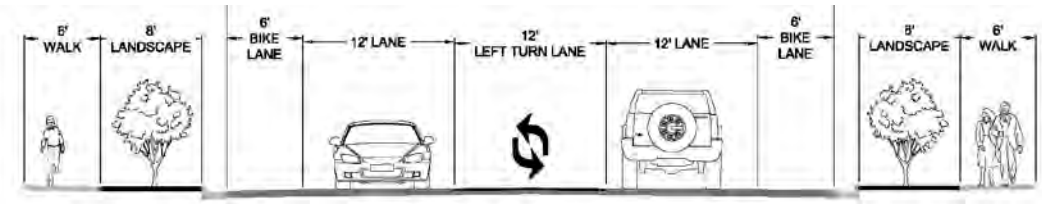
4. 2-Lane Roadway with a Median
   Under this Alternative, the existing Prairie Avenue median is maintained, but the number of traffic lanes is reduced to one lane in each direction with intersection left turn lanes. Similar to Alternative 3 described above, this alternative also includes five foot wide bike lanes in each direction, along with an eight foot wide landscape buffer area and six foot wide sidewalks, as shown on Figure 29. The total right-of-way required for the alternative is120 feet. The right-of-way required for this alternative is significantly less than required for the existing Prairie Avenue roadway cross-section. The traffic design capacity of this alternative is 14,500 vpd. The estimated cost of this alternative is $3,650,000.

Figure 29: Typical 2-Lane Cross Section for Prairie Ave with a Median



This design alternative includes provision of a three-lane (one lane in each direction and a center two-way left turn lane) design between Frontier Mall Drive and Dell Range Boulevard as shown in Figure 30.

Figure 30: Typical 3-Lane Cross Section for Prairie Ave (Frontier Mall Dr-Dell Range Blvd)



Based on the need to enhance pedestrian and bicycle mobility in the Dell Range Boulevard corridor area and the ability to meet current and projected year 2040 traffic demand it is recommended to reconstruct Prairie Avenue as a 2-lane divided facility with a median, bike lanes, curbed terrace and sidewalks with the section of Prairie Avenue between Frontier Mall Drive to Dell Range Boulevard reconstructed to a three-lane cross-section with bike lanes and sidewalks.

Summary

This corridor study examines existing traffic operation and safety on the segment of Dell Range Boulevard between Powderhouse Road and College Drive and the segment of Prairie Avenue east of Powderhouse Road to Dell Range Boulevard. Based on an analysis of existing traffic and safety patterns both short and long-term corridor improvements are recommended in this study. The study also addresses non-motorized bicycle and pedestrian improvements along the study corridors.

Traffic Safety: Over the 5-year time period between 2007 and 2012 there have been a total of 700 traffic crashes in the study corridor. The crashes have been relatively constant during this

time period ranging between 130 to 164 crashes per year. Only 1 fatality occurred during this time period with 27% of the crashes resulting in personal injuries. The majority of crashes, 49%, involved rear-end collisions followed by right angle crashes at 16% and angle crashes at 14%. The highest crash intersection is located on Dell Range Boulevard at its intersection with Converse Avenue with 145 crashes. The next highest crash intersection was located at College Drive which experienced a significantly lower crash history with 71 crashes. Based on a review of crash diagrams for each corridor intersection it is recommended to install an adaptive traffic signal system to reduce the number of vehicles required to stop along the corridor. Adaptive traffic signal control systems have been shown to reduce the number of stopped vehicles along a corridor by 47% to 88% and total crashes by 15% to 30%.

A Road Safety Audit (RSA) was conducted by a team of experts to determine road safety issues and opportunities for safety improvements. The high priority improvements identified in the RSA involved:

- Provide additional east-west collector roadway connections within 1/2 mile north of Dell Range Boulevard between Powderhouse Road and Converse Avenue
- Change the existing two-way left turn lane to a raised median with strategically located u-turn bulb-outs at Dell Range Boulevard intersections
- Modify east and westbound left turn signalized intersection movements to protected only operation
- Increase the 'all-red' traffic signal clearance interval to 2 seconds for all movements

Additional RSA improvements were recommended in the corridor for traffic and pedestrian safety.

Existing Traffic: Existing traffic on Dell Range Boulevard ranges between 18,300 to 30,000 vpd while daily traffic on Prairie Avenue is at 9,200 vpd. Peak hour traffic periods were identified to occur during the weekday 4:30 to 5:30 PM evening at approximately 2,700 vph and during the noon to 1:00 PM midday time period at approximately 2,500 vph. Saturday and Sunday peak periods were centered around the noon to 1:00 PM time period at approximately the same level as occurs during the weekday midday time period. The highest traffic volumes on Dell Range Boulevard occur during the months of June and July.

The following seven intersections were found to currently be operating with failing traffic movements (Level of Service 'E' or 'F') during the evening peak period:

1. Powderhouse Road (1 movement)
2. Driftwood Drive (2 movements)
3. Prairie Avenue (1 movements)
4. Rue Terre (1 movements)
5. Walmart Drive (1 movements)
6. Converse Avenue (4 movements)
7. College Drive (6 movements)

Both the Converse Avenue and College Drive are the only two intersections that currently experience overall traffic operation at LOS 'E' or 'F during the evening peak period.

Based on a traffic improvement analysis of each intersection it is recommended to construct dual east and southbound left turn lanes at the Converse Avenue intersection and to construct a northbound dual left turn lane at the College Drive intersection.

Based on traffic and pedestrian safety consideration it is recommended to reconstruct the following high speed channelized intersection right turn lanes to an urban design that tames traffic speeds and enhances pedestrian safety:

- Powderhouse Road - eastbound and southbound
- Stillwater Avenue- - eastbound and southbound
- Driftwood Drive - eastbound and southbound
- Frontier Mall Drive - westbound
- Prairie Avenue - westbound
- Rue Terre* - westbound
- Converse Avenue - eastbound
- Ridge Road - eastbound
- College Drive - eastbound

It is also recommended to realign the northbound approach of Prairie Avenue with the north side of the intersection and to reconstruct the north side of Rue Terre to eliminate the median drainage swale for improved alignment with the south side of the intersection.

Finally, a set of traffic signal operational improvements are recommended that involve: 1) Change pedestrian 'Walk' times from 4 seconds to 7 seconds; 2) change pedestrian 'Flashing Don't Walk' time length to reflect a 3.5 ft/second walking speed instead of the existing 4.0 ft/second; 3) Include pedestrian 'Walk' time to include yellow clearance interval; 4) Install pedestrian actuated push buttons at all signalized pedestrian crossings; and 5) modify and interconnect for traffic progression traffic signal cycle lengths for 90-seconds between Powderhouse Drive and Walmart Drive and for 100-seconds between Converse Avenue and College Drive.

The result of these recommendation should improve both traffic and pedestrian safety as well as traffic operation along the study corridor with only the College Drive intersection experiencing 2 traffic movements operating at LOS 'E' or 'F' conditions during the evening peak traffic period. The total estimated cost of these short-term intersection improvements and short-term traffic progression improvements is $5,720,000. These improvements and the installation of an adaptive traffic control system are expected to significantly reduce the number of stopped vehicles at the Dell Range Boulevard study intersections.

Future Traffic: The existing 30,000 vpd currently traveling on Dell Range Boulevard has been increasing at a range of 1.5 to 1.8% per year since 2000 with a projection based on this historic growth rate to increase to 40,000vpd to 48,000 vpd by the year 2040. The increase in traffic is expected to exceed the design capacity of the existing 4-lane Dell Range Boulevard corridor capacity in the near future and result in increased peak hour traffic congestion problems. All 12 study intersection are projected to experience failing LOS 'E' and 'F' traffic movements with a maximum of 10 failing movements at the College Drive intersection and 8 failing traffic movements at both the Converse Avenue and Ridge Road intersections by the year 2040. Peak hour traffic speeds are expected to range between 5 to 10 mph.

Three long-term improvements were considered to improve year 2040 traffic operating conditions. The first improvement involved reconstruction Dell Range Boulevard to a 6-lane

divided roadway with a design capacity of 35,000 vpd. This alternative would have significant impacts on businesses fronting on Dell Range Boulevard and is estimated to cost $20,290,000.

The second improvement involved completing the street network grid by constructing a new east-west collector facility between Powderhouse Road and Converse Avenue with regularly spaced north-south street connection between Dell Range Boulevard and Story Boulevard. This improvement is expected to reduce traffic volumes on Dell Range Boulevard by 3,000 vpd. This is a logical improvement for new development in the currently undeveloped Section 20 area north of Dell Range Boulevard and is consistent with the Cheyenne MPO long-range land use/transportation plan.

The final traffic improvement alternative is to limit future development along the Dell Range Corridor and adjacent undeveloped lands. This can be done by only approving low traffic generating land uses such as agriculture, light industrial, residential, hospitals, churches, schools, parks and automobile dealerships.

Based on the negative property impacts and cost of reconstructing Dell Range Boulevard to a 6-lane divided roadway it is recommended to pursue implementing a complete street grid network in Section 20 north of Prairie Avenue along with limiting the number of high peak hour traffic generators in the undeveloped lands of Section 20.

Pedestrian System Enhancements: Of the three options considered for the pedestrian crossing near Converse Avenue, only the two underpass options provided a safe crossing of Dell Range Boulevard without impacting traffic operations. Although the at-grade crossing is the lowest cost option, it would require the addition of a separate protected phase for pedestrians due to the high volume of left turning vehicles at the Converse Avenue intersection with Dell Range Boulevard. Both underpass options eliminate the pedestrian vehicle conflict associated with the at-grade crossing providing a safer crossing of Dell Range Boulevard.

The second option is an underpass of Dell Range Boulevard, east of Dry Creek, that requires the addition of a pedestrian bridge to allow users to cross Dry Creek. This option eliminates the pedestrian vehicle conflict, but the addition of the pedestrian bridge makes this the highest cost alternative.

The third option is also a pedestrian underpass of Dell Range Boulevard, East of Dry Creek. Instead of the pedestrian bridge the pedestrian path would circle around to run along the north side of Dell Range Boulevard. This option will require the extension of the existing drainage culvert for Dry Creek as well as right-of-way for the loop. In order to be ADA compliant and minimize right-of-way impacts the looping section of the path would be constructed as several 8 percent ramps with five foot landings.

Based on pedestrian safety concerns, right-of-way limitations, and ADA requirements option 2 is the recommended alternative. This option eliminates the pedestrian vehicle conflict while minimizing right-of-way impacts and providing an ADA compliant walkway that is comfortable for bicyclists as well.

Prairie Avenue: Prairie Avenue between Powderhouse Road to Dell Range Boulevard currently accommodates approximately 9,200 vpd. The existing roadway is designed with 4 traffic lanes (2 in each direction) with wide shoulders and a median containing a drainage swale between Powderhouse Road to Frontier Mall Drive and a 2-way center left turn lane between Frontier Mall Drive and Dell Range Boulevard. Traffic on Prairie Avenue is projected to increase

to 14,500 vpd by the year 2040. Four improvement alternatives were analyzed for Prairie Avenue. The first alternative involves improving the existing cross-section with bike lanes, curbed edge terrace and sidewalks. This improvement has a design capacity of 25,000 vpd. The estimated cost of this improvement is $5,930,000.

The second alternative involves reconstructing the existing roadway to provide a 4 lane undivided facility with similar bike lanes and curb terrace and sidewalks. The design capacity of this improvement is 17,000 vpd at an estimated cost of $4,990,000.

The third alternative involves reconstructing Prairie Avenue to a 2-lane roadway without a median but including bike lanes, a curbed terrace and sidewalks, The design capacity of this alternative is 13,000 vpd with an estimated cost of $3,440,000

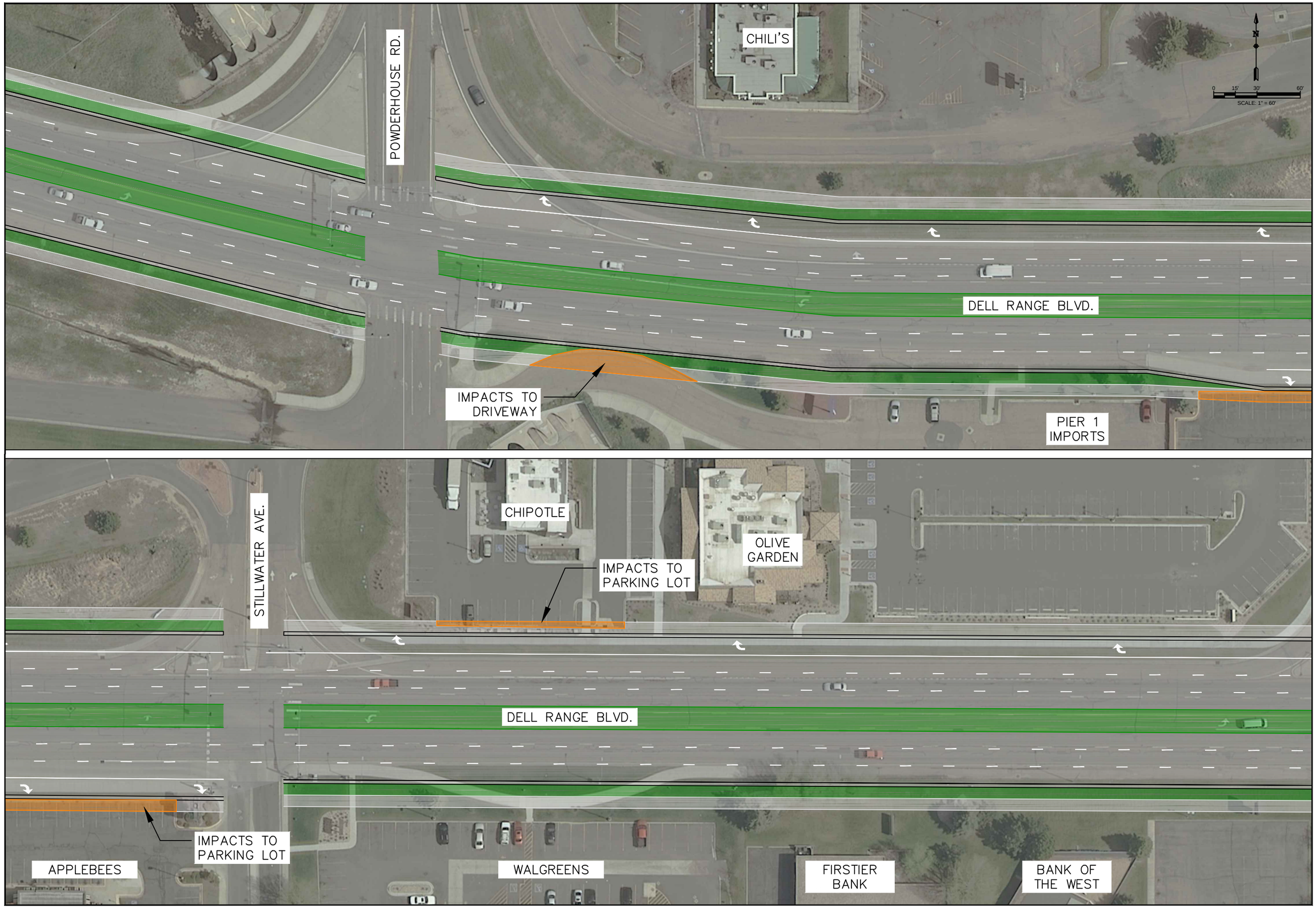
The final alternative involves reconstructing Prairie Avenue as a 2-lane roadway with a median, bike lanes, curbed terraces and sidewalks. The design capacity of this alternative is 14,500 vpd with an estimated cost of $3,650,000

Based on the need to enhance pedestrian and bicycle mobility in the Dell Range Boulevard corridor area and the ability to meet current and projected year 2040 traffic demand it is recommended to reconstruct Prairie Avenue as a 2-lane divided facility with a median, bike lanes, curbed terrace and sidewalks.

Appendix

Right-of-Way Impacts for 6-Lane Dell Range Boulevard

DELL RANGE 6-LANE EXPANSION IMPACTS		
LOCATION	**ADDRESS**	**TYPE OF IMPACTS**
PIER 1 IMPORTS	1345 DELL RANGE BLVD.	DRIVEWAY
APPLEBEES	1401 DELL RANGE BLVD.	PARKING LOT
CHIPOTLE	1508 DELL RANGE BLVD.	PARKING LOT
#1 PROPERTIES	1660 DELL RANGE BLVD.	PARKING LOT
BOOT BARN	4519 FRONTIER MALL DR.	PARKING LOT
BROWNS SHOE FIT	1802 DELL RANGE BLVD.	PARKING LOT
ACROSS FROM BROWNS	1774/1772 SPRING CT.	PARKING LOT
SUBWAY	1821 DELL RANGE BLVD.	PARKING LOT
IHOP	1938 DELL RANGE BLV.D	PARKING LOT
STEAMBOATS STEAKHOUSE	1947 DELL RANGE BLVD.	PARKING LOT
ADVANCE AUTO PARTS/BRAKES PLUS	2015 DELL RANGE BLVD.	PARKING LOT
BREEZE THRU CARWASH	2106 DELL RANGE BLVD.	PARKING LOT
BIG 5 SPORTING GOODS	2152 DELL RANGE BLVD.	PARKING LOT
SPRUCE RIDGE PLAZA	2206/2220 DELL RANGE BLVD.	PARKING LOT
ASPEN RIDGE PLAZA	2202 DELL RANGE BLVD.	PARKING LOT
DELL RANGE ANIMAL HOSPITAL	2314 DELL RANGE BLVD.	PARKING LOT
COLD STONE CREAMERY/AAA	2316 DELL RANGE BLVD.	PARKING LOT
STATE FARM	2320 DELL RANGE BLVD.	PARKING LOT
LOAF 'N JUG	2414 DELL RANGE BLVD.	PARKING LOT
MISTER MONEY USA	2470 DELL RANGE BLVD.	PARKING LOT
DT'S CARWASH	2514 DELL RANGE BLVD.	PARKING LOT
A NEW CONCEPT OPTICAL/SONIC	2528/2540 DELL RANGE BLVD.	DRIVEWAY
PRIVATE RESIDENCE	4600 GREYBULL AVE.	DRIVEWAY
PRIVATE RESIDENCE	4600 HILLTOP	PARKING LOT
PRIVATE RESIDENCE	4601 HILLTOP	PARKING LOT
PRIVATE RESIDENCE	4528 DARNELL PL	BUILDING
PRIVATE RESIDENCE	4527 DARNELL PL	BUILDING
KUM AND GO	4505 RIDGE RD.	PARKING LOT
PRIVATE RESIDENCE	4526 MARBLE AVE.	BUILDING
WARREN FEDERAL CREDIT UNION	3810 DELL RANGE BLVD.	PARKING LOT
PRIVATE RESIDENCE	4526 BOYSEN AVE.	BUILDING



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DELL RANGE BOULEVARD
6-LANE ARTERIAL EXPANSION

DELL RANGE BLVD/PRAIRIE AVENUE
TRAFFIC SAFETY AND
IMPROVEMENT STUDY

Revisions	Date

Project Mgr.	
Designed By:	
Drawn By:	
Approved By:	
Date:	

PROJECT NO.
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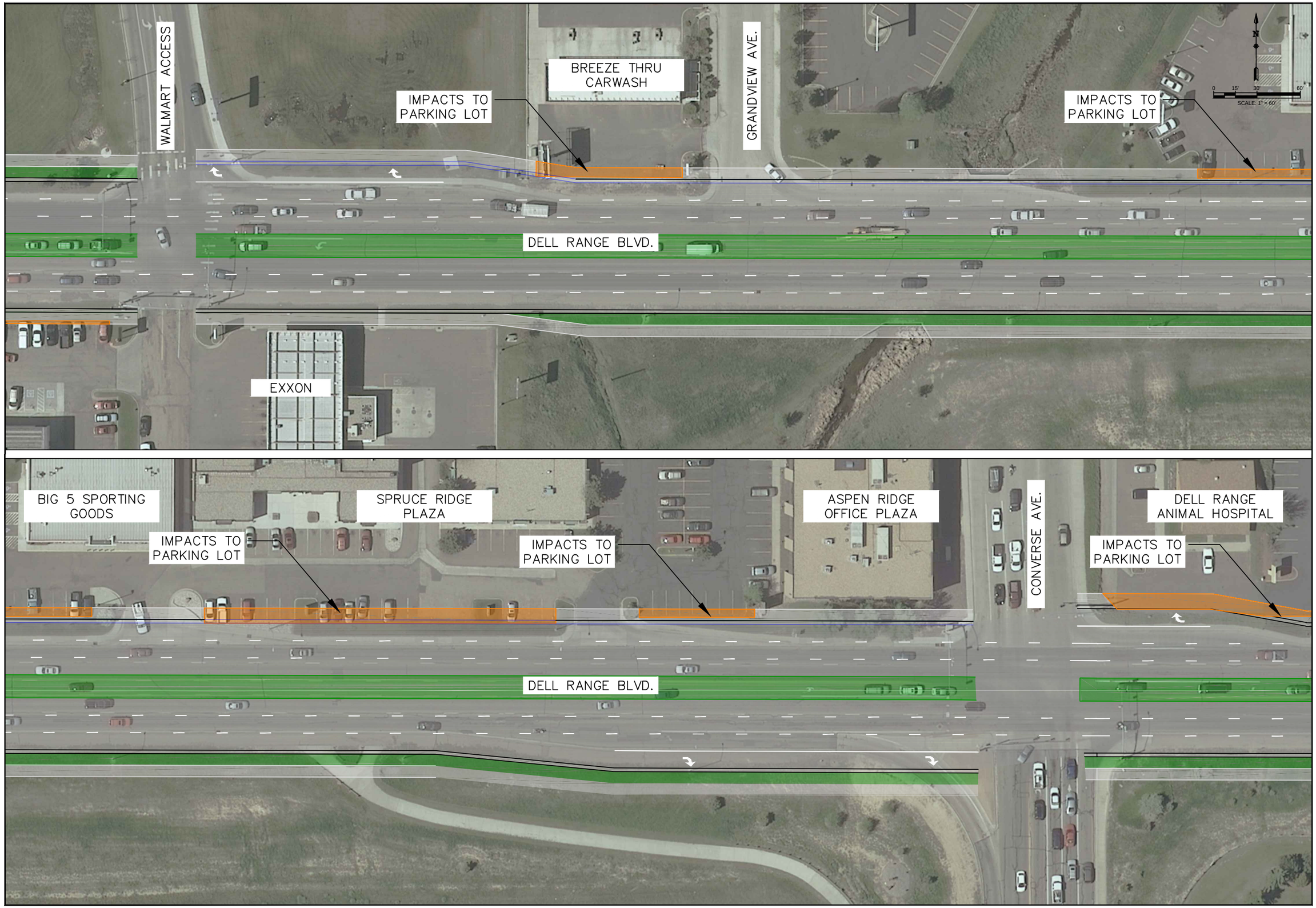

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COLD STONE CREAMERY, AAA

STATE FARM

MOUNTAIN RD.

LOAF 'N JUG

FIRST NATIONAL PAWN

ONCE UPON A CHILD

IMPACTS TO PARKING LOT

IMPACTS TO PARKING LOT

IMPACTS TO PARKING LOT

DELL RANGE BLVD.

MISTER MONEY USA

WINDMILL RD.

NIELSEN CHIROPRACTIC

DT''S CARWASH

IMPACTS TO PARKING LOT

IMPACTS TO PARKING LOT

DELL RANGE BLVD.

MENARDS

N

0 15' 30' 60'

SCALE: 1" = 60'

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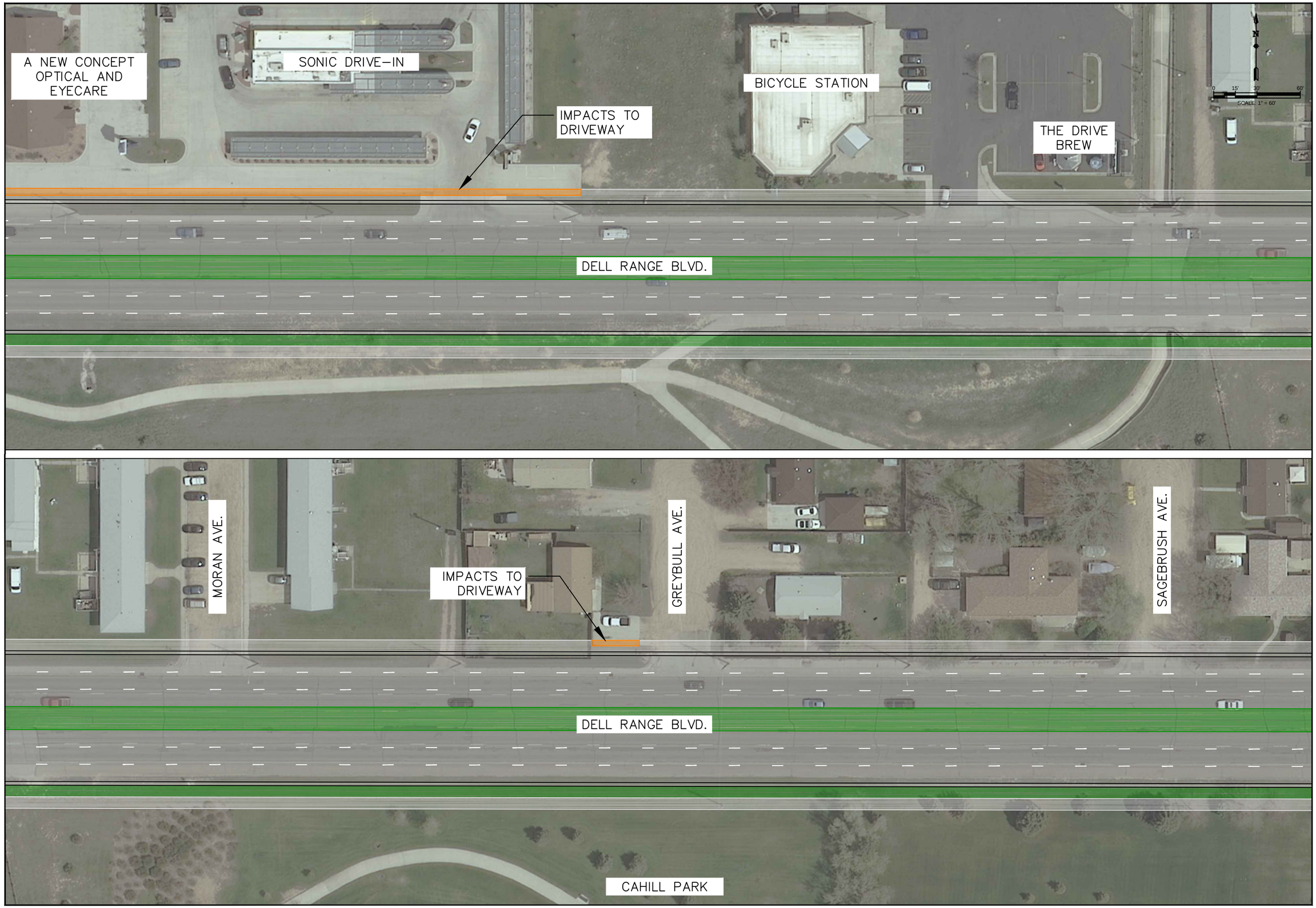

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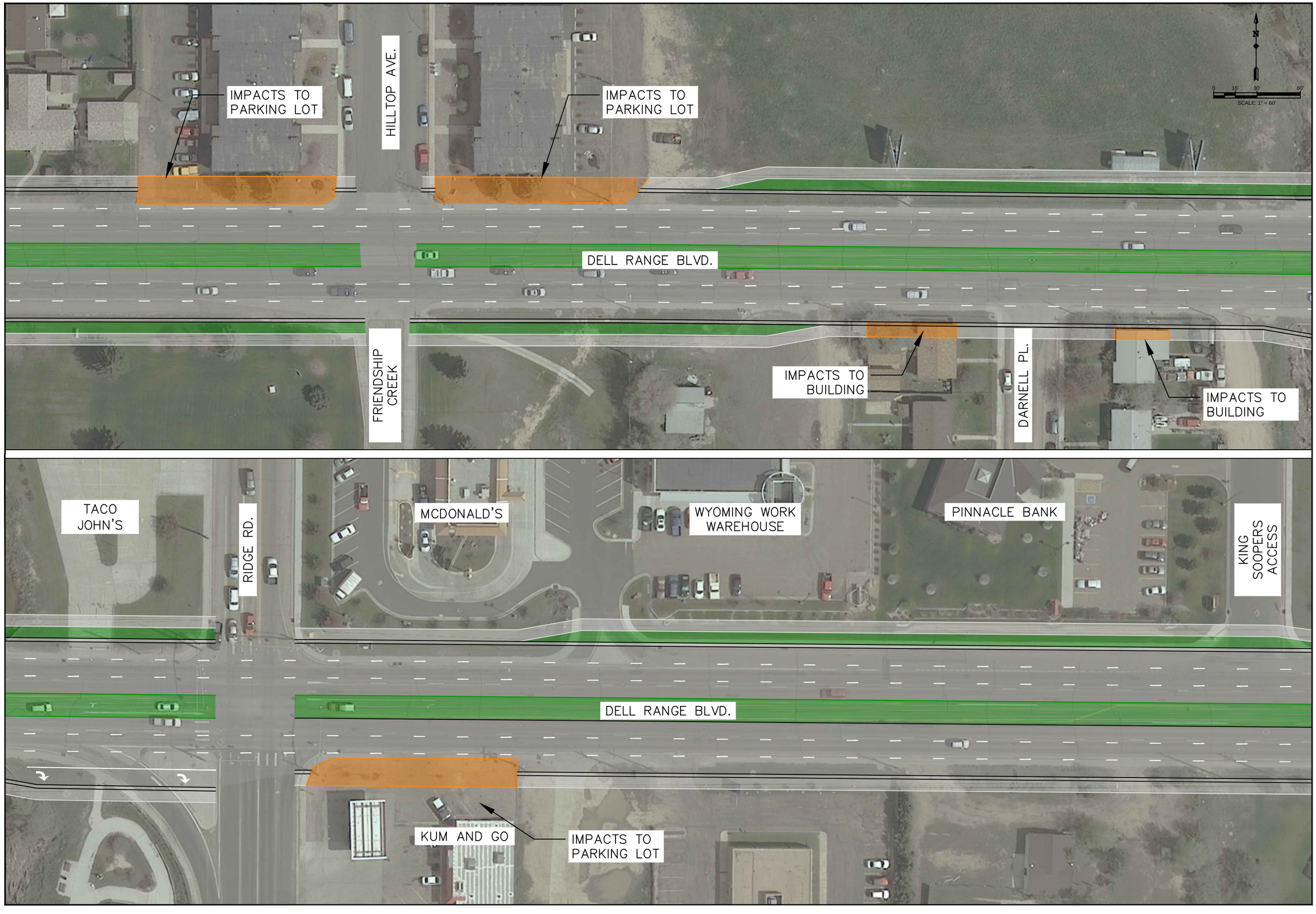

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KING SOOPERS

MARBLE AVE.

WARREN FEDERAL CREDIT UNION

IMPACTS TO PARKING LOT

N

0 15' 30' 60'

SCALE: 1" = 60'

DELL RANGE BLVD.

PARKVIEW DR.

IMPACTS TO BUILDING

IMPACTS TO BUILDING

BOYSEN AVE.

SIERRA HILLS ASSISTED LIVING

COLLEGE DR.

DELL RANGE BLVD.

IMPACTS TO BUILDING

BOYSEN AVE.

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