Draft Report for:

Converse/Dell Range Intersection Traffic Safety Plan & Converse Avenue 35% Design Plan

Prepared for and in coordination with

Converse/Dell Range Intersection Traffic Safety Plan & Converse Avenue 35% Design Plan

Cheyenne Wyoming

Draft Report

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1. Introduction

The Dell Range-Converse intersection is located in the northeast portion of the city of Cheyenne, as shown in Figure 1.1. This intersection connects two major routes in the city. Dell Range Boulevard is a four-lane principal arterial that connects from Yellowstone Road on the west to the developing eastern portions of the city. Dell Range Boulevard also provides connectivity to the most intensive retail development in Cheyenne, which includes the Frontier Mall. Converse Avenue is a four-lane principal arterial south of Dell Range Boulevard and a minor arterial north of Dell Range Boulevard. Converse Avenue provides connectivity from Lincolnway on the south, which provides access to downtown Cheyenne, to the developing northern portion of the city. The airport creates a barrier between the neighborhoods to the east of downtown. This causes increased traffic volumes on Converse Avenue, with predominately left turns onto Dell Range Boulevard from Converse Avenue. The confluence of these two roadways creates this major intersection, which is known for being the most congested and highest crash occurrence intersection in the city, possibly even the state.

The Converse Avenue corridor between Storey Boulevard and Ogden Road was constructed in 2003. Planning and preliminary design for the corridor between Ogden Road and Dell Range Boulevard is included in this study to complete the corridor between Storey Boulevard and Dell Range Boulevard.

Figure 1-1 - Study Location

HDR Engineering, Inc. was hired to prepare the Converse/Dell Range Intersection Traffic Safety Plan & Converse Avenue 35% Design Plan.

1.1. Existing Conditions

The current configuration of the Converse Dell Range intersection includes an exclusive left-turn lane and exclusive right-turn lane in each direction, except for the northbound approach that includes two exclusive left-turn lanes. Also, the eastbound right-turn lane is channelized. The intersection is signalized, with split phasing for the northbound and southbound approaches and a flashing yellow arrow for the eastbound left-turn and westbound left-turn movements. This signal operates in coordination along Dell Range Boulevard, with the coordinated corridor limits extending from College Drive on the east to Powderhouse Road on the west.

Existing traffic volumes for the AM, Midday, and PM peak hours were collected by the MPO earlier this year and provided to HDR for use in this project. The MPO also provided existing signal timing parameters for this intersection. This data is attached in Appendix C of this report. These traffic volumes, the intersection geometrics and the traffic signal timing parameters were loaded into the project's traffic operations analysis model. The model yielded LOS E, LOS C and LOS C for the AM, Midday and PM peak hours, respectively.

Crash statistics from 2006 to 2015 show a safety concern for this intersection. Within the past 10 years, there have been a total of 264 crashes at the Dell Range Boulevard and Converse Avenue intersection. During this time, approximately 147 people were injured, making this intersection one of the most dangerous intersections in the state of Wyoming. From 2007 to 2016, the crash rate at this intersection was 1.36. The predominate type of crashes, rear end collisions; have increased approximately 20% over this period. In addition to rear end collisions, angle crashes doubled between 2014 and 2015 and 90% of all crashes in this intersection occurred when vehicles were traveling in the East – West direction. On average, 67% of all crashes in the last ten years that occurred at the Dell Range - Converse intersection had reported property damage.

As part of the Converse / Dell Range Intersection Traffic Safety Plan Project; the Converse Avenue corridor has also been included and a 35% design effort performed. The construction of Converse Avenue from Ogden Road extending to the north and connecting to Storey Boulevard consists of a 55' wide road with 12' lanes and a center turn lane. A 10' wide concrete Greenway path exists on the west side of the road and a 5' wide sidewalk on the east side. The remaining segment of corridor from Ogden Road heading south to the intersection with Dell Range Boulevard remains in its existing condition; lacking adequate bicycle & pedestrian connectivity and necessitating roadway improvements to meet growing needs for additional traffic operational capacity and safety. The right-of-way through this section of the corridor is 100' wide. The existing street cross section consists of two 12-feet wide travel lanes and a 12-feet wide turn center turn lane. Curb and gutter is present on the east side of the road with an attached sidewalk, varying in width from 4 to 5 feet. The west side of the corridor contains a dirt shoulder and a drainage ditch located approximately 20 to 30 feet from the edge of the travel lane. Only one marked cross walk exists along the corridor, at the Dell Range Boulevard intersection.

1.2. Project Purpose

The purpose of this study is to evaluate existing and future traffic operations and safety for the Converse and Dell Range intersection and the Converse Avenue corridor between Dell Range and Ogden Road. The following are the project goals for this study:

Develop alternatives and a 35% design plan for a preferred alternative for the reconstruction of the Converse and Dell Range intersection the will improve safety and operations for motorists, pedestrians and bicyclists.

Develop a 35% design plan for the completion of Converse Avenue between Dell Range and Ogden for all modes and storm sewer.

2. Public Outreach and Meetings

A major component to this study was informing the public and obtaining public input for the evaluation of intersection alternatives and preliminary design. HDR worked with the Cheyenne MPO to conduct a comprehensive public outreach program that included two public open houses, online surveys, social media, media blasts, comment forms and one-on-one meetings to inform the public and gather input.

A project steering committee was also formed to assist and guide the project. The steering committee members are shown in Table 2-1. A total of four formal steering committee meetings were conducted during the course of the study. A summary of the public open houses and steering committee meetings are discussed below.

Table 2-1 - Steering Committee Roster

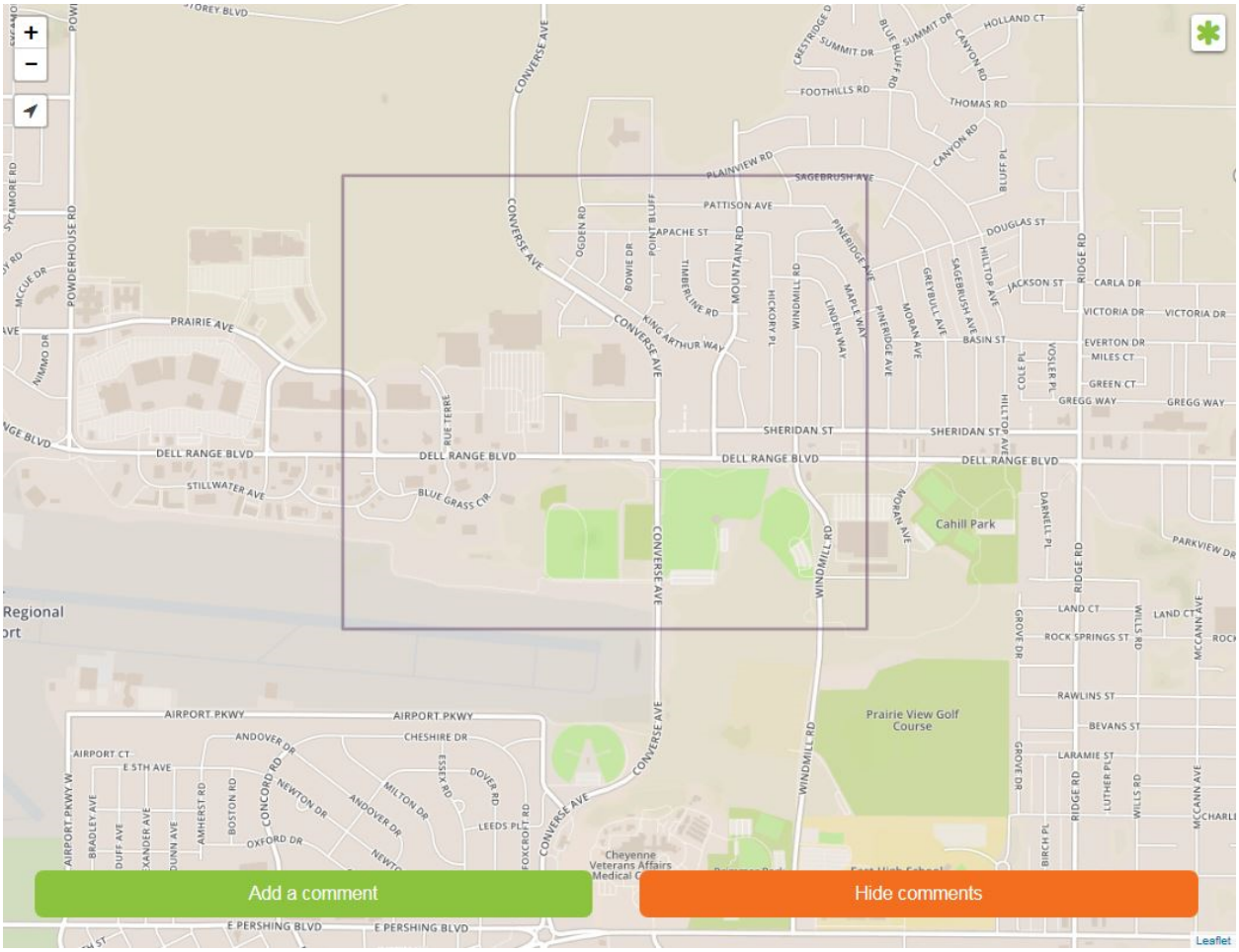
Organization	Name
Cheyenne MPO	Tom Mason
Cheyenne MPO	Nancy Olson
Cheyenne MPO	Sreyoshi Chakraborty
City Public Works	Craig LaVoy
City Engineering	Nathan Beauheim
BOPU	Brad Brooks
BOPU	Linda Gunter
WYDOT	Kevin McCoy
WYDOT	Mark Wingate
City Council	Jeff White
City Council	Dr. Mark Rinne
City Council	Jim Brown
Cheyenne Police Dept.	Sergeant John Gay
Cheyenne Police Dept.	Officer George Trammell
City Planning	Brandon Cammarata
Cheyenne Transit Program	Renae Jording
Transit	Keith McQueen - sub
Greenway and Trails	Jeff Wiggins
Parks and Recreation	Jason Sanchez
EMA	Matt Butler
Black Hills Energy	Jef McMann
Fire and Rescue	Chief Martin
HDR	Brandon Gebhart
HDR	Todd Mattson
HDR	John Seyer
HDR	Jason Kjenstad

2.1. Social Media, Online Surveys and Newspapers

Extensive efforts by the MPO and HDR were employed to incorporate social media tools to engage public input. The Cheyenne MPO Facebook page and webpage were used to inform the public of the project, gather comments, announce public meetings and provide links to surveys. Email transmissions were also used to inform stakeholders of upcoming events. Advertisements were also published in Wyoming Tribune Eagle and Trader Shoppers Guide. Additionally, KGWN Cheyenne and KFBC Radio shared notices of the open house meetings.

During the course of the study, online surveys were developed to garner public input as well as an online mapping tool to allow the public the opportunity to identify the locations of their concerns and identify or comment on what these concerns were. A screen shot of the online mapping tool is shown in Figure 2-1 - Online Mapping Tool. The results of the surveys and the four comments received from the online mapping tool are shown in Appendix D.

Figure 2-1 - Online Mapping Tool



The MPO website was also updated throughout the project to allow the public and stakeholders the opportunity to review the progress of the project, provide comments, view presentations and display materials from open house meetings and animations of traffic operations of the alternatives being evaluated.

2.2. Public Open House #1

The first public open house was conducted on September 13, 2016 at Anderson Elementary. The purpose of this meeting was to introduce the project components and need for improvements to the public, present preliminary examples for possible design solutions, as well as receives the community

members' input and priorities regarding the project. A series of displays were presented to the public that included;

- History & Project Context
- Safety Issues at the Intersection
- Existing capacity Issues at the Intersection
- About the Project: Mobility & Access, Drainage, Overall Goal
- Project Area Map
- Project Criteria - Public Input
- Design Concept Examples (Dual Left-Turn Lanes, Modern Round About, Continuous Flow Intersections, etc.)
- Timeline & Community Involvement (Project Scope, Intended Outcomes, & Public Resources)

Public attendees were also invited to view an animated presentation that included videos of possible design solutions for the intersection, speak with project team members, read & receive a Project Fact Sheet, provide their 4 most important outcomes of the project at the intersection, and fill out additional comment forms.

Comment Summary

During the public open house, participants were invited to provide written comments. Comments were also received through Facebook and an on-line mapping tool. Thirteen comment cards were received from the open house participants. Many of the comment cards contained multiple comments. Five comments were generated with the online tool and multiple comments were made via Facebook. In all, 92 comments were collected and reviewed and are included in Appendix D.

The comments were then categorized into 16 categories to evaluate what the public perception was as far as issues or possible resolutions to issues perceived with the existing intersection. Nine comments were not applicable to issues at this intersection and were excluded. Table 2-2 shows how each of the comments was categorized and the percentage of comments associated with each category.

Table 2-2 - Issue Identification

Category	Number of Comments	Percent of Comments
No Issue	8	10%
Against Roundabout at this location	17	20%
Signal Timing/issues	9	11%
Reduce congestion via alt. routes	5	6%
Lane configuration	6	7%
Red Light Camera/Violation Enforcement	11	13%
Driver Behavior/education	7	8%
Pro – Roundabout at this location	3	4%
Reduce Speed	4	5%
Bike/Ped Connectivity	3	4%
Emergency Vehicles	1	1%
Noise Pollution	1	1%
Funding/cost	2	2%
Construction Time	1	1%
Drainage	1	1%
Alternate Intersection design	4	5%

From the comments, it appears that a majority of the respondents welcome or encourage some version of improvement to the intersection. Many of the adverse comments made about the possibility of a roundabout were very direct. However, no negative or adverse comments were made about alternate intersection designs. Four comments were made that liked the idea of alternate intersection designs, including three comments that liked the continuous flow alternative presented at the public open house.

Many of the respondents indicated that the intersection could be improved by lane configuration alterations, signal alteration, enforcement and speed reduction.

Additional Comments

Thirteen additional comment forms were filled out and given back to project team members. The project also received feedback via the online comment web tool as well as comments on Facebook. Some common themes expressed in all three forms include:

- Necessity of project
    - Consensus on the need for the project, most respondents agreed that changes are necessary at the Converse Ave./Dell Range Blvd. intersection
- Safety concerns
    - For pedestrians and bicyclists, respondents included various suggestions for possible ways to increase safety
    - Many respondents expressed the issues with left-hand turns at the Converse/Dell Range intersection, in addition to other left-hand turns near the project boundaries

    - Red light traffic violations, along with issues of quick green rotations, reported as common and dangerous at the intersection, some respondents suggested installing a camera to help reduce drivers running the lights (blue-light indicators are in place)
- Lack of efficiency
    - Left-hand turn permissions at the Converse & Dell Range signals, and other signals along Dell Range reported to be long and inefficient
- Business Impacts
    - Request for project team and planners to be mindful of the business owners and residents in order to alleviate the effects of construction around the project area
- Concerns
    - Possibility of a roundabout – respondents had concern over the effectiveness and cost for this option
    - Noise and pollution resulting from the intersection –request for the possibility of mitigating these effects
    - Lack of a grade separated pedestrian/bicycle crossing across Converse Avenue between Dell Range and Point Bluff.

2.3. Public Open House #2

The second public open house was conducted March 1, 2017. A presentation was given of the top three alternatives and the no-build option. A Facebook Live stream of the presentation was made available on the Cheyenne MPO Facebook page. The public attendees were invited to provide additional comments and complete a survey card or online survey.

Twenty six people attended this open house. Five comment cards were received at the open house and three people completed the online survey. Of these responses, 3 people preferred the modern roundabout alternative, 3 people preferred the dual left turn alternative, and 2 people preferred the current intersection with Short Term Improvements. Of these responses 5 people indicated that they would support the funding and implementation of the preferred alternative and 3 indicated that they would like to reassess the need in 10-years.

2.4. Local Stakeholder Engagement

Emails and letters were sent to businesses and residents near the project area. These letters informed the local stakeholders of the project, invited them to public meeting and to participate in the online tools used for the project.

One-on-one meetings were also conducted for some of the residents and businesses in the immediate vicinity of the intersection to inform them of the project and allow them to provide input.

3. Intersection Alternatives Development and Analysis

The development of alternatives was based on the steering committee's and public's understanding of the intersection's deficiencies and the project's needs. Below is a description of this process.

3.1. Identification of Deficiencies

In order to establish the current conditions of the Dell Range – Converse intersection, a model of the existing geometry was developed. The results concluded that the existing intersection with current traffic volumes functions at a LOS E in the AM, which is considered poor and a LOS C during the Mid-day and PM peaks. If the intersection stays in its current configuration, it is projected that the level of service will only get worse due to increased traffic volumes. In addition to a continuance of poor level of service, the crash potential could also increase.

3.2. Alternatives Development

The alternatives that were analyzed for this intersection originated from HDR's proposal and were refined and finalized by the Steering Committee. The citizens of Cheyenne have been open to unique ideas that will maximize capacity and enhance safety at the Dell Range – Converse intersection. Currently, there are alternative designs in place around the City of Cheyenne; the multi-lane roundabout at the Converse-Pershing-19th intersection, and the diverging diamond interchange (DDI) at I-25 & College Drive. With these in mind as well as the conversations with City staff and citizens, HDR has developed seven alternative designs for the Dell Range-Converse intersection.

The list of alternatives is as follows:

1. Short Term Improvements
2. Dual Left-Turn Lanes
3. Modern Roundabout
4. Continuous Flow Intersection – Full
5. Continuous Flow Intersection – Modified
6. ThruTurn Intersection – Signals
7. ThruTurn Intersection – Roundabouts

Below are a brief description and a figure that illustrates each alternative.

Short Term Improvements. The option to not make any significant improvements provides a benchmark against which all other alternatives can be measured. The No-Build represents the conditions of the intersection in the future without major improvements, although some minor improvements or other previously committed improvements can be made. For this project, it was assumed that widening of the north leg would occur such that the split phasing will be eliminated and right-turn arrows will be added that will indicate to drivers that right turns are protected during the green time of the corresponding left-turn (i.e. the northbound right-turn movement would be given a green arrow simultaneously with the westbound left-turn movement).

The Dell Range Boulevard Corridor Study (Ayres Associates, 2016 a.) provided recommendations to this intersection. The preferred alternative to address pedestrian safety in this report was a grade separated crossing near Dry Creek to the west of the intersection. This report also recommends this alternative as the preferred pedestrian improvement for this alternative.

Another recommended improvement was to reconstruct the eastbound Dell Range right turn lane to follow an urban design that attempts to tame traffic. This report did not re-evaluate this recommendation.

Dual Left-Turn Lanes. This reconstruction alternative includes improving on the No-Build by adding a second left-turn lane to the eastbound, southbound and westbound approaches. The projected westbound left-turn volumes indicate that dual lefts may be warranted, and providing a second southbound left-turn lane is simple geometry since the northbound approach leg already has dual lefts; both receiving legs of these turn movements already have two lanes. The eastbound left-turn movement is not as simple, given that the north leg has only one receiving lane. The traffic volumes for this movement are fairly low, so consideration was given to keeping this movement as a single left-turn lane. See Figure 3-1.

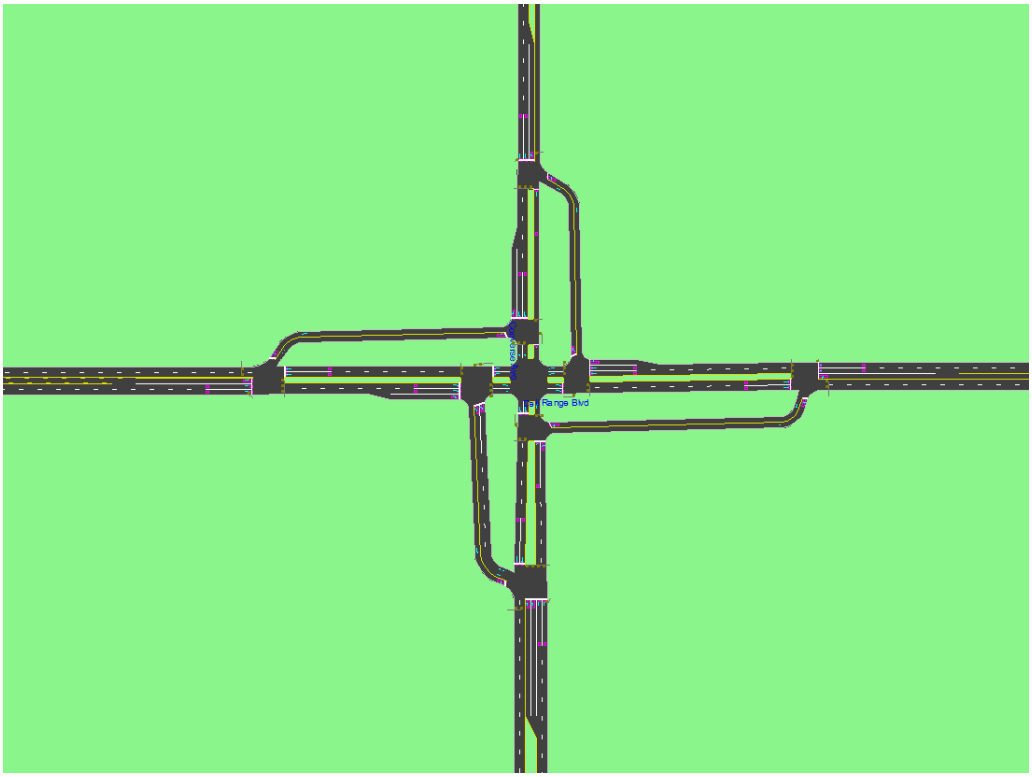
Figure 3-1- Dual Left Turn Lanes

Modern Roundabout. The modern roundabout was conceived as a viable option given the city's familiarity with roundabouts, the large percentages of left turns on some legs, the known safety benefits of roundabouts, and the fact that the crash history indicates that the conflict between thru movements and the opposing left-turn movements experience a persistence of crashes. This would be a multi-lane roundabout, possibly with three approach lanes from the south. See Figure 3-2.

Figure 3-2 - Modern Roundabout

Continuous Flow Intersection – Full. A continuous flow intersection (CFI) provides left-turn movements that are removed from the intersection for the benefit of reducing conflict points at the primary intersection and increasing the intersection's capacity. The left turns occur upstream of the primary intersection so that they can turn onto the approaching cross street at the same time as the opposing through movements. This alternative provides five two-phase signalized intersections that control traffic as it passes through the "intersection complex." See Figure 3-3.

Figure 3-3 - CFI - Full



Continuous Flow Intersection – Modified. The differences between the CFI-Modified alternative and the CFI-Full intersection are represented in the number of displaced left-turn movements. Based on volumes and crash history, the northbound left turns and the westbound left turns are the two movements that need additional capacity and conflict point mitigation. The traffic volumes at the other two left-turn movements are far less impactful to capacity and safety. In addition, modifying the CFI in this manner takes advantage of available right-of-way without impacting existing businesses. See Figure 3-4.

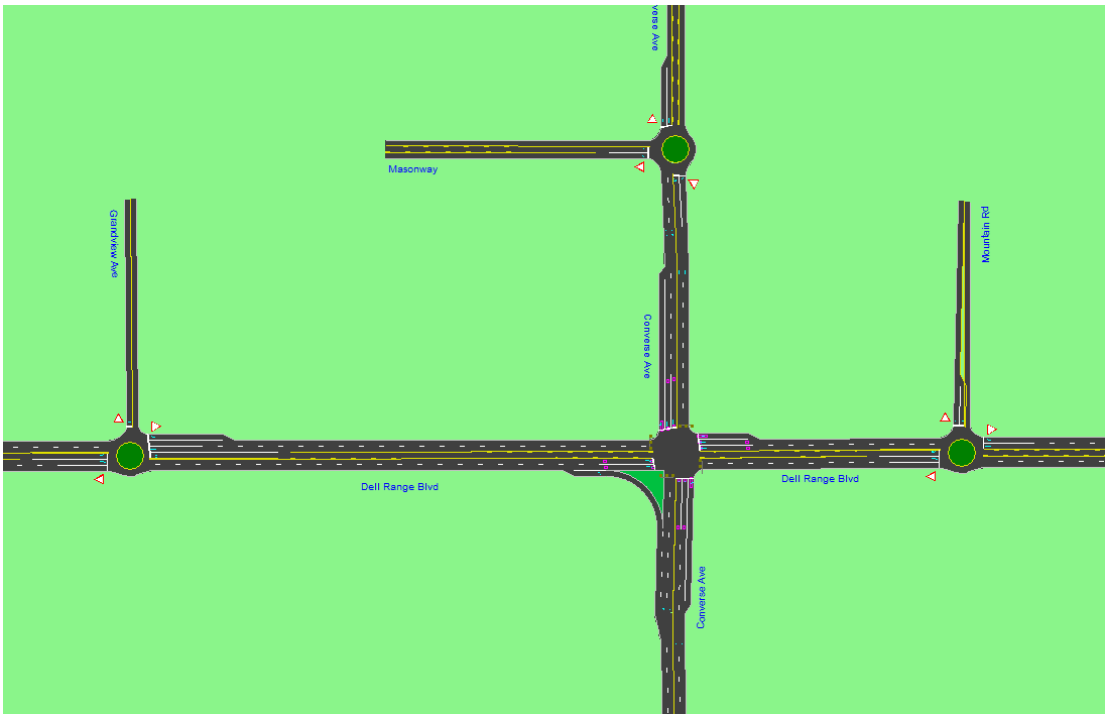
Figure 3-4 - CFI - Modified

ThruTurn Intersection – Signals. The ThruTurn intersection offers similar intersection capacity benefits as the CFI in that left turns do not occur at the primary intersection. The difference is that traffic wishing to make a left turn must make a different maneuver at the intersection and make a turn at a downstream intersection before reaching its final destination. As an example, to make a northbound left turn, traffic would proceed north through the intersection along Converse Avenue to the Masonway intersection where this traffic would make a U-turn, followed by a right-turn onto westbound Dell Range Boulevard. The "outlier" intersections would have minor geometric changes made to them to accommodate the U-turn movement, and those intersections would be signalized. See Figure 3-5.

Figure 3-5 - Thru Turn with Signals

ThruTurn Intersection – Roundabouts. This iteration of the ThruTurn intersection would provide modern roundabouts at the outlier intersections instead of traffic signals. This alternative would facilitate the U-turn movements effectively without introducing three new traffic signals. See Figure 3-6.

Figure 3-6 - Thru Turn with Roundabouts



3.3. Decision Matrix Development

An initial meeting was conducted with the steering committee to present a list of possible intersection alternatives and identify key issues and concerns to be used in the evaluations of these alternatives. A list of possible concerns were generated and presented to the committee to determine the most critical concerns of the committee that should be considered in comparing and evaluating alternatives. A ranking of the top issues were developed.

The first Public Open House, stakeholder meetings, one-on-one meetings and social media tools were also used to develop a list of issues in regards to the intersection and corridor. A compilation of the steering committee meeting and public input were used to develop criteria for a decision matrix to aid in the comparison of alternatives. The ranking of key issues from this compilation is presented below:

Table 3-1- Ranking of Key Issues

Issue	Rank
Safety	1
Ease of Use	2
Congestion/Queuing	3
Emergency Vehicle	4
Cost	5
Drainage	6
Business Access	7
Developed Land Acquisition	7
Undeveloped Land Acquisition	9

3.4. Alternatives Analysis

The seven alternatives were evaluated against the evaluation criteria. The criteria were established based on the values that the steering committee expressed to the design team and what the public shared at the first public open house. These criteria included:

1. Safety
2. Ease of Use
3. Congestion/Queuing
4. Business Access
5. Drainage
6. Land Acquisition

Initially, the alternatives were analyzed using the criteria of improved safety, ease of use, and reduction of congestion and queuing. The results of this analysis were presented to the steering committee to refine the alternatives down to three final alternatives. The congestion/queuing criterion was analyzed quantitatively using operations analysis software, as described below. The safety criterion was based on how effectively each alternative would reduce the overall number of conflict points. As such, this criterion was evaluated initially quantitatively, although some results were tweaked qualitatively. The ease of use criterion was evaluated qualitatively based on the complexity of the intersection, with consideration given to out-of-direction travel and how well pedestrians and bicyclists could maneuver through the intersection. Below is a description of how the alternatives were evaluated against these three criteria.

Safety. As noted above, this criterion was evaluated initially based on the number of conflict points within the intersection for each alternative. Given that some alternatives involve just the Dell Range-Converse intersection, while others involve the Mountain Road, Masonway and Grandview Avenue intersections, it's important that we include all four intersections in each

alternative. Given these considerations, below are the total numbers of conflict points for each alternative:

- No-Build = 59
- Dual Left-Turn Lanes = 59
- Modern Roundabouts = 35
- CFI – Full = 44
- CFI – Modified = 54
- ThruTurn – Signals = 38
- ThruTurn – Roundabouts = 28

Ease of Use. The Ease of Use criterion was evaluated with a qualitative approach. This approach considered the familiarity of local drivers and complexity of the intersection for all modes of travel, including vehicular traffic, pedestrian and bicycle traffic and emergency vehicle maneuverability.

Congestion/Queuing. The Trafficware, Synchro and SimTraffic software suite were used to analyze the operations for all of the alternatives, except for the modern roundabout alternatives; the modern roundabouts were analyzed using Rodel. Models for the AM peak, MD peak, and PM peak, using projected 2040 volumes, were developed for all alternatives. The future-year volumes were based on ADTs from the Dell Range Boulevard Corridor Study (Ayres Associates, 2016 a.) and the estimated Section 20 (Ayres Associates, 2016 b.)development patterns.

The primary focus of the analysis was the functionality of the Dell Range Boulevard and Converse Avenue intersection (DR-C). Currently, it is a signalized, four-legged intersection. Dell Range Boulevard has two, through lanes and one left-turn lane in the EB and WB directions. There is a designated right-turn lane in the WB direction onto NB Converse Ave. The SB leg has two through lanes, a designated right-turn lane, and one left-turn lane. The NB leg has one through lane, a designated right-turn lane, and two left-turn lanes onto WB Dell Range. Currently, the intersection functions as a LOS E during the AM peak and a LOS C during the MD and PM peak with an average delay of 39.9 seconds

- Short Term Improvements:
  The No-Build model was built using the existing intersection configuration and the 2040 volumes. In order to improve the functionality of the intersection, the signal timing was optimized for each peak hour. This adjustment improved the intersection's function during the AM peak from an LOS E to an LOS C. However, the LOS during the MD and PM peak declined to an LOS D. The average delay for the no-build model is approximately 35.6 seconds. Therefore, in order to see LOS improvement for all peak periods, the intersection's configuration will need to be altered.

- Dual Left-Turn Lanes:
  Due to the large amount of left turns in all directions, there is considerable delay due to the limited amount of left turn storage. A second left turn lane was added to SB Converse Ave, WB Dell Range Blvd, and EB Dell Range Blvd. The EB and WB directions have fewer left turns than that of the NB and SB directions. However, the through traffic along Dell Range Blvd is almost five times more than the through traffic along Converse Ave. Therefore, the left turn storage length for WB Dell Range Blvd was increased from 90 feet to 150 feet. This will assist in alleviating the through traffic delay as well as the left turn delay. After finalizing the configuration and optimizing the signal timing, the intersection functioned as an LOS C for all peak periods with an average delay of 29.4 seconds.
- Modern Roundabout:
  The roundabout model configuration consists of two circulating lanes throughout the entire roundabout. In the EB direction, there will be three approach lanes: one left-through lane, one designated through only lane, and one designated right turn only lane. The designated right turn only lane will be a bypass lane to SB Converse Ave. In the NB direction, there will be three approach lanes: one designated left turn only lane, one left-through lane, and one right-through turn lane. There will be three circulating lanes in the south-east quadrant to accommodate the three NB approach lanes and all legs will have two exit lanes. The LOS for the roundabout during all peak periods is an LOS A with an average delay of 5.6 seconds.
- Continuous Flow Intersection (Full):
  The CFI model configuration eliminates all left turns that occur at the Dell Range-Converse intersection. All left turns will occur ahead of the DR-C intersection. There will be a signalized intersection where the left turns will occur and cross over the opposing traffic lanes in order to bypass the main intersection. This bypass will provide storage for the left turns and allow for more green time to be dedicated to the through traffic. The left turns will access their target street at a connection point that will be placed after the main intersection. Once the timing was optimized and coordinated for all four legs, the CFI performed at a LOS C for all peak periods with an average delay of 29.6 seconds.
- Continuous Flow Intersection (Modified):
  The modified CFI model configuration is very similar to that of the full CFI model configuration. However, instead of eliminating left turns at the intersection for all four legs of the intersection, only two legs have left turns that occur ahead of the intersection. For the modified model configuration, the WB and NB left turns will bypass the main intersection. The WB left turn movement exceeds 300 left turns during the AM peak and the NB left turn movement exceeds 300 left turns during the PM peak; both movements have between 700 – 900 left turns during all three peaks. Once the timing was optimized and coordinated, the modified CFI performed at an LOS C for all peak periods with an average delay of 26.3 seconds.
- ThruTurn Intersection (Signals):
  The signalized ThruTurn model has a similar approach to the CFI model; eliminate the left turns at the Dell Range-Converse intersection. However, instead of the left turns bypassing

the DR-C intersection, left turns will be prohibited at the intersection. Therefore, vehicles wanting to turn left onto Converse Ave from Dell Range Blvd, or vise versa, will have to travel through the intersection and use either the Dell Range-Mountain intersection, Dell Range-Grandview intersection, or the Converse-Masonway intersection to make a U-turn. Vehicles will be able to turn right at the DR-C intersection once they have completed the U-turn. This ThruTurn model uses signals at all four of the intersections. Once all of the timing was optimized and coordinated, the model performed at an LOS B for the AM and MD peaks and an LOS C for the PM peak with an average delay of 16.4 seconds.

- ThruTurn Intersection (Roundabouts):
  The roundabout thruturn model has the same configuration as the signalized thruturn model, but will be using roundabouts instead of signals at the three intersections of Dell Range-Mountain, Dell Range-Grandview, and Converse-Masonway. Due to the use of two different modeling programs, Rodel and Syncro, for this alternative, the delays for both modeling programs had to be accounted for in the overall delay results. Once the delay was calculated correctly, the alternative performed at an LOS B for all peak periods with an average delay of 14.0 seconds.

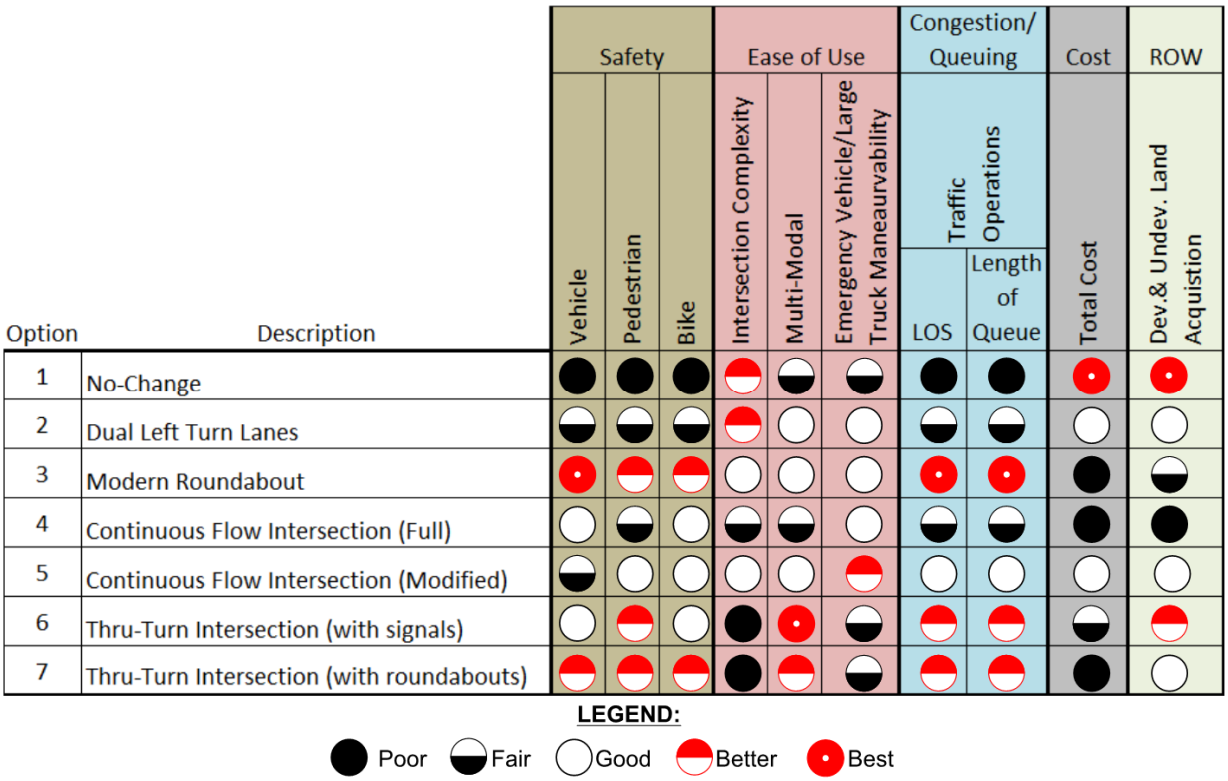
Based solely on the results from the models, the modern roundabout performed the best in terms of LOS and delay. The ThruTurn models performed the second best, with the modified CFI coming in third best overall. The Dual Left Turns alternative is a conventional design that also performed well. The worst results came from the Current Intersection with Short Term Improvements model. This solidifies the fact that the Dell Range-Converse intersection needs an alternative intersection design to alleviate current and future delay. See Table 3-2 for the LOS and delay results for all seven alternatives.

Table 3-2 - Intersection LOS and Delay

Alternative	AM Peak		MD Peak		PM Peak	
	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)
Short Term Improvements	C	27.1	D	37.8	D	42.0
Dual Left Turns	C	26.2	C	32.3	C	29.6
Modern Roundabout	A	3.3	A	7.6	A	5.9
CFI - Full	C	31.1	C	29.8	C	27.9
CFI - Modified	C	22.1	C	26.0	C	30.8
ThruTurn - Signals	B	10.9	B	13.7	C	24.5
ThruTurn - Roundabouts	B	11.1	B	12.8	B	18.1

These analyses where then used to populate the decision matrix shown Figure 3-7 .

Figure 3-7 - Decision Matrix



This matrix was presented and discussed with the MPO and the Steering Committee. The purpose of this meeting was to present the traffic analyses for all alternatives, present the preliminary decision matrix and determine the preferred alternatives. A concise decision for a preferred alternative was not able to be made. It was decided that three alternatives and the no-build alternative would be presented at the second open house, and further evaluation of the three alternatives to determine land and property impacts were needed. The top three alternatives were the dual left turns (see Figure 3-8), modern roundabout (see Figure 3-9), and the modified continuous flow (see Figure 3-10). Conceptual designs were developed for the three alternatives. These concepts were discussed by the group again and a ranking by the present Steering Committee members ranked the Modified Continuous Flow Intersection the highest, followed by the Dual Left Turn and lastly the Modern Roundabout Current intersection with Short Term Improvements alternative was not included in this ranking. Conceptual designs are shown below:

Figure 3-8 - Dual Left Concept

Figure 3-9 - Modern Roundabout Concept

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Figure 3-10 - CFI Modified Concept

A comparison of the pros and cons of each of these alternatives is presented in the table below;

Table 3-3 - Alternative Pros and Cons Comparison

	Dual Left Turns	Modern Roundabout	CFI - Modified
Pros	• Most conventional alternative • Lowest Cost of Remaining Alternatives • Anticipated to be least impactful to existing right-of-way	• Mitigates crash potential • Provides highest capacity	• Mitigates most noted safety concerns • Provides needed capacity enhancements • Meets project goals with relatively conventional geometry • Signalization at Mountain Road
Cons	• Doesn't mitigate noted safety concerns • Doesn't provide needed capacity enhancements	• Highest cost alternative • Most right-of-way & directly impacts private business • Extensive retaining walls • Impacts Ped. Bridge • Perceived most difficult for Pedestrians & Bicycles	• Doesn't mitigate all noted safety concerns • Impacts to Pedestrian Bridge Abutment

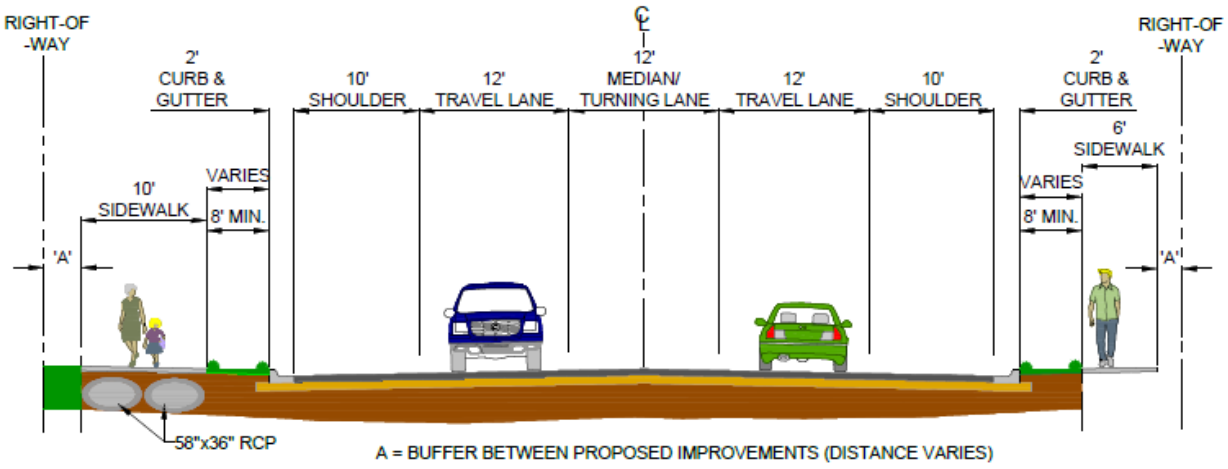
4. 35% Design

Converse Avenue 35% design between Ogden Road and Dell Range Boulevard has been performed in accordance with guidelines from the City of Cheyenne Unified Development Code, AASHTO Policy on Geometric Design of Highways and Streets (2011), and guidance from local governing agencies in the area. The 35% design is attached in Appendix A.

4.1. Typical Sections

The roadway "cross-section" or "typical section" was determined based on the roadway's functional classification of Minor Arterial. This functional classification meets the forecasted traffic volume demands as well as matches the existing Converse Avenue section from Ogden Road to Storey Boulevard. The typical section is anticipated to transition into the Converse Avenue / Dell Range Boulevard Intersection "No-Build" option at this time. Future transitions, including the intersection with Masonway, should be re-evaluated and design to match the corresponding intersection design option selected. The typical section as presented during the study process is shown in Figure 4-1 - Typical Section

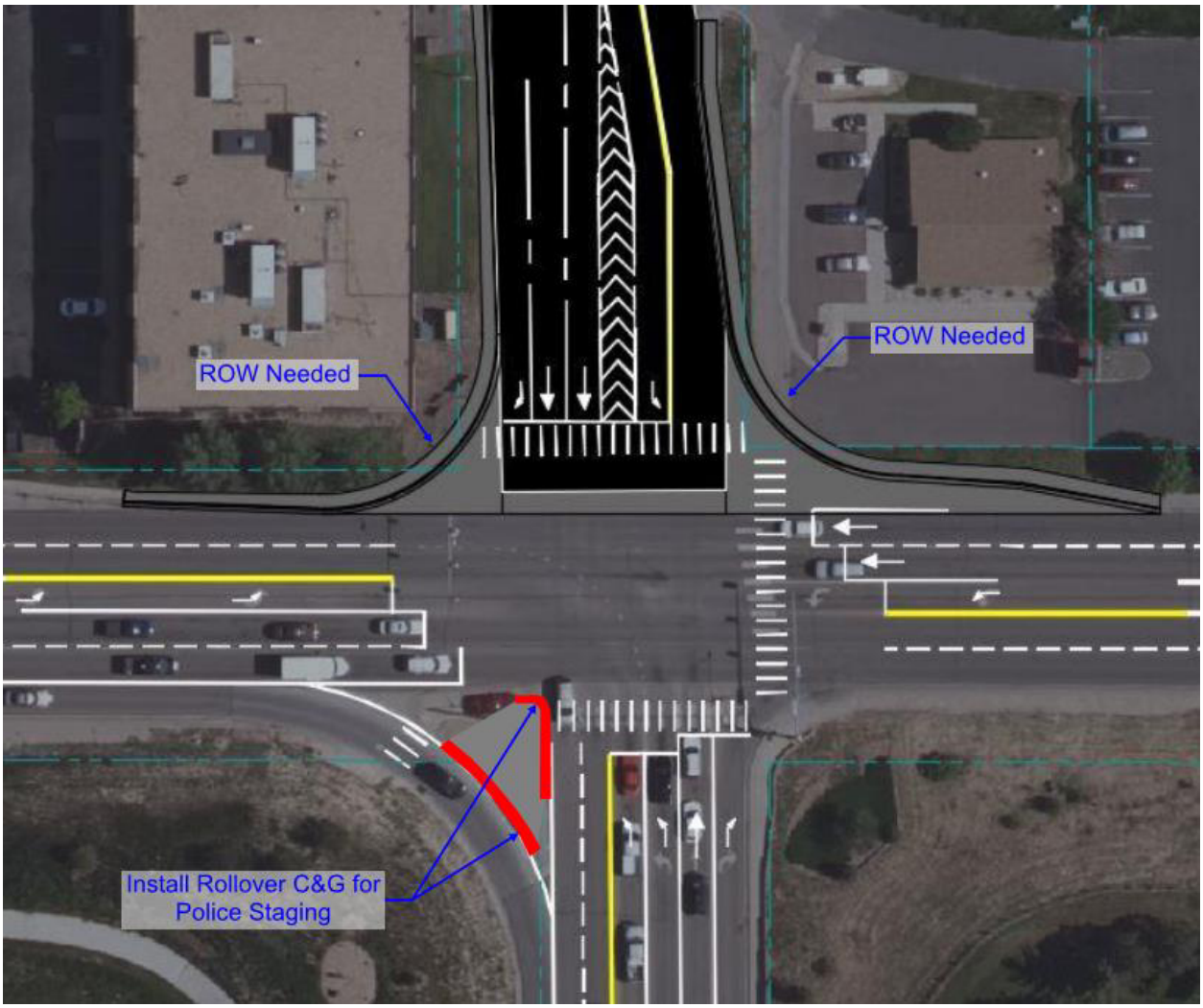
Figure 4-1 - Typical Section



4.2. Right-of-Way (ROW) and Control of Access

The ROW width along the Converse Avenue Corridor is approximately 100' wide from Ogden Road to Dell Range Boulevard. The impacts associated with construction of the new corridor section of Converse Avenue are anticipated to be minimal at this time. Existing ROW in the study area is anticipated to be sufficiently wide to accommodate the 2-Lane w/ median roadway section, including necessary landscaping boulevard(s), and necessary re-grading of southern open drainage ditch section when drainage is placed into the buried storm sewer. This includes the addition of sidewalk along the south and west side of the alignment to connect to existing Cheyenne Greenway routes. It is anticipated, however, that minor areas of right-of-way will be needed to construct the Short-Term Improvements alternative to the north side of the Converse Avenue and Dell Range Boulevard Intersection; see Figure 4-2.

Figure 4-2 - ROW Impacts



The existing Control of Access is not anticipated to be modified as all accessing approaches and streets provide connectivity to residential neighborhoods and adjacent businesses. Existing regulations will provide the framework for proper access management if additional development occurs within the corridor.

4.3. Posted Speed Limits and Design Speed

The posted speed limit of the Converse Avenue corridor study area is 30 mph between Dell Range Boulevard and Ogden Road and increases to 40 mph north of Ogden Road. The design speed of the roadway between Dell Range Boulevard and Ogden Road is 35 mph due to the horizontal curve, but is currently posted at 30 mph. An increase in the posted speed limit beyond 35 mph would require advisory signage for the curve. Given the residential nature of this section of road, the recommended speed limit should remain at 30 mph.

The Dell Range Boulevard evaluation is limited to the extents of potential new intersection layout alternatives; however, currently the posted speed limit on this roadway is 40 mph. It is anticipated that the speed limit will remain at 40 mph.

4.4. Pedestrian and Bicycle Facilities

The adjacent area land use is primarily residential; and as a result, the demand for adequate pedestrian and bicycle travel routes is a key item for consideration. The City of Cheyenne's "Greater Cheyenne Greenway" master plan and goal identifies "10' wide, grade separated, detached, reinforced concrete paths" as a goal to establish routes for non-motorized traffic independent of on-street transportation facilities. The Greenway provides a safe and connected transportation system. Currently the Greenway is discontinuous in this area and by planning a Greenway route along the Converse Avenue Corridor, two separate sections of existing Greenway can be joined, as shown in Figure 4-3

Figure 4-3 - Greenway Map

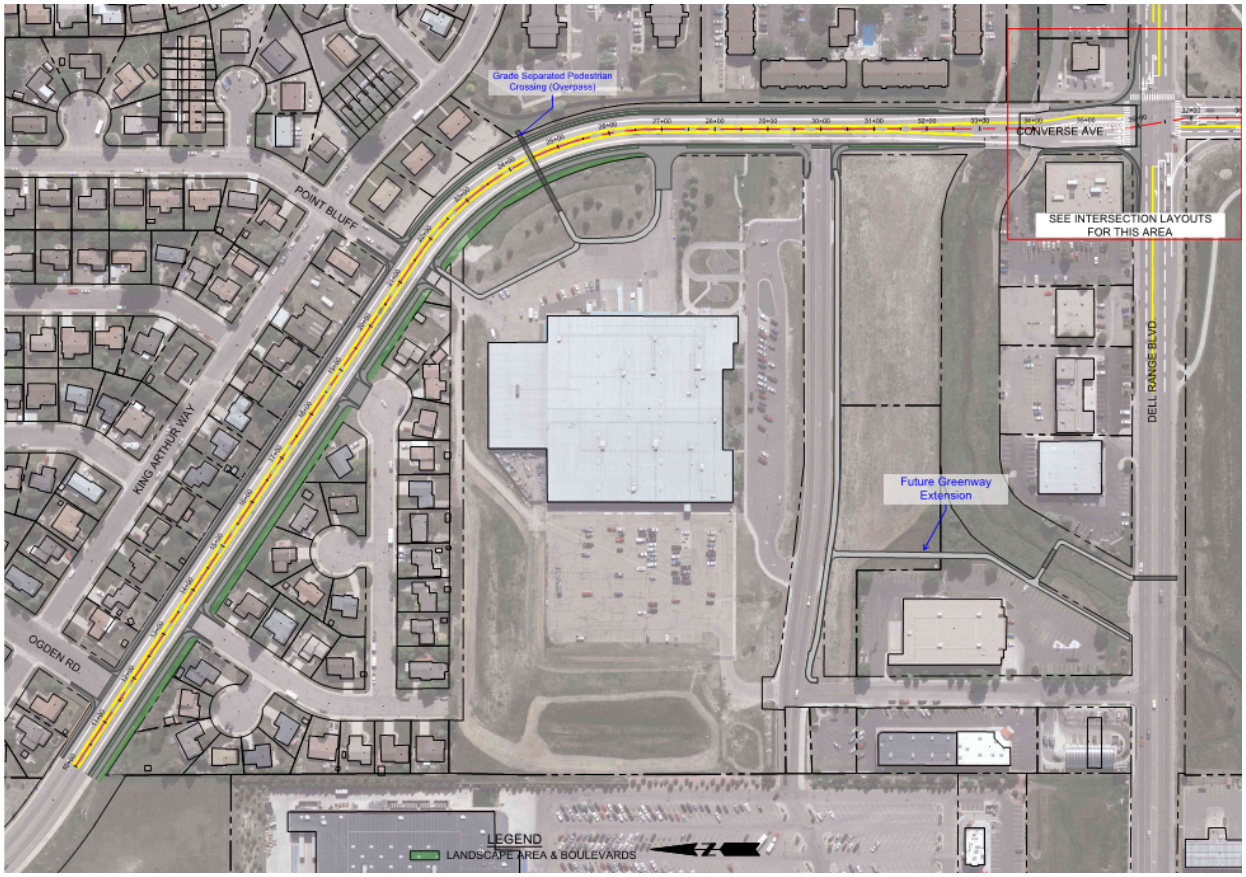
The improvements to the corridor also extend beyond the addition of a detached, designated, Greenway route. The roadway area will also have dedicated, 10' wide, shoulder areas adjacent to the traveled way that can also be used by bicyclists; currently no shoulder areas are present and only a small 4' sidewalk is available on the north and east side of the corridor. Existing corridor conditions can be seen in Figure 4-4.

Figure 4-4 - Corridor Existing Condition

Converse/Dell Range Intersection Traffic Safety Plan & Converse Avenue 35% Design Plan

During the public involvement process, citizens expressed concern that grade separated pedestrian crossings should be provided directly north of the Converse Avenue and Dell Range Boulevard intersection. Demand for this grade separated crossing stems from the high traffic volumes at this intersection and the lack of at-grade crossing facilities. Tentative placement an overhead pedestrian crossing near the center of the Converse Avenue corridor improvement area was also identified; and is also shown on Figure 4-5. The Dell Range Corridor Study (Ayres Associates, 2016 a.) also recommends a grade separated crossing near Grandview Avenue as shown.

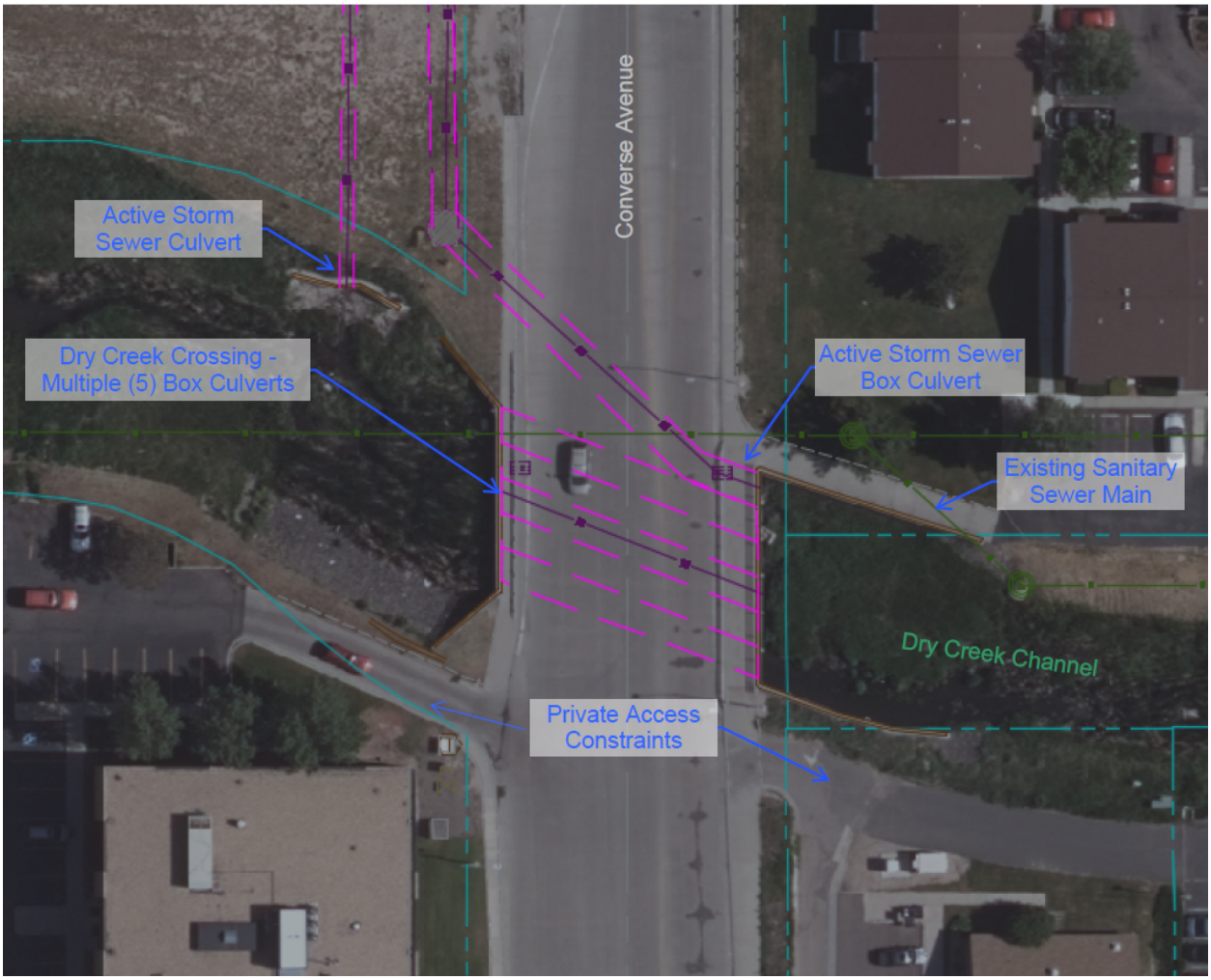
Figure 4-5 - Grade Separated Pedestrian Crossings



A grade separated crossing along Dry Creek under Converse Avenue would be very problematic. Because of the relatively good condition of the existing road crossing which consists of five concrete box culverts and a storm sewer box culvert, a bridge replacement is not recommended in this study. As such, the ability to incorporate a below grade crossing is complicated by the existing creek crossing. The creek crossing consists of six concrete box culverts. Five of the culverts convey stream flow and one (the northern most) box is a continuation of the existing storm sewer piping. The northern most box culvert is only accessible on the downstream side of the creek crossing. The upstream side is connected to the existing storm water piping and not accessible as a pedestrian tunnel. This also complicates using the adjacent box as a pedestrian tunnel because pedestrians would have to cross the active storm sewer flow on the downstream side of the crossing to exit the channel. Complications on the south side of the creek crossing are created by the close proximity of the accesses and buildings on the south side of the intersection and on both, the east and west sides of Converse Avenue. Figure 4-6 - Grade Separated Crossing Issues – Grade Separated Crossing Issues illustrates the issues with a below grade crossing.

Section 7 Conclusions of this report recommend that the pedestrian crossing at the Converse Avenue and Dell Range Boulevard intersection be improved to facilitate a better pedestrian crossing at this intersection. A future evaluation of an overhead grade separated crossing, as indicated above, is also recommended. If the existing Dry Creek crossing is replaced in the future, the planning should include the incorporation of a pedestrian crossing, but this is not feasible at this time.

Figure 4-6 - Grade Separated Crossing Issues



5. Drainage

A drainage study was conducted for the Converse Avenue corridor between Ogden Road and the Dry Creek Bridge north of Dell Range Boulevard. The scope of the analysis focused on converting the existing drainage channel that parallels Converse Avenue to a subsurface system with reconstruction and expansion of the roadway. Because the current intersection with Short Term Improvements alternative emerged as the preferred option for the near term, drainage features at the Converse/Dell Range intersection were not modified or changed. The original storm sewer through this area was installed in 1992 (based on City GIS data). Converse Avenue was reconstructed more recently from Ogden Road to

the north. The design flows for the study were provided by the City and recommendations are based on the 100-year peak discharges at specific concentration points along the existing drainage ditch.

The drainage analysis recommended the following pipe sizes, which are incorporated in the 35% designs in Appendix A:

- 8'x5' Concrete Box Culvert: connect to the existing 8'x6' Box Culvert and extend north to the Point Bluff intersection. The reduction in the box culvert height is needed to provide adequate cover over the box. The capacity is still sufficient for the flows evaluated.
- Dual 48" Reinforced Concrete Pipe: from the Point Bluff intersection and extending north to the Ogden Road intersection; the dual 48" trunk line should be connected to the 6 inlets on the north side of the intersection and the existing dual 36" RCP Arch pipes that continue north.

6. Environmental Considerations

A technical memorandum was prepared describing the methods and results of an environmental screening to identify any major obstacles that would need to be addressed in environmental documentation required for the project. This technical memorandum also provides a place of initiation for the National Environmental Policy Act (NEPA) process and documentation. The purpose of this environmental screening is to provide a review of existing databases, a synthesis of input from regulatory agencies, desktop evaluations, recommendations for detailed studies, and potential mitigation needs.

Environmental resources present were analyzed for the project. This screening does not evaluate the following resources because no adverse, long-term impacts as a result of the project are anticipated: air quality, energy, environmental justice, public facilities, visual impacts, and water quality.

Preliminary agency scoping letters were sent to agencies on October 12, 2016 to the following agencies:

- US Army Corps of Engineers
- US Fish and Wildlife Service
- Federal Emergency Management Agency
- Natural Resources Conservation Service
- WY Game and Fish Department
- WY State Historic Preservation Office
- WY Department of Environmental Quality
- Laramie County Public Works
- Laramie County Board of County Commissioners
- Laramie County Conservation District
- City of Cheyenne Engineer's Office
- WY Office of Homeland Security

Based on the agency responses and the environmental analysis, a summary of potential impacts was prepared and are shown in Table 6-1;

Table 6-1 - Environmental Impact Summary

Resource	Summary of Impacts from the Alternatives
Land Use	Consistent with Land Use Plans
Section 4(f) and 6(f)	Alternatives 2-7 would impact Section 4(f) properties and would require additional coordination. It is anticipated that a *de minimis* determination would be needed, meaning that all measures were considered to avoid, minimize, mitigate, and enhance the Section 4(f) properties and the project would not adversely affect the activities, features, or attributes qualifying the property for protection under Section 4(f). The official with jurisdiction, the City of Cheyenne, would need to concur to be a *de minimis* finding. Additional coordination would need to occur with the Wyoming State Parks Office for impacts to Section 6(f) properties.
Farmland	No impacts are anticipated.
Floodplains	Designated floodplain is present and additional coordination with the local Floodplain Administrator would be needed.
Wetlands and Other Waters of the U.S.	Potential jurisdictional aquatic resources are present in the Study Area. An aquatic resources inventory would need to be completed to permit any impacts to jurisdictional aquatic resources.
Cultural Resources	The area has been disturbed it is unlikely that cultural resources are located in the area. No further identification effort is needed unless the project footprint changes.
Wildlife	No impacts are anticipated.
Threatened and Endangered Species	Multiple threatened or endangered species are potentially in the Study Area according to IPaC guidance. However, USFWS stated that the project is in compliance with the Endangered Species Act of 1973. Additional coordination should occur with this office if any new information indicates there may be effects to protected species and their habitats
Noise	Project is expected to be a Type I project according to WYDOT guidance and therefore would require a noise analysis before impacts can be determined.

During implementation of a project, additions work would need to be completed to further assess impacts of the projects on environmental resources. The following identifies specific work that would likely be required:

- Aquatic Resources Inventory – This field survey would need to be completed to permit impacts to jurisdictional waters of the U.S. with the U.S. Army Corps of Engineers.
- Noise Study – A noise study would need to be completed to analyze impacts of the alternatives on the residences and businesses in the area.
- Section 4(f) and 6(f) Resources Impact Analysis – Coordination would be needed with the City of Cheyenne if the preferred alternative would impact parks or recreation areas. Early coordination would be ideal to incorporate minimization efforts or if mitigation is required.
- Floodplain Coordination – Additional coordination with the local floodplain administrator would be needed to coordinate impacts to the floodplain or floodway.

7. Conclusion

The analysis methodology, the resulting output, the public input and recommendations from the design team were presented to the Steering Committee and the MPO Technical Committee. The preferred intersection alternative from this entire process was the Modified Continuous Flow Intersection. Given that funding for this project did not make the sixth-penny ballot initiative in May, 2017, and that the funding source for this project is uncertain in the foreseeable future, the short term improvements to the existing intersection should be incorporated until the preferred alternative can be funded.

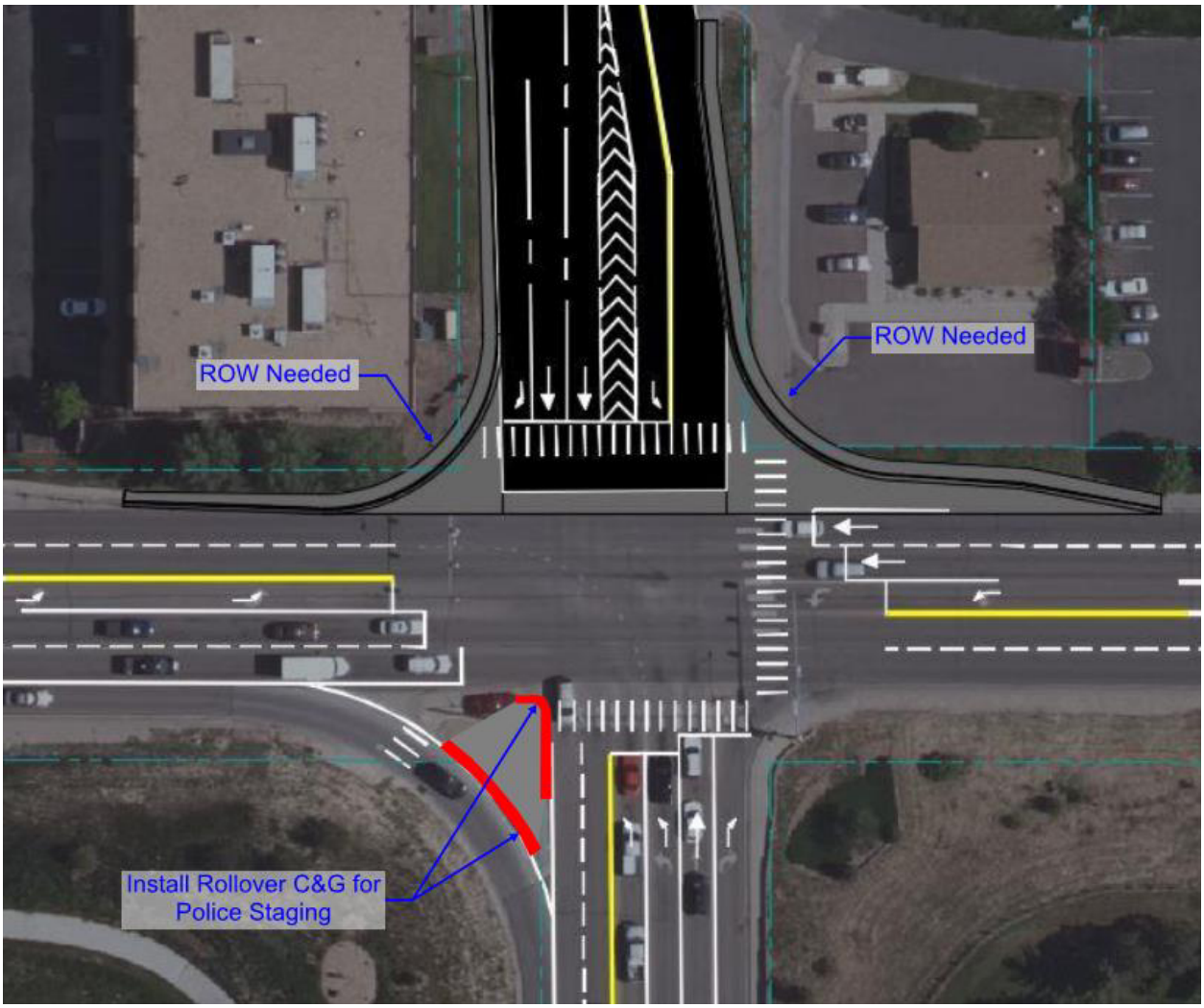
At this time, it is recommended that the improvements derived for the Short Term Improvements alternative be constructed to improve safety and functionality until a funding source for the preferred alternative become available. The recommended improvements were incorporated into the 35% design and the Engineer's Opinion of Probable Costs and include;

- Restriping the north leg to shift the southbound left-turn lane to the east
- Eliminate the split phasing for the north-south approaches
- Optimize the signal timing, including adding right-turn overlaps for the northbound right turn, the southbound right turn, and the westbound right turn
- Add supplemental left-turn heads for the eastbound and the westbound approaches
- Increase the curb-and-gutter radius in the northwest and northeast corner to better accommodate truck traffic
- Providing a staging location for law enforcement to monitor the intersection
- Provide 10 feet wide pedestrian crossings on the north, east and south legs of the intersection with stop bars. Pedestrian crossing times should be evaluated to ensure that it satisfies the current MUTCD standard for a 3.5 feet per second pedestrian speed.
- Stagger stop bars to move waiting vehicles out of the south bound left turn, west bound left turn, and north bound left turn movements as illustrated in Figure 7-1- Short Term Improvements.

Safety improvements will be realized inherently when the overall corridor improvements identified in this study and previous studies are completed. Improved connectivity and dedicated pedestrian and bicycle facilities will provide improved safety conditions when compared to existing conditions such as the creation of a grade separated Greenway crossing at Dry Creek, near Grandview Avenue.

Additionally, future analysis of a grade separated crossing along Converse Avenue between Dell Range and Point Bluff is recommended based on comments received during the public meeting process. Additionally, some improvement to traffic operations and a general increase in intersection safety will be realized by completing the Short Term Improvements alternative.

Figure 7-1- Short Term Improvements



Another recommendation is for the City to consider the purchase of a portion of, or the entire parcel of land on the northeast corner of the intersection. This would provide the needed land for the recommended improvements of the Short Term Improvements alternative and the preferred Modified Continuous Flow Intersection. This land could also be used to assist with traffic and law enforcement efforts at this intersection. A safe and visible staging area for law enforcement vehicle parking and observations could be incorporated on this land.

8. Engineer's Opinion of Probable Cost

The costs for the project were developed using average bid prices from projects previously bid in the City of Cheyenne, the City of Gillette, and WYDOT in Laramie County and historical HDR project experience using present 2017 dollars. Bid items have been compiled based on the best available knowledge of typical street reconstruction / rehabilitation and needs; specialty items that are large unknowns at this time such as ROW acquisition, traffic signal equipment upgrades (if needed), final surfacing material, any complications associated with the Dry Creek bridge crossing, and potentially even a grade separated pedestrian crossing would be captured in the 40% contingency that is indicated on the cost estimate. The contingency was developed from the American Association of Cost Estimators tables to apply an appropriate amount of contingency for our level of design. These costs do not include ROW acquisition, additions to the Dry Creek Bridge or grade separated pedestrian crossings. The Engineer's Opinion of Probable Cost was developed to reflect the costs associated with 35% designs for the Converse Avenue corridor and the Short Term Improvements alternative. These costs are attached in Appendix B of this report.

9. Works Cited

Ayres Associates. (2016 a.). *Dell Range Boulevard Corridor Study Powder House Road to College Drive.* Cheyenne, Wyoming: Cheyenne Metropolitan Planning Organization.

Ayres Associates. (2016 b.). *Dell Range Boulevard Corridor Study Phase II - Section 20.* Cheyenne, Wyoming: Cheyenne Metropolitan Planning Organization.