Tri-County Coal Truck Route Study

Recommendations Technical Memo

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PREPARED BY:

CDM SMITH

PREPARED FOR:

UTAH DEPARTMENT OF TRANSPORTATION

REGION 4

AND

UTAH DEPARTMENT OF TRANSPORTATION

PLANNING SECTION

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1. Purpose

The Tri-County Coal Truck Route Study will look at a specific route that is proposed to be taken by the coal trucks from the Alton Coal Mine to unloading destinations just west of Cedar City, Utah. The purpose of this study is to identify and evaluate impacts to this "coal truck route" based on the added truck volumes, dimensions, and weights, and develop recommendations for roadway improvements to mitigate these impacts. Mitigation of these impacts will address the Utah Department of Transportation's (UDOT) goal to preserve the safety, mobility, and accessibility of the traveling public.

The outcome from this process identified improvements necessary along the selected coal truck route between Alton and Iron Springs. The improvements listed within this study will be combined with the other projects within Region 4 and prioritized according to total need and benefit. UDOT has an established selection and prioritization process to develop lists of multi-modal projects for inclusion in the Statewide Transportation Improvement Program (STIP).

This study does not supersede the STIP process. It does identify potential projects and helps define the bounds, implementation phasing, and preliminary cost estimates for each project. Recommendations are designed to benefit the traffic and operations along the selected coal route. However, the Region must weigh the benefits and costs as compared to other potential improvements, to plan for the most productive use of available funds.

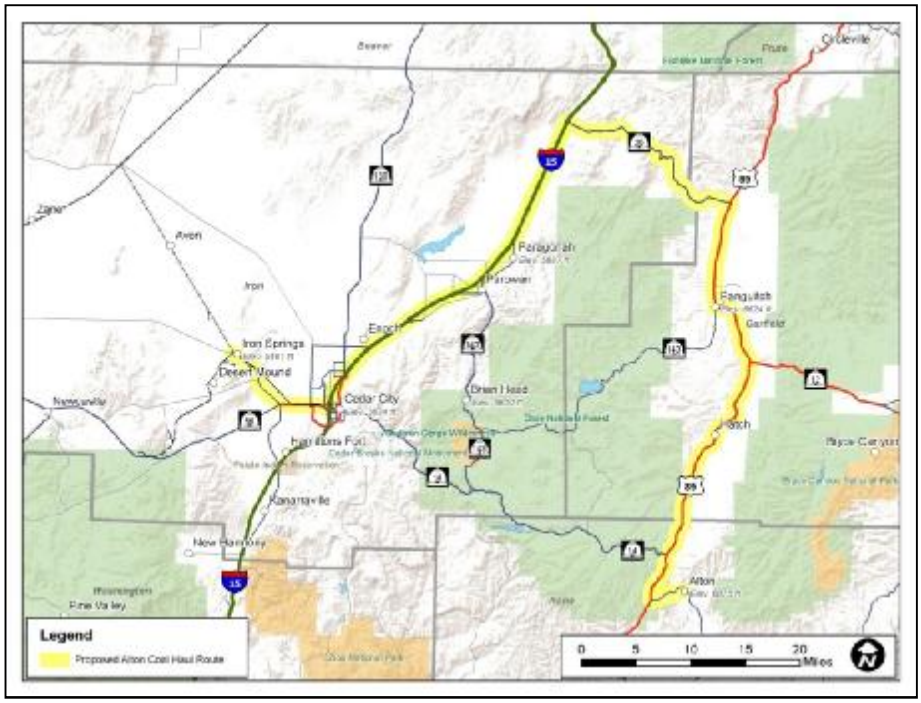
The proposed route, as shown in **Figure 1-1**, will include the following paved roadways:

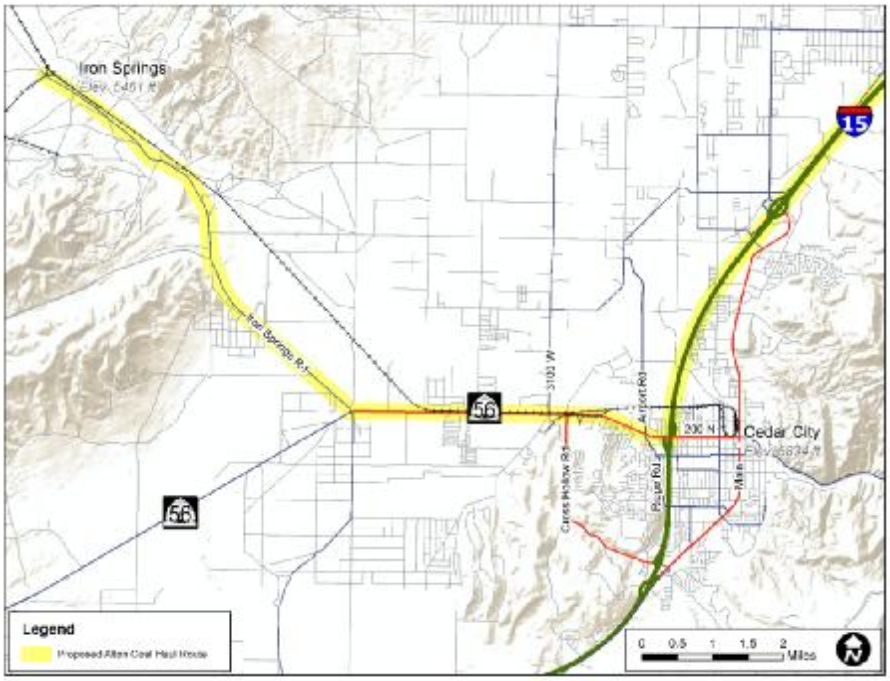
- Alton Road; from dirt road leading from mine to U.S. Highway 89;
- U.S. 89; from Alton Road to S.R. 20;
- S.R. 20; from U.S. 89 to I-15 Interchange at MP 95;
- I-15; from MP 95 to MP 59;
- S.R. 56; from I-15 Interchange at MP 59 to Iron Springs Road;
- Iron Springs Road; from S.R. 56 to an unloading station to the northwest.

Numerous potential routes were identified prior to the beginning of this study; including the most direct route from the mine to the Iron Springs site along S.R. 14. However, this direct route and many other alternatives were identified as not being feasible because of either challenging roadway geometrics and topography, a potentially unsafe mixing of trucks, cars and recreational vehicles, or negative mileage (longer route) and travel

times (longer time to drive). These potential routes were dismissed before the study began, and were not included in the study.

Figure 1-1: Study Area Maps





The proposed route will take trucks through Panguitch, Parowan, and Cedar City on their way to Iron Springs. This study examined potential improvement options for the proposed route, as well as developing recommended improvements that are necessary to accommodate the increased traffic. The study had multiple elements from traffic, operations, and safety; to economic impact and cost/benefit of the roadway improvements, asset management, and recommended staging of any new construction.

2. Recommended Projects

The recommended improvements which were identified for this final list were developed and analyzed throughout the study. The Final Conditions Technical Memo contains the detailed analysis as the study progressed to the recommendations.

2.1. Projects

Projects were developed within this study or were integrated from studies completed just prior to this study. Two other consultant lead studies were reviewed and the improvement projects included in this study. The findings from these studies were centered along the U.S. 89 corridor specifically. The first study was a detailed analysis of the U.S. 89/S.R. 12 intersection (report number S-0089 (225) 24, PIN 8355). Recommendations for U.S. 89/S.R. 12, which are shown in **Error! Not a valid bookmark self-reference.,** come from this study. Similarly, recommendations for passing lanes on U.S. 89 are from the U.S. 89 Passing Lanes Analysis (report number S-R499 (100), PIN 8277). These recommendations have been approved by UDOT and incorporated into this study to supply a comprehensive look at all potential improvements along the corridor as they relate to traffic, geometrics, and the addition of larger vehicles.

Table 2-1 shows the project list of recommended improvements for the tri-county area regarding the coal route study. Projects below are listed in order along the route traveling from Alton to Iron Springs, except for suggested local road improvements along Alton Road and Iron Springs Road, which are listed at the end.

Projects were developed within this study or were integrated from studies completed just prior to this study. Two other consultant lead studies were reviewed and the improvement projects included in this study. The findings from these studies were centered along the U.S. 89 corridor specifically. The first study was a detailed analysis of the U.S. 89/S.R. 12 intersection (report number S-0089 (225) 24, PIN 8355). Recommendations for U.S. 89/S.R. 12, which are shown in **Error! Not a valid bookmark self-reference.,** come from this study. Similarly, recommendations for passing lanes on U.S. 89 are from the U.S. 89 Passing Lanes Analysis (report number S-R499 (100), PIN 8277). These recommendations have been approved by UDOT and incorporated into this study to supply a comprehensive look at all potential improvements along the corridor as they relate to traffic, geometrics, and the addition of larger vehicles.

Table 2-1: Project List

Intersection	Recommended Improvement
U.S. 89/Alton Road	Add 1 mile acceleration lane to NB; improve Alton Road
U.S. 89/S.R. 14	Lengthen existing SB passing lane between MP 104-105
U.S. 89	Add SB passing lane at MP 107-108.5
U.S. 89/S.R. 12	Lengthen NB acceleration and deceleration lanes, widen shoulders, signing, lighting & pavement markings
U.S. 89/S.R. 143	Widen NE radius and close 1st drive along NB U.S. 89
U.S. 89/S.R. 20	Pave NW shoulder & widen SW radius
S.R. 20	Add passing lane WB at MP 7.5 - 10 and EB at MP 10 - 11.5
S.R. 20/I-15	Widen SE radius at exit ramp and add acceleration taper
NB I-15/S.R. 56	Lengthen acceleration lane by 2000'
SB I-15/S.R. 56	Lengthen deceleration lane by 1500'
	Add 2nd left turn lane for WB S.R. 56
S.R. 56/Airport Rd	Add through lane to EB lanes & left turn lane for SB Airport
S.R. 56/Lund Rd	Add left turn lane for SB and WB leg. Add WB intersection through lane.
S.R. 56/Iron Springs Rd	Widen NE radius; improve Iron Springs Road
Alton Road	Frequent visual inspections of the roadway pavement. Possible reconstruction at a later date. Complete pavement overlay. Additional roadway warning signs may need to be installed.
Iron Springs Road	Repave roadway. Continuous monitoring of the pavement, base and sub base for possible reconstruction. Replacement of roadway signs and new signage to meet current MUTCD standards. Potential new traffic signal at S.R. 56.

2.2. Projects Discussion

Detailed Fact Sheets for the following projects (except for the Alton Road and Iron Springs Road local road projects) exist in **Appendix A** of this technical memorandum. The following discussion will give a brief review of each project listed in **Table 2-1.**

U.S. 89/Alton Road

This project adds a one-mile passing lane to northbound U.S. 89. This project was identified based on the slight uphill nature of U.S. 89 traveling north from Alton Road. The heavy payload of these vehicles will require some time to build up speed. In order to avoid congestion potential and accidents for merging truck traffic, an acceleration lane is recommended.

U.S. 89/S.R. 14 and U.S. 89

Both of these recommendations come from UDOT report number S-R499 (100), PIN 8277. The study was performed by Morrison Maierle, Inc. in July 2011 for Region 4. The improvements include lengthening the existing southbound passing lane on U.S. 89 between MP 104-105 and adding a southbound passing lane at MP 107-108.5

U.S. 89/S.R. 12

This improvement came from UDOT report number S-0089 (225) 24, PIN 8355. It was completed by Civil Science, Inc. in April 2011 for Region 4. The improvements include lengthening the acceleration and deceleration at the intersection, widening the shoulders improving the intersection geometry/sight distance, and upgrading the signing, lighting and pavement markings at this T-intersection.

U.S. 89/S.R. 143

In order to accommodate the multiple trucks that currently use U.S. 89 through Panguitch and prepare for the increase in truck traffic, improvements to the turning radius of this intersection are necessary. Widening the northeast quadrant of the intersection and closing the first drive along northbound U.S. 89 will help both the safety aspect of the intersection and limit the deterioration of the curbing. It will also make the right turn on U.S. 89 easier for long combination vehicles and eliminate the need to swing wide and/or take up both travel lanes.

U.S. 89/S.R. 20

The turning movements to and from S.R. 20 and U.S. 89 are restricted due to the tight turning radii at this T-intersection. Right-of-way (ROW) exists on each side of the roadway to allow for pavement expansion. Therefore, this improvement was identified to allow better turning from U.S. 89 to S.R. 20 by paving the northwest quadrant of the intersection and allow safer merging to U.S. 89 from S.R. 20 by widening the southwest quadrant. This will allow trucks to turn more freely and help eliminate the trucks from entering opposite direction travel lanes during the turn.

S.R. 20

Passing lanes on S.R. 20 westbound at MP 7.5 - 10 (2.5 total miles) and eastbound at MP 10 - 11.5 (1.5 total miles) are recommended. This is the downhill area from the summit at 7,920 ft. Due to the 8% decline from the summit, passing lanes are recommended. At the summit, a short stretch of four lane roadway exists (MP 10).

S.R. 20/I-15

The traffic at this interchange exiting I-15 is primarily coming from the southbound lanes. The vehicles (mostly trucks and large RV-campers) will cross the bridge over I-15 and continue on S.R. 20 eastbound. With the returning coal trucks using the exit from northbound I-15, the need to increase the pavement on the southeast quadrant of the interchange is necessary to secure coal trucks merging onto S.R. 20 eastbound from the exit ramp without impeding the traffic in either direction on the two-lane S.R. 20.

NB I-15/S.R. 56

For returning trucks, the need to lengthen the acceleration lane by 2000 feet is apparent to avoid accidents as trucks gather speed and merge onto the interstate. The lengthening would carry the acceleration lane fully across the bridge crossing 560 North. The bridge is in good condition with a 95.4 sufficiency rating and is currently three lanes. Lengthening the lane past this bridge would help the trucks, because there is a slight uphill grade and the ramps current configuration is slightly curved at the beginning, further hampering the trucks initial opportunity to gain speed.

SB I-15/S.R. 56

With large vehicles traveling at interstate speeds of 70 mph on I-15, a longer deceleration lane will be necessary. Lengthening the deceleration lane by 1500 feet will allow trucks to slow as they merge onto a ramp that makes a sharp turn. This would put the beginning of the deceleration lane just after the I-15 bridge over 560 North. The ramp itself is constrained by other ramps and development, so redesign and land acquisition is too costly. Reducing speed is the next logical choice for heavy trucks (43 tons per truck loaded) approaching the 180 degree turn, to avoid tipping over.

At the end of the ramp, vehicles encounter a traffic signal at S.R. 56. The coal trucks will need to turn left and travel west on S.R. 56 to Iron Springs. This turning movement currently has a significant number of turns in an hour (as shown in the Future Conditions Technical Memo analysis) so it is recommended to add a second left turn lane for westbound S.R. 56. S.R. 56, identified as 200 N locally, has two travel lanes to accommodate the multiple turn lanes. The recommended improvement would reduce the signal delay and congestion that a 95 foot combination vehicle could produce, along with normal freight traffic exiting the interstate at this location.

S.R. 56/Airport Rd

Once on S.R. 56, the need to coordinate timing between the signal at Airport Rd and the I-15 exit ramp is necessary, especially for loaded trucks. The intersections are ¼ mile

apart. To help facilitate the separation of commercial and passenger traffic, it is also recommended to add a through lane to the eastbound lanes of S.R. 56 and add a left turn lane for southbound Airport to compensate for decreasing the green-time for the cross street as traffic turns onto S.R. 56 eastbound.

S.R. 56/Lund Rd

For the intersection at S.R. 56 and Lund Highway, an addition of a left turn lane for the southbound leg of Lund Road and an additional through lane for S.R. 56 are recommended. This will help safely complete the turning movement from Lund to S.R. 56.

S.R. 56/Iron Springs Rd

The final turn onto Iron Springs Road before reaching the rail load facility is a right turn that does not supply sufficient room for long combination truck movements. This recommendation includes widening the northeast quadrant radius with additional pavement and restriping the markings on Iron Springs Road as they have deteriorated and are barely visible.

Alton Road

This section of the selected route carries trucks from the dirt road leading to the mine out to U.S. 89. Alton Road is a 4.4 mile stretch of 2-lane roadway under county jurisdiction. The town of Alton is at the eastern end of this road while U.S. 89 is at the other. This road has limited shoulders, but the lane width is generous.

Trucks coming from the mine enter the paved roadway from County Road 10, a dirt road. Trucks ride along 200 South for 1/3 of a mile to 100 East (Main Street). Trucks must then turn right on Main Street and proceed north through town and out to the highway (U.S. 89). This right turn occurs at the city center where the church and school are located on the west side of Main Street and the post office is located on the east side (just past Center Street as traveling north). Most residents appear to live to the south and west of this area.

From visual inspection, the current pavement appears to be in good condition. Standard signs and slow speeds exist along the route to warn drivers of the upcoming conditions/hazards. The Kane County Road Maintenance Department has the responsibility of maintaining Alton Road. A drainage culvert was recently replaced on Alton Road, located just east of U.S. 89.

Future truck traffic will likely accelerate the pavement deterioration more rapidly than normal. Given the weight and frequency of the trucks, it is likely that the roadway pavement along the truck route will need replacing in half the time as previously estimated.

Specific problems may arise at the intersection of 100 E (Main Street) and 200 S. As loaded trucks turn north onto Main Street, the turning radius might not be adequate if an unloaded truck is traveling south and preparing to turn left onto 200 S simultaneously. Current residents seem to have adapted to the current traffic and given the limited daytime traffic, the interaction between trucks and local traffic are isolated to peak morning and evening traffic.

The following recommendations are suggested:

- The Kane County Road Maintenance Department should conduct more frequent visual inspections of the roadway pavement – specifically looking for pavement cracking that is consistent with unstable subgrade conditions. These unstable areas will need to have the subgrade replaced.
- The Department may need to consider reconstruction at a later date (cost to be determined at that date). This would be a long term improvement.
- A complete pavement overlay will need to be planned for in the medium-term.
- After truck traffic and local traffic interaction is observed, additional roadway warning signs may need to be installed along the truck route.

Iron Springs Road

Iron Springs Road is a paved 2-lane (1 lane in each direction) road with unpaved shoulders. It begins at the intersection of S.R. 56 at approximately milepoint 107.3 and continues to the northwest.

Iron Springs Road was last improved in 1989 with a 3” hot mix overlay and unspecified widening to its present roadway width of 30 ft.

A railroad spur off the Union Pacific mainline parallels the roadway to the northeast. There are some existing rail load facilities between the WELCO plant and the landfill. Current pavement is in poor condition. There is also inadequate and old/non-reflective signage for commercial and residential vehicles.

Along with the continued landfill activity, additional coal trucks will be using Iron Springs Road to access the rail loading facility. In addition, the iron mine[1] 20 miles west of Cedar City is preparing to reopen and will be moving freight via truck and railcar as the ore is shipped to China. According to plans, the mine should be operational in 2012. The rail facility will also serve to carry ore from the Alton mine. This will cause increased deterioration to Iron Springs Road. Depending on the nature and location of the rail facility improvements, Iron Springs Road will likely need to accommodate additional volumes of coal trucks from the Alton mine.

In addition to coal trucks and other truck traffic, increased fuel truck traffic is also occurring along Iron Springs Road. The UNEV pipeline has now been completed, and there is heavy truck traffic to/from the UNEV spur on Iron Springs Road. Given the weight and frequency of the trucks, it is likely that the pavement on Iron Springs Road will need replacing sooner than normally anticipated.

The following recommendations are suggested:

- Iron Springs Road will need repaving in the short to midterm future based on when the trucks actually begin hauling.
- Continuous monitoring of the pavement, base and sub base is encouraged into the future. The Iron County Engineer's office may need to consider reconstruction at a later date (cost to be determined at that date). This would be a long term improvement.
- Replacement of roadway signs and new signage meeting current MUTCD standards will be necessary.
- There is a potential need for a new traffic signal at S.R. 56 (depending on route and frequency of trucks from iron mine to the west and the coal trucks from the east). This would be a long-term improvement.

3. Staging of Recommendations

This section will outline the future scenarios, discuss the staging of the recommended improvements, and explain the cost estimation methodology.

[1] http://www.deseretnews.com/article/700045770/Utah-company-reopening-iron-mine-near-Cedar-City.html

3.1. Future Scenarios

The scenarios for the analysis were established in the *Future Conditions Technical Memorandum*. **Table 3-1** shows the projects as they appear in the analysis scenarios. The scenarios are described as follows:

1. No Build 2030

   This scenario will use the base 2008 Utah road network and 2030 demographics with the additional coal trucks using the specified route. This scenario will show the effect of travel patterns if no additional roadway expansion is done to serve the increased demand from projected traffic growth.

2. LRP 2030

   This scenario will use the roadway network proposed in UDOT's 2030 Long Range Transportation Plan (LRP), which includes the 2010-2030 fiscally- constrained list of projects. The 2030 LRP also takes into account the increased passenger demand in 2030 (more traffic).

3. Coal Truck Recommendations 2030

   This scenario will use the roadway network proposed in UDOTs 2030 Long Range Transportation Plan (LRP), taking into account:

   - The increased 2030 passenger demand
   - The additional coal trucks to/from the Alton Mine
   - Any recommendations from the Existing Conditions Tech Memo in the Tri-County Coal Truck Route Study that can be modeled using the Utah Statewide Travel Model (USTM).

Table 3-1: Recommendation Summary

Intersection	Recommended Improvement	Scenario Applicable To		
		1	2	3
US 89/Alton Road	Add 1 mile acceleration lane to NB			x
US 89/SR 14 [1]	Lengthen existing SB passing lane between MP 104-105			
US 89 [1]	Add SB passing lane at MP 107-108.5			
US 89/SR 12 [2]	Lengthen SB & NB acceleration lane, widen shoulders, signing, lighting & pavement markings	x	x	x
US 89/SR 143	Widen NW radius and close 1st drive along NB US-89			x
US 89/ SR 20	Pave NW shoulder & widen SW radius			x
SR 20	Add passing lane WB at MP 7.5 - 10 and EB at MP 10 - 11.5		x	x
SR 20/ I-15	Widen SE radius at exit ramp			x
SB I-15/SR 56	Lengthen deceleration lane by 1500'			x
	Add 2nd left turn lane for WB SR-56			x
NB I-15/SR 56	Lengthen acceleration lane by 2000'			x
SR 56/Airport Rd	Add through lane on EB & left turn lane for SB Airport	x	x	x
SR 56/Cross Hollow Rd	No improvements recommended			
SR 56/Lund Rd	Add left tun lane for SB and WB leg. Add WB intersection through lane	x	x	x
SR 56/Iron Springs Rd	Widen NE radius			x
Alton Road	Frequent visual inspections of the roadway pavement. Possible reconstruction at a later date. Complete pavement overlay. Additional roadway warning signs may need to be installed.	x	x	x
Iron Springs Road	Repave roadway. Continuous monitoring of the pavement, base and sub base for possible reconstruction. Replacement of roadway signs and new signage to meet current MUTCD standards. Potential new traffic signal at S.R. 56.	x	x	x

1 Improvement(s) identified in UDOT report number S-R499 (100), PIN 8277 with no associated cost.

2 Improvement and associated cost estimate are from UDOT report number S-0089 (225) 24, PIN 8355.

The scenario that each recommended improvement applies to is dependent on the type of improvement. If the improvement is due to an existing safety concern or projected capacity issue of existing traffic, it applies to all three alternatives. If the improvement is part of the LRP, then it applies to alternatives 2 and 3. Improvements to the study area that are needed for the coal trucks to safely traverse the coal truck route only apply to alternative 3.

The analysis shows recommendations based on the potential time of implementation. It is important to realize that the scenario analysis is not financially constrained. As mentioned previously in **Chapter 1**, the recommendations are to be folded into the STIP process as potential improvements and prioritized according to the overall benefit to the region.

3.2. Implementation Phase and Concept-level Cost Estimates

Concept-level cost estimates were completed for recommendations from the *Existing Conditions Technical Memorandum* that required further analysis. To analyze these recommendations a design vehicle matching the coal truck's dimensions was created in AutoTurn 7 to check existing intersection/interchange radii. In locations where the existing radii were not sufficient, these were improved to allow for the coal truck movement. There were also a number of recommendations that were made in the *Existing Conditions Technical Memorandum* that did not require additional analysis such as access management and addition/extension of acceleration and deceleration lanes.

Although improvements were identified, not all concept-level costs were determined for local road improvement recommendations on Alton Road and Iron Springs Road. Some of the local road improvements for Alton Road are included in the U.S. 89/Alton Road intersection recommendations, while some of the local road improvements for Iron Springs Road are included in the S.R. 56/Iron Springs Road intersection recommendations. Those that are not included are listed separately under headings for Alton Road and Iron Springs Road. No concept-level cost estimates have been developed for these recommendations. The cost estimates for these improvements will be determined by the appropriate jurisdictional agencies if and when the improvements enter the planning and design phases. However, we recognize the value and importance of these recommended improvements, and included them in the study.

Concept-level costs were determined for each recommendation based on data from field analysis, UDOT sources, and UDOT estimation procedures. These cost estimates do not include ROW, Preliminary Engineering (PE) Design Services, Construction Engineering (CE), Utilities, or Environmental costs except for the U.S. 89/S.R. 12 intersection. This recommendation's cost comes directly from the intersection project scoping report number S-0089 (225) 24, PIN 8355. The cost estimates are based on

UDOT standard pay items and average bid letting unit costs from 2010. For construction costs not explicitly calculated, percentage based costs were utilized. These percentages were discussed with, and agreed to, by UDOT staff.

As discussed in the Existing Conditions report, improvements were recommended to be implemented based on a prioritized construction schedule, as shown below in **Table 3-2**. These conceptual time frames are from current year to improvement implementation.

Table 3-2: Construction Implementation Schedule

Short-term	Safety Improvements (widen curb radii); striping; signal optimization
Medium-term	Operational improvements (add turn lane, widen shoulders); overlays
Long-term	Capacity improvements/large capital investments (passing lane, additional lane capacity at signalized intersections)

The total Investment for all phases of recommendations totaled $17 million in current year funds. The phasing breaks the concept-level costs down into the implementation phases, and shows the short-term improvements as $156,600, medium-term projects at almost $7.7 million, and long-term improvements at almost $9.2 million. This is illustrated in **Table 3-3**.

Table 3-3: Implementation Phase Summary

	Phase Total
Short-term	$ 156,600
Medium-term	$ 7,682,400
Long-term	$ 9,186,000
Total	$ 17,025,000

The recommended short-term, medium-term and long-term improvement projects for each scenario have been divided based on the recommended implementation schedule as shown in **Table 3-4**.

Each of the improvements documented in this report are based on a single peak traffic analysis and would need to be verified with a thorough project-level traffic analysis (AM, non-peak and PM turning movement analysis), to refine/confirm the extent of an improvement. As funds become available, smaller pieces of a recommended improvement can be implemented to best suit UDOT's budget constraints.

Signal timing optimization will likely be needed on S.R. 56 to accommodate growing traffic conditions between now and 2030. The long-term improvements along S.R. 56 were needed based on the 2030 traffic analysis and should be reviewed as level-of-service (LOS) worsens over time with increased traffic volumes. The phase of the

improvement projects were estimated based on the need, ease and cost of improvement implementation.

Table 3-4: Recommended Implementation Schedule

Intersection	Recommended Improvement	Cost Estimates
Short-Term Improvements		$156,600
U.S. 89/S.R. 143	Widen NE radius and close 1st drive along NB U.S. 89	$74,600
S.R. 20/I-15	Widen SE radius at exit ramp	$41,000
S.R. 56/Iron Springs Rd	Widen NE radius	$41,000
Alton Road	Frequent visual inspections	N/A
Iron Springs Road	Monitoring of the pavement, base and sub base	N/A
Medium-Term Improvements		$7,682,400
S.R. 56/Iron Springs Rd	Cold mill and overlay for Iron Springs Road. Sixteen new roadway warning signs along Iron Springs Road.	$2,524,000
U.S. 89/Alton Road	Add 0.33 mile acceleration lane to tie into existing NB passing lane; Cold mill and overlay for Alton Road. Six new roadway warning signs. In Alton, Main St./200 S. intersection improvements	$1,287,400
U.S. 89/S.R. 14 [1]	Lengthen existing SB passing lane between MP 104-105	N/A
U.S. 89 [1]	Add SB passing lane at MP 107-108.5	N/A
U.S. 89/S.R. 12 [2]	Lengthen SB & NB acceleration lane, widen shoulders, signing, lighting & pavement markings	$1,182,000
U.S. 89/S.R. 20	Pave NW shoulder & widen SW radius	$77,000
NB I-15/S.R. 56	Lengthen acceleration lane by 2000'	$2,612,000
Iron Springs Road	Monitoring of the pavement, base and sub base	N/A
Long-Term Improvements		$9,186,000
S.R. 20	Add passing lanes	$6,503,000
SB I-15/S.R. 56	Lengthen deceleration lane by 1500'	$1,866,000
	Add 2nd left turn lane for WB S.R. 56	$92,000
S.R. 56/Iron Springs Rd	New traffic signal	(Costs included in medium-term improvements)
S.R. 56/Airport Rd	Add through lane to EB lanes & second left turn lane for SB Airport.	$619,000

Intersection	Recommended Improvement	Cost Estimates
S.R. 56/Lund Rd	Add second left turn lane for SB and WB leg. Add WB intersection through lane.	$106,000
Alton Road	Possible roadway reconstruction	N/A
Iron Springs Road	Monitoring of the pavement, base and sub base; Possible roadway reconstruction	N/A
Grand Total		$17,025,000

1 Improvement(s) identified in UDOT report number S-R499 (100), PIN 8277 with no associated cost.
2 Improvement and associated cost estimate are from UDOT report number S-0089 (225) 24, PIN 8355. Elements of this project will be phased depending on Region 4 priorities and available funding.

Some of these recommendations may need to be expedited because of the mine operation lifeline and the importance to passenger and freight traffic safety. Most importantly is the need to lengthen or establish acceleration/deceleration lanes along the route. Investments in the U.S. 89/Alton Road project and lanes on northbound and southbound I-15 at S.R. 56 exit would be the most impactful to the corridor. While the improvements are very beneficial, modifying ramps along an Interstate requires special Interchange Justification Report from the FHWA. Therefore, UDOT should begin the process documentation and engineering now in order to be ready in a few years to build the ramps upon approval from the FHWA. A typical interchange proposal process and approval decision can take up to 30 months.

4. Next Steps

As mentioned in **Chapter 1**, the outcome of this process identified improvements necessary along the selected coal truck route between Alton and Iron Springs. The improvements listed within this study will be combined with the other projects within Region 4 and prioritized according to total need and benefit. UDOT has an established selection and prioritization process to develop lists of multi-modal projects for inclusion in the STIP.

This study does not supersede the STIP process. It does identify potential projects and helps define the bounds, implementation phasing, and preliminary costs estimates for each project. Recommendations are designed to benefit the traffic and operations along the selected coal route, but the Region must weigh the benefits and costs as compared to other potential improvements, to plan for the most productive use of available funds.

Appendix A

Detailed Fact Sheets for the following projects (except for some on Alton Road and Iron Springs Road) are found in this Appendix. They include:

1 U.S. 89/S.R. 143 - Widen NE radius and close 1st drive along NB U.S. 89

2 S.R. 20/I-15 - Widen SE radius at exit ramp and add merge taper at southeast radius to accommodate truck maneuvering

3 S.R. 56/Iron Springs Rd - Widen NE radius; New traffic signal in future; Cold mill and overlay for Iron Springs Road; Add 16 warning signs along Iron Springs Road

4 U.S. 89/Alton Road - Add 0.33 mile acceleration lane to NB U.S. 89; Cold mill and overlay for Alton Road; Six new roadway warning signs; In Alton, Main St./200 S. intersection improvements; Concept Report addressing options on US-89, SR-12 to Glendale

5 U.S. 89/S.R. 12 - Lengthen SB & NB acceleration lane, widen shoulders, signing, lighting & pavement markings

6 U.S. 89/S.R. 20 - Pave NW shoulder & widen SW radius

7 NB I-15/S.R. 56 - Lengthen acceleration lane by 2000 feet

8 S.R. 20 - Add passing lanes

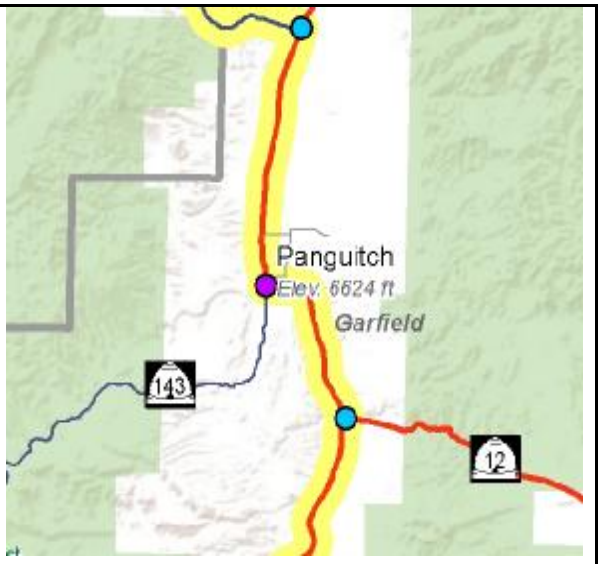
9a SB I-15/S.R. 56 - Lengthen deceleration lane by 1500 feet

9b SB I-15/S.R. 56 - Add second left turn lane for WB S.R. 56

10 S.R. 56/Airport Rd - Add through lane to EB lanes & second left turn lane for SB Airport

11 S.R. 56/Lund Rd - Add second left turn lane for SB and WB leg. Add WB intersection through lane.

Project Number:	**1**	
Road 1:	U.S. 89	
Road 2:	S.R. 143	
County:	Garfield	
Length (Miles):	Intersection	
Improvement: Widen NE radius and close 1st drive adjacent to the curve spring point		
Phase:	Short-term	
Cost:	$	74,600



Reasons Identified

The intersection realizes a large number of truck movements through a small urban area.
Coal route takes a 90 degree turn at this location, so radii and safety issues are a concern.

Existing Roadway Characteristics

Route Description	The existing four-leg intersection is an all stop with flashing red light signals and signs. Westbound U.S. 89 has a right turn lane with a tapered down parking lane for a total width of approximately 16 ft. Southbound U.S. 89 has two lanes, which provides necessary space for right turning trucks.		
Lanes	***Road 1***	4	
	Road 2	2	
Pavement Condition	***Overall***	Fair (on U.S. 89)	
	Condition/Ride Index	SB = 68.39 / 80.43	NB = 64.40 / 79.80
Crash Data	***3-year total ('07-'09)***	12	
	Fatals	0	
Existing Overall LOS	N/A	unsignalized	

Safety Analysis

There is noticeable curb and sidewalk damage in the NE quadrant, which has an approximate radius of 35 ft. Southbound U.S. 89 has a left turn lane to two lanes on eastbound U.S. 89, providing sufficient space for trucks. There were 12 crashes, all of which were no injury/PDO.

Committed Improvements, if any N/A

Current and Future Land Use

This intersection is in the heart of Panguitch, Utah and serves as the main intersection of town. The streets are mainly small commercial businesses and service stations.

Environmental Issues

None

Proposed Roadway Improvements

Widen the NE radius to accommodate truck maneuvering onto NB U.S. 89
Close or limit NE driveway(s) to avoid crash potential (close one of the driveways/curb cuts after the NB turn to Thomas's Service Center (old gas station)).

Project Number:	**2**	
Road 1:	S.R. 20	
Road 2:	I-15	
County:	Iron	
Length (Miles):	Intersection	
Improvement: Widen SE radius at exit ramp and add merge taper		
Phase:	Short-term	
Cost:	$	41,000
Reasons Identified Difficult turning movements for trucks Directional mix at interchange as coal trucks differ from normal truck traffic patterns		

Existing Roadway Characteristics

Route Description	The I-15 interchange with S.R. 20 is a diamond configuration with S.R. 20 spanning over I-15. The SB I-15 on ramp is approx. 2500 ft. long prior to its merge point. The NB I-15 off ramp is approx. 1900 ft. long with a single lane. The turning radius to EB S.R. 20 is approx. 80 ft. S.R. 20 has no turn lanes.		
Lanes	***Road 1***	2	
	Road 2	4	
Pavement Condition	***Overall***	Good (on S.R. 20)	
	Condition/Ride Index	EB = 92.10 / 83.00	WB = 92.46 / 84.40
Crash Data	***3-year total ('07-'09)***	9	
	Fatals	0	
Existing Overall LOS	A (0.05 = v/c)	unsignalized	

Safety Analysis
The few crashes at this interchange suggest that there is no existing operational or safety issues. Addition of a turn lane from WB S.R. 20 to SB I-15 and NB I-15 ramp to S.R. 20 may be necessary depending on future traffic volume increases. The radius from NB I-15 ramp to EB S.R. 20, for returning trucks, will likely need to be improved and/or a right merge lane added.

Committed Improvements, if any N/A

Current and Future Land Use
This interchange is in a rural area with no development in area.

Environmental Issues
None

Proposed Roadway Improvements
Widen the southeast radius at exit ramp from I-15 onto S.R. 20 to accommodate truck maneuvering
Add merge taper at southeast radius to accommodate truck maneuvering

Project Number:	**3**
Road 1:	S.R. 56
Road 2:	Iron Springs Road
County:	Iron
Length (Miles):	Intersection, roadway
Improvement: Widen NE radius and improve Iron Springs Road.	
Phase:	Short-term, medium – term, and long-term
Cost:	$ 2,565,000
Reasons Identified Difficult turning movements Improve infrastructure	

Existing Roadway Characteristics

Route Description	The existing T-intersection has a right turn lane from WB S.R. 56 to Iron Springs Road to one lane on Iron Springs Road. The intersection is flat with adequate sight distance for all legs. The paved turning radius from WB S.R. 56 is approximately 50 ft., with additional graveled room to the inside.		
Lanes	***Road 1***	5	
	Road 2	2	
Pavement Condition	***Overall***	Good (on S.R. 56)	
	Condition/Ride Index	EB = 89.4 / 79.20	WB = 87.06 / 78.78
Crash Data	***3-year total ('07-'09)***	8	
	Fatals	0	
Existing Overall LOS	N/A	unsignalized	

Safety Analysis

There are relatively few crashes at this intersection, with all of them being low severity which suggests there are no safety issues. The existing turn lane from WB S.R. 56 to Iron Spring Road may need to be lengthened to accommodate the additional trucks, along with a improving the radius. Depending on the volume of truck traffic, a signal may be warranted at this intersection.

Committed Improvements, if any N/A

Current and Future Land Use

This is a growing industries area, but is sparsely populated now. Intersection is located on the western edge of town. The trash dump is located down Iron Springs Road.

Environmental Issues

None

Proposed Roadway Improvements

Widen NE radius to allow safe maneuvering onto Iron Springs Rd by trucks. Cold Mill and overlay of Iron Springs Road. Sixteen new roadway warning signs along Iron Springs Road. New traffic signal at S.R. 56/Iron Springs Road intersection.

Project Number:	**4**
Road 1:	US89
Road 2:	Alton Road
County:	Kane
Length (Miles):	0.33
Improvement: Add 1 mile acceleration lane to NB US 89	
Phase:	Medium-term
Cost:	$ 2,066,000
Reasons Identified Difficult turning movements as truck need to gain speed as merge with U.S. 89. Improve infrastructure. Improve Alton Road.	

Existing Roadway Characteristics

Route Description	The existing T-intersection has a turn lane to Alton Road for SB U.S. 89. U.S. 89 slopes upwards from south to north with a nearby horizontal curve to the south. There appears to be adequate sight distance for all legs based on the site visit.		
Lanes	***Road 1***	2	
	Road 2	2	
Pavement Condition	***Overall***	Good (on U.S. 89)	
	Condition/Ride Index	SB = 93.76 / 87.34	NB = 84.90 / 86.50
Crash Data	***3-year total ('07-'09)***	7	
	Fatals	0	
Existing Overall LOS	A (0.04 = v/c)	unsignalized	

Safety Analysis
Since there is not excessive sight distance for trucks turning from Alton Road to NB U.S. 89, they will need to make a full stop. Lost momentum could lead to a potential issue of turning trucks slowing down NB U.S. 89 traffic. This issue could be solved by the addition of a merge lane, which should not lead to ROW impacts. There are no crash patterns that suggest existing operational or safety issues.

Committed Improvements, if any N/A

Current and Future Land Use
This is a rural area in NW Kane County. The town of Alton uses this road as it is the only paved link to U.S. 89. Because of the coal development, coal trucks will also use this road in and out of town.

Environmental Issues
In the national forest

Proposed Roadway Improvements
Add new 0.33 mile acceleration lane to NB U.S. 89, tie into the existing passing lanes for trucks turning from Alton. Concept Report addressing options on US-89, SR-12 to Glendale. Cold mill and overlay of Alton Road with six new roadway warning signs. In Alton, improve Main St./200 S. intersection.

Project Number:	**5**
Road 1:	U.S. 89
Road 2:	S.R. 12
County:	Garfield
Length (Miles):	0.9
Improvement:	Lengthen SB & NB acceleration lane, widen shoulders, signing, lighting & pavement markings
Phase:	Medium-term
Cost:	$ 1,182,000
Reasons Identified	Intersection geometry/sight distance Acceleration/deceleration lanes

Existing Roadway Characteristics

Route Description	The existing T-intersection has a diverge/merge lane to/from S.R. 12. This intersection appears to be relatively flat with some sight distance issues.		
Lanes	***Road 1***	2	
	Road 2	2	
Pavement Condition	***Overall***	Fair (on U.S. 89)	
	Condition/Ride Index	SB = 78.16 / 73.45	NB = 79.50 / 76.30
Crash Data	***3-year total ('07-'09)***	10	
	Fatals	1	
Existing Overall LOS	N/A	unsignalized	

Safety Analysis

Brake marks are noticeable indicating that drivers are reacting late to a missed turn, additional signing to and from S.R. 12 would help direct motorists. Half of the crashes involved a second vehicle with one fatality, suggesting that the non-standard intersection could be unsafe. The addition of coal trucks would compound the existing safety issues.

Committed Improvements, if any N/A

Current and Future Land Use

This is a rural area with no local development existing or planned.

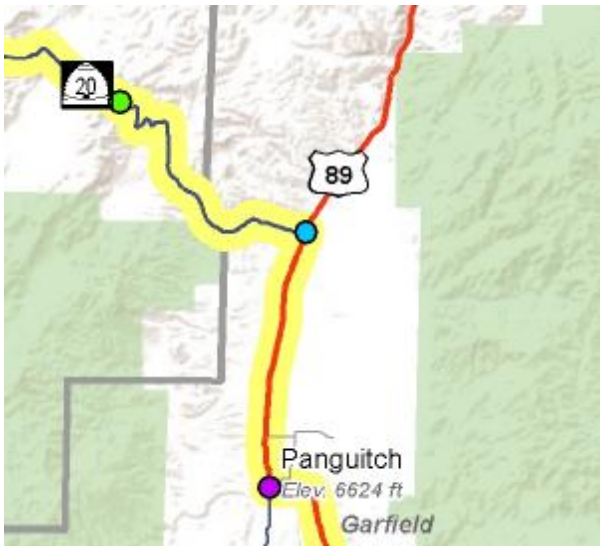
Environmental Issues

In proximity of ecological constraint area

Proposed Roadway Improvements

NB U.S. 89 acceleration lanes.
NB U.S. 89 right turn deceleration lanes.
4' median with rumble strips, revised lighting, signing and striping.

Project Number:	**6**
Road 1:	U.S. 89
Road 2:	S.R. 20
County:	Garfield
Length (Miles):	intersection
Improvement: Pave NW shoulder & widen SW radius	
Phase:	Medium-term
Cost:	$ 77,000
Reasons Identified Difficult turning movements to/from U.S. 89 Improve infrastructure	



Existing Roadway Characteristics

Route Description	The existing T-intersection has a turn lane from NB U.S. 89 to one lane on WB S.R. 20, and from EB S.R. 20 to two lanes on SB U.S. 89. The intersection is flat with adequate sight distance for all legs. The existing pavement radius in the SW quadrant is approximately 75 ft.		
Lanes	***Road 1***	2	
	Road 2	2	
Pavement Condition	***Overall***	Good/Fair (on U.S. 89)	
	Condition/Ride Index	SB = 82.21 / 81.91	NB = 75.90 / 80.30
Crash Data	***3-year total ('07-'09)***	6	
	Fatals	0	
Existing Overall LOS	N/A	unsignalized	

Safety Analysis

There are relatively few crashes at this intersection, with all of them being low severity which suggests there are no safety issues. The existing turn lane from EB S.R. 20 to two lanes of SB U.S. 89 should be verified for the design vehicle. The single lane and narrow paved shoulder of WB S.R. 20 is insufficient for trucks turning from NB U.S. 89, especially if a vehicle is waiting to turn from EB S.R. 20.

Committed Improvements, if any N/A

Current and Future Land Use

This is a rural area with no local development existing or planned. An abandoned store exists in the SW quadrant of the intersection.

Environmental Issues

In proximity of ecological and conservation constraint area

Proposed Roadway Improvements

Pave shoulder on WB S.R. 20 to assist in truck turning movement

Widen the turning radius from S.R. 20 to U.S. 89 SB to accommodate truck maneuvering

Project Number:	**7**	
Road 1:	I-15 NB	
Road 2:	S.R. 56	
County:	Iron	
Length (Miles):	0.4	
Improvement:		
Lengthen I-15 acceleration lane		
Phase:	Medium-term	
Cost:	$	2,612,000
Reasons Identified		
Acceleration/deceleration lanes Storage at signal as vehicles turn WB S.R. 20		

Existing Roadway Characteristics

Route Description	The I-15 interchange with S.R. 56 is a four ramp partial cloverleaf with I-15 spanning S.R. 56. The on ramp to NB I-15 has an additional horizontal curve in its alignment which is signalized. The acceleration lane to NB I-15 is approximately 650 ft. long. EB S.R. 56 has a left turn lane onto NB I-15.		
Lanes	***Road 1***	4	
	Road 2	5	
Pavement Condition	***Overall***	Fair (on I-15)	
	Condition/Ride Index	SB = 71.60 / 88.60	NB = 69.40 / 90.20
Crash Data	***3-year total ('07-'09)***	35	
	Fatals	1	
Existing Overall LOS	A (0.45 = v/c)	signalized	

Safety Analysis

Of the 35 crashes, six are associated with the NB I-15 on ramp with two being non-incapacitating. Lengthening the acceleration lane would allow trucks to merge onto NB I-15 closer to freeway speeds. Most crashes occurring at the signalized intersection with S.R. 56 were angle or front- to-rear. These are likely due to left turns which could be addressed by only allowing protected left turns.

Committed Improvements, if any N/A

Current and Future Land Use

A major interchange between I-15 and S.R. 56 (W 200 N) at downtown Cedar City. There is little available space bordering the interchange with significant commercial and residential development.

Environmental Issues

None

Proposed Roadway Improvements

Lengthen acceleration lane by 2000' onto I-15 NB at Exit 59

Project Number:	**8**	
Road 1:	S.R. 20	
Road 2:	n/a	
County:	Iron	
Length (Miles):	4.0 (total)	
Improvement: Add passing lanes		
Phase:	Long-term	
Cost:	$	6,503,000
Reasons Identified Climbing lanes/passing lanes as terrain changes		

Existing Roadway Characteristics

Route Description	This stretch of S.R. 20 is a rural pass through a mountainous area. Bordered by I-15 and U.S. 89 on each side, these are the only intersections for S.R. 20. At the highest summit, S.R. 20 reaches 7920 ft in elevation. There are climbing lanes in some locations with a 8% incline/decline.		
Lanes	***Road 1***	3	
	Road 2	-	
Pavement Condition	***Overall***	Good (on S.R. 20)	
	Condition/Ride Index	EB = 92.50 / 84.90	WB = 92.09 / 83.09
Crash Data	***3-year total ('07-'09)***	n/a	
	Fatals	n/a	
Existing Overall LOS	A	no intersection at location	

Safety Analysis
No significant safety issues were studied here

Committed Improvements, if any N/A

Current and Future Land Use
This is a rural area with no local development existing or planned.

Environmental Issues
In proximity of ecological constraint area

Proposed Roadway Improvements
Add passing lanes on S.R. 20 WB MP 7.5 - 10
Add passing lanes on S.R. 20 EB MP 10 - 11.5

Project Number:	**9a**	
Road 1:	SB I-15	
Road 2:	S.R. 56	
County:	Iron	
Length (Miles):	0.2	
Improvement: Lengthen I-15 deceleration lane		
Phase:	Long-term	
Cost:	$	1,866,000
Reasons Identified Deceleration lane onto I-15 NB at Exit 59 Storage at intersection Geometric concerns for ramp curve		

Existing Roadway Characteristics

Route Description	The I-15 interchange with S.R. 56 is a four ramp partial cloverleaf with I-15 spanning S.R. 56. The SB I-15 off ramp deceleration lane is approximately 750 ft. long prior to a low speed, 180 degree curve. The ramp widens to multiple lanes and terminates at a signalized intersection with S.R. 56.		
Lanes	***Road 1***	4	
	Road 2	5	
Pavement Condition	***Overall***	Fair (on I-15)	
	Condition/Ride Index	SB = 71.60 / 88.60	NB = 69.40 / 90.20
Crash Data	***3-year total ('07-'09)***	21	
	Fatals	0	
Existing Overall LOS	A (0.49 = v/c)	signalized	

Safety Analysis

The ten crashes along I-15 have been low severity with half being front-to-rear, suggesting that vehicles enter into the curve at varying speeds. This issue will likely be compounded with the addition of loaded coal trucks.

Committed Improvements, if any N/A

Current and Future Land Use

Environmental Issues

None

Proposed Roadway Improvements

Lengthen deceleration lane by 1500' from I-15 SB at Exit 59

Move the existing warning signs, including the truss with exit ramp speed advisory, to the beginning of the deceleration lane.

Project Number:	**9b**	
Road 1:	SB I-15	
Road 2:	S.R. 56	
County:	Iron	
Length (Miles):	0.1	
Improvement: Add 2nd left turn lane for WB S.R. 56		
Phase:	Long-term	
Cost:	$	92,000
Reasons Identified Add second WB left turn lane at intersection		

Existing Roadway Characteristics

Route Description	The I-15 interchange with S.R. 56 is a four ramp partial cloverleaf with I-15 spanning S.R. 56. The SB I-15 off ramp deceleration lane is approximately 750 ft. long prior to a low speed, 180 degree curve. The ramp widens to multiple lanes and terminates at a signalized intersection with S.R. 56.		
Lanes	***Road 1***	4	
	Road 2	5	
Pavement Condition	***Overall***	Good (on S.R. 56)	
	Condition/Ride Index	EB = 91.70 / 84.80	WB = 93.43 / 87.61
Crash Data	***3-year total ('07-'09)***	21	
	Fatals	0	
Existing Overall LOS	A (0.49 = v/c)	signalized	

Safety Analysis
The crashes at the signalized ramp terminus with S.R. 56 do not suggest that any safety issues exist. Signal phases will likely need to be re-timed to accommodate the left turning trucks on to WB S.R. 56.

Committed Improvements, if any N/A

Current and Future Land Use
A major interchange between I-15 and S.R. 56 (W 200 N) at downtown Cedar City. There is little available space bordering the interchange with significant commercial and residential development.

Environmental Issues
None

Proposed Roadway Improvements
Add second WB left turn lane onto S.R. 56 from off-ramp
Optimize signal timing at this intersection to allow traffic onto S.R. 56 without causing back-up
Coordinate signals along S.R. 56

Project Number:	**10**	
Road 1:	S.R. 56	
Road 2:	Airport Road	
County:	Iron	
Length (Miles):	0.1	
Improvement:		
Add third through lane to EB movement Add second left turn lane for SB Airport		
Phase:	Long-term	
Cost:	$	619,000
Reasons Identified		
Additional lane capacity Storage at intersection		

Existing Roadway Characteristics

Route Description	The existing four-leg signalized intersection has a right and left turn lane from both EB and WB S.R. 56 to Airport Road. The intersection is flat with adequate sight distance for all legs.		
Lanes	***Road 1***	5	
	Road 2	2	
Pavement Condition	***Overall***	Good (on S.R. 56)	
	Condition/Ride Index	EB = 89.40 / 79.20	WB = 87.06 / 78.78
Crash Data	***3-year total ('07-'09)***	19	
	Fatals	0	
Existing Overall LOS	B (0.55 = v/c)	signalized	

Safety Analysis
While only one confirmed injury occurred at this intersection, there are a large number of low speed crashes. These could be addressed by adding protected left turn phases to the traffic signal.

Committed Improvements, if any N/A

Current and Future Land Use
This is a growing area, but has small business and limited residential population currently. Intersection is located on the western side of town with Cedar City Municipal Airport.

Environmental Issues
None

Proposed Roadway Improvements
Add through lane to EB lanes. Add second left turn lane for SB Airport.
Coordinate signals along S.R. 56 (specific to I-15
SB ramp improvement)

Project Number:	**11**	
Road 1:	S.R. 56	
Road 2:	Lund Road	
County:	Iron	
Length (Miles):	0.1	
Improvement: Add second left turn lane for SB and WB leg		
Phase:	Long-term	
Cost:	$	106,000
Reasons Identified Additional capacity Storage at intersection		

Existing Roadway Characteristics

Route Description	The existing four-leg intersection has a right and left turn lane from both EB and WB S.R. 56 to Lund Highway. The intersection is flat with adequate sight distance for all legs.		
Lanes	***Road 1***	5	
	Road 2	2	
Pavement Condition	***Overall***	Good (on S.R. 56)	
	Condition/Ride Index	EB = 89.40 / 79.20	WB = 87.06 / 78.78
Crash Data	***3-year total ('07-'09)***	13	
	Fatals	0	
Existing Overall LOS	B (0.55 = v/c)	unsignalized	

Safety Analysis

Non-incapacitating injuries were the result of four angle and one sideswipe opposite direction crashes, likely from left turning vehicles. With these crashes and the additional truck traffic on S.R. 56, a traffic signal may be warranted at this intersection. Coal truck traffic will not be turning at this intersection, but they will make left turns onto S.R. 56 more difficult.

Committed Improvements, if any N/A

Current and Future Land Use

This is a growing area, but has small business and limited residential population currently. Intersection is located on the western side of town.

Environmental Issues

None

Proposed Roadway Improvements

Add second left turn lane for SB leg of Lund and WB leg of S.R. 56. Add WB intersection through lane.