# CMGC Design Phase - State Report

**For**

**SR-9; 300 W to 800 N Hurricane**

S-0009(15)9

PIN No. 5978


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## Purpose

The purpose of the State CMGC Report is to summarize the project in terms of which innovations were used and what were their impacts on the cost, schedule, quality, design, constructability and the benefit to the public. It will also contain information about the contractor's role in risk reduction, environmental stewardship and an analysis of the performance of this project.

## Project Overview

Project S-0009(15)9 is a state road widening project through downtown Hurricane Utah in Washington County. The length of the project is 1.46 miles with a pavement surfacing width of 63 feet.

**Table 1 – Project Overview Information Summary**

| | |
|---|---|
| **Project Type:** | Local Government |
| **Project Number:** | S-0009(15)9 |
| **PIN:** | 5978 |
| **Funding Source:** | State |
| **Commission Approved Funding (ePM, screen 495):** | $14,000,000 |

## Design Costs

Interstate Rock Products was selected to perform CMGC services and worked extensively with Horrocks and Tamerha Maxwell (UDOT Region 4 Project Manager) to complete the design of the project. Table 2 summarizes the fees required for design services. Stanton Constructability was selected to provide ICE services as a measurement of fair and equitable pricing at final bid opening.

**Table 2 – Design Fee Breakdown**

| | |
|---|---|
| **Designer's Fee (Horrock's)** | $1,053,969.02 |
| **CMGC Design Fee** | $100,536.00 |
| **ICE Preparer's Fee** | $62,460.09 |
| **Total Design Costs** | $1,216,965.11 |
| **CMGC fee as a Percent of Total:** | 8.26% |

## Bid Prices

The final bid was opened on November 16, 2009. The bid and ICE and EE were within the UDOT standard policy so the project was awarded to Interstate Rock Products. Table 3 shows the comparisons at bid opening.

**Table 3 –Final Bid Prices**

| | Final Bid |
|---|---|
| **Engineers Estimate (EE)** | $10,106,546.00 |
| **Independent Cost Estimate (ICE)** | $10,679,324.05 |
| **Contractor's Bid** | $10,203,871.40 |
| **Percent Difference of EE** | 0.96% |
| **Percent Difference of ICE** | -4.45% |

# Applicability of the CMGC Process

To assess the applicability of the CMGC process during the design phase of this project the Department conducted interviews with the designer, contractor, and UDOT staff. The actual interviews are included in Appendix A. On this particular project the contractor's involvement during design led to an improved utility plan, optimal Right-of-Way phasing, and meaningful public involvement. These specific benefits will be described in further detail below. In general, UDOT rates the applicability of the CMGC process during design according to how successfully the design team improved design and constructability, applied innovations, reduced schedule, enhanced project quality, produced direct benefits to the public, and controlled risk. The following section examines each of these criteria.

## Design and Constructability

This project had a programmed amount and the challenge was to determine how much scope to include while staying within budget. The contractor provided estimates that helped the design team develop the scope. As the scope was developed, the contractor identified constructability issues regarding utilities, pavement design, soft soils, Maintenance of Traffic (MOT) phasing, and property matching. After identifying these issues, the contractor provided recommendations for how to address them. This allowed the team to include the maximum amount of scope within the budget provided.

The primary goal of the design was to deliver a Guaranteed Maximum Price (GMP). By involving the contractor in the design phase the Department intended to obtain suggestions that

addressed constructability and risk issues, while also conforming to the GMP. The impact of contractor suggestions was estimated by running a cost model to determine each suggestion's cost, schedule, and stakeholder impact.

The contractor was able to present the MOT phasing plan to the public while in design, which allowed property owners along the corridor to provide input. The result is that the impact to the traveling public will be greatly reduced because of the amount of planning the contractor was able to put toward MOT.

The contractor's high level of involvement gave them a sense of ownership in the design. As a result the contractor was committed to delivering the full scope of the project. This commitment was demonstrated by the effort the contractor put into confirming that the design they recommended could be delivered within the project budget. To do so, the contractor provided cost models to help monitor scope against budget. The cost models were analyzed according to change over time on certain bid items. The contractor also provided recommendations for unit price versus lump-sum payments based on challenges they could anticipate from past experience. The contractor then rigorously verified quantities in order to meet the GMP. The result of the process is that the design team can confidently say that they have described the best project that can be built with the funding available.

## Innovations Used

In general CMGC facilitates innovations by applying the contractor's skills and experience to design solutions to problems that would otherwise be left unresolved in the plans. On this particular project the team reached innovative solutions by assigning the contractor to investigate unknowns, and cooperate with stakeholders. Innovative solutions were developed to mitigate risk, shorten schedule, enhance quality, reduce cost, and improve the public's perception of the project. This process led to the following innovations (Which will be discussed further in their associated sections):

- 3-D Modeling of Utilities (See Risk)
- Early Mix Design (See Risk)
- Block Walls (See Risk)
- Phasing of Utility Relocations (See Risk)
- Phased Right-of-Way Acquisition (See Risk)
- General Constructability Recommendations (See Schedule)

- Decorative Lighting (See Impact to Quality)
- Rock Wall Aesthetics (See Impact to Quality)
- Public input of work through Block Captains (See Benefit to Public)

## Impact to Schedule

There are two ways to consider the impact that the CMGC process has on the project schedule. One way is to look at the amount of time spent during selection and design as opposed to traditional projects. The other way is to consider the delays that will be avoided during construction thanks to the effort spent conducting sufficient investigation, and providing sufficient detail during design. This project experienced a 4 month interruption because the State of Utah froze spending due to budget issues, so it is difficult to assess whether selection and design proceeded slower, or more rapidly than on other projects. It is possible, however, to identify aspects of the construction that will be able to proceed with greater efficiency thanks to the contractor's involvement during design. The following innovations are expected to produce a reduction in the construction schedule:

- Use of Block Walls—The contractor was already familiar with the type of block walls that were chosen, which is expected to lead to more efficient installation.
- General Constructability Recommendations—The contractor provided details on the construction methods that were aimed at meeting the project schedule.

## Impact to Quality

The CMGC process has mostly provided improvements to project quality by avoided risks and a more efficient construction schedule. However, there are also a number of areas in which the contractor's involvement during design allowed the plans to include higher quality items. These include:

- Rock wall systems that will provide the most suitable aesthetic quality. The contractor was instrumental in selecting rock wall faces and colors that work well with the city's aesthetics scheme.
- Decorative lighting options chosen through a city workshop
- Higher quality pavement – With the contractor's input, the pavement design was agreed upon prior to bidding so that a GMP could be determined. This eliminated the budget risks associated with pavement design.

## Benefit to the Public

Because of the contractor's involvement in the design process the public experienced direct benefits concerning the quality of information provided to stakeholders.

The contractor's involvement in the design phase allowed the Department to provide an incentive for the contractor to provide the public with quality information regarding construction scheduling, phasing, and impacts to property owners. In this case the contractor is based in the community so they were strongly motivated to maintain a good relationship with the public. However, to provide additional motivation the department designated Block Captains to evaluate the contractor's work, and the Department gave the contractor incentives based on those evaluations. This early public involvement allowed the contractor to tailor the construction schedule around the concerns of the public.

## Risk

This section discusses the advantages the CMGC process offered the team concerning the way they handled risk. The contractor's involvement during design helped the team identify and evaluate risks. It also led the team to develop innovations to mitigate those risks. The CMGC process enabled UDOT to have more flexibility in delegating risks than traditional delivery methods allow.

The team used a risk matrix (see Appendix C) to identify risks, evaluate the potential cost of those risks, and determine the probability of encountering those risks. The team identified the following high-cost, high-probability risks:

- Soft Subgrade
- Identification of Utility Conflicts
- Underground Needs for Utility Enhancements
- Acquisition of Right of Way in time for Construction

Identifying the costliest risks enabled the team to focus on performing the necessary actions to minimize, and possibly eliminate them. Several innovations resulted from the team's effort to address the following risks.

- Identification of Utility Conflicts— There were many existing and proposed utilities in a very small area, which led to numerous potential conflicts. It was challenging to determine how to place utilities while still providing one lane of traffic in each direction; particularly because the existing roadway only includes one lane in each direction. The

contractor possessed a potholing system that was used to locate all of the utilities and develop a 3D model. Once the model was developed the contractor provided detailed recommendations for the placement of all utilities. This allowed the Department to partner with the utility companies. For example; the Department offered to provide surveying support to ensure that Questar placed their high pressure gas line as per designed. This allowed the Department to obtain an MOU that the utility company will compensate the Department if a specific deviation from the designed utility relocation obstructs the contractor. This enabled the Department to take direct responsibility for protecting itself from being liable for any costs that may be incurred from this potential conflict.

- Underground Needs for Utility Enhancements—The contractor worked with the Department and the sewer company to identify the need to upgrade old, brick-lined manholes.
- Soft Subgrade— By having such familiarity with the project the contractor was able to identify where additional geotechnical testing was required due to wet soils in the downtown area.
- Acquisition of Right of Way in time for construction— Clearing Right of Way was a threat to schedule, but the contractor identified the critical path of right of way required to begin construction on schedule. The contractor provided a letter stating which work could be completed within the existing Right-of-Way. This minimized Department and Contractor risk, and provided UDOT ROW with a timeline for obtaining all necessary ROW, thus allowing the rest of the right of way acquisition to be phased.

The CMGC process allowed the Department to delegate risks by creating design sub-committees to explore, evaluate, and mitigate each risk. These subcommittees consisted of representatives from the design firm, the contractor, and the city of Hurricane. Monthly meetings were scheduled where the subcommittees would report their recommendations to UDOT. This allowed UDOT to decide if and how the Department would handle risks.

# Analysis of Performance

## Schedule

The performance of CMGC in relation to this project will be strongly dependant on the final outcome in construction. Due to state budgetary issues the design was delayed 4 months. However, the innovations used to address the risks of utility conflicts show great promise in construction savings. A similar project, STP-0034(4)0 in St. George, Utah had 79 days added to the project, many of them dealing with utility conflicts.

## Cost Comparison

Table 4 below shows the relationship of the bid to the totals of the ICE. Bids for signing, lighting and structures showed a substantial difference. Special attention should be given on these items to identify if there was a clear understanding of the bidding components.

**TABLE 4 – Agreed Price vs. Independent Cost Estimate**

| Project Component | BID | ICE Price | Percent Change* |
|---|---|---|---|
| **Roadway** | $7,391,835.85 | $7,536,638.70 | -1.9% |
| **Water System** | $1,528,463.15 | $1,791,132.75 | -14.7% |
| **Structures** | $178,414.00 | $256,800.00 | -30.5% |
| **Landscaping** | $620,004.40 | $656,160.60 | -5.5% |
| **Signing** | $82,754.00 | $63,592.00 | 30.1% |
| **Signals** | $169,400.00 | $139,000.00 | 21.9% |
| **Lighting** | $132,000.00 | $134,000.00 | -1.5% |
| **ATMS** | $101,000.00 | $102,000.00 | -1.0% |
| **Total** | $10,203,871.40 | $10,679,324.05 | -4.45% |

**TABLE 5 – Bid Items Included in Contractor's Price Submittal Section of RFP**

| Description | Est. Quantity (Provided in RFP) | Unit | Winning Proposal Unit Price | State Average Price (11-16-08 to 11-15-09) | Ratio of Anticipated Price | Awarded Bid Unit Price |
|---|---|---|---|---|---|---|
| Roadway Excavation | 70000 | cu yd | $8.25 | $5.22 | 1.04 | $8.25 |
| Untreated Base Course | 10000 | cu yd | $22.30 | $20.93 | | $22.30 |
| HMA-3/4[1] | 10000 | cu yd | $140.00 | $154.99 | | $155.43 |

Notes:
1. Utilized 2.2 tons/cubic yard to convert to comparable state average units

Table 5 compares the prices proposed by the contractor during the selection process (Proposal Appendix D and E) when bidding was competitive. The ratio of Anticipated Price indicates that the contractor's proposed prices were above the state average bid prices. This indicates that it is not realistic to expect the final bid price to be below the state average price. It is important to note that basic pricing for roadway excavation and untreated base course were maintained in the final bid. It is anticipated that the price for ¾" HMA was impacted by a change to the mix design from the proposal to the bidding stage. This change in unit price represents over $140,000 in project cost increase (difference in unit costs per quantities in bid).

Two ratios of comparison is utilized by UDOT Program Management to track the pricing tendencies of the CMGC projects. The first ratio compares the bid item prices to the state average prices for each standard bid item and extrapolates the cost of the project based on the state average unit prices compared (See Appendix B for comparison). The bid price to the extrapolated price is the "Silver Standard" and is shown in Figure 1. This is a rough estimate of the pricing performance of the project. The second ratio is the Gold Standard and compensates for projects that are not indicative of the statewide unit prices. This ratio utilizes the ratio of anticipated price shown in Table 5 and the state average price to extrapolate the Anticipated Bid Price. The Anticipated Bid Price to the actual bid is an indicator of the creep in price during design.

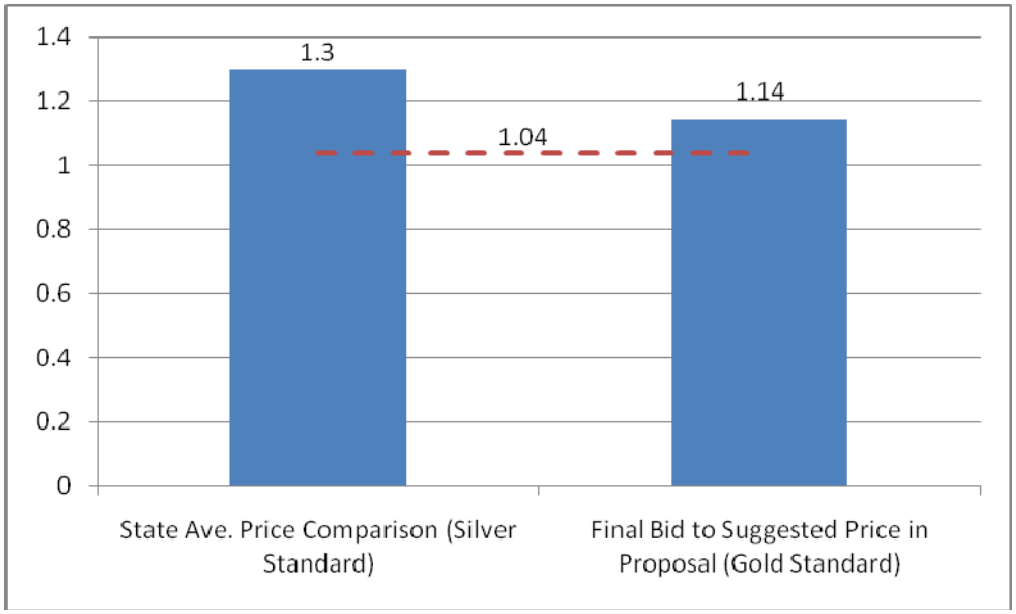


Figure 1 Standardized Pricing Results for SR-9 in Hurricane

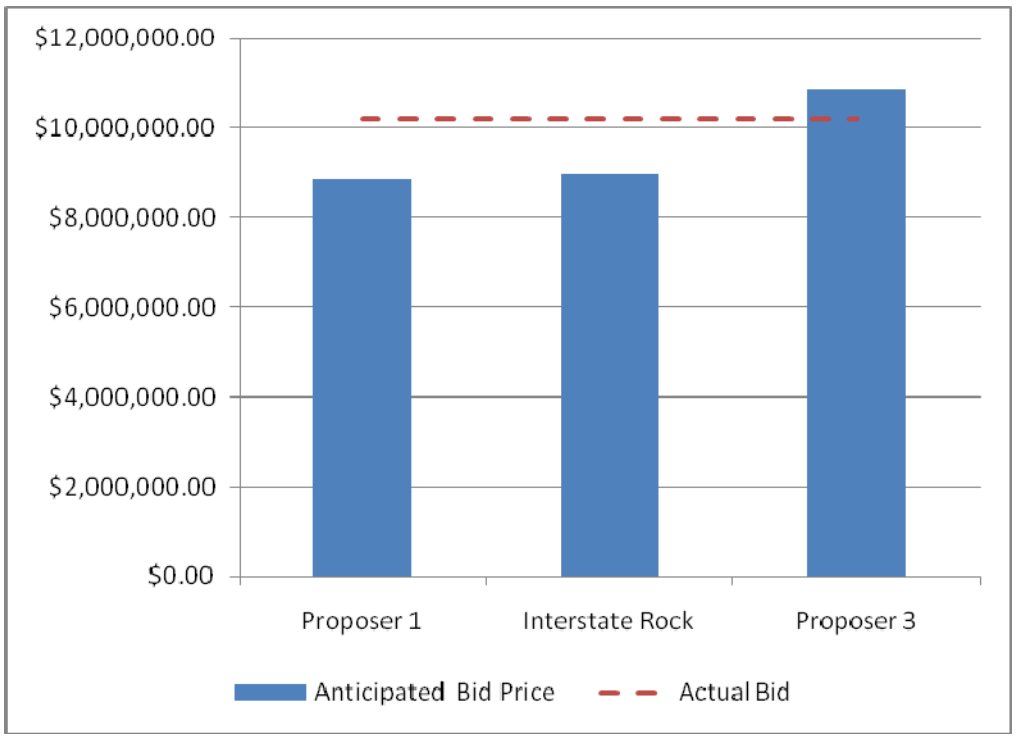


Figure 2 Extrapolated Bid Prices from the Proposal Stage

After bid opening the unit bid prices were compared with the state average unit prices to determine if the prices were fair and reasonable. The target for comparison is "1.04" as shown in Table 5. Figure 1 shows that project pricing was 30% higher than the state average unit prices on the items that were compared (Silver Standard Method). Furthermore the Gold standard method showed a 10% rise in pricing during design. This percentage of price creep is typical for CMGC projects in Utah and can be attributed to better understanding of project through design, increase scope, and lack of competitive bidding. It is recommended that UDOT make their anticipated price goal more apparent to the contractor during design to help minimize the creep in prices.

By determining the Ratio of Anticipated Price for each of the three companies that proposed on this project, the anticipated bid prices can be extrapolated. This is shown in Figure 2. This figure suggests that though the price shifted during the design phase, the final bid was still within the prices that were suggested by the other bidders in the proposal stage.

## Environmental Stewardship

Regarding the environmental impact of the project, the contractor was committed to the city's interest in saving trees and provided positive input for how to avoid impacting them. In addition, the contractor helped plan to reduce the impact to Pioneers Park. The contractor also was involved in discussion on how to monitor, and in some cases reduce, vibrations that would impact the foundations of nearby historic buildings.

## Lessons Learned

This project offered the Department an opportunity to recognize a number of areas in which the CMGC process could be refined. Specific lessons learned include:

- The process was useful for understanding the contractor's construction methods and how they apply to getting the best project.
- The biggest challenge with CMGC projects will always be verifying that contractors are providing fair market prices.
- Greater methods need to be implemented to ensure that unit prices are controlled.
- CMGC is a rare opportunity to get expertise from the contractor regarding constructability not normally available during design.

- It would be good to prevent the contractor from picking their subs up front to force the contractor to shop around.
- Perhaps it would be helpful to require the contractor to acquire three bids for subcontracted work.
- Sometimes subcontractors provide different bid prices to the ICE and the Contractor because the subcontractor is not as motivated to invest the necessary effort to give an accurate bid to the ICE.
- It would be good to give contractor's access to past RFPs.
- It is important to make it clear to the contractor that we are paying for his services during design, and that the arrangement has nothing to do with construction.
- It is important to be able to modify the contract during design. For example, we had to mod the contract to allow Interstate Rock to do mix design during our design phase, which save thousands of dollars when compared to the cost of having mix design included as a risk in the bid price.

## Conclusion

The Notice to Proceed was given to Interstate Rock Products on December 2, 2009 concluding the design services of the widening of SR-9 through Hurricane Utah. This local government project used the CMGC delivery method to enhance the design by better coordination of the utilities, construction schedule coordination with right of way, enhanced public involvement, better estimations of bid items, and an increased awareness of project issues by the designer and the contractor.

The bid opening process went smoothly with the difference between the ICE and the prepared bid being reasonable. Though it was anticipated that the project would have prices higher than the state average unit prices, the overall bid price was higher than anticipated. Nevertheless, the project was within the budget allowed and construction proceeded with the team confident that many of the risks had been addressed through innovation and proper planning during the design stage. The construction stage will whether the added time in design was beneficial in reducing change orders and project delays.

# Appendix A - Interview Notes

**CMGC Interview Questions**

UDOT Project Manager- Tamerha Maxwell
Project Manger (Designer) – Russel Youd
Project Manager (Contractor) – Trace Allan

| | |
|---|---|
| **Project Description:** | **SR-9 Hurricane** |
| **Pin:** | 5978 |
| **Project Phase:** | Design |
| **Anticipated construction cost:** | **$10,203,871.40** |
| **Anticipated construction time:** | **525 Days** |
| **Construction notice to proceed date:** | December 2, 2009 |

## Design

| | |
|---|---|
| What benefits did you see in design because of contractor participation? | • Contractor paid attention to design details. (Youd)<br>• Interstate Rock provided detailed recommendations for the placement of all utilities based on a 3-D model. This helped avoid utility conflicts during construction. (Youd)<br>• Contractor provided recommendations for pavement design. (Youd)<br>• Contractor provided recommendations for addressing soft soils. (Youd)<br>• Interstate Rock helped determine the appropriate amount of design effort to put into matching individual properties.<br>• Contractor was involved in designing maintenance of traffic. (Youd)<br>• The contractor helped direct the design team on how much detail was required for the contractor to provide a reliable lump sum bid on aesthetic treatments. (Youd)<br>• CMGC eliminates the uncertainty traditional projects have regarding project phasing, thus making it easier to work with the cities and property owners along the corridor.<br>• The Contractor is on hand to describe how construction will proceed.<br>• The Contractor is available to meet with the public and |

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|---|---|
| | describe his phasing plan and explain how his traffic controls will impact them.<br>• It is good to have the Contractor present to identify risk during design. This allows the team to develop ways to mitigate or eliminate risks early on. (see mix design, utilities, sewer)<br>• It is good to have Interstate Rock present to identify opportunities for innovation during design.<br>• Identifying risks and innovations allowed the project team to fine-tune the scope to meet the project goals and stay within the budget.<br>• Presenting the Contractor with a cost model up-front caused the Contractor to seriously consider how he would construct the project under the constraints of a Guaranteed Maximum Price and a goal of zero change orders.<br>• To meet the GMP the Contractor rigorously verified quantities. |
| Describe the nature and value of contractors' design suggestions? | • The project had a programmed amount and the challenge was determining how much scope to include while staying within budget. The contractor provided three or four estimates which helped the design team develop the scope. (Youd)<br>• The contractor became an integral member of the design team once he gained perspective on the type considerations that go into design. (Youd)<br>• There was an inherent value in having Interstate Rock know the project inside and out in a way that traditional projects do not allow.<br>• Allowing Interstate Rock to have such familiarity with the project enabled them to make valuable recommendations. This was especially true of the input Interstate Rock provided to develop a 3D model for the relocation of utilities.<br>• On this project the Department was able to work with Interstate Rock to plan the relocation of utilities in a way that would not impact the contractor, thus avoiding escalated utility conflicts in a sensitive downtown area. |
| How did you | • Almost all suggestions were incorporated. (Youd) |

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| evaluate and decide which suggestions to use? | • Employed a risk analysis matrix.<br>• Concentrated on high risk areas.<br>• Analyzed different alternatives.<br>• Did a cost model to determine the cost, schedule, and stakeholder impacts of suggestions.<br>• Confirmed that suggestions addressed constructability and risk issues, while also conforming to the GMP. |
| What Challenges came up during design and did you resolve them? | • The contractor provided recommendations for unit price versus lump-sum payments based on challenges the contractor could anticipate from past experience. (Youd)<br>• There were many existing and proposed utilities in a very small area, which led to numerous potential conflicts.<br>• It was challenging to determine how to place utilities including Ashe Creek Sewer, city water, Quest, Questar, Baja, city drainage while still providing one lane of traffic in each direction; particularly because the existing roadway only includes one lane in each direction.<br>• It was a challenge to determine phasing for proposed utility upgrades. |
| What is the cost savings anticipated and or produced by contractor's suggestions? | • The contractor provided good prices in part because the contractor was committed to delivering the full scope of the project. (Youd)<br>• The cost savings on this project are likely to be seen in a comparison between the percent of change orders on this project versus the St. George Blvd. Design Bid Build project. (Youd)<br>• Interstate Rocks early involvement in the design of utility relocations allowed the Department to partner with the utility companies. For example; the Department offered to provide surveying support to ensure that Questar placed their high pressure gas line as per designed. This allowed the Department to obtain an MOU that the utility company will compensate the Department if a specific deviation from the designed utility relocation obstructs the Contractor. This protects the Department from being liable for any costs that may be incurred from this potential conflict. |
| How did the contractor communicate cost | • The contactor provided cost models to help monitor scope against budget. The cost models could be analyzed |

| | |
|---|---|
| changes that corresponded with design changes? | according to change over time on certain bid items. (Youd)<br>• Interstate Rock was able to provide cost estimates for cast-in-place versus block walls, as well as cost estimates for the footings that would be required on cast-in-place walls.<br>• Interstate Rock also provided a price for a betterment to the proposed coated chain-link fencing. This allowed the Department to obtain a betterment agreement from the city. |

## Constructability

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|---|---|
| How was constructability improved by involvement of the contractor in design? | • The contractor provided details on the construction methods that were aimed at meeting the project schedule. (Youd)<br>• It will be interesting to see if the contractor can meet that schedule. (Youd)<br>• All of the Contractor's input improved the project's constructability.<br>• Interstate Rock provided a great deal of input to optimize phasing.<br>• The 3D modeling minimized risks once the open trench was dug.<br>• The contractor's involvement allowed the Department to provide a detailed construction schedule to the public. |
| What constructability issues identified by the contractor were included in design? | • Utilities<br>• MOT<br>• Property matching<br>• Soft spots (Youd)<br>• MOT phasing<br>• Utility phasing and relocation<br>• Interstate Rock provided a letter stating which work could be completed within the existing Right-of-Way. This minimized Department and Contractor risk, and provided UDOT ROW with a timeline for obtaining all necessary ROW. |

## Innovations

| | |
|---|---|
| What innovations were used to reduce cost? | • 3D modeling of utilities. (Youd)<br>• The contractor performed the Stone Matrix Asphalt (SMA) mix design before construction in order to provide a firm bid, which the design team then used to select SMA over concrete. (Youd)<br>• Interstate Rock provided a list of pros and cons for cast-in-place versus block walls.<br>• The rock walls that were chosen reduced the amount of ROW that was required.<br>• The phasing and relocation of utilities. |
| What innovations were used to reduce schedule? | • Clearing Right of Way was a threat to schedule. (Youd)<br>• The contractor identified the critical path of right of way required to begin construction on schedule. This allowed the rest of the right of way acquisition to be phased. (Youd)<br>• Interstate Rock was already familiar with the type of block walls that were chosen, which is expected to lead to more efficient installation. |
| What innovations were used to improve quality? | • Perhaps in the pavement. (Youd)<br>• Rock wall systems were chosen which provided the most suitable aesthetic quality. |
| What technology innovations were used? | • No (Youd)<br>• The decorative lighting subcontractor was available to conduct a city workshop to provide the city with the best and most up to date options. |
| What innovations were used to reduce impacts to the public? | • Interstate Rock is based in the community so the contractor is strongly motivated to maintain a good relationship with the public. (Youd)<br>• Block captains have been designated to evaluate the contractor's work, and the contractor has been given incentives based on those evaluations. (Youd)<br>• Interstate Rock was able to suggest rock wall faces and colors that worked well with the city's aesthetic scheme. |

## Project Schedule

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|---|---|
| How much time was saved in design? | • The contractor's involvement in matching properties and utilities helped avoid delays. (Youd) |

| | |
|---|---|
| How much cost was saved in design? | • The contractor's input helped the team achieve a better design at the same cost. (Youd)<br>• When the environmental document was created the Department hired a consultant to provide a cost estimate for the project. Three and a half years later this project was able to stay within budget. A similar traditional project saw a budget overrun of over 30 percent. On this project Interstate Rock was able to provide solutions which preserved the scope and adhered to the budget. |

## Risk

| | |
|---|---|
| How did the team identify, evaluate, and track project risk? | • The team kept a risk spreadsheet on bid items. When the items were discussed in terms of payment the high risk tended to be recommended as lump sum pay items. This enable the team to address the risks involved with those items. (Youd)<br>• Identification of the high risk involved with paving near driveways led to two separate bid items for pavement. The mainline pavement was handled as a lump sum, and the driveways were handled as a unit price. (Youd)<br>• The risk matrix contained comments and recommendations.<br>• The team concentrated on high risk items, as determined based on cost.<br>• CMGC allows the contractor to identify where addition investigation is required to quantify, minimize, and possibly eliminate risk. |
| Which contractor suggestions helped you to reduce risk and control cost? | • Phasing of utilities. (Youd)<br>• The contractor provided guidance on how to keep the sewer line live during construction. (Youd)<br>• Recommendations for dealing with soft soils and pavement. (Youd)<br>• On this particular project Interstate Rock possessed a potholing system, which made it possible to located all of the utilities and create the 3D model.<br>• Contractor identified where additional geotechnical testing was required due to wet soils in the downtown area. |

| | |
|---|---|
| | • Pavement was investigated.<br>• Worked with Contractor and sewer company to identify the need to upgrade old, brick-lined manholes. Allowing the old man holes to remain was a certain liability for he Department. |

## Environmental Stewardship

| | |
|---|---|
| How did bringing the contractor on early alleviate environmental concerns? | • The contractor was committed to the city's interest in saving trees and provided positive input for how to avoid impacting them. (Youd)<br>• The contractor was involved in planning to reduce the impact to Pioneers Park. (Youd)<br>• The contractor was involved in discussion on how to monitor, and in some cases reduce, vibrations that would impact the foundations of nearby historic buildings. (Youd)<br>• Having Interstate Rock present allowed the department to educate them on the presence of the historic downtown area. This alerted the Contractor to the need for a survey of the foundations of old buildings that could be impacted by construction activities carried out in their vicinity. |

## Benefits to Public

| | |
|---|---|
| How did the public benefit from the CM/GC process? | • The impact to the traveling public will be greatly reduced because of the amount of planning the contractor was able to put toward MOT and construction phasing. (Youd)<br>• Interstate Rock's involvement in the design phase has allowed the Department to provide an incentive for the contractor to provide the public with quality information regarding construction scheduling, phasing, and impacts to property owners. This gives the contractor ownership and pride in the public's relationship to the project. |

## Lessons Learned

| | |
|---|---|
| What did you learn in the CM/GC | • The process was useful for understanding the contractor's construction methods and how they apply to getting the |

| | |
|---|---|
| process? | best project. (Youd)<br>• The process was also useful for understanding the constraints that the contractor is under. (Youd)<br>• The process was useful for understanding how much design detail the contractor required so that designers could focus their effort on the appropriate areas. (Youd)<br>• It is a terrific way to educate the contractor about the goals of the contract.<br>• It is a rare opportunity to get expertise from the contractor regarding constructability not normally available during design. |
| Was there anything you would change during the RFP portion of the project? | • The proposals that were received were good. (Youd)<br>• The average bid model for evaluating pricing has some flaws.<br>• The price modeling needs to provide a way to take advantage of local resources. Sometimes there is a legitimate reason that a bid is exceptionally low.<br>• Sometimes it is difficult for the ICE to obtain bids from the Contractor's subcontractors because they are reluctant to give firm numbers.<br>• It would be good to prevent the contractor from picking their subs up front to force the contractor to shop around.<br>• Perhaps it would be helpful to require the contractor to acquire three bids for subcontracted work.<br>• Sometimes subcontractors provide different bid prices to the ICE and the Contractor because the subcontractor is not as motivated to invest the necessary effort to give an accurate bid to the ICE. |
| Would you have used different selection criteria? | • No (Youd)<br>• It would be good to give contractors access to past RFPs. |
| Would you change the way you selected based on price? | • No (Youd)<br>• Yes, change from average to low.<br>• We need to take advantage when contractors have good reasons for providing low bids. |
| What changes would you have | • None (Youd) |

| | |
|---|---|
| made in the way you developed the RFP? | • Yes, change from average to low.<br>• We need to take advantage when contractors have good reasons for providing low bids. |
| What changes would you make in the selection process? | • No, the selection process was smooth. (Youd)<br>• It would save time and money if we had a process for short listing proposers for interview.<br>• Sometimes the mandatory interview is a wasteful formality. |
| How would you improve the RFP development? | • We are doing great and getting better. Rudy is doing a great job. Ben has been instrumental.<br>• Sometimes it is difficult to objectively assess the feasibility of proposed innovations. |

## General Notes/Other Items

| | |
|---|---|
| Did you set a committed advertising date and did you meet your schedule? | • There was a 4 month interruption because of budget issues. (Youd)<br>• Yes<br>• It is important to be sure that upper management sees the RFP before advertising. |
| Describe negotiation problems and their resolution. | • There were none. (Youd)<br>• The ICE commented that the bid opening process was exceptionally smooth. (Youd)<br>• It is important to make it clear to the contractor that we are paying for his services during design, and that the arrangement has noting to do with construction.<br>• It is important to be able to modify the contract during design. For example, we had to mod the contract to allow Interstate Rock to do mix design during our design phase, which save thousands of dollars when compared to the cost of having mix design included as a risk in the bid price. |
| How would you rate the CMGC process prior to the beginning of the project? | • It is a fun process to be involved in. (Youd)<br>• The more we use it the better it becomes as a tool for project delivery. (Youd)<br>• The biggest challenge with CMGC projects will always be verifying that contractors are providing fair market prices. (Youd) |

| | |
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| | • I have come to see it as a wonderful process. |

# Appendix B – Bid Items List; Pricing Analysis

| | | | | |
|---|---|---|---|---|
| Project No: S-0009(15)9<br>Project Name: SR-9; HURRICANE<br><br>County: WASHINGTON | | **Interstate Rock Products** | State average Bid Prices from 11-16-2008 to 11-15-2009 | Gold Standard<br>1.04 |

| No. | Item No. | Description | Qty | Unit | Unit Price | Amount | Unit Price | Amount | Unit Price | Amount |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 012850010 | Mobilization | 1 | Lump | $726,800.00 | $726,800.00 | | | $726,800.00 | $726,800.00 |
| 2 | 013150010 | Public Information Services | 1 | Lump | $17,800.00 | $17,800.00 | $3,686.64 | $3,686.64 | $3,834.10 | $3,834.10 |
| 3 | 01554000* | Traffic Control | 1 | Lump | $864,930.00 | $864,930.00 | $56,343.88 | $56,343.88 | $58,597.63 | $58,597.63 |
| 4 | 015710025 | Check Dam (Fiber Roll) | 28 | ft | $20.00 | $560.00 | $3.85 | $107.80 | $4.00 | $112.11 |
| 5 | 015710030 | Silt Fence | 3059 | ft | $3.00 | $9,177.00 | $1.77 | $5,423.30 | $1.84 | $5,640.23 |
| 6 | 015710075 | Drop-Inlet Barrier (Fiber Roll) | 747 | ft | $8.00 | $5,976.00 | $4.74 | $3,541.38 | $4.93 | $3,683.03 |
| 7 | 01572002P | Dust Control and Watering (Est. Qty 7,322 1000 gal) | 7322 | 1000 gal | $20.00 | $146,440.00 | $9.40 | $68,834.12 | $9.78 | $71,587.49 |
| 8 | 017210010 | Survey | 1 | lump | $91,000.00 | $91,000.00 | $15,538.64 | $15,538.64 | $16,160.19 | $16,160.19 |
| 9 | 01727001* | Preconstruction Survey | 1 | lump | $310,000.00 | $310,000.00 | | $0.00 | $310,000.00 | $310,000.00 |
| 10 | 01891002P | Move Mailbox (Est. Qty 6 each) | 6 | each | $280.00 | $1,680.00 | $214.73 | $1,288.36 | $223.32 | $1,339.89 |
| 11 | 01892001P | Reconstruct Catch Basin (Est. Qty 1 each) | 1 | each | $5,000.00 | $5,000.00 | $946.45 | $946.45 | $984.31 | $984.31 |
| 12 | 01892004P | Reconstruct Valve Box (Est. Qty 6 each) | 6 | each | $430.00 | $2,580.00 | $486.96 | $2,921.78 | $506.44 | $3,038.66 |
| 13 | 01892005P | Reconstruct Manhole (Est. Qty 13 each) | 13 | each | $1,300.00 | $16,900.00 | $635.70 | $8,264.10 | $661.13 | $8,594.66 |
| 14 | 01892006P | Reconstruct Monument Box (Est. Qty 1 each) | 1 | each | $660.00 | $660.00 | $661.02 | $661.02 | $687.46 | $687.46 |
| 15 | 02056001P | Granular Borrow (Est. Qty 16,320 cu yd) | 16320 | cu yd | $28.00 | $456,960.00 | $12.39 | $202,212.64 | $12.89 | $210,301.14 |
| 16 | 02077002* | Geogrid Type 2 | 1000 | sq yd | $11.30 | $11,300.00 | | $0.00 | $11.30 | $11,300.00 |
| 17 | 02221000P | Remove Pipe Culvert (Est. Qty 2,093 feet) | 2093 | ft | $10.00 | $20,930.00 | | $0.00 | $10.00 | $20,930.00 |
| 18 | 02221001* | Remove Building, Basement, and Foundation | 1 | each | $20,000.00 | $20,000.00 | | $0.00 | $20,000.00 | $20,000.00 |
| 19 | 02221002* | Remove Manhole (Est. Qty 18 each) | 18 | each | $690.00 | $12,420.00 | $829.89 | $14,937.94 | $863.08 | $15,535.46 |
| 20 | 02221003* | Remove Fire Hydrant Assembly (Est. Qty 10 each) | 10 | each | $500.00 | $5,000.00 | | $0.00 | $500.00 | $5,000.00 |
| 21 | 02221003P | Remove Catch Basin (Est. Qty 28 each) | 28 | each | $460.00 | $12,880.00 | $446.88 | $12,512.66 | $464.76 | $13,013.17 |
| 22 | 02221004P | Remove Valve Box (Est. Qty 10 each) | 10 | each | $25.00 | $250.00 | | $0.00 | $25.00 | $250.00 |
| 23 | 022210050 | Remove Tree | 28 | each | $400.00 | $11,200.00 | $240.93 | $6,745.98 | $250.56 | $7,015.81 |
| 24 | 02221008* | Remove Gate (Est. Qty 2 each) | 2 | each | $172.50 | $345.00 | | $0.00 | $172.50 | $345.00 |
| 25 | 02221008P | Remove Fence (Est. Qty 1,695 feet) | 1695 | ft | $1.80 | $3,051.00 | $0.82 | $1,396.51 | $0.86 | $1,452.37 |
| 26 | 02221009* | Remove Retaining Wall (Est. Qty 512 feet) | 512 | ft | $8.00 | $4,096.00 | | $0.00 | $8.00 | $4,096.00 |
| 27 | 02221010* | Remove Light Pole (Est. Qty 12 each) | 12 | each | $600.00 | $7,200.00 | | $0.00 | $600.00 | $7,200.00 |
| 28 | 02221011P | Remove Concrete Sidewalk (Est. Qty 4,689 sq yd) | 4689 | sq yd | $5.25 | $24,618.00 | $5.67 | $26,563.19 | $5.89 | $27,625.71 |
| 29 | 02221012P | Remove Concrete Driveway (Est. Qty 76 sq yd) | 76 | sq yd | $7.30 | $555.00 | $10.03 | $762.30 | $10.43 | $792.79 |
| 30 | 02221013P | Remove Concrete Curb (Est. Qty 751 ft) | 751 | ft | $1.95 | $1,465.00 | $5.06 | $3,799.68 | $5.26 | $3,951.67 |
| 31 | 02221014P | Remove Concrete Curb and Gutter (Est. Qty 7,428 feet) | 7428 | ft | $1.95 | $14,485.00 | $3.89 | $28,865.86 | $4.04 | $30,020.49 |
| 32 | 02221015* | Remove Concrete Pavement (Est. Qty 637 sq yd) | 637 | sq yd | $6.50 | $4,141.00 | $4.89 | $3,112.00 | $5.08 | $3,236.48 |
| 33 | 02221016* | Remove Asphalt Pavement (Est. Qty 7,684 sq yd) | 7684 | sq yd | $4.00 | $30,736.00 | $2.77 | $21,281.61 | $2.88 | $22,132.87 |
| 34 | 02221017* | Remove Concrete Structure (Est. Qty 31 sq yd) | 31 | sq yd | $35.00 | $1,085.00 | | $0.00 | $35.00 | $1,085.00 |
| 35 | 02221018* | Remove Traffic Signal System (Est. Qty 2 each) | 2 | each | $3,000.00 | $6,000.00 | | $0.00 | $3,000.00 | $6,000.00 |
| 36 | 02316002P | Roadway Excavation (Est. Qty 46,175 cu yd) | 46175 | cu yd | $8.25 | $380,944.00 | $5.22 | $240,931.92 | $5.43 | $250,569.19 |

| No. | Item No. | Description | Qty | Unit | Unit Price | Amount | Unit Price | Amount | Unit Price | Amount |
|---|---|---|---|---|---|---|---|---|---|---|
| 37 | 023730010 | Loose Riprap | 7 | cu yd | $45.00 | $315.00 | $50.63 | $354.41 | $52.66 | $368.59 |
| 38 | 02610137P | 18 Inch Reinforced Concrete Pipe, Irrigation/Storm Drain, Class C, smooth | 1969 | ft | $55.70 | $109,673.30 | $42.70 | $84,081.05 | $44.41 | $87,444.29 |
| 39 | 026101386 | 18 Inch Irrigation/Storm Drain, Class C, smooth | 2817 | ft | $41.85 | $117,891.45 | $37.34 | $105,181.74 | $38.83 | $109,389.01 |
| 40 | 026101388 | 24 Inch Irrigation/Storm Drain, Class C, smooth | 1509 | ft | $55.00 | $82,995.00 | $48.17 | $72,688.53 | $50.10 | $75,596.07 |
| 41 | 026101390 | 30 Inch Irrigation/Storm Drain, Class C, smooth | 289 | ft | $67.00 | $19,363.00 | $49.56 | $14,321.45 | $51.54 | $14,894.31 |
| 42 | 026101391 | 36 Inch Irrigation/Storm Drain, Class C, smooth | 674 | ft | $71.00 | $47,854.00 | $58.83 | $39,650.12 | $61.18 | $41,236.13 |
| 43 | 026101392 | 42 Inch Irrigation/Storm Drain, Class C, smooth | 1169 | ft | $75.00 | $87,675.00 | $86.15 | $100,709.35 | $89.60 | $104,737.72 |
| 44 | 026101394 | 48 Inch Irrigation/Storm Drain, Class C, smooth | 572 | ft | $90.00 | $51,480.00 | | $0.00 | $90.00 | $51,480.00 |
| 45 | 02633000P | Catch Basin - CB 9 | 75 | each | $3,100.00 | $232,500.00 | | $0.00 | $3,100.00 | $232,500.00 |
| 46 | 02633001P | Manhole-4 ft Diameter | 7 | each | $1,950.00 | $13,650.00 | | $0.00 | $1,950.00 | $13,650.00 |
| 47 | 02633002P | Manhole-5 ft Diameter | 4 | each | $2,250.00 | $9,000.00 | | $0.00 | $2,250.00 | $9,000.00 |
| 48 | 02633003P | Manhole-6 ft Diameter | 9 | each | $3,100.00 | $27,900.00 | | $0.00 | $3,100.00 | $27,900.00 |
| 49 | 02633004P | Manhole-7 ft Diameter | 1 | each | $4,800.00 | $4,800.00 | | $0.00 | $4,800.00 | $4,800.00 |
| 50 | 02633005P | Manhole-8 ft Diameter | 1 | each | $5,600.00 | $5,600.00 | | $0.00 | $5,600.00 | $5,600.00 |
| 51 | 02721002P | Untreated Base Course (Est. Qty 13,363 cu yd) | 13363 | cu yd | $22.30 | $297,995.00 | $20.93 | $279,716.99 | $21.77 | $290,905.67 |
| 52 | 02721003P | Gravel Drive | 6012 | sq ft | $0.90 | $5,410.80 | | $0.00 | $0.90 | $5,410.80 |
| 53 | 02741006P | HMA - 3/4 inch (Plan Quantity) | 20336 | Ton | $70.65 | $1,436,738.40 | $70.45 | $1,432,608.16 | $73.26 | $1,489,912.48 |
| 54 | 02741007P | Asphalt Pavement Transition | 30980 | sq ft | $4.50 | $139,410.00 | | $0.00 | $4.50 | $139,410.00 |
| 55 | 02744006* | SMA - 1/2 inch (Plan Quantity) | 4336 | Ton | $116.00 | $502,976.00 | | $0.00 | $116.00 | $502,976.00 |
| 56 | 02765002* | Pavement Message Paint (Est. Qty 382 each) | 382 | each | $23.00 | $8,786.00 | $17.95 | $6,857.24 | $18.67 | $7,131.53 |
| 57 | 02765005* | Pavement Marking Paint (Est. Qty 208 gallon) | 208 | gal | $34.50 | $7,176.00 | $23.53 | $4,893.78 | $24.47 | $5,089.53 |
| 58 | 02771000P | Concrete Curb Type B4 (Est. Qty 141 feet) | 141 | ft | $20.50 | $2,890.00 | $38.39 | $5,412.99 | $39.93 | $5,629.51 |
| 59 | 02771001P | Concrete Curb Type B5 Modified (Est. Qty 11,888 feet) | 11888 | ft | $6.90 | $82,027.00 | $17.32 | $205,900.16 | $18.01 | $214,136.17 |
| 60 | 02771002P | Concrete Curb & Gutter Type B1 (Est. Qty 11,287 feet) | 11287 | ft | $15.00 | $169,305.00 | $15.29 | $172,578.23 | $15.90 | $179,481.36 |
| 61 | 02771004P | Concrete Driveway Flared, 7 inch Thick | 2366 | sq ft | $7.10 | $16,798.60 | $6.21 | $14,692.86 | $6.46 | $15,280.57 |
| 62 | 02771005P | Concrete Driveway Flared Modified, 7 inch Thick | 23180 | sq ft | $7.10 | $164,578.00 | | $0.00 | $7.10 | $164,578.00 |
| 63 | 02771006P | Pedestrian Access Ramp (Est. Qty 42 each) | 42 | each | $1,500.00 | $63,000.00 | | $0.00 | $1,500.00 | $63,000.00 |
| 64 | 02771010P | Plowable End Section Type I Modified (Est. Qty 19 each) | 19 | each | $500.00 | $9,500.00 | $466.29 | $8,859.49 | $484.94 | $9,213.87 |
| 65 | 02771011P | Plowable End Section Type II Modified (Est. Qty 3 each) | 1 | each | $2,310.00 | $2,310.00 | | $0.00 | $2,310.00 | $2,310.00 |
| 66 | 02771021P | Concrete Curb Type C1 (Est. Qty 328 feet) | 328 | ft | $24.00 | $7,872.00 | | $0.00 | $24.00 | $7,872.00 |
| 67 | 02771022P | Concrete Curb Type C2 (Est. Qty 6 feet) | 6 | ft | $29.50 | $177.00 | | $0.00 | $29.50 | $177.00 |
| 68 | 02771023P | Concrete Curb Type C3 (Est. Qty 13 feet) | 13 | ft | $27.62 | $359.00 | | $0.00 | $27.62 | $359.00 |
| 69 | 02771024P | Concrete Curb and Gutter Type C4 (Est. Qty 10 feet) | 1 | ft | $340.00 | $340.00 | | $0.00 | $340.00 | $340.00 |
| 70 | 02776001P | Concrete Sidewalk (Est. Qty 9,596 sq yd) | 9596 | sq yd | $34.20 | $328,184.00 | $40.79 | $391,420.84 | $42.42 | $407,077.67 |
| 71 | 02776003P | Concrete Flatwork 4 inch thick (Est. Qty 392 sq ft) | 392 | sq ft | $6.00 | $2,352.00 | $4.06 | $1,592.26 | $4.22 | $1,655.96 |
| 72 | 02776005P | Concrete Flatwork 7 inch thick | 3841 | sq ft | $7.30 | $28,039.30 | $8.04 | $30,878.95 | $8.36 | $32,114.11 |
| 73 | 02826000* | Ornamental Picket Fence | 1057 | ft | $43.00 | $45,451.00 | | $0.00 | $43.00 | $45,451.00 |
| 74 | 02844001P | Precast Concrete Full Barrier (New Jersey Shape) (Est. Qty 20 feet) | 20 | ft | $100.00 | $2,000.00 | $52.75 | $1,055.03 | $54.86 | $1,097.23 |
| 75 | 02896001* | Boundary Survey and Survey Plat | 1 | lump | $22,000.00 | $22,000.00 | $3,807.71 | $3,807.71 | $3,960.02 | $3,960.02 |
| 76 | 02896002* | UDOT Monument | 13 | each | $400.00 | $5,200.00 | | $0.00 | $400.00 | $5,200.00 |
| 77 | 029220040 | Broadcast Seed | 11 | 1000 sq ft | $100.00 | $1,100.00 | $29.78 | $327.60 | $30.97 | $340.71 |
| 78 | 02083010* | Fire Hydrant Assembly | 25 | each | $4,600.00 | $115,000.00 | | $0.00 | $4,600.00 | $115,000.00 |

| No. | Item No. | Description | Qty | Unit | Unit Price | Amount | Unit Price | Amount | Unit Price | Amount |
|---|---|---|---|---|---|---|---|---|---|---|
| 79 | 02511010* | 8" PVC C900 Waterline | 1763 | ft | $41.15 | $72,547.45 | | $0.00 | $41.15 | $72,547.45 |
| 80 | 02511011* | 10" PVC C900 Waterline | 3707 | ft | $32.50 | $120,477.50 | | $0.00 | $32.50 | $120,477.50 |
| 81 | 02511012* | 12" PVC C900 Waterline | 145 | ft | $73.00 | $10,585.00 | | $0.00 | $73.00 | $10,585.00 |
| 82 | 02511013* | 8" DIP Class 350 Waterline | 2407 | ft | $40.00 | $96,280.00 | | $0.00 | $40.00 | $96,280.00 |
| 83 | 02511014* | 10" DIP Class 350 Waterline | 669 | ft | $48.00 | $32,112.00 | | $0.00 | $48.00 | $32,112.00 |
| 84 | 02511016* | 14" DIP Class 350 Waterline | 877 | ft | $73.00 | $64,021.00 | | $0.00 | $73.00 | $64,021.00 |
| 85 | 02511022* | 6" Gate Valve | 1 | each | $1,660.00 | $1,660.00 | | $0.00 | $1,660.00 | $1,660.00 |
| 86 | 02511023* | 8" Gate Valve | 30 | each | $2,100.00 | $63,000.00 | | $0.00 | $2,100.00 | $63,000.00 |
| 87 | 02511034* | 10" Butterfly Valve | 14 | each | $2,800.00 | $39,200.00 | | $0.00 | $2,800.00 | $39,200.00 |
| 88 | 02511035* | 12" Butterfly Valve | 2 | each | $2,700.00 | $5,400.00 | | $0.00 | $2,700.00 | $5,400.00 |
| 89 | 02511036* | 14" Butterfly Valve | 2 | each | $6,600.00 | $13,200.00 | | $0.00 | $6,600.00 | $13,200.00 |
| 90 | 02511070* | 3/4" Service Connection | 64 | each | $1,330.00 | $85,120.00 | | $0.00 | $1,330.00 | $85,120.00 |
| 91 | 02511076* | 2" Service Connection | 3 | each | $4,000.00 | $12,000.00 | | $0.00 | $4,000.00 | $12,000.00 |
| 92 | 02741008* | Temporary Pavement Repair | 10359 | ft | $24.60 | $254,831.40 | | $0.00 | $24.60 | $254,831.40 |
| 93 | 02511015* | 4" C900 DR 25 Waterline | 118 | ft | $20.00 | $2,360.00 | | $0.00 | $20.00 | $2,360.00 |
| 94 | 02511017* | 6" C900 DR 25 Waterline | 1172 | ft | $40.00 | $46,880.00 | | $0.00 | $40.00 | $46,880.00 |
| 95 | 02511018* | 10" C900 DR 25 Waterline | 1424 | ft | $33.00 | $46,992.00 | | $0.00 | $33.00 | $46,992.00 |
| 96 | 02511021* | 4" Gate Valve | 2 | each | $1,100.00 | $2,200.00 | | $0.00 | $1,100.00 | $2,200.00 |
| 97 | 02511022* | 6" Gate Valve | 5 | each | $1,480.00 | $7,400.00 | | $0.00 | $1,480.00 | $7,400.00 |
| 98 | 02511024* | 10" Gate Valve | 4 | each | $2,750.00 | $11,000.00 | | $0.00 | $2,750.00 | $11,000.00 |
| 99 | 02511072* | 1" Service Connection | 4 | each | $1,250.00 | $5,000.00 | | $0.00 | $1,250.00 | $5,000.00 |
| 100 | 02511076* | 2" Service Connection | 2 | each | $3,200.00 | $6,400.00 | | $0.00 | $3,200.00 | $6,400.00 |
| 101 | 02741008* | Temporary Pavement Repair | 2518 | ft | $24.60 | $61,942.80 | | $0.00 | $24.60 | $61,942.80 |
| 102 | 02632010* | 8" PVC Sewer Pipe | 4821 | ft | $34.00 | $163,914.00 | | $0.00 | $34.00 | $163,914.00 |
| 103 | 02632020* | Core Drill Manhole | 4 | each | $2,300.00 | $9,200.00 | | $0.00 | $2,300.00 | $9,200.00 |
| 104 | 02633001P | Manhole-4 ft Diameter | 8 | each | $2,100.00 | $16,800.00 | | $0.00 | $2,100.00 | $16,800.00 |
| 105 | 02633002P | Manhole-5 ft Diameter | 12 | each | $2,625.00 | $31,500.00 | | $0.00 | $2,625.00 | $31,500.00 |
| 106 | 02633006P | Cast-in-Place Manhole-4 ft Diameter | 4 | each | $2,500.00 | $10,000.00 | | $0.00 | $2,500.00 | $10,000.00 |
| 107 | 02633007P | Cast-in-Place Manhole-5 ft Diameter | 6 | each | $2,960.00 | $17,760.00 | | $0.00 | $2,960.00 | $17,760.00 |
| 108 | 02632032* | 4" Service Connection | 43 | each | $1,620.00 | $69,660.00 | | $0.00 | $1,620.00 | $69,660.00 |
| 109 | 02632033* | 6" Service Connection | 2 | each | $1,810.00 | $3,620.00 | | $0.00 | $1,810.00 | $3,620.00 |
| 110 | 02741008* | Temporary Pavement Repair | 800 | ft | $38.00 | $30,400.00 | | $0.00 | $38.00 | $30,400.00 |
| 111 | 02831001* | Modular Block Wall (R-598A)(Est. Lump Qty. 288 sq ft) | 288 | sq ft | $37.00 | $10,656.00 | | $0.00 | $37.00 | $10,656.00 |
| 112 | 02831002* | Modular Block Wall (R-598B)(Est. Lump Qty. 458 sq ft) | 458 | sq ft | $37.00 | $16,946.00 | | $0.00 | $37.00 | $16,946.00 |
| 113 | 02831003* | Modular Block Wall (R-598C)(Est. Lump Qty. 839 sq ft) | 839 | sq ft | $37.00 | $31,043.00 | | $0.00 | $37.00 | $31,043.00 |
| 114 | 02831004* | Modular Block Wall (R-598D)(Est. Lump Qty. 165 sq ft) | 165 | sq ft | $37.00 | $6,105.00 | | $0.00 | $37.00 | $6,105.00 |
| 115 | 02831006* | Modular Block Wall (R-598F)(Est. Lump Qty. 430 sq ft) | 430 | sq ft | $37.00 | $15,910.00 | | $0.00 | $37.00 | $15,910.00 |
| 116 | 02831007* | Modular Block Wall (R-598G)(Est. Lump Qty. 292 sq ft) | 292 | sq ft | $37.00 | $10,804.00 | | $0.00 | $37.00 | $10,804.00 |
| 117 | 02831008* | Modular Block Wall (R-598H)(Est. Lump Qty. 274 sq ft) | 274 | sq ft | $37.00 | $10,138.00 | | $0.00 | $37.00 | $10,138.00 |
| 118 | 02831009* | Modular Block Wall (R-598J)(Est. Lump Qty. 417 sq ft) | 417 | sq ft | $37.00 | $15,429.00 | | $0.00 | $37.00 | $15,429.00 |
| 119 | 02831010* | Modular Block Wall (R-598K)(Est. Lump Qty. 585 sq ft) | 585 | sq ft | $37.00 | $21,645.00 | | $0.00 | $37.00 | $21,645.00 |
| 120 | 02831011* | Modular Block Wall (R-598L)(Est. Lump Qty. 1074 sq ft) | 1074 | sq ft | $37.00 | $39,738.00 | | $0.00 | $37.00 | $39,738.00 |
| 121 | 02777010* | Installation of City Furnished Tree Grate and Frame | 203 | each | $175.00 | $35,525.00 | | $0.00 | $175.00 | $35,525.00 |

| No. | Item No. | Description | Qty | Unit | Unit Price | Amount | Unit Price | Amount | Unit Price | Amount |
|---|---|---|---|---|---|---|---|---|---|---|
| 122 | 028120010 | Pressurized Irrigation System | 1 | lump | $283,700.00 | $283,700.00 | $35,087.88 | $35,087.88 | $36,491.40 | $36,491.40 |
| 123 | 02911001* | Rock Mulch | 300 | cu yd | $80.00 | $24,000.00 | | $0.00 | $80.00 | $24,000.00 |
| 124 | 02912001* | Contractor Furnished Topsoil | 2792 | cu yd | $17.25 | $48,162.00 | | $0.00 | $17.25 | $48,162.00 |
| 125 | 029220060 | Turf Sod | 3200 | sq ft | $0.70 | $2,240.00 | $0.68 | $2,163.84 | $0.70 | $2,250.39 |
| 126 | 029320030 | Plant - No. 1 Container | 5118 | each | $6.60 | $33,778.80 | $10.30 | $52,726.66 | $10.71 | $54,835.73 |
| 127 | 029320050 | Plant - No. 5 Container | 409 | each | $16.50 | $6,748.50 | $27.75 | $11,347.87 | $28.86 | $11,801.78 |
| 128 | 02932008D | Plant - 2 inch Caliper | 274 | each | $250.00 | $68,500.00 | | $0.00 | $250.00 | $68,500.00 |
| 129 | 02933010* | Impermeable Membrane (Est. Qty 3,727 sq yd) | 3727 | sq yd | $13.28 | $49,500.00 | | $0.00 | $13.28 | $49,500.00 |
| 130 | 029380010 | Tree Pruning | 10 | each | $0.01 | $0.10 | | $0.00 | $0.01 | $0.10 |
| 131 | 16581000* | Landscape Electrical System | 1 | lump | $67,850.00 | $67,850.00 | | $0.00 | $67,850.00 | $67,850.00 |
| 132 | 02891002P | Sign, Type A-1 (Est. Qty 81 sq ft) | 81 | sq ft | $51.75 | $4,192.00 | $25.90 | $2,097.51 | $26.93 | $2,181.41 |
| 133 | 02891003P | Sign Type A-1, 21 inch X 15 inch (Est. Qty 6 each) | 6 | each | $97.83 | $587.00 | $92.13 | $552.75 | $95.81 | $574.86 |
| 134 | 02891004P | Sign Type A-1, 24 inch X 12 inch (Est. Qty 5 each) | 5 | each | $80.60 | $403.00 | $76.78 | $383.91 | $79.85 | $399.27 |
| 135 | 02891005P | Sign Type A-1, 24 inch x 24 inch (Est. Qty 8 each) | 8 | each | $115.00 | $920.00 | $216.37 | $1,730.96 | $225.02 | $1,800.20 |
| 136 | 02891006P | Sign Type A-1, 24 inch X 30 inch (Est. Qty 6 each) | 6 | each | $143.83 | $863.00 | $119.27 | $715.62 | $124.04 | $744.24 |
| 137 | 02891007P | Sign Type A-1, 30 inch X 30 inch (Est. Qty 1 each) | 1 | each | $230.00 | $230.00 | $372.83 | $372.83 | $387.75 | $387.75 |
| 138 | 02891008P | Sign Type A-1, 36 inch X 8 inch (Est. Qty 1 each) | 1 | each | $173.00 | $173.00 | | $0.00 | $173.00 | $173.00 |
| 139 | 02891009P | Sign Type A-1, 36 inch X 36 inch (Est. Qty 1 each) | 1 | each | $403.00 | $403.00 | $256.78 | $256.78 | $267.05 | $267.05 |
| 140 | 02891010P | Sign Type A-1, 48 inch X 48 inch (Est. Qty 3 each) | 3 | each | $690.00 | $2,070.00 | $333.71 | $1,001.13 | $347.06 | $1,041.18 |
| 141 | 02891012P | Sign Type A-2 (Est. Qty 112 sq ft) | 112 | sq ft | $51.75 | $5,796.00 | $49.22 | $5,512.64 | $51.19 | $5,733.15 |
| 142 | 02891013P | Sign Type A-2, 21 inch X 15 inch (Est. Qty 1 each) | 1 | each | $87.00 | $87.00 | $63.30 | $63.30 | $65.83 | $65.83 |
| 143 | 02891014P | Sign Type A-2, 10 inch X 27 inch (Est. Qty 1 each) | 1 | each | $98.00 | $98.00 | | $0.00 | $98.00 | $98.00 |
| 144 | 02891015P | Sign Type A-2, 24 inch X 12 inch (Est. Qty 1 each) | 1 | each | $81.00 | $81.00 | | $0.00 | $81.00 | $81.00 |
| 145 | 02891016P | Sign Type A-2, 24 inch x 24 inch (Est. Qty 1 each) | 1 | each | $115.00 | $115.00 | | $0.00 | $115.00 | $115.00 |
| 146 | 02891017P | Sign Type A-2, 36 inch X 36 inch (Est. Qty 18 each) | 18 | each | $402.50 | $7,245.00 | | $0.00 | $402.50 | $7,245.00 |
| 147 | 02891018P | Sign Type A-2, 42 inch X 9 inch (Est. Qty 30 each) | 30 | each | $127.67 | $3,830.00 | | $0.00 | $127.67 | $3,830.00 |
| 148 | 02891019P | Sign Type A-2, 54 inch X 9 inch (Est. Qty 30 each) | 30 | each | $212.77 | $6,383.00 | | $0.00 | $212.77 | $6,383.00 |
| 149 | 02891020P | Relocate Sign Less Than 20 Square Feet (Est. Qty 2 each) | 2 | each | $110.00 | $220.00 | | $0.00 | $110.00 | $220.00 |
| 150 | 02891027P | Remove Sign Less Than 20 Square Feet (Est. Qty 56 each) | 56 | each | $110.00 | $6,160.00 | $80.85 | $4,527.86 | $84.09 | $4,708.97 |
| 151 | 02891028P | Remove Sign Greater Than or Equal to 20 Square Feet (Est. Qty 1 each) | 1 | each | $750.00 | $750.00 | $392.40 | $392.40 | $408.10 | $408.10 |
| 152 | 02891032P | Slipbase Sign Base With Top Casting SLB-2 (B3) (Est. Qty 72 each) | 72 | each | $345.00 | $24,840.00 | $186.60 | $13,434.85 | $194.06 | $13,972.25 |
| 153 | 02891036P | Sign Post P3 (Est. Qty 60 each) | 60 | each | $212.75 | $12,765.00 | $132.49 | $7,949.40 | $137.79 | $8,267.38 |
| 154 | 02891037P | Sign Post P4 (Est. Qty 7 each) | 7 | each | $402.57 | $2,818.00 | $182.86 | $1,280.02 | $190.17 | $1,331.22 |
| 155 | 02891038P | Sign Post P5 (Est. Qty 6 each) | 6 | each | $287.50 | $1,725.00 | $280.08 | $1,680.48 | $291.28 | $1,747.70 |
| 156 | 02892001D | Traffic Signal System SR-9/300 West | 1 | lump | $80,300.00 | $80,300.00 | | $0.00 | $80,300.00 | $80,300.00 |
| 157 | 02892002D | Traffic Signal System SR-9/Main St | 1 | lump | $89,100.00 | $89,100.00 | | $0.00 | $89,100.00 | $89,100.00 |
| 158 | 16525003D | Highway Lighting System 300 West to 800 North | 1 | lump | $132,000.00 | $132,000.00 | | $0.00 | $132,000.00 | $132,000.00 |
| 159 | 135940010 | Fiber Optic Communication System | 1 | lump | $101,000.00 | $101,000.00 | $256,152.63 | $256,152.63 | $266,398.74 | $266,398.74 |
| | | | | Sum | | $10,203,871.40 | | | | $8,986,987.08 |
| | | | | Sum that matched | | $5,488,892.35 | | $4,107,700.03 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Number of items that matched | 67.0 | | | |
| | | | | Percent of items that matched | 42.1% | | | |
| | | | | Percent of price that matched | 53.8% | | | |
| | | | | Silver Standard Ratio | 1.34 | =$5,488,892.35 / $4,107,700.03 | | |
| | | | | Gold Standard Ratio | 1.14 | =$10,203,871.40 / $8,986,987.08 | | |

# Appendix C – Risk Matrix

# SR-9 Construction / CMGC Process (PIN 5978)

## Risk Identification and Prevention Table

| topic | probability | severity | plan to reduce risk | team leads |
|---|---|---|---|---|
| **Right of Way** | | | | |
| 1. Acquisition of Right of Way in time for construction | H | M | On-going communication with ROW consultants and project team | Horrocks/UDOT / consultant |
| 2. Condemnations | L | M | Identify ASAP and begin communications | Horrocks/UDOT / consultant |
| 3. Unknown acquisition costs | M | L | Identify unknowns ASAP and begin research | Horrocks/UDOT / consultant |
| 4. Limitations for contractors | H | L | Contractor involved in monthly team meetings with additional weekly communications | Lee / Donald |
| 5. Angry property owners i.e. UDOT did not fulfill agreements | H | L | Personal visits to identify potential concerns; on-going communication throughout the process. | Lee / Lori |
| 6. Relocations | L | L | Identify ASAP and begin communications | |
| 7. Change orders that affect right of way | L | M | Contractor involved in monthly team meetings with additional weekly communications | Lee / Donald |

| | | | | |
|---|---|---|---|---|
| 8. Deeds too complex in time for acquisitions | L | L | On-going communication with ROW consultants and project team | Lee / Craig /ROW consultant |
| 9. Zion's Bank | M | M | Personal visit with UDOT | Tamerha |

| | | | | |
|---|---|---|---|---|
| **Geotechnical and Subsurface** | | | | |
| 1. Hard rock excavation for grade and utilities | L | M | Geotech testing | Horrocks |
| 2. Hazardous waste clean up | M | M | Work with Chevron | Chevron/ Horrocks |
| 3. Soft subgrade | H | H | Geotech testing | Horrocks |
| 4. Storm water | M | M | Meet with Hurricane City | Horrocks/City |
| 5. Underground water | L | M | Geotech | Horrocks |
| 6. Unforeseen obstacles like old concrete | L | M | | |

| topic | probability | severity | plan to reduce risk | team lead |
|---|---|---|---|---|
| **Utilities** | | | | |
| 1. Volume of Utility Upgrades | H | H | Coordinate with utility companies and contractor | Horrocks/IRP |
| 2. Extent of utility investigations | M | M | Conduct a SUE | Horrocks/IRP |
| 3. Identification of Utility Conflicts | H | H | Conduct a SUE | Horrocks/IRP |
| • Unexpected utility locations | L | M | | |
| • Abandoned utilities | M | L | | |
| • Unknown utilities | M | M | | |
| • Identifying all utilities | M | M | | |
| • Accurate Location of existing utilities | M | M | | |
| • Unforeseen Utility conflicts | M | M | | |
| • Subsurface conflicts | M | M | | |
| 4. Hitting existing utilizes (overhead or underground) | M | M | | |
| 5. Water line breaks | L | M | | |

| | | | | |
|---|---|---|---|---|
| 6. Delayed utility work holding up construction | L | M | Let Contractor schedule the utility work | IRP |
| 7. Timely relocation of utilities | L | M | Let Contractor be lead on utility relocations | IRP |
| • Early notification for sufficient time to relocate | L | M | | IRP |
| • US west design and work | M | M | Set up meetings with Qwest | Horrocks/IRP |
| • Hurricane City Water design and work | L | M | | Horrocks/IRP |
| • Replacement agreements | L | L | | Horrocks/Gernice |
| 8. Ash creek Special Services District Design and work | L | M | | Horrocks/Ash Creek |
| 9. Relocation design -- errors and or timely completion | M | M | | Horrocks |
| 10. Storm Drain conflicts with existing utilities | M | M | | Horrocks/IRP |
| 11. Conflicts with telephone | M | M | Set up meetings with Qwest | Horrocks/IRP |
| 12. Qwestar Gas High Pressure Line | M | M | Set up meetings with Questar | Horrocks |
| 13. Coordination of Private and public utility work | M | M | | IRP |
| 14. Temporary Utility service for utilities being relocated | M | M | IRS to coordinate | IRP |
| 15. Disruption of utility service | M | M | IRS to coordinate | IRP |

| | | | | |
|---|---|---|---|---|
| 16. Funding for Utility upgrades | M | M | | UDOT/Tamerha |
| 17. Timing of Utility upgrades | M | M | | |
| **Labor** | | | | |
| 1. Skilled operator shortage | L | L | | IRP |
| | | | | |
| **Leadership risks** | | | | |
| 1. Make decisions and take decisive action | L | L | Lief and Tamerha will work with IR | UDOT/IRP |
| 2. Last minute changes to anything | M | M | | |
| | | | | |
| **Safety** | | | | |
| 1. Oversized loads up to 146” wide traversing the construction site | H | L | | |
| 2. Accidents in the work zone | L | L | Follow MUTCD | |
| 3. Disabled vehicles in work zone | L | L | | |
| 4. Drunk Drivers | | | | |
| | | | | |

| | | | | |
|---|---|---|---|---|
| **Design Errors and Omissions** | | | | |
| 1. Pavement design | L | M | Coordinate with UDOT, IRP and Horrocks | |
| 2. Cost overrun due to poorly defined scope | L | M | | |
| 3. Cost overruns due to late city requirements | M | M | | |
| 4. Design Errors and Omissions | L | M | | |
| | | | | |
| **Weather** | | | | |
| 1. Heavy rain | M | H | | |
| 2. Flooding in lower sections of grade | M | H | | |
| 3. Water damage to construction site | M | H | | |
| **City Enhancements** | | | | |
| 1. Aesthetic issues decided early | L | L | | |
| 2. Funding for upgrades | H | L | Hurricane City | Arthur |

| | | | | |
|---|---|---|---|---|
| 3. Underground needs for city enhancements | H | H | Hurricane City needs to decide what they want now | UDOT/Horrocks/City |
| 4. Funding for landscaping | M | L | Hurricane City needs to decide what they want now | UDOT/Horrocks/City |
| 5. City drainage needs vrs roadway drainage | L | L | UDOT and Hurricane City need to come to an agreement | UDOT/Horrocks/City |
| 6. Approved plan material before transported to site | L | L | | |

| | | | | |
|---|---|---|---|---|
| **Materials** | | | | |
| 1. Delayed delivery such as street lights back ordered | L | L | | IRP |
| 2. Price increases for asphalt, pipe, cement, etc | H | H | | |
| 3. Availability of materials like asphalt, pipe, cement, etc | H | H | | |
| 4. Fuel costs | H | H | There is a spec that deals with fuel adjustments | UDOT |
| 5. Materials | M | M | | |
| 6. Delayed delivery such as street lights back ordered | M | M | Horrocks needs to provide signal materials list at the Plan-in-Hand meeting | Horrocks/UDOT |
| 7. Price increases for asphalt, pipe, cement, etc | H | H | | |

| | | | | |
|---|---|---|---|---|
| **Construction risk** | | | | |
| 1. Delayed starting date | M | M | | UDOT/IRP/Stanton |
| 2. Loss of existing trees at elementary school | L | L | Hurricane City has met with arborist | Hurricane City |
| 3. Damage to adjacent buildings | M | M | IRP to video building and adjust vibratory machines | IRP |
| 4. Loss of irrigation water to vacant lots | L | L | | |
| 5. Los of water to customers | L | | | |
| 6. Schedule conflict with local events | M | L | IRP to let property owner understand their schedule | IRP |
| 7. Stability of final slopes and cuts | L | L | | |
| | | | | |
| **Traffic Control** | | | | |
| 1. Inadequate traffic control | L | L | IRS needs to meet MUTCD standards | IRP |
| 2. Conflicts with school crossings | M | L | Coordinate with School and IRS | School/IRS |
| 3. School bus routes | L | L | Coordinate with School and IRS | School/IRS |
| 4. Control during Geotech activities | L | L | | |
| 5. Agreement between UDOT and City on closure of 600 north | L | L | Hurricane City and UDOT to decide the solution now | City/UDOT |

| | | | | |
|---|---|---|---|---|
| 6. Access agreements with property owners | L | L | Right of Way agents will provide signed copies to contractor | UDOT/IRP |
| 7. Access to business and residential during construction | M | H | IRS to coordinate with property owners | IRP |
| 8. Limiting construction efforts and extending project | L | M | | |
| 9. Pioneer Park turn lane | L | M | | |
| 10. Awkward rerouting that confuses motorists | M | M | IRS to get approval for rerouting with UDOT | UDOT/IRP |
| 11. Access to emergency vehicles | M | M | IRS to coordinate with police | IRP/Police |
| 12. Road closures | L | L | Decide in design when and if closures will be permitted and insert in specs | Horrocks/UDOT/Hurricane City |
| 13. I-15 incident between exits 16 and 27 that diverts interstate traffic through work zone | L | L | Coordinate with Hurricane City, property owners and Zion Park | Hurricane City/property owners/Zion Park |
| 14. Work zone signage and barricades | L | L | Follow MUTCD | UDOT/IRP |