**DISPUTE REVIEW BOARD REPORT AND RECOMMENDATION**

 **R5 PRIORITY CULVERT SH 184 MM 25.1‏ CHICKEN CREEK MONTEZUMA COUNTY, CO CDOT PROJECT NO. BR 184A-003**

 **DISPUTE CONCERNING DIFFERING SITE CONDITIONS AT 78” PIPE**

**Hearing Dates:** December 12, 2014

**Hearing Location:** CDOT Office, 3803 N. Main Avenue, Suite 200 Durango, CO

**Hearing Attendees:** Richard Davis – MVC – President

 Lane Johnson – MVC – Construction Manager

 Tom Olson – Olson Construction Law – Attorney for MVC

 Todd Kilduff – T. M. Kilduff Consulting – Expert for MVC

 Jeff Rumer – UIT – Expert for MVC

 Jim Moore – HammerHead Trenchless Equipment – Expert for MVC

 Ed Archuleta – CDOT – Program Engineer

 Steven Cross – CDOT – Resident Engineer

 Gwen Eberhart – Yeh & Associates – Consultant Project Engineer

 Benny Siljenberg – Brierley Associates – Expert for CDOT

 Brian Dorwart (By phone) - Brierley Associates – Expert for CDOT

**Background:** On December 19, 2013, Mountain Valley Contracting, Inc. (MVC) was awarded a Contract for $849,060 which included hammer boring 78” diameter and a 36” diameter pipes with ¾” wall thickness, that were furnished by CDOT, under State Highway 184 along with work associated with the completion of the pipe installation. A Notice to Proceed was issued on March 12, 2014.

Section 7 of the Contract incorporates the Plans, the Standard Specifications for Road and Bridge Construction dated 2011 and any Special Provisions for this Project and Revised Standard Specifications.

The 78” pipe was to be installed around an existing 36” CMP. MVC uncovered the end of the 36” CMP and found the 36” CMP was not at the location shown on the plans. The new 78” pipe had to be relocated to comply with the Army Corps of Engineers 404 permit. On April 15, 2014, MVC began ramming the 78” pipe and almost immediately had problems advancing the pipe which completely stopped after the pipe was advanced about 20 feet. The spoil was cleaned out of the pipe and large cobbles and boulders were found. After meetings and considerable correspondence, MVC sent a letter to CDOT on May 4, 2014 giving Notice of Differing Site Conditions. On June 9, 2014, CDOT sent CDOT Form 105-015 to MVC authorizing MVC to install the 78” culvert by using an open cut.

After numerous meetings and correspondence between the parties, CDOT sent a letter to MVC on August 26, 2014 indicating CDOT was initiating the DRB process.

**Statements of Dispute:**

**MVC:** Mountain Valley Contracting ("MVC") was unable to install the Colorado Department of Transportation’s ("CDOT") - specified pipe per the CDOT- specified ramming method when we encountered cobble and boulders, which subsurface conditions were not shown in the geotechnical memorandum and borings which CDOT prepared for the project. As a consequence, CDOT changed to an open-cut installation method. MVC complied with all of procedural requirements to get paid for its extra costs, including timely notice. Although CDOT subsequently granted MVC a time extension for much of the related delay, CDOT has refused to pay for the related extra costs.

MVC respectfully requests that the Dispute Resolution Board (“DRB”) recommend that CDOT pay for all of the extra costs MVC incurred in attempting to install the pipe by ramming, in installing the pipe by the non-specified open-cut method, and in delay-related costs for the time spent figuring out how to proceed once the cobble and boulders were encountered. MVC also requests that the DRB recommend the award of a time extension for all related delay, and thereby relieve MVC from the assessment of any liquidated damages.

**CDOT:** The Colorado Department of Transportation (CDOT) and Mountain Valley Contracting request that the Dispute Review Board answer the following regarding the differing site condition dispute on Project number BR 184A-003, SA 19870 R5 Priority Culvert SH 184 MM 25 (Chicken Creek Culvert): Is there a differing site condition on the project?

 Scope of Desired Decision:

 If the DRB decides there is a differing site condition:

 • Could the project have been completed as specified in the contract?

 • What compensation is due to Mountain Valley Contraction and/or the Colorado Department of Transportation if differing site conditions do exist?

 If the DRB determines there is no merit and no quantum then the project will be closed as it currently stands.

**Pre-hearing Submittal:**

In addition to the Plans and Specifications for the Project,the parties provided the DRB with a set of Common Reference Documents, including extensive photos. Both parties provided the DRB with Position Papers and lists of attendees per Spec 105.23(e). MVC also provided a binder which included, but was not limited to, documentary evidence relevant to the issues, serial letters, e-mails, speed memos, daily logs and handwritten notes.

**Contractor Presentation on Differing Site Conditions:**

MVC went over its experience doing highway and utility work including the ramming of large diameter pipes. They went to the pre-bid meeting and understood the requirements. They talked to HammerHead on the equipment during their bid preparation. Their intent was to have the 78” pipe “washover” (encapsulate) the existing 36” CMP which they assumed was bedded per the present CDOT specs with select fill and that the ramming would work in this material. The 36” CMP was not located where it was shown in the Plans and the 78” pipe had to be relocated about 6 feet from the location of the existing 36” CMP. This eliminated the “washover” condition.

MVC hired Kilduff to prepare the required engineering calculations which were submitted to CDOT. HammerHead was concerned with the ¾” wall thickness of the pipe as the HammerHead tables call for 1”. Discussions with CDOT were almost impossible but CDOT said to use the ¾” pipe that CDOT furnished.

MVC started ramming the pipe but the pipe hit refusal at about 12 feet. They worked with HammerHead and got a 60 ton static load on the pipe but at 20 feet hit refusal again. The pipe was to be rammed in 15 feet of manmade embankment so they were puzzled on what was buried in the fill. Using Hydro-excavation, MVC removed the spoils from the inside of the pipe and found cobbles and boulders that remained in the invert of the 78” pipe as shown in photos 43, 44, 46 and 47. Photos 48-52 and 55-60 showed cemented matrix with cobles and boulders as they stood in the open face. They talked to CDOT about the Differing Site Condition since cobbles and boulders were not shown in the Contract Documents and they could not “washover” the old CMP. CDOT said for MVC to look at MVC’s Methods Statement and getter a bigger ram. CDOT eventually issued CDOT Form 105-015 on June 9, 2014 allowing for open cut installation.

**Todd Kilduff**

Todd explained his geotechnical background and 20 years’ experience in trenchless construction. He understood the spec requirements and looked at the pipe loading and pipe deflection. He reviewed the soil borings provided by CDOT and understood the pipe alignment around the old CMP. The material was embankment that was mostly clay with sand at the lower level. The N values on the borings were 3, 12 and 18 which posed no problems for ramming. His calculations showed that all loads that were to be applied to the pipe were acceptable.

When MVC encountered problems, he saw pictures of the materials that were found. He was asked to reevaluate his calculations but said science “goes out the window” when nested cobbles and boulders are found. He sent a letter to MVC on May 9, 2014 concerning the problem and the possibility of pipe failure with a larger hammer.

Todd provided plots of the borings and noted the 2” split spoon sampler can’t recover cobbles. He would have dug a test pit under the existing conditions. The ground was much different than the original borings and the new Yeh borings as the pictures show.

**Jeff Rumer**

Jeff said he was the president of Underground Infrastructure Technologies (UIT), a pipe construction contractor, and had been in the business for 24 years installing pipes from 12” to 160” with most pipes in the 48” to 120’’ size. He was contacted by MVC in the last month and a half to give an opinion on the likelihood of success for driving the 78” pipe. Soil conditions usually determine the likelihood of success. He looked at the CDOT borings and the reports by Kilduff and Brierley. He also looked at the “washover” procedure for the 36” CMP which was probably installed in an open cut that used some sort of bedding material. The change of location for the 78” pipe was in a new location and not where the CDOT initial borings were located.

The driven portion of the 78” pipe was 100 feet. He evaluated the pipe shoe on the front of the pipe which helps reduce friction. Kilduff came up with 272.5 tons of force (60 tons of face resistance and 212.5 tons skin friction) on the pipe and Brierley came up with 340 tons but different formulas and interpretations can lead to different values. The experts were not surprised by these differences. He used 340 tons in his evaluation. The pipe supplied by CDOT was a good grade but only had a ¾”wall. Kilduff determined the maximum allowable force that could be applied to the pipe was 1,310 tons, far more than the calculated force of 340 tons by Brierley.

There are only two hammer manufacturers in the United States, HammerHead and Trenchless Technologies (TT), and he has used both. Both hammer manufacturers’ tables for hammer selection and pipe thickness are based on pipe diameter and pipe length. The calculated impact force for the 24” HammerHead hammer was 1,014 tons which was less than the allowable for the pipe of 1,310 tons. The 24” TT Taurus hammer could apply 2,248 tons of force which was greater than the allowable force of 1,310 tons for the ¾’ wall pipe supplied by CDOT.

Based on the original soils report, he would have selected the same hammer as MVC did. He also looked at the Yeh borings and the photos. It was impossible to determine the soils that were found on the borings. Visual inspection showed large boulders and nested cobbles and boulders. The pipe advances by displacing the material at the end of the pipe rather than fracturing the obstacles. With large boulders or nested cobbles, the material can’t be displaced, especially in soil that can’t be compressed easily. He stated that formulas used in the science of ramming go out the window when hitting cemented cobles and boulders. His opinion is that ramming by itself would not work in the materials that were encountered.

**CDOT Presentation on Differing Site Conditions:**

CDOT’s position is that there was no Differing Site Condition, either Type 1 or Type 2. MVC did not request the soils information until February 10, 2014 which is after the bid and this information is important for selecting the hammer. Some equipment was adequate but the air volume and air connections were not correct. MVC initial submittal had to be revised but MVC said it could be done even through the shale fragments and rocky condition at 16 feet that were shown in the borings.

CDOT hired Brierley to determine if the ramming could be done. The photos showed the cobbles fell into the pipe when the spoils were removed which indicated there was success in hammering. The fatal flaw was the air supply and air connections and how the hammer was attached to the pipe. The hammer connection and plate failed to transmit the force to the pipe. MVC did not account for the loss in the compressor capacity due to the elevation of the Project.

CDOT said they had the samples that Yeh took for the DRB to view.

**Brian Dorwart (On the phone)**

Brian said he had been in the trenchless business for over 40 years and had done a lot of engineering for contractors. He looked at three things:

1. Can it be built? Kilduff looked at it after the bid and referenced ORDOT SPT 710 is correct and the first of its kind of report on the subject. Kilduff’s assessment was adequate and he (Brian) came up with the same conclusions that the project could be built with the proper setup.

1. Did something change? The CDOT memo and borings show fill in the upper areas. It is not known how the fill was placed but it was not native embankment. The borings show “crunchy ground”. Yeh showed similar material with the split spoon and the spoon could have been advanced with enough energy. The photos don’t show cemented soil but rather well-compacted in the dry which is what should be expected in fill. There was a rocky condition at the pipe and a test pit would have shown more. His question was, at 20 feet into the ramming what was different the material encountered or energy? He said he has rammed pipe in dam rock but has seen rock stop cellular pipe.
2. Is the hammer big enough?
* He thinks “yes” if properly set up – SBR 710 Report. There is a loss in the compressor air due to altitude. The air is rated at the intake and higher altitude would be the same as a smaller inlet pipe. An air storage tank was needed.
* The hammer connection to the pipe needs to be tight with little rebound. The chains or cables need to be tightened often. He doesn’t know if the hammer jumped but it should have been tightened every couple of minutes.
* The 1½” plate used for the connection must be stiff and was not stiff as built. The stiffness is required for dynamic loading and not static loading. Bounce reduces energy transfer. Manufacturers recommend collets which are stouter than what MVC used. The plate needed stiffeners.
* In looking at pictures, no pipe deformations or buckling at the hammer end were evident. This indicated the energy was not getting to the pipe.
* Static formulas do not apply when using a PDA.
* His experience says the ramming could be done with a good set-up and hammer connection or a bigger hammer. He did not see a differing site condition. There was not a proper transfer of the hammer energy – 20 feet is a short distance for the pipe to get stuck.

**Contractor Rebuttal on Differing Site Conditions:**

CDOT did the borings and they do not show the rocks that were found which is a differing site condition. You need to look at unified soil classifications which are very specific. The boring logs are clear on the classification. The pictures clearly show rocks and clay. Yet, CDOT and Brierley say there is no differing site condition and the material did not differ from the logs. No pipe damage does not equate to a lack of sufficient force on the pipe.

The ACC 2300 compressor was adequate and Brian Dorwart had the standard procedure. MVC asked Brian if the diagram was predominantly correct and Brian said “Yes”.

Jim Moore said he had worked for both HammerHead and TT in sales for 25 years and had done 125 to 150 rams in 11 states. They have the contractor fill out a questionnaire about the job and then a tech becomes involved with the job. The tech on this job was Mike Walk who is a senior tech and has worked all over the world. Mike was on vacation and could not attend the hearing but he was on the job when the ramming was taking place. If the connection was as bad as CDOT said, the hammer would have been like hitting foam rubber and the pipe would not have gone 2 feet. He felt the pipe was flexing and that the hammer was not running loose with the chains that were installed. Mike said the connection was good and giving 178 +/- blows per minute. Every contractor has slightly different equipment to hook the hammer up. You need air volume to push the pipe but PSI is also important. The ACC compressor with 1,754 cfm (derated for altitude) was above HammerHead’s recommendation.

MVC asked Brian Dorwart about energy transfer to the pipe wall. Brian said there is friction on the pipe but the stiffer the pipe, the more force is transmitted to the end of the pipe and rigidity is a factor of the pipe wall thickness. MVC said that if that was the case, why wasn’t pipe with the recommended 1” wall provided.

**CDOT Rebuttal on Differing Site Conditions:**

CDOT said once there was a problem; they had a meeting with MVC. MVC had not done large pipes before. The geotech report is needed for a successful job and MVC did not request the soils information until after the bid.

Using a 2” spoon is like using a needle in the fill that covered a wetlands area. The bores showed gravel but the boulders that were encountered were not excessive. Problem was that MVC did not have the experience. CDOT said the pipe could be rammed and Brierley confirmed it.

A bidder must do a risk assessment and engineering before the bid. If they don’t have experience, they need to call for help. They need to measure their experience at bid time.

MVC did not look at the air connections and the compressor was at the limits for air. Bigger is always better. MVC had poor energy transmission at the pipe connection as evidenced by the broken welds. MVC had success in ramming the 36” pipe but the sound was different for the 72” pipe.

CDOT questioned pipe lubrication and why MVC did not try to ram the pipe again after the spoils had been removed. MVC was inefficient due to lack of experience. When a contractor runs into trouble they should asked for help in ramming the pipe rather than asking for an open cut. The project drug on after the open cut was completed.

CDOT spoke to TT on their hammer and then talked to MVC before July 4th. TT said there would be no charge for hammer rental if the TT hammer did not work. CDOT offered the split the freight charge with MVC so there was no reason for not changing hammers. Multiple compressors could have been used with a manifold to get more air.

The open cut was done in new asphalt and now CDOT is going to have to mill and fill the patch area.

CDOT questioned how there could be a differing site condition if MVC did not have the soils information at bid time.

**Brian Dorwart**

The bore logs are not scientific and interpretation is required. (CDOT said that any questions on the logs could have been vetted prior to the bid.)

The Oregon DOT Report shows experience is very important and more is learned on every job. The Report is a good start for the industry.

**Discussions by the Parties:**

1. MVC asked CDOT what engineering CDOT did to produce the plans and did not get an answer.
2. MVC said they walked the job prior to the bid and assembled a team with experience to put the bid together.
3. MVC (Todd Kilduff) said that CDOT dictated the means and methods for installing the pipe and MVC relied on the owner’s due diligence in preparing the bid documents.
4. CDOT said the MVC team was assembled after the bid. The team could have asked questions before the bid. What was MVC’s bid based on? The bidder had to look at the Project and needed experience for this type of job.
5. MVC said HammerHead (Jim Moore) was contacted before the bid for hammer size. The boring logs did not show boulders and the other bidders’ prices were similar to MVC’s. MVC could have done the job if there were no cobbles and boulders and the material was clay and sand as shown on the logs.
6. Jim Moore referred to HammerHead’s spec which shows a 1” pipe wall thickness and got HammerHead’s engineer involved who said he preferred 1” pipe and not ¾”. He feels TT would also have preferred 1” pipe. The experience to get the job done comes from the contractor getting the hammer manufacturer and an engineer involved and then being on the site when the work is done.
7. CDOT said MVC Tab 8 in the email dated March 6, 2014 from HammerHead shows ¾” pipe will work. MVC rammed the end of the pipe to under the pavement “white line” when the pipe stopped. The excavation for the open cut did not show there were more rocks and cobbles beyond where the pipe stopped. MVC said that when the pipe stopped, they had no idea of what material was ahead of the pipe. MVC also said under the time limitations imposed by CDOT to get the road open, they did not pay attention to the open cut excavation material as long as it could be removed by the 330 excavator and loaded on trucks.
8. CDOT said MVC had a poor design and did not get the energy transferred to the pipe. If HammerHead did not like the ¾” pipe, the risk could have been brought up before the bid. CDOT said they opened the door for the TT contact.
9. MVC referred to their “Note 5” on the Open Cut proposal where they said they would get a bigger hammer if CDOT would accept liability for the pipe but CDOT refused. CDOT did not continue to meet on the differing site condition per the dispute spec. CDOT said there was no point in continuing to meet since CDOT said there was no differing site condition.
10. Lane Johnson said he checked the ACC 2300 compressor losses for altitude and got 23.72% which results in air of 1,754.44 cfm which is more than what was in Kilduff’s calculations.

Brian Dorwart pointed out that corrections also had to be made for temperature and humidity but this would only be 5 to 8%. The charts use 60 degree air into the compressor but the air temperature when the ramming was done was much lower.

**Questions by the DRB on Differing Site Conditions:**

**1. To Both:** Was the location of the 78” pipe changed after the award?

Both parties said “yes”.

**2. To Both:** If the 78” pipe could have been rammed around the 36” CMP would less force have been required?

 MVC said “yes”. Brian Dorwart of Brierley said “yes” because the old CMP was not stiff which would allow the CMP to collapse as the soil was pushed into the pipe.

**3. To CDOT:** Does CDOT have the design for the 78” pipe that determined the ¾” wall thickness?

CDOT said “no” but they had contacted another contractor who had done two 60” pipes at Pagosa Springs.

**4. To CDOT:** Has CDOT Region 5 and CDOT statewide done pipe ramming over 60”?

Region 5 did two 60” pipes in Pagosa Springs. CDOT Region 5 did not know about CDOT for the rest of the state.

**5. To CDOT:** What did TT say, if anything, about more force on the 78” pipe since their chart calls for 1” wall thickness?

CDOT said Rick at TT asked why **MVC** supplied ¾” pipe. Lane Johnson said Dave Holcomb of TT was concerned about ¾” pipe when he talked to him.

**6. To CDOT:** If CDOT thought a larger hammer would do the ramming, then why did CDOT refuse to accept liability for the pipe if a larger hammer was used?

 CDOT said it was MVC’s job to complete the ramming. CDOT offered to split the freight costs for the larger hammer. CDOT said that MVC cut off the end of the pipe that CDOT supplied which changed the pipe CDOT supplied.

 Jeff Rumer drew a picture of the end of the pipe that CDOT supplied and explained that the end of the pipe with an inner and outer ring on the pipe end was not an industry standard since the end of the pipe was square. MVC beveled the ends of the rings at an angle and added welds which are more to industry standards. HammerHead wanted the cutting end of the pipe to force more soil into the 78” pipe and prevent the pipe from buckling inwards.

**7. To CDOT:** CDOT referred to boulders that were in the spoil that was removed. Where were the boulders in relation to the end of the pipe?

 CDOT said they didn’t know other than the rocks shown in the pictures. MVC got the pipe in 20 feet and CDOT felt the energy was not getting to the pipe.

 Lane Johnson of MVC said that force was getting to the pipe because some of the welds that joined pipe segments broke.

**8. To CDOT:** Did other bidders ask for the soils report prior to the bid and were their bids substantially different from MVC’s?

 CDOT said that the work on this Project was originally bid with the Pagosa Springs project but the bids were too high and the SH 184 work was deleted. American West bid both jobs but MVC did not bid the first time. MVC’s bid was $20,000 under the Engineer’s Estimate and $44,000 under the second bidder (Habitat). MVC’s price was $228,000 for the 78” pipe, while American West was $260,000.

 **9. To CDOT:** Where were original borings 2 and 3 relative to the 36” CMP and the changed location for the 78” pipe?

CDOT said the borings were not at the new pipe location but the ones done by Yeh were.

**10. To CDOT:** Did CDOT request the use of a PDA to check the ramming?

 CDOT said “no”. Brian Dorwart said a PDA could have been used but it’s not cheap. He had used a PDA on inclined piles.

**11. To Both:** How did the 36” pipe ramming go?

MVC said they did the ramming with two pipe lengths of 46 and 50 feet but it did not go per their expectations in that it took 18 hours.

 CDOT said the 36” pipe was much stiffer and took two days.

**12. To Both:** When the 330 excavator was used on the 78” pipe, did anything change?

 MVC said the 330 added more force but it didn’t help. It is industry practice to use an excavator to start pipes to help keep the pipe in place as it is started into the soil until there is some friction on the pipe to hold it in place.

**13. To Both:** How did anyone know what soil was beyond the area where the pipe stopped?

 CDOT said the only thing known for certain is what the new Yeh borings showed.

 MVC said what they saw is not what the new logs showed. They only used the 330 to excavate the material and load to trucks and were not concerned with the material as long as the 330 could dig it.

 Gwen Eberhart said the pictures show the material that was in the open cut.

**Contractor Presentation on Schedule Impact Due to Differing Site Conditions:**

MVC intended to complete the 78” pipe on the east side, then complete the 36” pipe on the east side, the 36” pipe on the west side and finish with the 78” pipe on the west side which the schedule showed to take 7 weeks. Because of the delays on the 78” pipe and the one lane requirement, the sequence changed.

They completed the 36” pipe and then only pumped water for one month at the 78” pipe. It took CDOT 5 weeks to issue the Form 105 for the open cut. CDOT would not allow the road to be shut down to do the open cut. CDOT required the installation of a temporary bridge which went through multiple revisions by CDOT and then they were allowed only 12 hours to get the bridge installed.

MVC said they also had their own problems and might be responsible for 10 days of delay. The Project was complete on October 2, 2014 and accepted on October 13, 2014. The guardrail subcontractor was one week late getting started due to being very busy on other work and originally should have been on the Project in June per the original schedule. The durations for the pipe follow-on work did not change.

MVC presented a schedule which showed the start of the job, the delay time and then the completion work.

**CDOT Presentation on Schedule Impact Due to Differing Site Conditions:**

The schedule with Pay Application 3 showed the open cut completing on July 3, 2014. CDOT did not want to possibly have the road closed for the July 4th holiday and wanted to delay the work. The revised schedule submitted with Pay Application 4 showed the open cut work starting on July 8, 2014, the open cut asphalt patch completing on July 18, 2014 and the Project complete on August 22, 2014. On August 1, 2014, CDOT sent a letter to MVC agreeing to a Contract Completion Date of August 15, 2014. (MVC said the schedule they had prepared focused on getting the asphalt paving done rather than the entire job. The schedule also added other work items.)

The schedule with Pay Application 5 showed the last activity (#129 - Install Guardrail - Highway 184) with a completion date of September 19, 2014, a one month slippage. The guardrail was one week later than originally scheduled. (MVC noted that there were two different highways where guardrail was to be installed and the sub did not want to split the schedule.)

The schedule with Pay Application 6 showed the last activity (#134 - Clean Up Site) with a completion date of October 1, 2014. CDOT said the road was closed for 3 days and not one overnight closure. CDOT said the asphalt work was completed on August 22, 2014. (MVC said other missing work items were added to the schedule. MVC also said that after the open cut work, there were 6 weather days, ½ day due to water and 1½ days for over excavation and backfill required to stabilize the headwall. CDOT said no additional work was required after the open cut work other than the water and stabilization that MVC mentioned.

**Questions by the DRB on the Schedule due to the Differing Site Conditions:**

**1. To MVC:** After the completion of the open cut for the 78” pipe, were all activities and durations the same?

MVC said the activities and durations used in the schedule MVC presented at the hearing were the same as the original schedule.

**2. To Both:** Were any additional work or quantities required to complete the Project other than the added stabilization work at the headwall?

 Both parties said “no”.

**3. To MVC:** Was all the work required to complete the Project shown in the schedule with Pay Application 4 with a completion date of August 25, 2014?

MVC said some items were missing that were on earlier schedules.

**4. To MVC:** Was the guardrail subcontractor advised in advance of the revised schedule requirements?

MVC said “yes”.

**5. To Both:** If the delaysdue to the differing site condition were added to the original baseline schedule, would the schedule have the same completion date as the schedule presented by MVC at the hearing?

This question led to discussions on an as-built schedule which was never done. MVC agreed to submit an as-built schedule to CDOT by December 17, 2014 which CDOT would review with the intention of having the as-built schedule submitted to the DRB by December 19, 2014. MVC also said they would send the DRB and CDOT a copy of the schedule that MVC presented at the hearing.

 **NOTE:** Both schedules were received by the DRB by December 18, 2014.

**Summation by Contractor:**

MVC’s position is:

* Means and methods were dictated by CDOT
* The pipe was furnished by CDOT and CDOT refused to increase thickness
* CDOT awarded the job to MVC and accepted MVC’s submittal that the job could be built
* The changed condition stopped MVC from continuing
* The changed condition impacted the methods MVC planned to build the job
* MVC did incur added costs and was delayed by the differing site conditions
* MVC did complete a usable facility

Rick Davis said he had discussions with Dave Holcomb on Thursday or Friday after talking with CDOT. He met the next week with Dave, who is a salesman for TT, and Dave would not guarantee the larger hammer would work. The hammer would hit harder but it could cause pipe problems. TT said there would be no cost for the hammer rental if it did not work but there were substantial costs to get the new hammer up and down. Also, CDOT would not accept liability for the pipe. MVC was looking for a way to get the job done.

**Jeff Rumer:**

CDOT said MVC lacked the proper experience and equipment but still awarded MVC the job. CDOT also questioned the air supply but MVC’s calcs show it was adequate. CDOT was wrong in stating the wrong collet caused energy loss. MVC did a proper risk assessment and enough engineering to bid the job.

In reviewing the files, he could not find a Notice to Cure from CDOT on engineering and the air supply and connection when the problem occurred. CDOT came up with these items later on. CDOT said there was a difference in the sound between the 36” pipe and the 78” pipe. The sound is always different and is not necessarily an indication of problems. The first thing CDOT mentioned was to increase the hammer size and said nothing on fixing the other problems that CDOT brought up later. CDOT’s insistence on a larger hammer seems to conflict with the actual problems that were found.

CDOT questioned MVC’s experience on the site. Mike Walk of HammerHead is one of the best in ramming. MVC might not have Mike’s experience but MVC had Mike on the job when the work was going on. The 78” pipe is not a standard size and almost any contractor would need to adapt their equipment to work for the 78” pipe. The weld breaks in the pipe joints indicate energy was being transferred to the pipe. He did not see anything in his review that differed from industry standards and he did not see much that he would have changed.

CDOT talked about proper risk management and yet CDOT did a design by talking to another contractor. Few contractors have done a 78” pipe. MVC did assemble an experienced team after the bid and things worked until the pipe was stopped. The team questioned the ¾” pipe wall and talked to CDOT but accepted it after calcs were done. CDOT was responsible for the means and methods and supplying the pipe and made an implied a warranty for the planned work by doing so.

**Summation by CDOT:**

MVC’s experts were not on site and are “arm chair” quarterbacks. CDOT’s letters of April 22, 2014 and June 18, 2014 to MVC cover CDOT’s position on the differing site condition. Since the cutting shoe was changed by MVC, CDOT refused to accept the liability for the pipe if a larger hammer was used.

CDOT’s position is there was no differing site condition, Type 1 or Type 2, and the Project could have been built per the plans. Nothing was found to show that it could not have been done. CDOT hired Brierley to determine if the job could be built and they came up with the same determination as MVC – It could be built.

There was no washover consideration given in the design. MVC did not express any concern when the 78” pipe was relocated or the lack of the washover condition.

The new bores did not show any cobbles in the area ahead of where the pipe stopped and MVC did not point out boulders in the excavation for the open cut. The problem was that the hammer was undersized and Brierley’s calculations were different from those by MVC’s engineer. There was a lack of energy being delivered to the pipe. The connection to the pipe was flexing and Ed Archuleta could hear the difference from the 36” ramming. In the case of the compressor, “bigger is always better” and you should round up using a 1.25 factor.

MVC lacked experience. After cleaning the pipe, MVC made no attempt to restart ramming. They maybe lubed 6 feet. MVC failed to follow through with TT and the added cost to change hammers was minimal compared to the open cut costs. MVC did not request help from another engineer or contractor - they just shut down.

MVC was responsible to complete the Project - they are the experts. The total cost claim is due to poor planning, engineering and effort by MVC.

**NOTE:** Since CDOT had said that an audit would be required on MVC’s costs if merit on the dispute was recommended by the DRB, the DRB explained that it made no sense for the DRB to hear presentations on merit at this hearing. If merit is determined on the dispute and an audit is conducted by CDOT, the Quantum issue would then be heard by the DRB if the parties cannot agree on Quantum.

**Findings:**

1. Note 17 on Plan Sheet 4 and Note 7 on Plan Sheet 12 make reference to the 78” pipe “encapsulating” the existing 36” CMP. The note on the 78” Steel Pipe Profile on Plan Sheet 15 sates, *Remove 94.5’ of 36” CMP from inside hammer bore pipe.* The 36” CMP was not at the location of the new 78” pipe. The 78” pipe was located on the Plans to comply with the Corps of Engineers 404 permit. **This resulted in a changed condition since the 78” pipe could not encapsulate or “washover” the existing 36” CMP.** In answering the DRB’s question, CDOT’s expert, Brian Dorwart of Brierley, said less force on the 78” pipe would have been required if the 36” CMP was encapsulated because the CMP would have collapsed as the soil was forced into the 78” pipe.
2. The geotechnical information Dated March 16, 2012 that was provided by CDOT to MVC after award stated, *This memorandum presents the results of a subsurface exploration program performed to identify the subsurface materials that may be encountered during the installation of a new culvert at the subject location.* Also, nothing in Paragraph 3 of the memorandum mentions the presence of cobbles or boulders that were subsequently encountered during the ramming operations. Boring B2, which was near the location where the ramming started and was attached to the memorandum, did not show cobbles or boulders but did note “rocky at 16’ ” but classified the material as “Sand, Gravelly”. Project Special Provisions, Special Construction Requirements (Page 38) states, *Reasonable effort has been made to determine the nature of the material that will be encountered during the jacking operations. It is estimated that man-made fill consisting of gravelly sand with* ***small to medium sized cobble material*** (emphasis added) *may be present along the proposed pipe alignment.* ASTM D653-14 defines cobble as, *a rock fragment, usually rounded or semirounded, with average dimensions between 3 and 12 inches.* Accordingly*,* small to medium sized cobbles would be in the 3 to 8 inch range. The cobbles and boulders shown in the pictures in the Common Reference Documents are much larger than 8 inches with some in the 14 to 26 inch range. The material encountered in the ramming was not what was shown in the borings or described in the Project Special Provisions. (It should be noted that Spec 105.09 lists “Project Special Provisions” as having the highest order of precedence.) The borings that were done by Yeh after the ramming would not advance the pipe do not indicate materials of the type that were actually encountered. Some cobbles were noted but “N” values in these areas were only 11 and 30. The Brierley Report dated October 21, 2014, which revised their June 16, 2014 Report, on Page 3 discussed the borings and the tools used for the borings and stated, *These tools can penetrate gravel and some cobble and weathered rock but typically cannot penetrate rock or* ***large cobble or boulders*** (emphasis added). The Report goes on to question the depth of the borings since they were shallower than industry standards and also mentioned possible problems with ramming where there is a mixed face of clay and fine alluvium. **Based on the foregoing, the presence of large cobbles and boulders is a Differing Site Condition per Spec 104.02.**
3. Revision of Section 619 stated, *The Contractor shall submit calculations that its equipment and procedures will be able to install the supplied pipe without deformation, buckling or crushing at the project location.* *A set of calculations verifying the installation procedure shall be stamped by a Registered Colorado Professional Engineer and included in the contractor’s submittals.* The analyses and calculations were prepared and stamped by Todd Kilduff, a Registered Colorado Professional Engineer, and submitted to CDOT along with other installation procedures. CDOT Form 105-010, dated 4/21/2014, approved MVC’s submittal. The submittal confirmed that the pipe could be rammed under the conditions enumerated in the Contract documents. CDOT’s Position Paper stated, *MVC completed incorrect engineering analysis after the contract’s notice to proceed.* CDOT did not take exception to MVC’s analysis when it approved MVC’s submittal on April 21, 2014 on CDOT Form 105-010. There was nothing presented at the hearing that indicated that Kilduff’s engineering analysis was incorrect.
4. After MVC had removed the material from the inside of the pipe which contained large cobbles and boulders, MVC notified CDOT of changed conditions by letter on May 4, 2014 in accordance with Spec104.02(a). Instead of investigating the cause of the problem as required by Spec104.02, CDOT waited until June 13, 2014 for Yeh to take additional vertical borings beyond where the pipe had stopped and insisted that MVC could complete the project using a larger hammer. HammerHead tech Mike Walk, who was on the site, and engineer Todd Kilduff both recommended against the larger hammer due to the undersized pipe wall thickness and potential damage to the pipe. MVC’s and its experts’ positions that the ¾” pipe would work was based on the soil material shown in the Contract documents and not on the cemented cobbles and rocks that were found inside the pipe. When MVC requested the calculations to determine the pipe wall thickness, CDOT replied on May 12, 2014, *..the pipe was supplied with no calculations.* Kilduff’s letter of May 9, 2014 to MVC considered the ramming conditions with blows exceeding 100 blows per inch and the material that was found in the pipe and stated, *Refusal type N-values encountered at the face, as per the Standard Penetration Test, could increase the face resistance of the pipe previously calculated by a whole order of magnitude (x10) or more.* **Based on the pipe wall thickness and the weld failures at the pipe section splices that MVC had noted after the pipe was cleaned, the suitability of the pipe as furnished by CDOT was a problem. The weld failures at the pipe section joints also bring into question CDOT’s insistence on the use of a larger hammer when it appears that the weld failures indicated that the hammer was transmitting force to the pipe.** At the hearing when questioned by the DRB, CDOT said it based the pipe selection on discussions with another contractor. Considering the technical information available to any designer, examples of which were contained in MVC’s Pre-hearing submittal, and the information provided by the two main hammer manufacturers in the U.S. who both recommended 1” wall pipe for pipe lengths over 65 feet, CDOT’s standards of care related to proper design fall below what any contractor should reasonably expect from an owner and its plans and specifications. There are many cases concerning the adequacy of contract documents and the implied warranty of such by the owner. The Revised Brierley Report dated October 21, 2014 on Page 4 discusses the pipe wall thickness and the part wall thickness plays in the pipe stiffness and stated, *Thinner pipe can work but* ***will absorb more energy*** (emphasis added) *as the pipe stiffness is lower. … the stiffness increase from 0.75 inch wall to a 1.0 inch wall is approximately 35% increase in pipe stiffness which is significant in having the ability in the pipe to transfer energy from the hammer to the drive tip.*  The Report goes on to state on Page 6, *Some industry literature suggests that a ¾ inch pipe thickness may not provide the necessary pipe stiffness for a drive of this length, although case histories of projects with similar length and diameter have demonstrated successful installations are possible.* The Revised Brierley Report dated November 7, 2014 on Page 1 after noting that the advancement of the pipe was stopped, stated*, The drive cannot exceed the structural capacity of the pipe. Typically it is not economical or a structurally sound practice to install pipe with an advancement rate of less than 6 inches per minute for any length of time.* The foregoing calls into question the design of the pipe that CDOT supplied and the capabilities and experience of the designer.
5. When CDOT was questioned by the DRB on CDOT’s refusal to accept liability for the pipe if a larger hammer was used, CDOT said they did not want to accept the liability because MVC cut the end of the pipe which was a change to the pipe that CDOT supplied. The change in the end of the pipe was discussed and it appears that the changes made by MVC were to get the end of the pipe closer to industry standards and facilitate pushing the material into the 78” pipe. The square ends of the pipe and inner and outer rings that CDOT supplied provided more resistance to ramming than the bevel ends that MVC cut. This calls into question the design of the cutting end of the pipe that CDOT supplied and the capabilities and experience of the designer since the pipe did not meet normal industry standards.
6. After CDOT awarded the project to MVC which was an indication that CDOT accepted MVC’s experience, CDOT maintained MVC did not have the proper experience. This Project was only the second ramming project in Region 5 and CDOT did not know how much ramming had been used by CDOT in other Regions. From the presentations at the hearing, it is quite apparent that the MVC team, including both the engineer and the HammerHead tech that was on site, were well-experienced with many years of experience in pipe ramming of this size. A further impact of the improperly engineered plans was the late realization of inadequate ROW acquisition to accommodate the size of the wing walls on the 78” pipe outfall (CDOT Form105-020 dated July 29, 2014) that necessitated a redesign of the wing wall angles and rip rap placement. It appears that the lack of experience falls more to CDOT and their Contract document preparation than to the MVC team.
7. Although CDOT maintained that the pipe could have been rammed based on the material that was later removed in the open cut, there was nothing to indicate that similar stoppages would not be encountered if the ramming continued. CDOT did not direct Yeh to do penetration tests or investigations at the exposed pipe heading to supplement their additional borings. CDOT would also not accept liability for the pipe as discussed in Findings 4 and 5 and MVC had also discovered some pipe damage and broken pipe segment splice welds from earlier ramming. CDOT, in several pieces of correspondence, eventually authorized an open cut operation to install the 78” pipe which is a **significant change in the character of the work**. The open cut operation also created major revisions in MVC’s work sequence that followed the abandonment of the ramming operations.
8. In light of Findings 2, 4, 5 and 7, **the pipe could not have been successfully driven without damage, given the deficiencies in the design and the conditions that were encountered.**
9. MVC prepared a set of questions dated May 11, 2014 to be discussed at the May 13 meeting that included items concerning the stopped ramming and changing to an open cut. The parties met on May 13, 2014 to discuss how to proceed on the Project. CDOT letter dated May 13, 2014 approved the open cut and set conditions that had to be met by MVC, one of which was the road could only be closed for 12 hours from 6 p.m. to 6 a.m. and another that a temporary bridge had to be designed and installed. CDOT also agreed to extend the Contract Completion Date *provided the conditions listed above are met and that the work on the project site is continuous.* CDOT was unwilling to accept less expensive and more expeditious suggestions from MVC and imposed difficult time constraints on the open cut method without regard to the cost impact or the final schedule outcome. CDOT’s objection to close the highway to install the 78” pipe does not seem to be reasonable based on a DHV of 541 for SH 184, especially if the work would be done after school was out and a detour using US 160 and SH 145 to Delores was set up.
10. On June 5, 2014, MVC submitted a revised completion schedule with the open cut work starting on June 25, 2014 and completing on July 3, 2014. CDOT Form 105-015 dated 06/09/2014 changed the Contract Completion Date to July 25, 2014. CDOT was concerned with having the highway completed and opened by the July 4th holiday and requested the open cut start be delayed until after the holiday. MVC submitted a revised schedule showing the open cut excavation starting on July 9, 2014, asphalt paving completed on July 18, 2014 and the guardrail complete on August 22, 2014. From an analysis of the As-built Schedule agreed to by the parties, it appears the logic in the MVC schedule did not include adding the pipe end section and wingwall work that had to be done in order to complete the backfill and paving. As shown on the Pay Estimate 2 Schedule, the work to complete the outfall end of the pipe was scheduled to take 10 working days, which would be 12 calendar days, and, if scheduled correctly, would have had extended the date for the paving to be complete to July 30, 2014. CDOT said the paving was completed on July 25, 2014. Other than the added work due to the wingwall soil stabilization, there were no changes or additional work that was required. Due to scheduling problems caused by the Project delays, the guardrail subcontractor, who was originally scheduled to install the guardrail in June 2014, was one week late in getting to the Project due to other work it had to complete. The Pay Estimate 1 Schedule showed the “West Side 78” work starting 4/21/14 and “HWY 184 Guardrail” work completing on 6/6/14, a total of 47 days. The As-built Schedule showed the “West Side 78” work starting 8/8/14 and “HWY 184 Guardrail” work completing on 10/8/14, a total of 62 days. This is a difference in schedule between planned and actual of 15 days. Spec 108.08(b), Completion Date Contract, addresses the assessment of contract time and refers to Spec 108.08(a)2. Accordingly, the 6 weather days claimed as an extension by MVC should be reviewed by CDOT and MVC to determine what weather days should be allowed. The As-built Schedule shows 2 days of delay for the added work at the wingwall. Allowing 7 days of excusable delay due to the guardrail subcontractor’s non- availability results in a time extension of 9 days. No explanation was given by MVC for the 5 day delay in installing the delineators which resulted in the scheduled work being complete on October 13, 2014. The Yeh Project Diary dated 10/13/14 stated, *At this time all known items for the Chicken Creek Project have been completed including punchlist items pending final erosion site walk.* CDOT gave a completion date of October 17, 2014 but no explanation was given as to why the Project was not considered complete on October 13, 2014. Based on the foregoing, it appears that MVC has eleven days of nonexcusable delay, less any weather days as discussed above, calculated as follows:

 Scheduled vs. actual days through the guardrail completion 15 days

 Less added wingwall work and guardrail sub delay (2 + 7) ( 9 days)

 Delay in installing delineators 5 days

 Less allowable weather days, if any ( )

 **Total 11 days**

**Recommendations:**

1. Based on Findings 1 and 2, MVC encountered conditions at the site that differed materially from those indicated in the Contract and notified CDOT in writing of such. **CDOT’s denial of the differing site condition is without merit.** Since MVC was not able to ram the 78” pipe, the work performed by MVC in setting up the ramming operation, attempting to ram the pipe and then removing the ramming equipment were to no avail and MVC should be compensated for their efforts.
2. Based on Finding 7, the change to the open cut method and related conditions dictated by CDOT to perform the open cut is a Significant Change in the Character of the Work and resulted in MVC having to perform Extra Work. Since CDOT and MVC did not follow Spec 104.02(c), Spec 104.03 and Spec 109.04, the parties should use their records to create actual costs based on Force Account methodology.
3. Based on Finding 9, unless CDOT or MVC can show that the time analyses are incorrect, MVC was 11 days late in completing the Contract, less any allowable days for weather.

Respectfully submitted, this 19th day of January 2015.



 **DISPUTE REVIEW BOARD REPORT AND RECOMMENDATION**

 **R5 PRIORITY CULVERT SH 184 MM 25.1‏ CHICKEN CREEK MONTEZUMA COUNTY, CO CDOT PROJECT NO. BR 184A-003**

 **DISPUTE CONCERNING DIFFERING SITE CONDITIONS AT 78” PIPE**

 **Response to Requests for Clarification and Reconsideration**

References:

 (1) Mountain Valley Construction Request for Clarification to Dispute Resolution Board’s Report and Recommendation dated January 27, 2015

 (2) Colorado Department of Transportation Request for Clarification as well as Reconsideration dated January 28, 2015

 (3) Mountain Valley Construction Response to CDOT Request for Clarification as well as Reconsideration dated January 29, 2015

The DRB has reviewed the above references, the DRB notes on the statements and facts presented by both parties at the hearing, and the pre-hearing submittals and provides the following clarifications.

**Reference (1)**

1. On Page 14 of the DRB Report and Recommendation dated January 19, 2015, in the NOTE, ***the DRB*** means the DRB that heard the dispute on December 12, 2015 unless a DRB member needs to be replaced per Spec 105.23(b)8.
2. In Recommendation 3 of the DRB Report and Recommendation dated January 19, 2015, the following shall be added:

 Extra work includes associated work that is the result of the changed conditions and the change in the character of the work. Compensation for Compensable Delays shall be determined by Spec 109.10.

1. To Finding 10 of the DRB Report and Recommendation dated January 19, 2015, the following shall be added: The guardrail at the SH 184 site was completed on October 8, 2014 and the delineators at the SH 184 site were completed on October 10, 2014, which is a delay of two (2) days. This agrees with the CDOT handwritten daily notes for October 17, 2014 which state, *Punchlist complete, emailed MVC today is Project Acceptance date. Only charge LDs thru Oct. 10.*

The last paragraph of Finding 10 shall be changed to read:

 Based on the foregoing, it appears that MVC has eight days of nonexcusable delay, less any weather days as discussed above, calculated as follows:

 Scheduled vs. actual days through the guardrail completion 15 days

 Less added wingwall work and guardrail sub delay (2 + 7) ( 9 days)

 Delay in installing delineators 2 days

 Less allowable weather days, if any ( )

 **Total 8 days**

Recommendation 3 of the DRB Report and Recommendation dated January 19, 2015, shall be changed to read:

 Based on Finding 10, unless CDOT or MVC can show that the time analyses are incorrect, MVC was 8 days late in completing the Contract, less any allowable days for weather.

1. To Recommendation 3 of the DRB Report and Recommendation dated January 19, 2015, the following shall be added: Once the delay days have been determined in accordance with Recommendation 3, Liquidated Damages should only be withheld by CDOT to the extent calculated per the Contract.
2. In Recommendation 2 of the DRB Report and Recommendation dated January 19, 2015, *Force Account methodology* refers the creation of daily records of labor, material, equipment, subcontractors and other items that are the result of the changed conditions, extra work and delays which would then be priced per Spec 105.24(b)12. Spec 105.24(b)12(9) addresses the payment of interest.

**Reference (2)**

The DRB has determined the only clarifications that are required are the following:

1. CDOT Item 10: DRB Report and Recommendation dated January 19, 2015, **CDOT Presentation on Schedule Impact Due to Differing Site Conditions:** Page 11, Paragraph 3 should be changed from *CDOT said the road was closed for 3 days and not one overnight closure* **to** *CDOT said MVC requested a road closure of 3 days but CDOT only allowed an overnight closure .*
2. CDOT Item 10: DRB Report and Recommendation dated January 19, 2015, **CDOT Presentation on Schedule Impact Due to Differing Site Conditions:** Page 11, Paragraph 3 should be changed from CDOT *said the asphalt work was completed on August 22, 2014* **to** *CDOT said the other work on the culvert after the asphalt work was completed was not completed until August 22, 2014.*
3. CDOT Item 20: Finding 5, DRB Report and Recommendation dated January 19, 2015,

 It should be pointed out that the emails CDOT provided in CDOT Item 20 were not introduced at the hearing and were not included in CDOT’s pre-hearing submittal or in the Common Set of Documents.

4. In reference to CDOT’s Summary Item 2 concerning conditions for a Type 1 Differing Site Condition, Finding 2 - Paragraph 2 adequately addresses CDOT’s question.

5. Spec 105.23(h) states, *The Board shall not accept requests for reconsideration that amount to a renewal of a prior argument or additional argument based on facts available at the time of the hearing.* Other than as clarified above, the DRB’s position is that the remainder of CDOT’s requests fall under the stated provision.

**Reference (3)**

Receipt of Reference (3) is acknowledged.

**This Response shall be included and made a part of the DRB Report and Recommendation dated January 19, 2015.**

Respectfully submitted, this 5th day of February 2015.

