

Applied Research and Innovation Branch

EVALUATION AND PERFORMANCE OF HDPE PIPES UNDER CDOT HIGHWAYS, T-REX, AND OTHER LOCATIONS

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16. Abstract

HDPE pipes used in CDOT drainage systems are expected to have a 50-year design life. During the T-Rex project in 2003 a number of HDPE pipes were installed with shallow cover. Later, the majority of these pipes had to be removed and replaced after they were damaged by construction equipment driving over installed pipes, and excavations occurring near installed pipes. In this study, performance of HDPE pipes under CDOT highways was evaluated by: an extensive literature review; field studies utilizing manual inspection, CCTV video inspection, and laser-ring profiling technology; and, by observing a CDOT HDPE pipe installation project. Since CDOT has a limited number of such sites, a literature search was conducted to determine if cities and counties within Colorado or other state DOTs have evaluated the performance of HDPE pipes in climate zones, terrain, and construction-zone conditions similar to those found in Colorado.

In general, review of other DOTs' experiences revealed that most have encountered HDPE performance problems in the form of excess deformation (greater than 5%). That review also has shown that structural integrity of installed HDPE pipelines tested by the DOTs generally is below acceptable levels of serviceability. The review also determined that not adhering to strictly-enforced HDPE pipe-installation procedures was the cause of many of the performance problems.

Field inspections carried out for this research project were limited in scope. However, laser-ring profiling of 5 HDPE pipes in 2016 near Colorado Springs confirmed a trend for progression of pipe deformation through time under shallow-cover conditions. After 4 years of operation, 3 of the 5 pipes experienced 5% deflection. HDPE pipe segments observed by CCTV video monitoring along the T-Rex Project site had in excess of 10 feet of cover. These pipes did not show any visible deformations, but they could not be laserring profiled due to the amount of debris in the system. The study recommends that these pipes be cleaned and fully inspected.

In Colorado, due to the limited number of HDPE pipe installations which have been in operation for more than 15 years, further laser-ring profiling of pipes is needed to evaluate their long-term performance. In general, it is recommended that all previous monitoring points established on prior research projects be measured and evaluated for long-term hydraulic and structural performance. Studies by Kentucky, Ohio, Missouri, South Carolina transportation departments and others demonstrated the difficulty of achieving problem-free installations of HDPE pipes, and that the pipes do not always perform in accordance with idealized, theoretical results. Significant-to-severe deflection, corrugation "growth," crown and invert flattening, racking, sagging, and radial cracking have been observed in pipe sections in numerous test cases.

Experiences by other DOTs demonstrate that not adhering to strictly-enforced installation procedures was the cause of some performance issues. A typical installation of an HDPE pipeline observed as part of this study showed that standards for trench width, depth, and cover were not being followed. It is recommended that these standards be strictly enforced.

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EXECUTIVE SUMMARY

HDPE pipes used in CDOT drainage systems are expected to have a 50-year design life. Some HDPE pipes installed on CDOT projects have failed due to shallow cover, moving and static loads (from construction equipment), and disturbances in or near the pipe trenches. CDOT's experience with failed HDPE pipes has led to uncertainty regarding the cost effectiveness of using this material. During the T-Rex project in 2003, a number of HDPE pipes were installed with shallow cover. Later, the majority of these pipes had to be removed and replaced after they were damaged by construction equipment driving over installed pipes, and excavations occurring near installed pipes.

In this study, the performance of HDPE pipes under CDOT highways was investigated by: an extensive literature review; field studies utilizing manual inspection, CCTV video inspection, and laser-ring profiling technology; and, by observing a CDOT HDPE pipe-installation project. Since CDOT has a limited number of such sites, a literature search was conducted to determine if cities and counties within Colorado or other state DOTs have evaluated the performance of HDPE pipes in climate zones, terrain, and construction-zone conditions similar to those found in Colorado.

In Chapter 1 of this report, the objectives of the study and methodologies to achieve those objectives are presented. Chapter 2 presents results of an extensive literature review covering various aspects of HDPE problems. Methodology, including the equipment and procedures used in conducting field inspections, is described in Chapter 3. Field-data collection and measurement results are presented in Chapter 4, and results of data analysis are discussed in Chapter 5.

In general, review of other DOTs' experiences revealed that most have encountered HDPE performance problems in the form of excess deformation (greater than 5%). That review also has shown that structural integrity of the installed HDPE pipelines tested by various DOTs generally is below acceptable levels of serviceability. The review also determined that not adhering to strictly-enforced HDPE pipe installation procedures was the cause of many performance problems.

Field inspections carried out for this research project were limited in scope. However, laser-ring profiling of 5 HDPE pipes in 2016 near Colorado Springs confirmed a trend for progression of pipe deformation through time under shallow-cover conditions. After 4 years of operation, 3 of the 5 pipes experienced 5% deflection. HDPE pipe segments observed by CCTV video monitoring along the T-Rex Project site had in excess of 10 feet of cover. These pipes did not show any visible deformations, but they could not be laser-ring profiled due to the amount of debris in the system. The study recommends that these pipes be cleaned and fully inspected.

In Colorado, due to the limited number of HDPE pipe installations which have been in operation for more than 15 years, further laser-ring profiling of pipes is needed to evaluate their long-term performance. In general, it is recommended that all previous monitoring points established on prior research projects be measured and evaluated for long-term hydraulic and structural performance. Studies by Kentucky, Ohio, Missouri, South Carolina transportation departments and others demonstrated the difficulty in achieving problem-free installations of HDPE pipes, and that the pipes do not always perform in accordance with idealized, theoretical results. Significant-to-severe deflections, corrugation "growth," crown and invert flattening, racking, sagging, and radial cracking have been observed in pipe sections in numerous test cases.

Experiences by other DOTs demonstrate that not adhering to strictly-enforced installation procedures was the cause of some performance issues. A typical installation of an HDPE pipeline observed as part of this study showed that standards for trench width, depth, and cover were not being followed. It is recommended that these standards be strictly enforced.

IMPLEMENTATION RECOMMENDATIONS

Review of the experiences of other states' DOTs, conducted as part of this study, found that most DOTs have encountered HDPE performance issues in the form of excess deformation (greater than 5%). It is apparent that structural integrity of the installed HDPE pipelines which were tested by Texas DOT and other DOTs is generally below acceptable levels of serviceability.

The field inspections carried out for this research project were limited in scope. However, laser-ring profiling of 5 HDPE pipes inspected in 2016 near Colorado Springs confirmed a trend for progression of pipe deformation through time under shallow-cover conditions. After 4 years of operation, 3 of the 5 pipes experienced 5% deflection. HDPE pipe segments observed by CCTV video monitoring along the T-Rex Project site had in excess of 10 feet of cover. These pipes did not show any visible deformation, but they could not be laser-ring profiled due to the amount of debris in the system. It is recommended that the pipes be cleaned and fully inspected.

In order to assess the long-term performance of CDOT HDPE pipe installations, and to minimize excess deformation issues, application and acceptance of laser-ring technology used by Florida, Ohio, Kentucky, California and other state DOTs is recommended. This technology allows accurate measurement of deformation which in the long term results in severe deflection, corrugation "growth," crown and invert flattening, racking, sagging, and radial cracks.

For existing HDPE installations, laser-ring profiling accomplished through periodic inspections is recommended for a more accurate assessment and record keeping of pipe performance.

Experiences by other DOTs revealed that not adhering to strictly-enforced installation procedures was the cause of some performance issues. A typical installation of an HDPE pipeline observed as part of this study showed that trench width, depth, and cover standards were not being followed. It is recommended that these standards be strictly enforced.

EVALUATION AND PERFORMANCE OF HDPE PIPES UNDER CDOT HIGHWAYS, T-REX, AND OTHER LOCATIONS

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$1. \ \mathsf{INTRODUCTION}$

1.1 BACKGROUND

Some high-density polyethylene (HDPE) pipes used on CDOT projects have failed due to shallow cover, moving and static loads (construction equipment), and disturbances in or near the pipe trenches. It is assumed that HDPE pipes used in CDOT drainage systems will have a 50-year service life. In addition to existing corrosion and abrasion guidelines, CDOT must develop new guidelines to determine how and where HDPE pipes may be safely installed. The performance of buried HDPE pipes is influenced by earth loads, vehicle (live) loads, backfill materials, trench dimensions, backfilling compaction, and in-situ soils. For corrugated HDPE pipes, the failure mechanisms are ductile failure due to high stresses, brittle cracking due to intermediate stress levels, and corrosion cracking caused by low stress levels.

In order to evaluate the performance of HDPE pipe with regard to site conditions, a research study was conducted to investigate sites where HDPE pipe has been used in Colorado. Since CDOT has a limited number of such sites, the team conducted a literature search to determine if other cities and counties within Colorado, and other state DOTs have evaluated the performance of HDPE pipes in climate zones, and terrain and construction-zone conditions similar to those found in Colorado.



Figures 1 and 2. Typical HDPE installation project in Colorado

1.2 PROBLEM STATEMENT

In accordance with SAFETEA-LU, the CDOT Pipe-Selection Policy requires consideration of HDPE pipes for cross drains, side drains, and subsurface drains. Currently, any pipe that meets the corrosion and abrasion criteria in this policy, and is installed per the plans and specifications, is assumed to have a 50-year service life. However, there is uncertainty regarding the cost effectiveness of using HDPE pipes based on CDOT's experience with failed HDPE pipes. During the T-Rex project in 2003, a number of HDPE pipes were installed with shallow cover. Later the pipes had to be removed and replaced after they were damaged by construction equipment running over installed pipes, and excavations occurring near installed pipes.



Figure 3. CDOT's T-Rex project in Denver, Colorado

HDPE pipes have been used successfully in some states, but in Colorado designers must consider extremes of climate and terrain in addition to construction practices. There is insufficient information regarding local performance of HDPE pipes. In particular, there is a lack of information that correlates construction practices, depth of cover, and trench configuration with cracking of HDPE pipes.

1.3 OBJECTIVES

The objectives of this research study were:

- Determine performance of HDPE pipes for use under roadways and other facilities
- Inspection of existing HDPE pipes currently utilized by CDOT
- Accurate data collection and verification using various methods:
 - Information from routine past maintenance inspections
 - Physical investigation of potential damage or failure (larger pipes)
 - Physical measurements of pipe diameter (H:V:D) and potential joint separation
 - CCTV video investigation of all joints and pipe-wall lengths
 - Laser-ring and video investigation and analysis



Figure 4. Manual inspection of HDPE pipes

1.4 RESEARCH TASKS

The tasks delineated by CDOT for this research project included:

- Task 1 perform a literature review to determine if there has been similar research that will aid CDOT;
- Task 2 conduct a national survey of state DOTs to determine if other states have had similar problems;
- Task 3 prepare the field-work plan;
- Task 4 inform personnel from traffic, maintenance, residencies, and HQ about field activities and visits at least three weeks in advance;
- Task 5 field inspection of all HDPE pipes by laser-ring method (the preferred method of inspection), and/or other applicable methodologies commonly used by CDOT and other state transportation agencies;
- Task 6 analyze data collected in above tasks; and
- Task 7 submit draft and final reports addressing findings of the study.

1.5 STUDY BENEFITS

Benefits of this study include:

- Improved design methodologies
- Updated materials specifications
- Improved construction techniques
- Improved maintenance and inspection practices
- Updated information to incorporate into CDOT's Drainage Design Manual
- Potential cost savings
- Prevention of failures of HDPE pipes



Figure 5. HDPE pipes with metal outlets across Interstate 25

2. CURRENT METHODOLOGIES REVIEW AND LITERATURE SURVEY

This report contains a bibliography from a comprehensive literature survey, including library searches and surveys of CDOT and other state DOTs, in the List of References. This survey has shown that, in general, literature on HDPE pipes can be classified under several broad categories:

- Modeling of HDPE pipes to determine structural strength and deformation under different soil and burial conditions. This information was derived from:
 - Laboratory and field experiments to determine structural properties of HDPE materials under different soil and loading conditions
 - Numerical modeling of stress fields around HDPE pipes under different soil properties
- Performance of HDPE pipes under fire conditions
- Pipe material-selection studies
- Performance of HDPE pipes in highway applications

Information from the literature review is presented in the following sections.

2.1 MODELING OF HDPE PIPES FOR STRUCTURAL PROPERTIES

Performance of HDPE pipes under deep-burial conditions has been the subject of numerous studies, both numerically and experimentally. Among the large-scale experimental studies, the Sargand et al. (2000) study was conducted to determine the performance of larger HDPE pipes under deep-soil cover using 42-in pipes. The burial depths used in the experiments were 20 ft and 40 ft. In the experiments, HDPE pipes with three different wall profiles were studied. These profiles were smooth-wall (PVC), corrugated (PVC and HDPE), and honey-comb (HDPE). After approximately 2 years of field-data collection, it was noted that all pipes were functioning satisfactorily. No pipe had more deformation than 2.5% vertically, and 1% horizontally.

In a different study, Sargand et al. (2009) examined the performance of HDPE pipes under deep-burial conditions after 20 years of operation. In the study entitled "Pennsylvania Thermoplastic Pipe Deep-Burial Project: 20th-Year Investigations," 24-in diameter corrugated HDPE pipe under 100-ft burial were examined. The pipe under study was located on I 279 near Pittsburgh, on the 20-year anniversary of the research project. Visual inspections along with an in-situ pipe-drilling experiment found that the pipe-drilling-induced strains in the pipe wall completely dissipated within 5 seconds. During a 2002 inspection, cracking was observed on one of the joints. However, these cracks did not seem to have increased substantially during the 2007 inspection (buried under 70 ft). Measurements showed that the horizontal deflection changed only by 0.3% over a period of 17 years, and the vertical deflection changed only by 0.2% over a period of 18 years.

Tafreshi and Khalaj (2007) studied structural properties of HDPE pipes in a controlled, laboratory environment. In the study entitled "Laboratory Test of Small-Diameter HDPE Pipes Buried in Reinforced Sand Under Repeated Load," Tafreshi and Khalaj applied loads to simulate the axle load of a 18,000 kg truck over two pairs of twin wheels. This load translates to 8.5 kg/cm². Without 5 cm of rigid asphalt, the maximum applied load was reduced to 5.5 kg/cm². Their conclusions were:

- For all tests, the larger portion of deformation of the pipe and settlement of soil surface happened at the end of the first pulse, compared with its total deformation due to a number of load cycles. The ratio of deformation of the pipe from the first to the last cycle changed from 0.5 to 0.9 in different tests.
- The rate of pipe deformation decreases significantly as the number of loading cycles increases. Consequently, a steady-response condition is achieved as the number of further cycles of loading reaches approximatley 140 cycles.
- The optimum length of geogrid is approximately 4-5 times the pipe diameter. The optimum embedded depth of the first reinforced layer is approximately 0.35 times the loading-surface width.
- Both the percent vertical-diameter change and settlement of soil surface of the pipe decrease with increased relative density of soil.
- The geogrid-reinforced sand decreased the pipe deformation and settlement of the soil surface significantly. Also, the performance of geogrid-reinforced loose soil is greater than unreinforced medium or dense soil.
- The vertical-diameter change of a pipe decreases, and settlement of the soil surface increases as the embedment depth of the pipe increases.
- The maximum deformation of the buried pipe is reduced approximately 54% by using 3 layers of reinforcement and an embedment depth of 3 times the external pipe diameter. This is based on a pipe-strain reduction factor, *PDRF*, of 0.46 for loose sand. The deformation is reduced by approximately 40% for dense sand using a PRDF of 0.6.
- The maximum settlement reduction due to five layers of reinforcement and the embedment depth of 3D reached approximately 58% for loose sand, and 51% for dense sand.
- In all tests performed on embedded pipes in weakly-compacted sand (relative loose state), and for embedment depth of the pipe below 2.5 times the external pipe diameter, the value of vertical diameter change was greater than 5%, regardless of the number of reinforced layers. Based on the accepted limit of 5% for vertical-diameter change, in this case the failure of the pipe occurred due to large deformation of the pipe, together with excessive settlement of the ground surface. For this relative density, the safety of the pipe is provided by embedment depth, and using the number of reinforced layers equal to 3 times the external pipe diameter. Leaving the surrounding soil uncompacted may result in serious damages to pipes during repeated loads.
- The pipe in medium-dense and dense sand with sufficient embedment depth of the pipe and a number of reinforced layers remained mostly undamaged at the time of the failure, which happened due to excessive settlement of the soil surface.

In a separate study, Kang et al. (2009) investigated short-term and long-term behavior of buried, corrugated, high-density polyethylene (HDPE) pipes using the finite-element method and soil models. Equations for deflections, wall stresses, arching factors, etc., were derived using soil-structure models and externally introduced into the numerical finite-element-method model. The main objective of the study was to investigate the considerable differences in the mechanics of short-term and long-term performance of buried HDPE pipes. The study found that while earth loads were significantly affected by time-dependent material properties and interface conditions, the deflections were not significantly affected by these factors.

2.2 HDPE FIRE HAZARD

It is documented in numerous field observations that HDPE pipes are subject to a fire hazard during ditchburning operations. In a study by the Florida DOT, Kessler and Powers (1994) investigated HDPE fire risks. In their "High Density Polyethylene Pipe-Fire Risk Evaluation" study, Kessler and Powers examined recent concerns related to flammability of HDPE pipes. Under FDOT standards, it was shown that there was no significant risk from fire to HDPE pipes, and that the heat gain in pipes was not sufficient to cause softening or weakening of the pipe. The expected burn rate was found to be very low (1.7 ft/hr). The pipe manufacturer's claim that there is insufficient oxygen within a pipe to support a fire was not confirmed.

2.3 PIPE MATERIAL-SELECTION STUDIES

Numerous studies in the extended literature are devoted to pipe-material-selection guidelines developed by various DOTs. As part of these studies, HDPE pipe was investigated for appropriate applications. An extensive review of these studies is summarized in Molinas and Mommandi (2009); NCHRP Synthesis Report 254, "Service Life of Drainage Pipe," 1998; and, NCHRP Synthesis 474, "Service Life of Culverts," 2015.

2.4 EVALUATION OF HDPE PIPE PERFORMANCE

The Blackwell and Yin (2002) study for the Missouri Department of Transportation investigated the installation and initial performance of two 60-in ADS HDPE pipes. This deflection/performance study examined how two large HDPE pipes with the same diameter performed when placed under crossroads with different installation procedures. Pipe 1 had only 4 in of bedding and a lower compaction than Pipe 2. Neither pipe installation met Missouri DOT standards. However, Pipe 2 was considered to have a better installation than Pipe 1, and was found to have far less deflection. The study determined that deflection over time increased for both pipes. Pipe 1 started at a maximum of 4.6% deflection, and after 26 months the deflection increased to 8.2%. There was less installation data for Pipe 2, but it ultimately experienced 5% (maximum allowable) deflection. The study showed how installation procedures influence immediate and long-term performance and deflection of pipes.

The Gassman et al. (2000) study entitled "Performance Evaluation of HDPE Culvert Pipes" inspected 45 HDPE pipes in South Carolina. Methods included both a mandrel set to 5% deflection, and visual inspections using a video camera. From these tests it was found that 36% of pipes inspected had circumferential cracks, localized bulges, tears or punctures, or deflections greater than 5% with the following details:

- 18% of the pipes had circumferential cracks
- 20% had localized bulges
- 7% had tears or punctures
- 20% had deflections greater than 5%

Of these results, Gassman et al. attributed most of the issues to poor construction techniques or incorrect backfill materials.

- 40% of the pipes backfilled with Class 4 soils did not pass the mandrel test
- Only 12% with Class 2 did not pass the mandrel test
- Class 3 backfill had no failed tests

• All pipe end damage was attributed to installation practices, mowers, and vehicle loads

Evaluation of HDPE Pipe Performance on Kentucky DOT and Ohio DOT Construction Projects was studied independently by Pipeline and Drainage Consultants (2005), utilizing visual observation through video inspections and laser-ring technology. For the Kentucky DOT projects, 7 installations were evaluated. The key findings of the study were:

- The average-maximum recorded corrugation in originally smooth-walled pipes was 0.5 in. As a result, it is suggested that the Manning's *n* may be more than two times higher (0.024) than the manufacturer's suggested value of 0.010.
- The authors were uncertain about how cracking affected the pipe structurally. However, it was observed that it caused problems when the inner liner pushed up and caught debris. Radial cracking was observed in approximately 20% of pipe sections.
- Sagging and ponding were observed in 26% of pipe sections.
- The majority of the pipes would fail a 5%-deflection test, and most pipes also would fail a 10%-deflection test.

Recommendations for the Kentucky DOT were:

- Further monitoring should be conducted.
- Post-installation deflection and video inspection should be required.
- Deflection should be limited to a maximum of 5%, with the anticipation of some post-construction creep.

Thirteen installations were evaluated for the Ohio DOT projects. The key findings of the study were:

- The maximum-recorded corrugation depth was 0.56 inch, with a typical average depth of approximately 0.39 inch. These pipes had a manufacturer's-suggested Manning's *n* value of 0.012. A typical corrugated metal pipe with 0.5 inch corrugations has Manning's *n* of 0.022.
- Of the cross drains that were inspected, cracking had increased by a factor of 4-7 since 2001.
- Several types of cracks were observed, including: radial cracks in the inner wall of the liner; cracking of dimpled areas; cracking in flattened inverts; longitudinal cracking in the crown in heavily-deflected areas; diagonal cracking in buckled wall sections; and, cracking in inverts resulting from bulges caused by improper bedding.
- The majority of the pipes would fail a 5%-deflection test, and most pipes also would fail a 10%-deflection test.

Recommendations from the Ohio DOT were:

- Further monitoring of HDPE pipe installations should be conducted.
- Post-installation video inspection and deflection testing should be required for quality control and quality assurance.
- Deflection should be limited to 5%, with the anticipation of some post-construction creep.
- All monitoring points established on a previous research project should be measured and evaluated for long-term performance.

- Specifications should ensure that correct bedding and backfill requirements, proper densities, and proper compaction efforts are achieved as outlined in ASTM D 2321 and AASHTO Section 30.
- A uniform pipe assessment/inspection program should be adopted for quality control and for long-term performance monitoring.
- A quality control / quality assurance inspection program should be established for all drainage materials and structures.
- Video inspection and laser profiling should be evaluated for adoption into the ODOT specification for quality control and quality assurance.

More recently, Abolmaali et al. (2010), University of Texas at Arlington, conducted a comprehensive study entitled "Evaluation of HDPE Pipelines' Structural Performance." As part of this study, 61 sites in 10 states were analyzed, utilizing visual observation through video inspections and laser-ring technology. In their study, Abolmaali et al. identified six structural-failure modes. They are:

- Cracking/fracture failure (fracture, rip, and rupture), where cracks may be in either longitudinal, diagonal, or radial directions
- Excessive-deformation failure the common limit of 5% was adopted for indicating excessive deformation
- Inverse-curvature failure due to buckling phenomena, which creates inverse curvature from excessive loads on the pipe
- Joint-displacement failure, where excessive joint displacement results in a gap between two adjacent pipe segments
- Corrugation-growth failure, where plastic deformation of pipes' interior liners due to the transfer of stress from the outer to the inner wall causes waviness of the interior pipe surface
- Buckling failure, which results in deformation due to large circumferential stresses, and causes radial wavy surfaces of the pipe

The recommendations from the University of Texas at Arlington study were:

- Due to the different and multiple modes of failure experienced by the pipes identified in the study, it is evident that the knowledge of the long-term performance properties of HDPE pipes subjected to diverse service load is limited. Further studies are needed to identify HDPE's long-term properties in order to avoid the unexpected failures observed in that study.
- Since 100% of the pipes experienced corrugation growth, a comprehensive study should be conducted to establish post-installation Manning's *n* values.
- Since 69% of the pipes tested experienced an excessive-deformation mode of failure (as high as 34% deformation), the long-term stiffness properties of HDPE pipes should be investigated.
- The progressive-failure characteristics of HDPE pipes should be investigated in order to identify the causes of multiple failure modes in most of the pipes investigated.

3. METHODOLOGY

In this section, the methodology followed in HDPE pipe inspections is presented and discussed. First, field-inspection methodologies are presented. Next, the advantages of laser-ring technology are discussed.

3.1 FIELD-INSPECTION METHODOLOGIES

The four commonly-used methods of HDPE pipe inspections are:

Mandrel Inspection (used commonly for new pipe installations)

Mandrels (Figures 6 and 7), which are sized physically to stop at any deflection or ovality exceeding design tolerance in a pipe, are pulled through pipes.



Figure 6. Typical mandrel



Figure 7. Mandrel being pulled through a culvert pipe

Manual Inspection (when possible)

Visual inspections are used to determine locations and extents of potential problems. Physical measurements are made at specific pipe locations to record:

- Deflections
- Joint separation
- Extent of deterioration or puncture of pipe walls



Figure 8. Personnel conducting visual inspection and recording physical attributes



Figure 9. Observed pipe failure detected through visual inspection

Video Inspection (CCTV or other)

Inspections using closed-circuit television (CCTV) or other video-recording methods are frequently performed. For video inspections in this study a CUES K2 portable CCTV system, coupled with a P&T zoom camera, steerable Pipe Ranger camera transporter, a wheeled dolly with a 500-ft Gold M/C TV cable, wired and wireless controllers, and DVR-SD digital recording were used. CCTV inspection has the following advantages:

- Provides a thorough inspection of pipe walls, joints, and potential deterioration of pipe material
- Provides a historical record of the condition of the pipe to determine performance over time
- Can be used on the majority of sizes and materials of pipes
- Inspecting with video is particularly effecitve when coupled with manual inspection and measurements



Figure 10. CCTV inspection of an HDPE pipe under CDOT T-Rex project



Figure 21. CCTV inspection of an HDPE pipe under CDOT T-Rex project

Laser-Ring Inspection in Conjunction with CCTV Operation

The laser-ring profiler is a tool for use with a CCTV survey system and camera to collect survey data containing measurements of faults and other features inside a pipeline. The data obtained includes measurements of pipe size, laterals, and water levels, as well as automatic analysis of pipe ovality and capacity up to 30 times a second. With this technology a ring of laser light is projected onto the internal pipe surface. The laser image is in the field of view of a camera as the camera moves through the pipe and a video recording is made. Analysis is performed on the ring of light using Laser Profiler software to build a digital pipe profile. The technology is for use live or with pre-recorded video (tape, CD, or DVD). For the present study, a CUES laser profiling and measurement system with a six-head laser, skid assemblies, laser profiler, and measurement software was used.



Figure 32. Laser-ring profiler with a skid system

3.2 BENEFITS OF LASER-RING INSPECTION

Benefits of laser-ring inspections include:

- Provides the ability to measure:
 - Pipe length
 - Pipe diameter (360°)
 - Deviations in pipe diameter (deflections) along the pipe length
 - Locations of pipe joints
- Provides the ability to inspect all sizes of common highway pipes
- Relatively-quick inspection times, improving the efficiency of inspections
- Minimal field calibrations are required for analysis
- Provides a detailed analysis with data and reports on the condition of the pipe

- Equipment can be operated with relatively minimal training
- Analysis only requires knowledge of common issues with pipes and how they correlate with the resulting data
- Provides the ability to monitor pipe performance and deterioration over time to help prevent pipe failure



Figure 43. Typical laser ring projected onto the internal surface of failed pipe



Figure 14. Setting up for laser-ring equipment inside an HDPE pipe under I-25



Figure 55. Close-up of a separated joint using CCTV recording

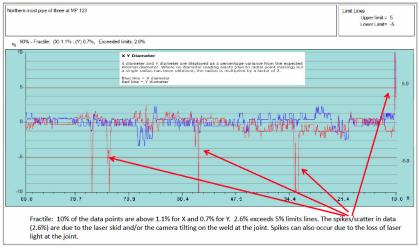


Figure 66. Reported output from Laser Profiler software



Figure 17. Reported output from Laser Profiler

3.3 LASER-RING INSPECTION CONCEPT

Camera Unit

- The camera unit consists of a robotic trolley with a mounted, rotatable CCTV camera.
- The trolley is connected to the video display system via a strong cable, with the CCTV cabling running parallel to it.
- The video-display system is attached to a winch system that sends cable release and retract lengths for the purpose of determining the location of the camera with respect to the pipe length.
- The camera trolley can be operated at variable speeds.



Figure 18. Robotic trolley with mounted, rotatable CCTV camera



Figure 19. Remote video display and recording system

Laser-Ring Unit

- The laser-ring unit consists of a sled of variable sizes for different pipes, with an attached 360° ring laser and battery.
- The laser-ring sled is attached to the camera unit via rope or cabling, and is pulled behind the camera unit at a slow speed.
- The laser-ring calibration is conducted after the pipe inspection, and consists of setting the laser behind the camera unit at the same distance used during inspection.
- A measuring device (meter/yard stick) is then held horizontally on top of the laser while the camera is recording. This provides distance measurements that will correlate to pixel distance of the video.

Inspection Process

- Manual inspections, photographs, and measurements of diameter and damage should always be completed if possible.
- Initially, the camera unit is sent through the pipe being inspected to video all joints and pipe walls for visual inspection.
- The laser unit (sled) is then attached to the camera unit on the other end of the pipe.
- A 360° laser ring is emitted onto the internal surface of the pipe.
- The laser unit and camera should sit horizontally, parallel to the pipe to provide video of the "perfect circle" of the laser. The projected laser ring should stay perpendicular to the angle of the camera.
- Minor debris accumulation in the pipe (sediment, leaves, etc.) should have minimal impact on the accuracy of the analysis.
- Major debris may either prevent passage through the pipe, or may cause errors in the results. Major debris should be cleared from the pipe if possible.
- If the laser and camera are separate units, the laser unit sits behind the camera unit within view of the camera at a distance of roughly 2 to 3 times the pipe diameter.
- Once the laser has been set at the appropriate distance, the pipe ends should be covered to eliminate as much light as possible. This allows the camera to record the laser light as clearly as possible.
- The camera-unit trolley then records the laser as it is pulled back through the pipe.
- A slow speed works best for collecting accurate data.
- With a system where the laser and camera are separate units, data may not be able to be collected towards the end of the pipe due to the distance between the camera and the laser.
- Once the inspection is complete the calibration is conducted.



Figure 20. Calibration of laser-ring device



Figure 21. Calibration of laser-ring device



Figure 22. Recorded video imagery along with location and other pertinent information



Figure 7. Recorded video imagery with location information under CDOT's T-Rex project



Figure 24. Mobilizing the robotic trolley during the inspection process



Figure 25. Laser ring reflected on the pipe surface under Interstate 25 at Fountain Creek

4. FIELD-DATA COLLECTION

4.1 HDPE PIPE INSTALLATION AND TRENCH-DIMENSIONS DATA

As a part of the HDPE pipe-performance study, a field trip to CDOT Region 3, Grand Junction, Colorado, was conducted to observe one of the stages of a 3,000-ft HDPE pipe installation. Figures 26 through 32 show the observed stages of a typical CDOT HDPE pipe installation for trench width, depth, and material placement.



Figure 26. Preparation for the installation of a 3,000-ft HDPE pipeline



Figure 27.8 Preparation for the installation of a 3,000-ft HDPE pipeline



Figure 28. Trench dimensions for HDPE pipe installation



Figure 29. Trench dimensions for HDPE pipe installation



Figure 30. Trench dimensions for HDPE pipe installation



Figure 31. HDPE pipe installation

4.2 HDPE PIPE PERFORMANCE INSPECTIONS

Two sites were selected for pipe-performance inspections. The first site was on Interstate 25 near Colorado Springs, in CDOT Region 2 (Figure 32). This site offered a close proximity to eight 48-inch HDPE cross culverts, and had easy access for the CCTV equipment. The site was also desirable since in 2013 a laser-ring pipe inspection had been performed to document the initial pipeline properties. The pipes along the inspection site had minimal cover (approximately 12 inches). However, they had been fortified using a spiral steel belt.



Figure 32. Pipe inspection site near Colorado Springs, CDOT Region 2

The second HDPE performance test section was along the CDOT's T-Rex project site in Denver. To locate HDPE pipes along T-Rex was challenging since, due to complaints about their performance, they had been removed from a majority of the drainage lines along the project. Figures 33 and 34 provide the site information of the I-25 segment selected for the inspections. As shown in these figures, the HDPE pipe drainage lines are located in the shoulder region of the Interstate 25 highway and are buried 11 ft. As such, they do not carry heavy, cyclic highway traffic (the reason they were left in place).

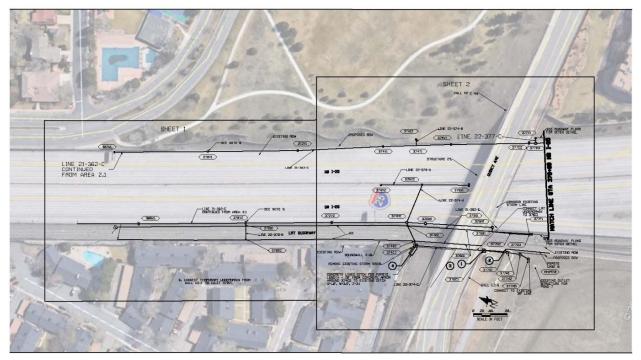


Figure 33. Location of HDPE pipe-inspection site on Interstate 25 along CDOT's T-Rex project site

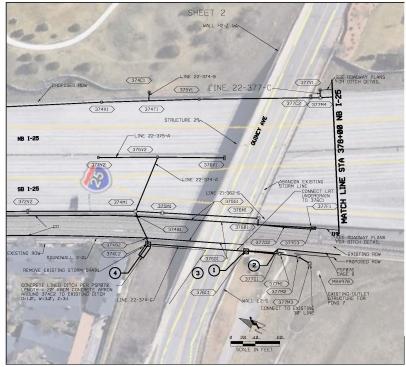


Figure 34. Location of pipe-inspection site along T-Rex project



Figure 35. Motorized robot carrying CCTV entering HDPE pipe near Colorado Springs, CDOT Region 2

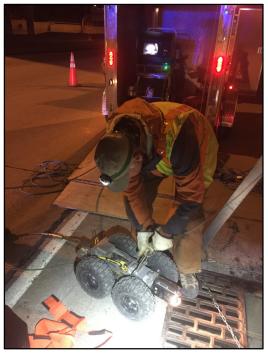


Figure 3610. Motorized robot carrying CCTV entering HDPE pipe along T-Rex Project site on I-25



Figure 37. CDOT Maintenance providing access to T-Rex HDPE site



Figure 38. CDOT Maintenance providing access to T-Rex HDPE site

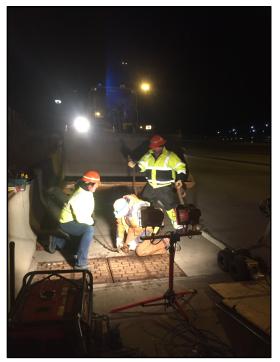


Figure 39. CDOT Maintenance crew providing access to T-Rex HDPE site



Figure 40. CDOT Maintenance crew providing access to T-Rex HDPE site

5. DATA ANALYSIS

5.1 FIELD-DATA COLLECTION RESULTS

5.1.1 T-Rex Area Pipes on I-25

A section of I-25 near the Quincy overpass was coned off on December 5, 2016 to conduct a performance inspection of the HDPE storm drains in the area. Several factors limited the amount of pipe that could be inspected, including difficulties in removing the bolts attaching the grates on the drop inlets, and removing the grates themselves. Also, heavy loads of sediment were in the inverts of the pipes. The inspection was limited to approximately 182 ft of estimated 36-inch HDPE. The pipe was inspected with a Cues robotic pipeline-inspection system. Figures 42 and 43 present photos from a CCTV inspection of HDPE pipes along CDOT's T-REX Project site and show the heavy loads of sediment. As stated above, this section of the drainage pipeline lies on the shoulder region of I-25 and therefore is not subject to heavy cyclic loading. The pipeline is buried 11 ft below the highway pavement and appeared to be sagging in areas. The overall shape of the structure appeared to be round, and the joints appeared to be performing as expected. A laser profile could not be conducted due to the amount of debris in the system. Some of the adjacent pipes coming into the two drop inlets were observed and appeared to be performing satisfactorily. It is recommend that the pipes be cleaned and fully inspected.



Figure 111. CCTV inspection of T-Rex HDPE pipes

Project Name: I-25 Denver					
Date: 12/5/2016 Pipe ID:					
Asset Location:	Start ID: Drop Inlet				
Length Surveyed: 183.2	End ID: Drop Inlet				
Run Number:	Direction: Downstream				
Pipe Size: 36	Pipe Type: HDPE				

Distance	Fault Observation	Picture
0.0	Start Inspection	2622 / 12/08 D6. 32 45
37.0	Heavy Debris in Invert	+37.2 FC.
56.8	View down barrel	456.8 FT.
90.0	Debris in invert	490.3 FT.
120.2	View down barrel	4120.3 FT. 2022/12/08 00.45.12

Figure 42. Photos from CCTV inspection of HDPE pipes along CDOT's T-REX project site

Distance	Fault Observation	Picture
154.9	View down barrel	+158.3 FT. 2822/12/08 09:45:34
169.5	Debris coming into drop inlet	+183.5 FT 2022/12/08 05:45:45
183.2	Drop Inlet	+163.2 FT. 2022112/08 05146-25
183.2	End Inspection	115.4 E2 2822/12/08 05.47.20

Figure 43. Photos from CCTV inspection of HDPE pipes along CDOT's T-REX project site

5.1.2 Fountain Colorado Pipes

Along I-25 near Colorado Springs in CDOT Region 2 a total of 5 pipes were video and laser profiled on September 30, 2013 and December 5, 2016. Also, a manual inspection was conducted on three additional pipes during the 2016 inspection. In 2013 a straight line, non-pan-and-tilt, portable camera unit was utilized for the inspection. In 2016 a robotic pan-and-tilt camera was utilized.

Table 1 presents the summary results of laser-ring profiling near Colorado Springs, CDOT Region 2 in a comparative analysis with 2013 measurements (Table 2). The 5 pipes inspected in 2016 had been previously inspected in 2013 after their installation, and provide insight into the development of deformation in HDPE pipes. As shown in the last column of Table 1, none of the pipes under study had exceeded the 5% deflection in 2013. After 4 years of operation, however, 3 of the 5 pipes had reached 5% deflection. It is recommended that these pipes be inspected in the future to ensure that their performance does not deteriorate.

Table 1. Summary results of laser-ring profiling near Colorado Springs, CDOT Region 2

Location: Fountain Colorado Route: I-25 Pipe Use: Culvert/Cross Drain



Deflection data was gathered at a frame rate of approximately 1 frame per every 0.1 ft. With 180 measurements taken per frame of video. Total readings per pipe section ranged from approximately 712,000 to 770,000.

Date Inspected: 9/30/13 (Red indicating potential changes in deflection since 2013).

Location	Date	Pipe Type	Pipe Size	Distance (ft)	Start ID	End ID	Deflection (2.5%)	Deflection (5%)	Observations
									Max deflection less than 2.5%, slight dent
							100% of		in left springline, wooden stake driven
							readings		through crown near inlet end. No significant
MP 123, Northern Pipe	9/30/2013	DuroMaxx	36-inch	88	Outlet	Inlet	below 2.5%		change in deflection since 2013.
									Max deflection approximately 4% at 23 ft,
							0.00% - 6	1000/ - 6	small dent at left springline at 73 ftl,
							92% of	100% of	wooden stakes driven through crown of
MP 123, Center Pipe	9/30/2013	DuroMaxx	36-inch	88	Outlet	Inlet	readings below 2.5%	readings below 5%, .	pipe near inlet end. Deflection at 5% in 2016
wir 125, Center ripe	3/30/2013	Durowaxx	JU-IIICII	00	Outlet	met	Delow 2.370	Delow 376, .	Max deflection approximately 2.5% at 24 ft.
							100% of		wooden stake driven through crown of pipe
							readings		near inlet. Deflections still below 5%. No
MP 123, Southern Pipe	9/30/2013	DuroMaxx	36-inch	88	Outlet	Inlet	below 2.5%		significant change in deflection since 2013
									Max deflection approximately 2.8% at 88 ft.
							86.8% of	100% of	Deflection at 4.8% in 2016
							reading	readings	
MP 122.5	9/30/2013	DuroMaxx	48-inch	102	Outlet	Inlet	below 2.5%	below 5%, .	
							77.2% of	<1.9% of	Max deflection approximately 5.30% near
							readings below 2.5%	readings above 5%	inlet end (approx. 90 to 88 ft). Deflection at
							below 2.5%	above 5%	5.8% in 2016, crown flattening and possible inverse curvature has occurred. Pipe
									moderately racked in right crown.
									Remainder of pipe 4% or less. Small
1									puncture due to stake near outlet, pipe
									slightly racked at 8 ft. Slight hump at right
									haunch at 46 ft. Slight dent in invert at 56 ft
MP 122	9/30/2013	DuroMaxx	48-inch	103	Outlet	Inlet			

Location: Fountain Co	olorado								
Route: I-25									
Pipe Use: Culvert/Cro	ss Drain								
Date Inspected: 9/30	/13								
· · · · · · · · · · · · · · · · · · ·									
Location	Date	Pipe Type	Dino Sizo	Distance (ft)	Start ID	End ID	Deflection (2.5%)	Deflection (5%)	Observations
Location	Date	TipeType	T Ipe 3ize	(III)	Start ID	LINUID	100% of	(570)	Max deflection less than 2.5%, slight dent
MP 123, Northern Pipe	9/30/2013	DuroMaxx	36-inch	88	Outlet	Inlet	readings below 2.5%		in left springline, wooden stake driven through crown near inlet end.
						8	92% of	100% of	Max deflection approximately 4% at 23 ft, small dent at left springline at 73 ftl,
MP 123, Center Pipe	9/30/2013	DuroMaxx	36-inch	88	Outlet	Inlet	readings below 2.5%	readings below 5%, .	wooden stakes driven through crown of pipe near inlet end.
MP 124, Southern Pipe	9/30/2013	DuroMaxx	36-inch	88	Outlet	Inlet	100% of readings below 2.5%		Max deflection approximately 2.5% at 24 ft, wooden stake driven through crown of pipe near inlet.
MP 122.5	9/30/2013	DuroMaxx	48-inch	102	Outlet	Inlet	86.8% of reading below 2.5%	100% of readings below 5%, .	Max deflection approximately 2.8% at 88 ft
	0.0012010	Saromaxx	-ro-mult	102	Ounot	met	77.2% of readings below 2.5%	<1.9% of readings above 5%	Max deflection approximately 5.30% near inlet end (approx. 90 to 88 ft). Pipe moderately racked in right crown. Remainder of pipe 4% or less. Small puncture due to stake near outlet, pipe slightly racked at 8 ft. Slight hump at right
MP 122	9/30/2013	DuroMaxx	48-inch	103	Outlet	Inlet			haunch at 46 ft. Slight dent in invert at 56 ft.

Table 2. Summary results of laser-ring profiling near Colorado Springs, CDOT Region 2 (2013)



Figure 4412. Manual inspection of I-25 HDPE cross-culverts near Colorado Springs

Table 3. Summary of manual-inspection results near Colorado Springs, CDOT Region 2 (2013)	Table 3.	Summary	/ of manual-inspectio	n results near C	olorado Springs,	CDOT Region 2 (2013)
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/ = /		,		
Pipe Station (ft)	Vertical Diameter (ft)	Horizontal Diameter (ft)	Diagonal Diameter (ft)	Notes
9	3.66	3.56	3.54	3 punctures at STA 8
20	3.61	3.63	-	
24	3.63	3.67	3.51	STA 26.25 joint separation 2 in max
35	3.65	3.68	3.65	
50	3.60	3.73	3.71	STA 48.16 joint separation 1.06 in max
56	3.54	3.73	3.59	Minor bulge at pipe invert
70.25	3.47	3.67	3.50	STA 70.25 joint separation 1.13 in max
86	3.65	3.67	3.60	
92.08	3.43	3.68	3.48	Deflection at joint
100	3.63	3.65	3.62	

12/5/2016 - Fountain, CO - Mile Marker 122.5 - 48" HDPE Pipe - Start at East End

12/5/2016 - Fountain, CO - Mile Marker 123.01 - 36" HDPE Pipe - Start at East End

Pipe Station (ft)	Vertical Diameter (ft)	Horizontal Diameter (ft)	Diagonal Diameter (ft)	Notes
0	2.69	2.68	2.67	Inlet damaged by traffic
25	2.52	2.75	2.60	
50	2.63	2.73	2.69	
75	2.67	2.71	2.69	
90	2.67	2.58	2.58	

Pipe Station (ft)	Vertical Diameter (ft)	Horizontal Diameter (ft)	Diagonal Diameter (ft)	Notes
0	2.69	2.58	2.71	Inlet damaged
25	2.52	2.75	2.60	
45	2.63	2.71	2.67	
75	2.67	2.71	2.69	
90	2.65	2.60	2.65	

5.2 DATA FROM LITERATURE REVIEW

One of the objectives of the current research study was to investigate the existence of HDPE performance data from states similar to CDOT. As pointed out in the literature review section of this report in Section 2, the University of Texas at Arlington (UT) conducted such a study in 2010 covering 10 states, including nearby Utah and Kansas. In the University of Texas study, structural performance of 191 HDPE pipelines located in 10 different states throughout the nation was investigated. The sites were selected to cover diverse geographical locations. In the study, manual inspections using qualitative and quantitative observations, a detailed quantitative pipeline-inspection camera, and pipeline laser-profiling-unit measurements were performed utilizing the same equipment and methodologies followed in the current inspection program. The failure modes identified for all tested pipelines included:

- Excessive deformation
- Cracking/fracture
- Inverse curvature
- Joint displacement
- Buckling
- Corrugation growth

All of these are commonly recognized as failure modes in the literature, and do not represent any controversial definitions. The UT study showed that 100% of the pipelines tested suffered from some or many of these failure modes. As shown in Table 5, in 68% of the pipes tested, the limiting maximum deformation (Y, X, and/or ovality) of 5% was exceeded. A maximum deformation value of 34% was observed, and the average of maximum deformations was 7.6% for all pipelines inspected. This study indicates that the structural health and integrity of the installed HDPE pipelines tested are generally below acceptable levels of serviceability.

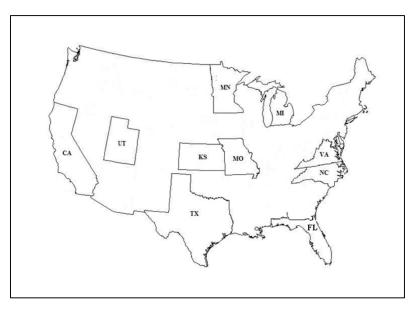


Figure 45. States covered in University of Texas at Arlington, 2010, HDPE pipe-performance study

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State	Number of	Number of	Total length of the pipelines		
State	site locations	pipelines	(ft)	(m)	
Texas	9	22	2,800	854	
North Carolina	6	11	600	183	
Virginia	8	21	3,000	915	
Minnesota	9	31	8,700	2,652	
Kansas	3	10	1,655	505	
Missouri	4	13	1,400	427	
California	2	29	2,545	776	
Utah	2	10	1,525	465	
Michigan	16	29	5,149	1,570	
Florida	2	15	4,405	1,343	
Total	61	191	31,779	9,689	

 Table 4. States included in the University of Texas at Arlington 2010 study

Table 5. Percentage of HDPE pipe failures in each state

State	Excessive deforamtion	Cracking / Fracture	Inverse Curvature	Joint Displacement	Buckling	Corrugation Growth
Texas	38%	23%	18%	27%	18%	100%
North Carolina	75%	73%	0%	73%	27%	100%
Virginia	100%	26%	11%	32%	16%	100%
Minnesota	58%	26%	0%	26%	3%	100%
Kansas	70%	50%	30%	0%	20%	100%
Missouri	69%	20%	0%	0%	0%	100%
California	56%	69%	21%	7%	3%	100%
Utah	100%	40%	40%	20%	20%	100%
Michigan	82%	33%	10%	19%	23%	100%
Florida	73%	42%	17%	100%	42%	100%
Total	69%	40%	15%	30%	17%	100%

State	Number of site locations	Number of pipelines	Total length of the pipelines		Maximum deformation	Average of maximum deformation	Percentage of pipelines with excessive deformation (>5%)
			(ft)	(m)	(%)	(%)	(%)
Texas	9	22	2,800	854	22.5	6.8	38
North Carolina	6	11	600	183	10.4	6.3	75
Virginia	8	21	3,000	915	22.3	10.5	100
Minnesota	9	31	8,700	2,652	15	6.4	58
Kansas	3	10	1,655	505	10.4	6.8	70
Missouri	4	13	1,400	427	8.8	5	69
California	2	29	2,545	776	15.3	5.9	52
Utah	2	10	1,525	465	34	10.4	100
Michigan	16	29	5,149	1,570	23.1	10.5	82
Florida	2	15	4,405	1,343	10.3	6.3	73
Total	61	191	31,779	9,689	34	7.5	69

 Table 6. Maximum observed HDPE pipe deformations in each state

Figure 46 presents a summary of experience with Kentucky DOT's HDPE pipeline installations. Measurements show that after the initial-installation phase, recorded deflections continually increased through time. In almost all Kentucky DOT pipe installations, measured deflections exceeded the maximum 5% failure limit.

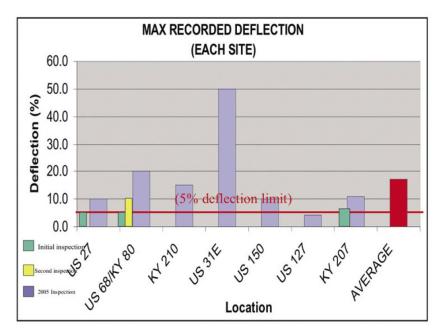


Figure 13. Experience with Kentucky DOT's HDPE pipe performance.

5.3 CDOT EXPERIENCE AT T-REX PROJECT

During construction of the T-Rex Project there were numerous Nonconformance Report and Evaluation (NCR/NCE) forms submitted by Southeast Corridor Constructors (SECC). Appendix 4 presents a compilation of these reports. Some of these reports state that HDPE pipe problems were encountered in the field with shallow cover and excavation around HDPE pipes. It is noted that at some locations it may be necessary to remove previously-installed HDPE and replace it with RCP. In order to resolve these nonconformance issues, SECC requested to change all remaining HDPE to RCP (6/23/2003).

6. SUMMARY AND CONCLUSIONS

In this study, performance of HDPE pipes under CDOT highways was investigated by:

- Conducting an extensive literature review
- Field studies utilizing manual inspection
- CCTV video inspections
- Laser-profiling technology
- Observing CDOT HDPE pipe-installation projects

The objectives of the study and methodologies used to achieve these objectives are presented in Section 1 of this report. Section 2 presents results of an extensive literature review covering various aspects of HDPE problems. Methodology, including equipment and procedures used in conducting field inspections, is described in Section 3. Field data collection and measurement results are presented in Section 4, and the Data Analysis results are discussed in Section 5.

An extensive literature search was conducted in order to assess the current methodologies used by CDOT and other highway agencies to measure the performance of HDPE pipe installations. In general, most DOTs have encountered HDPE performance problems in the form of excess deformation (greater than 5%). The general conclusion from the literature review is that structural integrity of the installed HDPE pipelines which were tested by various DOTs is generally below acceptable levels of serviceability. Further testing is needed to evaluate the long-term performance of HDPE pipes.

In general, it is recommended that all monitoring points established on prior research projects be measured and re-evaluated for long-term hydraulic and structural performance. Studies by Kentucky, Ohio, Missouri, South Carolina transportation departments and others have demonstrated the difficulty in achieving problem-free installations of HDPE pipes, and that these pipes do not always perform in accordance with idealized, theoretical conditions. In numerous test cases significant-to-severe deflections, corrugation growth, crown and invert flattening, racking, sagging, and radial cracking have been observed in pipe sections.

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APPENDIX I – FOUNTAIN COLORADO, DUROMAXX LASER PROFILE INSPECTION, I-25, MP 122, MP 122.5, AND MP 123 (2013) LEO JOHN FLECKENSTEIN

Fountain Colorado DuroMaxx Laser Profile Inspection I-25, MP 122, MP 122.5, and MP 123

September 30, 2013

B

Leo John Fleckenstein

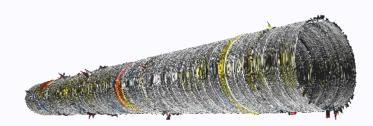
Project Summary: A total of 5 pipes were video and laser profiled on September 30, 2013. A straight line/non pan and tilt portable camera unit was utilized for the inspection. Joints were noted and observed during the inspection. Joint separation was minor to moderate with no significant distress or soil migration observed. Some minor racking, dents, and sags were also noted. Limited construction information was available. Several of the structures have limited cover. Minor post construction damage was noted towards the ends of several of the structures as straw wattles were placed over the pipe ends and wooden stakes driven through the crown of the pipes. The stakes do not appear to causing any structural issues with the performance of the pipes. Four of the five pipes were under 5% deflection for their full length. One pipe had a small localized area where pipe deflection was measured at 5.3% near the end of the structure. The non-uniform nature of the deflection and the fact that the deflected area is outside of the paved roadway would suggest that this deformation occurred during the installation process. The first 10 to 16 ft of the pipes near the outlet end of the structures could not be laser profiled due to the distance between the camera and the laser. Each pipe was totally captured/recorded on the straight line video Inspection.



Location: Fountain Colorado Route: I-25 Pipe Use: Culvert/Cross Drain Date Inspected: 9/30/13

				Distance			Deflection	Deflection	
Location	Date	Pipe Type	Pipe Size	(ft)	Start ID	End ID	. ,	(5%)	Observations
							100% of		Max deflection less than 2.5%, slight dent
							readings		in left springline, wooden stake driven
MP 123, Northern Pipe	9/30/2013	DuroMaxx	36-inch	88	Outlet	Inlet	below 2.5%		through crown near inlet end.
									Max deflection approximately 4% at 23 ft,
							92% of	100% of	small dent at left springline at 73 ftl,
							readings	readings	wooden stakes driven through crown of
MP 123, Center Pipe	9/30/2013	DuroMaxx	36-inch	88	Outlet	Inlet	below 2.5%	below 5%, .	pipe near inlet end.
							100% of		Max deflection approximately 2.5% at 24 ft,
							readings		wooden stake driven through crown of pipe
MP 124, Southern Pipe	9/30/2013	DuroMaxx	36-inch	88	Outlet	Inlet	below 2.5%		near inlet.
									Max deflection approximately 2.8% at 88 ft
							86.8% of	100% of	
							reading	readings	
MP 122.5	9/30/2013	DuroMaxx	48-inch	102	Outlet	Inlet	below 2.5%	below 5%, .	
							77.2% of	<1.9% of	Max deflection approximately 5.30% near
							readings	readings	inlet end (approx. 90 to 88 ft). Pipe
							below 2.5%	above 5%	moderately racked in right crown.
									Remainder of pipe 4% or less. Small
									puncture due to stake near outlet, pipe
									slightly racked at 8 ft. Slight hump at right
MP 122	9/30/2013	DuroMaxx	48-inch	103	Outlet	Inlet			haunch at 46 ft. Slight dent in invert at 56 ft.

Deflection data was gathered at a frame rate of approximately 1 frame per every 0.1 ft. With 180 measurements taken per frame of video. Total readings per pipe section ranged from approximately 712,000 to 770,000.

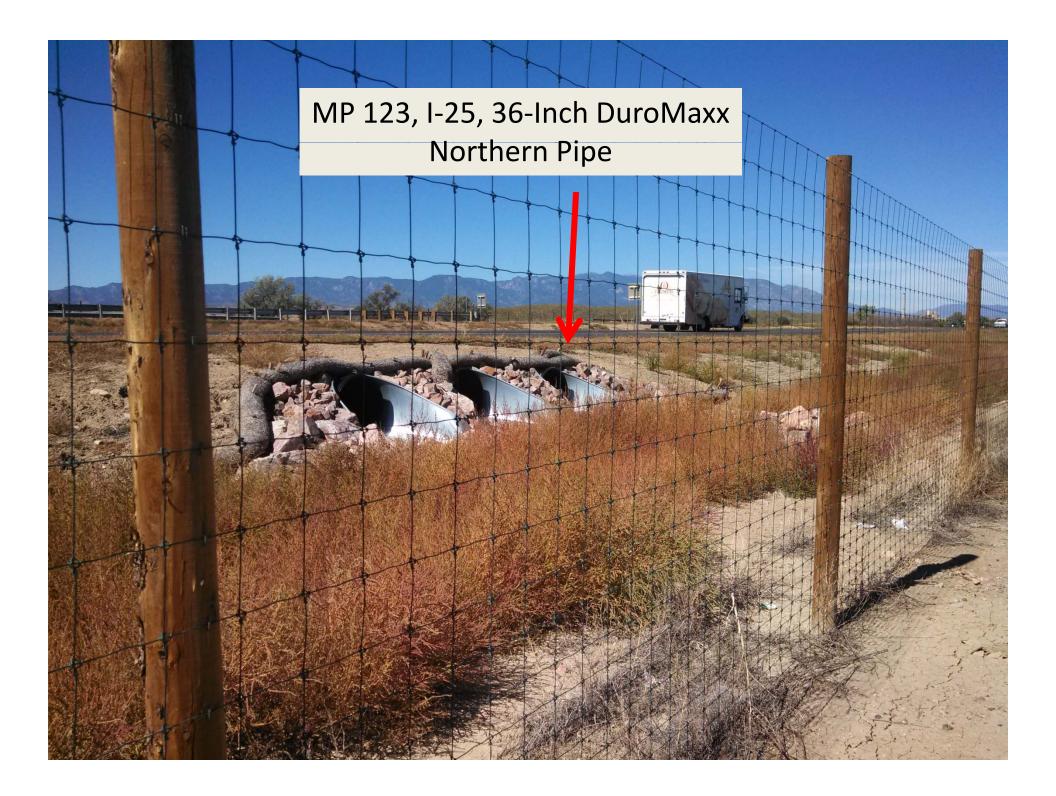






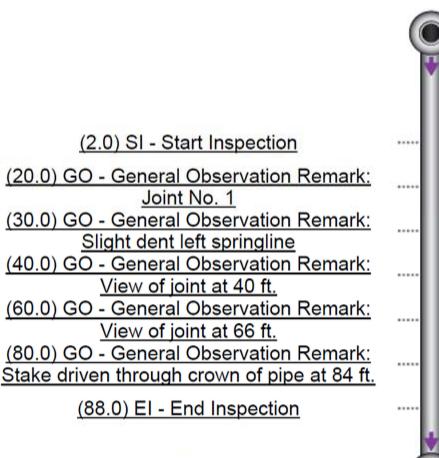






Project Name: I-25, Fountain, Colorado

Date: 9/30/2013 Asset Location: Distance: 0 Run Number: Pipe Size: 36 Pipe ID: MP 123 Start ID: Outlet End ID: Inlet Direction: Upstrm Pipe Type: DuroMaxx



ID Number: Outlet

ID Number: Inlet

Total Distance: 0

Project Name: I-25, Fountain, Colorado Pipe ID: MP 123 Start ID: Outlet

Date: 9/30/2013 Asset Location: Distance: 0 Run Number: Pipe Size: 36 Pipe ID: MP 123 Start ID: Outlet End ID: Inlet Direction: Upstrm Pipe Type: DuroMaxx

Distance	Fault Observation	Time	Picture
2.0	Start Inspection	01:14 00:00:00	
20.0	General Observation Remarks: Joint No. 1	03:13 00:00:26	
30.0	General Observation Remarks: Slight dent left springline	07:04 00:00:40	

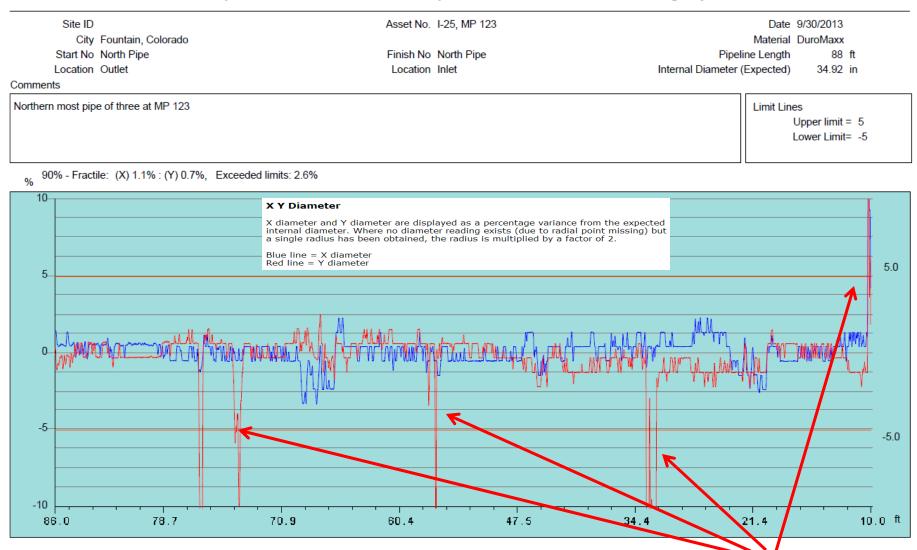
Distance	Fault Observation	Time	Picture
40.0	General Observation Remarks: View of joint at 40 ft.	8:10 00:00:45	
60.0	General Observation Remarks: View of joint at 66 ft.	10:33 00:01:13	
80.0	General Observation Remarks: Stake driven through crown of pipe at 84 ft.	12:37 00:01:45	

Distance	Fault Observation	Time	Picture
88.0	End Inspection	13:48 00:01:55	

Created with the **PDSM** report generator

XY Diameter Summary Report

Pipe well under 5% deflection, spikes in data due to camera tilting at joint



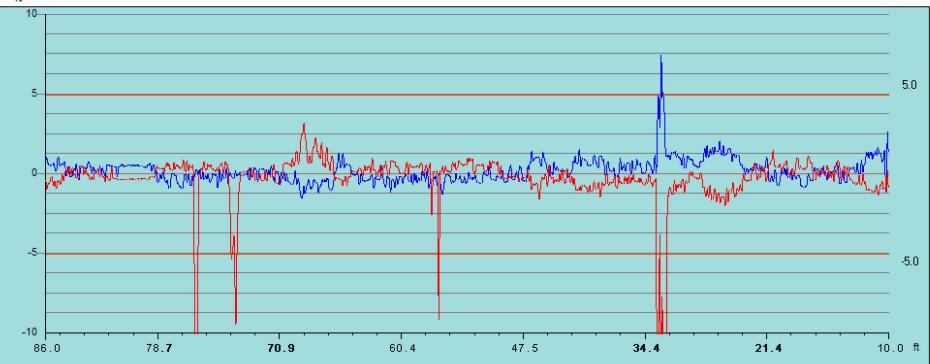
Fractile: 10% of the data points are above 1.1% for X and 0.7% for Y. 2.6% exceeds 5% limits lines. The spikes/scatter in data (2.6%) are due to the laser skid and/or the camera tilting on the weld at the joint. Spikes can also occur due to the loss of laser light at the joint.

XY Deflection Summary Report

Pipe under 5% (Deflection based off Median I.D. per frame of video)

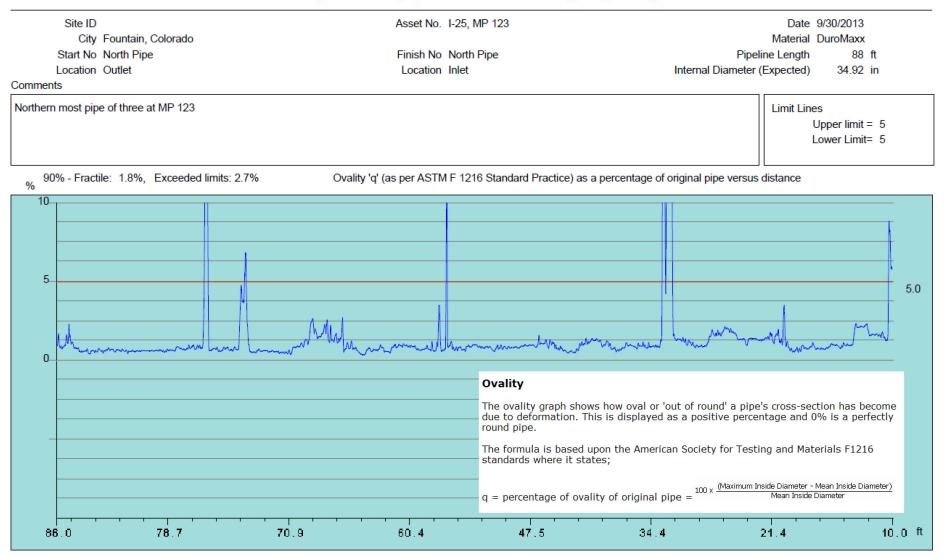
Site ID City Fountain, Colorado	Asset No. I-25, MP 123	Date 9/30/2013 Material DuroMaxx
Start No North Pipe	Finish No North Pipe	Pipeline Length 88 ft
Location Outlet	Location Inlet	Internal Diameter (Expected) 34.92 in
Comments		
Northern most pipe of three at MP 123		Limit Lines Upper limit = 5 Lower Limit= -5



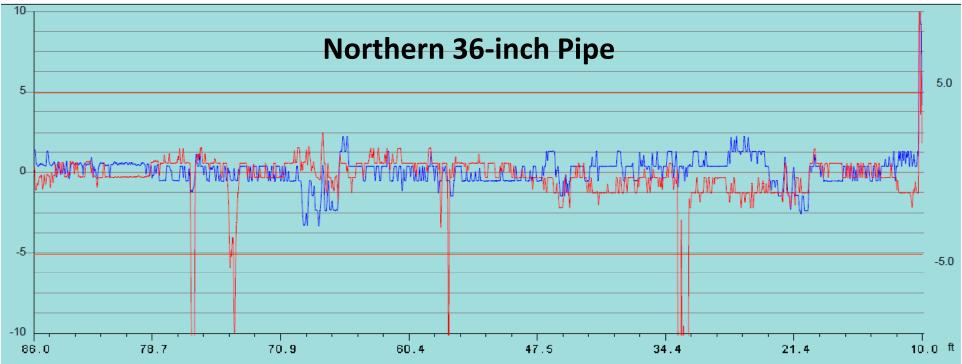


Ovality Summary Report

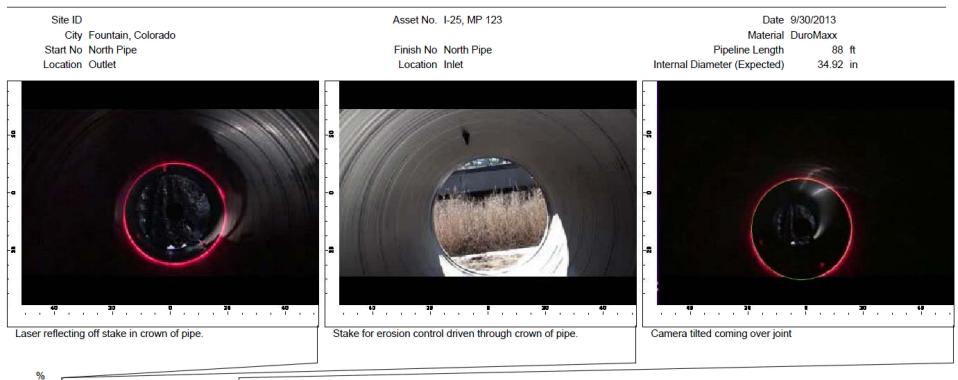
Ovality under 5%, spikes due to camera going over joints

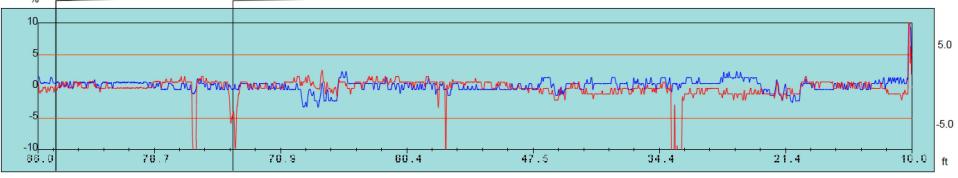






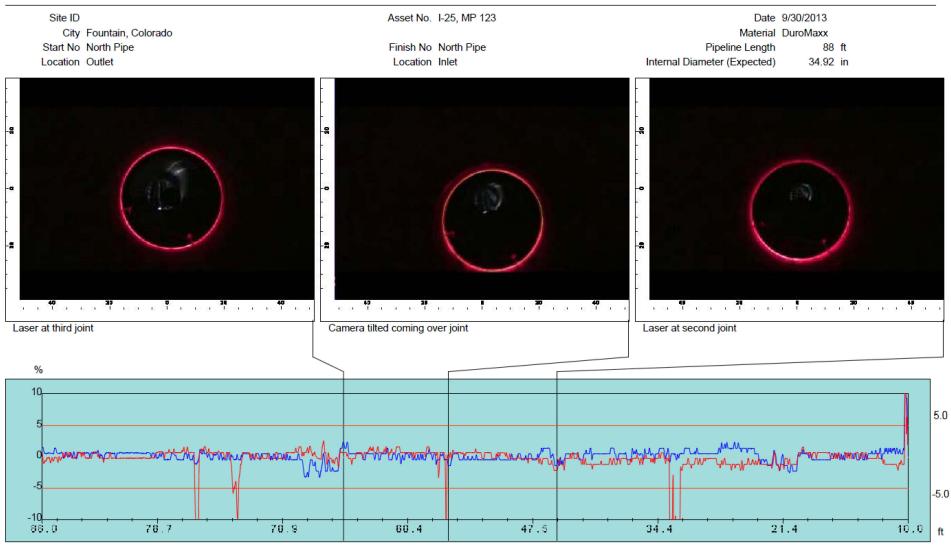
MP 123, I-25, DuroMaxx Installation, Fountain, Colorado





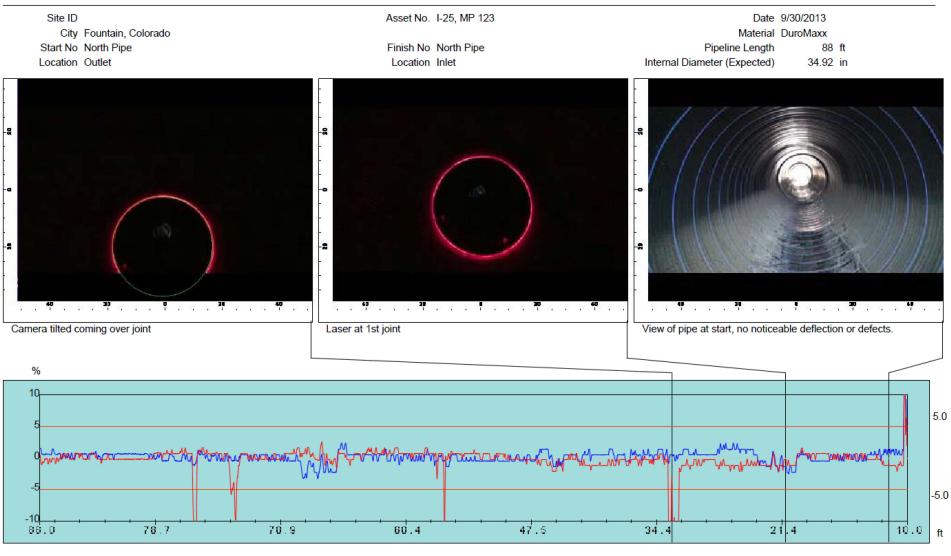
^{90% -} Fractile: (X) 1.1% : (Y) 0.7%, Exceeded limits: 2.6%

MP 123, I-25, DuroMaxx Installation, Fountain, Colorado

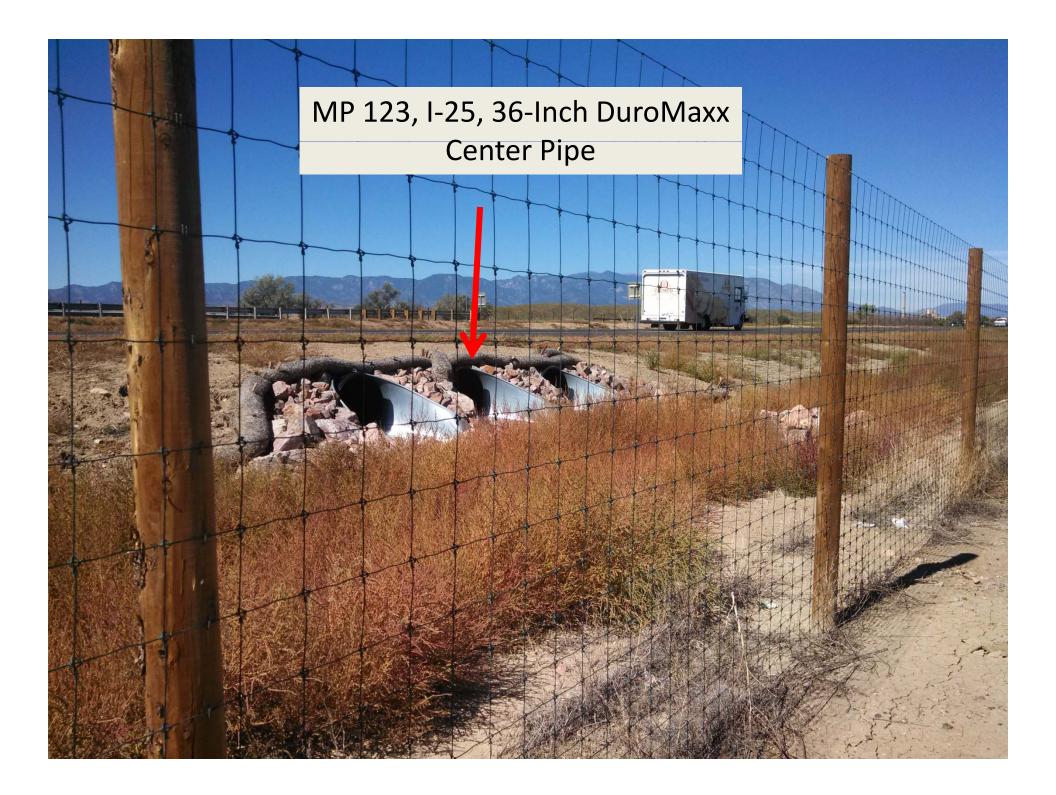


^{90% -} Fractile: (X) 1.1% : (Y) 0.7%, Exceeded limits: 2.6%

MP 123, I-25, DuroMaxx Installation, Fountain, Colorado



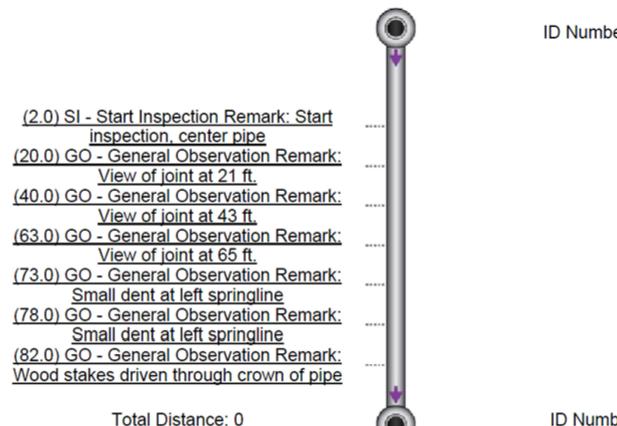
^{90% -} Fractile: (X) 1.1% : (Y) 0.7%, Exceeded limits: 2.6%



Project Name: I-25, Fountain, Colorado

Date: 9/30/2013 Asset Location: Distance: 0 Run Number: Pipe Size: 36

Pipe ID: MP 123, Center Pipe Start ID: Outlet End ID: Inlet Direction: Upstrm Pipe Type: DuroMaxx



ID Number: Outlet

ID Number: Inlet

Project Name: I-25, Fountain, Colorado Pipe ID: MP 123, Center Pipe Start ID: Outlet

Date: 9/30/2013 Asset Location: Distance: 0 Run Number: Pipe Size: 36 Pipe ID: MP 123, Center Pipe Start ID: Outlet End ID: Inlet Direction: Upstrm Pipe Type: DuroMaxx

Distance	Fault Observation	Time	Picture
2.0	Start Inspection Remarks: Start inspection, center pipe	01:09 00:00:00	
20.0	General Observation Remarks: View of joint at 21 ft.	04:45 00:01:14	
40.0	General Observation Remarks: View of joint at 43 ft.	05:44 00:01:39	

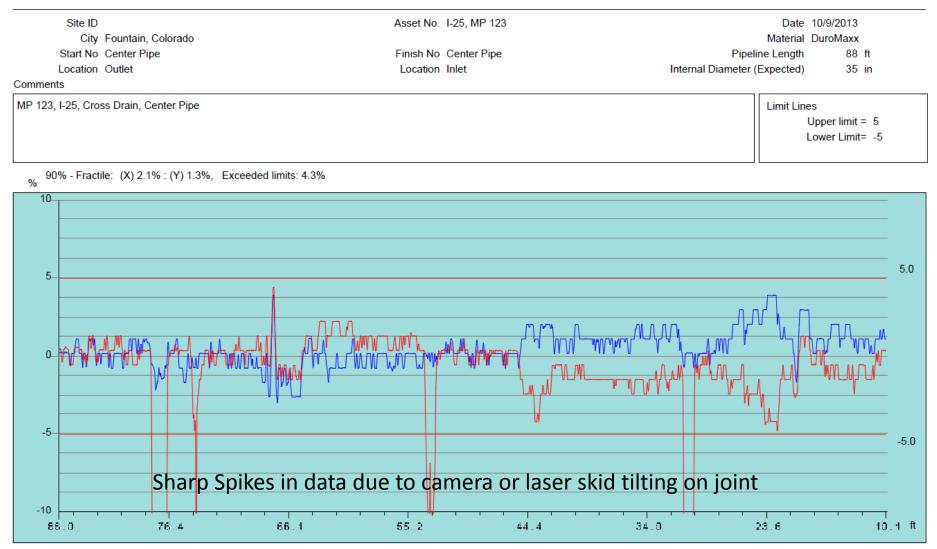
Distance	Fault Observation	Time	Picture
63.0	General Observation Remarks: View of joint at 65 ft.	07:52 00:02:14	
73.0	General Observation Remarks: Small dent at left springline	09:22 00:02:30	
78.0	General Observation Remarks: Small dent at left springline	10:33 00:02:53	

82.0 General Observation Remarks: Wood stakes driven through crown of pipe	Distance	Fault Observation	Time	Picture
	82.0	Remarks: Wood stakes driven		

Created with the **VPOSM** report generator

XY Diameter Summary Report

Pipe under 5% deflection, spikes in data due to camera tilting at joint

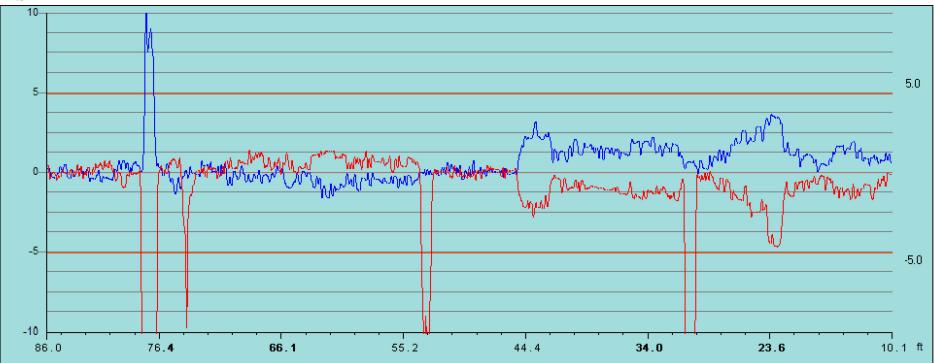


XY Deflection Summary Report

Pipe under 5% (Deflection based off Median I.D. per frame of video)

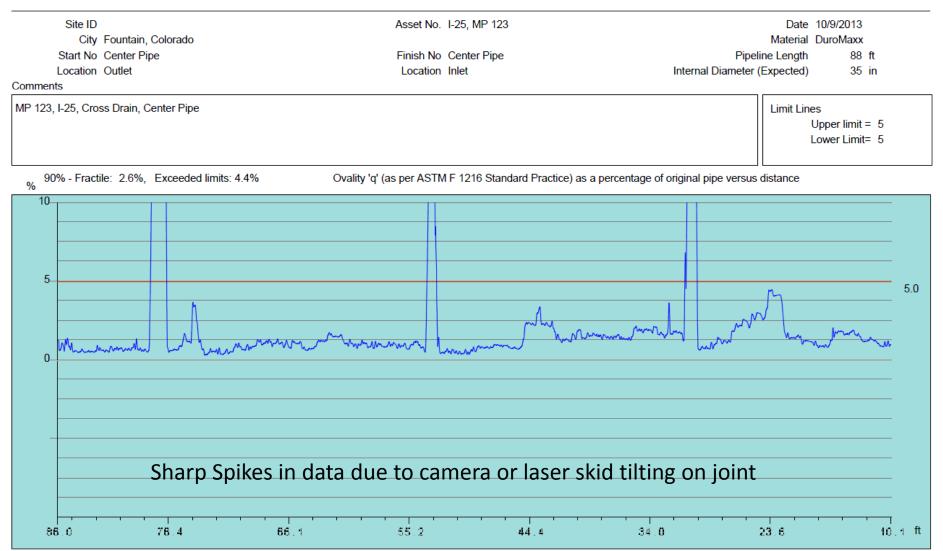
City Fountain, Colorado Material DuroMaxx Start No Center Pipe Finish No Center Pipe Pipeline Length 88 Location Outlet Location Internal Diameter (Expected) 35 Comments Internal Diameter Pipe Limit Lines Upper limit			
Start No Center Pipe Pipeline Length 88 Location Outlet Location Internal Diameter (Expected) 35 comments Internal Diameter Pipe Limit Lines Upper limit	Site ID	Asset No. I-25, MP 123	Date 10/9/2013
Location Outlet Location Inlet Internal Diameter (Expected) 35 omments Location Inlet Internal Diameter (Expected) 35 IP 123, I-25, Cross Drain, Center Pipe Limit Lines Upper limit	City Fountain, Colorado		Material DuroMaxx
omments IP 123, I-25, Cross Drain, Center Pipe Limit Lines Upper limit	Start No Center Pipe	Finish No Center Pipe	Pipeline Length 88 ft
IP 123, I-25, Cross Drain, Center Pipe Limit Lines Upper limit	Location Outlet	Location Inlet	Internal Diameter (Expected) 35 in
Upper limit	omments		
	IP 123, I-25, Cross Drain, Center Pipe		Limit Lines
Lower Limit			Upper limit = 5
			Lower Limit= -5

%



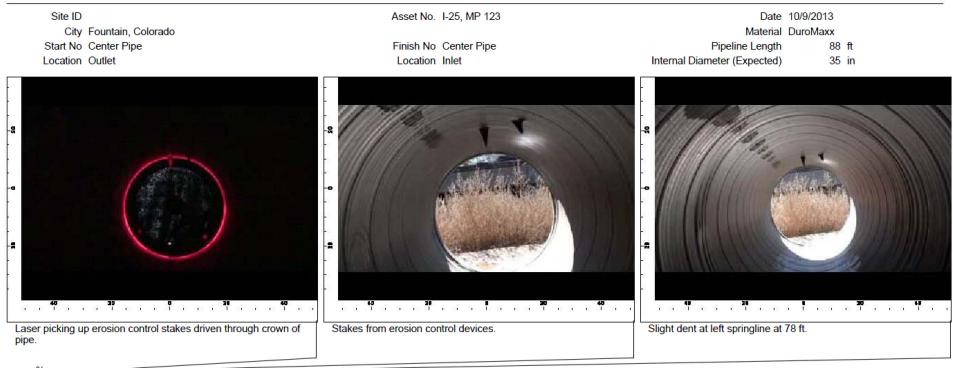
Ovality Summary Report

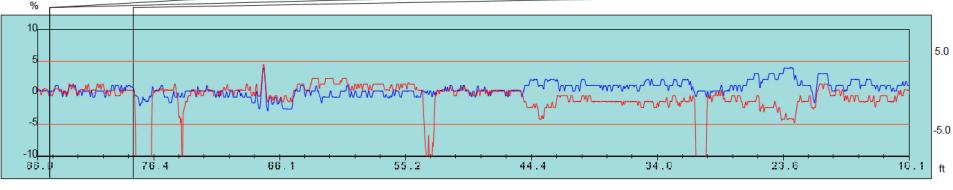
Ovality under 5%, spikes due to camera going over joints





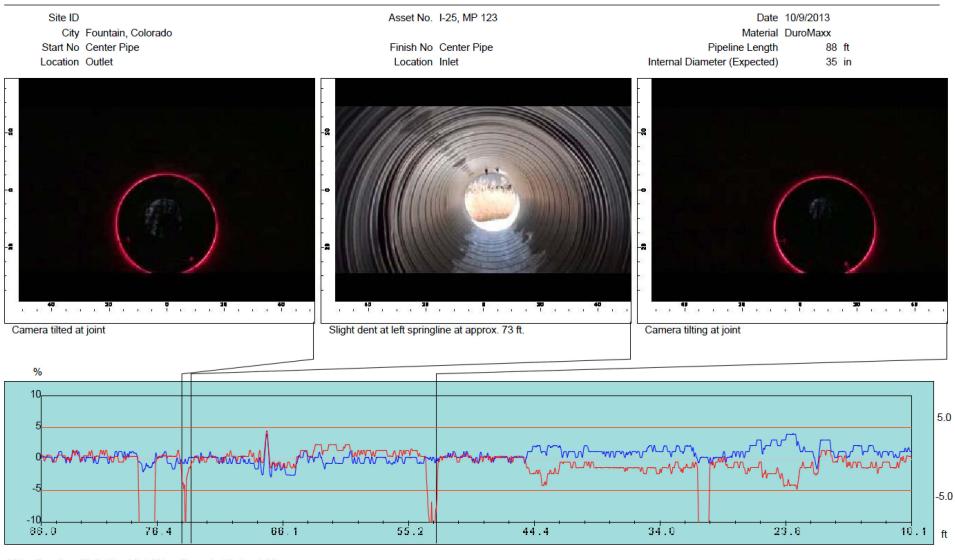
MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Center Pipe)





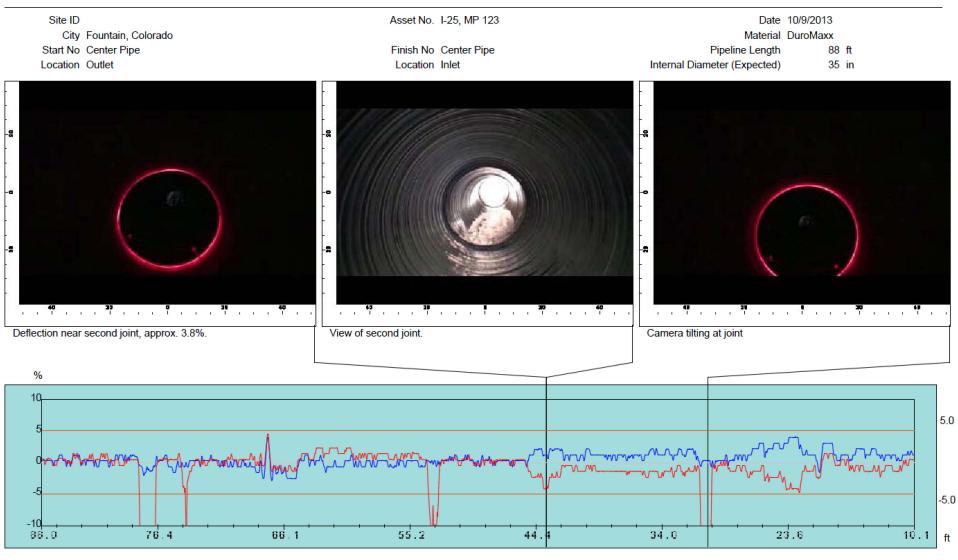
^{90% -} Fractile: (X) 2.1% : (Y) 1.3%, Exceeded limits: 4.3%

MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Center Pipe)



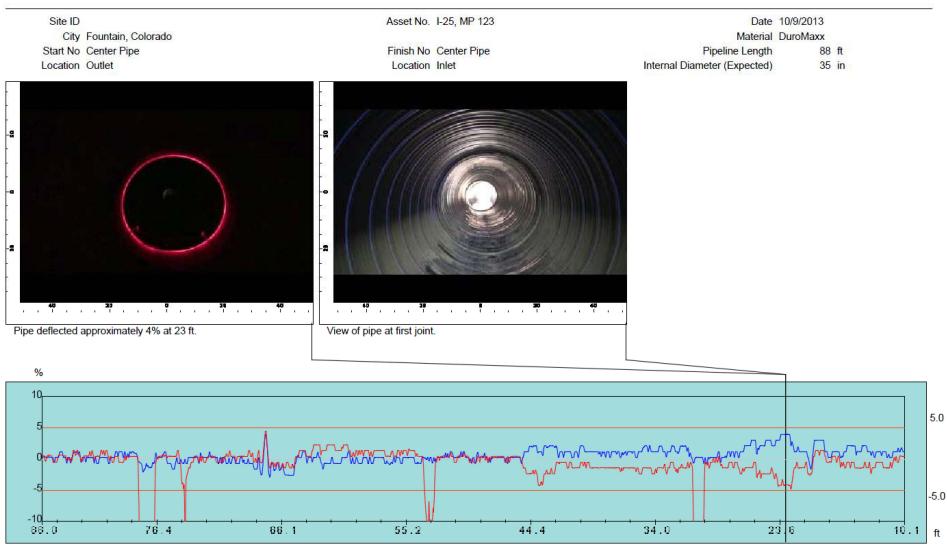
90% - Fractile: (X) 2.1% : (Y) 1.3%, Exceeded limits: 4.3%

MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Center Pipe)

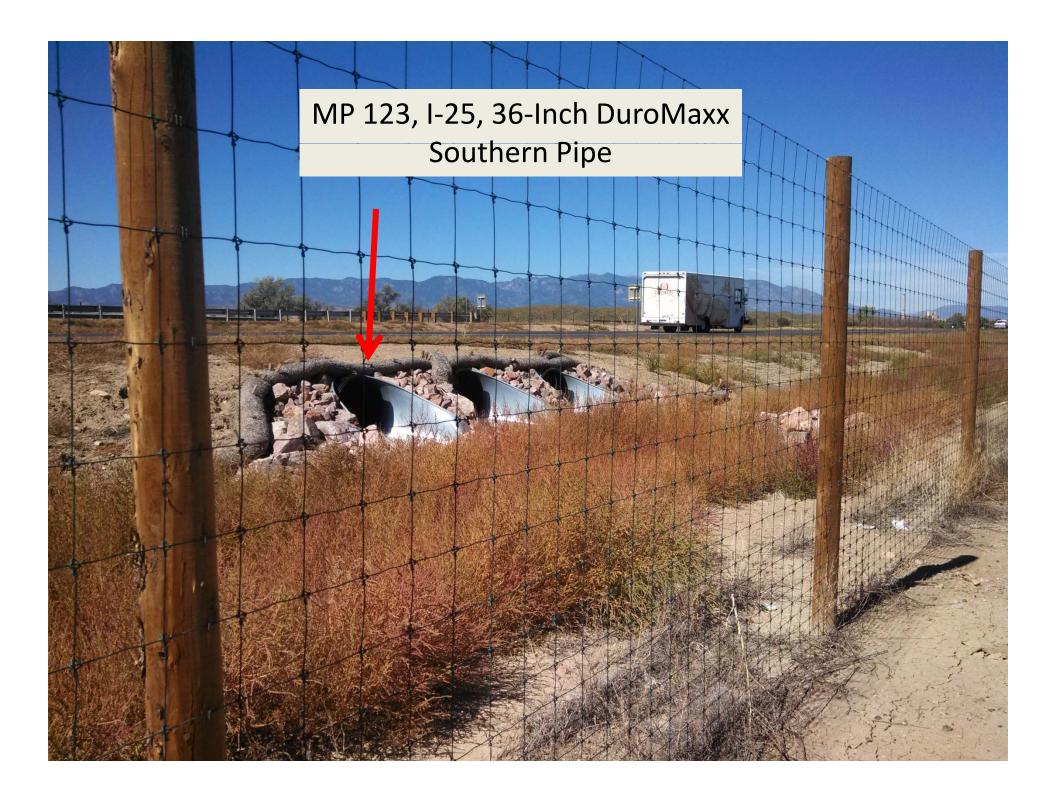


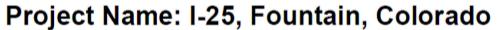
^{90% -} Fractile: (X) 2.1% : (Y) 1.3%, Exceeded limits: 4.3%

MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Center Pipe)

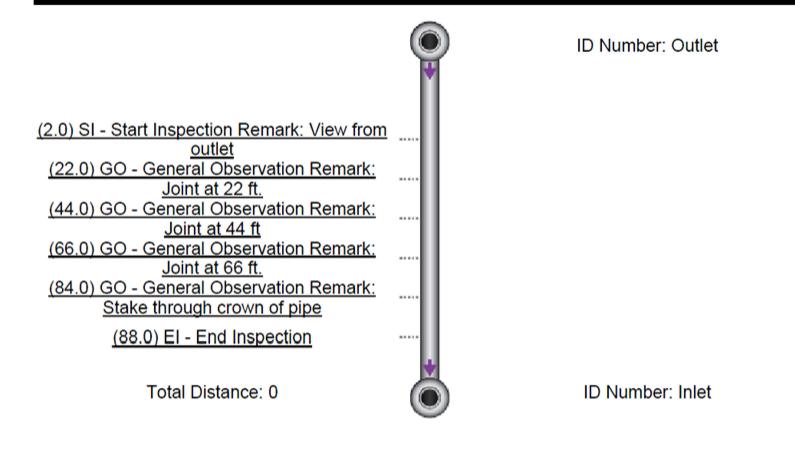


90% - Fractile: (X) 2.1% : (Y) 1.3%, Exceeded limits: 4.3%





Date: 9/30/2013 Asset Location: Distance: 0 Run Number: Pipe Size: 36 Pipe ID: Southern Pipe Start ID: Outlet End ID: Inlet Direction: Upstrm Pipe Type: DuroMaxx



Created with the **Created with the** Created with the

Project Name: I-25, Fountain, Colorado Pipe ID: Southern Pipe Start ID: Outlet

Date: 9/30/2013 Asset Location: Distance: 0 Run Number: Pipe Size: 36 Pipe ID: Southern Pipe Start ID: Outlet End ID: Inlet Direction: Upstrm Pipe Type: DuroMaxx

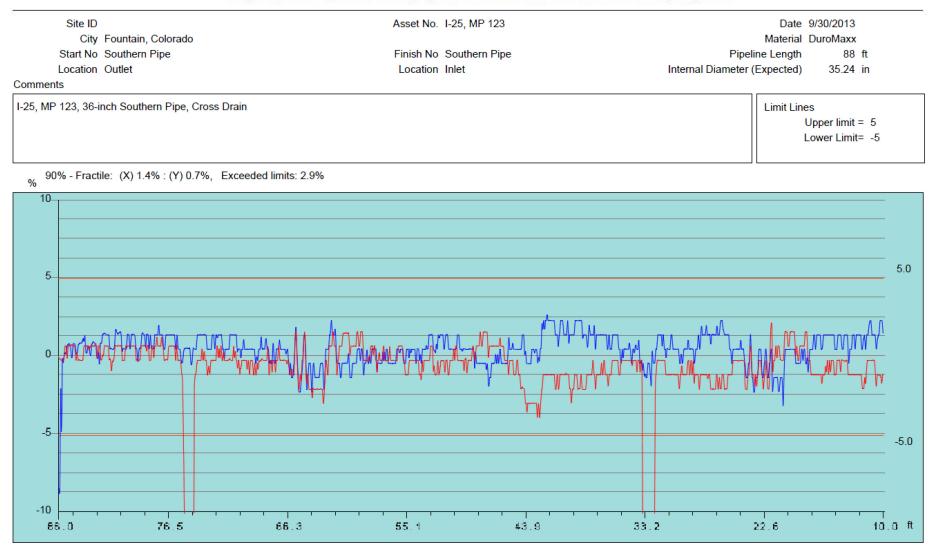
Distance	Fault Observation	Time	Picture
2.0	Start Inspection Remarks: View from outlet	01:47 00:00:00	
22.0	General Observation Remarks: Joint at 22 ft.	2:30:17 00:00:36	
44.0	General Observation Remarks: Joint at 44 ft	2:31:30 00:01:05	

Distance	Fault Observation	Time	Picture
66.0	General Observation Remarks: Joint at 66 ft.	2:32:18 00:01:26	
84.0	General Observation Remarks: Stake through crown of pipe	2:33:18 00:01:54	
88.0	End Inspection	2:33:47 00:02:01	



XY Diameter Summary Report

Pipe under 5% deflection, spikes in data due to camera tilting at joint

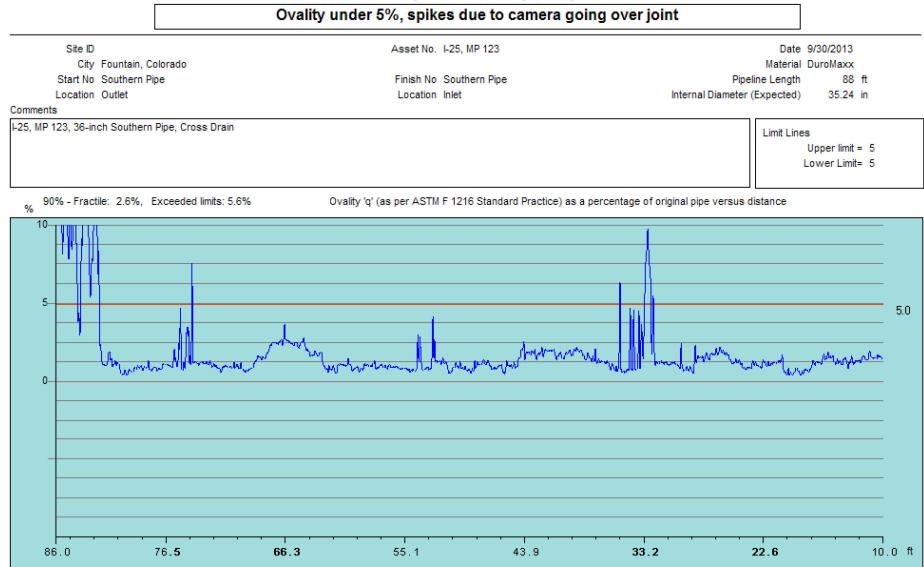


XY Deflection Summary Report

Pipe under 5% (Deflection based off Median I.D. per frame of video)

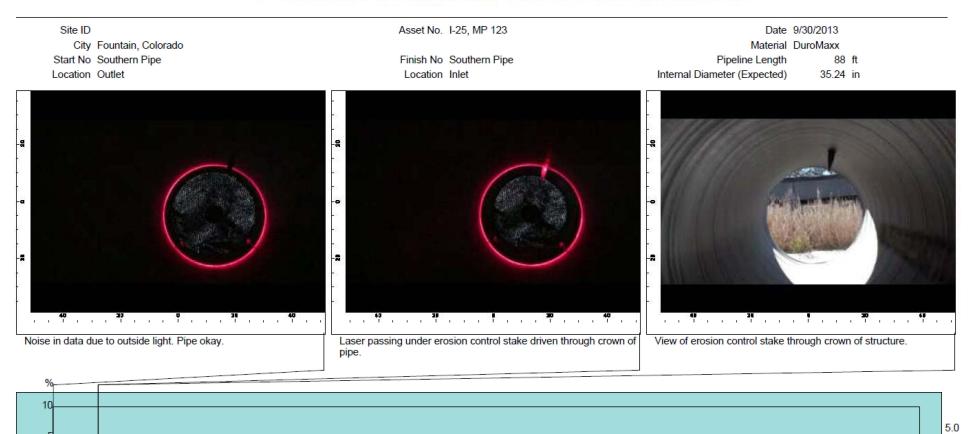


Ovality Summary Report





MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Southern Pipe)



43.9

33.2

22.6

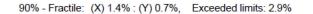
55.1

66.3

-5.0

ft

10.0

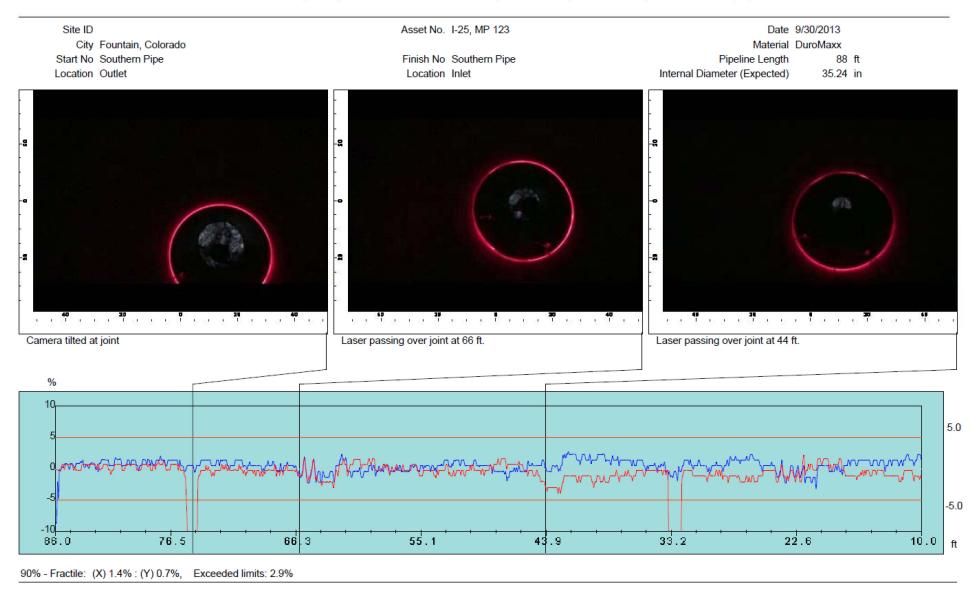


76.5

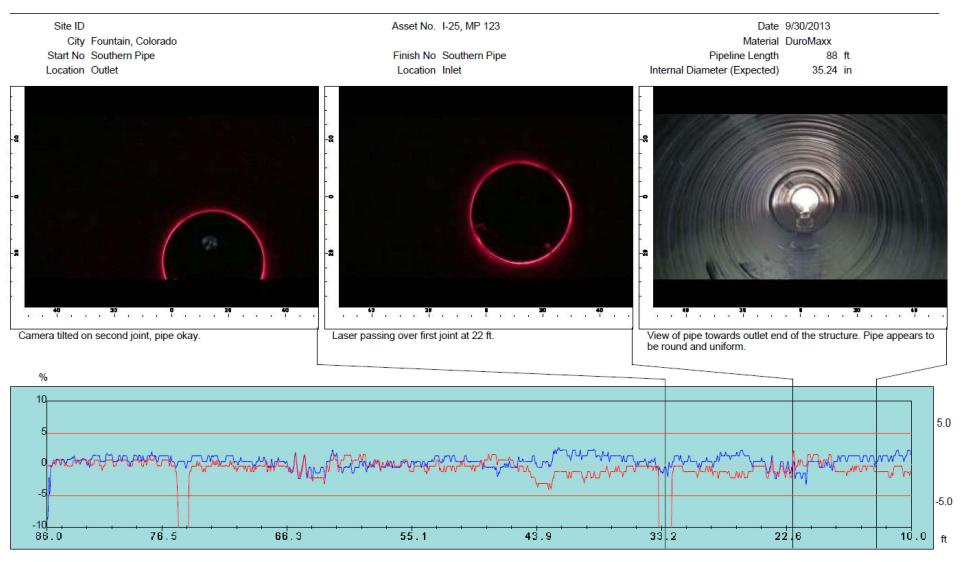
-10

86.0

MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Southern Pipe)



MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Southern Pipe)

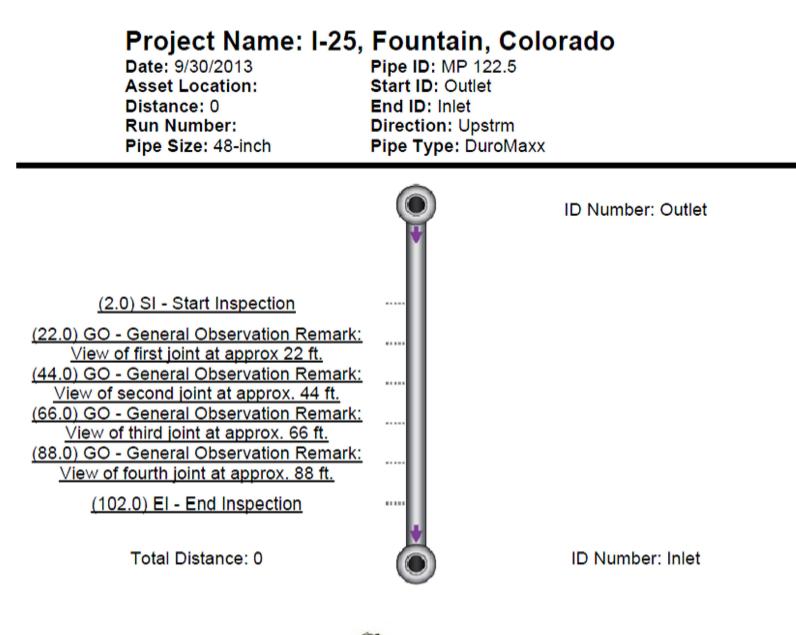


^{90% -} Fractile: (X) 1.4% : (Y) 0.7%, Exceeded limits: 2.9%









Created with the **PDSM** report generator

Date: 9/30/2013 Asset Location: Distance: 0 Run Number: Pipe Size: 48-inch

Project Name: I-25, Fountain, Colorado Pipe ID: MP 122.5 Start ID: Outlet End ID: Inlet Direction: Upstrm Pipe Type: DuroMaxx

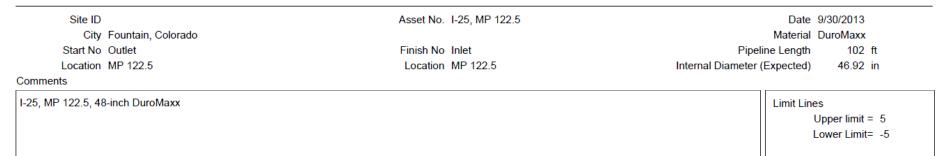
Distance	Fault Observation	Time	Picture
2.0	Start Inspection	04:18 00:00:00	Dijolitano dijolitano
22.0	General Observation Remarks: View of first joint at approx 22 ft.	06:09 00:00:48	
44.0	General Observation Remarks: View of second joint at approx. 44 ft.	07:51 00:01:24	01.01.1250 03/03/03/03

Distance	Fault Observation	Time	Picture
66.0	General Observation Remarks: View of third joint at approx. 66 ft.	10:39 00:01:53	
88.0	General Observation Remarks: View of fourth joint at approx. 88 ft.	11:51 00:02:27	
102.0	End Inspection	13:12 00:03:15	

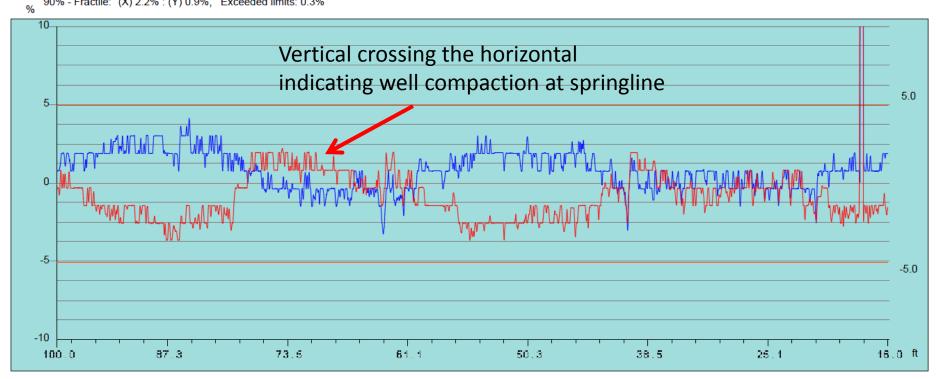
Created with the ***POSM** report generator

XY Diameter Summary Report

Pipe under 5% deflection, spikes in data due to camera tilting at joint



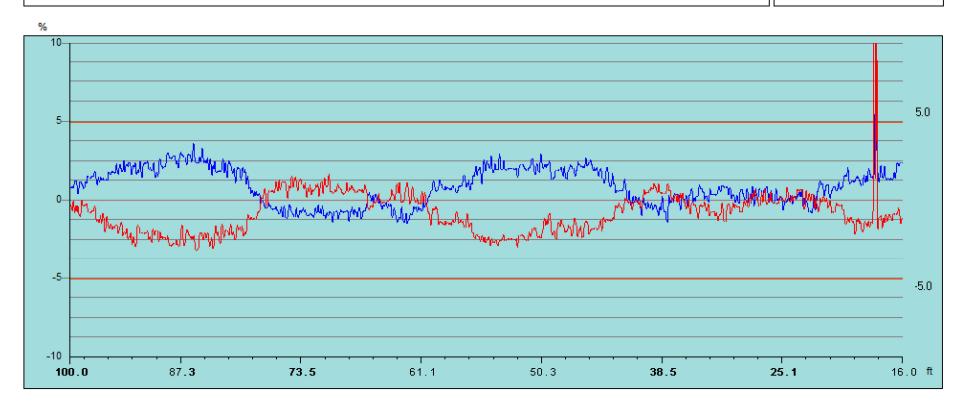
90% - Fractile: (X) 2.2% : (Y) 0.9%, Exceeded limits: 0.3%



XY Deflection Summary Report

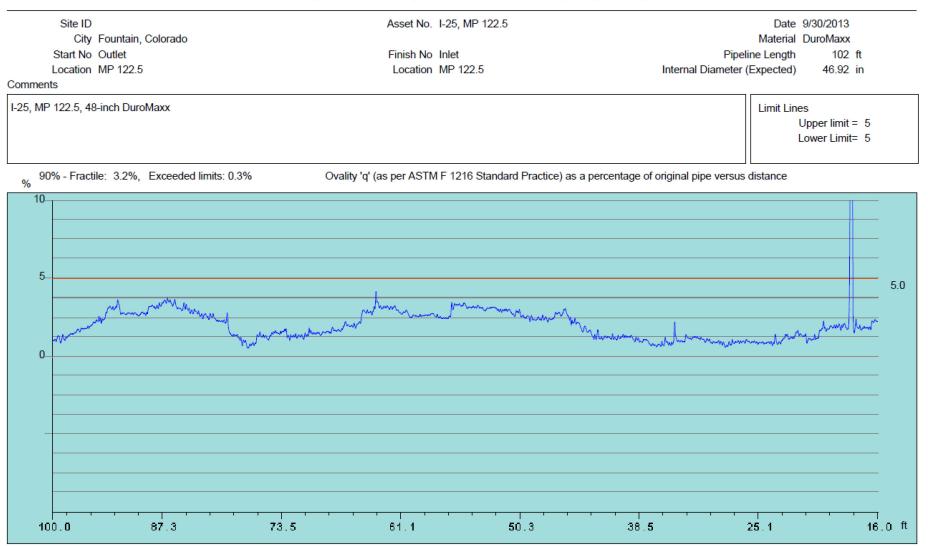
Pipe under 5% (Deflection based off Median I.D. per frame of video)

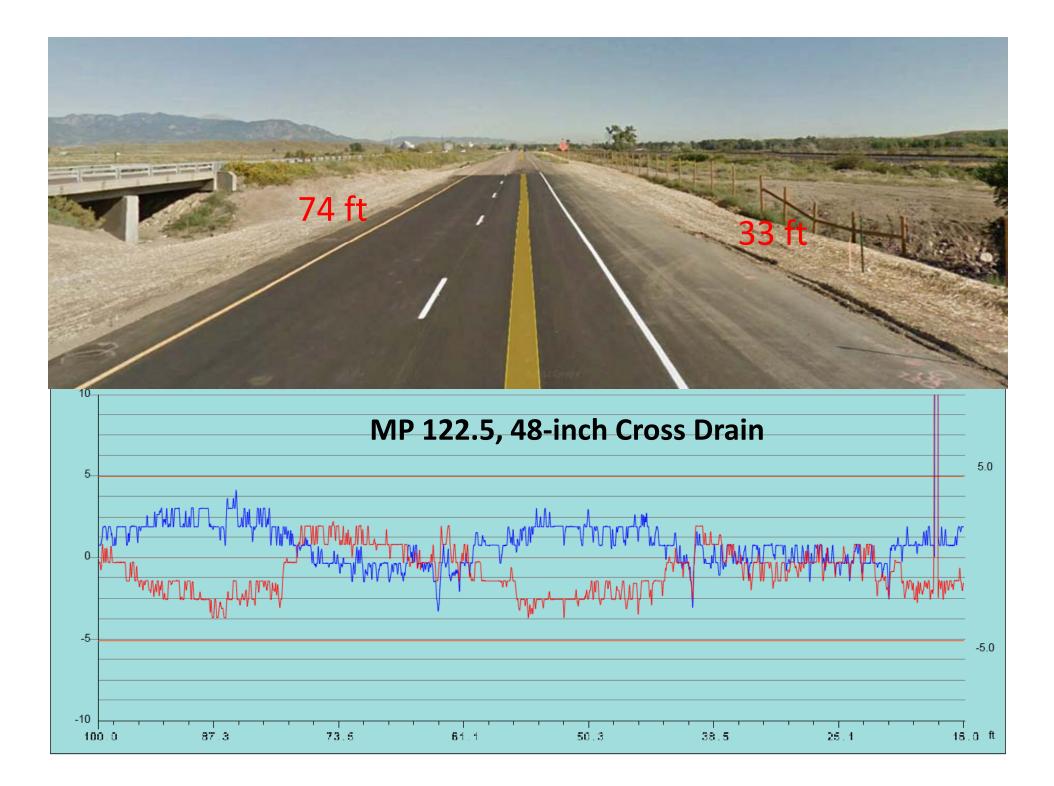
Asset No. I-25, MP 122.5	Date 9/30/2013
	Material DuroMaxx
Finish No Inlet	Pipeline Length 102 ft
Location MP 122.5	Internal Diameter (Expected) 46.92 in
	Limit Lines Upper limit = 5
	Lower Limit= -5
	Finish No Inlet



Ovality Summary Report

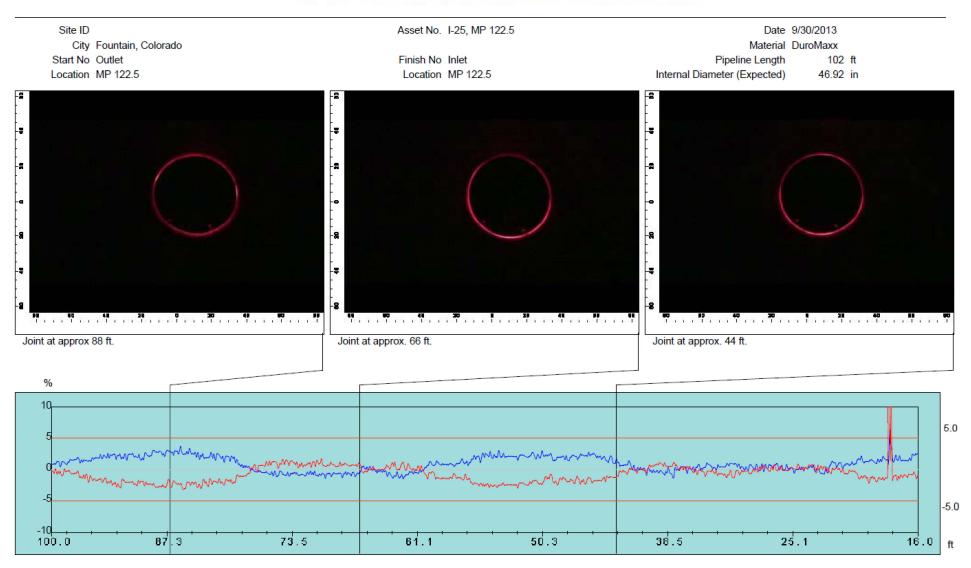
Ovality under 5%, spikes due to camera going over joint





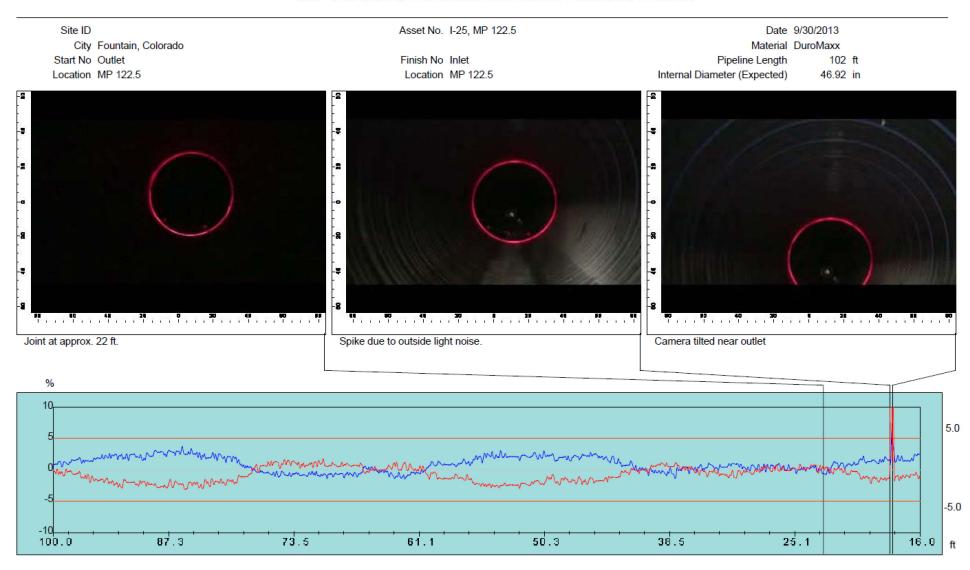
XY Deflection Observations Report

MP 122.5, I-25, DuroMaxx Installation, Fountain, Colorado



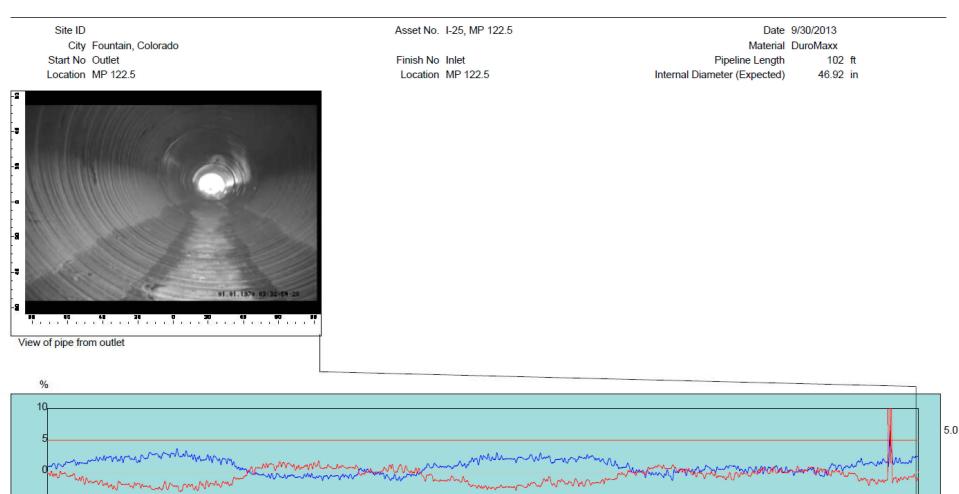
XY Deflection Observations Report

MP 122.5, I-25, DuroMaxx Installation, Fountain, Colorado



XY Deflection Observations Report

MP 122.5, I-25, DuroMaxx Installation, Fountain, Colorado



61.1

50.3

38.5

-10

100.0

87.3

73.5

-5.0

ft

16.0

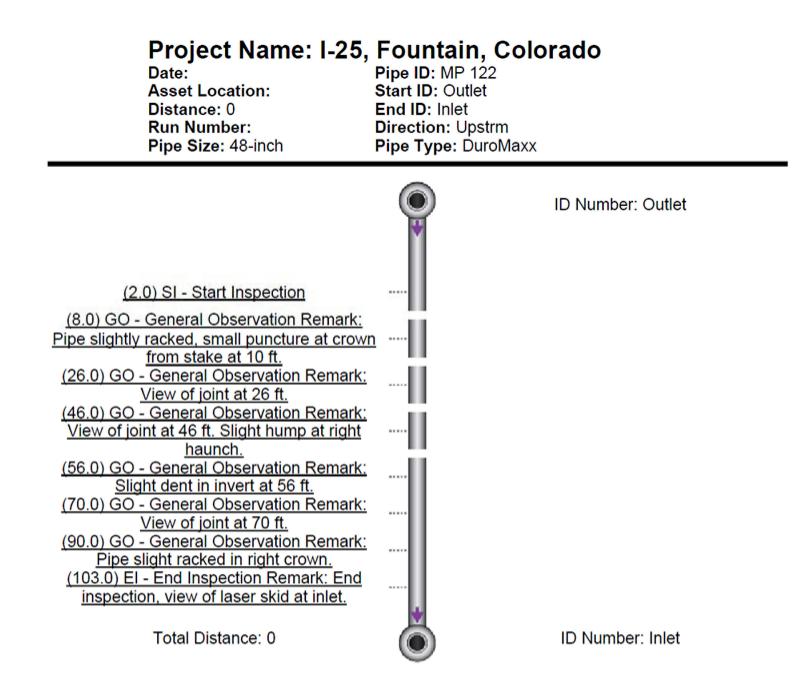
25.1













Project Name: I-25, Fountain, Colorado Pipe ID: MP 122 Start ID: Outlet End ID: Inlet

Date: Asset Location: Distance: 0 Run Number: Pipe Size: 48-inch Direction: Upstrm Pipe Type: DuroMaxx

Distance	Fault Observation	Time	Picture
2.0	Start Inspection	43 00:00:00	
8.0	General Observation Remarks: Pipe slightly racked, small puncture at crown from stake at 10 ft.	02:30 00:00:43	
26.0	General Observation Remarks: View of joint at 26 ft.	12:08 00:01:27	

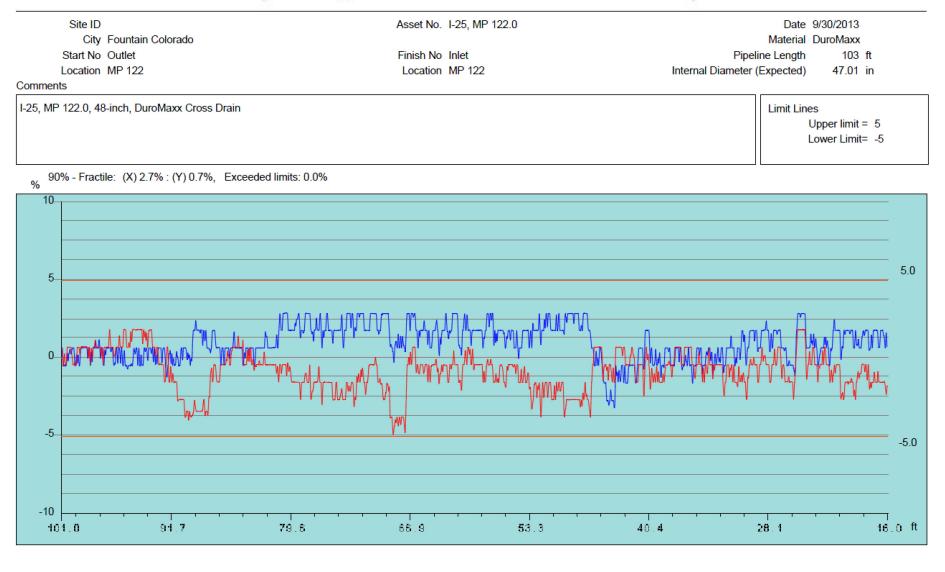
Distance	Fault Observation	Time	Picture
46.0	General Observation Remarks: View of joint at 46 ft. Slight hump at right haunch.	14:40 00:02:17	
56.0	General Observation Remarks: Slight dent in invert at 56 ft.	16:11 00:02:33	
70.0	General Observation Remarks: View of joint at 70 ft.	17:18 00:03:03	

Distance	Fault Observation	Time	Picture
90.0	General Observation Remarks: Pipe slight racked in right crown.	18:41 00:03:48	
103.0	End Inspection Remarks: End inspection, view of laser skid at inlet.	21:21 00:04:14	

Created with the **Created** report generator

XY Diameter Summary Report

Pipe under 5% deflection in horizontal and vertical deflection plot



XY Deflection Summary Report

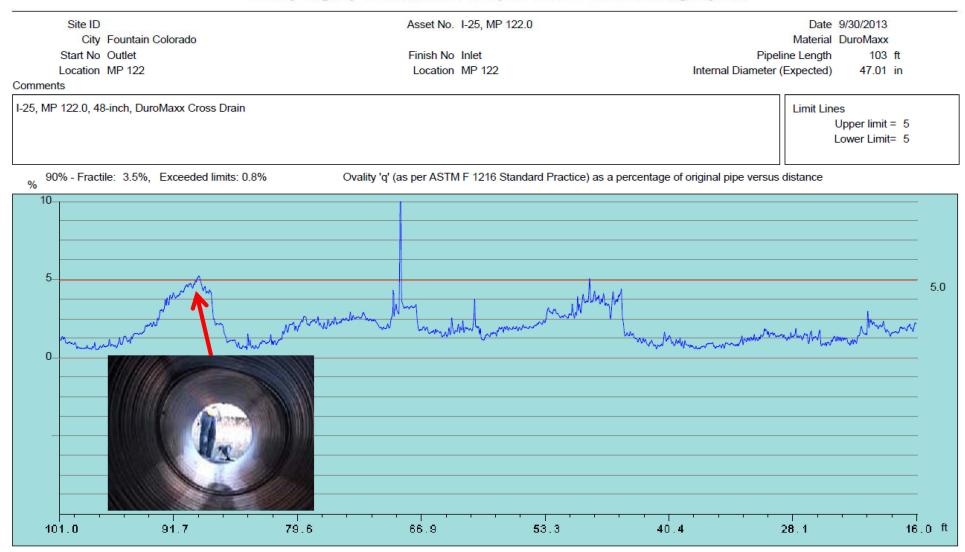
Pipe under 5% (Deflection based off Median I.D. per frame of video)

Site ID	Asset No. I-25, MP 122.0	Date 9/30/2013
City Fountain Colorado		Material DuroMaxx
Start No Outlet	Finish No Inlet	Pipeline Length 103 ft
Location MP 122	Location MP 122	Internal Diameter (Expected) 47.01 in
Comments		
I-25, MP 122.0, 48-inch, DuroMaxx Cross Drain		Limit Lines
		Upper limit = 5
		Lower Limit= -5

% 10-5.0 5-0--5--5.0 -10 91.7 28.1 101.0 79.6 66.9 53.3 40.4 16.0 ft

Ovality Summary Report

Ovality slightly over 5% at 90 ft. Spike due to camera tilting at joint.

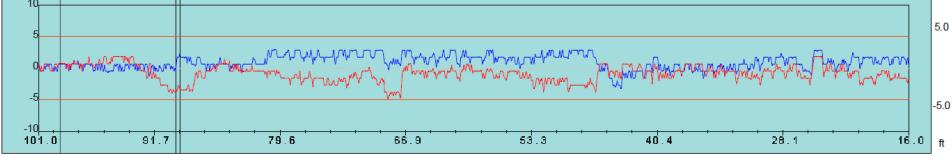




XY Diameter Observations Report

MP 122, I-25, DuroMaxx Installation, Fountain, Colorado

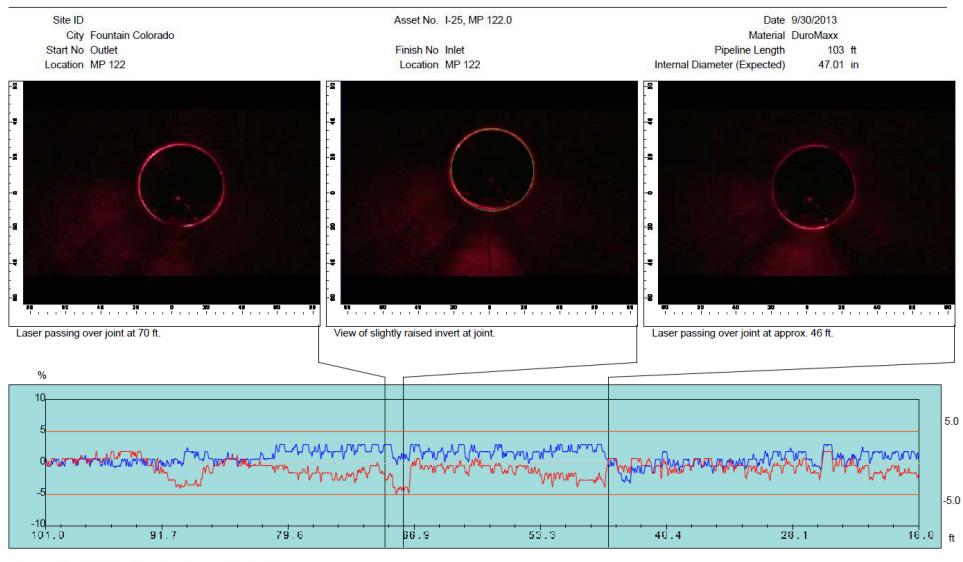




^{90% -} Fractile: (X) 2.7% : (Y) 0.7%, Exceeded limits: 0.0%

XY Diameter Observations Report

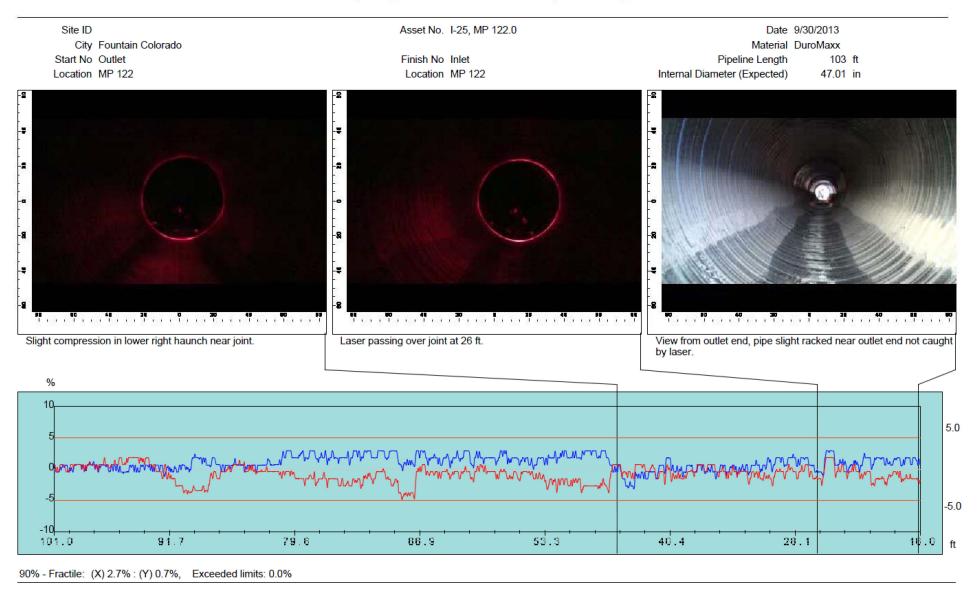
MP 122, I-25, DuroMaxx Installation, Fountain, Colorado



^{90% -} Fractile: (X) 2.7% : (Y) 0.7%, Exceeded limits: 0.0%

XY Diameter Observations Report

MP 122, I-25, DuroMaxx Installation, Fountain, Colorado



APPENDIX II – FOUNTAIN COLORADO, DUROMAXX LASER PROFILE INSPECTION, I-25, MP 122, MP 122.5, AND MP 123 (2016) LEO JOHN FLECKENSTEIN

Fountain Colorado **3 Year Performance Comparison** DuroMaxx Laser Profile Inspection1 I-25, MP 122, MP 122.5, and MP 123

R D Nixon Reservoir

September 30, 2013 vs December 5, 2016 (Draft Report December 16, 2016)

By

Leo John Fleckenstein Hydrau-Tech, Inc, And Colorado DOT **Project Summary:** A total of 5 pipes were video and laser profiled on September 30, 2013 and December 5, 2016. (A manual inspection was conducted on three additional pipes during the 2016 inspection. In 2013 a straight line/non pan and tilt portable camera unit was utilized for the inspection. In 2016 a robotic pan and tilt camera was utilized. (Images below)





Project Summary Continued: Joints were noted and observed during the both inspections. Joint separation was minor to moderate with no significant distress or soil migration observed. Some minor racking, dents, and sags were also noted. Limited construction information was available. Several of the structures have limited cover. In 2013 minor post construction damage was noted towards the ends of several of the structures as straw wattles were placed over the pipe ends and wooden stakes driven through the crown of the pipes. The stakes do not appear to causing any structural issues with the performance of the pipes. In 2016 severe damage was noted at the inlet end in two of the three pipes located at milepost 123. Apparently due to vehicle damage. In 2013 four of the five pipes were under 5% deflection for their full length. One pipe had a small localized area where pipe deflection was measured at 5.3% near the end of the structure. The non-uniform nature of the deflection and the fact that the deflected area is outside of the paved roadway would suggest that this deformation occurred during the installation process. The first 10 to 16 ft of the pipes near the outlet end of the structures could not be laser profiled due to the distance between the camera and the laser. Since the 2013 three out of the 5 pipes are showing some slight increase in deflection.



Location: Fountain Colorado Route: I-25 Pipe Use: Culvert/Cross Drain

Date Inspected: 9/30/13 (Red indicating potential changes in deflection since 2013).



Deflection data was gathered at a frame rate of approximately 1 frame per every 0.1 ft. With 180 measurements taken per frame of video. Total readings per pipe section ranged from approximately 712,000 to 770,000.

77.2% of readings below 2.5%<1.9% of readings above 5%Max deflection approximately 5.30% near inlet end (approx. 90 to 88 ft). Deflection at 5.8% in 2016, crown flattening and possible inverse curvature has occurred. Pipe moderately racked in right crown. Remainder of pipe 4% or less. Small puncture due to stake near outlet, pipe slightly racked at 8 ft. Slight hump at right haunch at 46 ft. Slight dent in invert at 56 ft										
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MP 122 9/30/2013 DuroMaxx 48-inch 103 Outlet Inlet .								below 2.5%	above 5%	inverse curvature has occurred. Pipe moderately racked in right crown. Remainder of pipe 4% or less. Small puncture due to stake near outlet, pipe slightly racked at 8 ft. Slight hump at right
	MP 122	9/30/2013	DuroMaxx	48-inch	103	Outlet	Inlet			

MP 123, I-25, 36-Inch DuroMaxx

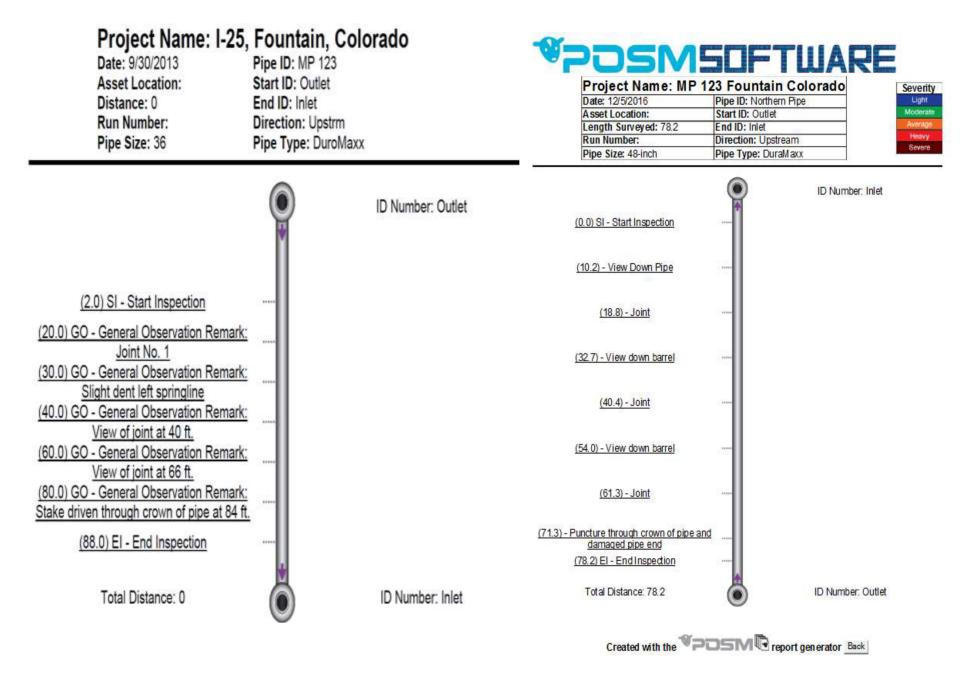
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MP 123, I-25, 36-Inch DuroMaxx Northern Pipe





Project Name: MP 123 Fountain Colorado

Date: 12/5/2016	Pipe ID: Northern Pipe		
A sset Location:	Start ID: Outlet	Start ID: Outlet	
Length Surveyed: 78.2	End ID: Inlet		
R un Number:	Direction: Upstream		
Pipe Size: 48-inch	Pipe Type: DuraM axx		

Distance	Fault Observation	Picture
0.0	Start Inspection	ADATA FOMAN TO P
10.2	ViewDown Pipe	20. 2 Pa
18.8	Joint	20 T F.
32.7	View down barrel	
40.4	Joint	46 (1 p.) 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

Project Name: I-25, Fountain, Colorado Date: 9/30/2013 Asset Location: Distance: 0 Run Number: Pipe Size: 36 Pipe Type: DuroMaxx

Fipe size.	55).	1.44	Type. Duromaxx
Distance	Fault Observation	Time	Picture
2.0	Start Inspection	01:14 00:00:00	
20.0	General Observation Remarks: Joint No. 1	03:13 00:00:26	
30.0	General Observation Remarks: Slight dent left springline	07:04 00:00:40	

Distance	Fault Observation	Time	Picture	Distance	Fault Observation	Picture
40.0	General Observation Remarks: View of joint at 40 ft. 00:00:45		54.0	View down barrel		
	Remarks: View of joint at 40 ft.	00:00:45		61.3	Joint	tion to
60.0	0.0 General Observation Remarks: View of joint at 66 ft. 00:01:13		71.3	Puncture through crown of pipe and damaged pipe end		
				78,2	E nd Inspection	
80.0	General Observation Remarks: Stake driven through crown of pipe at 84 ft.	12:37 00:01:45			Created with the POST	report generator Back

Distance	Fault Observation	Time	Picture
88.0	End Inspection	13:48 00:01:55	

Created with the **POSM** report generator

XY Diameter Summary Report

Pipe well under 5% deflection, spikes in data due to camera tilting at joint

						-
Site ID		Asset No.	I-25, MP 123		Date 9/30/201	3
City Fountai	n, Colorado				Material DuroMax	x
Start No North P	ipe	Finish No	North Pipe	Pipeli	ine Length 8	8 ft
Location Outlet		Location	Inlet	Internal Diameter (Expected) 34.9	2 in
Comments						
Northern most pipe of three	e at MP 123				Limit Lines Upper lim Lower Lin	
90% - Fractile: (X) 1	1.1% : (Y) 0.7%, Exceede	d limits: 2.6%				
10		X Y Diameter				
		X diameter and Y diameter are disp internal diameter. Where no diamet a single radius has been obtained,	layed as a percentage variance from the er reading exists (due to radial point mis the radius is multiplied by a factor of 2.	expected ising) but		
5		Blue line = X diameter Red line = Y diameter				5.0
						1
o www.mortype					AN PREMIMAN	
-5-		N N	K			
				R		-5.0
-10	78.7	70.9 60.4	47.5	34.4	21.4	10.0 ft

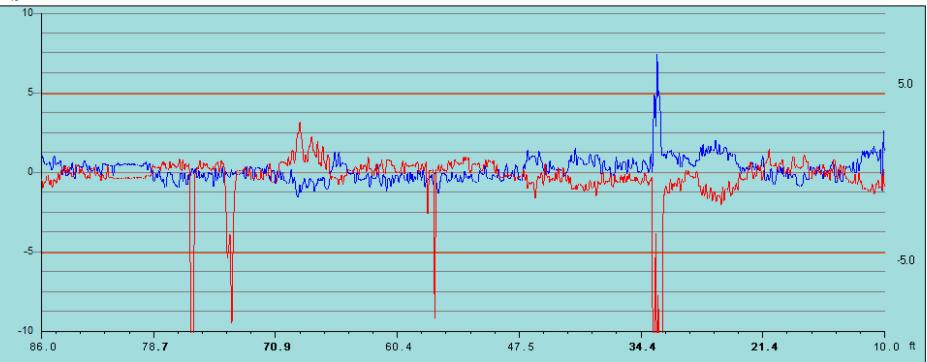
Fractile: 10% of the data points are above 1.1% for X and 0.7% for Y. 2.6% exceeds 5% limits lines. The spikes/scatter in data (2.6%) are due to the laser skid and/or the camera tilting on the weld at the joint. Spikes can also occur due to the loss of laser light at the joint.

XY Deflection Summary Report

Pipe under 5% (Deflection based off Median I.D. per frame of video)

Site ID		Asset No. I-25, MP 123	Date 9/30/2013
City	Fountain, Colorado		Material DuroMaxx
Start No	North Pipe	Finish No North Pipe	Pipeline Length 88 ft
Location	Outlet	Location Inlet	Internal Diameter (Expected) 34.92 in
Comments			
Northern most pipe	of three at MP 123		Limit Lines Upper limit = 5 Lower Limit= -5

%

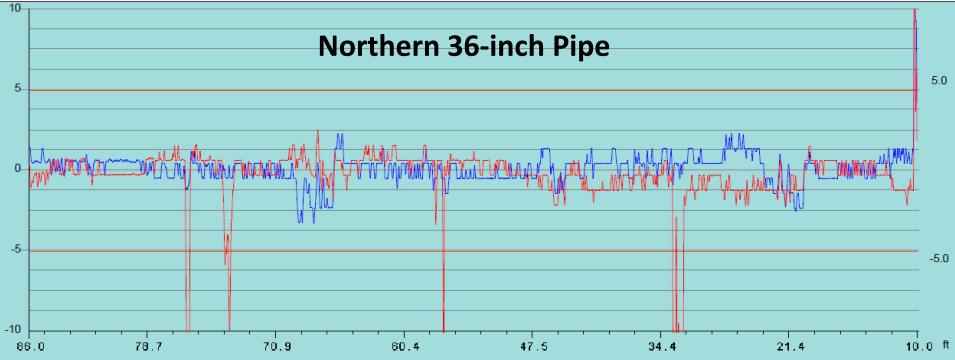


Ovality Summary Report

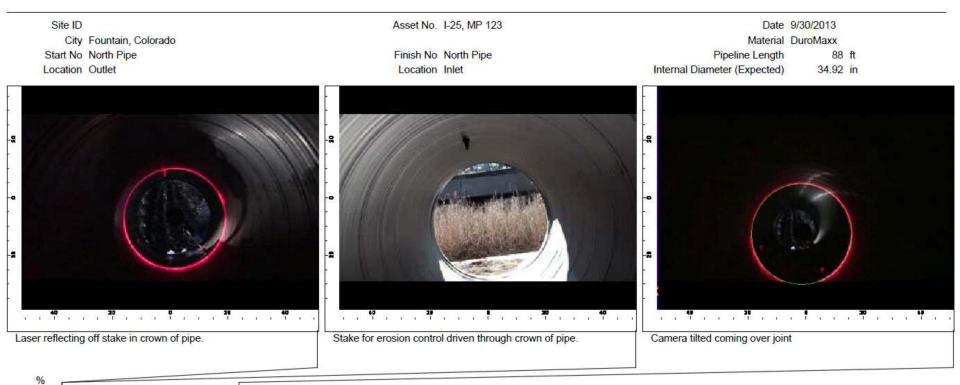
Ovality under 5%, spikes due to camera going over joints

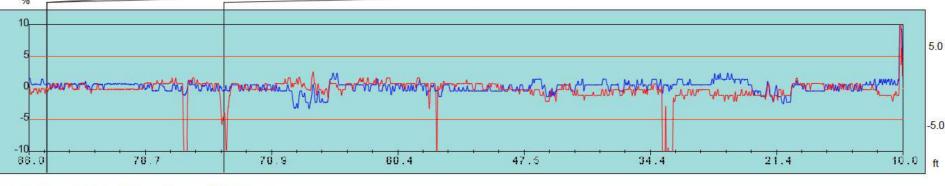
	Site ID			Asset No.	I-25, MP 123	Date	9/30/2013	
	City Fountain, Colorado					Material	DuroMaxx	
	Start No North Pipe			Finish No	North Pipe	Pipeline Length	88 ft	
	Location Outlet			Location		Internal Diameter (Expected)		
Comment				200000				
Northern	most pipe of three at MP 123					Limit Lir	nes Upper limit = 5 Lower Limit= 5	
90°	% - Fractile: 1.8%, Exceeded I	limits: 2.7	7% Ov	ality 'q' (as per ASTM	I F 1216 Standard Practice) as a percentage o	of original pipe versus distance		
10_								_
5_		<u> </u>					r	0
						1	D.	.0
				1		1		
	1		Adul				m	
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0_								
					Ovality			
						202 9 9 9	8 925 8	
					The ovality graph shows how oval or due to deformation. This is displayed round pipe.	'out of round' a pipe's cross-se I as a positive percentage and	ction has become 0% is a perfectly	
_					The formula is based upon the Ameri standards where it states;	ican Society for Testing and Ma	terials F1216	
					q = percentage of ovality of original	pipe = 100 x (Maximum Inside Diameter Mean Inside	- Mean Inside Diameter) 2 Diameter	
86	5 .0 78 .7		70.9	60.4	47.5 34.	4 21.4	10.0	ft





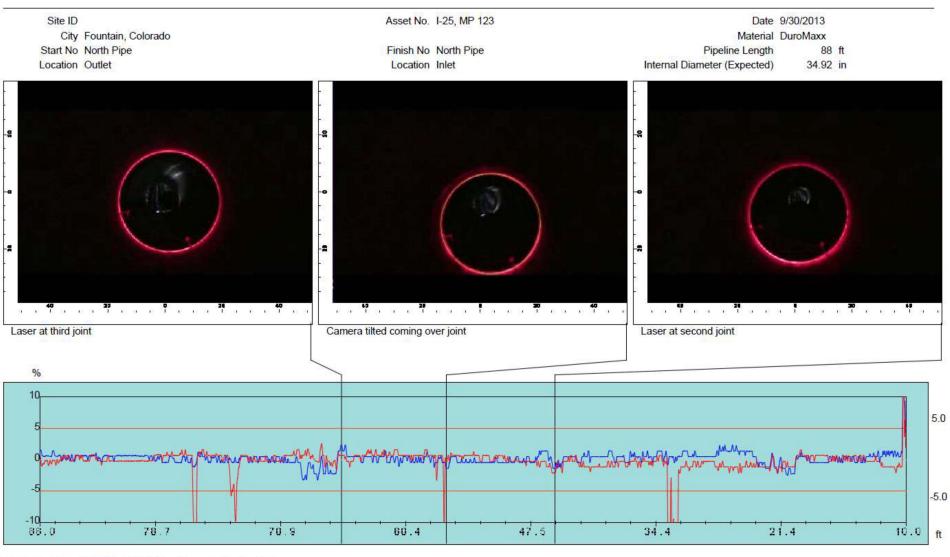
MP 123, I-25, DuroMaxx Installation, Fountain, Colorado





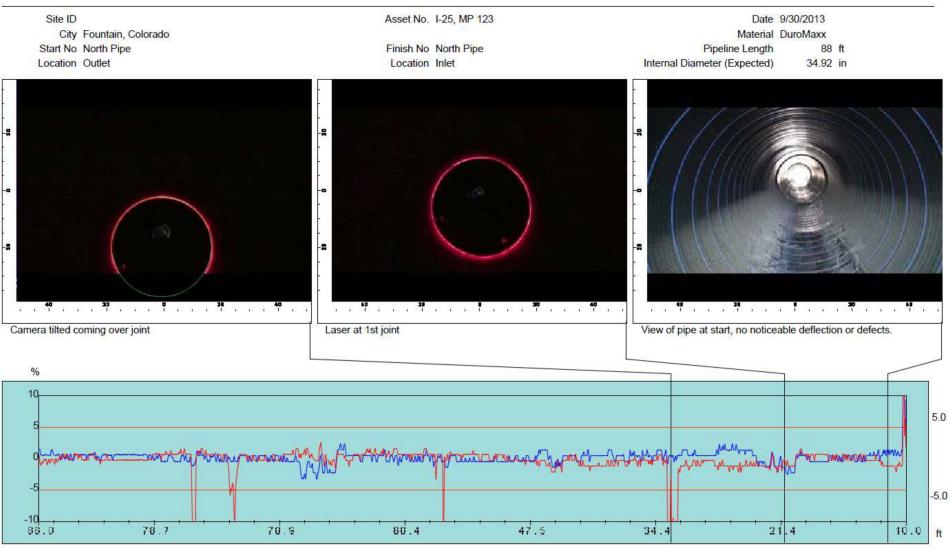
90% - Fractile: (X) 1.1% : (Y) 0.7%, Exceeded limits: 2.6%

MP 123, I-25, DuroMaxx Installation, Fountain, Colorado



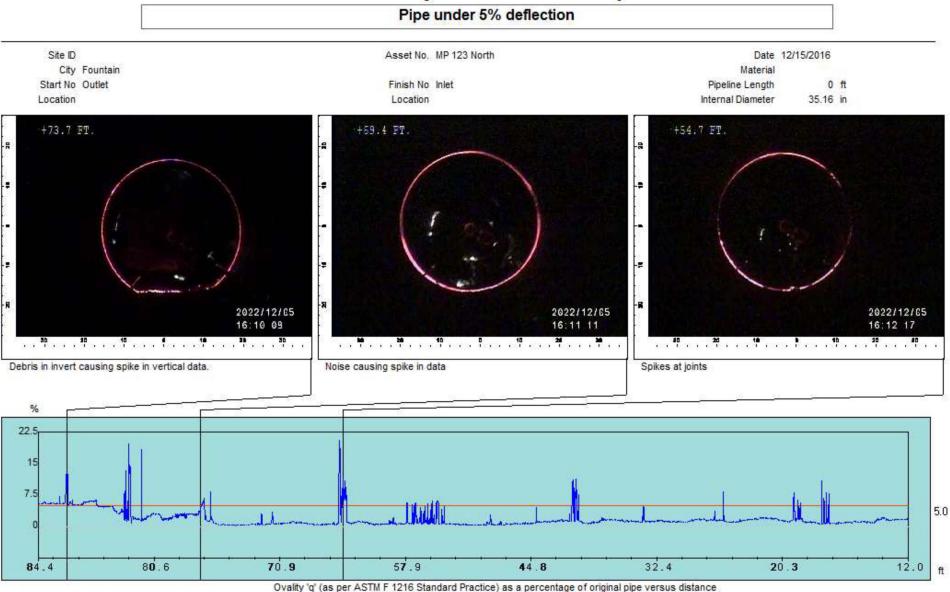
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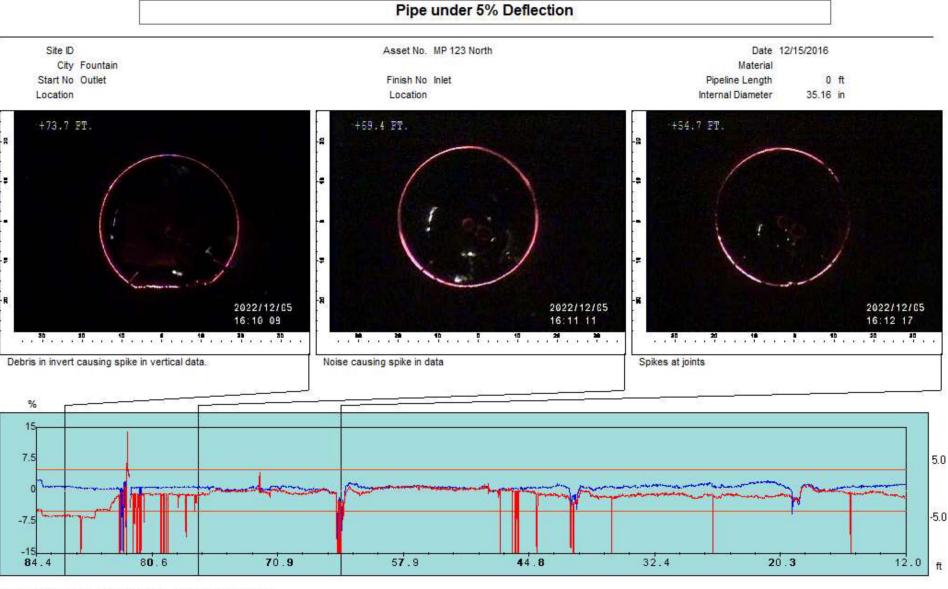
MP 123, I-25, DuroMaxx Installation, Fountain, Colorado



90% - Fractile: (X) 1.1% : (Y) 0.7%, Exceeded limits: 2.6%

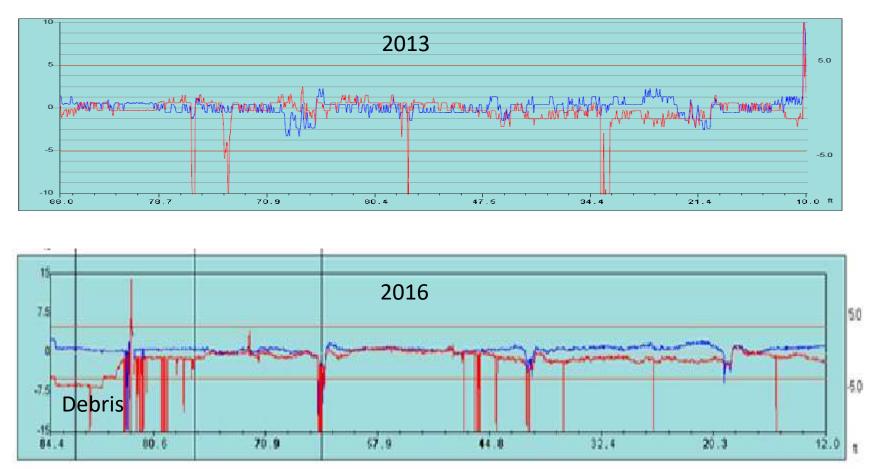
Ovality Observations Report





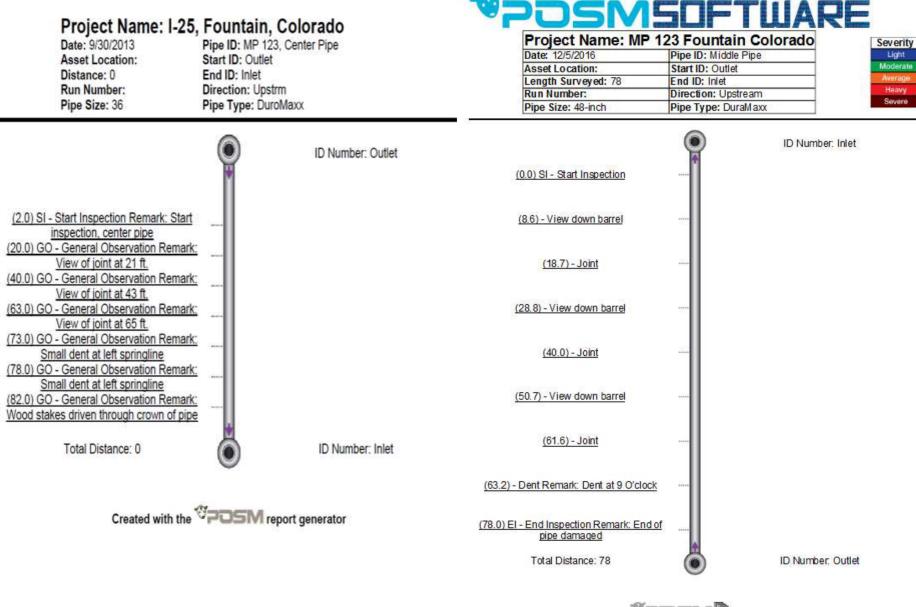
90% - Fractile: (X) 1.3% : (Y) 0.4%, Exceeded limits: 4.7%

Performance Summary MP 123 (Northern Pipe)



The inlet end of the structure had been severely damaged by a vehicle, minor punctures from construction stakes were still visible. Overall no significant change was observed in the overall condition or shape of the structure.

MP 123, I-25, 36-Inch DuroMaxx Center Pipe



Created with the POSM report generator Back



Froject Name. MF 125 Fountain Colorado				
Date: 12/5/2016	Pipe ID: Middle Pipe			
Asset Location:	Start ID: Outlet			
Length Surveyed: 78	End ID: Inlet			
Run Number:	Direction: Upstream			
Pipe Size: 48-inch	Pipe Type: DuraMaxx			

Distance	Fault Observation	Picture
0.0	Start Inspection	
8.6	View down barrel	-starter
18.7	Joint	e and all and all all all all all all all all all al
28.8	View down barrel	And
40.0	Joint	C. C

Project Name: I-25, Fountain, Colorado Pipe ID: MP 123, Center Pipe Start ID: Outlet

Date: 9/30/2013 Asset Location: Distance: 0 Run Number: Pipe Size: 36 Pipe ID: MP 123, Center Pipe Start ID: Outlet End ID: Inlet Direction: Upstrm Pipe Type: DuroMaxx

Distance	Fault Observation	Time	Picture
2.0	Start Inspection Remarks: Start inspection, center pipe	01:09 00:00:00	
20.0	General Observation Remarks: View of joint at 21 ft.	04:45 00:01:14	
40.0	General Observation Remarks: View of joint at 43 ft.	05:44 00:01:39	

Distanc	Fault Observation	Time	Picture		· · · · · · · · · · · · · · · · · · ·	
Distanc	Fault Observation	TIME	Ficture	Distance	Fault Observation	Picture
63.0	General Observation Remarks: View of joint at 65 ft.	07:52 00:02:14		50.7	View down barrel	ECOMPACE
				61.6	Joint	Market M
73.0	General Observation Remarks: Small dent at left springline	09:22 00:02:30		63.2	Dent Remarks: Dent at 9 O'clock	NERT.
78.0	General Observation Remarks: Small dent at left	10:33 00:02:53		78.0	End Inspection Remarks: End of pipe damaged	B C C C C C C C C C C C C C C C C C C C
	78.0 Remarks: Small dent at left springline	00.02.53			Created with the VPOST	report generator Back

Distance	Fault Observation	Time	Picture
82.0	General Observation Remarks: Wood stakes driven through crown of pipe	11:40 00:03:10	

Created with the **OPDSM** report generator

XY Diameter Summary Report

Pipe under 5% deflection, spikes in data due to camera tilting at joint

S	Site ID City Fountain, C Start No Center Pipe ocation Outlet			I-25, MP 123 Center Pipe Inlet			
Comments							
MP 123, I-	-25, Cross Drain, Ce	nter Pipe				es Upper limit = 5 Lower Limit= -5	
% ^{90%}	6 - Fractile: (X) 2.1%	: (Y) 1.3%, Exceeded lin	nits: <mark>4</mark> .3%		[
10 5 0		JA WALAND A				5.0	
-5					id tilting on joint	-5.0	
-10 85.			in data due to ca	mera or laser sk	id tilting on joint		l ft

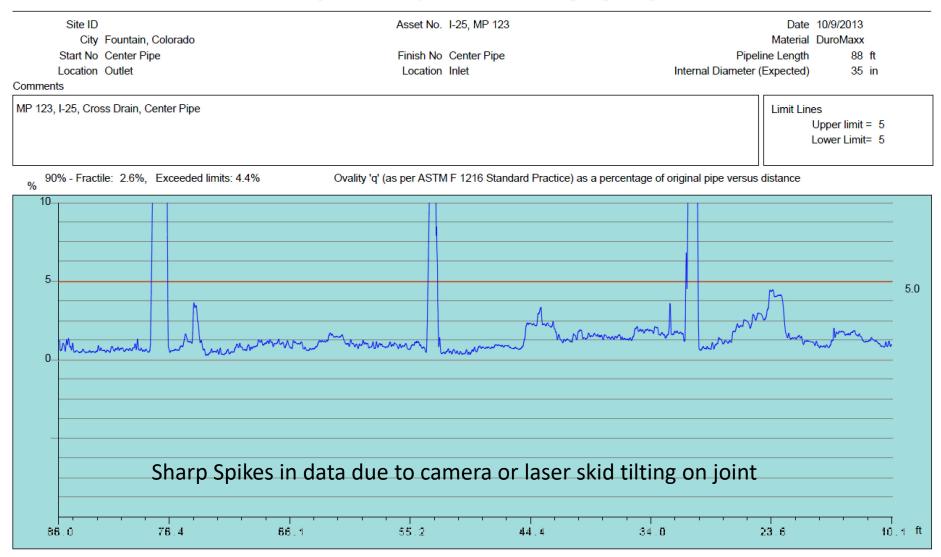
XY Deflection Summary Report

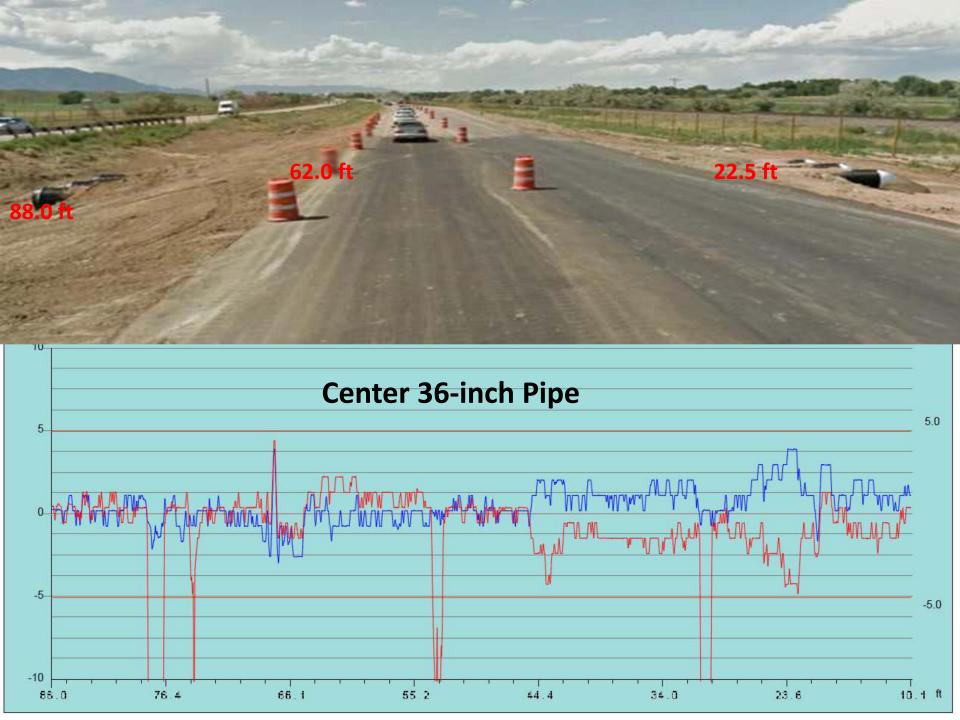
Pipe under 5% (Deflection based off Median I.D. per frame of video)

Site ID		Asset No.	I-25, MP 123		Date 10/9/2013	
City Founta	in, Colorado				Material DuroMaxx	
Start No Center	Pipe	Finish No	Center Pipe	Pip/	eline Length 88 ft	
Location Outlet		Location	Inlet	Internal Diameter	r (Expected) 35 in	
Comments						
MP 123, I-25, Cross Drain,	Center Pipe				Limit Lines Upper limit = 5 Lower Limit= -5	
%						
10						
5						5.0
		company with a state on	- Ay marking	monthing with	M La radio	
0 harden	A Wanter and a survey	Martin - aller and	all the all warmen and the area	man mar A Mart	AMMANAN	
					-h / · · · · · ·	
-5					W	-5.0
						-0.0
-10		₁ 🌡				
86.0	76. 4 66 .1	I 55.2	44.4	34.0	23.6 10.1	1 ft

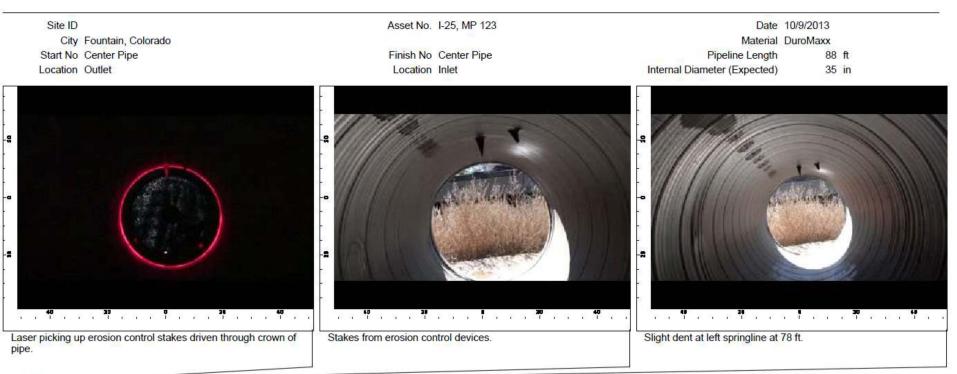
Ovality Summary Report

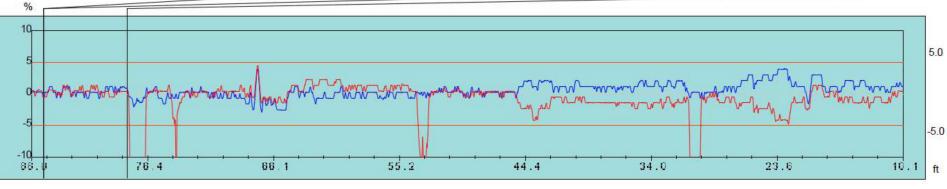
Ovality under 5%, spikes due to camera going over joints





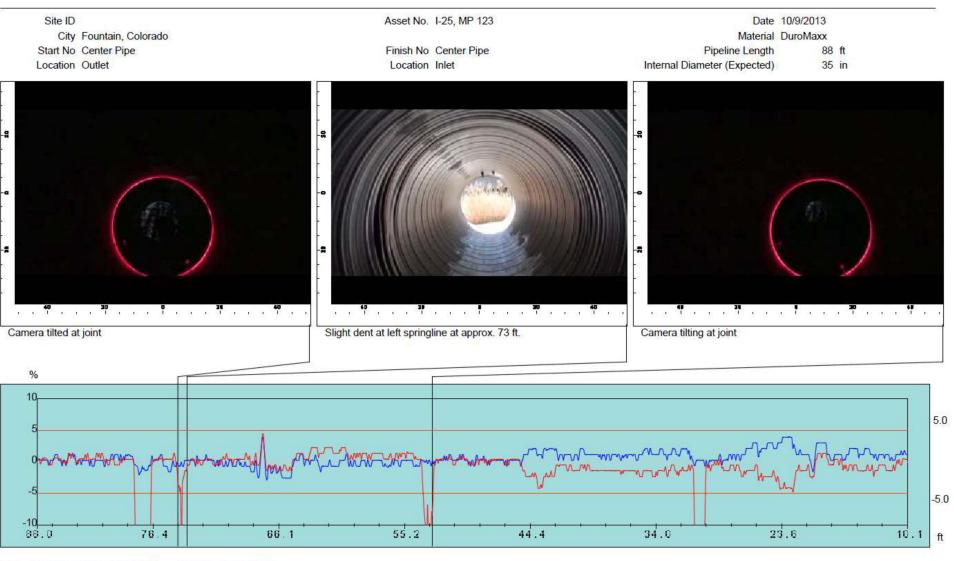
MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Center Pipe)





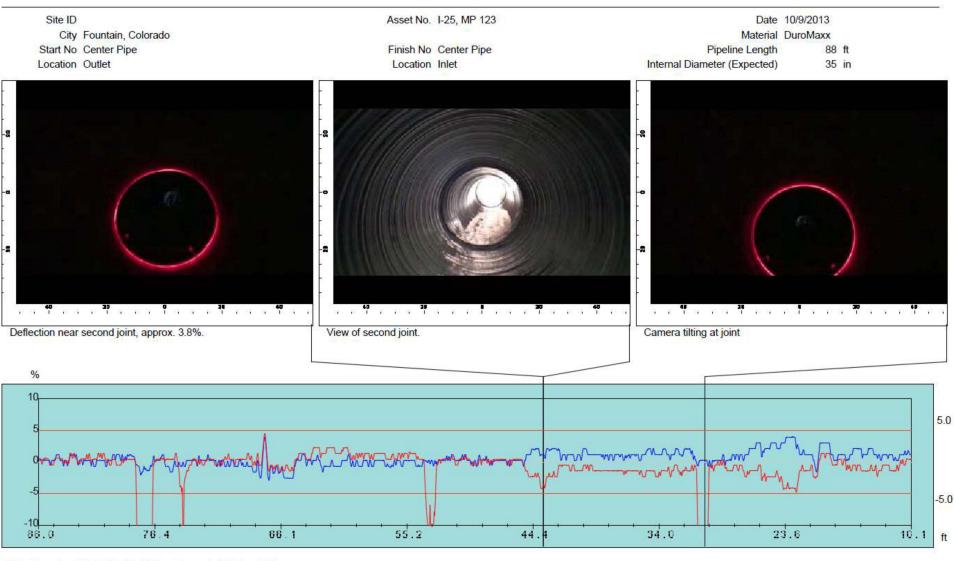
90% - Fractile: (X) 2.1% : (Y) 1.3%, Exceeded limits: 4.3%

MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Center Pipe)



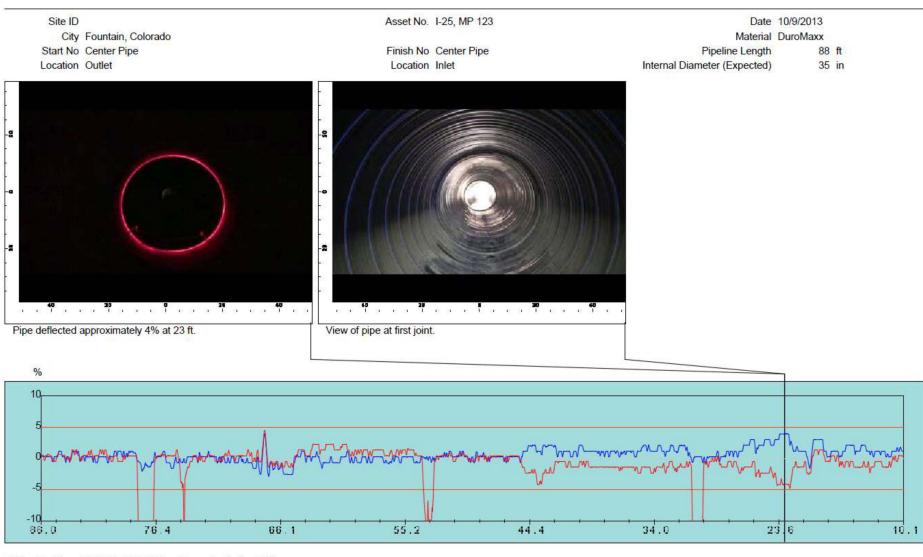
^{90% -} Fractile: (X) 2.1% : (Y) 1.3%, Exceeded limits: 4.3%

MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Center Pipe)



90% - Fractile: (X) 2.1% : (Y) 1.3%, Exceeded limits: 4.3%

MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Center Pipe)

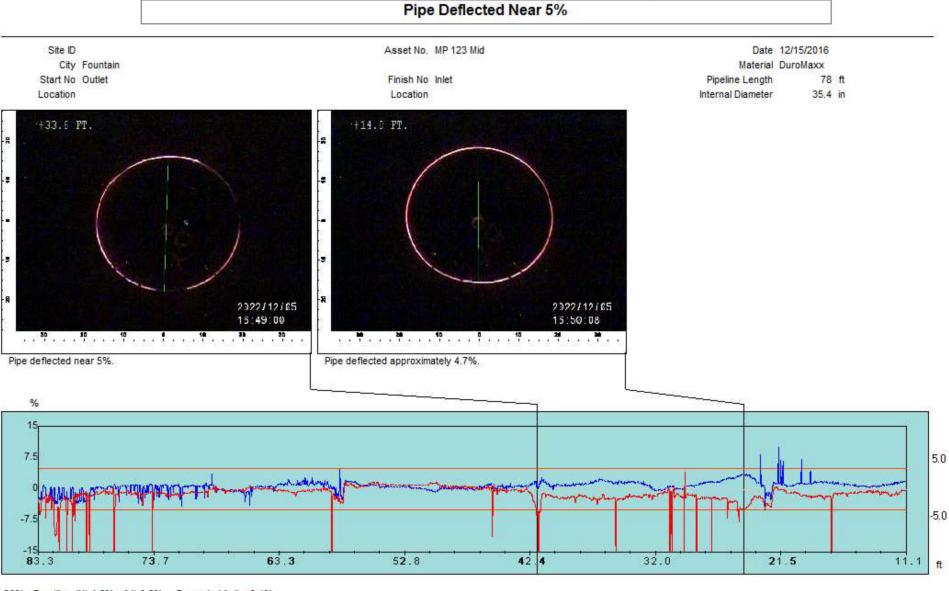


5.0

-5.0

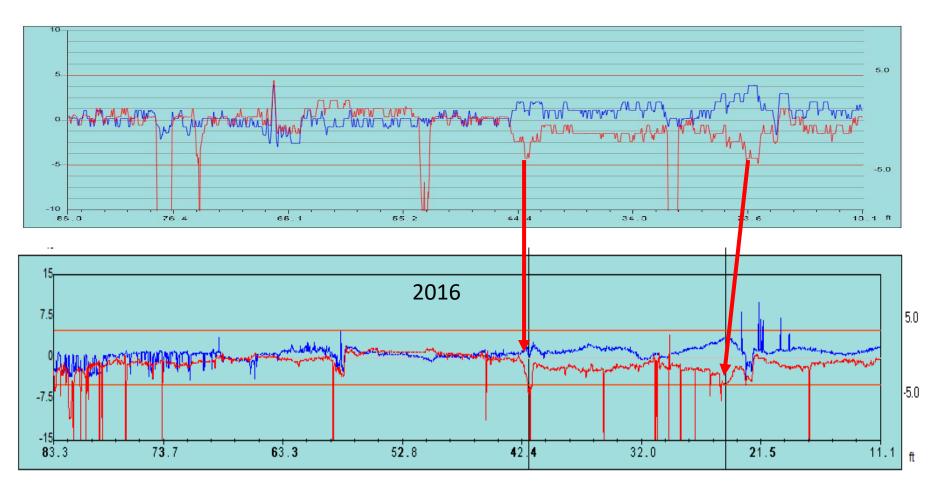
ft

90% - Fractile: (X) 2.1% : (Y) 1.3%, Exceeded limits: 4.3%



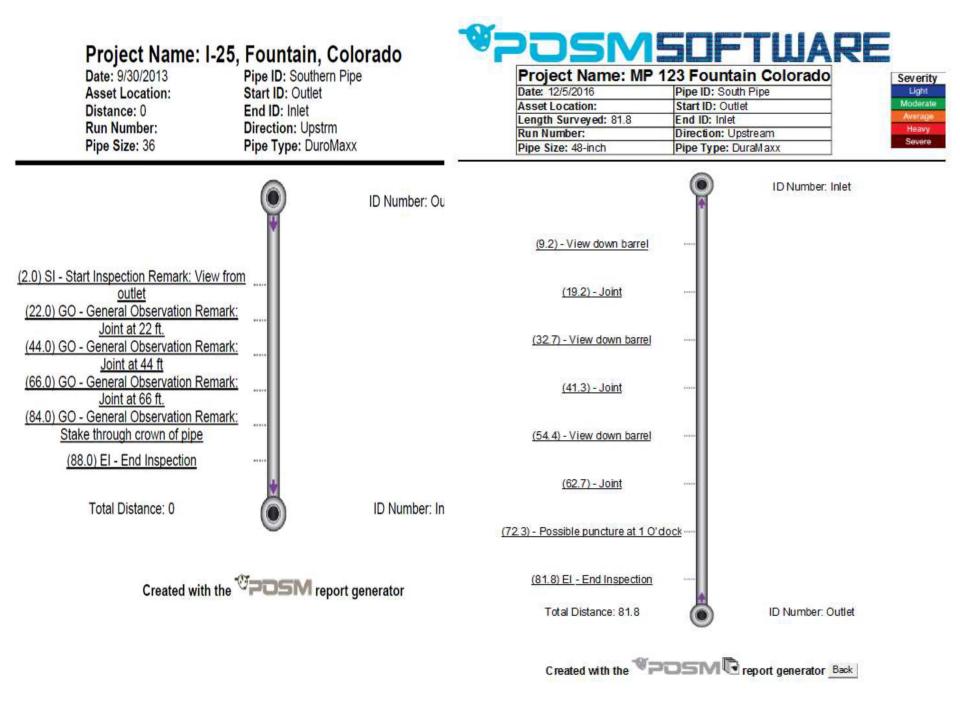
90% - Fractile: (X) 1.8% : (Y) 0.8%, Exceeded limits: 3.4%

Performance Summary MP 123 (Middle Pipe)



The inlet end of the structure had been severely damaged by a vehicle, minor punctures from construction stakes were still visible. It appears that some possible slight increase in deflection has occurred around at 23 and 42 ft. Deflection at 5%.

MP 123, I-25, 36-Inch DuroMaxx Southern Pipe



Pre	oject Name: I-25, Fountain, Colorado
Date: 9/30/2013	Pipe ID: Southern Pipe
Asset Location:	Start ID: Outlet
Distance: 0	End ID: Inlet
Run Number:	Direction: Upstrm
Pipe Size: 36	Pipe Type: DuroMaxx

Distance	Fault Observation	Time	Picture
2.0	Start Inspection Remarks: View from outlet	01:47 00:00:00	
22.0	General Observation Remarks: Joint at 22 ft.	2:30:17 00:00:36	
44.0	General Observation Remarks: Joint at 44 ft	2:31:30 00:01:05	

Project Name: MP 123 Fountain Colorado

Date: 12/5/2016	Pipe ID: South Pipe	
Asset Location:	Start ID: Outlet	
Length Surveyed: 81.8	End ID: Inlet	
Run Number:	Direction: Upstream	
Pipe Size: 48-inch	Pipe Type: Dural axx	

Distance	Fault Observation	Picture
9.2	Viewdown barrel	ACTION OF ACTION
19.2	Joint	HE S H
32.7	Viewdown barrel	12 200 12 200 12 200 10 200 10 200 10 200
41.3	Joint	Stanta de
54.4	Viewdown barrel	4-2 ± 11 5423461.42 11 * 73.44

Distance	Fault Observation	Time	Picture
<u>66.0</u>	General Observation Remarks: Joint at 66 ft.	2:32:18 00:01:26	
84.0	General Observation Remarks: Stake through crown of pipe	2:33:18 00:01:54	
88.0	End Inspection	2:33:47 00:02:01	A REAL PROPERTY

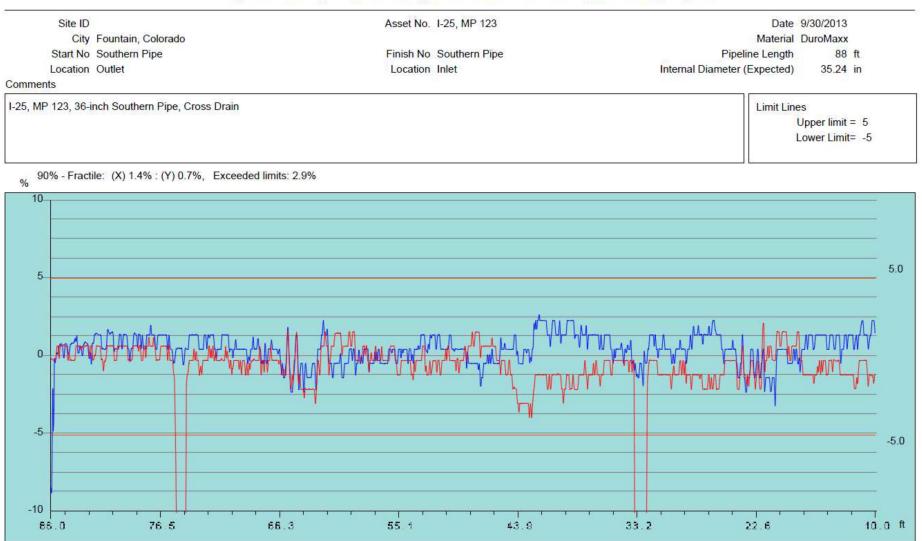


Distance	Fault Observation	Picture		
62.7	Joint	ALCONTRACTOR		
72.3	Possible puncture at 1 O'clock	ACCARD BALIELAN PLATE		
81.8	End Inspection			

Created with the TOSM report generator Back

XY Diameter Summary Report

Pipe under 5% deflection, spikes in data due to camera tilting at joint

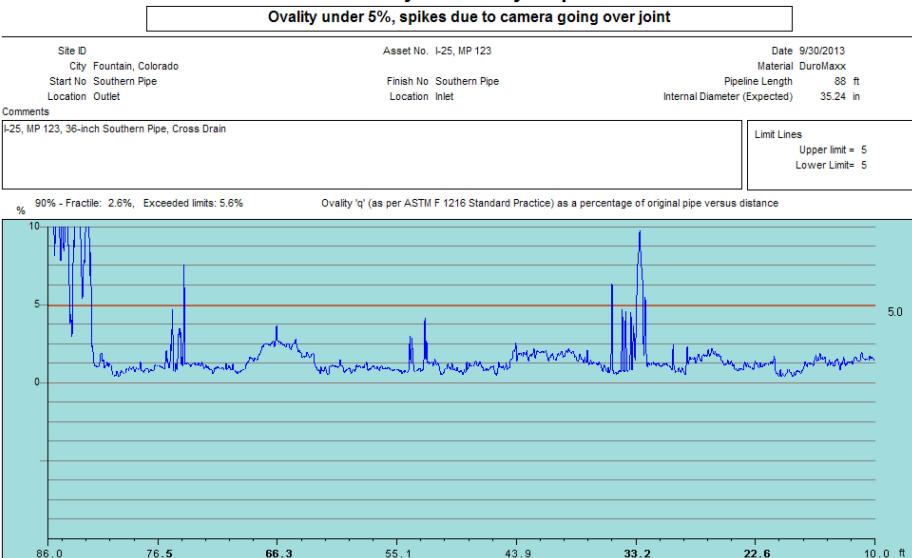


XY Deflection Summary Report

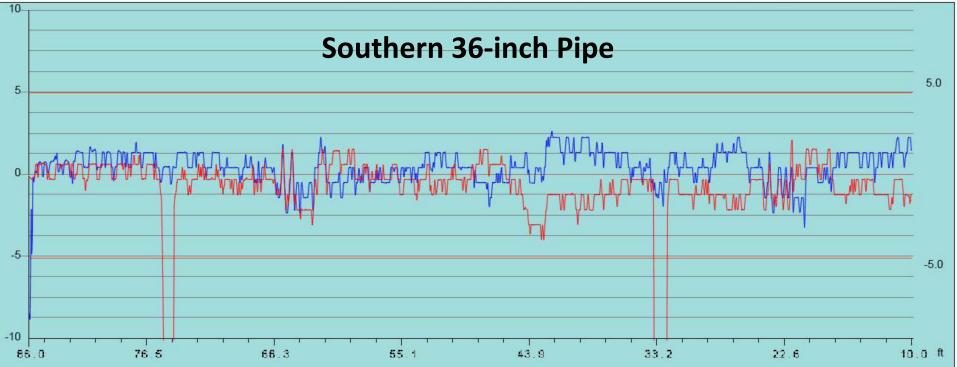
Pipe under 5% (Deflection based off Median I.D. per frame of video)

Site ID		Asset No.	I-25, MP 123		Date 9/30/2013	
City Fou Start No Sou	untain, Colorado uthern Pine	Finish No	Southern Pipe	Pipeline	Material DuroMaxx Length 88 ft	
					Diameter (Expected) 35.24 in	
Comments						
I-25, MP 123, 36-inch S	Southern Pipe, Cross Drain			L	imit Lines Upper limit = 5 Lower Limit= -5	
%						
			Marking Ma Marking Marking Mar	han	Man Marine A	5.0
-5	76. 5	66.3 55.1	43.9 33 .	2 22		-5.0 .0 ft
00.0	70.0	00.3 55.1	43.5 33.	2 22	.0 10.	.0 11

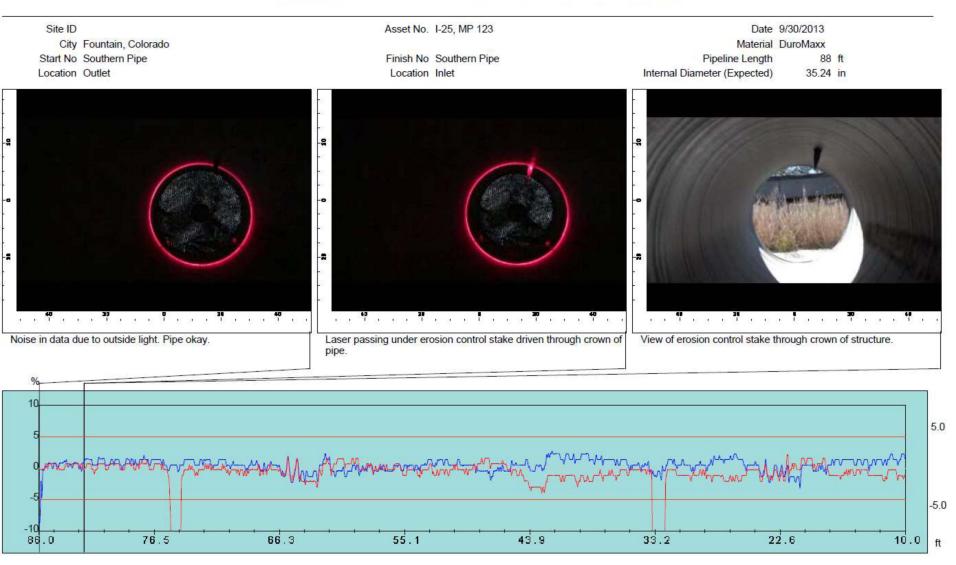
Ovality Summary Report





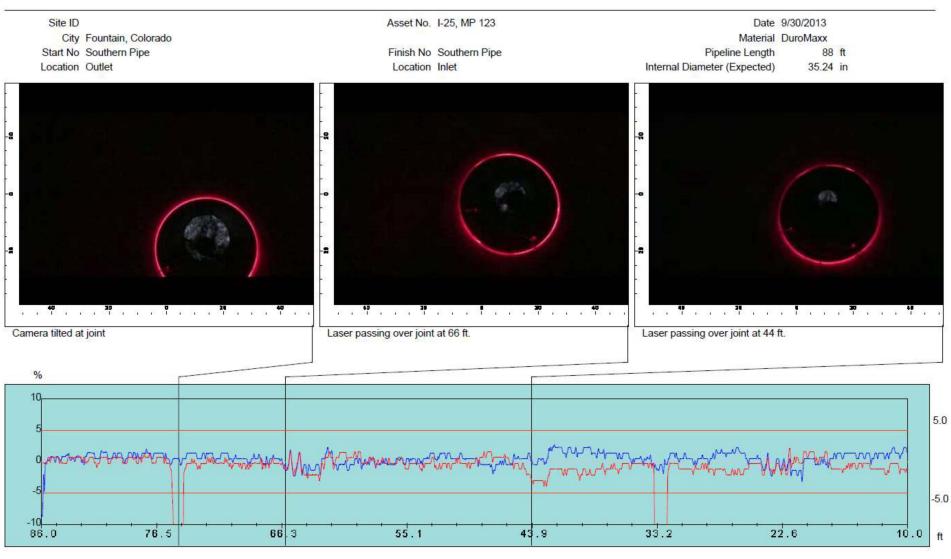


MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Southern Pipe)



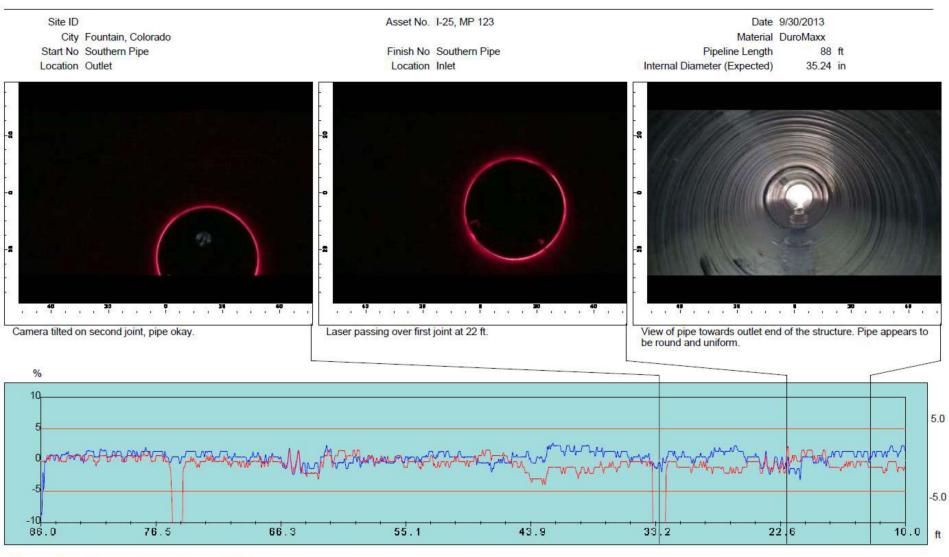
90% - Fractile: (X) 1.4% : (Y) 0.7%, Exceeded limits: 2.9%

MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Southern Pipe)



90% - Fractile: (X) 1.4% : (Y) 0.7%, Exceeded limits: 2.9%

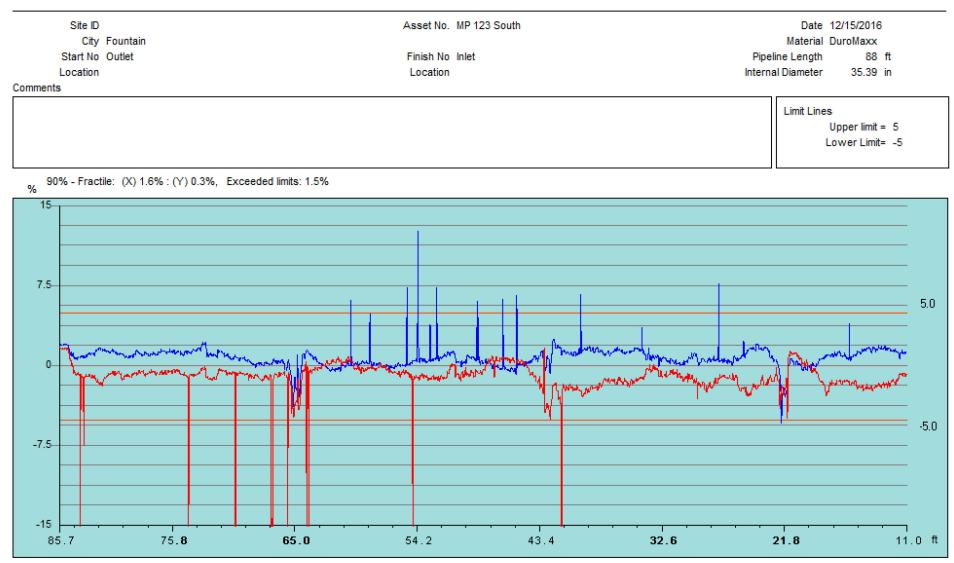
MP 123, I-25, DuroMaxx Installation, Fountain, Colorado (Southern Pipe)



^{90% -} Fractile: (X) 1.4% : (Y) 0.7%, Exceeded limits: 2.9%

XY Diameter Summary Report

Pipe under 5.0% Deflection



Performance Summary MP 123 (Southern Pipe)



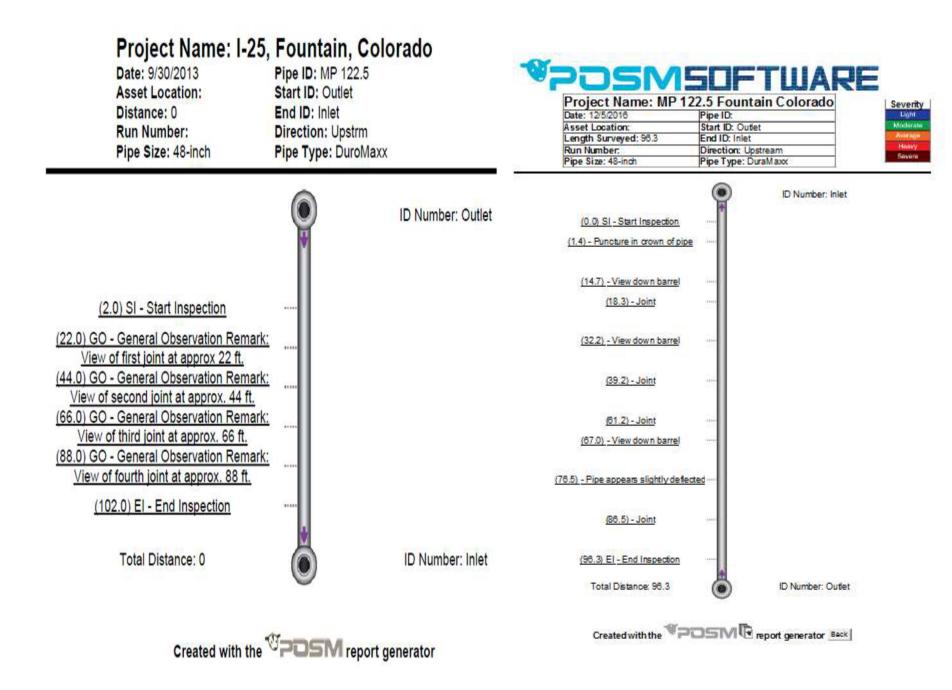
Minor punctures from construction stakes were still visible at the inlet end. Deflections are still below 5%. Some slight possible movement might have occurred around 44 ft.

MP 122.5, I-25, 48-Inch DuroMaxx









Project Name: I-25, Fountain, Colorado

Date: 9/30/2013 Asset Location: Distance: 0 Run Number: Pipe Size: 48-inch Pipe ID: MP 122.5 Start ID: Outlet End ID: Inlet Direction: Upstrm Pipe Type: DuroMaxx

Distance	Fault Observation	Time	Picture
2.0	Start Inspection	04:18 00:00:00	O
22.0	General Observation Remarks: View of first joint at approx 22 ft.	06:09 00:00:48	
44.0	General Observation Remarks: View of second joint at approx. 44 ft.	07:51 00:01:24	

POSMSOFTWARE

Project Name: MP 122.5 Fountain Colorado

Date: 12/5/2018	Pipe ID:		
Asset Location:	Start ID: Outlet		
Length Surveyed: 96.3	End ID: Inlet		
Run Number:	Direction: Upstream		
Pipe Size: 48-inch	Pipe Type: DuraMaxx		

Distance	Fault Observation	Picture		
0.0	Start Inspection			
1.4	Puncture in crown of pipe			
14.7	View down barrel			
18.3	Joint			
32.2	View down barrel			

Distance	Fault Observation	Time	Picture	Distance	Fault Observation	Picture
66.0	General Observation Remarks: View of third joint at	10:39		39.2	Joint	
	approx. 66 ft.	00:01:53	KLOLUZZE MPH (MIL)	61.2	Joint	
88.0	General Observation Remarks: View of fourth joint at approx. 88 ft.	11:51	67.0	View down barrel		
		00:02:27	H H HP OF HT H	76.5	Pipe appears slightly deflected	511 S ⁴
102.0	End Inspection	13:12 00:03:15		86.5	Joint	and the second sec
		00.03.15		96.3	End Inspection	

Created with the ***POSM** report generator

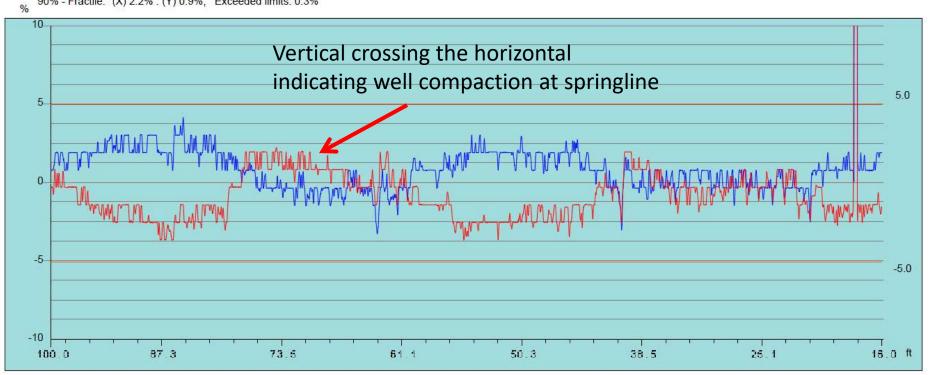
Created with the POSM report generator

XY Diameter Summary Report

Pipe under 5% deflection, spikes in data due to camera tilting at joint

Site ID	Asset No. I-25, MP 122.5	Date	9/30/2013
City Fountain, Colorado		Material	DuroMaxx
Start No Outlet	Finish No Inlet	Pipeline Length	102 ft
Location MP 122.5	Location MP 122.5	Internal Diameter (Expected)	46.92 in
nments		Extended the second the	
5, MP 122.5, 48-inch DuroMaxx			es Upper limit = 5 Lower Limit= -5

- Fractile: (X) 2.2% : (Y) 0.9%, Exceeded limits: 0.3% 90%

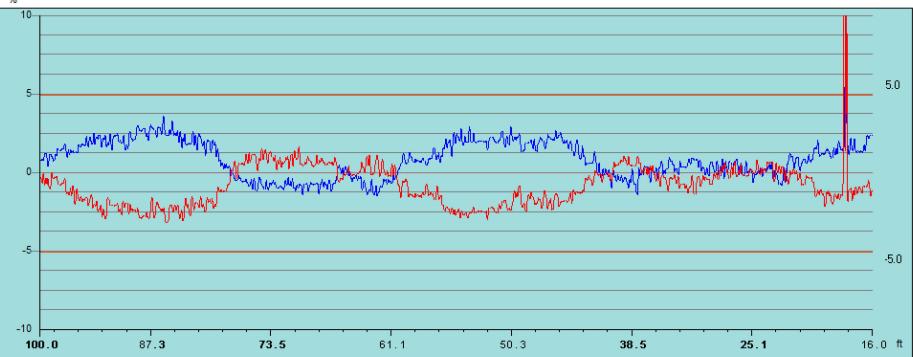


XY Deflection Summary Report

Pipe under 5% (Deflection based off Median I.D. per frame of video)

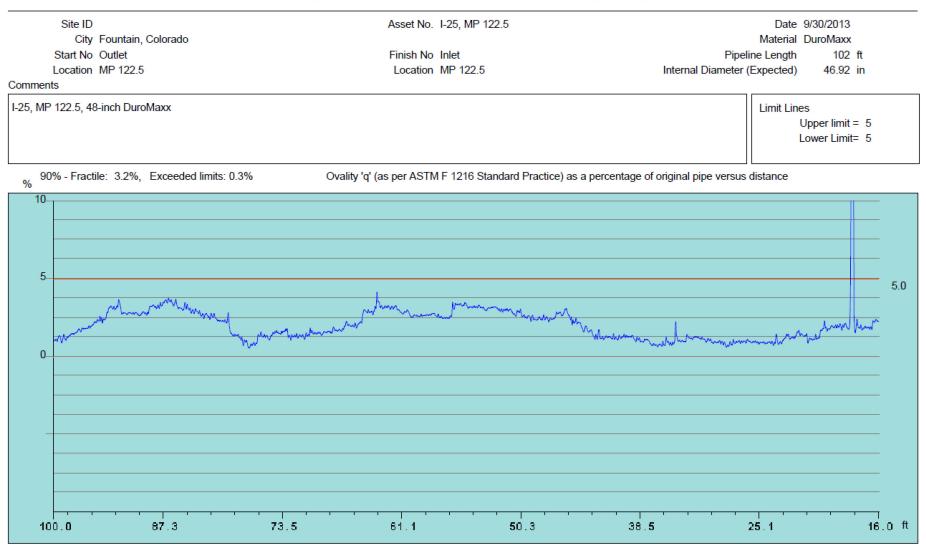
Site ID		Asset No.	I-25, MP 122.5		Date	9/30/2013	
City	Fountain, Colorado				Material	DuroMaxx	
Start No	Outlet	Finish No	Inlet	Pipeli	ine Length	102	ft
Location	MP 122.5	Location	MP 122.5	Internal Diameter (Expected)	46.92	in
Comments							
I-25, MP 122.5, 48-	inch DuroMaxx				Limit Line	es Upper limit Lower Limi	

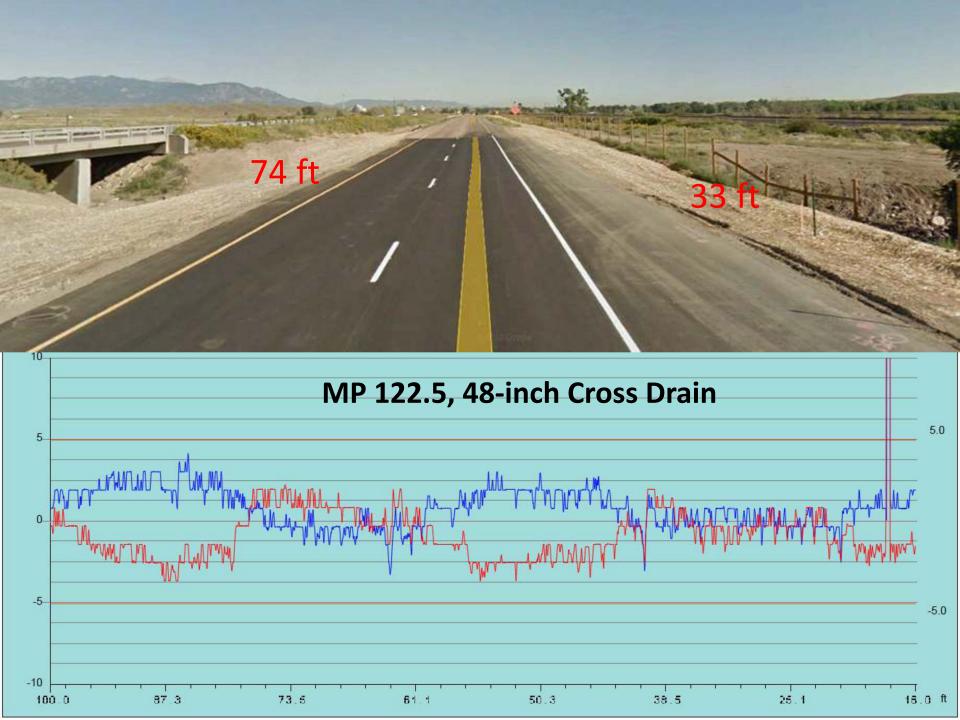




Ovality Summary Report

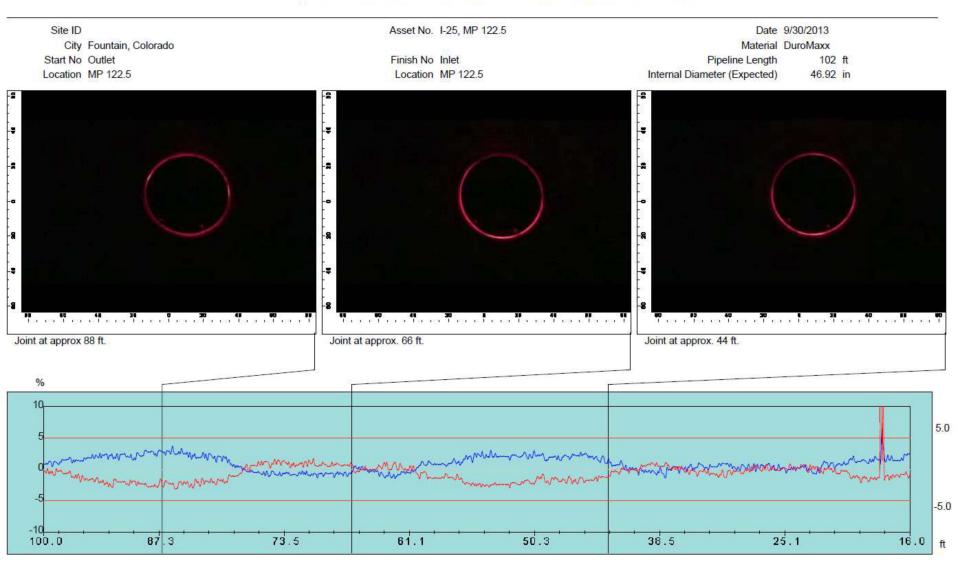
Ovality under 5%, spikes due to camera going over joint





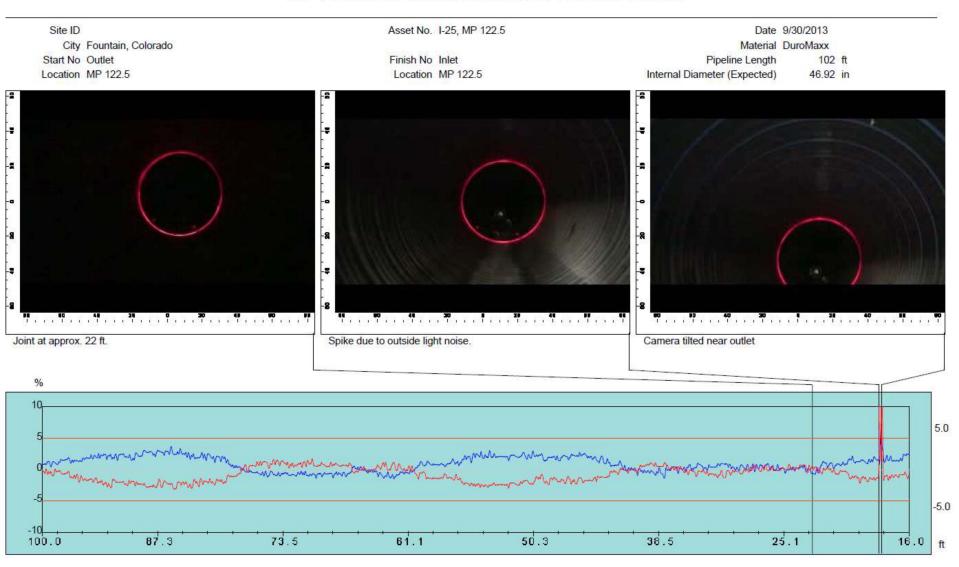
XY Deflection Observations Report

MP 122.5, I-25, DuroMaxx Installation, Fountain, Colorado



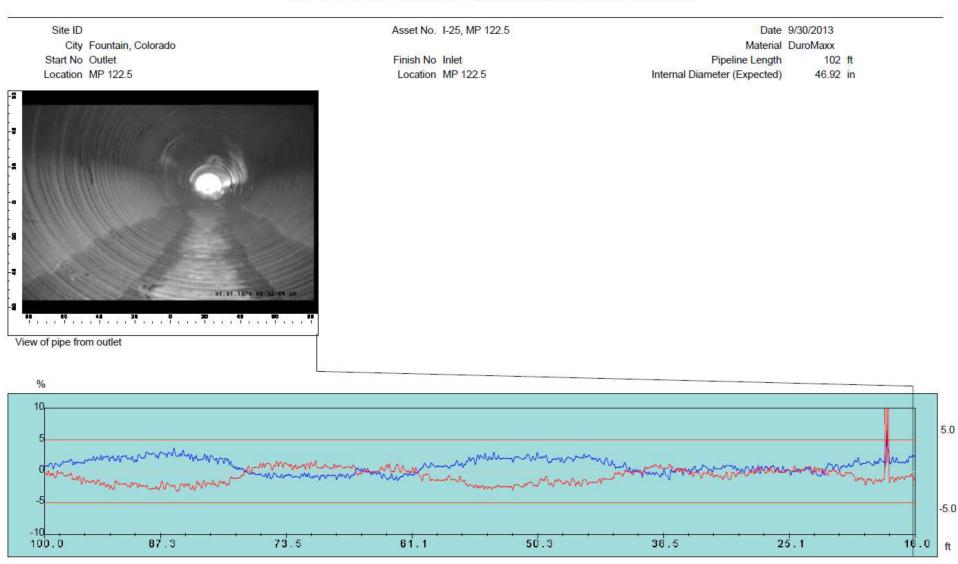
XY Deflection Observations Report

MP 122.5, I-25, DuroMaxx Installation, Fountain, Colorado

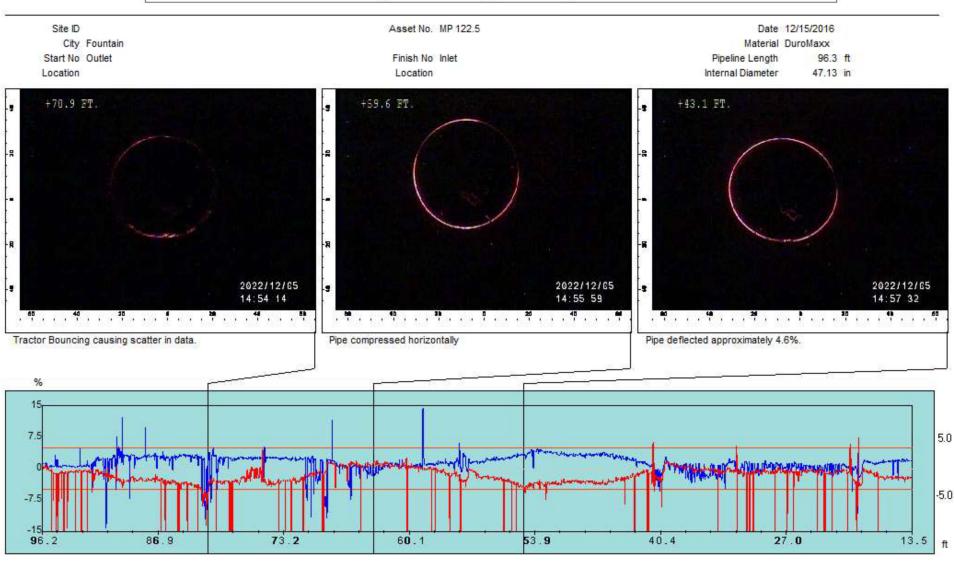


XY Deflection Observations Report

MP 122.5, I-25, DuroMaxx Installation, Fountain, Colorado

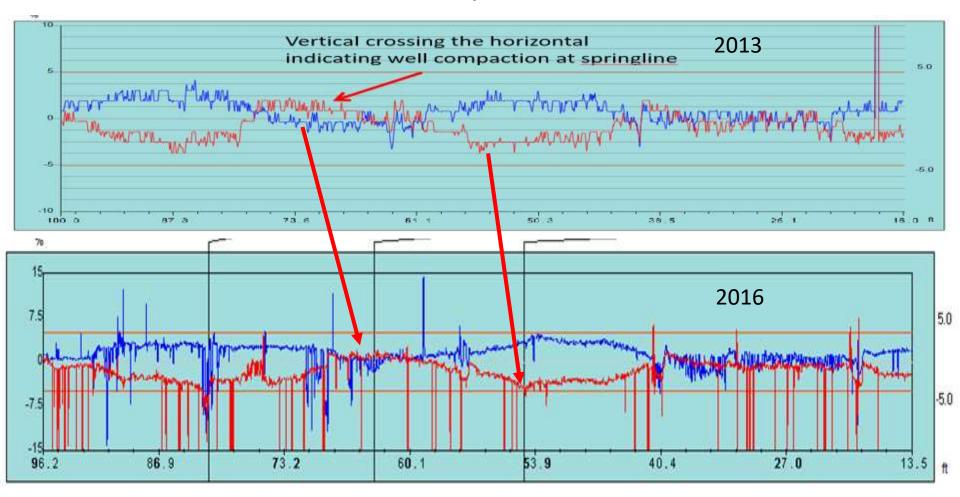


Pipe Deflected Approximately 4.6%



90% - Fractile: (X) 3.2% : (Y) 0.5%, Exceeded limits: 6.1%

Performance Summary MP 122.5



Minor puncture was noted near the outlet end during the 2016 inspection that was not documented during the 2013 inspection. Deflection is still under 5%, but it appears that additional deflection has occurred in the center of the structure since the 2013 inspection.

MP 122, I-25, 48-Inch DuroMaxx









Project Name: I-25, Fountain, Colorado

Date: Asset Location: Distance: 0 Run Number: Pipe Size: 48-inch Pipe ID: MP 122 Start ID: Outlet End ID: Inlet Direction: Upstrm Pipe Type: DuroMaxx



Severity

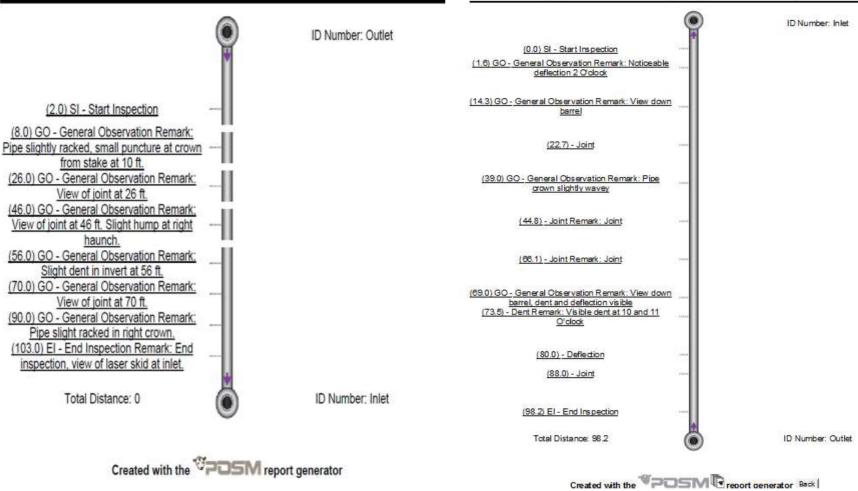
Light

Moderate Averag

Heavy

Severe

Date: 12/5/2016	Pipe ID:
A sset Location:	Start ID: Outlet
Length Surveyed: 98.2	End ID: Inlet
Run Number:	Direction: Upstream
Pipe Size: 48-inch	Pipe Type: DuraMaxx



Project Name: I-25, Fountain, Colorado 122 llet

Date:	Pipe ID: MP 122
Asset Location:	Start ID: Outlet
Distance: 0	End ID: Inlet
Run Number:	Direction: Upstrm
Pipe Size: 48-inch	Pipe Type: DuroMaxx

Distance	Fault Observation	Time	Picture
2.0	Start Inspection	43 00:00:00	
8.0	General Observation Remarks: Pipe slightly racked, small puncture at crown from stake at 10 ft.	02:30 00:00:43	
26.0	General Observation Remarks: View of joint at 26 ft.	12:08 00:01:27	



Project Name: MP 122 Fountain Colorado

Date: 12/5/2018	Pipe ID:	
Asset Location:	Start ID: Outlet	
Length Surveyed: 98.2	End ID: Inlet	
Run Number:	Direction: Upstream	
Pipe Size: 48-inch	Pipe Type: DuraMaxx	

Distance	Fault Observation	Picture
0.0	Start Inspection	
1.6	General Observation Remarks: Noticeable deflection 2 O'clock	
14.3	General Observation Remarks: View down barrel	PTAN BXB
22.7	Joint	
39.0	General Observation Remark s: Pipe crown slightly wavey	

General Observation Remarks: View of joint at 46 ft. Slight hump at right haunch.	14:40 00:02:17		44.8	Joint Remarks: Joint
				1
			66.1	Joint Remarks: Joint
General Observation i6.0 Remarks: Slight dent in invert	16:11	69 .0	General Observation Remarks : View down barrel, and deflection visible	
at 56 ft.	00:02:33		73.5	Dent Remarks: Visible dent at 10 a O'clock
General Observation	17:18		80.0	Deflection
Remarks: View of joint at 70 ft.	00:03:03		88.0	Joint
	Remarks: Slight dent in invert at 56 ft. General Observation	Remarks: Slight dent in invert at 56 ft. General Observation 17:18	Remarks: Slight dent in invert at 56 ft. 10:11 00:02:33 General Observation 17:18	General Observation Remarks: Slight dent in invert at 56 ft. 16:11 00:02:33 73.5 General Observation Remarks: View of joint at 70 ft. 17:18 00:03:03 80.0

Joint Remarks: Joint	HILD IT
Joint Remarks: Joint	
General Observation Remarks: View down barrel, dent and deflection visible	ALC OF
Dent Remarks: Visible dent at 10 and 11 O'clock	
Deflection	
Joint	23.3 P
	Remarks: Joint Joint Remarks: Joint General Observation Remarks: View down barrel, dent and deflection visible Dent Remarks: Visible dent at 10 and 11 O'clock Deflection

Picture

Distance	Fault Observation	Time	Picture
90.0	General Observation Remarks: Pipe slight racked in right crown.	18:41 00:03:48	
103.0	End Inspection Remarks: End inspection, view of laser skid at inlet.	21:21 00:04:14	

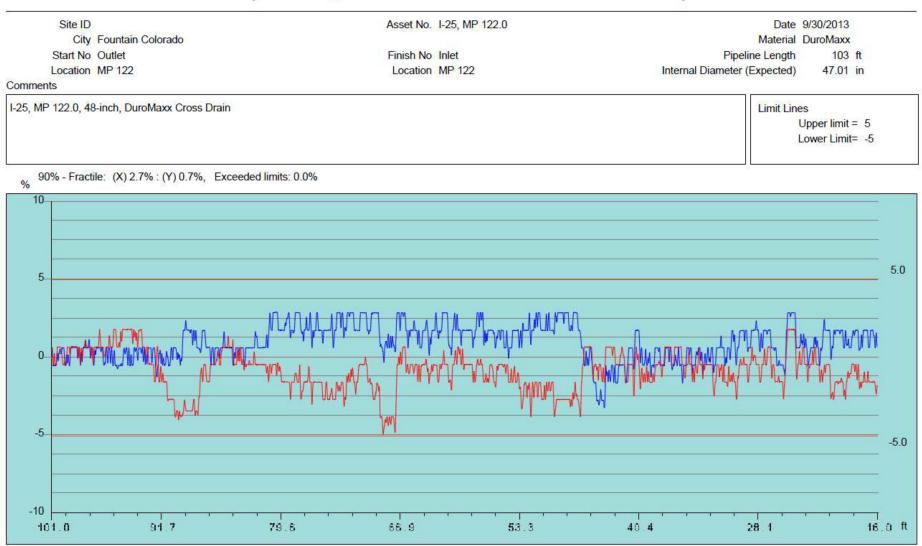
Distance	Fault Observation	Picture
98.2	End Inspection	da am

Created with the POSIN report generator

Created with the CPOSM report generator

XY Diameter Summary Report

Pipe under 5% deflection in horizontal and vertical deflection plot



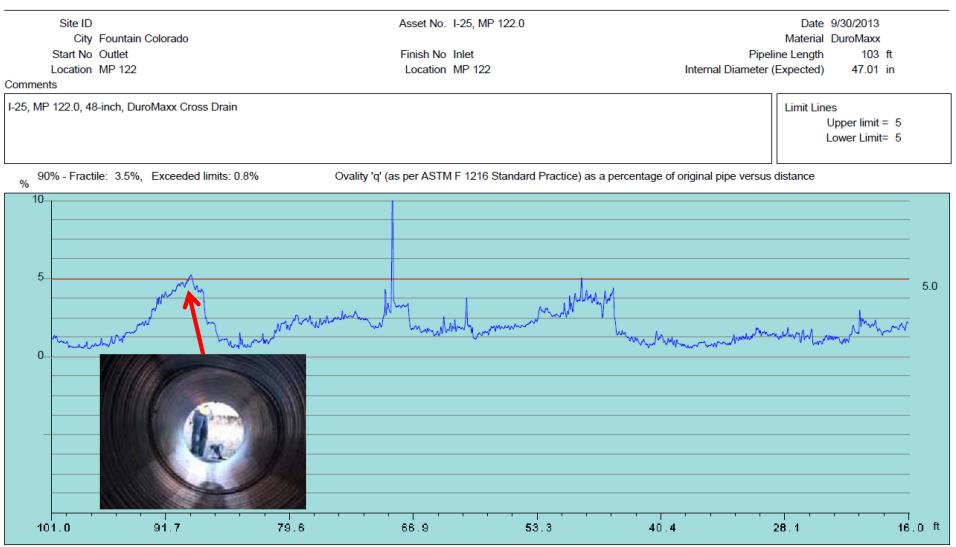
XY Deflection Summary Report

Pipe under 5% (Deflection based off Median I.D. per frame of video)

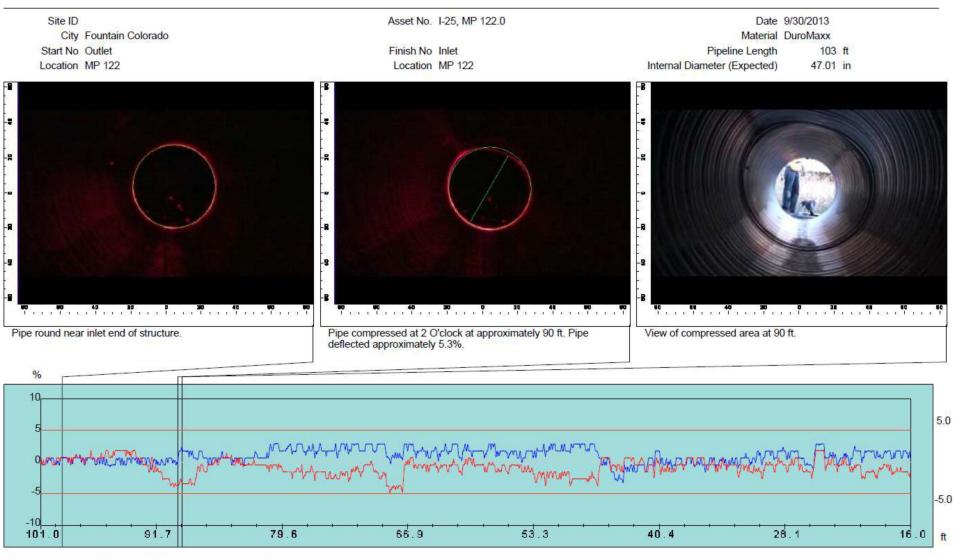
	Site ID			Asset No.	I-25, MP 122.0		Date 9	9/30/2013	
	City	Fountain Colorado					Material E	DuroMaxx	
	Start No	Outlet		Finish No	Inlet	Pipe	line Length	103 ft	
	Location			Location	MP 122	Internal Diameter		47.01 in	
Comments									
I-25, MP 1	22.0, 48	inch, DuroMaxx Cross Drain						: Upperlimit = 5 owerLimit= -5	
%									
10—									
5	il and the second s		Mr. M. Mar W	Long the second	hour all and	And the second of the second o	- And Antonia	MAAN MAAN	5.0
-5			han Multingent A	рания 1 радини и на 1 радини	www.www.whilewhilewhile			····· Papal ^{e a} Wt.,.	-5.0
	1.0	91. 7	79.6	66.9	53.3	40.4	28.1	16	.0 ft

Ovality Summary Report

Ovality slightly over 5% at 90 ft. Spike due to camera tilting at joint.

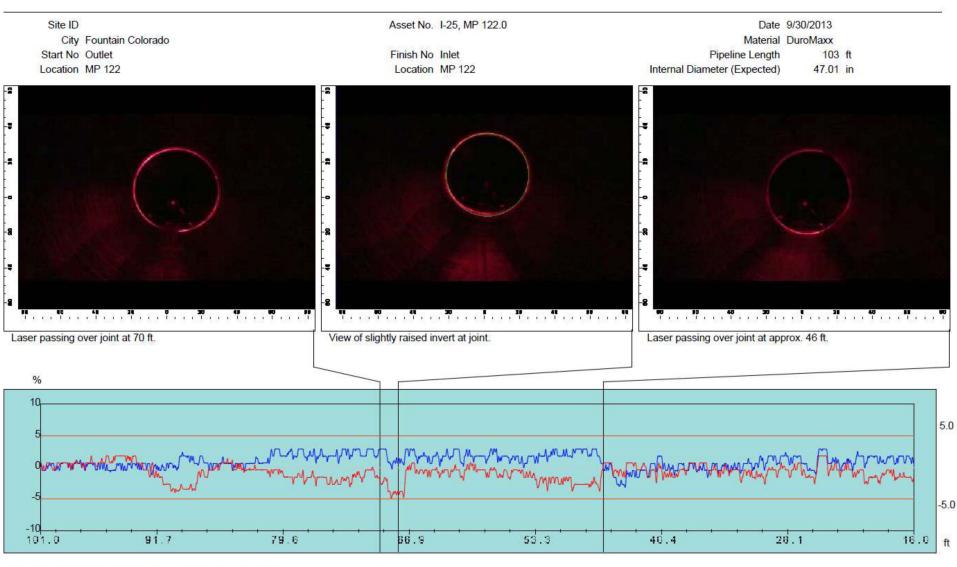


MP 122, I-25, DuroMaxx Installation, Fountain, Colorado



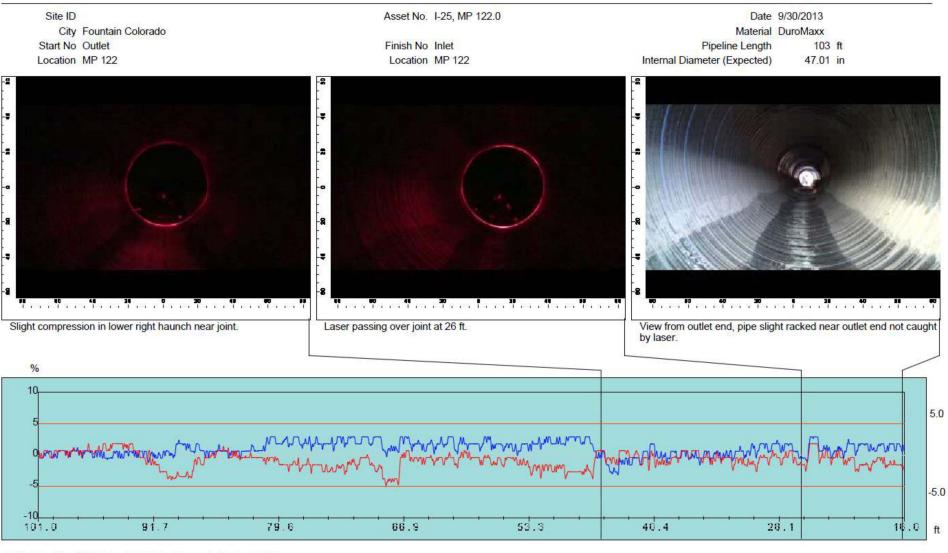
90% - Fractile: (X) 2.7% : (Y) 0.7%, Exceeded limits: 0.0%

MP 122, I-25, DuroMaxx Installation, Fountain, Colorado



^{90% -} Fractile: (X) 2.7% : (Y) 0.7%, Exceeded limits: 0.0%

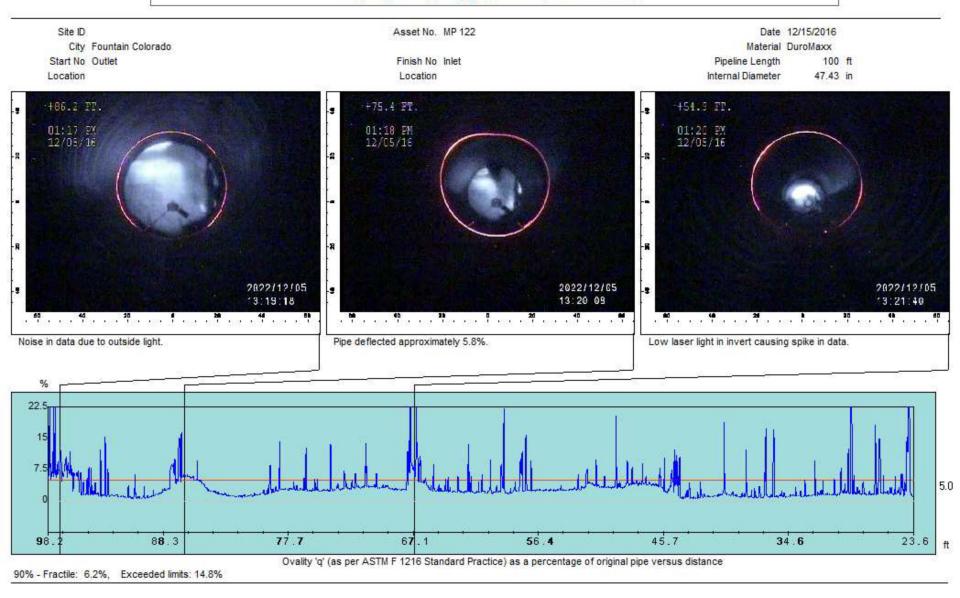
MP 122, I-25, DuroMaxx Installation, Fountain, Colorado



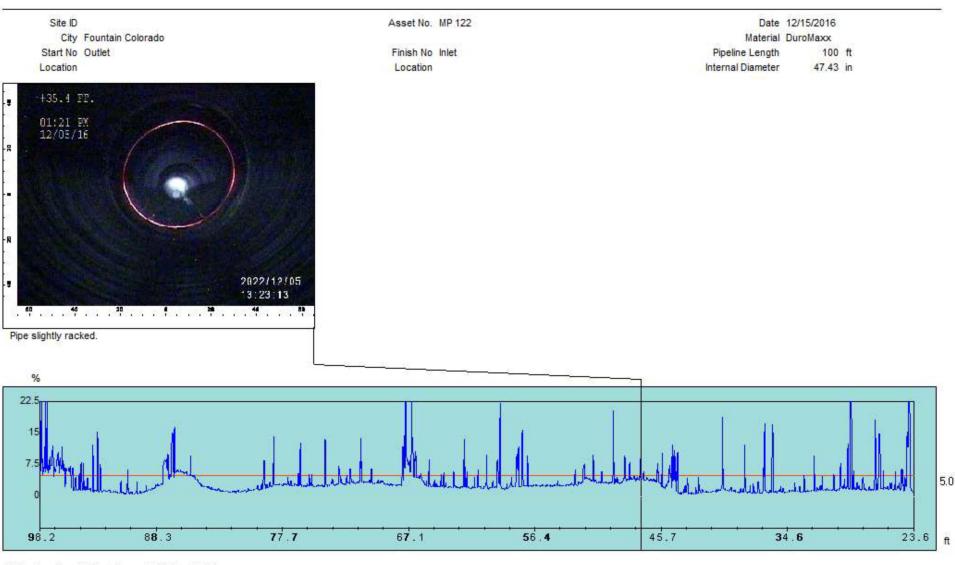
90% - Fractile: (X) 2.7% : (Y) 0.7%, Exceeded limits: 0.0%

Ovality Observations Report

Pipe Deflected Approximately 5.8% at 87 ft.

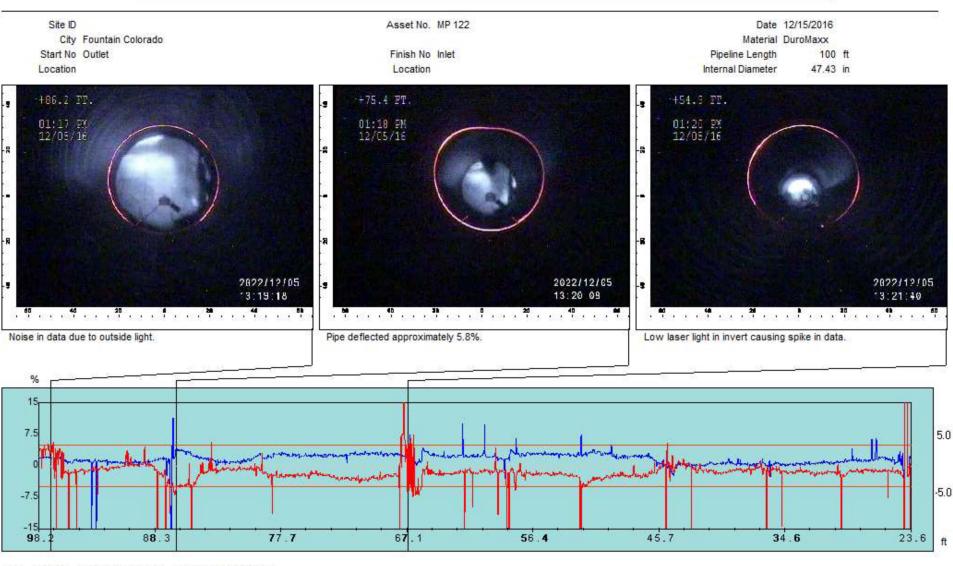


Ovality Observations Report

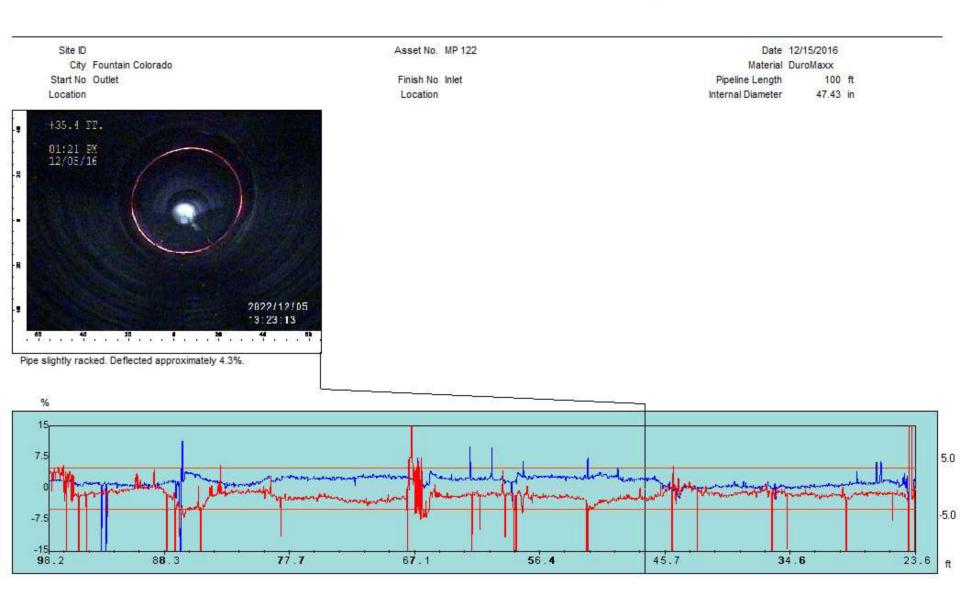


90% - Fractile: 6.2%, Exceeded limits: 14.8%

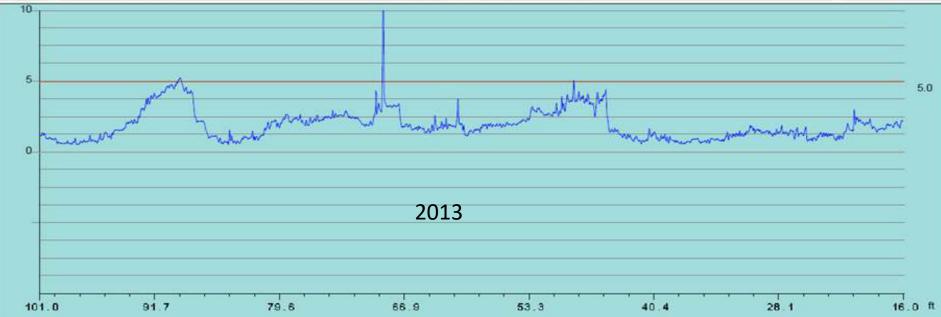
Pipe Deflected Approximately 5.8%



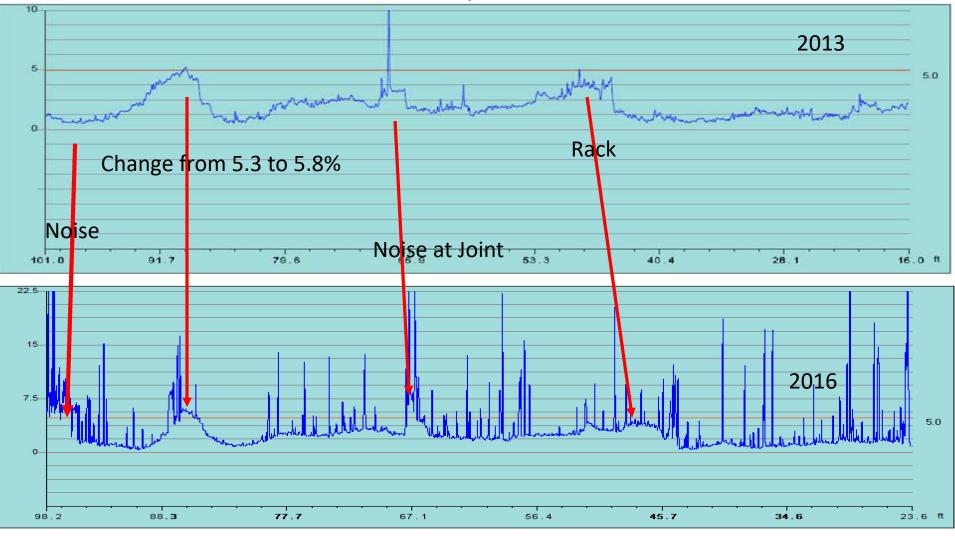
90% - Fractile: (X) 2.9% : (Y) 0.0%, Exceeded limits: 5.5%







Performance Summary MP 122

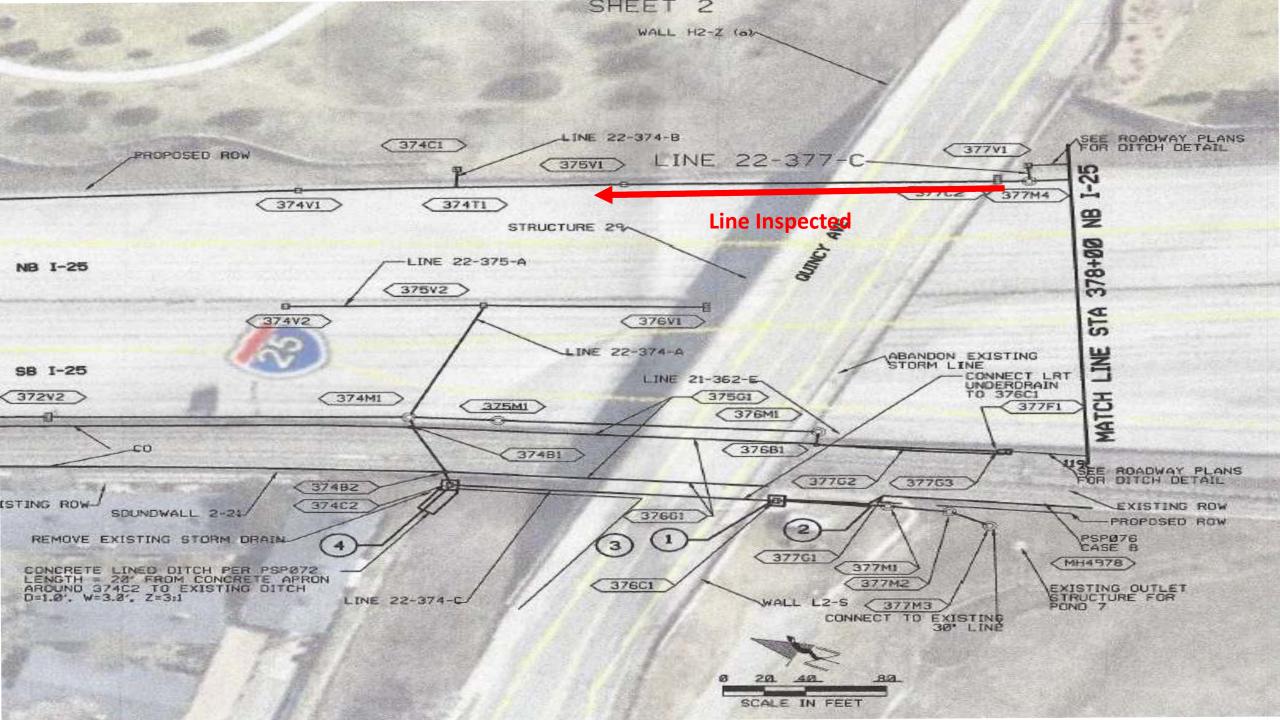


Racking, Deflection, Minor punctures have been documented near the outlet end of the structure. Uneven flowline/hump and wall waviness have been documented mid pipe. Dent, deflection and racking has been documented towards the inlet end. Increased has occurred towards the inlet end of the structure that is not under pavement. Crown and possible invert curvature has occurred. **Conclusion:** Punctures through the wall of the pipes observed during the 2013 inspection have not impacted the performance of the structures. Most of the punctures were due to the shallow cover and damage due to wooden stakes driven through the crown of the pipe during placement of straw wattles. Severe damage was observed in the inlet ends of two of the three pipes at MP 123 due to vehicle damage. Only a slight increase in deflection was observed in three of the five structures. Four of the structures are at or below 5%, and the other is at 5.8% with some signs of crown flattening and potential inverse curvature. This is outside the pavement area and in areas of shallow cover. In summary no significant changes have been observed since the 2013 inspection other than the damage due to vehicle damage. Settlement within the pavement reported in one of the locations does not appear to be due to issues with the underlying pipe structures.



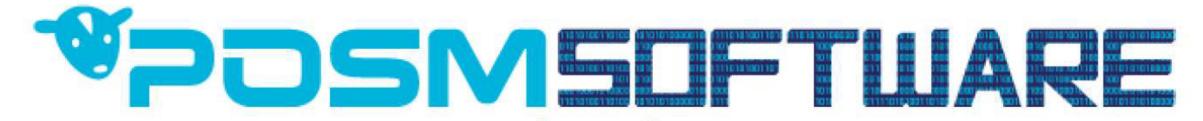
APPENDIX III – DENVER COLORADO HDPE PERFORMANCE INSPECTION HDPE STORM DRAIN, I-25 AND QUINCY AVENUE LEO JOHN FLECKENSTEIN DECEMBER 5, 2016





Project Summary and Conclusions: A section of I-25 near the Quincy overpass was coned off on December 5, 2016 to conduct a performance inspection of the HDPE storm drains in the area. Several factors limited the amount of pipe that could be inspected including difficulties in removing the bolts attaching the grates on the drop inlets, and removing the grates themselves. Heavy loads of sediment was also in the invert of the pipes. The inspection was limited to approximately 182 ft of estimated 36-inch HDPE. The pipe was inspected with Cues robotic pipeline inspection system. The pipe appeared to be sagging in areas. The overall shape of the structure appeared to be round and the joints appeared to be performing as anticipated. A laser profile could not be conducted due to the amount of debris in the system. Some of the adjacent pipes coming into the two drop inlets were glanced into and appeared to be performing satisfactory. It is recommend that the pipes be cleaned and fully inspected.





Project Name Direction Pipe Size Start ID End ID Comments I-25 Denver Downstream 36 Drop Inlet Drop Inlet Inspection Date Pipe Type Pipe ID Start Location Completed

12/5/16 HDPE

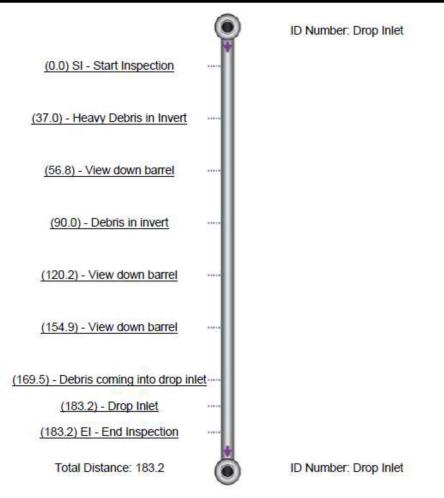
Yes

Inspection 2

Length Surveyed 183.2



Project Na	Project Name: 1-25 Denver				
Date: 12/5/2016	Pipe ID:	Light			
Asset Location:	Start ID: Drop Inlet	Moderate			
Length Surveyed: 1	83.2 End ID: Drop Inlet	Average			
Run Number:	Direction: Downstream	Heavy			
Pipe Size: 36	Pipe Type: HDPE	Severe			
	Date: 12/5/2016 Asset Location: Length Surveyed: 1 Run Number:	Asset Location: Start ID: Drop Inlet Length Surveyed: 183.2 End ID: Drop Inlet Run Number: Direction: Downstream			





Project Name: I-25 Denver						
Date: 12/5/2016 Pipe ID:						
Asset Location:	Start ID: Drop Inlet					
Length Surveyed: 183.2	End ID: Drop Inlet					
Run Number:	Direction: Downstream					
Pipe Size: 36	Pipe Type: HDPE					

Distance	Fault Observation	Picture
0.0	Start Inspection	2K22.152/03 Ds.35.45
37.0	Heavy Debris in Invert	+31.2 PE.
56.8	View down barrel	496.10 PT:
90.0	Debris in invert	490.3 FT.
120.2	View down barrel	+120.47 PT-

istance	Fault Observation	Picture
154.9	View down barrel	+154.9 JT.
169.5	Debris coming into drop inlet	A159.5'77:
183.2	Drop inlet	PLEA, J. PT.
183.2	End Inspection	D1221/12/08 B2-41/28

Created with the **POSM** report generator Back

APPENDIX IV - SOUTHEAST CORRIDOR CONSTRUCTORS NONCONFORMANCE REPORT AND EVALUATIONS

T-REX PROJECT, 2003

Discipline: Activity Number:		Contractor: Subcontractor: Supplier:	None			
Part I: Identify Nonconformance						
Issued by:	Jay Stepetin SECC		Carnazzo Thoendel Ross] Wilson] Mackin	Commented [MCO1]: Double- mark	click on grey box to insert check
Referenced Contract Spec:	N/A		Ross	Vetter		
Referenced Drawing Number:	D102, D201					
Location of Nonconformance:	Drain Line 31-507-B					
NB I-25 or I-225 Stationing:	506+92 & 507+67	(show nearest 500')				
		h of structure 506V1 and 12 fee wall, concrete barrier, moment nis area of conflict.				
Superintendent:	Gary Palmer					
Subcontractor:						
Supplier:	None					
Part II: Review by Construction	QA Management					
This NCR request has been review	wed by:					
Terry Con	stable	John Lee				
☐ Tim Nelso ☐ Anthony 0		Pat McCready Kevin Segrue				
Brian Bull Glen Tona	en	Other QA Mana	gement:			
Part III: Distribution The NCR/N or a change in status has taken place. Log.	CE form will be distributed to t The person making the distrit	he appropriate parties via e-mail af ution at these occurrences must u	ter each step when pdate the status co	e action is required lumn of the NCR		
TO: ✓ SECC Document Control (No		SECC Construction Quality A Structures – Tim Nelson	ssurance			
SECC QA Manager – Consta		Grading/Drainage - Antho	ony Crockett, Brian B	Bullen		
SECC Design and Construction ✓ Post Design – Klemz, Uyema	atsu. Field Design Coord	Paving – Pat McCready ITS – John Lee				
Highways – Doug Brannan		LRT – Kevin Segrue				
Structures – 1 Don Muns, 2/ ✓ Grading – 1 Tim Driver, 2/3 S		Procurement – Glen Tona	IK			
Paving – Dave Ross Survey – Jim Bodi		<u>T-REX Oversight and Other</u> ✓ Oversight – Basner, Walk	er Stevenson			
ITS/Elec – Bruce Wilson		Segment 1 – Jeff Cleveng	er, Danielle Smith			
LRT– Tim Mackin, Wilson, La Stations – JD Vetter, Mackin		✓ Segment 2/3 – Al Eastwo , LRT –Starling, Bacus, Re		stems)		
	onnelley	ITS – Gonzales, Lipp				
MHT – Lloyd Maier, Luke Co		Design Oversight –				
Segment 1 - Carnazzo, Sato		Utility Company (DW-Mc	Quade, DWWM-Gair	nes)		
	eml		Quade, DWWM-Gair	nes)		

.

A CONTRACTOR OF THE OWNER	SOUTHEAST CORF	RIDOR CONSTRUCTORS	
NONCO	NFORMANCE REPO	RT and EVALUATION (NCR/	NCE)
NCR Numbe	er: 709	Date Issued: 9/12	
	a: 3.1	Contractor: SEC	C
	e: Drainage	Subcontractor: Non Supplier: Non	
Activity Number	30001.20	Supplier. Non	<u> </u>
Part IV: Identify Need for Nor	conformance Evaluation		
N	ote: NCE is not needed if Contract Specificatio	the work is to be removed and replac n Compliance.	ed, or reworked to
NCE Need	led?	d but requires Project Manager approva	ıl
	🛛 Yes, by QA Disc	ipline Manager approval	
	No (skip to Part)		
	QA or PM Approved:		Date: 9/12/03
Proposed Resolu	tion: Evaluate remove/repla alternative.	ce Drain Line 31-507-B at location of da	maged pipe or NCE
	allemative.		
		Date Sent to Post Design:	
		Response Requested by:	
Part V: Post Design Respons	ie -		
Respo	nse:		
Revised Plans needed before	e this Yes	If Yes, Plans to be Reissu	ed by:
change can be Implement			
Plans or Specs to be chan	ged:		
Design Work Charged to V	VBS:	H	lours:
Responde	d by:Post Desi		Date:
	Post Desi	gn Services	
Checke	d by:		
Attachm	ents: Yes 🗌		
	No 🗌		
UP-999-Q05-1	P	age 2 of 3	Rev Date 07/10/03
0399-000-1			

NCR Number:	09	Date Issued:	9/12/03	
Area:	3.1	Contractor:		
		Subcontractor:		
Activity Number:	0001.20	Supplier:	None	
rt VI: Public Utility NCEs				
Response from Utility Company: _			Date:	
	Name of Utility Company Representa	tive		
	Attached utility company response or ind	icate location of re	esponse on Fi	IeNET.
rt VII: Resolution of NCR				
Type of Resolution:	Remove and Replace		(s	kip to Part IX)
	Repair/Rework to Contract Specif	ication Complianc		kip to Part IX)
	Repair/Rework to acceptable star	dards		
	Leave As Is (Use As Is) does not	require QA reinsp	ection	
Description of Resolution:				
Expected Closure Date:				
rt VIII: T-REX Technical Closure	1		Date:	
	1		Date:	
rt VIII: T-REX Technical Closure Closure by:			Date:	
rt VIII: T-REX Technical Closure Closure by:		ersight)		
rt VIII: T-REX Technical Closure Closure by: rt IX: SECC QA Disposition Action:	(Segment Oversight or Segment Design Ov	ersight) Decification Compl	iance	
nt VIII: T-REX Technical Closure Closure by: nt IX: SECC QA Disposition	(Segment Oversight or Segment Design Oversight or Segment	ersight) Decification Compl	iance	
art VIII: T-REX Technical Closure Closure by: art IX: SECC QA Disposition Action: Comments or Verification of	(Segment Oversight or Segment Design Oversight or Segment Design Oversight or Segment Design Oversight of Reinspected verifying Contract Space Reinspected and Accepted based	eersight) Decification Compl on T-REX Techn	iance ical Closure	
art VIII: T-REX Technical Closure Closure by: art IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: art X: Compliance with Contract	(Segment Oversight or Segment Design Oversight or Segment Design Oversight or Segment Design Oversight or Segment Design Oversight of Segment Segment Design Oversight of	ersight) becification Compl on T-REX Techn	iance ical Closure	
art VIII: T-REX Technical Closure Closure by: art IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: art X: Compliance with Contract	(Segment Oversight or Segment Design Oversight or Segment	ersight) Decification Compl on T-REX Techn	iance ical Closure	
art VIII: T-REX Technical Closure Closure by: art IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: art X: Compliance with Contract Note: This disposition resu	(Segment Oversight or Segment Design Oversight or Segment Design Oversight or Segment Design Oversight of Reinspected verifying Contract Segments and Accepted based bas	ersight) Decification Compl on T-REX Techn	iance ical Closure Date: YES NO	(circle one)
rt VIII: T-REX Technical Closure Closure by: rt IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: rt X: Compliance with Contract Note: This disposition resu	(Segment Oversight or Segment Design Oversight or Segment Design Oversight or Segment Design Oversight of Reinspected verifying Contract Segments and Accepted based bas	ersight) Decification Compl on T-REX Techn	iance ical Closure Date: YES NO	

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NONCON	SOUTHEAST CORRID			1	
NCR Number: Area: Discipline: Activity Number:	3.1 Drainage	Date Issued: Contractor: Subcontractor: Supplier:	SECC None		
Part I: Identify Nonconformance	e				
Issued by:	Jay Stepetin SECC	lssued to: ⊠	Carnazzo Thoendel Ross	☐ Wilson☐ Mackin☐ Vetter	Commented [MC01]: Double-click on grey box to insert check mark
Referenced Contract Spec:	N/A		11033		
Referenced Drawing Number:	D102, D201				
Location of Nonconformance:	Drain Line 31-507-B				
NB I-25 or I-225 Stationing:	506+92 & 507+67	(show nearest 500')			
Description of NCR:	Mandrel failed 24 feet North Drain Line 31-507-B. MSE w have been constructed in this	all, concrete barrier, moment			
Superintendent:	Gary Palmer				
Subcontractor:	None				
Supplier:	None				
Part II: Review by Construction	QA Management				
This NCR request has been revie	ewed by:				
☐ Terry Co ☐ Tim Nels ☐ Anthony ⊠ Brian Bu ☐ Glen Tor	son Crockett Ilen	 John Lee Pat McCready Kevin Segrue Other QA Mana 	gement:		
Part III: Distribution The NCR/I or a change in status has taken place Log.	NCE form will be distributed to the . The person making the distribut	appropriate parties via e-mail af ion at these occurrences must u	ter each step v pdate the statu	where action is required s column of the NCR	
IO: ✓ SECC Document Control (N ✓ SECC QA Manager – Cons SECC Design and Construction ✓ ✓ Post Design – Klemz, Uyern Highways – Doug Brannan Structures – 1 Don Muns, 2 ✓ Grading – 1 Tim Driver, 2/3 Paving – Dave Ross Survey – Jim Bodi ITS/Elec – Bruce Wilson LRT – Tim Mackin, Wilson, I Stations – JD Vetter, Mackii MHT – Lloyd Maier, Luke C Segment 1 – Carnazzo, Sat ✓ ✓ Segment 2/3 – Thoendel, D Dynalectric – Vecchione, W D	itable natsu, Field Design Coord 2/3 Rich Westerheid Scott Cromack Larson n, Larson ionnelley to	SECC Construction Quality A Structures – Tim Nelson / Grading/Drainage – Antho Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue Procurement – Glen Tona ////////////////////////////////////	ony Crockett, Br ik er, Stevenson rer, Danielle Sm od, David Wiede itter, (Shrestha i	ith ar f Systems)	
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A CONTRACTOR OF	SOUTHEAST CORR	IDOR CONSTRUCTORS	
NONCON	ORMANCE REPOR	RT and EVALUATION (N	CR/NCE)
NCR Number:	709	Date Issued:	9/12/03
Area:		Contractor:	
	Drainage		
	30001.20	Supplier:	
art IV: Identify Need for Nonco			
Note	: NCE is not needed if the Contract Specification	he work is to be removed and r Compliance.	eplaced, or reworked to
NCE Needed?	? 🗌 May be requested	but requires Project Manager ap	proval
	Yes, by QA Discip	line Manager approval	
	No (skip to Part V	II)	
			D. I. Olivera
Proposed Resolution		Joe Jensen e Drain Line 31-507-B at location	
	alternative.		
		Date Sent to Post Desig	jn:
		Response Requested b	ру:
art V: Post Design Response			
Response			
Response			
Revised Plans needed before this change can be Implemented		If Yes, Plans to be R	eissued by:
Plans or Specs to be changed	:		
Design Work Charged to WBS	:		Hours:
Dessended by			Date:
Responded by	Post Desig	n Services	Date.
Checked by	r:		
Attachments	∷Yes □ No □		
P-999-Q05-1	Par	ge 2 of 3	Rev Date 07/10/03

	OUTHEAST CORRIDOR CONSTRUCTORS			
NONCONF	RMANCE REPORT and EVALUATION (NCR/N	CE)	
NCR Number: 7 Area: 3 Discipline: 6 Activity Number: 3	1 Contractor rainage Subcontractor	SECC		
art VI: Public Utility NCEs				
Response from Utility Company: _	Name of Utility Company Representative			NET.
art VII: Resolution of NCR				
Type of Resolution:	 Remove and Replace Repair/Rework to Contract Specification Complia Repair/Rework to acceptable standards 			p to Part IX) p to Part IX)
Description of Resolution:	Leave As Is (Use As Is) does not require QA rein	spection		
art VIII: T-REX Technical Closure Closure by:		Date:		
Closure by.	(Segment Oversight or Segment Design Oversight)	Date.		
art IX: SECC QA Disposition				
Action: Comments or Verification of Reinspection:	 Reinspected verifying Contract Specification Con Reinspected and Accepted based on T-REX Tec 		sure	
QA Manager:		Date:		
Part X: Compliance with Contract	al Requirements			
Note: This disposition rest T-REX Signature:	Its in the work being in full contract compliance. Submit Change Order:	YES	NO	(circle one)
Print or Type Na	ne Signature		D	ate
To be signed by Jeff Cleve	ger, Al Eastwood, Del Walker, Jim Starling, Gary Gonzales, Pranaya s	Shrestha, or .	Jerry Nen	as appropriate.
T-REX accepts the effected elements of t pursuant to the Contract, nor does it creat	e work described by this NCR. This acceptance does not char e any additional liabilities for CDOT or RTD, nor does it change a ge Order (RCO) if acceptance requires concessions pursuant to	nge SECC's any rights SE	responsi ECC has	bilities for the Wor under the Contrac

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NONCON		IDOR CONSTRUCTORS RT and EVALUATION (N	CR/NCE)		
NCR Number: Area: Discipline: Activity Number:	709 3.1 Drainage	Date Issued: Contractor: Subcontractor: Supplier:	9/12/03 SECC None		
Part I: Identify Nonconformance	e				
Issued by:		Issued to:	Carnazzo Thoendel Ross	☐ Wilson☐ Mackin☐ Vetter	Commented [MCO1]: Double-click on grey box to insert check mark
Referenced Contract Spec:	N/A	Ö			
Referenced Drawing Number:	D102, D201				
Location of Nonconformance:	Drain Line 31-507-B				
NB I-25 or I-225 Stationing:	506+92 & 507+67	(show nearest 500')			
Description of NCR:		th of structure 506V1 and 12 fee E wall, concrete barrier, moment his area of conflict.			
Superintendent: Subcontractor: Supplier:	None			•	
This NCR request has been revie Terry Co Tim Nels Anthony Brian Bu Glen Tor	nstable son Crockett llen	 ☐ John Lee ☐ Pat McCready ☐ Kevin Segrue ☐ Other QA Mana 	gement:		
Part III: Distribution The NCR/I or a change in status has taken place	NCE form will be distributed to b. The person making the distri	the appropriate parties via e-mail at bution at these occurrences must u	fter each step wh pdate the status	nere action is required column of the NCR	
Log. T0:	stable Inatsu, Field Design Coord 2/3 Rich Westerheid : Scott Cromack Larson in, Larson connelley to beml	SECC Construction Quality A Structures – Tim Nelson Grading/Drainage – Anth Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue Procurement – Glen Ton: T-REX Oversight and Other Oversight – Basner, Wall Segment 1/3 – Al Eastwor LRT – Starling, Bacus, Re ITS – Gonzales, Lipp Design Oversight – Utility Company (DW-Mc	ony Crockett, Bria ak ter, Stevenson ger, Danielle Smit od, David Wieder itter, (Shrestha if	h Systems)	
Dynalectric – vecchlorie, w	ingit.				

JIEASI COL		SOU	THEA	ST CORR	IDOR CO	NSTRUCTORS		
	NONCON	FOR	MANC	E REPOR	RT and E	VALUATION (N	ICR/NCE)	
SINC	NCR Number:	709				Date Issued:	9/12/03	
	Area:				_	Contractor:		
	Discipline:	Drain			_	Subcontractor:	None	
	Activity Number:	30001	1.20		-	Supplier:	None	
Part IV: Ide	ntify Need for Nonco	nforma	ance Ev	aluation				
	Note			needed if t pecification		to be removed and line.	replaced, or re	worked to
	NCE Needed	?	May	be requested	d but require	es Project Manager a	oproval	
		\bowtie	Yes.	by QA Disci	oline Manad	ger approval		
				kip to Part V				
	Drenseed Deselution			Approved:			Date:	
	Proposed Resolution		aluate re ernative.		ce Drain Lin	e 31-507-B at location	n or damaged p	pe or NCE
					D	ate Sent to Post Desi	gn:	
					ł	Response Requested	by:	
Part V: Pos	at Design Response							
	Response	e :						
Revised P	lans needed before thi	s Ye	es 🗌			If Yes, Plans to be R	Reissued by:	
	ge can be Implemented		lo 🗌					
Plans o	or Specs to be changed	4:						
Desian	Work Charged to WBS	3:					Hours:	
	0							
	Responded by	y:					Date:	
				Post Desig	gn Services			
	Checked b	y:						
	Attachment							
		No						
10 000 005	4			D	age 2 of 3			Rev Date 07/10/03
UP-999-Q05	-1			Pa	age 2 or 3			Nev Date off 10/00

		THEAST CORRIDOR CONSTRUCTORS			
NONCONF	URI	IANCE REPORT and EVALUATION	NCR/	NCE)	
NCR Number: Area: Discipline: Activity Number:	3.1 Draina	age Subcontractor	r: SEC r: Non	e e	
art VI: Public Utility NCEs					
Response from Utility Company: _	N	ame of Utility Company Representative	D	ate:	
	Attac	hed utility company response or indicate location c	of respor	ise on Fil	eNET.
art VII: Resolution of NCR					
Type of Resolution:		Remove and Replace		(sk	ip to Part IX)
		Repair/Rework to Contract Specification Complia Repair/Rework to acceptable standards			ip to Part IX)
Description of Resolution:		Leave As Is (Use As Is) does not require QA reir	spection	ſ	
Expected Closure Date: art VIII: T-REX Technical Closure Closure by:	9		Date [.]		
		Segment Oversight or Segment Design Oversight)	Date.		
art IX: SECC QA Disposition					
Action: Comments or Verification of		Reinspected verifying Contract Specification Cor Reinspected and Accepted based on T-REX Tec			
Reinspection:					
QA Manager:			Date:		
Part X: Compliance with Contract	ual R				
T-REX Signature:	uits i	Submit Change Order:	YES	NO	(circle one)
Print or Type Na	me	Signature		Г	Date
			0		
T-REX accepts the effected elements of pursuant to the Contract, nor does it crea	the wo	N Eastwood, Del Walker, Jim Starling, Gary Gonzales, Pranaya rk described by this NCR. This acceptance does not char additional liabilities for CDOT or RTD, nor does it change a rder (RCO) if acceptance requires concessions pursuant to	nge SECC	SECC has	ibilities for the Wo under the Contrac

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RASI CONT

SOUTHEAST CORRIDOR CONSTRUCTORS

Simulas						
Field Memo Number		Date of Request:				
Area Package		_ Discipline: _ Contractor:	Drainage			
Fachage			3200			
Part I: Identify Field Design Change Request or RFI						
Requested by:	Josh Schlee	_ Phor	ne: (303) 357-8456			
	SECC	FDC (for wor RFI	rk that has NOT been constructed)			
Reference Drawing Number:	Various	_				
Drawing Package Title:	Drainage Plans (Profiles)	_ Response needed b	oy:6/30/03			
RFC Date of Drawings:	Various	_				
Description of Problem: (attach plan mark up if needed)	HDPE pipe problems encounter over installed pipe), and excavate may be necessary to remove pre-	ting around installed HDPE	E pipe. At some locations it			
Field Design Change Requested:	Change all remaining HDPE to F structures to accommodate the I the pipe and the structure is great less than 3", grouting between the installation. Design has mention switching to RCP, and it may be locations, or stay with HDPE at the on a case-by-case basis; the may to RCP without any major design	larger O.D. associated with ater than 3", collaring arou ne structure and the RCP w ned that there is a slight de necessary to increase the those locations. We will ne ajority of pipe left to install of	n RCP. If the gap between nd the RCP will be required; if would be the method of crease in pipe capacity when pipe diameter at a few eed to evaluate these areas			
	nge meet the requirements of the uests that design work be tracked	🗌 No If I	No, complete Parts V and VI			
Part II: Distribution						
TO: ✓ SECC Document Control ✓ T-REX Document Control SECC Construction Quality // Structures – Tim Nelson ✓ Grading/Drainage – Bria Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue ✓ Procurement – Glen Tor SECC Construction ✓ Survey – Jim Bodi Paving – Dave Ross MHT – Lloyd Maier, Luke ITS/Elec – Bruce Wilson LRT– Mackin, Wilson, Lai ✓ Stations – Mackin, Larso ✓ Segment 1 – Carnazzo, ✓ Dynalectric – Vecchione	ol (FDC File) ol – Shelle Pope Assurance In Bullen, Anthony Crockett hak e Connelley arson on, Vetter Sato I, Deml	 T-REX Oversight and Other Oversight – Basner, Steve Segment 1 – Jeff Cleveng Segment 2/3 – Al Eastwood LRT – Starling, Bacus, Regent TS – Gonzales, Lipp Design Oversight – John O CCD Joe Barsoom SECC Design Management Post Design Field Coordir PDS Administration – Jea Design Management – Kle Discipline Design Mgr – R Design Coordinator for Co Originator – Josh Schlee Steve Arent Scott Cromack, Jim Johns Lino Cruz, Jason Miner, J 	jer, Danielle Smith od, David Wieder eitter, (Shrestha if Systems) Griffith nators inette Bordner (FDC File) emz, Wise, O'Malley Roger Kilgore onstruction – Laura Elliot			



Field Memo Number:		Date of Request:		
-	Project Wide Drainage Plans (Profiles)	Discipline: Contractor:		
		Contractor.		
Part III: Response				
Response:	The requested change is acc drainage profiles to indicate t RCP. Drainage Design will re criteria are satisfied. A separ containing the revised draina If Drainage Design determine or make any other significant document those changes.	he locations where HDP evise Q _{full} values, and ch rate FDC shall then be p ge profiles.	E pipe is to be o eck that velocity rocessed for each upsize any parti	hanged to / and HGL ch Area cular pipe runs,
Revised Plans needed before this change can be Implemented	e Yes 🔲	If Yes, Plans to be Re	eissued by:	
Plans or Specs to be changed	: Separate FDC's shall be proc profiles.	cessed for each Area co	ntaining the revi	sed drainage
Does this field design change	meet the requirements of the C	ontract? ⊠ Yes □ No If N	No, complete Pa	irts V and VI
Design Work Charged to	: Post-Design Services ⊠ Design Target □	If PDS, Ind	icate WBS: Hours:	200
Responded by	Don Clark		Date:	6/27/03
Checked by	:			
Attachments	∷Yes □ No ⊠			
Part IV: Utility FDCs				
Response from Utility Company	Name of Utility Company Attached utility company res			n FileNET.

Rasi Contine

SOUTHEAST CORRIDOR CONSTRUCTORS

FIELD DESIGN CHANGE/RFI MEMO

Field Memo Number:	G273	Date of Request:	6/23/03
Area:	Project Wide	Discipline:	Drainage
Package:	Drainage Plans (Profiles)	Contractor:	SECC

Part V: Final Proposed FDC Resolution by SECC (if change does not meet contract requirements)

Related Contract References:

Final FDC Resolution:		
Cost Implications:		
□ No Cost □ Deductiv	Change /e Change – \$	
	ve Change TBD	_
Agreement of FDC Resolution and Cost Im	plications proposed by SECC:	
<u>SECC Signature</u> :		
Print or Type Name	Signature	Date
Fint of Type Name	Signature	Dale
To be signed by Tom Howell, Do or JD Vetter as appropriate.	ug Brannan, Ben Carnazzo, Barry Thoendel, Br	uce Wilson, Dave Ross, Tim Mackin,
Part VI: Field Design Change acceptance	(if change does not meet contract requirer	nents)
<u>T-REX Signature</u> :		
Print or Type Name	Signature	Date
To be signed by Jeff Clevenger, a appropriate.	Al Eastwood, Del Walker, Jim Starling, Pranaya	Shrestha, or Jerry Nery as

T-REX accepts the use of the described field design change for the subject application only. This acceptance does not change SECC's responsibilities for the Work pursuant to the Contract, nor does it create any additional liabilities for CDOT or RTD, nor does it change any rights SECC has under the Contract. SECC agrees to submit a Request for Change Order (RCO) if the accepted field design change results in a cost reduction.

REAST COL

SOUTHEAST CORRIDOR CONSTRUCTORS

Field Memo Number Area Package		Date of Request: Discipline: Contractor:	Drainage			
Part I: Identify Field Design Change Request or RFI						
Requested by:	Josh Schlee	Phone	e:(303) 357-8456			
	SECC	FDC (for work	k that has NOT been constructed)			
Reference Drawing Number:		_				
Drawing Package Title:	Drainage Plans (Profiles)	_ Response needed b	y:6/30/03			
RFC Date of Drawings:	Various	_				
Description of Problem: (attach plan mark up if needed)	HDPE pipe problems encounter over installed pipe), and excava may be necessary to remove pr	ting around installed HDPE	pipe. At some locations it			
Field Design Change Requested:	Change all remaining HDPE to I structures to accommodate the the pipe and the structure is gre less than 3", grouting between t installation. Design has mention switching to RCP, and it may be locations, or stay with HDPE at on a case-by-case basis; the may to RCP without any major desig	larger O.D. associated with ater than 3", collaring arour he structure and the RCP w ned that there is a slight dec e necessary to increase the those locations. We will ne ajority of pipe left to install c	RCP. If the gap between ad the RCP will be required; if yould be the method of crease in pipe capacity when pipe diameter at a few ed to evaluate these areas			
Construction req Subcontractor:	uests that design work be tracked		lo, complete Parts V and VI			
Part II: Distribution						
TO: ✓ SECC Document Control ✓ T-REX Document Control Secc Construction Quality Structures – Tim Nelson ✓ Grading/Drainage – Bria Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue ✓ ✓ Procurement – Glen Tor SECC Construction ✓ ✓ Procurement – Glen Tor SECC Construction ✓ ✓ Survey – Jim Bodi Paving – Dave Ross MHT – Lloyd Maier, Luk ITS/Elec – Bruce Wilson LRT– Mackin, Wilson, L ✓ Segment 1 – Carnazzo, ✓ Segment 2/3 – Thoendee ✓ Dynalectric – Vecchionee	ol (FDC File) ol – Shelle Pope Assurance in Bullen, Anthony Crockett nak e Connelley arson on, Vetter Sato sl, Deml	T-REX Oversight and Other ✓ Oversight – Basner, Stevel ✓ Segment 1 – Jeff Clevenge ✓ Segment 2/3 – Al Eastwoo ✓ LRT – Starling, Bacus, Rei ITS – Gonzales, Lipp ✓ ✓ Design Oversight – John G ✓ CCD Joe Barsoom SECC Design Management ✓ ✓ Post Design Field Coordinator ✓ POS Administration – Jear ✓ Design Management – Kle ✓ Discipline Design Mgr – Ro ✓ Design Coordinator for Coi ✓ Originator – Josh Schlee ✓ Scott Cromack, Jim Johns: ✓ Lino Cruz, Jason Miner, Jear	er, Danielle Smith od, David Wieder itter, (Shrestha if Systems) Griffith ators nette Bordner (FDC File) emz, Wise, O'Malley oger Kilgore nstruction – Laura Elliot ton, Jay Stepetin			



Field Memo Number:		Date of Request:		
	Project Wide		Drainage	
Package:	orainage Plans (Profiles)	_ Contractor:	SECC	
Part III: Response				
Response:	The requested change is an drainage profiles to indicate RCP. Drainage Design will criteria are satisfied. A sep containing the revised drain If Drainage Design determi or make any other significa document those changes.	e the locations where HDP revise Q _{full} values, and ch arate FDC shall then be p nage profiles. nes that it is necessary to p	E pipe is to be o eck that velocit rocessed for ea upsize any part	changed to y and HGL ch Area icular pipe runs,
Revised Plans needed before this change can be Implemented:	Yes D No 🛛	If Yes, Plans to be Re	eissued by:	
Plans or Specs to be changed:	Separate FDC's shall be pr profiles.	ocessed for each Area co	ntaining the rev	ised drainage
Does this field design change n	neet the requirements of the	Contract? 🛛 Yes 🗌 No If N	lo, complete Pa	arts V and VI
Design Work Charged to:	Post-Design Services	If PDS, Ind	icate WBS:	
	Design Target		Hours:	200
Responded by:	Don Clark		Date:	6/27/03
Checked by:				
Attachments:	Yes □ No ⊠			
Part IV: Utility FDCs				
Response from Utility Company:			Date:	
Response from Utility Company:			-	
	Attached utility company re	esponse or indicate locatio	n of response c	on FileNET.



FIELD DESIGN CHANGE/RFI MEMO

Field Memo Number:	G273	Date of Request:	6/23/03
Area:	Project Wide	Discipline:	Drainage
Package:	Drainage Plans (Profiles)	Contractor:	SECC

Part V: Final Proposed FDC Resolution by SECC (if change does not meet contract requirements)

Related Contract References:

Final FDC Resoluti	on:			
Cost Implicatio	ns:			
	No Cost CharDeductive Ch	ige	\$	
	Deductive Ch		Φ	
Agreement of FDC Resolution	n and Cost Implicat	ions proposed by SE	ECC:	
SECC Signature:				
		0		
Print or Typ	e Name	Signature		Date
To be signed by T or JD Vetter as a		annan, Ben Carnazzo,	Barry Thoendel, Brud	e Wilson, Dave Ross, Tim Mackin,
Part VI: Field Design Chang	e acceptance (if ch	ange does not meet	contract requireme	ents)
T-REX Signature:				
Print or Typ	e Name	Signature		Date
To be signed by appropriate.	Jeff Clevenger, Al Eas	stwood, Del Walker, Jir	n Starling, Pranaya S	hrestha, or Jerry Nery as

T-REX accepts the use of the described field design change for the subject application only. This acceptance does not change SECC's responsibilities for the Work pursuant to the Contract, nor does it create any additional liabilities for CDOT or RTD, nor does it change any rights SECC has under the Contract. SECC agrees to submit a Request for Change Order (RCO) if the accepted field design change results in a cost reduction.

REAST COMPANY

SOUTHEAST CORRIDOR CONSTRUCTORS

: <u>G273</u>	Date of Request:	6/23/03		
Area: Project Wide		Discipline: Drainage		
: Drainage Plans (Profiles)	Contractor:	SECC		
Change Request or REI				
•		(000) 057 0450		
	Phor	ne: (303) 357-8456		
SECC	FDC (for wor	rk that has NOT been constructed)		
Various				
Drainage Plans (Profiles)	Response needed b	oy:6/30/03		
Various				
over installed pipe), and exca	avating around installed HDPE	E pipe. At some locations it		
structures to accommodate the the pipe and the structure is g less than 3", grouting betwee installation. Design has men switching to RCP, and it may locations, or stay with HDPE on a case-by-case basis; the	he larger O.D. associated with greater than 3", collaring aroun in the structure and the RCP with tioned that there is a slight de be necessary to increase the at those locations. We will ne majority of pipe left to install of	n RCP. If the gap between nd the RCP will be required; if would be the method of crease in pipe capacity when pipe diameter at a few eed to evaluate these areas		
uests that design work be trac	ked for possible back charge.			
ol (FDC File) ol – Shelle Pope Assurance in Bullen, Anthony Crockett nak e Connelley arson on, Vetter Sato	T-REX Oversight and Other ✓ Oversight – Basner, Steve ✓ Segment 1 – Jeff Cleveng ✓ Segment 2/3 – Al Eastwood ✓ LRT – Starling, Bacus, Re ITS – Gonzales, Lipp ✓ ✓ Design Oversight – John O ✓ CCD Joe Barsoom SECC Design Management ✓ ✓ Post Design Field Coordin ✓ PDS Administration – Jea ✓ Design Management – Kle ✓ Design Coordinator for Co ✓ Design Coordinator for Co ✓ Originator – Josh Schlee ✓ Steve Arent ✓ Scott Cromack, Jim Johns ✓ Lino Cruz, Jason Miner, Johns	er, Danielle Smith od, David Wieder eitter, (Shrestha if Systems) Griffith nators nette Bordner (FDC File) emz, Wise, O'Malley toger Kilgore onstruction – Laura Elliot		
	Project Wide Drainage Plans (Profiles) Change Request or RFI Josh Schlee SECC Various Drainage Plans (Profiles) Various HDPE pipe problems encourn over installed pipe), and exca may be necessary to remove Change all remaining HDPE structures to accommodate the the pipe and the structure is gless than 3", grouting betwee installation. Design has men switching to RCP, and it may locations, or stay with HDPE on a case-by-case basis; the to RCP without any major de Inge meet the requirements of the uests that design work be tracted Inge meet the requirements of the assurance In Bullen, Anthony Crockett arson on, Vetter	Project Wide Discipline: Drainage Plans (Profiles) Contractor: Change Request or RFI		



	G273	Date of Request:	the second se	
	Project Wide Drainage Plans (Profiles)	Discipline: Contractor:		
.		-		
Part III: Response				
Response	 The requested change is acc drainage profiles to indicate RCP. Drainage Design will criteria are satisfied. A sepa containing the revised draina If Drainage Design determin or make any other significan document those changes. 	the locations where HDP revise Q _{full} values, and ch irate FDC shall then be p age profiles. es that it is necessary to	E pipe is to be leck that velocit rocessed for ea upsize any part	changed to y and HGL ch Area icular pipe runs,
Revised Plans needed before this change can be Implemented	e Yes 🗌	If Yes, Plans to be Re	eissued by:	
Plans or Specs to be changed	: Separate FDC's shall be pro profiles.	cessed for each Area co	ntaining the rev	ised drainage
Does this field design change	meet the requirements of the C	Contract? ⊠ Yes □ No If N	No, complete Pa	arts V and VI
Design Work Charged to	: Post-Design Services	If PDS Ind	licate WBS:	
Design work charged to	Design Target	l	Hours:	200
Responded by	: Don Clark		Date:	6/27/03
Checked by				
Attachments	∵Yes □ No ⊠			
Part IV: Utility FDCs				
-			Data	
Response from Utility Company	Name of Utility Company	Representative	Dale.	
	Attached utility company res		n of response c	n FileNET.

Reast Corrections

SOUTHEAST CORRIDOR CONSTRUCTORS

FIELD DESIGN CHANGE/RFI MEMO

Field Memo Number:	G273	Date of Request:	6/23/03
Area:	Project Wide	Discipline:	Drainage
Package:	Drainage Plans (Profiles)	Contractor:	SECC

Part V: Final Proposed FDC Resolution by SECC (if change does not meet contract requirements)

Related Contract References:

Final	FDC	Reso	lution:
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Cost	Imn	licatio	ne
Cost	qinip	licalic	ns.

No Cost Change

Deductive Change

Deductive Change TBD

Agreement of FDC Resolution and Cost Implications proposed by SECC:

SECC Signature:

Print or Type Name

Signature

\$

Date

To be signed by Tom Howell, Doug Brannan, Ben Carnazzo, Barry Thoendel, Bruce Wilson, Dave Ross, Tim Mackin, or JD Vetter as appropriate.

Part VI: Field Design Change acceptance (if change does not meet contract requirements)

T-REX Signature:

Print or Type Name

Signature

Date

To be signed by Jeff Clevenger, Al Eastwood, Del Walker, Jim Starling, Pranaya Shrestha, or Jerry Nery as appropriate.

T-REX accepts the use of the described field design change for the subject application only. This acceptance does not change SECC's responsibilities for the Work pursuant to the Contract, nor does it create any additional liabilities for CDOT or RTD, nor does it change any rights SECC has under the Contract. SECC agrees to submit a Request for Change Order (RCO) if the accepted field design change results in a cost reduction.

REAST CONTRACTOR

SOUTHEAST CORRIDOR CONSTRUCTORS

	: G273 : Project Wide : Drainage Plans (Profiles)	Date of Request:6/2Discipline:DraContractor:SE	ainage
Part I: Identify Field Design	Change Request or RFI		97. 197. 197. 197. 197. 197. 197. 197. 1
Requested by:		Phone:	(303) 357-8456
	SECC	☑ FDC (for work the □ RFI	at has NOT been constructed)
Reference Drawing Number:		_	
Drawing Package Title:	Drainage Plans (Profiles)	_ Response needed by:	6/30/03
RFC Date of Drawings:	Various	_	
Description of Problem: (attach plan mark up if needed)	HDPE pipe problems encounter over installed pipe), and excava may be necessary to remove pr	ting around installed HDPE pip	be. At some locations it
Field Design Change Requested:	Change all remaining HDPE to structures to accommodate the the pipe and the structure is gre less than 3", grouting between t installation. Design has mention switching to RCP, and it may be locations, or stay with HDPE at on a case-by-case basis; the may to RCP without any major design	larger O.D. associated with RC ater than 3", collaring around the structure and the RCP wou ned that there is a slight decre- e necessary to increase the pip those locations. We will need ajority of pipe left to install can	CP. If the gap between the RCP will be required; if Id be the method of ase in pipe capacity when be diameter at a few to evaluate these areas
Construction rec Subcontractor	quests that design work be tracked		complete Parts V and VI
Part II: Distribution <u> TO:</u> SECC Document Contro T-REX Document Contro <u> SECC Construction Quality</u> Structures – Tim Nelson	ol (FDC File) ol – Shelle Pope <u>Assurance</u>	T-REX Oversight and Other ✓ Oversight – Basner, Stevenso ✓ Segment 1 – Jeff Clevenger, I ✓ Segment 2/3 – AI Eastwood, I ✓ LRT – Starling, Bacus, Reitter	Danielle Smith David Wieder
✓ Grading/Drainage – Bria Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue ✓ Procurement – Glen Ton Survey – Jim Bodi Paving – Dave Ross MHT – Lloyd Maier, Luk ITS/Elec – Bruce Wilson ✓ Stations – Mackin, Larse ✓ Segment 1 – Carnazzo, ✓ Segment 2/3 – Thoendee	nak e Connelley n arson on, Vetter Sato	ITS – Gonzales, Lipp ✓ Design Oversight – John Griff ✓ CCD Joe Barsoom SECC Design Management ✓ Post Design Field Coordinator ✓ PDS Administration – Jeanett ✓ Design Management – Klemz ✓ Discipline Design Mgr – Roge ✓ Design Coordinator for Constri ✓ Originator – Josh Schlee ✓ Steve Arent ✓ Scott Cromack, Jim Johnston ✓ Lino Cruz, Jason Miner, Jeff S	rs e Bordner (FDC File) , Wise, O'Malley r Kilgore ruction – Laura Elliot , Jay Stepetin



Field Memo Number:		Date	e of Request:		
	Project Wide Drainage Plans (Profiles)		Discipline: Contractor:		
Fachage	Jianage Flans (Flones)		Contractor.	3200	
art III: Response					
Response:	The requested change is drainage profiles to indic RCP. Drainage Design v criteria are satisfied. A s containing the revised dr If Drainage Design deter or make any other signifi document those changes	ate the location will revise Q _{full} eparate FDC s ainage profiles mines that it is cant changes,	ns where HDP values, and ch shall then be p s. necessary to	E pipe is to be neck that velocit rocessed for ea upsize any part	changed to y and HGL ach Area icular pipe runs
Revised Plans needed before this change can be	Yac 🗖	lf Yes,	Plans to be R	eissued by:	
Implemented:	Yes ∐ No ⊠				
Plans or Specs to be changed:	Separate FDC's shall be profiles.	processed for	each Area co	ntaining the rev	ised drainage
Does this field design change r	neet the requirements of t	he Contract?	⊠ Yes □ No If I	No, complete Pa	arts V and VI
Design Work Charged to:	Post-Design Services	\boxtimes	If PDS Inc	licate WBS:	
Design Work onlarged to.	Design Target			Hours:	200
Responded by:	Don Clar	k		Date:	6/27/03
Checked by:					
Attachments:	Yes □ No ⊠				
Part IV: Utility FDCs					
Response from Utility Company:				Date:	
Response norn duity dompany.	Name of Utility Compa	any Represent	ative		
	Attached utility company	response or i	ndicate locatio	on of response of	on FileNET.



FIELD DESIGN CHANGE/RFI MEMO

Field Memo Number:	G273	Date of Request:	6/23/03
Area:	Project Wide	Discipline:	Drainage
Package:	Drainage Plans (Profiles)	Contractor:	SECC

Part V: Final Proposed FDC Resolution by SECC (if change does not meet contract requirements)

Related Contract References:

Final FDC	Resolution:
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Cost Implications:

No Cost Change Deductive Change

Deductive Change TBD

Agreement of FDC Resolution and Cost Implications proposed by SECC:

SECC Signature:

Print or Type Name

Signature

\$

Date

To be signed by Tom Howell, Doug Brannan, Ben Carnazzo, Barry Thoendel, Bruce Wilson, Dave Ross, Tim Mackin, or JD Vetter as appropriate.

Part VI: Field Design Change acceptance (if change does not meet contract requirements)

T-REX Signature:

Print or Type Name

Signature

Date

To be signed by Jeff Clevenger, Al Eastwood, Del Walker, Jim Starling, Pranaya Shrestha, or Jerry Nery as appropriate.

T-REX accepts the use of the described field design change for the subject application only. This acceptance does not change SECC's responsibilities for the Work pursuant to the Contract, nor does it create any additional liabilities for CDOT or RTD, nor does it change any rights SECC has under the Contract. SECC agrees to submit a Request for Change Order (RCO) if the accepted field design change results in a cost reduction.

NONCON NCR Number:	FORMANCE REF	RRIDOR CONSTRUCTO	DN (I	NCR/NCE _9/12/03	<u>)</u>		
Area:		Contra					
Discipline: Activity Number:		Subcontra		None None			
Activity Number.		Sup	pher.	none		_	
Part I: Identify Nonconformance	9						
Issued by:	Jay Stepetin SECC	Issued to:		Carnazzo Thoendel	Wilson Mackir	n	Commented [MCO1]: Double-click on grey box to insert check mark
Referenced Contract Spec:	N/A		Н	Ross	U Vetter		
Referenced Drawing Number:	D113 D209						
Location of Nonconformance:							
		(channed 500))					
NB I-25 or I-225 Stationing:	631+00	(show nearest 500')					
Description of Nerk.		South of structure 613S1 and : Concrete barrier and permane					
Superintendent:	Gary Palmer						
Subcontractor:	None						
Supplier:							
This NCR request has been revie Terry Co Tim Nels Anthony Brian Bui Glen Tor	nstable on Crockett llen	☐ John Lee ☐ Pat McCre ☐ Kevin Seg ☐ Other QA	grue	gement:			
Part III: Distribution The NCR/h or a change in status has taken place. Log. IO: SECC Document Control (N ✓ SECC Design and Construction ✓ Post Design – Klemz, Uyerr Highways – Doug Brannan Structures – 1 Don Muns, 2 ✓ Grading – 1 Tim Driver, 2/3 Paving – Dave Ross Survey – Jim Bodi ITS/Elec – Bruce Wilson LRT – Tim Mackin, Wilson, I Stations – JD Vetter, Mackin MHT – Lloyd Maier, Luke C Segment 1 – Carnazzo, Sat Segment 2/3 – Thoendel, D Dynalectric – Vecchione, W Dynalectric – Vecchione, W	. The person making the d ICR File) table matsu, Field Design Coord 2/3 Rich Westerheid Scott Cromack Larson n, Larson onnelley o eml	Istribution at these occurrences r SECC Construction Qu Structures – Tim N Grading/Drainage Paving – Pat McCr ITS – John Lee LRT – Kevin Segru Procurement – Gle T-REX Oversight – Basne Segment 2/3 – Alf LRT – Starling, Bac ITS – Gonzales, Li Design Oversight – Utility Company (D	must u lelson – Antho ready ue en Tona <u>Other</u> Eastwo cus, Re pp –	pdate the stat ssurance ony Crockett, E k er, Stevenson ier, Danielle Sr od, David Wied itter, (Shrestha	us column of the irian Bullen irith ier if Systems) I-Gaines)	₽ NCR	
UP-999-Q05-1		Page 1 of 3			Rev (07/10/03	

	SOUTHEAST CORR	IDOR CONSTRUCTORS	
NONCONF	ORMANCE REPO	RT and EVALUATION (N	ICR/NCE)
NCR Number:	711	Date Issued:	9/12/03
	3.1	Contractor:	SECC
Discipline:	Drainage	Subcontractor:	
Activity Number:	30251.20	Supplier:	
Part IV: Identify Need for Noncon	formance Evaluation		
Note:		the work is to be removed and i	replaced, or reworked to
NCE Needed?			
NCE Needed?		d but requires Project Manager ap	oproval
		pline Manager approval	
	No (skip to Part V	(11)	
	OA or PM Approved	Joe Jensen	Date: 9/12/03
Proposed Resolution:		ce Drain Line 31-613-C at location	
	alternative.		
		Data Cant to Dest Desi	
		Date Sent to Post Desig	gn:
		Response Requested	by:
Part V: Post Design Response			
Response:			
Revised Plans needed before this change can be Implemented:		If Yes, Plans to be R	eissued by:
change can be implemented.			
Plans or Specs to be changed:			
Design Work Charged to WBS:			Hours:
			Deter
Responded by:	Post Desic	n Services	Date:
Checked by:			
Checked by.			
	V		
Attachments:	Yes ∐ No □		
UP-999-Q05-1	Pa	age 2 of 3	Rev Date 07/10/03

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		HEAST CORRIDOR CONSTRUCTORS			
NCR Number:	711	ANCE REPORT and EVALUATION (NO	9/12/0	3	
Area:	3.1	Contractor:			
Discipline:	Drainag	ge Subcontractor:			
Activity Number:	30251.2	20 Supplier: _	None		
art VI: Public Utility NCEs					
Response from Utility Company:		me of Utility Company Representative	Dat	e:	
	Attach	ed utility company response or indicate location of re	sponse	e on File	I.
Part VII: Resolution of NCR					
Type of Resolution:		Remove and Replace		(ski	p to Part IX)
		Repair/Rework to Contract Specification Compliance	е		p to Part IX)
		Repair/Rework to acceptable standards			
		Leave As Is (Use As Is) does not require QA reinspo	ection		
Description of Resolution:			ootion		
Expected Closure Date					
Part VIII: T-REX Technical Closu	re)ate [.]		
	re		Date: _		
Part VIII: T-REX Technical Closu Closure by	re	egment Oversight or Segment Design Oversight)	_		
Part VIII: T-REX Technical Closu Closure by	(S	E	_		
Part VIII: T-REX Technical Closu Closure by Part IX: SECC QA Disposition	(S	egment Oversight or Segment Design Oversight)	iance		
Part VIII: T-REX Technical Closu Closure by Part IX: SECC QA Disposition	re (S	egment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Compl	iance		
Part VIII: T-REX Technical Closur Closure by Part IX: SECC QA Disposition Action Comments or Verification o	re (S	egment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Compl Reinspected and Accepted based on T-REX Techni	iance		
Part VIII: T-REX Technical Closur Closure by Part IX: SECC QA Disposition Action Comments or Verification or Reinspection QA Manager Part X: Compliance with Contract	re(s	egment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Compl Reinspected and Accepted based on T-REX Techni	iance ical Clo		
Part VIII: T-REX Technical Closur Closure by Part IX: SECC QA Disposition Action Comments or Verification or Reinspection QA Manager Part X: Compliance with Contract	re(s	egment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Compl Reinspected and Accepted based on T-REX Techni guirements the work being in full contract compliance.	iance ical Clo		(circle one)
Part VIII: T-REX Technical Closur Closure by Part IX: SECC QA Disposition Action Comments or Verification or Reinspection QA Manager Part X: Compliance with Contrac Note: This disposition re T-REX Signature:	re (s	egment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Compl Reinspected and Accepted based on T-REX Techni quirements the work being in full contract compliance. Submit Change Order:	iance ical Clo Date:	NO	
Part VIII: T-REX Technical Closur Closure by Part IX: SECC QA Disposition Action Comments or Verification of Reinspection QA Manager Part X: Compliance with Contract Note: This disposition re T-REX Signature: Print or Type N	(S	egment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Compl Reinspected and Accepted based on T-REX Techni guirements the work being in full contract compliance.	iance ical Clo Date:	NO	(circle one)

T-REX accepts the effected elements of the work described by this NCR. This acceptance does not change SECC's responsibilities for the Work pursuant to the Contract, nor does it create any additional liabilities for CDOT or RTD, nor does it change any rights SECC has under the Contract. SECC agrees to submit a Request for Change Order (RCO) if acceptance requires concessions pursuant to Section 10.1.2 of the Contract.

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Page 3 of 3

NCR Number:		T and EVALUATION (NCR/NCE) Date Issued: 9/12/03	
Area:	3.1	Contractor: SECC	
Discipline: Activity Number:	Drainage 30251.20	Subcontractor: <u>None</u> Supplier: None	
Part I: Identify Nonconformance			
Issued by:	Jay Stepetin	Issued to: Carnazzo Di Wilson	
issued by.	SECC	Issued to:	Commented [MCO1]: Double-click on grey box to insert check mark
Referenced Contract Spec:	N/A		
Referenced Drawing Number:	D113, D209		
Location of Nonconformance:	Drain Line 31-613-C		
NB I-25 or I-225 Stationing:	631+00	(show nearest 500')	
		n of structure 613S1 and 20 feet North of structure 614S1 on rete barrier and permanent asphalt have been constructed in	
Superintendent:	Gary Palmer		
Subcontractor			
-	QA Management		-
	QA Management wed by: nstable on Crockett len	 John Lee Pat McCready Kevin Segrue Other QA Management: 	-
Part II: Review by Construction This NCR request has been revie Terry Coi Tim Nels Anthony Brian Bul Glen Ton Part III: Distribution The NCR/h or a change in status has taken place.	QA Management wed by: nstable on Crockett len ak	Pat McCready Kevin Segrue	
Part II: Review by Construction This NCR request has been revie Terry Col Tim Nelse Anthony Brian Bul Glen Ton Part III: Distribution The NCR/M or a change in status has taken place. Log. <u>TO:</u>	QA Management wed by: nstable on Crockett len lak ICE form will be distributed to th The person making the distributed	Pat McCready Kevin Segrue Other QA Management: Other QA Management: eappropriate parties via e-mail after each step where action is require ution at these occurrences must update the status column of the NCR SECC Construction Quality Assurance	
Part II: Review by Construction This NCR request has been revie Terry Con Tim Nelss Anthony Brian Bul Glen Ton Part III: Distribution The NCR/M or a change in status has taken place. Log. TO: SECC Document Control (N SECC QA Manager – Const	QA Management wed by: nstable on Crockett len lak ICE form will be distributed to th The person making the distribu- ICR File) table	Pat McCready Kevin Segrue Other QA Management: Other QA Management: Stuctures – Tim Nelson Grading/Drainage – Anthony Crockett, Brian Bullen	d
Part II: Review by Construction This NCR request has been revie Terry Coi Tim Nelse Anthony i Brian Bul Glen Ton Part III: Distribution The NCR/N or a change in status has taken place. Log. <u>TO:</u> SECC Document Control (N	QA Management wed by: nstable on Crockett len lak ICE form will be distributed to th The person making the distribu- ICR File) table	Pat McCready Kevin Segrue Other QA Management: Other QA Management:	
Part II: Review by Construction This NCR request has been revie Terry Coi Tim Nelse Anthony Brian Bul Glen Ton Part III: Distribution The NCR/N or a change in status has taken place. Log. ID: SECC Document Control (N SECC Design and Construction SECC Design – Klemz, Uyem Highways – Doug Brannan	QA Management wed by: nstable on Crockett len wak ICE form will be distributed to th The person making the distribu- ICR File) table	Pat McCready Kevin Segrue Other QA Management: Be appropriate parties via e-mail after each step where action is require trution at these occurrences must update the status column of the NCR SECC Construction Quality Assurance Structures - Tim Nelson ✓Grading/Drainage - Anthony Crockett, Brian Bullen Paving - Pat McCready TS - John Lee LRT - Kevin Segrue	d
Part II: Review by Construction This NCR request has been revie Terry Col Tim Nelse Anthony I Brian Bul Glen Ton Part III: Distribution The NCR/M or a change in status has taken place. Log. TO: SECC Document Control (N SECC Document Control (N SECC Design and Construction Post Design – Klemz, Uyem Highways – Doug Brannan Structures – 1 Don Muns, 2 CGrading – 1 Tim Driver, 2/3	QA Management wed by: nstable on Crockett len lak ICE form will be distributed to th The person making the distribu- lCR File) table watsu, Field Design Coord	Pat McCready Kevin Segrue Other QA Management: Other QA Management: Structures – Tim Nelson Grading/Drainage – Anthony Crockett, Brian Bullen Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue Procurement – Glen Tonak	d
Part II: Review by Construction This NCR request has been revie Terry Col Tim Nelse Anthony I Brian Bul Glen Ton Part III: Distribution The NCR/M or a change in status has taken place. Log. TD: SECC Document Control (N SECC Document Control (N SECC Design and Construction Post Design – Klemz, Uyem Highways – Doug Brannan Structures – 1 Don Muns, 2 Grading – 1 Tim Driver, 2/3 Paving – Dave Ross	QA Management wed by: nstable on Crockett len lak ICE form will be distributed to th The person making the distribu- lCR File) table watsu, Field Design Coord	Pat McCready Kevin Segrue Other QA Management: Other QA Management: Secc Construction Quality Assurance Structures – Tim Nelson Grading/Drainage – Anthony Crockett, Brian Bullen Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue Procurement – Glen Tonak T-REX Oversight and Other	
Part II: Review by Construction This NCR request has been revie □ Terry Col □ Tim Nels □ Anthony 1 □ Brian Bul □ Glen Ton Part III: Distribution The NCR/h or a change in status has taken place. Log. T0:	QA Management wed by: nstable on Crockett len lak ICE form will be distributed to th The person making the distribu- lCR File) table hatsu, Field Design Coord 2/3 Rich Westerheid Scott Cromack	Pat McCready Kevin Segrue Other QA Management: Other QA Management: Secc Construction Quality Assurance Structures – Tim Nelson Grading/Drainage – Anthony Crockett, Brian Bullen Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue Procurement – Glen Tonak TREX Oversight and Other ✓ Oversight – Basner, Walker, Stevenson Segment 1 – Jeff Clevenger, Danielle Smith	d
Part II: Review by Construction This NCR request has been revie Terry Coi Tim Nelse Anthony Brian Bul Glen Ton Part III: Distribution The NCR/N or a change in status has taken place. Log. IO: V SECC Document Control (N SECC Design and Construction V Post Design – Klemz, Uyem Highways – Doug Brannan Structures – 1 Don Muns, 2 Grading – 1 Tim Driver, 2/3 Paving – Dave Ross Survey – Jim Bodi	QA Management wed by: nstable on Crockett len lak ICE form will be distributed to th . The person making the distribu- tick File) table hatsu, Field Design Coord 2/3 Rich Westerheid Scott Cromack	Pat McCready Kevin Segrue Other QA Management: Description at these occurrences must update the status column of the NCR SECC Construction Quality Assurance Structures – Tim Nelson ✓ Grading/Drainage – Anthony Crockett, Brian Bullen Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue Procurement – Glen Tonak T-REX Oversight and Other ✓ Oversight – Basner, Walker, Stevenson	
Part II: Review by Construction This NCR request has been revie □ Terry Col □ Tim Nels □ Tim Nels □ Tim Nels □ Tim Nels □ Brian Bul □ Glen Tom Part III: Distribution The NCR/N or a change in status has taken place. Log. IO: ✓ SECC Document Control (N ✓ SECC Design and Construction ✓ Post Design – Klemz, Uyem Highways – Doug Brannan Structures – 1 Don Muns, 2 ✓ Grading – 1 Tim Driver, 2/3 Paving – Dave Ross Survey – Jim Bodi ITS/Elec – Bruce Wilson LRT – Tim Mackin, Wilson, L Stations – JD Vetter, Mackin MHT – Lloyd Maier, Luke Cd	QA Management wed by: nstable on Crockett len lak ICE form will be distributed to th The person making the distribu- lCR File) table table v3 Rich Westerheid Scott Cromack	Pat McCready Kevin Segrue Other QA Management: SECC Construction Quality Assurance Structures – Tim Nelson Grading/Drainage – Anthony Crockett, Brian Bullen Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue Procurement – Glen Tonak T-REX Oversight and Other ✓ Oversight – Basner, Walker, Stevenson Segment 1 – Jeff Clevenger, Danielle Smith ✓ Segment 1/3 – Al Eastwood, David Wieder LRT – Starting, Bacus, Reitter, (Shrestha if Systems) [ITS – Gonzales, Lipp	d
Part II: Review by Construction This NCR request has been revie Terry Col Tim Nelse Anthony i Brian Bul Glen Ton Part III: Distribution The NCR/h or a change in status has taken place. Log. <u>TO:</u> SECC Document Control (N SECC QA Manager – Const <u>SECC Qasign and Construction</u> V Post Design – Klemz, Uyem Highways – Doug Brannan Structures – 1 Don Muns, 2 Grading – 1 Tim Driver, 2/3 Paving – Dave Ross Survey – Jim Bodi ITS/Elec – Bruce Wilson LTAT–Tim Mackin, Wilson, L Stations – JD Vetter, Mackin	QA Management wed by: nstable on Crockett len iak ICE form will be distributed to th The person making the distribu- ick File) table iatsu, Field Design Coord 2/3 Rich Westerheid Scott Cromack	Pat McCready Kevin Segrue Other QA Management: SECC Construction Quality Assurance Structures – Tim Nelson Grading/Drainage – Anthony Crockett, Brian Bullen Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue Procurement – Glen Tonak TREX Oversight – Basner, Walker, Stevenson Segment 1 – Jeff Clevenger, Danielle Smith Segment 27 – Al Eastwood, David Wieder LRT – Starling, Bacus, Reitter, (Shrestha if Systems)	

NONCON	FORM	IANCE F	REPORT a	and EVALUATION	(NCR/NCE)	
NCR Number:				Date Issue	d: 9/12/03	
Area:	3.1			Contracto	or: SECC	
Discipline:	Draina	ge		Subcontracto		
Activity Number:	30251	.20		Supplie	er: None	
Part IV: Identify Need for Nonco	onforma	nce Evalua	ition			
Not			eded if the w ification Co	ork is to be removed an mpliance.	nd replaced, or re	eworked to
NCE Needed	?	May be re	equested but	requires Project Manager	r approval	
	\boxtimes	Yes, by Q	A Discipline	Manager approval		
			o Part VII)	0		
		or PM App	roved.	Joe Jensen	Date:	9/12/03
Proposed Resolutio	n: Eval	uate remov		ain Line 31-613-C at loca		
	alter	native.				
				Date Sent to Post De	esign:	
				Response Requeste	ed by:	
Part V: Post Design Response						
Respons	e:					
				KV Disesta b	Deineward hur	
Revised Plans needed before th				If Yes, Plans to be	e Reissued by: _	
change can be Implemente	u. No					
Plans or Specs to be change	d:					
Design Work Charged to WB	S:				Hours:	
Responded b	у:	Po	st Design Se	nuices	Date: _	
		FU	st Design Se	i vices		
Checked h	w.					
Attachmen	s: Yes					
	No					
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		NCE REPORT ar				
NCR Number:	711		Date Issued:	9/12/03		
Area:	3.1		Contractor:			
Discipline:	Drainage	9	Subcontractor:			
Activity Number:	30251.2	0	Supplier:			
_						
art VI: Public Utility NCEs						
Response from Utility Company:				Date	e:	
	Nam	ne of Utility Company Re	epresentative			
	Attache	d utility company respor	nse or indicate location of i	resnonse	on File	NET
	,			reopende		
art VII: Resolution of NCR						
Type of Resolution:		Remove and Replace			(eki	o to Part IX)
spe of Resolution.			A Cassification Course			
			act Specification Complian	ce	(SKI	o to Part IX)
		Repair/Rework to accept	table standards			
		_eave As Is (Use As Is)	does not require QA reins	pection		
Description of Resolution:						
Expected Closure Date:					_	
Expected Closure Date: art VIII: T-REX Technical Closur	 e			Dete:		
Expected Closure Date:	re	gment Oversight or Segment		Date:		
Expected Closure Date: art VIII: T-REX Technical Closur	re			Date:		
Expected Closure Date: art VIII: T-REX Technical Closur Closure by:		gment Oversight or Segment				
Expected Closure Date: art VIII: T-REX Technical Closur Closure by: art IX: SECC QA Disposition	(See	gment Oversight or Segment	Design Oversight)	pliance		
Expected Closure Date: art VIII: T-REX Technical Closur Closure by: art IX: SECC QA Disposition Action:	(See	gment Oversight or Segment	t Design Oversight)	pliance		
Expected Closure Date: art VIII: T-REX Technical Closur Closure by: art IX: SECC QA Disposition	(See	gment Oversight or Segment	Design Oversight)	pliance		
Expected Closure Date: art VIII: T-REX Technical Closur Closure by: art IX: SECC QA Disposition Action: Comments or Verification of	(See	gment Oversight or Segment	Design Oversight)	pliance		
Expected Closure Date: art VIII: T-REX Technical Closur Closure by: art IX: SECC QA Disposition Action: Comments or Verification of Reinspection:	(See	gment Oversight or Segment Reinspected verifying Co Reinspected and Accept	Design Oversight) Contract Specification Comp ted based on T-REX Techn	oliance nical Clos	sure	
Expected Closure Date: art VIII: T-REX Technical Closur Closure by: art IX: SECC QA Disposition Action: Comments or Verification of Reinspection:	(See	gment Oversight or Segment	Design Oversight) Contract Specification Comp ted based on T-REX Techn	oliance nical Clos	sure	
Expected Closure Date: art VIII: T-REX Technical Closur Closure by: art IX: SECC QA Disposition Action: Comments or Verification of Reinspection:	re (See F	gment Oversight or Segment Reinspected verifying Co Reinspected and Accept	Design Oversight)	oliance nical Clos	sure	
Expected Closure Date: art VIII: T-REX Technical Closur Closure by: art IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: art X: Compliance with Contrac	re (See F	gment Oversight or Segment Reinspected verifying Co Reinspected and Accept uirements he work being in full co	Design Oversight)	oliance nical Clos	sure	

T-REX accepts the effected elements of the work described by this NCR. This acceptance does not change SECC's responsibilities for the Work pursuant to the Contract, nor does it create any additional liabilities for CDOT or RTD, nor does it change any rights SECC has under the Contract. SECC agrees to submit a Request for Change Order (RCO) if acceptance requires concessions pursuant to Section 10.1.2 of the Contract.

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	SOUTHEAST CO		ORS				
NONCON NCR Number: Area: Discipline: Activity Number:	709 3.1 Drainage	Contr Subcontr	actor:	9/12/03 SECC	<u>)</u>		
Part I: Identify Nonconformance	e						
Issued by:		Issued to:		Carnazzo Thoendel		Wilson Mackin	Commented [MC01]: Double-click on grey box to insert check mark
Referenced Contract Spec:	N/A			Ross	\square	Vetter	
Referenced Drawing Number:	D102, D201						
-	Drain Line 31-507-B						
NB I-25 or I-225 Stationing:	506+92 & 507+67	(show nearest 500')					
Description of NCR:	Drain Line 31-507-B.	North of structure 506V1 and MSE wall, concrete barrier, m I in this area of conflict.					
Superintendent: Subcontractor: Supplier: Part II: Review by Construction	None None						
This NCR request has been revie Terry Co Tim Nelse Anthony U Brian Bul Glen Ton	nstable on Crockett Ilen	☐ John Lee ☐ Pat McCrr ☐ Kevin Seg ☐ Other QA	eady grue	gement:			
Part III: Distribution The NCR/N or a change in status has taken place.							
Log. IO: ✓ SECC Document Control (N ✓ SECC QA Manager – Const SECC Design and Construction ✓ Post Design – Klemz, Uyem Highways – Doug Brannan Structures – 1 Don Muns, 2 ✓ Grading – 1 Tim Driver, 2/3 : Paving – Dave Ross Survey – Jim Bodi ITS/Elec – Bruce Wilson LRT – Tim Mackin, Wilson, L Stations – JD Vetter, Mackin MHT – Lloyd Maier, Luke CC Segment 1/2 – Thoendel, De Dynalectric – Vecchione, Wr	able atsu, Field Design Coord /3 Rich Westerheid Scott Cromack arson , Larson onnelley o eml	SECC Construction Qu Structures – Tim N Grading/Drainage Paving – Pat McCr ITS – John Lee LRT – Kevin Segru Procurement – Gle T-REX Oversight – Basne Segment 1 – Jeff (Segment 2/3 – Al E LRT – Starling, Bac ITS – Gonzales, Li Design Oversight – Utility Company (D	lelson – Antho ready ue en Tona other r, Walk Cleveng Eastwo cus, Rei pp	k k er, Stevenson er, Danielle Sm d, David Wied tter, (Shrestha	lith er if Systems		
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Juensi Colt	SOUTHEAST CORRIDOR	CONSTRUCTORS	
NONCONF	ORMANCE REPORT and	EVALUATION (NCR/NCE)
NCR Number:	709	Date Issued: 9/12/03	
_	3.1	Contractor: SECC	
	Drainage	Subcontractor: None	
Activity Number:	30001.20	Supplier: None	
art IV: Identify Need for Noncor	formance Evaluation		
Note:		is to be removed and replaced, o	r reworked to
NCE Needed?		uires Project Manager approval	
	Yes, by QA Discipline Mar		
		lager approval	
	No (skip to Part VII)		
	QA or PM Approved:	Joe Jensen Date:	9/12/03
Proposed Resolution:		Line 31-507-B at location of damage	d pipe or NCE
	alternative.		
		Data Sant to Post Docian:	
		Date Sent to Post Design: Response Requested by:	
		Response Requested by.	
art V: Post Design Response			
Response:			
Revised Plans needed before this	Yes 🗌	If Yes, Plans to be Reissued by:	
change can be Implemented:		in res, Flans to be reissued by.	
Plans or Specs to be changed:			
Design Work Charged to WBS:		Hours:	
Responded by:		Date	
Responded by.	Post Design Service	es Date.	
Checked by:			
Attachments:	Yes 🗖		
Attachments.	No		
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NCR Number:	709	Date Issued:	Date Issued: 9/12/03				
	3.1		Contractor: SECC				
Discipline:	Draina	age Subcontractor:	the second se				
Activity Number:	30001	.20 Supplier:	None				
VI: Public Utility NCEs							
esponse from Utility Company: _			Date	e:			
	Na	ame of Utility Company Representative					
	Attac	hed utility company response or indicate location of	response	on Fil	eNET.		
VII: Resolution of NCR							
Type of Resolution:		Remove and Replace		(sk	(ip to Part IX)		
		Repair/Rework to Contract Specification Complian	nce	(sk	(ip to Part IX)		
		Repair/Rework to acceptable standards					
		Leave As Is (Use As Is) does not require QA reins	spection				
Description of Resolution:							
Expected Closure Date:							
VIII: T-REX Technical Closure	3						
)		Date:				
VIII: T-REX Technical Closure Closure by:)	Segment Oversight or Segment Design Oversight)	Date:				
VIII: T-REX Technical Closure Closure by: IX: SECC QA Disposition		Segment Oversight or Segment Design Oversight)					
VIII: T-REX Technical Closure Closure by:)	Segment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Com	pliance				
VIII: T-REX Technical Closure Closure by: IX: SECC QA Disposition		Segment Oversight or Segment Design Oversight)	pliance				
VIII: T-REX Technical Closure Closure by: IX: SECC QA Disposition Action: Comments or Verification of	e (5 () ()	Segment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Com Reinspected and Accepted based on T-REX Tech	pliance nnical Clos	sure			
VIII: T-REX Technical Closure Closure by: IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager:) (§	Segment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Com Reinspected and Accepted based on T-REX Tech	pliance nnical Clos	sure			
VIII: T-REX Technical Closure Closure by: IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: X: Compliance with Contract	(S	Segment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Com Reinspected and Accepted based on T-REX Tech	pliance nnical Clos	sure			
VIII: T-REX Technical Closure Closure by: IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: X: Compliance with Contract	(S	Segment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Com Reinspected and Accepted based on T-REX Tech	pliance nnical Clos	sure			
VIII: T-REX Technical Closure Closure by: IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: X: Compliance with Contract Note: This disposition rest	e constant de la cons	Segment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Com Reinspected and Accepted based on T-REX Tech	pliance Inical Clos Date:	sure			

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	SOUTHEAST CORRI	DOR CONSTRUCTORS			
NONCON	FORMANCE REPOR	T and EVALUATION (N	ICR/NCE)		
NCR Number: Area: Discipline: Activity Number:	3.1 Drainage	Date Issued: Contractor: Subcontractor: Supplier:	SECC None		
Part I: Identify Nonconformance	9				
Issued by:	Jay Stepetin SECC		Carnazzo Thoendel Ross	☐ Wilson☐ Mackin☐ Vetter☐	Commented [MC01]: Double-click on grey box to insert check mark
Referenced Contract Spec:	N/A	Ö			
Referenced Drawing Number:	D102, D201				
Location of Nonconformance:	Drain Line 31-507-B				
NB I-25 or I-225 Stationing:	506+92 & 507+67	(show nearest 500')			
Description of NCR:		of structure 506V1 and 12 fee wall, concrete barrier, moment is area of conflict.			
Superintendent: Subcontractor: Supplier:	None				
Part II: Review by Construction This NCR request has been revie Terry Cor Tim Nelse Anthony G Brian Bull Glen Ton	wed by: nstable on Crockett len	 John Lee Pat McCready Kevin Segrue Other QA Manag 	gement:		
Part III: Distribution The NCR/N or a change in status has taken place. Log.					
Y SECC Document Control (N ✓ SECC QA Manager – Const SECC Design and Construction ✓ ✓ Post Design – Klemz, Uyema Highways – Doug Brannan Structures – 1 Don Muns, 2 ✓ Grading – 1 Tim Driver, 2/3 § Paving – Dave Ross Survey – Jim Bodi ITS/Elec – Bruce Wilson LRT– Tim Mackin, Wilson, Li Stations – JD Vetter, Mackin, Luke Co Segment 1 – Carnazzo, Sato ✓ Segment 2/3 – Thoendel, De Dynalectric – Vecchione, Wr Straticre – Vecchione, Wr	able atsu, Field Design Coord /3 Rich Westerheid Scott Cromack arson , Larson innelley b	SECC Construction Quality As Structures – Tim Nelson Grading/Drainage – Antho Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue Procurement – Glen Tonal TREX Oversight – Basner, Walke Segment 1 – Jeff Cleveng, Segment 2/3 – Al Eastwoo LRT – Starling, Bacus, Reil ITS – Gonzales, Lipp Design Oversight – Utility Company (DW-McQ	ny Crockett, Bria r, Stevenson ar, Danielle Smil d, David Wiedei ter, (Shrestha if	h - Systems)	
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STORE COL	SOU	THEAST CORR	IDOR CONSTRUCTORS	
NONCON	FORM	IANCE REPOR	RT and EVALUATION (N	ICR/NCE)
NCR Number:	709		Date Issued:	9/12/03
Area:	3.1		Contractor:	
Discipline:	Draina	ige	Subcontractor:	
Activity Number:	30001	.20	Supplier:	None
Part IV: Identify Need for Nonco	onforma	nce Evaluation		
Not		E is not needed if t tract Specification	he work is to be removed and r r Compliance.	replaced, or reworked to
NCE Needed	?	May be requested	l but requires Project Manager ap	oproval
	\boxtimes	Yes, by QA Discip	bline Manager approval	
		No (skip to Part V	11)	
	0.0			Dete: 0/40/02
Proposed Resolutio			Joe Jensen e Drain Line 31-507-B at location	
	aiter	native.	Date Sent to Date Dasis	10.
			Date Sent to Post Desig	gn:
			Response Requested b	Бу:
Part V: Post Design Response				
Response	e:			
Revised Plans needed before th change can be Implemented			If Yes, Plans to be Re	eissued by:
Plans or Specs to be changed	ł:			
Design Work Charged to WBS	S:		_	Hours:
Responded by	<i>.</i> .			Date:
Responded by		Post Desigr	n Services	
Checked by	<i>r</i> :			
Attachments	s: Yes No			
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	SOUTHEAST CORRIDOR CONSTRUCTOR				
NONCONF	ORMANCE REPORT and EVALUATION	I (N	CR/N	CE)	
Discipline:	Z09 Date Issue 3.1 Contract Drainage Subcontract 30001.20 Suppli	tor:	SECC None	;	
art VI: Public Utility NCEs					
Response from Utility Company: _	Name of Utility Company Representative		Da	te:	
	Attached utility company response or indicate location	n of re	spons	e on Fil	eNET.
art VII: Resolution of NCR					
Type of Resolution:	Remove and Replace Repair/Rework to Contract Specification Comp Repair/Rework to acceptable standards Leave As Is (Use As Is) does not require QA re				ip to Part IX) ip to Part IX)
Description of Resolution:		entopy	solion		
Expected Closure Date:					
art VIII: T-REX Technical Closure					
Closure by:	(Segment Oversight or Segment Design Oversight)	D	ate: _		
art IX: SECC QA Disposition					
Action:	 Reinspected verifying Contract Specification Co Reinspected and Accepted based on T-REX Te 			osure	
Comments or Verification of Reinspection:					
QA Manager:		D	ate:		
art X: Compliance with Contract	al Requirements Its in the work being in full contract compliance.				
<u>-REX Signature</u> :	Submit Change Order:	Y	ES	NO	(circle one)
Print or Type Na	ne Signature			D	ate
	nger, Al Eastwood, Del Walker, Jim Starling, Gary Gonzales, Pranay.	n Chro	otho c-		
T-REX accepts the effected elements of pursuant to the Contract, nor does it crea	nger, an Eastwood, bei warker, sinn stammig, Gary Gonzales, Pranay he work described by this NCR. This acceptance does not ch e any additional liabilities for CDDT or RTD, nor does it change nge Order (RCO) if acceptance requires concessions pursuant t	nange e any r	SECC's	respons ECC has	ibilities for the W under the Contra

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EBS TUE INFO

SOUTHEAST CORRIDOR CONSTRUCTORS

	: Project Wide)rainage
	Drainage Plans (Profiles)	Contractor: _S	ECC
Part I: Identify Field Design (•		
Requested by:	Josh Schlee SECC	Phone	: (303) 357-8456
Defense Device Number		FDC (for work t	that has NOT been constructed)
Reference Drawing Number:			0 /0 0 /0 0
	Drainage Plans (Profiles)	Response needed by	: 6/30/03
RFC Date of Drawings:	Various		
Description of Problem: (attach plan mark up if needed)	HDPE pipe problems encounter over installed pipe), and excave may be necessary to remove p	vating around installed HDPE p	pipe. At some locations it
Field Design Change Requested:	Change all remaining HDPE to structures to accommodate the the pipe and the structure is ge less than 3", grouting between installation. Design has menti switching to RCP, and it may be locations, or stay with HDPE a on a case-by-case basis; the r to RCP without any major design	e larger O.D. associated with F reater than 3", collaring around the structure and the RCP wo oned that there is a slight decr be necessary to increase the p at those locations. We will nee najority of pipe left to install ca	RCP. If the gap between d the RCP will be required; if build be the method of rease in pipe capacity when ipe diameter at a few d to evaluate these areas
Construction req Subcontractor:	uests that design work be track		o, complete Parts V and VI
Part II: Distribution			
TO: ✓ SECC Document Contro ✓ T-REX Document Contro SECC Construction Quality A Structures – Tim Nelson ✓ Grading/Drainage – Brian Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue ✓ Procurement – Glen Ton SECC Construction ✓ Survey – Jim Bodi Paving – Dave Ross MHT – Lloyd Maier, Luke ITS/Elec – Bruce Wilson LRT– Mackin, Wilson, La ✓ Stations – Mackin, Larso ✓ Segment 1 – Carnazzo, S ✓ Dynalectric – Vecchione,	ol – Shelle Pope Assurance n Bullen, Anthony Crockett ak e Connelley arson n, Vetter Sato , Deml	T-REX Oversight and Other ✓ Oversight – Basner, Stevens ✓ Segment 1 – Jeff Clevenger, ✓ Segment 2/3 – Al Eastwood, ✓ LRT – Starling, Bacus, Reitter ITS – Gonzales, Lipp ✓ ✓ Design Oversight – John Gritter ✓ CCD Joe Barsoom SECC Design Management ✓ ✓ Post Design Field Coordinated ✓ PDS Administration – Jeaned ✓ Design Management – Klem ✓ Design Coordinator for Cons ✓ Design Coordinator for Cons ✓ Originator – Josh Schlee ✓ Steve Arent ✓ Scott Cromack, Jim Johnston ✓ Lino Cruz, Jason Miner, Jeff	, Danielle Smith David Wieder er, (Shrestha if Systems) ffith ors tte Bordner (FDC File) z, Wise, O'Malley er Kilgore struction – Laura Elliot



Field Memo Number:		Date of Request:		
	Project Wide	Discipline:		
Package:	Drainage Plans (Profiles)	Contractor:	SECC	
Part III: Response				
Response:	The requested change is acc drainage profiles to indicate to RCP. Drainage Design will re- criteria are satisfied. A separa containing the revised drainal If Drainage Design determine or make any other significant document those changes.	the locations where HDP evise Q _{full} values, and ch rate FDC shall then be p ge profiles. es that it is necessary to	E pipe is to be eck that veloci rocessed for ea upsize any par	changed to ty and HGL ach Area ticular pipe runs,
Revised Plans needed before this change can be Implemented:	Yes □ No ⊠	If Yes, Plans to be Re	eissued by:	
Plans or Specs to be changed:	Separate FDC's shall be proc profiles.	cessed for each Area cor	ntaining the rev	rised drainage
Does this field design change r	neet the requirements of the C		lo, complete Pa	arts V and VI
Design Work Charged to:	Post-Design Services	If PDS, Indi	cate WBS:	
	Design Target		Hours:	200
Responded by:	Don Clark		Date:	6/27/03
Checked by:				
Attachments:	Yes □ No ⊠			
Part IV: Utility FDCs				
Response from Utility Company:			Date:	
	Name of Utility Company F Attached utility company resp		of response o	n FileNFT
	, addined dailing company roop			



FIELD DESIGN CHANGE/RFI MEMO

Field Memo Number:	G273	Date of Request:	6/23/03
Area:	Project Wide	Discipline:	Drainage
Package:	Drainage Plans (Profiles)	Contractor:	SECC

Part V: Final Proposed FDC Resolution by SECC (if change does not meet contract requirements)

Related Contract References:

Final FDC Resolution:		
Cost Implications:		
No Cost C		
	Change TBD	
Agreement of FDC Resolution and Cost Implie	cations proposed by SECC:	
SECC Signature:		
Drink or Truce Norma	<u>O'ana tana</u>	Data
Print or Type Name	Signature	Date
To be signed by Tom Howell, Doug or JD Vetter as appropriate.	Brannan, Ben Carnazzo, Barry Thoendel, B	ruce Wilson, Dave Ross, Tim Mackin,
Part VI: Field Design Change acceptance (if	change does not meet contract require	ments)
<u>T-REX Signature</u> :		
Print or Type Name	Signature	Date
To be signed by Jeff Clevenger, Al appropriate.	Eastwood, Del Walker, Jim Starling, Pranaya	a Shrestha, or Jerry Nery as

T-REX accepts the use of the described field design change for the subject application only. This acceptance does not change SECC's responsibilities for the Work pursuant to the Contract, nor does it create any additional liabilities for CDOT or RTD, nor does it change any rights SECC has under the Contract. SECC agrees to submit a Request for Change Order (RCO) if the accepted field design change results in a cost reduction.



sinstructure					
Field Memo Number		Date of Request:	6/23/03		
Area		Discipline:			
Package	Drainage Plans (Profiles)	Contractor:	SECC		
Part I: Identify Field Design (Change Request or RFI				
Requested by:	•	Pho	one: (303) 357-8456		
Requested by:	SECC				
			ork that has NOT been constructed)		
Reference Drawing Number:	Various				
Drawing Package Title:	Drainage Plans (Profiles)	Response needed	by:6/30/03		
RFC Date of Drawings:	Various				
Description of Problem: (attach plan mark up if needed)	HDPE pipe problems encounter over installed pipe), and excave may be necessary to remove p	ating around installed HDF	PE pipe. At some locations it		
Field Design Change Requested:					
	nge meet the requirements of the uests that design work be tracke	🗌 No If	No, complete Parts V and VI		
Part II: Distribution					
TO: ✓ SECC Document Control ✓ T-REX Document Contro SECC Construction Quality A Structures – Tim Nelson ✓ Grading/Drainage – Briar Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue ✓ Procurement – Glen Tona SECC Construction ✓ Survey – Jim Bodi Paving – Dave Ross MHT – Lloyd Maier, Luke ITS/Elec – Bruce Wilson LRT– Mackin, Wilson, La ✓ Stations – Mackin, Larson ✓ Segment 1 – Carnazzo, S ✓ Segment 2/3 – Thoendel, ✓ Dynalectric – Vecchione,	I – Shelle Pope ssurance Bullen, Anthony Crockett ak Connelley rson h, Vetter Sato Deml	T-REX Oversight and Other Oversight – Basner, Stev Segment 1 – Jeff Cleven Segment 2/3 – Al Eastwo LRT – Starling, Bacus, R ITS – Gonzales, Lipp Design Oversight – John CCD Joe Barsoom SECC Design Management Post Design Field Coordi PDS Administration – Jea Design Management – K Discipline Design Mgr – I Design Coordinator for C Originator – Josh Schlee Steve Arent Steve Arent Lino Cruz, Jason Miner, A	ger, Danielle Smith bod, David Wieder eitter, (Shrestha if Systems) Griffith inators anette Bordner (FDC File) lemz, Wise, O'Malley Roger Kilgore ionstruction – Laura Elliot		



	G273		6/23/03	
	Project Wide Drainage Plans (Profiles)	Discipline: Contractor:	Drainage	
	Brainage Frane (Fremedy	Contractor		
Part III: Response	ne anna a sao a fairte na anna anna anna anna anna anna anna		****	
Response	 The requested change is accerdinate profiles to indicate th RCP. Drainage Design will recriteria are satisfied. A separa containing the revised drainag If Drainage Design determines or make any other significant of document those changes. 	e locations where HDP vise Q _{full} values, and ch te FDC shall then be p e profiles. that it is necessary to	E pipe is to be eck that veloci rocessed for ea upsize any par	changed to ty and HGL ach Area ticular pipe runs,
Revised Plans needed before this change can be Implemented	e Yes 🗌	If Yes, Plans to be Re	eissued by:	
Plans or Specs to be changed	Separate FDC's shall be proce profiles.	essed for each Area cor	ntaining the rev	ised drainage
Does this field design change	meet the requirements of the Co		lo, complete Pa	arts V and VI
Design Work Charged to	Post-Design Services 🛛 🗌 Design Target	lf PDS, Indi	cate WBS: Hours:	200
Responded by:	Don Clark		Date:	6/27/03
Checked by				
Attachments				
Part IV: Utility FDCs				
Response from Utility Company	Name of Utility Company Re		Date:	
	Attached utility company Re		of response o	n FileNET.

A CONTRACTOR OF CONTRACTOR OF

Field

SOUTHEAST CORRIDOR CONSTRUCTORS

FIELD DESIGN CHANGE/RFI MEMO

Memo Number:	G273	Date of Request:	6/23/03
Area:	Project Wide	Discipline:	Drainage
Package:	Drainage Plans (Profiles)	Contractor:	SECC

Part V: Final Proposed FDC Resolution by SECC (if change does not meet contract requirements)

Related Contract References:

Fi	nal FDC Resolution:		
	Cost Implications:	ange	
	Deductive C	Change – \$	_
Agreement o	Deductive C Deductive C of FDC Resolution and Cost Implica	•	
SECC Signa			
	Print or Type Name	Signature	Date
	To be signed by Tom Howell, Doug B or JD Vetter as appropriate.	Brannan, Ben Carnazzo, Barry Thoendel, Br	uce Wilson, Dave Ross, Tim Mackin,
Part VI: Field	d Design Change acceptance (if c	change does not meet contract requirer	nents)
T-REX Signa)
	Print or Type Name	Signature	Date
	To be signed by Jeff Clevenger, Al Ea appropriate.	astwood, Del Walker, Jim Starling, Pranaya	Shrestha, or Jerry Nery as

T-REX accepts the use of the described field design change for the subject application only. This acceptance does not change SECC's responsibilities for the Work pursuant to the Contract, nor does it create any additional liabilities for CDOT or RTD, nor does it change any rights SECC has under the Contract. SECC agrees to submit a Request for Change Order (RCO) if the accepted field design change results in a cost reduction.

En structure	SOUTHEAST CORRIDO	and EVALUATION (N			
NCR Number: Area: Discipline: Activity Number:	3.1 Drainage	Date Issued: Contractor: Subcontractor: Supplier:	SECC None		
		Supplier.	None		
Part I: Identify Nonconformance			0		
Issued by:	Jay Stepetin SECC	Issued to:	Carnazzo Thoendel Ross	 Wilson Mackin Vetter 	Commented [MC01]: Double-click on grey box to insert check mark
Referenced Contract Spec:	N/A	_			
Referenced Drawing Number:	D113, D209				
Location of Nonconformance:	Drain Line 31-613-C				
NB I-25 or I-225 Stationing:	631+00	(show nearest 500')			
Description of NCR:	Mandrill failed 28 feet South of Drain Line 31-613-C. Concrete this area of conflict.				
Superintendent:	Gary Palmer				
Subcontractor:	None				
Supplier:	None				
Part II: Review by Construction					
This NCR request has been revie	nstable on Crockett Ien	John Lee Pat McCready Kevin Segrue Other QA Manag	gement:		
Part III: Distribution The NCR/N or a change in status has taken place.					
Log. TO: 	able atsu, Field Design Coord /3 Rich Westerheid Scott Cromack arson , Larson onnelley o eml	SECC Construction Quality A Structures – Tim Nelson Grading/Drainage – Antho Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue Procurement – Glen Tona TREX Oversight – Basner, Walkd Segment 1 – Jeff Cleveng Segment 2/3 – Al Eastwoo LRT – Starling, Bacus, Rei ITS – Gonzales, Lipp Design Oversight – Utility Company (DW-McC	ny Crockett, Bria k ar, Stevenson er, Danielle Smi d, David Wiede tter, (Shrestha if	th r Systems)	
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STERS COL	:	sout	HEA	ST CORRI	OOR CONSTRUCTORS		
	NONCONF	ORM	ANC	E REPOR	T and EVALUATION (NCR/NCE)	
structor	NCR Number:	711			Date Issued:	9/12/03	
	Area:					SECC	
	Discipline:	Draina	ge		Subcontractor:		
	Activity Number:	30251.	20		Supplier:	None	
Part IV: Ide	ntify Need for Noncon	forma	nce Er	valuation			
	Note:			t needed if the Specification	e work is to be removed and Compliance.	replaced, or re	worked to
	NCE Needed?		May	be requested I	but requires Project Manager a	pproval	
		\boxtimes	Yes,	by QA Discipli	ne Manager approval		
			No (s	skip to Part VII)		
		0.4		A	les lesses	Data	0/40/00
	Proposed Resolution:				Joe Jensen Drain Line 31-613-C at locatio		
					Date Sent to Post Desi	gn:	
					Response Requested	by:	
Part V: Pos	t Design Response				an da a manana kana da da babanan baban yana ana ana ana ana ana ana ana ana		101 101 101 101 101 101 101 101 101 101
1 410 1 105	Response:						
	ans needed before this e can be Implemented:				If Yes, Plans to be R	eissued by:	
Plans o	r Specs to be changed:						
Design	Work Charged to WBS:				-	Hours:	
	Responded by:					Data	
	Responded by.			Post Design	Services	Date.	
	Checked by:						
	Attachments:	Yes No					
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NCR Number:	711 Date Issued	9/12/03		
	3.1 Contractor	the second s		
	Drainage Subcontractor			
Activity Number:	30251.20 Supplier	None		
Part VI: Public Utility NCEs				
Response from Utility Company:		Date:		
	Name of Utility Company Representative			
	Attached utility company response or indicate location of	f response on FileNET.		
Part VII: Resolution of NCR				
Type of Resolution:	Remove and Replace	(skip to Part IX)		
	Repair/Rework to Contract Specification Complia	(skip to Part IX)		
	Repair/Rework to acceptable standards			
	Leave As Is (Use As Is) does not require QA rein	spection		
Description of Resolution:				
Expected Closure Date:				
Expected Closure Date:		Date:		
Expected Closure Date: art VIII: T-REX Technical Closure		Date:		
Expected Closure Date: art VIII: T-REX Technical Closure Closure by:	3	Date:		
Expected Closure Date: Part VIII: T-REX Technical Closure Closure by:	3			
Expected Closure Date: Part VIII: T-REX Technical Closure Closure by: Part IX: SECC QA Disposition	(Segment Oversight or Segment Design Oversight)	npliance		
Expected Closure Date: Part VIII: T-REX Technical Closure Closure by: Part IX: SECC QA Disposition	(Segment Oversight or Segment Design Oversight)	npliance		
Expected Closure Date: Part VIII: T-REX Technical Closure Closure by: Part IX: SECC QA Disposition Action: Comments or Verification of	 (Segment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Corr Reinspected and Accepted based on T-REX Tech 	npliance		
Expected Closure Date: Part VIII: T-REX Technical Closure Closure by: Part IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: Part X: Compliance with Contract	(Segment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Com Reinspected and Accepted based on T-REX Tech	npliance hnical Closure		
Expected Closure Date: Part VIII: T-REX Technical Closure Closure by: Part IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: Part X: Compliance with Contract	(Segment Oversight or Segment Design Oversight) (Segment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Corr Reinspected and Accepted based on T-REX Tech ual Requirements	npliance hnical Closure		

T-REX accepts the effected elements of the work described by this NCR. This acceptance does not change SECC's responsibilities for the Work pursuant to the Contract, nor does it create any additional liabilities for CDOT or RTD, nor does it change any rights SECC has under the Contract. SECC agrees to submit a Request for Change Order (RCO) if acceptance requires concessions pursuant to Section 10.1.2 of the Contract.

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NONCON		RIDOR CONSTRUCTORS	ICR/NCE)		
NCR Number: Area: Discipline: Activity Number:	3.1 Drainage	Date Issued: Contractor: Subcontractor: Supplier:	SECC None		
Part I: Identify Nonconformance	e				
Issued by:	Jay Stepetin SECC		Carnazzo Thoendel Ross	WilsonMackinVetter	Commented [MC01]: Double-click on grey box to insert check mark
Referenced Contract Spec:	N/A		1055		
Referenced Drawing Number:	D113, D209				
Location of Nonconformance:	Drain Line 31-613-C				
NB I-25 or I-225 Stationing:	631+00	(show nearest 500')			
Description of NCR:		uth of structure 613S1 and 20 feet ncrete barrier and permanent aspl			
Superintendent:					
Subcontractor:	None				
Supplier:	None				
Part II: Review by Construction	QA Management				
This NCR request has been revie Terry Col Tim Nels Anthony Brian Bul Glen Ton	nstable on Crockett len	☐ John Lee ☐ Pat McCready ☐ Kevin Segrue ☐ Other QA Manag	jement:		
Part III: Distribution The NCR/N or a change in status has taken place. Log.					
ID: ✓ SECC QA Manager – Const SECC Design and Construction ✓ Post Design – Klemz, Uyem Highways – Doug Brannan Structures – 1 Don Muns, 2 ✓ Grading – 1 Tim Driver, 2/3 Paving – Dave Ross Survey – Jim Bodi ITS/Elec – Bruce Wilson LRT – Tim Mackin, Wilson, L Stations – JD Vetter, Mackir MHT – Lloyd Maier, Luke Co Segment 1 – Carnazzo, Sati ✓ Segment 2/3 – Thoendel, Da Dynalectric – Vecchione, With	able atsu, Field Design Coord /3 Rich Westerheid Scott Cromack arson , Larson onnelley o eml	SECC Construction Quality As Structures – Tim Nelson Grading/Drainage – Anthor Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue Procurement – Glen Tonak T-REX Oversight and Other ✓ Oversight – Basner, Walke Segment 1 – Jeff Clevenge ✓ Segment 2/3 – Al Eastwood LRT – Starling, Bacus, Reitt ITS – Gonzales, Lipp Design Oversight – Utility Company (DW-McQu	ny Crockett, Briar r, Stevenson r, Danielle Smith d, David Wieder ter, (Shrestha if S	systems)	
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ALL STREET		SOUTHEAST CORR	DOR CONSTRUCTORS	
NON	CONF	ORMANCE REPOR	T and EVALUATION (N	ICR/NCE)
Discip	Area:	711 3.1 Drainage 30251.20	Subcontractor:	SECC
Part IV: Identify Need for I	Noncon	formance Evaluation		
	Note:	NCE is not needed if the Contract Specification	ne work is to be removed and i Compliance.	replaced, or reworked to
NCE N	eeded?		but requires Project Manager ap line Manager approval I)	pproval
Proposed Res	olution:		Joe Jensen e Drain Line 31-613-C at locatior	Date: <u>9/12/03</u> of damaged pipe or NCE
			Date Sent to Post Desig	
			Response Requested b	ру:
Revised Plans needed befo			If Yes, Plans to be Re	eissued by:
change can be Implen				
Plans or Specs to be ch				
Design Work Charged to	WBS:		_	Hours:
Respon	ded by:	Post Design	Services	Date:
Chec	ked by:			
Attach	iments:	Yes D No D		
110 000 005 1			o 2 of 2	Bay Data 07/10/02

		sou	JTHEAST CORRIDOR	CONSTRUCTOR	s			
NCF	R Number: Area:	711 3.1	MANCE REPORT an	Date Issue Contract	ed: 9/12 or: SEC	/03 :C		
	Discipline: y Number:		nage i1.20	Subcontract Suppli	er: Non			
Part VI: Public Utility	NCEs							
Response from Utility	y Company:	N	Name of Utility Company Rep Iched utility company respons			eate:	IET.	
Part VII: Resolution of	of NCR							
Туре с	of Resolution:		Repair/Rework to Contrac Repair/Rework to accepta	able standards		(skip	to Part to Part	,
Description o	of Resolution:		Leave As Is (Use As Is) d		mspecuol			
	Closure Date:							
Part VIII: T-REX Tech								
	Closure by:	-	(Segment Oversight or Segment [Design Oversight)	Date:			
Part IX: SECC QA Dis	sposition							
	Action:		Reinspected verifying Cor Reinspected and Accepte					
Comments or V F	/erification of Reinspection:	_		A DASEU UN I-REA TE		losuie		
C	QA Manager:				Date:			
Part X: Compliance w Note: This dis			Requirements in the work being in full co	ntract compliance.				
T-REX Signature:			Submit	Change Order:	YES	NO	(circle o	one)
Pri	int or Type Na	ame	Signat	ture		Date	e	
To be sig	ned by Jeff Clev	enger, A	Al Eastwood, Del Walker, Jim Starlir	ng, Gary Gonzales, Pranaya	a Shrestha, o	or Jerry Nery a	s appropr	ate.
pursuant to the Contract,	nor does it creater	ate any	ork described by this NCR. This y additional liabilities for CDOT or Order (RCO) if acceptance require	RTD, nor does it change	any rights	SECC has un	nder the	
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Area: Discipline: Activity Number:	Drainage	Date Issued: Contractor Subcontractor Supplier	SECC None	
art I: Identify Nonconformance)			
Issued by:	Jay Stepetin SECC	Issued to:	Carnazzo 🗌 Wilson Thoendel 🗌 Mackin Ross 🔲 Vetter	Commented [MCO1]: Double-click on grey box to insert che mark
Referenced Contract Spec:	N/A		Ross Vetter	
Referenced Drawing Number:	D105, D205			
Location of Nonconformance:	Drain Line 31-536-A			
NB I-25 or I-225 Stationing:	536+00	(show nearest 500')		
		ure 539E1 on Drain Line 31-53 en constructed in this area of c		
Superintendent:	Gary Palmer			
-	N/A			
Supplier:	N/A			
Terry Con Tim Nelso		 John Lee Pat McCready Kevin Segrue 		
Anthony C Brian Bull Glen Tona		Other QA Mana	gement:	
⊠ Brian Bull ☐ Glen Tona	ak CE form will be distributed to th	Other QA Mana	ter each step where action is required	

JEASI COL	SOUTHEAST CORR	IDOR CONSTRUCTORS	
NONCONF	ORMANCE REPOR	RT and EVALUATION (N	CR/NCE)
NCR Number:	710	Date Issued:	9/12/03
Area:		Contractor:	
	Drainage	Subcontractor:	
Activity Number:	30001.20	Supplier:	
Part IV: Identify Need for Noncor			
Note:	NCE is not needed if the Contract Specification	he work is to be removed and r Compliance.	eplaced, or reworked to
NCE Needed?	May be requested	l but requires Project Manager ap	proval
	Yes, by QA Discip	line Manager approval	
	No (skip to Part V	II)	
	OA as DM Assessed		D-t 0/10/00
Proposed Resolution:		Joe Jensen e Drain Line 31-536-A at location	Date: 9/12/03 of damaged pipe or NCE
	alternative.		
		Date Sent to Post Desig	
		Response Requested b	ру:
Part V: Post Design Response			
Response:			
Revised Plans needed before this	Yes	If Yes, Plans to be Re	eissued by:
change can be Implemented:			
Plans or Specs to be changed:			
Design Work Charged to WBS:			Hours:
5			
Responded by:			Date:
	Post Design	Services	
Checked by:			
Attachments:			
	No 🗌		
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NCR Number:	710 Date Issued:	9/12/03	
Area:	3.1 Contractor:	SECC	
Discipline:	Drainage Subcontractor:		
Activity Number:	30001.20 Supplier:	None	
art VI: Public Utility NCEs			
Response from Utility Company: _		Date:	
	Name of Utility Company Representative		
	Attached utility company response or indicate location of	response or	n FileNET.
art VII: Resolution of NCR			
Type of Resolution:	Remove and Replace		(skip to Part IX)
.,	Repair/Rework to Contract Specification Complian	nce	(skip to Part IX)
	Repair/Rework to acceptable standards		
	Leave As Is (Use As Is) does not require QA reins	spection	
Description of Resolution:			
Expected Closure Date:			
art VIII: T-REX Technical Closure)	Date:	
)	Date:	
art VIII: T-REX Technical Closure Closure by:		Date:	
art VIII: T-REX Technical Closure			
art VIII: T-REX Technical Closure Closure by: art IX: SECC QA Disposition Action:	(Segment Oversight or Segment Design Oversight)	pliance	
art VIII: T-REX Technical Closure Closure by: art IX: SECC QA Disposition	(Segment Oversight or Segment Design Oversight)	pliance	
art VIII: T-REX Technical Closure Closure by: art IX: SECC QA Disposition Action: Comments or Verification of Reinspection:	(Segment Oversight or Segment Design Oversight)	pliance nnical Closur	
art VIII: T-REX Technical Closure Closure by: art IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: art X: Compliance with Contract	(Segment Oversight or Segment Design Oversight) (Segment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Com Reinspected and Accepted based on T-REX Tech ual Requirements	pliance nnical Closur	e
art VIII: T-REX Technical Closure Closure by: art IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: art X: Compliance with Contract	(Segment Oversight or Segment Design Oversight)	pliance nnical Closur Date:	e
art VIII: T-REX Technical Closure Closure by: art IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: art X: Compliance with Contract Note: This disposition resu	(Segment Oversight or Segment Design Oversight) (Segment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Com Reinspected and Accepted based on T-REX Tech Jual Requirements Just in the work being in full contract compliance. Submit Change Order:	pliance nnical Closur Date:	e IO (circle one)
Int VIII: T-REX Technical Closure Closure by: Int IX: SECC QA Disposition Action: Comments or Verification of Reinspection: QA Manager: Int X: Compliance with Contract Note: This disposition resu	(Segment Oversight or Segment Design Oversight) (Segment Oversight or Segment Design Oversight) Reinspected verifying Contract Specification Com Reinspected and Accepted based on T-REX Tech Jual Requirements Just in the work being in full contract compliance. Submit Change Order:	pliance nnical Closur Date:	e

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NONCON		RRIDOR CONSTRUCTORS	NCR/NCE)		
NCR Number: Area: Discipline: Activity Number:	3.1 Drainage	Date Issued: Contractor: Subcontractor: Supplier:	SECC None		
Part I: Identify Nonconformanc	e				
Issued by:	Jay Stepetin SECC	Issued to: □ □ □	Carnazzo Thoendel	Wilson Mackin	Commented [MC01]: Double-click on grey box to insert check mark
Referenced Contract Spec:	N/A		Ross	Vetter	
Referenced Drawing Number:	D102, D201				Υ
Location of Nonconformance:	Drain Line 31-507-B				
NB I-25 or I-225 Stationing:	506+92 & 507+67	(show nearest 500')			
Description of NCR:		North of structure 506V1 and 12 fee ISE wall, concrete barrier, moment in this area of conflict.			
Superintendent:	Gary Palmer				
Subcontractor:	None				
Supplier:	None				
Part II: Review by Construction	QA Management				
This NCR request has been revie					
Terry Co Tim Nels Anthony Brian Bul Glen Tor	nstable on Crockett Ilen	John Lee Pat McCready Kevin Segrue Other QA Mana	gement:		
		to the appropriate parties via e-mail af stribution at these occurrences must u			
IO: ✓ SECC Document Control (N ✓ SECC QA Manager – Consis SECC Design and Construction ✓ ✓ Post Design – Klemz, Uyem Highways – Doug Brannan Structures – 1 Don Muns, 2 ✓ Grading – 1 Tim Driver, 2/3 Paving – Dave Ross Survey – Jim Bodi ITS/Elec – Bruce Wilson LRT – Tim Mackin, Wilson, 1 Stations – JD Vetter, Mackin MHT – Lloyd Maier, Luke C Segment 1/2 – Carnazzo, Sat ✓ ✓ Segment 2/3 – Thoendel, D Dynalectric – Vecchione, Wilson 1	table (13 Rich Westerheid Scott Cromack arson h, Larson onnelley o eml	SECC Construction Quality A Structures – Tim Nelson / Grading/Drainage – Antho Paving – Pat McCready ITS – John Lee LRT – Kevin Segrue Procurement – Gien Tona ////////////////////////////////////	ony Crockett, Bria uk er, Stevenson jer, Danielle Smitt od, David Wieder itter, (Shrestha if :	n Systems)	
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STEASI COL	SOUT	HEAST CORI	RIDOR CONSTRUCTORS	
NONCON	ORM/	ANCE REPO	RT and EVALUATION (N	ICR/NCE)
NCR Number:	709		Date Issued:	9/12/03
Area:			Contractor:	SECC
Discipline:	Drainage	е	Subcontractor:	None
Activity Number:	30001.2	.0	Supplier:	None
art IV: Identify Need for Nonco	nformand	ce Evaluation		
Note		is not needed if ract Specification	the work is to be removed and on Compliance.	replaced, or reworked to
NCE Needed?	\sim	May be requeste	ed but requires Project Manager a	pproval
	\boxtimes	Yes, by QA Disc	ipline Manager approval	
		No (skip to Part	VII)	
	QA o	or PM Approved:	Joe Jensen	Date: 9/12/03
Proposed Resolution		ate remove/repla	ace Drain Line 31-507-B at location	
			Date Sent to Post Desi	gn:
			Response Requested	
				~y
art V: Post Design Response				
Response				
Revised Plans needed before this change can be implemented:			If Yes, Plans to be R	eissued by:
Plans or Specs to be changed:				
Design Work Charged to WBS:				Hours:
Responded by:				Date:
		Post Desig	gn Services	
Checked by:				
Attachments:	Yes No			
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		ORMAN	CF REPORT and	EVALUATION (N	NCR/N	CE)	
3 # Instructures	NCR Number:			Date Issued:			
		3.1		Contractor:			
		Drainage		Subcontractor:			
	Activity Number:			Supplier:	None		
art VI: Pub	lic Utility NCEs						
Response fr	rom Utility Company:				Da	te:	
		Name o	f Utility Company Repr	resentative			
		Attached ut	ility company response	e or indicate location of	respons	e on File	eNET.
art VII: Res	olution of NCR						
	Type of Resolution:	Rem	ove and Replace			(sk	ip to Part IX)
		🗌 Rep	air/Rework to Contract	Specification Complian	nce	(sk	ip to Part IX)
		🗌 Rep	air/Rework to acceptat	ole standards			
		Leav	e As Is (Use As Is) do	es not require QA reins	pection		
	cription of Resolution:			es not require QA reins	pection		
Ex	cription of Resolution: spected Closure Date:			es not require QA reins	pection		
Ex	xpected Closure Date:	e					
Ex	xpected Closure Date: EX Technical Closur	e					
E> 'art VIII: T-R	cpected Closure Date: EX Technical Closur Closure by: C QA Disposition	e (Segmer	nt Oversight or Segment De	esign Oversight)	Date: _		
E> Yart VIII: T-R	xpected Closure Date: EX Technical Closur Closure by:	e (Segmer	t Oversight or Segment De	esign Oversight)	Date: _		
E> Part VIII: T-R Part IX: SEC	cpected Closure Date: EX Technical Closur Closure by: C QA Disposition Action:	e (Segmer	t Oversight or Segment De	esign Oversight)	Date: _		
E> Part VIII: T-R Part IX: SEC	cpected Closure Date: EX Technical Closur Closure by: C QA Disposition	e (Segmer	t Oversight or Segment De	esign Oversight)	Date: _		
E> Part VIII: T-R Part IX: SEC	expected Closure Date: EX Technical Closure Closure by: C QA Disposition Action: nents or Verification of Reinspection:	e (Segmer Rein	t Oversight or Segment De	esign Oversight) tract Specification Comp based on T-REX Tech	Date: _	osure	
E> Part VIII: T-R Part IX: SEC Comm	cpected Closure Date: EX Technical Closur Closure by: C QA Disposition Action: Action: nents or Verification of Reinspection: QA Manager: Diliance with Contract	e (Segmer Rein Rein	t Oversight or Segment De spected verifying Cont spected and Accepted	esign Oversight) tract Specification Comp I based on T-REX Tech	Date: _	osure	
E> Part VIII: T-R Part IX: SEC Comm	expected Closure Date: EX Technical Closure Closure by: C QA Disposition Action: Action: Meinspection: QA Manager: Diance with Contract This disposition res	e (Segmer Rein Rein	t Oversight or Segment De spected verifying Cont spected and Accepted ments rork being in full cont	esign Oversight) tract Specification Comp I based on T-REX Techt tract compliance.	Date: _	osure	
E) Part VIII: T-R Part IX: SEC Comm Comm	expected Closure Date: EX Technical Closure Closure by: C QA Disposition Action: Action: Meinspection: QA Manager: Diance with Contract This disposition res	e (Segmer Rein Rein ual Require ults in the v	t Oversight or Segment De spected verifying Cont spected and Accepted ments rork being in full cont	esign Oversight) tract Specification Comp I based on T-REX Tech tract compliance. hange Order:	Date: _ pliance nical Clo Date: _	NO	

T-REX accepts the effected elements of the work described by this NCR. This acceptance does not change SECC's responsibilities for the Work pursuant to the Contract, nor does it create any additional liabilities for CDOT or RTD, nor does it change any rights SECC has under the Contract. SECC agrees to submit a Request for Change Order (RCO) if acceptance requires concessions pursuant to Section 10.1.2 of the Contract.

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