PVC Pipe Offers Two-Day Aerial / Over River Installation for Much-Needed Water Delivery

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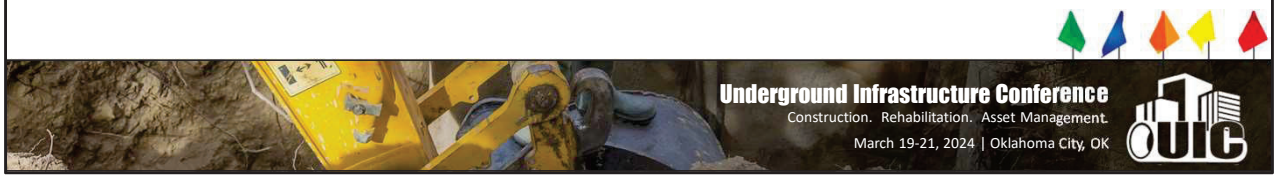


Thank you for that introduction. For my part, I want to thank my co-authors. Dustin Segraves was the engineering lead on this project for the City. Wade Vakulick was the main point-of-contact for Krapff Reynolds. Unfortunately, UIC coincided with School Spring Break for them. They are enjoying vacation time with their respective families.

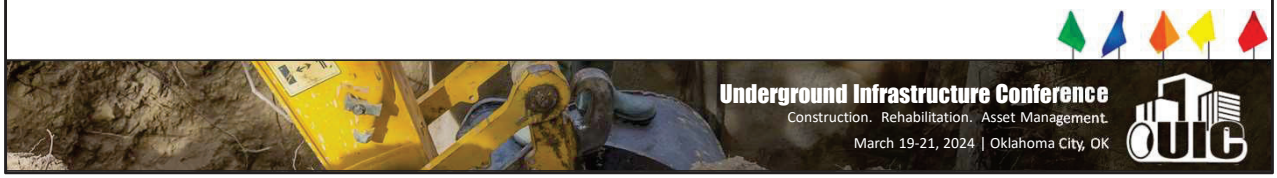
Today's Discussion

Weather impact on an 18-inch waterline.

Emergency replacement project.

Basic design issues.

Successful installation.



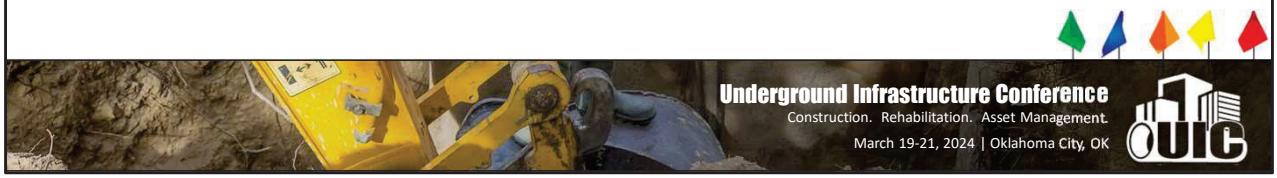
Today, I will be visiting with you about a particular 18" waterline that had successfully served Oklahoma City for over 50 years. Severe weather events resulted in the need to replace the line on an emergency basis. During the compressed design phase, several questions needed answering. Which pipe material? How will it be installed on a 600 foot long pipe bridge? What about the existing 18" pipe? The answers to these design questions will be presented and a successful installation will be reviewed..

Today's Discussion

Background.

Project site. Pipe and alignment selection.

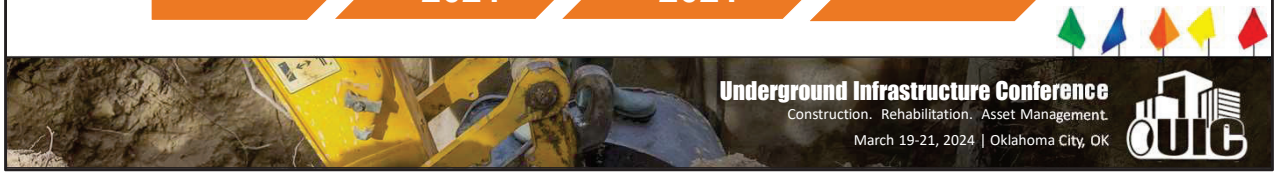
Installation details.



I will first frame the discussion by reviewing some basic background details. Then we will look at the project site and two options on the new pipe's position. Finally, we will go over the installation method the contractor used to install 600 feet of 18" water pipe in two days on a pipe bridge.

Project Background

1960s → Feb. 2021 → Summer 2021 → CIP 2023



The original 18” steel pipe was installed in the mid to late 1960s. It served the City well until the fiercely cold and long cold snap the south central US experienced in February of 2021. As you can see, the pipe was exposed to the elements. During what we called “SnowMagidon”, the City posted its lowest temperature since 1899. It hit 14 below zero. The numbers get even crazier if you factor in wind chill. Once things warmed up, the repair crews tried getting this line back in service. They went through six iterations of trying to repair the line. They installed a repair sleeve at a leak, then repressurized, and then identified another leak. This process repeated itself a total of six times at which point the line was deemed to be beyond repair. A project to replace the line was proposed and approved and was scheduled for installation in 2023. The replacement line was going to go under the North Canadian River instead of over it.

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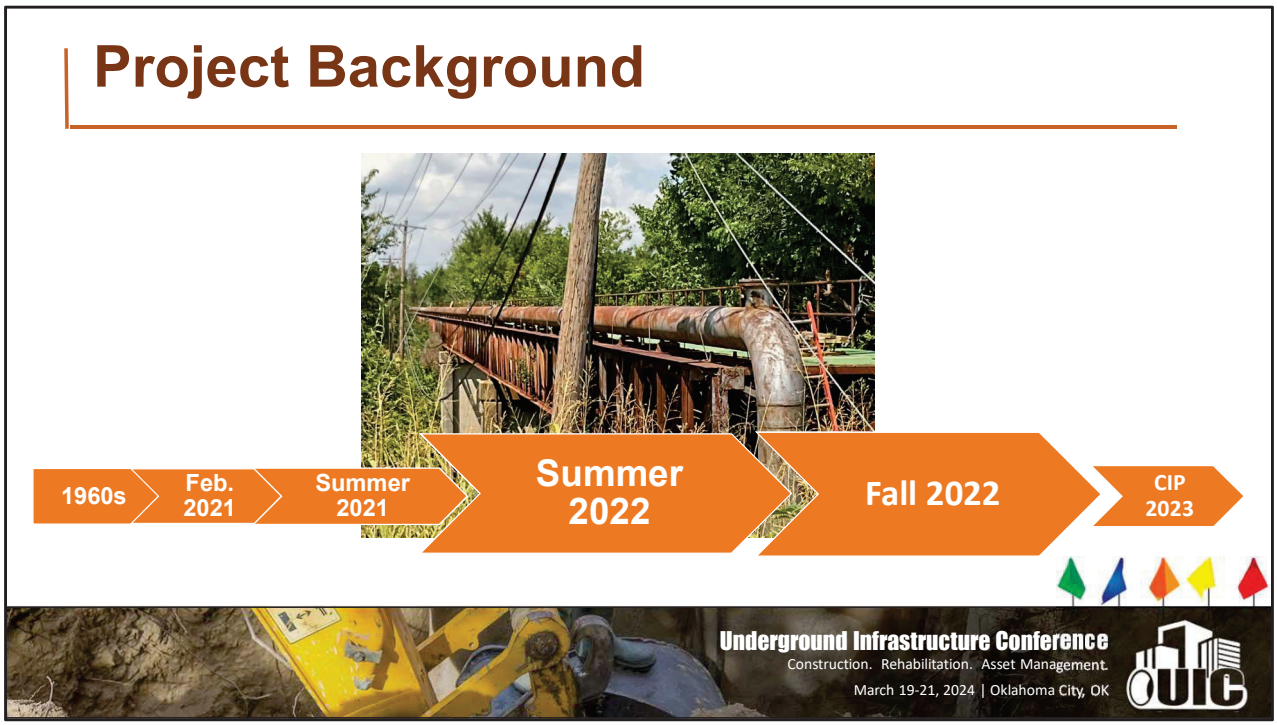
- 18” Steel Pipe w/ 0.25” Wall.
  - Mid to Late 1960s.
- Feb 2021. Fierce / Long Cold Snap. Wikipedia quote. OKC -14F. Lowest since 1899. Power outages across south central US. This 18” line one of the casualties.
- Summer 2021. Line beyond repair.
- Project Approved.

- Permanent Project 2023



Weather events changed things again. In the Summer of 2022, the south central US was in a severe drought. I found an article dated July 18, 2022, which said that 100% of Oklahoma was in a drought and 22% or Oklahoma was in a severe drought. Drought conditions put additional water demands on the system. And with this 18" line out of service, water delivery to the west side of town has to take a less efficient route. The decision was then made to install a new 18" temporary line on the pipe bridge in order to put this section of the water system back on line. And this was to be done on an emergency basis.

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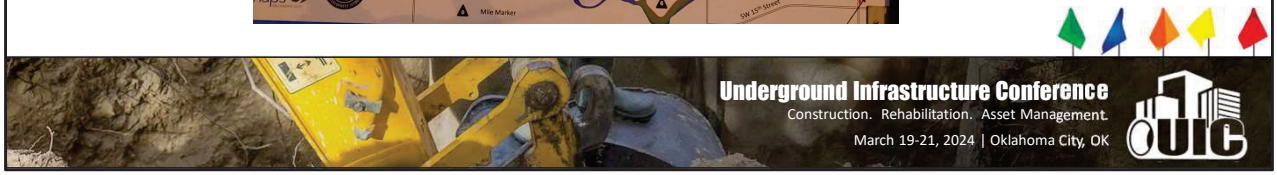
- Summer 2022. Drought. High demand.

'Flash drought' underway in Oklahoma: What it means for the rest of summer.
by Meteorologist Jordan Evans. Mon, July 18th 2022 at 5:30 AM **Updated** Wed, July 20th 2022 at 10:40 PM
100% of OK experiencing drought. 22% experiencing severe drought.

- Emergency Repair while design work for the permanent replacement project continues.

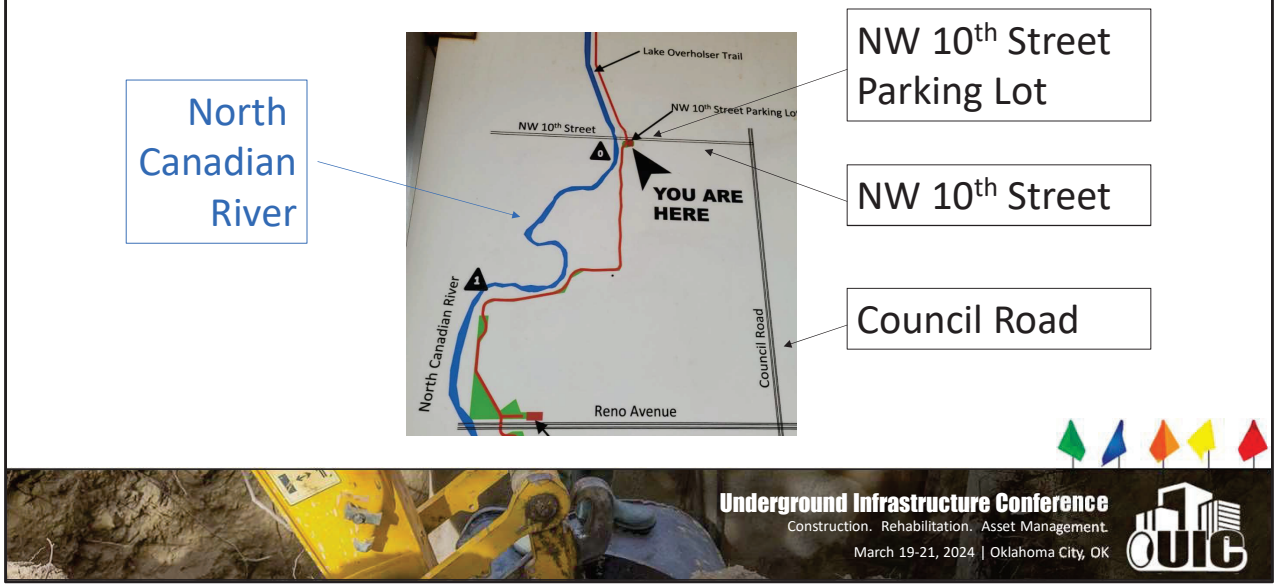
- Permanent Project 2023. That is another story for another time.

Project Location



The project site was adjacent to the City's West River Trail system.

Project Location



The 18” water line crossed the North Canadian river next to the NW 10th parking lot for the hike and bike trail. That parking lot was used as a staging area for the project. The locator map is shown here. The parking lot is at the intersection of North Eagle Lane and NW 10th Street. The water line runs parallel to NW 10th street.

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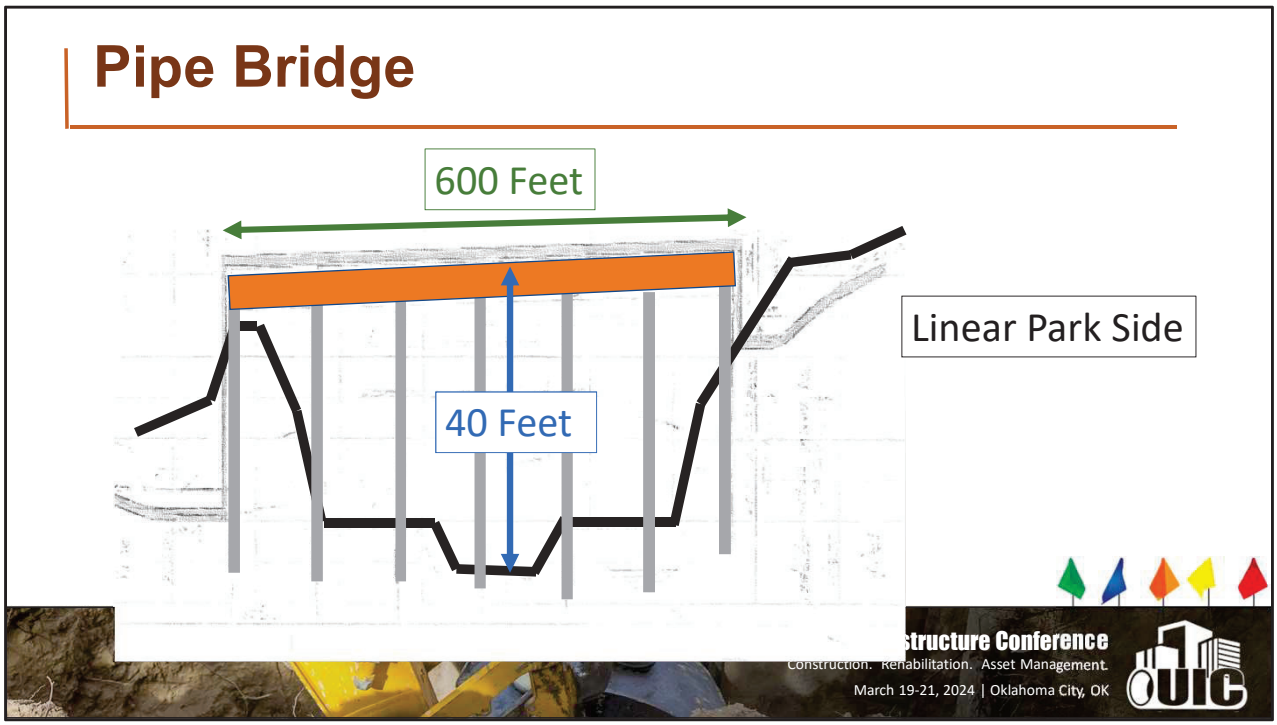
Project Location

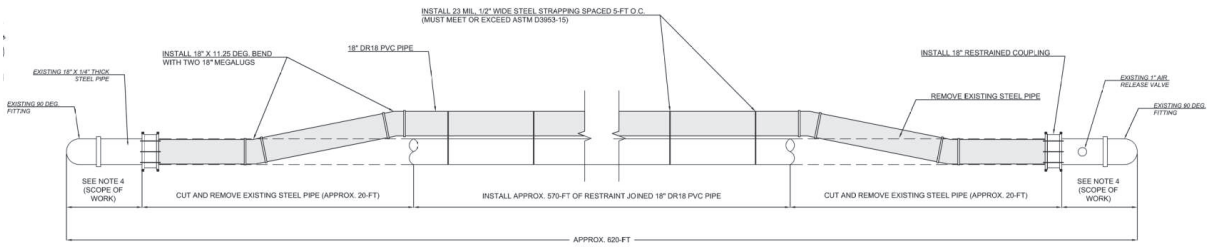
- Hike/Bike Trail
- City Owned Parking Lot
- Pipe bridge parallel to NW 10th Street.



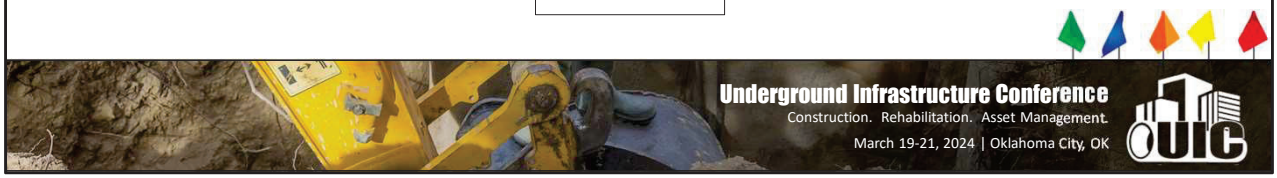
This sketch gives the basic dimensions for the pipe bridge. In the background, you can see where I cut and pasted the bridge elevation view from the 1965 design drawings. That drawing was faint and busy, so I inserted some basic shapes to convey the key details. This orange rectangle represents the box truss bridge structure. These light gray rectangles are the piers and pilings. This black line represents the ground elevation after it had been re-graded to a more rational cross section. From the bridge deck to the lowest point in the channel is 40 feet. This is approximately 600 feet of pipe on the pipe bridge. This grey area represents the 18" water main. The hike and bike trail and the parking lot are on the west side of the bridge structure.

Besides the horrible snow storm and the scorching drought, the City was also dealing with supply chain disruptions caused by Covid 19. Ductile iron and HDPE would have normally been part of the piping materials considered, but their delivery times eliminated them from consideration for this emergency replacement project. That left Fusible PVC and segmental PVC. The contractor opted for segmental for basic feasibility and ease of installation reasons.

Pipe Alignment

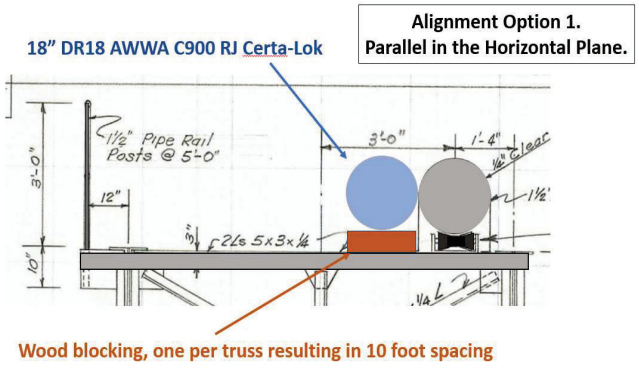


Plan View



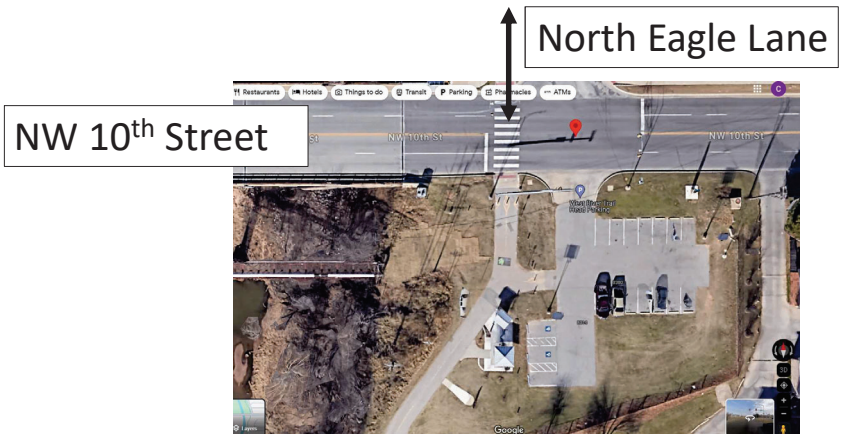
The original plan was to only cut a few short sections of the existing 18” steel water line --- about 20 feet on either side. Two pairs of 11-1/4 degree bends were specified to accommodate a horizontal offset. The new PVC Certa-Lok was to be laid parallel to the existing line and then strapped to it.

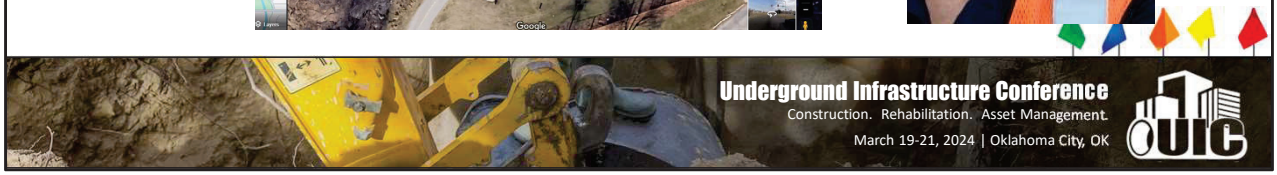
Pipe Alignment



This is what a cross sectional view of that would look like. The existing steel pipe is on the bow tie rollers. The new PVC pipe would be blocked to a similar height. The two parallel lines would be strapped together. The contractor had an alternate idea, and this is what made a two day installation of 600 feet possible. The option was approved and will be reviewed in the next few slides.

Job-Site Details



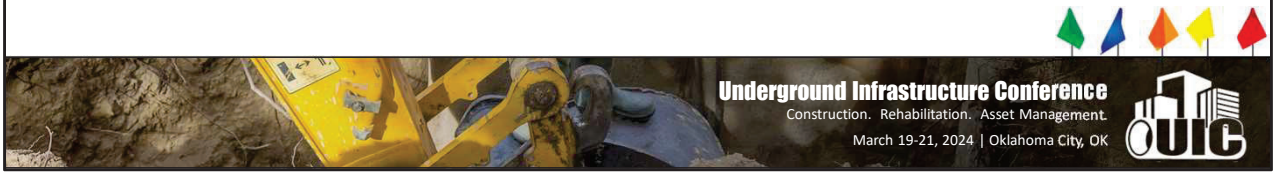


This is an aerial view of the project location. The parking lot for the hike and bike trail doubled as a staging area for the project. The pipe bridge is visible here. This is the hike and bike trail. They wanted that portion of the trail to remain open during construction if possible.

I took three selfies and cropped my face every single time. Way to go boomer!

Job-Site Details

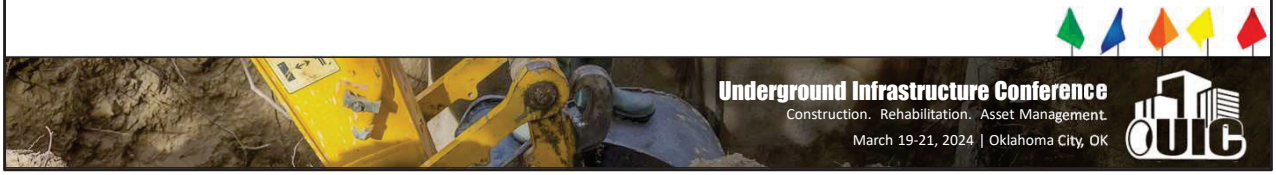
Pipe Lay Down Area



Certa-Lok RJ comes in 20’ or 40’ lengths. The contractor selected 40 footers. His equipment could handle the weight and it cut in half the number of joints he would have to swing up onto the bridge deck. That also cut the number of joints needing to be assembled in half. The pipe was staged on the grassy area represented by the grey rectangle. On the right, you can see the last six sticks of pipe to be installed. The first nine sticks were installed the day I drove up from Dallas/Fort Worth. We wrap and cap the pipe to protect it while it is transported from the factory to the jobsite.

Jobsite Details

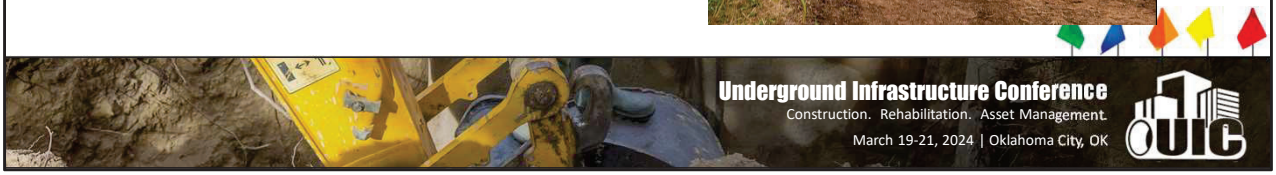
Rubber Tracked Skid Steer



To prevent damaging the surface of the hike and bike trail and the parking lot, a small rubber tracked skid steer was used to move the 40 footers from the storage area to the backhoe.

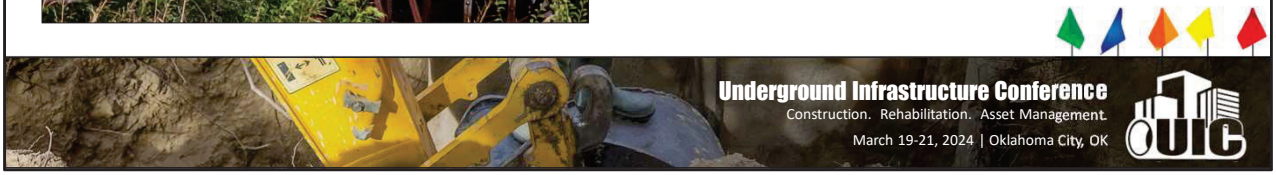
Job-Site Details

Backhoe



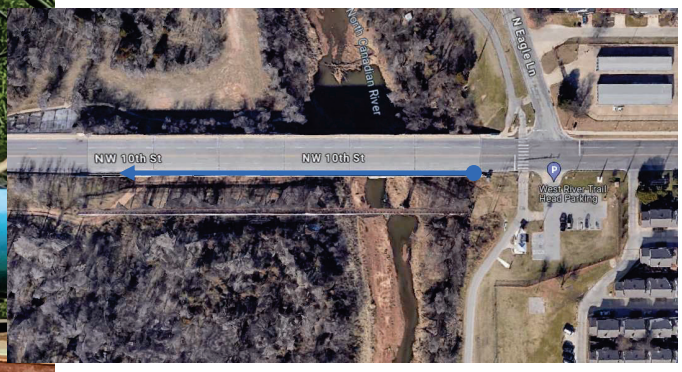
The backhoe arm was contracted. The pipe was rigged to the bucket. The cab then rotated while the arm lifted and extended to set the pipe onto the bridge's bow tie rollers. In the photo on the right, the backhoe has just finished swinging a piece of pipe onto the bridge deck.

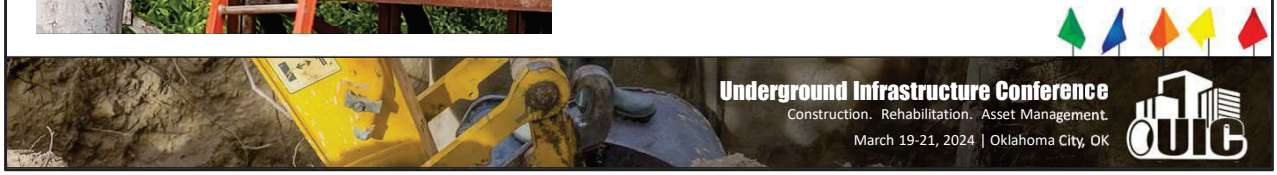
Job-Site Details



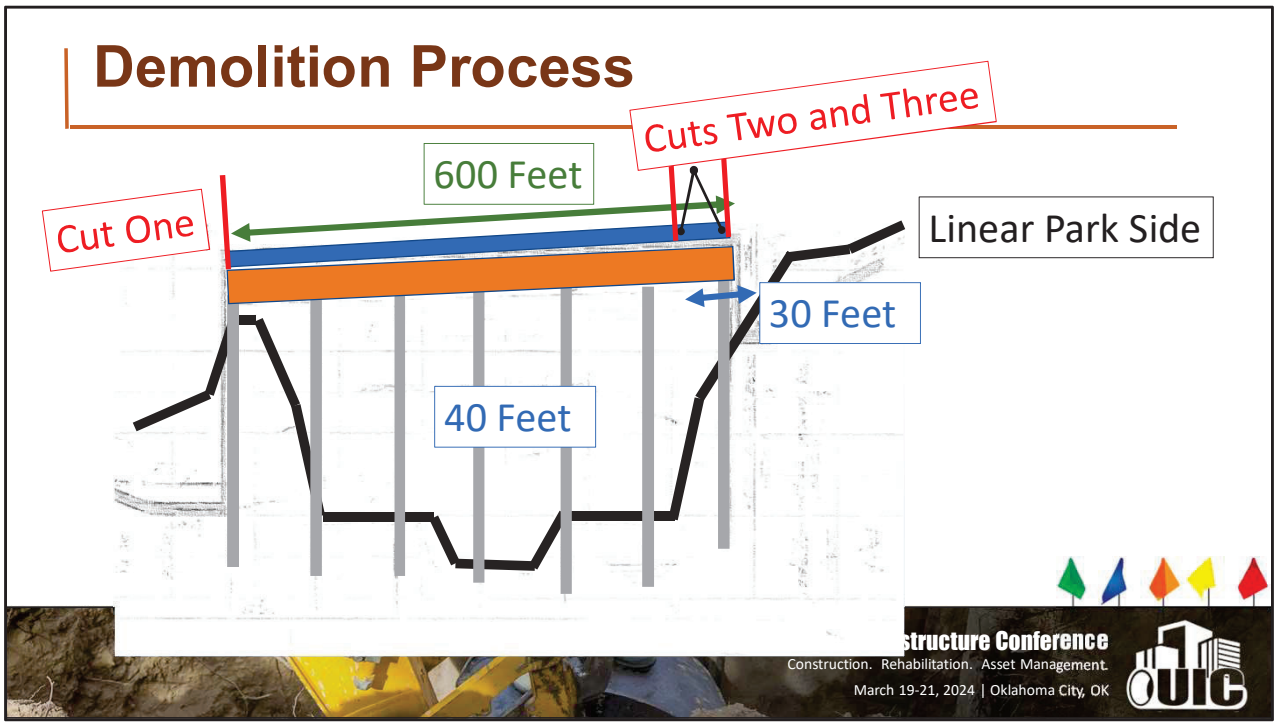
Once the existing steel pipe was removed, the bow tie rollers supporting it were in good shape. These bow tie rollers made it very easy to manually move the pipe on the bridge deck. The photo on the right shows the entirety of the 600 foot long pipe bridge. If this project had gone fused, pre-fusing that 600 foot long pipe string would have blocked several side streets interesting NW 10th from the south. Also, fusing the 11 or so joints would have added to the installation time. Pulling that 600 foot length up on to the bridge deck would have been a complicated process. The segmental solution was the best for this project site.

Job-Site Details

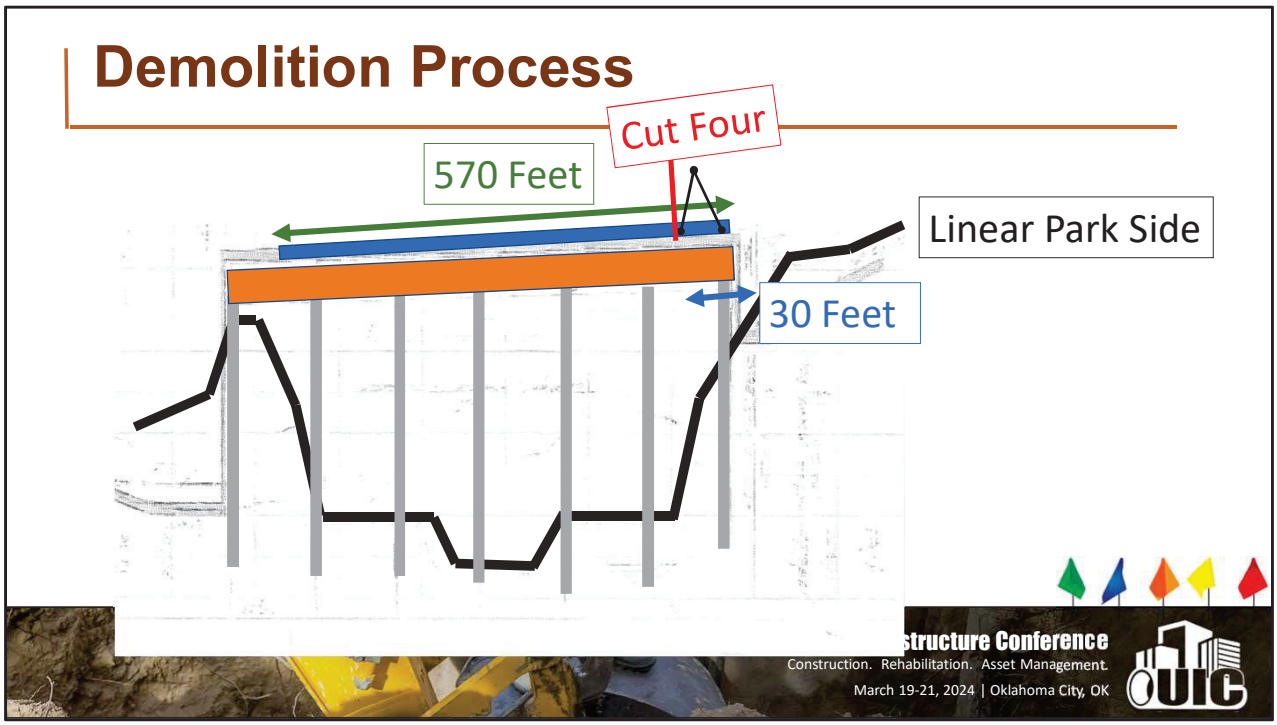




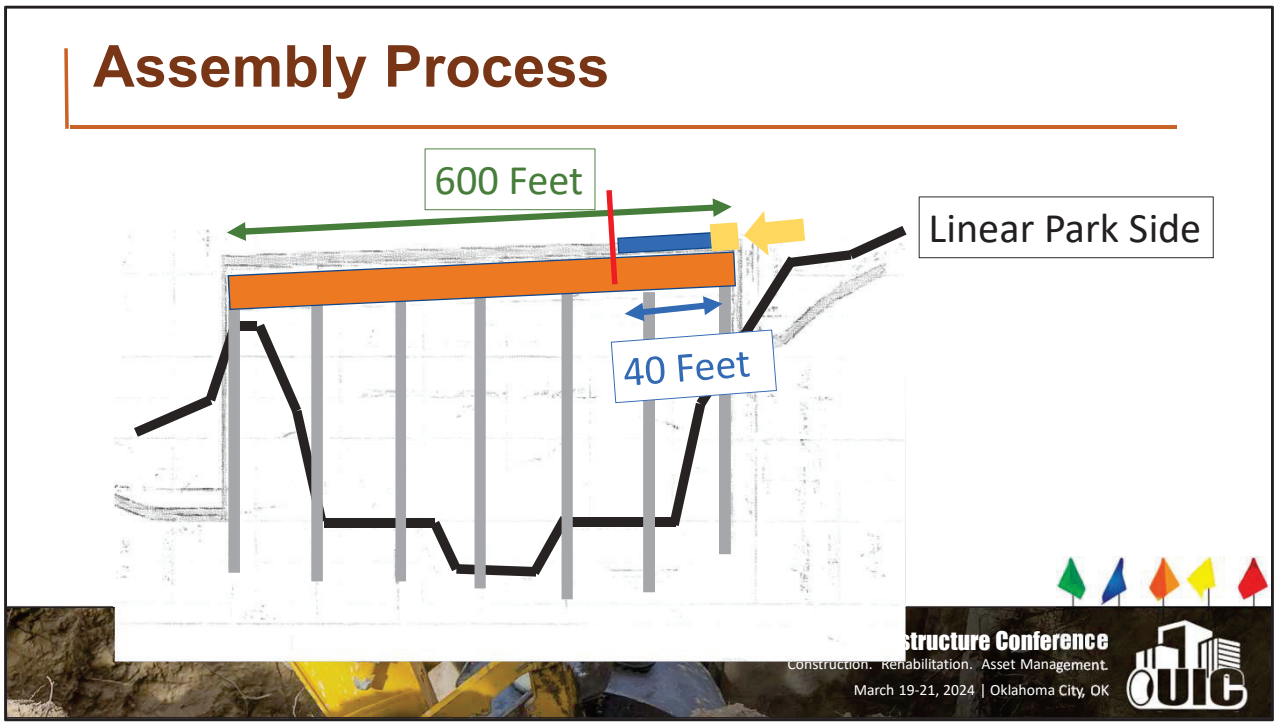
Two nylon sling were rigged to the pipe in a choker fashion at the far end of the pipe. One nylon sling was rigged to the close end. The grooves at each end were perfect tie points. Three workers could easily move the pipe down the bridge using the bow tie roller system.



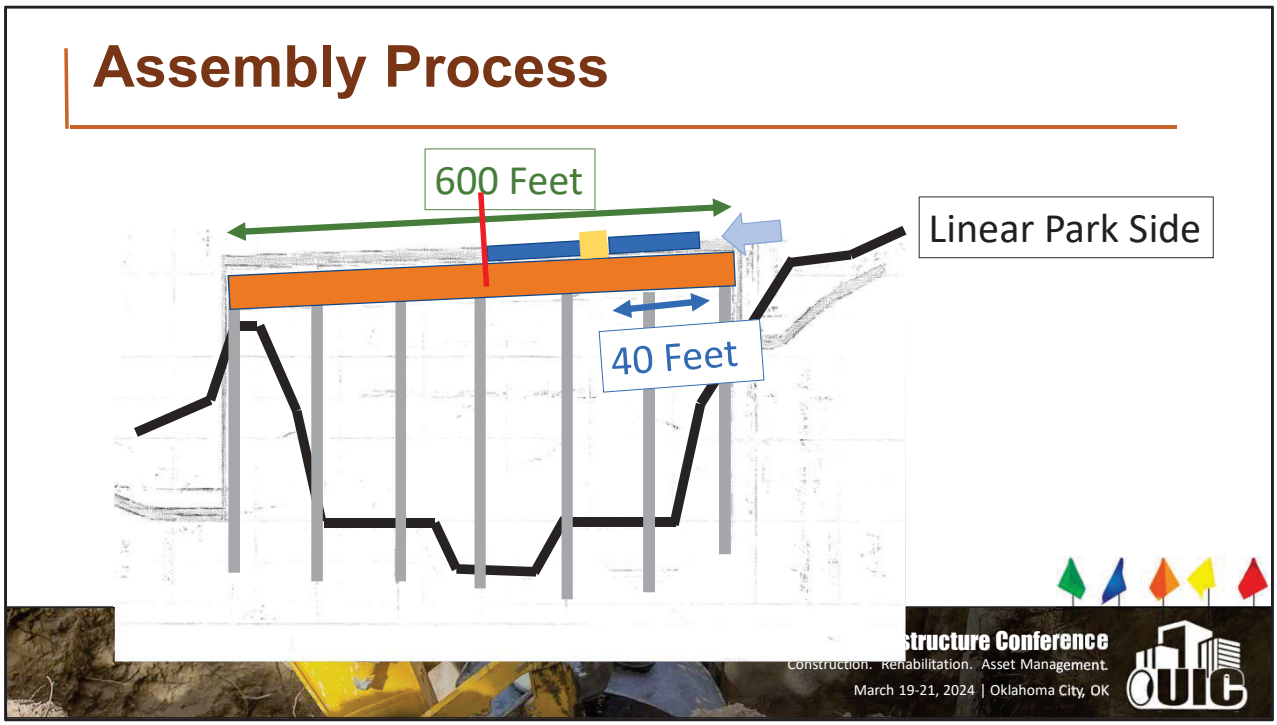
Remember one of those initial design questions? What are we going to do with the existing 18" steel pipe? Turns out Wade had an easy solution. Cut and remove the existing pipe 30 feet at a time. First cut the west end (far end) of the pipe shown here by cut one. Then rig the last 30' of the pipe to the backhoe. Make two more cuts to free that 30' section. Swing it onto the waiting tractor trailer.



Wade repeated that operation 19 more times. This freed up the original alignment for the new 18" Certa-Lok, and it made it much easier to move the pipe when on the pipe bridge.

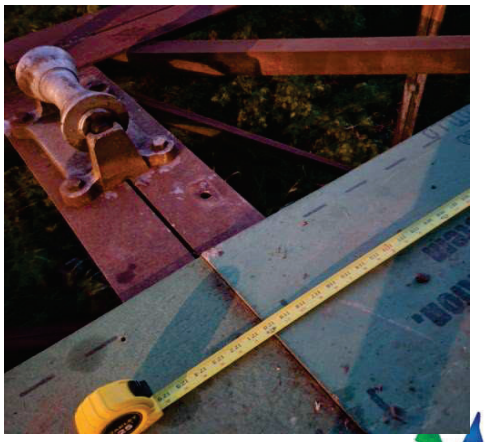


The assembly operation of the new pipe was almost the mirror image of the demolition process. Swing a 40 foot length of Certa-Lok onto the rollers. Position the Certa-Lok coupler. Brace one end of the pipe against the super structure. Use the backhoe bucket to push the coupler onto the pipe. Insert the nylon spline.



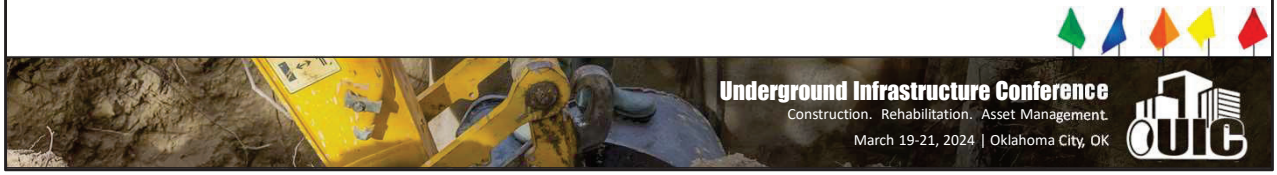
That pipe and coupler assembly was then rolled 40 feet down the bridge to make room for the next length of Certa-Lok pipe. Use the backhoe bucket to push the spigot into the coupler. Spline lock the assembly together.

Bow-Tie Roller System



Here are two photos of that bow tie roller system. The tape measure is there for scale. There was one roller every ten feet. That spacing coincided with the horizontal segments on the box truss bridge. A close up of a single roller is shown on the right.

Manual Handling on Bridge



The couplers were staged within reach of the backhoe bucket. In sizes 14” and larger, the couplers are made of fiberglass. In sizes 12” and down, they are made of PVC. Couplers for 18” pipe weigh 47 lbs each. They are easily maneuvered on the deck. The worker just rolls them to the assembly location. Then two workers lift it into position. Unlike iron fittings, the gaskets are installed in the coupler at the factory.

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Coupler 47 lbs. Once backhoe transports to bridge deck, just roll the coupler to its assembly location.
Fiberglass coupler 14” and larger. PVC couplers 12” and less.

Assembled Joint

Remember to orientate the access ports so that they are easily accessed. The nylon spline is inserted into these holes to lock the joint together. We have a spline insertion tool that makes this installation step simple.

Favorite Photo

I arrived before sunset but after the crew was done for that day. I got this photo as the sun set. It is my favorite.

Completed Project

When PVC is used above ground, there are two options. One option is to use PVC formulated for above ground use, as is the case with vinyl siding. The product line we have for that is called YeloMine. The other option is to either wrap it or coat it. The contractor went the coat it route. We provided him some guidelines for accomplishing that.

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1. Clean the surface thoroughly by scrubbing with warm, soapy water.
2. Lightly scuff the exterior surface in order to promote the paint sticking to the PVC.
3. Rinse and wipe thoroughly to remove any dirt and dust.
4. Primer is likely not necessary but could be considered if adhesion issues are encountered.
5. The primer should be water or latex based. Oil or solvent based paint could cause material degradation.
6. Sherwin-Williams Extreme Bond Primer would be a suitable primer.

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Thank you for giving me an opportunity to tell you about this project. Installing 600 feet of 18" water pipe on a bridge in just two days is quite the accomplishment. Wade thought outside the box. And Dustin was open to the idea.