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On the Cover:

29,000 feet of 24 to 48-inch diameter precast concrete gravity sanitary sewer.

Cover photo courtesy of LNS Services.

Editorial

Engineers are Responsible for Buried Critical Infrastructure that is Resilient

Matt Childs, P.E., President
American Concrete Pipe Association

Engineers are responsible for the safety, health, and welfare of the public. This is far more than an expectation, it is enshrined in "The Obligation of an Engineer," which is an oath administered by the U.S. Order of the Engineer. A recent decision in Minnesota to nullify its existing statute of repose in the case of the I-35W bridge failure is cause for alarm for construction firms, and their insurers, nationwide. In an environment where states can retroactively change their laws to hold engineers liable for perceived design flaws, specifying inferior products or products with inherent installation risks, can be professional, and financial, suicide. The full meaning of the oath, can no longer be taken lightly.

Robbyn P. Wysocki, Attorney & Counselor with the Wysocki Legal Group, P.C. carefully laid out the case that the engineer has a responsibility to analyze the structural integrity, durability and efficiency of installed pipe materials as well as their ability to withstand unexpected events such as tanker spills, wildfires and any other risks that may be identified during the selection process.

Compounding the importance of her observation is the Presidential Policy Directive on Critical Infrastructure Security and Resilience. On February 12, 2013, in conjunction with the release of an executive order on Improving Critical Infrastructure Cybersecurity, President Obama signed a Presidential Policy Directive on Critical Infrastructure Security and Resilience (PPD-21). The PPD established two national critical infrastructure centers operated by the Department of Homeland Security, one for physical and the other for cyber infrastructure. Included in the objective of the executive order is to make the nation's critical infrastructure more resilient.

Wysocki's paper has great value in reminding civil (structural) engineers especially, that buried infrastructure is critical buried infrastructure in both form and function. Whether a sanitary sewer transporting waste to treatment facilities before returning treated water to the environment, or a pipeline or culvert channelling snowmelt and storm water to natural water bodies, pipes and boxes are there to build a sustainable society.

She notes that too often, even when years of practical experience had demonstrated otherwise, engineers have no choice under certain circumstances but to adhere to the letter of the law and select piping or culvert materials they knew would likely require excessive maintenance and/or repairs well before the end of their "projected" service life. This was the case until the new federal transportation bill – the "Moving Ahead for Progress in the 21st Century Act" (MAP-21) – gave engineers from state departments of transportation more professional discretion when selecting culvert and storm sewer products for highway construction projects. "State DOT engineers and contractors can breathe a little easier knowing that the federal DOT will now allow them to determine the best choice of material for culvert pipes used in the construction of highways," says Wysocki.

Not all civil engineers are design engineers, and projects don't get built without comprehensive, well considered specifications based on the best Standards for products, materials and installation. Engineers may not write those specifications and Standards, but all are reviewed by engineers. Delivering critical infrastructure that is resilient has been and still is the watchword of the profession. It is implied in their oath. With the door wide open for the exposure of engineers to increased personal risk when states nullify existing statutes of repose, or through Presidential Policy Directives focused on critical infrastructure, engineers have to be acutely aware of their work environment and responsibility for public safety.

LINKS

- Article by Robbyn P. Wysocki, Attorney & Counselor, Wysocki Legal Group, P.C.
  www.concrete-pipe.org/pdf/DesignEngineersLiabilityMayNowBeExtendedIndefinitelyWysocki.pdf

Concrete Pipe Resiliency Acknowledged for Vital Sanitary Sewer Interceptor

By Paul Lohmiller
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Concrete pipe[1] has long been acknowledged as the premier product of choice for countless sanitary sewer projects, providing resilient infrastructure through engineered strength and durability. County Materials Corporation[2] is supplying over 29,000 feet of 24 to 48-inch diameter precast concrete sanitary sewer and jacking pipe for a major interceptor in the Milwaukee Metropolitan Sewerage District[3].

Sewage was projected to be present in the interceptor for long transient times. To keep the interceptor in service for 75 to 100 years, the designation of interceptor materials was very important to mitigate corrosion as much as possible. It was decided that the interceptor pipe materials be limited to those that would resist corrosion by sulfuric acid[4] formed by hydrogen sulfide buildup, while providing a sewer system capable of maintaining structural integrity at the required depths of 30-45 feet. For these reasons, PVC-lined reinforced concrete pipe and fiberglass reinforced polymer mortar pipe were selected. In addition, precast concrete manholes with field applied epoxy-coated interiors were specified.

Strength, service life, corrosion resistance and joint performance were the major considerations in the design of the interceptor. With depths reaching up to 45 feet, and portions of the project requiring tunneling under wetlands, Ruekert & Mielke[5], civil engineers for the project, selected precast concrete pipe as the clear material of choice. From the vertical overburden depth to the axial load of jacked-pipe tunneling, concrete pipe provides the flexibility of design to meet specific load requirements.

The interceptor project runs approximately 6 miles from Muskego to the Milwaukee Metropolitan Sewerage District (MMSD) interceptor at 60th street in Milwaukee. Ruekert & Mielke awarded contracts to three local contractors who chose County Materials Corporation to supply T-Lock[6] lined concrete pipe. The T-Lock lined concrete pipe incorporates a PVC inner liner during the manufacturing process. Fully anchored into the concrete prior to curing, the liner and pipe perform as a single product to resist both load and corrosion. Project-specific strength designs were individually engineered to support the variety of loads on the various sections of the sewer. To assure that the interceptor would be able to serve the entire service area by gravity, it was necessary to complete the preliminary design of more than 81,000 feet of local sewers (12 inch and greater in diameter) to determine the required invert elevations of the interceptor sewer.

Crews utilized open cut, jacking with tunnel boring machine, jacking with hand mining, hand mining with timber sets, auger boring and microtunneling to install the sewer system. These different methods were necessary given the varying conditions and topography found in the project corridor. In addition to the placement of 29,000 feet of gravity sewer, the project included 2,000 feet of microtunneling, four stream crossings, numerous wetland crossings, wetland mitigation, acquisition of forty-five easements, public participation with multiple communities, local, state, county and federal permitting, four extensive intermunicipal agreements and a Clean Water Fund financing plan.

LINKS

1. www.concrete-pipe.org/pages/why.html
2. www.countymaterials.com
3. www.mmsd.com
4. www.concrete-pipe.org/p3training/techmod1/techmod1-durability.pdf
5. www.ruekert-mielke.com
6. www.nov.com/industrial/protective_lining_products.aspx

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- **Keyword Search on American Concrete Pipe Association Website**
  (sanitary, sewer, interceptor, liner, T-Lock, acid, corrosion, microtunnel)
  www.concrete-pipe.org
- **Concrete Pipe Design Manual**
  www.concrete-pipe.org/pages/design-manual.html
- **Concrete Pipe News**
  www.concrete-pipe.org/pages/cpnews.html

Concrete pipe installed by open cut, jacking with tunnel boring machine, jacking with hand mining, hand mining with timber sets, auger boring, and microtunneling.

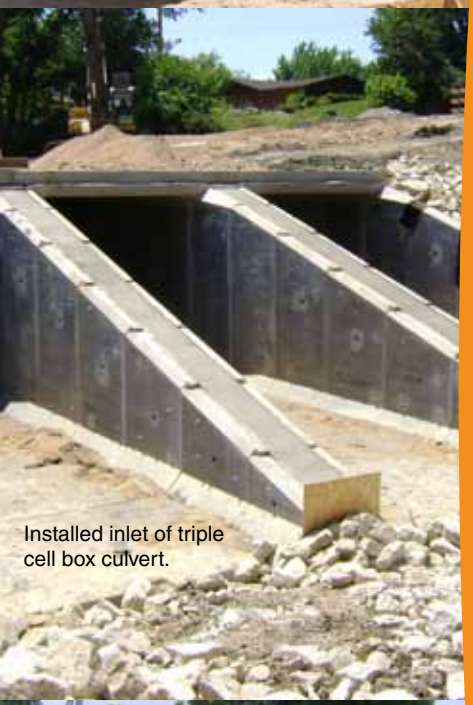
Installation of T-Lock lined reinforced concrete sanitary sewer pipe.

Resilient concrete pipe to last 75 to 100 years.

Installation of T-Lock lined reinforced concrete sanitary sewer pipe.

Photos: Courtesy of Ruekert & Mielke – civil engineering

Installation of 14-foot x 14-foot box section.



Installed inlet of triple cell box culvert.

Triple cell box culvert to replace concrete arch structure.

Rapid Response by Concrete Pipe Producers Make it Easy for Culvert Replacement

By Jim Sweeney, Cretex, and Bill Adams, Hancock Concrete Products, LLC
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Production teams at Cretex[1] and Hancock Concrete Products[2] joined forces in June, 2013 to produce precast boxes used for a triple cell 14-foot x 14-foot reinforced concrete box culvert near the Town of Osage, Iowa. A concrete arch bridge that was constructed in 1921 had to be replaced after 92 years of service following heavy floods on May 19 that damaged the arch across Sugar Creek on Highway 9 and temporarily closed the road. The new structure was designed with a minimum 60 year design life to carry a volume that was similar to the arch that was removed. The precast boxes have a service life that extends well beyond 60 years.

Iowa Highway 9 is the most northern of Iowa's east–west highways, traversing the entire northern tier of counties. Replacement of the culvert was carried out on an accelerated schedule over a 40-day contract that included cash incentives for early completion and penalties for each day past the contracts completion date. To meet the terms of the contract, a materials contract was bid separately and awarded to Cretex before contracts were awarded to contractors. Cretex subcontracted 50% of the precast production to Hancock. Both companies double-poured boxes to help expedite the project. Production of the 90 boxes was completed within three weeks.

Cretex used self-consolidating concrete for it mixes while Hancock used a standard wet cast mix according to ASTM C1433 - 13b[3], *Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers*. This specification deals with the Standards for single-cell precast reinforced concrete box sections cast monolithically and proposed for use in the construction of culverts and for the conveyance of storm water industrial sewage. Because of their size, boxes were shipped on their side.

Top Grade Excavating of Farley, the general contractor was hired by the Iowa Department of Transportation (IowaDOT)[4]. Local contractors Popp's Excavating of Osage and L.R. Falk Construction[5] of St. Ansgar supplied equipment and materials. The contractor had to by-pass the creek, accommodate existing utilities, and work through a rainy spring season to complete the project ahead of schedule. There was no field testing of the boxes required, but Cretex assigned a field representative to the construction site for each day of installation.

The Concrete Pipe Association of Iowa worked with Iowa DOT to draft a precast box culvert template for a specification that was approved in late 2012 and published in 2013. By having the specification in place, it was much easier for Iowa DOT to respond rapidly to the pavement failure by designing and tendering a contract for a new concrete culvert in a short period. The result was limited impact to the movement of traffic on Iowa Highway 9.

LINKS

1. http://cretexcompanies.com
2. www.hancockconcrete.com
3. www.astm.org/Standards/C1433.htm
4. www.iowadot.gov/index.html#/services
5. www.lrfalk.com/

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  (box, culvert, triple, cell, replace)
  www.concrete-pipe.org
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  www.concrete-pipe.org/pages/design-manual.html
- **Concrete Pipe News**
  www.concrete-pipe.org/pages/cpnews.html

Photos: Bill Adams and Jim Sweeney, Cretex

Concrete Pipe a Major Element of Atlanta's Upgraded South River Basin Sewer System

By Russell Tripp, P.E. – ACPA Georgia Engineer
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Reinforced concrete pipe (RCP) has been used extensively on the upgrade and replacement of Atlanta, Georgia's storm and sanitary sewer system. The Department of Watershed Management is working to upgrade the system and eliminate sanitary sewer overflows in the South River Basin[1]. To accomplish this, construction crews are removing and upgrading the East Point line, the North sewer line, and the South sewer line by replacing the existing pipeline with a larger sized main.

Of the 9,600 feet of sanitary pipe required on the North Replacement Sewer Project, nearly 6,300 feet of RCP was selected for the sewer. The remainder was lined ductile iron pipe. Sections being replaced are brick and some concrete pipe that had been in service for more than 70 years. Due to the topography, there are inverts 35 feet below final grade. One third of the project required Class IV and Class V RCP to meet the strength requirement.

The North Replacement Sewer Project[2] of the three South River Basin projects was let in the fall of 2011 and awarded to Reeves Contracting Company[3] based in Sugar Hill, Georgia. Reeves and the City's design consultant formerly Metcalf and Eddy and Cardozo Engineering, now AECOM[4] and Cardozo Engineering[5], recognized the value of allowing durable, long-term products like reinforced concrete pipe (RCP) for the replacement of this part of the system. The contractor awarded Rinker Materials– Concrete Pipe Division CEMEX[6] in Stockbridge, GA the RCP portion of the project in June 2012.

The design requirements for the RCP included limestone aggregate to inhibit hydrogen sulfide gas reactions, USBR R4 joints and C-wall pipe. One unique requirement was to use color-coded latex paint on the bells and spigots to identify easily the pipe Class III through V. Cherne[7] joint testing in the field was required. The Cherne Air-Loc® Low Pressure Air-Testing System has been successfully used for testing sewer pipe installations for over 40 years. The specifications required each section of pipe to be vacuum tested at Rinker's plant in Stockbridge. Rinker fabricated a set of specially designed fiberglass bulkheads for the bell and spigot for each size pipe diameter. The 12-foot pipe lengths were another interesting design feature that reduced the number of joints in the system. Rinker began production of concrete pipe for the North Replacement Sewer Project in August 2012 and continued delivering pipe through the summer and fall until completion in December 2013.

For more than 40 years, Atlanta routinely dumped hundreds of millions of gallons of untreated and partially treated sewage into South River each year from its Custer Avenue and McDaniel-Glenn combined sewer facilities on the city's east and southeast side. The South River Basin Sewer Replacement Project was designed to mitigate this situation.

Cherne joint testing in the field.

Color-coded latex paint on the bells and spigots to identify easily the pipe Class III through V.

LINKS

1. www.atlantawatershed.org/projects/south-river-basin-sewer-replacement-project
2. www.atlantawatershed.org/default/?linkServID=74EEBA79-1603-439B-AE5060D35C8A6598&showMeta=2&ext=.pdf
3. http://reevescontracting.com
4. www.aecom.com
5. www.cardozo.com/home.php
6. www.rinkerpipe.com/default.shtml
7. www.cherneind.com/Testing/Air_Loc_Joint_Testers

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  (storm, sanitary, combined, vacuum, joint, pressure)
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Photos: Russell Tripp, PE – ACPA Georgia Engineer

Concrete Pipe Supplied for Industrial Escapeway

By Larry Sunnus, P.Eng, Technical Marketing Manager - Region Canada
Inland Pipe / Ocean Pipe, divisions of Lehigh Hanson Materials Limited
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Neptune Bulk Terminals[1] built a phosphate rock storage and handling facility at their terminal facility in North Vancouver, BC in 2013. Included in the project is a 57.5-meter escapeway constructed with 2400mm diameter Class V reinforced concrete pipe (RCP) supplied by Ocean Pipe[2] to provide egress. Colin Cameron, Project Manager for the installation contractor LNS Services[3], was faced with a decision between corrugated metal pipe (CMP) or precast concrete pipe for the construction of the escapeway. CMP is sometimes used for reclaim tunnels under material stockpiles at mining operations. From his extensive background in the construction aggregates mining industry, Mr. Cameron fully appreciated the importance of bedding for flexible pipe products. His decision to use concrete pipe was based on the high groundwater table, poor native soils, and a tight budget and construction schedule.

The structural design engineers, Sacré-Davey Engineering[4], required the pipe to withstand two different load conditions: the surcharge load of a 20-metre pile of material when the storage building is full (resulting working load of 300 kPa), and the impact of machinery driving directly on the top slab of the tunnel when the building is empty. Precast concrete pipe was chosen over cast-in-place concrete to minimize installation time to meet the construction schedule and product quality risk during winter installation conditions. A cast-in-place concrete bedding was specified to enhance the resiliency of the escapeway and anticipated loading.

Concrete pipe[5] and boxes have a wide range of uses outside the traditional application of sewers and culverts. Escapeways are but one unique application. Many overlook the fact that each piece of concrete pipe that leaves the production facility is an engineered product. Concrete pipe is designed for the intended use with common Standards or special designs. In most situations, standard concrete pipe can be ordered from yard inventory or scheduled for delivery months in advance of construction. The 2400mm diameter Class V reinforced concrete pipe used for the escapeway is a standard product with a 100-year service life.

In the USA, the Mine Safety and Health Administration (MSHA) publishes regulations that typically require escape or outlet pipes to provide emergency evacuation. Under Title 30 Code of Federal Regulations 77.213[6], when it is necessary for a tunnel to be closed at one end, an escapeway not less than 30 inches in diameter (or of the equivalent, if the escapeway does not have a circular cross section) shall be installed which extends from the closed end of the tunnel to a safe location on the surface. If the escapeway is inclined more than 30 degrees from the horizontal it shall be equipped with a ladder which runs the full length of the inclined portion of the escapeway.

LINKS

1. http://wikimapia.org/1745058/Neptune-Bulk-Terminals
2. www.oceanpipe.com
3. www.lns.ca
4. http://sacre-davey.com
5. www.concrete-pipe.org/pages/why.html
6. www.msha.gov/30CFR/75.380.htm

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  (tunnel, pedestrian, escape, industrial)
  www.concrete-pipe.org
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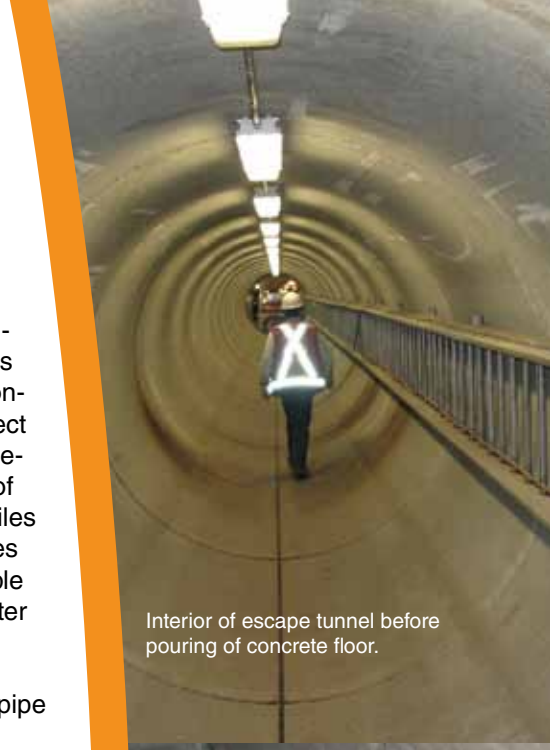
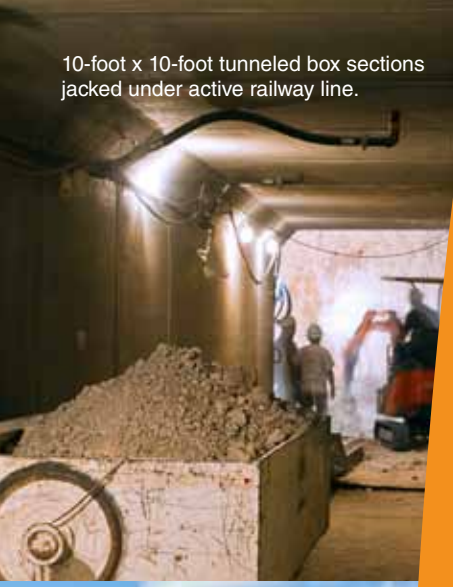


Interior of escape tunnel before pouring of concrete floor.

Concrete bedding for finished escapeway.

2400mm diameter RCP escapeway prior to backfill.

Photos: Courtesy of LNS Services



10-foot x 10-foot tunneled box sections jacked under active railway line.

Box sections prepared for installation by open cut method.

15-foot x 7-foot boxes produced by J & G Concrete Products / South Plains Concrete.

Complex Drainage Improvement Project Demonstrates the Versatility of Gasketed Precast Concrete Boxes

By Kenneth E. Waite, P.E., Regional Engineer
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The Northwest Lubbock Drainage Improvement Phase 1 project serves approximately 12,160 acres in the central and northwestern portion of Lubbock, Texas encompassing approximately 19 playa lakes. The precast concrete box drainage system was required for FEMA re-mapping to remove 1,262 existing drainage structures from 100-year Special Flood Hazard Areas. The project includes 177 feet of 15-foot x 7-foot, and 11,031 feet of 10-foot x 10-foot reinforced concrete boxes for construction of a storm sewer outlet. The City of Lubbock will spend over $70 million on this multi-stage project.

Utility Contractors of America (UCA)[1] was awarded Phase 1 of the project to be installed by direct trench excavation and five separate tunnel segments, plus various roadway reconstruction and other associated activity. Challenges faced by the contractor were depth of excavation (up to 50 feet) in an established neighborhood, tunneling 235 feet under an active Burlington Northern Santa Fe (BNSF) Railway line and through petroleum-contaminated soils in close proximity to the tunnel. Petroleum-contaminated soils would degrade a normal gasket. Nitrile gaskets were specified to neutralize reactions with chemicals in the soil to mitigate infiltration of contaminants through the joints. The contractor elected to excavate soils at face of the tunnel with a Bobcat excavator within a steel-plated shield. The precast box structure was then jacked into the tunnel and the annular space grouted.

Aside from the magnitude of the overall project, major challenges included supply of the 10-foot x 10-foot boxes for the railway tunnel and another 700 feet (approx.) of tunneling at 4 other sites. J & G Concrete Products[2] / South Plains Concrete (SPC) was contracted to supply the gasketed precast boxes. The challenge to the precaster was not the sizes and strength design of the boxes, but hydrostatic testing at every 800 feet of box production. SPC's products passed what is described as the most stringent hydrostatic test in Texas, prior to delivery of box sections to the project sites.

Proof of design and internal pressure testing of the gasketed joints with ½-inch gap and tightly sealed for 48-hour periods were the testing requirements. Hamilton Kent's model Tylox Super Seal™ Box Culvert Gasket[3] (used in the test and installations) are pre-lubricated and designed specifically for RCB applications with a single off-set joint. The internal hydrostatic pressure from 5 to 20 psi was held for 1 hour to verify the design of the RCB and gasketed joint designed to ASTM C1677 - 11a, *Standard Specification for Joints for Concrete Box, Using Rubber Gasket*[4]. Many engineers throughout Texas are specifying ASTM C1677 joints to prevent infiltration and exfiltration for structures in contaminated soils, utility duct banks, and high internal pressure applications. J & G Concrete (SPC) has manufactured over 20 similar projects in the past 5 years.

To maintain continuity and seize economic opportunity, the City of Lubbock extended the base contract with UCA Inc and installed an additional 2,513 feet of 8-foot x 7-foot gasketed RCB and associated utilities. This segment will serve areas under development by Texas Tech University.

LINKS

1. www.ucatexas.com
2. www.jandgconcrete.com
3. www.hamiltonkent.com
4. www.astm.org/Standards/C1677.htm

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Photos: Parkhill Smith And Cooper Engineering

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Plastic vs. Concrete Pipe Installation

Have you heard that flexible pipe is faster and easier to install than concrete pipe? Check out this video by the American Concrete Pipe Association that demonstrates the installation of each product according to national Standards and manufacturers' recommendations. Pipe used in the comparison was 24-inch diameter concrete and polyethylene. The same trench conditions and lay length existed for each type of pipe that was backfilled to the critical structural zone.

LINK TO VIDEO
www.concrete-pipe.org/pages/videos.html?goback=%2Egmr_1920373%2Egde_1920373_member_259304496

Save this link www.concrete-pipe.org/pages/cpnews.html to your favorites list to increase your knowledge about drainage applications and innovative ways to use precast reinforced concrete pipe and boxes to build structures that will last.