

CONCRETE PIPE NEWS



The Magazine of the American **Concrete Pipe** Association

Utah's FrontRunner Commuter Rail Uses New and Re-used Reinforced Concrete Pipe



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Concrete Pipe News is published four times each year by the American Concrete Pipe Association. It is designed to provide information on the use and installation of precast concrete pipe products for a wide variety of applications, including drainage and pollution control systems. Industry technology, research and trends are also important subjects of the publication. Readers include engineers, specifiers, public works officials, contractors, suppliers, vendors and members of the American Concrete Pipe Association.

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American Concrete Pipe Association

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The Design Manual is a hardbound book with accompanying CD that is a companion volume to the Concrete Pipe Handbook. A "CD only" version can be downloaded from the ACPA website and both the book/CD, or the CD only version can be purchased online or from the ACPA Resource Center.

Extensive use of new and used RCP ranging in size from 12 to 84-inch diameter used on 44-mile project.



Photo: Greg Davis, Commuter Rail Constructors

editorial

Matt Childs
President
American Concrete Pipe Association

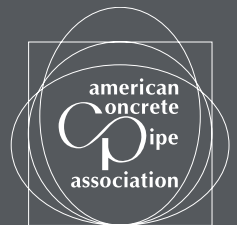


ACPA CELEBRATES 100 YEARS, WHILE CHARTING A COURSE TO 2107

When the founders of the American Concrete Pipe Association held their first conference in 1907 as the Interstate Cement Tile Manufacturers Association, they were working in an economy that was undergoing fundamental change. It may have been bewil-

dering to some pipe producers to see their products being standardized by third party forces and benchmarks being set for quality. The American Society for Testing and Materials (ASTM) had been established in 1898. By 1904, eight technical committees had been organized and six more added. One was Committee C-4 on Clay and Cement-Concrete Sewer Pipe which later became C-13 on Concrete Pipe. Establishment of a concrete pipe association in 1907, only three years after the formation of C-4 was likely no coincidence. We can imagine the owners of those early concrete pipe companies working with ASTM officials on C-4 to ensure a fair and equitable level of competition with clay pipe producers!

The decisions taken by the cement tile manufacturers over a century ago led to the growth of an industry that can be described, without reservation, as an astonishing success. No one could have imagined the dependence that American society would place on today's reinforced concrete pipe products that were once essentially comprised of portland cement, aggregates and water. Success can be determined by judging an industry's contributions to the social fabric, economy and environment of towns and cities. The concrete pipe industry delivers products that cannot



American
Concrete Pipe
Association



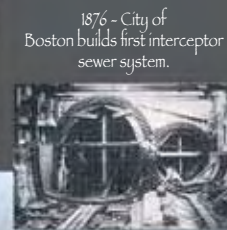
3750 BC - Egyptians use concrete in pyramids.



800 BC - Romans build famous aqueducts.



1840 - First modern sewer built in Hamburg, Germany



1876 - City of Boston builds first interceptor sewer system.



1907 - ACPA founded as the Interstate Cement Tile Manufacturers Association.
1914 - Changes name to the American Concrete Pipe Association

easily be substituted on major works.

Without the presence of a strong association of concrete pipe producers and the companies that develop the equipment and supplies needed to produce pipe and boxes, the quality of America's buried infrastructure could be quite different. By establishing an association of concrete pipe producers, the early founders laid the keystone for a vibrant industry destined to thrive for centuries.

So, what has 100 years of precast concrete pipe history taught us? Concrete pipe producers have learned that the industry cannot be complacent by leaving the path to success in the hands of others. It must be forever vigilant in the halls of legislators, the laboratories of universities and governments, and the marketplace where perceptions often cloud the reality of applied science.

The concrete pipe industry's design pioneers, Marston and Spangler and their co-workers through the '20s and '30s along with subsequent theories, such as the work by Frank Heger, have formed the basis for American and Canadian standards and specifications for the selection of bedding, backfill and pipe strengths for over seven decades. These early researchers and scientists unlocked the potential for reinforced concrete pipe and set the minimum standard for performance.

As the industry matured, advances in thermoplastic technology after WWII moved more quickly through the '70s and '80s. The concrete pipe industry had relied on technology, science and the forces of supply and demand to hold market share. New competitive materials

for producing drain pipe entered the market supported by strong marketing and government relations strategies. Some of the small diameter pipe market was lost to aluminum, PVC and later HDPE conduits for storm and sanitary sewers and culverts in many areas of the USA. The agriculture drain market upon which the "cement tile" industry had depended at the turn of the 19th century had disappeared. Through the late '60s, '70s and '80s, the concrete pipe industry found itself in a marketplace that had become unfamiliar to many producers.

In that period of market adjustment, producers rediscovered the value of a strong concrete pipe association and began a long, arduous task to reintroduce the values and capability of concrete pipe through its association to an industry of new university graduates with little knowledge about concrete pipe. The shine of new 20th century materials seemed to blind specifiers, regulators and contractors to the features and benefits of proven precast concrete products that had withstood the test of time.

The first step that producers, their suppliers and association staff took was to introduce a concrete pipe design manual in 1970 and supportive textbooks that could be used by university students studying civil and structural engineering.

The industry realized that they had to be proactive and re-educate an industry that had all but forgotten the long-term performance and quality of reinforced concrete pipe. Once again, the industry itself was going through a renaissance. Vigilance became the watchword as

1916 - Road Act establishes concept of a national highway system.



1920 - Mass production of concrete pipe meets growing need.

1924-1927 - Concrete pipe tonnage doubles to 1,750,000.



AMERICAN SOCIETY FOR TESTING MATERIALS
3800 MARKET STREET, PHILADELPHIA, PA.



1930 - Committee C15 on Concrete Pipe formed.



1930's - Concrete pipe design furthured by Marston, Spangler and Schlick.

skills were developed in technical marketing and working with government agencies and elected representatives to influence policy at the state and local levels.

Within a blink of an eye, the concrete pipe industry had entered into the modern era of computer technology, robotics, sophisticated marketing strategies and tactics, and the political arena.

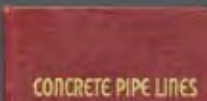
The 1990s moved rapidly into the twenty-first century on a wave of industry consolidation, advanced technology and science. It had become a cohesive industry that had learned how to communicate knowledge about concrete pipe science and applications. It had learned how to work with a new generation of engineers, regulators, specifiers and contractors who had been taught to consider concrete pipe as the product of choice for sanitary and storm sewers, culverts and a wide variety of special applications, not even dreamed by the founders in 1907.

Can we possibly envision what the future may hold for our industry at a time when we are preparing for a manned mission to Mars, exploring the inner space of an atom and cracking codes that define life? We can never again be complacent and stand down from being forever vigilant. There are new materials and products that will enter our market before this decade is done. In a global marketplace, we can expect advances in technology and materials to come from China's industrial dragon and India's tiger. We have to look beyond our traditional marketplace and nation and be prepared to

meet market threats from other countries head on, while at the same time competing with an entrenched plastic products industry in America.

The concrete pipe producers who banded together in 1907 recognized the need for an association. Their business world may have seemed threatening and uncertain to them, but it was far more straightforward than the marketplace we find ourselves in today. Yet the current situation is not much different from that of 100 years ago. Our industry is under fire from competitive products, there is a strong need and demand for precast concrete pipe and boxes, and research in universities and government labs may push the industry in new directions in pipe and box design and concrete mixes. Science and technology appear to be opening new opportunities for concrete pipe, as long-term performance of HDPE is being challenged by data being generated through field inspections and tests. Marketing has become integrated into business strategies of the American Concrete Pipe Association and is no longer taken for granted. Skillful lobbying and government relations practices are proving that changes can be made in the short term, with long-term impact on the use of concrete pipe.

No one knows where the industry will be by 2107. However, generations that follow will know that beneath the urban areas and highways of America are countless miles of reinforced concrete pipe and boxes that were installed through the 1900s and early years of the twenty-first century that are still functioning as designed. ☺



1942 - CONCRETE PIPE LINES printed.



1956 - Plans underway for a National Highway System.

1988-2006 - ACPA develops software to bring industry into computer age.



1970-2006 - Concrete Pipe Design Manual.



www.concrete-pipe.org

Feature Story

Utah's FrontRunner



Photo: Utah Transit Authority

Commuter Rail Uses New and Re-used Reinforced Concrete Pipe

By Randy Wahlen, P.E.
Mountain States Concrete Pipe Association
801-942-7552

The Wasatch Front of the Salt Lake Valley in Utah is facing a transportation crisis that is being mitigated by a massive public transit network. Despite the reconstruction of Interstate 15, several years ago and the success of the TRAX light rail line that carries more than 55,000 riders each day, the region's transportation needs are growing faster than its ability to meet them. Utah is one of the fastest growing states in the country. As its population boom continues, the number of automobiles is increasing and traffic congestion poses a significant threat to Utah's economic vitality.

To connect the urban centers north and south of Salt Lake City, the Utah Transit Authority purchased 175 miles of railroad corridors between Payson and Brigham City in 2002 to construct, among other facilities, a

commuter rail system known as "FrontRunner." The first phase of the FrontRunner commuter rail alignment extends from Pleasant View to Salt Lake City and lies on the east side of the existing Union Pacific Railroad (UPRR) mainline tracks. The alignment extends 44 miles, contains 38.15 miles of exclusive right-of-way, shares 5.87 miles of track with UPRR, has 43 at-grade crossings and a 2,043-foot bridge over the UPRR Ogden rail yard.

The extreme geography of the area, along with the population boom, are important factors in understanding the need for mass transit. The Great Salt Lake combined with the Wasatch Mountain Range creates a very narrow transportation corridor just north of the congested Salt Lake Valley. As residential communities continue to push north, mass transit has become a more viable option for moving people. The popularity of mass transit was a major reason that in November 2006, sixty-four percent of voters elected to increase the sales tax to support more mass transit and roads in the Salt Lake Valley.

Construction of FrontRunner started in August 2005, and by November 2006, construction of the commuter rail was 50 percent complete. Much of the early work involved a network of utility relocations. Storm drains have run parallel to the existing railroad and I-15 freeway corridor for years, transporting runoff from the mountains to key railroad crossings where it is then directed to the Great Salt Lake. With the commuter rail being constructed between the existing UPRR freight tracks and



the I-15 freeway, much of the parallel storm drain had to be relocated. Mr. Von Larson, a hydraulic consultant for Parsons Brinkerhoff commented on the challenge presented by the existing drain. "We had some areas where utility conflicts would have made storm drain relocation extremely difficult. As most of the storm drains along the tracks were reinforced concrete pipe, we decided that the strength of the original pipe could allow it to remain in place. We were pleased to verify, through field inspections, that the reinforced concrete pipe was functioning as designed, and we were able to avoid relocation of several sections."

Although the condition of the pipe was sound in certain sections of the project, it was determined that the tracks would have to run over the pipe for long distances. Relocation of the drain was considered a better long-term option. In these cases, the contractor salvaged as much concrete pipe as possible for reuse by the Davis County Public Works Department. Over 2,000 feet of 54-inch diameter reinforced concrete pipe (RCP) was salvaged. The pipe was fitted with new gaskets and reused in various stream channels throughout the county. Some of the pipe that showed wear after 25 years of constant flow and bedload was rotated to re-orient the invert.

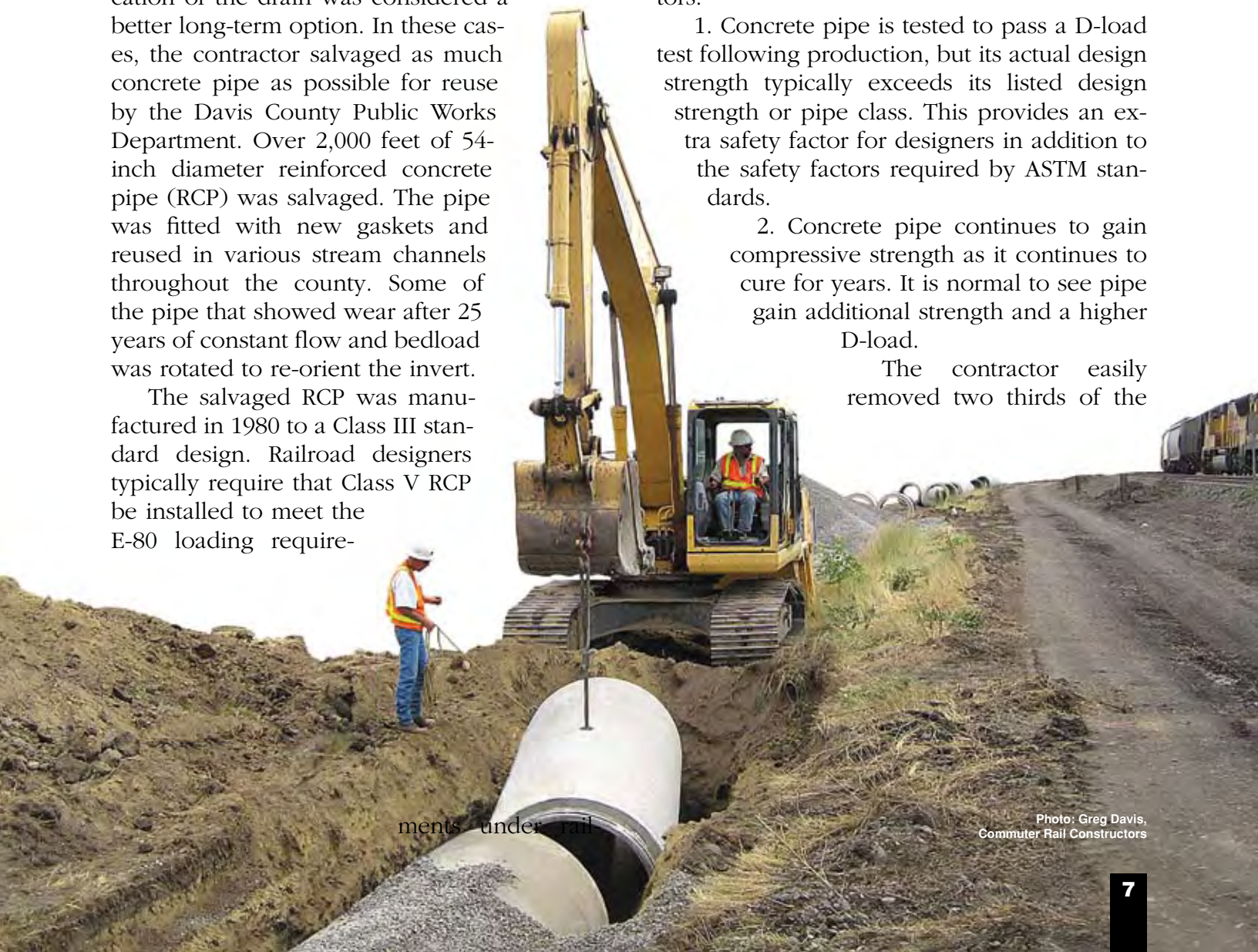
The salvaged RCP was manufactured in 1980 to a Class III standard design. Railroad designers typically require that Class V RCP be installed to meet the E-80 loading require-

ments under rail roads tracks. To verify the actual class of the salvaged pipe, design load (D-load) testing of the salvaged 54-inch diameter pipe was conducted at the Amcor Precast plant in Ogden, Utah. D-load testing found that the ultimate strength of the pipe was 125,000 lbs. or 3,472 lbs. per foot of diameter per foot of length. This was just a few percentage points under a Class V pipe criteria even though the pipe was designed and manufactured as a Class III pipe. It is estimated that the pipe exceeded its original design requirements by 73 percent. This strength of the concrete far exceeded the typical design requirement of 4,000 psi for pipe that conforms to ASTM C76.

This gain in strength is not uncommon when testing salvaged concrete pipe. The strength increase can be attributed to two factors:

1. Concrete pipe is tested to pass a D-load test following production, but its actual design strength typically exceeds its listed design strength or pipe class. This provides an extra safety factor for designers in addition to the safety factors required by ASTM standards.
2. Concrete pipe continues to gain compressive strength as it continues to cure for years. It is normal to see pipe gain additional strength and a higher D-load.

The contractor easily removed two thirds of the



ments under rail

Photo: Greg Davis,
Commuter Rail Constructors

Feature Story



Photo: Greg Davis,
Commuter Rail Constructors

Existing 72-inch diameter RCP supported by I-beam as crew pours a concrete foundation for a 96-inch precast manhole.

pipe to be re-used without damage by equipment and a fast-paced crew. Mr. Tom Smith, Davis County Public Works Director commented, "We have had a fairly tight budget for flood control projects. To have \$175,000 worth of concrete pipe immediately available for our projects is quite a windfall." This outcome demonstrated the salvage value of concrete pipe, an area of life cycle cost analysis that is often overlooked.

Life Cycle Cost Analysis (LCCA) for concrete pipe systems is covered in ASTM C-1131. The procedures include provisions for residual or salvage value, which is the remaining value of the structure at the end of its design life. If an LCCA was applied to the FrontRunner project (with a 25-year design life), the salvaged concrete pipe would increase even further in value as the cost of new pipe would have increased incrementally since it was produced in 1980. From the University of Utah report, "The Economic Costs of Culvert Failures" by Dr. Joseph Perrin, Jr., a discount rate of 4% was used in comparing the life cycle costs of

different products. Using this same discount rate and assuming that only two thirds of the original concrete pipe could be removed by the contractor without damage, the life cycle cost analysis would find that concrete pipe could have cost at least three times more than alternative products and still be more cost effective in the long run. This life cycle cost analysis scenario is provided to illustrate the overall cost effectiveness of installing an "engineered structure" with a long service life.

The FrontRunner project includes over 6,500 feet of newly manufactured reinforced concrete pipe and associated cleanouts and junction boxes. The pipe was specified as Class V, if it were to be under the rail line or under heavy construction loads. Class III pipe was specified in areas of more typical loading and construction. The drainage facilities, with either new or salvaged concrete pipe, should serve the residents of the area for decades to come. ☺

Project:	FrontRunner Commuter Rail Project Davis County, Utah
Owner:	Utah Transit Authority
Hydraulics Consulting:	Parsons Brinkerhoff Salt Lake City
Engineer:	
Contractor:	Salt Lake City Commuter Rail Constructors (joint venture of Stacy and Witbeck, Inc. and Herzog) and Brinkerhoff Excavation Salt Lake City
Producer:	Amcor Precast (a division of Oldcastle Precast, Inc.) Ogden, Utah
Quantities:	1,928 feet of 12 to 18-inch diameter reinforced concrete pipe 3,000 feet of 24 to 36-inch diameter reinforced concrete pipe 1,620 feet of 48 to 84-inch diameter reinforced concrete pipe

The Ogden, Utah facility of Amcor Precast has been in service for more than 50 years. Along with a complete line of concrete pipe and manhole products, Amcor also produces utility vaults, catch basin products, box sections, and a wide variety of other precast concrete products. See www.oldcastle-precast.com.

Historical Railway Trestle Replaced with Reinforced Concrete Pipe

By Patrick Kelly
Rinker Materials - Concrete Pipe Division,
Pittsburgh Pipe Plant
412-923-2490

An ongoing arson investigation quickly followed the brush fire that engulfed and seriously damaged the Divener wooden railway trestle in Butler County, 50 miles northeast of Pittsburgh, Pennsylvania on May 10, 2006. Constructed prior to the Civil War, the 624-foot long creosote-soaked structure crossed a small stream and wetland at a height of 60 feet. It was a vital structure to three chemical plants that were serviced daily by the Buffalo & Pittsburgh Railroad (B & P). The line is a dead end track on which the train services the plants. With the trestle out of service, the plants could have faced closure until rail service was restored. A new steel bridge would have taken up to twelve months to engineer and erect, while an earthen structure would have taken six weeks at half the cost of the \$4,000,000 estimate of a steel structure.

Jon Hiser, P.E., of Hiser Engineering, and Justin Wagner, P.E., of Gateway Engineers, designed an earthen bridge that included a concrete culvert covered by 60 feet of locally blasted sandstone and a new railroad bed and tracks. Wagner contacted the Pittsburgh Pipe Plant of Rinker Materials, which specializes in designs for deep-fill applications, and regularly produces reinforced concrete pipe (RCP) for installations that range in depth from 40 to 120 feet.

After review of the project requirements, it was determined that there was not enough time to engineer and produce a special design. Subsequently, Jim Shannon, P.E., Director of Product Engineering for Rinker's Concrete Pipe Division prepared an installation specification for 72-inch diameter (Class-V) RCP and 1,100 yards of flowable fill to meet the requirements

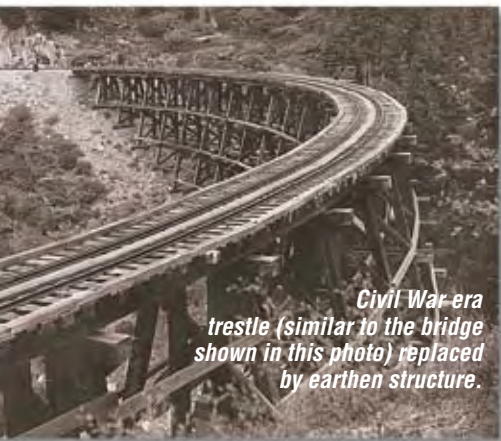


Photo: Patrick Kelly

Culvert comprised of 208 feet of 72-inch diameter (Class-V) reinforced concrete pipe replaced wooden trestle.

of the 60-foot fill height and Cooper E-80 loading.

On June 2, Gasparovich Excavating placed an order for 208 feet of the 72-inch diameter (Class-V) RCP. The full order was shipped to the site in less than a week. Starting on June 10, the contractor's installation crews started installing pipe around the clock for ten days. Within that time, 60 feet of backfill was placed over the concrete pipe culvert and 600 feet of track was laid over the new railroad bed.



Civil War-era trestle (similar to the bridge shown in this photo) replaced by earthen structure.

Local, state and federal agencies collaborated to help the Buffalo & Pittsburgh Railroad expedite the required permitting in an environmentally responsible manner to commence

and complete work over a period that covered 41 days from the outbreak of the fire. On June 22, B&P announced that its freight rail service had resumed to the three chemical companies. The plants were major employers in the county that had continued operations without layoffs. After six weeks and according to schedule, the East Butler to Bruin, PA line of B & P was reopened for business. The Buffalo & Pittsburgh Railroad, headquartered in Rochester, NY, operates a 770-mile regional rail system in western Pennsylvania and New York and is a Genesee & Wyoming Inc. company. ☺

Project: Buffalo & Pittsburgh Railroad Trestle Replacement
Pittsburgh, Pennsylvania

Owners: Buffalo & Pittsburgh Railroad
Rochester, NY

Consulting Engineers: Hiser Engineering,
Worthington, Pennsylvania
John Hiser, P.E.
Gateway Engineers,
Justin Wagner, P.E.
Pittsburgh, Pennsylvania

Contractor: Gasparovich Excavating
McKees Rocks, Pennsylvania

Producer: Rinker Materials - Concrete Pipe Division
Pittsburgh, Pennsylvania
Jim Shannon, P.E., Director of Product Engineering

Quantities: 208 feet of 72-inch diameter (Class-V) RCP

Rinker Materials Corporation (the US subsidiary of Rinker Group Limited), headquartered in West Palm Beach, Florida, is one of the largest producers of heavy building materials in the United States with its principal operations in Florida and Arizona and additional operations in 29 states. Products manufactured include crushed stone, cement, concrete, concrete block, concrete pipe and asphalt. See www.rinkermaterials.com.

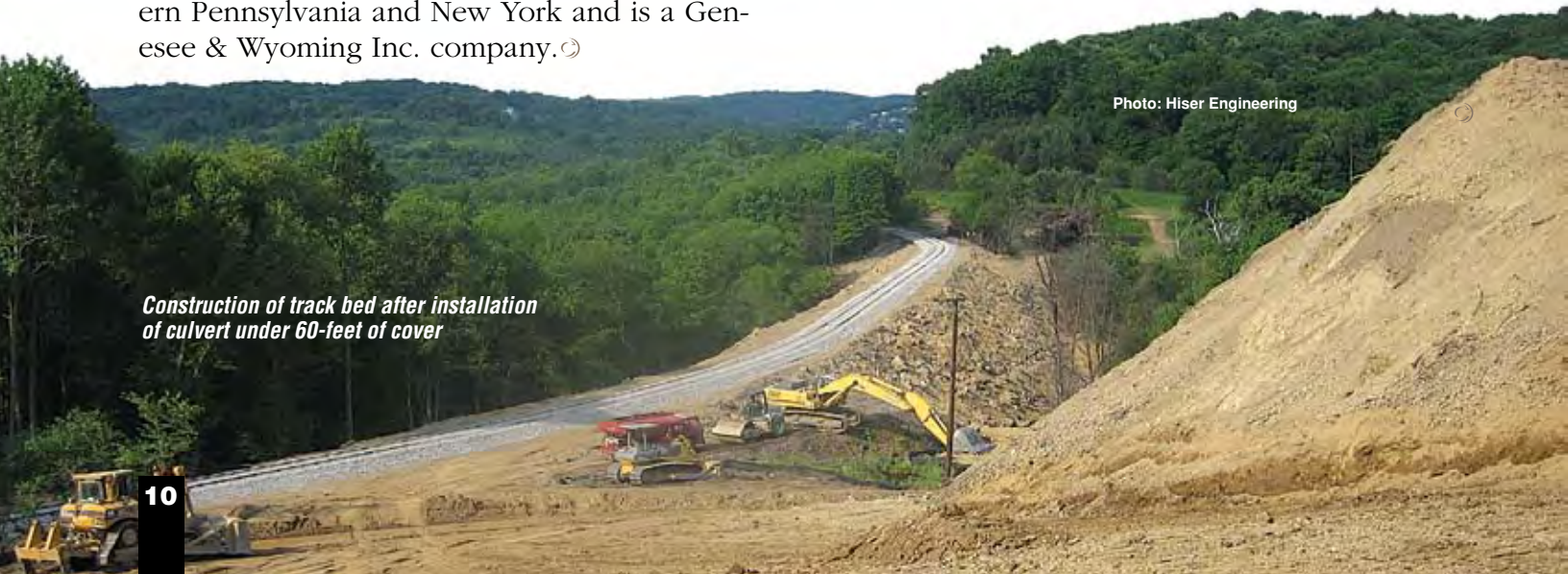


Photo: Hiser Engineering

Construction of track bed after installation of culvert under 60-feet of cover

and now you know... _____

Innovations in Storm Water Management Rely on Concrete Pipe, Boxes and Manhole Components

Precast concrete products are filling technology gaps between existing products and the need for innovative solutions created by environmental legislation and regulations. Departments of Transportation and municipalities are seeking many of these innovations. Changing weather patterns, urban intensification and overall climate change are having a profound effect on managing storm water in America's towns and cities, and in some cases, the rural landscape. Precast concrete pipe and boxes are in demand in this emerging market for innovative products.

In the late 19th century, cement tile was used for agricultural drains throughout America. Cement and clay tiles filled a technological need for producing food and fiber for domestic markets and trade. There have been several periods in America during the last 100 years where weather patterns suddenly changed, causing economic hardship and social upheaval for

prolonged periods. During the time of urban settlement, storm water and snowmelt was seen by many as obstacles that needed to be collected and discharged into receiving streams, rivers and lakes in the easiest and cheapest way. It was dealt with in massive flood control programs in cities and small municipal sewer systems throughout the nation.

The Federal Water Pollution Control Act Amendments of 1972 set regulations requiring storm water quality programs. When the Act was further amended in 1977, it became the Clean Water Act and continued requirements to set water quality standards for all contaminants in surface waters. In addition, the Act made it unlawful to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions. All discharges of pollutants into waters of the United States had to be authorized by a National Pollutant Discharge Elimination System (NPDES) permit. The Act gave the Environmental Protection Agency (EPA) the authority to implement pollution control programs such as setting wastewater standards for industry and funded the construction of sewage treatment plants.

Many large urban areas had constructed combined sewer overflow (CSO) systems intended to treat storm and sanitary effluent prior to discharge. In the event of major storms, the treatment plant was bypassed and sewage discharged into surface waters, untreated. Today, discharges must meet EPA and Clean Water Act regulations and many of the CSOs are being separated, so that storm water and sewage can be properly managed as separate effluent streams.

The Federal Clean Water Act and pollution control programs of the EPA stimulated the concrete pipe market in ways that many pipe producers had never imagined. It also opened the door for alternative materials and products to take a run at filling technology gaps best suited to precast concrete products. The stage was set for a highly competitive drainage pipe market now faced by the American Concrete Pipe Association and its member firms. Their competitive spirit only opened new applications for precast reinforced concrete pipe and boxes.

Precast concrete pipe, boxes and manhole components remain the product of choice of designers of storm sewers and culverts for all the right reasons. Today's products are designed to perform as expected for 100 years. When life cycle cost analyses are performed at the planning stage of major works, concrete pipe is the most cost efficient product over the design life of the project. It adds to the credit worthiness of a municipality, because it adds value to the infrastructure assets. Above all, the material and product can be trusted to build structures that will protect the health and safety of the people who depend upon public works for a vibrant society.

Concrete pipe producers

are now supplying products to build galleries and vaults to intercept and store storm water for slow release and/or treatment before it is discharged into surface waters. Engineers sometimes face a regulatory challenge when designing systems to treat storm water before it is released into water bodies. When this challenge is coupled with the system capacity requirements of a densely populated development, the use of storm water ponds for treatment is not always desirable, or feasible. In areas prone to heavy rainfalls or flash flooding, an underground detention system allows for collection and storage of the storm water that can be discharged later into the municipal storm sewer system at a controlled rate to meet existing storm sewer capacities and to eliminate dangerous and costly flooding. In dry areas, water can be stored for use during droughts or other times of need.

For these projects, designers look to precast concrete pipe or boxes because the products come in many shapes and sizes to fit small or large footprints, with concrete mixes to accommodate the chemical nature of the runoff. Surface areas can also be used as traveled roadways or parking lots. In addition, there are no places for



the proliferation of disease-bearing mosquitoes, or the potential for liability issues related to health and safety with an open-pond system.

Some producers are now applying precast concrete boxes as components of small dams and pump stations required as major features of stormwater management plans. Manhole risers and concrete pipe are being increasingly used for drop structures and energy dissipaters to prevent erosion of natural features and to control discharges in environmentally sensitive areas.

Oil sediment separators (OSS) for storm water treatment are essential elements of many stormwater management plans of municipalities throughout North America. The majority are located in heavily urbanized areas where storm water and snowmelt quality affects the health of ecosystems of receiving lakes and rivers serving as municipal potable water sources. Among other things, selection criteria include climate and local weather conditions, regulations and practices. Devices are used routinely to treat runoff from paved sites of approximately 12 acres or less, or space-constrained locations. The devices are in demand to preserve aquatic ecosystems and the quality of

water sources for municipal use.

One area of the USA that has responded effectively to changing climate conditions is the lush tropical territory of The Rio Grande Valley of South Texas at the far southern tip.

It is a massive delta formed over centuries of flooding by the Rio Grande. The area is technically a desert with the Rio Grande River as the only source of water. To convey water from the Rio Grande to where it is needed, the Valley depends upon an irrigation system unparalleled in the United States. Hundreds of miles of canals, pipelines and ditches move water from pumping stations on the river to points of use up to 35 miles away.

One of the problems facing the water supply is that the open ditches and canals are not efficient in preventing water loss, especially in times of prolonged drought. Today, many of the canals are enclosed in concrete pipe to prevent water loss.

Modern stormwater management systems benefit from the basic attributes of concrete pipe and boxes. Concrete pipe and box sections accommodate great volumes of effluent within a small construction and environmental footprint. Concrete pipe is a rigid pipe that provides both structure and conduit when it arrives on site. Concrete pipe is recognized for quality of manufacturing, consistent strength, availability in designs and sizes to serve most installations. It is also contractor friendly and competitive with poured-in-place concrete structures and flexible pipe. Production of concrete pipe and boxes is a consequence of computer-aided design and analysis, advanced concrete mix designs, automated and computer controlled batching, precision fabricated wire reinforcement, quality-driven manufacturing techniques, improved watertight joints, and new installation standards. With such high performance built into each unit, producers of precast concrete pipe, boxes and manholes will continue to supply products for structures that fill technology gaps in stormwater management programs. ☺

Photos:
John Simpson, P.E.
Sherman-Dixie

By John Simpson, P.E.
Sherman-Dixie
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615-386-4407

Combined Sewer Replaced by Reinforced Concrete Pipe Sanitary Sewer



Chattanooga, Tennessee is one of approximately 1,200 cities in the United States that manages combined sewer overflow (CSO) facilities within their interceptor sewer system. Among the various facilities of the city's sewer system are eight combined sewer overflow storage chambers situated below grade. The 1994 CSO Control Policy of the Environmental Protection Act is a national framework for control of CSOs through the National Pollutant Discharge Elimination System (NPDES) permitting program. It was implemented so that municipalities could meet the Federal Clean Water Act's pollution control objectives.

Combined sewer systems are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. Most often, CSOs transport all of their wastewater to a sewage treatment plant, where it is treated and then discharged to a water body, such as the Tennessee River in Chattanooga. The wastewater volume in a combined sewer can sometimes exceed the capacity of the sewer or treatment plant during heavy rainfall or rapid snowmelt. CSOs have been designed to overflow and discharge excess wastewater with primary or no treatment directly to a receiving water body.

The City of Chattanooga had a combined sewer within its downtown area along Tampa Street that needed replacement because of new development within the city core. Although the city had a history of specifying reinforced concrete pipe for sanitary sewer projects, it was concerned about the pipe meeting the design life for this particular project, given the corrosive nature of the sewage and the

need for high performance infrastructure in a heavily used area of the city center. The new sewer had to be long lasting with low maintenance. The city again turned to reinforced concrete pipe.

When the project was awarded to Mayse Construction, Sherman-Dixie received the order to supply one thousand feet of 72-inch diameter Class III reinforced concrete pipe to be installed by open cut at depths ranging from 8 to 20 feet. Fully aware of the need for products that could be easily supplied to accommodate the corrosive nature of the sewage, Sherman-Dixie presented the idea of using the additive Xypex for additional protection against



1,000 feet of 72-inch diameter Class III RCP installed by open cut method.



Red dye mixed with additive to verify even distribution through each pipe. Additive provided additional protection against potential of sulfuric acid corrosion.

degradation of the inner wall of the concrete pipe by hydrogen sulfide-induced sulfuric acid corrosion. Xypex Admix C-1000 consists of portland cement, very finely treated silica sand and various active, proprietary chemicals added to the concrete mix at the time of batching. The chemicals in the additive react with the moisture in fresh concrete and by-products of cement hydration to cause a catalytic reaction, which generates a non-soluble crystalline formation throughout the pores of the concrete. The concrete becomes permanently sealed against the penetration of water and protected long-term from harsh environmental conditions. Plant quality control staff were able to confirm that the additive was evenly distributed throughout each pipe unit since a red dye was mixed with the additive giving a terra cotta color to the pipe. Xypex had been used for manholes, pump stations and other poured-in-place products, but this was the first use in Tennessee of a horizontal application.

Supply of a product that would meet the design life of the project was just one of the significant considerations. The contractor was also concerned about potential escalating costs due to the complex terrain of the pipe alignment and the possible need for large junction boxes and manholes. The time-saving solution to the challenge was the precasting of special pipe bends and saddle tees for access into the system.

The city demanded water tight joints to mitigate infiltration and exfiltration of fines and sewage. Sherman-Dixie undertook a complicated process of manufacturing the specially designed pipe with rubber compound gasketed joints. The contractor had

to install the pipe with precision, as the city field-tested the jointing system.

Good communications between representatives of the pipe producer, contractor, city and design engineer was also a factor in the early completion of the project. Because of limited space in the downtown area for storing product at the construction site and ever-present pedestrian and vehicular traffic, just-in-time delivery from the nearby Chattanooga pipe plant became the only way to supply the contractor in some areas of the installation. Clear communications between the installation crew and shipping ensured delivery of the project on schedule. The project started in May 2005 and finished four months later. ☺

Project:	Combined Sewer Overflow Replacement Tampa Street Chattanooga, Tennessee
Owner:	City of Chattanooga Jerry Stewart, P.E., Director – Waste Resources Bill Payne, P.E. City Engineer Mike Patrick, P.E., System Engineer Dennis Malone Gordon Phillips Wiatt Wehunt
Consulting Engineer:	Betts and Associates Chattanooga, Tennessee Jim Crownover, P.E. Mark Oliver
Contractor:	Mayse Construction Chattanooga, Tennessee Todd Mayse
Quantities:	1,000 feet of 72-inch diameter Class III reinforced concrete pipe
Producer:	Sherman-Dixie Concrete Industries. Chattanooga, Tennessee Facility

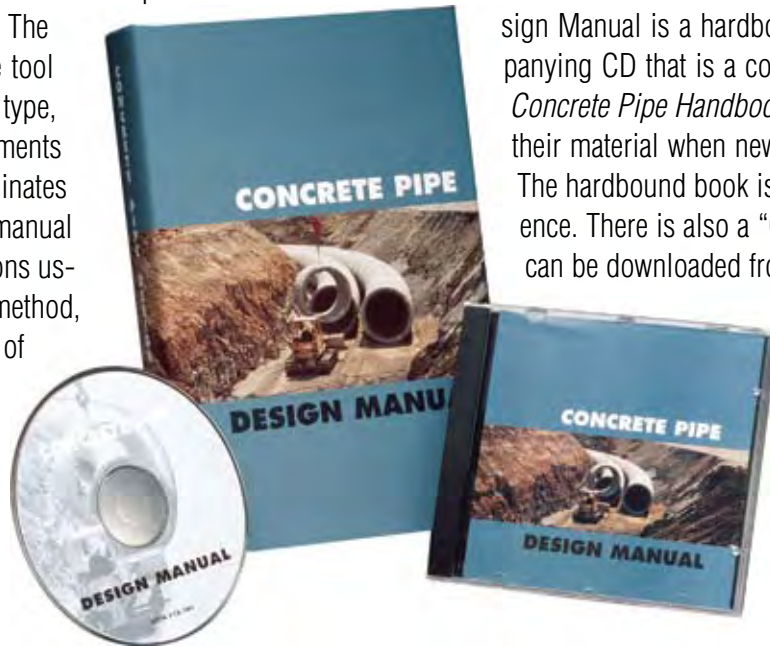
Sherman-Dixie manufactures and markets precast concrete pipe and precast concrete storm and sanitary sewer structures for market areas in the southeast United States. The company has plants located in Hermitage, Chattanooga, Franklin and Knoxville Tennessee, as well as Louisville, Elizabethtown, and Lexington, Kentucky, Cullman, Alabama, and Dayton, Ohio. Its corporate office is located in Nashville, Tennessee. See www.shermandixie.com for details about products and services.

Concrete Pipe Design Manual and CD Are Necessary Companions

The **Concrete Pipe Design Manual** has been published by the American Concrete Pipe Association since 1970. The manual is an indispensable tool to help engineers select the type, size, and strength requirements of concrete pipe, and eliminates lengthy computations. The manual includes standard installations using the indirect design method, and more than 500 pages of tables and figures covering hydraulics of sewers and culverts, live loads and earth loads, supporting strengths and supplemental design data. De-

tailed example problems of specific applications illustrate the use of the time saving design aids. The Design Manual is a hardbound book with accompanying CD that is a companion volume to the *Concrete Pipe Handbook*. Users should update their material when new versions are released. The hardbound book is a handy desktop reference. There is also a "CD only" version which can be downloaded from the ACPA website at

www.concrete-pipe.org. Both the book/CD or the CD only version can be purchased online or from the ACPA Resource Center by calling 800-290-2272. ☺



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