

Concrete Pipe News

Fall 2016



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Concrete Pipe Week 2016,
August 14 to 20

American **Concrete Pipe** Association

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

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Commentary on Concrete

Cementitious materials have been used by civilizations over the past 5,000 years. The Egyptians used mud mixed with straw to bind dried bricks, and gypsum mortars and mortars of lime are evident in the pyramids. In that same period, 5,000 years ago, the Chinese used cementitious materials to bind bamboo in their boats and later rocks in portions of the Great Wall. These cementitious materials evolved with the advancement of science and technology to the concrete mixes of today. In the modern era, as in past civilizations, concrete is the single most widely used material in the world.

There are milestones in the [history of concrete¹](#) that should not go unnoticed. Between 300 BC and 479 CE the Romans used pozzolana cement from Pozzuoli, Italy near Mt. Vesuvius to build the Appian Way, Roman baths, the Coliseum and Pantheon in Rome, and the Pont du Gard aqueduct in southern France. They used lime as a cementitious material. Pliny reported a mortar mixture of 1-part lime to 4 parts sand. Vitruvius reported a 2 parts pozzolana to 1-part lime. Animal fat, milk, and blood were used as admixtures (substances added to cement to increase the properties).

In 1818, Maurice St. Leger was issued patents for hydraulic cement, and Natural Cement (limestone that naturally has the appropriate amounts of clay) was produced in the USA. Six years later in 1824, Joseph Aspdin of England invented Portland cement by burning finely ground chalk with finely divided clay in a lime kiln until carbon dioxide was driven off. The sintered product was then ground and he called it Portland cement named after the high quality building stones quarried at Portland, England. By 1860 concrete mixes contained Portland cements of modern composition.

It was during the period between the turn of the century and 1840s that concrete pipe entered the American marketplace. In 1867, Joseph Monier of France reinforced William Wand's (USA) flower pots with wire thereby ushering in the idea of iron reinforcing bars (rebar). In 1889, the first concrete reinforced bridge was built, quickly followed by concrete buildings and roads.

The 20th century was marked by concrete marvels including dams, bridges, skyscrapers, road networks, major underground drainage and collection systems. Concrete found its place in America as the single most widely used construction material. Materials were standardized and specifications adopted for many applications of concrete mixes. But the story of concrete did not end there and continues to unfold.

In the 1980s, superplasticizers were introduced as admixtures and silica fume was introduced as a pozzolanic additive resulting in high strength concrete. By the end of the 1990s, a Swedish company introduced concrete polishing to the United States and now the technology is commonplace.

The story of concrete continues into the 21st Century. Age-old Portland cement is now supplied as Portland-Limestone cement to reduce the carbon footprint of kilns and projects within the context of rules and regulations intended to mitigate the effects of climate change. Concrete products and structures such as buildings and small bridges can now be formed using 3D printers instead of centuries-old labor-intensive production and construction techniques. Scientists and manufactures of concrete products have introduced fibers into the concrete mix as an alternative to steel rebar and mesh. Transparent concrete (translucent concrete or light transmitting concrete) is achieved by replacing aggregates with transparent alternate materials to transmit light by using clear resins in the concrete mix. And researchers have developed a bendable concrete that may be stronger and more durable than regular concrete.

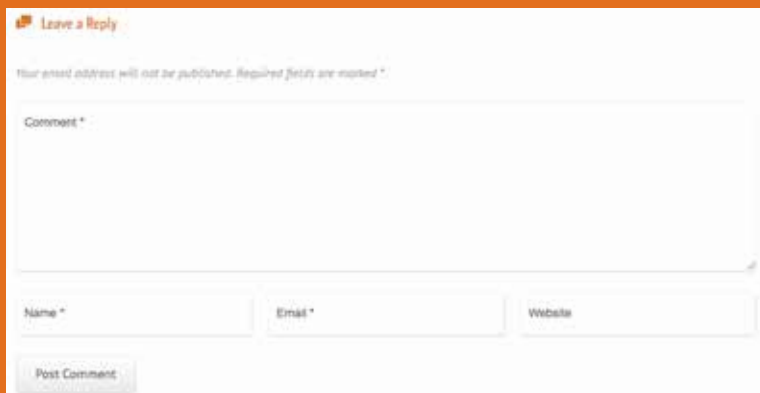
This brings us to the characteristic of concrete that transcends time to the palaces of the Egyptian Pharaohs. Concrete is a durable material and when reinforced, can last for centuries in many of the Earth's environments. Durability, or service life of a material is as equally important as its ability to perform intended structural functions. The capability of a structure to continue to perform satisfactorily for an acceptable period is a fundamental engineering consideration. It is an exciting time for producers of precast concrete structures. History teaches us that it is a certainty that concrete will continue to be the world's most widely used construction material. With assurance of demand for concrete and a little insight, precasters can look at the history of concrete, the new concrete mixes entering the marketplace, along with advances in modern technology for construction to get a glimpse of new markets and applications of precast.

References

1. concretepipe.org/web/HistoryofConcrete.pdf

GET INVOLVED....BLOG YOUR THOUGHTS!

Have something to say to Matt Childs about this editorial? The blog is published under Latest News at concretepipe.org. Get involved and leave a comment.



The image shows a screenshot of a web form titled "Leave a Reply". At the top, it says "Your email address will not be published. Required fields are marked *". Below this is a large text area labeled "Comment *". At the bottom, there are three input fields: "Name *", "Email *", and "Website". A "Post Comment" button is located at the bottom left of the form.

Concrete Pipe Week 2016

Proclamations from 26 States Representing 64% of Americans

The accomplishments of America's concrete pipe industry were celebrated with state proclamations, plant tours, educational events and social activities between August 14 and 20. By the end of the celebrations, 26 state governors had signed proclamations. Those 26 states represent 64% of the population of the United States of America.

Concrete Pipe Week recognizes the importance of the reinforced concrete pipe and precast products industry to our nation's infrastructure, the importance of the industry to our economic well-being, and the substantial contribution of the individuals in the concrete pipe and precast concrete products industry to the health, safety, welfare and quality of life of U.S. citizens and states. Concrete is the most overlooked, taken-for-granted, yet irreplaceable material for wide-spread construction on Earth.

RCP and precast products are essential to safe, durable, and long-lasting stormwater and sanitary sewer drainage systems in transportation and public works projects. Concrete pipeline systems designed by Transportation Departments, Public Works Departments, and private sector consulting engineers are indicative of planning for resilient critical infrastructure and a sound practice of adding long-term value to a community's infrastructure assets.

Concrete Pipe Week is also a time to recognize the contributions of ACPA's associate members that include steel producers, form producers, casting producers, the trucking industry, sand and rock producers, cement producers, contractors, academia and everyone associated with the buried infrastructure industry and the products, services and materials required by the concrete pipe industry.

Some events marking Concrete Pipe Week included an Open House, Partner Appreciation by Concrete Pipe & Products, LLC, Hanover, VA to highlight the versatility of concrete pipe and precast products. Transportation professionals from VDOT, James City County Public Works Department and City of Hanover attended the festivities. Contractors, owners, engineers, and inspectors joined CP&P staff for a catered lunch and plant tours to learn how reinforced concrete pipe is manufactured.

U.S. Congressman John Carney (DE) along with State Senators Bruce Ennis and David McBride (Senate Majority Leader) and Mayor Kenneth Branner were among the guests that toured Rinker's Middletown concrete pipe plant. At their Frederick, MD Rinker Materials – Concrete Pipe Division Plant, CEMEX held an Open House highlighting the versatility of concrete pipe and precast products. Transportation and public works professionals from Maryland State Highway Administration, Frederick County Public Works Department and City of Frederick attended the activities. Contractors, owners, engineers, and inspectors joined Rinker Materials staff to learn how reinforced concrete pipe is manufactured. They toured two plants on the property.

Representatives of Gossett Concrete Pipe Co., Inc. and the ACPA met with SC Governor Nikki Haley in Columbia to receive the Governor's proclamation, and Forterra Pipe & Precast held several events at their facilities across the country. In many other locations, members of the American Concrete Pipe Association joined as delegations to meet with their state governors.

Constituents can request a letter or proclamation to commemorate special events from their local or state government offices. Requests usually will go through an internal review and approval process. Proclamations can be issued for civic celebrations, non-profit organizations, and significant events with historical and/or unique importance to the citizens or individuals who have made a significant contribution to society.



Quick Notes

Who	American Concrete Pipe Association
What	Concrete Pipe Week 2016 concretepipe.org/concrete-pipe-week-2016
Why	To recognize the importance of the reinforced concrete pipe and precast products industry to U.S. infrastructure, the importance of the industry to the U.S. economic well-being, and the substantial contribution of the individuals in the concrete pipe and precast concrete products industry to the health, safety, welfare and quality of life of U.S. citizens and states.
When	Annually in the third week of August.
Where	All states of the United States of America.
How	State proclamations, plant tours, educational events and social festivities.

Photos: Courtesy of American Concrete Pipe Association and its members.



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A Pipeline of Communications: The Dearborn CSO

Brian Harman, Northern Concrete Pipe

132-in. diameter wall stub.



The Dearborn Combined Sewer Overflow (CSO) Storage Pipeline is part of the ongoing Toledo Waterways Initiative. After startup in 2002, and when all phases are completed, it will eliminate all known sanitary sewer overflows and significantly reduce CSOs that release contaminants directly into local waterways during heavy rain. The Dearborn CSO Storage Pipeline will significantly reduce the combined sewage overflows to the Maumee River.

The project began with the City of Toledo listening to residents and choosing the most economical and environmentally beneficial design for the project. Miller Bros. along with Mosser Construction and NCP worked together to bring the project to life and saw it through to completion.

After considering the options of an underground cast-in-place concrete storage basin or a large diameter precast concrete storage pipeline, it was determined that a large diameter storage pipeline would be the most cost effective choice. The structure required a storage capacity of 1.6 million gallons. It would consist of approximately 2,170 feet of 132-inch diameter reinforced concrete pipe (RCP), buried 35 to 40 feet in difficult soil conditions.

There were many considerations that had to be addressed before the project was bid. From special pipe fittings and logistics to undercutting unstable soils, the project required constant communication between all parties for construction of the pipeline to run smoothly. One unpredictable challenge was the weather, with Dearborn experiencing one of the rainiest summer's ever. While Miller Bros. was installing the system, over 5 inches fell in one day during the first week of pipe laying.

The delivery schedule and route required Northern Concrete Pipe (NCP) to obtain oversized load permits in advance of shipping to the job site. For this reason, Miller Bros. along with NCP's dispatch team remained in constant contact with each other to schedule delivery of pipe as efficiently as possible. Construction moved swiftly following an onsite pipe-handling tutorial between NCP and Miller Bros. at the time the first shipment of pipe



Haul roads constructed to fit the needs of the truck drivers hauling pipe into locations that wouldn't normally be conducive to semi-trucks.

arrived. Miller Bros. adapted the haul roads to fit the needs of the truck drivers hauling pipe into locations that wouldn't normally be conducive to semi-trucks.

Midway through the project, Miller Bros. encountered an area of soil that would require a significant undercut to import stable soil to bed the pipe. The soil conditions were identified in Stantec's detailed design, and this information enabled NPC to delay pipe deliveries while the soil conditions were adjusted to accommodate the pipe. Toward the end of the project, NCP and Miller Bros. were able to coordinate an accelerated delivery schedule to stockpile the remainder of the pipe when it was necessary to eliminate the only haul road that could be used to deliver and offload the pipe.

The Dearborn Combined Sewer Overflow Storage project was more than construction of a system to eliminate all known sanitary sewer overflows. It was a very good example of a pipeline of communication that led to the success of the project from start to finish. The cost of the project was \$9,349,500.

Brian Harman; bharman@ncp-inc.com

Photos: Northern Concrete Pipe



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Quick Notes

Who	Owner: City of Toledo Project Engineer: Stantec Consulting Services Inc. General Contractor: Miller Bros. Const., Inc. with Mosser Construction Pipe Supplier: Northern Concrete Pipe
What	Toledo Waterways Initiative Phase II - Dearborn CSO Storage Pipeline.
Why	To eliminate all known sanitary sewer overflows and significantly reduce CSOs that release contaminants directly into local waterways during heavy rain.
When	2014 - 2016
Where	City of Toledo
How	Approximately 2,170 feet of 132-inch diameter reinforced concrete pipe, buried 35 to 40 feet in difficult soil conditions.

Approximately 2,170 feet of 132-inch diameter RCP selected for the Dearborn Combined Sewer Overflow Storage Pipeline conducive to semi-trucks



CP Info Precast Concrete Pipe Durability

ACPA Resource # 02-713 (07/16)

Design methods for buried pipe are well established, but durability has not been given proper consideration. Determining a project design life and the durability, or service life, of a pipe are considerations as significant as its hydraulic and structural functions. The definition of a durable pipe contains three variables that must be evaluated; required performance, pipe properties, and service conditions. CP Info #02-713, Precast Concrete Pipe Durability reviews the significance of various physical and chemical factors which may be aggressive to concrete pipe; reviews the significance of service factors and concrete pipe properties; and durability design and performance of concrete pipe.

Durability, or service life, of a pipe material is as equally important as its ability to perform intended structural and hydraulic functions. The capability of the pipe to continue to perform satisfactorily for an acceptable period is a fundamental engineering consideration. Predictions of durability, however, cannot be made with the same degree of precision as can structural and hydraulic performance; consequently, durability is not granted adequate consideration. Durability is concerned with life expectancy, or the endurance characteristics of a material or structure. Much research has been focused on the durability of some pipe materials, but the varying nature of climate, soils and geology, fluid impurities, construction materials, and the construction process itself have prevented the development of a systematic and practical theory for predicting performance.

The problem has been compounded by the assumed requirement that pipe must last almost indefinitely. The U.S. Bureau of Reclamation defines a durable pipe

as one that will withstand, to a satisfactory degree, the effects of service conditions to which it will be subjected. This definition contains three variables that must be evaluated; the pipe, the satisfactory degree of performance, and service conditions.

There is no known pipeline material completely inert to chemical action and immune to physical deterioration. Concrete, under what might be considered normal exposure conditions, has a very long life.

Concrete pipelines have a history of excellent durability, and it is unlikely this record will change. Drainage pipelines are commonly below ground where temperatures have very little variation, where atmospheric exposure is either not present or is greatly reduced, and where the materials in close proximity to the pipe may be non-aggressive. Laboratory test results, and damage records for cast-in-place concrete pavements and structures that have been exposed to atmospheric conditions, should not be related to buried precast concrete pipe unless it is determined that comparable conditions exist. Improper application of data could lead to over-design and excessive cost.

Precast concrete pipe has served communities well for more than 150 years, and has experienced very few problems. When problems do occur, they tend to be associated with specific environments. Countermeasures have been developed to alleviate most problems.



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Quick Notes	
Who	American Concrete Pipe Association
What	Technical Resource: CP Info Precast Concrete Pipe Durability.
Why	A review of the significance of various physical and chemical factors which may be aggressive to concrete pipe; review of the significance of service factors and concrete pipe properties; and review of durability design and performance of concrete pipe.
When	July, 2016
How	A summary of a literature review of industry publications focused on the durability of concrete pipe.



Precast Box Pedestrian Underpass Spans Two CN Rail Lines in Whistler, B.C.

Brent Schofield B.A., CTech, BC-CESCL, Technical Marketing, Langley Concrete Group



3.6m X 3.05m precast box pedestrian underpass beneath two rail lines.

Precast box structures provide immediate structural capacity and space to any project, including a pedestrian passage designed by Creus Engineering of North Vancouver. Creus was contracted by the Resort Municipality of Whistler and the developer, Mons Holdings to design a pedestrian underpass at 'Mons Crossing' that would span two vital Canadian National (CN) rail lines. The box underpass provides safe and reliable year-round pedestrian and bicycle passage along Valley Trail (the main pedestrian link) to home and business owners in Whistler Village located north of the rail line.

The underpass spans two active rail lines utilizing 48 sections of 3.60m span x 3.05m width x 1.25m lay length precast box sections weighing approximately 15,000kg each for a total span of 30.5 meters. The length of the underpass is

finished and painted for aesthetics by a local artist, and fitted with surface and subsurface drainage for year-round, 24-hour illuminated use.

Box sections were dry cast by The Langley Concrete Group at their Chilliwack facility. The dry cast concrete mixture combined with high amplitude vibration compaction produces a dense, resilient product with excellent strength and inherent freeze thaw resistance. Manufacturing can produce up to 15 box sections in a shift which are then steam cured and held for minimum seven days allowing verification of design strengths.

ASTM 1433, AASHTO, CSA, and AREMA E90 Standards were followed in the design. All aspects of the box manufacturing, including reinforcement, mix design, production process, curing, post production and loading were overseen

by Langley Concrete Group's quality control department. Precast products produced at the company's Q Cast-Certified Chilliwack plant are monitored and verified by the Quality Assurance team, daily.

Installation of the crossing provided unique challenges such as poor soils, a seasonally high water table, active rail lines (only a 15-hour construction window allowed by CN), pedestrian traffic, and the broad range of weather conditions characteristic of this mountain resort.

Box joint connections were designed to be watertight utilizing the Hamilton Kent SuperSeal Gasket. The durable self lubricated gasket is capable of sealing joints to 13 psi. All gaskets were installed at the plant thereby reducing field preparation and installation time. 'Post tensioning' of the box assembly was provided by DWIDAG threaded rods in each corner of the box structures. This was a requirement of CN to ensure that movement was restricted under the forces of the train loading combined with the shallow cover above the structure.





CN closed both tracks for 15 hours for the contractor to excavate, place suitable bedding soils, compact the bedding, place the box sections, backfill and reinstall both rail lines; a significant amount of work for the allotted time.

Langley Concrete supplied a hydraulic JB Pipe Puller with a 25 ton pulling force. The puller assists 'homing' joints without damaging or pinching of the gaskets. Once the boxes are set, the puller pulls the joint home without using heavy equipment to push on or lever the box sections. Installation was completed and the structure ready for active trains within 12 hours, leaving time to spare.

The developer had been considering a pedestrian bridge prior to Creus Engineering contacting Langley Concrete who was able to provide an efficient, cost effective structural solution for Whistler and the developer. In addition to pedestrian underpasses, box structures have been successfully used for fish ladders, manholes, culverts, and stormwater detention/retention chambers.

Quick Notes	
Who	Owner: Resort Municipality of Whistler (RMOW) Developer: Mons Holdings Engineer: Creus Engineering Ltd, North Vancouver, Kevin Nealy, P. Eng. Contractor: CN Rail Precaster: Langley Concrete, Chilliwack, B.C.
What	Valley Trail pedestrian underpass constructed with 48 sections of 3.6m (12-foot) X 3.05m (10-foot) precast box sections.
Why	To provides safe and suitable year-round pedestrian and bicycle passage to home and business owners located north of the rail line in Whistler Village.
When	2016
Where	Whistler Village
How	Open cut construction method within a 15-hour window for excavation, placement of suitable bedding soils, compaction of the bedding, placement of the box sections, backfill and re-installment of both rail lines.

Photos: The Langley Concrete Group

Brent Schofield B.A., CTech, BC-CESCL; bschofield@langleyconcretegroup.com



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12-foot x 10-foot Precast Reinforced Concrete Box Culvert.

Fort Berthold Tribal Council Replaces Corrugated Steel Arch Culverts with Precast Boxes

Riley Dvorak, Sales Manager, Forterra Pipe & Precast, Southern ND

Three separate structural plate corrugated steel arch culverts along Bureau of Indian Affairs (BIA) Route 18 southwest of White Shield were showing significant signs of distress, and failure. The bottom floor of the culverts had begun to collapse upwards. By theory, a combination of soil conditions, freeze-thaw cycles and a flexible corroding material caused the bottoms of the culverts to bend upwards.

The failing culverts below grade contributed to major issues with the paved roadway above the culverts characterized by unwelcome "speed bumps," which were an obvious hazard for drivers. In June 2015, the MHA Nation - Three Affiliated Tribes at the Fort Berthold reservation near White Shield, ND decided it was time for a solution to the failing culverts and roadbed. As a permanent solution was being explored, the

Excavated corrugated steel arch culvert.



immediate remedy was to overlay the surface of the roadway to get it back to drivable conditions. However, this additional burden only accelerated the culverts' failure. After levelling the pavement multiple times over several years the pavement depth quickly grew to be nearly 20 inches in some areas.

A major flood in June, 2015 exacerbated the situation and each site experienced a severe amount of uplift, erosion, and scouring at the ends of the culverts. The Three Affiliated Tribes of Mandan, Hidatsa, and Arikara Nation consulted Interstate Engineering Inc. to research alternatives to make the road safer and solve the problem attributed to the failing culverts. Interstate recommended the most favorable, long-term, cost effective solution; replace each of the culverts with a reinforced concrete box culvert.

Soon after, the Three Affiliated Tribes released to the public, a culvert replacement project as designed by Interstate Engineering Inc.

Meyer Contracting Inc. was selected to perform the work and Forterra Pipe and Precast supplied precast boxes for each of the culverts from their Menoken, ND facility. Production of the boxes began after the project was bid, and the first box was installed in April, 2016. All three locations were completed one month later. Over 60 pieces (12-foot x 10-foot and 12-foot x 8-foot) and 850 tons of concrete product were shipped to the project location in a timely manner, as the contractor moved from site to site.

Riley Dvorak; riley.dvorak@forterrabp.com

Quick Notes

Who	Owner: The MHA Nation - Three Affiliated Tribes, Ft. Berthold Reservation Engineer: Interstate Engineering, Inc. Mandan, ND Contractor: Meyer Contracting Inc. Maple Grove, MN
What	Replacement of 3 structural plate corrugated steel arch culverts with precast concrete box culverts.
Why	Structural plate corrugated steel arch culverts were showing significant signs of distress, and failure.
When	Replacement began in April, 2016.
Where	(BIA) Route 18 southwest of White Shield, ND
How	Over 60 pieces (12-foot x 10-foot and 12-foot x 8-foot) and 850 tons of concrete product supplied to construct the three precast concrete culverts by open cut method.

Photos: Forterra Pipe & Precast, Southern ND



Failing road surface after several overlays.



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Failed corrugated steel arch culvert.

Video Features

The Concrete Pipe Advantage: Installation Success

A focus on the installation of rigid and flexible pipe and design considerations.

WATCH VIDEO

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The Concrete Pipe Advantage: Built for The Future

Sustainable Development and a review of the three pillars of sustainability: economic growth and equity, conserving natural resources and the environment, and social responsibility.

WATCH VIDEO

SUBSCRIBE

Concrete Pipe: Rigid. Rugged. Resilient

Video of the D-Load machine taking a pipe to ultimate load conditions at the Geneva Pipe Salt Lake plant. This is a 15-inch, Class III pipe that was loaded to represent the loads that the pipe will see in the field. The first crack didn't appear until well after the acceptable "0.01-inch D-Load" was applied.

WATCH VIDEO

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