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On the Cover:

A 2,000-foot reinforced concrete pipe stormwater detention system of 12 runs comprised of standard 48-inch diameter RCP. (Story on page 4)

Editorial

Reality Check

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

A millennium is a very long time. In terms of years, a generation is about 30 between the birth of parents and birth of their offspring. Accepting this average period, then a millennium is comprised of 33 generations. Each generation is witness to events that amaze and bewilder. Recent claims[1] by the latest two generations of manufacturers of flexible pipe products, and the scientists and applied scientists allied with the flexible pipe products industry are bewildering. It is time for a reality check.

Rigid pipe[2] has been used in various forms since 4000 BCE. Mohenjo-Daro, a town of 35,000 in southern Pakistan, is considered by many historians to be the birthplace of sewers. Beginning around 3500 BCE, drains made of cut stone or man-made masonry units were developed and became the prototype of many surface drains used throughout the ancient world – the forerunners of pipe. Six hundred years before the Christian era, the Romans built the Cloaca Maxima, one of the ancient world's best known sewage systems constructed to drain local marshes and channel Rome's sewage to the River Tiber. A few portions of Rome's ancient rigid sewers still function today - well over two millennia later. At least 66 generations have benefited from rigid sewers in Rome.

The concrete pipe industry has never claimed that its products would last 1,000 years, yet the evidence is in place suggesting that rigid sewers last for generations, and we have said so. We know without question that concrete sewers will perform for the design life of a project, when designed for the environment of the sewer. This is not speculation of service life of products, or linear regression analysis. This is a fact.

Where does the flexible pipe industry find the facts for its claims of generations of service life[3] for its products, or materials when cases are dotted all over America and other countries of short term failures requiring complete replacement of systems? It is an accepted fact that corrugated steel culverts[4] and pipelines have a service life of 50 years or less. There is no widely accepted evidence that variations of CSP systems will last any longer. What about HDPE? We believe that claims of performance of 75 years[5] and more are bewildering. How can claims of generations of high performance for HDPE sewers and culverts be acceptable, when the evidence is to the contrary, marked by catastrophic failures and poor performance throughout our country?

Past generations can be heard in print and film laying claim to the success of rigid sewer systems. A reality check, however, is often lost to the two living generations that are committed to careers and employers in the flexible pipe industry. Only present generations proclaim the durability of flexible pipe products, because flexible pipe systems did not exist before their time, and have no legacy of long-term durability and performance.

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Clarification:

In the Fall 2010 Issue of CP News, the article on Page 3, Bridging The Technology Gap – Precast Concrete Box Utility Chamber Showcases Best Practice for Utilities Maintenance, leaves the impression that the pallets and headers are considered part of the forms. This is not the case. Scurlock had existing modular drycast box culvert equipment from **Mid-American Manufacturing**. As noted in the long version of the article, archived on the ACPA Web site, "For the watertight joint requirement of this project, Scurlock invested in 10 sets of precision machined modular pallets and headers purchased from **American Manufacturing Group** (AMG – www.amg-equip.com)." The pallet can be identified by paint color and the double flange as an AMG item. ACPA wishes to make it clear that AMG provided the 10 sets of precision pallets and headers. The correct email for Mark Ludwig is Mludwig@jkpolysource.com.

Bridging The Technology Gap

Sustainable Development Is a Key Driver of Innovation

The challenge of generations X[1] and Y[1] is to meet the needs of a much larger population, and this cannot be done in the absence of sustainable development[2]. Policies being developed by local, State and federal agencies accommodate intensification of the population in urban places to meet growth projections. This means that pipelines for sewers, and culverts for transportation drainage systems, will continue to be very valuable assets[3]. What may not be apparent or top-of-mind however, are the innovative uses of concrete pipe and precast boxes to close the gap between existing buried infrastructure needs and those that have yet to materialize, as a result of emerging public policy.

Most urban areas are addressing sustainable development and looking to industry to help implement policies. It is our elected representatives, who place the weight of implementation on specifiers and regulators in the public service. It is industry representatives, who introduce new products and services. Yet many products being presented as sustainable are failing far within the planned design life of projects, because the bidding process favors low bids, and this opens the door for cheap unproven products.

Rainwater harvesting[4] and recharging soils with stormwater and snow melt are but two areas receiving focused attention for sustainable solutions in new development. The concrete pipe industry produces standardized concrete pipe[5] and precast boxes that detain runoff for irrigation, cooling systems and maintenance of water levels in wetlands and streams during dry periods. Precast concrete products are supplied for oil and grit sediment removal to cleanse runoff before it is returned to natural channels. Concrete pipes accommodate storm surges and dissipate the energy of concentrated flows before damage can be done to roadways and riverbanks.

Demand is increasing for precast concrete utility chambers and tunnels protecting pipes for utilities and sewage in densely populated downtown cores, on sites with limited space for maintenance, and where security of buried infrastructure is of concern. Products comprised of alternative materials, especially thermoplastics and thin steel conduits are not an option when it comes to protecting buried services and utilities.

Concrete pipe is used for energy conservation as geothermal earth tubes for heating and cooling on LEED projects. Recent applications suggest that concrete pipe can serve simultaneously as a sewer pipeline and energy source.

These recent and some not-so-recent innovations using concrete pipe and precast boxes are driven by policy developed since the late 1980s for sustainable development. Anytime that new development in urban areas is planned, concrete pipe and precast boxes have the service life[6] to meet the projected design life of infrastructure projects.

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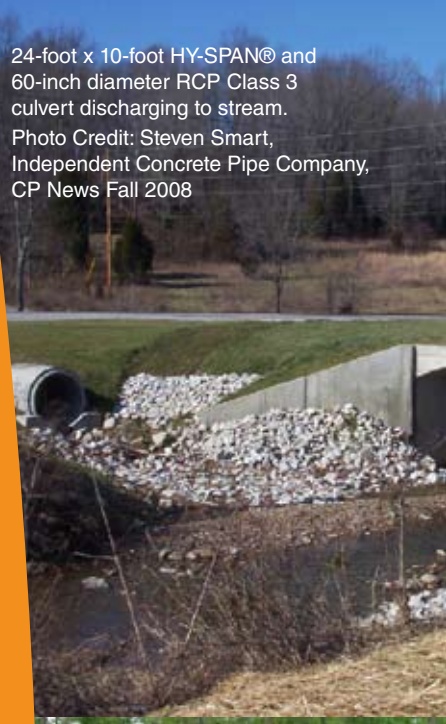
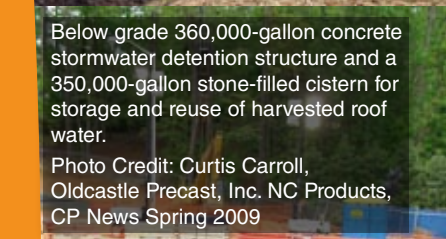


24-foot x 10-foot HY-SPAN® and 60-inch diameter RCP Class 3 culvert discharging to stream.
Photo Credit: Steven Smart, Independent Concrete Pipe Company, CP News Fall 2008



Below grade 360,000-gallon concrete stormwater detention structure and a 350,000-gallon stone-filled cistern for storage and reuse of harvested roof water.
Photo Credit: Curtis Carroll, Oldcastle Precast, Inc. NC Products, CP News Spring 2009

Concrete pipe used for culvert designed with internal energy dissipaters.
Photo Credit: Scott Snelling, Missouri DOT,
CP News Summer 2008

Failed HDPE storm water detention system replaced with RCP system.

Completed RCP storm water detention system covered by pavement structure.

Reinforced concrete pipe storm water detention system pipe runs and manifold.

Photos: Donald E. McNutt, PE, Hanson Pipe & Precast and Frank Mood, Mid-Atlantic Drainage, Inc.

Failing Grade for HDPE Underground Stormwater Detention System

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Installation of HDPE stormwater detention systems under parking lots seems to be increasing, but so are the failures[1]! An HDPE detention system at the Satchel Ford Elementary School in Columbia, South Carolina, received a failing grade for performance in the spring of 2010 after attempted repairs to the system in turn failed. A poured-in-place concrete vault was considered for replacing the HDPE system until it became apparent that there was not enough time to construct the vault before students returned for the fall term. The need for a fast-tracked project opened the door for a 2,000-foot reinforced concrete pipe system of 12 runs comprised of standard 48-inch diameter reinforced concrete pipe. Equalizing lateral pipes joined the runs of concrete pipe that connected to a manifold at the downstream end, designed with manholes for inspection and cleaning. Construction of the concrete pipe system began in June and was completed before the students returned in September.

Documented cases are beginning to suggest that HDPE underground stormwater detention systems do not perform for long periods, especially under structures like pavements for parking lots. The Satchel Ford Elementary School system was installed around 1998. Twelve years later, the system was replaced with a concrete pipe system that could have met the specifications for the project in 1998. Instead of channelling resources to students and the classroom, resources were used to pay for two stormwater detention systems.

Mid-Atlantic Drainage, Inc.[2] supplied reinforced concrete pipe[3], manholes and associated precast products for the system designed by Chao & Associates, Inc.[4] that was installed by Cherokee, Inc. Representatives of Mid-Atlantic Drainage worked with the contractor to design the system capable of handling the 244,000 gallon storage requirement. The design was subsequently approved by the project engineer.

Reasons for the failure are undetermined. It is, however, well understood that HDPE is viscoelastic, which means the material keeps deforming under sustained load. This behavior is called creep. It is also well-known that strength and stiffness are two vital elements of HDPE systems. Stiffness is a measure of the resistance to deformation, and is defined as the force required to deform a component per unit of deformation. There are two separate measures of stiffness, one applicable to the material of the component and the other to the geometry of the cross-section of the component. The material stiffness is called the modulus of elasticity and is defined as the ratio of stress divided by strain for an elastic material.

Whatever the reason for the failure may be, the replacement of the system is a reminder to designers of underground stormwater detention systems that rigid and flexible systems are different and cannot be installed using the same installation procedures or standard specifications. Precast concrete systems are designed to perform in the plant before arriving on site. The structural integrity of flexible pipe systems must be constructed on site. Designers and installers must read and understand the details of manufacturers specifications for HDPE systems, and ensure that the products are installed accordingly.

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- **Concrete Pipe News**
  http://www.concrete-pipe.org/cpnews.htm

Penny Wise Pound Foolish
CSP Applications Can Be Costly

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The increasing frequency of sinkholes and washouts on private property and roadways is often attributed to flash floods and prolonged flooding by the media. These are symptoms of the failure of corrugated steel pipe (CSP) culverts and pipelines, or CSP systems that have surpassed their service life[1]. When CSP systems[2] begin to corrode and weaken, they collapse under the weight of fill, or allow fines and coarse material in the backfill to enter the pipe through corroded inverts and joints. Backfill and bedding washes away, creating a void around the pipeline. The dramatic 2010 washout of the storm sewer at the Sonic Restaurant[3] in Cleveland, Georgia exemplifies the differences in performance between rigid and flexible pipe and that alternative materials and products should be carefully considered at the time of specification.

A combination of torrential rains on August 21 and a failed corrugated steel storm sewer opened a sinkhole in front of Cleveland's only Sonic Drive-In restaurant and next-door car wash. The chasm measured some 200 feet long, 20 feet wide and 20 feet deep. The storm sewer was privately installed by a previous land owner some 15 to 25 years before the failure.

When the failed CSP storm sewer was excavated, design flaws became evident. The 42-inch diameter CSP pipe was joined to an existing 42-inch diameter concrete pipe storm sewer, that has been functioning as designed for about 45 years, without a manhole for a transition. A steel band may have been the connecting device. At the southwest corner of the lot, 300 feet downstream from the existing 42-inch concrete pipe, an existing manhole used to connect the 42-inch diameter CSP with a 60-inch CSP outlet showed that the CSP may not have been properly connected to the manhole at the inlet and outlet.

While the Sonic Drive-In management continued to work with its insurance company to agree on a settlement, the landowner agreed to a long-term solution; a reinforced concrete pipe[4] storm sewer. A new manhole was installed at the north end of the sewer alignment to accommodate connection to the existing 42-inch diameter RCP and the installation of a new 48-inch diameter RCP sewer to replace the failed 42-inch CSP pipeline. The manhole components were supplied by Hanson Pipe & Precast[5] from its Athens, Georgia plant, while the concrete pipe was supplied from the company's Rome, Georgia plant.

The failure and resulting damage is a sharp reminder that there is a difference in the performance of flexible and rigid pipelines[6] and culverts, and designers must match service life of structures to design life of projects.

Full Story: http://concrete-pipe.org/CP/PennyWisePondFoolish.pdf

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CSP may not have been properly connected to the manhole.


Dramatic 2010 washout of the storm sewer at the Sonic Restaurant.


New manhole to connect 42-inch diameter RCP with new 48-inch diameter sewer.

Photos: Donald E. McNutt, PE

Airports Not the Place to Gamble With Infrastructure

Lafarge North America
Pipe Division
403-292-9503

Is the use of drainage products other than concrete pipe in or adjacent to major airport facilities really worth the risk? Many design engineers don't think so. They specify concrete pipe[1] because it doesn't burn or rust, gains strength over time and the service life is proven to be longer than 100 years.

Calgary International Airport (CAA)[2] has a ten-year plan that envisions the development of more than 700 acres of industrial, aviation, and recreational land. Deerfoot North Trade Park will be the CAA's newest trade park catering to commercial, airside and logistics users. The design engineer, MMM Group Limited, had specified concrete and polyvinyl chloride (PVC) pipe for the Deerfoot North Deep Utilities and Surface Works, Package #3. Calgary Airport Authority called tenders for the servicing of the park which listed high density polyethylene pipe (HDPE)[3] for portions of the storm sewer.

The Alberta Chapter of the Canadian Concrete Pipe Association (CCPA)[4] presented the proper engineering design requirements for HDPE pipe to the contractor and Airport Authority addressing all potential failure modes. The CCPA engineer showed why owners of buried infrastructure must consider the danger of burning pipe[5].

The contractor, WRD Borger Construction Ltd.[6] was concerned with the tender addendum that called for such a large quantity of large diameter HDPE pipe. The contractor's experience did not include any project where large diameter HDPE was installed. Subsequently Lafarge, along with CCPA's engineer, presented similar information to the contractor. Based on the information presented the CAA accepted the original specification that called for concrete pipe.

Lafarge supplied over 3,700 metres (almost 4 km) of Class II, III IV and V reinforced concrete pipe in diameters ranging from 900mm to 2400mm in diameter. In addition, the company supplied over 70 manholes ranging in size from 1200mm in diameter to 2800 x 2800mm square vaults. The contact for the supply of pipe was $2.4 million and the manholes, $500,000. The Package #3 contract was completed in the spring 2010.

Full Story: http://concrete-pipe.org/CP/AirportsNotPlaceToGambleWBuriedInfrastructure.pdf

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- **Concrete Pipe Design Manual**
  www.concrete-pipe.org/designmanual.htm
- **Concrete Pipe News**
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Photos: Supplied by Lafarge.

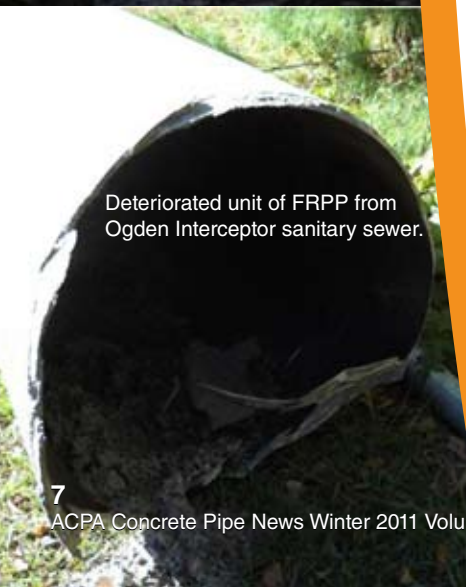
Large diameter RCP used for storm sewer installed by contractor.

Almost 4 km of RCP installed ranging in size from 900mm to 2100mm in diameter.

Over 70 manholes supplied by Lafarge.

Extracted unit of FRPP Ogden Interceptor sanitary sewer.

Workers remove failed FRPP at Ogden Interceptor sanitary sewer.



Deteriorated unit of FRPP from Ogden Interceptor sanitary sewer.

Fiberglass Sewer Collapses Can Be Expected

By Al Hogan, PE
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There may indeed be industrial uses for FRPP, but applications for sanitary sewers may not be appropriate, especially at great depths. A flexible pipe[1] product that looks good may not perform as expected. Recent history strongly suggests that FRPP sanitary sewer installations may fail prematurely along the crown of the installation.

Sections of Brighton Road in Brookings, S.D. caved in twice in 1996 because of a cracked fiberglass sewer line that had been installed in 1979. Both cave-ins caused craters, the first resulting in personal injury. It was determined that prematurely cracked pipes eroded the backfill that resulted in a road collapse. Subsequent to the road closures, the sewer line was examined with a mini-camera. Cracks appeared on the top of the fiberglass pipes and allowed earth and gravel to infiltrate into the sewage that was pumped to the city's wastewater treatment plant. About 4,500 feet of fiberglass pipe had to be replaced by the City at a cost of about $600,000.

Some history appears to be repetitive. Failures along a 9,000-foot section of the 36-inch diameter FRPP Ogden Interceptor sanitary sewer in New Hanover County N.C. occurred in 2008, 2009 and 2010. The interceptor was built in the late 1990s to help ease demands on the Northeast Interceptor by drawing flow from the line and the City's Southside wastewater treatment plant, thereby increasing overall capacity to allow more development. The failing line carried 2 million gallons a day. Some spilled into Smith Creek when emergency bypass pumps failed.

After assuming responsibility for the repair and replacement project, The Cape Fear Public Utility Company had to cut funding or delay $millions worth of projects to pay for the emergency repairs and replacement. Projects affected included new sewer pipes in unserviced areas, rehabilitation of old sewer pipes, and construction of new water lines. In addition, $8million had to be set aside in a reserve in case of other emergencies. The emergency replacement with ductile iron pipe cost $7million.

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Photos: Tyson H. Hicks, PE
Rinker Materials Concrete Pipe Division CEMEX

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2011 Project Achievement Award

The fifth Project Achievement Award Program rewards creativity and excellence in precast concrete pipe and box culvert design and installation. Any state DOT may enter the award program before March 1, 2011. State DOTs and ACPA members are invited to submit projects jointly or separately. ACPA members submitting projects separately must obtain the signature of the state DOT on their entry form.

The winning award is based upon public involvement and education, use of new materials or large diameter concrete pipe, use of new technologies, innovation, complexity, cost effectiveness and environmental benefits. Winners will be announced in May 2011 at the Awards presentation ceremony during the AASHTO Bridge and Structures Subcommittee meeting. The application is at www.concrete-pipe.org.

Save this link www.concrete-pipe.org/cpnews.htm 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.