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Precast Concrete Pipe Drives New Nissan Auto Plant to Completion

- Innovative Technology Used to Replace CMP Tunnel with RCP
- Lined RCP Built for Bakersfield Sanitary Sewer
- Conditions Investigation on HDPE Pipe

This issue:

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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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Inset photo: Artist concept of a Quest Minivan, one of several vehicles scheduled to roll off the plant's new assembly line in 2003. (Photo courtesy of Nissan North America, Inc.)

President's Report

John J. Duffy

Concrete Pipe Plants Are Safe And Healthy Places

The American Concrete Pipe Association recently completed its 2001 Summary on Injury Statistics and Trends, and is pleased to report that the concrete pipe industry continues to maintain one of the safest working environments among comparable heavy industries. The report verifies that the concrete pipe industry has continued to decrease its incidence rates from 1996 through 2001. The total incidence rate has decreased from 10.5 to 7.3, and the lost-time incidence rate has decreased by approximately one-half over that same period. This is an indication that the safety programs in place in members' plants appear to be successful in lowering the total number of accidents and lost-time accidents throughout the industry.

The purpose of the Association's report is to measure the effectiveness of the safety programs instituted by the concrete pipe industry by analyzing the safety performance of the industry over the last several years, and by comparing the safety records of the concrete pipe industry against those of similar industries.

As growth in the concrete pipe industry has occurred, so has the need for increased safety. Common injuries in industry include slips, trips, falls, dust in the eyes, vehicular injuries, back injuries, and injuries to the fingers, hands and feet. A reduction in the occurrence of injuries and accidents is beneficial to the employee, the employer and customer. The employee benefits from a lower risk of injury, and better health. The employer benefits economically with lower health care costs reduced insurance costs, less production down time, and lower employee turnover. And the customer benefits from a steady work force, producing a quality product with consistent delivery and accountability. Lower operational costs also factor into final product cost to the customer.

This past year, the Association created the Chairman's Safety Award to recognize outstanding safety initiatives implemented by ACPA-member company plant personnel. The 2001 winner of the Safety Award, Rinker Materials-Hydro Conduit Division's Denver Plant, was selected for its *New-Hire Orientation Program*. The program assists new workers with adjusting to working in a concrete pipe plant by assigning a buddy for the first two weeks. Each new employee is required to wear a green hard hat for identification.

The American and Canadian concrete pipe industries have moved very quickly over the past 20 years to embrace new product design technology, production processes, quality assurance programs and healthy workplaces. Concrete pipe plants offer jobs to people entering the workforce for the first time, or careers to graduates of colleges and universities. This is an industry that prides itself in producing products that make a significant contribution to the health and safety of our nation.

Our products prevent loss of life and property damage through uncontrolled flooding. They are the buried lifelines that collect and carry waste to facilities that treat effluent and return clean water to our natural environment.

People interested in making a contribution to healthy environments work in concrete pipe plants. Now, data shows that workers themselves are benefiting from the same duty of care that pipe producers have for the communities they serve. They can work at their jobs knowing that precautions are in place to protect them from injury in the workplace, and that the industry in which they work has an outstanding safety record. Concrete pipe plants are indeed safe and healthy places to work.

Industry Spotlight

John P. (Jay) Gleason

President, Portland Cement Association

Since 1986, the Portland Cement Association (PCA) has been guided by John P. "Jay" Gleason, as President. He possesses a wealth of experiences and accomplishments in the public and private sectors that benefit the cement and concrete products industries. Prior to his duties with PCA, Mr. Gleason served for nine years as President and Chief Executive Officer of the Brick Institute of America, where he was responsible for all programs in planning, research, marketing, administration, member services, and public affairs. From 1970 to 1977, he was Deputy Assistant Secretary in the U.S. Department of Commerce in Washington, DC. He managed the development, coordination, and marketing of all major domestic and international programs to the U.S. business community. In 1976, Mr. Gleason received the Commerce Department's Silver Medal Award for exceptional planning and management.

Mr. Gleason is a graduate of Georgetown University, School of Foreign Service, and a graduate of the Program for Management Development of Harvard Business School. He is listed in Who's Who in America, and has served as Chairman of the Council for Masonry Research, and the National Codes and Standards Council. He is also on the Board and Executive Committee of the American Concrete Pavement Association, and Chairman of the Board of Directors of Construction Technology Laboratories, an engineering consulting and research firm, that is a subsidiary of PCA.

Mr. Gleason and his staff have been very active in working with the American Concrete Pipe Association, its members, state concrete pipe associations and shipper groups to develop and implement the joint Strategic Promotion Plan for North America. The plan is designed to promote the use of cement and precast concrete drainage products in the USA and Canada. The strategy has been very successful since its beginning in 1999. We asked Mr. Gleason several questions about the portland cement industry and his perspective about the success of the Strategic Promotion Plan. Here is what he had to say.

Q: *Portland cement consumption is a very important barometer of construction trade and infrastructure health. Is the North American economy healthy, or getting healthier?*

Gleason: Each consecutive year over the past eight years has been a record year for cement sales, including 2001 when the economy was impacted by 9/11. In 2002 we expect a slight downturn in the United States of 1.5 percent and in Canada of 3 percent. Even though Ontario and Qubec will perform well, the remaining provinces are expected to have below average sales, thus lowering the Canadian performance. In 2003, the United States sales will remain close to 2002 levels and increase again in 2004. In Canada we expect sales to increase 3 percent in 2003 and 2 percent in 2004. Indeed, the outlook for both the United States and Canada is a healthy economy.

Q: *What are some of the most challenging issues facing the cement industry? How do you see these challenges affecting the precast concrete pipe industry?*

Gleason: The cement industry in the United States remains challenged by energy and environmental regulations. If extreme regulations are imposed, then cement and concrete products could be impacted.

The precast concrete pipe industry, as well as the local promotional organizations, must be aware of the upcoming re-authorizing of TEA 21 and AIR 21 transportation legislation. This is the first time that both bills come up for reauthorization in the same year. Billions of dollars of funding for highways, bridges and runways are at stake. There is concern over the level of funding that will be authorized at the national and state level. Precast concrete pipe is a product used in all areas of funding affected by these bills. If there is an increase in public works projects, there will be an increase in opportunities for the concrete pipe industry.

Q: *Manufacturing of portland cement has changed during the past decades. What do you feel has been the most important change?*

Gleason: What has changed significantly is the efficiency of the process combined with better environmental controls. Great energy savings have resulted from the addition of preheaters and precalciners. Over the past 30 years, on a per-ton basis we have witnessed reductions in energy consumption of more than 30% and over 50% for labor intensity. These efficiencies have help cement and concrete products to remain very competitive.

Q: *The Portland Cement Association is active in a number of markets. Which markets represent the largest potential for growth?*

Gleason: In the U.S. pavement markets have the greatest potential for growth. Highways, streets and roads, airports, and parking areas combined have an annual growth potential of over 100 million tons of cement. To put this in perspective, total U.S. shipments in 2001 were 112 million tons. Potential growth in the single-family residential market is also significant at over 36 million tons per year. Two additional markets have been opened by recent funding bills. The farm bill promises millions of dollars for dams that create opportunities for roller compacted concrete. Another bill currently winding its way through Congress could provide funding of as much as $40 billion for sewer and clean water projects over the next five years.

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Choctaw Rallies with RCP to Welcome Nissan to Mississippi

By Bill Polk, Sales Representative
Choctaw, Inc., Jackson, Mississippi
601-982-1100

Nissan is building a new 2.6 million square-foot vehicle assembly plant in Canton, Mississippi, about 15 miles north of Jackson. When opened in the summer of 2003, the plant will produce about 250,000 vehicles a year and employ 4000 people. Vehicles assembled in the plant will include a full-size pickup truck, a full-size sport-utility vehicle, and the next generation of the Nissan minivan.

Canton was selected for the $930 million plant because the State was able to assure Nissan that the site had no outstanding wetlands, archeology, or protected species issues that would keep the company from clearing land quickly once an agreement to use the site was reached. The State's pre-approval work through its Mississippi Major Economic Impact Authority (MMEIA) paved the way for Nissan to quickly match its needs. Local contractors and suppliers pulled together with State and Nissan officials to present a site tailor-made for the new plant and supporting product suppliers. ACPA member company, Choctaw, Inc., was among the local enterprises that rallied its resources to ensure a serviced site to close the deal. The MMEIA knew all there was to know about the site, understood the infrastructure needs of Nissan, and demonstrated that the State could meet Nissan's development schedule that tied into their "Revival Plan" and the national automotive market.

The MMEIA proposed a site that had good arterial highway and rail access, the necessary utilities, right workforce and even the best weather to minimize lost days to elements such as ice and snow. In addition, there was strong support among local, state and federal officials for the project. Mississippi agreed to provide about $295 million in incentives that included the site development, worker job training and highway improvements to Interstate 55 that abuts the property. Pipe deliveries to the site

Precast manholes were manufactured at several Choctaw plants and were essential for the fast-tracked construction of the new Nissan Assembly Plant in Canton, Mississippi.

by Choctaw, Inc. began in January 2001 when Eutaw Construction Company of Aberdeen, Mississippi was contracted by the MMEIA to begin site work. The contract included installation of 3,000 feet of 72-inch reinforced concrete pipe to divert a stormwater ditch that traversed the site to a route that would not interfere with the operations of the assembly plant.

W.G. Yates & Sons Construction Company of Philadelphia, Mississippi, the State's largest construction firm, assembled the team to construct the plant designed by the architectural/engineering firm, SSOE, Inc. of Toledo, Ohio. Yates partnered with Detroit, Michigan-based Walbridge Aldinger on portions of the project unique to auto plants. The Troy Ohio-based TKS Industrial Company will design and build the facility's paint plant.

Yates was also the prime contractor for the site development package that included earthwork, underground utilities, and storm drain system. Time constraints on the project required the selection (by Yates) of Hemphill Construction Company of Florence, Mississippi and Eutaw to install the 30-inch and larger portion of the storm drain system. Hemphill and Delta Constructors of Jackson, Mississippi installed the sanitary sewer, industrial waste, potable water, and fire water systems.

The site lies between Interstate 55 and a major railway line. In addition to the improvements to the Interstate highway by Angelo Iafrate Construction Company, a spur had to be constructed from the existing railway line into a rail yard servicing the plant by Queen City Railroad Construction of Knoxville, Tennessee. Choctaw's products accommodated the drain diversion, new spur line and Interstate improvements.

Due to Nissan's requirement that there be no wetlands on the site, stormwater was directed to a retention pond that is controlled by Nissan. It is engineered to hold runoff from the site that might have an impact on the public storm sewer and watershed.

A complete range of rubber gasket reinforced concrete pipe (RCP) in sizes from 12 to 108-inch diameter, and 8-foot x 5-foot reinforced concrete boxes were required. In addition to

▲ *Choctaw provided more than 150 precast concrete catch basins for roadway and parking lot drainage at the new Nissan plant. The plant is scheduled to open in 2003.*

◀ *Large diameter precast reinforced concrete pipe was used exclusively to convey stormwater at the new Nissan Assembly Plant.*

the pipe, Choctaw supplied 150 (2 x 3-foot) catch basins and 442 feet of 122- inch x 77-inch reinforced concrete arch pipe. 24-inch diameter RCP was used for draining smaller areas of the site into the trunk storm sewer. Choctaw supplied storm manholes to the project and special transition sections to reduce the pipe system to 48-inch diameter. Sanitary sewer manholes were installed at average depths of 20 to 25 feet.

Choctaw's local network of production facilities played a crucial role in the servicing of the site. Calling upon its production facilities in Jackson (two plants), Hattiesburg, Como, and Columbus, Mississippi; and plants in Little Rock and West Memphis, Arkansas; Mobile, Alabama; and New Orleans, Louisiana, there were no delays in supplying material to the fast-tracked site development. Ninety percent of the required material for this project was shipped and installed in 120 days. The experienced crews were able to install the precast shipments as quickly as the excavations were prepared for the placement of products.

Nissan is building an assembly plant that is designed to regain market share. Timing is critical for Nissan to introduce their new product into a highly competitive market. All the companies involved in the project, the MMEIA, and local, state and federal officials know what is at stake for Nissan, and are responding to the needs of the project with all available resources. The plant is being built with the best technology in the automotive industry, and is a major asset for Mississippi and local businesses in the Canton/Jackson region.

The reinforced concrete pipe and associated drainage products supplied by Choctaw ensure a dependable buried infrastructure that will perform for the design life of the facility. Precast reinforced concrete drainage products have been engineered to exceed the requirements of twenty-first century technology. Its specification on this critical project for the state and Nissan proves that RCP is truly the product of choice.

Project:	Nissan Assembly Plant Canton, Mississippi
Owner:	Nissan
Designer:	The Lathrop Co., Toledo, Ohio SSOE, Inc., Toledo, Ohio Jim Resna, P.E., Project Engineer
Contractor:	W.G. Yates and Sons, Philadelphia, Miss. Harvey Keith, Laura Trott Walbridge Aldinger, Detroit, Mich. Eutaw Construction, Jackson, Miss.
Quantities:	160 feet – 96-inch diameter rubber gasket RCP 3,500 feet – 72-inch diameter rubber gasket RCP 1,400 feet – 66-inch diameter rubber gasket RCP 2,242 feet – 60-inch diameter rubber gasket RCP 2,954 feet – 54-inch diameter rubber gasket RCP 3,262 feet – 48-inch diameter rubber gasket RCP 3,216 feet – 42-inch diameter rubber gasket RCP 2,888 feet – 36-inch diameter rubber gasket RCP 1,378 feet – 30-inch diameter rubber gasket RCP 8,248 feet – 24-inch diameter rubber gasket RCP 1,908 feet – 21-inch diameter rubber gasket RCP 11,770 feet – 18-inch diameter rubber gasket RCP 6,279 feet – 12-inch diameter rubber gasket 416 feet (8-foot x 5-foot) precast concrete box units 442 feet (122-inch x 77-inch) reinforced concrete arch pipe Approx. 200 manholes of various sizes up to 108-inch diameter Approx. 150 (2-foot x 3-foot) catch basins
Producer:	Choctaw, Inc. Jackson, Mississippi Bill Polk, Sales Representative

With headquarters in Memphis, Tennessee, Choctaw has been manufacturing drainage products for over 80 years. The company is a leading producer of precast concrete products throughout the mid south USA, including Alabama, Arkansas, Louisiana, Mississippi and Tennessee. Choctaw's multiple manufacturing facilities produce a comprehensive line of precast products including concrete pipe; box culverts, manholes, and precast bridges. Hanson Pipe & Products, Dallas, Texas acquired Choctaw in May of this year. For more information, see www.choctawpipe.com.

Innovative Technology Used to Replace Failing CMP Tunnel with RCP

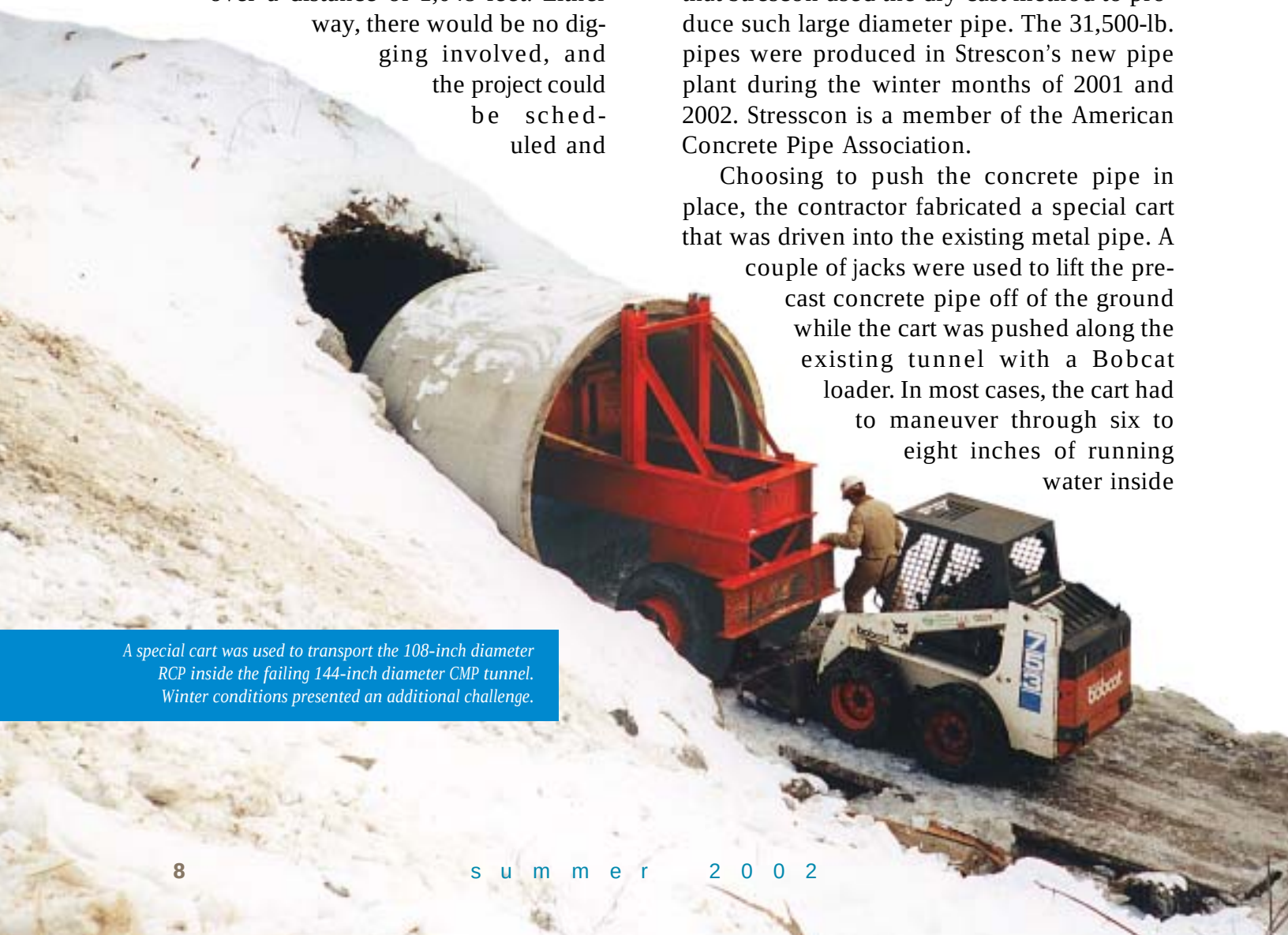
By Gaetan Vaillancourt
Strescon Limited, Saint John, New Brunswick
506-633-8877

A failing 144-inch corrugated metal pipe tunnel in Lewiston, Maine was replaced with a reinforced concrete pipe (RCP) structure using an innovative installation method. The contractor, Diaz Corporation of Jay, Maine, devised the method to avoid having to excavate the existing pipe that runs under existing and proposed streets, highway ramps and a railway line, sometimes at depths of 45 to 55 feet. Diaz had the choice of either pulling (by winch), or pushing the concrete pipe in place over a distance of 1,048 feet. Either way, there would be no digging involved, and the project could be scheduled and carried out during winter conditions.

First constructed in 1972, the large diameter metal culvert (tunnel) conveys the flow of Jepson Brook under highway ramps, railway and local roads. Any sign of failure with this major structure had to be addressed immediately. Piece-meal rehabilitation was not an option.

Diaz contacted Strescon Limited of Saint John, New Brunswick, Canada to supply the 108-inch diameter RCP. This was the first time that Strescon used the dry-cast method to produce such large diameter pipe. The 31,500-lb. pipes were produced in Strescon's new pipe plant during the winter months of 2001 and 2002. Stresscon is a member of the American Concrete Pipe Association.

Choosing to push the concrete pipe in place, the contractor fabricated a special cart that was driven into the existing metal pipe. A couple of jacks were used to lift the precast concrete pipe off of the ground while the cart was pushed along the existing tunnel with a Bobcat loader. In most cases, the cart had to maneuver through six to eight inches of running water inside



A special cart was used to transport the 108-inch diameter RCP inside the failing 144-inch diameter CMP tunnel. Winter conditions presented an additional challenge.

▲ *Driving the RCP inside the CMP*

Two 6-ton come-alongs were used to home the RCP sections inside in the tunnel. ▶

the pipe. As a section of pipe was moved into position, the jacks were lowered and the pipe homed with the previously positioned pipe using two six-ton come-alongs. The come-alongs were anchored in two holes that were later used for pumping grout between the old metal and new concrete pipe. The process was repeated for each unit of pipe by pulling the cart out of the tunnel and loading it with another concrete pipe. No special reinforcement of the bells of the pipe was necessary since the pipe was homed using come-alongs.

With such an overwhelming need for the rehabilitation and upgrade of infrastructure in the United States and Canada, the use of more innovative approaches to installing reinforced concrete pipe are possible. Although most rehabilitation projects are expected to involve routine construction practices, periodically the contractor, owner and consulting engineer will be challenged to come up with an innovative solution. In this case, a viable solution was found to a problem that would have cost a great deal more to correct if the conventional open cut method had been used. Alternate pipe materials do not have the versatility of precast concrete pipe. This case demonstrates that the versatility of reinforced concrete pipe can contribute significantly to improving our buried infrastructure and providing drainage systems that will endure for generations.

Project:	Jepson Brook Culvert Rehabilitation
Owner:	Maine Department of Transport Dennis Dubois, Fabrication Engineer
Designer:	Maine Department of Transport
Contractor:	Diaz Corporation, Jay, Maine Dave Israelson
Quantities:	1,048 feet – 108-inch diameter Class V RCP
Producer:	Trescon Limited Saint John, New Brunswick, Canada Gaetan Vaillancourt, Pipe Division Manager

Trescon Limited began its operations in 1963 by establishing a precast plant in Saint John, New Brunswick. A variety of projects were successfully completed in the company's initial years using both structural and architectural precast concrete products. In 1978, Trescon expanded its operations into Nova Scotia with the opening of a new precast plant in Bedford, Nova Scotia. It has grown to become the largest precast and prestressed concrete products manufacturer in Eastern Canada. The company now manufactures a wide range of precast concrete pipe, prestressed concrete products, manholes and ready mix concrete. Its products are marketed throughout the four Canadian Atlantic Provinces and the New England region of the United States. Trescon is a member of the Ocean Steel Group of Construction Companies.

Five-Mile Long Sanitary Trunk Sewer Built in Bakersfield

By Peter Hunot and Bob Milton
Rinker Materials, Hydro Conduit Division
Fresno, California
559-275-2241

20-foot sections of Class IV and Class V 42-inch and 48-inch diameter wet cast RCP were installed in Bakersfield at depths up to 26 feet.

360-degree T-Lock® lined pipe was used throughout the sanitary trunk sewer project.

The warm California sun, business opportunities, high-tech industries and unique lifestyles are major draws for many people who move to the Golden State, and solid reasons for families to stay for generations. Considered the fifth or sixth most dynamic economy on the planet, the State of California continues to urbanize to support a population that exceeds 33 million. The Fresno Metropolitan Area is under constant pressure to expand its urban services, placing demands on local wastewater treatment plants and collection systems for upgrade and expansion. The City of Bakersfield is expanding its sanitary trunk sewers and wastewater treatment plants, and upgrading water treatment facilities to accommodate its share of residential and industrial growth.

Associated with the expansion of Plant 3, is the construction of a five-mile-long sanitary sewer interceptor known as the Buena Vista Trunk Sewer. Plant 3 is being upgraded to treat 16 million gallons per day, as part of an ongoing expansion including a 3rd pump at the effluent pump station, conversion of a trickling filter to a roughing filter, adding a pump station, and covering the filter for odor control. Other projects include an increase in the inflow pumping and bar screen capacity, and new storage reservoirs.

The Buena Vista Trunk Sewer runs along Buena Vista Road to McCutcheon Road and then on to Gosford Road. The project is a continuation of a previous phase that began on Allen Road. Ten miles of trunk sewer installation were included in the two phases of the Allen Road-Buena Vista Road sewer trunk lines. Rinker Materials, Hydro Conduit Division in Fresno, California provided over 27,000 linear feet of precast concrete pipe products for the project.

The Buena Vista sewer is comprised of 20-foot lengths of wet cast 42 and 48-inch diameter reinforced concrete pipe (RCP) with a 360-degree T-Lock® Protective Lining system. Manufactured by Ameron International, T-Lock Lining is a poly-vinyl chloride sheet material designed to protect concrete sewer pipe against hydrogen sulfide gas attack and other types of corrosion. The line consists of 2,100 feet of Class IV and 3,200 feet of Class V 42-inch

diameter RCP, and 17,300 feet of Class IV and 4,500 feet of Class V 48-inch diameter RCP. In addition to these quantities, Rinker Materials' Hydro Conduit Division supplied 35 feet of 144-inch diameter RCP from its Fresno plant for a wet well lift station. The sewer installation contractor was Utah Pacific Construction of Murieta, California.

The project involved road and rail crossings that ranged in length from 120 and 150 feet. Boring and jacking technology was utilized because road and rail traffic could not be disrupted by the trunk sewer construction. The five rail crossings called for pipe with steel joint rings that were bored into position. RCP was jacked under the road crossings.

Aside from the road and rail crossings, the trunk sewer was installed using open trench technology for the entire length of the project. The contractor was able to use the native soil for backfill since concrete pipe was specified. No backfill material was imported to the construction site. This would not have been possible with alternate pipe products. The depth to the pipe invert ranged from 20 to 26 feet with cover ranging from 15 to 20 feet. The rate of installation averaged 400 to 450 feet per day. Hydro Conduit shipped a total of 645 truckloads to the project over a distance of 112 miles (one way).

Pipe produced in Rinker Hydro Conduit plants are subject to its *Zero Defect Program*. This quality assurance program ensured successful air testing in the field. The final inspection of the entire sewer line was made by camera. The video of the line was viewed by an independent engineering company and then filed with the City of Bakersfield. This was the last procedure before acceptance of the project by the city. The new Buena Vista Trunk Sewer was commissioned for service in June 2002.

Workers position a section of 144-inch diameter RCP for a wet well lift station on the Buena Vista Trunk Sewer Project.

Project:	Buena Vista Trunk Sewer
Owner:	City of Bakersfield, Calif. Conchita Nieto-Moreno, P.E., Project Engineer
Designer:	Martin - McIntosh Engineering, Bakersfield, Calif.
Inspection:	Carollo Engineers, Bakersfield, Calif. Dale McPherson, P.E., Chief Inspector
Contractor:	Utah Pacific Construction, Murieta, Calif. Lynn Matthews
Quantities:	17,300 feet – 48-inch Class IV 360° T-Lock Lined RCP 4,500 feet – 48-inch Class V 360° T-Lock Lined RCP 2,100 feet – 42-inch Class IV 360° T-Lock Lined RCP 3,200 feet – 42-inch Class V 360° T-Lock Lined RCP 35 feet – 144-inch RCP Wet Well
Producer:	Rinker Materials, Hydro Conduit Division Fresno, California George Kerr, Region Manager – Northern California Peter Hunot, General Manager – Operations, Northern California Bobby R. Milton, Field Coordinator Cheryl Menser, Transportation Coordinator Rene Morquecho, Quality Assurance

Rinker Material's Hydro Conduit plant in Fresno, California has been manufacturing and supplying reinforced concrete pipe for the Central California area since 1956. The Fresno plant manufactures reinforced concrete pipe by the centrifugal, wet cast and packerhead processes in sizes from 12 inches to 144 inches in diameter. Florida-based Rinker Materials Corporation is a major supplier of construction materials, aggregates, and ready-mixed concrete throughout the United States. For more information on Rinker Materials, Hydro Conduit Division, visit: www.rinker.com.

Inspection Protocol

The inspection protocol for each installation included the following tasks.

Diameter measurements – Diameter measurements were typically made every 5 feet along the length of the pipe system starting at the inlet, with the exception of the drains inspected in two of the states where the diameters were measured every 10 feet. At each measurement location, the vertical, horizontal, and each 45-degree angle diameters were measured. The diameters were measured to the nearest 1/8-inch with internal diameter measuring equipment. All measurements were recorded on field data sheets. ASTM D 2412 allows up to 5% deflection tolerance in the diameter of the pipe. This 5% tolerance was used as the deflection criteria. The percent deflection is based on the nominal diameter of the pipe.

Still and video photography – Any areas of distress inside the pipe systems such as buckling, cracking, and joint separation and misalignment was photographed. Photographs were taken of the site conditions and surrounding area. All photographs were documented, detailing the location of picture and picture description. The entire length of each pipe system was videotaped highlighting any areas of distress.

Alignment measurements – A laser level was set up at the end of the pipe systems (either the inlet or outlet), and the distance from the crown of the pipe to the level was measured.

Measurements were then taken from the crown of the pipe every 5 feet along the length of the pipe system.

Distress documentation – All areas of distress were recorded emphasizing location and type of distress. The types of distress encountered were as follows: joint separation, exfiltration or infiltration at joints, wall buckling, cracking, horizontal and vertical misalignment, bulging and swelling of the pipe, undermining, and pipe deflection. All joints and pipe system sections were labeled in ascending order starting from the inlet of the drain, unless noted.

ACPA RELEASES REPORT ON CONDITION INVESTIGATIONS OF HDPE PIPE

Compiled by Matt Childs, P.E.
Director of Engineering Services
American Concrete Pipe Association
From Research Report prepared by
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Paul D. Krauss, Project Manager
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847-272-7400

Wiss, Janney, Elstner Associates, Inc. was contracted by the American Concrete Pipe Association (ACPA) in the spring of 2002 to study High Density Polyethylene (HDPE) piping systems in selected states of the United States. The goal of the study was to inspect and document HDPE pipe performance under a variety of installation conditions. Determination of the causes of distress was not investigated. The focal point of the study was pipe of 30-inch diameter and greater, and pipes used in culvert and cross drain applications. The scope of work involved inspecting and documenting pipes in six different states.

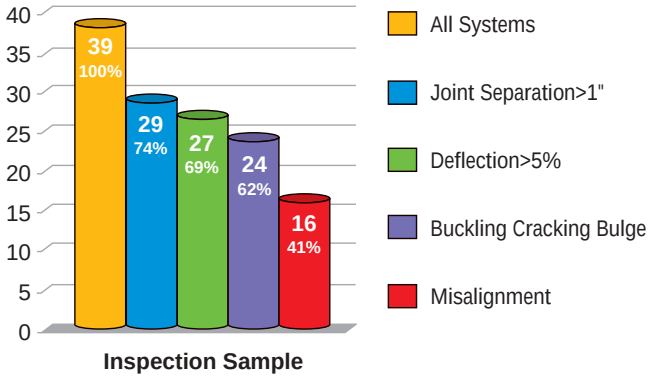
In each state, the HDPE pipe system locations were found by contacting the state Departments of Transportation, or similar departments. Every location provided by each state was inspected.

Inspection Record

The study consisted of inspecting 39 HDPE pipe systems located in six different states. The inside diameters of the pipes ranged from 24 to 60 inches. Twenty-nine out of 39 drains (74%) had joint separations greater than 1-inch. Twenty-seven drains (69%) had deflections greater than 5%. Twenty-four of the drains (62%) had developed buckling, cracking, or

bulging. Sixteen of the drains (41%) had noticeable misalignment (See Figure 1.)

Figure 1



Of the 27 drains that exhibited deflections greater than 5%, seventy-four percent (20 drains) also had cracking or buckling. Thus, twenty-six percent (7 drains) of the drains with deflections greater than 5% had no cracking or buckling. These drains had few deflections greater than 7%.

Of all the drains inspected, 68% had deflections greater than 5%, with State 6 having the least with 40%, and State 1 having the highest with 93%.

The following tables summarizing the results present a list of the pipes inspected by state. State names were omitted from the report at the request of the American Concrete Pipe Association. Pipe deflection, distress, and misalignment problems are listed.

If the pipe had deflections greater than 5%, then a “yes” was entered in the pipe deflection column. If buckling (swelling), bulging, or cracking was apparent in the pipe, then a “yes” was entered. If the pipe had joint separations that exceeded 1-inch, or if the misalignment of the pipe was apparent, then a “yes” was entered in the appropriate column. Pipes that were installed as test, or pilot installations, are identified.

Conclusion

The study suggests that in the six states that participated in the study, there is a problem associated with HDPE culverts and cross

State 1

Drain #	Diameter	Year	Pipe Deflection (>5%)	Buckling Cracking Bulging	Joint Separation	Test Installation	Misalignment
1	36	1992	Yes	Yes	Yes	No	No
2	60	1995	Yes	No	Yes	No	Yes
3	42	1996	Yes	No	Yes	No	Yes
4	30	1998	Yes	Yes	No	No	No
5	30	1997	Yes	Yes	Yes	No	No
6	48	1999	Yes	Yes	Yes	No	No
7	42	1992	Yes	Yes	No	No	No
8	42	1999	Yes	Yes	Yes	No	No
9	42	1994	Yes	Yes	Yes	No	No
10	48	1999	Yes	Yes	Yes	No	No
11	42	1999	Yes	No	Yes	No	Yes
12	48	1999	Yes	Yes	Yes	No	No
13	42	1999	Yes	Yes	Yes	No	Yes

State 2

Drain #	Diameter	Year	Pipe Deflection (>5%)	Buckling Cracking Bulging	Joint Separation	Test Installation	Misalignment
1	48	1999	Yes	Yes	Yes	No	Yes
2	36	1997	Yes	No	Yes	No	Yes
3	36	1997	No	Yes	Yes	No	Yes
4	30	1998	No	Yes	Yes	No	No
5	48	1998	Yes	Yes	No	No	No
6	60	1996	Yes	Yes	Yes	No	No
7	60	1996	Yes	Yes	Yes	No	Yes

State 3

Drain #	Diameter	Year	Pipe Deflection (>5%)	Buckling Cracking Bulging	Joint Separation	Test Installation	Misalignment
1	54	1996	No	No	Yes	Yes	No
2	48	1998	No	No	No	No	No
3	42	1994	Yes	Yes	No	No	Yes
4	30	1991	Yes	No	Yes	No	Yes

State 4

Drain #	Diameter	Year	Pipe Deflection (>5%)	Buckling Cracking Bulging	Joint Separation	Test Installation	Misalignment
1	42	1997	No	No	Yes	Yes	No
2	42	1997	No	No	Yes	Yes	No
3	48	1998	No	No	Yes	No	No
4	36	1998	Yes	No	Yes	No	Yes
5	36	1998	Yes	No	Yes	No	Yes
6	30	1987	Yes	Yes	Yes	No	Yes

State 5

Drain #	Diameter	Year	Pipe Deflection (>5%)	Buckling Cracking Bulging	Joint Separation	Test Installation	Misalignment
1	48	1996	No	Yes	No	Yes	Yes
2	36	1996	No	No	No	No	No
3	30	1996	Yes	Yes	Yes	No	Yes
4	36	1989	Yes	Yes	Yes	Yes	Yes

State 6

Drain #	Diameter	Year	Pipe Deflection (>5%)	Buckling Cracking Bulging	Joint Separation	Test Installation	Misalignment
1	30	1992	Yes	Yes	Yes	No	No
2	24	1999	No	No	No	No	No
3	36	1999	No	No	Yes	No	No
4	30	1998	No	Yes	No	No	No
5	42	1999	Yes	Yes	No	No	No

drains. The likelihood that similar problems exist in other states is certainly a possibility. The significant observation of cracking and buckling can be attributed to pipe that is incapable of carrying the designed load, non-uniform compaction of pipe embedment material, poor resin quality, inappropriate application of the pipe product (poor design), and excessive load on the pipe. The specifiers and owners of HDPE products may have cause for concern if the products they are specifying and purchasing are not being tested and installed with the greatest of care.

For a copy of the complete report, "Condition Investigations of HDPE Pipe In-Service in the United States (Six States)," contact the ACPA Resource Center, (800) 290-2272, FAX (972) 291-0622 and request Resource Item #03-246. Cost: $9.00 member/$18.00 non-member, plus shipping and handling. Check, Visa, MasterCard, American Express accepted.

Failure Mode Definitions (ACPA)

Although determination of the causes of distress of each inspected pipe system was not investigated in the study, it is important to understand the meaning of the types of distress encountered during the inspections to appreciate the results of the inspections.

Joint separation – This is defined as excessive space in the pipe joint system, caused by poor installation, shifting soils or differential settlement. Thermal contraction and expansion of HDPE pipe may also cause this failure. The impact of this distress is infiltration or exfiltration of water and bedding material that may result in loss of pipe embedment material, pipe failure, or erosion of the road foundation characterized by sinkholes.

Exfiltration and infiltration – This is the movement of fluid or solid into or out of a pipe system. The cause is attributed to an improperly sealed joint, service connection or cracked pipe. Differential deflection of flexible pipe at the joint is also a cause. The impact is usually loss of bedding material that leads to pipe failure with potential for road structure damage.

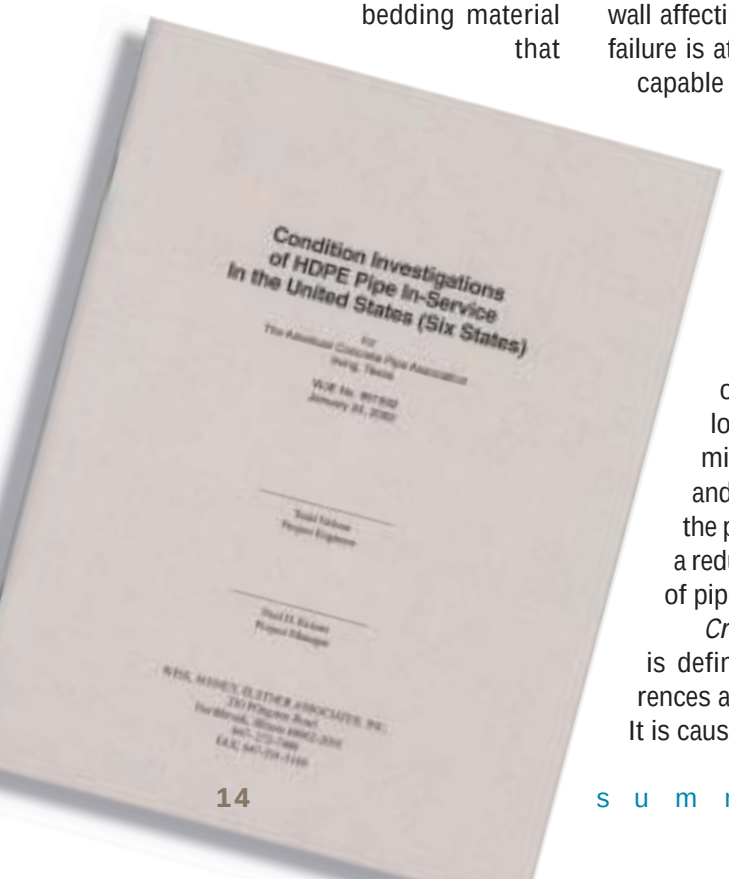
Wall buckling and cracking – This is destructive occurrences in the pipe wall affecting pipe performance. This failure is attributed to pipe that is incapable of carrying the designed load. Reasons for this include non-uniform compaction of pipe embedment material, poor resin quality, inappropriate application of the pipe product (poor design), and excessive load on the pipe. The impact is loss of hydraulic efficiency, migration of water and soil, and unanticipated stresses in the pipe wall. The result may be a reduction in flow capacity, loss of pipe support, or pipe failure.

Cracking, rips and tears – This is defined as destructive occurrences affecting pipe performance. It is caused by poor manufacturing, poor resin quality, and poor installation. The impact is loss of bedding material that may result in a reduction in flow capacity and pipe failure.

Horizontal and vertical misalignment – This occurs when installed pipe sections are not square to one another. The cause is the shifting of lightweight flexible pipe at joints during backfilling. Migration of bedding material as a result, may lead to reduction in the pipe support, and pipe failure with the potential for damage to the road structure.

Bulging and swelling – This is also referred to as corrugation growth and is defined as deformation of the internal pipe wall. It is caused by local buckling in the pipe profile and/or soil pressure on the external pipe wall and corrugations, especially a thin pipe wall. The interior pipe surface becomes uneven, or rippled with the potential for loss of hydraulic efficiency, cracking and splitting of the pipe walls.

Pipe deflection – This is the vertical and/or horizontal change in pipe diameter. It is caused by non-uniform compaction of flexible pipe embedment material, load on the pipe, and the trench width being too narrow. The impact of this condition on the system is the creation of unanticipated stresses in the pipe, and a decrease in hydraulic capacity. The possible result could be pipe failure over time, and settlement of soil and foundation material over the top of the pipe.



John P. (Jay) Gleason

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Q: *Cement shipments to concrete pipe manufacturers increased significantly over the past four years. To what do you attribute this dramatic increase?*

Gleason: It is abundantly clear that there is an increase in cement shipments to concrete pipe producers. Four years ago, the Portland Cement Association and American Concrete Pipe Association developed strategies for a joint marketing program. It is also clear that success has been the result of a national and local level commitment to the national strategy developed by both associations and their member groups. Local shipper groups and state concrete pipe associations have learned to work together effectively with the national organizations. Subsequently we have seen improved market penetration.

Q: *Support from Regional Cement Groups to local concrete pipe associations has increased dramatically during the past four years. Do you see any correlation in this support and increased consumption?*

Gleason: Cement shipper groups are starting to appreciate local concrete pipe associations. Members of the American Concrete Pipe Association and PCA got involved and helped regional cement shipper groups form alliances with local concrete pipe associations. Where local groups have worked together effectively, there have been increases in consumption of cement and increased market penetration of concrete pipe products. We are aware that the final purchase decision is made at the local level and we need good promotion teams at that level.

Q: *The PCA-ACPA joint promotion program on concrete pipe in North America is beginning to make an impact on user perceptions. How do you feel this market-specific program will positively impact the cement industry?*

Gleason: There is no doubt that there has been an impact on user perception. The reason goes back to the cooperation between cement and concrete pipe groups at the local level. The model has been proven in other market sectors like highways and above-grade residential walls where there has been local and national cooperation. Where this model is used, dramatic increases in market share and penetration can be expected.

"Quality Cast" Certified Plants

In an effort to improve the overall quality of all concrete pipe products, the American Concrete Pipe Association offers an on-going quality assurance program to member and non-member companies. Called the "Quality Cast" Plant Certification Program, the 124-point audit-inspection program covers the inspection of materials, finished products and handling/storage procedures, as well as performance testing and quality control documentation. Plants are certified to provide storm sewer and culvert pipe or under a combined sanitary sewer, storm sewer and culvert pipe program. The following plants are currently certified under ACPA's Quality Cast Certification Program:

Storm Sewer and Culvert Pipe

- Cayuga Concrete Pipe Company (Oldcastle, Inc.), Croydon, Pa. - Allen Reed
- Cayuga Concrete Pipe Company (Oldcastle, Inc.), New Britain, Pa. - Jim Savana
- Elk River Concrete Products (Cretex), Billings, Mont. - Milton Tollefsrud
- Elk River Concrete Products (Cretex) Helena, Mont.
- Kerr Concrete Pipe Company (Oldcastle, Inc.), Hammonton, N.J. - Bob Berger
- Kerr Concrete Pipe Company (Oldcastle, Inc.), Farmingdale, N.J. - Scott McVicker
- South Dakota Concrete Products (Cretex), Rapid City, S.D. - Jeff Ulrich
- Riverton Concrete Products Company (Cretex), Riverton, Wyo. - Butch Miller
- Sherman-Dixie Concrete Industries, Inc., Chattanooga, Tenn. - Earl Knox
- Sherman-Dixie Concrete Industries, Inc., Franklin, Tenn. - Roy Webb
- Sherman-Dixie Concrete Industries, Inc., Lexington, Ky. - Darrel Boone
- Americast-Pipe Division, Inc., Charleston, S.C. - Bill Gary
- Amcor-White Company (Oldcastle, Inc.), Hurricane, Utah - Brent Field
- Carder Concrete Products, Littleton, Colo. - Bruce Spatz
- Carder Concrete Products, Colorado Springs, Colo. - Bruce Spatz
- Grand Junction Concrete, Grand Junction, Colo. - Ben Burton
- California Concrete Pipe (Oldcastle), Stockton, Calif. - Qing Lian Gao

Sanitary Sewer, Storm Sewer and Culvert Pipe

- Advanced Pipes & Cast Company, Abu Dhabi, United Arab Emirates - Nasser Kammar
- Amcor Precast (Oldcastle, Inc.), Nampa, Idaho - Mike Burke
- Amcor Precast (Oldcastle, Inc.) Ogden, Utah - Tim Wayment
- Atlantic Concrete Pipe, San Juan, P.R. - Miguel Ruiz
- Elk River Concrete Products (Cretex), Elk River, Minn. - Bryan Olson
- Geneva Pipe Company, Orem, Utah - Fred Klug
- Kansas City Concrete Pipe Co. (Cretex), Shawnee, Kan. - Rich Allison
- NC Products (Oldcastle, Inc.), Fayetteville, N.C. - Preston McIntosh
- NC Products (Oldcastle, Inc.), Raleigh, N.C. - Mark Sawyer
- Ocean Construction Supplies Limited (Inland Pipe), Vancouver, B.C., Canada - Ron Boyes
- Amcor-White Company (Oldcastle, Inc.), Ogden, Utah - J. P. Conn
- CSR Hydro Conduit, Denver, Colo. - Ed Anderson
- Waukesha Concrete Products Company (Cretex), Waukesha, Wis. - Jay Rhyner

PipePac Software is Successful Beyond Expectations!

When there is a need for new technology, higher performance standards, enhanced product quality and tools that assist designers and contractors to build lasting infrastructure systems, the North American concrete pipe industry has stepped up to the plate.

PipePac Software is a tool developed by the concrete pipe industry in the U.S.A. and Canada that is now used industry wide. The program is a cooperative effort between the American Concrete Pipe Association, Canadian Concrete Pipe Association, Ontario Concrete Pipe Association, Tubecon (Quebec-based Association) and Giffels Associates Limited (software engineers.) Over 10,000 copies of PipePac Software have been distributed or downloaded by engineers, educators, government officials, contractors and consultants over the past five years. Considering its distribution at trade shows, and by various local concrete pipe associations and member companies, it is easy to see why PipePac has quickly become one of the most popular design tools available to the pipeline design community.

PipePac offers an integrated analysis using three independent programs for D-load calculations (3EB), estimating the material costs of the pipe and embedment zones (CAPE) and calculating the real cost of the materials specified over the design life of the project (LCA). Users can select either metric or Imperial units for calculations and results, with defaults to most common specifications in both the United States and Canada. The program is versatile and user-friendly in a Windows-based environment.

You can download the latest version at www.concrete-pipe.org, or obtain a CD-ROM through ACPA members. You may also order a copy of the software program from ACPA's Resource Center by calling 1-800-290-2272. Cost: $5.00 member/$10.00 non-member, plus shipping and handling. Company check, Visa, MasterCard and American Express are accepted.

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