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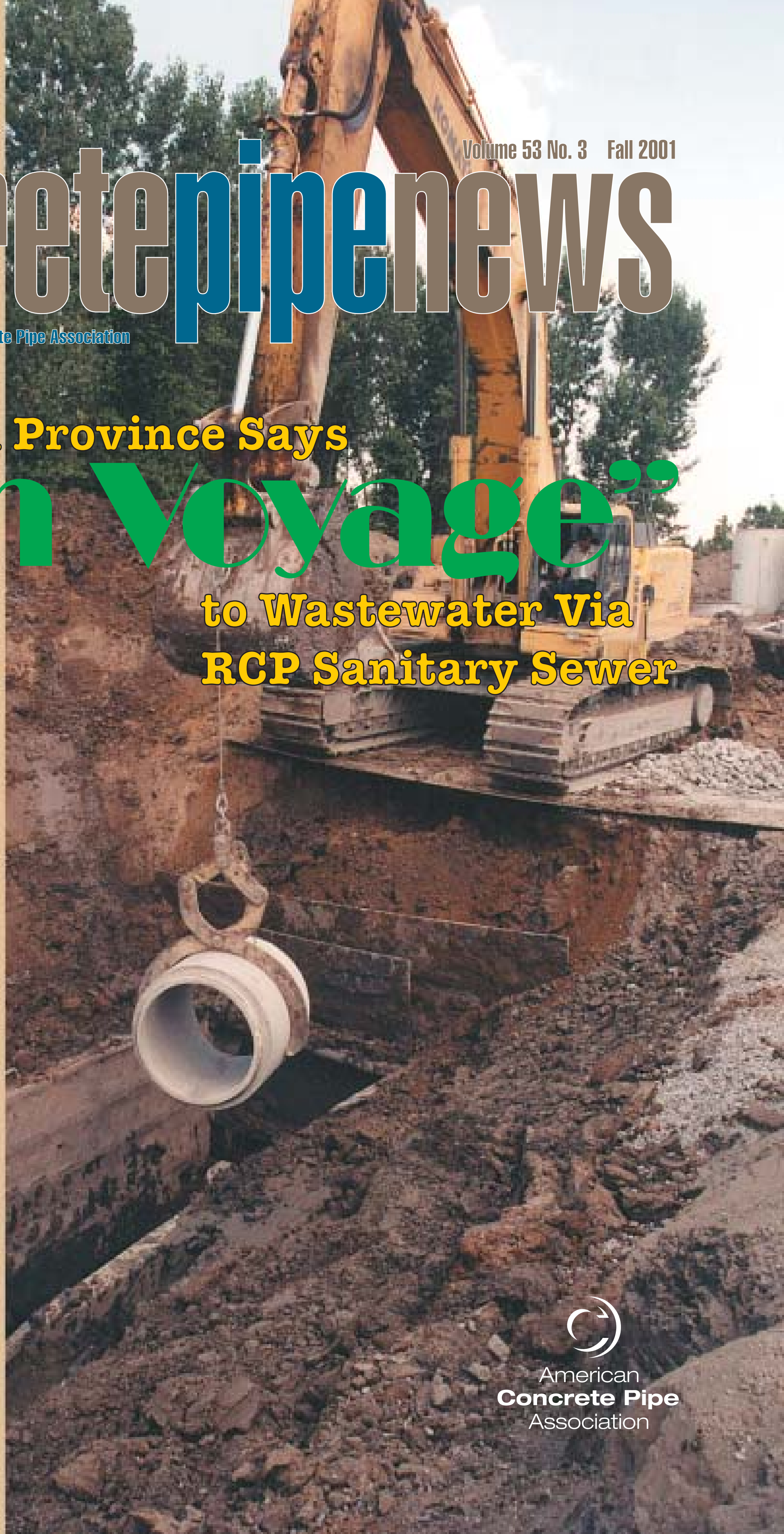

Canadian Province Says "Bon Voyage" to Wastewater Via RCP Sanitary Sewer

- Twin Cell Concrete Box Culvert Minimizes Environmental Impact
- Large Diameter RCP and Concrete Box Sections Used for Flood Relief Storm Drain
- DASH Software Streamlines Detention and Sewer Hydraulic Calculations

American Concrete Pipe Association

This issue:

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Fall 2001

Concrete Pipe News is designed to provide a communication forum for the concrete pipe industry to facilitate the exchange of information regarding product use and applications, industry technology and trends among members of the American Concrete Pipe Association, contractors, engineers, vendors, suppliers and other interested parties.

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American Concrete Pipe Association

Table of Contents

Regular Departments

Features

Precast reinforced concrete pipe was installed at depths up to 8 meters (25 feet) in the Cities of Brossard and St-Hubert near Montréal, Québec to handle increased demand for waste water drainage from the urban development of the two cities.

President's Report

John J. Duffy

"Don't Tread On Me!"

Throughout one's lifetime, there are events that are indelibly etched in our memory. The events of Tuesday, September 11, 2001 will surely be one of those events – with the deliberate and deadly attack by terrorists on United States soil. Nurtured by the goodwill and freedom of a peaceful society, terrorists consumed with hate, destruction and mayhem reared their evil heads and struck at the heart of a Nation and its people.

America the Beautiful is hurt. The blood of its people has once again seeped into the earth of its homeland. All etched memories pale in comparison to the surreal images of jetliners full of fuel and passengers slicing into the twin towers of the World Trade Center. And as if that was not enough to leave us speechless and numb with despair, a third bomb filled with humans slammed into the Pentagon, and a fourth crashed into a meadow as a result of brave passengers who took back their freedom in their last moments of life.

Americans and their friends in the free world will never forget the images as the attack unfolded, the bravery of New Yorkers, workers at the Pentagon, and the memorials that followed. People all over the world are united in feelings of outrage.

Military personnel, law enforcement and secret service agents, peacemakers and citizens of the free world will stand with Americans, shoulder to shoulder, to uncover the leaders of terrorist organizations, sever their networks and show the world the face of corrupt governments who sponsor terrorists. The war we are engaged in will be long. We are fighting an evil that can tear at the fabric of freedom and democracy on its own time. We must be patient. But we must be persistent.

America is the homeland for people and their descendents from over 200 nations. Americans have many faces and practice many faiths. This is not a war on any religious belief, it is a war on terrorism, and terrorists have no religion. What they have is corrupt and self-serving interpretations of the Word.

America is one of the few places in the world where change is possible. We have the will of the people, laws, and a government of the people which functions in war and peace. Changes are possible in our brand of democracy. The terror of September 11 has awakened an attitude in us that our country, our ideals, our freedom is worth fighting for.

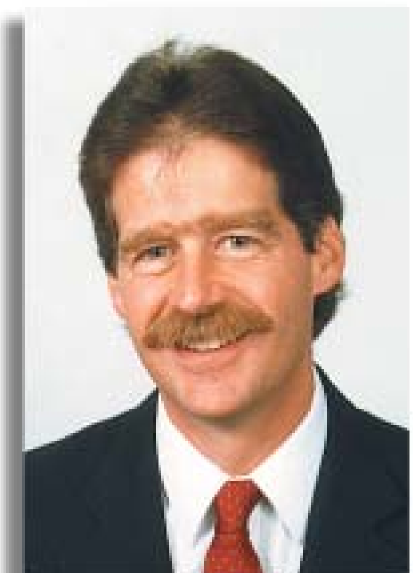
The enemy has hurt a peaceful nation that is fierce when stirred to anger. Our history is rich in moments of glory that drive us forever forward into an unknown territory. The battle cry of our patriots in the War of Independence over 200 years ago was "Don't Tread on Me!" As President Bush declared, we are embarking on a War of Good Versus Evil. This time it is a global war to rid us of terrorists that have meted out terrible crimes against humanity.

To them, we say loud and clear, "Don't Tread On Me!"

Industry Spotlight

John J. Meyer, P.E.

John Meyer is general manager of the Milwaukee operation of American Concrete Pipe Company, Inc., a long-time member of the ACPA. At a time when people are less inclined to volunteer their time and expertise due to busy life styles and job-related responsibilities, John continues to volunteer for ACPA activities and see projects through to completion, despite his personal and business-related demands. He is a champion of the concrete pipe industry who works tirelessly to advance the understanding of concrete pipe applications through committee work on specifications and marketing.



John was chairman of the ACPA's AASHTO Task Group in 1992 and 1993, and now in 2001. He also served the ACPA Marketing Committee as chairman in 1994, 1995 and 1996. For this, and other work within the Association, he received the Special Recognition Award in 1996 and the Award for Outstanding Service in 1997.

Representation on the American Society for Testing and Materials (ASTM) and the Transportation Research Board (TRB) is vital to the work of the American Concrete Pipe Association. John recognizes this and has made long-term commitments to participate fully to bring benefits to the concrete pipe industry. We contacted this very active person to get his perspective on the value of volunteering time to serve on the AASHTO Task Group and work with ASTM and the TRB:

Q: *You were recently appointed chairman of ACPA's AASHTO Task Group. What are the functions of the Task Group?*

Meyer: ACPA's AASHTO Task Group is charged with reviewing the existing or proposed specifications for concrete pipe and alternate drainage products. The Task Group then forwards recommendations to the various AASHTO Committees (i.e. culvert, construction, materials) regarding the appropriateness of the specifications. The Task Group bases its recommendations on engineering principles, academic research, and completed projects.

Q: *What is the relationship between the AASHTO Task Group and the Transportation Research Board (TRB)?*

Meyer: The TRB is a division of the National Science Foundation (NSF). NSF was established in 1863 by Abraham Lincoln, and the TRB was later established as an arm of the NSF. Every year in January, the TRB holds its annual meeting. Approximately 9,000 attendees gather to hear presentations about research on transportation related matters that cover a wide range of subjects including pipe and culvert durability. Subcommittees review existing research in their area of expertise.

A subcommittee may propose additional research that may be needed. Approximately 5% of the collected federal gasoline tax is appropriated for research. AASHTO Task Group members volunteer for an eight-year term on TRB subcommittees. Members monitor the research by reviewing numerous presentations, learned papers and submissions. Much of the research performed under TRB either confirms existing AASHTO Standards or leads to their modification.

Q: *What qualifications do the members of the AASHTO Task Group have in common?*

Meyer: The AASHTO Task Group is comprised of dedicated and enthusiastic individuals who have come together to work as a team. All members contribute, and readily take on assignments. I am extremely proud, and honored to serve as chairman of this group of excellent contributors.

Q: *You have been an active member of the ACPA for the past two decades. What keeps you motivated to continue participating actively in the ACPA?*

Meyer: I have found personal rewards in the work I do with the American Concrete Pipe Association. The ACPA is comprised of members with many talents that make this industry great. I found that participation on ACPA's committees, whether technical, marketing, government relations, or one of the many task groups, helps advance the technical aspects of the concrete pipe industry, and its identity in industry and government. I believe that I receive much more than I put into the Association. I would urge all ACPA members to stay active.

Twin Cell Precast Concrete Box Culvert Minimizes Environmental Impact

By Tyson Hicks, EIT and Steve Kitchen
Rinker Materials, Hydro Conduit Division
Thomasville, N.C.
800-475-6302

Progress in the application of precast concrete drainage products is evident in North Carolina where twin cell precast concrete box culverts were used in the construction of a new road. It was the first time that Rinker Materials, Hydro Conduit Division (formerly CSR Hydro Conduit) in Thomasville, N.C. produced a twin cell box culvert.

In March 2001, Blue Green Golf Development, Wilmington, N.C., and the CE Group Inc., Apex, N.C., chose the twin cell culvert for use on a large project located 30 minutes outside of Raleigh, N.C. "The Preserve at Lake Jordan" is a new golf and residential community located in the wooded hills of Chatham County. The access road to the development winds through the heavily treed landscape, raising environmental concerns over the construction of the road. Storm water management best practices were incorporated into the design of the residential-golf course community, and this included the twin cell structure to accommodate increased wet-weather flows from the completed development.

The structure measured 14-foot wide x 7-foot high, and consisted of twin 7-foot x 7-foot cells. A total of 22 sections were produced for the 170-foot run. After the concrete box culvert was produced, the bells and spigots were primed to accept a closed-cell neoprene joint sealant, manufactured by Concrete Sealant, Inc., New Carlisle, Ohio. The joint sealant was attached to the bell prior to shipment. The neoprene joint sealant helped speed the

Installation of the 170-foot long twin cell reinforced concrete box culvert was completed in one week.

Closed-cell neoprene joint sealant was applied to the bell of each box section prior to shipment to the job site.

installation of the culverts by Sanford Construction, Sanford, N.C. Work that traditionally may have taken 2 to 2.5 months for construction of a cast-in-place culvert, took only one week using the precast concrete culverts.

The engineer on the project, Mark Ashness, P.E. of CE Group liked the fact that precast concrete culverts can be installed quickly. This was a major consideration by the CE Group since new regulations in North Carolina have targeted environmental impact and erosion control issues. The quick installation reduced the construction time and the possibility of detrimental impacts on the local natural environment – a major consideration since the project is in the watershed of Lake Jordan.

Another major consideration in the CE Group's box culvert recommendation was the pH of the native clay soil. The 1995 study titled Forecasting Service Life of Culverts in North Carolina by the North Carolina Department of Transportation (NCDOT) and Federal Highway Administration (FHWA) determined that precast concrete systems had a service life of 45 to 59 years (no recorded NCDOT installations prior to 1936 were available). The study reported that corrugated metal pipe (CMP) products had an average service life of 20 to 25 years, and that soil pH was one attribute that affects culvert service life. Chatham County is known for its red acidic clay that exhibits low pHs of 4.5 to 5.0 – an acidic soil condition that would affect the service life of a CMP installation.

Use of precast concrete boxes and pipes for cross drains is getting the attention of specifiers and regulators in many parts of the country. Life cycle cost considerations and economy of installation are very important reasons why people specify precast concrete drainage systems. The twin cell concrete culvert under the road leading to The Preserve at Lake Jordan will serve the community for the design life of the road. Rinker Materials, Hydro Conduit Division has played a significant role in introducing a new application that will serve its clients well.

Project:	The Preserve at Lake Jordan Access Road - Twin Cell Culvert
Owner:	Blue Green Golf Development Wilmington, N.C. David Edwards, Vice President Donnie Longecker, Construction Coordinator
Designer:	CE Group, Inc Apex, N.C. Mark Ashness, P.E. Rinker Materials, Hydro Conduit Division Wayne Hodge, P.E. - Houston, Texas
Contractor:	Sanford Construction, Inc. Sanford, N.C. Richard Holshouser, Vice President & General Manager of Bridge Division
Quantities:	22 (14-foot x 7-foot) twin cell reinforced concrete box units
Producer:	Rinker Materials, Hydro Conduit Division Thomasville, N.C. John Peter, General Manager Tom Lester, Production Manager David Horning, Sales Representative

Rinker Materials, Hydro Conduit Division, Thomasville, a long-time member of the American Concrete Pipe Association, has been manufacturing and supplying precast box culverts for the North Carolina area since the early eighties. Florida-based Rinker Materials operates manufacturing plants nationwide. With four Carolinas facilities, the Hydro Conduit Division maintains a comprehensive line of precast products, utilizing the latest in manufacturing and production technologies for the creation of reinforced concrete pipe (round and elliptical), precast box culverts, and a variety of associated products including, catch basins, flared inlets, and end treatments. For information on Rinker Materials, Hydro Conduit Division, visit www.csra.com.

La Belle Province Says "Bon Voyage" to Wastewater Via RCP Sanitary Sewer

By Bernard Brunet
Béton Brunet Ltée, Valleyfield (Montréal), Québec
450-373-8262

The cities of Brossard and St-Hubert, on the south shore of the St. Lawrence Seaway near Montréal, Québec, Canada have grown extensively since the mid 1980s. The topography of the south shore is very flat, posing a great challenge to provide adequate surface water drainage. Adding to this challenge is the management of wastewater for these two municipalities. The Baillargeon Collector is a trunk sanitary sewer that has accommodated flows from both municipalities, but it has now reached its full capacity.

The solution to the existing situation is construction of a new collector called the "Matte Intermunicipal Sanitary Phase II Collector" that is partially funded by provincial subsidy programs. This large-scale project includes overflow from the Baillargeon Collector. The Matte Collector is being constructed in certain sectors of the City of Brossard, and the major urban development zone of the City of St-Hubert.

Collecting and treating these wastewaters will result in major environmental benefits. The project provides both municipalities with a large diameter reinforced concrete sanitary sewer that can handle the increased demand from the urban development in the two cities. Phase I of the sanitary water management project was carried out in the early 1990s. Phase II is ongoing, and is scheduled to end in late September 2001. Sectors C, L and J of the City of Brossard, are included in Phase II, as well as part of the Daigneault Bassin in the area bordered by the northern part of Boulevard Cousineau. The project is carried out in the area bordered on the north by the Daigneault Bassin, on the south by Boulevard Matte, on the east by Autoroute 30-Rue Cousineau and on the west by the CN Railway.

6,900 meters (22,638 feet) of precast reinforced concrete pipe was used for the Matte Collector System. The line was designed to accommodate flows from sub-basins.

The 6,900-meter (22,638-foot) Matte Collector, comprised of 1050-mm (42-inch), 1200-mm (48-inch) and 1500-mm (60-inch) diameter reinforced concrete pipe (RCP), was designed to accommodate the flows from sub-basins. Because of the length of the system, and connections with sub-basins, several manholes had to be installed along the collector. High water tables, located approximately two to three meters (6 to 10 feet) from the surface, determined that the pipe joints and connections with manholes had to be watertight. This was a special requirement of the project specifications. In some places along the main trunk sewer, the RCP had to be buried approximately eight meters (25 feet) at its deepest point, in primarily clay soil. Therefore, Class V pipe was required for the project.

Béton Brunet Ltée, a member of the American Concrete Pipe Association and producer of precast concrete products in the Montréal region, worked closely with the project participants in finding innovative solutions that reduced costs and prevented potential groundwater infiltration. Instead of using traditional manholes, T-shaped manholes using RCP were proposed. To make manholes in the shape of a T, RCP was modified to accommodate an access well. Just like common manholes, the T-shaped manholes included all the necessary accessories for safely accessing the network (ladder or rungs, security levels, etc.). This solution provided four benefits: ease of carrying out work, better productivity for the contractor, reduced project costs, and watertight joints. Rubber gaskets were used for all joints and connections. A total of 45 T-shaped manholes were made for the collector. This large number of special manholes required well-planned logistics for production to meet the contractor's rate of installation.

In Québec, the Bureau de normalisation du Québec (BNQ) is the agency responsible for drafting standards for manufacturing products. The standard governing the manufacture of concrete pipe is NQ2622-126, and the manufacture of manholes is NQ2622-420. The BNQ also manages certification protocols, and can act as auditor for plant certification programs. Béton Brunet Ltée has been certified for the manufacture of concrete pipes since 1977. The new certification protocol published in December 2000, bearing the number NQ2622-951, deals with pipes, manholes, sumps and valve chambers. Adding certification for manholes is a great improvement for the industry. Many clients already recognize the benefits of BNQ-certified pipe, and some have already set up a schedule for obtaining certification for manholes, sumps and valve chambers in their specifications.

Complying with BNQ standards was a prerequisite of the producer to be able to

T-shaped manholes helped speed installation, reduce project costs and decrease potential groundwater infiltration.

Stringent quality control efforts and exacting installation procedures yielded watertight joints at all manholes.

supply product to the trunk sewer project. Among other things, in the pipe and manhole standards, hydrostatic testing is paramount to ensure watertight products. Béton Brunet regularly demonstrates the quality of its products by performing these tests and others, stipulated in the BNQ standards.

To permit the municipalities of Brossard and St-Hubert to accept construction work for this project, rigid controls were put in place by BPR Groupe-Conseil, the project's consulting engineering firm. Inspections are routinely carried out to check the structural condition of the pipe, and to determine that installation of pipe is done according to specifications. Moreover, on-site tests are carried out to check for watertight joints and connections, and to confirm the performance of the network prior to backfilling the trench.

The Matte Collector is being constructed to the satisfaction of all members of the project team. According to Mr. Fedele, Engineer and Director of the construction company Construction F. Catania & Associates, Inc., the strength and watertight performance of the concrete pipe has contributed to the success of the project. Mr. Racicot, Engineer and Director of the City of Brossard's engineering department, is satisfied with the work, since the concrete pipe collector provides a long-term solution to this major infrastructure investment. Durability and performance of reinforced concrete pipe was key to the solution.

Project:	Matte Intermunicipal Sanitary Phase II Sanitary Water Collector
Owners:	City of Brossard Louis Racicot, Engineer/Director of Engineering Department City of St-Hubert Michel Brousseau, Engineer/Division Chief of Administration And Technical Services for Public Works
Designer/ Consulting Engineer:	BPR Groupe-Conseil Montréal, Québec Jean Charles Désy, Engineer/Project Manager
Contractor:	Construction F. Catania & Associates, Inc. Longueuil, Québec Pasquale Fedele, Engineer/Director
Quantities:	2,320 meters (7,612 feet)–1050-mm (42-inch) diameter Class V RCP 3,250 meters (10,662 feet)–1200-mm (48-inch) diameter Class V RCP 360 meters (1,181feet) – 1500-mm (60-inch) diameter Class V RCP 45 units — T-shaped manholes
Producer:	Béton Brunet Ltée Valleyfield (Montréal), Québec Bernard Brunet, Owner

Béton Brunet Ltée is a family-run company, which has produced precast concrete products for over 70 years. Béton Brunet employs approximately 125 people in its Valleyfield and Sainte-Élisabeth plants. In addition to manufacturing pipes of varying diameters (250-mm to 3600-mm), Béton Brunet manufactures manholes, sumps, valve houses, rectangular box culverts, barriers and other custom products. Béton Brunet Ltée is an active member of the American Concrete Pipe Association, Tubecon, Inc. (Québec concrete pipe producers) and Canadian Concrete Pipe Association.

Major Flood Spurs Construction of Large Capacity Storm Drain

By Donald T. Grzesiek, Vice President Sales
Carder Concrete Products Company
Littleton, Colorado
303-791-1600

On July 28, 1997, Fort Collins, Colorado was hit by a major storm that caused massive flooding at Colorado State University and an established neighborhood east of the campus. The catastrophic effects of the downpour received coverage on all major national television networks over several days. The city had been developing its master drainage plans since the early 1990s, and was making progress in improving its storm drainage systems when the storm hit. The 1997 flood dramatically altered timetables for reconstruction, as funding suddenly became available for flood relief projects.

The Locust Street Outfall was a drainage improvement project designed to improve storm drainage and reduce flooding in the Old Town Storm Drainage Basin. At the time the design was initiated, there were 132 homes and 16 commercial structures that were within the 100-year floodplain. The goal of the project was to relocate the 100-year floodplain surrounding these structures. The project required phased reconstruction of nine blocks of residential streets to install a large diameter precast concrete storm sewer. The system discharges into a storm water quality pond adjacent to the Poudre River. There, the debris is removed by a water quality structure before entering the river.

The trench box used during installation of 8-ft. x 5-ft. reinforced concrete box sections allowed for smaller excavation and minimized site problems from wet weather runoff.

Precast concrete pipe was specified because of ease of installation and longevity. Other types of pipe material were investigated early in the design process. However, it was concluded that installation of other pipe materials would have been much more demanding, and that they did not have the same service life as precast concrete pipe. Carder Concrete Products Company, Littleton, Colo., was selected to provide the precast concrete products for the projects. Products included 84-inch and 108-inch diameter reinforced concrete pipe, and 16-foot x 5-foot; and 8-foot x 5-foot concrete box sections. Engineers specified gasketed joints in the storm sewer because the sewer runs through a 100 year-old neighborhood that is congested with utilities. Also, infiltration and exfiltration had to be limited.

Andrea Faucett, water resources engineer for Sear-Brown, Fort Collins, Colo., the lead design firm for the project said "There is no reason to believe that the storm sewer installed in the Locust Street project will ever be taken out of service, therefore it had to be built to last. Also the ease of installation of concrete pipe allowed the contractor to install an average of eight units of large diameter pipe per day, barring any unexpected interruptions. This cut down on the construction time which, of course, reduced the overall cost."

Faucett went on to say, "I appreciate all of the standards and testing which concrete pipe must adhere to. I know when I specify concrete pipe that I will get a uniform, quality product because of these standards. Also, I appreciate the flexibility I have in design because of the different sizes and shapes which are available."

Grimm Construction of Louviers, Colo., was selected by the Fort Collins Utilities to construct the new storm and sanitary sewer because of their track record of successfully completing large projects for the city. Beginning in the fall of 2000, construction was scheduled to run through the winter, spring and summer of 2001.

Construction of the precast reinforced concrete storm sewer began with installation of 108-inch diameter reinforced concrete pipe (RCP) at Riverside Avenue, then to Laurel Street and on to Stover Street. The sewer construction continued south on Stover to Plum Street and west on Plum to Whedbee Street. Mid-block on Whedbee Street the 108" RCP transitions to a 16-foot x 5-foot reinforced concrete box (RCB) sewer. At the intersection of Whedbee and Locust the 16-foot x 5-foot box transitions to an 8-foot x 5-foot RCB sewer. Approximately 300 feet west of the Locust/Whedbee intersection the 8-foot x 5-foot box transitions to an 84-inch RCP (See Map). The 84-inch and 108-inch storm sewer pipe was placed in trenches ranging in depth from 12 to 20 feet, and 16 feet wide, which required Class II pipe.

The intersection of Whedbee and Locust is the area that exhibited the worst flooding along the storm sewer's route. It is referred to as "the sump" where the historical drainage of the Old Town Basin and the pipeline meet. The main feature in the area is a low street intersection requiring the 8-foot x 5-foot RCB and a transition structure to connect downstream to the 16-foot x 5-foot RCB sewer, and another transition structure further downstream to the 108-inch pipe. At the lowest point at the intersection, there are eight inlets to intercept flows from the north, east, south and west sections of the city. In addition to these surface flows, two existing storm sewers are intercepted and connected where the 8-foot x 5-foot structure transitions to 16-foot x 5-foot box structure.

◀ *16-ft. x 5-ft. precast RCB sections replaced a similar-size cast-in-place structure.*

▲ ***Installation of 108-inch diameter RCP approaches the transition/drop structure.***

▲ ***45 special fabrications were used on the project, including this 83-degree bend.***

The Whedbee Street storm sewer was originally specified as a 16-foot x 5-foot cast-in-place structure. The excavation would have required considerable sloping and support. Such work was cost prohibitive, and would have eliminated most vehicular access during construction as it was to be constructed near the middle of a residential street. That, combined with the close proximity to the low point for flooding, and the prospect of having an excavation open for a lengthy period, made the perceived risk too great, and the decision was made to use precast boxes.

Jeffrey Moore, project manager said, "Grimm Construction had learned while installing the 108-inch diameter RCP that it could control existing storm sewer flows by installing temporary connections (evenings and weekends) from existing pipes to the 108-inch conduit." Moore explained that the smaller excavation, permitted by using a trench box, limited damage to the excavation from wet weather runoff. An open cut, sloped excavation (without a trench box) with formwork and rebar would have been exposed to flooding over the period of the construction schedule.

The precast option was a major public relations boost for the project. It reduced risks associated with installing the cast-in-place conduit, and represented a considerable savings to the City of Fort Collins. The precast option also allowed the use of a trench box for sidewall support, eliminating the need for extensive excavation associated with cast-in-place conduits. The precast option provided homeowners with vehicular access during construction, residential parking, use of front yards, and a significant acceleration of the construction schedule.

Grimm Construction presented the RCB option to Carder Concrete Products, who explored twin cell and single cell equivalents against the original 16-foot x 5-foot cast-in-place-structure. Carder took the concept a major step further by proposing that the 108-inch diameter RCP be extended upstream until it ran out of cover. At this point Carder proposed joining the 16-foot x 5-foot RCB to a 108-inch diameter RCP transition, and continuing upstream with the 16-foot x 5-foot RCB. This approach solved a major hydraulic problem associated with the original design, as it made the transition from 16-foot x 5-foot box sewer to 108-inch RCP in-line rather than a 90-degree bend at the downstream street intersection. The 90-degree bend was accomplished by using two 45-degree 108-inch diameter RCP bends. The in-line transition and the 45-degree bends considerably improved the hydraulics in this stretch of the project.

Carder Concrete Products was contracted in the summer of 2000 to begin production of the 108-inch diameter and 84-inch diameter RCP system. Specifications also called for ASTM C443 rubber gasket joints for the reinforced concrete pipe, and ASTM C990 flexible mastic sealant joints for the reinforced concrete box portion of the sewer.

Close coordination between Carder Concrete staff, the contractor and engineer were key in obtaining quick approvals from the city. The Internet played a significant role from the beginning of the project by allowing Carder Concrete Products to quickly respond with numerous product submittals and provide weekly production schedules. The Carder staff sent e-mails on a weekly basis, noting how many pieces of 108-inch diameter RCP, 84-inch diameter RCP, and 8-foot x 5-foot RCB units were in their yard. The weekly e-mails also outlined which specials were complete, which specials were in fabrication, and approximated the dates that specials needed further upstream were to be fabricated. Grimm Construction was never delayed by a lack of precast concrete pipe or pipe specials.

The $7 million Locust Street Outfall Drainage Improvements Project substantially improved the storm sewer systems in the Old Town drainage basin. In addition to the new infrastructure, citizens of Fort Collins are also equipped with a comprehensive flood warning system, which began operating in June 1999. When the next major storm hits the city, the effect of the storm will be much less of a hardship due to the foresight of its council in the early nineties to prepare for such events, and the performance of the newly-installed precast concrete drainage system.

Project:	Locust Street Outfall Drainage Improvements Project
Owner:	Fort Collins Utilities Fort Collins, Colo.
Designer:	Sear Brown Fort Collins, Colo. Andrea H. Faucett, P.E. Water Resources Engineer
Contractor:	Grimm Construction Louviers, Colo. Jeffrey J. Moore, Project Manager
Quantities:	1,500 linear feet – 84-inch diameter Class II RCP 3,950 linear feet – 108-inch diameter Class II RCP 240 linear feet – (16-foot x 5-foot) RCB units 275 linear feet – (8-foot x 5-foot) RCB units 45 special fabrications (wyes, manhole tees, bends)
Producer:	Carder Concrete Products Company, Inc. Littleton, Colo.

Carder Concrete Products Company (CCP) was founded in the late 1960s in Littleton, Colorado. During the 70s and 80s, CCP orchestrated a series of acquisitions that included the formation of Wyoming Concrete Products Company (WCP) in Casper, Wyoming. Both companies are currently employee-owned and operated. In 1997, CCP expanded operations by constructing a new production facility in Colorado Springs. CCP employs approximately130 people in Colorado and WCP employs approximately 25 in Wyoming. CCP manufactures circular nonreinforced concrete pipe (NRCP) and RCP, horizontal elliptical (HERCP), concrete jacking-pipe, and precast RCB units. WCP manufactures circular RCP, HERCP, concrete jacking-pipe, precast RCB units, precast manholes, vaults and various other specialty precast concrete infrastructure products. CCP and WCP are also the official licensees (in Colo., Wyo., Utah, Idaho, Mont., N. Dak., and S. Dak..) for the "Stormceptor System" stormwater quality device. All CCP plants are ACPA "Q-Cast" Quality Certified and the WCP plant is also NPCA Plant Certified. For information on Carder Concrete Products Co., visit www.carderconcrete.com

DASH Software Streamlines Detention and Sewer Hydraulic Calculations

Glenn Clayton, P.E., Marketing Director
Illinois Concrete Pipe Association, Naperville, Illinois
(630) 357-9327

The new DASH (Detention and Sewer Hydraulics) CD gives civil engineers quick and easy-to-use interactive design software for underground storm water detention design, as well as storm and sanitary sewer hydraulic calculations. The software was developed as a joint effort of the American Concrete Pipe Association and the Illinois Concrete Pipe Association, with technical assistance from Earth Tech in Oak Brook, Illinois and the programming services of Giffels in Toronto, Ontario, Canada.

Precast concrete box sections being used for storm water detention.

History of Storm Water Storage Facilities

In the middle of the last century, the rapid urbanization of the U.S. resulted in the need to protect roads, buildings and other infrastructure from storm water damage. This need led to the design of storm sewer systems, which could provide rapid, efficient conveyance of storm water runoff from streets and yards into streams. It wasn't long, however, until it became apparent that this type of development led to localized flooding downstream. The need to control the maximum runoff rate from new development led to the concept of on-site and regional storm water detention basins.

As state, county and local governments continue to enact ever-stricter regulations concerning storm water runoff, temporary on-site storage of storm water has become an integral aspect of site development in many urban areas. Often times, the designer is required to "maintain pre-development conditions" or limit storm water runoff to a prescribed maximum discharge rate. This storage requirement can be met with a myriad of facility types, including detention ponds (designed to completely drain after the design storm has passed), retention ponds (designed to contain a permanent pool of water), rooftop, parking lot and street detention, infiltration ditches/beds and underground detention in pipes, vaults or other structures. Of late, some of the drawbacks of ponds have resulted in a growing trend toward underground storm water detention.

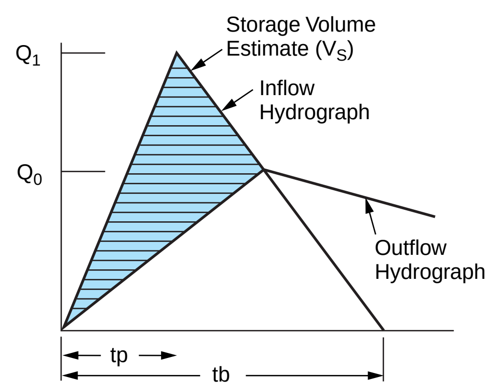
Advantages of Underground Storm Water Detention

In-fill sites (open lots in developed areas) and redeveloped sites in large urban areas often do not have sufficient area for a pond. Furthermore, detention ponds pose a potential drowning hazard and aging surface ponds may become unattractive if not maintained properly. On the other hand, underground storm water detention does not have any of these drawbacks. Ultimately, however, the driving force behind underground storm water detention has come from the rising cost of real estate, making it more economical to store storm water underground and reclaim the area for other uses as opposed to tying up valuable land for detention ponds. As storm water regulations become stricter, the detention volumes continue to increase, making it more difficult to find space for ponds.

Design Considerations

As mentioned above, a primary design criterion for sizing detention basins is the maximum release rate allowed by the governing authority. Current allowable post-development release rates for both residential and commercial developments are as low as 0.1 cfs/acre for a 100-year recurrence interval storm. Some storm water ordinances require that the engineer compare the pre-development release rate with the general release rate requirement (e.g. 0.1 cfs/acre) and use the lower of the two. The storage volume must then be calculated that will limit storm water runoff to this maximum rate.

A preliminary estimate for the required storage volume can be made by comparing simplified inflow and outflow hydrographs, as shown below:



The detention volume is the area between the two hydrographs and can be expressed as:

$$V_s = 0.5T_i (Q_i - Q_0)$$

Where: V_s = storage volume estimate, ft^3
Q_i = peak inflow rate, cfs
Q_0 = peak outflow rate, cfs
T_I = duration of storage facility inflow, sec

T_p = time to peak of storage facility inflow, sec

T_b = time base of the storage facility inflow, sec

Most government agencies require much more sophisticated methods of determining storage volumes than this approximate method and many computer programs have been developed through the years to perform these calculations. Among them are the following:

HEC-1, one of the earliest computer programs ever introduced to perform hydrologic calculations was developed by the staff of the Hydrologic Engineering Center (HEC) of the U.S. Army Corps of Engineers in 1967. This program can be used to develop runoff hydrographs that can be routed through the storage structure using the actual physical characteristics of the storage and outlet structures.

TR-20, or "Technical Release No. 20: Computer Program for Project Formulation Hydrology", is a physically based watershed runoff event model similar to HEC-1 developed by the U.S. Soil Conservation Service (SCS), now called the Natural Resources Conservation Service (NRCS).

TR-55, or Technical Release No. 55, also developed by the SCS in 1975, calculates runoff volumes, peak discharge rates, hydrographs and required storage volumes for small urbanized watersheds. Since TR-55 represents a simplified approach, with storage calculations based on average storage and routing effects for many structures, calculated storage volumes should be considered merely approximate. Other limitations of TR-55 include: a free discharge (no tailwater) condition is required, no off-site flows may be routed through the facility, and the peak outflow to peak inflow ratio must be between 0.1 and 0.8. Therefore, in areas requiring very low release rates, TR-55 will be unable to calculate a storage volume. Nonetheless, it is still widely used by many government agencies throughout the U.S.

The **Modified Rational Method** is a simple and common method used to estimate peak runoff rates and corresponding detention storage volumes. Although many government agencies continue to allow its use for detention basin sizing, it has been shown to greatly underestimate detention storage volumes for sites with high imperviousness such as commercial developments. Therefore, it is recommended for use only as a preliminary sizing tool.

Besides storage capacity, other design considerations include chosing the most appropriate pipe material, shape and size of the pipe, and layout of the system. Some of the issues which must be addressed include:

- outlet elevation
- minimum required cover for the pipe to carry the anticipated live loads
- pipe, bedding and backfill costs
- area available for underground detention
- access into the pipe for cleaning/maintenance

The most economical solution is generally the largest pipe the site constraints will allow. Concrete pipe can often help the designer to achieve the maximum detention volume in the smallest area (especially if precast box culverts are used), since it can be designed to carry high live loads with minimal cover and little or no support from the backfill.

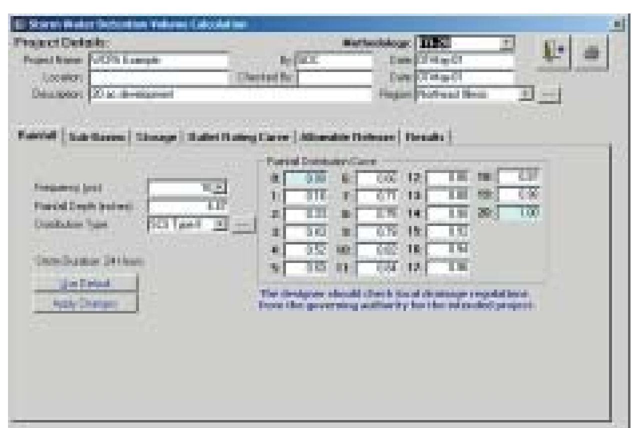
As an example of using concrete pipe for storm water detention, the Village of Elmwood Park, Illinois sought to relieve a flooding problem in an area with an existing combined sewer system. Christopher B. Burke Engineering, Ltd. designed 160 linear feet of 4-foot by 10-foot precast box culverts as an underground storm water detention system. The construction presented several considerable challenges including an 8-inch water main within 10-feet of the proposed alignment, soil conditions consisting of running sand to a depth of 4 feet (which required sheeting driven to an average depth of 12 feet), and scheduling with a concurrent roadway reconstruction project.

According to Chris Burke, Ph.D., P.E., President of Christopher B. Burke Engineering, Ltd., underground detention allows the full use of the property and requires little maintenance, although it can be costly and provides minimal water quality benefits. Chris also warns about underground detention proposals that include "too good to be true" claims, and encourages engineers to evaluate future loading conditions and provide for maintenance access in underground detention system designs.

DASH Software Overview

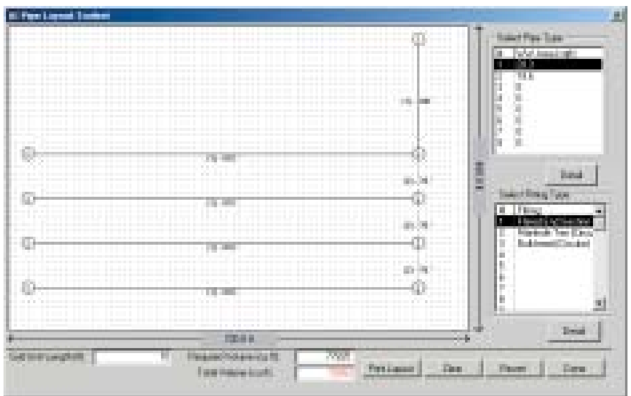
The DASH software provides a way for designers to quickly and easily calculate required detention volumes, design the layout of the system and prepare a material cost estimate of the system components. DASH is divided into four "modules", each of which addresses specific aspects of hydrologic and hydraulic design, and cost analysis. Navigation has been made simple by putting each design input requirement in a "file folder" format. All input data is entered in a Windows format, with much of the required input already provided in drop-down menus. Wherever applicable, the user may override the default values to input specific project requirements.

The first module in DASH, **Storm Water Detention Volume Calculation**, provides the means to determine the required detention volume for a particular site, giving the designer four of



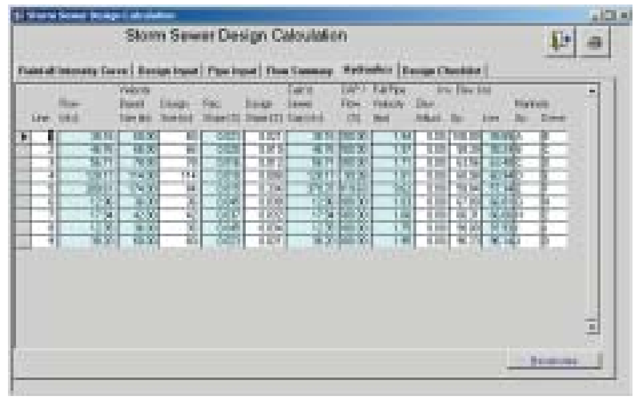
the most common hydrologic tools for use in detention system sizing; TR-20, TR-55, HEC-1 and the Modified Rational Method. DASH has made the execution of these methods as user-friendly as possible. The software does the work, including time of concentration and curve number calculations of the project site. The software allows the user to save rainfall input data to be used on subsequent projects. Once the data input is completed, the required detention volume is returned instantaneously with a click of the mouse.

The **Storm Water Detention System Design** module allows the user to draw the proposed system layout to scale. The required system components, including pipe sizes and shapes and fitting types, can be selected from drop-down menus and inserted into the drawing with a click of the mouse. The program



monitors the total volume of the system being drawn and alerts the user when the required volume has been achieved by showing the total volume in red. Once the layout has been completed, the "Pipes" and "Fittings" input screens allow the user to input unit cost information, and the program will then calculate the total material costs for the project. To assist in determining the total material cost for the project, the program includes a link to the popular "PipePac" software developed by the Ontario Concrete Pipe Association in conjunction with the American Concrete Pipe Association. From the PipePac menu, the user can enter the 3EB program, which will calculate the total load on the installed pipe and provide the appropriate class, as well as the CAPE (Cost Analysis of Pipe Envelope) program, which calculates the bedding and backfill costs. The results of these programs can then be retrieved by the Detention System Design Tool for use in calculating the total system material cost, which can then be printed out on the "Detention System Cost Estimate." If unit costs are not known, a "Quotation Request" report can be printed out for submittal to local suppliers for quotations.

The **Storm Sewer Design Calculation** module provides a convenient tool for performing hydraulic calculations for storm sewer design, using the Rational method for developing design flows. The program provides screens for inputting rainfall intensity curves (which can each be saved for later retrieval from the drop-down menu), type of pipe, Manning's roughness coefficient, minimum design velocity, and fall across manholes. A preliminary layout is necessary to develop the required input for the program, including pipe number, upstream/downstream manhole designations, pipe length, area and C factor for the drainage area to each pipe, and the initial time of concentration and invert elevations for the upstream manholes of each branch in the system. The program will then display the design flow, recommended pipe size, recommended slope, calculated sewer capacity, full pipe ve-



locity, and pipe invert elevations at both the upstream and downstream manholes for each pipe in the system. The user may then adjust the sizes and slopes of the pipes and provide additional drops at manholes to modify the system as desired. The modified results are instantly displayed for review. A "Flow Summary" tab allows the user to review the flow calculations. Once the design has been completed, the "Design Checklist" tab can be viewed, which compares each pipe's capacity and flow velocity with the design flow and minimum flow velocity, respectively. This tab also displays the calculated partial pipe flow characteristics for the design flow condition.

The **Sanitary Sewer Design Calculation** module calculates sanitary flow using typical methodologies and then recommends pipe sizes, slopes and invert elevations, as in the storm sewer design module. Required input includes type of pipe, Manning's roughness coefficient, minimum design velocity, fall across manholes, residential, industrial and commercial population densities, average per capita flow rate and peaking factor method. As in the storm sewer design module, a preliminary layout is necessary with the corresponding pipe input. The program allows the user to input additional flows when necessary without applying a peaking factor to them. The hydraulic calculations are identical to the storm sewer module, providing the design flow, recommended pipe size, recommended slope, calculated sewer capacity, full pipe velocity, and pipe invert elevations.

In conclusion, the new DASH software gives the designer of underground detention systems, storm sewers and sanitary sewers a powerful tool for performing hydrologic and hydraulic calculations, as well as providing layout assistance and cost analysis. To order your copy of DASH, call the ACPA Resource Center at 800-290-2272 or contact your local concrete pipe producer.

“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:

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- Americast-Pipe Division, Inc., Charleston, SC - Bill Gary
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- Cayuga Concrete Pipe Company (Oldcastle, Inc.), Croydon, PA - George Stoffa
- Cayuga Concrete Pipe Company (Oldcastle, Inc.), New Britain, PA - Edward Pentecost
- Elk River Concrete Products (Cretex), Billings, MT - Milton Tollefsrud
- Kerr Concrete Pipe Company (Oldcastle, Inc.), Hammonton, NJ - Bob Berger
- Riverton Concrete Products Company (Cretex), Riverton, WY - Butch Miller
- South Dakota Concrete Products (Cretex), Rapid City, SD - John Link
- Sherman-Dixie Concrete Industries, Inc., Chattanooga, TN - Earl Knox
- Sherman-Dixie Concrete Industries, Inc., Franklin, TN - Roy Webb

Sanitary Sewer, Storm Sewer and Culvert Pipe

- Advanced Pipes & Cast Company, Abu Dhabi, UAE - Poul Jacobsen
- Amcor Precast (Oldcastle, Inc.), Nampa, ID - Mike Burke
- Amcor Precast (Oldcastle, Inc.) Ogden, UT - Tim Wayment
- Amcor-White Company (Oldcastle, Inc.), Ogden, UT - J. P. Conn
- Atlantic Concrete Pipe, San Juan, PR - Miguel Ruiz
- CSR Hydro Conduit, Denver, CO - Ed Anderson
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- Geneva Pipe Company, Orem, UT - Fred Klug
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- NC Products (Oldcastle, Inc.), Fayetteville, NC - Preston McIntosh
- NC Products (Oldcastle, Inc.), Raleigh, NC - Mark Sawyer
- Ocean Construction Supplies Limited (Inland Pipe), Vancouver, BC, Canada - Rod Boyes
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