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The Magazine of the American Concrete Pipe Association

An Oasis of Quality Concrete Pipe

- Precast Concrete Box Culverts Serve Dual Purpose in Lake Ontario
- New Canadian Bridge Design Standards Published
- South Dakota DOT Uses RCP Energy Dissipators

This issue:

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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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Cover Photo: Twenty-four 8-inch pumps empty water from the trench where over 920 meters (3,018 ft.) of 1800-mm (72-inch) diameter precast reinforced concrete pipe was installed near Abu Dhabi, U.A.E. Inset Photo: The epoxy coating on pipes provide added protection from in-situ chlorides and sulfates.

President's Report

John J. Duffy

Global Influence on Quality Pipe Production

Think globally and act locally was the economic and political mantra for many businesses and governments throughout the 1980s and early 1990s. For an industry with a North American history approaching two centuries, many concrete pipe producers thought that global marketplaces and forces did not quite have a place in daily business activities. After all, concrete pipe plants traditionally serve a market area within a couple of hundred miles from the plant. What possible benefit would thinking globally have on a local enterprise? National issues were, and still are, viewed by many as the ones that really matter.

That was yesterday. Internet technology and recent trans-national trade agreements have opened the gates to global influences on local markets. There are no longer any true national borders in the information age. Information flows freely into and out of the offices of Corporate America. In seconds, Internet technology can produce information that collapses the decision making process to minutes and hours, instead of days, weeks and years. Trans-national trade agreements bring with them standards and specifications from other countries, that impact on local operations.

For example, the concrete pipe industry in the United States and Canada recently joined forces to tackle the pipe tie-down issue for shipping concrete pipe throughout North America. Impetus for the cooperative effort was provided by NAFTA. PipePac, the software program for aiding engineers and specifiers in pipe product choices, is used internationally. Since 1997, it has been made available from Web sites in Canada and the United States. *Concrete Pipe News*, ACPA's quarterly magazine, is distributed in the U.S., Canada and more than 25 foreign countries. National borders were ignored, and the concrete pipe industry has benefited greatly by its use.

Most recently, the Q-Cast quality assurance program of the ACPA is making an impact, globally. The "Quality Cast" Plant Certification Program has a 124-point audit-inspection feature that covers the inspection of materials, finished products, and handling/storage procedures, as well as performance testing and quality control documentation. This program, similar in some respects to the international ISO registration program, presents a comprehensive quality assurance program for the concrete pipe industry that enhances both the local and global credibility of a business. Ocean Construction Supplies Limited in Vancouver, B.C. was the first company in North America, outside of the U.S. to achieve Q-Cast certification. Advanced Pipes and Cast Company in Abu Dhabi, United Arab Emirates (U.A.E.) received its certification in 2000, and became the first globally certified plant. The concrete pipe industry's quality assurance programs are second to none in the world's drainage pipe industry.

This issue of *Concrete Pipe News* demonstrates successes of quality assurance programs of member firms in the U.S., Canada, and around the world that have excelled because of the quality of their plants and products. Our Industry Spotlight focuses on Don Schmidgall of The Hawkeye Group who shares his perspective of changes in equipment used for pipe production. And this issue's technical section highlights the new Canadian Bridge Design Standards published by Canadian Standards Association (CSA).

Our cover story features the construction of a new concrete pipe plant based entirely on quality assurance. The award-winning plant is now pro-

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Industry Spotlight

Don H. Schmidgall

Associate Members of the American Concrete Pipe Association play a significant role in the development of new equipment and services to the precast concrete pipe industry. Their efforts directly contribute to production efficiencies and quality of products offered by concrete pipe producers. Many Associate Members take an active interest in the activities of the Association, and serve on committees and task groups. Don Schmidgall, Vice President of Marketing with The Hawkeye Group, Inc., Mediapolis, Iowa, is one such member. He serves the ACPA through his work on the Associate Members Executive Committee and Government Relations Committee.

During his undergraduate years, Don worked in many areas of Hawkeye's Mediapolis plant as a machine fabricator. Upon graduation from Iowa State University in 1974, with a Bachelor of Science degree in Engineering Operations, he was hired by Hawkeye as Vice President, Marketing.

Reflecting upon his work over the last three decades, he said, "The really nice thing about my career is the travel that allows me to see a wide range of concrete pipe production operations, meet all kinds of fine people, and tour exceptional plants."

In addition to his duties at Hawkeye, Don is involved as a Director on several Boards of area businesses and a charitable foundation.

We asked Don to talk about change in the manufacturing of equipment used in the production of reinforced concrete pipe. Here is what he had to say.

Q: *Over the past 20 years, the manufacturing process for reinforced concrete pipe has changed dramatically. What has changed the most?*

Schmidgall: Our industry's manufacturing plants have become much more sophisticated and flexible. Where we used to see plants set up to just manufacture round pipe, now they have the versatility to also produce non-round pipe, box sections, manholes, and related products. The use of automation and new technology has also made a big impact, and we're seeing more sophisticated machinery with quicker change-over times to maximize plant efficiency and agility.

Q: *Machine tolerances are critical to maintain consistency of pipe products. How do members monitor tolerances in the production process?*

Schmidgall: This is a very important question. The first step begins with management. Quality oriented plants have that attitude instilled in their employees. They establish procedures and see that they are carried out. Raw materials need to be inspected. There needs to be a scheduled procedure for maintaining, inspecting, and measuring form sets and joint rings against specified tolerances and industry standards. Also, integrating a test line into the manufacturing process permits each product to be vacuum tested and gauged. This goes a long way toward ensuring that only quality pipe leaves the plant.

Q: *For someone who has never seen how concrete pipe is produced, what would they find most surprising?*

Schmidgall: I think that people form perceptions about concrete pipe manufacturing based on what they see in their day-to-day activities. They see concrete being poured into a mold and left to set overnight, indeed a slow process. So, when these folks tour a concrete pipe production facility, they are first of all, impressed with the speed of production and the immediate de-molding of the product. They're also amazed at the sophistication of the equipment used to produce the pipe and the quality of the finished product. Their eyes open wide and they go away with a new appreciation of precast concrete drainage products.

Q: *Total automated plants and robotic systems are appearing throughout the concrete pipe industry. Where do you see this technology taking the concrete pipe industry over the next 20 years?*

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New Plant Produces Quality Concrete Pipe in the United Arab Emirates

By M. Boon, Quality Manager • Advanced Pipes and Cast Company W.L.L., • Abu Dhabi, United Arab Emirates • (011) 971-2-551-1400

Seven lines of 1400-mm (54-inch) diameter reinforced concrete pipe converge in a manhole where a 2400-mm (96-inch) diameter line will transport the water to a treatment station.

Advanced Pipes and Cast Company W.L.L. (APACC), an International Member of the American Concrete Pipe Association, began life in 1996 as a manufacturing facility for a construction company, Bin Hafeez Establishment (B.H.E.). The United Arab Emirates is a developing country, which 40 years ago had very little infrastructure. New roads are being constructed to link existing towns and villages. Sewerage, drainage and storm water networks are being laid, and residential areas planned. Consequently, there is room in the marketplace for small to medium sized construction companies. Supplying materials to these companies is an area that has no defined limits, and it is relatively easy for new manufacturers or products to establish themselves.

The beginning of oil production in the region sparked an urgent necessity to provide living and working accommodations, together with all supporting amenities, for the flood of people pouring into the country. As with all projects undertaken in a great

hurry, more attention was paid to physical results than to quality. Outside of the oil industry itself, quality has become an issue in the last six to ten years, and environmental issues are only now beginning to be addressed by private industry.

Advanced Pipes and Cast Company plant encompasses over 13,900 square meters (150,000 sq.ft.) with ample room for yarding.

The policy of no-compromise with respect to the quality of its product, led Advanced Pipes and Cast Company to adopt the bold step toward vertical integration in its line of business. The prime objective of its integration was to ensure better control over the company's products by controlling the source of the materials required to produce them.

In the beginning, Advanced Pipes and Cast Company relied upon the resources and skills that B.H.E. already had in place to support the rapid growth it had experienced in the previous five years. These included huge capital investments in plant and equipment, a specialized management team focused on quality, and the outstanding financial security of B.H.E.

Work on the reinforced concrete pipe plant began in early 1997, making use of state-of-the-art technology in pipe production processes and equipment. It employed experienced staff to ensure that the reinforced concrete pipe produced would consistently meet the high standards that it had set for itself, and that all those involved in the operation of machinery, received extensive training from suppliers. This is a prac-

Global Growth of the ACPA Plant Certification Program

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The American Concrete Pipe Association's "Q-Cast" Plant Certification Program became international in January 2000, when Ocean Construction Supplies Limited in Vancouver, British Columbia achieved ACPA certification. Global growth occurred in December 2000, when Advanced Pipes and Cast Company (W.L.L.), located in Abu Dhabi, United Arab Emirates, achieved ACPA certification.

I was fortunate to participate in the certification audit of Advanced Pipes and Cast Company. To get to Abu Dhabi from Chicago (where WJE is headquartered), you can travel east, west or north. My flight was 11,880 km (7,384 miles) and included two legs, Chicago to London Heathrow 6,360 km (3,953 miles), and London Heathrow to Abu Dhabi 5,520 km (3,431 miles). The time difference between Abu Dhabi and Chicago is 10 hours.

I arrived in Abu Dhabi after traveling for 18 hours, and was warmly greeted at the airport by Poul Jacobsen, the Plant Manager, and Nasser, the Plant QC Inspector. It was about 8 p.m. Friday night, their only day off. The plant operates 6 days a week, observing Friday as the holy day.

After discussing the next few days' schedule, I departed with the driver sent by the hotel to meet me. The Mafraq Hotel is remote, but very pleasant and modern. The hotel was nearly deserted since I had arrived in the middle of Ramadan, the 9th month of the Islamic year, observed as sacred with fasting practiced from dawn to sunset. The hotel staff was excited to see their almost sole customer.

Advanced Pipes and Cast Company manufactures pipe with diameters from 600-mm (24-inch) to 2400-mm (96-inch) in diameter. Most of the pipe is lined using HDPE, and the liner joints are field welded. The plant was producing unlined pipe during the inspection, which allowed me to better inspect the barrel appearance, D-Load and hydrostatic testing. The plant applied for the more difficult Combined Stormwater and Sanitary certification.

I was picked up from the hotel and driven the 15 minutes to the plant. The main road is a modern four-lane divided highway, complete with periodic jarring speed bumps. To avoid the occasional congestion caused by construction or accidents, trucks often drive off the pavement and sometimes become stuck as deep as their axles in the soft sand. I saw several on my way to the plant.

The one-km road leading to the plant was under construction. It was a dirt road that parallels, and occasionally crosses, the new pavement not yet opened. Very rutted and with severe dips, it would not have been passable without our four-wheel drive vehicle. I made a mental note to take a close look at the pipe loading procedures at the plant.

I learned that the plant received ISO 9001 certification in 1998 (one year after commencing operations), and ISO 14001 certification for environmental management in 1999. In 1999 the plant also received Gold recognition for the Sheik Khalifa Industry Award as well as the Sheik Khalifa Excellence Award. It was clear when I inspected the modern, well-maintained pipe manufacturing equipment in the plant that the management team had done a great job.

Advanced Pipes and Cast Company faces several challenges due to their location in a hot and dry desert climate. Daily high temperatures range from 20 to 35° C (68 to 95° F) in the winter, and 38 to 45° C (100 to 113° F) in the summer. Water is scarce with the average annual rainfall of only 110 mm (4.3 inches), which occurs mainly between December and March. When I

A 2400-mm (96-inch) diameter Class IV reinforced concrete pipe undergoes a three-edge bearing test as part of Advanced Pipes and Cast Company's extensive quality assurance

tice that continues whenever new machinery or technology is introduced.

The first test pipe was produced in July 1997. By November, Advanced was producing pipe for its first project. Early in 1998, Advanced Pipes and Cast Company W.L.L. was registered as a separate, independent entity.

September 1998 saw confirmation of APACC's commitment to quality when the company had its quality management system certified to ISO 9001: 1994. A significant number of the Advanced Pipe's staff is trained to be internal quality auditors and carry-out this function in addition to their every day jobs.

During the following nine months, Advanced Pipes & Cast Company redesigned the spigot of its pipe and modified the plant's operations to improve the speed and efficiency of the production process, while enhancing the quality of the product. In parallel with these developments, the management team identified the environmental aspects related to the factory and production processes, and implemented its Environmental Management System (E.M.S.). Four percent of staff is qualified to audit E.M.S., and

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arrived in December, it had not rained for over a year.

The plant has several underground tanks to hold or recycle water. Due to the hot climate, no heat curing is needed. During the hot summer months the pipes are cooled to prevent cracking and high concrete temperatures. Immediately after finishing, each pipe is individually wrapped in plastic sheeting to maintain the moisture within the concrete.

Pipe mould being lowered into the production pit.

Production of steel reinforcement cages at Advanced Pipes' plant.

Quality aggregates are difficult to obtain in Abu Dhabi, so aggregates are trucked in from Al 'Ain which is over 150 km (93 miles) away. The plant has a single primary concrete mix design that has been carefully optimized for pipe production. The moisture content of the aggregates is closely monitored, and the mix water is adjusted. The aggregate is stored in covered bins and cooled with water during hot weather.

During the inspection, several people mentioned the current "cool" weather. With daytime highs near 23° C (73° F), it felt wonderful to me for December and coming from Chicago. Correspondence overseas is best-done using E-mail and the Internet. After checking my e-mail, I found that our office in Chicago was closing early due to a snow emergency, with over 24 inches (600 mm) of blowing snow. The sun and heat felt even better.

The two-day inspection included the review of plant manuals, QC procedures, calibration records, raw material test reports, pipe test reports; inspection of production practices; measurement and testing of pipe in stock; testing of concrete and gaskets; review of product repair, storage, and shipping; as well as many other aspects of quality control. Being ISO-certified, Advanced Pipes has developed extensive records that are well organized and well maintained. Complementing ISO certification with ACPA certification is beneficial since the ACPA certification is specifically designed for concrete pipe while ISO certification is broad based. ISO certification procedures tend to be procedurally-oriented, while ACPA certification is product (pipe) quality-oriented.

The ACPA certification requires successful completion of unique hydrostatic tests of pipe joints in the maximum off-center loading, and structural proof tests of pipe joints performed on pipe randomly selected from stock by the auditor. More standard three-edge bearing tests and hydrostatic tests must also be passed during the audit on randomly selected pipe. The ISO and ACPA certifications are complimentary and together show a clear dedication to quality.

Most specifications in the UAE reference British standards, and most work uses metric units. The inclusion of foreign plants in the certification program provides ACPA an opportunity to closely compare the US and British standards and update the ACPA certification manual with both US and

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in July 1999, the system was registered ISO 14001: 1996. The safety manual is an integral part of the E.M.S., and there is one person for every 12 employees qualified in first aid.

Advanced Pipe Secures Major Project

In 1999, APACC secured a contract to supply approximately 15 km (9.5 miles) of reinforced concrete pipe, in nine different diameters, on a project for the Sewerage Projects Committee of the Government of Abu Dhabi. Known as 219/B, the project was a surface drainage system using reinforced concrete pipe.

The purpose of the project was to install a storm water drainage system for a new residential area. Most of the product was supplied in 1999, but delivery of the product did not go according to plan because excavators broke through the ceiling of several caverns, and discovered an underground brackish lake in one of them. The pipeline could not be diverted from its route, so engineers had to find a way to divert the lake – at least temporarily. This required some innovative thinking from the project manager because re-routing a lake through a desert is not a common occurrence! The project manager and the design team accomplished the diversion by installing twenty-four 8-inch water pumps that operated nonstop for 144 hours, while the pipe was installed and covered with concrete.

Pipe was placed at an average depth of 6 meters (20 feet); approximately 4.5 meters (15 feet) below the water table that is normally not more than 1.5 meters (5 feet) from the surface. Because of the quality of the pipe, and the perseverance of production and field staff to ensure that the pipe was

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Client: Sewerage Projects Committee
Government of Abu Dhabi

Project: Abu Dhabi Social Services
Contract 219/B, Surface Water Drainage,
Khalifa City B, Abu Dhabi

Contractor: Nael & Bin Harmal Hydroexport Establishment

Quantities:
4,473 meters (14,675 feet) of 2400-mm (96-inch) diameter RCP
4,038 meters (13,248 feet) of 2000-mm (78-inch) diameter RCP
920 meters (3,018 feet) of 1800-mm (72-inch) diameter RCP
742 meters (2,434 feet) of 1600-mm (60-inch) diameter RCP
1,057 meters (3,468 feet) of 1400-mm (54-inch) diameter RCP
580 meters (1,903 feet) of 1200-mm (48-inch) diameter RCP
1,832 meters (6,010 feet) of 900-mm (36-inch) diameter RCP
989 meters (3,245 feet) of 700-mm (27-inch) diameter RCP
627 meters (2,057 feet) of 600-mm (24-inch) diameter RCP

Producer: Advanced Pipes and Cast Company W.L.L.
Abu Dhabi, United Arab Emirates

Advanced Pipes and Cast Company W.L.L. was established in 1997 to supply reinforced concrete pipe to the United Arab Emirates marketplace. The plant is equipped with two pipe machines and covers an area of approximately 13,935 square meters (150,000 square feet.) It received its "Q-Cast" plant certification from ACPA in 2000, and produces a variety of concrete pipe products ranging in size from 600-mm diameter (24-inch) to 2400-mm (96-inch) diameter. In addition to reinforced concrete pipe, the plant also produces all kinds of pipe related fittings.

CSA Publishes New Canadian Bridge Design Standards

Paul Smeltzer, P. Eng.,
Ontario Concrete Pipe Association, and
Matt Childs, P.E.,
American Concrete Pipe Association

The Canadian Standards Association (CSA) recently introduced the latest edition of the CAN/CSA-S6-00 Canadian Highway Bridge Design Code. Developed in cooperation with provincial regulators from across Canada, the code provides comprehensive, updated requirements for highway bridges. It replaces two previous publications: OHBDC-91-01, Ontario Highway Bridge Design Code, 3rd Edition, and CAN/CSA-S6-88, Design of Highway Bridge Structures.

CAN/CSA-S6, The Canadian Highway Bridge Design Code, supports a national transportation system with uniform minimum standards and design loads for bridges on interprovincial highways. This consistency makes it easier and more cost-effective to design, construct and maintain interprovincial highways, and to transport goods between jurisdictions.

The new standard includes requirements for engineered soil and for the selection of the structural properties and dimensions of buried structural systems, including precast concrete circular and elliptical pipe, boxes and segmental structures including arches and three-sided boxes. The new standard also specifies the construction procedures, the properties and dimensions of the engineered soil components, and the requirements for construction supervision.

One significant revision to the standards is the inclusion of Standard Installations to calculate induced soil-pressure and internal force components on precast concrete pipe. The Standard Installations are a result of a long range research program by the ACPA on the interaction of buried concrete pipe and soil. The four Standard Installations are defined by the types and densities of the bedding and embedment soils required for each installation type. The procedure replaces the historical B, C and D beddings with the four new Standard Installations.

The four Standard Installations provide an optimum range of soil-pipe interaction characteristics. For the relatively high quality materials and high compaction effort of a Type 1 Installation, a lower strength pipe is required. Conversely, a Type 4 Installation requires a higher strength pipe, because it was developed for conditions of little or no control over materials or compaction. Much of the design philosophy developed for concrete pipe using Standard Installations has also been incorporated into precast concrete box culvert design in the new Canadian Standard.

The design of the pipe wall structure in the new CSA Standard follows the standard principles of reinforced concrete design. Concrete pipe designs are controlled by the limit states of flexure, shear or diagonal tension, as well as the combined effect of shear and radial tension. The standard also includes provisions for crack control.

The code is available in a number of convenient formats in both English and French. It can be purchased as a hard copy, or as a down-loadable PDF from the CSA online store at www.csa.ca or call 1-800-463-6727.

PRECAST CONCRETE BOX CULVERTS
Used as Groynes and Aquatic Habitat

By Paul Martin, Centennial Concrete Pipe & Products Inc., Cambridge, Ontario,
Cindy Toth, City of St. Catharines, Ontario and
Brian Rankin, Stephens and Rankin Inc.,
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888-888-3222

Precast concrete box culverts do more than channel runoff to provide safe crossing of waterways and drainage systems. They are used as structures for people and animals to pass safely under railways and major roadways. They also serve as storage structures for storm water to prevent flooding, and tunnels for traffic. Availability, durability, and speed of installation, factor significantly into the specification of precast box units.

Now, precast concrete box culverts have been used as water deflectors (known as groynes), with a value-added ecological feature. This application introduces a 21st century way of thinking to solve a complex problem involving industrial requirements, local tourism/recreation trade, and safe use of waterfront amenities in a major city.

The Dalhousie Yacht Club, founded in 1935, is a well-developed destination on the south shore of Lake Ontario, in the province of Ontario, a few miles west of the Welland Canal. In 1988, St. Catharines' Hydro-Electric Commission built the Heywood Generating Station upstream of the yacht club. There were strong current and water surges in the yacht dockage area of the club that raised safety and mooring issues.

Loose bundles of tree branches were placed in the lower precast concrete box units to provide an enhanced aquatic habitat.

The yacht club financed a study in 1997, which showed that a series of groynes would redirect currents away from the boat moorings and solve the club's problem with rushing water. A partnership followed between the City of St. Catharines, Dalhousie Yacht Club, and Hydro-Electric Commission to fund the engineering required to construct the groynes.

When the engineering firm, SHAL Consulting Engineers undertook the pre-design study, it recommended construction of two groynes made with precast concrete box units, after considering rubble mound groynes, and a steel sheet-piling deflector that would protrude above the water. Since the box culvert alternative would be more attractive and better suited for incorporating into the mooring basin, it was recommended as the preferred solution. Construction was scheduled for the spring of 2000, but the challenges were not yet over.

The Ontario Ministry of Natural Resources (MNR) issued an absolute requirement to complete construction with minimal in-water work by the end of March, or first week of April, to avoid the spawning season of certain fish species. The Canadian Coast Guard issued a permit that required completion of construction by the second week of April, or another permit application would need to be filed. Approval was also required from the Niagara Peninsula Conservation Authority. The contract for the construction of the groynes accommodated all approval requirements, and called for the project to be completed between March 13 and April 30, before the 2000 boating season.

The precast concrete box culvert option was the preferred solution because:

- It promised little in-water work to avoid disturbing fish habitat;
- It could be constructed quickly within very tight permitting periods;
- It would function fully as a groyne to deflect water flows;
- It could be removed, if necessary;
- It would resist pressures from ice due to its mass; and,
- It would last for the full term of the design life of the project.

But the box units also had another advantage that the designers recognized. Submerged units could serve as fish habitat to enhance the ecology of the fishery in the harbour.

Both groynes were designed to accommodate a two-tier box culvert system at right angles from the existing concrete shoreline. Each culvert was comprised of three box units, and each groyne had one culvert placed on top of the other, for a total of six box units.

One groyne, located outside of the mooring basin, was 2400-mm wide x 1800-mm high x 2500-mm long (8-foot x 6-foot x 8.2-foot). The second, constructed inside the mooring basin, was 1800-mm wide x 1200-mm high x 2500-mm long (6-foot x 4-foot x 8.2-foot). The six units of each groyne had rip-rap boulders placed inside the units for ballast. The three submerged lower units were filled with loose bundles of pruned tree branches to provide a habitat for fish and aquatic animals. The end unit of the top culvert

The installation of 2400-mm wide x 1800-mm high x 2500-mm long (8-foot x 6-foot x 8.2-foot) precast concrete box units helped divert strong currents and water surges and provide a safer docking area for boaters.

on each groyne was capped to prevent the entry of ice and debris. Wooden bumper strips were placed along the sides of each upper unit for mooring watercraft. The end unit of the submerged culvert was not capped, so that fish could access the habitat of boulders and branches.

Stephens and Rankin staff has years of experience in the Welland Canal and Port Dalhousie area, and knew that the harbor bottom consisted of very soft material, that would not support the weight of the precast concrete box units. SHAL engineers had also considered the bottom material of the basin, and worked with Stephens and Rankin to design rock mattresses to support each of the groynes.

During the summer of 2000, boaters visiting the harbour and members of the yacht club enjoyed safe harbour of their crafts; and anglers were observed catching fish near the publicly accessible groyne located outside of the yacht club's mooring basin. Many members of the club have reported that mooring in the harbour has improved. With the use of precast concrete box culverts for groynes and the associated possibilities of enhancing aquatic habitat, a new application has been established for precast concrete products.

Project:	Dalhousie Yacht Club Groynes
Owners:	City of St. Catharines, Cindy Toth, Dalhousie Yacht Club, St. Catharines' Hydro-Electric Commission
Designer/ Consulting Engineer:	SHAL Consulting Engineers Toronto, Ontario
Contractor:	Stephens and Rankin Inc., St. Catharines, Ontario Brian Rankin Jerry Hayes
Quantities:	Six 2400-mm x 1800-mm x 2500-mm (8-foot x 6-foot x 8.2-foot) reinforced concrete box units Six 1800-mm x 1200-mm x 2500-mm (6-foot x 4-foot x 8.2-foot) reinforced concrete box units
Producer:	Centennial Concrete Pipe & Products Cambridge, Ontario

Centennial Concrete Pipe & Products is Canada's largest producer of precast concrete drainage system components. With three plants strategically located in Windsor, Cambridge and Ottawa, Ontario, the company serves all major market areas. The company's commitment to product quality is reflected in its ISO 9002 registration, and participation in the Canadian concrete pipe industry's Plant Prequalification Program. Centennial provides a complete range of concrete drainage products including all sizes of precast reinforced concrete pipe, box units, microtunneling pipe, manholes, valve chambers, catch basin/ditch inlets and appurtenances, plus Stormceptor® containment/separation systems.

South Dakota DOT Breaks New Ground with Reinforced Concrete Pipe

By Dan Painter, P.E.
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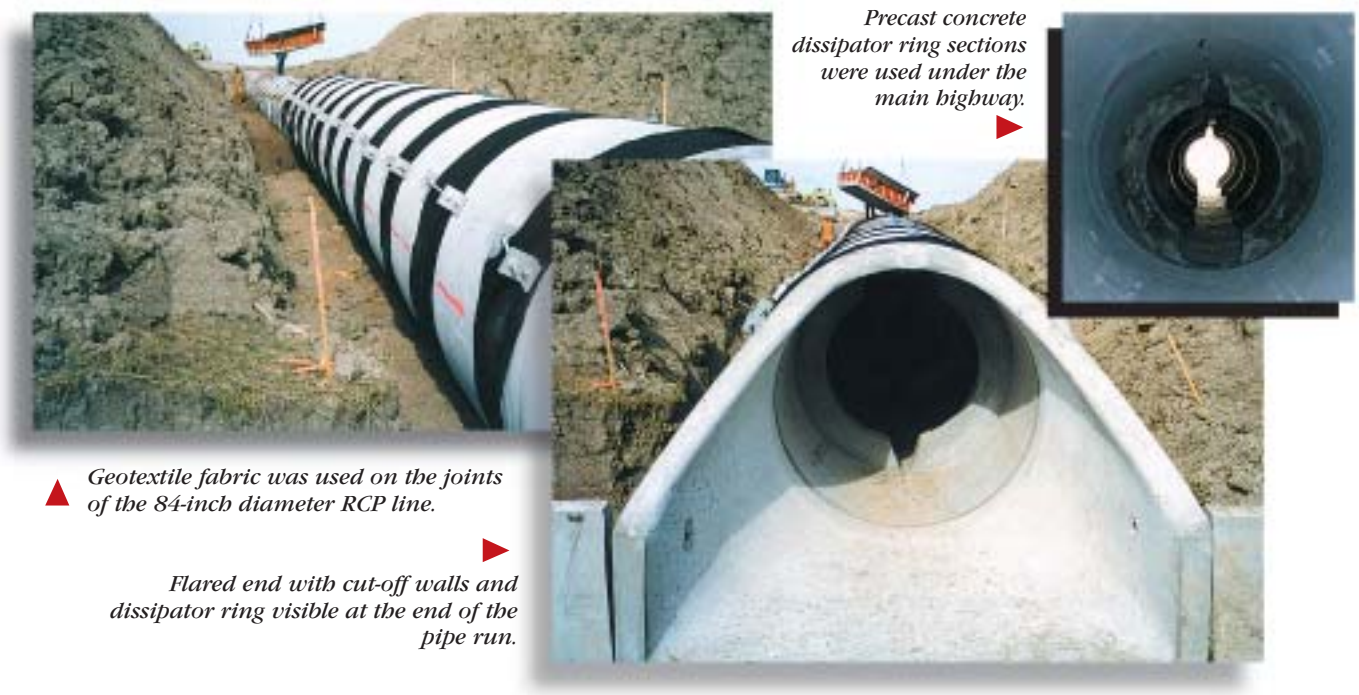
The South Dakota Department of Transportation made history with an emergency culvert pipe replacement project on Highway 34 in Buffalo County, South Dakota, east of Fort Thompson. This was the first time that the DOT designed reinforced concrete pipe (RCP) energy dissipator sections for use under a main roadway and used the new Standard Installation specification for installing the pipe.

South Dakota DOT engineers met the challenge of replacing two failed corrugated metal pipe (CMP) culverts, located 200 feet apart, that had reached the end of their service lives. They specified RCP that could accommodate an internal energy dissipator design. The local concrete pipe producer, South Dakota Concrete Products, of Pierre, SD, used the concrete pipe industry's PipePac 2000 software to determine a pipe design that could be manufactured in the shortest amount of time. The DOT engineers accepted the PipePac design, and the project commenced immediately to avoid any further deterioration of the roadway and disruption to traffic.

In early September of 1999, the outlet ends of the existing CMP culverts had partially collapsed and separated during a storm, eroding a 25-foot embankment up to the edge of the asphalt pavement. On September 13, the DOT contacted South Dakota Concrete Products to check on the availability of RCP for this emergency repair. The existing culverts were buried under approximately 26 feet of fill at the centerline of the roadway. Using the normal DOT bedding specifications, shear steel would have been required in the RCP, which would have added several weeks to the required production time while waiting for delivery of the shear steel.

South Dakota Concrete Products staff used PipePac to come up with a pipe bedding design that eliminated the need for shear steel. By using the Standard Installation Type 2 bedding, the use of shear steel was eliminated in both the 72-inch diameter and 84-inch diameter concrete pipe. This design allowed the pipe producer to go into production very quickly, after receiving approved shop plans on September 19, 1999. The first shipment of pipe arrived on site on October 18, 1999; the last on November 2, 1999.

Having met the challenge of delivery of the required quantities, sizes, and strengths of reinforced concrete pipe, the DOT took advantage of



Precast concrete dissipator ring sections were used under the main highway.

Geotextile fabric was used on the joints of the 84-inch diameter RCP line.

Flared end with cut-off walls and dissipator ring visible at the end of the pipe run.

a grading project being completed nearby by Schwiegert Construction. Through traffic on Highway 34 was already detoured one-half mile away because of the grading project, making the required road closure easier. The culvert pipe replacement project was change-ordered onto the existing grading project, thereby bypassing the normal contract tendering process. The change-order allowed the project to be completed prior to the end of the 1999 construction season. This is not common practice by the DOT, but circumstances called for a bold plan of action, and Schwiegert Construction had the experience to complete the job.

Each of the 72-inch diameter concrete culverts were sized the same as the culverts being replaced. However, the difference in the new concrete pipe installation was the inclusion of the energy dissipators between lengths of 84-inch RCP running up to the outfalls. The use of the precast dissipator rings between lengths of 84-inch diameter RCP solved significant outlet velocity problems. The rings were selected after review of energy dissipator options in the Federal Highway Administration's HY8 Hydraulics Program. One of the culverts had a 100-year flow of 344 cubic feet per second (cfs), and an outlet velocity of 29.6 feet per second (fps). The 84-inch dissipators reduced the outlet velocity to 11.2 fps. The second culvert had a 100-year flow of 328 cfs, and an outlet velocity of 25.3 fps. With the 84-inch dissipator pipe, the outlet velocity was reduced to 11.2 fps. This resulted in substantial savings in the size of the stilling basin needed for outlet protection.

All the pipe joints for the RCP culvert and dissipator sections were tied with specially designed tie-bolt assemblies. The 84-inch dissipators had joint seal around the entire joint, while the 72-inch pipe were installed with joint seal in the bottom third of the pipe. All joints were wrapped on the outside in geotextile fabric to prevent any possibility of migration of fines.

The Highway 34 culvert replacement project was completed successfully within a very short construction period because of the close cooperation between the South Dakota DOT engineers, the concrete pipe producer, and contractor. It is yet another example where reinforced concrete pipe was used in an innovative way by people willing to accept new age pipe design tools and bedding standards. The South Dakota DOT recognized the opportunity to develop a long-term solution using the latest in concrete pipe design and technology.

Project:	Highway 34 Pipe Replacement Buffalo County, South Dakota
Owner:	South Dakota Department of Transportation Dave Coley, P.E., Project Engineer, Bridge Design Office Kevin Goeden, P.E., Engineering Supervisor, Bridge Design Office Wayne Cramer, P.E., Huron Area Engineer Richard Philips, P.E., Hydraulics Engineer
Contractor:	Schwiegert Construction
Quantities:	60 linear feet: 72-inch diameter Class II, C wall RCP 184 linear feet: 72-inch diameter Class IV, C wall RCP 72 linear feet: 72-inch diameter Class V, C wall RCP 120 linear feet: 84-inch diameter Class III, B wall RCP Two: 72-inch diameter RCP flared ends with precast cut-off walls Two: 72-inch to 84-inch diameter increaser bushings Ten: 84-inch diameter dissipator rings Two: 84-inch diameter RCP flared ends with precast cut-off walls
Producer:	South Dakota Concrete Products, Pierre, S.D. Dan Painter, P.E.

South Dakota Concrete Products Company, a long time American Concrete Pipe Association member, has been manufacturing precast drainage products for the transportation industry for over 80 years. The company is part of the Cretex family of companies, which has its headquarters in Elk River, Minnesota. South Dakota Concrete Products manufactures round pipe, arch pipe and elliptical pipe in a variety of sizes from 12-inch diameter through 120-inch diameter, single cell box units from 6 foot x 3 foot to 14 foot x 14 foot, double cell box culverts from 2-7 foot x 3 foot to 2-14 foot x 14 foot, pre-stressed bridge beams up to 130 foot long, and a variety of manholes, inlets and miscellaneous precast items. More information can be found about South Dakota Concrete Products at www.cretexinc.com.

New Plant Produces

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installed properly, the project was successfully completed in the beginning of year 2000.

Awards Attest to Product and Plant Quality

During the year 2000, APACC added two local and one more international benchmark to the standards against which it measures itself. In the spring, a Gold Award in the Sheikh Khalifa Award for Industry was followed by an outright win in its class in the Sheikh Khalifa Award for Excellence.

The toughest challenge, however, came in December 2000, when the company was subject to a very stringent quality audit as part of the American Concrete Pipe Association's "Q-Cast" Plant Certification Program. Paul Krauss of Wiss, Janney, Elstner Associates, of Northbrook, Illinois led the quality audit. APACC became the first company outside the North American Continent to achieve the right to use the "Q-Cast" symbol on its pipes, and is believed to be the first in any field in Abu Dhabi to have its plant certified.

Advanced Pipes and Cast Company W.L.L. does not rest on its laurels. On the production side, research and development is continuing to produce jacking pipes for a project with a unique specification. Administratively, a completely new 'triangular' management system is being developed and autumn of 2001 is the target to have a single certificate which will encompass ISO 9001:2000, ISO 14001 and OHSAS 18001.

APACC has taken giant strides in the last four years by establishing itself in the marketplace, and achieving global recognition for its quality programs and precast concrete products. The firm is looking forward to even greater challenges, with confidence.

Global Growth

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metric equivalents. Updating the manual to include foreign standards will allow easier acceptance overseas and show that the ACPA is a global partner.

I would like to express my sincere appreciation to all the employees of Advanced Pipes and Cast Company (W.L.L.) for their wonderful hospitality and assistance during the audit. Their efforts in preparation for the ACPA certification audit and commitment to produce high quality concrete pipe is truly commendable. On behalf of ACPA's plant certification program and Wiss, Janney, Elstner, we welcome our new friends from the other side of the world.

With headquarters in Northbrook, Illinois, Wiss, Janney, Elstner Associates, Inc. (WJE), is a professional firm providing practical, innovative, and technically sound solutions to structural, architectural, and materials problems. Since 1956, WJE has completed more than 40,000 projects around the world for building owners, property managers, corporations, lawyers, universities, and governmental agencies. WJE employs more than 200 engineers, architects, and material scientists in seventeen offices located regionally throughout the United States. In 1997, ACPA selected WJE to provide auditing services for the Association's "Q-Cast" plant certification program. Paul Krauss, P.E., is a principal auditor and the primary coordinator of the program.

President's Message

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ducing the best pipe in the Middle East. Paul Krauss of Wiss, Janney, Elstner Associates, certified the plant under the Q-Cast Program, and describes his travels to the plant and certification in an accompanying article.

In Ontario, Centennial Concrete Pipe & Products Inc., supplied box units to a waterfront project that used them as submerged culverts to act as groynes, or current deflectors, and aquatic habitat at a prestigious yacht club on Lake Ontario.

Our third story deals with the use of specially designed concrete pipe culverts that also serve as energy dissipaters. South Dakota Concrete Pipe of Pierre, SD supplied the products for the culverts, and its staff used the Association's PipePac 2000 software to assist in the pipe design.

The contents of this issue reflect the global influence of the North American concrete pipe industry on local projects, and quality assurance of plants and products. Information moves quickly nowadays, and the new ideas and programs highlighted in *Concrete Pipe News*, makes this world just a little smaller when it comes to concrete pipe performance.

Don H. Schmidgall

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Schmidgall: When we meet with someone to talk about upgrading, we first talk about marketplace, diversity of products, and output to determine the appropriate level of automation for their plant. It is clear that several trends are driving the need for automation, and I see a higher level of automation being more and more appropriate for most pipe producers.

One of the major trends is our more competitive workplace environment — the challenge in hiring people to operate equipment, and then keeping them long-term. We need to provide pleasant, healthy, and safe workplaces to attract and retain employees.

When robotics and automation is used, unskilled jobs are eliminated. Typically, these kinds of duties are the most difficult to fill and results in a high level of employee turnover which makes it very difficult to operate efficiently, and consistently produce a quality product. Additionally, there is less damage to equipment caused by rough handling, fewer worker compensation claims, and overall, fewer man-hours per ton of output.

I believe that we'll continue to see automation play an increasing role in helping us produce more consistent quality, suppressing our unit costs, and providing an attractive workplace for our employees.

Q: *How will buyers and specifiers of precast concrete pipe benefit from production, or testing equipment, in the future?*

Schmidgall: Buyers and specifiers will benefit most with delivery of a product known for its consistent high quality, at a reasonable cost. This is the result of new in-plant technology and rigorous inspection of equipment and testing of products.

"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

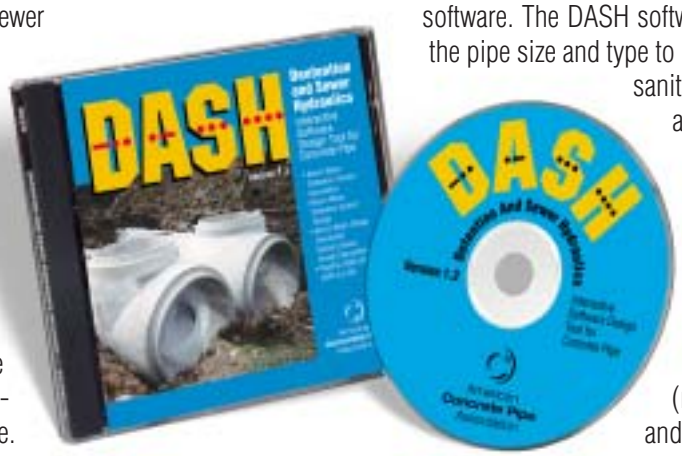
- Cayuga Concrete Pipe Company (Oldcastle, Inc.), Croydon, PA - George Stoffa
- Cayuga Concrete Pipe Company (Oldcastle, Inc.), New Britain, PA - Edward Pentecost
- Elk River Concrete Products (Cretex), Billings, MT - Milton Tollefsrud
- Kerr Concrete Pipe Company (Oldcastle, Inc.), Hammonton, NJ - Bob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

Sanitary Sewer, Storm Sewer and Culvert Pipe

- Advanced Pipes & Cast Company, Abu Dhabi, United Arab Emirates - Poul Jacobsen
- Amcor Precast (Oldcastle, Inc.), Nampa, ID - Mike Burke
- Amcor Precast (Oldcastle, Inc.) Ogden, UT - Tim Wayment
- Atlantic Concrete Pipe, San Juan, PR - Miguel Ruiz
- CSR Hydro Conduit Corporation, Tulsa, OK - Jeff Bassett
- Elk River Concrete Products (Cretex), Elk River, MN - Bryan Olson
- Geneva Pipe Company, Orem, UT - Fred Klug
- Kansas City Concrete Pipe Co. (Cretex), Shawnee, KS - Rich Allison
- N C Products (Oldcastle, Inc.), Fayetteville, NC - Preston McIntosh
- N C Products (Oldcastle, Inc.), Raleigh, NC - Mark Sawyer
- Ocean Construction Supplies Limited (Inland Pipe), Vancouver, BC, Canada - Rod Boyes
- Amcor-White Company (Oldcastle, Inc.), Ogden, UT - J. P. Conn
- CSR Hydro Conduit, Denver, CO - Ed Anderson

DETENTION AND SEWER HYDRAULICS DESIGN NOW A FLASH WITH DASH!

The American Concrete Pipe Association recently released its new interactive software for the hydraulic design of concrete pipe detention systems, storm drainage and sanitary sewers. Called DASH (**D**etention **A**nd **S**ewer **H**ydraulics) software, the interactive PC-based software was developed in conjunction with the Illinois Concrete Pipe Association (ICPA), Earthtec and Giffels Associates Limited.



DASH software provides design engineers and other users with a complete set of design tools to prepare, calculate and evaluate comprehensive storm water detention systems using concrete pipe. Using Microsoft's Windows format, the software program consists of four modules: Storm Water Detention Volume Calculation, Storm Water Detention System Design, Storm Sewer Design Calculation, and Sanitary Sewer Design Calculation.

In addition to the powerful design modules included with DASH, the program includes ACPA's popular PipePac 2000 software. The DASH software allows designers to select the pipe size and type to use for detention, drainage and sanitary systems, and perform a cost analysis of the system.

To order the DASH software, contact the ACPA Resource Center at (800) 290-2272, fax (972) 291-0622 and request Resource Item #15-500. The cost is $10.00 (ACPA member) and $45.00 (non-member), plus shipping and handling charges. All orders must be prepaid. Visa, MasterCard and American Express are accepted. For further information, contact the American Concrete Pipe Association, (972) 506-7216, or e-mail: info@concrete-pipe.org.

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