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concretepipejournal

WINTER2017

CCPPA Supports University of Manitoba Municipal Infrastructure Chair

The University of Manitoba Municipal Infrastructure Chair is a research program supported by the City of Winnipeg, the Province of Manitoba, and construction industry contractors, suppliers and associations. The Chair partners will work together to develop and test innovative solutions that will extend the life and durability of infrastructure, improve and harmonize design and construction practices, and reduce the risk of implementing new innovations to infrastructure owners and contractors.

The Canadian Concrete Pipe and Precast Association is supporting this important initiative with cash and in-kind contributions.

The Municipal Infrastructure Chair will accelerate R&D in the areas of design, construction, maintenance and management of municipal transportation infrastructure including roads and active transportation facilities. The Chair will also offer specialized training opportunities for engineering students and professional engineers, and increase the supply of highly-qualified professionals to the job market.

The funding of the five-year Chair program was announced in October 2016. Dr. Ahmed Shalaby, P.Eng was named as Chairholder.

Dr. Ahmed Shalaby is a professor of Civil Engineering and a professional engineer specializing in pavement design and highway materials. He has taught at the University of Manitoba since 1998, where he leads the Pavement Research Group. His research aims to improve the performance of road materials and pavement structures and to improve the maintenance and construction practices in Canada and around the world.

Dr. Ahmed Shalaby, P.Eng
(Photo: Winnipeg Free Press)

Dr. Shalaby believes that the condition of a road surface and the standards for road construction and maintenance of transportation networks play major roles in protecting the safety of road users, and are critical to providing an efficient and economically-viable transportation system for future generations.

The five-year Chair program is funded by one million dollars in cash, and up to one million dollars in in-kind contributions from all partners. Additional funding of $500,000 will be applied for under a federal collaborative research and development program.

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Flotation of Circular Pipe

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Paul Imm, P.Eng.
Director of Technical Services, CCPPA

Design engineers of buried structures appreciate the need for a comprehensive geotechnical investigation. In addition to determining the soil conditions below the surface, it is vital that the groundwater levels, including fluctuations throughout the year, be verified during the design stage.

While lightweight pipe materials such as corrugated steel or plastic are more prone to flotation, all buried pipe can experience flotation under a variety of installation conditions such as insufficient soil cover, a high groundwater table or in flood plains. Even concrete pipe, with a density of approximately 2.4 times that of water, could experience buoyant forces significant enough to heave the pipe and compromise the grade elevation or alignment.

Culverts under high embankments may also require suitable end treatments to resist buoyant forces if the culvert pipe projects significantly beyond the embankment limits and is subjected to high headwater or backwater elevations.

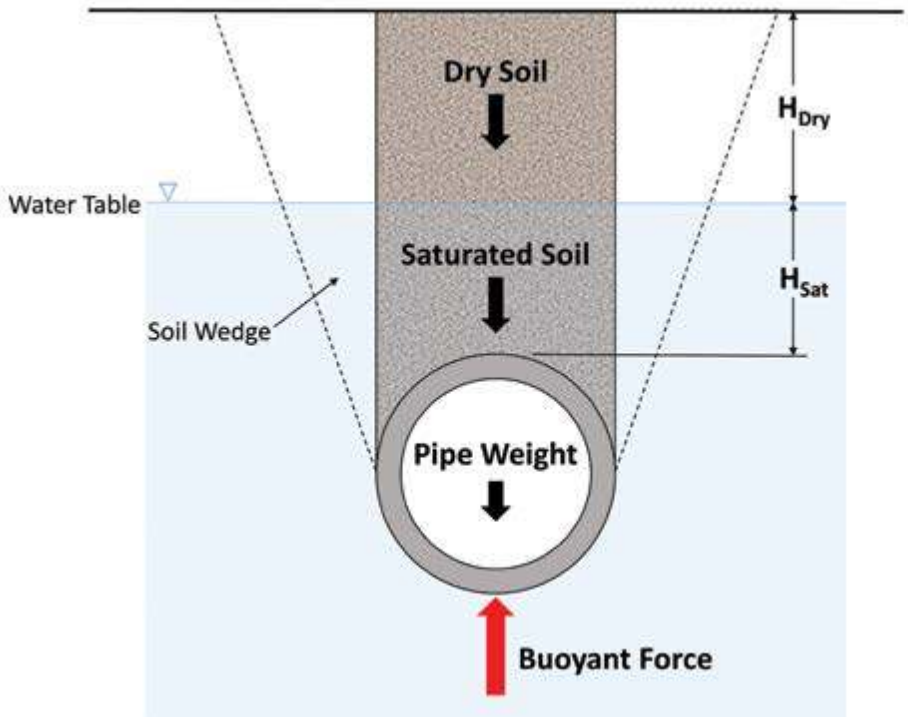

Figure 1 – Vertical forces considered for pipe flotation

High water table and low cover

Flotation Principle

The physical law of buoyancy, also known as Archimedes' principle, states that the upward buoyant force that is exerted on an object completely or partially submerged in a fluid is equal to the weight of the fluid displaced by the object.

In the case of a buried pipe where the groundwater encroaches into the pipe zone, flotation is normally determined by:

- Volume of groundwater displaced by the pipe;
- Weight of the pipe; and
- Weight of the backfill material over the pipe.

When the upward buoyant force on the pipe exceeds the downward force of the pipe weight and backfill weight, the pipe will rise or heave. Where flotation is a possibility, proper installation of the pipe is critical, and a preventative measure such as anchoring the pipe may be necessary. Figure 1 illustrates the acting vertical forces when the groundwater level is above a buried pipe.

Upward Buoyant Force

To estimate the upward buoyant force, the volume of displaced groundwater by the outside diameter of the pipe is multiplied by the density of the groundwater – typically 1000 kg/m^3 for fresh water and 1025 kg/m^3 for seawater. It is important to note that the use of a controlled low strength material (CLSM), commonly referred to as flowable fill, during construction will result in a greater buoyant force due to the higher unit weight of CLSM over water.

$$F_b = \frac{\pi D^2}{4} \times 1000 \ \ kg/m^3$$

Where:

F_b = weight of displaced water, kg/m of pipe
D = outside pipe diameter, m

Downward Pipe and Soil Weights

The weight of different pipe materials or wall profiles can vary greatly and can usually be found in design manuals or manufacturer's catalogues.

The unit weight of compacted backfill material varies with specific gravity, the grain size, and the level of compaction. For the unit weight of dry backfill above the water table, average values for saturated surface dry (SSD) density and specific gravity of backfill materials are commonly used. The unit weight of the saturated backfill soil below the water table is equal to the SSD density of the backfill minus the weight of water displaced by the solid particles.

Factor of Safety

In any design, a factor of safety is required to account for variations in the installed condition such as poor installation practices, unexpected external loads or natural disasters. For pipe buoyancy calculations, designers may use one overall factor of safety for flotation resistance. That is, the downward forces (soil and pipe) should be greater than or equal to a factor of safety times the upward buoyant force. Alternatively, another approach may be to use a reduction factor to decrease the weight of the backfill soil by dividing this downward force by a factor of safety ranging between 1.0 and 1.5. This would avoid being excessively conservative since backfill density is the one parameter that could lack uniformity, or have varying degrees of compaction.

Columbus, Ohio Airport – polypropylene pipe floating out of ground

Other considerations that make the analysis of buoyancy inherently conservative with additional factors of safety are the neglecting of skin friction between the pipe and soil, assuming an empty pipe and ignoring the weight of any effluent inside it, and only considering the weight of the soil column directly over the pipe to hold the pipe down. The reality is that a floating pipe must lift a soil wedge, as depicted in Figure 1.

The PERFECT PIPE for Infrastructure Challenges

Municipal inflow and infiltration reduction programs across the country have changed long-term expectations regarding the sustainability and resilience of sanitary sewers.

For example, York Region and its area municipalities have committed to implementing specifications and standards for inflow and infiltration in their existing and future sanitary sewer systems. Reducing inflow and infiltration is a high priority initiative with a budget of $100 million over a 20-year period.

PERFECT Pipe

Inflow and infiltration reduce the capacity of the sewage systems leaving less for existing residents and future growth. When sewage is diluted by water, treatment becomes less efficient. The cost of water to residents increases because plants are required to treat a higher volume of flow.

Another challenge within municipal sewage systems is microbial induced corrosion (MIC). A sanitary sewer that has a shallow gradient, with low flow velocity is an ideal environment for a slime layer to develop on the surface of the pipe below the water level. Anaerobic bacteria reduce sulphate to sulphide. Above the sewage level, the hydrogen sulphide gas is consumed by Thiobacillus, a sulfur oxidizing bacteria (SOB), which produces sulphuric acid that reacts with the exposed concrete surface causing corrosion.

To mitigate MIC and improve concrete durability, engineers reference CAN/CSA A23.1 and specify a C-XL exposure class in combination with other commercially-available admixtures and additives which may be unsubstantiated in their performance while adding cost to the production process.

A third challenge designers often face in Ontario, due to our increasingly built infrastructure resulting from continued population growth, is the need to fit sanitary sewer extensions into an already crowded underground space. Subsequently, sanitary sewers often need to be installed deeper with increased joint capacity. Open cut construction is disruptive to municipalities, businesses and the public, thereby opening opportunity for microtunnelling, which has seen continuous growth as a preferred construction option.

Con Cast Pipe worked with Schlusselbauer Technology GmbH & CoKG Austria to introduce PERFECT Pipe into the Ontario market to address the inflow and infiltration, microbial induced corrosion and microtunnelling challenges.

PERFECT Pipe combines the strength and structure of reinforced concrete pipe with the chemical resistance of high density polyethylene (HDPE), and a water-tight jointing system. PERFECT Pipe is manufactured in diameters up to 1200mm. The pipe is fully-protected with an HDPE liner that demonstrates superior abrasion resistance when compared to competitive products.

The HDPE liner protects the interior concrete surface from the damaging effects associated with corrosive gases and liquids that form in the sanitary sewer system by mitigating MIC and improving the durability and life cycle resilience of the pipeline.

PERFECT Pipe has a dual jointing system that seals the liner using a thermoplastic internal connector with dual elastomeric rubber gaskets joining pipe sections. No field welding is required. PERFECT Pipe is designed as a gravity pipe for use in open cut and microtunneling applications. The 1.65mm thick liner has 900 homogenously extruded anchors per square metre. The pattern increases in density toward the thermoplastic coupler to ensure that the liner is firmly anchored at the joint. Each anchor has a pull-out strength of 250 N (56 lbs) while providing an overall pull-out strength of 0.255 N/mm^2. Self-consolidating concrete is used in the production of PERFECT Pipe because of its wetcast properties that make it highly flowable, yet stable enough to spread easily into the formwork, thereby covering the anchors and reinforcement without any mechanical consolidation.

Con Cast Pipe is manufacturing PERFECT Pipe in 600mm, 900mm and 1200mm diameters with pipe classes of 65-D, 100-D and 140-D and a standard lay length of 3.0m. This lay length is 23% longer than typical reinforced concrete pipe which in turn reduces the number of joints and opportunities for infiltration. This difference is also important for microtunneling, since the jointing process is the only time when pipe jacking is stopped.

Aside from the chemical and abrasion resistance, the PERFECT Pipe also has an improved joint performance compared to traditional concrete pipe systems. PERFECT Pipe is especially suitable for specification where designers need to mitigate infiltration, exfiltration, corrosion or require deep bury sanitary sewers or micro tunneling.

Con Cast Pipe has commissioned the PERFECT Pipe manufacturing equipment at its Oakville, Ontario production facility and has added the PERFECT Pipe to its Plant Prequalification Certificate. Municipal wastewater infrastructure faces many challenges. PERFECT Pipe can be the first step in mitigating these sanitary sewer challenges by protecting pipeline assets, public health and the natural environment.

Flotation of Circular Pipe

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Hydrostatic Pressure for Structural Design

While a design check for pipe flotation is critically important, the hydrostatic load from external groundwater pressure can also affect the structural performance of a pipe. Hydrostatic load does not affect ring deflection in a flexible pipe; however, due to the low cross-sectional area of some thermoplastic pipes with a profile wall, hydrostatic loading should be calculated in all cases where the water table may be above the pipe springline since it can be a significant load on the pipe and contribute to wall thrust or buckling.

It is clear that groundwater can impact a buried pipe in more ways than creating a potential for flotation. Other risk factors include corrosion depending on the chemistry of the groundwater, infiltration, "piping" along a pipe barrel where migration of the surrounding soil could erode the soil support around the pipe, or soil liquefaction if a low-density soil becomes saturated and shaken from seismic events or nearby construction activity. Flotation problems could also be an unintended consequence of the rehabilitation of a sewer system to reduce inflow and infiltration (I/I), or from the introduction of Low Impact Development (LID) structures designed to manage storm runoff at the source and recharge the groundwater.

References:

1. Flotation of Circular Concrete Pipe. American Concrete Pipe Association, Design Data 22M.

2. Pipe Flotation. Advanced Drainage Systems, Technical Note TN 5.05.

2017 CCPPA Technical Seminars in Western Canada

The Canadian Concrete Pipe and Precast Association is offering six technical seminars in western Canada for both government agencies and consulting engineering firms.

This seminar series is the largest training event that the CCPPA conducts across Canada.

There is no cost to register, and breakfast and lunch will be provided.

Delegates will receive information that should help them to protect themselves both legally and professionally. The topics covered in the seminars include:

- Assessment of pipe systems
- Rigid and flexible pipe design
- Rigid and flexible pipe installation
- Trenching issues
- Precast Concrete Boxes
- Quality and inspection

Schedule:

January 31 – Winnipeg, MB
February 1 – Regina, SK
February 2 – Saskatoon, SK
February 14 – Prince George, BC
February 15 – Burnaby, BC
February 16 – Kamloops, BC

The seminars are entitled "PROTECTING YOURSELF AS A GRAVITY PIPE ENGINEER OR INSPECTOR"

These seminars have proven to be very useful for Design Engineers/ Technologists, Project Managers, Contract Administrators and Construction Inspectors.

To register visit www.ccppa.ca or email resources@ccppa.ca.

Professional Engineers Ontario Investigate Engineering Work Related to Nipigon River Bridge Failure

Nipigon River Bridge Failure
(Photo: Ashley Littlefield)

Professional Engineers Ontario (PEO), the licensing and regulating body for professional engineers and professional engineering in the province, initiated investigations related to the January 10, 2016 failure of the Nipigon River Bridge.

"As a regulator, it's our responsibility to investigate any possible engineering practice deficiencies related to the failure and determine if engineering work was carried out by appropriately licensed people and companies," said PEO Registrar Gerard McDonald, P.Eng. "This investigation is consistent with our mandate to govern PEO license and certificate of authorization holders, and regulate and advance professional engineering practice to protect the public interest."

As outlined in section 33 of the Professional Engineers Act, PEO's Registrar can initiate investigations in the absence of a complaint being filed, on reasonable and probable grounds that a PEO license holder or a holder of a certificate of authorization has committed an act of professional misconduct or incompetence.

Investigators appointed by the Registrar under Section 33 investigations are provided powers, similar to those provided to law enforcement officials under a search warrant, to enter the business premises of the license or certificate of authorization holder under investigation and examine anything relevant to the subject of the investigation. These investigations could lead to the discipline of PEO license or certificate of authorization holders.

As set out in section 38 of the Professional Engineers Act, all information relating to any investigation must be kept confidential. When matters or allegations are referred to the Discipline Committee for hearing, the discipline proceedings are generally open to the public.

About Professional Engineers Ontario:

Under the authority of the Professional Engineers Act, PEO governs over 85,000 license and certificate holders and regulates professional engineering in Ontario. PEO's mission is to regulate and advance the practice of engineering to protect the public interest. Its vision is to be the trusted leader in professional self-regulation. Professional engineering safeguards life, health, property, economic interests, the public welfare and the environment. Professional engineers can be identified by the P.Eng. after their names. Holders of limited licenses can be identified by LEL or LET after their names.

Vancouver North Arm Interceptor Project

Matthew deMediros, EIT
Technical Sales, Ocean Pipe, BC

The North Arm Interceptor Project involved the relocation of an existing Metro Vancouver owned sanitary sewer line located at 1041 SW Marine Drive. The new line was to be 1350mm diameter concrete pipe with a plastic lining to negate the potential for corrosion due to hydrogen sulphide growth. Construction began in late July and was completed in September 2014.

The project, although only approximately 72 metres in length, required careful design and planning prior to manufacturing the product. The project posed a significant challenge since the sanitary line was to remain in full operation throughout the entire construction process. Omni Engineering included two bypasses to account for this, one upstream and one downstream, in their design. Another challenge was that the two tie-in points between the existing line and the new line had to align perfectly. Ocean Pipe managed this challenge by drafting detailed CAD drawings showing how each individual piece would be manufactured and would fit into the larger scope of the project. The job consisted of twenty-one specialty/fittings pieces and thirteen standard lengths of straight pipe. A total of twelve single mitre bends, five manhole tees, two steel wyes off concrete pipe which were used to bypass the existing line into the new one, and four custom-length pieces were all created for this sanitary line.

Plastic lined concrete pipe and precast

Ocean Pipe chose to line the pipe using AGRU 2mm high density polyethylene liner. The AGRU liner was chosen for two reasons: the HDPE was stiffer than other products on the market which made it easier to work with during manufacturing, and the v-shaped anchor system, a patented AGRU system known as Sure-Grip, allowed for a more uniform embedment within the concrete pipe than other anchor systems.

Taking the Learning Outside the Classroom

Niagara College Students at Con Cast Pipe

Con Cast Pipe, Guelph, Ontario: Students from Niagara College's Construction Engineering and Civil Engineering Technician programs had the opportunity to tour the Con Cast Pipe plant in Guelph on September 3, 2016. There were 28 students from the Municipal Design class who participated in the plant tour. A few students were fortunate to have worked with concrete pipe based on prior work experiences, but for many others, the plant tour provided the opportunity to see first-hand how concrete pipe and other precast products for sewer, drainage, road and water are manufactured on a daily basis. The chance for students to see the actual products that they are learning to both structurally and hydraulically design in class was a great learning experience.

The Civil and Construction students were accompanied by Gilles Laroche (Program Coordinator) and Denise Van Osch (Professor) of Niagara College's Civil Engineering Program (Welland Campus). Each year, approximately 35 students graduate from both the Construction and Civil programs. Students in the 2-year Civil Engineering Technician program have the option to continue on in the Construction Engineering Technology program. Both programs are currently working on the process towards National Accreditation through Technology Accreditation Canada (TAC). Graduates from each qualify to become associate members of the Ontario Association of Certified Engineering Technicians and Technologists (OACETT).

Precon, Lethbridge, Alberta: On October 14th, 2016, 10 visitors from the faculty of Lethbridge College and partnered engineering firms toured Precon's manufacturing facility which is located near Lethbridge, AB. Scott Cunningham, Production/Systems Manager with Precon, led the tour. Jason Veres with Precon was also present during the tour to explain different quality control procedures and demonstrate a concrete cylinder compressive strength test for the group. During the tour, the visitors witnessed the dry cast production of different manhole components, and they also learned about various aspects of manufacturing precast concrete products including pre-benching of manhole bases and reinforcing cage assembly.

Joint CCPPA and ACPA 2017 Annual Meetings in Hilton Head, SC

The Canadian Concrete Pipe & Precast Association will hold its Annual General Meeting on March 20, 2017 for the first time at the same venue as the American Concrete Pipe Association Annual Meeting. It will take place at the Westin Hilton Head Island Resort & Spa from March 19 to 21. Most meetings of the CCPPA will be open to ACPA delegates who will be warmly welcomed.

In September 2016, Hurricane Matthew blew in from the Caribbean and rolled along the Atlantic coast of the Southeastern United States, leaving behind a path of destruction. Before weakening, Matthew slammed into Hilton Head, venue of the 109th Annual Convention of the ACPA, as a Category 1 hurricane with 75 mph winds.

Hilton Head had chosen precast concrete pipe for most of its drainage systems. Because of this choice, much of the transportation infrastructure remained intact, allowing first responders to react to emergencies without impediment, and cleanup crews to begin work immediately following the storm.

Hilton Head Island is an outstanding example of the resiliency of critical buried infrastructure and how a community can bounce back quickly - stronger than ever before - from an unexpected destructive force! The convention will highlight how precast concrete pipe and boxes withstood the impact of Matthew and how this experience should be referenced when marketing concrete pipe.

Public works officials from South Carolina will describe how the state reacted to the hurricane and the importance of infrastructure for safe and speedy evacuation routes. To conclude the education agenda, an FHWA representative will discuss reasons for using resilient construction materials.

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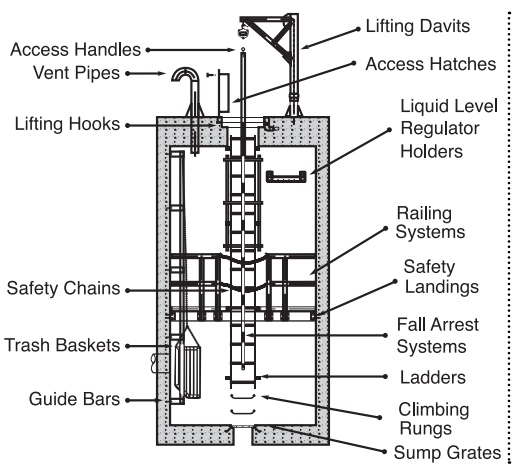

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Precast Box – Pedestrian Underpass Spans Two CN Rail Lines in Whistler, B.C.

Precast Box - Pedestrian Underpass

Thinking outside, or perhaps, inside the box. The use of precast box structures provides immediate structural capacity and space to any project, especially pedestrian underpass crossings of a railway.

Creus Engineering of North Vancouver was contracted by the Resort Municipality of Whistler and the developer, Mons Holdings, to design a pedestrian crossing that would span two vital Canadian National rail lines at mile 77.41, known as 'Mons Crossing'. The box underpass was to provide safe and suitable year-round pedestrian and bicycle passage to home and business owners located north of the rail line to Whistler Village by continuing the Valley Trail, the main pedestrian link in the Municipality of Whistler.

The underpass spans two active rail lines utilizing 48 sections of 3.60m span x 3.05m height x 1.25m lay length precast box sections weighing approximately 15000 kg each for a total length of 30.5m. At project completion the underpass was to be painted internally by a local artist for aesthetics and fitted with surface and subsurface drainage, to allow year-round use, and lighting to allow 24-hour use.

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

Standards including ASTM C1433, AASHTO, CSA, and AREMA E90 were addressed and met in the design for this project. All aspects of the box manufacturing including reinforcement, mix design, production process, curing, post production and loading were overseen by Langley Concrete Groups' quality control department. All precast products produced at the company's Q Cast Certified Chilliwack plant are monitored and verified by the Quality Assurance team daily.

Installation of the crossing provided some unique challenges such as poor soils, seasonally high water table, active rail lines (only a 15-hour construction window allowed by CN), pedestrian traffic and the broad range of weather conditions seen in this mountain resort. Box joint connections were designed to be watertight utilizing the Hamilton Kent Super- Seal Gasket. This durable self lubricated gasket is capable of sealing joints to 13 psi. All gaskets were installed at the plant reducing field preparation and installation time. In this particular project, 'post tensioning' of the box assembly was provided by the use of DYWIDAG threaded rods in each corner of the box structures. This was a requirement of CN to insure movement was restricted under the forces of the train loading combined with the shallow cover on top of the box structure.

CN Rail closed both tracks for 15 hours in order for the contractor to excavate, place suitable bedding soils, compaction, placement of box sections, backfill and reinstallation of both rail lines; a significant amount of work for this amount time.

Langley Concrete provided a JB Pipe Puller, a hydraulic puller capable of 25 ton pulling force, which assisted 'homing' the joints without creating unnecessary damage or pinching of the gaskets. Once the boxes are set in the proper position the puller simply pulls the joint home without using heavy equipment to push on or lever the box sections. The installation was completed and ready for the active train crossing in 12 hours, leaving time to spare.

This project provided a highly effective, cost effective structural solution for Whistler and the developer who had been considering a bridge prior to Creus contacting The Langley Concrete Group. Congratulations to the Resort Municipality of Whistler for the Valley Trail extension. Thank you to all the contractors and engineers who helped make this project such a success.

Box structures have been successfully used to provide solutions for use as fish ladders, manholes structures, culverts, detention/retention chambers and pedestrian crossings as a few examples.

On your next project, contact The Langley Concrete Group and allow us to help you investigate the possibility of using precast box structures to provide a solution as successful as the Mons Crossing.

Project Details:

Project: Valley Trail pedestrian underpass, Whistler, B.C.

Engineer: Creus Engineering Ltd, North Vancouver
Kevin Nealy, P. Eng.

Owner: Resort Municipality of Whistler (RMOW)

Contractor: CN Rail

Manufacture, plant: Langley Concrete, Chilliwack, B.C.

Box size: 30m of 3.6m (12') X 3.05m (10') sections

Precast box section staging area

Gene Shelestynsky Retires

Gene Shelestynsky, P.Eng.

Gene Shelestynsky, P.Eng., retired at the end of 2016.

Gene was the Consulting Engineer responsible for the Plant Prequalification Program and has conducted many audits in precast concrete pipe plants across Canada over the last 26 years.

He has been involved with this program since 1990. The program has since seen many changes over the years and there are 27 plants currently in the program.

Gene has worked closely with the industry in order to expand the program to include structural product made in accordance with the CSA A23.4 Standard.

Gene was a vice-chair of the Committee CSA Standard A23.4 – Precast Concrete – Materials and construction. He was also a member of the committee CSA A257 – Standards for concrete pipe and manhole sections. He participated on the CPCI Quality Assurance Council for a few years as well.

He obtained his Bachelor's and Master's degree in civil engineering, specializing in concrete technology, from the University of Western Ontario and began his consulting practice under the name of Procon Engineering Inspections Inc.

Prior to taking on the Plant Prequalification Program audits for concrete pipe, Gene was on contract to CSA for 16 years. At CSA he audited the precast concrete plants across Canada that produced architectural, structural and prestressed concrete products.

Gene consulted on many precast concrete projects for many precast concrete plant producers over the past 45 years, and had some participation in audits in the USA for the ACPA. He was also an auditing engineer for the RMCAO for approximately 10 years, doing Ready-Mix plant audits.

For a number of years Gene had a concrete repair company (The Concrete Doctor Inc.) doing architectural and structural concrete repair. We wish Gene a long and healthy retirement.

Canadian National Concrete Canoe Competition

Concrete Canoe Club depends on sponsors

The Canadian Concrete Pipe and Precast Association was a proud sponsor of St. Clair College in the Canadian National Concrete Canoe Competition that was held in Montreal in May 2016.

This event gives university and college teams, composed of students with a variety of different backgrounds, a chance to design, build and compete in their very own concrete canoe with pride. Students bridge the gap between hands on engineering and academics using the skills they have learned in the classroom to solve the complex challenges presented in designing and building a concrete canoe.

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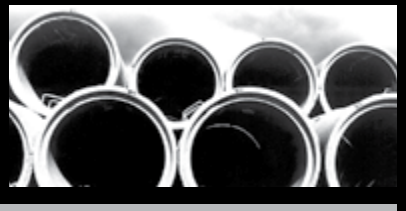

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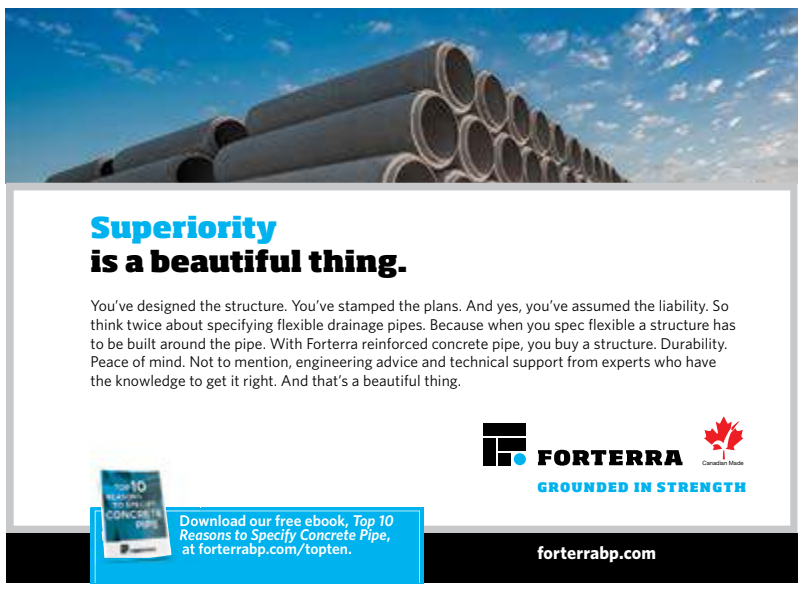
Website: www.jdindustrialsales.com
Contact: Drew Black

CCPPA news

CCPPA to Exhibit at OGRA's 2017 Conference

The CCPPA will exhibit at the 2017 OGRA Conference taking place from Sunday, February 26 - Wednesday, March 1, 2017 at the Fairmont Royal York, Toronto.

OGRA organizes and hosts the annual conference where approximately 2,200 municipal leaders from across Canada and transportation and public works leaders from around the world will come together to discuss topics of local, provincial, national and international importance. The goal is to invigorate public debate about how Ontario's municipalities will respond to emergent challenges and opportunities.

The mandate of the Ontario Good Roads Association is to represent the transportation and public works interests of municipalities through advocacy, consultation, training and the delivery of identified services.

Visit us at Booth #18.