

Regional Municipality of York implements new valve chamber design



*by Mark Eaton
Sales & Marketing Representative
Con Cast Pipe*

Valve chambers are structures associated with watermains that house a valve for regulating the flow of water, often redirecting watermain pipe when bends in the pipeline are required. They are often characterized as a chamber that contains a vertical stem from the location of the valve in the pipe so that maintenance crews can open or close a valve without having to enter the chamber. The engineering involved in the design of a valve chamber is complex, considering that the pipelines are under pressure and will move in the event that the valve is closed or opened. This movement must be restrained to maintain the integrity of the pipeline and to prevent any leaks or breaks at the valve chamber.

Precast concrete valve chambers have been produced in Ontario for decades, and used throughout the province. Originally, smaller circular chambers were used, but larger rectangular chambers have become increasingly popular over the past decade. Many municipalities had been using cast-in-place chambers for larger watermain pipe. Typically their standards included cast-in-place designs but not precast designs. Therefore, if a contractor elected to install a precast concrete chamber, in lieu the cast-in-place structure specified by the consulting engineer, he would have to work with a precast concrete producer to create an alternative design. With no precast concrete chamber standard to follow, the producer would try to match the cast-in-place standard by selecting a precast chamber that was reasonably close in size, and alter the design to suit. This led

to a variety of different results from different producers. It became evident that a separate standard for precast concrete chambers was necessary. Some municipalities, like York Region, excluded rectangular precast concrete valve chambers from watermain contracts until a satisfactory solution became available. Producers had to re-examine valve chamber technology to be able to develop the market.

In early 2001, Jason Spencer and Brian Clarke of Con Cast Pipe met with several office and field staff of York Region to document the problems that had been identified over many years with valve chambers. Clearly, the problems were industry-wide and not specific to any single producer. The Ontario Concrete Pipe Association (OCPA) whose staff worked with Con Cast Pipe, Hanson Pipe & Products Canada and Gamsby and Mannerow Limited, consulting engineers upgraded the design of valve chambers, and proposed a new technique for installation.

As a result of the initiative taken by the industry, Con Cast Pipe now has two precast concrete valve chambers installed as pilot installations in York Region. The new standard for the Region will limit supply of precast chambers up to 750 mm diameter watermains. This size limitation covers most of the industry specifications where a valve chamber is required, so the market for these products is substantially improved.

Design Challenges Revisited

When the Region's staff was first consulted, they noted the following concerns with the valve chambers:

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- Watertight joints are required to minimize infiltration,
- Quality of workmanship in the field – there was no way to accommodate thrust blocks on the precast structure to prevent movement of the pipeline. (Parging by the contractor was not effective),
- Aligning the pipe and the valve stem was difficult for contractors when a precast structure is supplied,
- Replacement of heavy valves when their service life has expired.

Proposed Solutions

The OCPA and Con Cast Pipe staff redesigned precast concrete valve chambers with the following major changes:

- Dowels to anchor the cast-in-place thrust block to the precast valve chamber. The dowels would hold the thrust block in place and solve the problem of the pipe moving under forces produced by the pressurized water when the valve was closed or opened.
- Suppliers may provide reinforcing mats to support the dowels in holding the thrust block in position on the valve chamber.
- Valve chamber manufacturers can achieve watertight joints with different products, including butyl and rubber gaskets.
- An insert is now included that has a sliding mechanism allowing a lifting eye to be moved to the ideal location (directly above the valve lifting point), to facilitate maintenance of the valve.

York Region's design criteria for precast concrete valve chambers

- Precast valve chambers can only be used on watermains which are 750 mm and smaller.
- Suppliers must supply prefabricated steel for reinforcement of thrust blocks.
- Valve chambers must have a rubber compound gasket.
- Standard sizes include (2400 mm x 1800 mm) and (3000 mm x 2400 mm) precast units.

- Valve chambers must have inserts and dowels in the wall to attach prefabricated thrust reinforcing.
- Inserts for dowels are also required around the doghouse opening on the inside to anchor the cast-in-place formwork.
- Valve chambers are to be benched to slope toward the sump in the base slab by the contractor.
- Loading design is according to the Canadian Highway Bridge Design Code, 3rd edition.
- A lifting block is to be installed on the underside of the flat cap to accommodate lifting of valves after installation of the chamber. The hook on the underside of the flat cap is actually an insert that accommodates a threaded lifting eye.

Precast concrete valve chambers are used when circular maintenance holes are no longer feasible. Con Cast Pipe valve chambers may be comprised of a base slab, riser sections in 0.305 m increments, and a flat cap or transition depending on the structure requirements.



The valve chambers are installed in a watermain being constructed as a component of the first phase of a new 50 ML/day water treatment plant in Willow Beach on Lake Simcoe. Completion of the first phase will see commissioning of a 20 ML/day facility in early 2003. With the pilot installations working well, development of a new industry-wide standard is the next task to be initiated by the OCPA. Drawings prepared by Gamsby and Mannerow will be submitted to the Watermain Committee of Ontario Provincial Standards for approval.