Industry Innovations
Concrete Pipe & Box Sections
What is Innovation?

A notable change in a product or method that creates new value in the form of convenience, quality, safety, cost savings, sustainability, and/or efficiency.
Innovation Fuels Progress
Risks of Innovation

Some inventions or product alterations may have unforeseen disadvantages

Galaxy Note 7
Improved storage capacity, larger screen, better battery life

Freon
“Miracle compound”
A safe alternative to other harmful refrigerant chemicals

Aircraft Manufacturer
Larger engine, same cockpit design for less training, improved fuel efficiency
Importance of Responsible Infrastructure Innovations

Infrastructure is the foundation which makes social and economic life possible. It connects people, communities, and businesses.
Product Innovation Phases

- **Invention**: Development of inherently new product
- **Upgrade**: Significant product alterations
- **Optimization**: Micro-enhancements resulting in small, but measurable benefits

Risk Levels:
- **High Risk**
- **Medium Risk**
- **Low Risk**
Concrete Pipe & Box Sections

Heavily researched infrastructure product line with responsible advancements.
Concrete Mix Designs

Innovations occur regularly

- Alternative concrete ingredients
  - Supplementary Cementitious Materials (SCM)
  - Admixtures
- Variations in ingredient ratios

Benefits

Improved production rate, safety, sustainability, aesthetics, product cost and service life
Concrete Mix Designs

Different production methods – consistency, repeatability, controlled environment

Wet Cast
- Standard Slump

Dry Cast
- Zero Slump

SCC
- Spread Test
Reinforcement

Research & technology improvements have let to incredible advancements

**Reinforcement Optimizations**

- Increased quality and performance of the reinforcement while also optimizing steel areas
- Reduced product weight and cost

**Technology Advancements**

- Safer, faster, and more precise production
- Less material waste, creating a more cost friendly and sustainable end product
Joints

Immense evolution & advancements of joint configurations & capabilities

Various Joint Advancements

Variety of joint & gasket types such as tongue & groove, flexible sealant, Confined O-ring, Single Offset, and pre-lubricated gaskets provide enhanced performance characteristics for all concrete pipe shapes.

Infiltration and exfiltration resistance, ability to accommodate lateral or longitudinal movement, continuity and smooth flow line and ease of installation.
# Production & Quality

*Innovative production methods have improved functionality and quality*

<table>
<thead>
<tr>
<th>Product Shape &amp; Size</th>
<th>Plant Automation</th>
<th>Quality Control</th>
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<tbody>
<tr>
<td>Boxes sections, arch &amp; elliptical pipe</td>
<td>Capabilities of individual machine or full plant automation</td>
<td>Quality assurance and control is the main focus of the industry</td>
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<td>Helps achieve added functionality</td>
<td>Increased quality, speed and safety of production</td>
<td>Improves quality and consistency of products</td>
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Standards & Design Aids

Research & technology improvements have let to incredible advancements

Development of Standards

Hundreds of standards established through organizations such as ASTM, CSA, ASCE, and AASHTO

Ensures product quality and consistency across the board

Design Tools & Programs

Developed to assist manufacturers and specifiers

Comprehensive designs for even the most complex projects with consistency, ease and time efficiency
Installation

Many advancements in the installation of concrete pipe and structures

Research & Standards Development

Development of installation requirements and procedures
Consistent and proven product installation nationally

Innovative Installation Techniques

Innovative installation techniques such as trenchless and flooded backfill installations
Safer, quicker and more disruption-free concrete pipe installations even for complex projects
Many Innovative Manufacturers

Hundreds of individual manufacturers all trying to gain a larger market share through improvements.

Only proven & effective innovations are adopted by other producers and implemented as standard.

Many Ongoing Research Projects

Seeking to improve the quality and efficiency of the reinforced concrete pipe of the future.

Examples include fiber-reinforced concrete pipe and efforts to mitigate microbial induced corrosion.

Research

While innovation fuels progress, research fuels innovation.
Recent Industry Innovations

- **2005**: ASTM C1619 & C1577
- **2005**: Flooded Backfill by Iowa DOT
- **2006**: Research on fatigue evaluation for RCB
- **2006**: ACPA Chairman Safety Awards
- **2008**: Tools for joint measuring equipment
- **2008**: Research on Shear Behavior in RCB
- **2010**: Production of welders to produce circular sheets
- **2010**: First curved microtunneling project in the U.S.
Consistent Advancements

- **1842**: First recorded install of concrete pipe in U.S.
- **1867**: Reinforced concrete is patented in U.S.
- **1896**: Slag cement in concrete production in U.S.
- **1896**: Reinforcement in concrete pipes
- **1896**: Pipe jacking under NP Railroad
- **1900**: Slag utilized more commonly
- **1905**: Tamp machine
- **1906**: RCP in the US
- **1906**: RCP for 24” and small 18”
- **1896**: Reinforcement in concrete pipes in U.S.
- **1906**: First Packerhead machine in U.S.
- **1906**: Centrifugal pipe production
- **1905**: RCP in the US
- **1905**: First recorded use of dry cast concrete in U.S. to make RCP
- **1916**: First Packerhead machine in U.S.
- **1916**: Double tamp machines
- **1918**: New method of centrifugal production
- **1920**: Annual pipe production 1,000,000 tons
- **1922**: Annual pipe production 2,000,000 tons
- **1925**: Centrifugal pipe production
- **1925**: Annual pipe production 1,000,000 tons
- **1930**: Centrifugal pipe production
- **1930**: Annual pipe production 2,000,000 tons
- **1930**: ASTM C76
- **1930**: Fly ash as SCM
Questions