Defining the Direction of Change: Mission 2030 and the CPCI Sustainable Plant Program

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CANADIAN PRECAST/PRESTRESSED CONCRETE INSTITUTE
INSTITUT CANADIEN DU BÉTON PRÉFABRIQUÉ ET PRÉCONTRAINT
“Need to slow the growth rate of GHGE and then reversing it is the key to addressing climate change and keeping global average temperature below 2°C above pre-industrial levels.”
Concepts are not enough
Rating Systems and Municipal Programs are not enough

Complex problems can’t be solved by making random moves...

EPD
Environmental Product Declarations

EPR Policies
Extended Producer Responsibility
HOW Great Leaders Inspire Everyone to Take Action

Conventional Path

Change Strategy
Communication
Integration & Education
Tools & Support
Research & Technology

Remarkable Change

Regulations
Standards
Certifications
Ratings
Initiatives – i.e.:
Mission 2030

WHAT

Resource Efficiency

WHY

Great Leaders
Inspire Everyone to Take Action
WHY: The purpose, cause or belief, the driving motivation for action

A problem growing at an alarming rate
WHY: The purpose, cause or belief, the driving motivation for action
Underestimated methane and black carbon

Construction Waste Landfill
Medicine Hat Alberta
Fire prompts evacuation, state of emergency

References: What a Waste – A Global Review of Solid Waste Management
Blog: Why We Need to Pay More Attention to the Role of Landfills in Global Warming
WHY:  The purpose, cause or belief, the driving motivation for action
The need to define zero waste and understand “greenwashing”
HOW: the CRI Council guiding principles to realize the WHY

- Change Strategy
- Communication
- Integration & Educations
- Tools Support
- Research & Technology

Image Reference: How great leaders inspire great actions
Ref.: Simon Simek, Golden Circle
HOW: the CRI Council guiding principles to realize the WHY

**Change Strategy and Management**

1. Defining the direction of change
2. Overcome inertia
3. Taking the 1\textsuperscript{st} steps:

   - Awareness
   - Desire
   - Knowledge
   - Ability
   - Reinforcement
With this document, our organization sets out a framework to build policies that will help our building industry sector to change how it views and deals with waste and recoverable resources.

Having reviewed the information provided by the Construction Resource Initiatives Council (CRI Council), we understand and share the need for the following:

- A clear strategy with a clear direction and vision of the objectives is necessary for the building industry.
- Communication between all stakeholders is critical for change alignment.
- Integration and education should be paramount to minimize change costs and maximize industry transformation.
- Research and technology will help us make sound decisions on internal policies and support those by other decision-makers affecting our sector.
- Tools and support enabling stakeholders to fast-track industry change.

We are committed to doing all that is within our power and capabilities to support the Mission 2030 call to action and change initiative – aimed at decreasing the concept of building waste, within our sector, respecting the waste hierarchy.

Therefore, we will carefully consider all of our decisions in respect to building project delivery methodologies, building and product design, practices, purchasing policies, operations, and maintenance, in order to minimize the life cycle of materials related to construction, renovation, and demolition, as follows:

- 2013: Ensure that we have a clear understanding of our direct and indirect waste production.
- 2015: Minimize our waste generation. Adopt industry accepted measurable and verifiable policies.
- 2020: Set our Construction and Demolition (C&D) related waste reduction to landfill targets.
- 2025: Zero C&D Waste to Landfill, nearly or devoid.

We make this pledge, understanding that:

- the transformation from our current industry project delivery models, policies, and practices to those supporting a circular economy, that presents opportunities and challenges, which we must seize or address together, and as a whole in order to maximize synergies, and minimize trade-offs.
- the CRI Council is a start-up non-profit and non-partisan organization, and that we will not hold them, or any of their members responsible for any of the information provided on the web site, communication or otherwise, which may not meet our expectations.
- this is a collaborative effort with various views, and that Mission 2030 is in essence a “journey”, which will present unexpected factors, potentially requiring an adjustment of the targets, with the principle objective of engaging as many stakeholders as possible, to acknowledge their role and current waste generation – taking the first step.

www.cricleCouncil.com
International Contest
SCRAP to ART
October 2, 2013

Contest Objective: Integrate the building industry with the art community to raise awareness of Mission 2030 and the importance of collaborative creativity

EVENT

This unique project is inspired by Tori B Designs, creator of the Mission 2030 jewelry collection and is aimed at all people over the age of 18.

The full contest details and schedule will be officially announced as part of the Ottawa Architecture Week events.

Join us on October 2, 2013 for art silent auction, at St-Brigids Centre for the Art – 310 St-Patrick St., Ottawa and learn more.

For more information call 613-795-4632 or email info@cricouncil.com

The Art Categories: Wearable, Residential, Commercial; Industrial and Landscape

Confirmed judges: Rosanne Bilanger, Artist; Douglas Cardinal, Architect; David Newman, President, ISWA; Paula Murray, Potter; Carroll Thatcher, CFM, IFMA Fellow
HOW: the CRI Council guiding principles to realize the WHY

Communication

- www.cricouncil.com ✓
- Linkedin Groups ✓
- Twitter & Facebook ✓
- Crowdsourcing ✓

"The best way to have a good idea, is to have a lot of ideas”
Linus Pauling

Image: www.smarterer.com
Waste Management to Resource Management
3R to 5R
Recycling and Landfill to Safe Cycle and Final Sinks
Pay Now or Pay Later to Invest Now or Be Liable Later
Integration and Education

✓ Waves of Change, Train-the-Trainer
✓ Resource Planning & Waste Management
✓ Resource Efficiency & Rating Systems
✓ Lean Manufacturing & Lean Supply Chain
✓ Lean Healthcare
✓ Lean Design & Construction
✓ Greenwashing Monsters
✓ Waste Management Planning
✓ Design for Disassembly and Adaptability
✓ Deconstruction

Tell me, I may forget,
Show me, I may remember;
Include me and I will understand;

Chinese Proverb

http://www.cricouncil.com/?page_id=259
CRI Council Education Program aligned w/UNEP-SBCI (United Nations Environment Programme-Sustainable Built and Climate Initiatives) Guidelines on Education Policy for Sustainable Built Environment
Waves of Change Workshop Series

Starting with

How Responsible Design Can Help Win More Business

- **Waves of Change** represent both a danger – and an opportunity. Find out what the coming change tsunami in the building industry is and how you can take advantage of it.

- **Responsible Design** – Beyond Energy Efficiency: What is it and is it valuable?

- **Defining its Value**: To you and your customer

- **Using Responsible Design** to Increase Your Business: An easy-to-implement messaging template
Partnership for LearnTech Programs

- Lean Manufacturing
- Lean Health Care
- Lean Certification
Tools and Support

✓ Waste Management Planning
✓ Waste Saver Mobile APP
✓ Mission 2030 Reference Guide
✓ Virtual Green Product Library
✓ BIM (Building Information Modeling)
✓ Online Waste Management Planning, Tracking & Reporting
WASTE SAVER Mobile APP for iOS and androids

Mission 2030 Guide: A thought provoking document on:
• Why Zero Waste
• How Zero Waste is Possible
• What Can You Do

Addressing
• Lexicon and Semantics
• Best Practice Approach
• Debates, Challenges, Opportunities
• Study Case and Other References
• Evaluating Products and Systems
• Policies, Standards, Guidelines and Initiatives
• Material Consumption and Production Patterns Facts
• Waste/Resource Minimization Planning/Management
• Big Questions – Straight Answers on Practices in various sectors
• Nanotechnologies and Hazardous Chemicals.

Research and Technology

• Construction Waste Management
• Life Cycle Assessments (LCA) – Precast Concrete
• Research on Natural Resources & Building Materials
  - Drywall Recycling in NCR
  - Drywall Recycling in Agricultural Sector
  - Interior Retrofits for Health, Safety and Zero Waste Impact Growth
  - Other materials, including Cement, Wood, PVC, Aluminum, Gravel, Potash, Roofing, Insulation...

• Emerging Technologies

http://www.cricouncil.com/?page_id=1778
Do You Know...

- **How much waste** YOUR decisions and actions generate?
- **Where** does that waste go?
- If you do, **how can you help change** the way industry views and deals with resources, starting with waste?
- If you don’t, **why are you waiting** to take the first steps to find out?

- **Where does resource/waste management start?**
- **Who is responsible for the building or demo permit?**
In the words of Winston Churchill: “I never worry about action, only inaction”

For More Information on the CRI Council and Mission 2030:
Visit [www.cricouncil](http://www.cricouncil)
E-mail [info@cricouncil.com](mailto:info@cricouncil.com)
Or, call 613-795-4632

Please help us help others take action and walk the talk...
Meeting the 2030 Challenge: Reducing Resources and Waste Through Benchmarking and Optimization

CPCI Sustainable Plant Program
CPCI Sustainable Plant Program

Canadian Precast/Prestressed Concrete Institute (CPCI) launched the Sustainable Plant Program in 2012. The program builds on the LCA for precast commercial buildings which included an analysis of the manufacturing stage for precast elements.
Program Overview

The program is designed to encourage continuous improvement and compliance to environmental and sustainability regulations and standards.
Why A Sustainable Plant Program?

• Sustainable Development is seeing an ever increasing importance in infrastructure development and our evolving businesses.

• Precast concrete has many attributes that can be tuned/aligned to meet today’s and future needs.

• Transparency and integrity are critical to owners, decision makers, and regulators.
Value Proposition

• The CPCI Sustainable Plant program is a tool that is extremely important:
  – It demonstrates our industries' **commitment** to Sustainable Development.
  – It provides the structure to **benchmark** and identify opportunities to reduce our environmental impact.
  – It will assist governments in the development of regulations.
Value Proposition

- **Plants Benchmark** by: product, by quarter, by facility.
- Drives plant and facility **efficiencies** in resource and energy consumption.
- Provides reliable data to **assist owners** in their infrastructure improvements.
- Provides **meaningful information** to owners by **product** and **by project**.
CPCI Sustainable Plant Program

The program is two faceted:

1. **Sustainability** - Tracking and Benchmarking GWP, TPE and Water Use in CPCI member Precast Plants
   - Software developed by **Athena** to calculate the plant environmental key performance indicators

2. **Environmental Compliance** – Tracking and Benchmarking compliance to dust, water (waste and process) and noise.
SUSTAINABLE PLANT SOFTWARE

Developed By the Athena Sustainable Materials Institute (ASMI)
CPCI Sustainable Plant Performance Report

SECOND QUARTER 2013

CPCI SUSTAINABLE PLANT PERFORMANCE REPORT

CPCI SPP 13 – 03

SUSTAINABLE PRECAST PLANT PROGRAM
Industry Summary - Plant Profiles

- Each plant has its own unique profile for energy use, total primary energy and global warming potential (GWP shown below)

<table>
<thead>
<tr>
<th></th>
<th>Contribution from Raw Materials</th>
<th>Contribution from Raw Material Transportation</th>
<th>Contribution from Precast Plant Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry Average</td>
<td>78.3%</td>
<td>3.6%</td>
<td>18.1%</td>
</tr>
<tr>
<td>High</td>
<td>92.1%</td>
<td>4.7%</td>
<td>30%</td>
</tr>
<tr>
<td>Low</td>
<td>68.3%</td>
<td>1%</td>
<td>6.2%</td>
</tr>
</tbody>
</table>
CO2 eq. by Life Cycle Stage

Global Warming Potential by Lifecycle Stage

- Contribution as a percent of total

Plant:
- 1
  - Plant Operations: 5%
  - Raw Materials: 5%
  - Transportation: 90%
- 2
  - Plant Operations: 30%
  - Raw Materials: 5%
  - Transportation: 70%
- 3
  - Plant Operations: 5%
  - Raw Materials: 90%
  - Transportation: 5%
- 4
  - Plant Operations: 30%
  - Raw Materials: 5%
  - Transportation: 70%
- 5
  - Plant Operations: 5%
  - Raw Materials: 90%
  - Transportation: 5%
- 6
  - Plant Operations: 10%
  - Raw Materials: 90%
  - Transportation: 5%
Sample: CO2 eq. by Life Cycle Stage and by Material

CO2e Emissions by Life Cycle Stage (kg CO2e/mton of precast)

- Raw Materials: 390
- Raw Material Transportation: 25
- Plant Operations: 180

CO2e Emissions by Material (kg CO2e/mton of precast)

- Portland Cement: 165
- Pigments: 78
- Rebar: 59
- Strand: 58
- Brick: 25
- Granite: 22
- Fine Aggregate: 5
- Other: 5

(CPCl)
The software also tracks TPE by Life Cycle Stage

**Total Primary Energy by Lifecycle Stage**

- Plant Operations: 53.9%
- Raw Materials: 5.9%
- Transportation: 40.2%

**Primary Energy by Life Cycle Stage (MJ/mton of precast)**

- Raw Materials: 4,780 MJ/mton
- Raw Material Transportation: 342 MJ/mton
- Plant Operations: 3,139 MJ/mton

**Total Primary Energy by Life Cycle Stage (%)**

- Raw Materials: 53.9%
- Plant Operations: 40.2%
- Raw Material Transportation: 6.9%
Plants also profile their “Plant” Water Use – Batch, Wash & Upstream

Water Consumption by Process

- **Contribution as a percent of total**

<table>
<thead>
<tr>
<th>Plant</th>
<th>Upstream Process Water</th>
<th>Wash Water</th>
<th>Batch Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example of Plant Water Use – Batch, Wash & Upstream

Water Use (%)

Batch Water: 4%
Wash Water: 38%
Upstream Process Water: 58%
"ENVIRONMENTAL MEASUREMENTS" SHEET; Includes tracking of Waste, Dust, Storm water, Chemical, Waste Water, as well as Noise Measurement and Evaluation.
Internal/External Partnerships are Key

1. Working with our upstream supplier partners
   - Raw Materials
   - Energy
   - Water

2. Working with our production teams
   - Air Emissions
   - Water Emissions
   - Land Emissions
   - Other Products
Meeting the 2030 Challenge:

Sample Plant Initiatives Arising from the CPCI Sustainable Plant Program
Sustainable Plant Program Update
Case Study: Lafarge, Winnipeg
CPCI Summer Meeting, Sustainability Committee
by Dawn Fraser
Lafarge & the Sustainable Plant Program

Getting Past the First Hurdle

- **Team approach**
  - Management
  - Operations
  - Accounting
  - Project Managers

- **Baseline data collection**
  - Finding the Data
    - Utilities
    - Material Inputs
    - Transportation
  - Compiling & Tracking
  - Streamlining collection
Lafarge & the Sustainable Plant Program

Next Step

- **Analysis**
  - Understanding what you're looking at
  - Macro and Micro views

- **Education**
  - MB Hydro
  - Canadian Industry Program for Energy Conservation (CIPEC)

![Chart showing Total Primary Energy by Life Cycle Stage](chart.png)
Lafarge & the Sustainable Plant Program

Improving Plant Efficiency

• Energy Audits
  – Identifying Efficiency areas
  – Incentives
  – Payback periods

• Environmental Performance Measures
  – BMPs

CPCI Summer Meeting
May 28, 2013
# Sample Lafarge Energy Improvements

<table>
<thead>
<tr>
<th></th>
<th>Demand Savings</th>
<th>Energy Savings</th>
<th>Incentive amount received</th>
<th>Est. Total Cost of Savings annually</th>
<th>Est. Payback Period - years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting Hollow Core Induction Fixtures</td>
<td>23.4 Kw/month</td>
<td>158,000 KwH/year</td>
<td>$23,000</td>
<td>$8,000</td>
<td>2.0</td>
</tr>
<tr>
<td>Motion Sensor Lighting Main Office</td>
<td></td>
<td>8,000 KwH/year</td>
<td>$1,000</td>
<td>$400</td>
<td>1.0</td>
</tr>
<tr>
<td>Lighting Florescent upgrades</td>
<td>6.6 Kw/month</td>
<td>36,000 KwH/year</td>
<td>$6,600</td>
<td>$1,800</td>
<td>2.5</td>
</tr>
<tr>
<td>Natural Gas Optimization Direct Fired Water Heater</td>
<td></td>
<td>29,300 m3/year</td>
<td>$8,800</td>
<td>$7,500</td>
<td>8.0</td>
</tr>
<tr>
<td>Performance Optimization Compressor</td>
<td>9.7 Kw/month</td>
<td>18,000 KwH/year</td>
<td>$3,700</td>
<td>$1000</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>39.7 Kw/month</td>
<td>220,000 KwH and 29,300 m3</td>
<td>$43,100</td>
<td>$18,700</td>
<td></td>
</tr>
</tbody>
</table>
Future Opportunities

• Energy
  – Next reachable branches
  – Closer monitoring

• Water
  – Water Audits

• Waste
  – Waste Audits
  – Closing the loop

• Innovation
  – Leveraging ‘low hanging fruit’ to get bigger results
Meeting the 2030 Challenge: Reducing Waste Through Optimal Design

Precast Concrete Architectural and Structural Design Examples
Ultra High Performance Concretes
Thinner Sections; Reducing Construction Materials

Reference
First Use of UHPC
Thin Precast Concrete Roof Shell for Canadian LRT Station
Enzo Vicenzino, Gerry Culham, Vic H. Perry, Don Zakariasen, Terry S. Chow
PCI Journal, V. 50 no. 5, September/October 2005
Today’s UHPC: Efficient Bridge Design
Minimizing Construction Materials

- UHPC Pier Column Shells
- **Traditional Pier Caps Eliminated** with UHPC “Pier Cap Beam”
- The Hodder Avenue Underpass (2013) is the first structure in North America to incorporate precast UHPC pier cap and pier column shells along with high-performance precast concrete box girders, parapet walls and approach slabs.
THREE DIMENSIONAL MODELLING

Reference
A Target Benchmark
Impact of Three-Dimensional Parametric Modeling in Precast Construction
Rafael Sacks, Charles M. Eastman, Ghang Lee, David Orndorff
PCI Journal, V. 50 no. 4, July/August 2005
Today’s Precast Structures Routinely Utilize “BIM”

• Allows the precast team, (estimating, engineering, production and erection) to visualize and assist with design development of the structure – reduces waste through reduction of on-site errors
Integrated Design: Total Precast Structure and Hollowcore Flooring
Reducing on-site Form and Ductwork
High Performance Enclosures: Double-wythe insulated panels - eliminating the need for stud wall framing and insulation trades on the exterior envelope
Designing Disaster Resilient Structures
Minimizes Waste in the Aftermath of Catastrophic Storm Events

Resilience: “Ability of a System and its counterparts to anticipate, absorb, accommodate or recover from the effects of a hazardous event in a timely and efficient manner”

Source: IPCC (2012)
Architectural Considerations

Master Mold Concept – Reducing resources and Plant Waste

Maximum number of reuses per project
Changes through pre-engineered molds
Next Steps: Product Category Rules (PCR) and Environmental Product Declarations (EPDs)

The Canadian Precast/Prestressed Concrete Institute (CPCI), National Precast Concrete Association (NPCA) and Precast/Prestressed Concrete Institute (PCI) have hired ASTM to produce a third party verified industry Product Category Rule (PCR) for North American precast concrete; intended for use in the development of precast concrete Environmental Product Declarations (EPDs).

Precast PCR and EPDs will be available in 2014.
CPCI Precast Concrete Certification and Sustainable Plant Programs

Leading the Construction Industry in Quality and Sustainability Stewardship
For More Information

For More Information on the CRI Council and Mission 2030:
Visit www.cricouncil
E-mail info@cricouncil.com
Or, call 613-795-4632

www.cpci.ca

- Life Cycle Assessment of Precast Concrete Commercial Buildings Technical Brochure
- LCA Product Transparency Brochure
- Sustainable Plant Program Brochure
- CSCE 2012 Paper - LCA for Sustainable Design of Precast Concrete Commercial Buildings in Canada
- TAC 2013 Paper - Implementation of GHG Tracking Software for Sustainable Transportation Infrastructure Projects
THANK YOU

www.cpci.ca