

# ECOSMART™ CONCRETE Project

a concrete contribution to the environment

Michel de Spot, P.Eng.  
President & CEO,  
ECOSMART Foundation

Concrete Technologies for Sustainable Buildings  
Vancouver, November 23, 2006

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## Concrete & Cement



Cement production accounts for more than 90% of the energy used to make concrete

Producing 1 tonne of cement emits about 1 tonne of CO<sub>2</sub> and other CAC in smaller quantities.

8% Air  
11% Portland Cement  
41% Gravel or Crushed Stone (Coarse Aggregate)  
26% Sand (Fine Aggregate)  
14% Water

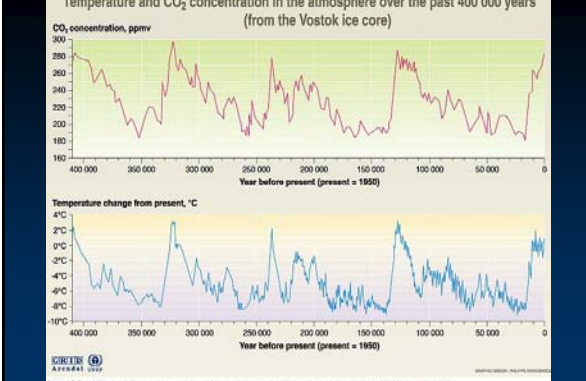
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## One Tonne CO<sub>2</sub>



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## Temperature and CO<sub>2</sub> concentration in the atmosphere over the past 400 000 years (from the Vostok ice core)



CO<sub>2</sub> concentration, ppmv

Temperature change from present, °C

Source: J.P. Petit, et al. (1999), 'Atmospheric CO<sub>2</sub> concentration and temperature 400 000 years before present from the Vostok ice core in Antarctica', Nature 399 (6791), pp 921-926, 1999.

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## CO<sub>2</sub> concentration in the atmosphere: Mauna Loa curve



ppmv

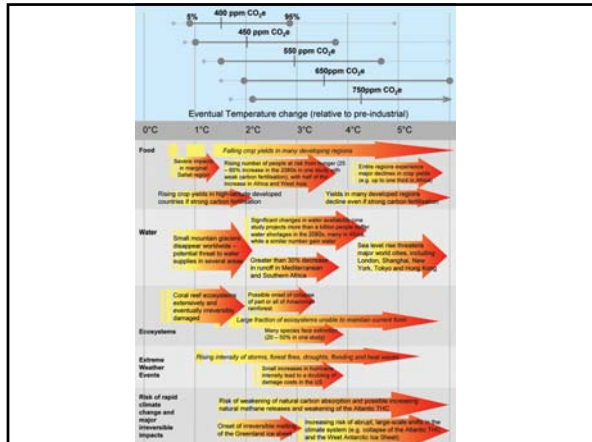
— Monthly average  
— Annual average

Source: Scripps Institution of Oceanography (SIO), University of California, 1998.

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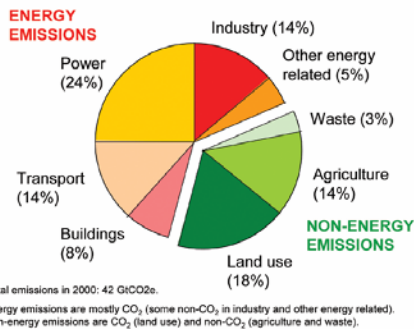
## Stern Review

- Current level is 430 ppm from 280 ppm (pre-industrial)
- If GHG emission did not increase, it will reach 550ppm by 2050
- 550 ppm → 77% of 2° C increase
- If GHG emissions continue to raise, this level will be achieved by 2035
- Costs to stabilize CO<sub>2</sub> to 550 ppm by 2050 will be about 1% of world GDP
- Weak response in the next 10-20 years will make it impossible economically to reach this level

Stern review on climate change: <http://www.hm-treasury.gov.uk>

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Figure 1 Greenhouse-gas emissions in 2000, by source



Source: Prepared by Stern Review, from data drawn from World Resources Institute Climate Analysis Indicators Tool (CAIT) on-line database version 3.0.

## EcoSmart Concrete Objectives

To minimize GHG "signature" of concrete by optimizing replacement of Portland cement with Supplementary Cementing Material such as fly ash while improving or maintaining

- Cost
- Performance
- Constructability



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## SCM: Zero (or low) GHG



## Benefits of SCM Concrete

1. Stronger and more durable concrete
2. Easier to place and to finish.
3. SCM costs less to produce than cement
4. GHG reduction and credits: 1T of SCM reduce GHG emission by up to 1T.
5. Superior appearance.
6. Address cement shortage.



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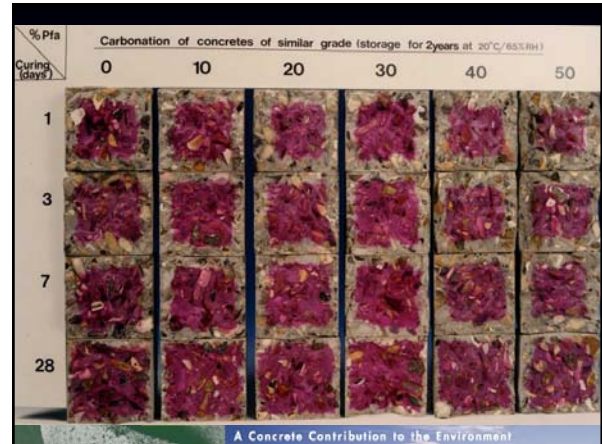
## Risks of SCM Concrete

1. Slower setting time particularly in cold climate
2. QA/QC is particularly important
3. "Fly ash makes good concrete better ....and bad concrete worse"



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## 50% FA



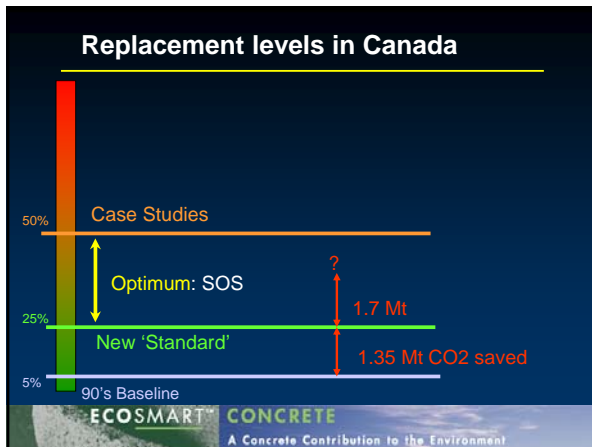
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## Optimization



## Replacement levels in Canada



## Performance Parameters

## Special Int. Groups

- Material**
  - Type of SCM: FA, GGBFS, SF
  - Cost, Availability, distance
- Technical**
  - Type of element: slab, walls, footings
  - Strength: Stripping, 28d, 56d
  - Durability, scaling, exposure
  - Curing, carbonation
  - Standards, liability
- Construction**
  - Placing, finishing, forms, curing
  - Setting time: Stripping and finishing
  - Architectural: Color, texture, finish
- Environment**
  - GHG Signature
  - Waste reduction
  - Expected lifespan

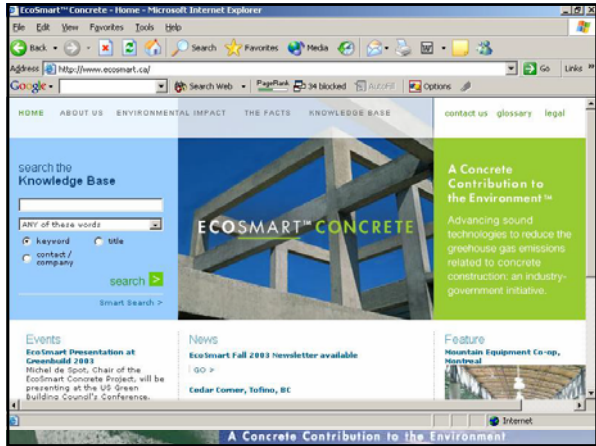
- Supply**
  - Cement Manufacturers
  - Ready-Mixed Concrete Producers
  - SCM producers / suppliers
- Design**
  - Developers
  - Architects
  - Structural Engineers
  - Material engineers & test labs
  - Code officials
- Build**
  - Contractors
  - Sub-trades: Concrete placers

Collaborative Interactive Decision-supporting tool



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# Thank You

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Questions  
Comments  
Suggestions



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The slide features a dark blue background. At the top, the text "Thank You" is displayed in white, followed by a horizontal line. Below this, the words "Questions", "Comments", and "Suggestions" are listed vertically in white. To the right of this text is a small rectangular photograph showing a child splashing in water. At the bottom of the slide, the "ECOSMART CONCRETE" logo is shown in white, with the slogan "A Concrete Contribution to the Environment" underneath it.