EcoSmart Concrete Project

a concrete contribution to the environment

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USGBC - Pittsburgh
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Concrete Mix

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

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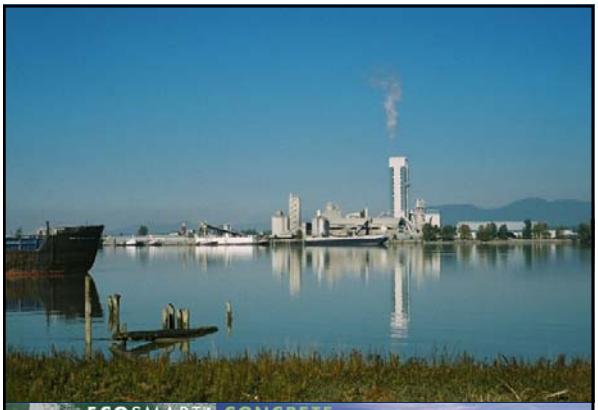

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The Cement Kiln: 1 tonne cement = 1 tonne CO_2

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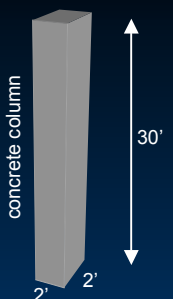
The CO2 Numbers *(approximate)*

1 tonne clinker = 1 tonne CO2

8,000 Km

Forest sink
2,000 m2/a



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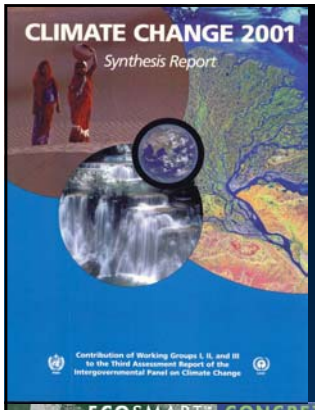
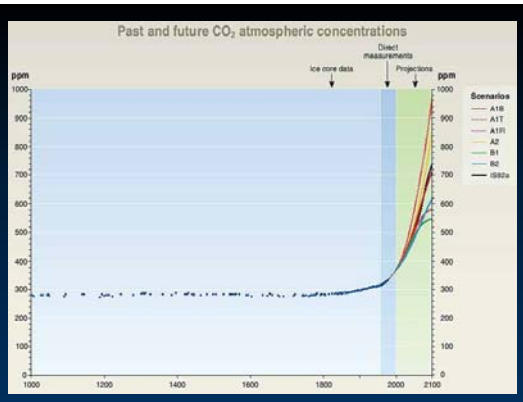


Climate Change is for real

Humans are causing change

Future very likely beyond our experience



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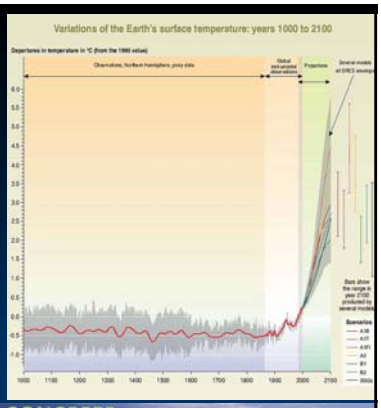
Temperature



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The Trend

Concrete is a dominant construction material
with increasing use worldwide
resulting in increasing demand for cement

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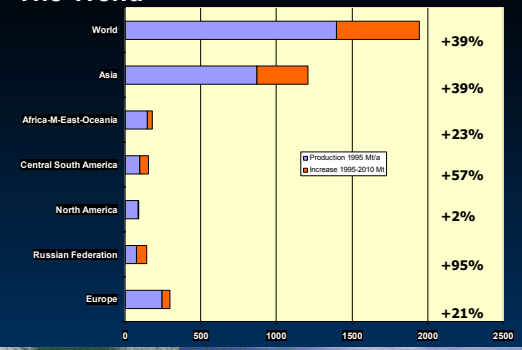
The Trend



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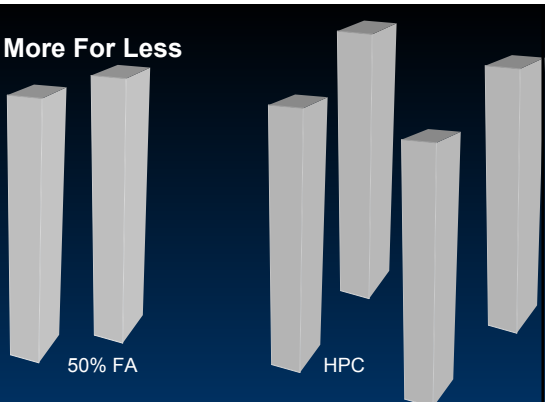
More For Less



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The Objectives

Develop a partnership with industry and professionals
To minimize GHG "signature" of concrete
by replacing portland cement with SCM
or reduce the amount of concrete per use

Through technological developments in

- SCM
- Design
- Construction

EcoSmart Formula

Less
CO_2 per unit of Concrete

Same or Better
Cost
Performance
Ease of Construction

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The Basis

$SCM_{(*)}$ can replace up to 50% of Portland cement in concrete

* Supplementary Cementing Material such as fly ash

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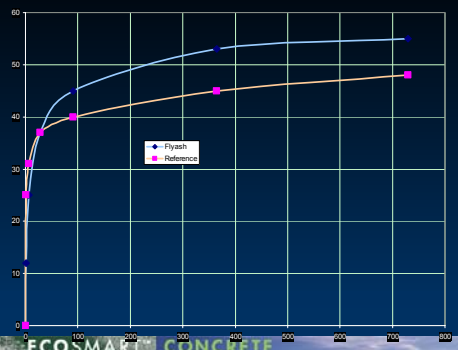
The Lab data



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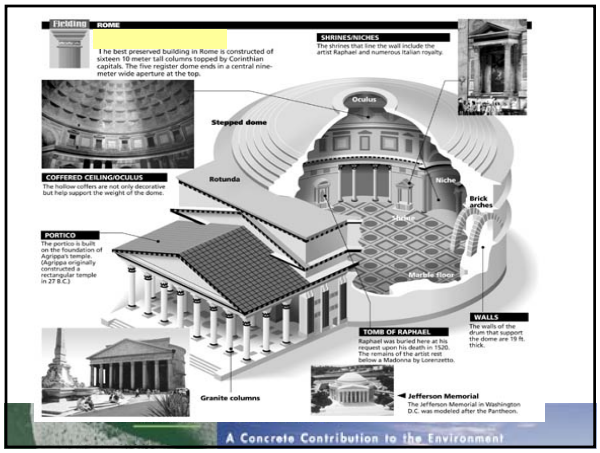

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Liu Centre
50% fly ash
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BC Gas Office Building
40% fly ash
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Brentwood Skytrain Station
30% fly ash in pre-cast
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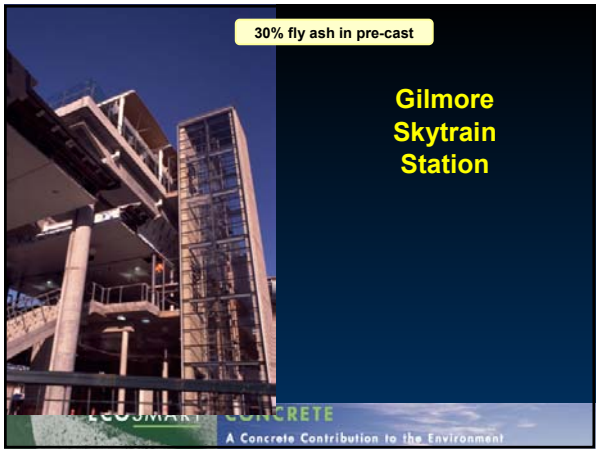
30% fly ash in pre-cast
Gilmore
Skytrain
Station
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50% fly ash
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York University Computer Science
50% fly ash
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Ardencraig Residential Renovation

50% fly ash

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Cranberry Commons Townhouse

50% fly ash

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Nicola Valley Institute of Technology

50% fly ash

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Bayview High Rise Building

30 - 40% fly ash

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Mountain Equipment Coop Montreal

TerCem 3000

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TEF III

40% Fly Ash

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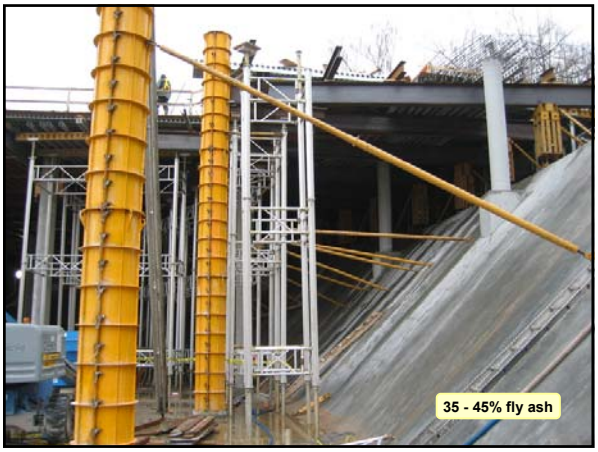
Little Mountain Reservoir



Coal Fired Power Plant

Coal Fired Power Plant

LEED Rating

	Concrete Building			Steel Building		
$/ft	Cost	Mat	%	Cost	Mat	%
Concrete	3.5	1.8	3.5%	2.2	1.1	2.2%
Rebar	3.5	1.8	3.5%	1.2	0.6	1.2%
Formwork	13.0	6.5	13.0%	2.2	1.1	2.2%
Structural Steel				14.4	7.2	14.4%
Other materials	80.0	40.0	80.0%	80.0	40.0	80.0%
Total	**100.0**	**50.0**	**100.0%**	**100.0**	**50.0**	**100.0%**

Mix Design

Component	Min 28/56 Day Strength Mpa (Ksi)	Fly Ash Content %	Air Content %	Exp. Class
Footings	25 (36)	50		
Foundation Walls/Shear Walls	30 (44)	50		
Foundation Walls exposed to freezing and Thawing	30 (44)	50	4-7	F2
Walls Above Grade	25 (36)	50		
Columns	30 (44)	50		
Columns exposed to freezing & thawing	30 (44)	50	4-7	F2
Suspended Slabs, Beams -	25 (36)	50		
Exterior Slab on Grade & other concrete exposed to de-icing	32 (46)	0	5-8	C2
Interior Slab on Grade	25 (36)	50		

Credit Calculations

Concrete		Steel	
Project Cost $/ft	100	Project Cost $/ft	100
Material value $/ft	50	Material value $/ft	50
Concrete value %	3.5%	Steel value %	14.4%
Concrete Value $/ft2	1.75	Steel value $/ft2	7.2
FA in cement %	50%		
% cement in Concrete	12.5%		
% FA in Concrete	6.3%	% recycled	100%
Recycled value $/ft	0.109375	Recycled Value	7.2
% value recycled/Total	0.22%	% value	14.4%
% for points	0.11%	% for points	14.4%
Credit MR 4.1	**0**	**Credit MR 4.1**	**1**
Credit MR 4.2	**0**	**Credit MR 4.2**	**1**
Total	**0**	**Total**	**2**
Ratio concrete /steel	**131.7**		

Environmental Impact Reduction

Saving kg/ft2	Concrete 50% FA	Steel 100% recycled
CO2	1.97	5.39
Fuel (Coal)	0.66	2.08
Primary material (Limestone/Iron Ore)	3.28	4.09
Secondary material (Shale /Limestone)	0.44	0.18

same order of magnitude

In Conclusion

1. Use of SCM reduces significantly the GHG signature of Concrete.
2. Case studies have shown HVSCM (35%-45%) are achievable without major impact on cost or construction.
3. Future LEED versions need to recognize the environmental benefits of SCMs….
4. …particularly in the context of Climate Change.

Thank You

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