ECOSMART™ CONCRETE Project

a concrete contribution to the environment

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President & CEO,
ECOSMART Foundation

CIRCA Seminar

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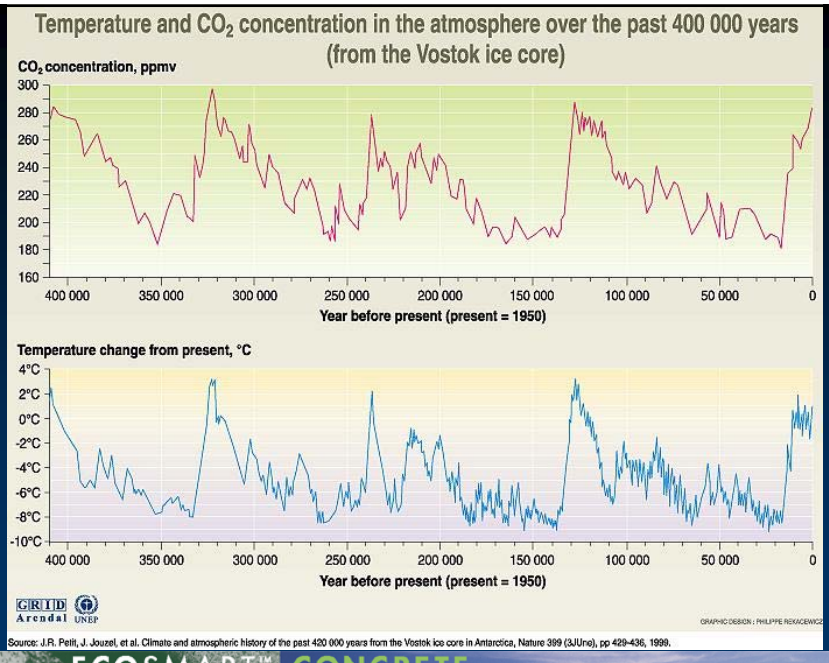

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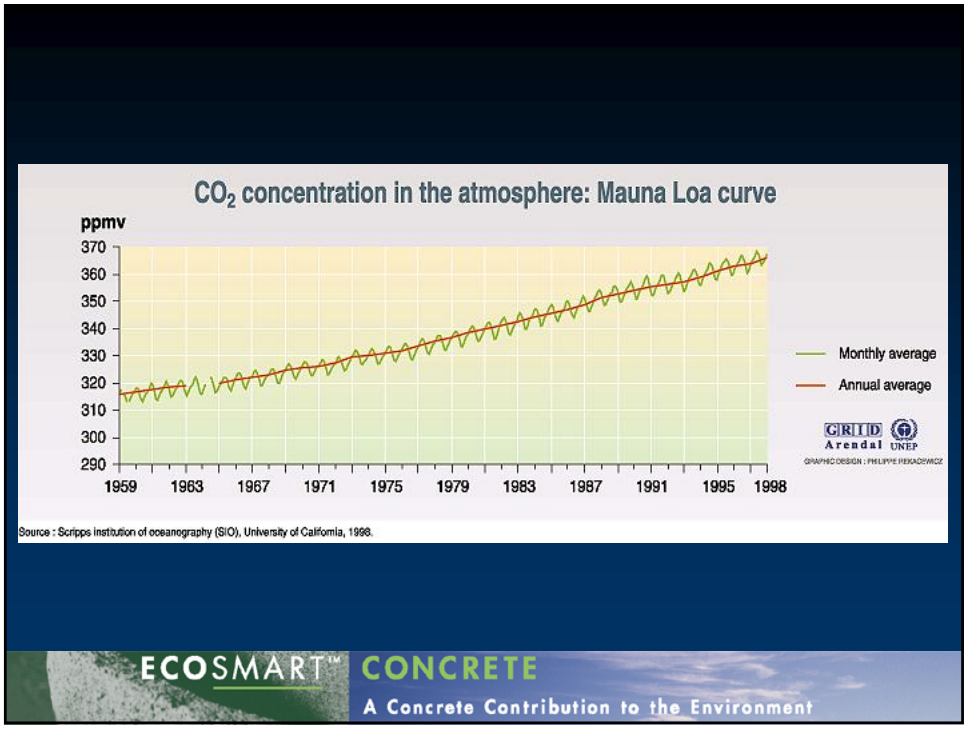
CO_2 concentration in the atmosphere: Mauna Loa curve
ppmv
370
360
350
340
330
320
310
300
290
1959
1963
1967
1971
1975
1979
1983
1987
1991
1995
1998
Monthly average
Annual average
GRID Arendal UNEP
Source : Scripps institution of oceanography (SIO), University of California, 1998.
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EcoSmart Objectives

To minimize GHG “signature” of concrete
by optimizing replacement of Portland cement with SCM
while improving or maintaining

- Cost
- Performance
- Constructability

EcoSmart is a non-profit organization based on a partnership between

- Federal government
- Building industry
- Building professionals

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SCM : Traditional

SCM	Production 2001	Useable as SCM	Used
Fly Ash	4,800,000	2,200,000	450,000
BFS	1,500,000	380,000	216,000
SF	20,000	20,000	20,000

Source: Canmet

Case Studies

How much SCM replacement can be achieved, what effect on:
Cost – Performance - Constructability

As experienced by

Supply

Cement manufacturers , ready-mixed concrete producers, SCM producers / suppliers

Design

Developers & owners, architects, structural engineers, Material engineers & test labs, code officials

Build

Contractors, Sub-trades (concrete placers, finishers, form installers)

Learning by doing

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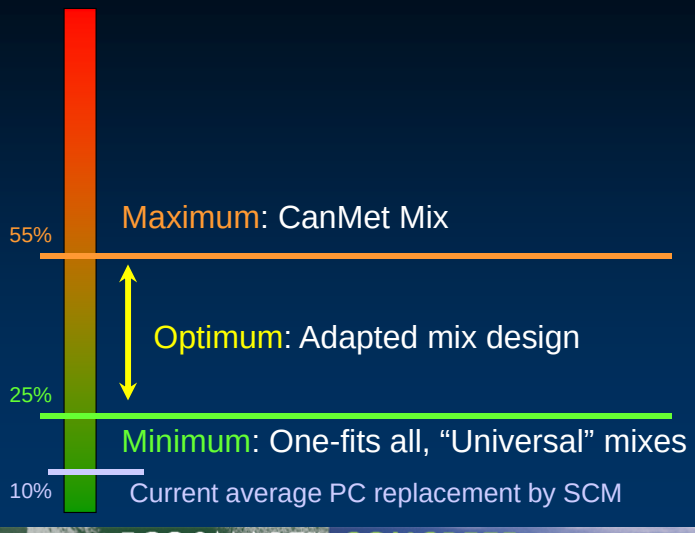
Case Studies



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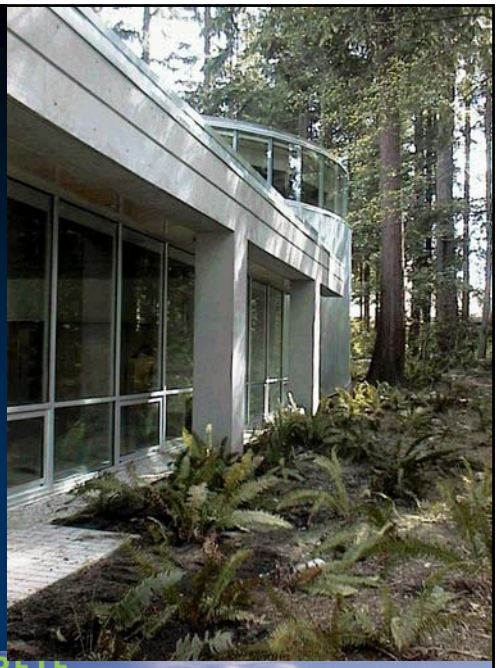
50% FA

- Greater strength @ 56d
- Superior appearance
- Less water
- Excellent workability
- 'Repeated customers'

- More cementitious
- Increased setting time at low temp
- Contractor training
- Finishing slab @ low T & low w/c
- **Curing**



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50% FA

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50% fly ash
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Minimum
25% SCM
Yellowknife
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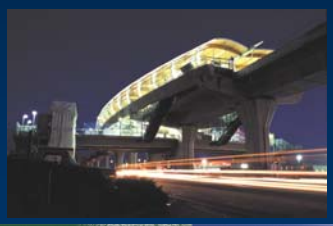
Other Applications



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Optimization

Element	Min. 28 Day Strength (mPa)	% flyash replacement (Ledcor Standard)	% flyash replacement (Actual)	W/CM
Parking Slabs & Slab Bands	35	15	33	0.40
Slab on Grade Interior Parking	25	20	20	0.50
Slab on Grade Exterior	32	20	20	0.45
Core Footing	30	40	45	0.50
Other Footings	25	40	45	0.50
Shear Walls & Columns				
Foundation to 8th Floor	40	15	33	0.45
8th to 12th Floor	35	15	33	0.45
12th to 16th Floor	30	20	33	0.45
16th Floor to Roof & Other Walls	25	20	33	0.45
Tower Slabs	25	15	15 to 25	
Toppings & Housekeeping Pads	20	15	45	

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Little Mountain Reservoir

FA %	Winter		Summer	
	Spec	Real	Spec	Real
Wall Column	35	40	35	47
Roof Slab	30	50	30	47
Lean Concrete	50	50	50	57

Source: Little Mountain reservoir report: Sukhumar, Shertobitoff, Seabrook, Huber

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Seymour Filtration Plant

	% FA	Mpa @56d
Footings	55	30
Mass Fill	55	25
Walls and columns	40	30
Extrior Slabs	35	30
Interior Slabs	35	30
Beams	40	30
Lean Concrete	50	10

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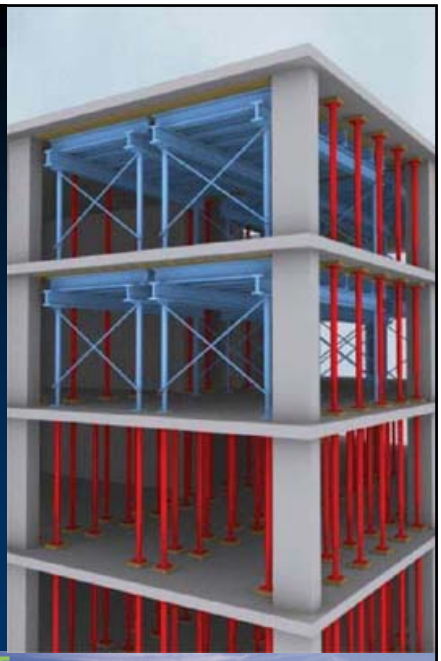
Optimization

- Optimization for components
- Winter / summer mix design
- In-situ test

- Increased complexity
- Design for stripping strength



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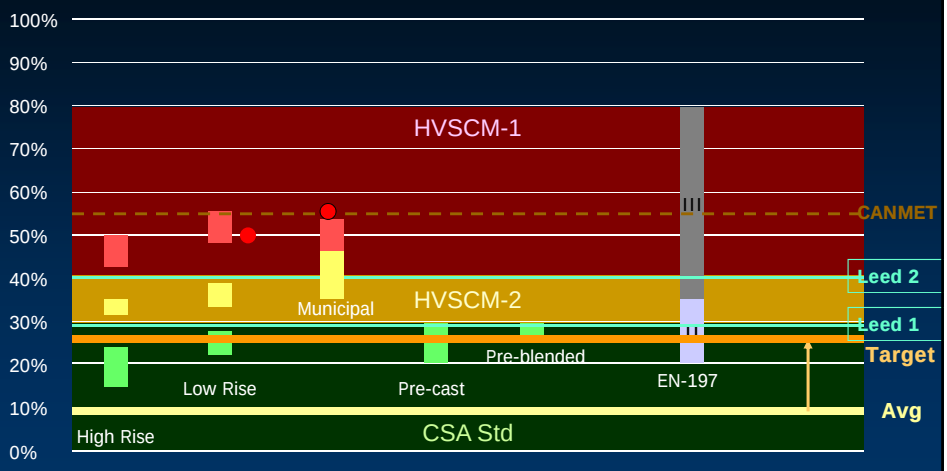
How Much?



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Parameters

Material
- Type of SCM: FA, GGBFS, SF, other
- Cost, Availability, distance

Technical
- Type of element: slab, walls, footings, ..
- Strength: Stripping, 28d, 56d
- Durability, resistance to scaling, exposure
- Curing, carbonation
- Standards, liability

Construction
- Placing, finishing, forms, curing
- Setting time: Stripping and finishing
- Architectural aspect : Color, texture, finish

Environment
- GHG Signature
- Waste reduction
- Expected lifespan

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Industry decision-makers

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

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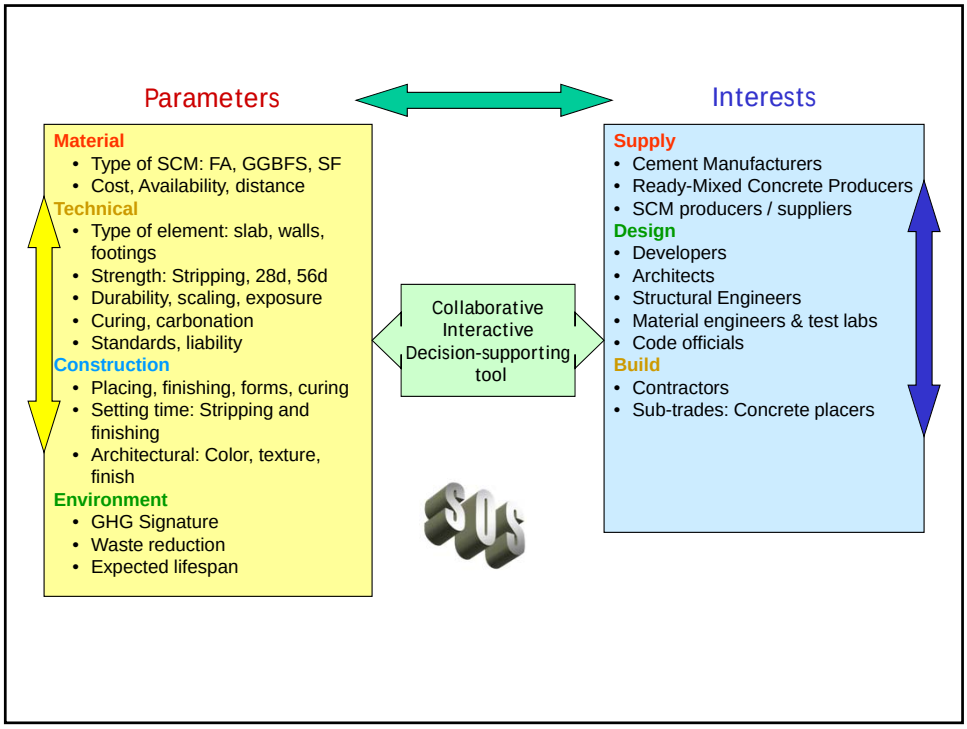
Parameters
Interests
Material
• Type of SCM: FA, GGBFS, SF
• Cost, Availability, distance
Technical
• Type of element: slab, walls, footings
• Strength: Stripping, 28d, 56d
• Durability, scaling, exposure
• Curing, carbonation
• Standards, liability
Construction
• Placing, finishing, forms, curing
• Setting time: Stripping and finishing
• Architectural: Color, texture, finish
Environment
• GHG Signature
• Waste reduction
• Expected lifespan
Collaborative
Interactive
Decision-supporting
tool
Supply
• Cement Manufacturers
• Ready-Mixed Concrete Producers
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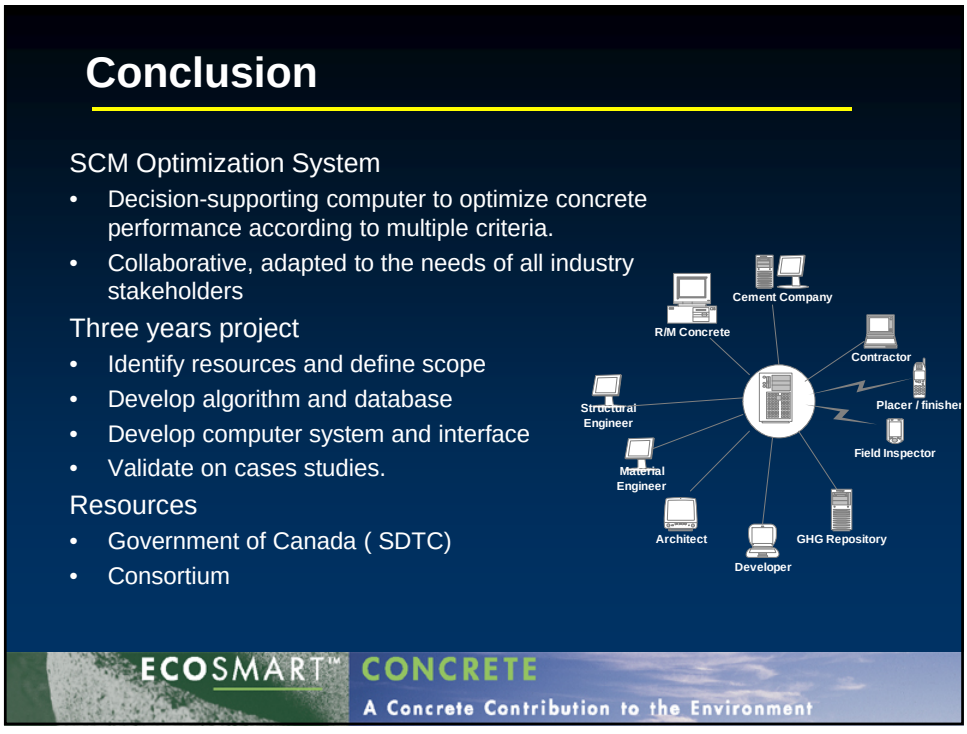
Conclusion
SCM Optimization System
• Decision-supporting computer to optimize concrete performance according to multiple criteria.
• Collaborative, adapted to the needs of all industry stakeholders
Three years project
• Identify resources and define scope
• Develop algorithm and database
• Develop computer system and interface
• Validate on cases studies.
Resources
• Government of Canada (SDTC)
• Consortium
Cement Company
R/M Concrete
Contractor
Placer / finisher
Field Inspector
Structural Engineer
Material Engineer
Architect
Developer
GHG Repository
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Conclusions (the last decade)

1. Climate Change a reality - Kyoto, credits, regulations.
2. Greater SCM awareness – Case studies
3. Increased use when possible - greater average, blended
4. From 50% to optimization – as result of case studies, SOS
5. Revised CSA standard – HVSCM-1 & -2
6. Value and Precautions – Performance, carbonation
7. Performance Specification – Proprietary Mix Design
8. Green Building movement – LEED

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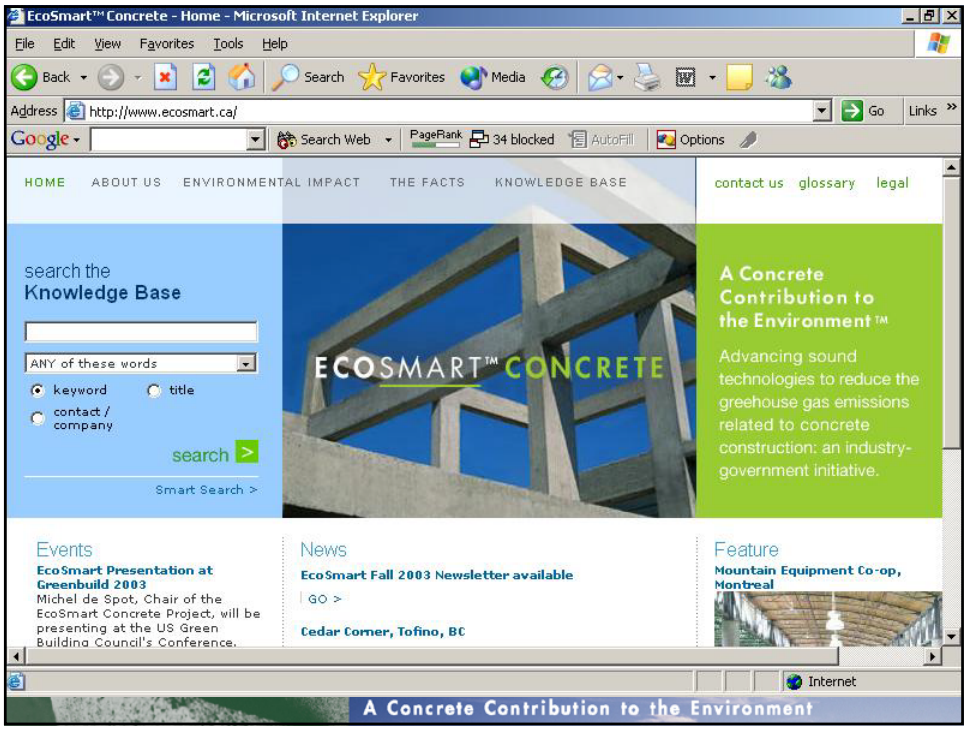

Thank You

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Inquiries?

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