

# ECOSMART™ CONCRETE Project

a concrete contribution to the environment

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

Sustainability and Concrete  
Westmar, January 3, 2008



## EcoSmart™ Foundation

Non-Profit Organization  
Created in 1999.  
Supported by the Government of Canada.  
Effective industry-government partnership.  
Introduce technology innovations that reduce GHG signature of concrete.



## One tonne Clinker, one tonne CO<sub>2</sub>

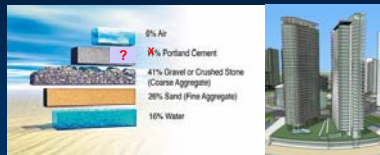
50% Process  
40% Fuel  
10% Electricity,  
Transportation



## EcoSmart Concrete Objectives

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

- Cost
- Performance
- Constructability



## SCM: Zero (or low) GHG





### Demonstration Project

How much SCM replacement can be achieved, how does it affect:  
Cost – Performance – Constructability in the Emirates context  
With:

- Suppliers**  
Cement manufacturers, ready-mixed concrete producers, SCM producers / suppliers
- Designers**  
Developers & owners, architects, structural engineers, material engineers & test labs, code officials
- Builders**  
Contractors, sub-trades (concrete placers, finishers, form installers)

**Learning by doing**

**ECOSMART™ CONCRETE**  
A Concrete Contribution to the Environment

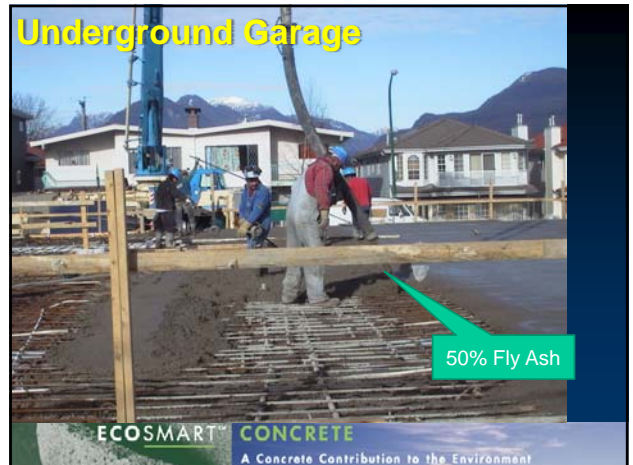


## York University Building

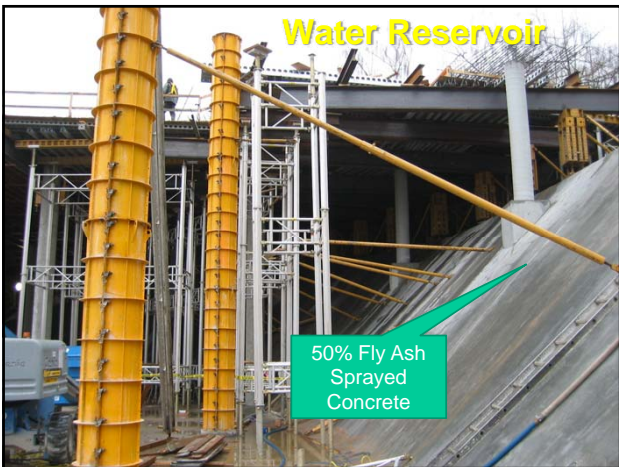
Age (days)	Control (MPa)	50% Northern Ash (MPa)
0	0	0
28	~45	~40
56	~55	~50
84	~60	~55

50% Fly Ash

**ECOSMART™ CONCRETE**  
A Concrete Contribution to the Environment







### Seymour Water Filtration Plant

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

**ECOSMART CONCRETE**  
A Concrete Contribution to the Environment

### Seymour Water Filtration Plant

Age (Days)	Compressive Strength (MPa)
12	~10
28	~20
56	~30
315	~35

**ECOSMART CONCRETE**  
A Concrete Contribution to the Environment

### Bayview High Rise Building

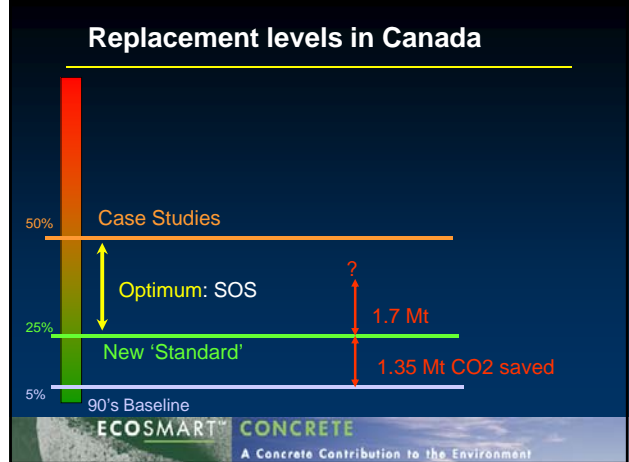
Element	Min. 28 Day Strength (nPa)	% flyash replacement (Leodor Standard)	% flyash replacement (Actual)	WCM
Parking Slabs & Slab Bands	35	15	33	0.43
Slab on Grade Interior Parking	25	20	20	0.50
Slab on Grade Exterior	32	20	20	0.45
Core Footing	30	40	45	0.50
Other Footings	25	40	45	0.50
Shear Walls & 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 Slabs	20	15	45	

**ECOSMART CONCRETE**  
A Concrete Contribution to the Environment

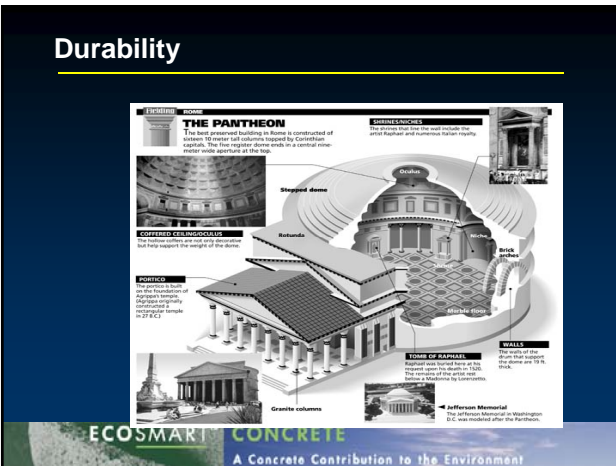
## Brentwood Skytrain Station



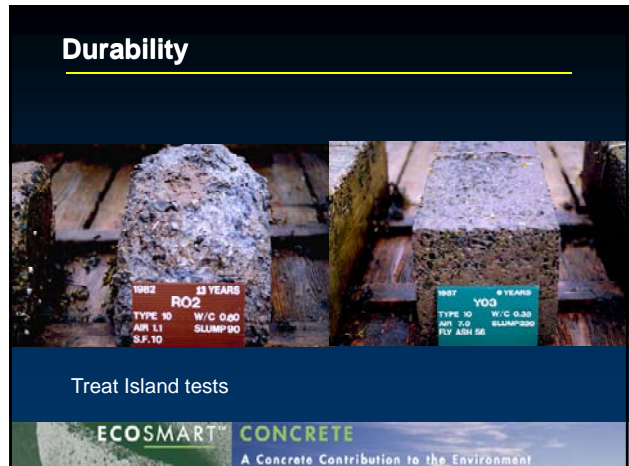
## Replacement levels in Canada



## Durability



## Durability



## Emirates



## Dubai





## 'a very dynamic construction market'



A Concrete Contribution to the Environment

## EcoSmart Emirates

Introduction of the technology in the Emirates by

- Demonstration Projects
- Showcasing feasibility, benefits and cost-effectiveness
- Addressing technical issues and risks
- Developing innovative solutions
- Linking Canadian companies to local clients



ECOSMART CONCRETE

A Concrete Contribution to the Environment

## Demonstration Projects

- DP World Tanker Jetty
- YAS Island (Ferrari F1 Circuit)
- Dubai World Trade Centre
- Burgh Dubai Tower
- UNIBETON Project



ECOSMART CONCRETE

A Concrete Contribution to the Environment

## Ferrari experience



Yas Island

A Concrete Contribution to the Environment

## Key Strategic Elements in the UAE

### Cost

- Supply source
- 100 Mt /a in India (free ?)
- Reduce cost in the Emirates

### Strength

- Tests comparing performance with traditional concrete

### Durability

- Tests and studies comparing durability with "durable" concrete

### Ease of construction

- Pumpability
- Less water and admixtures
- Heat of hydration (cracking, ice)

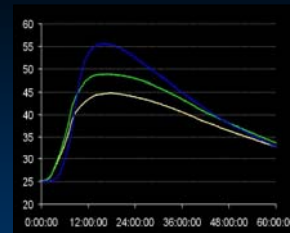
### GHG Saving

- LEED
- GHG credits
- Publicity

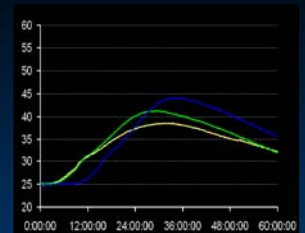
ECOSMART CONCRETE

A Concrete Contribution to the Environment

## Heat of Hydration



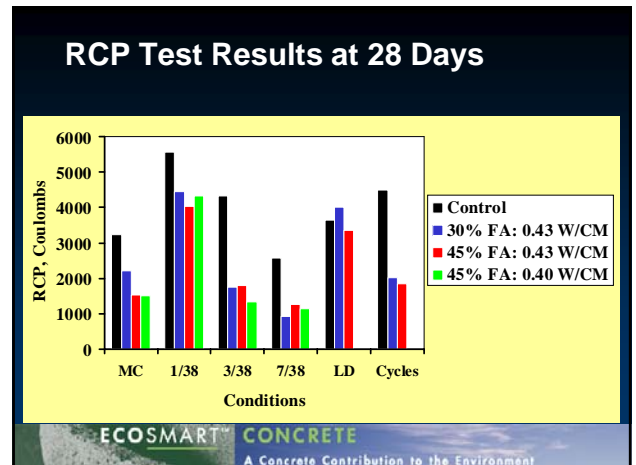
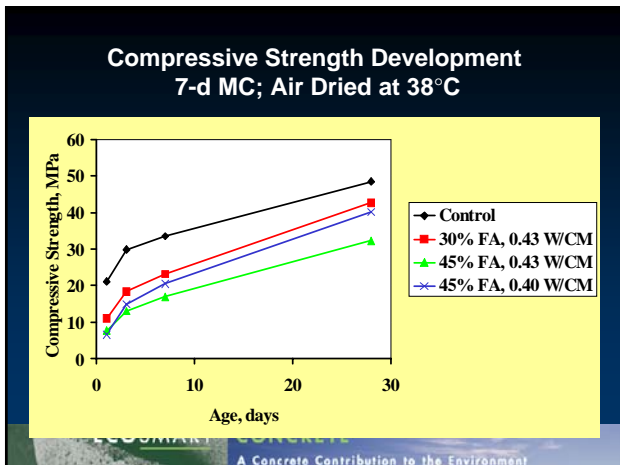
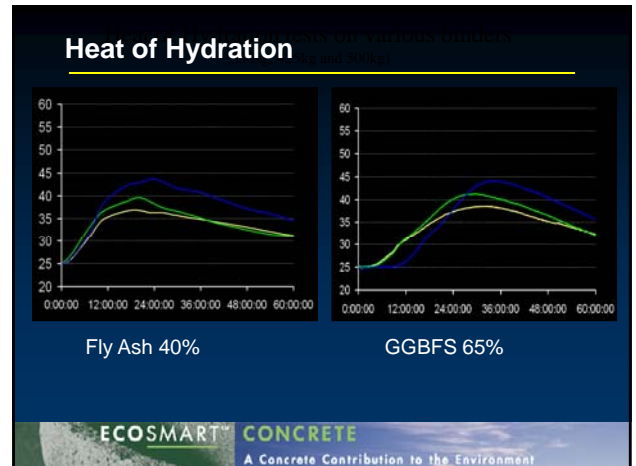
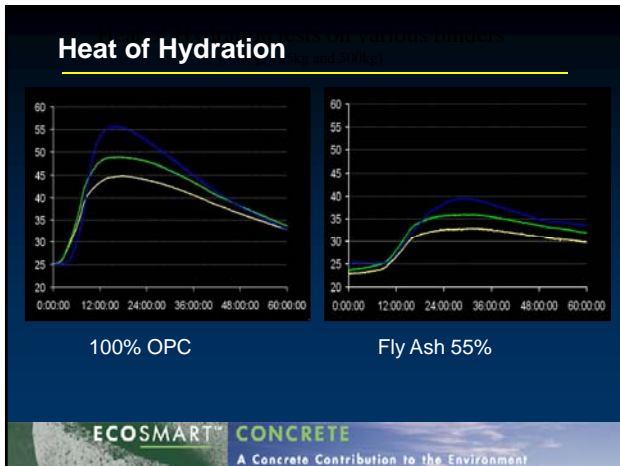
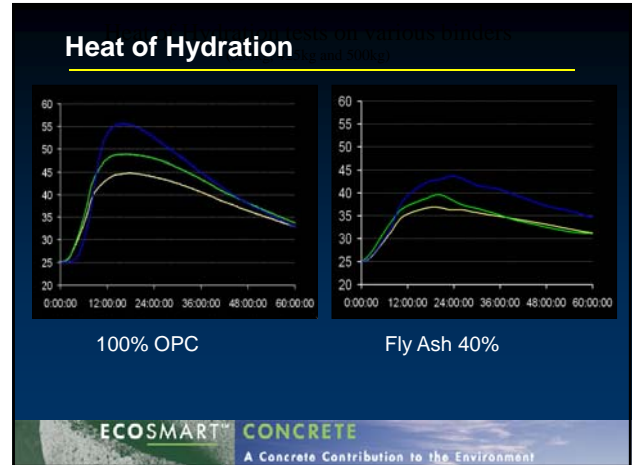
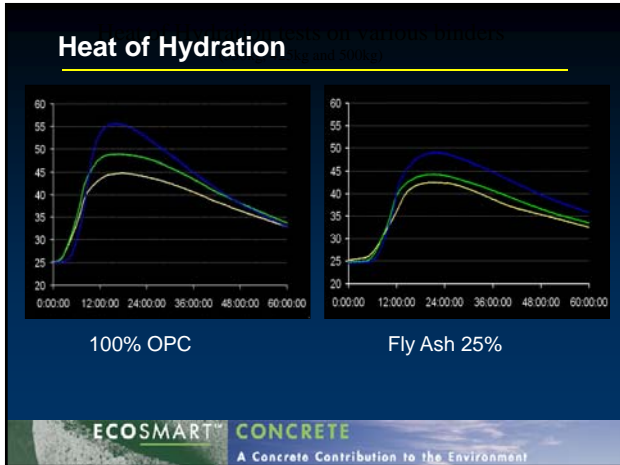
100% OPC



GGBFS 65%

ECOSMART CONCRETE

A Concrete Contribution to the Environment



## Fly Ash Supply



## What's next

SOS

ECOSMART CONCRETE  
A Concrete Contribution to the Environment

## 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 and chemical attacks  
Curing, carbonation  
Heat of hydration  
Standards, liability

### Construction

Placing, finishing, forms, curing  
Setting time: Stripping and finishing

### Environment

GHG Signature  
Waste reduction  
Expected lifespan

ECOSMART CONCRETE  
A Concrete Contribution to the Environment

## 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

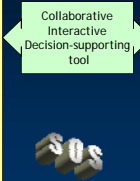
- Contractors
- Sub-trades: Concrete placers



ECOSMART CONCRETE  
A Concrete Contribution to the Environment

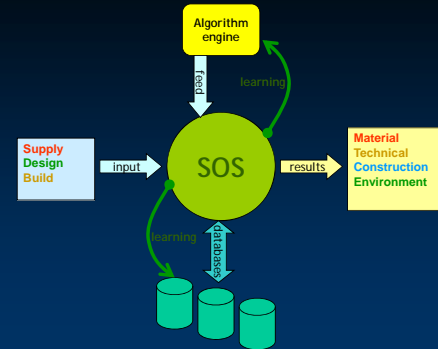
## Parameters ↔ Interests

- 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



- 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

ECOSMART CONCRETE  
A Concrete Contribution to the Environment



ECOSMART CONCRETE  
A Concrete Contribution to the Environment

## Consortium

- Universities
- Material Engineers
- Structural Engineers
- Cement producers
- Contractor
- Architect
- Developer
- Government

**Budget:** 3,800,000 CAD\$  
50% Government / 50% private

ECOSMART™ CONCRETE

A Concrete Contribution to the Environment

## Benefits of SCM Concrete

1. SCMs cost less to produce than cement
2. Stronger at long term
3. Easier to place, pump and finish
4. Lower heat of Hydration
5. More durable and resistant to salt and sulfates
6. GHG reduction and credits: 1T of SCM reduce GHG emission by up to 1T.
7. Address cement shortage



ECOSMART™ CONCRETE

A Concrete Contribution to the Environment

## 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"



ECOSMART™ CONCRETE

A Concrete Contribution to the Environment

## Thank You



ECOSMART™ CONCRETE

A Concrete Contribution to the Environment