

SOS Software Development Consultation

Calgary, Edmonton, Halifax, Montreal,
Ottawa, Toronto, Winnipeg
Feb. 3 – 12th, 2009

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Some definitions: SCMs and SOS

- **SCMs** – Supplementary Cementing Materials
 - Used to partially replace cement in concrete
 - Fly ash, ground granulated blast furnace slag (GBFS), silica fume, metakaolin, etc.
- **SOS** – **S**upplementary Cementing Materials **O**ptimization **S**ystem

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Key Organizations: EcoSmart

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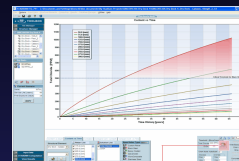
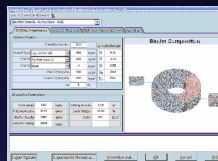
- SOS Project Manager
- Non-profit corporation promoting environmentally friendly technologies –especially in construction.
- Has championed numerous case studies of high volume SCM projects in Canada and elsewhere



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Key Organizations: SIMCO

- SIMCO
 - SOS Software Developer
 - Experts in concrete modeling and service life prediction
 - Developers of STADIUM Software



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Key Organizations: SOS Consortium

- | | |
|--|---|
| • AMEC | • Levelton Consultants |
| • British Columbia Institute of Technology | • Metro Vancouver |
| • Busby, Perkins + Will | • National Research Council |
| • C&CS Atlantic | • Public Works and Government Services Canada |
| • Canadian Steel Producers Association | • Read Jones Christoffersen Ltd. |
| • EcoSmart Foundation | • SIMCO Technologies |
| • Environment Canada | • UniBeton Ready Mix |
| • Graham Ltd. | • Windmills Development |
| • Halcrow Yolles | |
| • Lafarge Cement | |
| • Lehigh Cement | |

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Climate Change and GHGs

- Now take as a given that:
 - the world is warming at a rate unprecedented in human history
 - man-made emissions of GHGs are a major factor in this warming
- Most important GHG at present is CO₂

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Cement and CO₂

- Cement is an essential building material
- Manufacturing cement releases about one tonne of CO₂ for each tonne of cement produced (world average).
- World-wide, cement manufacture accounts for more than 5% of total man-made emissions of CO₂
- Much interest – by governments, cement producers and the construction industry – in reducing this CO₂ burden

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One tonne Clinker, one tonne CO₂



50% Process
40% Fuel
10% Electricity,
Transportation

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Emissions data for Cement

- Canada's cement plants emit 12.8 million tonnes of CO₂ every year. This is equivalent to the emissions from about 2.3 million cars.
- Global cement emissions of CO₂ are estimated to be 2.6 billion tonnes

Production (tonnes)	GHG Emissions (tonnes)	Intensity (tonnes _{CO2} /tonne _{Cement})
15,000,000	13,000,000	0.85

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SCMs and EcoSmart

- Supplementary cementing materials can partially replace cement in concrete.
- In recent years EcoSmart, with strong government and industry support, has fostered a number of successful demonstrations of SCM use – especially at high levels (up to 50% cement replacement)
- Major lesson learned: SCMs work very well provided expert advice and guidance is available

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SCMs – pros and cons

Pro

- Generally cheaper than cement
- Can produce superior concrete
 - Lower permeability
 - Higher long-term strength
- Reduced heat of hydration (fly ash)
- Less water
- More easily pumped

Con

- Slower initial strength gain (longer stripping times)
- More difficult to finish
- Require diligent engineering and quality control
- more variable than cement – quality control important

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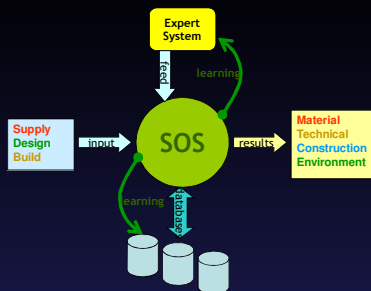
SOS

- Rationale
 - Computer-based expert guidance system to help industry determine the optimal replacement level of cement by SCMs for a given project, and the benefits thereby accruing.
 - SOS will be a mix guidance tool. It will give guidance on the suitability of SCMs, the percentage replacement, the factors to consider, and the cost and GHG implications.

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SOS: Basic Structure

- Databases
 - Concrete data
 - Cost data
 - Climatic data
- Expert System
- GHG Module
- Financial Module



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SOS Consultation

- Ensure SOS meets needs of intended users
- Timeframe for development SOS is to end December 2010
- EcoSmart is meeting user groups across Canada

Objective: determine what users want and need
SOS to do for the program to be useful to them

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Breakout session 1

SOS is envisaged as an optimization tool

- Given a set of variables and constraints, SOS will suggest the appropriate level of SCM

When designing/specifying concrete:

- What are the constraints involved
- What are the variables
- For variables, how much flexibility is there

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Breakout Session 2

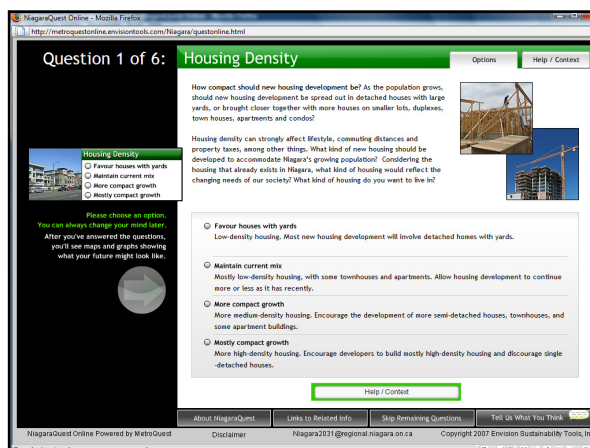
- Given the desire to reduce the GHG footprint of concrete how could SOS help you evaluate various options?
- Some examples:
 1. MetroQuest
 2. Homer

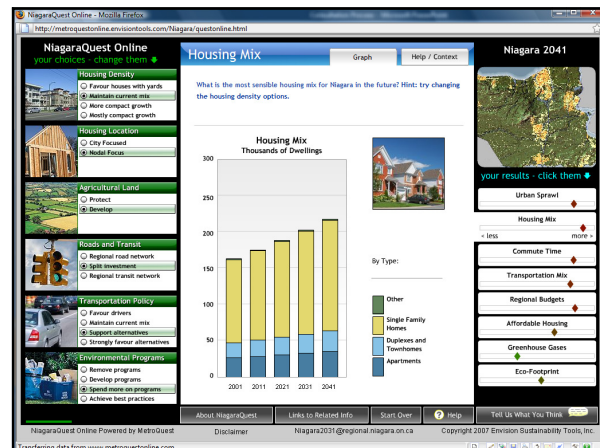
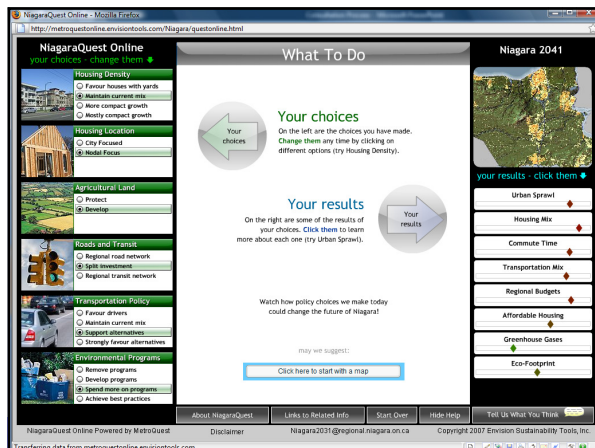
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MetroQuest

- Community Planning Tool
- “What-if” scenario modelling tool
- Aimed to generate discussion on planning issues and reconcile differences between stakeholders

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Example - MetroQuest

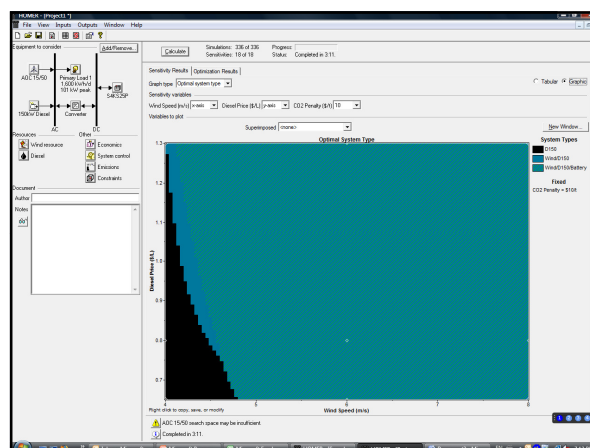
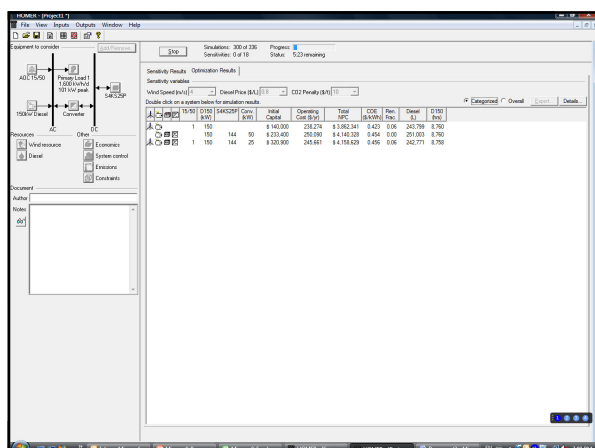
- Notes
 - Animated visuals, graphs and charts
 - Comparison against previous case only
 - Illustrates the interplay between choices
 - Does not directly show assumptions and calculations

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Homer

- Energy Systems Optimization Program
 - Determines the optimal energy generating mix according to various system designs
 - Geared towards a technical audience

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Example – Homer

- Descriptive and user defined inputs (and outputs)
- Little in the way of guidance (assumed knowledge)
- Simple but structured layout
- Varying complexity of analysis available
- Focused on a technical audience

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Examples – Comparison

MetroQuest:

- Provides Options
- Communicates Impacts
- Shows interplay
- Generates discussion
- What-if Scenario exploration, communication and educational tool

HOMER:

- Define System/Options
- Define Resources
- Estimates Variability
- Determines lowest cost scenario
- Detailed Design & Optimization, Calculation Tool

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Breakout session 2

- Given the desire to reduce the GHG footprint of concrete, how do you see SOS helping you?

Examples

1. Assess different scenarios (impact on variables)
2. Communicate options to clients, etc.
3. Reduce time in developing solutions

- How would you use SOS in your job?

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Next Steps

1. Compile information from discussions
2. Hold other workshops across Canada
3. Translate information into system specifications and SOS code
4. Provide regular updates on program development through EcoSmart / SOS website, newsletters or emails

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Thank you

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