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STADIUM®

Case Study: Software Application for a Bridge Rehabilitation Project

Dennis Burns

October 22, 2010

SIMCO Technologies

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STADIUM® is a multiionic transport model that can predict the degradation of cement-based materials exposed to aggressive environments

The STADIUM® Approach

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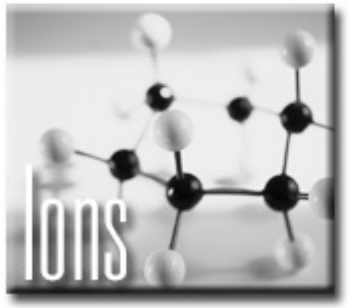
Coupled transport



Chemical damage

Chemical equilibrium

An Integrated Solution

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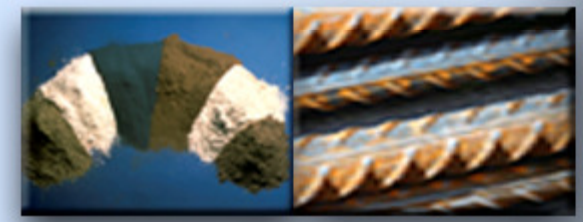
Local Exposure Conditions

Properties of Materials



Protection Solutions

Registered Program

SIMCO Technologies inc.

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Chemical Degradation

Steel Corrosion

Moisture Emission

New STADIUM® 3.0

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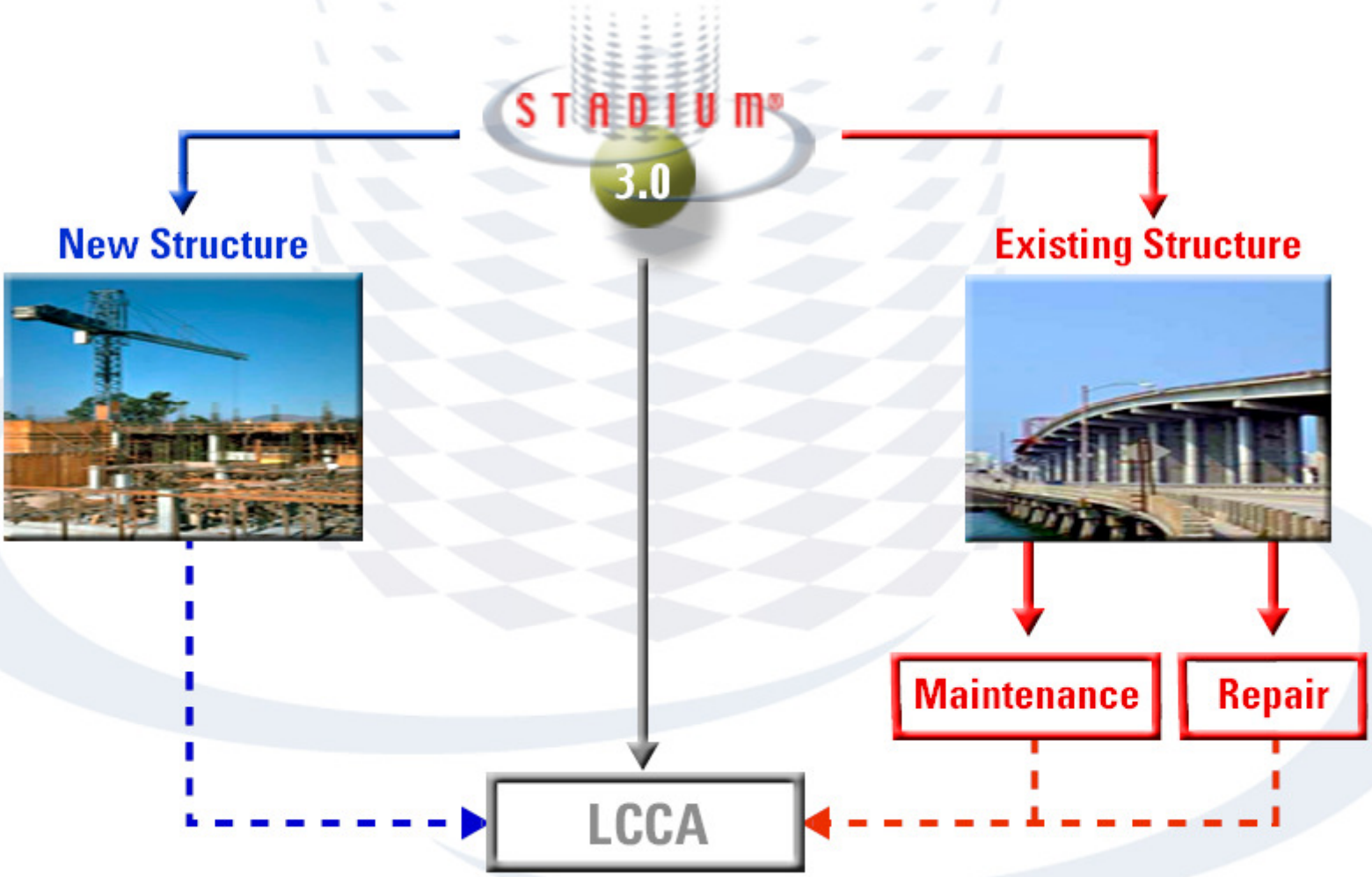

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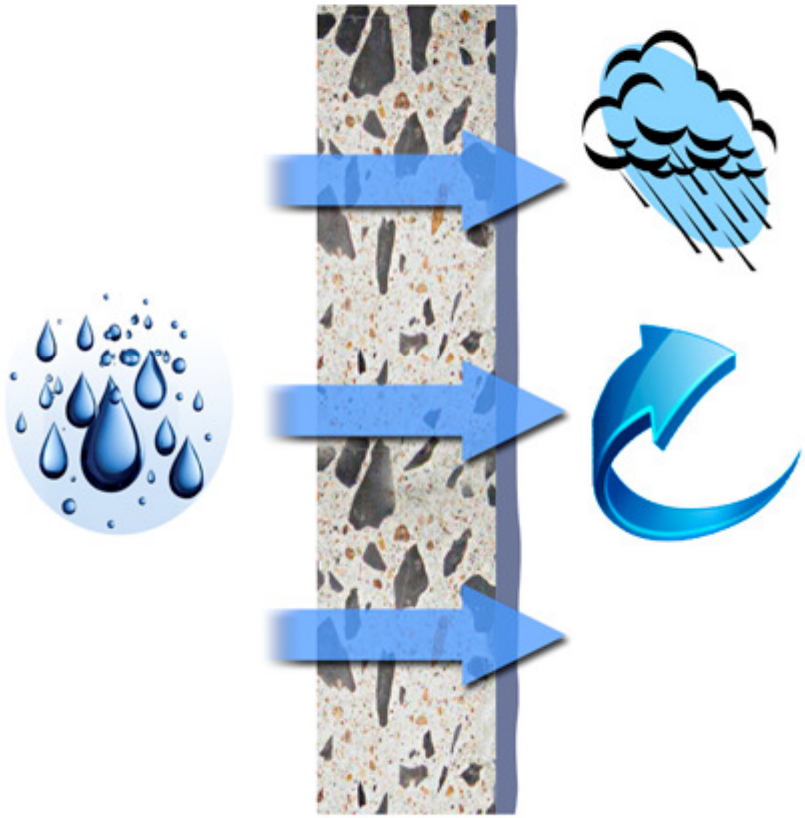
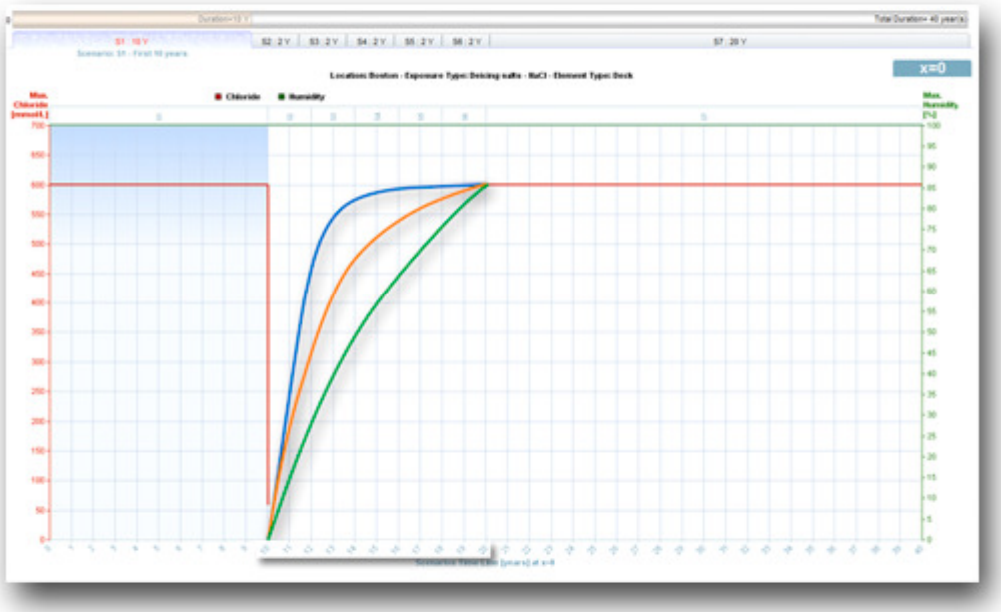
Topical sealer application





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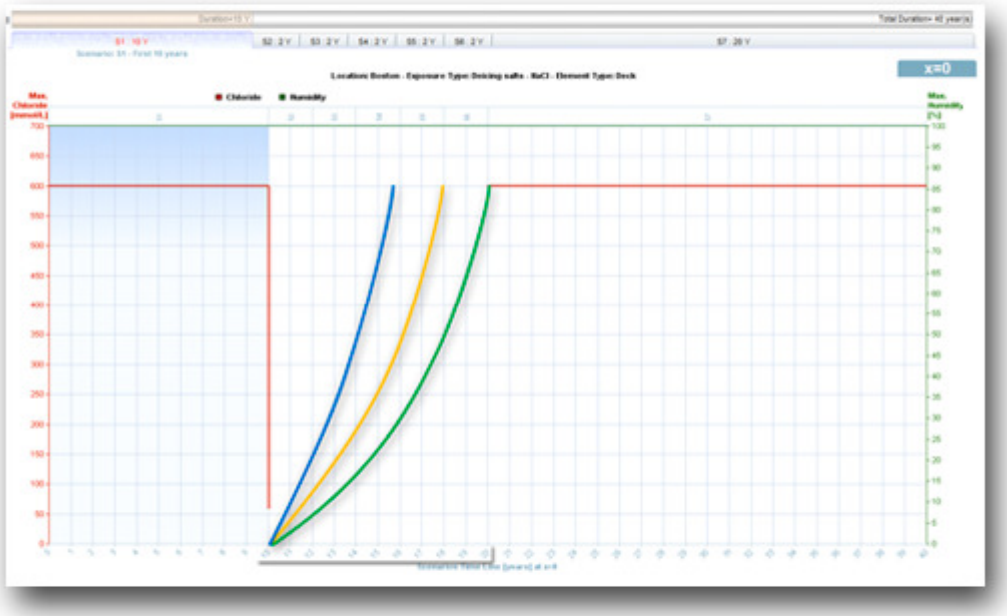
Membrane application



Life-Cycle Cost Analysis

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Alternative #1

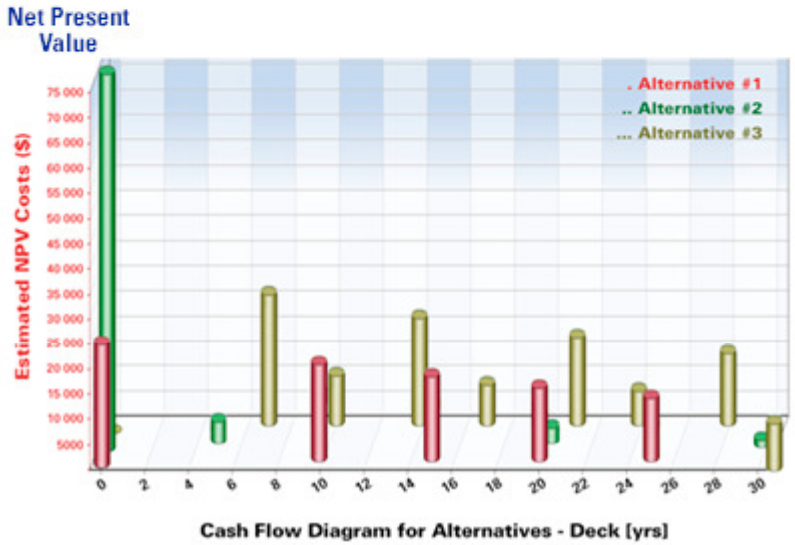
Initial Cost: $25,000
Maintenance Cost (after 10 years): $20,000
Maintenance Cost: $17,500/5 years

Alternative #2

Initial Cost: $75,000
Maintenance Cost: $8,000/6 years

Alternative #3

Initial Cost: $0
Maintenance Cost: $35,000/6 years
Maintenance Cost: $20,000/10 years



Multiple Repair Scenarios

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STADIUM 3.0

- No Intervention
- Partial Depth Repair
  - Two Layers
  - Multiple Layers
  - Thick Bonded Overlay
- Full Depth Repair

Bridge Location – New Jersey

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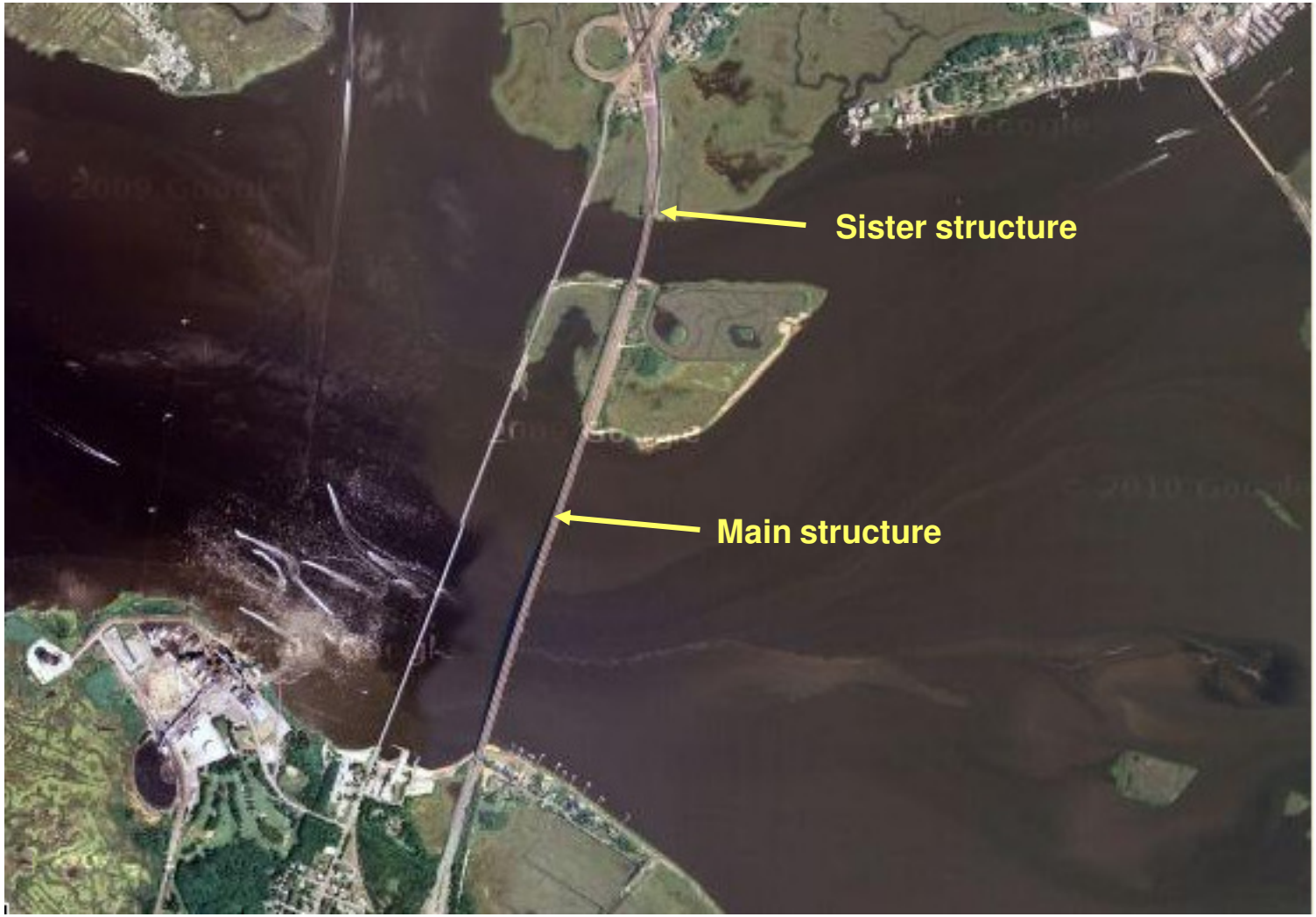


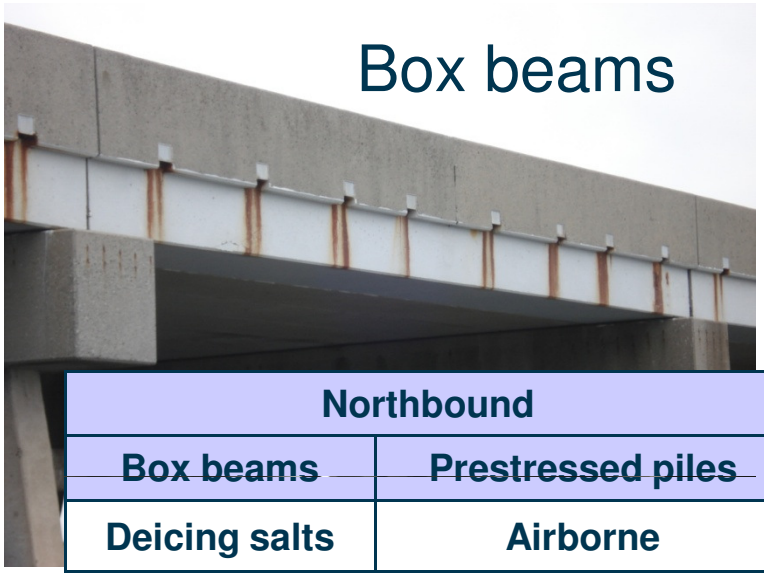
Background Information

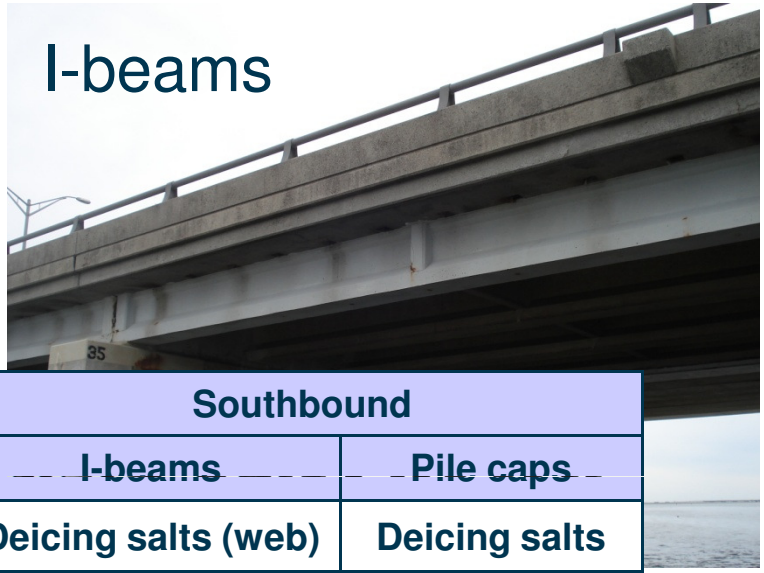
- Different structures for northbound and southbound directions

- Southbound structure:
  - Year of construction: 1956
  - Precast and cast-in-place concrete elements

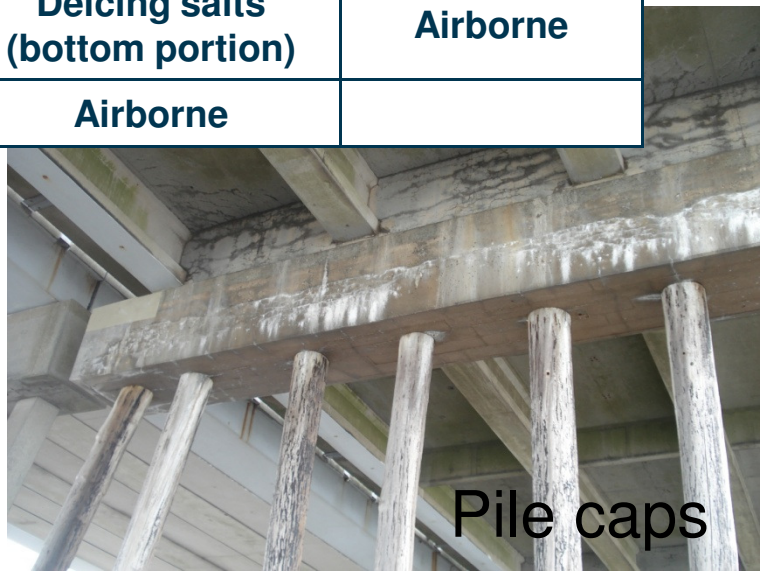
- Northbound structure:
  - Year of construction: 1973
  - All elements under investigation were precast

Elements Investigated





Northbound		Southbound	
Box beams	Prestressed piles	I-beams	Pile caps
Deicing salts	Airborne	Deicing salts (web)	Deicing salts
Airborne	Splash zone	Deicing salts (bottom portion)	Airborne
		Airborne	



Five-Step Approach

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Know your concrete

Know your environment

Know your structure

Estimate residual service life

Analyze and select optimum solution

STADIUM® Methodology

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Visual Inspection

Walk through/damage survey

Concrete Core Extraction

Core sampling

Laboratory Investigation

Concrete characterization

Service Life Predictions

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Know Your Concrete – Coring

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- Total number of cores: 56

- 31 cores from the northbound structure:
  - 15 in the box beams
  - 16 in the prestressed piles

- 26 cores from the southbound structure:
  - 12 in the I-beams
  - 13 in the pile caps

Existing Structure

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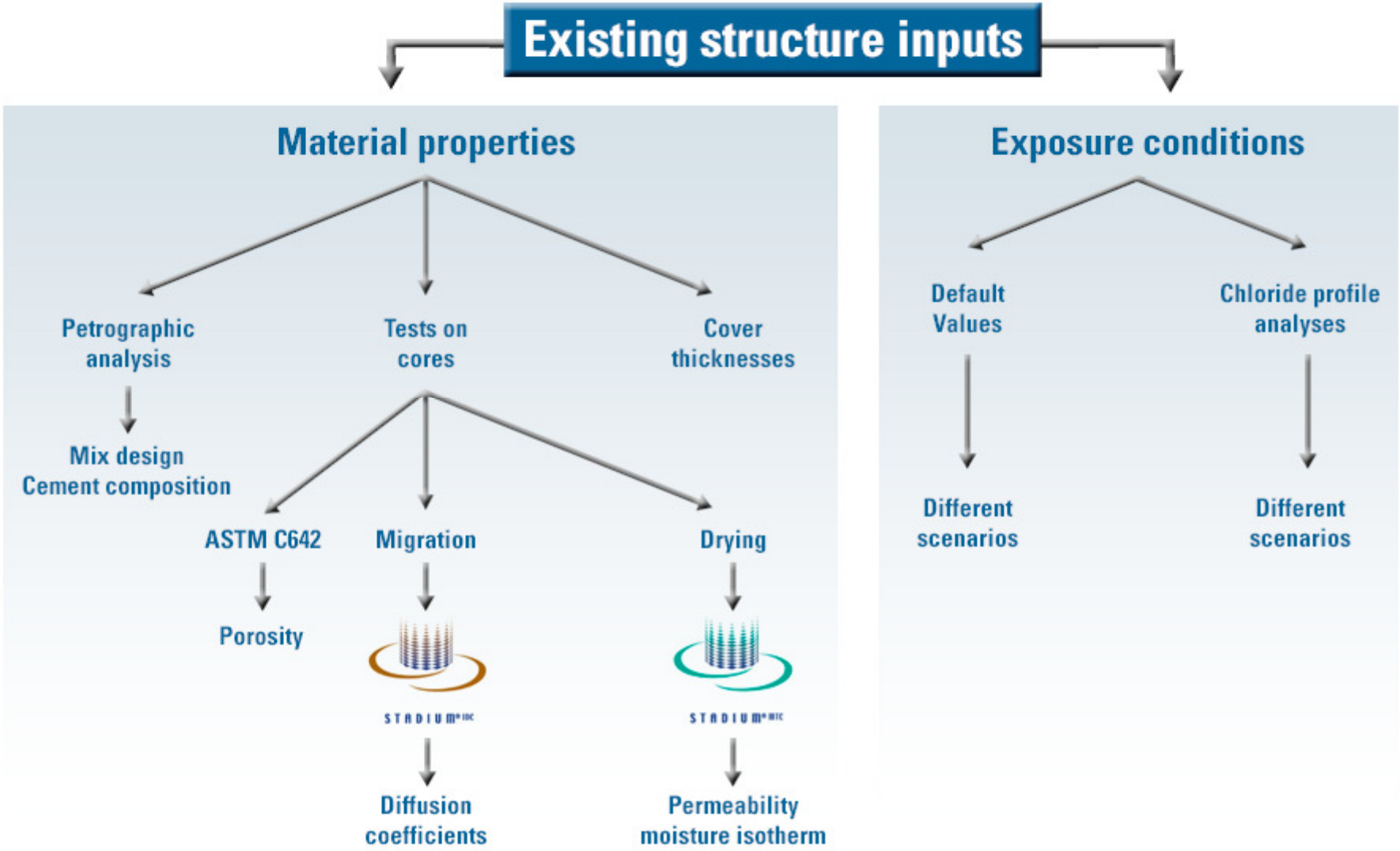

Test Results

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- Concrete properties
- Experimental chloride profiles

	Box beams	I-beams	Pile caps	Prestressed piles
Porosity	14.2	12.3	12.0	12.7
Diffusion coefficient	23.0	18.5	19.0	13.0
Water-binder ratio	0.40	0.40	0.40	0.40
Paste vol. (%)	28	32	28	29

Service Life Simulations

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Box beams		I beams		Pile caps		Prestressed piles	
Deicing	Airborne	Deicing (web)	Deicing (bottom)	Deicing	Airborne	Airborne	Splash
No repair		No repair		No repair		No repair	
3 inch repair		2.0 inch repair	3.5 inch repair	2, 3, 6 inches repairs	Sealer every 10 years	Sealer every 10 years	Pile jacket
		Sealer every 10 years					1.5 inch repair with 0, 2 and 4 inch jacket

Simulation Results

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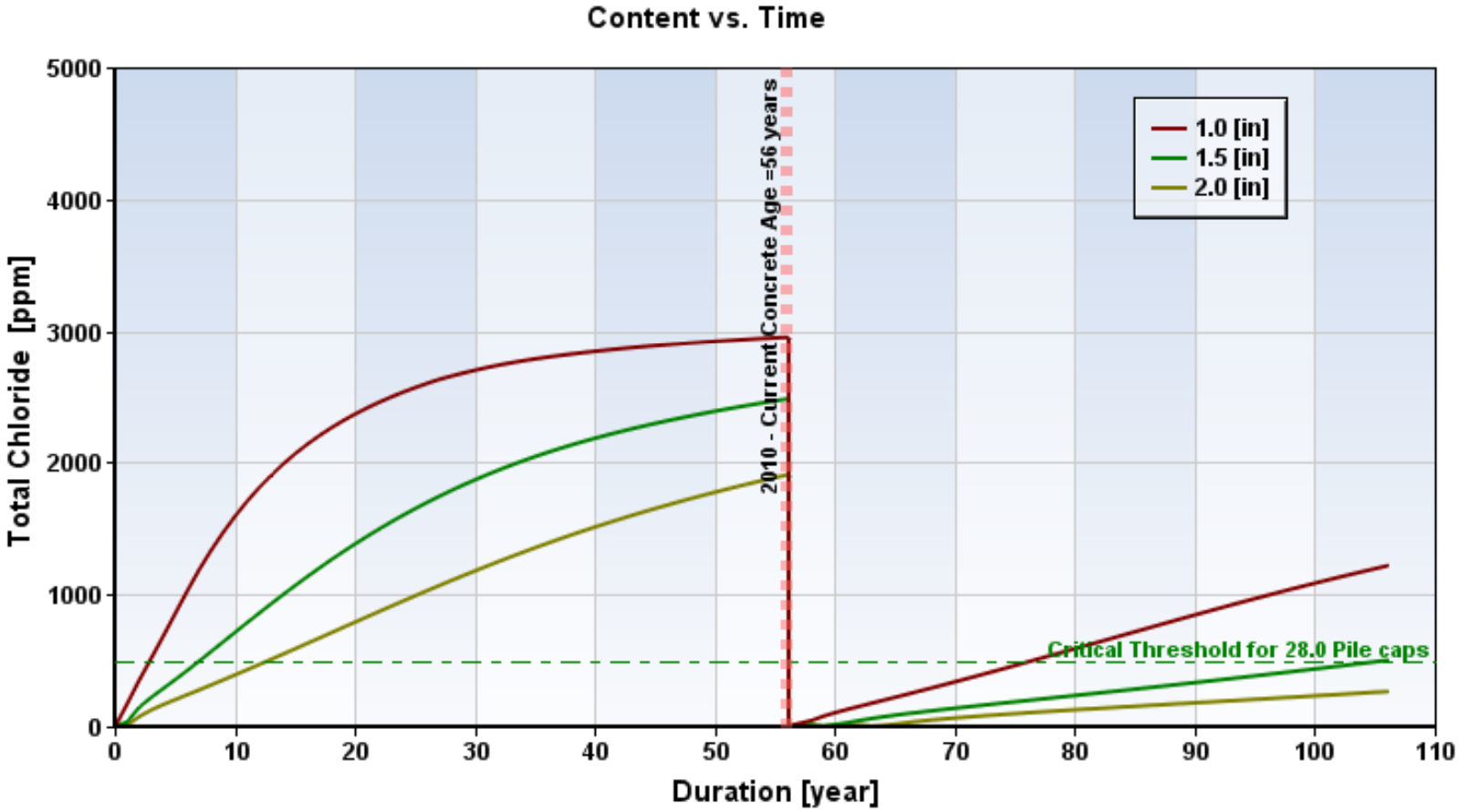

Simulation Results

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Live results from software

Thank you!

Dennis Burns, Eng. M.Sc.
SIMCO Technologies
dburns@simcotechnologies.com