ECOSMART
Concrete Technologies for Sustainable Buildings

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Presented by
Martin Nielsen,
MAIBC, P.Eng., LEED™

BUSBY PERKINS+WILL

Concrete Design and Construction:
An Architect's Perspective

- Why Architects Design with Concrete
- What do Architects want from Concrete
- What do Clients want from Concrete
- Concrete and LEED™
- Issues with Specifying SCM's

Design Philosophy:

Good Buildings are Good for People

Create the finest possible environment

- Healthy
- Practical
- Stimulating
- Bright, sunlit
- Flexible
- Safe
- Airy, Clean
- Efficient
- Friendly, warm
- A great place to work or live

Climate Change

Environmental Context

- **Energy**
- **Water**
- **Materials**
- **Land Use**
- **Health & Well-being**

Global Impact of Buildings

Building construction and operations around the world consumes, or is responsible for:

- 40% of total energy use
- 30% of raw materials
- 25% timber harvest
- 35% CO_2 emissions
- 16% fresh water
- 40% waste to landfills
- 50% ozone depleting CFCs

Why Architects Design with Concrete

- Structural Expression
- Purity of Form
- Presence – Mass and Solidity
- Timeless Quality
- Durable
- Fire Resistance
- Thermal Mass
- Seismic Capacity
- LEED Points
- Cost Efficient

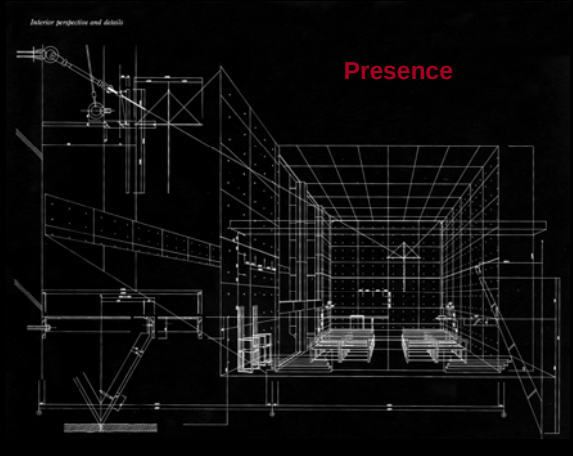
Structural Expression

Structural Expression

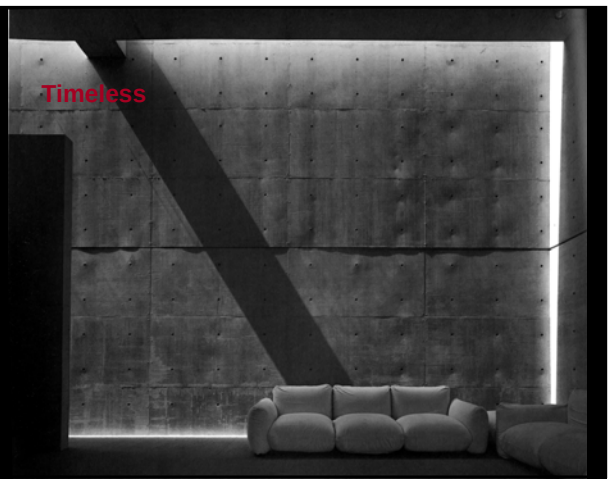
Purity of Form

Presence

Presence



Timeless

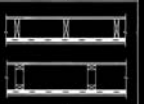


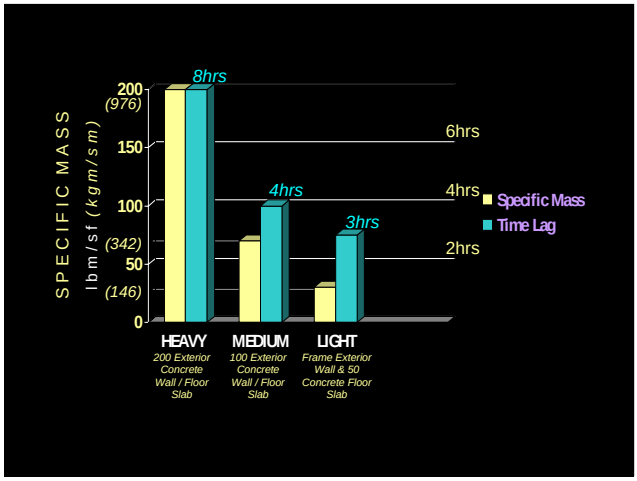
Timeless Quality

Durable

Fire and Sound Resistance

Table A-9.10.3.1.B.
Fire and Sound Resistance of Floors, Ceilings and Roofs

Type of Assembly	Assembly Number	Description	Fire Resistance Rating	Typical Sound Transmission Class[1][2]
Concrete Slabs	F1	• reinforced concrete with no finish on either side		
	F1a	• 90 mm reinforced concrete with 20 mm minimum cover over reinforcing steel	1 h	48
	F1b	• 130 mm reinforced concrete with 25 mm minimum cover over reinforcing steel	2 h	52
Open Web Steel Joists	F2	• concrete deck, minimum 50 mm thick • on open web steel joists spaced 400 mm o.c. • furring channels spaced not more than 600 mm o.c. wired to underside of joists • 1 layer of gypsum board on ceiling side		
	F2a	F2 with • 15.9 mm Type X gypsum board[3]	45 min	53
Wood Floor Joists or Wood Floor Trusses	F3	• subfloor of 19 mm tongue and groove lumber or 15.5 mm plywood, OSB or waferboard • on wood joists spaced not more than 400 mm o.c., or on wood trusses[4] spaced not more than 600 mm o.c. • absorptive material in cavity[5] • resilient metal channels spaced at 200 mm o.c. • 1 layer of gypsum board on ceiling side		
	F3a	F3 with • 15.9 mm Type X gypsum board[3]	45 min	48



Issue of 'Quality of Appearance'

- Consistency – color, surface, grain
- Durability – weathering, maintenance, wear
- Flexibility – form, structure, seismic

1.3 REFERENCE STANDARDS

.4 LEED™ BC Adaptation Guide for facilitating the use of the LEED™ Green Building Rating System. Comply with the following LEED™ requirements for the work of this section:

.1 Sustainable Sites:

Prerequisite SS-P1

.2 Material and Resources:

Credits MR-2.1 and MR-2.2 - Construction Waste Management

Credits MR4.1 and MR4.2 - Recycled Material Requirements,

Credits MR-5.1 and MR-5.2 - Local / Regional Material Requirements

2.2 RECYCLED CONTENT

.1 Concrete and Precast Concrete (where possible):

.1 Replace Portland Cement with minimum 40% fly ash content by weight.

.2 Aggregates: Use recycled aggregate where possible.

.2 Reinforcing steel to contain 75% post consumer recycled content and 90% total recycled content. Fabricator to provide mill certificates to verify recycled content.

Materials and Resources

Credit 4.1: Recycled Content (7.5%)

4.2: Recycled Content (15%)

Credit 5.1: Local/Regional Materials (10%)

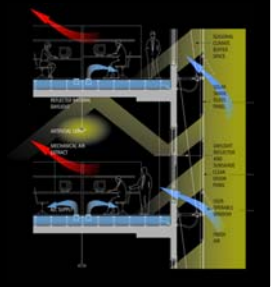
5.2: Local/Regional materials (20%)

Credit 8.0: Durability

Energy & Atmosphere

Credit 1: Optimize Energy Performance (10 points)

-thermal mass



Innovation and Design Process

Credit 1: Innovation in Design (4 available)

One point available for SCM's 40% above baseline (i.e. 25% SCM in BC)

Issues with Specifying SCM's

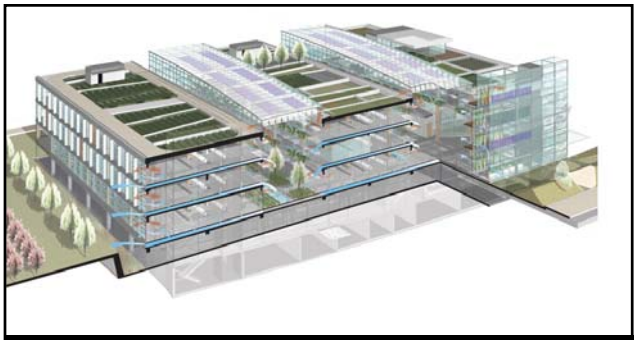
- Liability – untested, unknown
- Cure Time – construction schedule
- Quality and Appearance
- Cold Weather Curing – construction delays
- Material Cost & Supply – price fluctuation, local supply

Centre for Interactive Research on Sustainability

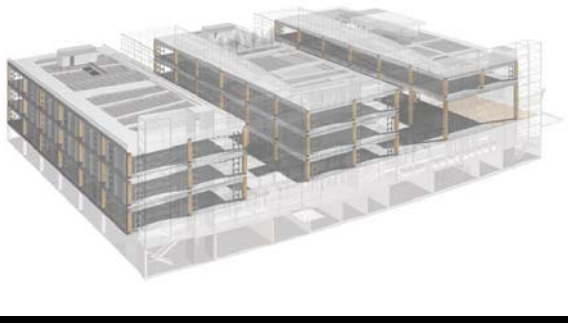
"Accelerating Sustainability"

CIRS Sustainable Design Goals

- Integrated and paperless design
- Sustainable mobility program
- Positive environmental impact
- GHG neutral
- Minimal mechanical ventilation/cooling
- Net energy producer*
- 100% daylighting
- 100% rainwater collection for potable water
- Zero liquid waste
- Zero Solid Waste
- Sustainable building materials
- Healthy air quality
- Super monitoring; adaptive controls



Energy: Ventilation and Air Supply
- minimize mechanical cooling requirements
- optimize thermal mass strategies



Resource Conservation
- modular, flexible structural system
- Maximize building utilization
- Procure resource efficient building materials and furniture systems

Lagoons Development - Dubai

Lagoons

Concluding Thoughts

- Value-Added Factors:
  - Increase Confidence within Design Community
  - Consistency
  - Case Studies
  - Contractor/Construction Industry Buy-in
  - Work into Specification
  - Create a Product - Branding
  - Promote the benefits toward LEED