MON-A10 Living Architecture: Optimized Performance Through Enlightened, Integrated Design

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Green Roofs for Healthy Cities

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Conservation Design Forum

Learning Objectives

1. Improve living-architecture performance and value through design.
2. Realize the enormous latent potential of all building surfaces.
3. Learn from pioneers of living architecture with more than a decade of built experience.
4. Find more aggressive and creative applications of living architecture.

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Living systems support high-performing places to sustain us

Chicago City Hall Rooftop Garden Demonstration Project

Chicago's Green Crown

GREEN ROOF SYSTEMS PLAN

CITY HALL, CHICAGO
URBAN GREEN PLANNING INITIATIVES
Rooftop Project
Northwest Corner
Plant Establishment at NW Corner

October 2000  May 2001

Northwest Corner

Spring 2002

Northwest Corner

Early Summer 2002

Magenta Zone in Bloom

Summer 2002

Photo: Bruce Dvorak

Photo: City of Chicago DOE

Photo: Charlie Miller, Roofscapes

Photo: Green Roofs for Healthy Cities
What is Resilience?

Broadly defined, resilience is an ability to recover from or adjust easily to misfortune or change.
Why Resilience is of Growing Importance

In the last 2 years, the United States experienced 25 climate and weather-related disasters…

... these disasters exceeded $1 billion ($115 billion total) in damages and claiming 1,019 lives. (NOAA)

Role of Living Architecture in Securing Urban Resiliency

Water:

Role of Living Architecture in Securing Urban Resiliency

Food:

- Average city has 3 to 4 days of fresh food supply
- According to rooftop hydroponic industry, 15 ft² of roofspace is required to feed a single person for an entire year
Role of Living Architecture in Securing Urban Resiliency

**Energy:**

- Integration of green roofs and photovoltaic panels.
- GSA's 50 United Nations Plaza Building
- (Left – Right) John Rahaim, Director of San Francisco Planning Department; Steven Peck, President of GRHC; Ruth Cox, GSA Regional Administrator, Pacific Rim Region; Juliet Ellis, Assistant General Manager for External Affairs at SFPUC
Green Roofs for Healthy Cities

**Mission Driven:**
To Build the Green Roof and Wall Industry through education, advocacy and celebrations of excellence.

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**Green Roof Industry Growth**

<table>
<thead>
<tr>
<th>Year</th>
<th>Square Footage Installed Per Year</th>
</tr>
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<tbody>
<tr>
<td>2004</td>
<td>0</td>
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<tr>
<td>2005</td>
<td>0</td>
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<tr>
<td>2006</td>
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<td>2009</td>
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<td>2010</td>
<td>0</td>
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<tr>
<td>2011</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>0</td>
</tr>
</tbody>
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**Education: New and Updated Training**

- Integrated and Updated 101-201 Courses
- New Living Architecture and Sustainable Energy (Launched)
- Integrated Water Management for Building and Sites (December Launch)
- Moving towards an online platform for delivering training in 2014

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**Education and GRP Advocacy**

- [Image of GRP Advocacy materials]

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Education and Advocacy

Education: Green Infrastructure Charrette

Charette: Standard Land Use

Charette: With Intense Green Infrastructure
Education: Student Design Challenge

Education: Living Architecture Monitor

2013 Highlights
• Digital magazine readership and website readership are skyrocketing!
• Over 50% increase in readership
• Community Health; Business Case; Food, Water & Energy; and International (Awards of Excellence)
• New features

2014 Plans
• Green Roof & Wall Directory (free Corporate Member listing) and Journal of Living Architecture
• Revitalization; Health; Innovation; Business Case

Education and Research: JOLA

JOURNAL
OF LIVING ARCHITECTURE

Editorial Review Board:
- Chair: Dr. Robert Bergelage (Penn State University)
- Dr. Reid Coffman (Kent State University)
- Dr. Nigel Dunnett (University of Sheffield)
- Dr. Brad Bass (Environment Canada)
- Dr. Sabina Shaikh (University of Chicago)
- Dr. Bill Retzlaff (Southern Illinois University Edwardsville)
- Barry Lehman (California State Polytechnic University, Pomona)
- Dr. Maureen Connolly (British Columbia Institute of Technology)
- Thomas D'Arcy (US Environmental Protection Agency)
- Dr. Richard Sutton (University of Nebraska-Lincoln)
- Virginia Russell, MLA (University of Cincinnati)
- Dr. Youbin Zheng (University of Guelph)
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Education and Research: LAPT

• Living Architecture Performance Tool
• Creating a comprehensive series of metrics to evaluate the performance of green roof and wall technologies
• Focus in 2014 on water-related performance metrics
• In discussions with USGBC, GSA, and DC Water over funding opportunities
• Critical to advancing quality products and services in the marketplace.
The Mountain Equipment’s Co-op store
North Vancouver, BC

Performance Metrics:
• 100% of stormwater capture for a 10 year storm event (no municipal storm connection);
• 50% of paved site surfaces covered with tree canopy and permeable surfacing;
• Daylighting: natural light to the entire retail floor admitted by clerestory windows is reflected off the white sawtooth ceiling;
• No potable water use for the landscape (except during first year of establishment)
The Burnside Gorge Community Centre
Victoria, BC

Performance Metrics:
- Accessible to the public 24/7,
- The roof is a partial restoration of the endangered Garry Oak ecosystem
- It covers 90% of the building partially buried into the hillside
- LEED Gold certification
The Seymour – Capilano Filtration Plant
Vancouver, BC

Performance Metrics:
• 16 hectare (40 acre) site including 10 hectares of site restoration.
• Second largest green roof in Canada.
• Accessible to the public 24 / 7
• Green roof system counteracts the upward hydrostatic pressures on the underground reservoir.
• The area was restored with native flora and fauna of the Seymour watershed.
• LEED® Gold certification

The Visitor Centre at VanDusen Botanical Garden
Vancouver, BC

Performance Metrics:
• Reflects the Pacific Northwest Coastal grassland community and includes over twenty species of plants, bulbs, and grasses.
• Roof garden runoff is directed to an underground cistern, and provides base flow for the existing stream, enhanced infiltration beds, and wetlands.
• The project is anticipating both the Living Building Challenge and LEED® Platinum certification.
Paul Kephart
President and Founder
Rana Creek
Integrated Design Process

in·te·grate
To make into a whole by bringing all parts together; unify
possibilities...

I. Design Elements –
- Energy
- Water
- Waste
- Ecology
- Human health/well being

LIVING SYSTEMS DESIGN
- ENERGY

COASTAL WETLAND
CONSTRUCTED WETLAND
Aquaponics

LIVING SYSTEMS – BIODIVERSITY

• Re-connect Habitat - Link within corridors
• Provide habitat for migratory species of birds, butterflies and invertebrates.
• Improve site and water quality conditions for local reptiles, amphibians, and fish.
II. APPLICATIONS – LIVING SYSTEMS DESIGN – SUMMARY

Natural Systems
- Examples
  - Creeks
  - Pools
  - Seeps
  - Springs
  - Estuaries
  - Wetlands

Natural Analogues
- Attributes applied
  - Topography
  - Morphology
  - Permeability
  - Plant Structure & Form
  - Capacity
  - Scale

Engineered Systems
- Applications
  - Bioswales
  - Raingardens
  - Constructed Vernal Pools
  - Constructed Wetlands
  - Living Walls
  - Living Pools

EUROPEAN PRECEDENT
- Nine Houses, Dietikon, Switzerland
  - Architect: Peter Vetsch AG
  - Year: 1993
  - Size: 4,105.6 sq.ft.
  - Slope: 35%

LOW INPUT ROOFS
- Low Input Applications, Low Cost
- Self-Vegetating, “Volunteer” Plants
- Habitat Creation, Microtopography
- Stormwater Retention, Vernal Pools
INTEGRATED DESIGN
Paul Kephart, President and CEO of Rana Creek
November 30, 2011

NORTH AMERICAN EXPANSION

PHEIFFER RIDGE HOUSE
Big Sur, California
Croton Water Treatment Plant

Project Architect: Grimshaw Architects
Ecology & Living Roof: Rana Creek
Environmental Consultant: Atelier Ten

Complexity & Scale
Water Systems
Product Focus Vs. Project Delivery
Security
Process flow diagram.

- 100% of building wastewater and stormwater is treated on-site for non-potable uses
- Engineered wetland on roof for final filtration
- Treated water redistributed for: irrigation, flushing toilets, water features
Transbay Water Goals

Key design ideas:

- Water is related to energy. Synergies between water conservation and energy conservation should be explored.
- Off-site impacts of water use should be considered, including the impacts and energy use needed to get water from its source to San Francisco.
- Water is related to habitat & heat island effect mitigation; synergies between these should be explored.

Local Green Building Codes
San Francisco Green Building Ordinance

- Requires public or private buildings to meet LEED, energy, and water targets.
- Gets more stringent over time
- Varies by building program and size

SF Green Building Ordinance for large commercial buildings:
Initial requirements, 2009:
- meet LEED Silver
- provide space for trash, recycling, & compost
- recycle 75% of construction waste
- reduce irrigation water use by 50%; reduce domestic water use by 20%
- reduce stormwater runoff by 25% or filter 90% of runoff

Additional requirements, 2010 – 2012:
- meet LEED Gold
- reduce domestic water use by 30%
- provide 5% of building’s...
Transbay Water Requirements

- San Francisco Stormwater Design Guidelines: For combined sewer areas, draft guidelines require compliance with LEED SSc6.1, Stormwater Design, Quantity Management. A previous draft required that 80% of runoff from a typical storm be managed on site.

- Recycled Water Piping: SF BIC Appendix J "Reclaimed Water for Non-residential Buildings" requires that all toilets and urinals are piped for the future supply of city recycled water.

- LEED 2009 Gold Certification: Under LEED 2009 BD+C, all projects must reduce domestic potable water by 20% as a new prerequisite. Other water credits will contribute to Gold certification.
INTEGRATED DESIGN
Paul Kephart, President and CEO of Rana Creek
November 30, 2011
Project Goal: Platinum Level Certification > 52 points

Six Rating Categories:

- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation in Design
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Q & A