Green Infrastructure for Great Cities

Urban Surfaces and Stormwater
Green CiTTS webinar

Richard M. Daley
Mayor

Janet L. Attarian, AIA, LEED AP, Project Director
Streetscape and Sustainable Design Program
Old Fashioned and New Fashioned Sustainability

Accommodate the needs of ALL users in a limited amount of space

Minimize impact on land, air and water resources
Leadership: Chicago Climate Action Plan

Permeable Pavement

Adaptation (Infiltration)

Mitigation (Energy use)
Green Alley Program

• Six pilot locations, and over 130 locations citywide

• Program includes use of permeable pavements, recycled materials, high-albedo pavements, and dark-sky lighting.

• Improves stormwater management and energy use through infrastructure improvements
Waste Management: Green Alley Program

Development of Permeable Asphalt and Concrete:

• Best Practices
• Material Testing
• Trial Batches
• Recycled Content- Slag/GTR

The Ground Tire Rubber Solution:

• Approx 600 tires recycled per alley
• Solved cohesion problem
Maintenance and Commissioning

May 2008 Green Alleys Monitoring

<table>
<thead>
<tr>
<th>Description</th>
<th>Albedo</th>
<th>Cores</th>
<th>Infiltration</th>
<th>Sweep?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pervious HMA alley</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>3 methods</td>
</tr>
<tr>
<td>Pervious concrete alley</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>3 methods</td>
</tr>
<tr>
<td>Block pavers</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Pervious concrete strip w/high-albedo panels</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Power-wash</td>
</tr>
<tr>
<td>High-albedo pavement</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

• Owner Needs
• Level of Service
• Life Cycle Costs
Belmont Alley – Installation Innovation

28-day compressive strength: 2757 psi (core)

Permeability: 19.5 gpm/sq ft

Aggregate Mix
CM11: 2076 lbs.
CM13: 425 lbs.
Maxwell Street Permeable Market Plaza

- .89 acres of permeable, high albedo pavers
- Pavers have initial SRI of .30 or 32%
Market Plaza: Preliminary Monitoring Results

1/16/09 (temp in degrees)
Air: -7.0
Deep: 38.6
Middle: 34.1
Shallow: 33.4

EPA Research Questions
- Runoff Volume and Rate
- Surface Water Quality
- Ground Water Quality
- Freeze/Thaw Performance

Sept 2008 - Feb 2009
Parkways

Parking Stalls

Plazas

Parking lanes
Sustainable Streets

The Cermak / Blue Island Streetscape
<table>
<thead>
<tr>
<th>Sustainable Goals</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stormwater Management</strong></td>
<td>Divert 80% of the typical average annual rainfall and at least 2/3 of rainwater falling within catchment area into stormwater best management practices.</td>
</tr>
<tr>
<td><strong>Water Efficiency</strong></td>
<td>Eliminate use of potable water for irrigation, specify native or climate adapted, drought tolerant plants for all landscape material.</td>
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<tr>
<td><strong>Transportation</strong></td>
<td>Improve bus stops with signage, shelters and lighting where possible, promote cycling with new bike lanes, improve pedestrian mobility with accessible sidewalks.</td>
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<tr>
<td><strong>Energy Efficiency</strong></td>
<td>Reduce energy use by min. 40% below a typical streetscape baseline, use reflective surfaces on roads/sidewalks, use dark sky-friendly fixtures. Min. 40% of total materials will be extracted, harvested, recovered, and/or manufactured within 500 miles of the project site.</td>
</tr>
<tr>
<td><strong>Recycling</strong></td>
<td>Recycle at least 90% of construction waste based on LEED NC criteria, Post/Pre- Consumer recycled content must be min. 10% of total materials value.</td>
</tr>
<tr>
<td><strong>Urban Heat Island, Air Quality</strong></td>
<td>Reduce ambient summer temperatures on streets and sidewalks through use of high albedo pavements, roadway coatings, landscaping, and permeable pavements. Require ultra low sulfur diesel and anti-idling.</td>
</tr>
<tr>
<td><strong>Education, Beauty &amp; Community</strong></td>
<td>Provide public outreach materials/self-guided tour brochure to highlight innovative, sustainable design features of streetscape. Create places that celebrate community, provide gathering space, allow for interaction and observation of people and the natural world.</td>
</tr>
<tr>
<td><strong>Commissioning</strong></td>
<td>Model Stormwater BMP’s in Infoworks to analyze and refine design. Monitor stormwater BMP’s to ensure predicted performance and determine maintenance practices.</td>
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</tbody>
</table>
Integrated Infrastructure Design Example: Blue Island Cross-section

- High SRI for Lighting and UHI
- Photocatalytic for Air Quality
- Permeable Pavement for Stormwater Management
- Bike/Parking Lane
Permeable pavers with photocatalytic cement face mix will have a minimum SRI of .45.

Pavers should maintain their SRI better due to "self-cleaning" aspect.

Over 50,000sqft of permeable pavers.
Blue Island Details

- Permeable, photocatalytic, high albedo pavers
- Infiltrating planters
- Belt and suspenders
- Landscape survival

Permeable Parking/Bike Lane

Sidewalk Planter

Stormwater Storage Extends to Planted Area
Asphalt

• Pre-2006: Max RAP allowable within IDOT Specification, N30
• 2006: Pilot use of N30LC, using 45% RAP + 15% Recycled Concrete + 10% GTR in the AC Liquid
• 2006: Permeable asphalt with GTR
• 2007: Pilot use GTR in N90 arterial application
• 2008: Pilot 4.75 binder course with GTR with SMA surface
• 2008: Piloted two Evotherm warm mix asphalt projects
• 2009: Pilot use of 5% post-consumer asphalt shingles + 23% RAP, N30, reducing amount of virgin asphalt concrete
• 2011: N90 Warm mix asphalt with 10% FRAP, 20% Course FRAP, 5% RAS and GTR with high albedo micro-thin concrete overlay
Concrete

- **2006**: Permeable Concrete with slag
- **2006**: High Albedo Concrete with slag
- **2009**: Concrete with recycled wash water
- **2009**: Refined permeable concrete mix design to accommodate new maintenance protocol and tested asphalt paver installation method
- **2010**: Concrete with 30% recycled aggregate, recycled wash water and 10% slag
Meteorological Station

Intersection of Cermak Road, Blue Island Avenue and Ashland Avenue will be coated with micro-thin concrete overlay.

Can compare air temperature and surface temperature in real time.
Air Quality Pre-Data Collection

Data Points Include: NO, NO2, NOx, Wind Speed, UV
Get Points!

- LEED-NC
- Stormwater Design
  - Quantity
  - Quality
- Heat Island Effect: Non-Roof
- Recycled Content
- Regional Materials
- Innovation
- LEED- ND
- The Sustainable Sites Initiative
- I-LAST, IDOT rating system
- Greenroads
<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>Design Strategy</th>
<th>Rating System</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Identify Stakeholders and develop Stakeholders Involvement Plan</td>
<td>2</td>
<td>------</td>
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</tr>
<tr>
<td></td>
<td>Engage Stakeholders to conduct Context Audit and develop project purpose</td>
<td>2</td>
<td>------</td>
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</tr>
<tr>
<td></td>
<td>Involve Stakeholders to develop and evaluate alternatives</td>
<td>2</td>
<td>------</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Employ Stakeholder involvement techniques to achieve consensus for Preferred Project Alternative</td>
<td>2</td>
<td>------</td>
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</tr>
<tr>
<td></td>
<td>Plan for Context Sensitive Solutions (CSS)</td>
<td>------</td>
<td>5</td>
<td>------</td>
<td>------</td>
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</tbody>
</table>

**TOTAL POINTS EARNED:**

<table>
<thead>
<tr>
<th>Points Possible:</th>
<th>228</th>
<th>118</th>
<th>250</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage % of possible points:</td>
<td>57%</td>
<td>67%</td>
<td>40%</td>
<td>32%</td>
</tr>
<tr>
<td>Ranking:</td>
<td>N/A</td>
<td>Evergreen (&gt;60% of total)</td>
<td>One Star (Four Star possible)</td>
<td>(need 8 more Points to become &quot;Certified&quot;)</td>
</tr>
</tbody>
</table>
Sustainable Streets are Cost Effective

Cost is 30% less than projected...

- Cermak total project cost ($)
- Actual bid

... And is 20% less expensive than the average block in 2010

- Average construction cost per block in 2010
- Cermak cost per block

30%

21%
How complete is your pavement?

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January 25, 2011

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