Conventional vs. Sustainable: A Matrix for Decision Making

APWA National Sustainability Conference
Pittsburg, PA
June 26, 2012
Introduction

Larry Stevens, PE
Project Director, HR Green, Inc., Johnston, IA
Director, Institute for Sustainable Infrastructure
Director, American Public Works Association

Jennifer Winter, PE
Project Director, HR Green, Inc., Cedar Rapids, IA
Committee Member, Institute for Sustainable Infrastructure
Objectives

Advantages of sustainable design and construction

Framework to compare/contrast conventional vs. sustainable

Obstacles to implementing sustainable design
The Dilemma

• Defining true cost of conventional projects
• Measuring benefit of “externalities” of sustainable projects
• Challenges by peers, elected officials, and the public of the worth of sustainable vs. conventional methods
• Conventional thinking limits opportunities
• Current approaches are conducive to sustainability
The Conventional Approach

- Identify the problem
- Determine the solution to the problem
- Implement the solution – generally by the most cost effective and timely path
Why Conventional Approaches are becoming less applicable

• Urban areas are more dynamic
  • Development patterns try to integrate residential, commercial, civic, and employment centers rather than separate them
• Cumulative impacts of projects are becoming more pronounced
  • This is particularly true for stormwater impacts, water quality, and air quality, just to name a few
• There is heightened interest in those things that just make good financial sense
• More emphasis on quality of life issues
Sustainable approach
Progress toward Sustainable Approaches

• Why is it important to work towards sustainability in public works?
• Sustainability in public works means seeking a balanced approach (APWA)
  • for a vibrant community today and tomorrow, and
  • it is accomplished by the efficient delivery of infrastructure
  • in an environmentally and socially responsible way that
  • ensures the best economic choice in the long term
Envision™ Categories

- Quality of Life
- Leadership
- Resource Allocation
- Natural World
- Climate and Risk
Envision™ Credit List

1 PURPOSE
- DL1.1 Improve Community Quality of Life
- DL1.2 Stimulate Sustainable Growth & Development
- DL1.3 Develop Local Goals & Capabilities

2 WELLBEING
- DL2.1 Enhance Public Health & Safety
- DL2.2 Minimize Noise & Vibration
- DL2.3 Minimize Light Pollution
- DL2.4 Improve Community Mobility & Access
- DL2.5 Encourage Alternative Modes of Transportation
- DL2.6 Improve Accessibility, Safety, & Wayfinding

3 COMMUNITY
- DL3.1 Preserve Historic & Cultural Resources
- DL3.2 Protect View & Local Character
- DL3.3 Enhance Public Space

1 COLLABORATION
- LD1.1 Provide Effective Leadership & Commitment
- LD1.2 Establish a Sustainability Management System
- LD1.3 Foster Collaboration & Teamwork
- LD1.4 Provide for Stakeholder Involvement

2 MANAGEMENT
- LD2.1 Pursue By-Product Synergy Opportunities
- LD2.2 Improve Infrastructure Integration

3 PLANNING
- LD3.1 Plan for Long-Term Monitoring & Maintenance
- LD3.2 Address Conflicting Regulations & Policies
- LD3.3 Enhance Useful Life

1 MATERIALS
- RA1.1 Reduce Net Embodied Energy
- RA1.2 Support Sustainable Procurement Practices
- RA1.3 Use Recycled Materials
- RA1.4 Use Regional Materials
- RA1.5 Divert Waste From Landfills
- RA1.6 Reduce Excavated Materials Taken Off Site
- RA1.7 Provide For Deconstruction & Recycling

2 ENERGY
- RA2.1 Reduce Energy Consumption
- RA2.2 Use Renewable Energy
- RA2.3 Commission & Monitor Energy Systems

3 WATER
- RA3.1 Protect Fresh Water Availability
- RA3.2 Reduce Potable Water Consumption
- RA3.3 Monitor Water Systems
- RA3.4 Innovate or Exceed Credit Requirements

1 SITING
- NW1.1 Preserve Prime Habitat
- NW1.2 Protect Wetlands & Surface Water
- NW1.3 Preserve Prime Farmland
- NW1.4 Avoid Adverse Geology
- NW1.5 Preserve Floodplain Functions
- NW1.6 Avoid Unsuitable Development on Steep Slopes
- NW1.7 Preserve Greenfields

2 LAND+WATER
- NW2.1 Manage Stormwater
- NW2.2 Reduce Pesticide & Fertilizer Impacts
- NW2.3 Protect Surface & Groundwater Contamination

3 BIODIVERSITY
- NW5.1 Preserve Species Diversity
- NW5.2 Control Invasive Species
- NW5.3 Restore Disturbed Soils
- NW5.4 Maintain Wetland & Surface Water Functions

1 EMISSIONS
- CE1.1 Reduce Greenhouse Gas Emissions
- CE1.2 Reduce Air Pollutant Emissions

2 RESILIENCE
- CE2.1 Assess Climate Threat
- CE2.2 Avoid Taps & Vulnerabilities
- CE2.3 Prepare For Long-Term Adaptability
- CE2.4 Prepare For Short-Term Hazards
- CE2.5 Manage Heat Island Effects

3 CLIMATE AND RISK
- CE3.0 Innovate or Exceed Credit Requirements

NWC.0 Innovate or Exceed Credit Requirements

TOTAL CREDITS: 10 CREDITS
Comparing Conventional vs. Sustainable

CASE STUDIES
### Envision™ Stage 1 checklist

<table>
<thead>
<tr>
<th>Quality of Life</th>
<th>Purpose</th>
<th>Yes</th>
<th>No</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>QL 1.1 Improve Community Quality of Life</td>
<td>QL 1.2 Stimulate Sustainable Growth and Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QL 1.3 Develop Local Skills and Capabilities</td>
<td>QL 1.4 Enhance Public Health and Safety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QL 1.5 Minimize Noise and Vibration</td>
<td>QL 1.6 Minimize Light Pollution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QL 2.1 Improve Community Mobility and Access</td>
<td>QL 2.2 Encourage Alternative Modes of Transportation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QL 2.3 Minimize Traffic Noise and Vibration</td>
<td>QL 2.4 Improve Accessibility, Safety and Wayfinding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QL 3.1 Preserve Historic and Cultural Resources</td>
<td>QL 3.2 Preserve Views and Local Character</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QL 3.3 Enhance Public Space</td>
<td>QL 4.1 Manage Heat Island Effects</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Leadership | LD 1.1 Provide Effective Leadership and Commitment | | | |
| LD 1.2 Establish a Sustainability Management System | LD 1.3 Foster Collaboration and Teamwork | | | |
| LD 1.4 Promote Stakeholder Involvement | LD 1.5 Pursue By-Product Synergy Opportunities | | | |
| LD 1.6 Improve Infrastructure Integration | LD 1.7 Plan for Long-term Maintenance and Monitoring | | | |
| LD 1.8 Extend Useful Life | LD 1.9 Address Conflicting Regulations and Policies | | | |

| Resource Allocation | RA 1.1 Reduce Net Embodied Energy | | | |
| RA 1.2 Support Sustainable Procurement Practice | RA 1.3 Use Recycled Materials | | | |
| RA 1.4 Use Regional Materials | RA 1.5 Avoid Adverse Geology | | | |
| RA 1.6 Reduce Lesealed Materials Taken Offsite | RA 1.7 Provide for Deconstruction and Recycling | | | |
| RA 1.8 Reduce Energy Consumption | RA 1.9 Protect Fresh Water Availability | | | |
| RA 2.2 Use Renewable Energy | RA 2.3 Commission and Monitor Energy Systems | | | |
| RA 2.4 Use Efficient Lighting | RA 2.5 Prepare for Long-Term Climate Adaptability | | | |
| RA 2.6 Provide for Deconstruction and Recycling | RA 2.7 Prepare for Short-Term Hazards | | | |

| Natural World | NW 1.1 Preserve Prime Habitat | | | |
| NW 1.2 Preserve Wetlands + Surface Water | NW 1.3 Preserve Prime Farmland | | | |
| NW 1.4 Avoid Adverse Geology | NW 1.5 Preserve Floodplain Functions | | | |
| NW 1.6 Avoid Unsuitable Development on Steep Slopes | NW 1.7 Provide for Deconstruction and Recycling | | | |
| NW 2.1 Manage Stormwater | NW 2.2 Reduce Pesticides and Fertilizer Impacts | | | |
| NW 2.3 Protect Surface + Groundwater Contamination | NW 2.4 Protect Fresh Water Availability | | | |
| NW 3.1 Preserve Species Biodiversity | NW 3.2 Control Invasive Species | | | |
| NW 3.3 Restore Disturbed Soils | NW 3.4 Maintain Wetland & Surface Water Functions | | | |

<p>| Climate and Risk | CR 1.1 Reduce Greenhouse Gas Emissions | | | |
| CR 1.2 Reduce Air Pollutant Emissions | CR 2.1 Assess Climate Threat | | | |
| CR 2.2 Avoid Traps and Vulnerabilities | CR 2.3 Prepare for Long-Term Climate Adaptability | | | |
| CR 2.4 Prepare for Short-Term Hazards | | | |</p>
<table>
<thead>
<tr>
<th>Purpose</th>
<th>Quality of Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>QL 1.1 Improve Community Quality of Life</td>
<td></td>
</tr>
<tr>
<td>QL 1.2 Stimulate Sustainable Growth and Development</td>
<td></td>
</tr>
<tr>
<td>QL 1.3 Develop Local Skills and Capabilities</td>
<td></td>
</tr>
<tr>
<td>QL 2.1 Enhance Public Health and Safety</td>
<td></td>
</tr>
<tr>
<td>QL 2.2 Minimize Noise and Vibration</td>
<td></td>
</tr>
<tr>
<td>QL 2.3 Minimize Light Pollution</td>
<td></td>
</tr>
<tr>
<td>QL 2.4 Improve Community Mobility and Access</td>
<td></td>
</tr>
<tr>
<td>QL 2.5 Encourage Alternative Modes of Transportation</td>
<td></td>
</tr>
<tr>
<td>QL 2.6 Improve Accessibility, Safety and Wayfinding</td>
<td></td>
</tr>
<tr>
<td>QL 3.1 Preserve Historic and Cultural Resources</td>
<td></td>
</tr>
<tr>
<td>QL 3.2 Preserve Views and Local Character</td>
<td></td>
</tr>
<tr>
<td>QL 3.3 Enhance Public Space</td>
<td></td>
</tr>
<tr>
<td>QL 4.1 Manage Heat Island Effects</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
QUALITY OF LIFE

1. Purpose

QL 1.1 Improve Community Quality of Life

Intent: Does the project improve the net quality of life of all communities affected by the project and mitigate negative impacts to communities?

Metric: Measures taken to assess community needs and improve quality of life while minimizing negative impacts.

- How has the project team identified and taken into account community needs, goals, plans and issues?
- How has the project team sought to align the project vision and goals to the needs and goals of the host and affected communities as well as address potential adverse impacts?
- How were affected communities meaningfully engaged in the project design process? Have the affected communities been meaningfully engaged in the project design process?
- Have the project owner and the project team designed the project in a way that improves existing community conditions and rehabilitates infrastructure assets?
Case Study: Highway Corridor

- Project Challenges:
  - LOS
  - Deteriorating pavement
  - Project limits impact two cities
  - Project funding challenges
  - Construction
The Conventional Approach

• Add Lanes
• Reconstruct or Resurface
• Develop Plans
• Bid
• Build
What Have We Missed?

• Impacts of widening
  • Segregation of commercial businesses
  • Pedestrian movements

• Public Input
  • Complete Streets
  • Stormwater

• Other
  • Social
  • Environmental
  • Economic
Framework to Compare – Quality of Life
Purpose/Community/Wellbeing

Conventional Approach
Problem – Need Capacity  Solution - Add Lanes

Sustainable Approach
• Improving the net quality of life?
• Improving community mobility and access?
  • Impacts of added lanes
  • Are pedestrian underpasses needed?
• Encouraging alternative modes of transportation?
  • Opportunity to add bike lane or path?
  • Bus stops/pullovers
• Preserving views and local character?
Framework to Compare – Leadership Collaboration/Management/Planning

Conventional Approach
- Passive – distribute information
- Impact Focused – road closures, access
- Less costly?

Risks – “angry mob” mentality, minimal buy-in, lawsuits, etc.

Sustainable Approach
- Establish meaningful involvement
  - Active approach
  - Engage stakeholders
  - Provide opportunities for input into decision-making
Framework to Compare – **Resource Allocation**
**Materials/Energy/Water**

**Conventional Approach**
- Materials selection mainly cost based
- Recycling - with economic benefit

**Sustainable Approach**
- Recycled materials –
  - Reduce load on landfill → Save $$ in future
  - Reduce use of virgin material
- Regional materials
  - Improve local economy
  - Reduce transportation costs
- Reduce excavated materials taken offsite
  - Minimize soil movement/balance the site
  - Save $$ - transportation/disposal
Framework to Compare – **Natural World**

### Siting/Land & Water/Biodiversity

**Conventional Approach**

- Stormwater – use piping, meet min. regulatory requirements

**Sustainable Approach**

- Minimize impact of infrastructure on stormwater runoff quantity & quality
- Prevent surface & groundwater contamination
  - Rural ditches → Bioswales
  - Concrete → Permeable pavers
Framework to Compare – Climate & Risk

Emissions/Resilience

Conventional Approach
  Meet minimum regulations

Sustainable Approach
  • Reduce greenhouse gas emissions
  • Reduce air pollutant emissions
    • Life-cycle carbon analysis?
    • Encourage alternate modes of travel
    • Correctly set signal timings
    • Reduce transportation during construction
Case Study: Former Quarry Redevelopment

• Challenges:
  • Abandoned quarry donated to the City;
  • City required to prepare a master plan defining the reuse of this site;
  • Access to capital;
  • Questions about the viability of this facility – will people use it?
Framework to Compare – Quality of Life
Purpose/Community/Wellbeing

Conventional Approach
• Meet EPA’s definition?
• Funds available for cleanup/repurposing

Sustainable Approach
• Improving the net quality of life?
  • How does the decision not to participate affect the quality of life?
  • Enhance the natural environment and public spaces
  • Create recreational opportunities
  • Remove environmental impairments that would otherwise stigmatize the property
  • Create a self-sufficient facility driven by rental payments for camp sites and facility fees.
• Encouraging alternative modes of transportation?
• Preserving views and local character?
Framework to Compare - Design

Conventional Approach
• 89 Campsites  
  • (69 with 50 amp electrical service)  
• 9,900 Lineal Feet of Recreational Trail  
• 7,500 Lineal Feet of Paved Roads  
• A dump station and 2 water stations  
• 3 restroom facilities (one with shower facilities)  
• Access for river fishing  
• Beach area and access for swimming  
• 2 ponds for fishing including 2 fishing docks  
• Scenic Overlook area

Sustainable Approach
• See that trails tie into the regional trail system – enhancing the use and impact to the area  
• Paving projects used recycled materials and local contractors  
• Quarry basins were enhanced to create habitat for fish and related plant life
Questions & Closing

Presenter Contact Information:
Larry Stevens, P.E.
lstevens@hrgreen.com

Jennifer Winter, P.E.
jwinter@hrgeen.com

Useful Links:
ISI – www.sustainableinfrastructure.org