


Sustainability Trends Measured by the Greenroads Rating System

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Overview

- Research Background
- Overview of Greenroads
- Scope of research
 - Project Collection
 - Scoring Method
- Trend analysis
- Discussion



Sustainability is a characteristic that describes a system's capacity to support natural laws and human values.



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Road splits in 2011 Japan earthquake. Photo by LA Times.

The Need for Sustainability in Roadways

Roadways have substantial impacts on the environment, society and the economy. Research shows a growing interest from roadway owners and stakeholders.



Research & Owner Interest

- Lots of work defining sustainable transportation
- Majority of existing research is for strategic planning
- Owners are interested = funding research
 - Some State DOTs avidly pursuing sustainability
- Three common types of sustainability approaches:
 - Guidance documents like NCHRP Report 708
 - Compilations of performance metrics like NCHRP Report 451
 - Rating Systems

4 Zietman et al. 2011; Amekudzi et al. 2005; Amekudzi, 2011; Muench et. al. 2012



Development of Greenroads

- Development:
 - Began in 2007 at University of Washington
 - Industry, local and DOT research support
 - 5 years, over 100 people, 120+ test projects



- Managed by Greenroads Foundation since 2010
 - Independent 501(c)(3) non-profit organization

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The Greenroads® Rating System

- Third-party certification process similar to LEED®
 - Applies to new and reconstructed road projects
 - Recognizes and quantifies roadway sustainability
 - Awards points for sustainable practices
- Project-based rating system
 - Focuses on design and construction activities
- Provides simple way to communicate the idea of “green”
 - What can I do on my project now to be more sustainable?

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Category Structure (v1.5)

Category	Description	Points
Project Requirements	Minimum requirements for a Greenroad	Req.
Voluntary Credits		
Environment & Water	Stormwater, habitat, vegetation	21
Access & Equity	Modal access, culture, aesthetics, safety	30
Construction Activities	Construction equipment, processes, quality	14
Materials & Resources	Material extraction, processing, transport	23
Pavement Technology	Pavement design, material use, function	20
Total Voluntary Credit Points		108
Custom Credits	Write your own credit for approval	10
TOTAL POINTS		118

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Certification Levels



32-42 points



43-54 points



55-63 points



64+ points

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Project Evaluation Objectives

- Questions:
 - How does Greenroads measure sustainability on a project?
 - What makes a project “sustainable” or not?
- Collect data (105 projects)
 - 40 “sustainable”
 - 65 “typical”
- Score the projects using Greenroads v1.5
- Evaluate trends

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Anderson, 2012



Project Data Sources

Who Provided It

- UW Greenroads Research Sponsors
- Industry data contributed by:
 - CH2M HILL, Inc.
 - Pertect, Inc.
 - AECOM, USA, Inc.
 - GeoEngineers, Inc.
 - HNTB
 - ARUP
 - Parsons Brinckerhoff
 - KPG, Inc.
 - ISL Engineering, Inc.
- Student class/research projects
- Greenroads Foundation

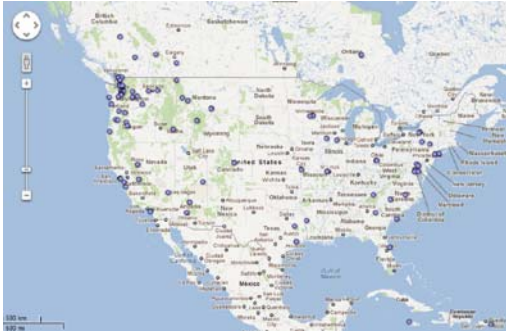
What It Was

1. Verbal. (88 projects).
2. Website (79 projects).
3. Public information (99 projects).
4. Site visit, maps, images (104 projects).
5. Environmental reports. (51 projects).
6. Design documents (54 projects).
7. Contractor documents (54 projects).

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Locations* of Evaluated Projects



Anderson, 2012. * This study includes only projects shown here within U.S. borders and adds 2 more projects in WA.



Scoring Method

Three key scores:

Raw Score

Intent present in documents

NA Score

Not appropriate for project context

Economical Score

Appropriate for project context and likely not to add substantial cost

Sample Project Title

Project Requirements (PR)		PR Subtotal: 11				
No.	Title	Econ	Raw	NA	Rem	
PR-1	Environmental Review Process	Req	x	x		
PR-2	Lifecycle Cost Analysis	Req	x		x	
PR-3	Lifecycle Inventory	Req	x		x	
PR-4	Quality Control Plan	Req	x		x	
PR-5	Noise Mitigation Plan	Req	x		x	
PR-6	Waste Management Plan	Req	x		x	
PR-7	Pollution Prevention Plan	Req	x	x		
PR-8	Low-Impact Development	Req	x	x		
PR-9	Pavement Management System	Req	x	x		
PR-10	Site Maintenance Plan	Req	x	x		
PR-11	Educational Outreach	Req	x		x	
Environment & Water (EW)		EW Subtotal: 21				
		Econ	Raw	NA	Rem	
EW-1	Environmental Management System	2	0	0	0	2
EW-2	Runoff Flow Control	1 - 3	1	0	0	3
EW-3	Runoff Quality	1 - 3	1	0	0	3
EW-4	Stormwater Cost Analysis	1	1	0	0	1
EW-5	Site Vegetation	1 - 3	3	3	0	0
EW-6	Habitat Restoration	3	0	0	0	3
EW-7	Ecological Connectivity	1 - 3	1	3	0	0
EW-8	Light Pollution	3	3	3	0	0

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Scoring Assumptions & Limitations

- No custom credits included = 108 points available
- Project Requirements have no weight (treated separately)
- Intent is acceptable for credit
 - Multiple reviewers, some may have been more stringent
 - Informal compared to certification
- Variations in data quality and quantity are present
- Owner's selection of featured projects
- Complex projects (mix of large and small)

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Example: Presidio Parkway Phase I – San Francisco, CA

Owner: Caltrans et al.
Project Length: ~1.5 miles

Contract Price: \$134.8 million
Functional Class: Principal Arterial

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Potential reasonable score of Silver or Gold with low effort and cost.



Results

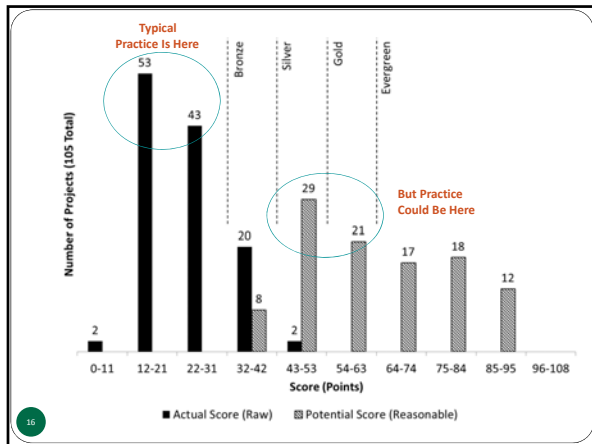
- Most common:
 - PR-9 Pavement Management System (93%)
 - AE-3 Context Sensitive Solutions (97%)
- Least common:
 - PR-3 Lifecycle Inventory (8%)
 - MR-1 Lifecycle Assessment (0%)
- Aggregate results:

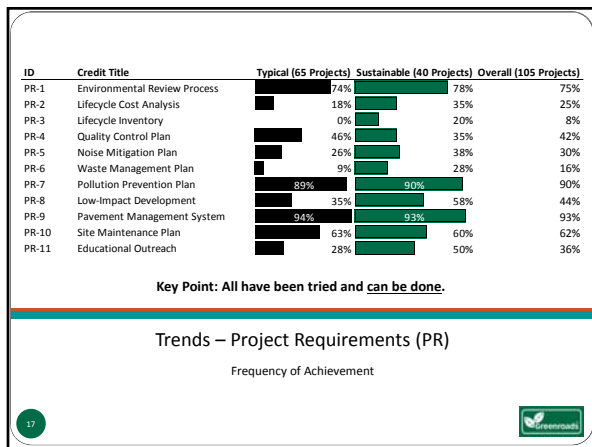
Group	Number of Projects	Average Raw Score ¹	Median ²	Mode ³	Standard Deviation
Typical	65	24	23	25	7.7
Sustainable	40	28	30	21	9.7
Overall	105	26	25	21	8.6

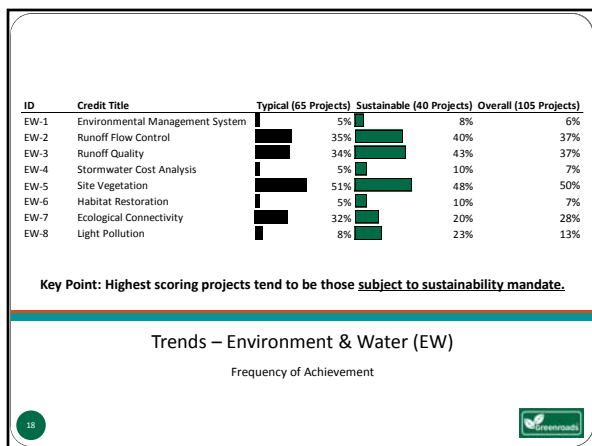
¹Minimum score required for Bronze is 32 points

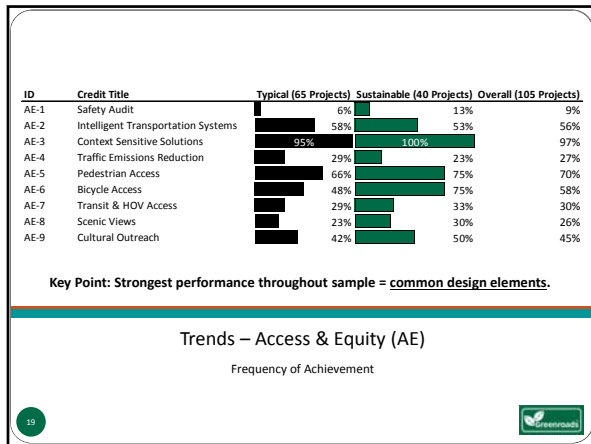
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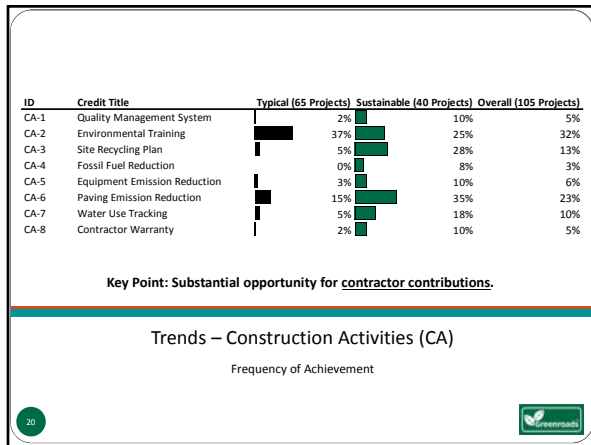


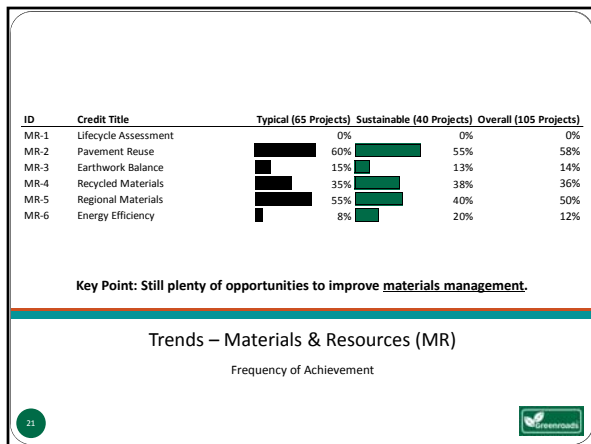


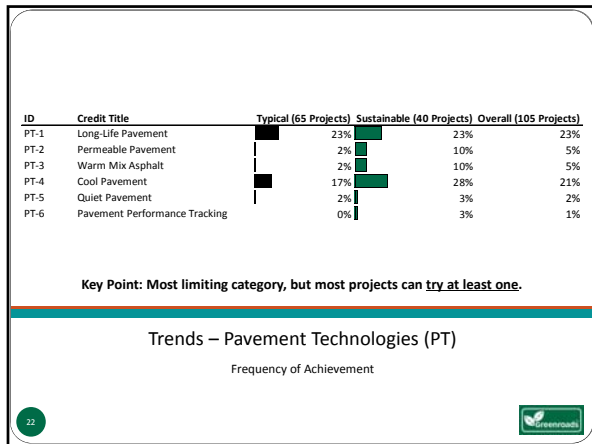












- ## Some Highlights & Takeaways
- Award thresholds appear to be achievable by all projects
 - Project Requirements can be achieved with small effort
 - Practice falls just short of Bronze but within reach
 - Typical projects likely already do a few Greenroads credits
 - Some credits commonly achieved
 - Many others may be low hanging fruit
 - All projects show strength in modal and design elements
 - Opportunities in construction, materials management, and going beyond environmental minimums
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