

Greenroads: Sustainability and Savings

2013 NWPMA Conference

16 October 2013 | Vancouver, WA



Steve Muench
University of Washington
Greenroads Foundation

Greenroads Registered Project: Presidio Parkway, Caltrans
Photo credit: Jeralee Anderson



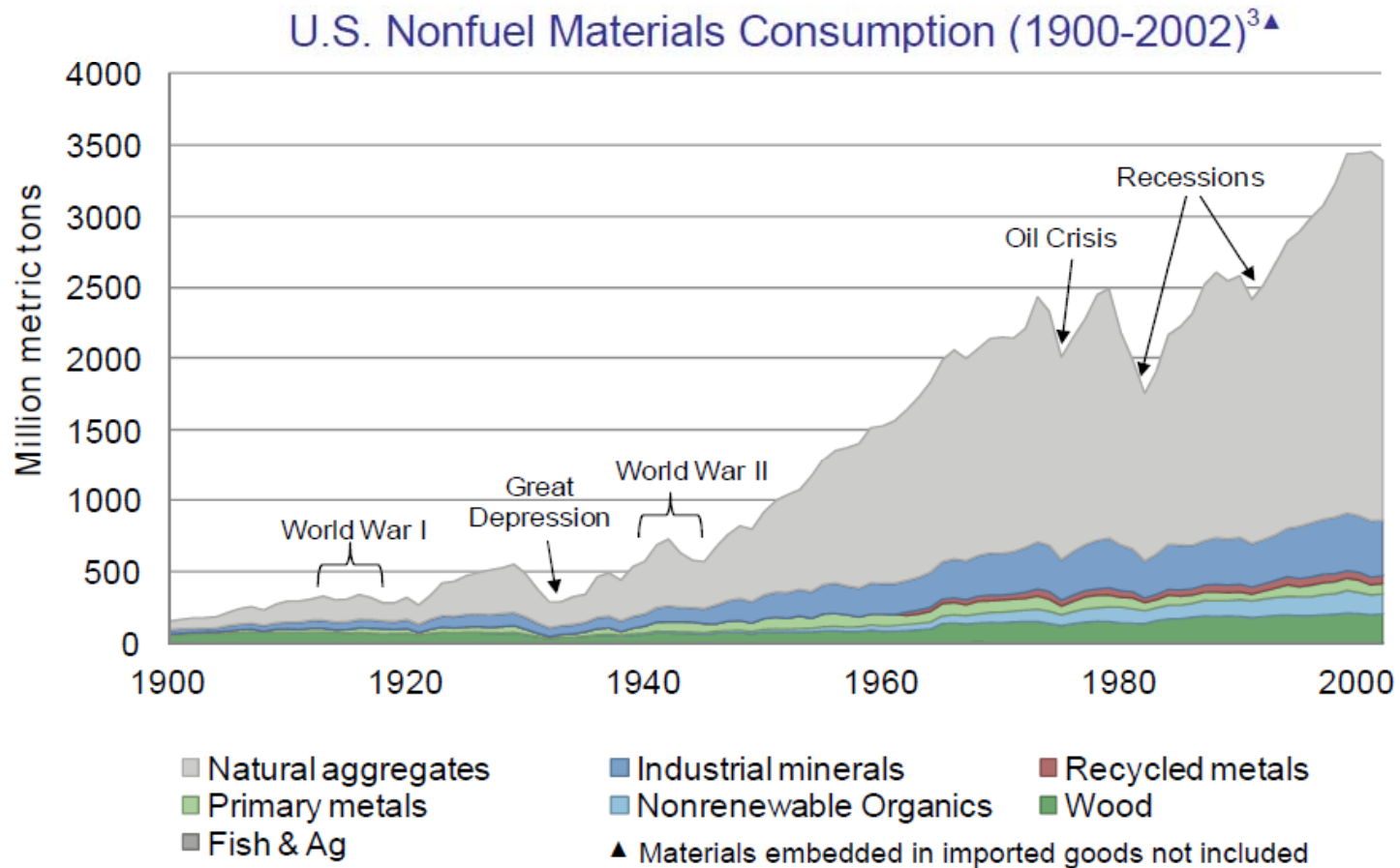
WHAT IS THE BASIC ISSUE?



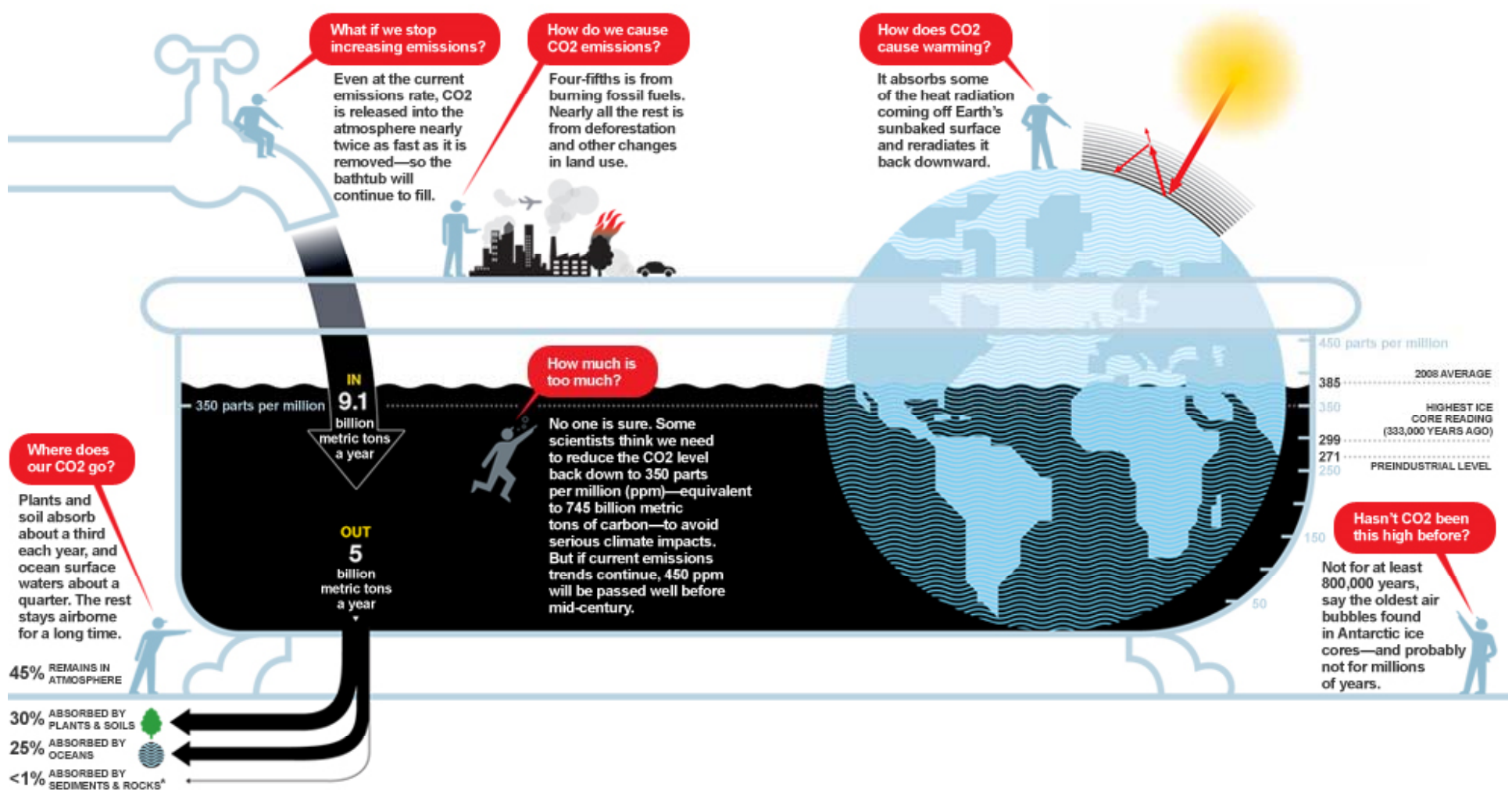
There are lots of us on this planet and we are all striving to improve our quality of life.

	World	U.S.
Land Area	57.5 million mi ²	3.8 million mi ²
Population	6,830,586,985	310,232,863
Coastline	221,208 miles	12,380 miles
Economy (GDP)	\$70.29 trillion	\$14.25 trillion
Labor force	3.179 billion	154.1 million
Electricity Prod.	19.25 trillion kWh	4.11 trillion kWh
Roads	42.8 million miles	4.02 million miles

The better off we are, the more material we consume...



...and the more waste we produce.

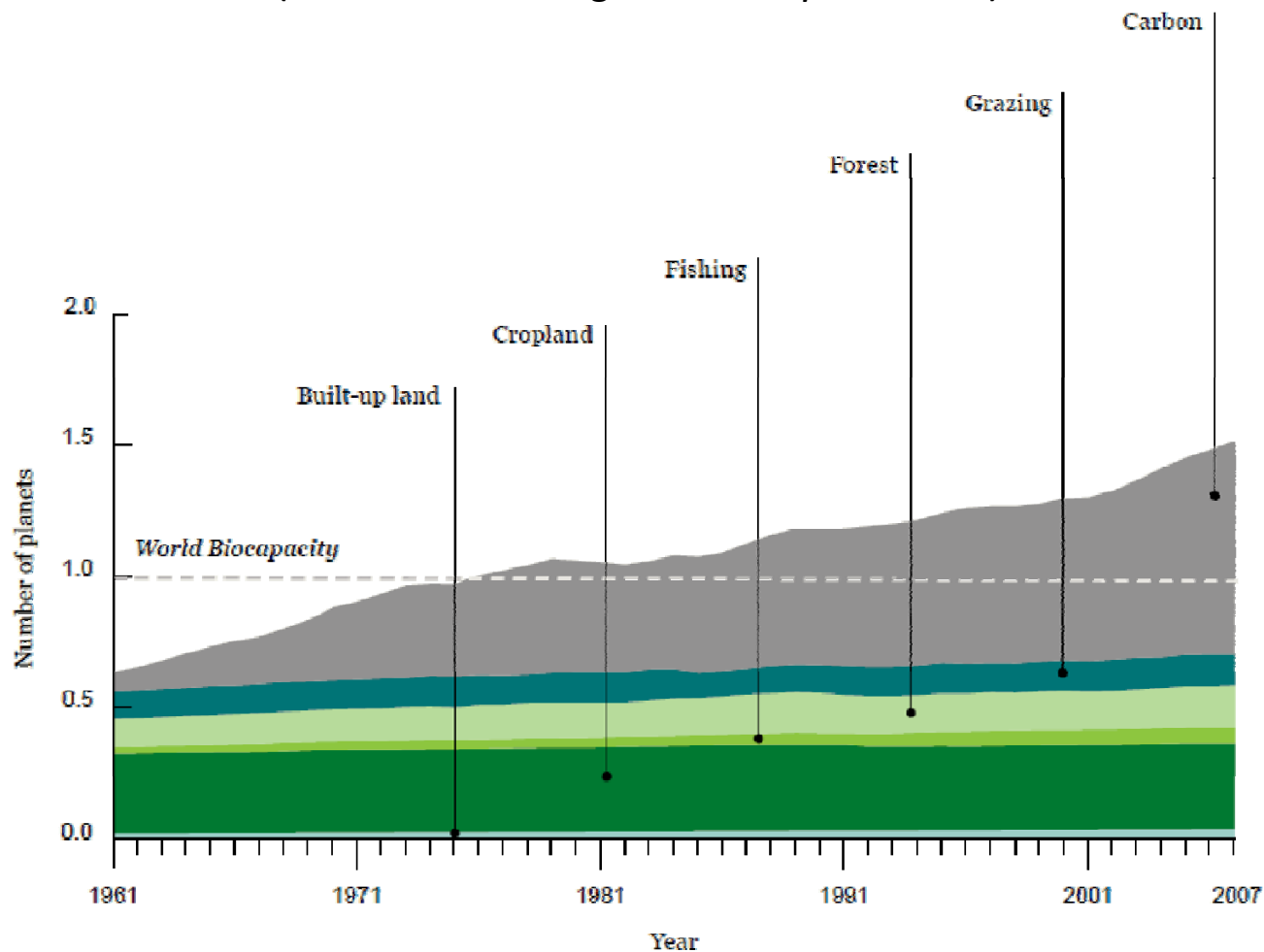


* PERCENTAGES DO NOT ADD UP TO 100 BECAUSE OF ROUNDING.

from The Carbon Bathtub, *National Geographic* (December 2009)

What we demand of the earth exceeds its capacity.

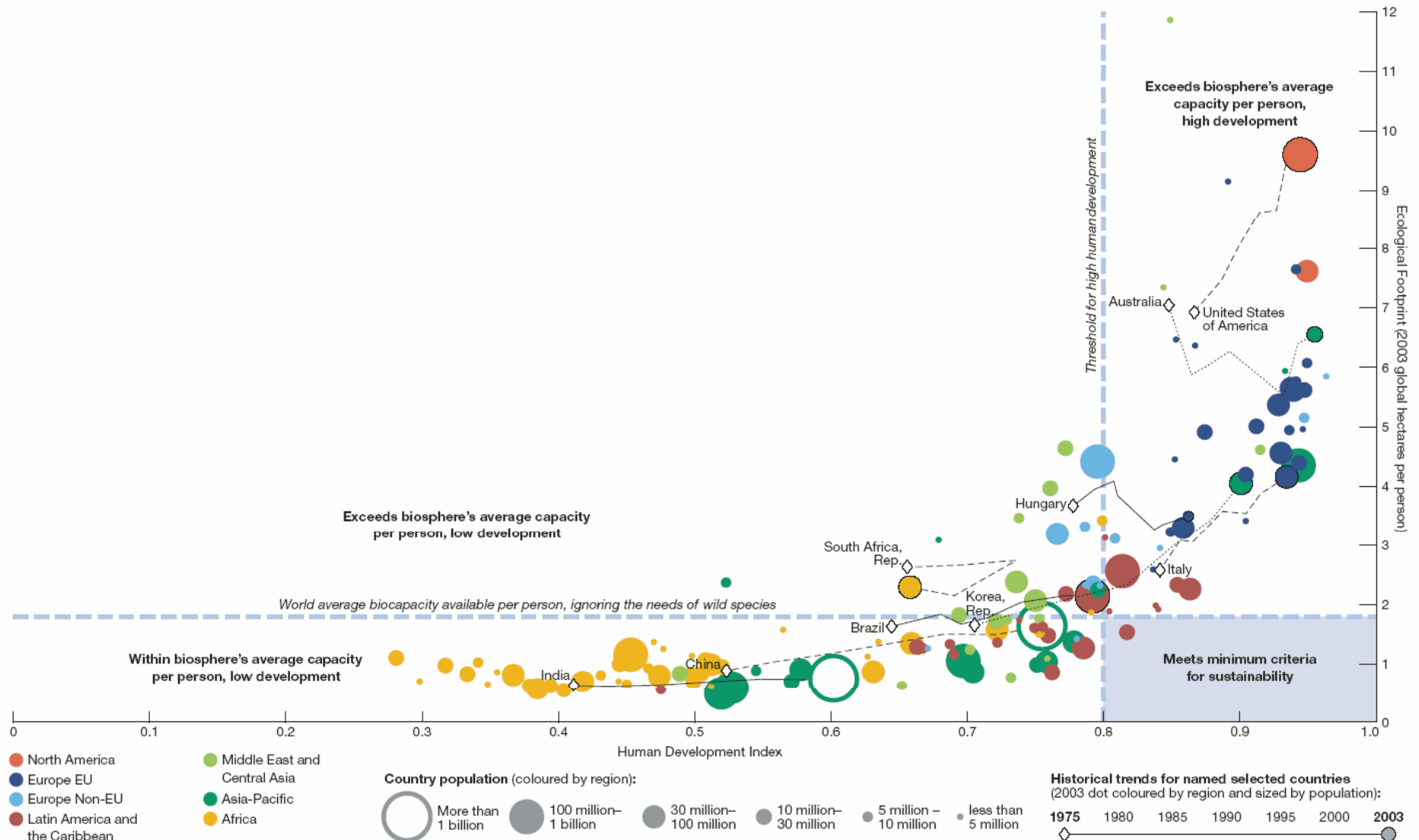
Ecological Footprint by Component (from WWF *Living Planet Report 2010*)



The problem in one graph: Human Development Index vs. Ecological Footprint

From the WWF *Living Planet Report 2006*

Fig. 22: HUMAN DEVELOPMENT AND ECOLOGICAL FOOTPRINTS, 2003



THE RESPONSE: SUSTAINABILITY

THE COLLEGE SUSTAINABILITY REPORT CARD

A Review of Campus & Endowment Policies at Leading Institutions

Published by Sustainable Endowments Institute



Green Products

More people are purchasing eco-friendly items to conserve energy and help save the environment. What are some of the most popular "green products"?

▶ Nature's Kiss, the earth-friendly, ineffective oven cleaner

▶ ZookTubes, the zucchini that fits in most common fluorescent-light fixtures

▶ 10,000 Tomorrows, the reusable toilet paper

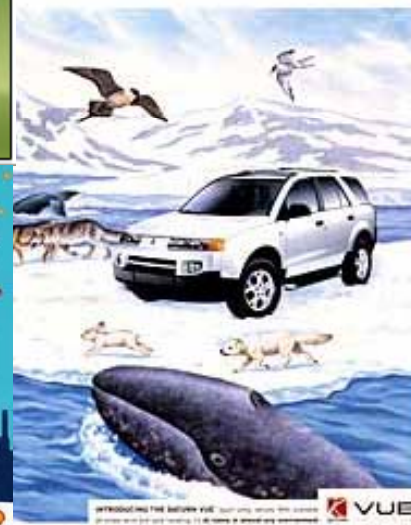
▶ Coal, the fuel that comes right out of the earth, as nature intended

▶ Thermonuclear sun emulator, for charging solar-powered gadgets at night

▶ Rats, "nature's garbage disposal"

▶ Sheetwood, the environmentally friendly, renewable sheetrock substitute

▶ Kleener Wieners, the hot dog made from 100 percent post-consumer meats



Renewable Energy

Power Race | Renewable energy use in the U.S.

Electricity generated from renewables, by state (2009)

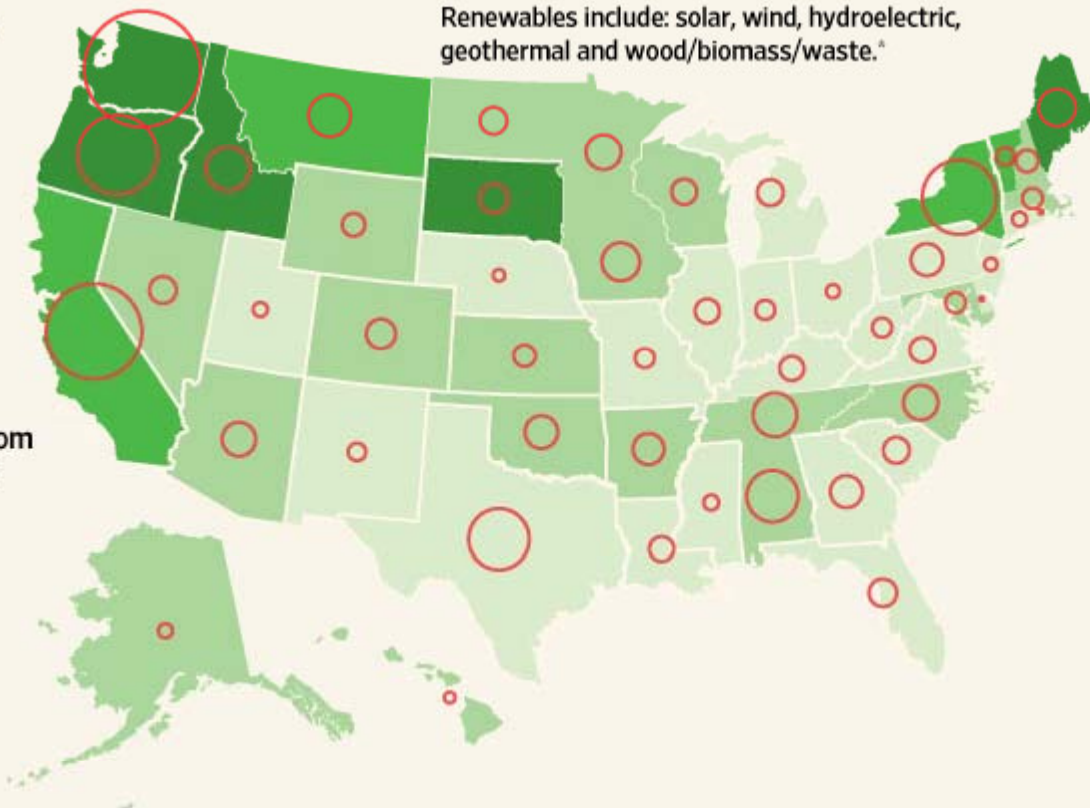
Percentage of electricity generation from renewables



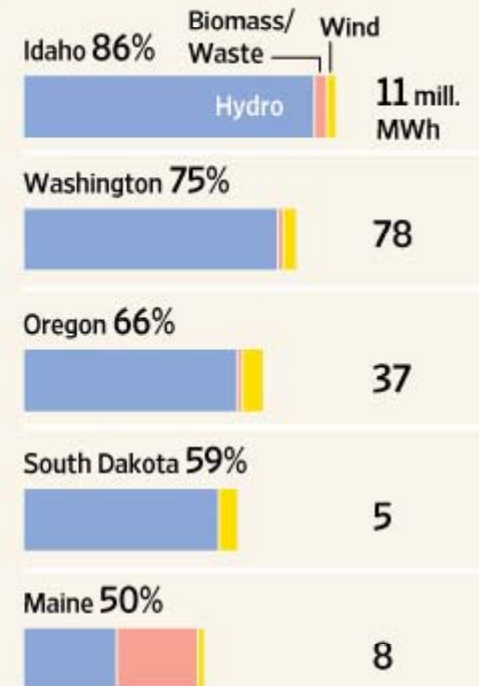
Electricity generated from renewables, megawatt hours



Renewables include: solar, wind, hydroelectric, geothermal and wood/biomass/waste.*



Top states for pct. of electricity generated from renewables



From: Gold, R. (31 March 2011). Wind, Sun Power Still Face Hurdles, *WSJ*.

WHAT DOES “SUSTAINABILITY” MEAN?

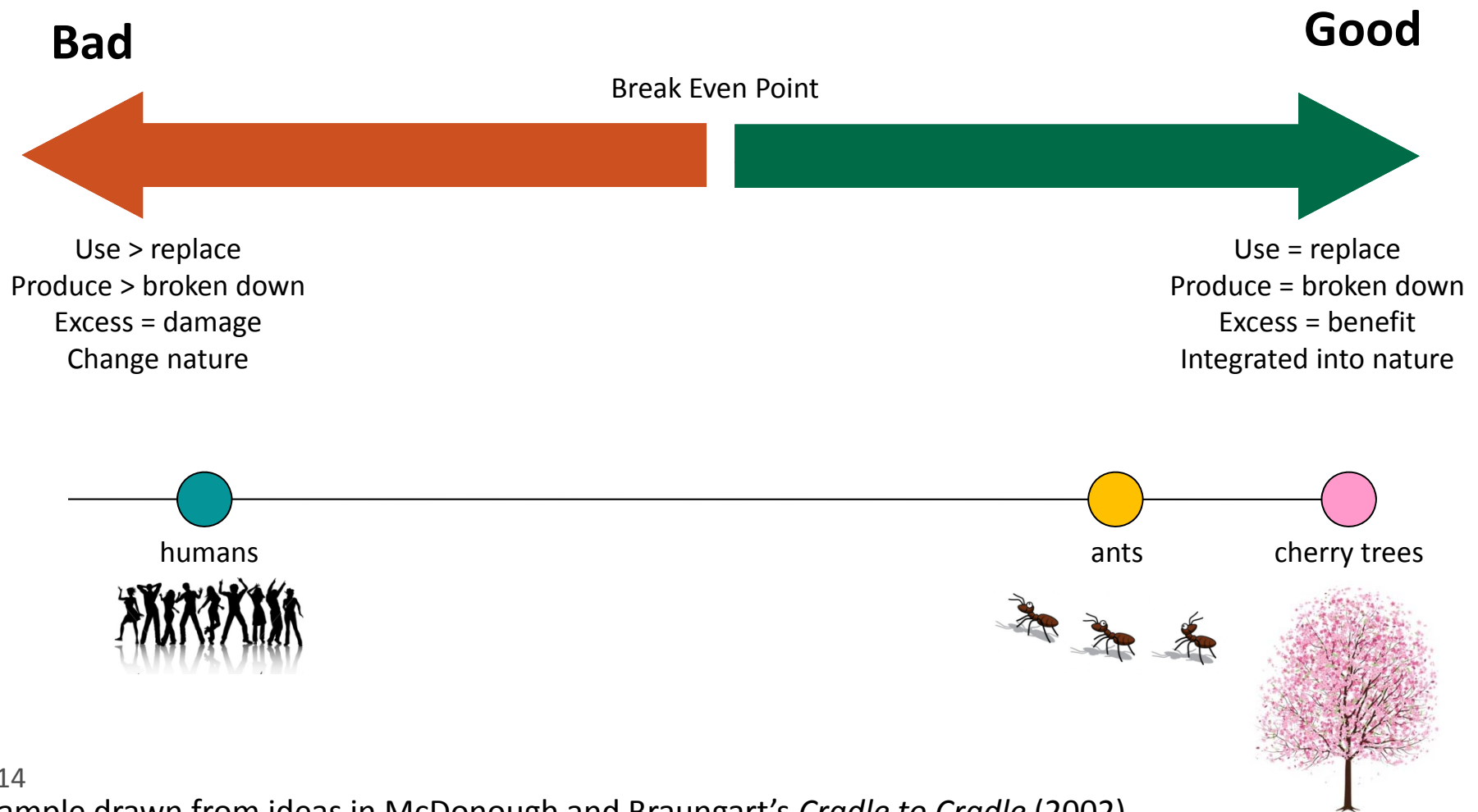
Our Definition:

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

The 5 simple sustainability rules:

1. Don't take stuff from the earth faster than it will go back in.
2. Don't produce stuff faster than it can be broken down.
3. Don't alter ecosystems.
4. Seek quality of life for all.
5. Manage resources wisely.

We are really talking about being “more sustainable” than we were.
We are going for “do less bad”. The goal is “do good”.





GREENROADS



U.S. 97: Lava Butte – S. Century Dr. Oregon Department of Transportation



What is Greenroads?

An independent 3rd party sustainability rating system for roadway design and construction. It awards points for more sustainable practices and can help quantify and communicate the sustainable attributes of a roadway project.

It is like LEED® for roads.



Camp Garcia Entrance Road, Vieques Island NWR, PR

U.S. Fish and Wildlife Service, FHWA Federal Lands Highway



What can Greenroads do?

- ✓ Define sustainable features on your project
- ✓ Benchmark and manage sustainability
- ✓ Communicate sustainability efforts to key stakeholders
- ✓ Stimulate the market for green transportation

It helps improve roadway sustainability.



Cheney Sustainable Stormwater Project

City of Tacoma



Who owns Greenroads?

The Greenroads Foundation, an independent non-profit U.S. corporation, manages the review and certification process for sustainable roadway projects.

The Greenroads Foundation.





14th Street: Market Street to Colfax Avenue

City and County of Denver



Photos from Concrete Works or Colorado, Inc. (prime contractor)

What does Greenroads Address?

Greenroads is a project-oriented system focusing on design and construction, which is a conscious scope choice. Planning/operations/maintenance are mega-important; this tool is meant to address the design/construction piece.

Greenroads addresses design and construction.



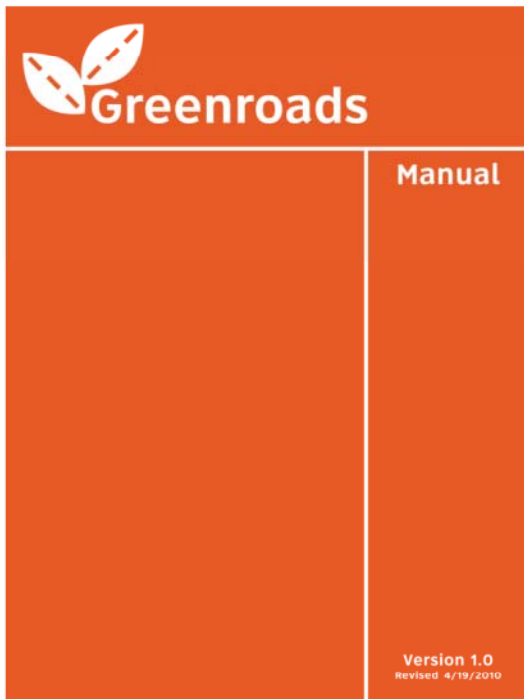
Pioneer Way City of Oak Harbor, WA



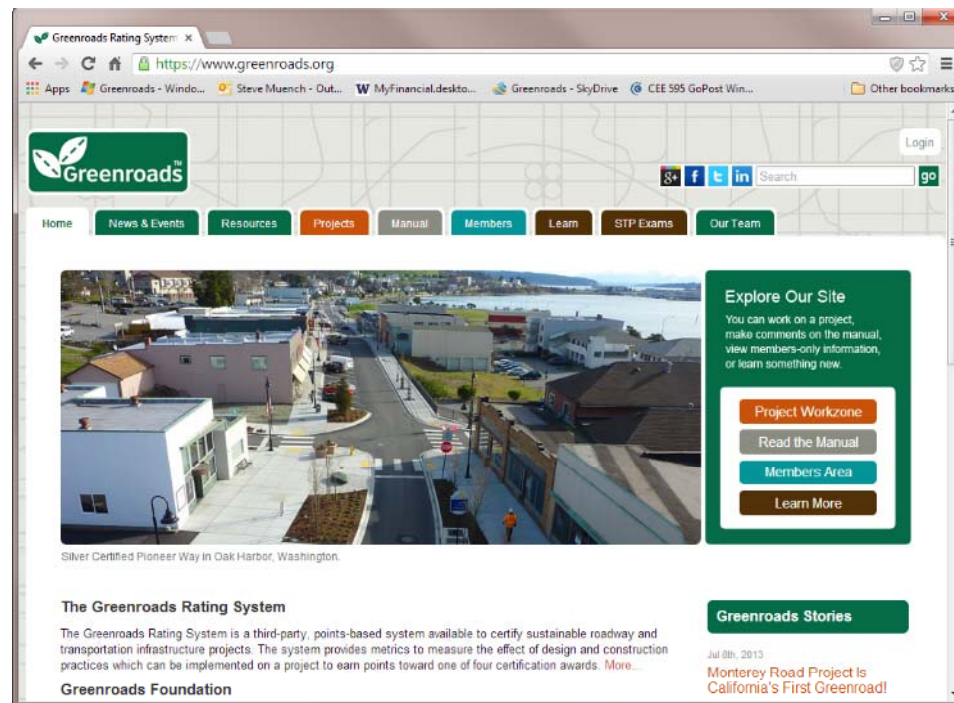
Does Greenroads work for my project?

Greenroads works for all roadway projects and more. It is applicable to a wide range of project sizes and scopes. It works for huge billion dollar mega-projects and for routine pavement overlay projects and everything in between.

Greenroads works for all types and sizes of road projects.



Version 1.5 manual



www.greenroads.org



Greenroads Version 1.5: Overview

Category	Description	Points
Project Requirements (11)	Minimum requirements for a Greenroad	Req.
Voluntary Credits (37)		
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

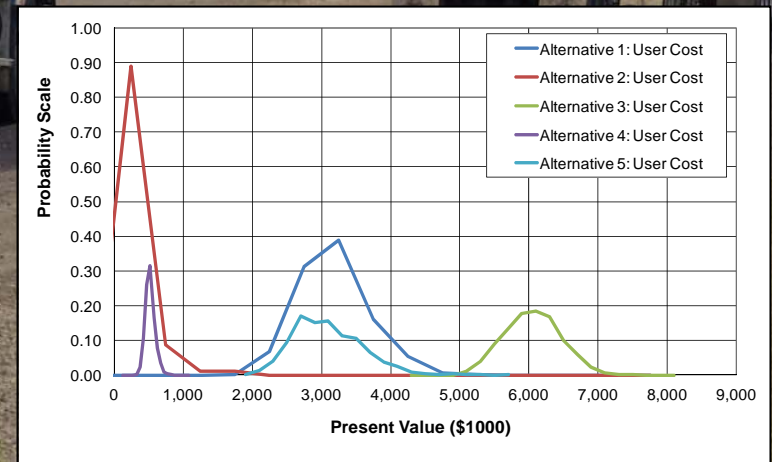
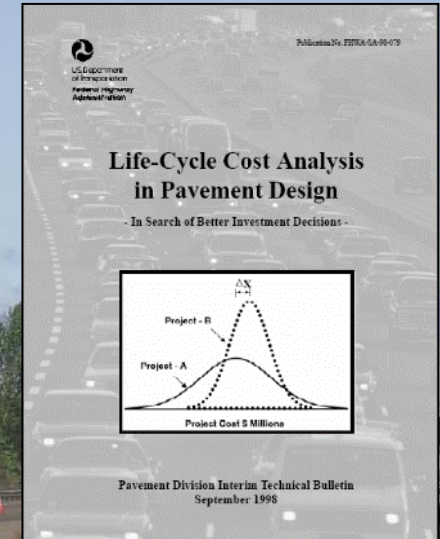


Project Requirements

Requirement	Description
PR-1 Environmental Review Process	Complete and environmental review process
PR-2 Life Cycle Cost Analysis (LCCA)	Perform LCCA for pavement section
PR-3 Life Cycle Inventory (LCI)	Perform LCI of pavement section with computer tool
PR-4 Quality Control Plan	Have a formal contractor quality control plan
PR-5 Noise Mitigation Plan	Have a construction noise mitigation plan
PR-6 Waste Management Plan	Have a formal plan to divert C&D waste from landfill
PR-7 Pollution Prevention Plan	Have a TESC/SWPPP
PR-8 Low-Impact Development (LID)	Feasibility study for LID stormwater management
PR-9 Pavement Mgmt. System	Have a pavement management system
PR-10 Site Maintenance Plan	Have a site maintenance plan
PR-11 Educational Outreach	Publicize sustainability information for project

PR-2 Lifecycle Cost Analysis (LCCA)

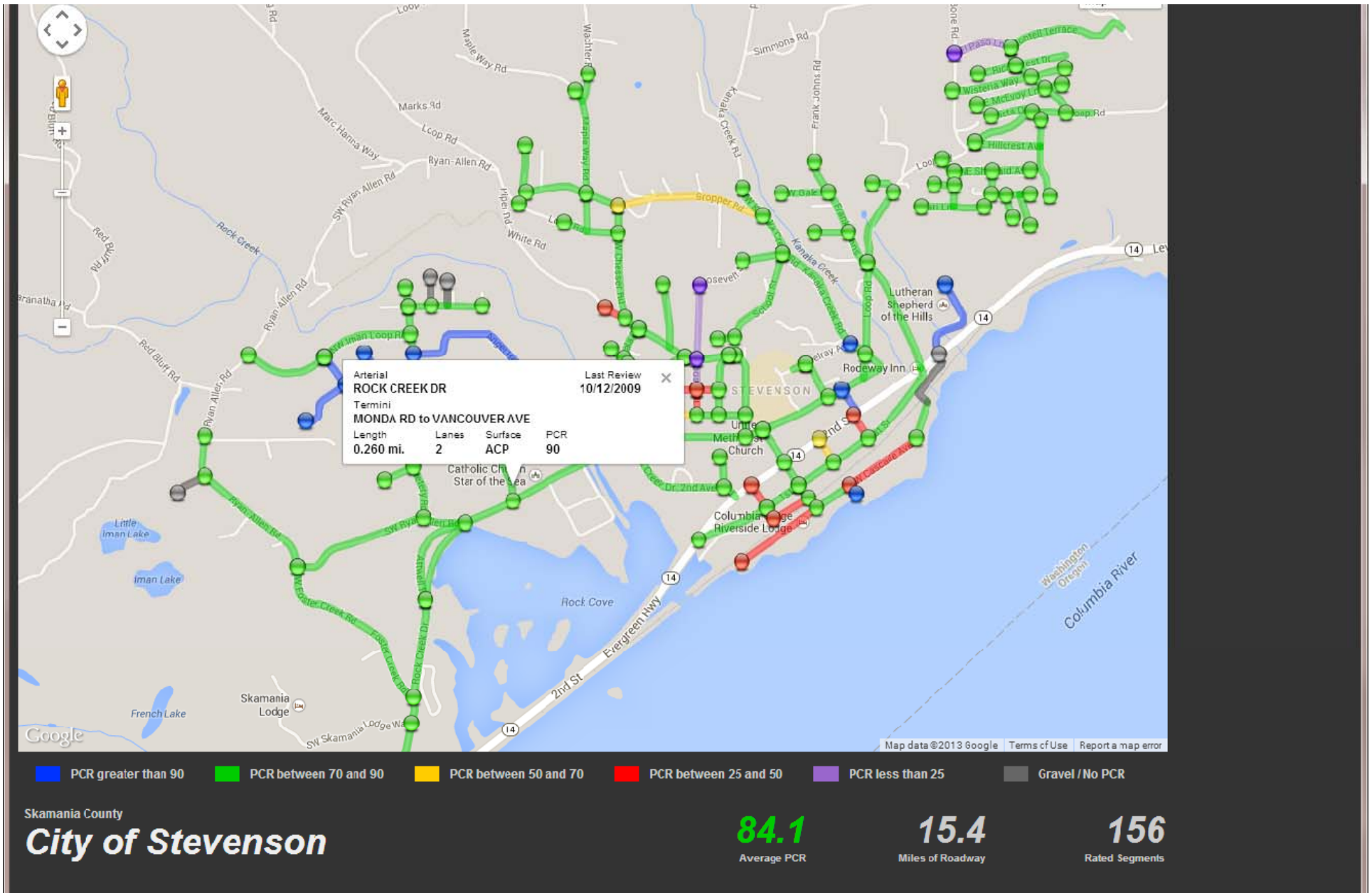
Determine the lifecycle cost for the roadway project to aid in decision-making.



Overlay of I-90 near Ellensburg, WA

PR-2 Pavement Management System

Make roadway capital assets last longer and perform better by preserving and maintaining them.



TIB Performance Management Dashboard for Small City Street Maintenance



Environment & Water

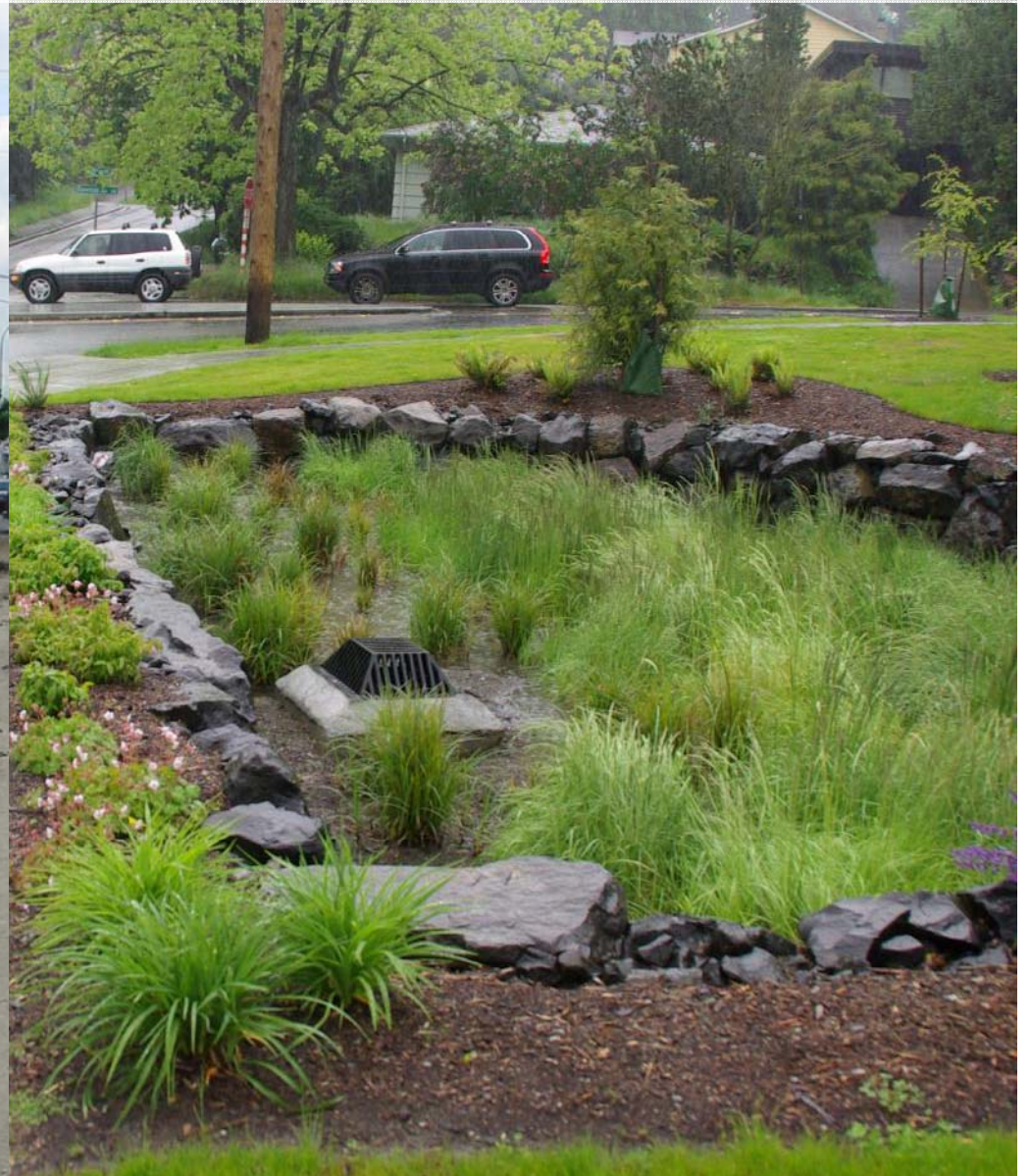
Voluntary Credit	Points	Description
EW-1 Environmental Mgmt. Sys.	2	ISO 14001 or eq. cert. for general contractor
EW-2 Runoff Flow Control	3	Capture stormwater/reduce runoff quantity
EW-3 Runoff Quality	3	Treat stormwater to a higher level of quality
EW-4 Stormwater Cost Analysis	1	Conduct an LCCA for stormwater BMP/LID
EW-5 Site Vegetation	3	Use native low/no water vegetation
EW-6 Habitat Restoration	3	Create new habitat beyond what is required
EW-7 Ecological Connectivity	3	Connect habitat across roadways
EW-8 Light Pollution	3	Discourage light pollution
Total	21	

EW-4 Stormwater Cost Analysis

Determine lifecycle costs and savings associated with low impact development techniques and best management practices for stormwater utilities.



Stormwater pipe awaiting installation



LID stormwater facility in Seattle, WA



Access & Equity

Voluntary Credit	Points	Description
AE-1 Safety Audit	2	Perform roadway safety audit
AE-2 Intelligent Transp. Sys. (ITS)	5	Implement ITS solutions
AE-3 Context Sensitive Planning	5	Plan for context sensitive solutions
AE-4 Traffic Emissions Reduction	5	Reduce VMT or SOV travelers
AE-5 Pedestrian Access	2	Provide/improve pedestrian accessibility
AE-6 Bicycle Access	2	Provide/improve bicycle accessibility
AE-7 Transit/HOV Access	5	Provide/improve transit/HOV accessibility
AE-8 Scenic Views	2	Provide views of scenery or vistas
AE-9 Cultural Outreach	2	Promote art/culture/community values
Total	30	

AE-8 Scenic Views

Provide access to pleasant views of scenery from the roadway.



View from Lava Butte in the Newberry National Volcanic Monument, Deschutes National Forest, OR



Construction Activities

Voluntary Credit	Points	Description
CA-1 Quality Management System	2	ISO 9001 cert. or eq. for general contractor
CA-2 Environmental Training	1	Provide environmental training
CA-3 Site Recycling Plan	1	On-site recycling and trash collection
CA-4 Fossil Fuel Use Reduction	2	Use alt. fuels in construction equipment
CA-5 Eqpt. Emission Reduction	2	Meet EPA Tier 4 stds. for nonroad equipment
CA-6 Paver Emission Reduction	1	Use pavers that meet NIOSH requirements
CA-7 Water Use Tracking	2	Develop data on water use in construction
CA-8 Contractor Warranty	3	Warranty on the constructed pavement
Total	14	

CA-2 Environmental Training

Provide construction personnel with the knowledge to identify environmental issues and best practice methods to minimize environmental impact.



Sea-to-Sky Highway Project, British Columbia, Canada



Materials & Resources

Voluntary Credit	Points	Description
MR-1 Life Cycle Assessment (LCA)	2	Conduct a detailed LCA of the entire project
MR-2 Pavement Reuse	5	Reuse existing pavement sections
MR-3 Earthwork Balance	1	Balance cut/fill quantities
MR-4 Recycled Materials	5	Use recycled materials for new pavement
MR-5 Regional Materials	5	Use regional materials
MR-6 Energy Efficiency	5	Improve energy eff. of operational systems
Total	23	

MR-4 Recycled Materials

Reduce lifecycle impacts from extraction and production of virgin materials.





Pavement Technologies

Voluntary Credit	Points	Description
PT-1 Long-Life Pavement	5	Design pavements for long-life
PT-2 Permeable Pavement	3	Use permeable pavement as a LID technique
PT-3 Warm Mix Asphalt (WMA)	3	Use WMA in place of HMA
PT-4 Cool Pavement	5	Contribute less to urban heat island effect
PT-5 Quiet Pavement	3	Use a quiet pavement to reduce noise
PT-6 Pvmt. Performance Tracking	1	Relate construction to performance data
Total	20	

PT-1 Long-Life Pavement

Minimize life cycle costs by promoting design of long-lasting pavement structures.



Paving 13 inches (330 mm) of jointed concrete pavement on I-5 in Seattle, Washington, United States

Certification Levels

Version 1.5: 108 Voluntary Credit Points



32-42 points
PR + 30% VC



43-54 points
PR + 40% VC



55-63 points
PR + 50% VC



64+ points
PR + 60% VC

WHY BOTHER?

Save money.

Credit		Cost & Savings	Source
PR-8	Low-Impact Development	15-80% initial cost savings Lower initial cost	EPA
EW-5	Site Vegetation	30% premium on initial const. 15% savings per year Payback in 2 years	Santa Monica, CA
AE-1	Safety Audit	\$1,000-\$8,000 initial cost B/C ratio: 3:1 or more Payback in 1 year	NCHRP Synthesis 336
MR-4	Recycled Materials	17% savings for materials 10% savings for HMA in-place Lower initial cost	Kristjansdottir et al. (2007) using 20% RAP
PT-1	Long-Life Pavement	\$65,000 premium on initial const. \$165,000/lane-mile over 50 yrs Payback in 20 yrs	Muench et al. (2004) for 2-lane road
PT-3	Warm Mix Asphalt	\$50,000 initial investment \$0.35-\$5.00 savings/ton Payback in 10,000-145,000 tons	Kristjansdottir et al. (2007) for foaming plant attachments

Save Money:

City of San Jose, CA saved \$350,000 on a \$2.7 million job by using cold in-place recycling.

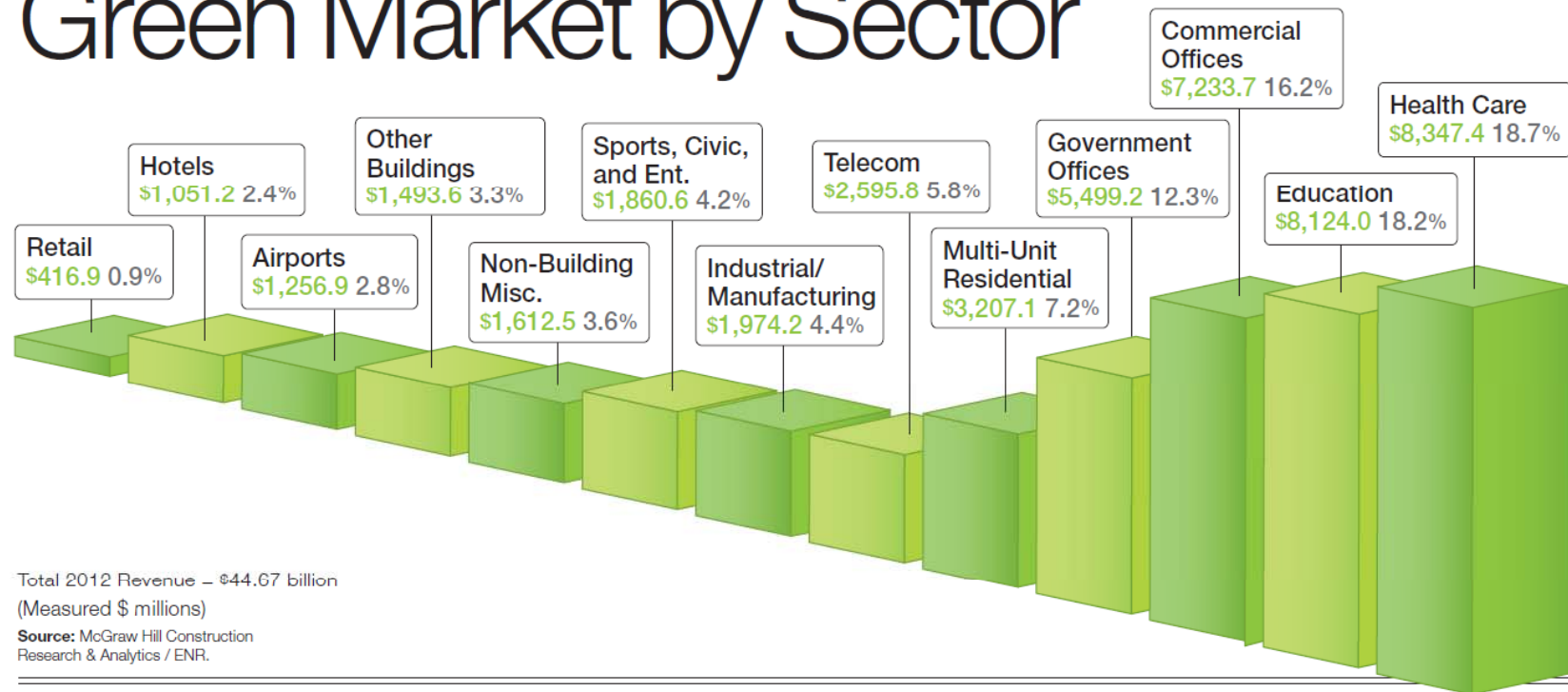


2010 STP Resurfacing and Rehabilitation project – Monterey Road, San Jose, CA

Tell people.

Tulacz, G. (2013). The Top 100 Green Contractors, *ENR*, 16/23 September 2013.

Green Market by Sector



- \$44.67 billion 2012 revenue
- Over 1/3 of total revenue from green projects

Tell people:

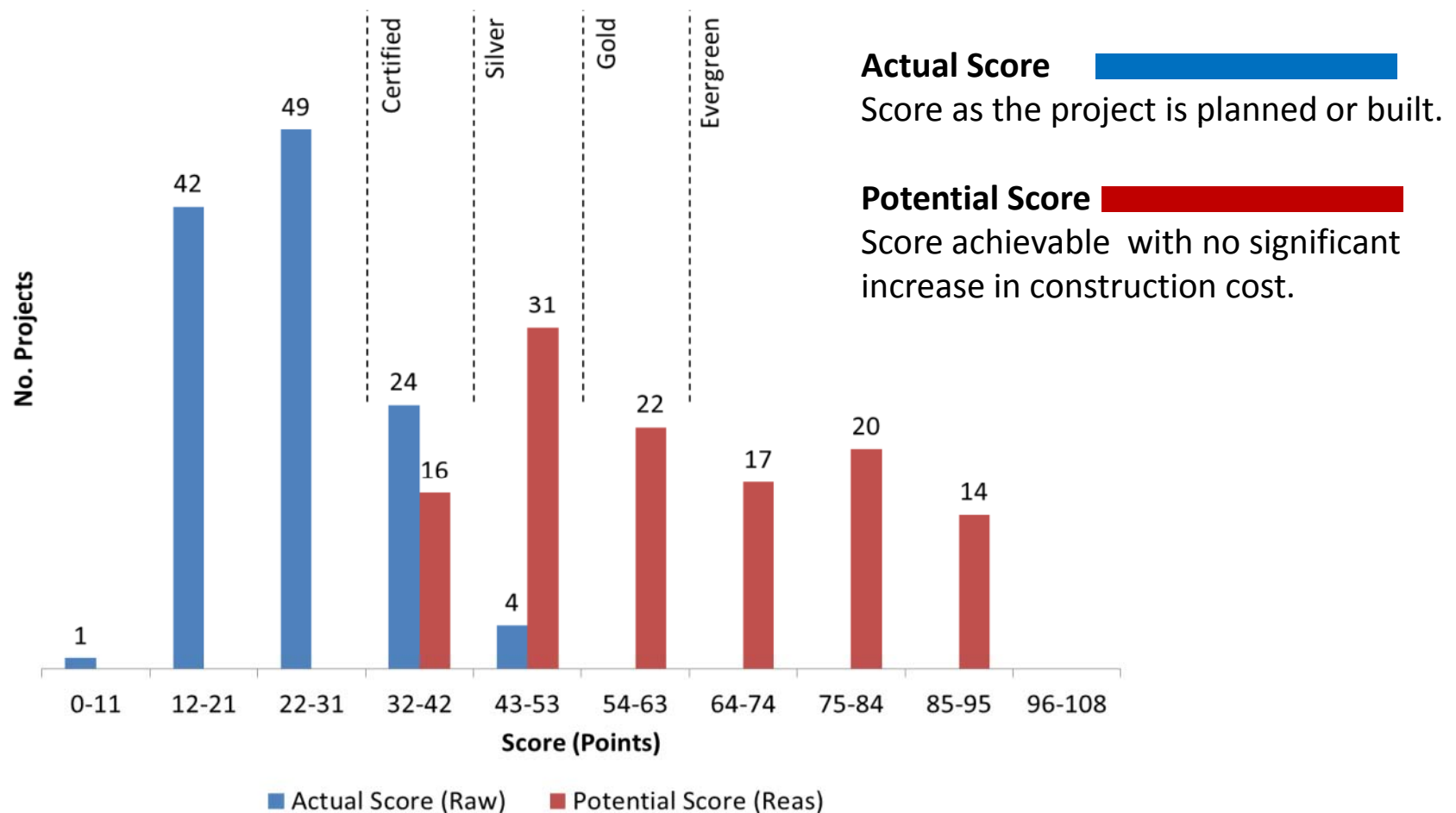
If you do something well tell folks about it. "It ain't braggin' if you done it." – Dizzy Dean



PROVEMENT	
Washington State	
	
Washington Improvement Board	
D	\$3,200,000.00
	\$2,100,100.00
	\$5,300,000.00
	









We can be more sustainable for the same cost.

Results from a UW study of 120 roadway projects looking at actual Greenroads score vs. potential score










Urban Arterial Program (UAP) Criteria Rating Guidelines SUSTAINABILITY CATEGORY (15 POINTS MAX)

Item	Points
 ADOPTED GREENHOUSE GAS EMISSIONS POLICY	1
MODAL MEASURES	8 MAX
 Completes gap in HOV system	3
 Adds HOV lanes in each direction	2
 Adds queue jump or transit only lane	1
Peak hour transit buses	0-3
 Sidewalk width > TIB standard and/or planter strip	0-3
Bicycle facilities	
 Completes gap in adopted bike plan with separated/signed/striped	3
 Extends adopted bike plan	2
 Adds adopted bike plan path or lanes	1



Urban Arterial Program (UAP) Criteria Rating Guidelines SUSTAINABILITY CATEGORY (15 POINTS MAX)

Item	Points
 ENERGY MEASURES	4 MAX
Replace or install low energy street lighting	3
Solar powered signage	1
ENVIRONMENTAL MEASURES	4 MAX
 Low impact drainage practices	2
 Hardscape or climate appropriate planting	2
RECYCLING MEASURES	4 MAX
 Onsite grinding & reuse of pavement	2
Use of base treatment to avoid over-excavation	2
 Use of stockpiled recycled materials	1

GREENROADS TODAY

Greenroads: From Small Beginings



The Greenroads project rating program represents over \$4 billion in construction value.

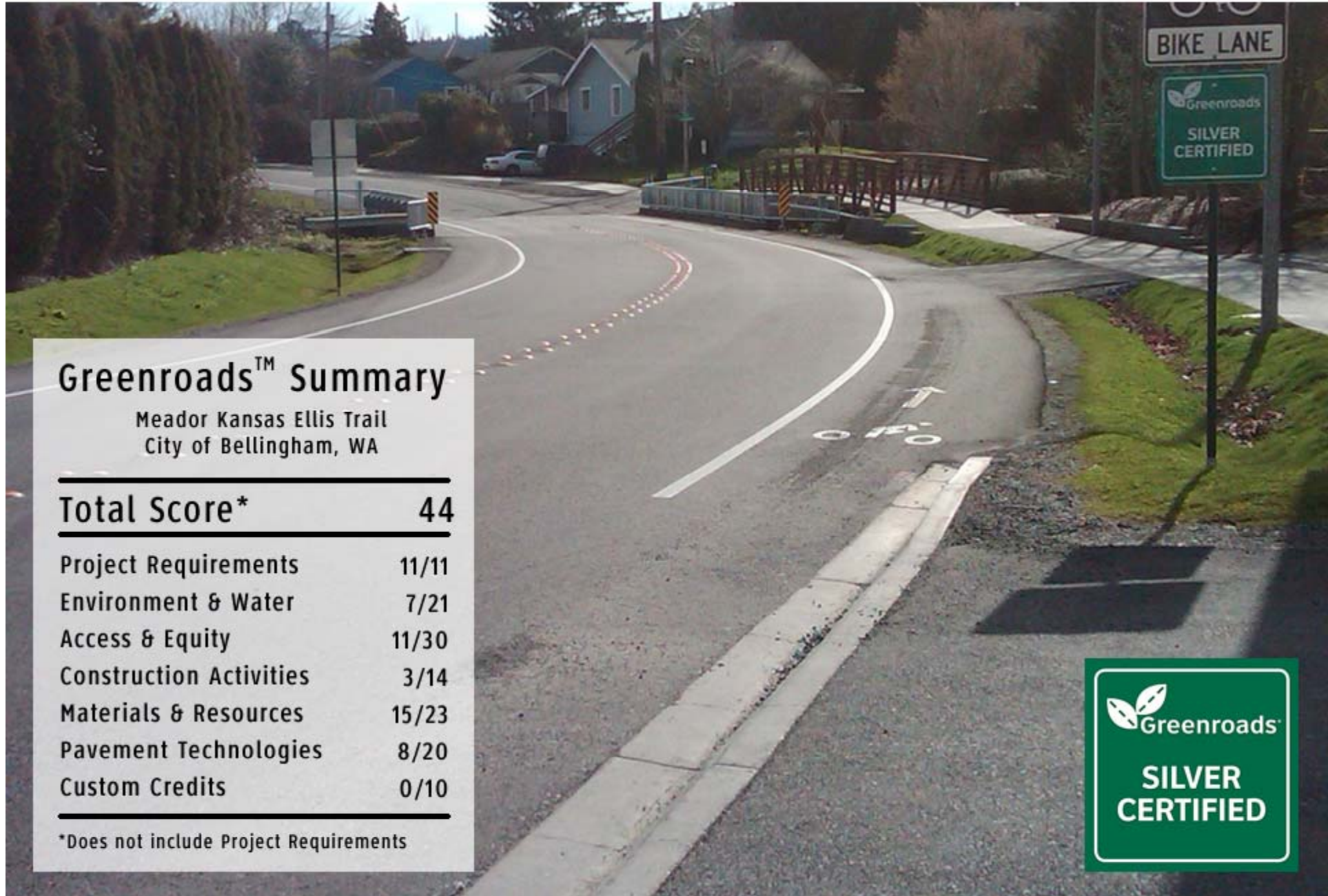
- 7 Certified
- 39 Projects Pursuing Certification (in Progress)
 - 7 states registered, 2 in Canada, 3 in New Zealand
 - At least 5 more projects pending registration in 2013
- 7 Projects Pursuing Assessment (Pilot, A-Lined)
 - Canada (1), New Zealand (4), South Africa (2)



The Greenroads Foundation team

Meador Kansas Ellis Trail

City of Bellingham, WA



Greenroads™ Summary

Meador Kansas Ellis Trail
City of Bellingham, WA

Total Score*	44
Project Requirements	11/11
Environment & Water	7/21
Access & Equity	11/30
Construction Activities	3/14
Materials & Resources	15/23
Pavement Technologies	8/20
Custom Credits	0/10

*Does not include Project Requirements



SE Pioneer Way Reconstruction

City of Oak Harbor, WA



Greenroads™ Summary

SE Pioneer Way Reconstruction
City of Oak Harbor, WA

Total Score* **43**

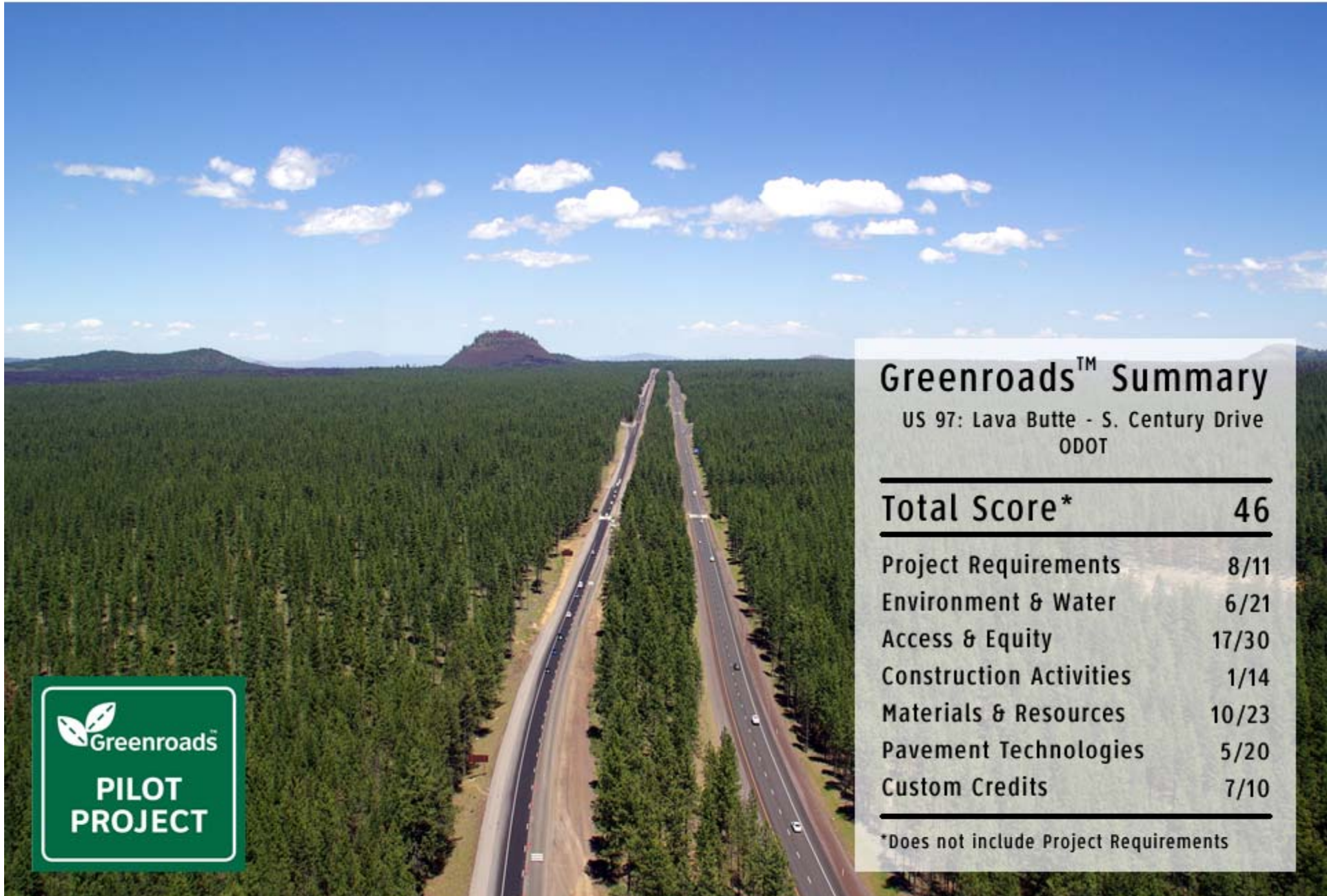
Project Requirements	11/11
Environment & Water	5/21
Access & Equity	10/30
Construction Activities	5/14
Materials & Resources	10/23
Pavement Technologies	8/20
Custom Credits	5/10

*Does not include Project Requirements



US 97: Lava Butte - S. Century Drive

Oregon Department of Transportation



Greenroads™ Summary

US 97: Lava Butte - S. Century Drive
ODOT

Total Score*	46
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Project Requirements	8/11
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Environment & Water	6/21
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Access & Equity	17/30
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Construction Activities	1/14
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Materials & Resources	10/23
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Pavement Technologies	5/20
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Custom Credits	7/10
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*Does not include Project Requirements



Presidio Parkway

Caltrans



Greenroads™ Summary

Presidio Parkway - Doyle Drive
Caltrans, CA

Potential Score* **43**

Project Requirements	11/11
Environment & Water	4/21
Access & Equity	19/30
Construction Activities	5/14
Materials & Resources	4/23
Pavement Technologies	6/20
Custom Credits	5/10

*Does not include Project Requirements



WWW.GREENROADS.ORG

