

# Sustainability, Rating Systems, and Greenroads

National Pavement Preservation Conference

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Sustainability

## 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.

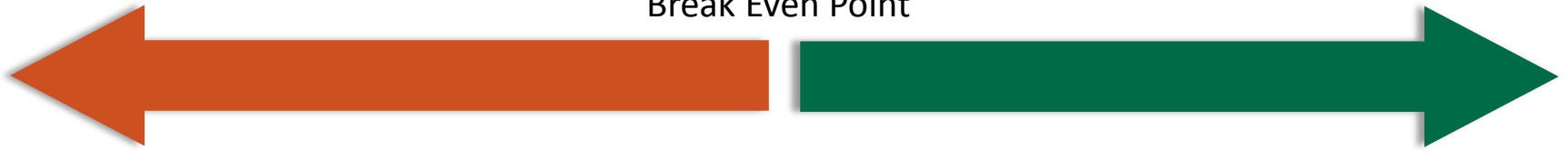


We are really talking about being “more sustainable” than we were. We are going for “do less bad”. The goal is “do good”.

**Bad**

**Good**

Break Even Point



Use > replace

Use = replace

Produce > broken down

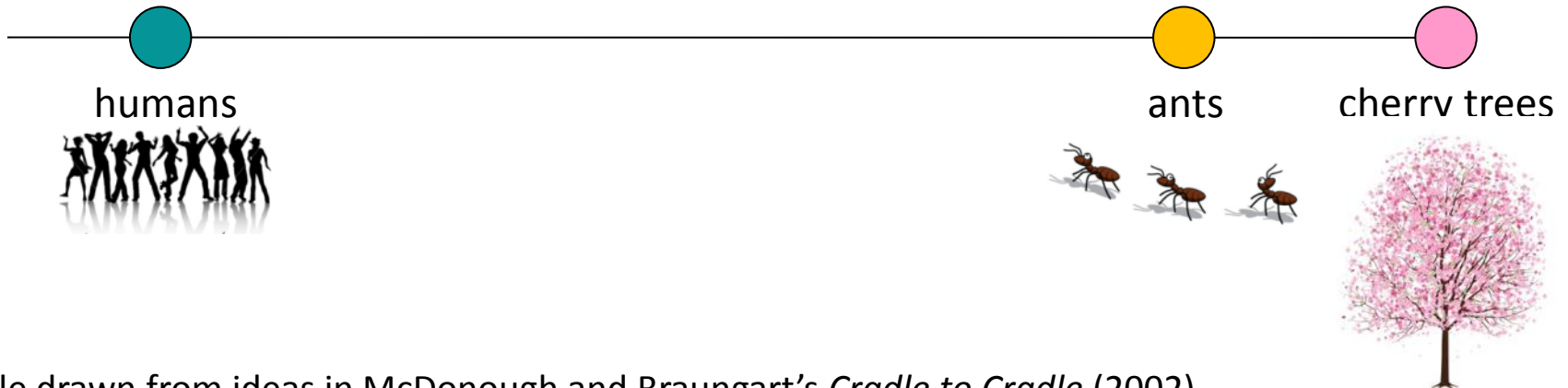
Produce = broken down

Excess = damage

Excess = benefit

Change nature

Integrated into nature



## How “sustainability” fits within an organization

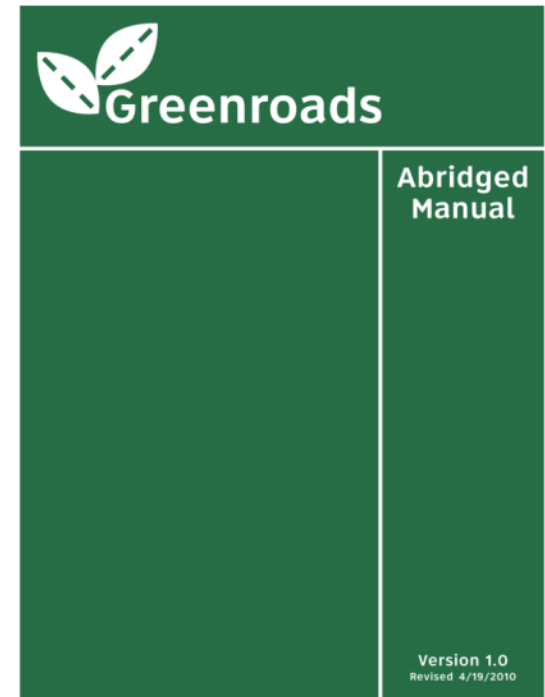
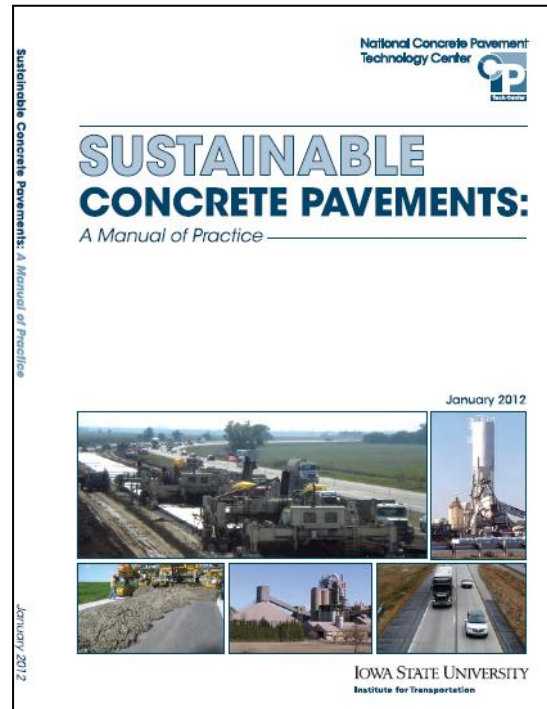
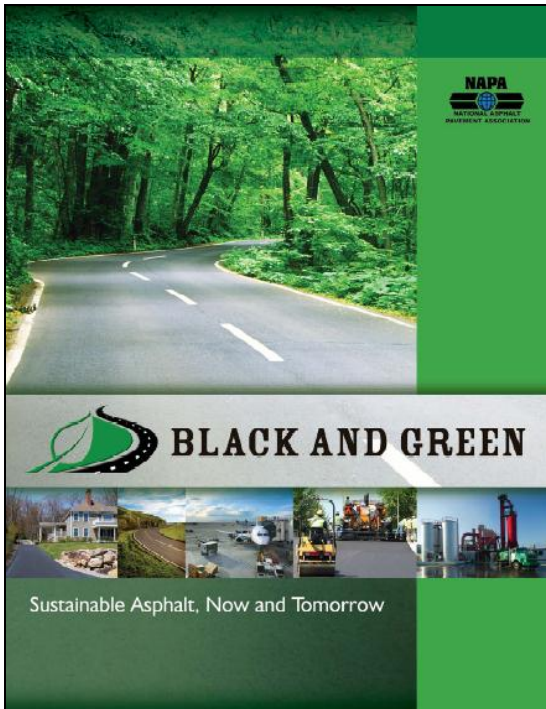
- “Sustainability” is the highest order consideration
  - It means consider everything when you undertake a project
  - It is not an add-on feature for a project
- Organizations set priorities within “sustainability”
  - Consider the bigger systems picture
  - Raise emphasis on human needs and environment
- Defining sustainability
  - Worthwhile exercise but the actual definition is not very important
  - Definitions give no direction to organization



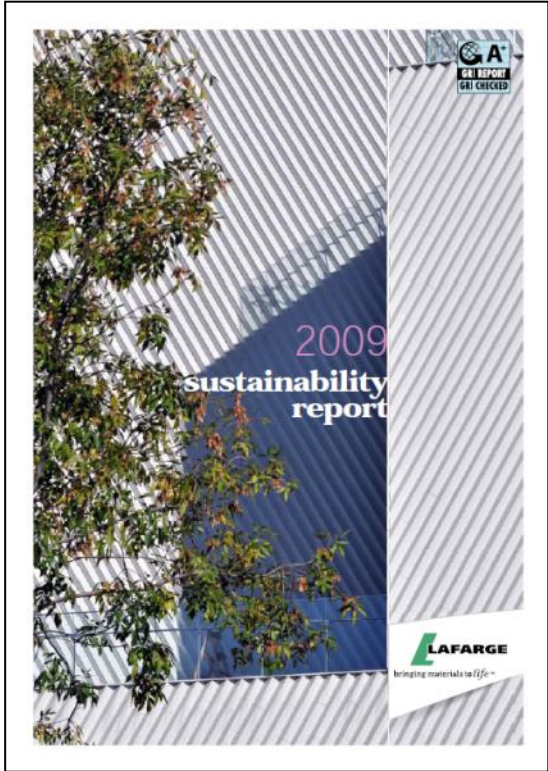
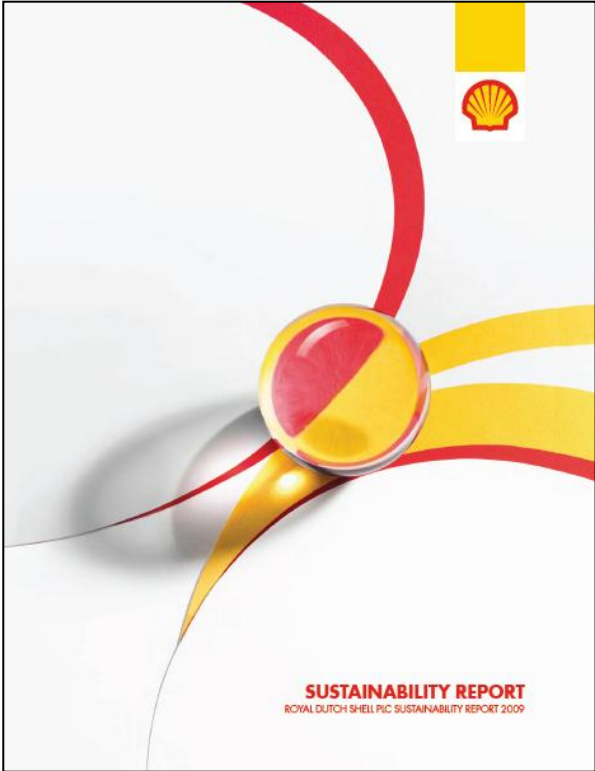
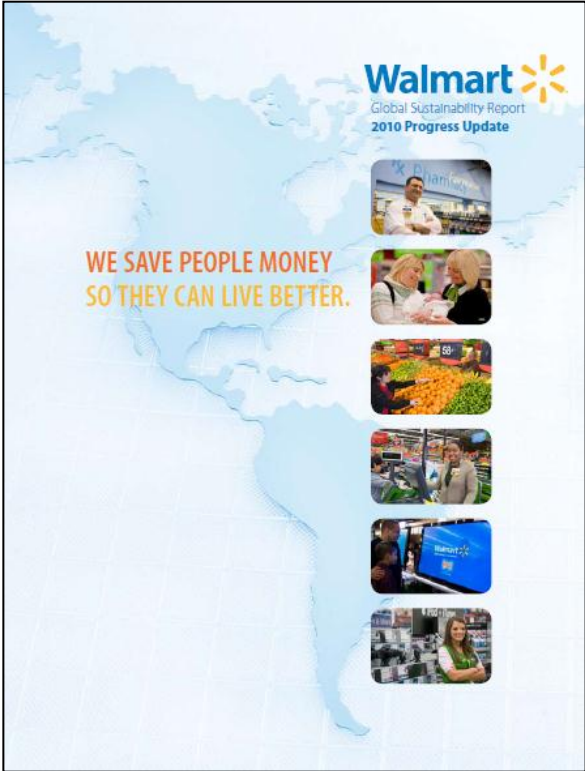
How organizations address sustainability

Industry is trying to figure out how to do sustainability.

Owners and organizations are trying to figure out what constitutes sustainability to their organization and how they will be more sustainable. Results of these efforts range from strategic direction, to guidance documents to rating systems.

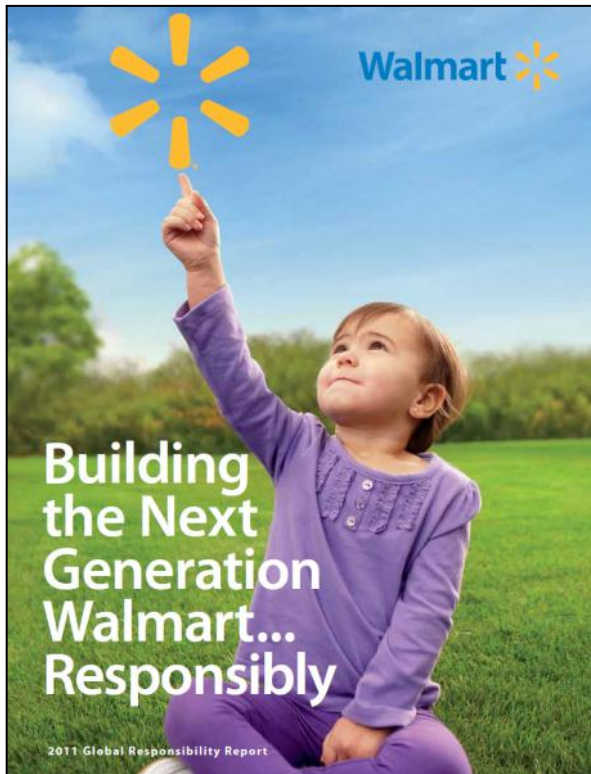


Right now, private organizations are ahead of us.





Right now, private organizations are ahead of us.



Be supplied  
**100%**  
by renewable energy



Create  
**zero**  
waste



Sell products that  
**sustain people**  
and the  
**environment**

Walmart

1-800-331-0085 www.walmartstores.com

#### Supplier Sustainability Assessment: 15 Questions for Suppliers

##### Energy and Climate: Reducing Energy Costs and Greenhouse Gas Emissions

1. Have you measured your corporate greenhouse gas emissions?
2. Have you opted to report your greenhouse gas emissions to the Carbon Disclosure Project (CDP)?
3. What is your total annual greenhouse gas emissions reported in the most recent year measured?
4. Have you set publicly available greenhouse gas reduction targets? If yes, what are those targets?

##### Material Efficiency: Reducing Waste and Enhancing Quality

1. If measured, please report the total amount of solid waste generated from the facilities that produce your product(s) for Walmart for the most recent year measured.
2. Have you set publicly available solid waste reduction targets? If yes, what are those targets?
3. If measured, please report total water use from facilities that produce your product(s) for Walmart for the most recent year measured.
4. Have you set publicly available water use reduction targets? If yes, what are those targets?

##### Natural Resources: Producing High Quality, Responsibly Sourced Raw Materials

1. Have you established publicly available sustainability purchasing guidelines for your direct suppliers that address issues such as environmental compliance, employment practices and product/ingredient safety?
2. Have you obtained 3<sup>rd</sup> party certifications for any of the products that you sell to Walmart?

##### People and Community: Ensuring Responsible and Ethical Production

1. Do you know the location of 100 percent of the facilities that produce your product(s)?
2. Before beginning a business relationship with a manufacturing facility, do you evaluate the quality of, and capacity for, production?
3. Do you have a process for managing social compliance at the manufacturing level?
4. Do you work with your supply base to resolve issues found during social compliance evaluations and also document specific corrections and improvements?
5. Do you invest in community development activities in the markets you source from and/or operate within?

# Rating Systems

## A Sampler of Rating Systems and Guides

<b>Name</b>	<b>Owner/Developer</b>	<b>Begun</b>
CEEQUAL	CEEQUAL, Ltd.	2007
Complete Streets	Complete Streets Coalition	2005
Envision	Institute for Sustainable Infrastructure	2012+
Green Alleys	City of Chicago	2006
Green Guide for Roads	Transp. Assn. of Canada (TAC)	2008
Green Streets	Stantec	2007
GreenLITES	New York State DOT	2008
GreenPave	Ontario Ministry of Transportation	2010
Greenroads	Greenroads Foundation	2007
I-LAST	Illinois Joint Sustainability Group	2009
INVEST	FHWA	2010
INVEST	VicRoads (Australia)	2010
LEED ND	USGBC	2007
STARS	TriMet, CH2M HILL, Portland, et al.	2008
STEED	HW Lochner	2008

## Observations on rating systems

- Sustainability is an opportunity to adjust course
  - Greater emphasis on larger systems
  - Industry wants to know what specific adjustments owners will make
- Rating systems or guidelines will play a role
  - Means to manage/communicate sustainability efforts
- Rating systems will not replace good design/construction
  - People will not chase points and do silly things
- Rating systems do not *supply* sustainability
  - They are best used within an organizational approach to sustainability
- Different owners want different things
  - Smaller/private organizations: credibility for sustainability
  - Larger organizations: internal metrics, accounting, credit

Greenroads®



U.S. 97: Lava Butte – S. Century Dr.

Oregon Department of Transportation



## What is Greenroads?

An independent 3<sup>rd</sup> 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 for you?

- ✓ 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.**







14<sup>th</sup> 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



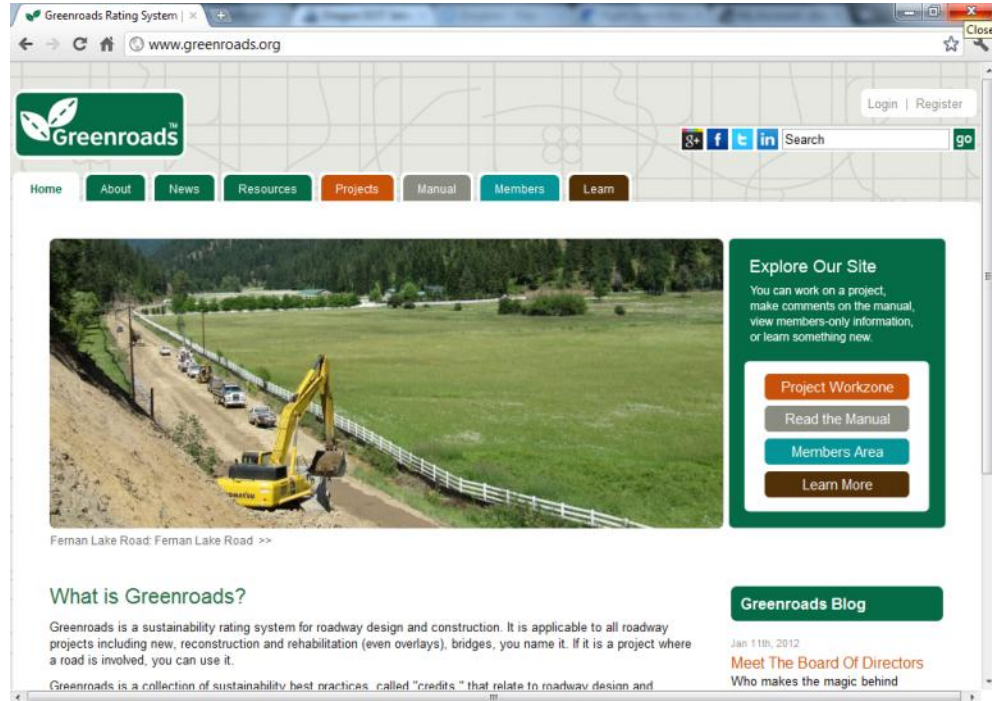
## Does Greenroads work for my project?

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](http://www.greenroads.org)





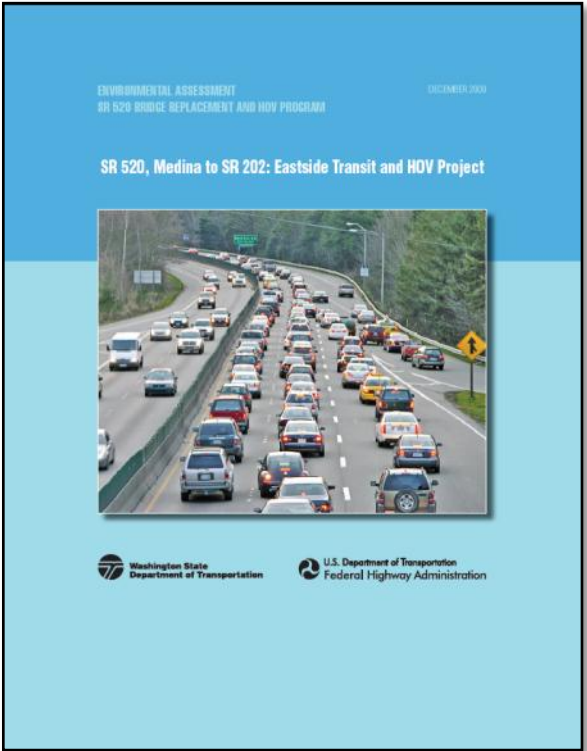
Category	Description	Points
Project Requirements (11)	Minimum requirements for a Greenroad	Req.
<b>Voluntary Credits (37)</b>		
Environment & Water	Stormwater, habitat, vegetation	21
Access & Equity	Modal access, culture, aesthetics, safety	30
Construction Activities	Construction equipment, processes, quality	14
Materials & Resources	Material extraction, processing, transport	23
Pavement Technology	Pavement design, material use, function	20
<b>Total Voluntary Credit Points</b>		<b>108</b>
Custom Credits	Write your own credit for approval	10
<b>Total Points</b>		<b>118</b>



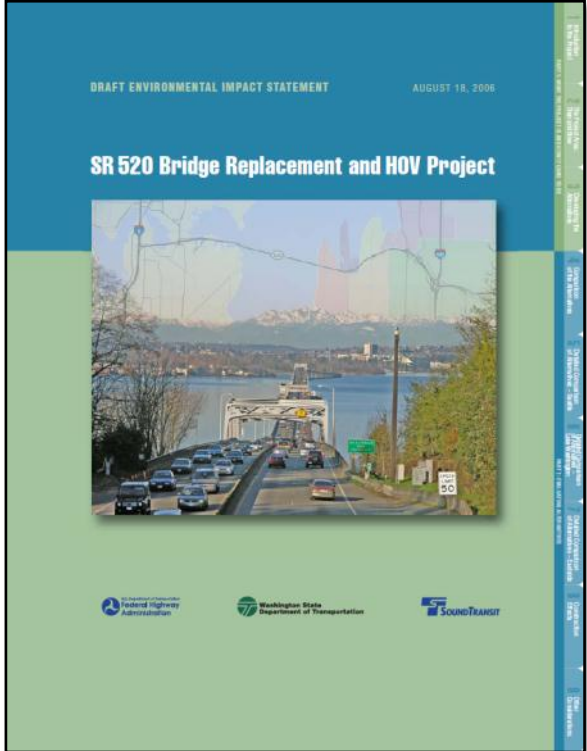
<b>Requirement</b>	<b>Description</b>
PR-1 Environmental Review Process	Complete and environmental review process
PR-2 Life Cycle Cost Analysis (LCCA)	Perform LCCA for pavement section
PR-3 Life Cycle Inventory (LCI)	Perform LCI of pavement section with computer tool
PR-4 Quality Control Plan	Have a 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-1 Environmental Review Process

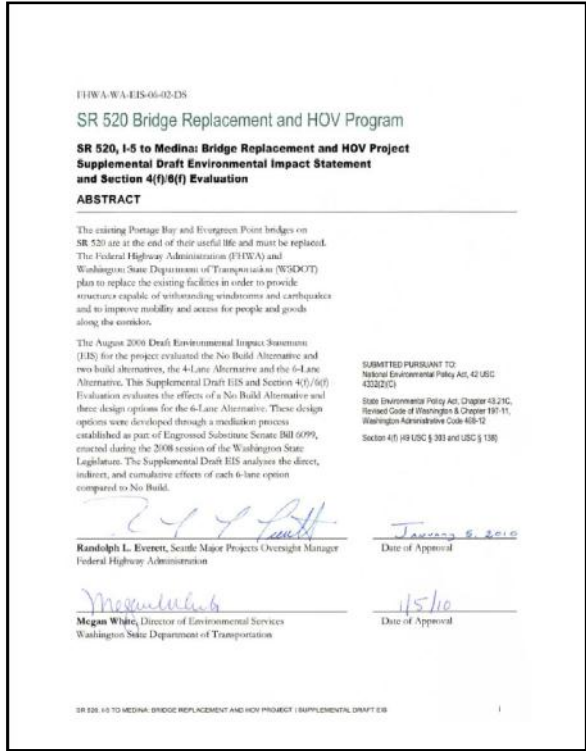
Evaluate impacts of roadway projects through an informed decision-making process.



Environmental Assessment



Environmental Impact Statement



Supplemental EIS

# PR-4 Quality Control Plan

Have a process in place to monitor and improve construction quality.



Quality control efforts in I-90 in Ellensburg, WA



<b>Voluntary Credit</b>		<b>Points</b>	<b>Description</b>
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
<b>Total</b>		<b>21</b>	





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
<b>Total</b>		<b>30</b>	

## AE-8 Scenic Views

Provide access to pleasant views of scenery from the roadway.



Paving Chain-of-Craters Road, Volcanoes National Park, Hawai'i, United States



<b>Voluntary Credit</b>	<b>Points</b>	<b>Description</b>
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
<b>Total</b>	<b>14</b>	

## 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



<b>Voluntary Credit</b>		<b>Points</b>	<b>Description</b>
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
<b>Total</b>		<b>23</b>	

# MR-2 Pavement Reuse

Reuse existing pavement materials.



Hot in-place recycling on SR 542, Washington, United States

## MR-4 Recycled Materials

Reduce lifecycle impacts from extraction and production of virgin materials.



Milling up existing HMA surface, Ka'ahumanu Rd., Pearl City, Hawai'i, United States



<b>Voluntary Credit</b>		<b>Points</b>	<b>Description</b>
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
<b>Total</b>		<b>20</b>	



# 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

# PT-3 Warm Mix Asphalt

Reduce energy expended in HMA production.



Paving Sasobit warm mix asphalt on I-90 near the Columbia River, 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

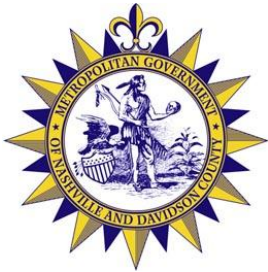
Why bother with sustainability?

You are already doing it.

Some examples from LEED:



**Vanderbilt University: First TN University with LEED building**  
Vanderbilt now has 12 LEED certified buildings. Ingram Commons won the State Environmental Stewardship Award for Green Buildings.



**City of Nashville: Substitute Ordinance #BL2007-1374**  
All publicly-funded building projects of 5,000 ft<sup>2</sup> or greater (or exceeding \$2M in project costs) are to be designed and built to LEED Silver certification.



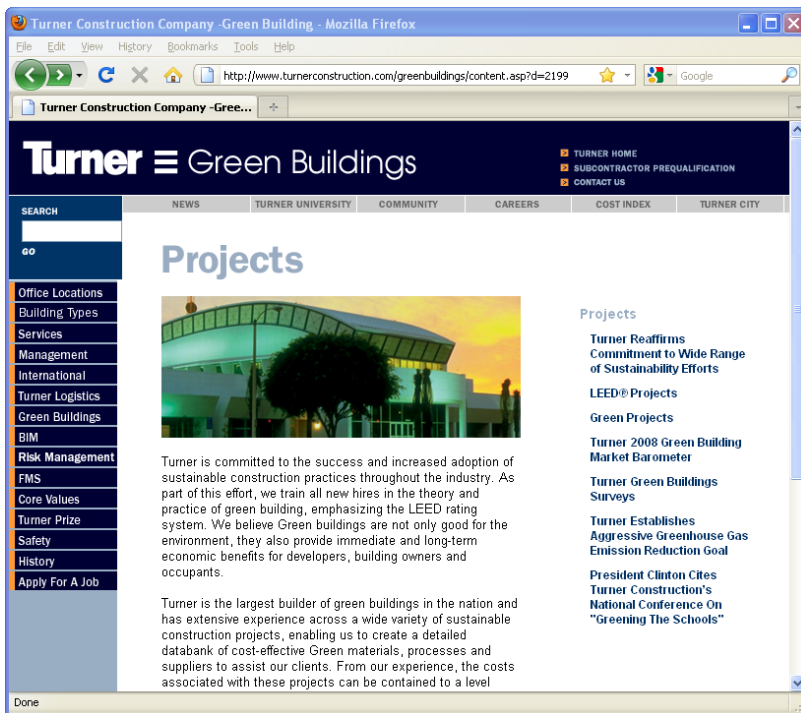
**State of Tennessee: Senate Bill 1919 (2009)**  
Permits housing authorities to finance additional investments in green building and energy efficiency, and specifically any costs related to modeling, and LEED.

## 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

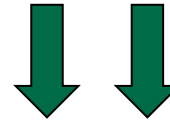
Make money.

## One example from LEED...



From the Turner Construction website:  
“We believe Green buildings are not only good for the environment, they also provide immediate and long-term economic benefits for developers, building owners and occupants

# Make money.



## From: 2011 ENR Top 100 Green Contractors

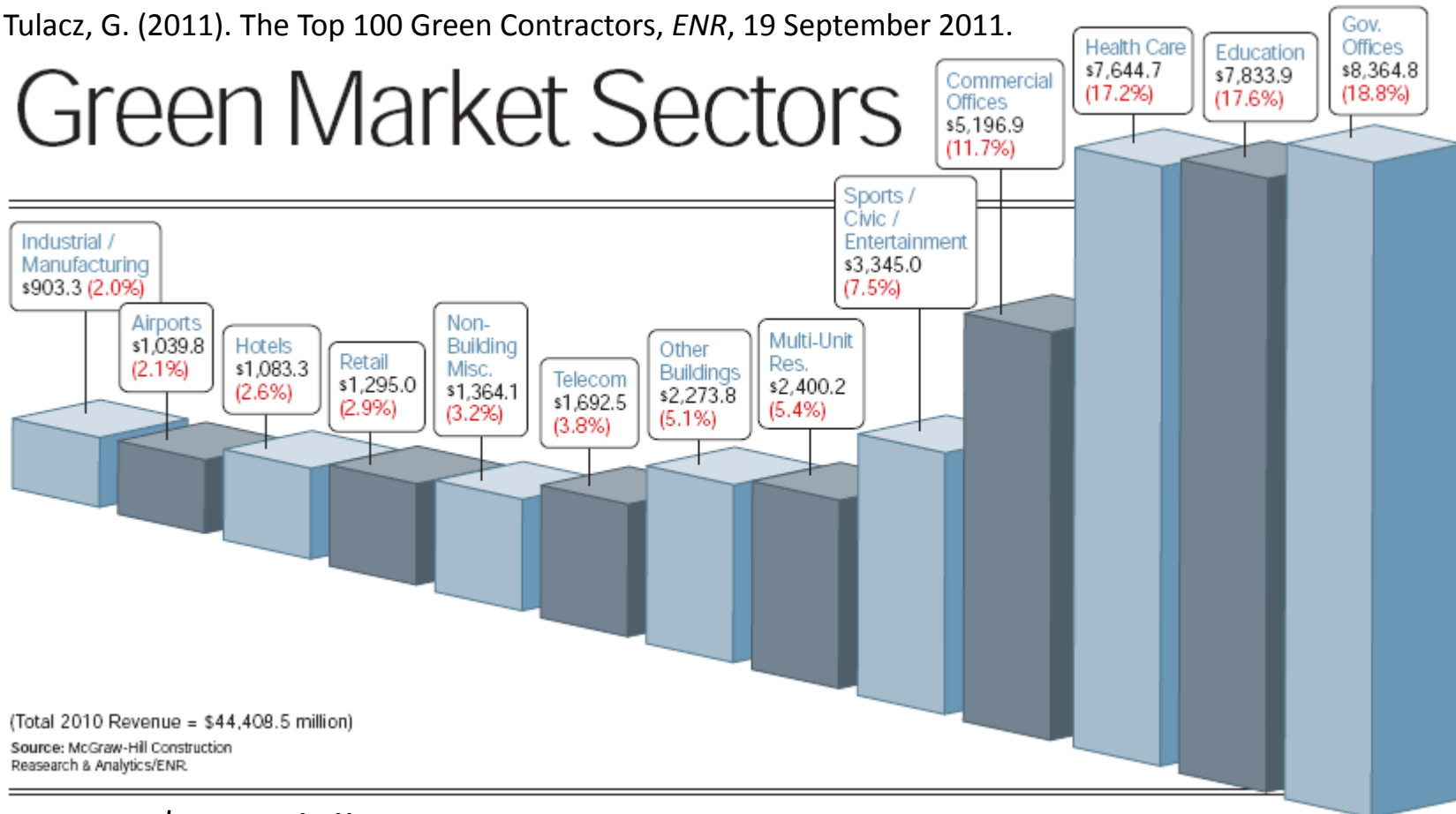
RANK 2011		ACC. STAFF	2010 GREEN REVENUE		RETAIL / OFFICE	GOVERNMENT OFFICE	EDUCATION	HEALTH CARE	HOTEL	MULTI-RESIDENTIAL	SPORTS / ENT. / CIVIC	OTHER BUILDINGS	OTHER MARKETS
			IN \$ MIL.	% OF TOTAL REVENUE									
1	THE TURNER CORP., New York, N.Y.	1252	4,229.1	56	11	9	27	24	4	2	2	4	16
2	GILBANE BUILDING CO., Providence, R.I.	505	2,541.7	85	11	5	31	35	0	0	2	10	6
3	CLARK GROUP, Bethesda, Md.	275	2,408.9	53	12	42	5	31	4	5	0	3	0
4	HENSEL PHELPS CONSTRUCTION CO., Greeley, Colo.	361	2,026.2	80	0	56	15	3	1	5	0	21	0
5	TUTOR PERINI CORP., Sylmar, Calif.	251	1,678.0	53	3	5	3	2	4	0	81	0	1
6	PCL CONSTRUCTION ENTERPRISES INC., Denver, Colo.	332	1,507.1	30	32	8	10	18	0	4	8	14	6
7	THE WHITING-TURNER CONTRACTING CO., Baltimore, Md.	228	1,478.8	46	12	18	30	12	4	7	7	2	8
8	SKANSKA USA, New York, N.Y.	444	1,305.2	27	6	8	25	35	0	0	9	3	14
9	HOLDER CONSTRUCTION CO., Atlanta, Ga.	168	1,179.0	73	18	0	7	0	0	0	0	0	75
10	BALFOUR BEATTY US, Dallas, Texas	380	1,001.4	29	12	38	8	10	13	12	0	7	1
11	HUNT CONSTRUCTION GROUP, Scottsdale, Ariz.	225	968.1	55	0	1	13	23	0	0	45	18	1
12	MORTENSON CONSTRUCTION, Minneapolis, Minn.	266	879.8	36	44	0	0	19	0	0	37	0	0
13	THE WALSH GROUP LTD., Chicago, Ill.	200	765.8	22	4	35	2	2	0	32	0	21	3
14	LEND LEASE, New York, N.Y.	250	751.5	31	7	2	20	4	0	60	2	0	4
15	WEBCOR BUILDERS, San Francisco, Calif.	105	701.2	99	4	9	10	29	6	14	18	0	9
16	MANHATTAN CONSTRUCTION GROUP, Tulsa, Okla.	81	673.4	50	4	78	7	5	0	1	5	0	0
17	CLAYCO INC., St. Louis, Mo.	75	660.0	75	51	0	0	0	0	0	0	49	0
18	MCCARTHY HOLDINGS INC., St. Louis, Mo.	407	608.0	25	0	2	44	17	0	0	2	22	12
19	DPR CONSTRUCTION INC., Redwood City, Calif.	375	581.2	41	7	0	15	34	1	0	0	0	43
20	B.L. HARBERT INTERNATIONAL LLC, Birmingham, Ala.	30	564.4	86	0	100	0	0	0	0	0	0	0



# Tell people.

Tulacz, G. (2011). The Top 100 Green Contractors, *ENR*, 19 September 2011.

## Green Market Sectors



(Total 2010 Revenue = \$44,408.5 million)

Source: McGraw-Hill Construction Research & Analytics/ENR.

- \$44.41 billion 2010 revenue
- Up 3.2% from 2009
- 38.8% of total revenue
- In 2013 US Navy will require LEED Gold

Steve Muench

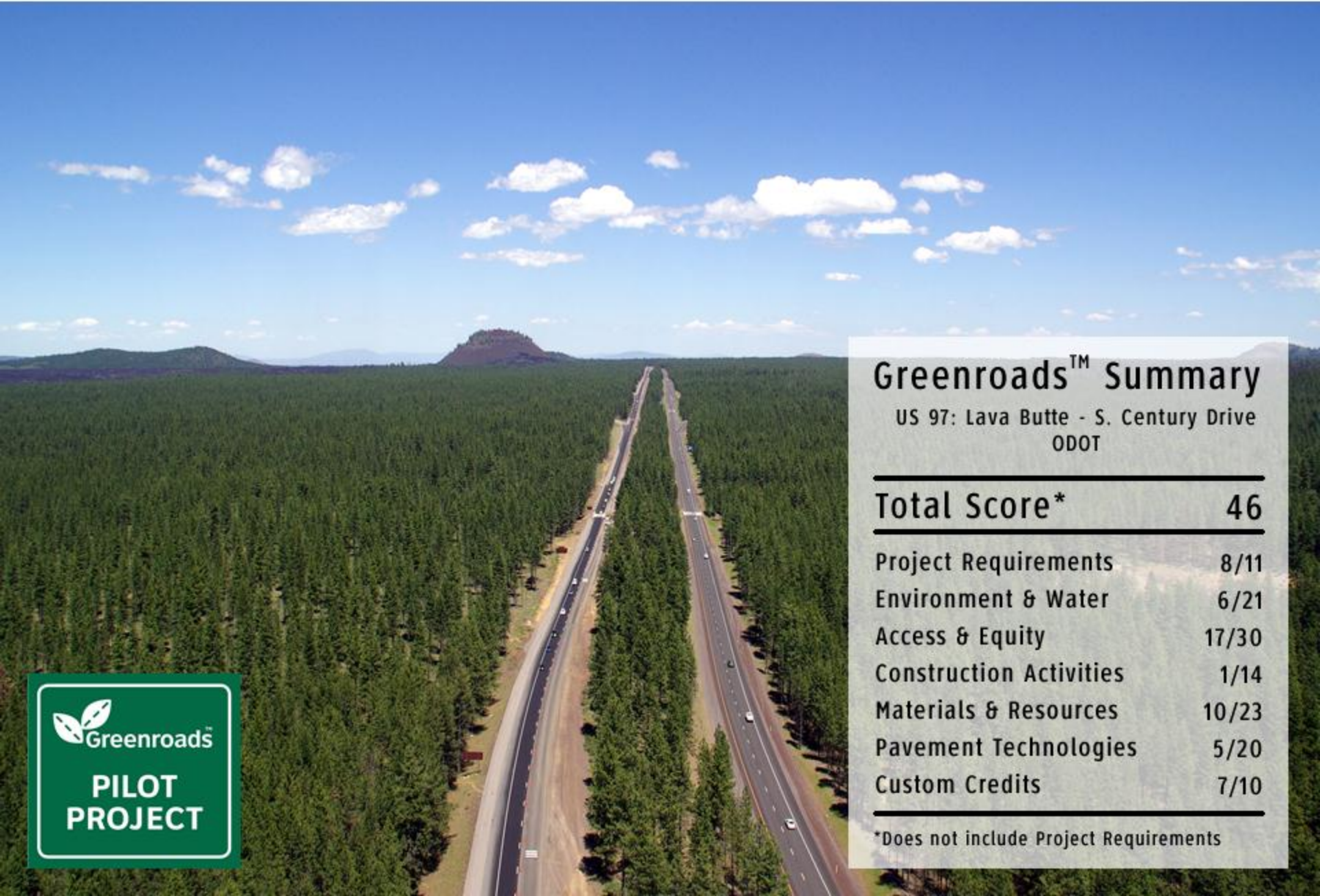
Associate Professor  
University of Washington

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## A few Greenroads Projects



## Greenroads™ Summary

US 97: Lava Butte - S. Century Drive  
ODOT

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<b>Total Score*</b>	<b>46</b>
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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

## Greenroads™ Summary

BRONZE CERTIFIED

South Division Street Promenade  
City of Auburn, Washington

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<b>Total Score*</b>	<b>33</b>
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Project Requirements	11/11
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Environment & Water	6/21
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Access & Equity	14/30
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Construction Activities	0/14
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Materials & Resources	5/23
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Pavement Technologies	8/20
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Custom Credits	0/10
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\*Does not include Project Requirements



Greenroads

**BRONZE  
CERTIFIED**

## Greenroads™ Summary

SILVER CERTIFIED

Meador Kansas Ellis Trail Project  
City of Bellingham, Washington

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<b>Total Score*</b>	<b>44</b>
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Project Requirements	11/11
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Environment & Water	7/21
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Access & Equity	11/30
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Construction Activities	3/14
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Materials & Resources	15/23
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Pavement Technologies	8/20
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Custom Credits	0/10
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\*Does not include Project Requirements



**SILVER  
CERTIFIED**

Steve Muench

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University of Washington

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206-616-1259



## Greenroads™ Summary

US 20: Newton Creek - OR 99W  
ODOT

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<b>Total Score*</b>	<b>25</b>
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Project Requirements	5/11
Environment & Water	0/21
Access & Equity	15/30
Construction Activities	1/14
Materials & Resources	9/23
Pavement Technologies	0/20
Custom Credits	0/10

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\*Does not include Project Requirements



**PILOT  
PROJECT**



## LIFECYCLE INVENTORY

### GOAL

Incorporate energy and emissions information into the decision-making process for pavement design alternatives.

### REQUIREMENTS

Complete a lifecycle inventory for the final pavement design alternative for the project using the software tool, PaLATE v2.2 as modified for Greenroads, or approved equal. Report only results for total energy use and global warming potential (GWP) (in carbon dioxide equivalent emissions, CO<sub>2</sub>e) for the final pavement design alternative. The following input values are required for PaLATE v2.2:

- **Total weight and types of virgin materials.** This includes aggregates, binders, base materials, and structures. These amounts can be design estimates or constructed totals.
- **Total weight and types of recycled materials.** PaLATE v2.2 models emissions and energy for several types of materials.
- **Expected transportation distances for all materials.** This means distances from source to production as well as from production to site. Transportation of waste to disposal is also included.
- **Expected construction vehicle types.** These include, but are not limited to, pavers, mixers, hauling vehicles, excavators, rollers, and finishing equipment.
- **Estimated design life.** Use the same input data as used in the PR-2 Lifecycle Cost Analysis.
- **Scheduled years and expected type of maintenance.** Use the same input data as used in the PR-2 Lifecycle Cost Analysis. This information should also match the project specifications provided to meet the requirements for PR-9 Pavement Maintenance Plan and PR-10 Site Maintenance Plan.



PR-3

### REQUIRED

#### RELATED CREDITS

- ✓ PR-2 Lifecycle Cost Analysis
- ✓ PR-9 Pavement Management System
- ✓ PR-10 Site Maintenance Plan
- ✓ MR-1 Lifecycle Assessment

#### SUSTAINABILITY COMPONENTS

- ✓ Ecology
- ✓ Equity
- ✓ Extent
- ✓ Expectations
- ✓ Exposure

#### BENEFITS