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Green Roads: Tools and Approaches

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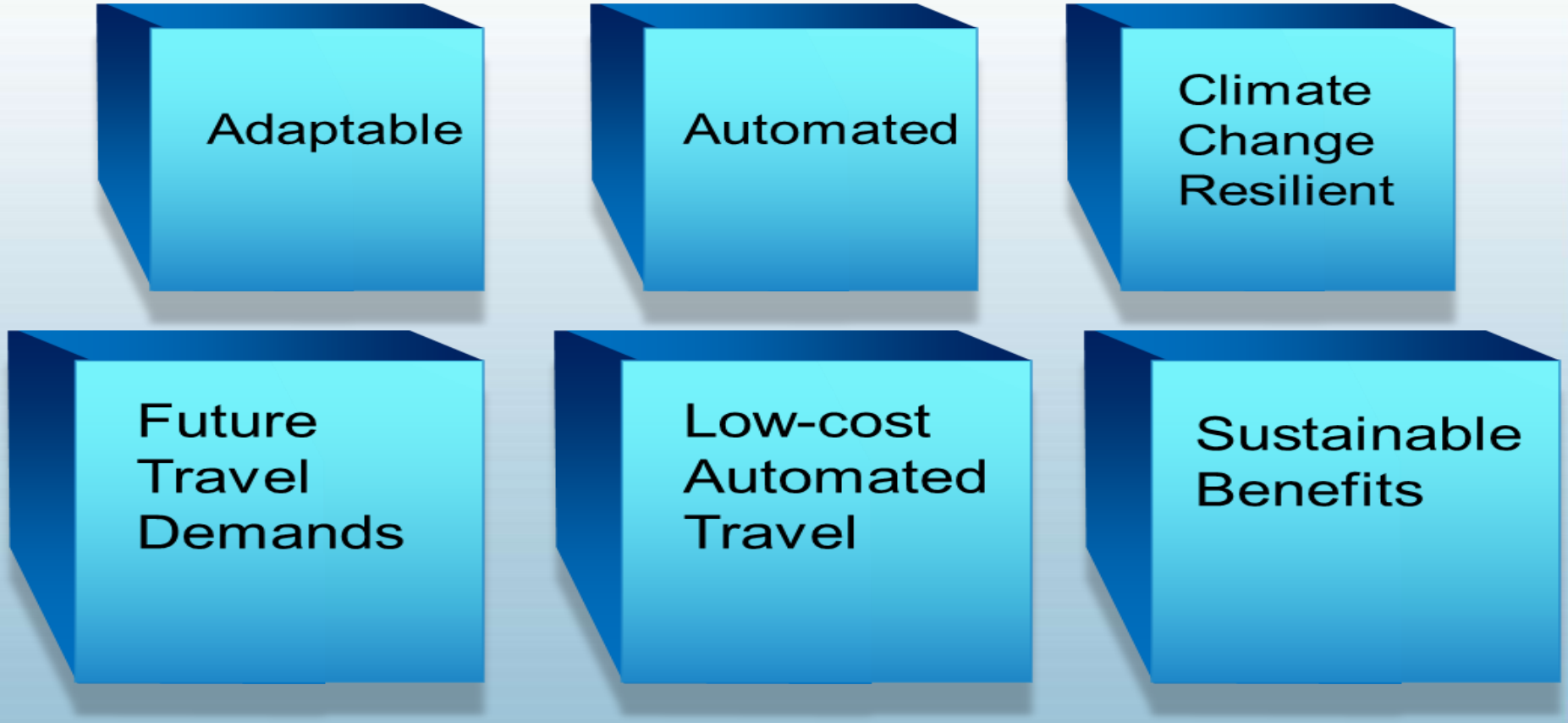
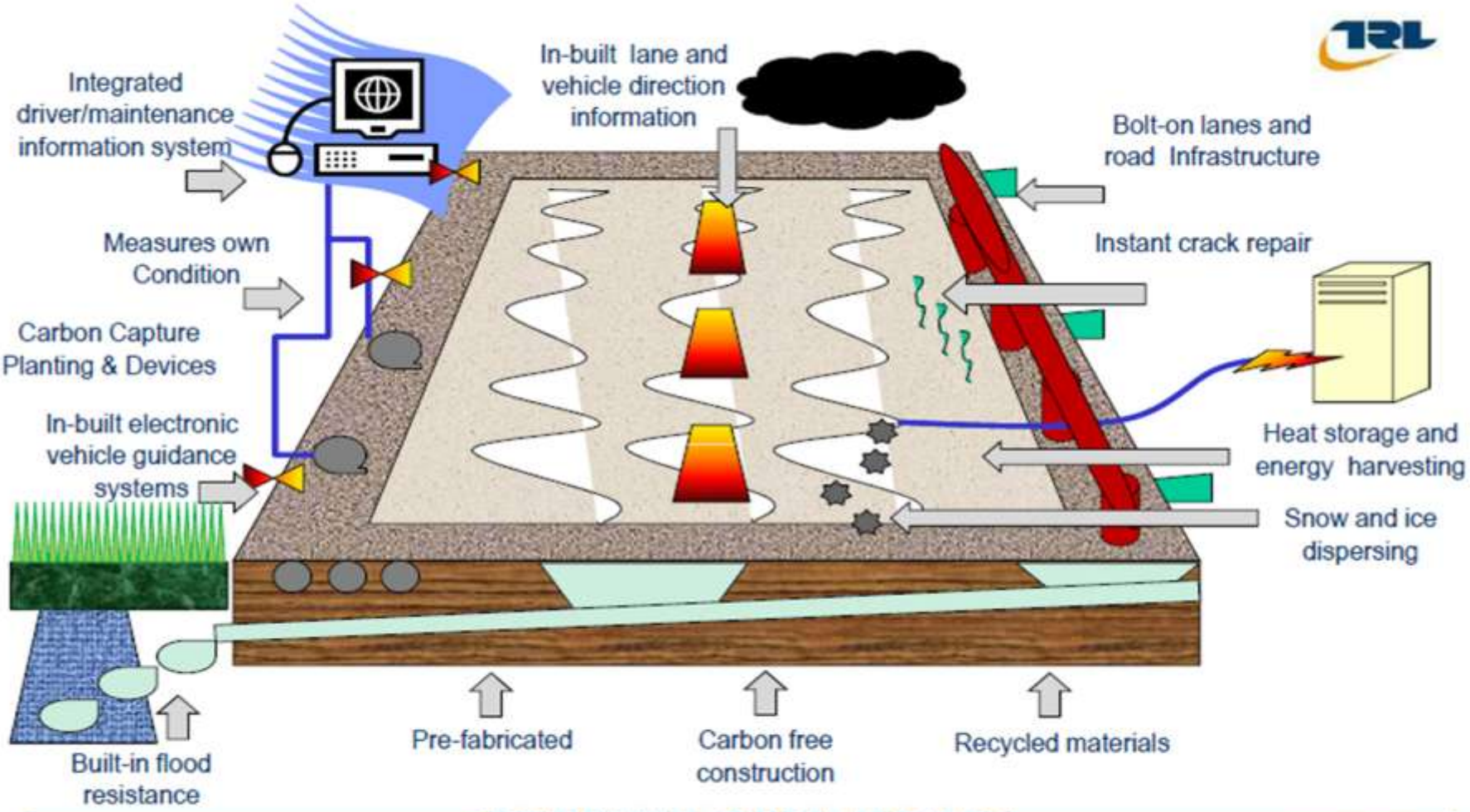
Better living for all—sustainably

Outline

- Approach
  - 5th Generation Roads
- Tool
  - Greenroads Rating System
- Case Study
  - The Sea to Sky Highway, British Columbia

The 5th Generation Road




Integrated driver/maintenance information system
In-built lane and vehicle direction information
Bolt-on lanes and road Infrastructure
Measures own Condition
Instant crack repair
Carbon Capture Planting & Devices
In-built electronic vehicle guidance systems
Heat storage and energy harvesting
Snow and ice dispersing
Built-in flood resistance
Pre-fabricated
Carbon free construction
Recycled materials

The Approach

Early stage innovative solutions are unlikely to be implemented. Conversely the design, construction and operation of **full-scale research demonstrators** where risk is taken mainly (but not entirely) by the road authority, is likely to make a difference.

Work Phases

- 2010 – 2014: Testing and labeling of single innovations
- 2014 – 2018: Integration of several innovations in a few selected research demonstrators, making it possible for …
- 2020: Full 5th Generation Road demonstrator, through the cross fertilization of the different research demonstrators.

What is the Greenroads rating system?

A rating system for roadway design and construction that awards points for more sustainable practices. Greenroads helps quantify the sustainable attributes of a roadway project.

What can I do on my project tomorrow to be more sustainable?

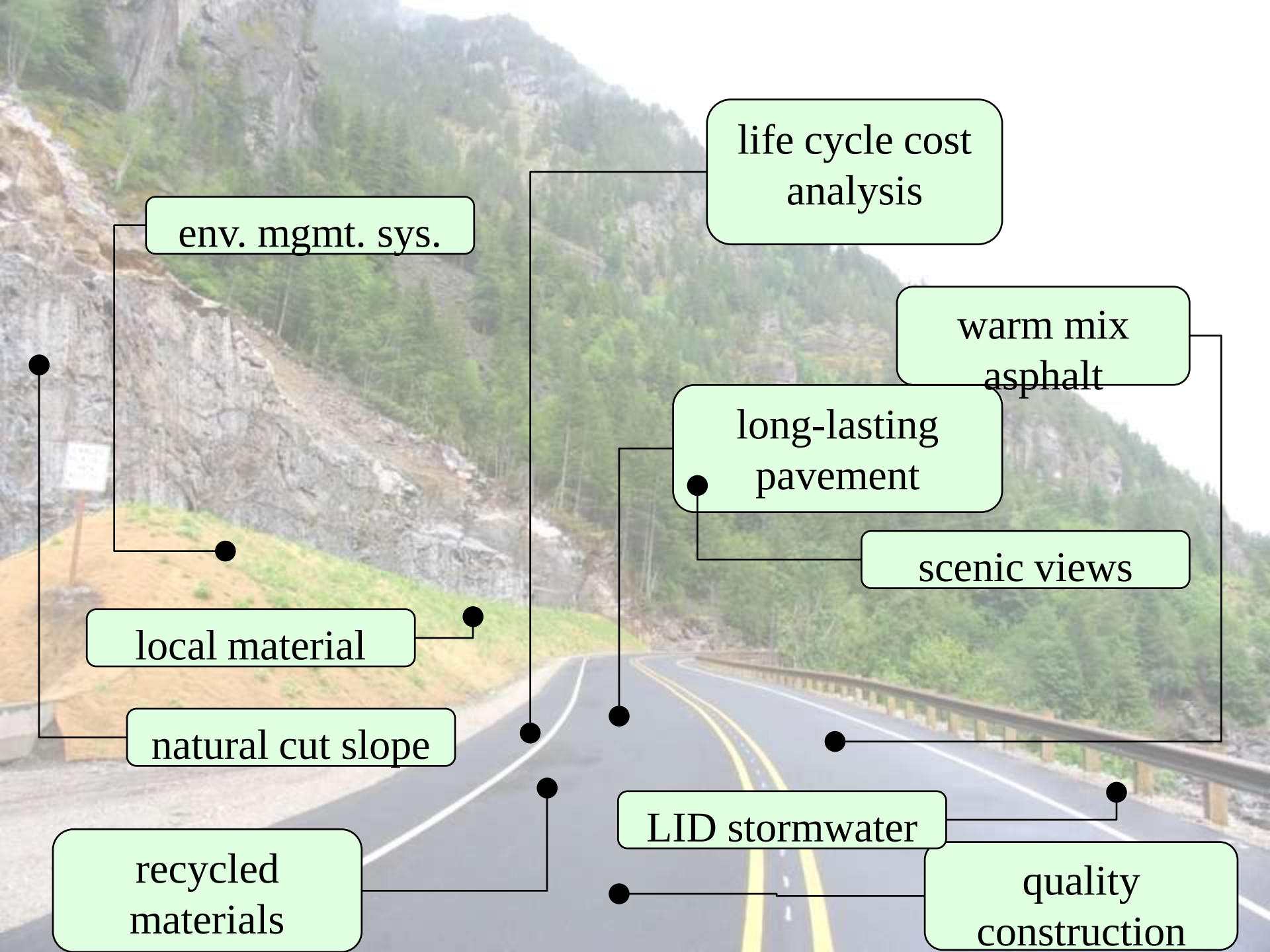
Greenroads is a project-oriented system

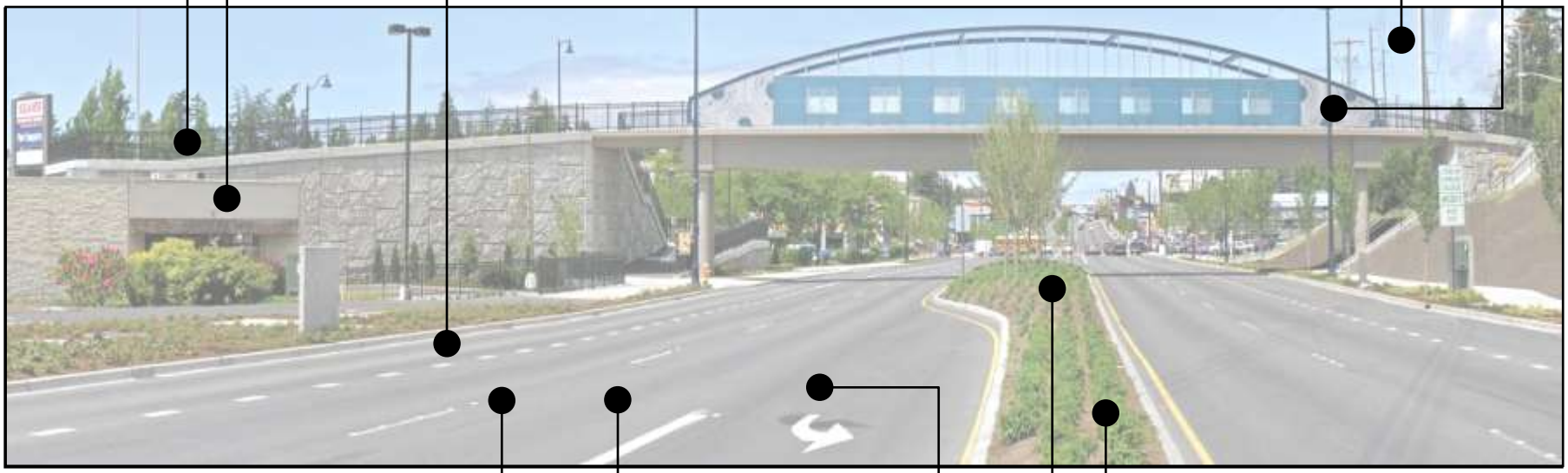
It focuses on design and construction.

What can Greenroads do?

- Communicate sustainable project attributes to stakeholders.
- Define what project attributes contribute to roadway sustainability.
- Provide a sustainability accounting tool for roadway projects.
- Manage and improve roadway sustainability.
- Stimulate the market for sustainable practices and products

Overall goal: improve roadway sustainability


life cycle cost analysis
env. mgmt. sys.
warm mix asphalt
long-lasting pavement
scenic views
local material
natural cut slope
LID stormwater
recycled materials
quality construction


ped./bicycle access
art
recycled materials
fewer emissions
bus rapid transit
CSS
regional material
quality construction
LID stormwater
native vegetation

Greenroads Categories: Version 1.5

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**

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

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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

Environment & Water

Voluntary Credit		Pts.	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-7 Ecological Connectivity

Provide or improve wildlife access and mobility across roadway facility boundaries and reduce vehicle-wildlife collisions and related accidents.

Picture from FishHabitatNexus.com

Materials & Resources

Voluntary Credit		Pts.	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.

Milling up existing HMA surface, N 75th Street, Seattle, Washington, United States

Pavement Technologies

Voluntary Credit		Pts.	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

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

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Other Tools: Carbon Calculators

- CHANGER (IRF)
- Carbon Gauge (Australia)
- Bilan Carbone (France)

Case Study, B.C. Canada
Sea-to-Sky Highway Improvement Project

- Undertaken as PPP
- Design Build Maintain Operate (DBMO)
- Fixed Price Procurement
- Multiple international prizes
- Multi-disciplinary teams of environmental specialists

More information

- 5th Generation Road
  - Contact : http://www.fehrl.org
- Green Roads Ratings:
  - Conducts free webinars
  - Can connect with them on Skype or Google Hangout or Webex by request at info@greenroads.org.
- B.C. Roads

  www.gov.bc.ca

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Thank you

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