

Sustainability and Concrete Pavements



THE
TRANSTEC GROUP

Sabrina I. Garber
March 5, 2010



Review of Sustainability

- “...we must find an **alternative** to our ingrained **behaviour** of burdening future generations resulting from our **misplaced belief** that there is a **choice** between economy and the environment. That choice, in the long term, turns out to be an illusion with awesome consequences for humanity,” Charles Caccia, 1986.

Review of Sustainability

- “meeting the needs of the present without compromising the ability of future generations to meet their own needs.”

-WCED

- How does that apply to concrete pavements?

Review of Sustainability

- “Green Highways” (www.acpa.org)
 1. Longevity
 2. Reduced fuel consumption
 3. Use of industrial byproducts
 4. Recyclability and reusability
 5. Limiting use of natural resources
 6. Reduced heat island effect and increased light reflectivity
 7. Lower energy footprint
 8. Improved water quality
 9. Improved surface textures

Green Highways
Environmentally and Economically Sustainable Concrete Pavements
concrete pavement research and technology special report

Contents

- 1 Introduction
- 2 Longevity
- 3 Reduced Vehicle Fuel Consumption and Emissions
- 4 Lower Construction Fuel Demand
- 5 Use of Industrial Byproducts
- 6 Recyclability/Reusability
- 7 Reduced Use of Natural Resources
- 8 Light Color and Cost
 - Reduced Lighting Requirement
 - Heat Island Mitigation
 - Snow Reduction
- 9 Lower Energy Footprint
- 10 Improved Water Quality
- 11 Surface Textures
- 12 References

Introduction

The concepts of “sustainability” and “sustainable development” are receiving much attention as the issues of global warming and climate change are debated. The World Commission on Environment and Development has defined sustainable development as “meeting the needs of the present without compromising the ability of future generations to meet their own needs” (report to the United Nations General Assembly, August 1987).

In 2005, the U.S. Environmental Protection Agency (EPA) started the Green Highways Initiative as an instrument for coordinating transportation and environmentalism. According to this initiative, “green highways” are those that are environmentally responsible and sustainable in all aspects, including design, construction, and maintenance.

A major focus of the initiative is to demonstrate and ensure that sustainable practices in pavements can go hand in hand with economic success. This is indeed true of concrete pavements.

Particularly because of its long life, concrete is an economical, cost-effective pavement solution that conserves minimal materials, energy, and other resources for construction, maintenance, and rehabilitation activities over its lifetime. Beyond longevity, other features of concrete pavement further enhance its sustainability:

- Properly constructed and bedded concrete pavements have reduced pavement deflection, which results in reduced vehicle fuel consumption.
- The consistency of concrete pavements consumes less fuel (particularly diesel) during materials production, transportation, and placement than the construction of asphalt pavements.

- Concrete pavement increases incorporate inert materials (byproducts like fly ash and slag cement), which lowers the disposal needs, reduces the demand on virgin materials, and conserves natural resources.
- Concrete pavement itself is recyclable and 100% recyclable.
- Concrete pavement requires less carbon aggregate materials for structural support than asphalt pavements.
- Concrete pavements’ lighter color and increased reflectivity improve nighttime visibility, reduce the amount of power needed to illuminate urban at night, and help mitigate urban heat island and smog generation.
- Concrete pavements exhibit a lower energy footprint, associated with their production, delivery, and maintenance than asphalt pavements do over a predetermined time period.
- Concrete pavements designed with porous concrete shoulders minimize surface-water discharge and help replenish groundwater supplies.
- Optimized concrete pavement surface textures produce quieter pavements over longer periods of time, reducing noise pollution.

Although cement is a relatively energy-intensive and carbon dioxide (CO₂)-intensive material in manufacture, it is important to recognize that cement manufacturing accounts for only 1.9% of

ACPA
American Concrete Pavement Association
October 2007

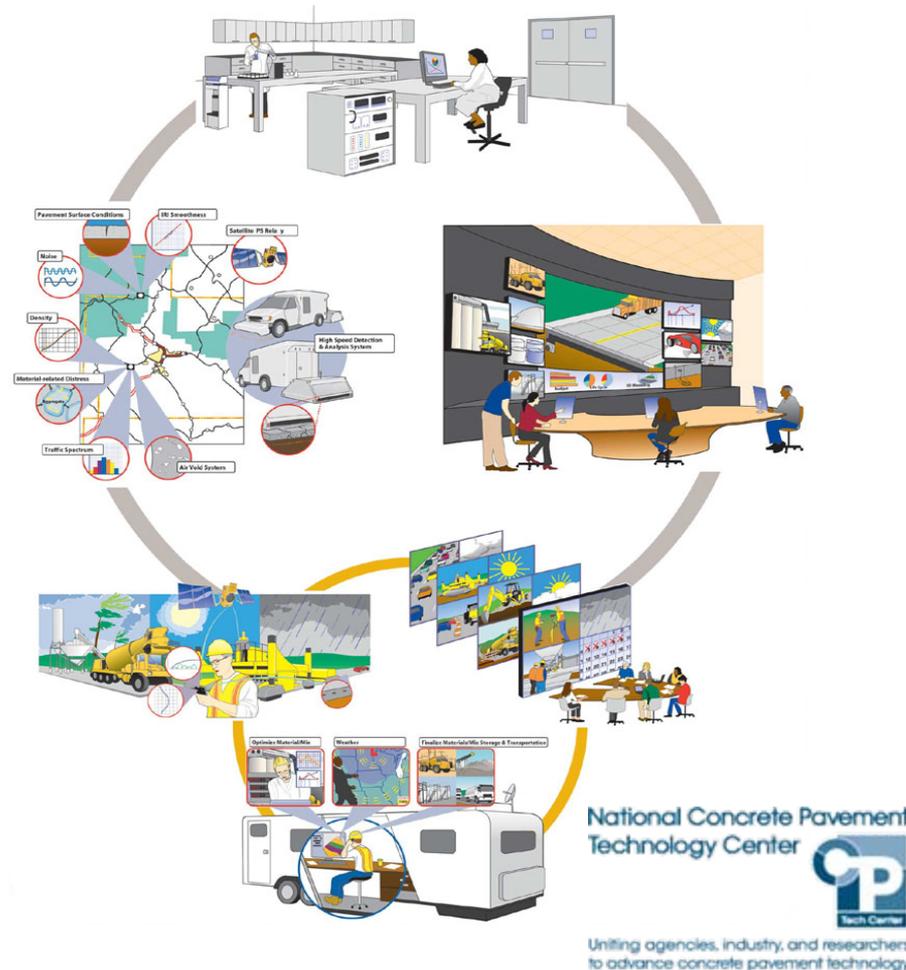
Review of Sustainability

Track #13 = Sustainability



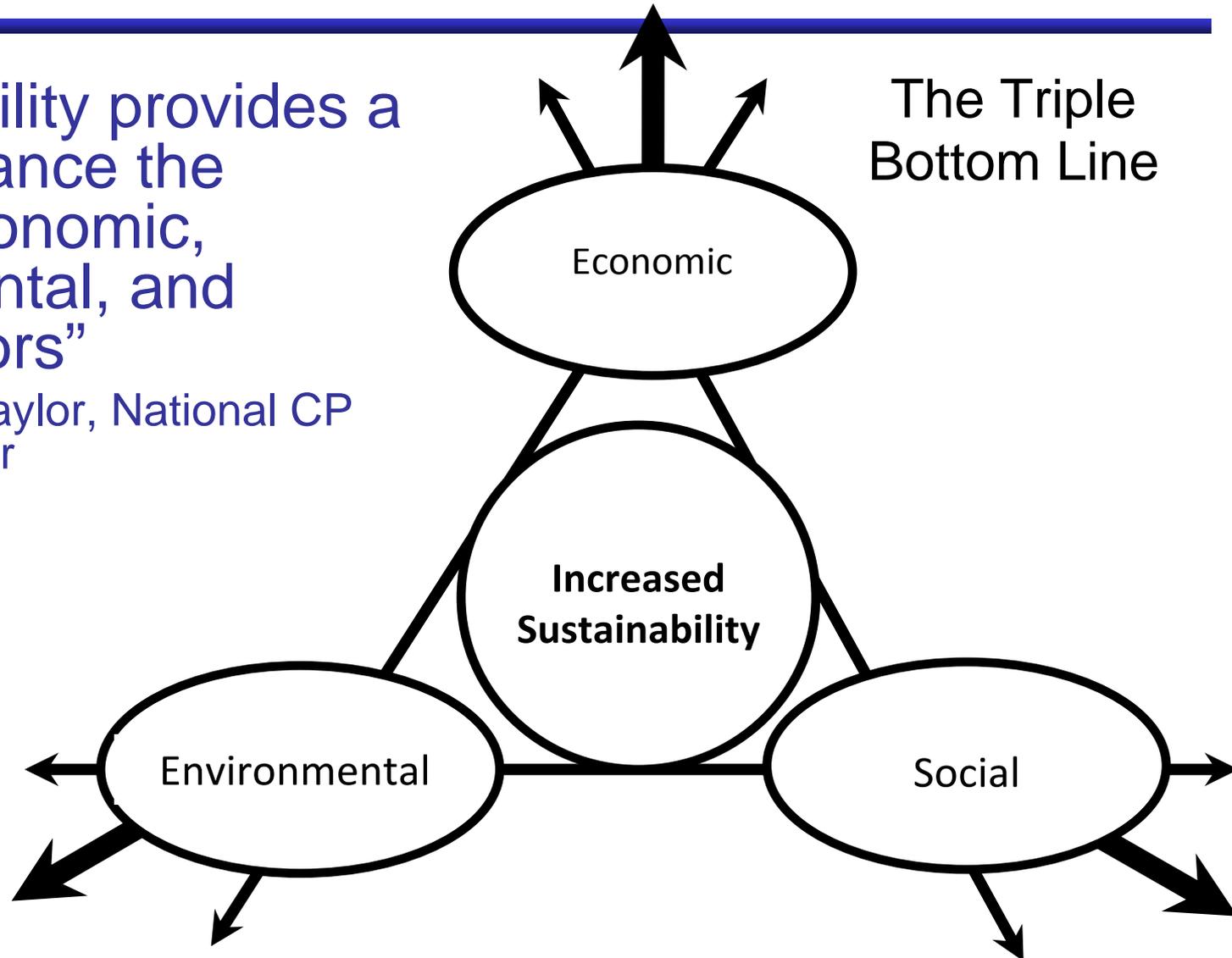
CP ROAD MAP
shaping the future of concrete pavement

www.CPRoadMap.org



Review of Sustainability

- “Sustainability provides a way to balance the various economic, environmental, and social factors”
 - Dr. Peter Taylor, National CP Tech Center

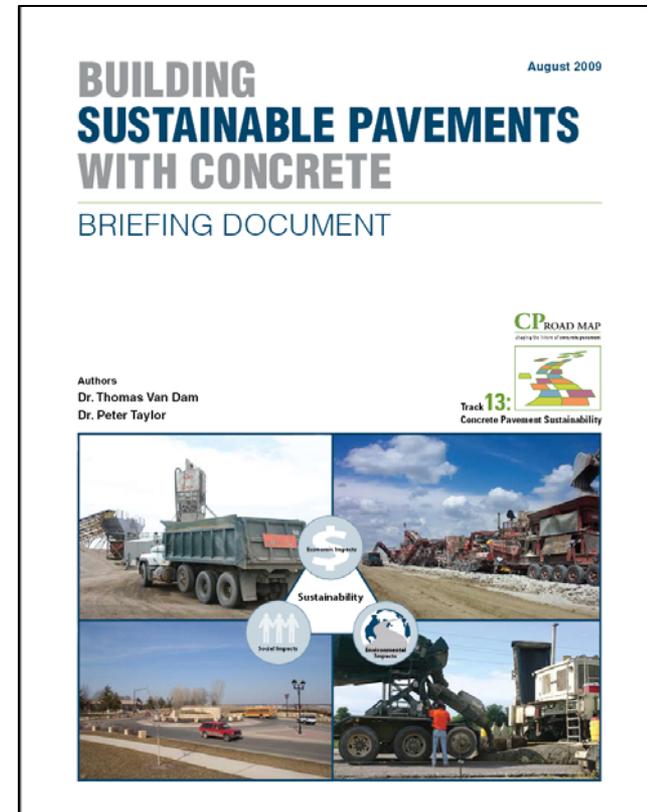


Review of sustainability

- Minimizes the use of energy and non-renewable resources.
- Generating a minimum of pollutants.
- Use the most cost effective manner possible.
- Maximize the benefits to society.

Making Sustainability a Reality

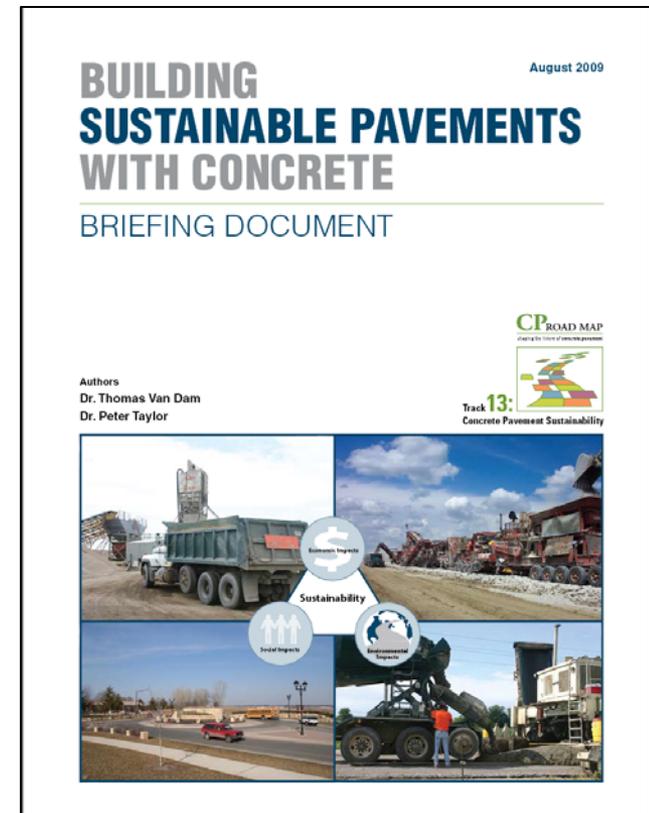
- 7 Common Sense Principles
 1. Get Smart
 2. Design to Serve the Community
 3. Choose what you use
 4. Less is More
 5. Minimize the Negative Impact
 6. Take Care of what you have
 7. Innovate



www.CPRoadMap.org

Making Sustainability a Reality

- Quantifying
 - Green Roads, GreenLITES
 - Life Cycle Environmental Analysis (LCEA)
- Factors
 - Emissions
 - Toxicity potential
 - Raw materials consumption
 - Waste generated



www.CPRoadMap.org

National Concrete Pavement
Technology Center



Uniting agencies, industry, and researchers
to advance concrete pavement technology

Making Sustainability a Reality



Green Highways Partnership
Stewardship, Safety, & Sustainability

- Partnering of industry
- Goal:
 - “...to incorporate **environmental streamlining and stewardship** into all aspects of the highway lifecycle”
- Three teams:
 1. Watershed-driven Stormwater Management
 2. Recycle and Reuse
 3. Ecosystem Conservation and Protection

www.greenhighwayspartnership.org

Making Sustainability a Reality

- “...we are focused on sustainable transportation with regards to roads, highways. **Roads and highways we know for many years tend to have multiple impacts on the environment** everywhere from water quality to watershed habitat fragmentation, to air, and we thought that in working through ways to solve problems as it relates to these impacts around transportation, in this case highways, **we would ultimately develop models and solutions that could have more universal application.** Roadways traditionally are impervious surfaces.”

Dominique Lueckenhoff

Environment Matters Podcast, October 2008

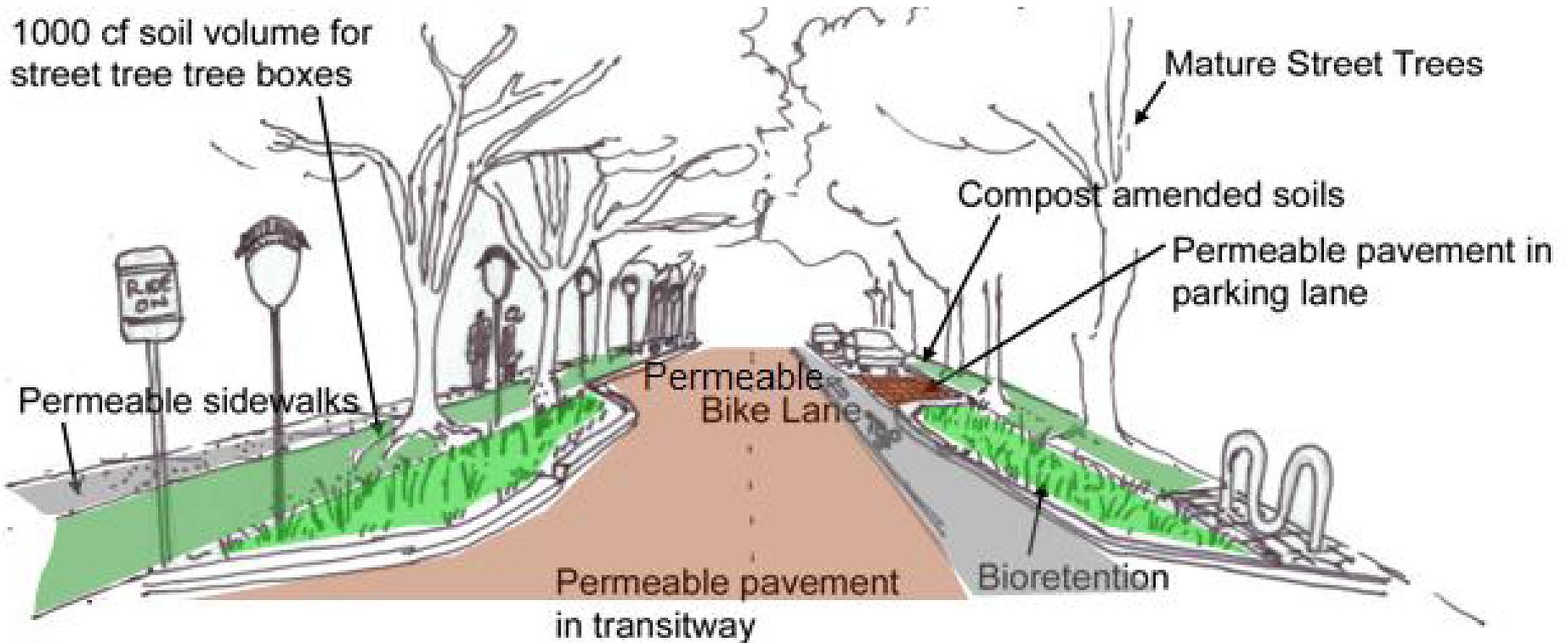


Making Sustainability a Reality

- Low Impact Development (LID)
 - new approach
- LID Center
 - comprehensive land planning
 - engineering design
- Goal: “maintain and enhance the pre-development hydrologic regime of urban and developing watersheds”



Making Sustainability a Reality



A graphic depiction of some of the LID features that can be used in the public right-of-way
Image: The Low Impact Development Center, Inc.



Making Sustainability a Reality

- **Green Highways Initiative**
 - Protocols and management
- **Permeable Interlocking Concrete Pavement (PICP) Outreach and Training Program**
 - Coop with Interlocking Concrete Pavement Institute (ICPI)
 - To demonstrate the effectiveness of permeable interlocking concrete pavement (PICP) at meeting stormwater management water quality regulatory requirements and related resource protection issues
- **Nannie Helen Burroughs Avenue (NHB Ave) Revitalization Project**
 - Working with District of Columbia's Department of Transportation with creating and implementing a model "Green Street"



Making Sustainability a Reality



Conclusion

- Sustainability is not going away.
- Concrete pavements are sustainable and have the potential for being even more sustainable.
- Organizations are making an effort.
- We just need to follow through.

Conclusion

- A final note
 - ***International Conference on Sustainable Concrete Pavements***
 - September 15-17, 2010 in Sacramento, Ca
 - FHWA and CP Tech Center

www.ACPA.org

www.CRRoadMap.com

www.greenhighwayspartnership.org

The Future of Sustainability and Pavements

- The big picture
 - Solar Highway
 - I-5 and I-205 in Oregon



The Future of Sustainability and Pavements



<http://www.wsdot.wa.gov/Partners/GreenHighways>



Imagine driving down Interstate 5 – all 1,350 miles of it from British Columbia to Baja, California – without using a drop of gas or releasing an ounce of harmful carbon emissions.

There's no need to imagine much longer. Soon, I-5 will become the first U.S. interstate specifically equipped to carry electric vehicles border-to-border, threading Washington, Oregon and California with recharging stations spaced within the range of standard electric vehicle (EV) technology.