

WELCOME

NATIONAL CONCRETE CONSORTIUM

ST. LOUIS, MO

OCTOBER 6-8, 2009



Common Sense Sustainability for Concrete Pavements

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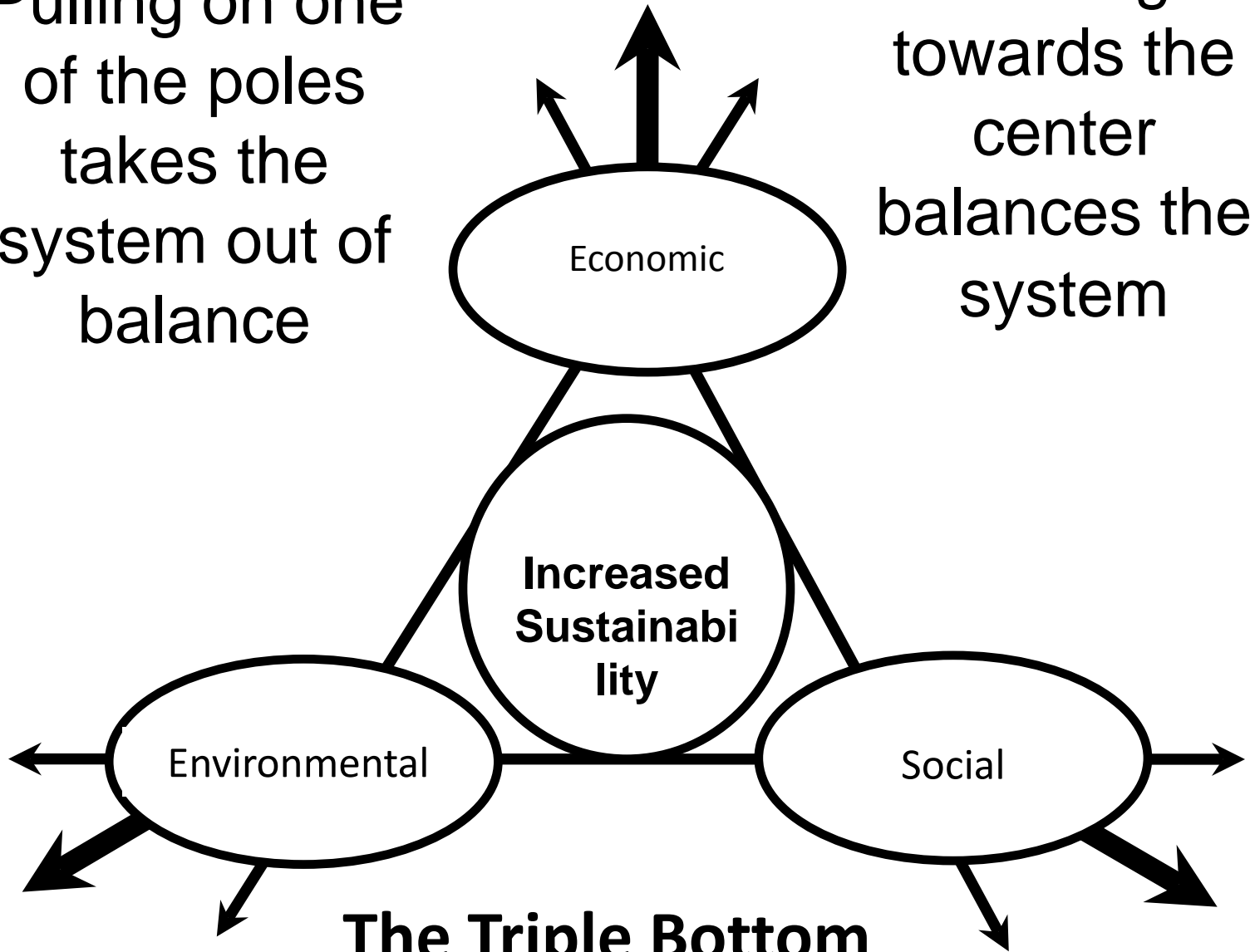
Background

- Concrete is the most commonly used building material on the planet
 - Modern civilization is built on concrete
 - The positive social impacts are immense
- Therefore, it has a relatively large environmental footprint
- Sustainability provides a way to balance the various economic, environmental, and social factors



Pulling on one of the poles takes the system out of balance

Moving towards the center balances the system



The Triple Bottom Line

What makes a Roadway More Sustainable?

The use of practices and materials in concrete pavement that provides a durable pavement over the design life of the pavement, and that

- minimizes the use of energy and non-renewable resources
- while generating a minimum of pollutants
- in the most cost effective manner possible
- while maximizing the benefits to society.

Sustainable Design

- It is simply good engineering
 - Using limited resources to achieve design objectives
 - Not about perfection, but about balancing competing, and often contradictory, interests
- Considers life-cycle economic, environmental and societal factors
- It's complicated – get over it



In Addition

Sustainability:

- Is being demanded
- Appeals to a younger workforce
- Allows the industry to communicate the good that is being done
- Makes the concrete industry more competitive
- Drives innovation
- Is an important part of the stimulus package



BUILDING SUSTAINABLE PAVEMENTS WITH CONCRETE

August 2009

BRIEFING DOCUMENT

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http://www.cproadmap.org/publications/sustainability_briefing.pdf

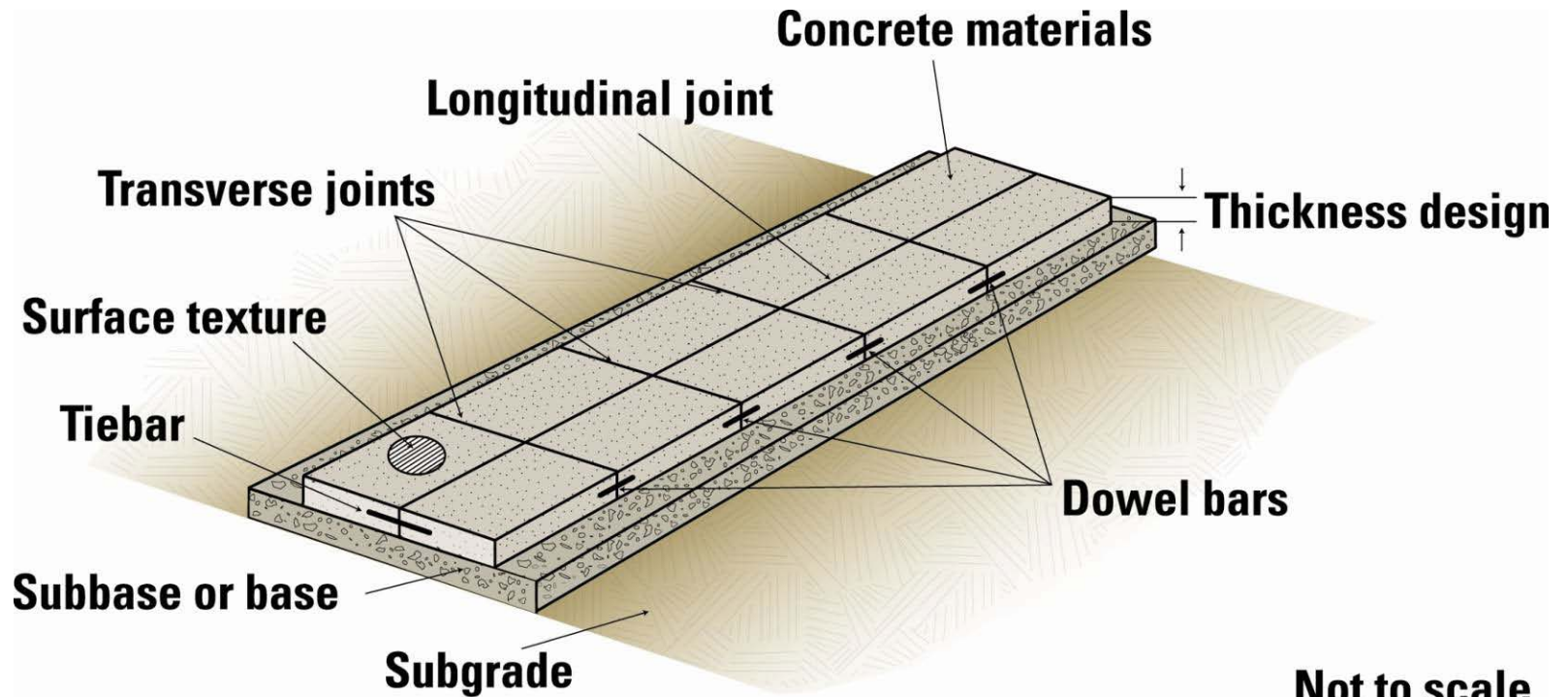
Common Sense Principles of Sustainability – v 1.0

1. Get smart
2. Design to serve the community
3. Choose what you use
4. Less is more
5. Minimize impact
6. Take care of what you have
7. Innovate

No. 1: Get Smart

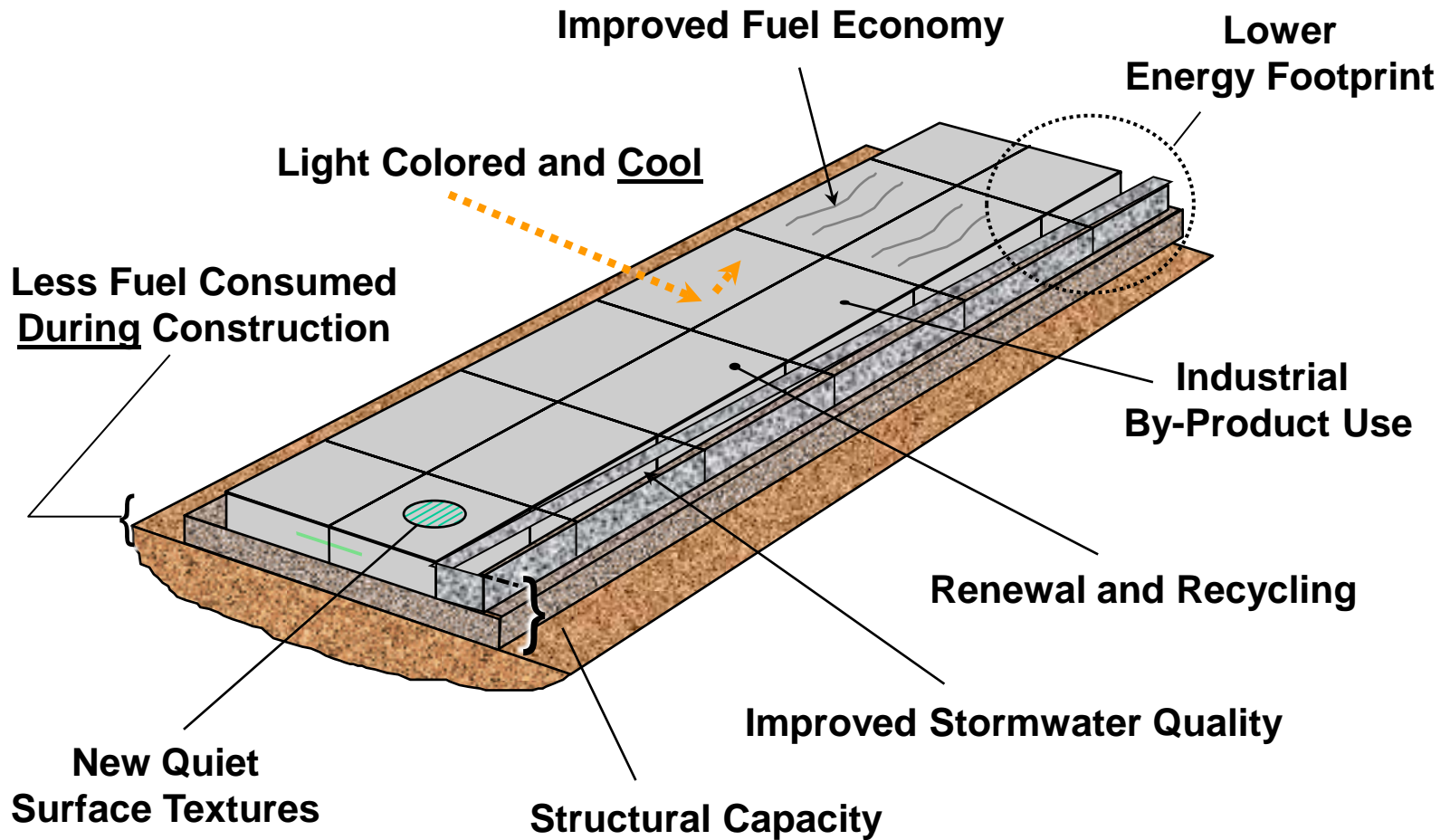
- Design for what you need
 - No more and no less
 - Don't sacrifice engineering quality
- Incorporate design features that ensure that the design criteria are met
 - Holistic approach to design – it is not just thickness
- Incorporate innovative features that enhance sustainability
 - Standardized details

Holistic Concrete Pavement Design



Not to scale

Design Beyond Longevity



No. 2: Design to Serve the Community

- Listen to the communities being affected
 - The “community” includes both the human community and natural community
- Design to address the specific needs of the community
 - Now and for the life of the pavement

No. 3: Choose What You Use

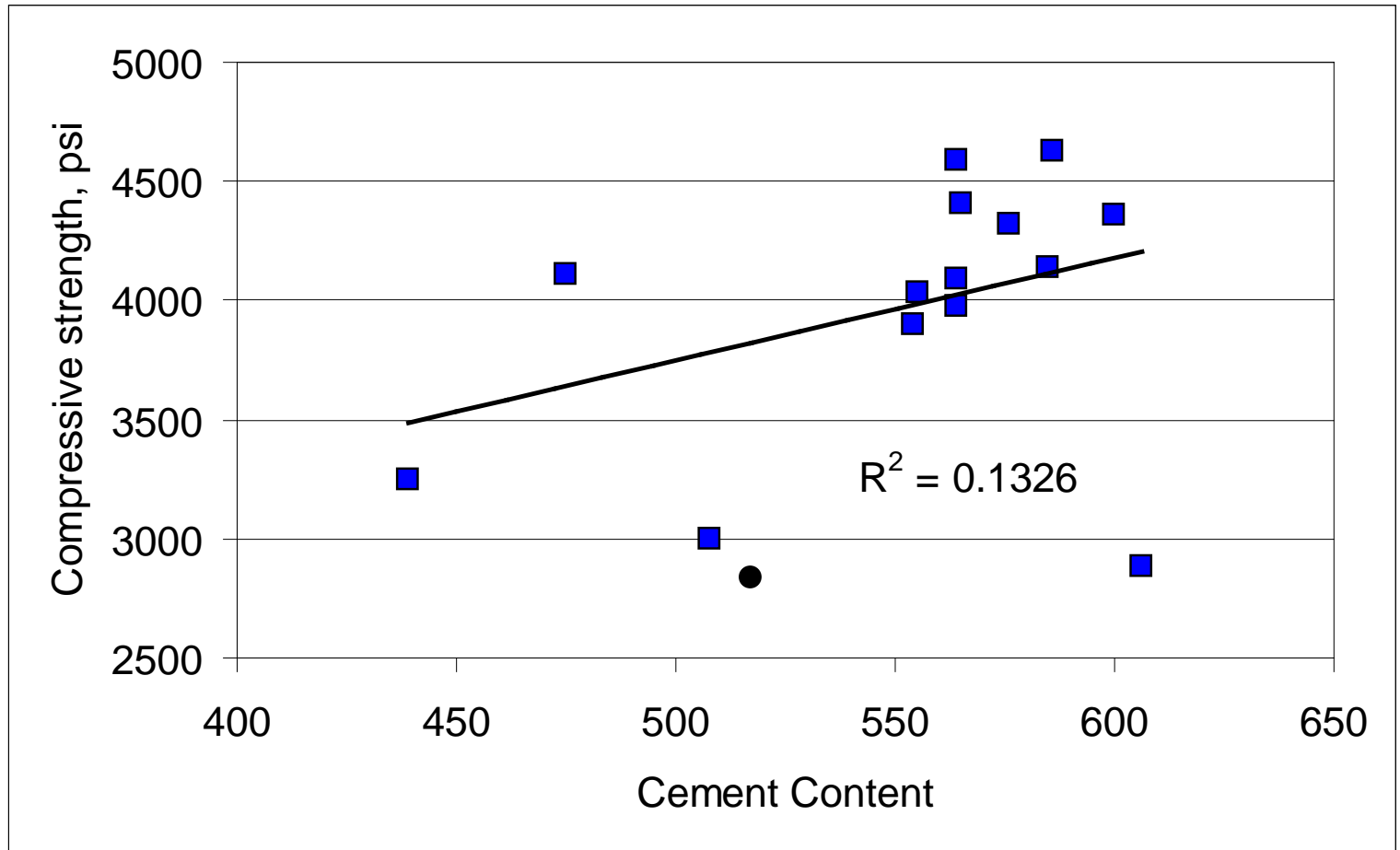
- Recycle – zero-waste
- Local first – minimize transportation
- Select the materials to use – don't let the materials select themselves
 - Understand what is available
 - Import only what you need



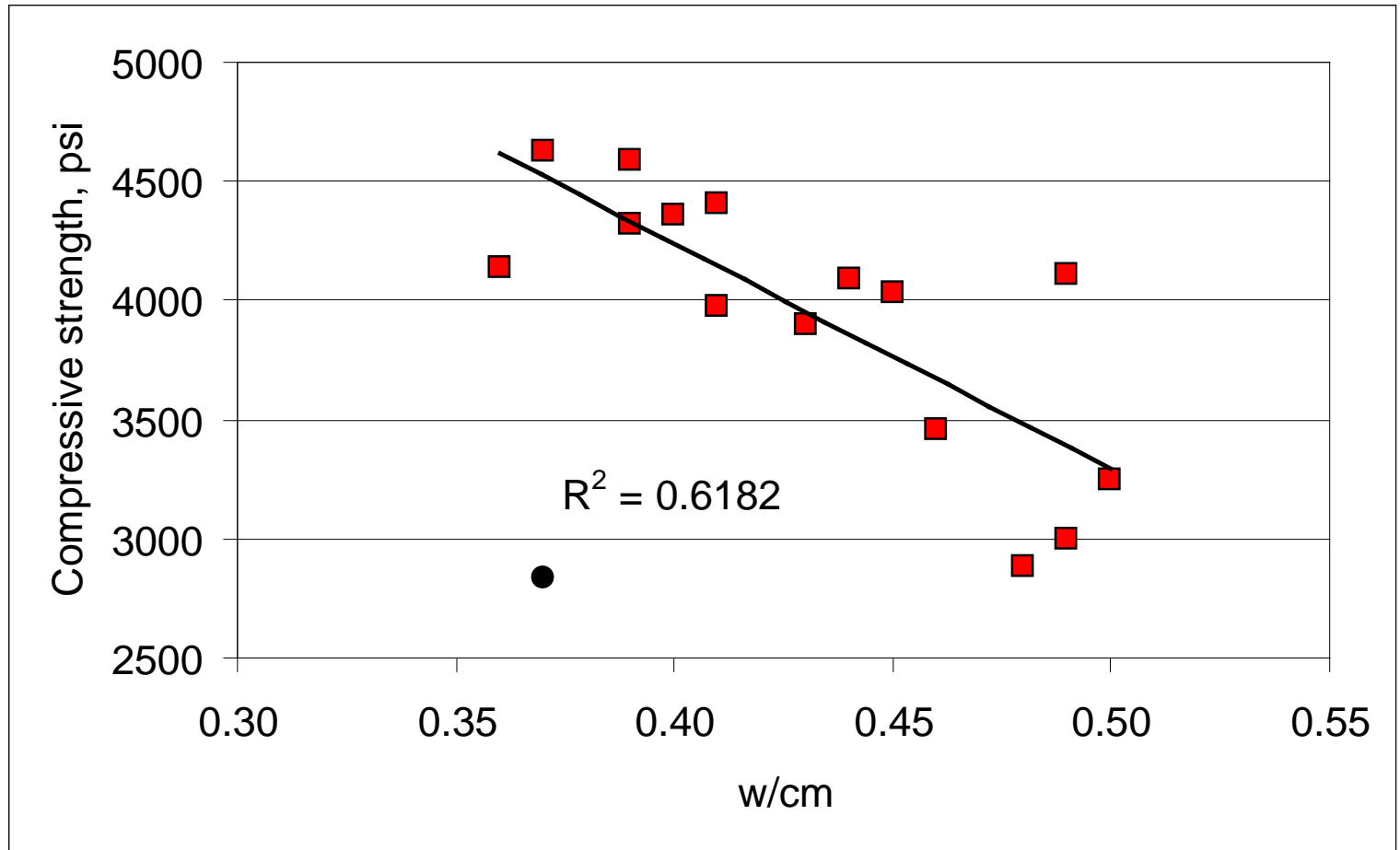
No. 4: Less is More

- All things equal, less material means less impact
- Using less portland cement can improve sustainability
 - Blended (ASTM C595) and performance specified (ASTM C1157) cements
 - Supplementary cementitious materials (SCMs – fly ash, slag, etc.)
 - Aggregate grading
 - Optimized mixture design

Why specify cement content?



Why specify cement content?



No. 5: Minimize Impact

- Noise – Construction and traffic
- Safety
 - Splash and spray
 - Lighting
- Delays – During construction and rehabilitation
- Emissions
 - Green house gases
 - Pollution
 - Particulates

No. 5: Minimize Impact

- Energy efficiency –
 - Construction
 - Operation
 - Lighting
- Urban heat island effect

Phases of a Pavement's Life

- Design
- Construction
- Operation
- Rehabilitation
- Recycling, Removal

Factors Affecting Sustainability Design

Cut and fill

Design life

Construction
method

Drainage

Thickness

Life cycle
Cost

Materials
selection

Capacity

Factors Affecting Sustainability Construction

Virgin
materials

Dust

CO₂

VOC's

Delay
time

Energy

Noise
pollution

Life cycle
Cost



Factors Affecting Sustainability Operation

Maintenance

Capacity

Noise
pollution

Water
runoff

Reflectivity

Heat
island

Safety

Friction to vehicles

Longevity

Factors Affecting Sustainability Repair/Rehabilitation/Removal

Removal = waste
disposal

Repair/ Rebuild =
similar issues to
construction

Recycling in base

Recycling
in concrete

No. 6: Take Care of What you Have

- Use the equity already in the existing pavement
- Longevity is a hallmark of sustainable practice
- Well timed maintenance and rehabilitation is essential
- Design to maintain
 - For high volume roadways, accommodate future diamond grinding to extend pavement life



No. 7: Innovate

- Identify problems/opportunities, generate solutions, implement, and reiterate
- Learn from mistakes
- Good specifications
- Evaluate emerging technologies and adopt those with demonstrated promise
- Educate and challenge yourself and your workforce



Innovative construction approaches

- 2-lift
- Ternary
- Recycle
- ...



Quantification

- Rating systems
 - Green Roads, GreenLITES
 - LEED
- Life cycle inventory (LCI)/life cycle assessment (LCA)
 - The future is now (ISO 14000)
 - Need to establish regional data and usable software tools

Concrete Pavement Road Map Sustainability Track Activities

- A Briefing Document
- A “Best Practices” training manual
- An International Conference – Sept 2010
- Demonstration projects

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