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- American Concrete Pavement Association
- California Nevada Cement Association
- Cement Council of Texas
- New York State Concrete Masonry Association
- Pavement Recycling Systems, Inc.
- Precast/Prestressed Concrete Institute- NE Region
- PCA-Northeast Cement Shippers Association
- VRMCA and MRMCA
Presentation Overview

- Define “GREEN” and “Sustainable”
- All Construction Markets Need Concrete
- Cement, Carbon and the World
- Industry Achievements and Targets
- Concrete for DOT Markets
- Beyond Longevity
- Resources
What is sustainable development?

- "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."  
  
  *World Commission on Environment and Development’s Report Our Common Future (Oxford University Press, 1987).*
Why Now?

Natural Drivers
- Global warming
- Limited resources
  - Water
  - Energy
  - Land
PEOPLE + PLANET + PROFIT = GREEN
Perspective
Concrete is Essential in every Market
Big Industry Footprint

• After water, concrete is the most widely used material in the world

• 2x more than plastic, steel, aluminum, and wood, combined

• CO2 from cement mfg:
  • Global = 5%
  • U.S. < 1.5%
Cement Mfg.
Key Reactions

- CaCO₃, calcium carbonate, is usually obtained from limestone
- $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ @ 1,100 to 1,650 °F
- Clinkering (combining CaO with silicates, aluminates and ferrites) requires additional energy
Combustion 35 – 40%
Calcining 60 - 65%
How Big Are We?

For More Information


Industry Action Plan

Voluntary Code of Conduct  (Established in 1991)

1. Health and Safety
2. Reduce emissions (land, water and air)
3. Responsibly manage wastes
4. Energy and material conservation
5. Alternative fuel and material solutions
6. Mine in an environmentally sound manner
7. Collaborate with stakeholders
Industry Improvement Results

Energy Use ↓37%

Cement Kiln Dust ↓75%
Improvement Results

Alternative Fuels
65% of plants

Alt. Materials
45% of plants
Continuous Improvement Goals

- By 2020 the following reductions:
  - Reduce carbon dioxide - 10% *
  - Reduce energy use – 20% *
  - Reduce cement kiln dust – 60% *

- Environmental Management Systems
  - 75% of member plants by 2010

* from a 1990 benchmark
Annual Reporting

www.cement.org/smreport08
Sustainability – for DOT Projects

- Bridges and Pavements
- 25% to 40% land coverage in urban areas
- Impacts water, air, energy, health, stress, productivity
Perspective
Perspective
Everyone pays

- Energy costs
- Emissions
- Productivity
- Stress
Sustainable must be Durable

- Optimal material utilization – less waste from replacement
- Lower maintenance costs and construction congestion
- Lower total cost of ownership
- Long life = smaller eco-footprint
Longevity Means Less Frequent Reconstruction

- Less raw materials
  - Cement, aggregates, steel
- Lower energy
  - Manufacturing, construction, maintenance, replacement
- Lower community impact
  - Construction congestion
  - Less cost and waste
Designed To Last Several Lifetimes
Longevity of Concrete Pavements!

- Route 23 – Ogilvie, MN
  - Built 1948
  - 9” thick, doweled
  - Serviceability Rating = Very Good
Longevity of Concrete Highways

I-10 east of Los Angeles:

- Originally constructed in 1946 as part of US Route 66
- Ground in 1965, 1984 and 1997
- After 63 years, currently handling 240,000 vehicles/day...
Mission Critical Concrete Runways

- Majority of Airports in U.S. were built during WWII using concrete
- Pittsburgh, Baltimore, Miami, Washington National, and more are 60+ years old
Green Beyond Longevity

- Reduced Energy During Construction
- Improved Fuel Economy
- Lighter and Cooler
- Recycling and Waste Reduction
- Water Efficiency
- Sustainable Sites
Construction Energy Savings

Concrete:
- Production: 548 gal/mi
- Hauling and Placement: 1,369 gal/mi

Asphalt:
- Production: 8,981 gal/mi
- Hauling and Placement: 1,737 gal/mi

Temperatures:
- Concrete: 325°F
Construction Energy Savings

500 million tons of HMA placed annually

If ½ were concrete instead: annual fuel savings greater than 500,000,000 gallons!!!

Savings are staggering - CO₂ equivalent to taking 1.4 million cars off the road!
Improved Fuel Economy

- Rigid Surface = Less Deflection = Less rolling resistance
- In-depth study by National Research Council Canada
  Significant fuel consumption reductions for trucks on concrete pavement (0.8-6.9%)
Improved Fuel Economy

Example: 62 mile long arterial highway
20,000 vehicles /day  15%
truck traffic 5.5 mpg
saving; 30 yr design life

Saved 165,000 tons of CO₂

- CO₂ associated with concrete pavement is compensated for during the first 9 years

3x more CO₂ saved during use than invested in manufacturing
Safety and Savings for Owners

Enhanced Nighttime Visibility:
- Improved pedestrian and vehicle safety

Reduced lighting & energy requirement:
- Fewer fixtures and/or lower wattage

A recent PCA Parking Lot Lighting study revealed over 37% energy savings ($28 per space per year)
Urban Heat Island Effect
Heat islands enhance smog formation
Recycling and Reuse

According to Construction Materials Recycling Association (2008), 140 million tons of concrete per year.
Recycling and Reuse

- Concrete is 100% recyclable
- Recycled concrete aggregate (RCA) can be used in:
  - new concrete
  - Subbases (PC/RCC/CTB)
  - granular fill
  - two-lift (FHWA)

Opportunities for on-site operations that save time and money and conserve energy
Recycled Content

- Recycled Aggregate
- Flyash
- Slag
- Silica Fume
Water Efficiency

- Pervious Concrete Pavements
  - Reduce storm water runoff
  - Capture/treat pollutants
  - Recharge groundwater
  - Evaporative cooling
  - Reduce noise pollution
  - Ongoing EPA/Industry studies
Sustainable Sites

- Roller-Compacted Concrete
- Full-Depth Reclamation
- Cement-Treated Base
- Cement-Modified Soil
- Pervious
- Pavers
- Underground

Integrated Pavement Solutions (IPS)
Green DOT?

- GreenRoads – still in formative stages
- GreenLITES – took GreenRoads and developed program for NY state
- Green Highways Partnership

Friday Green Concrete Paving – Sabrina Garber, The Transtec Group
Summary

- Smaller eco-footprint!
- Long lasting
- Less energy for production, construction and use
- Recycled / recyclable
- Water improvements
- Lighting and safety
- Less resources
- Reduced waste
Further Information Resources

- http://www.pavements4life.com/
- http://www.concretethinker.com/
- http://www.greenhighways.org/index.cfm
- http://www.epa.gov/heatisland/mitigation/pavements.htm
- http://www.think-harder.com
Remember to keep it all in the proper perspective!
Thank you