



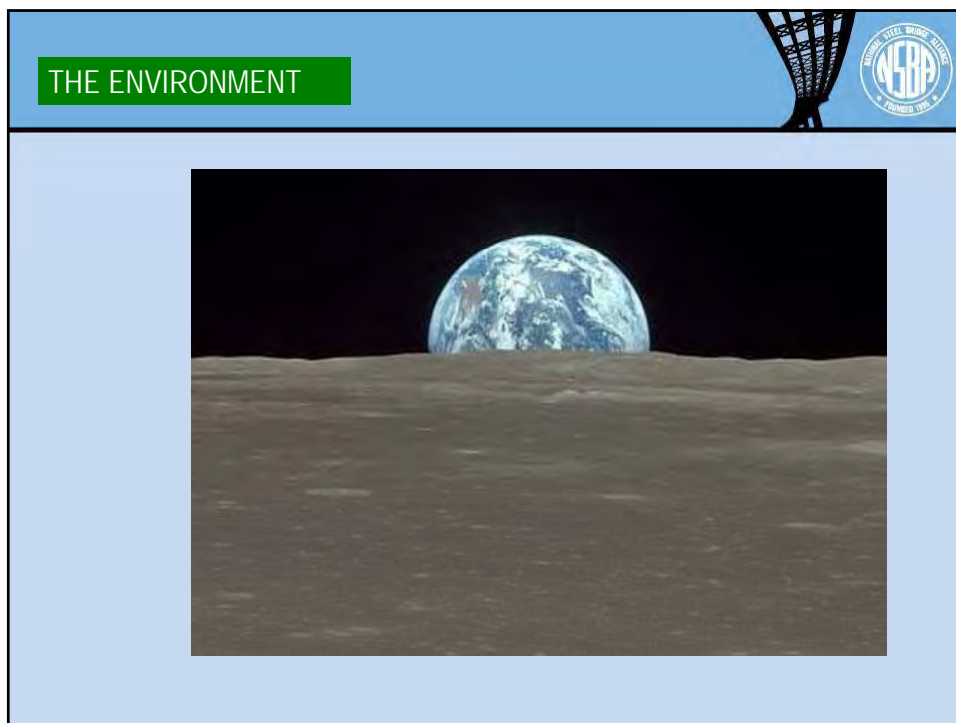
STEEL BRIDGE FORUM  
Raleigh, NC  
September 14, 2011

STEEL  
THE Sustainable Bridge Material





Bill McEleney  
Director, National Steel Bridge Alliance

The graphic features a blue background with a large, faint circular logo in the background that reads "NATIONAL STEEL BRIDGE ALLIANCE" and "FOUNDED 1999". On the right side, there is a black silhouette of a steel bridge truss structure against a light blue sky.

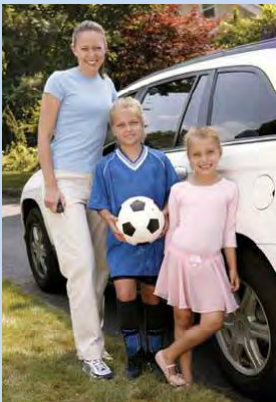





THE ENVIRONMENT




The slide has a light blue background. At the top left, a green rectangular box contains the text "THE ENVIRONMENT" in white. In the top right corner, there is a small circular logo for the National Steel Bridge Alliance. The central focus is a photograph showing the Earth as seen from the surface of the Moon, with the horizon of the Moon in the foreground and the Earth rising above it against a black sky.

**ENVIRONMENTALISTS**

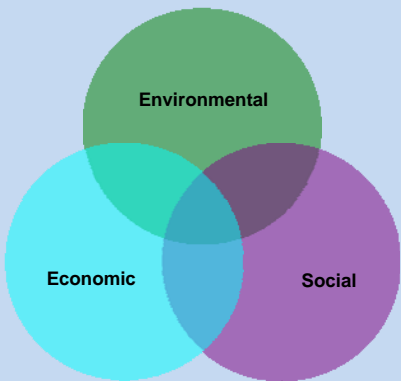


**SUSTAINABILITY**

- environmental
- economic
- social




**Sustainable development:** "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."




**SUSTAINABLE MATERIAL**

- environmental
- economic
- social



now

- 0.5 labor hours/ton
- 67% reduction in energy use (since 1980)
- 47% reduction in carbon footprint (since 1990); on track for 10% more by 2012
- 45% reduction in greenhouse gas emissions (since 1975)
- 40% higher strength (since 1990)
- EPA best performance recognition





**SUSTAINABLE MATERIAL**

- environmental
- economic
- social




RECYCLED CONTENT

- environmental
- economic
- social





93.3%

electric arc furnace vs. basic oxygen furnace




RECYCLED CONTENT

- environmental
- economic
- social




93.3%




**RECYCLED CONTENT**

- environmental
- economic
- social




**Highest recycled content of any material = 93.3%**  
**Highest recycling rate of any material = 98%**  
**Significant potential for material reuse**  
**Not down-cycled or just recycled, but multi-cycled with no loss of functionality**  
**A true cradle-to-cradle material!**




**WATER USE**

- environmental
- economic
- social




**Superior water resource management of a closed loop system with no external discharges**  
**(requiring 70 gallons make-up water / ton of steel produced)**







WATER USE

- environmental
- economic
- social






**1 lb. of steak = 1,857 gallons**




**1 ton of steel = 70 gallons**

**1 glass of beer = 20 gallons**



FABRICATION

- environmental
- economic
- social



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Collected Information

- Steel received and fabricated
- Scrap generated
- Water usage
- Electrical usage
- Waste disposal
- Fuel usage (natural gas, propane, diesel)
- Welding/cutting supplies
- Chemicals (paint, lubricants, cleaning agents)

Criteria

- Global warming potential
- Acidification potential
- Eutrophication potential
- Smog potential
- Non-renewable energy primary demand

**FABRICATION**

- environmental
- economic
- social

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**Global Warming Potential**

kg CO2 equiv / kg steel

Site Number

**LIFE-CYCLE ANALYSIS (LCA)**

**LCA Tools**

- ATHENA Impact Estimator and EcoCalculator**
- BEES – Building for Environmental and Economic Sustainability (National Institute of Standards and Technology)**
- Carnegie Mellon University’s Green Design Institute’s Economic Input-Output Life-Cycle Analysis Tool**
- GaBi Life Cycle Engineering Software and SoFi Software (Five Winds International and PE Americas)**
- U.S. LCI Database (National Renewable Energy Laboratory)**
- World Steel Association database**

## LIFE-CYCLE ANALYSIS (LCA)



### LCA Carbon Footprint Numbers for Steel

BEES/NIST	2.4 tons CO <sub>2</sub> /ton
AISI average	1.4 t/t
World Steel	0.937 t/t
ATHENA	0.936 t/t
Five Winds	0.895 t/t
BCSA	0.762 t/t
AISC	0.73 t/t
SMA	0.62 t/t

We need better numbers!  
Estimates are *not* exact



## FABRICATION

- environmental
- economic
- social



Solar panels and daylighting  
Material tracking and documentation  
More energy-efficient processes and machinery  
Cut-length optimization (less scrap)





JOB SITE IMPACT

- environmental
- economic
- social



JOB SITE IMPACT

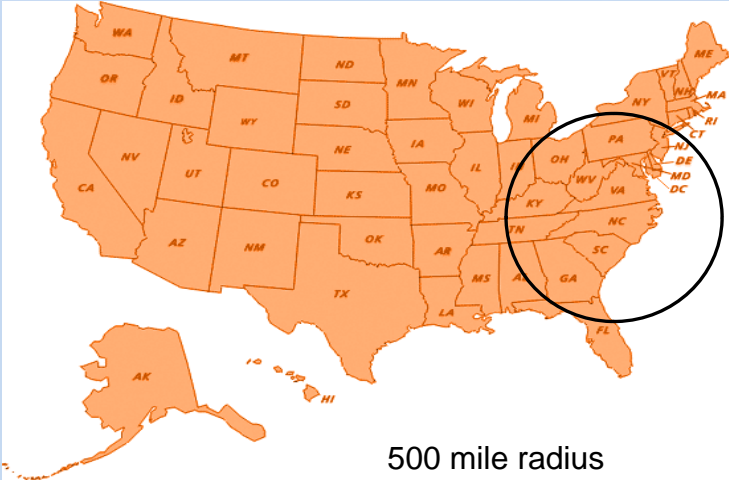
- environmental
- economic
- social



prefabricated bridges

LOCAL/REGIONAL SOURCES

- environmental
- economic
- social

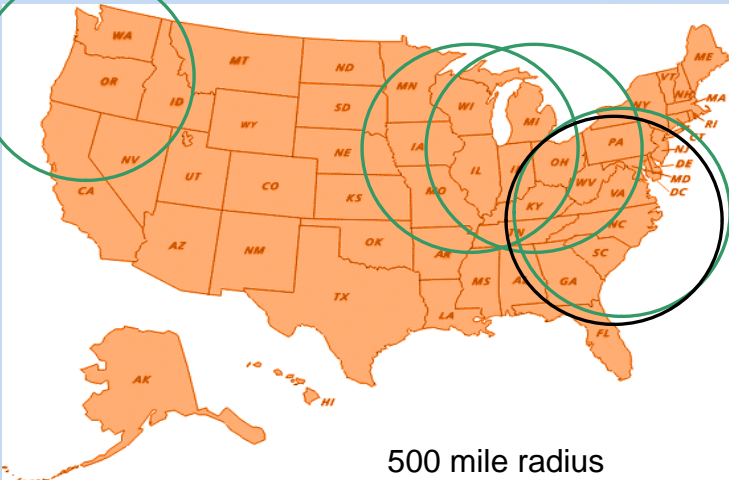


500 mile radius

The slide features a blue header with a green box containing the text 'LOCAL/REGIONAL SOURCES' and a list of three bullet points: 'environmental', 'economic', and 'social'. To the right of the header is a logo for the National Steel Bridge Institute (NSBI) with the tagline 'FORWARD 1908'. Below the header is a map of the United States with a black circle indicating a 500-mile radius centered on the Northeast region, encompassing states from New York to Virginia.

LOCAL/REGIONAL SOURCES

- environmental
- economic
- social



500 mile radius

The slide features a blue header with a green box containing the text 'LOCAL/REGIONAL SOURCES' and a list of three bullet points: 'environmental', 'economic', and 'social'. To the right of the header is a logo for the National Steel Bridge Institute (NSBI) with the tagline 'FORWARD 1908'. Below the header is a map of the United States with three overlapping green circles indicating 500-mile radii centered on the West Coast, Midwest, and Northeast regions.



LOCAL/REGIONAL SOURCES ?



LOCAL/REGIONAL SOURCES ?

**Transportation Options**

- Semi = 1 ton @ 150 miles/gallon
- Rail = 1 ton @ 450 miles/gallon
- Barge = 1 ton @ 675 miles/gallon



NEW STRUCTURES

- environmental
- economic
- social



no touch / light touch  
Mt. Si, King County, WA



NEW STRUCTURES

- environmental
- economic
- social

no touch / light touch





## EXISTING STRUCTURES

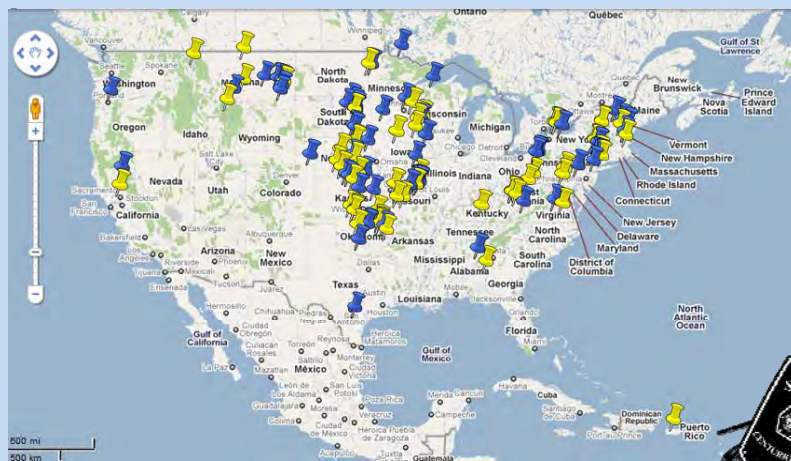
- environmental
- economic
- social



re-use / modify/ re-purpose  
Cornell University, Ithaca, NY

## EXISTING STRUCTURES

- environmental
- economic
- social



reduce (thru long life)  
127 Steel 'Centurions'



**RENEWABLE**

- environmental
- economic
- social



**Domestic wind power grew by 39% in 2009; it's nearly 2% of total power use.**



**Domestic solar power has increased by 40% per year for last eight years.**



**RENEWABLE**

- environmental
- economic
- social



**AISC Member Fabricator  
Hamilton Construction  
Springfield, Oregon**

**74.3 KW Solar Electric System**

Expected cost savings:

- \$4,638 in first year
- \$280,400 (with a 3% annual energy rate inflation) lifetime savings

Environmental savings:

- 2,000 tons of CO<sub>2</sub>
- 6,000 trees planted
- 209,000 gallons of gasoline





## WHAT CAN I DO ?



**Recognize sustainable design and construction is a growing market and movement**

**Engage in collaborative design with the full project supply chain**

**Avoid the “popular” issues – be analytical**

**Support the development of a balanced, consensus based standard for all construction materials in high-performance, green bridges**

**Operate in a sustainable manner  
turn off the lights!**

## CONTACT INFO

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