NRMCA Sustainable Concrete Plant Guidelines: The Next Step Towards Concrete Sustainability

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NRMCA®

Impact of U.S. Buildings

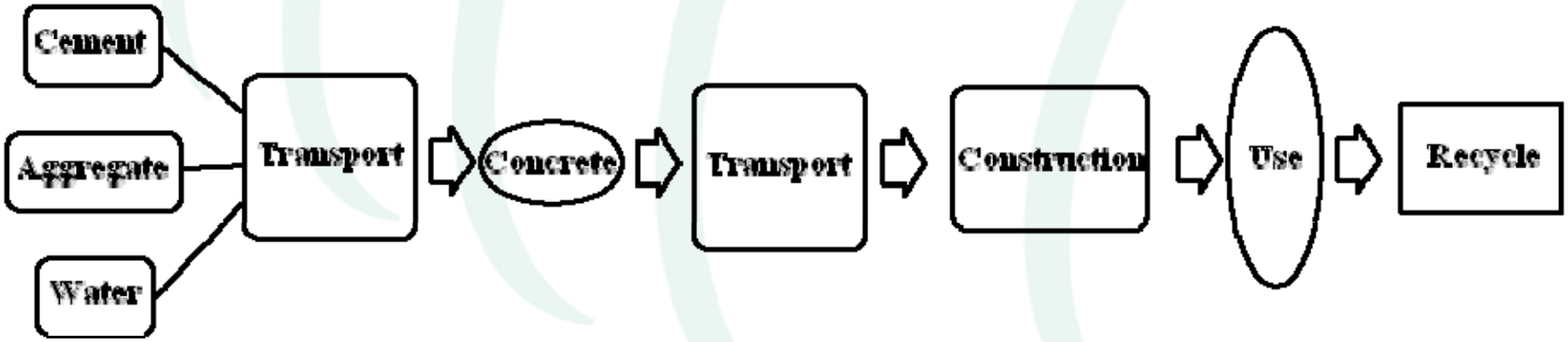
- **14%** Potable Water Use
- **30%** Waste Output
- **38%** CO_2 Emissions
- **40%** Raw Materials Use
- **39%** Energy Use
- **72%** Electricity Consumption

What makes a Building Green?

- Efficient Use of:
  - Energy
  - Water
  - Other Resources
- Protecting Occupant Health
- Improving Employee Productivity
- Reducing:
  - Waste
  - Pollution
  - Environmental Degradation

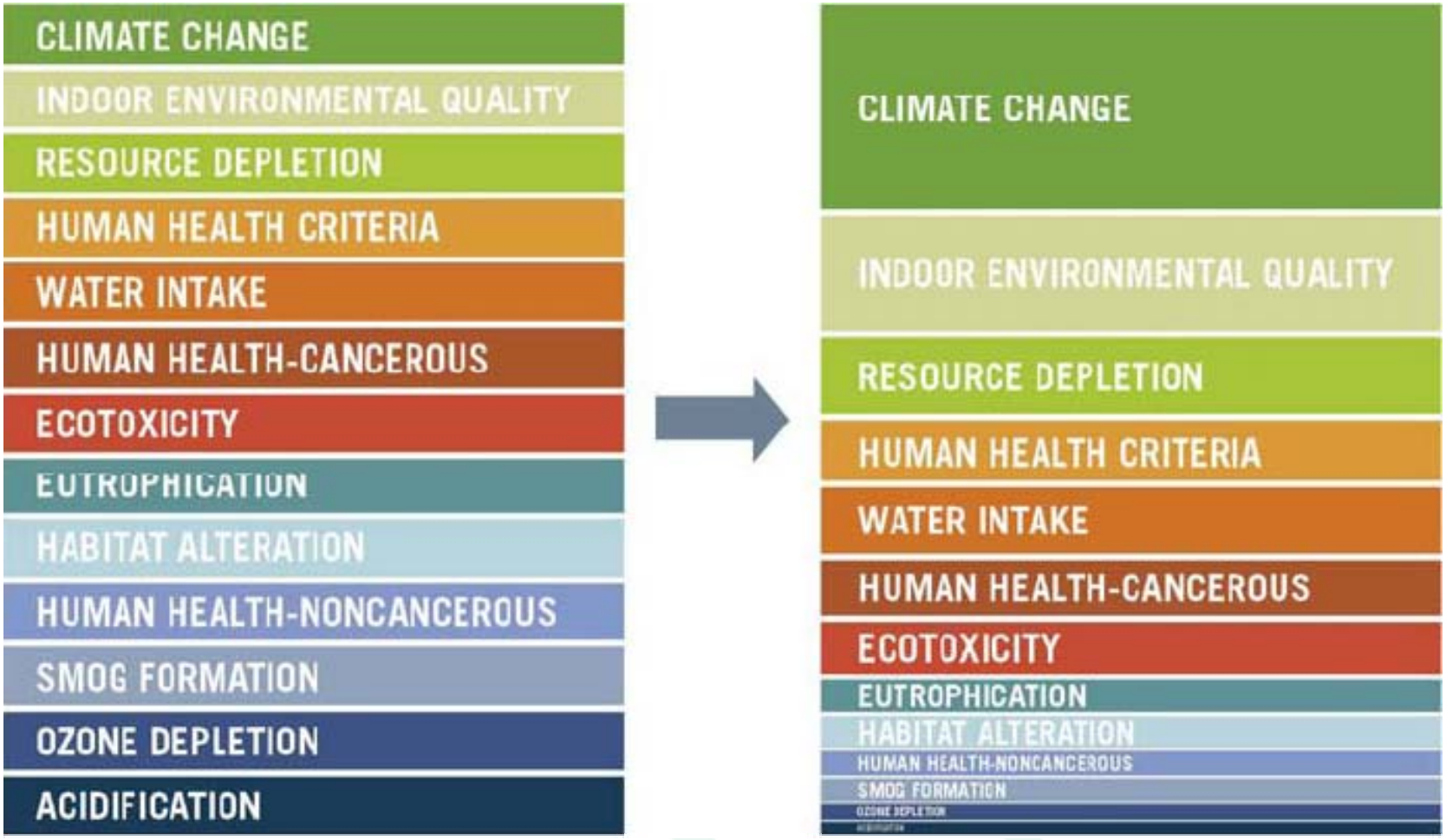
How Do You Measure Sustainability?

- Best Approach: Life Cycle Assessment
- LCA is a technique to assess the environmental aspects and potential impacts associated with a product, process, or service



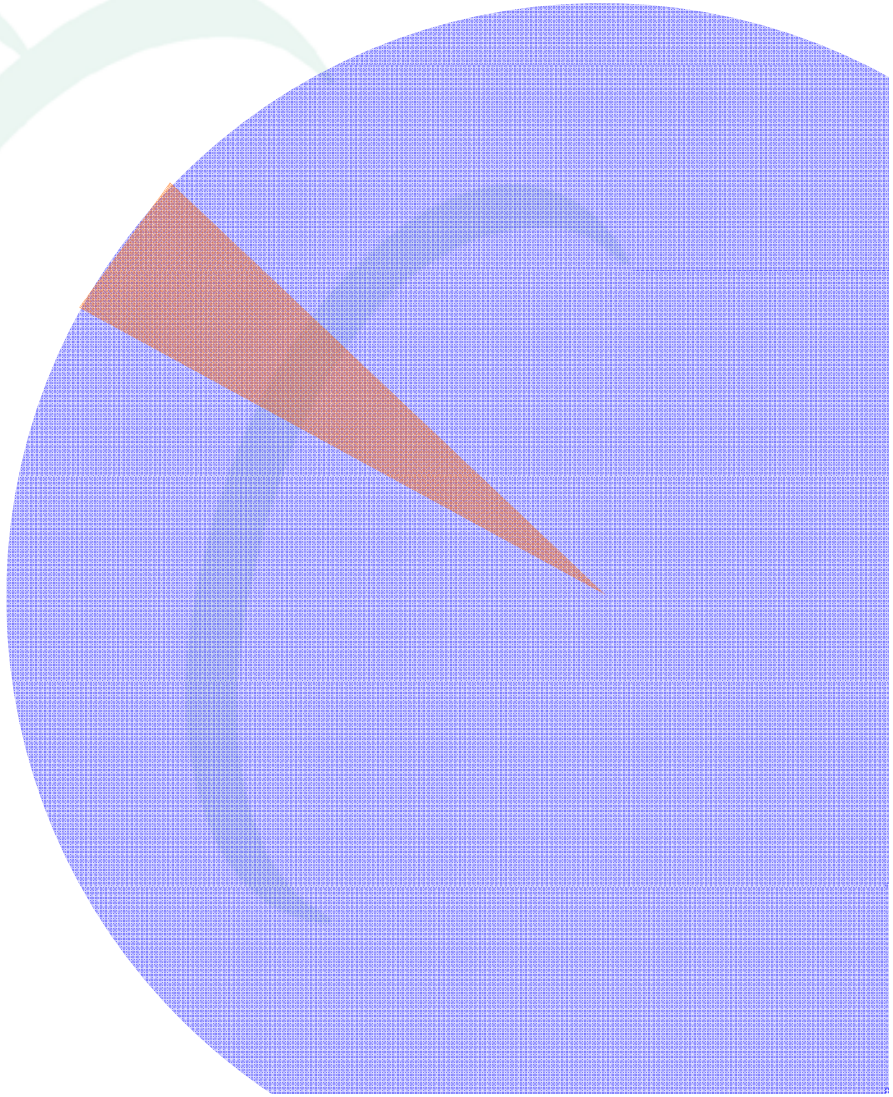
Impacts Measured

Prioritize Impacts



Life Cycle Impacts

- **2% to 10% impact from material extraction, manufacturing and construction**
- **90% to 98% in building operations**



How Does Concrete Compare to Other Materials?

- Some LCA studies
- Some Partial LCAs
- Common Measures
  - Energy Consumption
  - Carbon Footprint

LCA: Concrete vs. Wood Frame

- Compared residential framing systems
- Concrete systems reduced energy by 17%

2x12 (R 38) = 6” ICF

Gajda, John, Energy Use of Single-Family Houses With Various Exterior Walls, CD026, Portland Cement Association, Skokie, IL, 2001, 49 pages.

LCA: Concrete Frame vs. Steel Frame*

Structural System	CO2 (kg/m2)
Concrete	550
Steel	620

* Partial LCA: Material Extraction, Manufacturing, Construction

Guggemos, A. A. and Horvath, A., Comparison of Environmental Effects of Steel- and Concrete-Framed Buildings, ASCE Journal of Infrastructure Systems, June 2005, American Society of Civil Engineers, Reston, VA, 2005

LCA: Concrete vs. Asphalt*

Pavement System	CO2 (t/km)
Concrete	674
Asphalt	738

* 50 year life cycle
* Asphalt pavement required 3 times more energy than concrete pavement

A Life Cycle Perspective on Concrete and Asphalt Roadways: Embodied Primary Energy And Global Warming Potential, Athena Institute, Ottawa, Ontario, 2006.

Should we Conduct LCA for Every Product/Project?

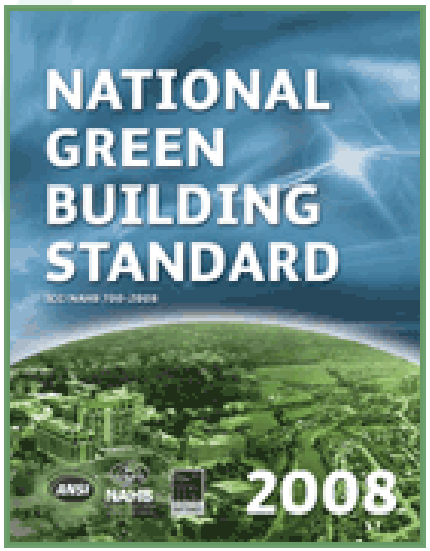
- Not realistic

- Rating Systems and Building Codes
- Surrogates for LCA
- Identify Impacts
- Prioritize Impacts
- Identifies Trade Offs

Examples

- LEED
- Green Globes
- NAHB National Green Building Standard

- All place emphasis on building operations
- All Favorable to Concrete



LEED Green Building Rating System

- Voluntary program
- Positive image to community
- Energy and cost savings
- Increased labor productivity
- Contribute directly to a company's profits

LEED Credit Categories

Organized for building design process

LEED Certification Levels

- Platinum
- Gold
- Silver
- Certified

How Does Concrete Perform in LEED

Category	Total Possible	Concrete Influences
Sustainable Sites	26	12
Water Efficiency	10	10
Energy & Atmosphere	35	19
Materials & Resources	14	11
Indoor Environmental Quality	15	6
Innovation Credits	6	6
Regional Priority Credits	4	4
Total Points	**110**	**68**

So Isn't Concrete Sustainable Enough?

- Continuously improve product




- Continuously improve process




NATIONAL READY MIXED CONCRETE ASSOCIATION

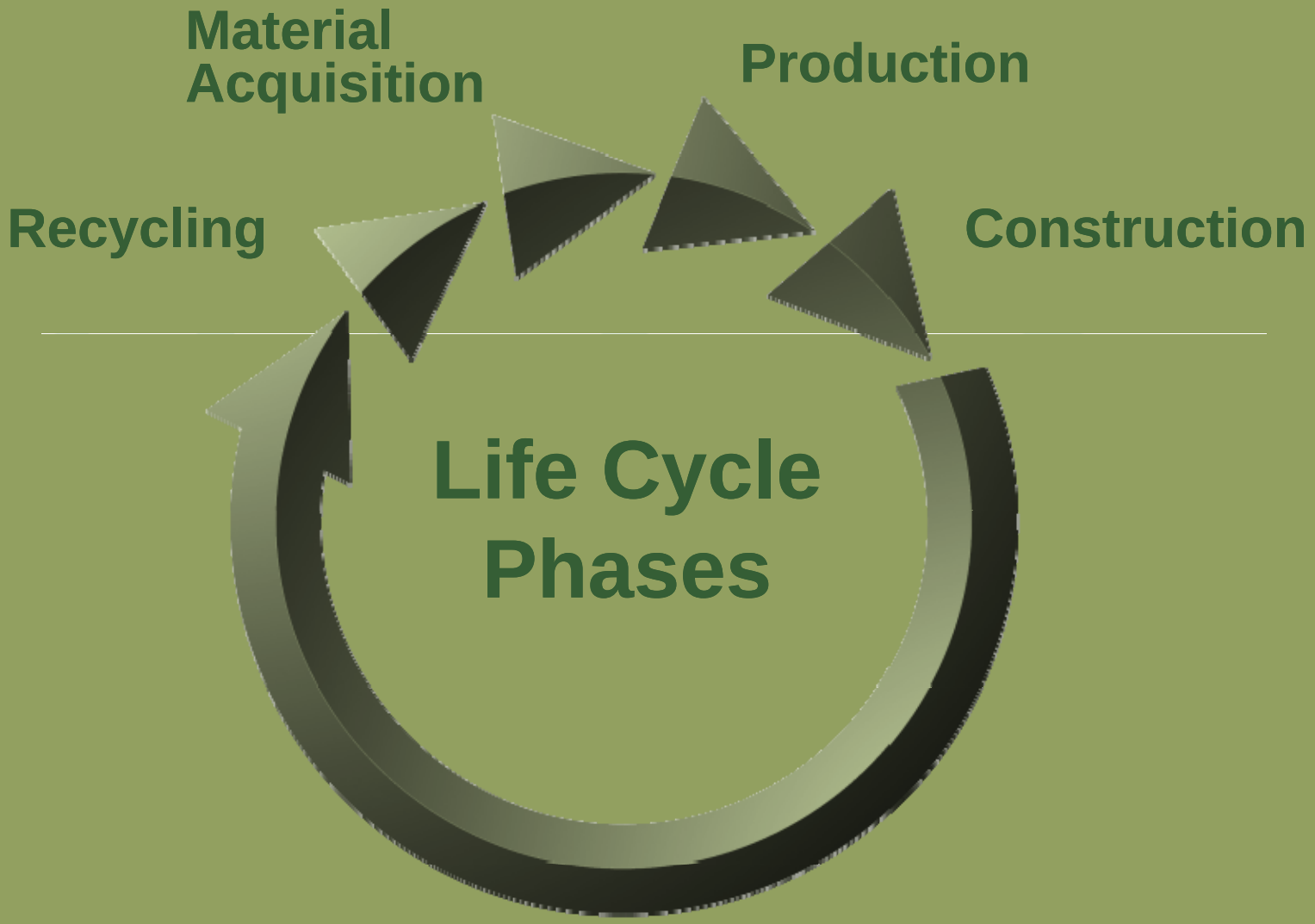
SUSTAINABILITY INITIATIVES

NRMCA™

Vision

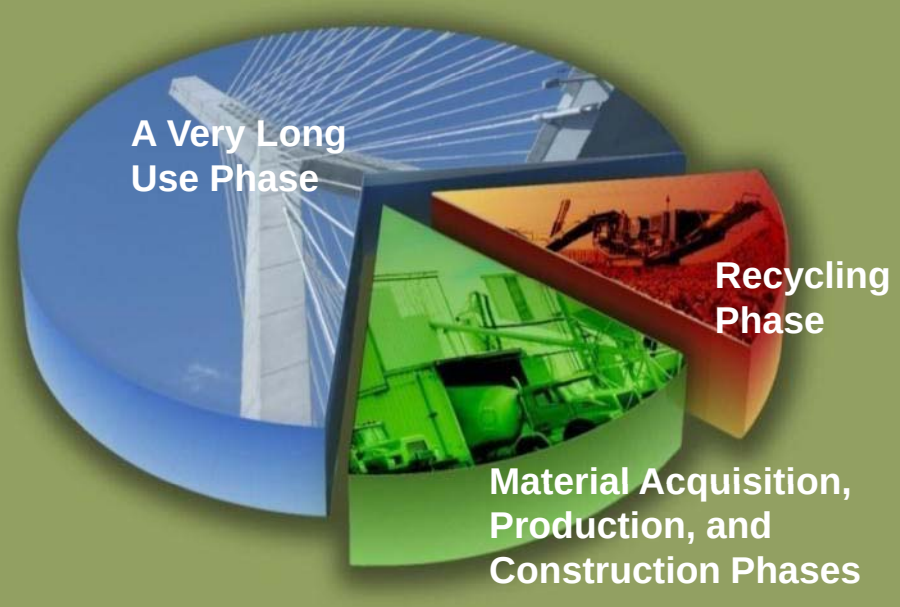
The vision of the ready mixed concrete industry is to transform the built environment by improving the way concrete is manufactured and used in order to achieve an optimum balance among environmental, social and economic conditions.

Life Cycle Perspective



Objectives

- Minimize Energy Use
- Reduce Emissions
- Conserve Water
- Minimize Waste
- Increase Recycled Content



Life Cycle Perspective

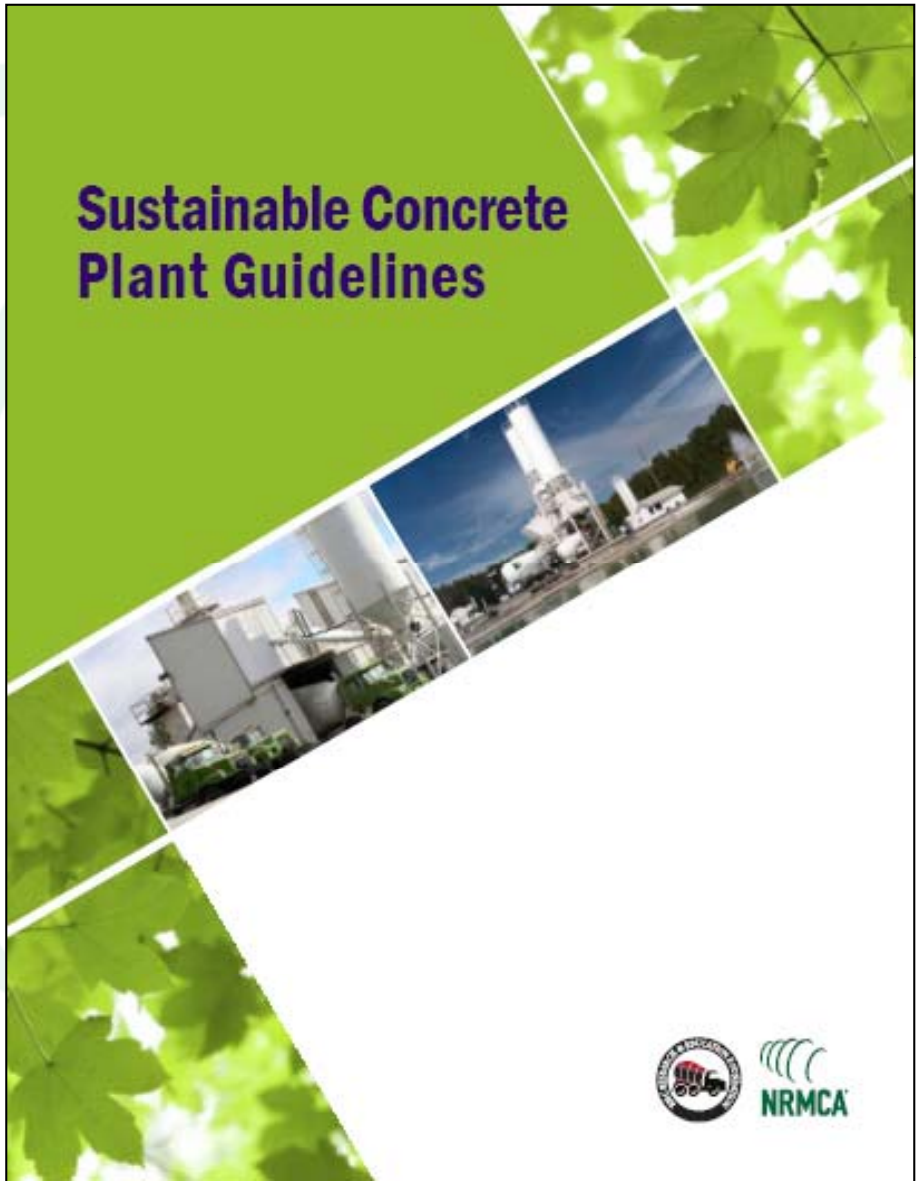
Targets Per Unit of Concrete Produced from 2007 Levels

- Embodied energy:
  - 20% reduction by 2020
  - 30% reduction by 2030
- Carbon footprint:
  - 20% reduction by 2020
  - 30% reduction by 2030
- Potable water:
  - 10% reduction by 2020
  - 20% reduction by 2030
- Waste:
  - 30% reduction by 2020
  - 50% reduction by 2030
- Recycled content:
  - 200% increase by 2020
  - 400% increase by 2030

NRMCA Sustainability Programs

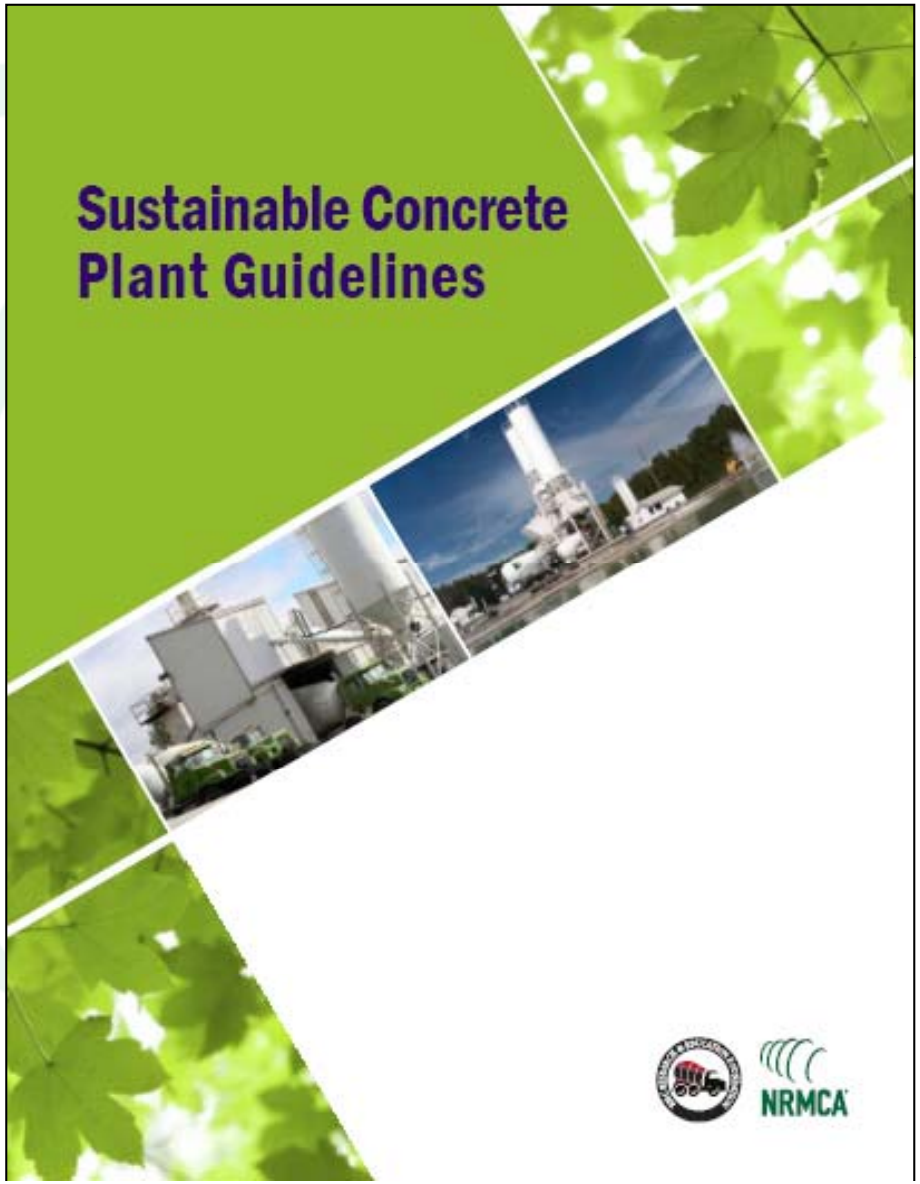
How Do We Improve the Process?

- LEED for Concrete Plants?



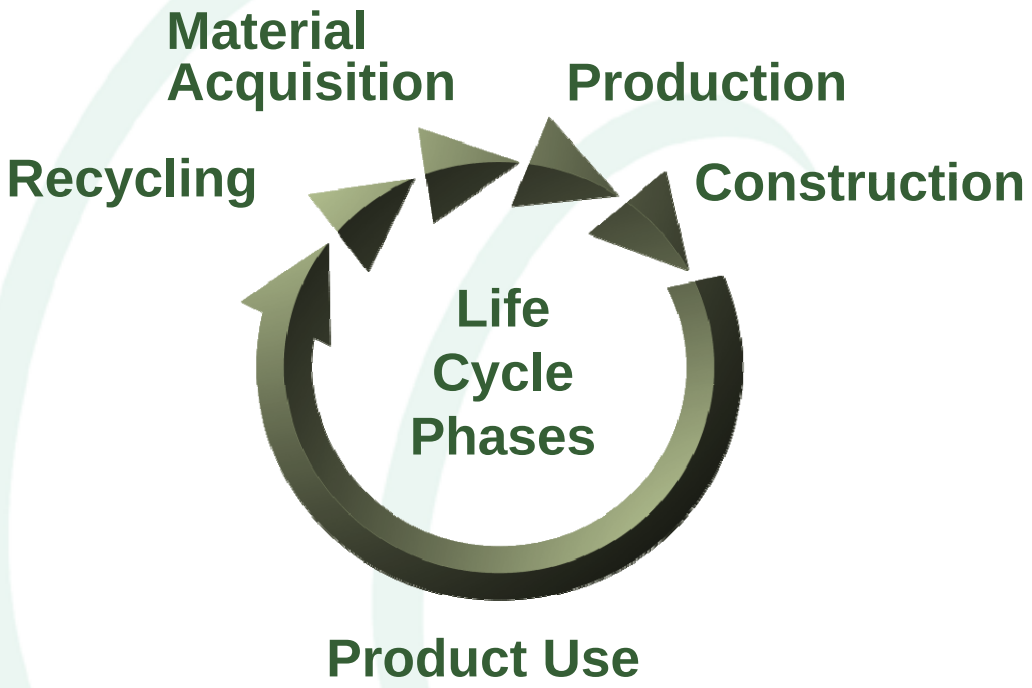
Sustainable Concrete Plant Guidelines

- Voluntary program
- Positive image to community
- Energy and cost savings
- Increased productivity
- Contribute directly to a company's profits



Credit Categories

Organized for concrete production process



Impact Categories

Embodied Energy

Carbon Footprint

Water Use

Waste

Recycled Content

Social Concerns and Human Health

Sustainability Levels

- Platinum
- Gold
- Silver
- Bronze

Sustainability Credits

Category	Credits
Material Acquisition	16
Production	52
Construction	13
Product Use	6
Recycling	8
Additional Points	5
Total Points	100

Metrics

- Equations
- Worksheets
- Carbon Calculator

Recycled Aggregate Credit

$$\text{recycled aggregate (\%)} = \frac{\text{recycled aggregate (tons)}}{\text{total aggregate purchases (tons)}} \times 100$$

≥ 2% recycled aggregate	1 point
≥ 4% recycled aggregate	+1 point
≥ 6% recycled aggregate	+1 point
≥ 8% recycled aggregate	+1 point

Air Quality Credit

≥ 50% weighted process emission controls	1 point
≥ 75% weighted process emission controls	+1 point
100% weighted process emission controls	+2 points

Air Quality Credit

Point source emissions		weight
Cement delivery to silo*		
Silo top baghouse or silo vented to central vacuum collector system	No	5%
Silo equipped with overfill warning system	No	15%
Silo equipped with high pressure protection system (pinch valve/alarm)	No	5%
SCM delivery to silo*		
Silo top baghouse or silo vented to central vacuum collector system	No	5%
Silo equipped with overfill warning system	No	15%
Silo equipped with high pressure protection system (pinch valve/alarm)	No	5%
Cement/SCM weigh batchers		
Weigh batcher vented to batcher filter vent or vented to central dust collector (direct or indirect)	No	5%
Fines collected in the dust collectors are recycled	No	5%
Coarse and fine aggregate transfer to conveyor		
Transfer underground or transfer point enclosed, or conveyor covered	No	5%
Coarse and fine aggregate transfer to elevated storage		
Plant enclosed or transfer point enclosed	No	5%
Truck loading hopper		
Hopper is surrounded (3 sides) by shroud and is vented to a central dust collector	No	20%
Hopper is equipped with a telescopic boot	No	5%
Spray bar used (in lieu of central dust collector). If central dust collector is present, please mark this "Yes".	No	5%
CONTROLLED PROCESS EMISSION SOURCES	**0.00%**	

Energy Management Credit

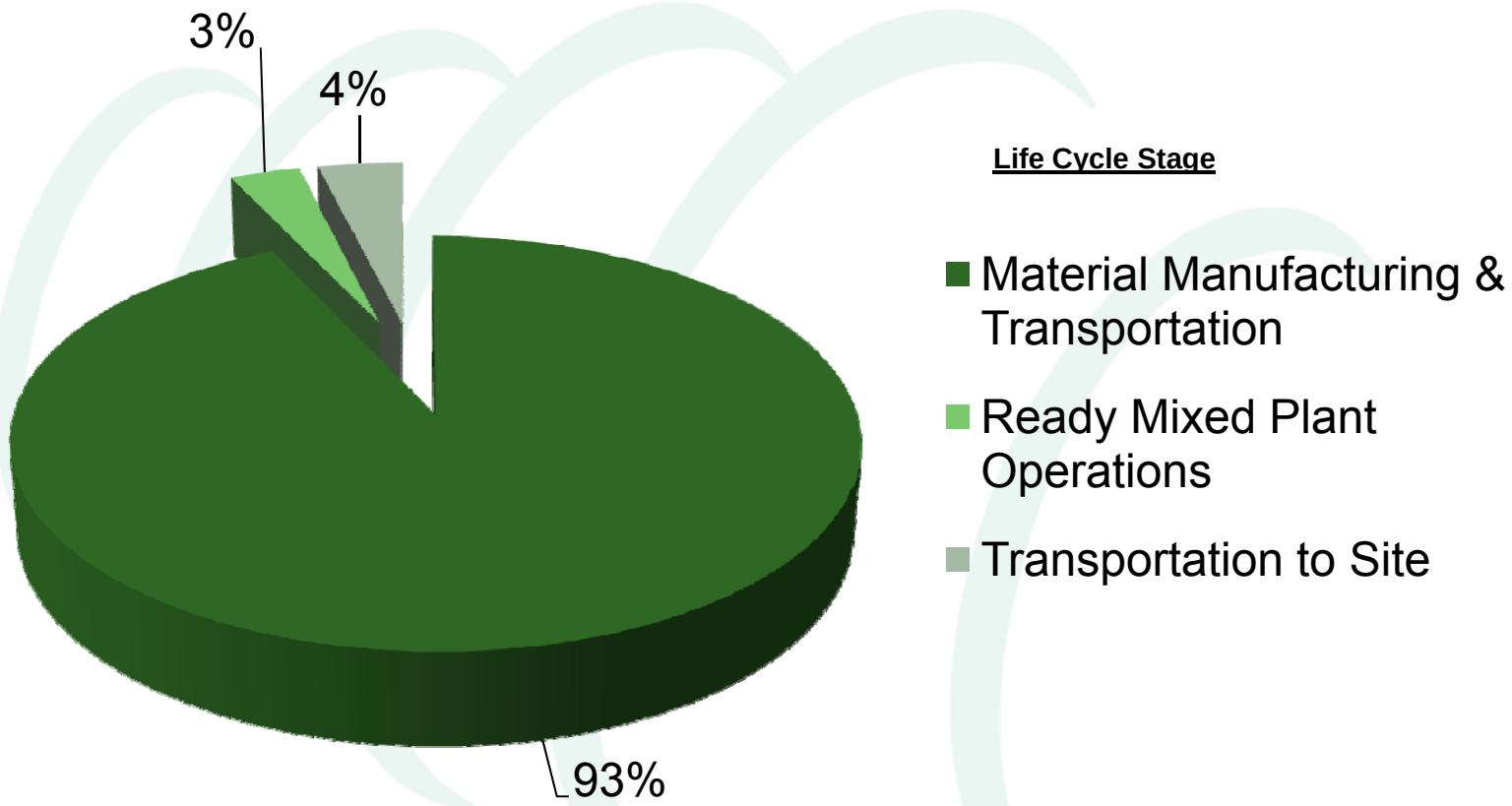
$$CO2e\ (\%\ below\ baseline) = \frac{national\ baseline\ \left(\frac{CO2e}{cy}\right) - plant\ CO2\ footprint\ \left(\frac{CO2e}{cy}\right)}{national\ baseline\ \left(\frac{CO2e}{cy}\right)} \times 100$$

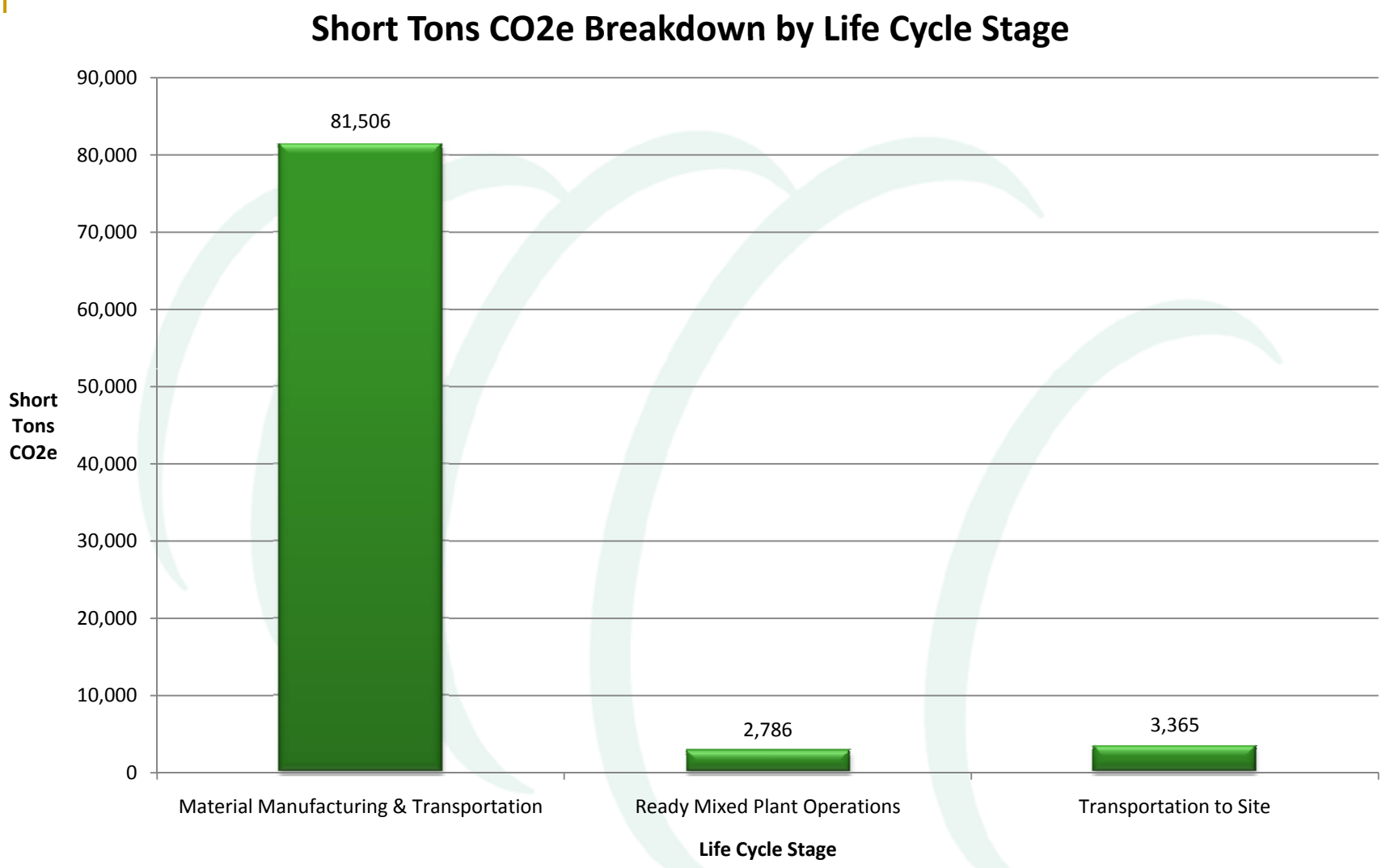
Annual CO2e/cy ≥ 10% below baseline	1 point
Annual CO2e/cy ≥ 15% below baseline	+1 point
Annual CO2e/cy ≥ 20% below baseline	+1 point
Annual CO2e/cy ≥ 25% below baseline	+1 point
Annual CO2e/cy ≥ 30% below baseline	+1 point

Energy Management Credit

- Carbon Calculator
  - Material Purchase Data
  - Plant Energy Data
  - Fleet Energy Data

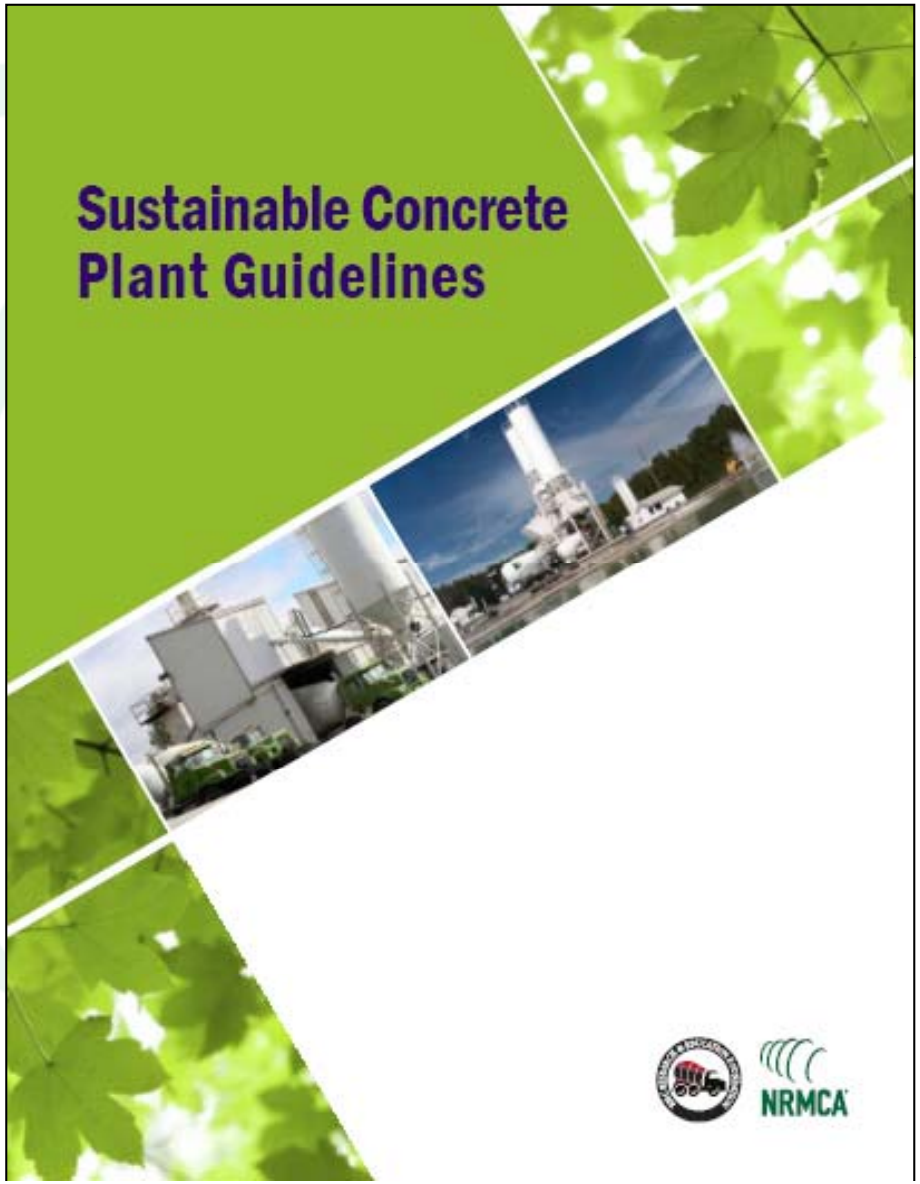
Short Tons CO2e by Life Cycle Stage




Short Tons CO2e Breakdown by Life Cycle Stage
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Short Tons CO2e
81,506
2,786
3,365
Material Manufacturing & Transportation
Ready Mixed Plant Operations
Transportation to Site
Life Cycle Stage

Next Steps

- Formalize certification process
- Third party verification
- Conduct pilot program
- Approach USGBC for LEED credit?



Continuous Improvement

- April 13-15, 2010
- Tempe, AZ
- NRMCA and ASU are Co-sponsors
- Topics include
  - Sustainable Concrete Construction
  - Sustainable Concrete Manufacturing
- Many other industry partners

Summary

- LCA is best method for measuring sustainability
- Concrete performs well using LCA
- Rating systems are good surrogates for LCA
- Concrete performs well in rating systems
- Sustainable concrete plant guidelines will help improve industry performance

Thank You

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