

# Industrial Resources Council

Improving Performance of Transportation Projects Using Industrial Materials

Ohio Sustainable Roadways Workshop  
December 3, 2014



# Sustainable Highways

- Construction of transportation systems can significantly impact the environment.
- Environmental impact can be reduced through sensitive system design.
- Quality and cost can be maintained while meeting technical performance standards





# Drivers for Environmental Stewardship

- National and international focus on energy, climate change and sustainability
- National and state focus on waste reduction, pollution prevention, and recycling
- Escalating costs of energy, labor and materials
- Environmental effects of mining, processing and transporting materials

# FHWA Recycling Policy

- Recycling & Reuse can offer Engineering, Economic and Environmental Benefits
- Recycled materials should get first consideration in materials selection
- Engineering & environmental properties are important
- Life Cycle Costs assessment is helpful
- Restrictions on recycled material without technical basis should be removed

### Industrial Resources Council

- A collaborative partnership working to develop markets for industrial materials
  - Goals:
    - Create awareness & increase understanding
    - Share technical & environmental information
    - Develop codes, standards, and regulatory guidance through organizational partnerships
  - National, regional and state workshops
- <http://www.industrialresourcescouncil.org/>

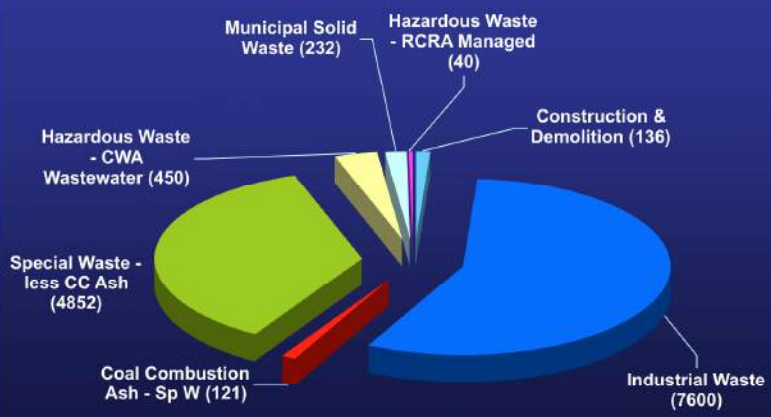
### How can the IRC help transportation Agencies?

- IRC is comprised of non-profit industry associations who spearhead their industry's efforts on material utilization
  - American Coal Ash Association
  - Construction & Demolition Recycling Association
  - AFS- FIRST (Foundry Industry Recycling Starts Today)
  - National Council for Air & Stream Improvement
  - National Slag Association
  - Rubber Manufacturers Association

### Why should Agencies care about IRC materials?

- Material volumes are large
  - Less fragmented than Municipal Solid Waste
- Industrial materials can:
  - Provide comparable or better performance
  - Meet engineering standards
  - Save money
  - Help achieve sustainability goals

The RCRA Program  
Total Quantity of Wastes Generated (million tons)



## Availability of IRC Materials

- Generation Rate:
  - CCPs
    - 122 million TPY
  - Steel Mill Residuals
    - 19.7 million TPY
  - Foundry Sands & Slags
    - 10 million TPY
  - Paper Mill Residuals, Boiler Ash & Others
    - 15 million TPY
  - Tires
    - 300 million tires/yr
  - Recycled Concrete
    - 180 million tons est.
    - 325 million total C&D
- Number of Facilities:
  - Power Plants: ~500
  - Steel Mills: ~130
  - Foundries: 2,800
  - Pulp & Paper Mills: ~430
  - Tires: Municipal, commercial & industrial generation points
  - Recycled Concrete: ~2,300

## Industrial Material Applications

- **Manufactured products**
  - Cement
  - Asphalt
  - Concrete pavement
  - Concrete products
    - Brick, block, mortars
  - Flowable fill/CLSM
- **Geotechnical applications**
  - Bases and subbases
  - Structural fills
  - Embankments
- **Soil amendments**
  - Manufactured topsoils
  - Rain gardens & swales
  - Mulches & composts

## "Greener" Roadways

**Sub-base Materials** using fly ash, bottom ash, iron and steel slags, recycled concrete, recycled asphalt or foundry sands

**Pavements** using concrete or asphalt containing coal ash, foundry sand, recycled concrete, asphalt shingles, or steel slags

**Embankments and Fills** using CCPs, steel slag, tires, recycled concrete or foundry sands

**Landscaping materials** using compost, foundry sands and other industrial materials

## US EPA's IMR Program



- Cooperative outreach effort w/other parties, inc. IRC & FHWA
- Currently dormant but materials on EPA website
- Hope to reenergize in the future

### Why Use Industrial Materials in Roadways?

**Environmental Benefits**

Reusing industrial materials can reduce the amount of material that is landfilled or incinerated. This helps reduce greenhouse gas emissions and air pollution. Additionally, using industrial materials can reduce the need for virgin aggregate materials, which helps conserve natural resources.

**Cost-Effective**

Using industrial materials can be a cost-effective way to build roads. This is because industrial materials are often less expensive than traditional aggregate materials. Additionally, using industrial materials can help reduce the overall cost of a road project by reducing the amount of material that needs to be transported.

**Performance Benefits**

Industrial materials can provide a number of performance benefits for roads. For example, they can help improve the strength and durability of a road. Additionally, they can help reduce the amount of water that is absorbed by a road, which can help reduce the risk of potholes and other road damage.

**Green Design**

Using industrial materials in roadways is a key component of green design. This is because it helps reduce the environmental impact of road construction. Additionally, it can help reduce the carbon footprint of a road project.

### Roadway Applications for Industrial Materials

Industrial materials can be used in a variety of roadway applications. Some of the most common applications include:

- Base Course:** Industrial materials can be used as a base course for roads. This is because they provide a strong, stable foundation for the road surface.
- Subgrade:** Industrial materials can be used to improve the subgrade of a road. This is because they help increase the strength and stability of the subgrade.
- Shoulder:** Industrial materials can be used for road shoulders. This is because they provide a durable, long-lasting surface that can withstand heavy traffic.
- Drainage:** Industrial materials can be used for drainage applications. This is because they help improve the drainage of water from a road, which can help reduce the risk of water damage.

## Construction - Engineered Fill

## Asphalt

## Cement Manufacturing & Concrete Products



# Flowable Fill (CLSM)



# Specialty Soils & Landscaping Products



# IRC website

APPLICATIONS	MATERIALS				
	Coal Ash/Slag Fly Ash	Slag Products	Recycled Tires	Recycled Industrial Materials	Recycled Auto Materials
<b>Specialty Concrete</b>					
Light Aggregate Concrete	✓	✓	✓	✓	✓
Decorative Aggregate	✓	✓	✓	✓	✓
Stabilizer	✓	✓	✓	✓	✓
<b>Reinforced Concrete</b>					
Light Aggregate	✓	✓	✓	✓	✓
Decorative Aggregate	✓	✓	✓	✓	✓
<b>Specialty Masonry</b>					
Light Aggregate	✓	✓	✓	✓	✓
Decorative Aggregate	✓	✓	✓	✓	✓
Stabilizer	✓	✓	✓	✓	✓
<b>Stabilized Base</b>					
Stabilizer	✓	✓	✓	✓	✓
Stabilizer	✓	✓	✓	✓	✓
<b>Reinforced Fill</b>					
Stabilizer	✓	✓	✓	✓	✓
Light Aggregate	✓	✓	✓	✓	✓
Decorative Aggregate	✓	✓	✓	✓	✓
<b>Other</b>					
Decorative Aggregate	✓	✓	✓	✓	✓
Stabilizer	✓	✓	✓	✓	✓
Stabilized Concrete	✓	✓	✓	✓	✓
<b>Construction</b>					
Underdrains	✓	✓	✓	✓	✓
Stabilized Fill	✓	✓	✓	✓	✓
Soil Stabilization	✓	✓	✓	✓	✓
Stabilized Layers	✓	✓	✓	✓	✓
<b>Land Use</b>					
Soil Conditioning	✓	✓	✓	✓	✓
Stabilized Soil	✓	✓	✓	✓	✓
Stabilization	✓	✓	✓	✓	✓

- Industrial Resources Council is a resource for information about how to use industrial materials in various applications
- <http://www.industrialresourcescouncil.org>

# Industry Snapshots

- Where does each material come from
- Info on generators
- How much material
- Most common uses

**Steel Manufacturing**

**Industry Snapshot**

Hot metal is produced in a blast furnace. Most furnace slag (BFS) is composed of the iron oxides, phosphorus, residual lime and other slag-forming components. It consists of 70% iron, 20% silica, and 10% lime. Blast furnace slag (BFS) is composed of iron, silica, and lime. Most BFS and BGS have unique physical and chemical properties that make them particularly well suited for a variety of concrete and civil engineering projects.

**Industry Facts**

There are 143 facilities in the United States. There are 35 states that have steel manufacturing facilities. For general information on our industry: American Iron and Steel Institute [www.aisti.org](http://www.aisti.org) Steel Manufacturers Association [www.steel.org](http://www.steel.org)

**According to our annual industry survey:**

- There are 23 - 25 million tons of potentially reusable by-product material generated annually.
- 45-50 percent of this material is recycled or repurposed annually.

# Material Profiles



- Snapshot of each material type
- Downloadable as PDF's
  - CCP's
  - Foundry Sands & Slags
  - Steel Furnace Slags
  - Pulp & Paper Industry Materials
  - Reclaimed Concrete Aggregate
  - Tire-Derived Materials

# Application Profiles



- Structural fill
- Embankments
- Granular bases
- Stabilized bases
- PCC Concrete
- Hot Mix Asphalt
- Flowable Fill
- Portland Cement
- Other PCC concrete products
- Soil Stabilization

# Sustainable Materials Matrix

APPLICATIONS	MATERIALS				
	Recycled Materials	High Strength	High Modulus	Highly Recycled	High Performance
<b>Structural Concrete</b>	✓	✓	✓	✓	✓
<b>Embankments</b>	✓	✓	✓	✓	✓
<b>Granular Bases</b>	✓	✓	✓	✓	✓
<b>Stabilized Bases</b>	✓	✓	✓	✓	✓
<b>Flowable Fill</b>	✓	✓	✓	✓	✓
<b>Other</b>	✓	✓	✓	✓	✓
<b>Concrete</b>	✓	✓	✓	✓	✓
<b>Asphalt</b>	✓	✓	✓	✓	✓
<b>Soil Stabilization</b>	✓	✓	✓	✓	✓
<b>Other</b>	✓	✓	✓	✓	✓

- Matches between Materials and Applications
- Downloadable PDF
- E-version provides additional details
- Work in progress
- FHWA wants your inputs!

# E-matrix

- How is material used in this application?
- How does it perform?
- Technical issues?
- QA/QC Issues?
- Environmental issues?
- Other Resources

### IRC, FHWA & DOT's

- Sustainable highways require efficient material management systems to account for embedded costs
- DOT leadership important
  - DOT's set construction standards
  - Most pavement miles controlled at county or local level
- Materials are often the highest cost in any construction project
  - Recovered materials can save dollars
  - Specifications should be performance-based, not material-based

### Working Together

- FHWA encourages support for a proposed project to build a robust web-based E-matrix
- FHWA webinar series:
  - <http://www.industrialresourcescouncil.org/Events/SustainableMaterialsWebinars/>
- National & regional workshops:
  - See EVENTS tab on IRC website
  - IRC welcomes outreach partnerships

### For More Information

American Coal Ash Association  
[www.aaaa-usa.org](http://www.aaaa-usa.org)



Construction & Demolition Recycling Association  
[www.cdrecycling.org](http://www.cdrecycling.org)  
[www.concreterecycling.org](http://www.concreterecycling.org)



AFS-FIRST, Inc.  
[www.foundryrecycling.org](http://www.foundryrecycling.org)



### For More Information

National Council for Air & Stream Improvement  
 269-276-3548  
[www.NCASI.org](http://www.NCASI.org)



National Slag Association  
[www.nationalslag.org](http://www.nationalslag.org)



Rubber Manufacturers Association  
[www.rma.org](http://www.rma.org)

