Cold In-Place Recycling

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Dunn Company

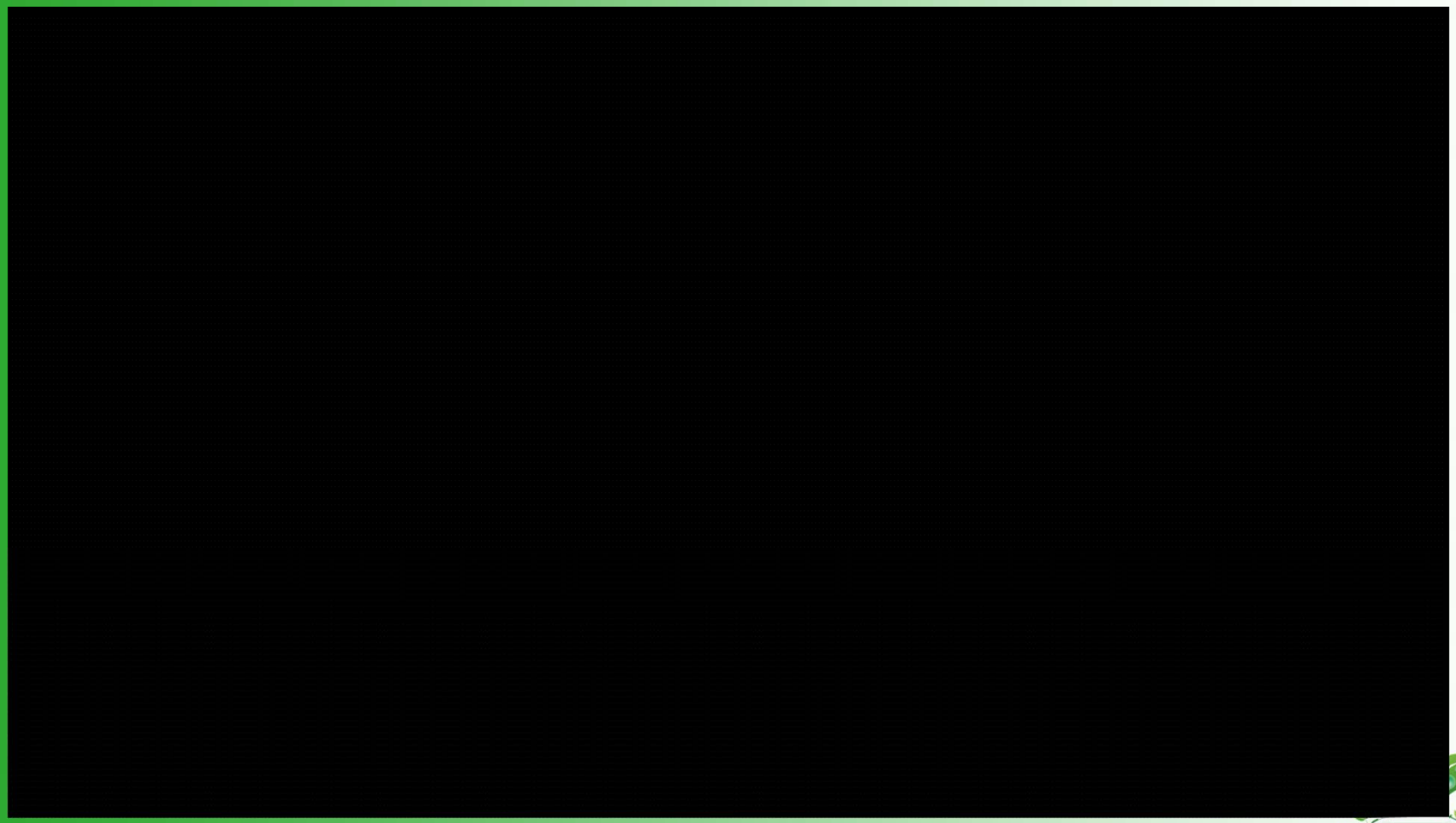
What is Cold In-Place Recycling **CIR**

- Been in U.S. since 1970s
- On site recycling of asphalt pavement without the use of heat
- Material is mixed with additives to provide a reprocessed material
- Removes distress at depths up to 5 inches
- Material is processed and repaved in a single pass

CIR Process

- Pulverize existing pavement up to 5 inches deep
- Addition of new asphalt binder/other additives
- Mixing of all components
- Placement of recycled mixture
- Compaction of recycled mixture

Wirtgen 3800 Short Train



Mix Design Process

- Not Cook Book Recipe
- Performance Based
- Project Specific
- Foamed Asphalt
- Engineered Emulsion

Compaction

- Since CIR mixes are placed in thicker lifts, heavier rollers are required for compaction
- Compaction normally begins once the mix has turned from brown to black
- Water system on tires and drums is required to prevent mix from sticking to rollers

Hamm Roller

CAT Rubber Tire Roller

HAMM Finish Roller

What does the new mix look like?

Behind the Paver

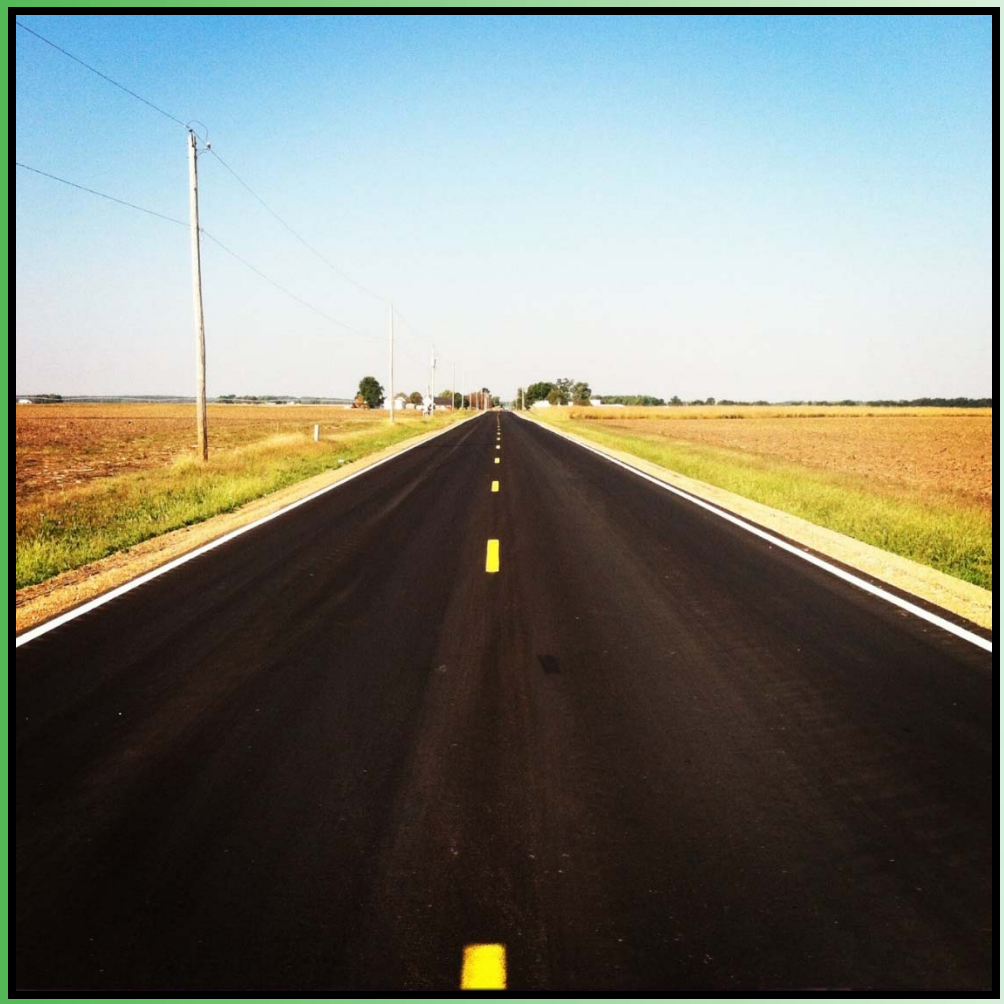
After Compaction

Wearing Surface

- CIR must be covered with a wearing surface
- HMA used with high traffic routes or where additional strength is needed
- Chip Seal, Micro Surfacing or Cape Seal can be used on lower volume roadways

Cape Seal

Mason County



Oil and Chip

Henry County

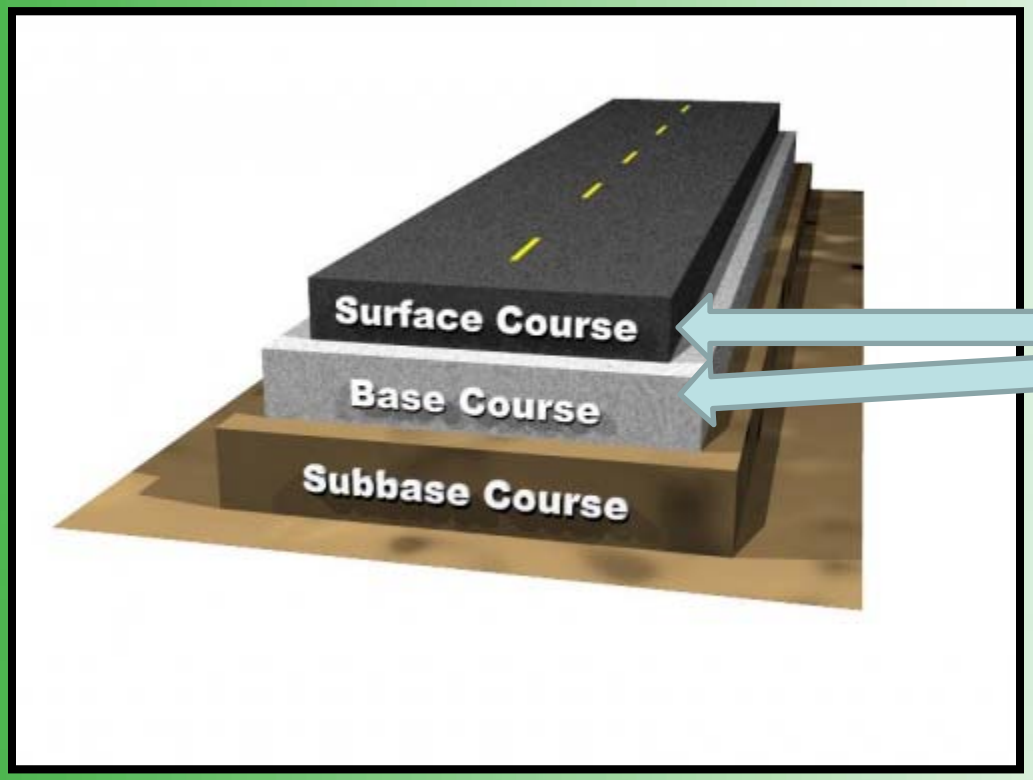
HMA

Champaign County

CIR in Illinois and Midwest

- IDOT District 2 (experimental)
  40,000 – 50,000 sy per year (last 3 years)
- Illinois Local Roads
  600,000 – 750,000 sy per year
- Iowa DOT
  4 - 6 million sy per year
- Michigan DOT
  200,000 - 300,000 sy per year
- Wisconsin DOT
  300,000 – 400,000 sy per year

Project Evaluation



Determining CIR Candidacy

- No visible Failures / good drainage
- Current Structure of Pavement
- Type of Traffic
- PCI Value 60-20
- History of Roadway/Past condition surveys
- Expectations after CIR (.28 per inch)
- Coring
- Recon – Recon – Recon - Recon

Distresses that can be treated with CIR

- Raveling
- Rutting – find out why
- Fatigue and Edge Cracking
- Reflective Cracking
- Thermal Cracking
- Poor Ride Quality

Basic Asphalt Recycle Manual BARM-ARRA

Condition		CR Applicability
Surface Defects	Raveling	Yes
	Pot Holes	Yes
	Bleeding	Yes
	Skid Resistance	Yes
Deformations	Shoulder Drop Off	No
	Rutting - Wear	Yes
	Rutting - Mix Instability	Possible, see note a
	Rutting - Deep Structural	Possible, see note b
	Corrugations	Yes
	Shoving	Possible, see note a
Load Associated Cracking	Fatigue - Bottom Up	Possible, see note c
	Fatigue - Top Down	Possible, see note c
	Edge	Possible, see note d
	Slippage	Possible, see note e
Non-load Associated Cracking	Block	Yes
	Longitudinal	Yes
	Transverse	Yes
	Reflective	Yes
Combined Cracking	Joint Reflective	Possible, see note f
	Discontinuity	Yes
Base/Subgrade Deficiencies	Swells, Bumps, Sags Depressions	Possible, see note g
Roughness	Ride Quality	Yes
Other Criteria	All Levels of Traffic	Yes, see note h
	Rural	Yes
	Urban	Yes, see note i
	Stripping	Possible, see note a
	Poor Drainage	No, see note j

Unacceptable pavement Conditions for CIR

- Failures caused by wet, unstable base or sub-grades
- Failures caused by heaving or swelling in underlying soils
- Deformation caused by high asphalt content or fine aggregates
- Pavements with aggregate stripping due to water infiltration from the base

Not an ideal CIR candidate

Weather and Temps are Critical

Why Recycle

- Cost savings 30-40% vs Mill and Overlay
- Extend Pavement Life
- Use of entities greatest asset
- Mitigate Reflective Cracking - +70%
- Construction under traffic

More Reasons to Recycle

- Large price fluctuation and material availability in: Asphalt / Aggregates
- Decreased energy consumption
- Decreased Green House Gas Emissions
- Performance cost versus traditional methods

Even More Reasons

According ARRA and the U.S. Department of Transportation Federal Highway Administration

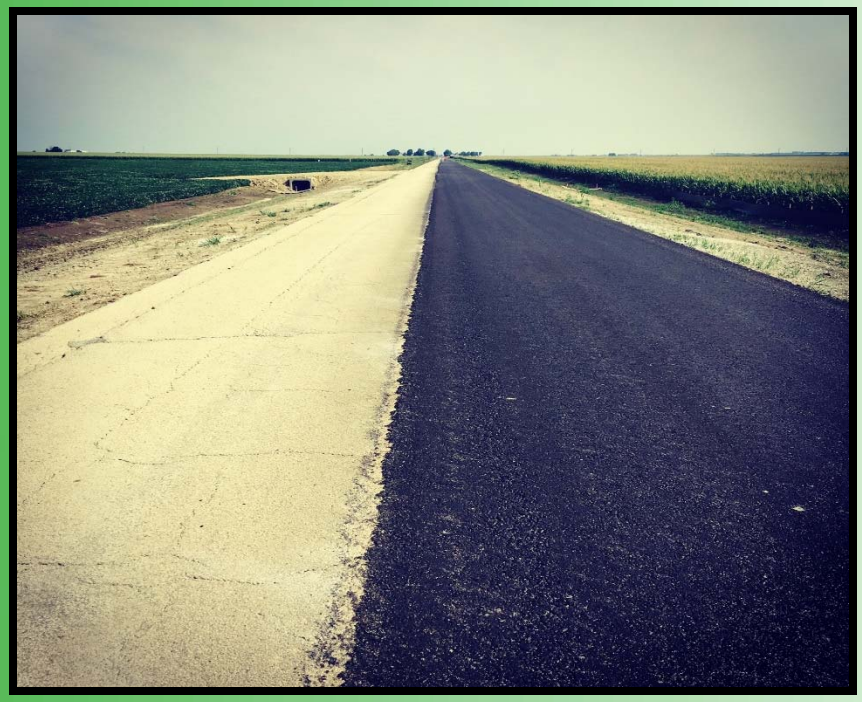
(Basic Asphalt Recycling Manual)

CIR w/ surface Treatment: avg 8-12+ years

CIR w/ HMA: avg 10-20+ years

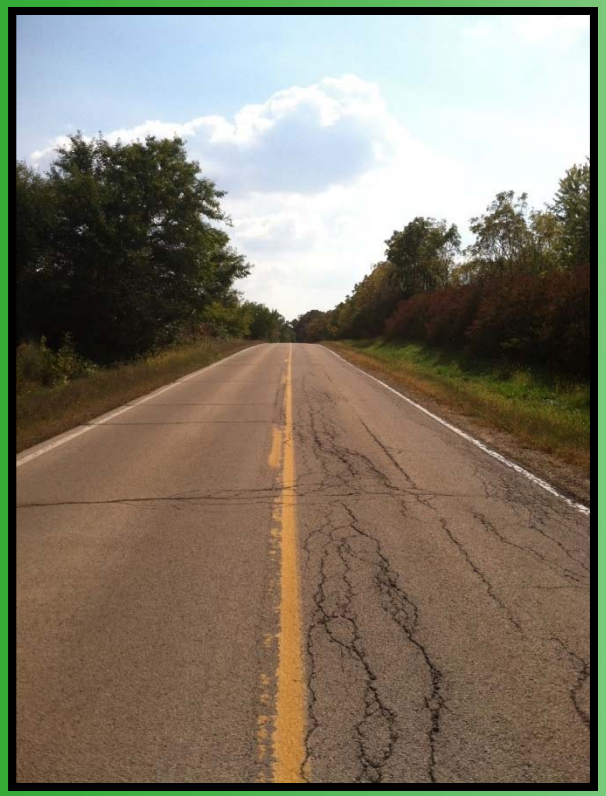
Controls Reflective Cracking

- CIR creates a flexible layer that disperses energy
- Prevents underlying cracks from reflecting through

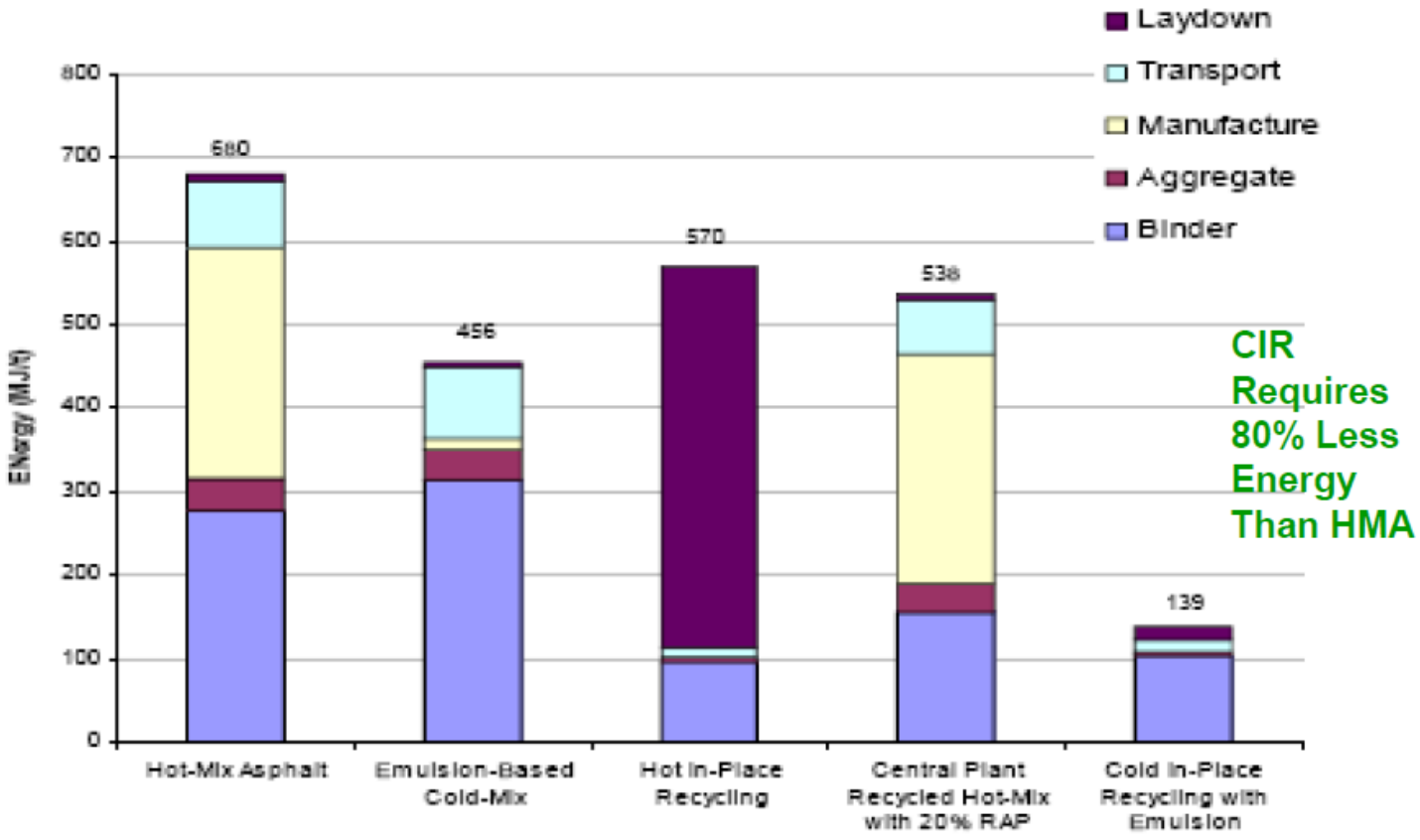


The reality

- Most agencies have the largest stockpile of aggregate in the state in their existing pavements

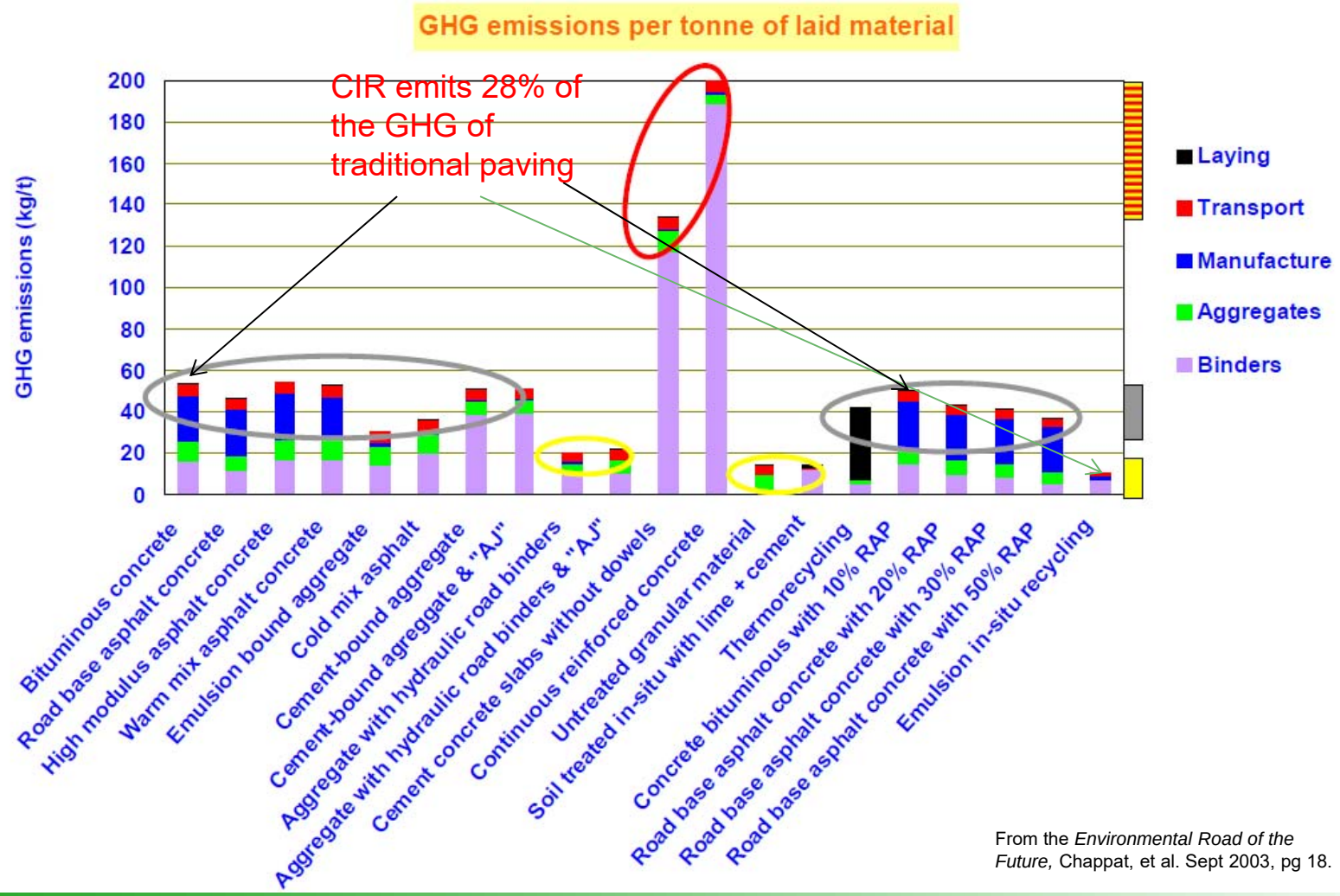


Conserves Energy



Source: *The Environmental Road of the Future, Life Cycle Analysis* by Chappat, M. and Julian Bilal. Colas Group, 2003, p.34

Reduces Green House Gas Emissions



From the *Environmental Road of the Future,* Chappat, et al. Sept 2003, pg 18.

Additional Tools with CIR

- Widening can be accomplished to add lane width or a safety shoulder
- Increased Structural thickness with add rock
- Increased structural value (.28 per inch)


New 12’ Wide
Original 11’ Wide

After a few days of traffic

Cost Savings

8 mile County Highway

	Units	Mill 1.5” and 3” HMA Overlay (20% Recycle)	CIR 3.5” and Chipseal Surface Treatment	
Mill 1.5”	112,000 SY	$140,000		
Pave 3”	20,500 Tons	$1,500,000		
Recycle 3.5”	112,000 SY		$593,600	
A-2 Chipseal	112,000 SY		$296,800	**Savings**
Total Costs		**$1,640,000**	**$890,400**	**$749,600**
Total/SY		$13.45	$7.95	
Tons of RAP Used		5,500	23,500	

Assume $1.25/sy for milling, $75/ton for hotmix, $5.30/sy for CIR, $2.65/sy for A-2

Cost Effective

- **Cost Savings**

CIR vs. Mill & Overlay	$ 749,600
Overall Cost Saving	47%
Savings/SY (13.45-7.95)	$ 5.50/SY
Savings/Ton (75-27.50)	$ 47.50/Ton
Unused RAP (5,500T @$25)	$ 137,500

Prior to CIR

To this, with 47% less

Conserves Energy

	Energy Required to Produce 24,780.8 tons (8 miles)	Equivalent Energy in diesel	Equivalent Energy in natural gas	Green house gas emissions from producing 24,780.8 tons (8 miles)
Hot Mix (traditional)	4,680,666.6 kW-hrs	127,887.06 gallons	159,749 Therms	1288.56 tons
CIR	956,783.33 kW-hrs	26,141.6 gallons	32,654.7 Therms	371.1 tons
Savings	3,723,883.3 kW-hrs	101,746 gallons	127,095 Therms	917.46 tons

The energy savings from an 8 mile job is enough to power 350 homes for one year.

Conserves Materials

- Over 21,500 tons of RAP was reused in building this project
- Only 600 tons of new asphalt was added to existing RAP
- Saves over 850 tons of liquid asphalt and 16,000 tons of virgin aggregate. (Based on 20% recycle in HMA)

CIR

- Cost Effective
- Controls Reflective Cracking
- Conserves Energy
- Conserves Material
- Environmentally Friendly
- Right Treatment, Right Road, Right Time

Thank you