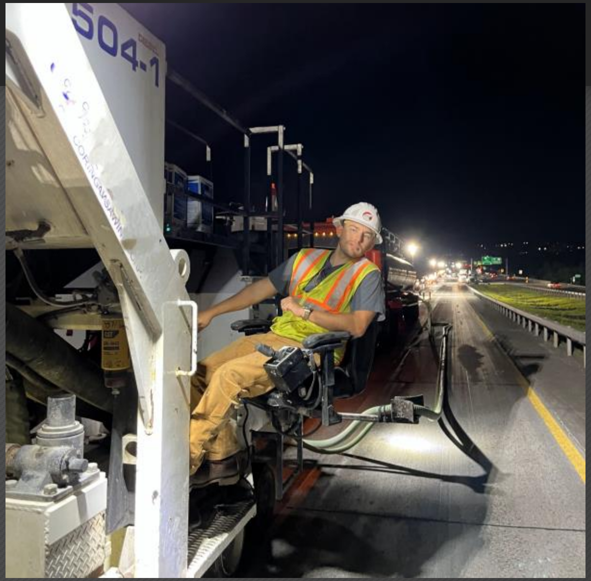
Concrete Pavement Preservation: The Key to Long-Life Pavements

IGGA
International Grooving & Grinding Association
Your Pavement Preservation Resource® since 1972



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Iowa Concrete Pavement Conference 2024

Topics of Discussion

- Pavement Preservation
- Improved use-phase cost and carbon impact
- Examples
- Federal Funding eligibility
- Other notable considerations
- IGGA Interactive CPP Tool on the new website

Pavement Preservation Philosophy

The Difference Between Preservation Techniques and Routine Repair Techniques?

Same treatments …better TIMING!

World Bank's Evaluation

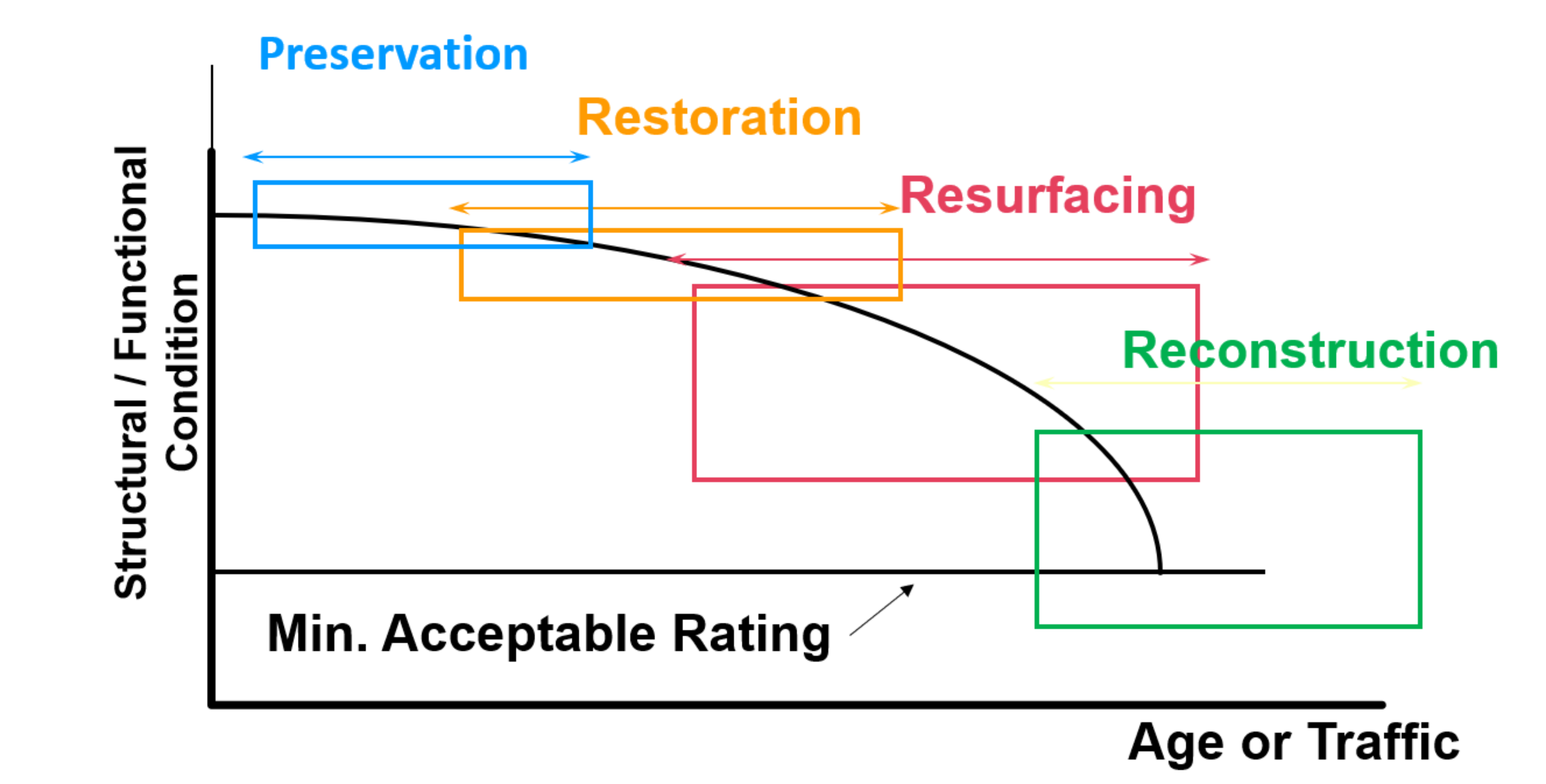
Transport Notes from the World Bank evaluated the relationship between maintenance timing and cost on South African highways.

- It was determined that 3 years of maintenance neglect resulted in 6 times the repair cost.
- 5 years of neglect resulted in up to 18 times the repair cost.

MIT's Take

- Researchers at the MIT Concrete Sustainability HUB has suggested that the most carbon conscious approach is to perform CPR and Diamond Grinding every 15 years, as opposed to waiting 20+ years or overlaying with asphalt.

Rehabilitation Timing



Expected benefits?

Preservation of investment

Improved pavement performance

Long term cost savings/leveling

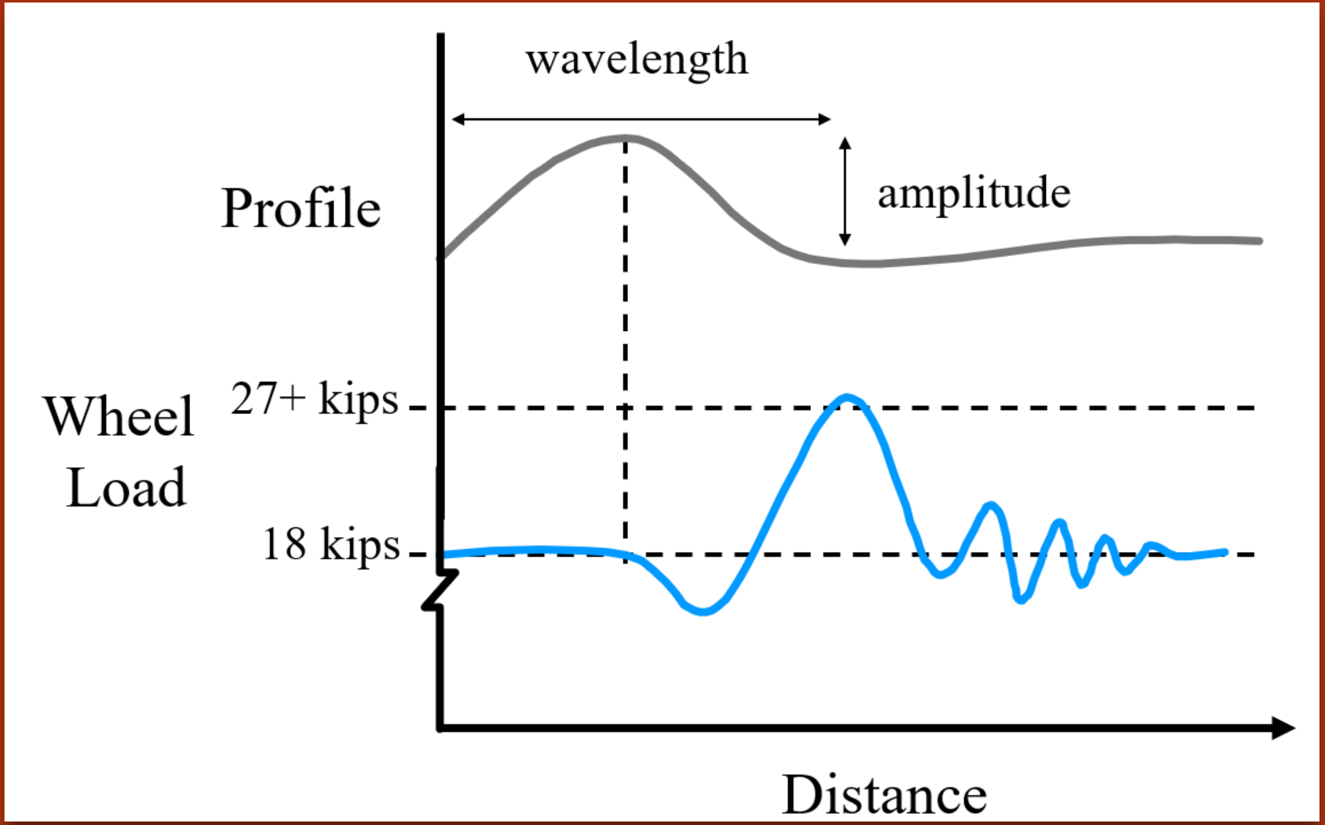
Maintain a high level of service

Increased safety

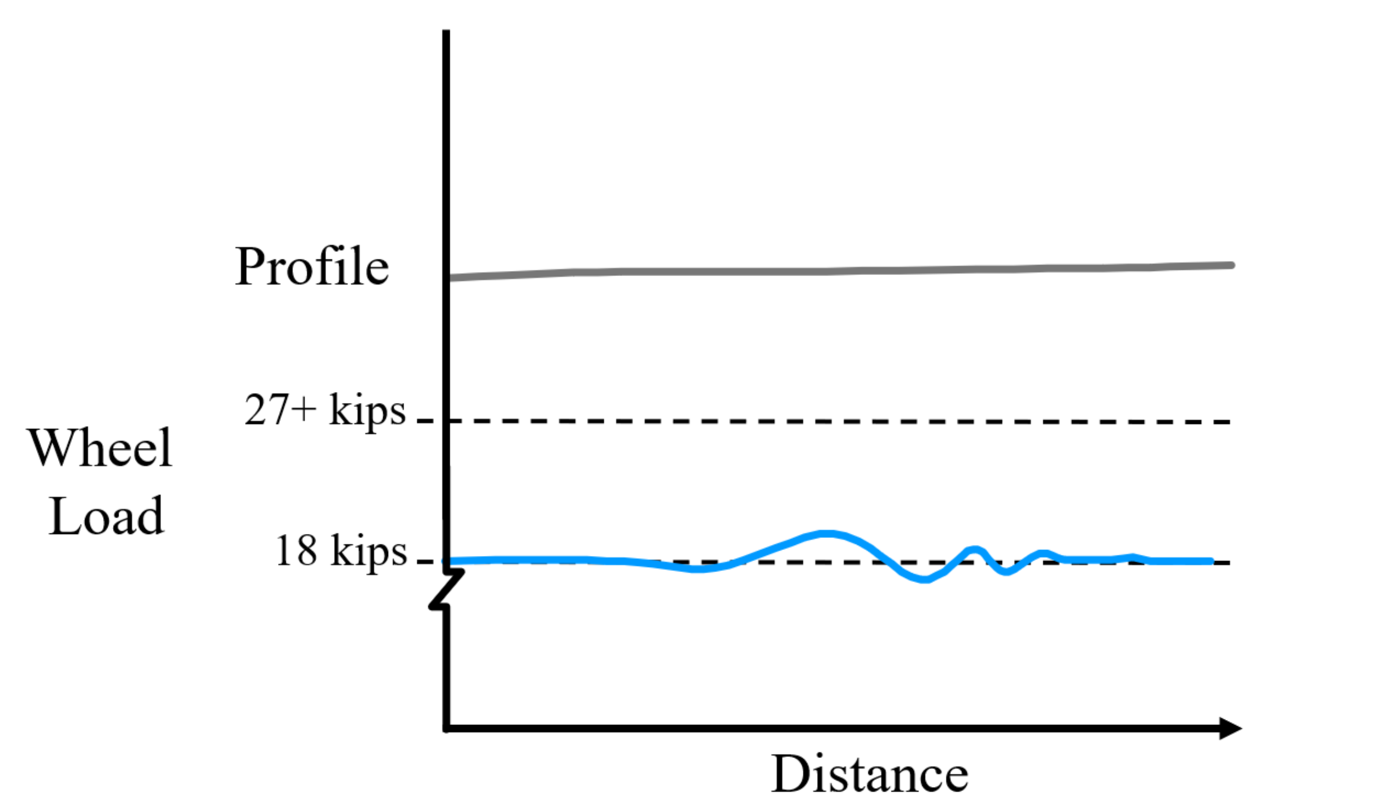
Greater customer satisfaction

Increased fuel economy

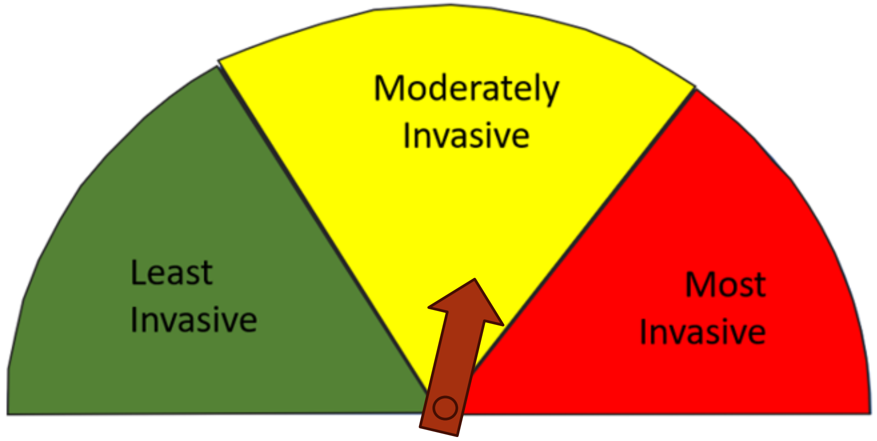
Rough Pavement



Smooth Pavement



What is the Cost of Pavement Repairs?



The less invasive a repair procedure is, the more cost effective it is and the less risk it carries.

Diamond Grinding



What is Diamond Grinding?

When you have soft aggregate

Safety groove can add macro texture and improved friction to pavements with polish prone aggregates

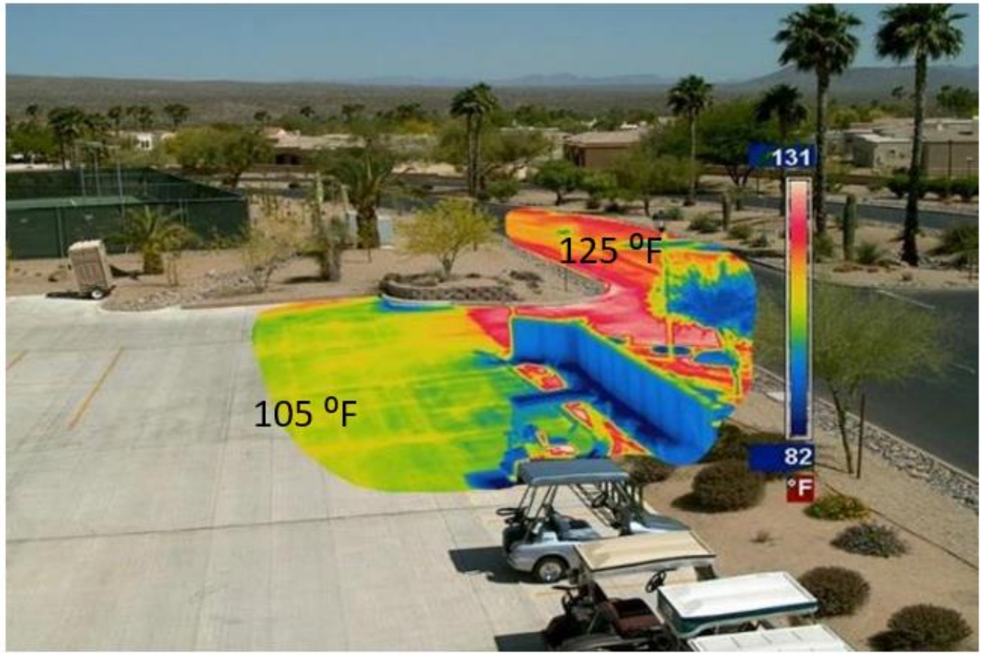
If a diamond grind project is underway, grooving will cost about $2 a sqyd

Fun Fact!

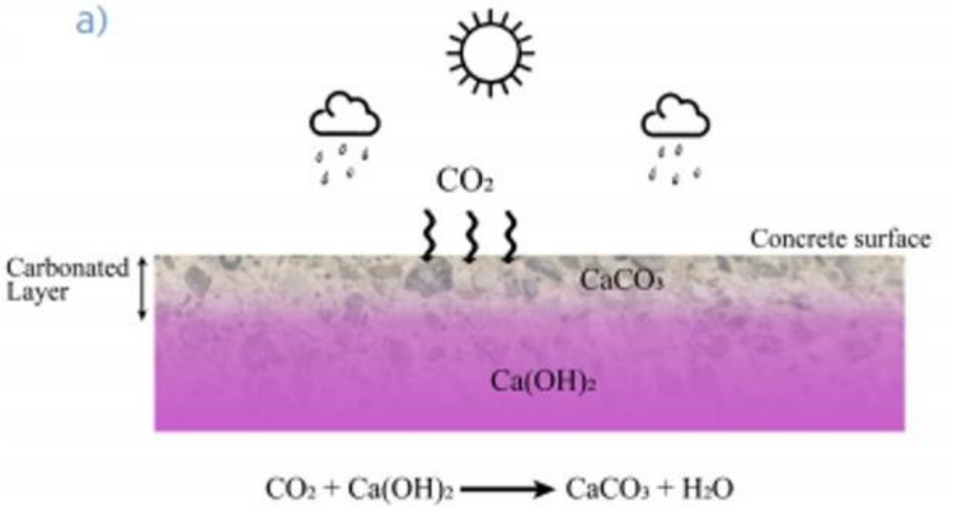
Diamond Grinding- Fun Fact

In Wisconsin, overall accident rates for ground surfaces were 40% less than for un-ground surfaces over a 6-year period, 57% in wet weather conditions

Other benefits of Diamond Grinding



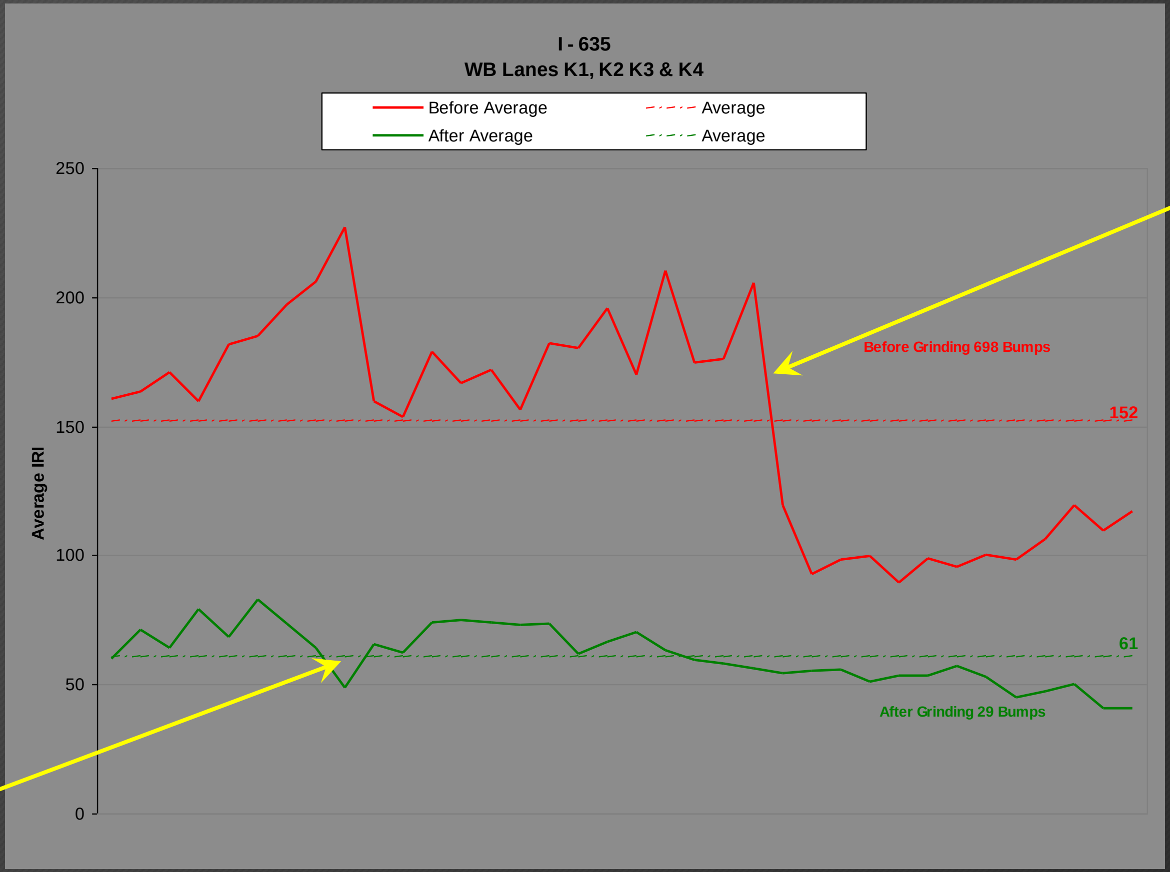
Albedo is the ability of surfaces to reflect sunlight



Year 0 to 10: 6298lbs of carbon sequestered

Year 10 to 20: 2609lbs of carbon sequestered

Improve International Roughness Index by 50-70%



Before Grinding

After Grinding

Why Is It The Most Cost-Effective Preservation Technique?

- Material mining
- Material hauling
- Smaller crew than asphalt paving
- Rolling road closures

Alternative?

- Asphaltmagazine.com says an asphalt overlay of concrete can last 12 years when properly maintained

$100 per ton

$86,000 per lane mile

WWW.IGGA.Net

IGGA International Grooving & Grinding Association

Fuel/Carbon Savings Calculator

Rigid Pavement Savings Calculator

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MIT CSHub

MIT Concrete Sustainability Hub

MIT Fuel/Carbon Savings Calculator

This app was developed using the concepts and models discussed in Journal of Cleaner Production in 2016. The Fuel/Carbon Saving App looks at an instantaneous improvement in IRI for a set amount of traffic on a daily basis. This daily savings can then be used to estimate annual savings for a set period of time. Estimating actual IRI for future years was considered but not used due to the fact that the estimates could never be confirmed. Allowing the user to extrapolate the findings on a daily level to an annual level was seen as the best estimate. Users should understand these are only estimates based on current traffic and smoothness calculations.

Estimated IRI Pre-Grind: 112 in/mi

Estimated IRI Post-Grind: 75 in/mi

Traffic Speed: 60 mph

Average Daily Traffic: 30000

Percent Trucks: 10 %

Calculations

Cars Per Day	27,000
Trucks Per Day	3,000
Daily Fuel Savings Per Mile	$74.08
Annual Fuel Savings Per Mile	$27,040.13

Cost/Carbon Savings Calculator- Actual Project Data

- What is the environmental and Financial benefit of IRI improvement?
  - [Fuel/Carbon Savings Calculator - IGGA | The International Grooving and Grinding Association]

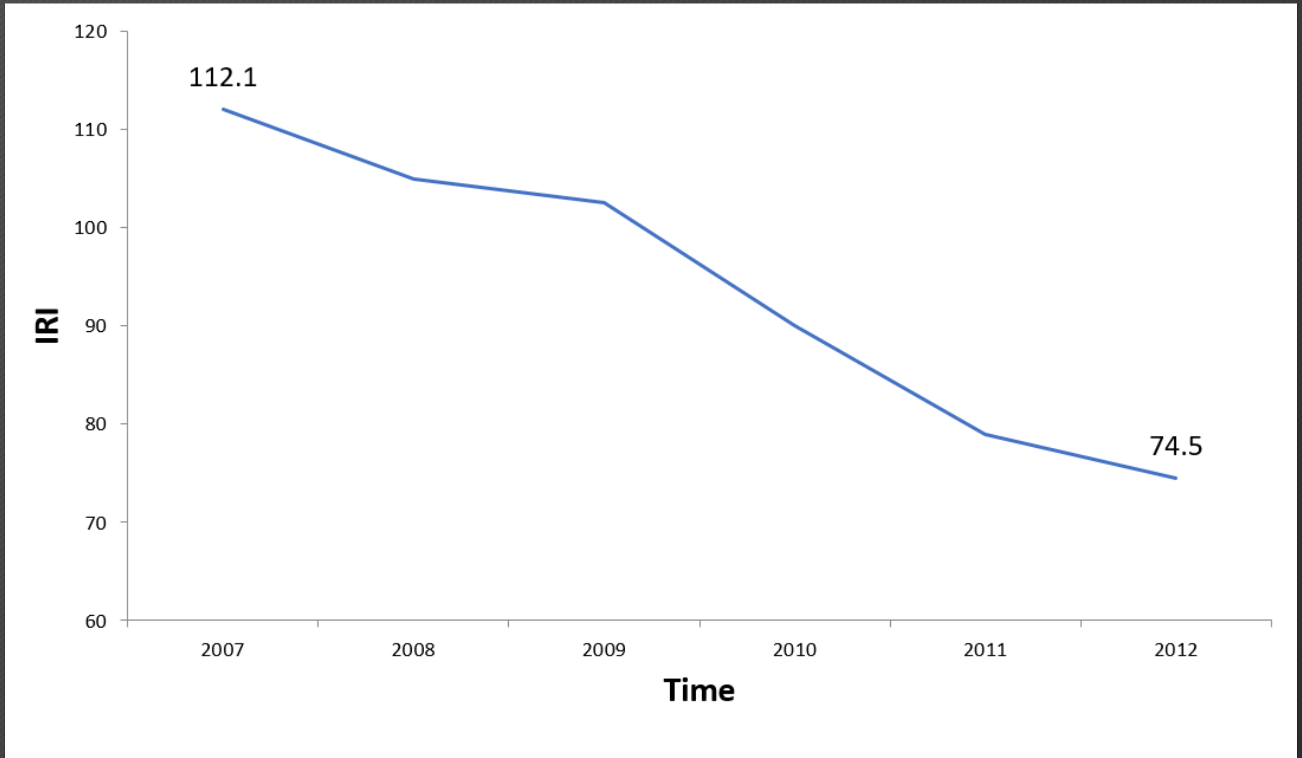
Example project
- Initial IRI: 98 in/mi
- Actual Final IRI: 43 in/mi
- AADT:39,152
- Percent trucks: 15%
- Length:6.6 miles
- Width: 4 lanes
- Cost to Grind: $4.60 sqyd

Cost Carbon Benefit Table

Print

Category	10 Year Benefit		20 Year Benefit	
	Cost ($)	Carbon (Metric Tons)	Cost ($)	Carbon (Metric Tons)
Fuel Savings for IRI	$3,918,999.72	4559.63	$7,837,999.45	9119.27
Carbon Sequestration		20.78		29.39
Cost of Grinding	($854,937.60)	(250.91)	($854,937.60)	(250.91)
Total (savings)	$3,064,062.12	4329.51	$6,983,061.85	8897.76

Kentucky PCC Interstate Improvement Project



Costs and Impact

- IRI Improved from 112.1 to 74.5 in 5 years
- Lowest recorded average IRI ever covering 536 miles
- $188,000 per lane mile
- Diamond grinding had an avg. cost of $2.75 per sq. yd. in KY over a 5-year period
- Reconstruction cost would have been $1.5 - $2.5 million/lane mile
- Preservation saved over $1 Billion

Estimated IRI Pre-Grind: 112 in/mi

Estimated IRI Post-Grind: 75 in/mi

Traffic Speed: 60 mph

Average Daily Traffic: 30000

Percent Trucks: 10 %

Gasoline Cost Per Gallon: $ 3.5 USD

Diesel Cost Per Gallon: $ 5 USD

Length Of Road: 536 miles

Total Project Lane Width (Cost Estimate): 12 feet

Diamond Grinding Cost Per Yard: $ 2.75 USD

Cost Carbon Benefit Table

Print

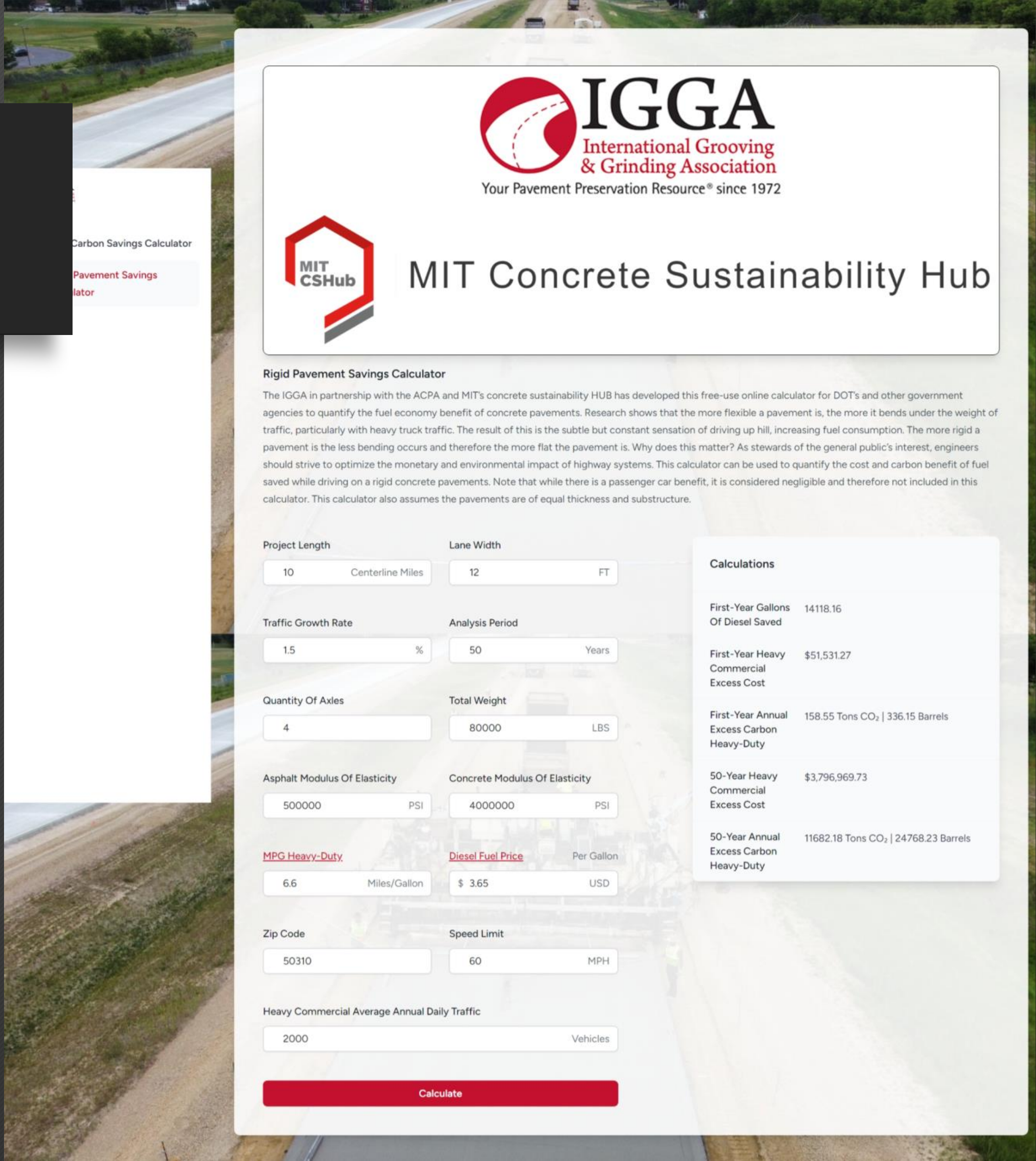
Category	10 Year Benefit		20 Year Benefit
	Cost ($)	Carbon (Metric Tons)	Cost ($)
Fuel Savings for IRI	$144,935,113.43	345246.12	$289,870,226.85
Carbon Sequestration		4910.48	
Cost of Grinding	($10,376,960.00)	(10188.29)	($10,376,960.00)
Total (savings)	**$134,558,153.43**	**339968.32**	**$279,493,266.85**

How Good is it?

Pavement Diamond Grinding is the only highway treatment that can be cost and carbon negative!

Rigid pavement calculator

- 10 mile section of interstate In Des Moines zip code
- 2000 heavy commercial vehicles per day
- $50,000 a year in fuel savings
- $3.8 million over the pavements design life



How Can This Help With Highway Funding?

Carbon Reduction Strategy

- Requires each State, in consultation with any MPO designated within the State, to– [§ 11403; 23 U.S.C. 175(d)]
  - develop a carbon reduction strategy not later than 2 years after enactment; [§ 11403; 23 U.S.C. 175(d)(1)] and
  - update that strategy at least every four years; [§ 11403; 23 U.S.C. 175(d)(3)]
- Requires the carbon reduction strategy to–
  - support efforts–and identify projects and strategies–to support the reduction of transportation emissions;
  - at the State's discretion, quantify the total carbon emissions from production, transport, and use of materials used in the construction of transportation facilities in the State; and
  - be appropriate to the population density and context of the State, including any MPO designated within the State. [§ 11403; 23 U.S.C. 175(d)(2)]
- Allows the carbon reduction strategy to include projects and strategies for safe, reliable, and cost-effective options to–
  - reduce traffic congestion by facilitating the use of alternatives to single-occupant vehicle trips, including public transportation facilities, pedestrian facilities, bicycle facilities, and shared or pooled vehicle trips within the State or an area served by the relevant MPO;
  - facilitate use of vehicles or modes of travel that result in lower transportation emissions per person-mile traveled as compared to existing vehicles and modes; and
  - facilitate approaches to the construction of transportation assets that result in lower transportation emissions as compared to existing approaches. [§ 11403; 23 U.S.C. 175(d)(2)(B)]
- Requires FHWA to–
  - review the State's process for developing its carbon reduction strategy and certify that the strategy meets statutory requirements; and
  - at the request of a State, provide technical assistance in the development of the strategy. [§ 11403; 23 U.S.C. 175(d)(4) and (5)]

Interactive CPP Toolkit

- Helps DOT's and Designers select the appropriate repairs for PCC pavement to help optimize repair spending.

Identify your pavement's problem area. Click on the photo that represents your pavement problem:

Spalled Joints and Cracks

Faulted Joints

Subsurface Voids

Cracked Slabs

Low-Severity Longitudinal Cracks or Joints

Low-Severity Transverse Cracks

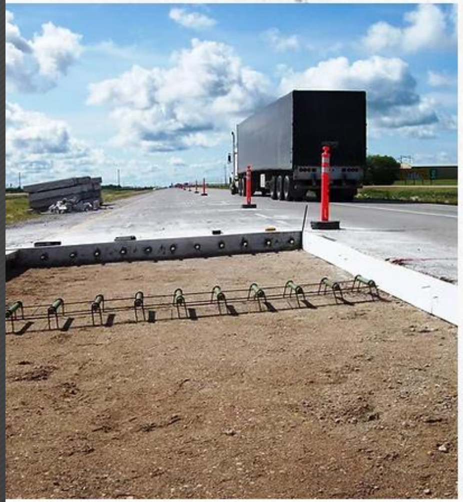
Slab Warping or Unevenness

Joint Sealant Failure

Hydroplaning on Pavement

Learn About the Repair

Images, information, and resources on the appropriate repair



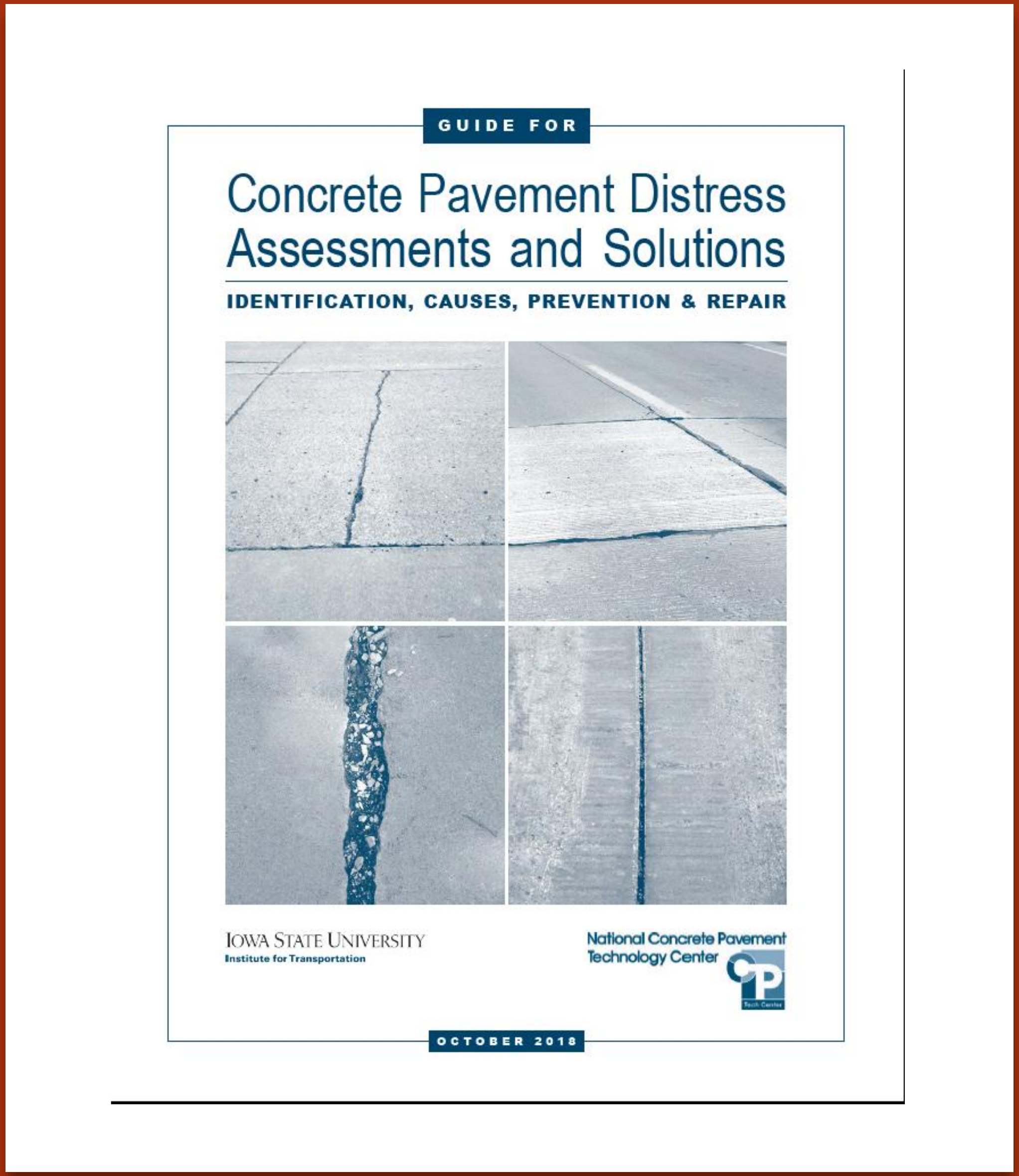
If you have **cracked slabs**, you need to perform:

Full-Depth Repairs

Full-depth repair is the removal and replacement of full slab thickness sections of deteriorated pavement. Length can vary based on conditions present. A common minimum patch size is four to six feet long and a full lane width wide. This type of repair can be completed on both jointed and continuously reinforced concrete pavement. On jointed pavement, the transverse construction joints at the patch ends are typically doweled and/or tied to restore load transfer across the joints. Additionally, on longer patch sections, dowel bar assemblies are placed at intervals to coincide with the existing transverse joint pattern present. On continuously reinforced concrete, the reinforcing steel pattern of the existing pavement is removed and replaced with new steel within the repair section. The transverse repair boundaries are first sawed and jackhammered to

Other resources

Pavement repair guides produced by the National Concrete Pavement Technology Center (CPTECH Center)



Total Benefits Smooth Concrete Pavements?

1. Better Fuel Economy
2. Improved safety (40% reduction in accidents, 57% reduction in wet weather accidents for diamond ground pavements)
3. Reduced freight damage
4. Reduce maintenance spending
5. Reduced GHG Emissions for use-phase

Conclusion

Keep your pavements smooth; It’s the most affordable option

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Find Out More at IGGA.net!