



# Environmental Benefits of Pavement Preservation

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# Presentation Outline

- Overview Sustainability
- Measuring Sustainability – Eco-efficiency Analysis
- Eco-efficiency Case Studies in Pavement Preservation

# Integration of the Three Pillars

## Sustainable Development

### Economy



### Ecology



### Social Responsibility



# Eco-Efficiency Analysis (EEA)

## Sustainability assessment of innovations through LCA



**Roland Berger**  
Strategy Consultants

Joint concept  
1996



pending

Independent third  
party validation

- Assessment of equally weighted economic and ecological aspects of products and processes
- Consideration of the entire life cycle (LCA in accordance with ISO norms)
- Eco-efficiency is analyzed from an end use perspective, so comparison is done for a defined level of output
- Standard and Strategic tool in the BASF Group with more than 400 analyses carried out worldwide.
- Results can support Environmental Product Declaration (EPD) according to ISO14025



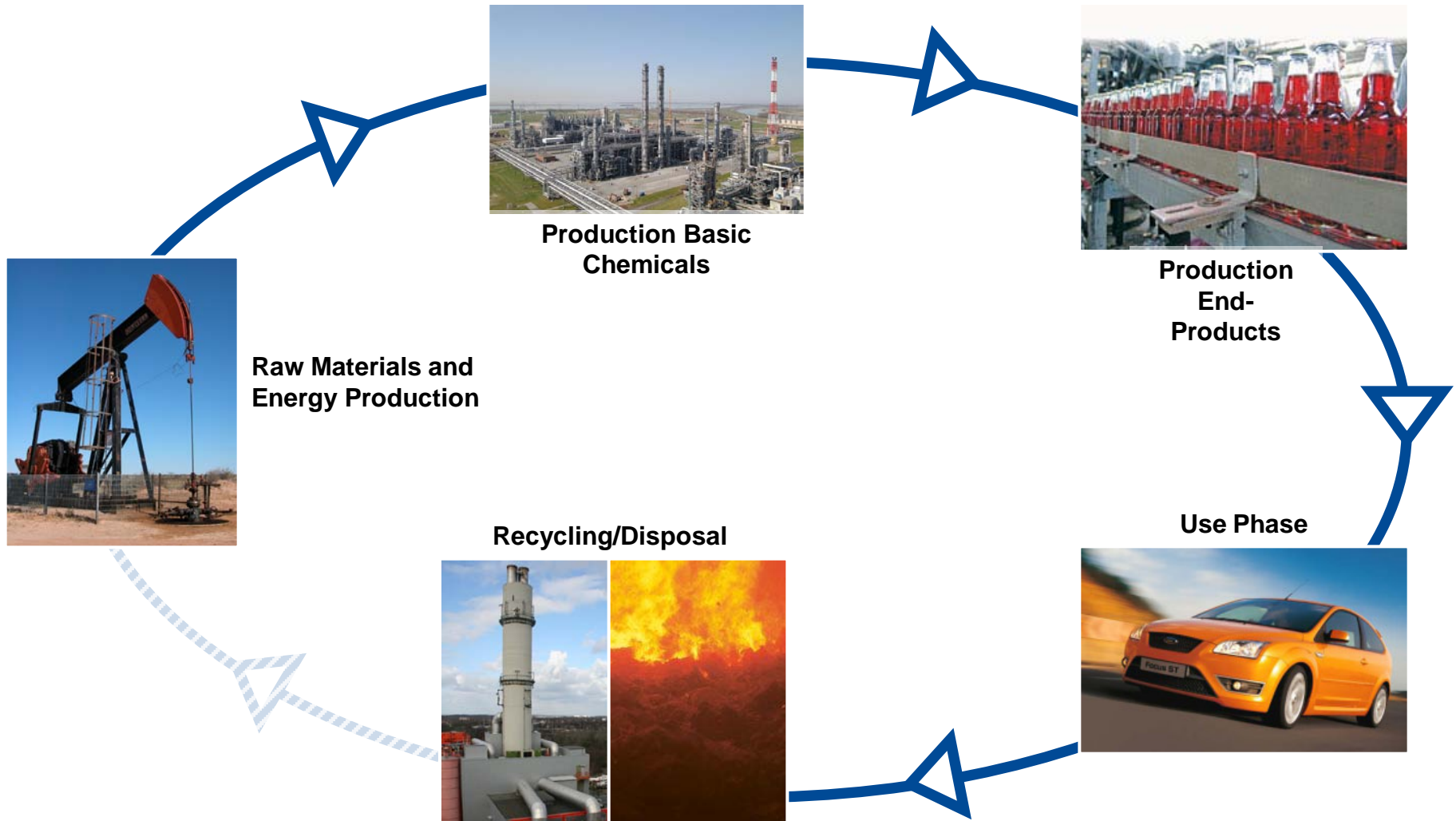
Acceptance and  
acknowledgment

# Measuring Sustainability



**Being able to measure sustainability is critical to its successful integration into business strategy**

# Eco-Efficiency is a Life-Cycle Approach



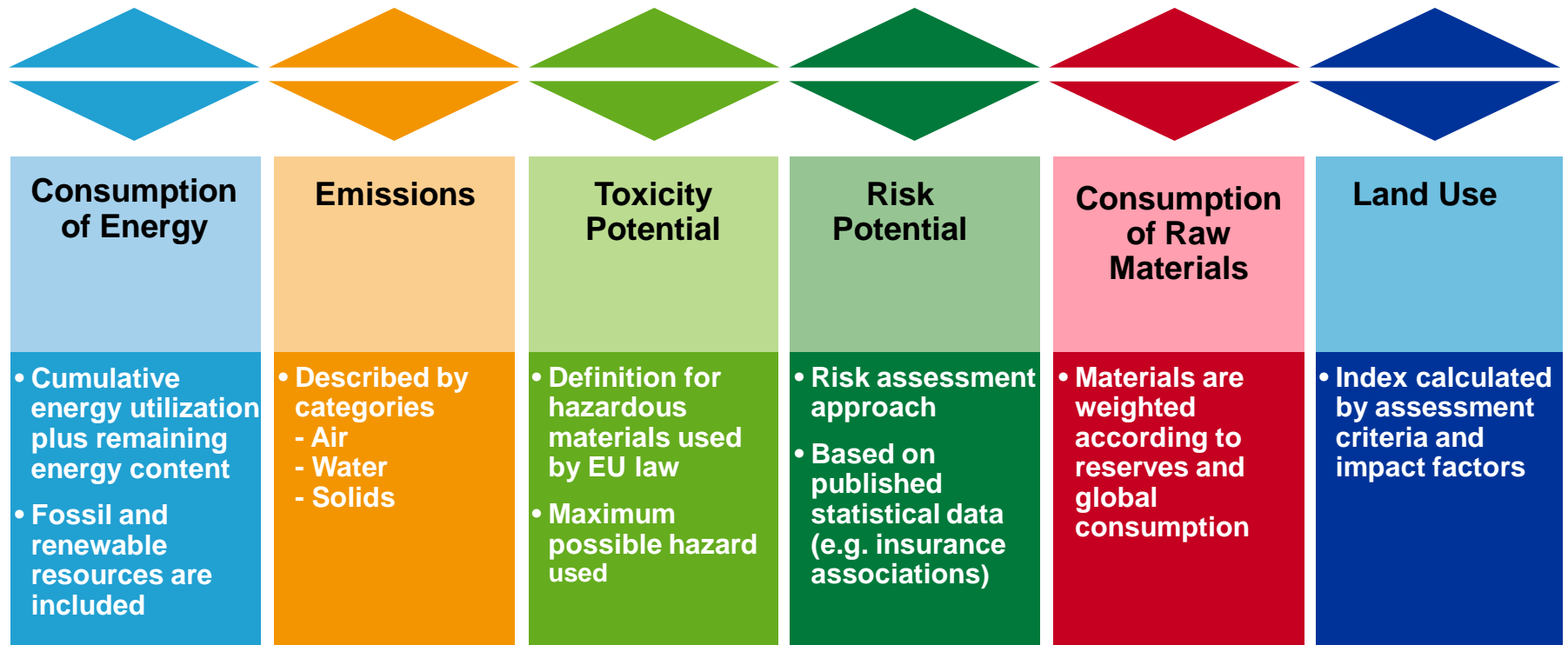
# Economic Impact Categories (over life cycle)

- Definition of acceptable service life
- Labor costs.
- Raw material costs.
- Energy (process and transportation).
- Capital & non-capital investment costs.
- EH&S programs and regulatory costs.
- Illness & injury costs (medical, legal, lost time).
- Waste costs (hazardous, non-hazardous)
- Recycling costs.
- Other as applicable



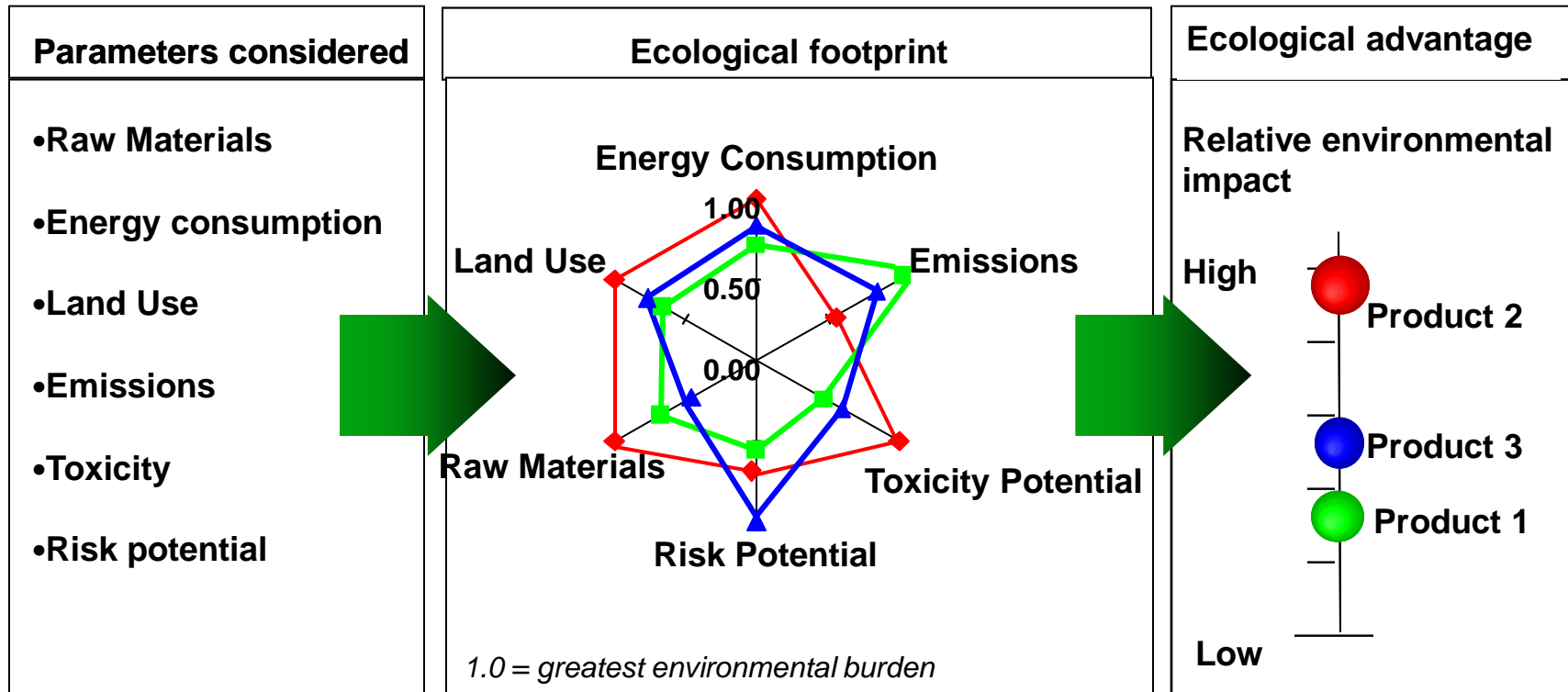
# Environmental Categories

## Environmental impact over the entire life cycle\*



\*Data acquisition and calculation is done according to ISO 14040 and 14044 (ecological part)

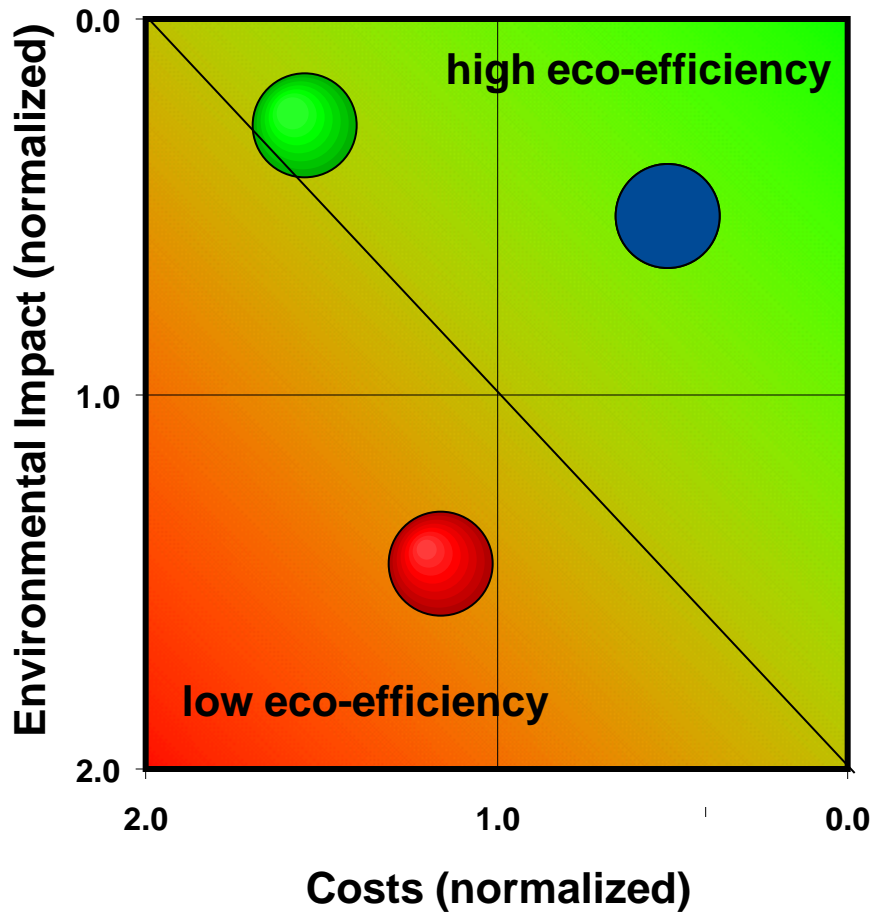
# Development of Environmental Impacts



Life-cycle data is gathered in six environmental categories and depicted on an ecological footprint. The data are then weighted and aggregated to obtain an overall environmental impact.

# Eco-Efficiency Portfolio: Costs and Environmental Burden

Customer benefit :  
  
1 functional unit for ....



- Alternative 1
- Alternative 2
- Alternative 3

The most eco-efficient product has the lowest environmental impact and cost. Eco-efficiency is measured from the diagonal line.

Alternative 3 is most eco-efficient.

# Completed Eco-Efficiency Studies

## Transportation Sector



- Chip Seal Asphalt Resurfacing
- Micro-surfacing vs. Thin Hot Mix Asphalt (HMA) Overlays

# The Eco-efficiency of Chip Seals



A collaborative project  
by BASF, AEMA, and  
other industry experts.

# Chip Seal Resurfacing

Customer benefit  
(CB)

- **Resurfacing of a 1-mile, 22-ft wide road stretch, with a lifetime of 7 years, using chipseal**

Hot alternative

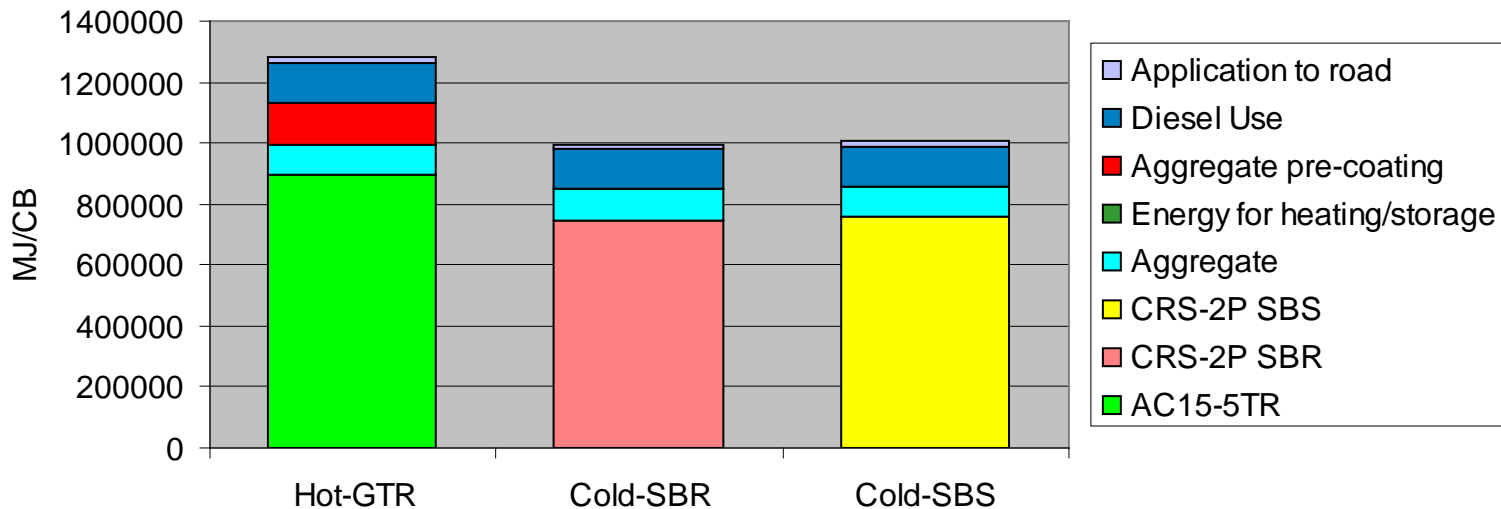
- **Hot Chip Seal, polymer-modified non-emulsified with ground tire rubber (AC-15-5TR or AC-20-5TR)**

Cold alternative

- **Cold polymer-modified Chip Seal, emulsified asphalt (CRS-2P) using SBR or SBS polymers**

# Energy consumption

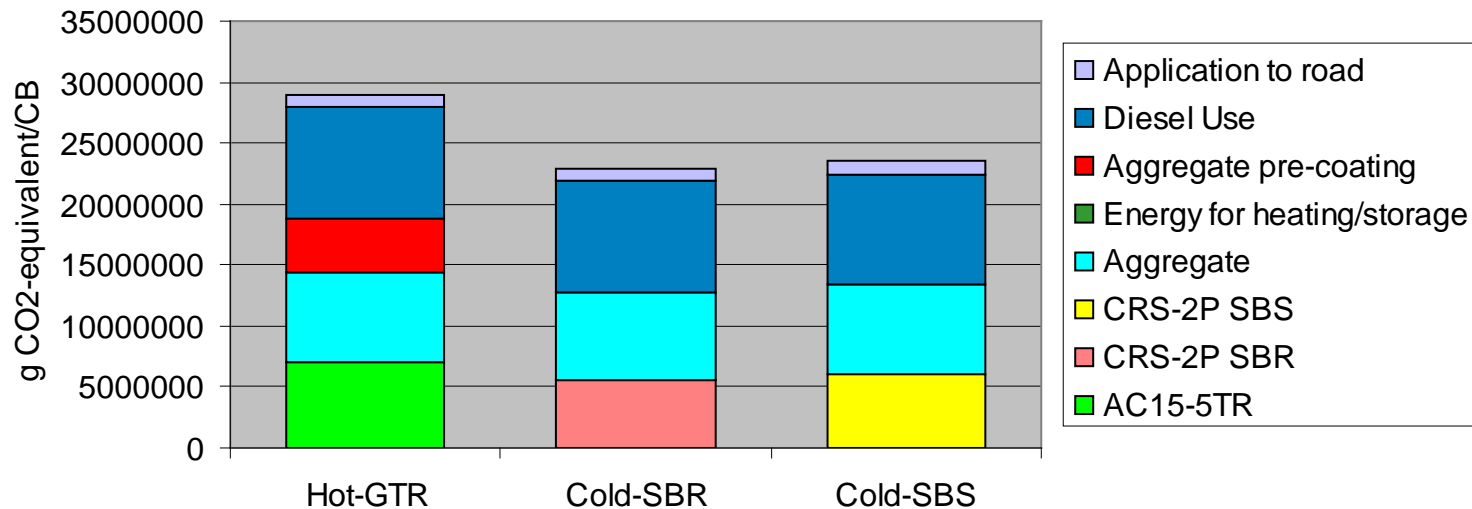
Primary energy consumption



The hot chipseal product uses the most energy due to the higher asphalt content and temperatures, and pre-coating of the aggregate.

# Global Warming Potential

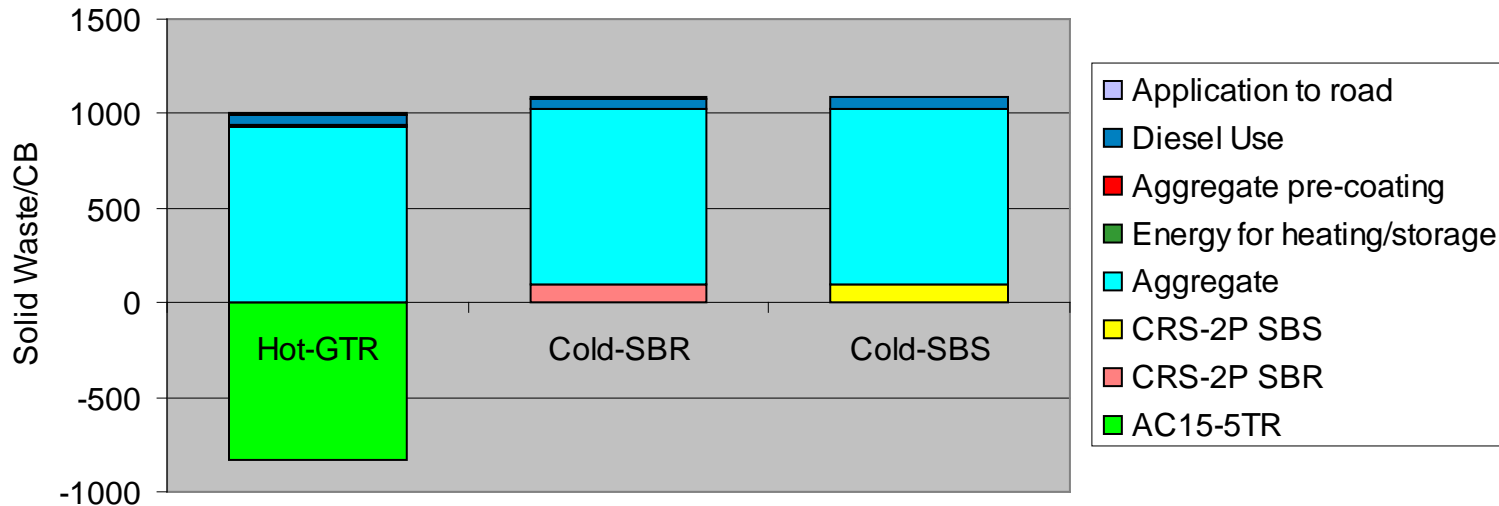
Global Warming Potential



Asphalt used to pre-coat the aggregate and greater energy consumption with Hot-GTR results in higher global warming potential.

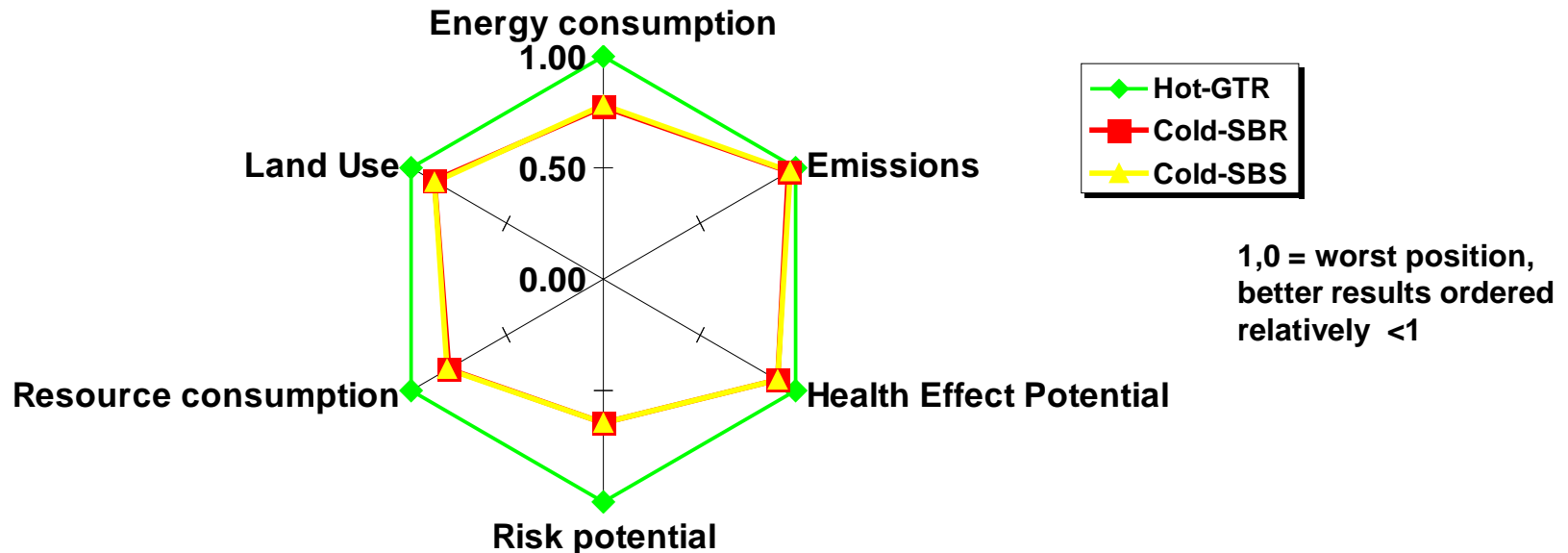
# Solid Waste Emissions

## Solid Waste



Solid waste emissions are primarily from aggregate quarrying. The ground tire rubber alternative has the advantage of recycling material that would otherwise be solid waste, but this is outweighed by the higher impacts in other environmental categories.

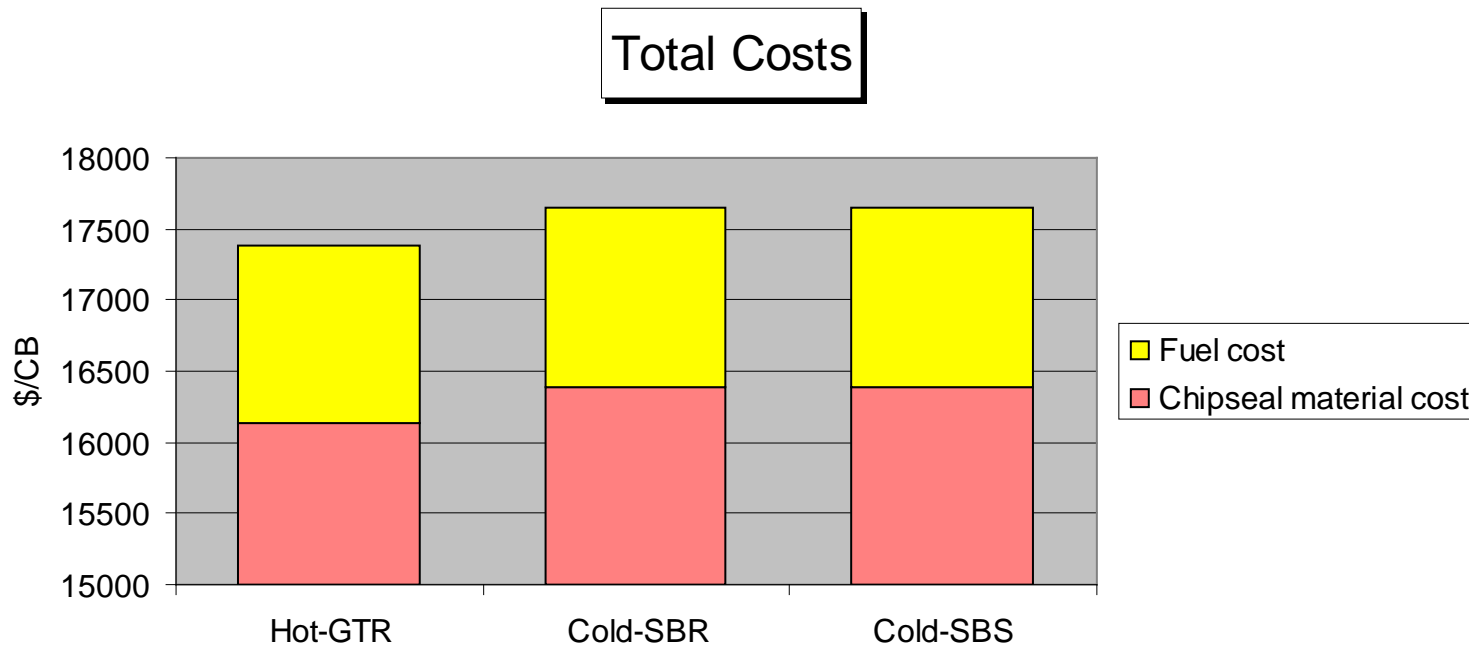
# Ecological Fingerprint



The Cold Chip Seal alternatives have lower overall environmental impact in all categories because:

- they contain less asphalt because they do not require pre-coating of the aggregate – meaning less emissions, resource and energy consumption
- they are applied at much lower temperatures, improving application safety and energy usage

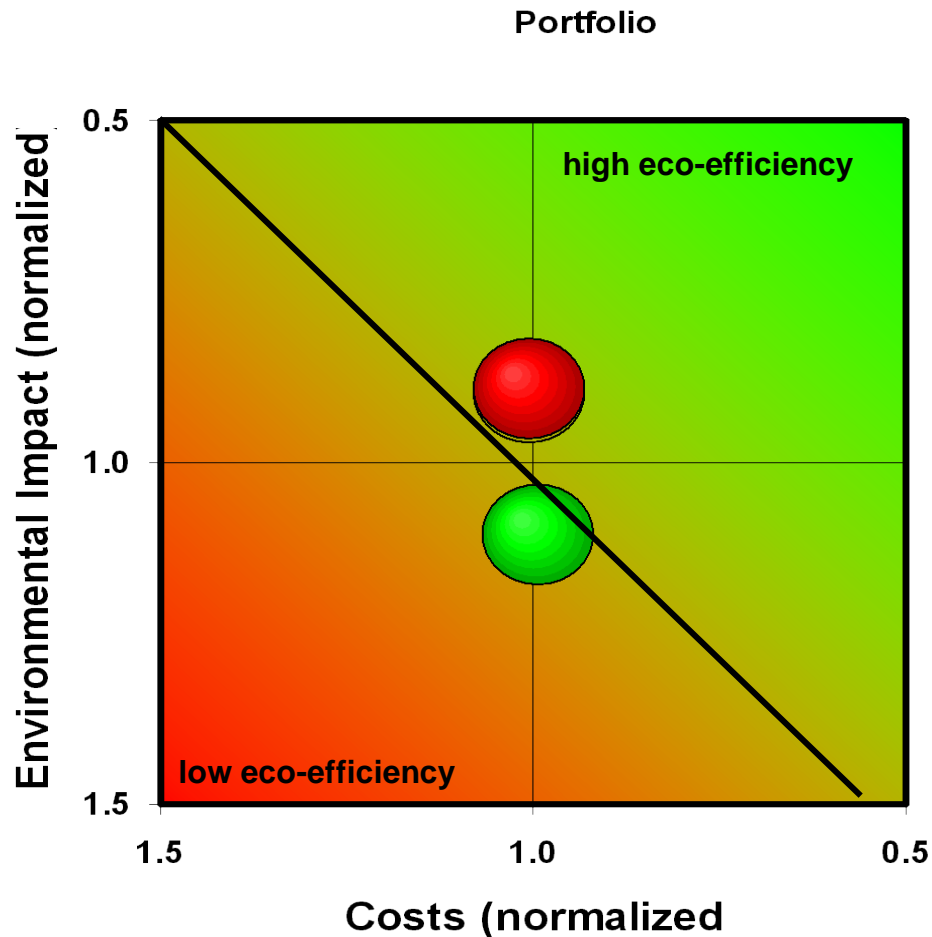
# Application Costs



The hot chipseal is slightly less expensive than the cold chipseal alternatives.

# Chipseal Eco-efficiency Portfolio

•Resurfacing of a 1-mile, 22-ft wide road stretch, with a lifetime of 7 years, using chipseal



The Cold SBR and SBS alternatives are more eco-efficient.

# The Eco-efficiency of Micro-surfacing vs. Thin Hot Mix Asphalt (HMA) Overlays



# Micro-surfacing vs. Thin Hot Mix Asphalt (HMA) Overlays

Customer benefit  
(CB)

- **Maintenance of 1 lane-mile over a lifetime of 40 years.**

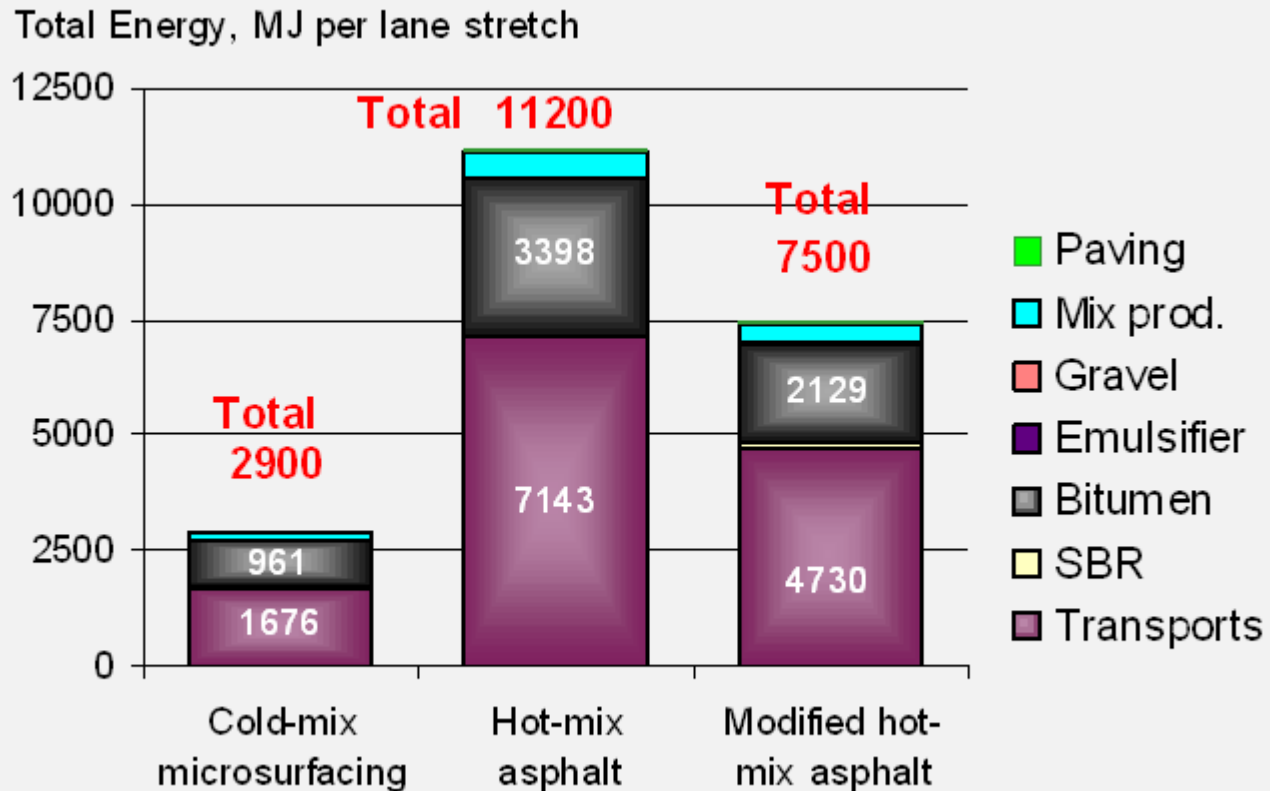
Hot alternative

- **Hot mix asphalt, polymer modified**
- **Hot-mix asphalt (unmodified)**

Cold alternative

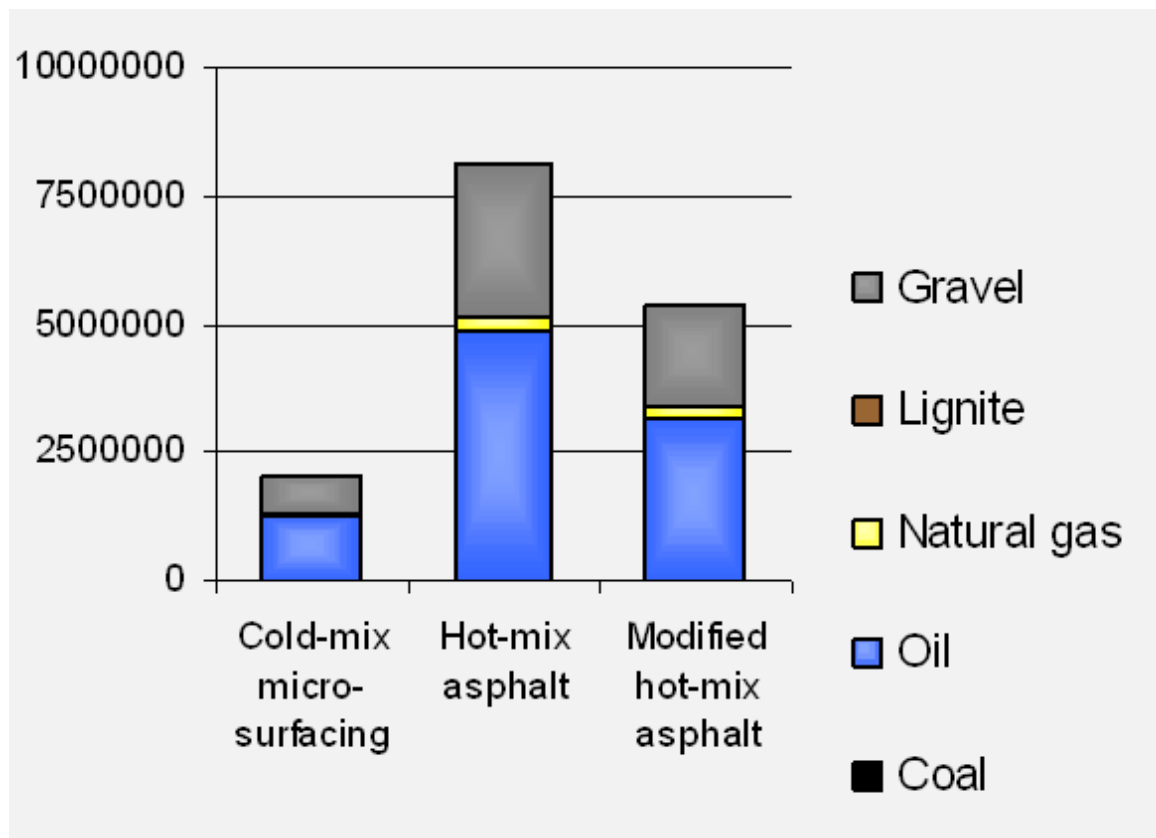
- **Cold-mix asphalt micro-surfacing**

# Energy consumption



# Raw Material Consumption

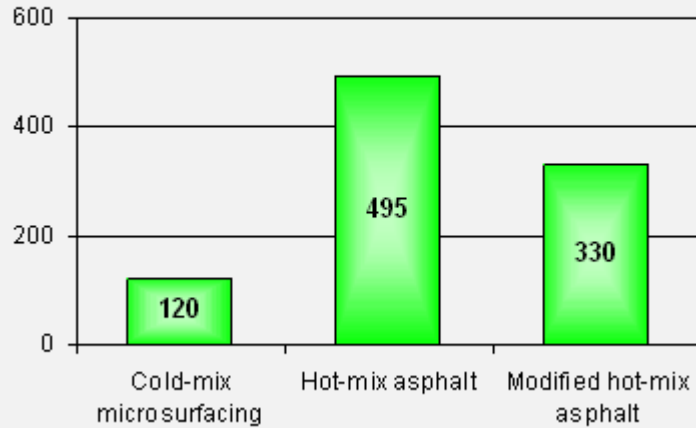
## Resurfacing: Weighted material consumption during a lifespan of 40 years



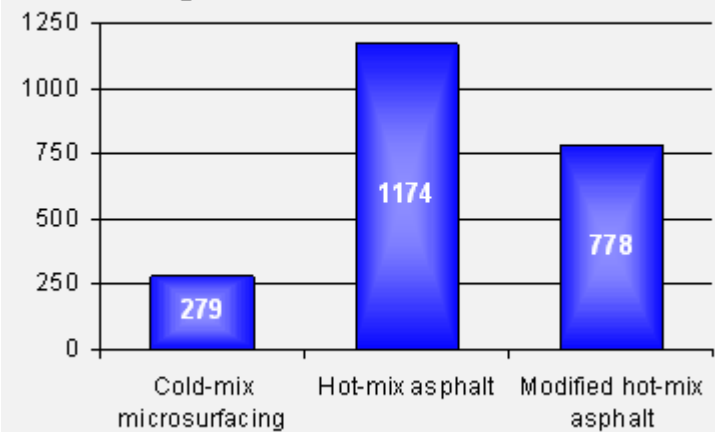
tons per annum and lane mile

# Air Emissions

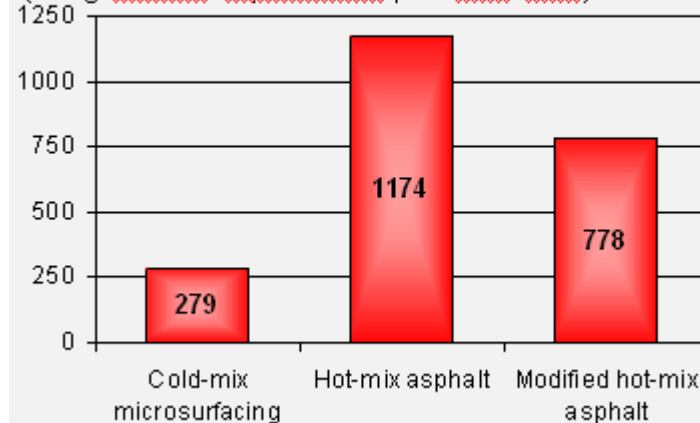
Global warming potential  
(in t CO<sub>2</sub>-equivalents per lane mile)



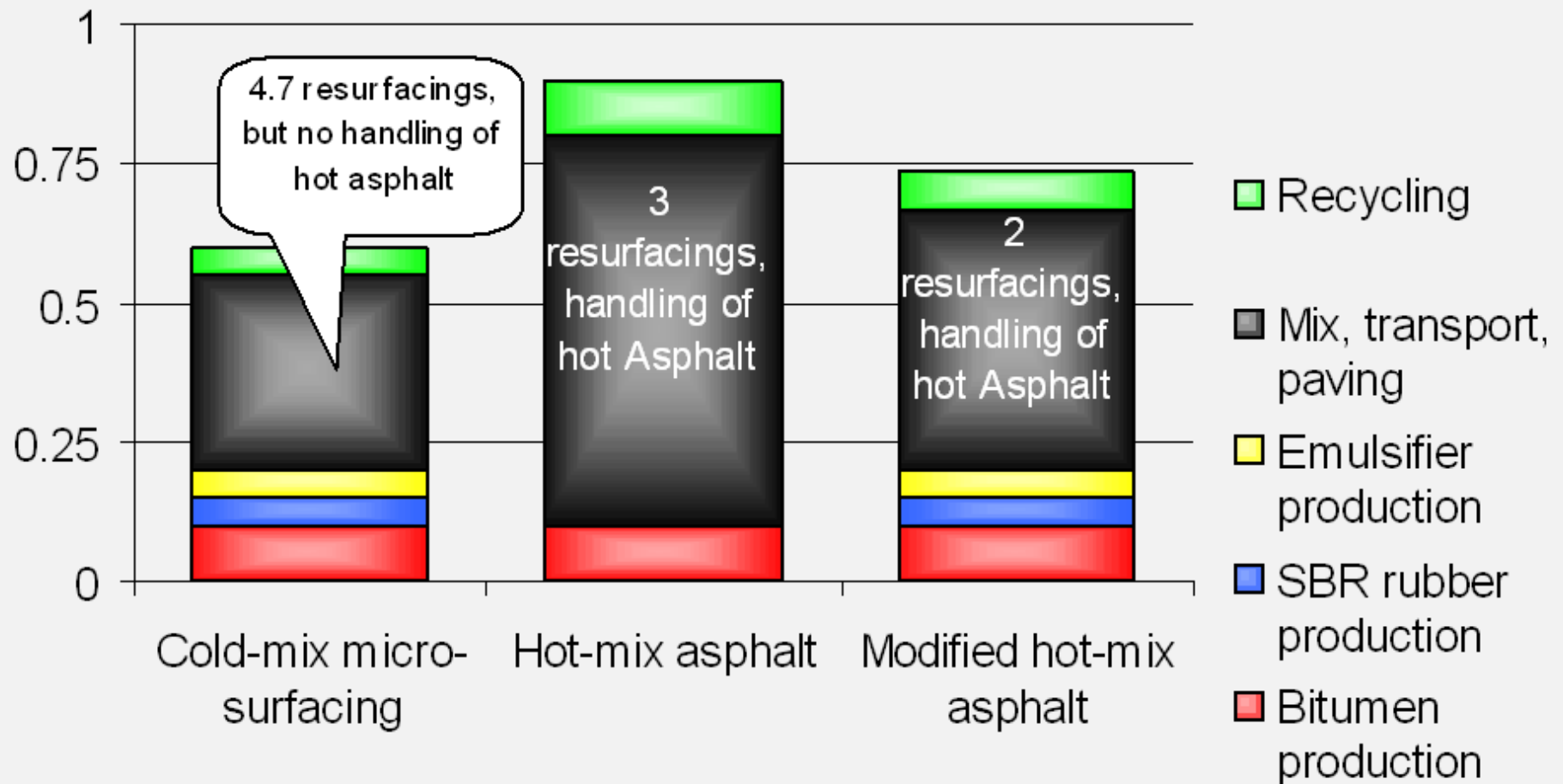
Acidification potential  
(in kg NO<sub>2</sub>-equivalents per lane mile)



Photochemical ozone creation potential  
(in kg ethene-equivalents per lane mile)

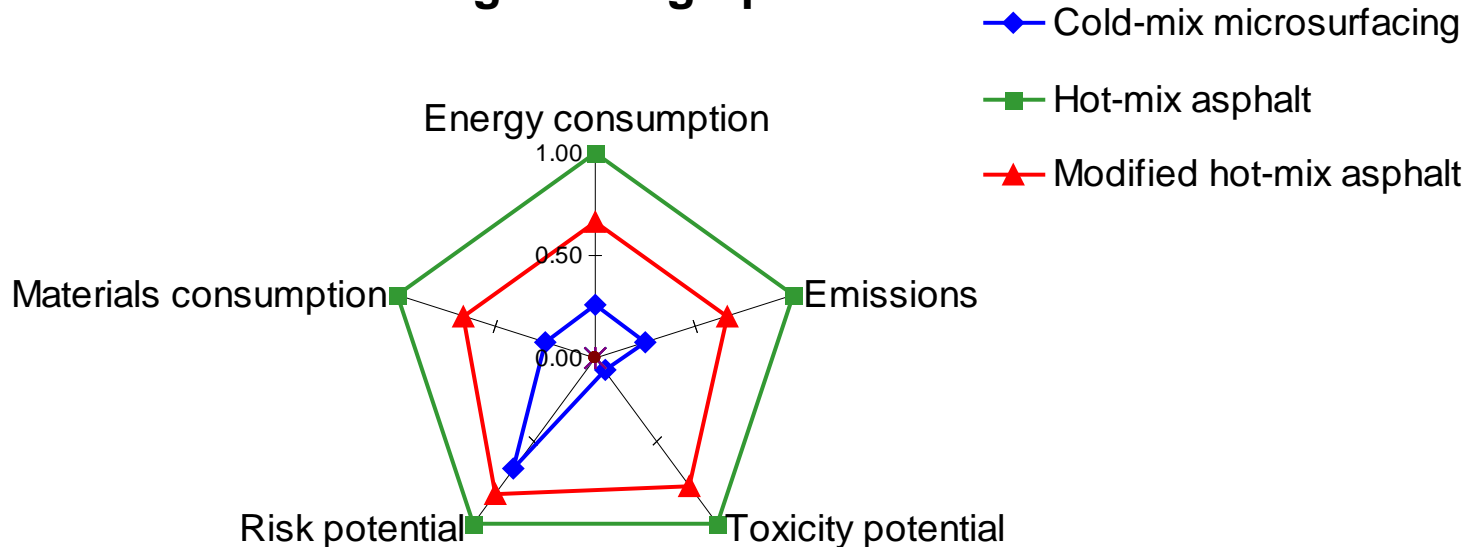


# Risk Potential



# Micro-surfacing vs. Thin Hot Mix Asphalt (HMA) Overlays

## Ecological Fingerprint



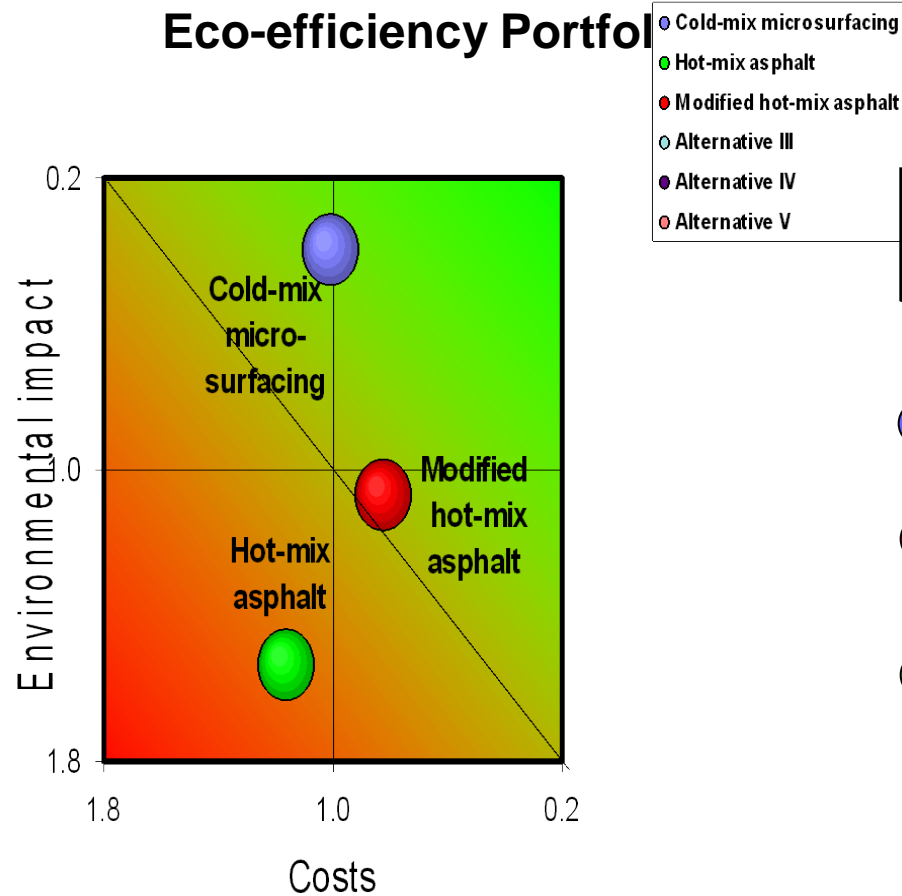
The cold-mix microsurfacing alternatives have lower overall environmental impact in all categories because:

- reduced thickness of the road surface leads to advantages in material consumption, emissions and energy consumption.
- handling less material and the avoidance of workplace aerosols during application in street construction leads to a lower overall toxicity (human health) potential.
- cold-mix microsurfacing has a lower risk potential because no hot bitumen is used during application on the street surface

# Micro-surfacing vs. Thin Hot Mix Asphalt (HMA) Overlays

• Maintenance of 1 lane-mile over a lifetime of 40 years.

**Eco-efficiency Portfolio**



Alternatives considered

- Cold-mix micro-surfacing
- Modified hot-mix asphalt
- Hot-mix asphalt

# Contact Information



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