

# RMRC



## Recycled Materials Resource Center



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## Research Project 85

# Urban Highway Life Cycle Assessment and Data Collection Methodology

### Project Objectives

- Determine a better methodology for gathering input data for Life Cycle Assessments (LCA) and Life Cycle Cost Analyses (LCCA).
- Better document the economic and environmental benefits of using recycled materials roadways through LCA and LCCA.

### Project Summary

In this case study, an LCA and LCCA were constructed for a reconstruction and expansion project on the eastbound section of Wisconsin's Beltline Highway from Whitney Way to Seminole Highway. The typical "reference" design using 100% virgin materials was compared to a design that incorporated fly ash, recycled concrete aggregate (RCA), recycled asphalt shingles (RAS) and recycled asphalt pavement (RAP) for the 2.4 kilometer (1.5 mile) section.

To avoid the over-generalisations of previous studies which used post construction data, real time data was collected. This reduced assumptions in the data set, leading to more a more accurate representation of both project's impacts.

Environmental impact criteria compared between the reference and actual design were:

- Energy (TJ)
- Water Consumption (g)
- CO<sub>2</sub> (kg)
- NO<sub>x</sub> (g)
- PM<sub>10</sub> (g)
- SO<sub>2</sub> (g)
- CO (g)
- Hg (g)
- Pb (g)
- RCRA Hazardous Waste Generated (g)
- Cancerous human toxicity potential (HTP) (kg)
- HTP non cancer (Mg)

An LCCA was constructed using unit cost data from the Wisconsin Concrete Pavement Association (WCPA), Wisconsin Department of Transportation (WisDOT), Wisconsin Asphalt Paving Association (WAPA) and the National Asphalt Paving Association (NAPA)

### Project Partners

Wisconsin Department of Transportation, Construction Materials Support Center, Wisconsin Asphalt Paving Association, National Asphalt Paving Association

### End Results

Reductions were seen in the LCA for all environmental criteria except HTP cancer. The most significant reductions were seen in PM<sub>10</sub> (20%), HTP non cancer (17%), Energy (13%), CO<sub>2</sub> (13%) and Water Consumption (12%). LCCA showed a 10% reduction in cost over the 50 year lifetime of the project, equating to \$250,000 in cost. \$222,000 (9%) was saved in the initial construction. \$130,000 was saved specifically from the use of RAP and RAS. These results suggest that using recycled materials significantly improves the sustainability of road construction.

### Further Information

The Recycled Materials Resource Center (RMRC) is a national center that promotes the appropriate use of recycled materials in the highway environment. It focuses on the long-term performance and environmental implications of using recycled materials