Saving Money and Reducing Environmental Impact Through Innovation: The Illinois Tollway Story

William R. Vavrik, Ph.D., P.E.
Vice President & Principal Engineer

WAPA’s 58th Annual Conference and Business Meeting
Illinois Tollway System

• 286-mile system comprised of four Tollways
  o Tri-State (I-94/I-294/I-80)
  o Jane Addams Memorial (I-90)
  o Reagan Memorial (I-88)
  o Veterans Memorial (I-355)
• Opened in 1958 as a bypass around Chicago to connect Indiana and Wisconsin
• Carries more than 1.4 million vehicles per day
• User-fee system – no state or federal gas tax dollars used for maintenance and operations
Freight Planning
Innovations, Scenarios, and Environmental Justice

Plus:
Safety Culture Lessons from the Offshore Oil Industry
Mileage-Based User Fees: What Does the Public Think?
Driverless Cars: The Need for Interdisciplinary Research
Implementing Sustainability Research Saves Illinois Tollway More Than $200 Million

STEVEN GILLEN

The Illinois Tollway has made a significant impact on the environment and society by adopting sustainable practices and implementing research and development projects. The tollway has a long-term vision of becoming a leader in sustainable transportation, and this effort has led to significant cost savings and environmental benefits. In this article, we will explore the tollway's sustainability efforts and the cost savings achieved through research and development.

**Transportation**

The Illinois Tollway has successfully implemented a range of sustainability practices over the past 12 years, producing new standards and policies for planning, materials, and recycling. The tollway recently received the designation of a carbon-neutral organization and found that the adoption of more sustainable transportation practices could result in substantial cost savings. In 2016, the tollway's research and development initiatives resulted in a 15% reduction in greenhouse gas emissions and a 10% reduction in energy consumption.

**Recycled Asphalt Pavement**

The Illinois Tollway has implemented several projects to reduce the amount of virgin materials used in pavement construction. By using recycled asphalt pavement (RAP), the tollway has been able to reduce the amount of virgin materials used in pavement construction. This has resulted in significant cost savings and environmental benefits.

**Funding Mechanisms**

To ensure the sustainability of the tollway's efforts, the Illinois Tollway has created a funding mechanism for research and development projects. This mechanism allows the tollway to allocate funds to projects that will have long-term benefits for the environment and society.

**Aggregates**

In 2016, approximately 10 million tons of aggregate were used in Illinois Tollway construction projects. The tollway plans to continue implementing sustainable practices to reduce the amount of aggregate used in future projects.

**Asphalt**

Asphalt is a critical component of the Illinois Tollway, and the tollway has been actively pursuing sustainable practices to reduce the amount of asphalt used in future projects. The tollway has implemented several projects to reduce the amount of asphalt used, resulting in significant cost savings and environmental benefits.

**Cost Savings**

The Illinois Tollway has reported significant cost savings through its sustainability efforts. These cost savings are attributed to the implementation of sustainable practices and the reduction of greenhouse gas emissions. The tollway has implemented a range of projects to reduce the amount of materials used in pavement construction, resulting in significant cost savings for the agency.

**References**

Implementing Sustainability Research Saves Illinois Tollway More Than $200 Million

Steven Gillen

The Illinois tollway has recently increased the implementation of research findings over the past few years, with the objective of incorporating recycled materials into the asphalt mixes used in the construction of tollway systems. The Illinois Department of Transportation (IDOT) has been at the forefront of this effort, with the Illinois Tollway implementing a significant amount of research and development projects to improve the sustainability and performance of their asphalt pavements.

The Illinois Tollway has recently implemented a project called the "Recycled Asphalt Program," which involves the use of recycled asphalt in the construction of new tollway systems. This program has been successful in reducing the amount of asphalt produced from landfills, and has also resulted in significant cost savings for the Illinois Tollway.

In addition to the Recycled Asphalt Program, the Illinois Tollway has also implemented a number of other sustainability initiatives, such as the use of biofuels in their vehicles, the implementation of energy-efficient lighting in their facilities, and the use of sustainable building materials in the construction of new tollway systems.

The Illinois Tollway is committed to improving the sustainability of their operations, and continues to invest in research and development projects to further reduce their environmental impact. The Illinois Tollway is a model for other transportation agencies around the world, and their efforts to implement sustainable practices are helping to create a more environmentally friendly transportation system.
Aggregate Initiatives in Recycling

Cost savings started from the bottom up using established methods of recycling

- Existing aggregate subbases re-used
- Existing concrete recycled by rubblization
- Existing concrete recycled as new porous base
- Existing asphalt recycled for many applications
Research opened the door or the Tollway to reach sustainability goals

Pavement initiatives started with asphalt

- Ground tire rubber mixes tested and analyzed
- Hot & warm asphalt mixes with varied levels of FRAP produced & tested for performance
- Roof shingle and high FRAP mixes studied
- Early age rutting potential of high ABR SMA mixes with various warm mix processes studied
- In place SMA surface mixes with low, medium, and high ABR content studied to show performance being maintained.
Asphalt Research Continues

- Other options for ground tire rubber modifications being explored
- Research to find the best lab test methods to use with performance based specifications for asphalt mix designs
Summary of Asphalt Mix Savings

- Higher levels of FRAP reduces virgin aggregate needs and liquid asphalt quantities

- Option for grounded tire rubber modified asphalt in high performance SMA mixes eliminated the need for fiber reinforcement in the mixes and competes with SBS modifiers to reduce prices further

- Use of RAS allowed for asphalt binder replacement (ABR) levels to go higher and reduced need for fibers in SMA

- Total savings since these initiatives were introduced in 2006 has saved the Tollway approximately $74,000,000
Concrete also included…

- NCHRP study on quietest pavement textures
- Development of specs for performance engineered concrete mixes for patching, HPC decks, & new pavements, most all designs fully optimized and ternary
- SHRP2 R05 project on precast pavements
- SHRP2 R21 project on composite pavements
- U of I evaluation of black rock concrete mixes for composite pavements
- Performance related specifications for concrete pavement construction developed and implemented
Design practices contribute

Jointed concrete built on asphalt base with asphalt shoulders.

Pavement ME to optimize designs for actual conditions and expected future traffic
Savings through 2015

Savings indirectly related to research by others
- Aggregate related initiatives - $113,000,000
- Pavement design initiatives - $29,000,000

Savings directly related to recent Tollway research
- Asphalt related initiatives - $74,000,000
- Concrete related initiatives - $31,500,000

Total estimated savings = $247,500,000
Goal is to be sustainable

- Economic
- Environmental
- Social

- Life Cycle Cost Analysis
- Life Cycle Assessment
- Sustainability Rating System

Sustainable
Rating system for qualitative measurement

INVEST

System Planning & Processes

Project Development

Operations & Maintenance

Infrastructure Voluntary Evaluation Sustainability Tool (INVEST)

www.sustainablehighways.org
System Planning Scores
Operations and Maintenance Scores

<table>
<thead>
<tr>
<th>Year</th>
<th>Score</th>
<th>Category</th>
<th>Rating</th>
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<tbody>
<tr>
<td>2000</td>
<td>Pre-CRP</td>
<td>87 points</td>
<td>Silver Rating</td>
</tr>
<tr>
<td>2004</td>
<td>Start CRP</td>
<td>142 points</td>
<td>Platinum Rating</td>
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<tr>
<td>2009</td>
<td>CRP</td>
<td>159 points</td>
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</tr>
<tr>
<td>2013</td>
<td>Move Illinois</td>
<td>210 points</td>
<td>Platinum Rating</td>
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## Project Development Scores

<table>
<thead>
<tr>
<th>Capital Program</th>
<th>Number of Projects Scored</th>
<th>Avg. % Total Points Achieved per Project</th>
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<tbody>
<tr>
<td>Pre-CRP</td>
<td>1</td>
<td>9%</td>
</tr>
<tr>
<td>CRP</td>
<td>21</td>
<td>20%</td>
</tr>
<tr>
<td>Move Illinois</td>
<td>15</td>
<td>44%</td>
</tr>
</tbody>
</table>

### Capital Program Breakdown

- **Pre-CRP**: 1 project, 9% average points achieved per project.
- **CRP**: 21 projects, 20% average points achieved per project.
- **Move Illinois**: 15 projects, 44% average points achieved per project.
LCA is next step

Why must we quantify?

If it is not quantified, it is not valued

- Without value, it won’t get done
- Without value, it cannot be improved upon
- Without value, there is no incentive
Tollway LCA is full roadway system
Soon we will be showing environmental improvements

2000 Mixes
• No recycle content
• SBS-modified binder

2008 Mixes (as constructed)
• SMA surface and binder for mainline
• ABR content ranging from 15 to 47 percent
• GTR binder

2014 Mixes (similar projects)
• Warm-Mix Asphalt (WMA)
• ABR content ranging from 24 to 53 percent
• Includes RAS
Expecting remarkable results
In summary...

Research leads to innovation…
Innovation facilitates doing more with less

Measurement allows good management
Managing facilitates sustainable success
Questions