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

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WAPA's 58th Annual Conference
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Illinois Tollway System

- 286-mile system comprised of four Tollways
  - Tri-State (I-94/I-294/I-80)
  - Jane Addams Memorial (I-90)
  - Reagan Memorial (I-88)
  - 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


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Implementing Sustainability Research Saves Illinois Tollway More Than $200 Million

STEVEN GILLEN

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The Illinois Tollway has steadily increased the implementation of research findings over the past 12 years, producing new standards and policies for pavements, materials, and recycling. The tollway recently reviewed the documentation of construction costs and found that the adoption of more innovative and sustainable material specifications saved an estimated $218.5 million between 2004 and the start of 2016. Normalized to 2015 dollar values, the cost savings demonstrate that sustainable recycling of aggregate, asphalt, and concrete materials have yielded substantial economic benefits, in addition to environmental and social benefits.

Aggregates

In 2004, approximately $9 billion of an $18-billion, 25-year capital program were allocated to reconstruct and expand much of the Illinois Tollway (see Figure 1, below). Before then, the tollway did not use cost-efficient methods to reprocess pavements into recycled aggregates, although other agencies had developed and successfully implemented on-site processing techniques and concrete pavement rubblization (1).

The Illinois Tollway rubblized nearly 32 miles of concrete pavement in place along the Interstate 88 (I-88) extension for reuse as the new base for an asphalt pavement. Compared with the cost of totally reconstructing the mainline roadway, the cost of this strategy saved the tollway approximately $29.5 million. The Illinois Tollway's program management organization, HNTB, confirmed that the remainder of the capital projects saved an estimated $83.5 million through 2015 by recycling all pavements into the new bases of the reconstructed and widened roadways.

FIGURE 1 Illinois Tollway system map.

Asphalt

After realizing the economic benefits of adopting new initiatives for recycling or improving sustainability through aggregate production, the Illinois Tollway began investigating how similar savings could be achieved with more sustainable asphalt materials without sacrificing performance or durability.

Ground Tire Rubber–Modified Asphalt Binder

Fractionated Reclaimed Asphalt Pavement

Recycled Asphalt Shingles

TABLE 1 Estimated Cost Savings, by Materials

Applications	Years	Total Cost Savings
Aggregate	2004–2015	$113,000,000
Asphalt	2007–2015	$74,000,000
Concrete	2011–2016	$31,500,000
Total approximate savings		$218,500,000

References

Suggestions for Research Pays Off topics are welcome. Contact Stephen Maher, Transportation Research Board, Keck 488, 500 Fifth Street, NW, Washington, DC 20001; 202-334-2955; smaher@nas.edu.

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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

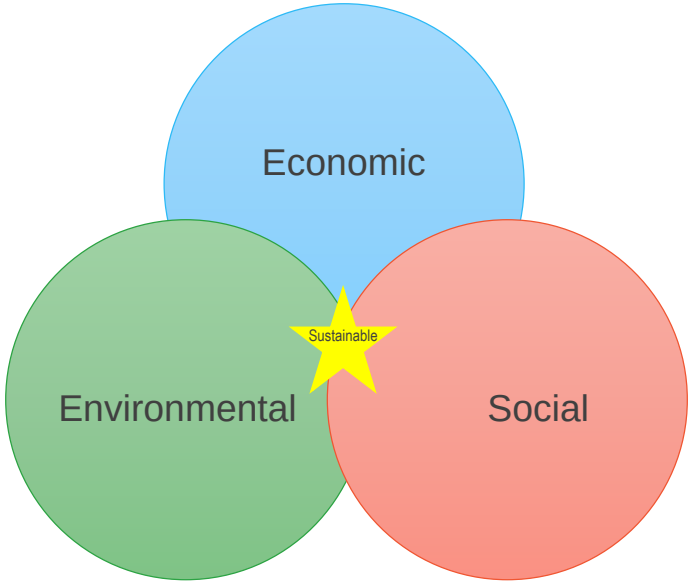
- Aggregate related initiatives - $113,000,000
- Pavement design initiatives - $29,000,000

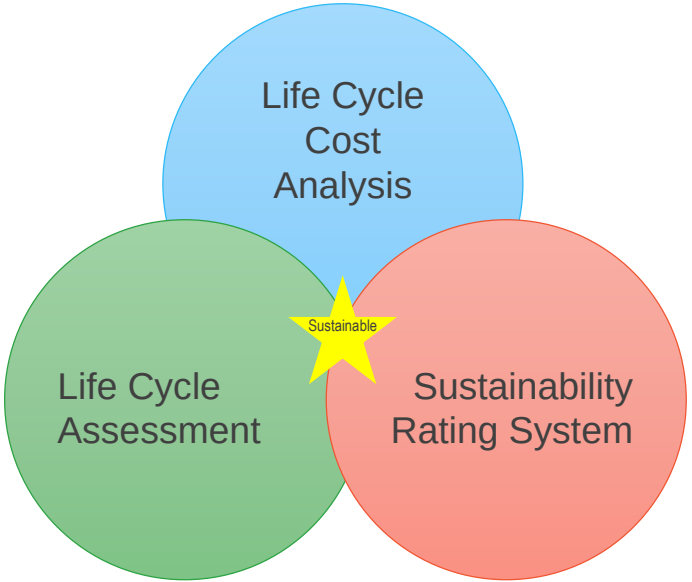
Savings directly related to recent Tollway research

- Asphalt related initiatives - $74,000,000
- Concrete related initiatives - $31,500,000

Total estimated savings = $247,500,000

Goal is to be sustainable





Rating system for qualitative measurement

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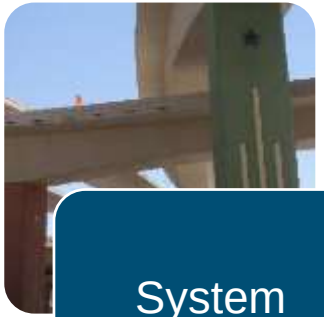
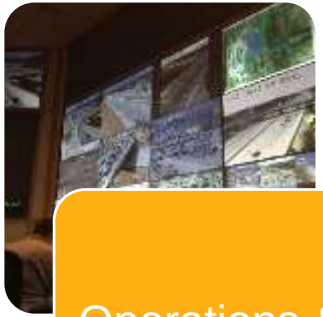


System Planning & Processes

Project Development

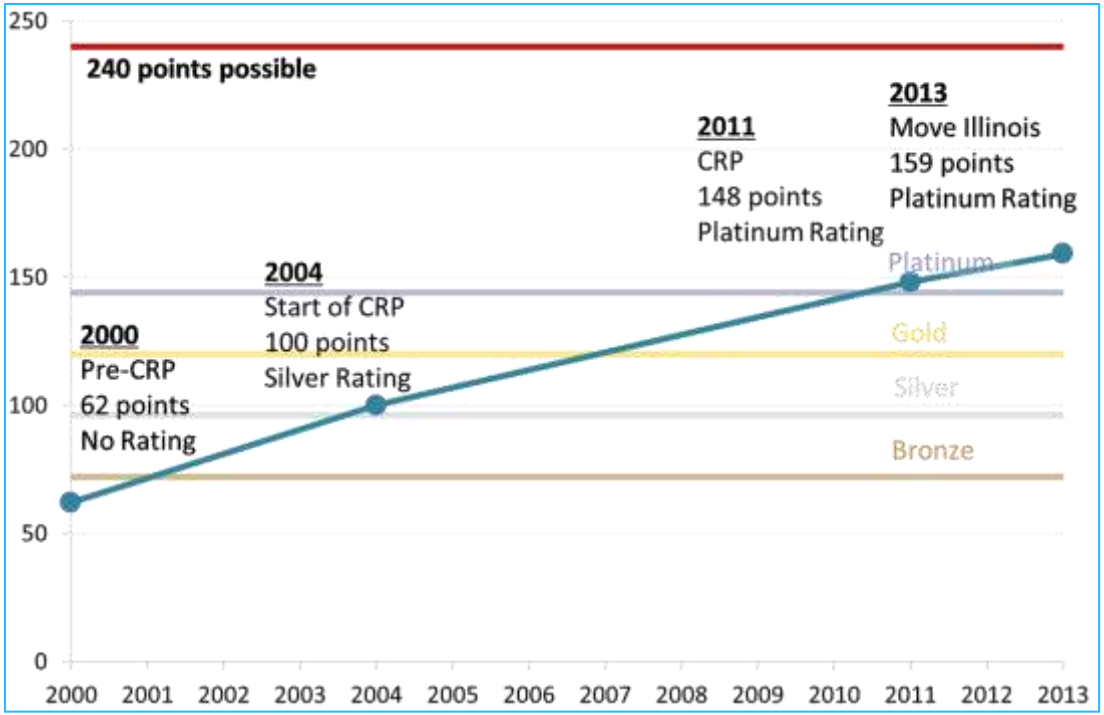


Operations & Maintenance

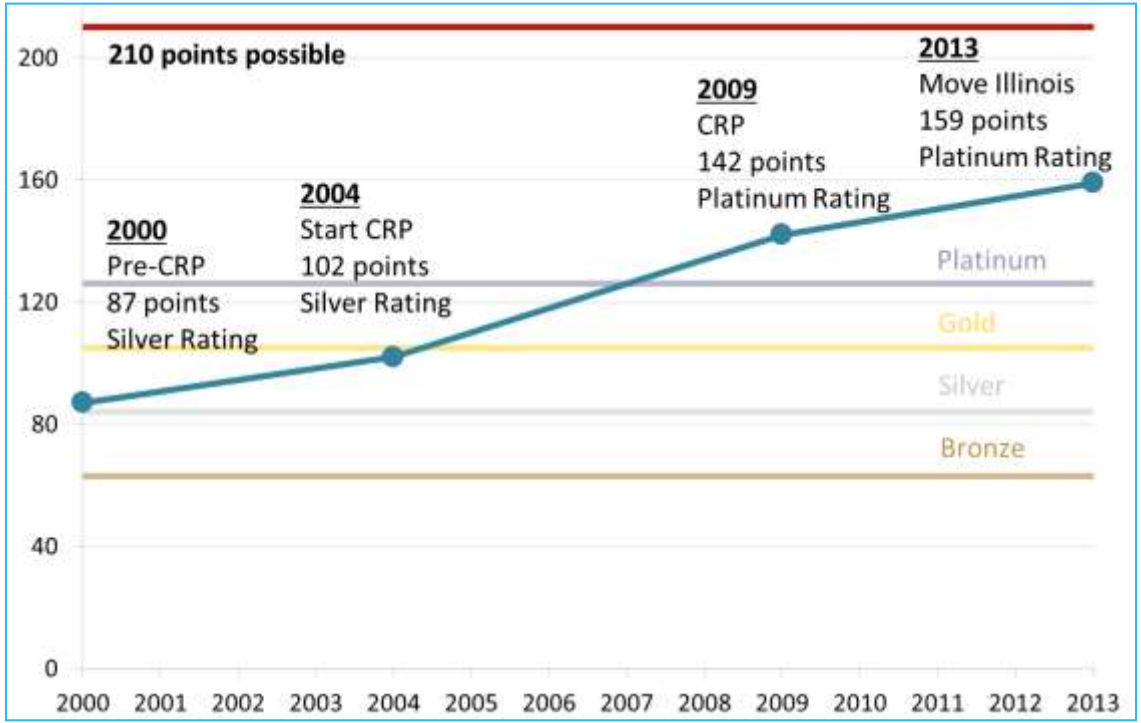
Infrastructure Voluntary Evaluation Sustainability Tool (INVEST)

www.sustainablehighways.org

System Planning Scores

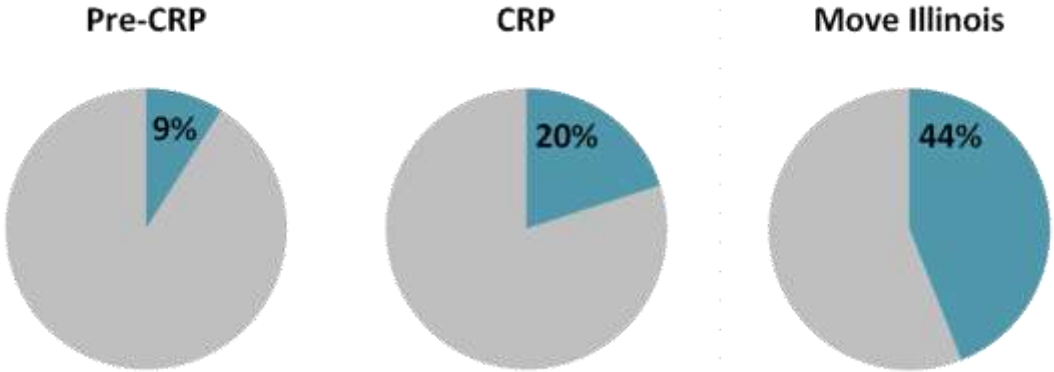


Operations and Maintenance Scores



Project Development Scores

Capital Program	Number of Projects Scored	Avg. % Total Points Achieved per Project
Pre-CRP	1	9%
CRP	21	20%
Move Illinois	15	44%



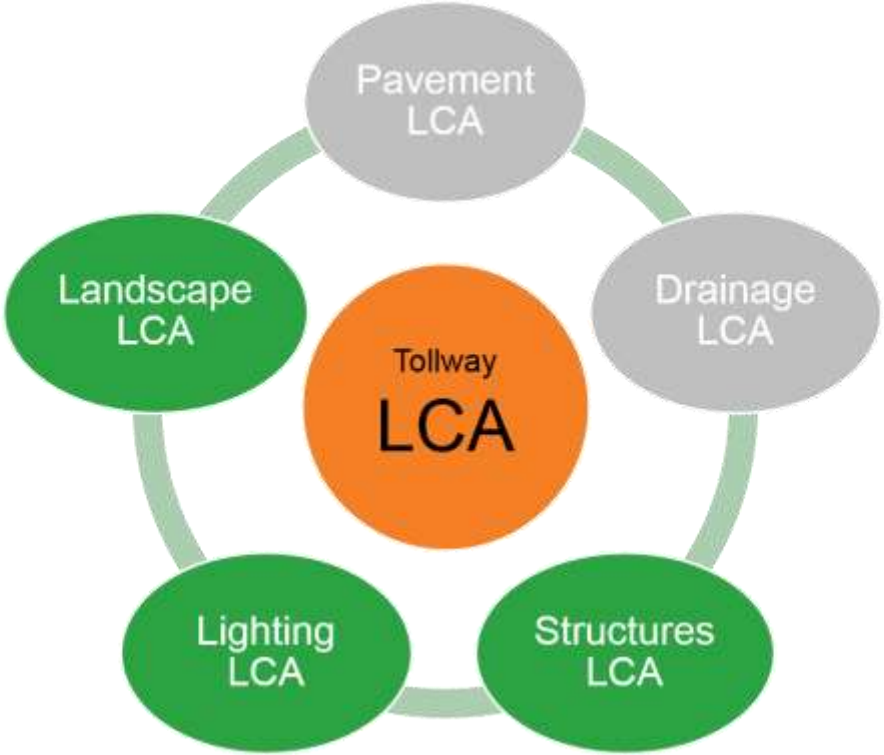
LCA is next step

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



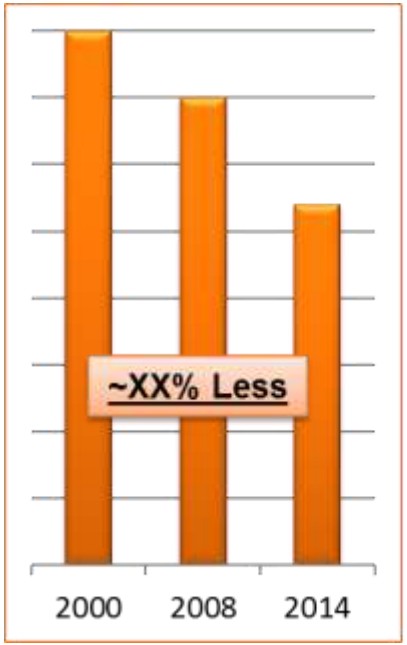
Soon we will be showing environmental improvements

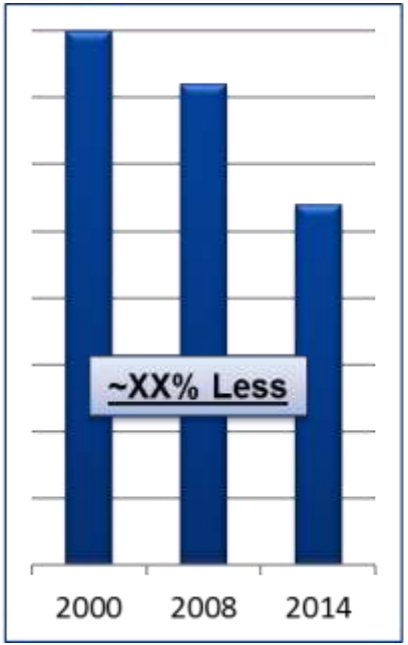
2000 Mixes
- No recycle content
- SBS-modified binder

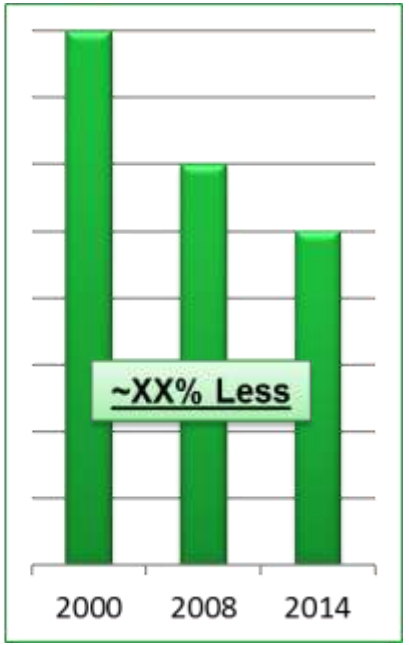
2008 Mixes (as constructed)
- SMA surface and binder for mainline
- ABR content ranging from 15 to 47 percent
- GTR binder

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

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