Update

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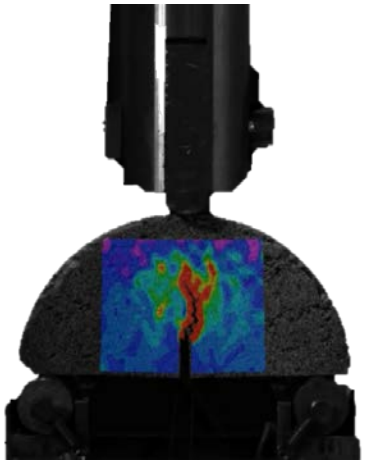
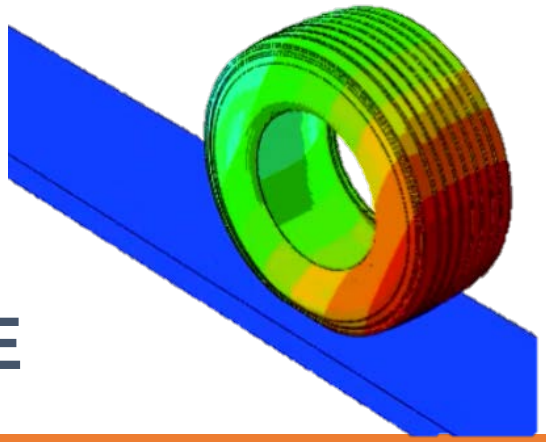
ICT Impact in Recent Years

- Research focus on **Sustainability, Performance, Social and Cost Efficiency**
  - Return to sponsors and economic impact
- **Innovation:** regional, national and international recognition
  - **Website** – 835,000 hits monthly
- **Inclusive** of universities, industry, and other agencies
- **Training:** offer courses, seminars, and conferences
- Proactive response to **IDOT requests**

RESEARCH

- Transportation Infrastructure Health Monitoring
- Advanced Laboratory and Full-Scale Accelerated Testing
- Hazardous Mitigation and Risk Assessment
- Advanced Pavement/ Bridge Modeling and Technologies
- Transportation Geotechnics & NDE



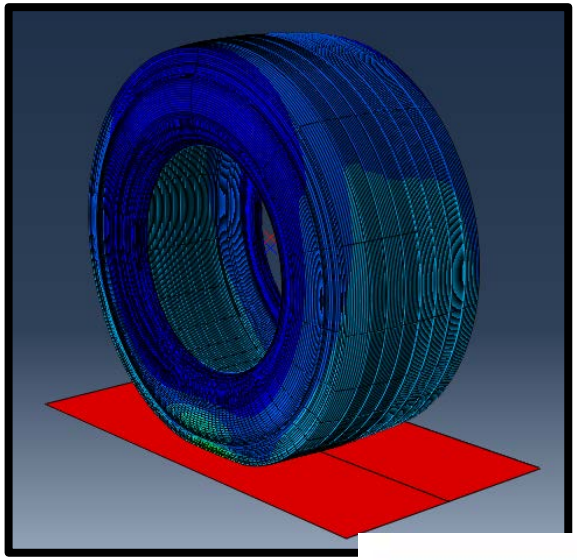


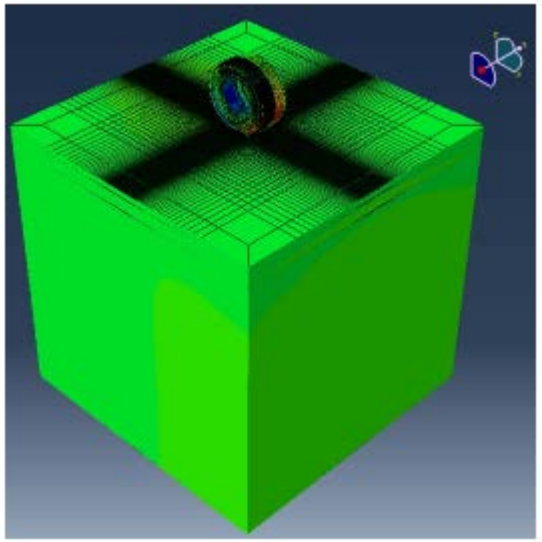
RESEARCH

- Autonomous and Connected Vehicles
- Innovative and Safe Multimodal Transportation
- Freight Optimization and Economics
- Sustainability

Impact of Wife-Base Tires on Pavement Damage

- Quantify the impact of WBT on pavement damage using theoretical modeling and full-scale testing
- Numerical tire model to generate 3D non-uniform contact stresses
- Effect of rolling conditions at various loads, tire pressures, and speeds
- Tire-Pavement Interaction: contact stresses and rolling resistance





Wide-Base Tool

ICT_Wide 1.03

ILLINOIS

ICT-Wide Tool

University of Illinois Wide-base tire effect on pavements
Artificial Neural Networks tool
Version 1.03

ILLINOIS CENTER FOR TRANSPORTATION

Damage Calculation

Load Information

Tire Type

Wide-Base (445/50 R22.5) Dual Tire (275/80 R22.5)

Half Axle Load	24.5	kN
Differential Tire Pressure?	No	
Tire Pressure	552	kPa

Pavement Structure

Select Road Class: Interstate / Low Volume Road

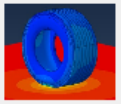
Select Input Level: -- Level

Thickness :

Wearing Surface	25	Select Level
Intermediate	37.5	Select Level
Binder	62.5	Select Level
Base Granular	150	Modulus = [140~415 MPa] 140
Subgrade		MR (MPa) = 70

Units
Thickness : mm
Material Properties : MPa

Response Prediction



Damage Calculation

Damage

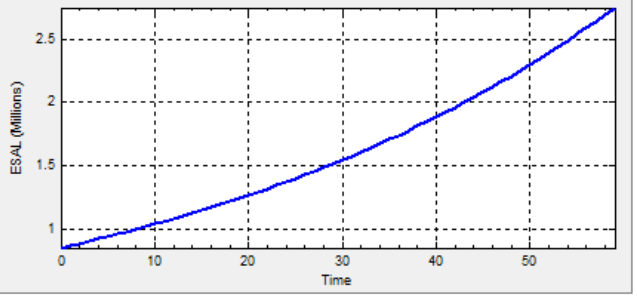
General Information
Analysis period (years): 60

Wide-base Tire
Market penetration (%): 10
Percent of axles with wide-base tire (%): 50

Traffic Information

Directional AADT	40000
Growth rate (%)	2
Truck percent (%)	20
Truck factor	0.65
Lane distribution factor	0.45

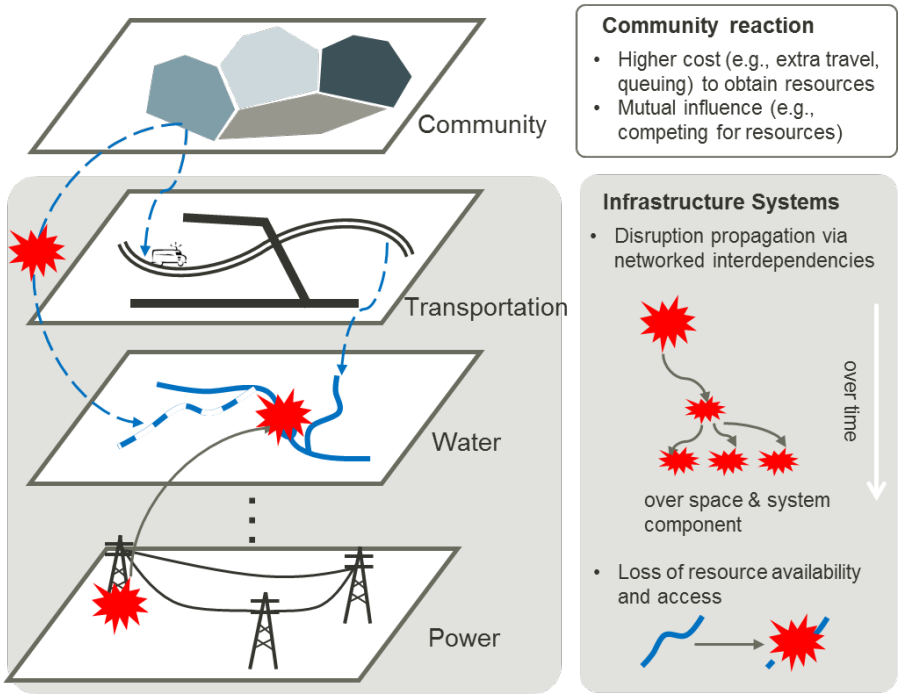
ESAL Calculator



Help
Calculate Damage
Cancel

Research Impact – Resiliency

Resilient Urban Infrastructures and Communities against Disasters and Cascading Disruptions

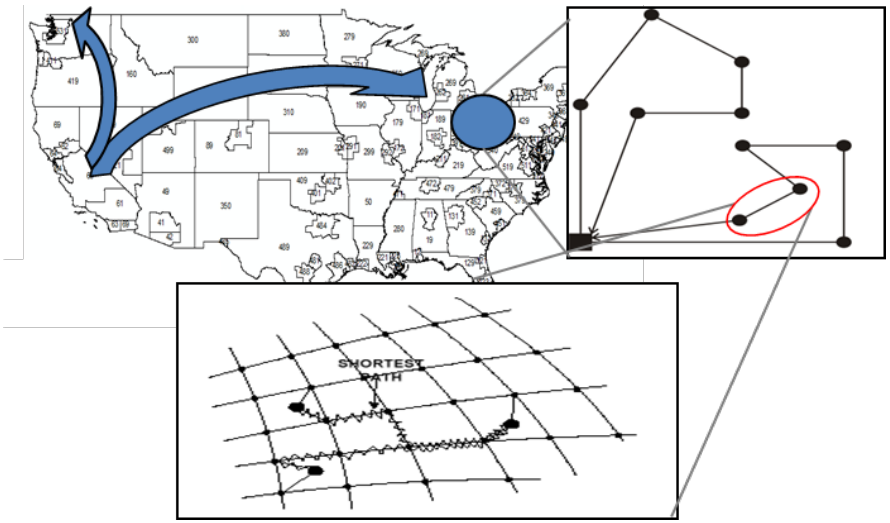


Impact:

Strategies for protection, recovery, restoration, and rebuilding of critical urban infrastructures, taking into account vulnerability and resiliency of infrastructures and communities to disasters and cascading disruptions

Research Impact – Emissions

Air Quality and Climate Impacts from Freight Transportation on Various Temporal-Spatial Scales

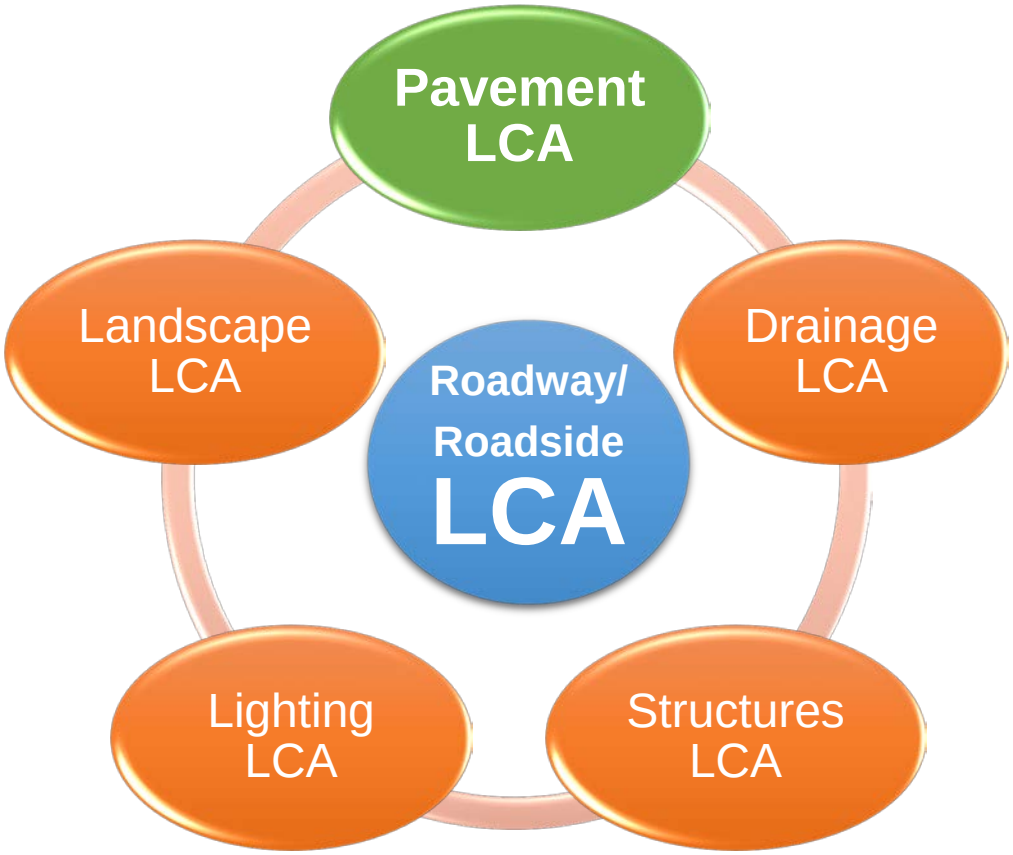


Impact:

Effects of global, national, regional and local freight transportation, as interrelated to future economic growth and urban spatial structure changes, on emissions and climate change

Illinois Tollway LCA

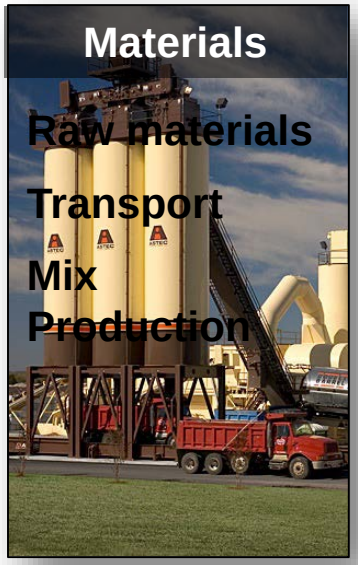
Development of a complete roadway/ roadside LCA tool



Goal &Scope Definition

Goal and Scope

Fuel | Electricity | Resources



Emissions to air | Emissions to water | Emissions to soil

Inventory Analysis

Ex. Hot-Mix-Asphalt Plant

Raw Materials

Greenhouse Gases (CO_2, CH_4, N_2O)

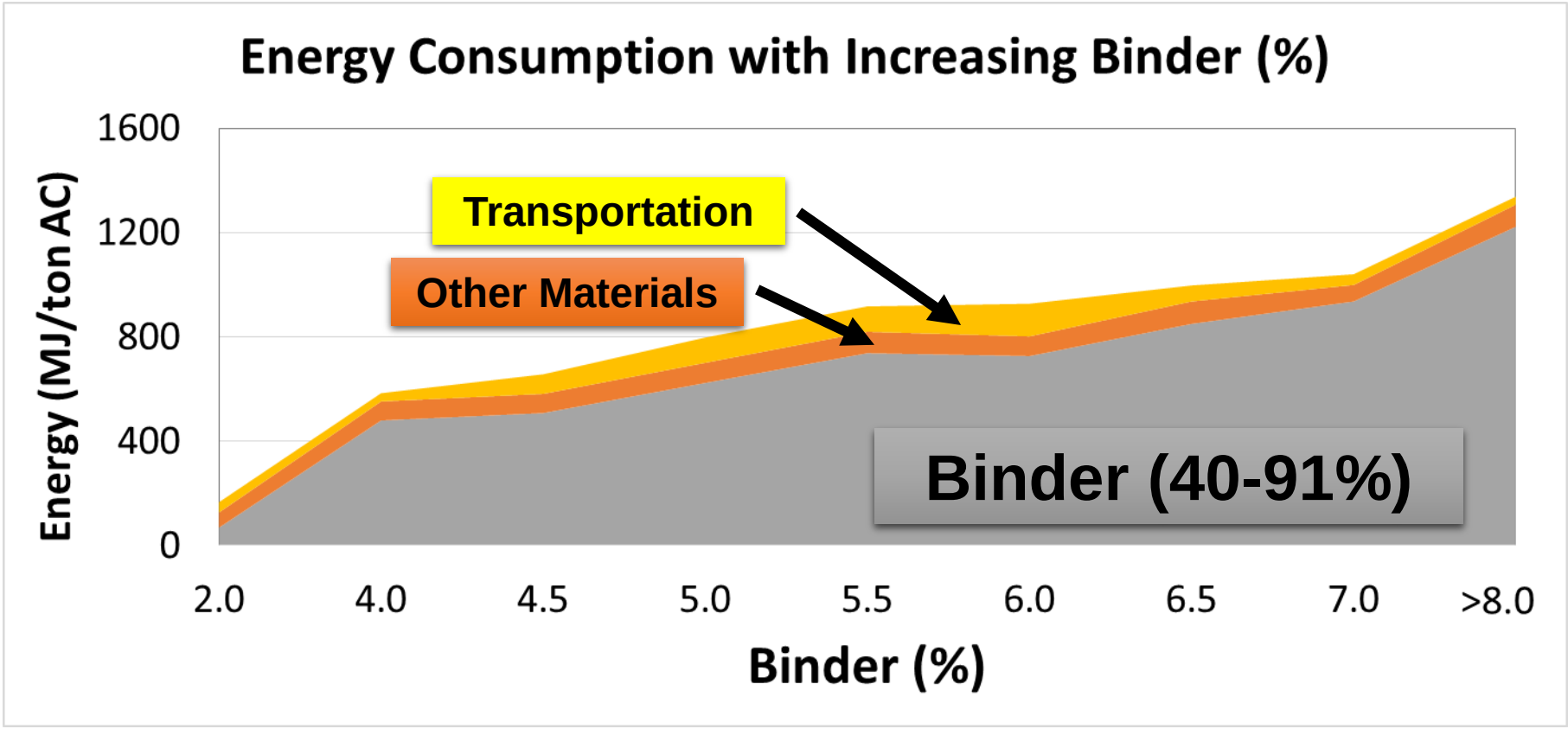
Air Pollutants (PMs, NO_x)

Fuel Production & Transport

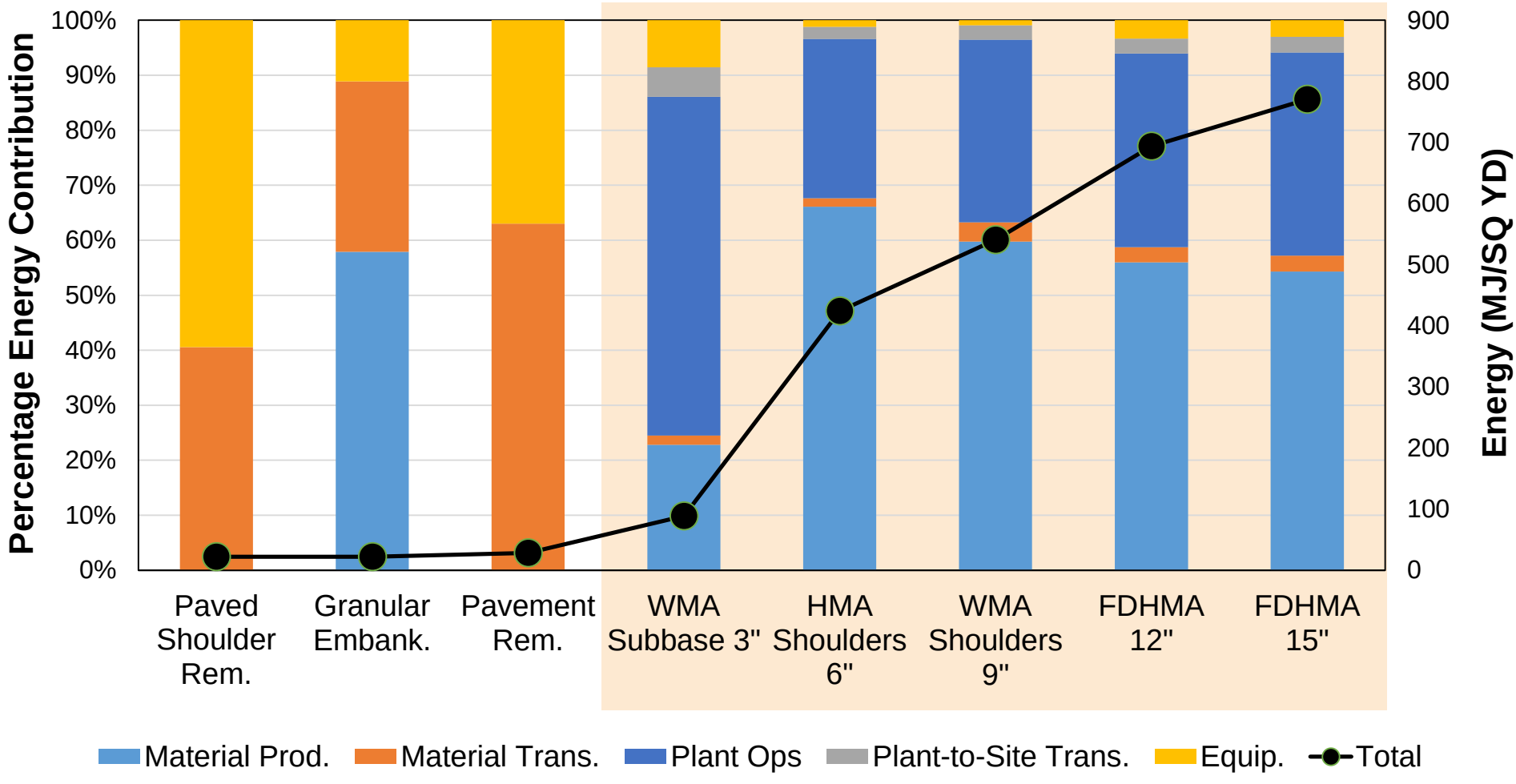
Electricity Generation & Transmission

Contribution of Asphalt Binder

- While only 5-7% of the mix by weight, binder's environmental impact is the highest



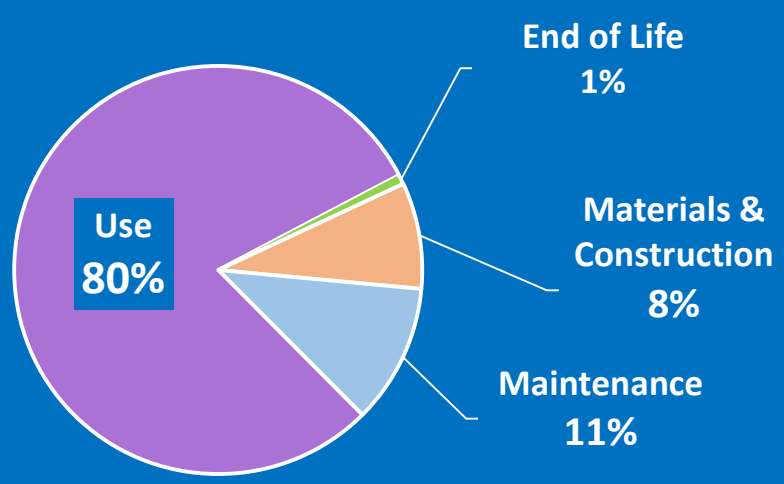
Contri[redacted] Total [redacted]y Items



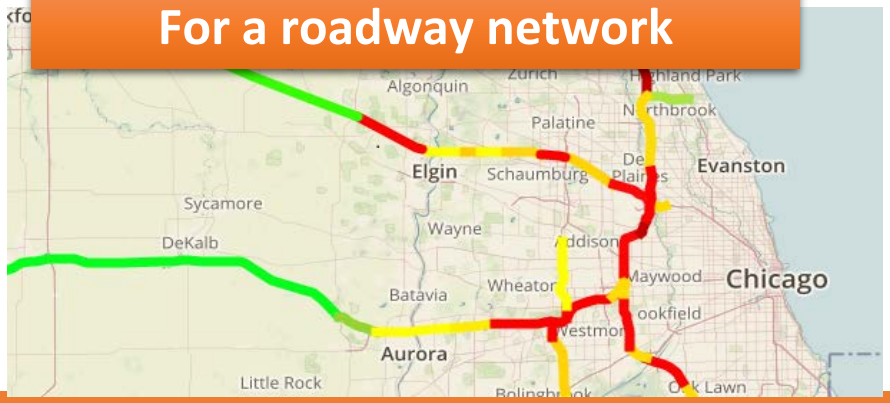
LCA Environmental Impacts

For a single project

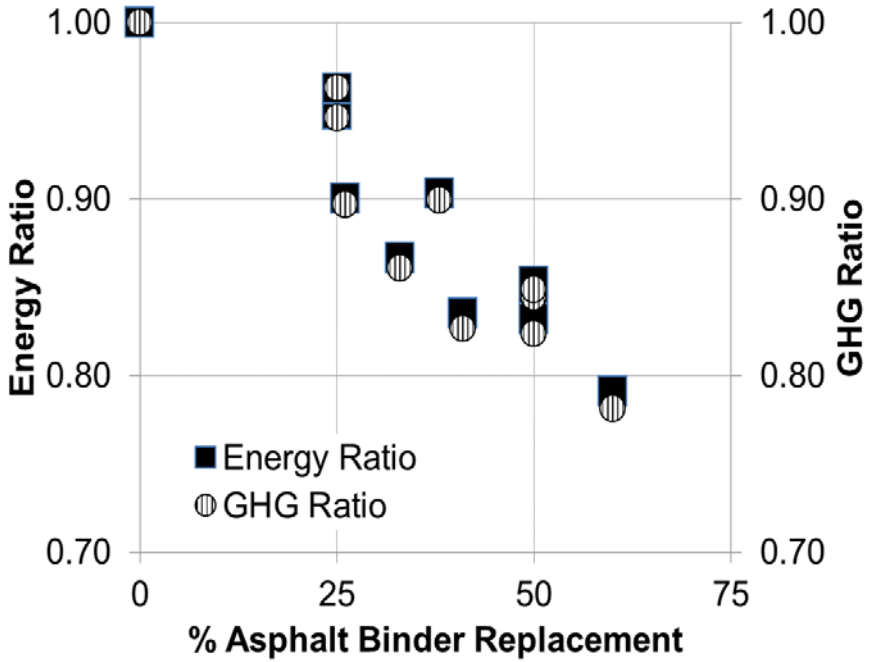
Typical Energy Consumption



For a roadway network



Using more recycled materials



Calculation of Results

- Summing impacts over pay items

$$E^{proj} = \sum_{p=1}^{P} \left[X_p \times (1 + waste_p) \times (E_p^{mat} + E_p^{Tmat} + E_p^{equip} + E_p^{Tequip} + E_p^{oper} \right] + E^{use}$$

Environmental impacts, E, of project

For each pay item, p, in the set of pay items, P

Quantity, X, for pay item, p

Waste for pay item, p

Environmental impacts from material acquisition and production

Environmental impacts from material transportation

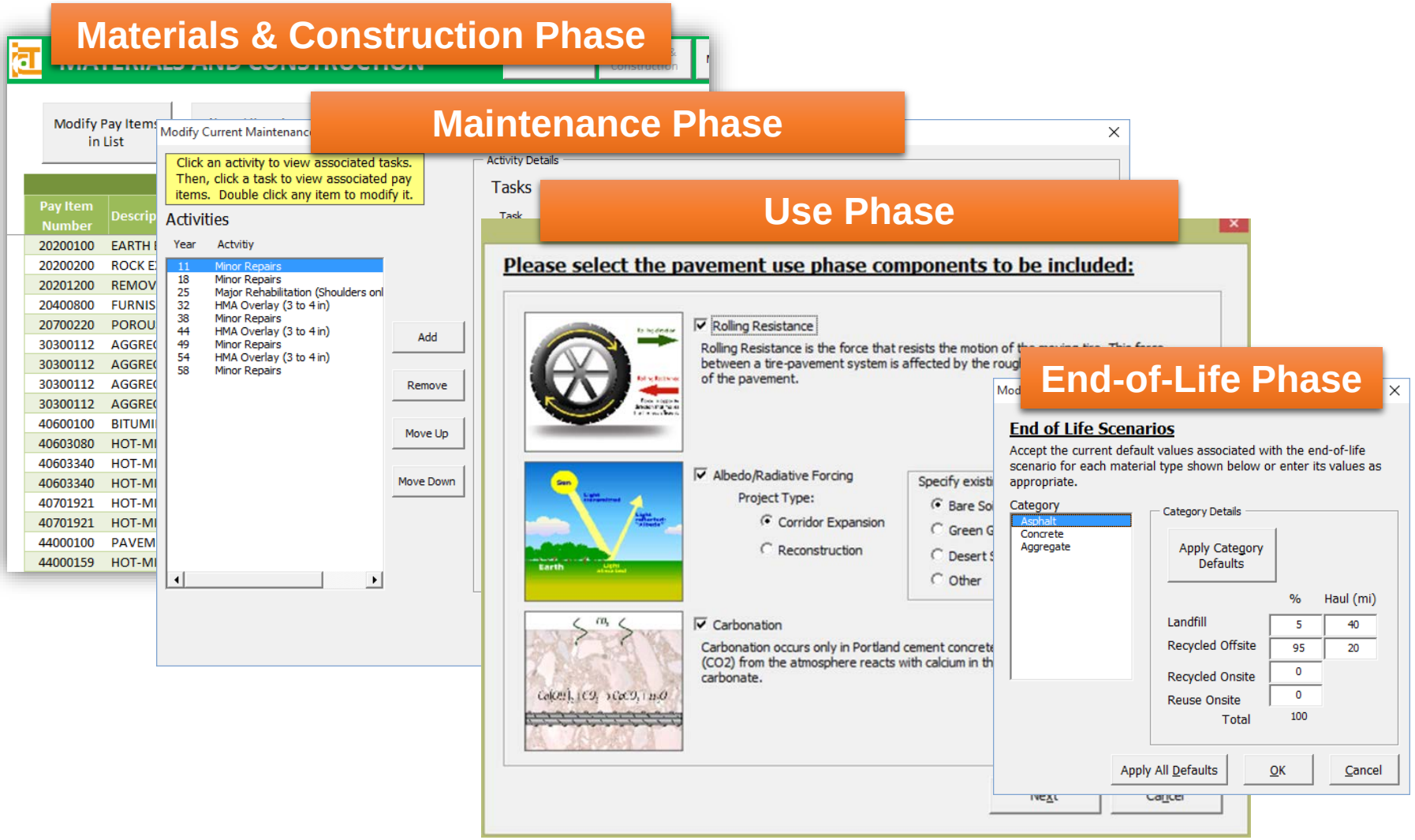
Environmental impacts from equipment use

Environmental impacts from equipment transportation

Environmental impacts from operations

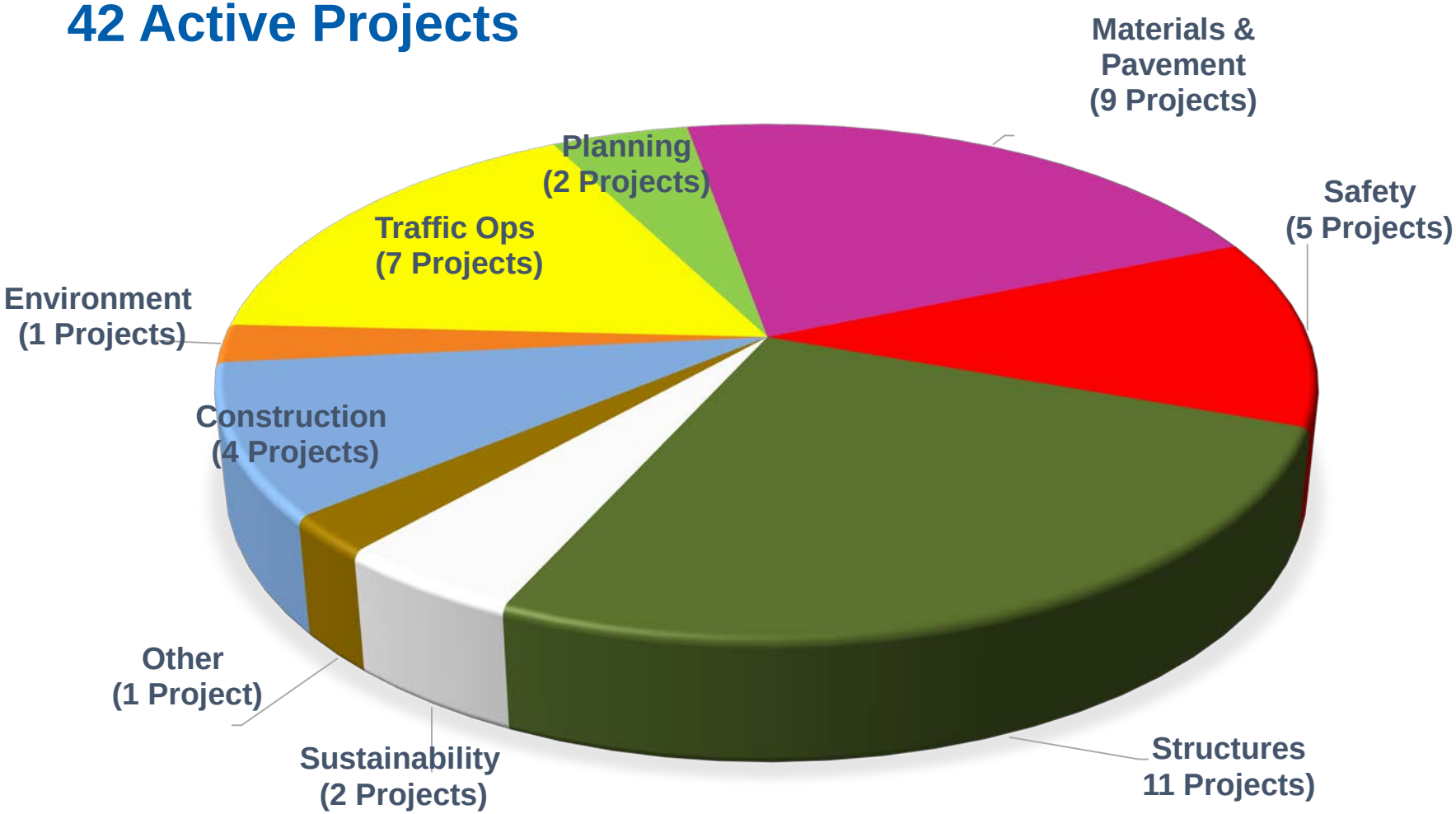
Environmental impacts from use

LCA Phases


Materials & Construction Phase
Maintenance Phase
Use Phase
End-of-Life Phase
Modify Pay Items in List
Pay Item Number
Descrip
20200100 EARTH
20200200 ROCK E
20201200 REMOV
20400800 FURNIS
20700220 POROU
30300112 AGGREC
30300112 AGGREC
30300112 AGGREC
30300112 AGGREC
40600100 BITUMI
40603080 HOT-MI
40603340 HOT-MI
40603340 HOT-MI
40701921 HOT-MI
40701921 HOT-MI
44000100 PAVEM
44000159 HOT-MI
Modify Current Maintenanc
Click an activity to view associated tasks. Then, click a task to view associated pay items. Double click any item to modify it.
Activities
Year Actvitiy
11 Minor Repairs
18 Minor Repairs
25 Major Rehabilitation (Shoulders onl
32 HMA Overlay (3 to 4 in)
38 Minor Repairs
44 HMA Overlay (3 to 4 in)
49 Minor Repairs
54 HMA Overlay (3 to 4 in)
58 Minor Repairs
Add
Remove
Move Up
Move Down
Activity Details
Tasks
Please select the pavement use phase components to be included:
Rolling Resistance
Rolling Resistance is the force that resists the motion of
between a tire-pavement system is affected by the roug
of the pavement.
Albedo/Radiative Forcing
Project Type:
Corridor Expansion
Reconstruction
Specify existi
Bare So
Green G
Desert S
Other
Carbonation
Carbonation occurs only in Portland cement concrete
(CO2) from the atmosphere reacts with calcium in th
carbonate.
End of Life Scenarios
Accept the current default values associated with the end-of-life scenario for each material type shown below or enter its values as appropriate.
Category
Asphalt
Concrete
Aggregate
Category Details
Apply Category Defaults
% Haul (mi)
Landfill 5 40
Recycled Offsite 95 20
Recycled Onsite 0
Reuse Onsite 0
Total 100
Apply All Defaults
OK
Cancel

Active Projects by TAG

42 Active Projects



Research Impact - Environment

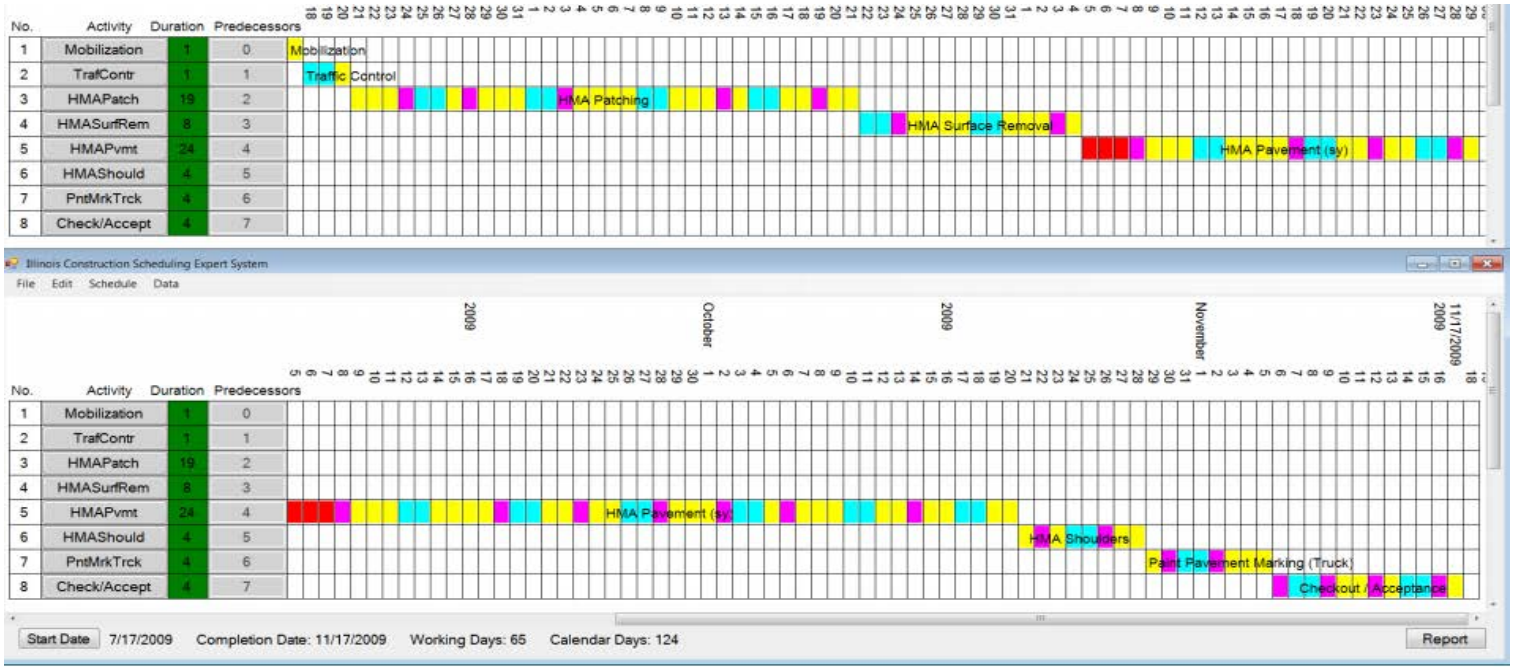
Installation & Performance Testing of Ditch Checks & Inlet Protection Structures

Benefits:

- Construction savings
  - Potential less labor and material
- Sediment reduction from sites

Research Impact - Construction

Enhancements to the Highway Construction Expert System – Phase II



Major Outcome:

An enhanced expert system tool ICSES (Illinois Construction Scheduling Expert System)

Research Impact – Operations

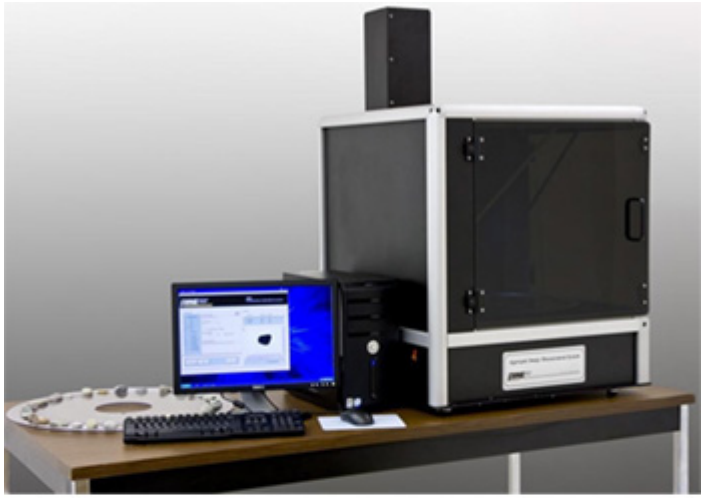
Development of Chloride Reduction Training

Benefits:

- 3,500 maintenance workers benefit from training
- Program shared with other states departments
- Available for local public agencies
- Reduce chlorides that go into environment/ waterways

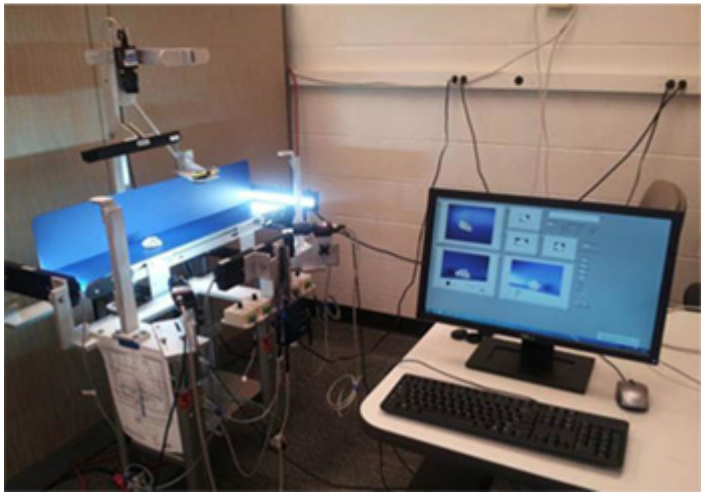
Research Impact – Pavements/ Materials

Implementation of AIMS in Measuring Aggregate Resistance to Polishing, Abrasion, and Breakage



Major Outcome:

Development of experimental procedure to evaluate aggregate friction properties



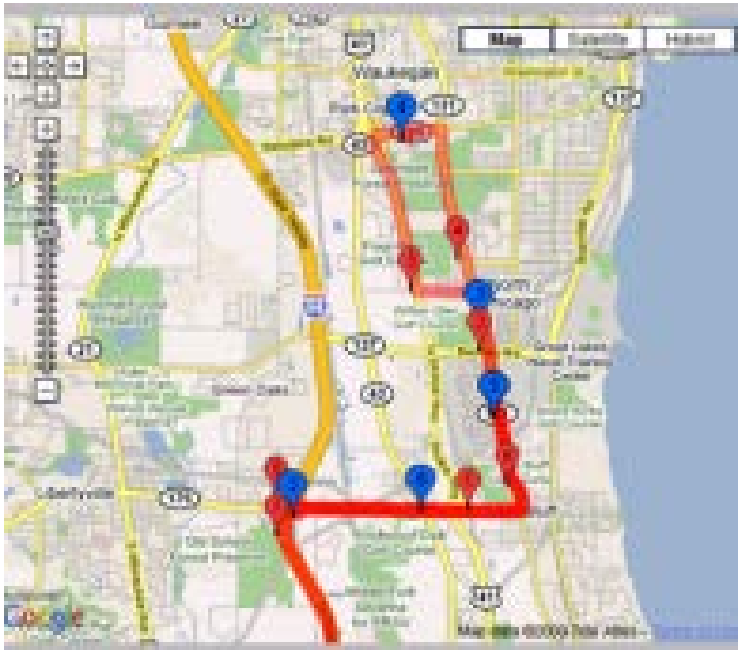
Research Impact - Planning

Revised Condition Rating Survey Models to Reflect All Distresses

- **Benefits:**
  - Meet long term planning goals
  - Allocate funds efficiently
  - Maintain overall good road conditions

Research Impact – Public & Intermodal Transportation

Modeling Seniors Activity – Travel Data



Major Outcomes:

- Improved understanding of senior travel activities
- Resulted in more efficient transportation services for seniors

Research Impact - Safety

Improving the Effectiveness of Smart Work Zone Technologies

Impact:

Improve effectiveness of smart work zone applications including queue detection, travel time estimation, and speed estimation

Research Impact – Structures

Calibration and Refinement of Illinois Earthquake Resisting System Bridge Design Methodology

Impact:

Better understanding of Bridge Bearing Seismic Performance and of Bridge System Behavior in Earthquakes

Research Project Participants

Conferences & Training

- 2016 Bituminous Conference

- Erosion Control Training
- 365 participants in 2015

- Documentation Training
- 883 participants in 2015

IDOT-ICT Partnership in a Decade

- **208 Total Projects Approved to Date**
  - *178 Regular Projects*
  - *30 Special Projects*
- **166 Projects Completed**
  - *137 Regular Projects*
  - *29 Special Projects*
- **42 Active ICT Projects**
  - *41 Regular Projects*
  - *1 Special Projects*
- **184 FHWA/IDOT Reports Published**
- **135 Researchers Contributing**
- **365 Graduate Students Supported**
- **26 Universities Participating**

Project Spotlight

Testing Protocols to Ensure Performance of High Asphalt Binder Replacement Mixes Using RAP & RAS

Major Outcome:

Allow IDOT to develop a single cracking performance specification, named the Illinois Flexibility Index Test (I-FIT)

The latest version of the IL-SCB device.