Resilience and Addressing Climate Change – Airport Pavements

Presented to: REDAC
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Sustain Our Future
We will advance aviation in an environmentally responsible and energy efficient manner. We will minimize noise and emission impacts on communities, reduce aviation’s carbon footprint, invest in new technology, foster sustainable alternative fuels research, and advance other innovations that promote environmentally friendly solutions.
RESILIENCE AND ADDRESSING CLIMATE CHANGE – AIRPORT PAVEMENTS

Strategies
1. Improve scientific knowledge of environmental impacts.
2. Develop effective decision support tools.
3. Foster research and development.
4. Develop sustainable airport facilities.
RESILIENCE AND ADDRESSING CLIMATE CHANGE
– AIRPORT PAVEMENTS

Full-Scale APT

1. Generate performance data for recycled/sustainable materials under aircraft loading.

ADVANCED CHARACTERIZATION OF PAVING MATERIALS

Research continues to evaluate new asphalt material technologies for use on airport pavements. Currently evaluating Warm Mix Asphalt - reduces production fuel costs (by about 20 percent), increases the hauling distance, lengthens the paving season, is environmentally friendly, and ensures safer working conditions.

**Test Cycle-1 Completed**

- Compare WMA performance with P401 HMA performance (rutting);
  - Comparable Performance in rutting.
  - Cracking performance need to be evaluated (TC2)
- Effect of polymer modified binder (PMA) on pavement rutting;
  - Improves rutting performance significantly.
- Effect of temperature on pavement rutting.
  - Rutting performance of HMA/WMA is more sensitive to temperature than tire pressure.
ADVANCED CHARACTERIZATION OF PAVING MATERIALS

Research continues to evaluate new asphalt material technologies for use on airport pavements. Currently evaluating WMA & RAP - reduces production fuel costs, increases the hauling distance, lengthen the paving season, is environmental friendly, and ensures safer working conditions.

Test Cycle-2 in progress
Evaluate different WMA technologies (chemical, organic, hybrid)

• Compare WMA performance with P401 HMA performance (rutting);
• Compare WMA performance with P401 HMA performance (fatigue);
• Compare performance (rutting & fatigue) of different WMA additives;
• Evaluate performance of RAP+WMA
ADVANCED CHARACTERIZATION OF PAVING MATERIALS

Quantified benefits of using Polymer Modified Binders – improves pavement life, reduce downtime at our nation’s airports for pavement construction and maintenance activities.
ADVANCED CHARACTERIZATION OF PAVING MATERIALS

Developing advanced pavement analysis tool PANDA-AP to use material characterization properties – improved pavement life prediction, compare predicted life of “green materials” with “conventional materials” before being placed on airport, and more efficient pavement designs.

Compare performance of “green materials” and conventional materials:
- In laboratory – use lab test results and PANDA-AP analysis to predict pavement performance.
- Verify performance under accelerated pavement tests (APT) at NAPMRC & NAPTF.
- A comparable performance will lead to a more wider use of “green materials” and lower carbon footprint.
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Life Cycle Assessment (LCA):

1. Efforts to address sustainability are incomplete if environmental impacts due to airfield infrastructure are not considered.

2. Life-cycle assessment (LCA) - identify and quantify the life-cycle environmental impacts of a system such as the airfield infrastructure. Currently, FAA decisions regarding airfield infrastructure do not require using the LCA approach for evaluating airfield infrastructure.

3. Objective - to develop an LCA framework that will support the FAA and airports’ capacity and capability to consider environmental impacts in decision-making.
4. An airfield LCA framework and guidelines have been developed. The guidelines include recommendations for all phases of LCA, including goal and scope definition, life-cycle inventory development, impact assessment, interpretation, critical review, and reporting.

5. The LCA framework - support decisions regarding the life cycles of air-side features found inside the fence line of an airfield, including airside pavements (such as runways, overruns, taxiways, aprons, shoulders, and airside land vehicle roads), drainage, airfield lighting and other lighting and navigational aids, exterior fencing, and maintenance of airside grounds. Landside and airside features related to aircraft servicing and fueling, fire suppression systems, wash racks and other cleaning equipment, gate operations, and all buildings have not been included in the study’s scope.
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– AIRPORT PAVEMENTS

Life Cycle Assessment (LCA):

6. Currently working with UC Davis (PI – Dr. John Harvey) on developing a web-based LCA tool for use by airports. This is going to be a joint project in partnership with Federal Highway Administration (FHWA).
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FAA Report

Life-Cycle Assessment of Airfield Pavements and Other Airside Features: Framework, Guidelines, and Case Studies

February 2019

Final Report

This document is available to the U.S. public through the National Technical Information Services (NTIS), Springfield, Virginia 22161.

This document is also available from the Federal Aviation Administration William J. Hughes Technical Center at actlibrary.tc.faa.gov.

U.S. Department of Transportation
Federal Aviation Administration

ACRP Student Grant

An Iterative Framework for Performance and Environmental Impacts of Airfields

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The Federal LCA Commons  
Collaboration between Federal Agencies to advance LCA

Our Mission:

• Advance LCA data, research and information systems
• Improve modeling methods consistency
• Enhance public access to Federal LCI data

https://www.lcacommons.gov/memorandum-understanding-0
Our Original Perspective

Deep LCA Modeling Expertise

LCA Commons
Community of Practice

Tools and Deployment

Knowledge Management

"The Public"
A New Specific User Has Emerged…

Deep LCA Modeling Expertise

Green Public Procurement

LCA Commons
Community of Practice

Tools and Deployment

Knowledge Management

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What are EPDs?

“Nutrition Labels for Products”

Or to be precise, **EPDs are a specific form of LCA result.**

*Is this a fair analogy?*
EPDs in Pavement LCA
Certain datasets go into everything, many different data sources

Legend
A1 - materials extraction and upstream production
A2 - transport to production facility
A3 - manufacturing
A4 - transport to the site
A5 - construction
B - Use
C - End of life

Transportation agencies & contractors
- Pavement construction
- Maintenance
- End of life
- Recycled materials
- Materials
- Energy

Material manufacturers
- Asphalt mixture EPD
- Aggregate production
- Energy
- Asphalt binder production
- Energy
- Admixtures production
- Admixtures
- Raw materials
- Wastes, emissions
- Asphalt mixture
- Asphalt binder
- Energy
- Aggregate EPD
- Asphalt binder EPD
- Wastes, emissions
- Energy

EPDs in Pavement LCA
Certain datasets go into everything, many different data sources
OST’S EMBODIED CARBON WORKING GROUP


2. The Working Group is tasked with developing an action memo to the Secretary on embodied carbon. Provide content and recommendations for a memo that will be submitted to S1.

3. First meeting on 6/22/2021.

4. Draft memo - Andrew Wishnia, Deputy Assistant Secretary for Climate Policy, DOT
POST-CONSUMER PLASTICS IN PAVEMENTS

• SBIR Project funded by FHWA.


• ATRD participating in the proposal/project evaluation panel.
• OST Project - Recycle Plastic Materials in Transportation and Other Infrastructure Networks Study
• ATRD assisted in writing statement of work in collaboration with FHWA.

• Excerpt from House Report 116-452

Recycled plastic materials in transportation.--The Committee provides $800,000 for the Secretary to enter into an agreement with the National Academies of Sciences, Engineering, and Medicine to conduct a study through the Transportation Research Board on the use of recycled plastic materials in transportation infrastructure. The study should (1) identify domestic and international examples of transportation infrastructure projects which have used recycled plastic materials and projects in which recycled plastic materials have been incorporated into or with other transportation infrastructure, (2) assess the effectiveness and utility of recycled plastic materials, (3) assess the extent to which recycled plastic materials are consistent with recognized specifications and standards for transportation infrastructure, (4) review relevant impacts of recycled plastic materials compared to non-waste plastic materials, (5) assess the health, safety, and environmental impacts of recycled plastic materials on humans and animals, (6) assess the ability of recycled plastic materials to withstand natural disasters and extreme weather events, and (7) assess the potential economic benefits of recycled plastic materials. The Committee directs the Secretary to submit to the House and Senate Committees on Appropriations a final study, with recommendations, developed by the National Academy of Sciences, Engineering, and Medicine no later than 2 years after enactment of this Act.
OTHER IDEA’S TO CONSIDER

1. Use of crushed recycled asphalt pavement (RAP) or crushed PCC as subbase.
   • Large quantities can be used.
   • Fines are coated with asphalt and are insensitive to moisture changes.
   • No durability issues (protected by base and surface layers).
   • Performance can be evaluated at NAPTF.

2. Airfield Pavement Assessment and Aircraft Operation Decision System for Durations of Excessive Moisture *(based on a presentation at ISAP event)*
   • Develop a user-friendly decision toolkit that would help transportation agencies to decide on post-flooding runway opening decisions by mechanistically assessing the pavement capacity on basis of pavement section characteristics, material properties, climatic conditions (past and forecasted), and traffic scenarios.
   • Decision support system for airfield pavements would consider different types of aircraft and loading scenarios (apron areas, taxiways, runways as well as departure and arrival loading conditions), have capability for both post-flooding evaluation to make decisions to resume airfield operations as well as ability to use forecasted climate conditions to make operational plans, be able to utilize existing FAA tools (such as, FAARFIELD) for mechanistic evaluations, and a user-friendly interface for use by airport managers.