



REDEFINING VALUE SUSTAINABILITY AND RESILIENCE

ILLINOIS BITUMINOUS CONFERENCE

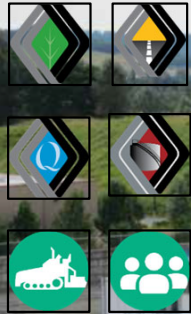
DECEMBER 8-9, 2020

JOSEPH SHACAT, DIRECTOR OF SUSTAINABLE PAVEMENTS



NATIONAL ASPHALT
PAVEMENT ASSOCIATION

NAPA Overview



Mix Producers



Paving Contractors, Equipment Producers, & Suppliers

1,100 Member Companies



Research & Engineering
Education & Member Services



Federal Advocacy

- Highway & Airport Investment
- EH&S Regulatory Issues



**Let's start with
Sustainability**

Sustainability is not a new concept

“He plants his trees to serve a race to come”

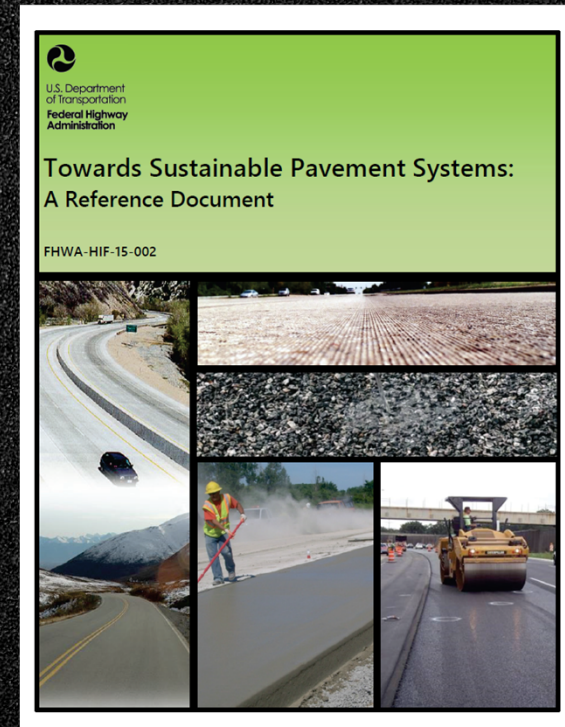
- Staius, *Comrades*, as reported by Cicero, 44 B.C.



What is a sustainable pavement? FHWA says...

Sustainable pavements should:

- Achieve the engineering goals for which they were constructed
- Preserve and (ideally) restore surrounding ecosystems
- Use financial, human, and environmental resources economically
- Meet human needs such as health, safety, equity, employment, comfort, and happiness



Triple Bottom Line of Sustainability

As applied to pavements:

Economic

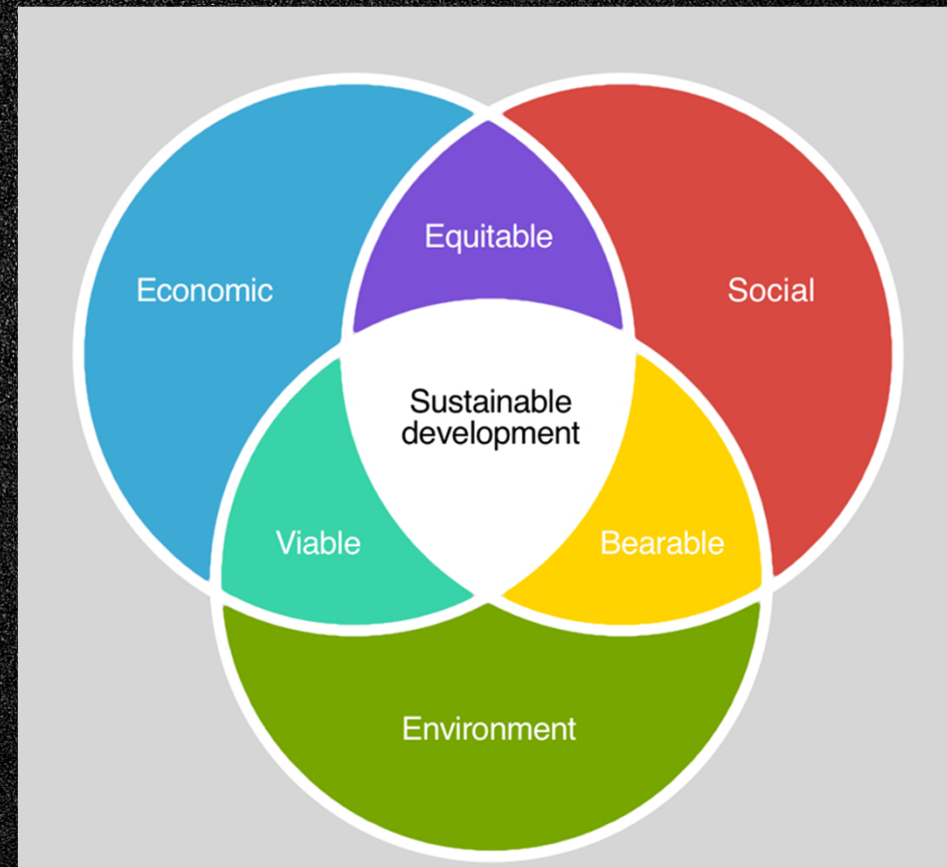
- Agency costs
- User costs

Social

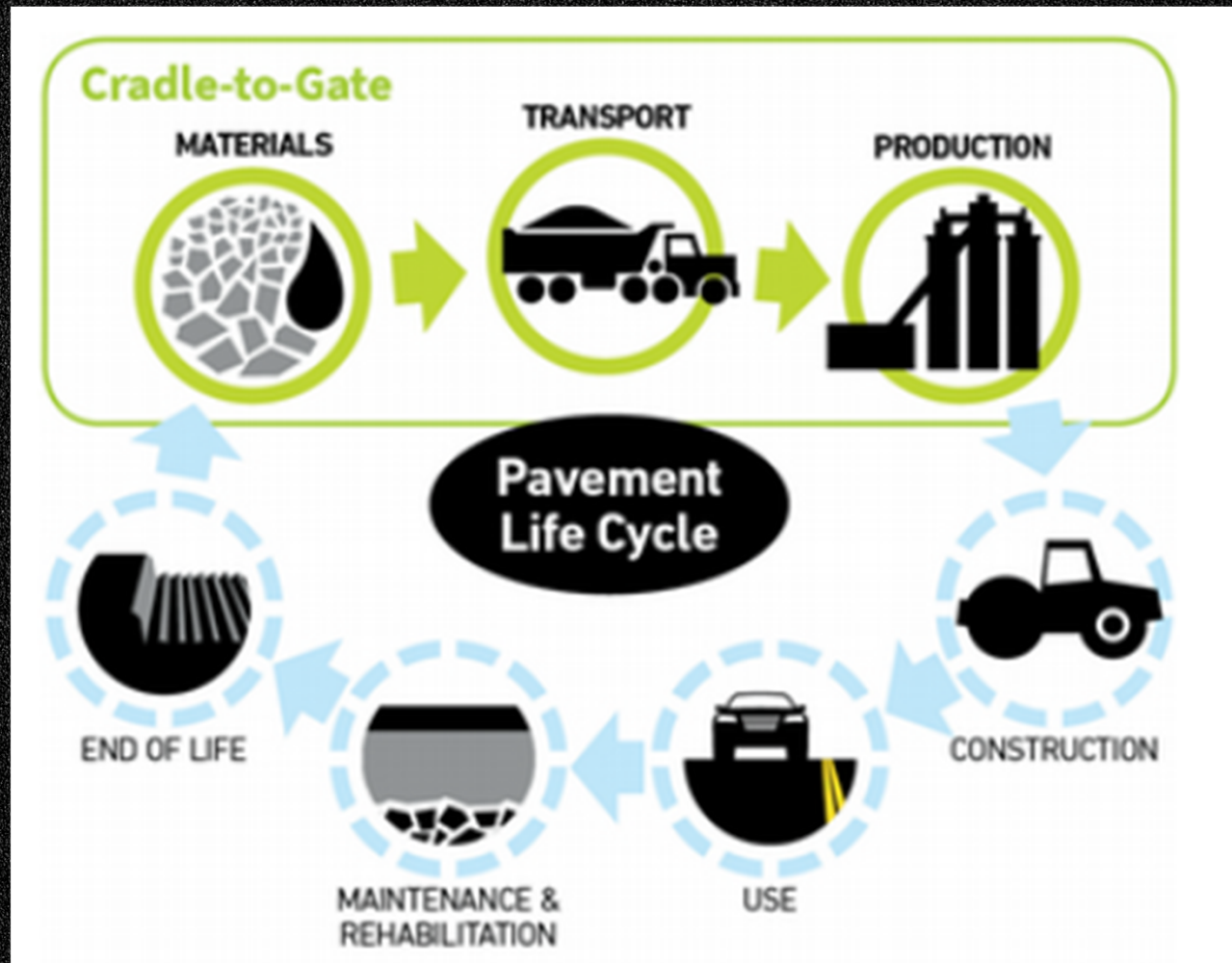
- Safety (skid resistance)
- Work force

Environmental

- Emissions
- Runoff
- Materials (Circularity)



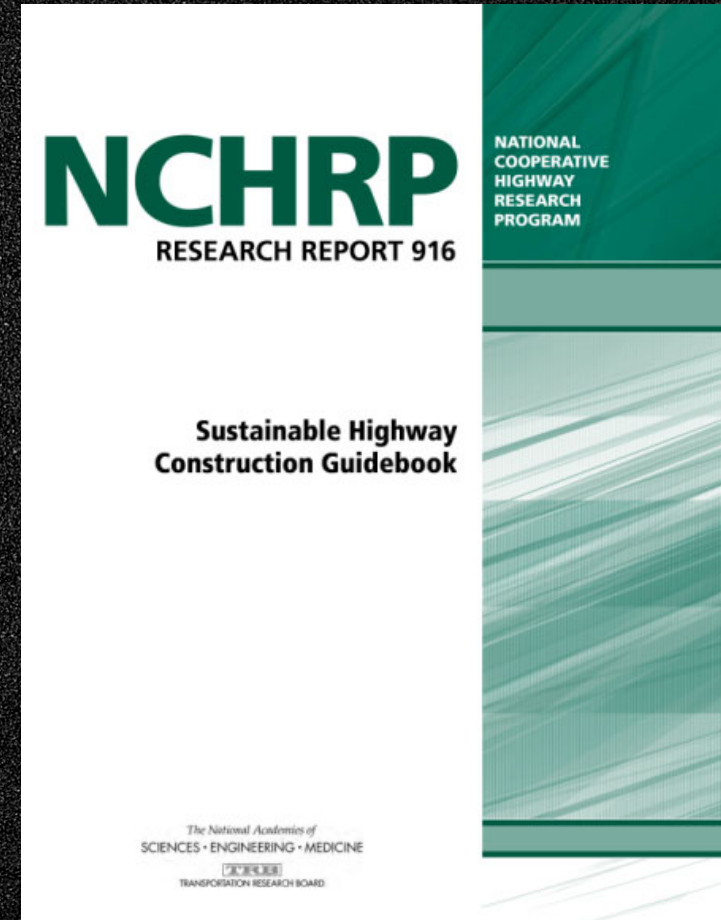
Pavement Life Cycle



Sustainability Strategies for Pavements

Sustainable Construction Practices for Asphalt Pavements

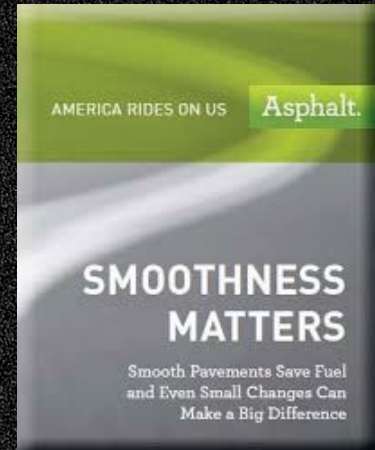
- Smoothness
- Quality/Long Life
- Recycled Materials (RAP)
- Density (WMA as compaction aid)
- Longitudinal Joints
- Eliminate Segregation
- Tack Coat Application



<https://www.nap.edu/catalog/25698/sustainable-highway-construction-guidebook>

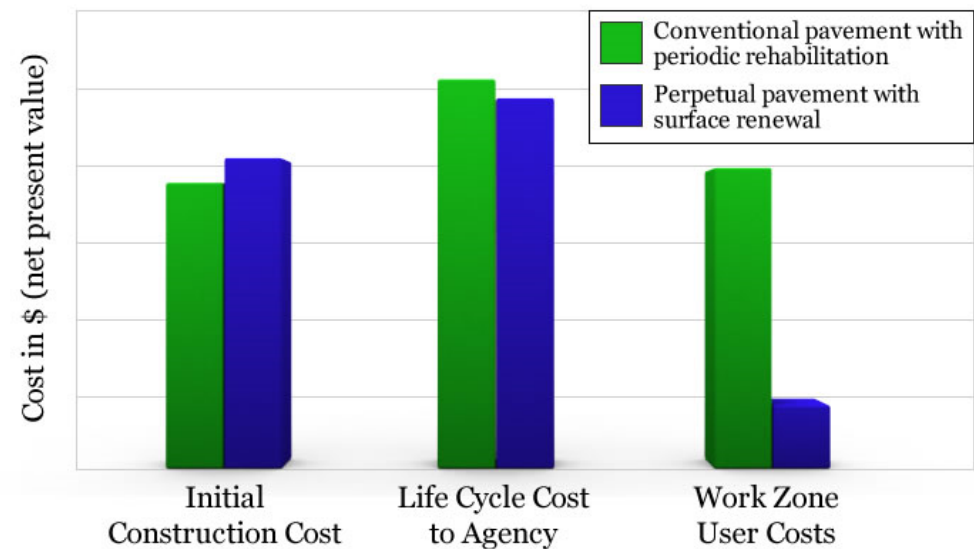
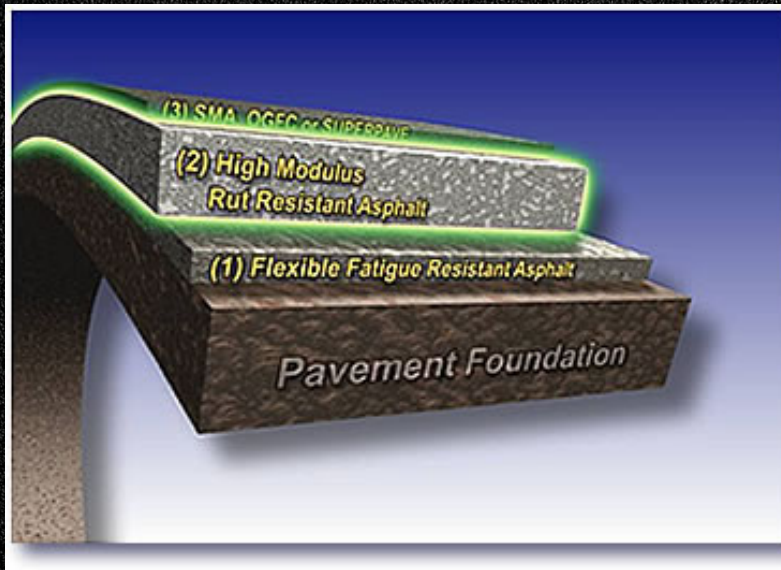
Pavement Smoothness

- Vehicle wear and tear
- Pavement wear and tear
- Fuel efficiency (Rolling Resistance)
- Noise
- Safety



Perpetual Pavements

- Designed to never experience structural rutting or cracking
- Higher initial cost typically offset by lower life cycle cost





Asphalt Pavement Industry Survey on Recycled Materials and Warm-Mix Asphalt Usage 2019

Information Series 138



10th Annual Survey



ASPHALT PAVEMENT
IS **RECYCLED** AT A RATE
GREATER THAN ANY
OTHER PRODUCT



Asphalt Mix & RAP Tonnage

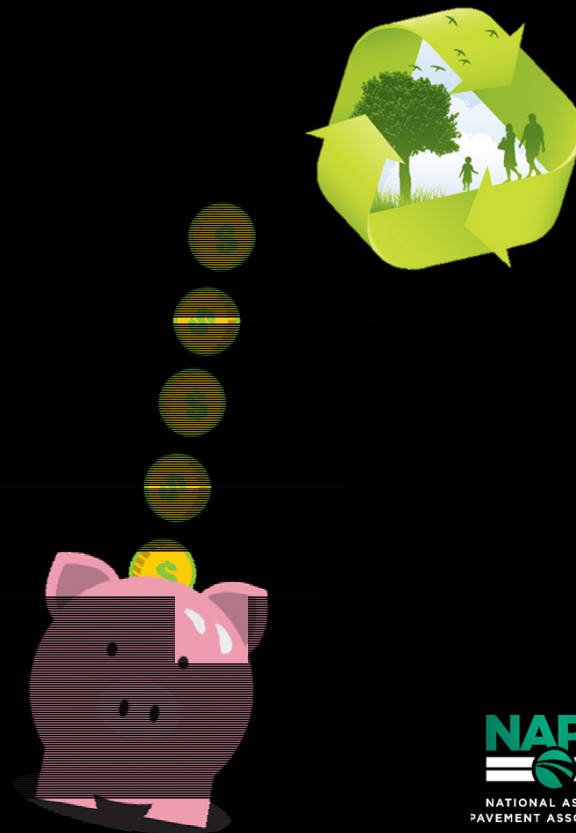
Sustainability



Impact of RAP Utilization

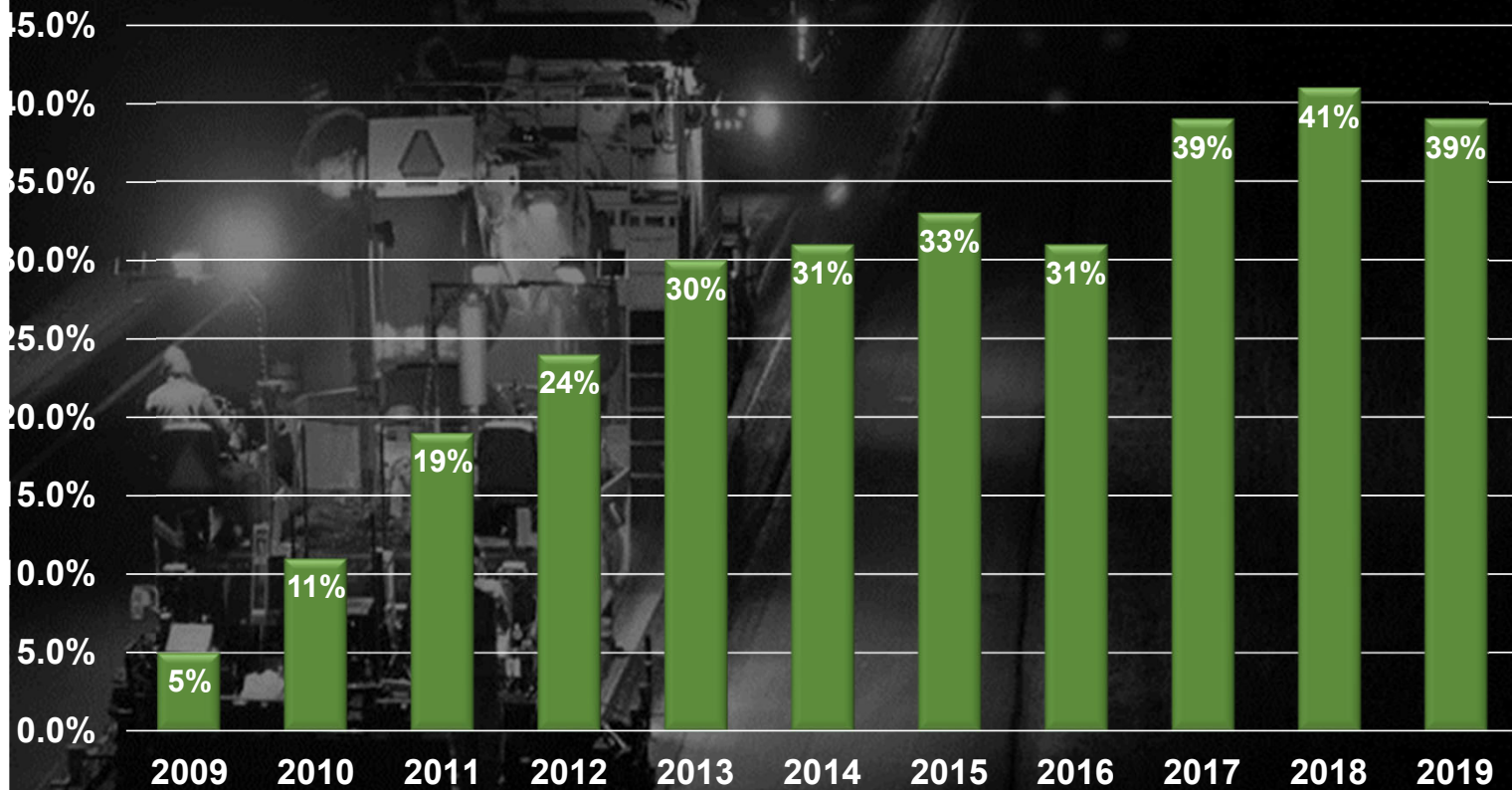
2019 Estimates

- 24 million barrels of liquid asphalt binder
- 84 million tons of aggregate
- 2.4 million tons reduction in GHG emissions (\approx 520,000 cars)
- **\$3.2 Billion in SAVINGS**



WMA Usage

Percentage of Total Asphalt Production in US



Current Survey

- FHWA continues to support the survey effort
- Recycle/WMA Survey
 - 2020 Construction Season Data
 - Survey will collect responses between 01/01/2021 and 04/01/2021
 - Available on SurveyMonkey @ <https://www.surveymonkey.com/r/RMWMASurvey2020>
 - 2020 report completed 4th quarter of 2021
- Report accuracy counts on strong industry support / participation

NAPA Sustainability Resources

Paving awards are given for quality, safety, community, and ecology/environment. Sustainability.

- Paving Awards

- Sheldon G. Hayes Award for Highest Quality in Construction
- Ray Brown Airport Pavement Award – Highest Quality
- Larry H. Lemon Quality in Construction Awards
- Quality in Construction Awards

- Operational Excellence Awards

- Asphalt Operations Safety Innovations
- Community Involvement Award
- Ecological Award → Environmental Excellence Award

Diamond Commendations are given for above-and-beyond efforts. Sustainability.



Diamond Achievement Commendation



Diamond Sustainable Commendation



Diamond Terminal Commendation



Diamond Paving Commendation



Diamond Quality Commendation

Emerald Eco-Label – NAPA’s Tool for Environmental Product Declarations (EPDs)

- Evaluate environmental impacts of **plant operations** and **supply chains**
- Quantify **improvement** of your products’ environmental impacts over time
- Create new **marketing opportunities**
- Help customers earn credit under LEED v4 and other **green rating systems**



An Environmental Product Declaration for Asphalt Mixtures

Company

Test Organization is an asphalt mixture producer.

Test Plant 1

101 W Lakeshore Dr
Houghton, MI

Product Description

This EPD reports the impacts for Test Mix 1, a Dense-Graded Superpave asphalt mixture which can be incorporated as part of the structure for a roadway, parking lot and recreational pavement and meets mix specifications provided for its application.

This asphalt mixture is categorized as a hot mix. This asphalt mixture was produced within a temperature range of 100.0 to 250.0 °F.



Declaration Number: 1.1.1.6

Date of Issue: Apr 17, 2018

Period of Validity: Jan 31, 2022

This declaration is an environmental product declaration in accordance with ISO 14025:2006⁶ Type III environmental performance labels and European Committee for Standardization (CEN) EN 15804:2012², which transparently describes the potential environmental impacts of the described product caused during the identified stages. The data specific to this product can be found on page 3 of this document.

Other NAPA Resources

www.asphaltpavement.org

- Practical Guide to Sustainable Asphalt Pavements
- Porous Pavement Guidance
- LEED v4 Guidance
- Greenhouse Gas Calculator
- Recycled Materials & Warm Mix Survey
- Publications on energy efficiency, RAP, RAS, SMA, OGFC, etc.
- Webinars – live and recorded

Sustainability in Practice 102



Sustainable Asphalt Pavements: A Practical Guide Sustainability Specifics

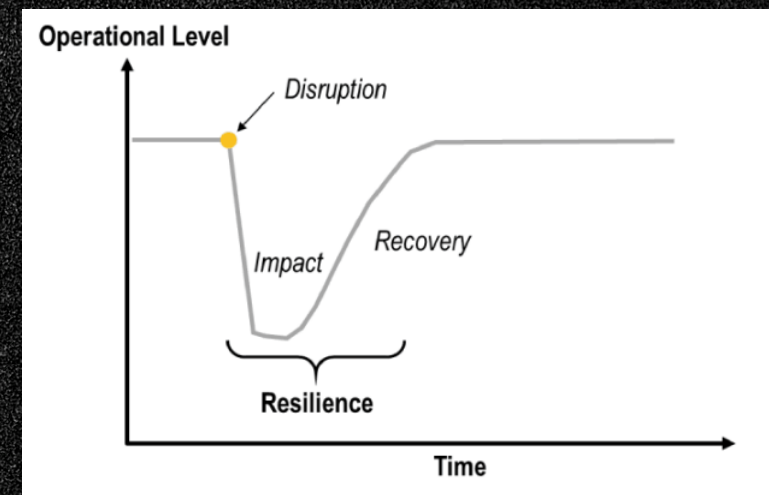


Resiliency and Asphalt Pavements

What is Resilience?

The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions

- *FHWA Directive 5520*

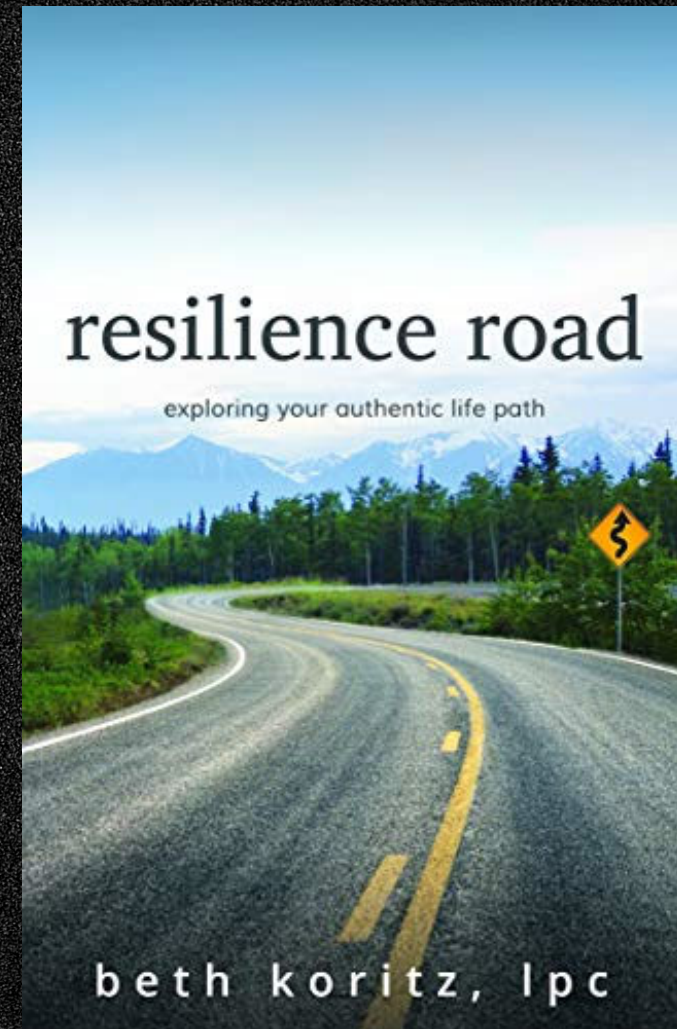


https://transportgeography.org/?page_id=10994

Resilience and Asphalt Pavements

Natural disasters

- Hurricanes, floods, earthquakes, landslides, tornadoes
- Damaged roads affect **mobility**
 - Emergency services
 - Access to medical care
 - Food supplies
 - Commerce
- With unexpected events, the key is to **quickly restore service**



Resilience – Earthquake Response



- 8 major transportation corridors severely damaged
- All 8 major roads repaired within 5 days
- Anchorage, AK
- December 1, 2018

<https://www.theverge.com/2018/12/8/18128983/alaska-earthquake-roads-fixed-anchorage-damage>

Resilience – Speed of Construction

- Hurricane Michael severely damaged U.S. 98 in Franklin County, Florida (October 2018)
- 40-mile stretch of highway affected, 15 miles badly damaged
- Lanes were reopened to traffic after every shift



<https://www.tallahassee.com/story/news/2018/10/11/u-s-98-closed-east-lanark-village/1601275002/>

Resilience – Warm Mix to the Rescue

U.S. 34, Colorado, 2013

- 3-hr. haul distances
- Late season paving at high elevation
- Steep canyons with little sun and high winds
- Warm mix was key to getting the job done

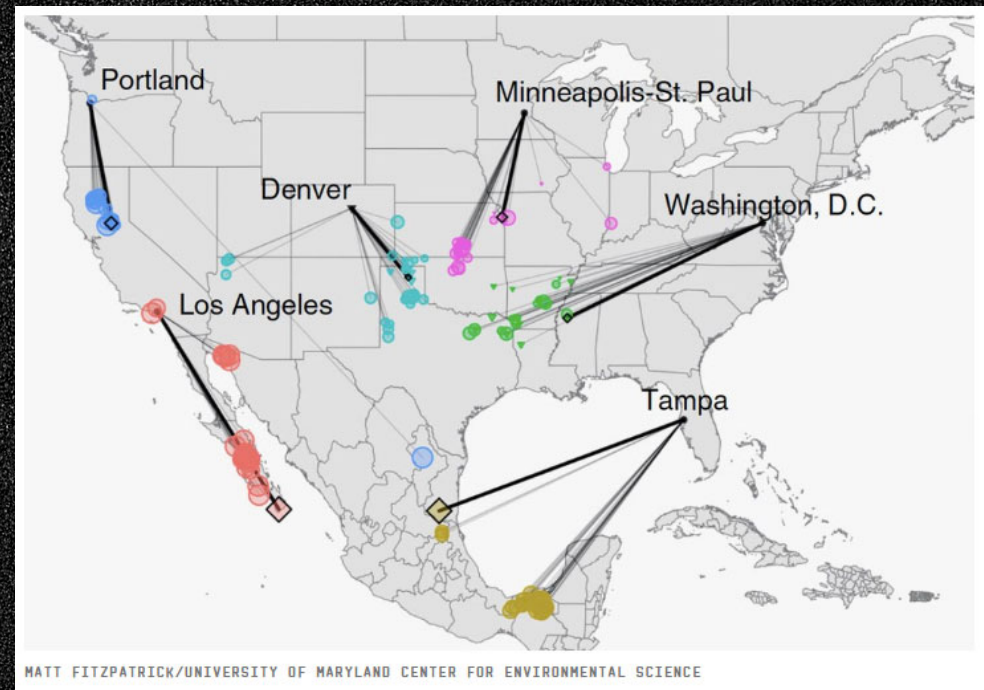


<https://www.roadbridges.com/asphalt-paving-able-reconnect>

<https://www.cpr.org/2016/09/29/brace-yourself-northern-colorado-us-34-big-thompson-canyon-closure-is-almost-here/>

Resilience – Hotter Temperatures

- Use climate forecasts rather than historical data for pavement design
- Integrate design changes into routine maintenance overlays
- Can be cost effective if planned appropriately



FHWA references for pavement resilience

Impact of Environmental Factors on Pavement Performance in the Absence of Heavy Loads (FHWA-HRT-16-078)

www.fhwa.dot.gov/publications/research/infrastructure/pavements/ltp/16078/16078.pdf

Climate Change Adaptation for Pavements (FHWA-HIF-15-015)

www.fhwa.dot.gov/pavement/sustainability/hif15015.pdf

Vulnerability Assessment and Adaptation Framework, Third Edition (FHWA-HEP-18-020)

www.fhwa.dot.gov/environment/sustainability/resilience/adaptation_framework

Adaptation Decision-Making Assessment Process (ADAP) (FHWA-HEP-17-004)

www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/teacr/adap

Synthesis of Approaches for Addressing Resilience in Project Development (FHWA-HEP-17-082)

www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/teacr/synthesis

TECHBRIEF **Impact of Environmental Factors on Pavement Performance in the Absence of Heavy Loads**

LTPP

FHWA Publication No.: FHWA-HRT-16-078
FHWA Contact: Jack Springer, HRTI-30, (202) 493-3144, jack.springer@dot.gov

This document is a technical summary of the Federal Highway Administration Long-Term Pavement Performance Program report, Analysis of the Study of Environmental Effects in the Absence of Heavy Loads (FHWA-HRT-16-078).

The Long-Term Pavement Performance (LTPP) Program monitors the performance of pavements constructed using different materials that are subject to varied traffic loads across many climates. One experiment category developed by the program for study is the effect the environment has on pavement deterioration. The data analysis results summarized in this TechBrief use test sections from an LTPP Specific Pavement Studies (SPS) experiment, Study of Environmental Effects in the Absence of Heavy Loads (SPS-8), matched with test sections from other LTPP experiments that have normal truck traffic to compare and show the proportion of total damage caused by environmental effects. This analysis, which looked at data collected over a 15-year period, also identified many practical design and materials effects, including some very informative results.

Introduction

Initiated as part of the Strategic Highway Research Program, the primary purpose of the SPS-8 experiment was to characterize the impact of environmental factors

U.S. Department of Transportation
Federal Highway Administration
Research, Development, and Technology
Turner-Fairbank Highway Research Center
6300 Greenway Plaza
McLean, VA 22108-2296
www.fhwa.dot.gov/research

TechBrief **CLIMATE CHANGE ADAPTATION FOR PAVEMENTS**

AUGUST 2015 FHWA-HIF-15-015

INTRODUCTION

Climate change can and is producing a wide array of impacts that affect infrastructure on a broad scale. An infrastructure asset's vulnerability to climate change is highly context sensitive, with its location and the adaptive capacity of local business, government, and communities all being influential (IC 2015). Much has been written generally about climate change and its impacts on transportation systems, and literature is now emerging on how climate change specifically affects pavement systems and what adaptation strategies might be pursued. However, at the level of pavement systems, the state of the practice is largely limited to general observations and a paucity of data specific to pavement systems. This Tech Brief provides an overview of climate change and pavement research impacts, and then addresses specific climate change adaptation strategies that can be implemented now and in the future.

Scope

This Tech Brief is specific to hard-surfaced pavement systems (i.e., asphalt and concrete pavements) including the wearing course and all underlying layers down to and including subgrade treatment. Importantly, this Tech Brief does not address climate change adaptation issues for transportation systems or infrastructure that are beyond the scope of pavement systems, such as (1) relocation of vulnerable routes, (2) route rerouting or sea level rise, (3) identification and treatment of vulnerable structures (e.g., bridges), and (4) fortification of pavement systems against extreme weather events where such fortification is generally infeasible (e.g., relocation or complete reconstruction is more cost-effective than fortification). This Tech Brief also does not address climate change vulnerability assessment processes, which are more thoroughly covered in other documents such as those by the FHWA (2012) and the European Commission (Infrastructure and CIVIL 2012). While this Tech Brief focuses on pavements alone, a comprehensive approach to climate change adaptation should consider all of these in concert.

BACKGROUND

Climate Change Impacts

Changes in the global climate and the understanding that human activities have been the dominant cause is supported by a combination of physical observation and climate modeling both at a national and global scale (IPCC 2013). Current climate models generally project that the climate will continue to change and do so at an increasing rate over the next century or longer (IPCC 2013, IPCC 2014). While the magnitude and timing of projected climate change generally agreeable, climate scientists warn that the rate of climate change is accelerating and that the impacts on the U.S. and other developed nations are likely to be significant (IPCC 2013, IPCC 2014).

U.S. Department of Transportation
Federal Highway Administration

Vulnerability Assessment and Adaptation Framework

THIRD EDITION

FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF PLANNING, ENVIRONMENT, & REALTY

U.S. Department of Transportation
Federal Highway Administration

March 2018 (18)

TEACR Engineering Assessment

Adaptation Decision-Making Assessment Process (ADAP)

Introduction

The Adaptation Decision-Making Assessment Process (ADAP) is proposed as a tool for planners and designers to account for the increasing role of climate change in the design of civil works projects. ADAP is intended as a risk-based tool to aid decision makers in determining which project alternative makes the most sense in terms of life cycle cost, resilience, regulatory and political settings, etc. ADAP provides a framework for generating the information needed to identify preferred approaches to project design based upon costs and benefits. The process can be tailored to meet an agency's specific requirements. Although the Framework lays out specific steps, unique situations may warrant adjustments within the general context of the Framework.

ADAP can be used in two ways: (1) to assess existing assets for their sensitivity to projected climate changes and (2) for the design of new infrastructure projects. For new projects, it is intended to be applied during the planning stage of project development so as to provide the maximum opportunity to explore project alternatives.

ADAP was also designed to be general enough to apply to the entire spectrum of climate-influenced highway infrastructure, from a small drainage culvert on a country road to a complex bridge in a major urban area. Determining which facilities/projects ADAP should be applied to will be a policy decision made by each agency. Agencies may choose to apply ADAP to existing or new projects. Some agencies may use ADAP for all projects, while others use it only when projects meet certain criteria related to cost, importance, potential vulnerability, etc. ADAP may not be the ideal process to follow in all situations, however, it lays out the range of considerations that should inform an agency's thinking about climate change vulnerability and adaptation options.

Finally, ADAP is designed from the perspective of assessing a single asset, but it could be easily adapted to consider more system-level considerations, such as a system of culverts within a watershed. The language in this document assumes that a single asset is being evaluated. If a system approach is taken, then the same ADAP steps should also be followed, but adjusted as needed to account for system-level considerations.

The ADAP steps are captured in the decision tree in Figure 1. As can be seen, not all steps are required in all situations. The process is simple to implement, the evaluation process in situations where the consequences of asset failure are low and where the cost of adapting to climate change is relatively small. The steps are explained in more detail in the following sections.

September 2016 FHWA-HEP-17-004

U.S. Department of Transportation
Federal Highway Administration

Synthesis of Approaches for Addressing Resilience in Project Development

U.S. Department of Transportation
Federal Highway Administration

FHWA-HEP-17-082

July 2017



Questions?

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