

A Fresh Look at Concrete Pavement for Local Agencies

Technology Tuesday Webinar

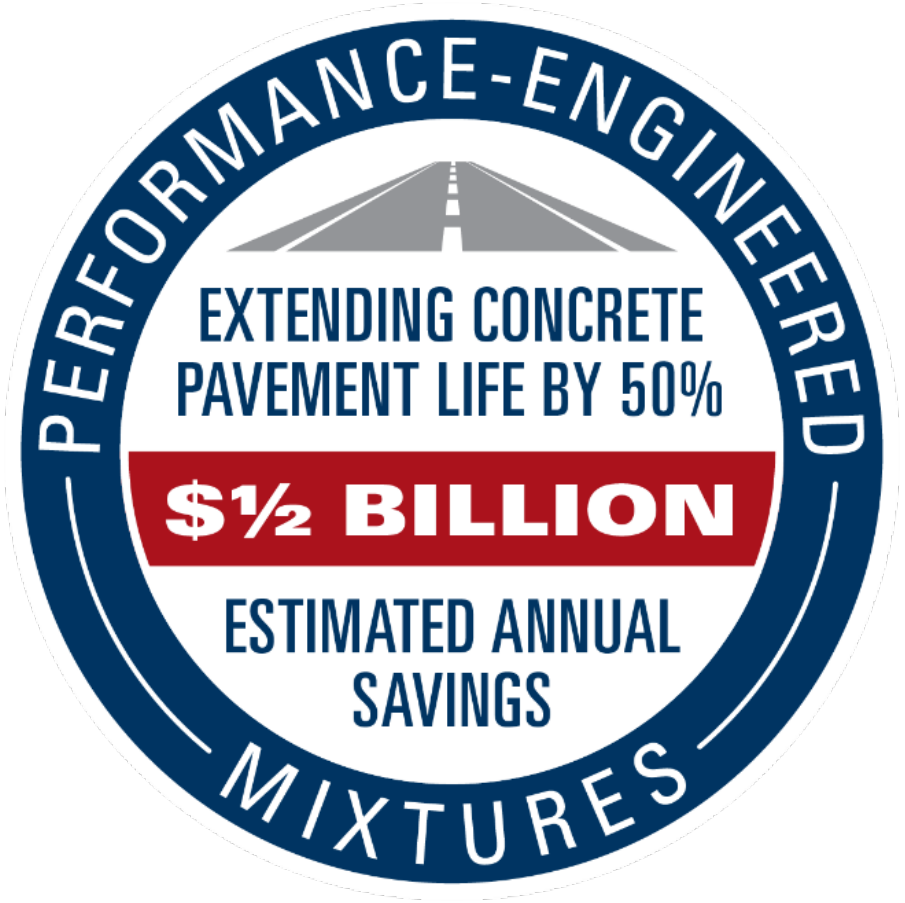
October 13, 2026

FHWA Efforts



PEM Impacts

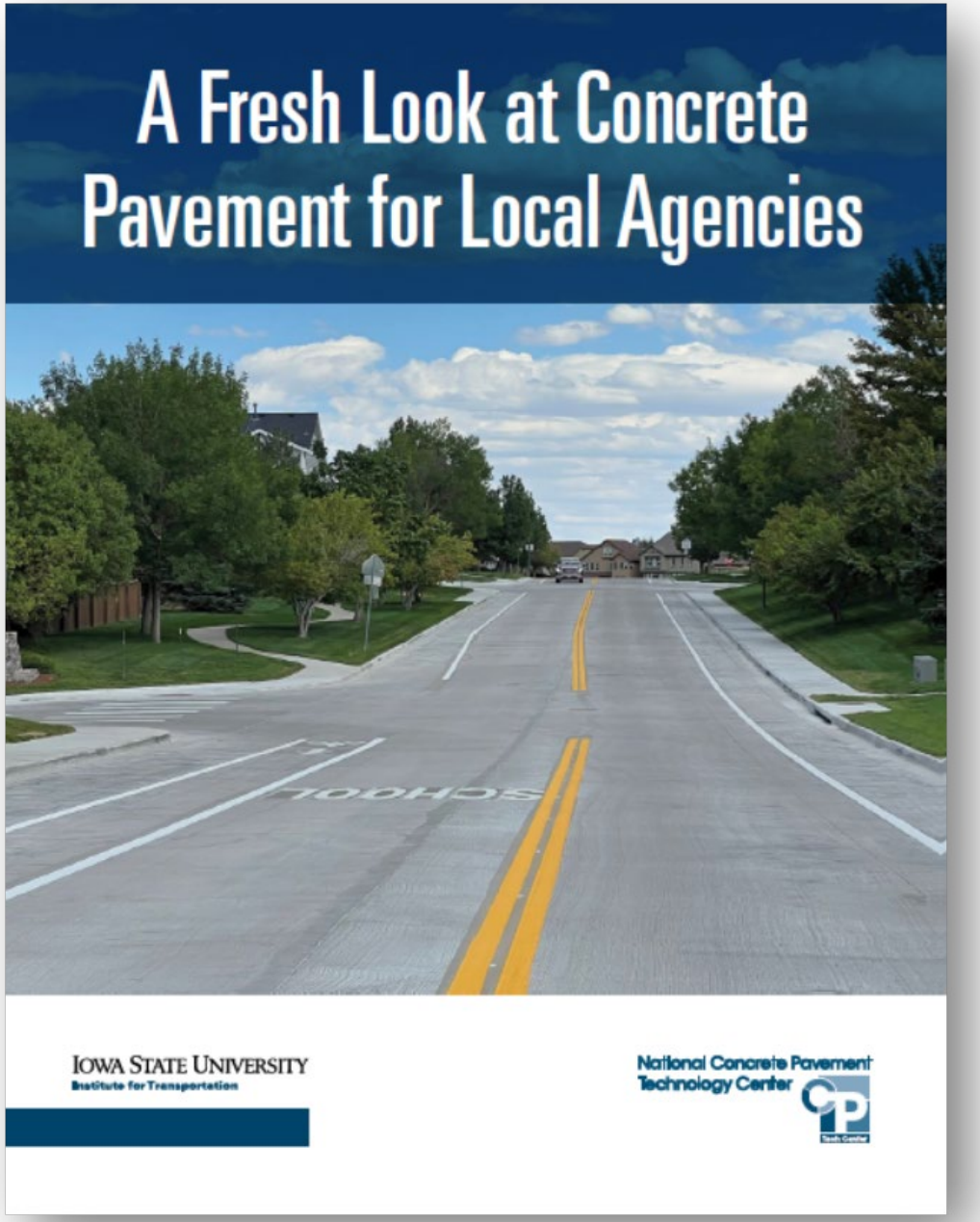
- PEM concretes are designed to increase service life by 50%.
- 25 DOTs have embraced PEM principles, with many already making specification updates.
- If estimated life cycle extension is seen in the concrete placed by those DOTs, there is an estimated savings of ½ Billion per year.



Source: L. Wathne, et al. 2026. *Performance Engineered Mixtures: How a Cooperative Effort Between FHWA, State Highway Agencies, and Industry is Improving Concrete Pavement Practices in the USA.*

A Fresh Look....

- Broad resource.
- Tailored for agencies without an extensive concrete pavement program.
  - Offers information at an appropriate level of detail.
  - Addresses common misconceptions.
- Highlights real-world success stories.
- Identifies resources and tools.



Acknowledging the Project Team

Dan King &
John Adams
(retired)

Robert Spragg
(Sponsor)

Jerry Voigt
(Primary Author)

Jerod Gross
(Second Author)

Technical Advisory Committee Members

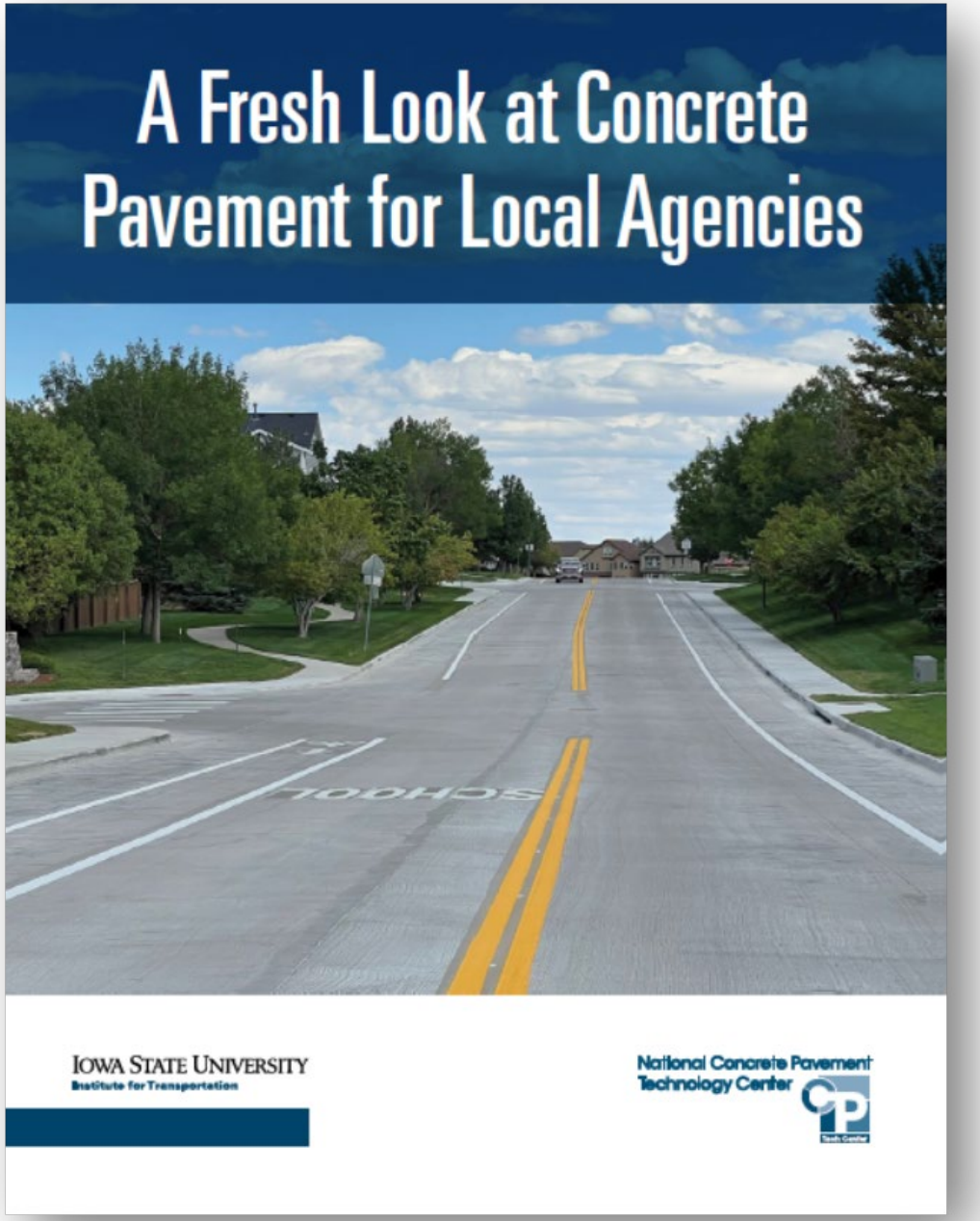
- Rich Brumm
  Mitchell & Worth Counties, Iowa
- Angela Folkestad
  CO/WY Chapter ACPA
- Jesse Jonas
  Illinois RMC Assn &
  Concrete Council of St. Louis
- Brian Killingsworth, NRMCA
- Heath Schopf
  Vinton Constr. Company
- Amy Wedel
  Florida Concrete & Products Assn
- Nick Weitzel, NCE, Inc.
- Paul Wiegand, SUDAS (retired)
- Matt Zeller
  Concrete Paving Assn.
- Brian Zuroff
  North Dakota Concrete Council

Availability?

Final proof is in review!

Document will be posted in next week or two

Watch for notification from CP Tech Center!



Why Take a Fresh Look?

- Introduce concrete pavements to local agencies who:
  - Lack familiarity with the technology
  - Have lost institutional knowledge
  - Don’t realize the full scope of concrete pavement applications
  - Don’t know how to get started



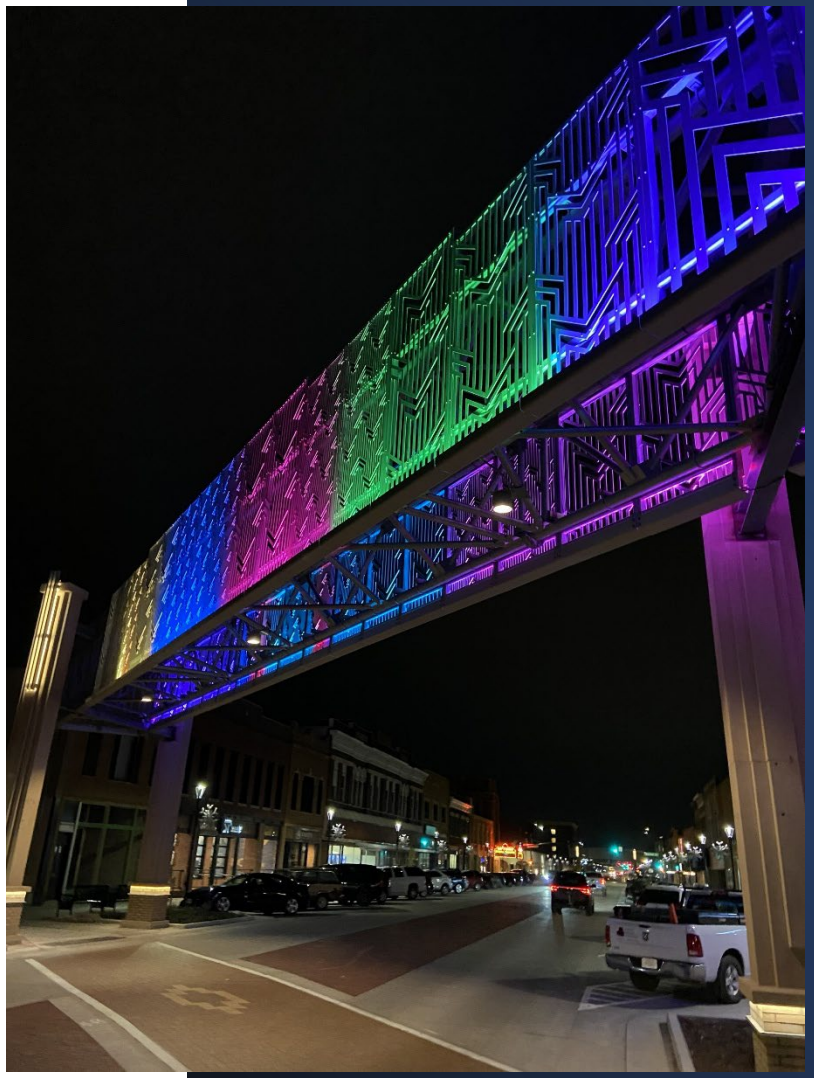
Why Take a Fresh Look?

- Many people are stuck on old impressions
- We can show that concrete pavements DO NOT:
  - *“Cost too much”*
  - *“Take too long” or*
  - *Are not “too difficult to repair”*

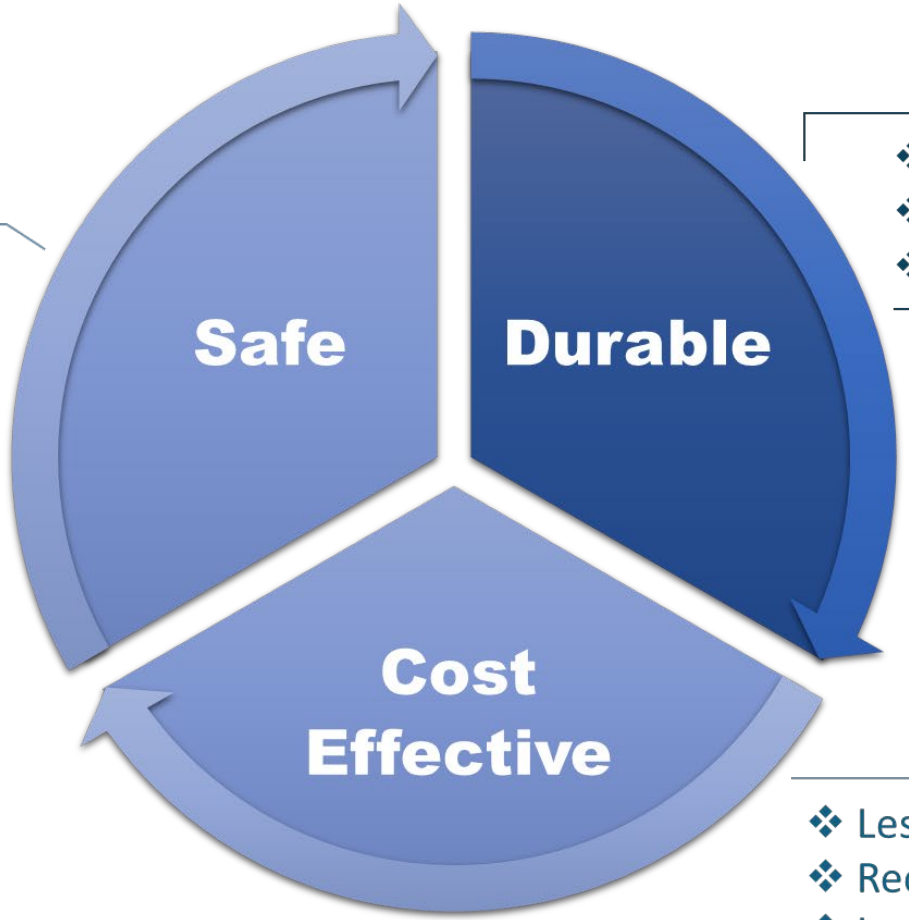


Why Take a Fresh Look?

- In past decade a new path has been opened by many U.S. towns, cities and counties
- We can showcase projects that demonstrate the benefits
- We can provide ideas and strategies to begin implementation



We Demonstrate Concrete Pavement's Core Benefits



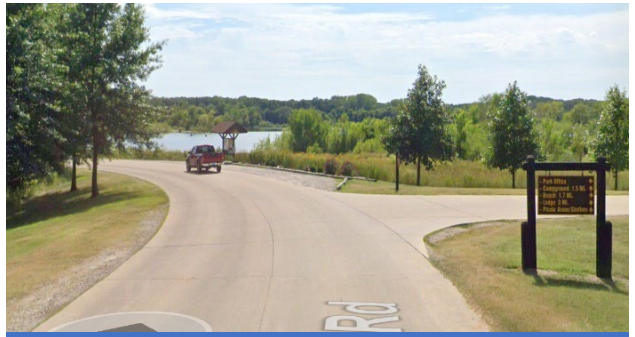
- Non-deforming surface
- Skid resistant textures
- High light reflectance

- Long life
- Holds up to heavy loads
- Low maintenance

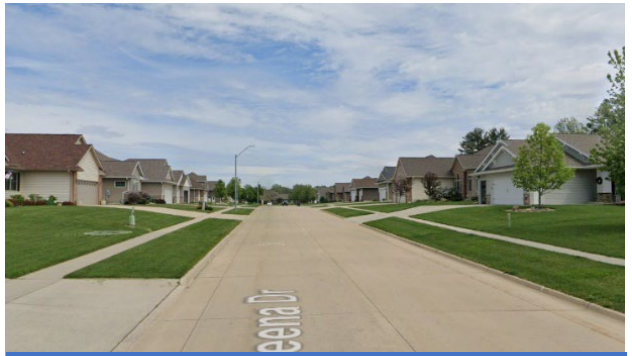
- Less raw materials
- Reduced user delays
- Low ownership costs

Fits FHWA's Mantra!

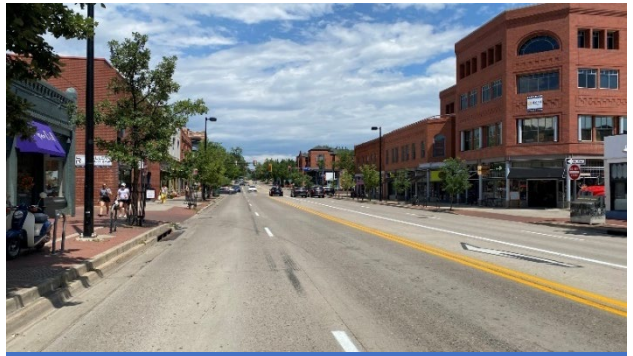
Scope

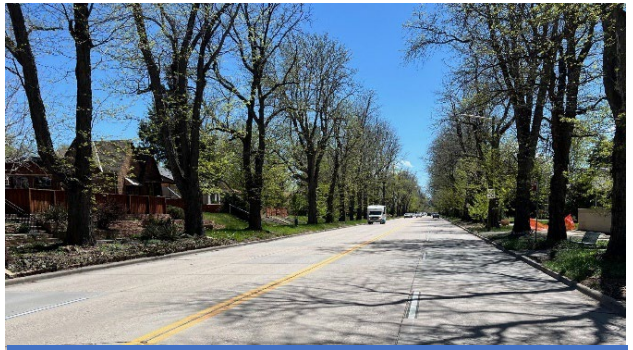

Park Roads


Bike Paths

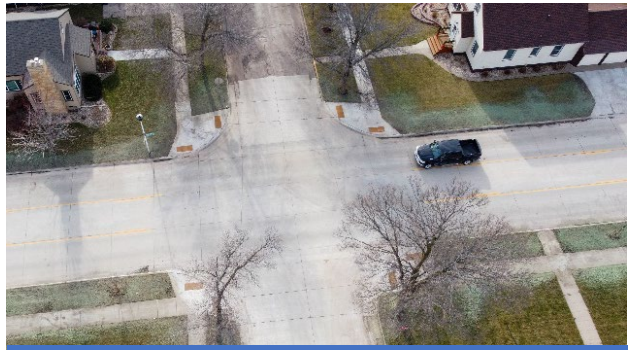

Neighborhood Streets


County / Rural Roads


Urban Arterials

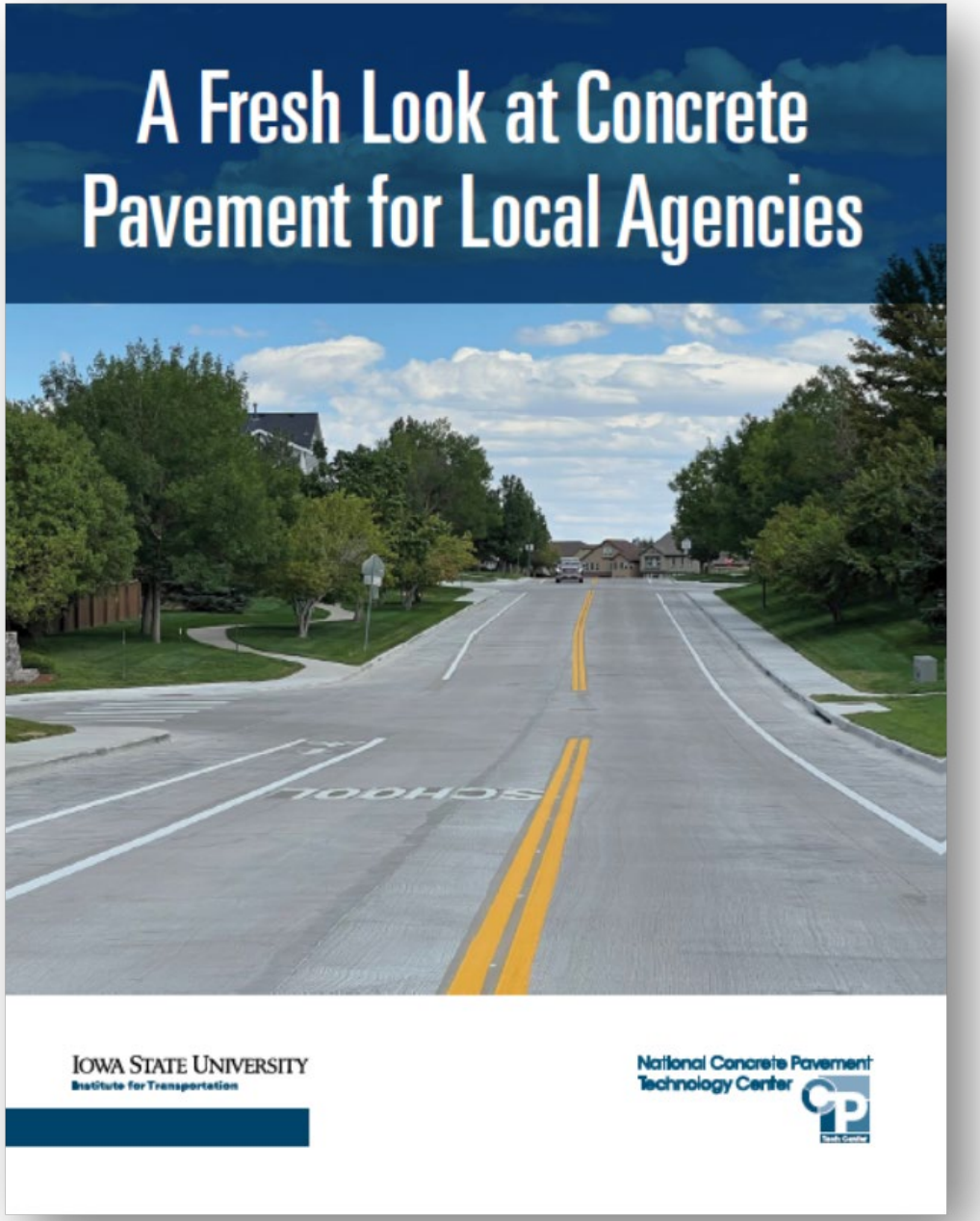

Local Roads


Round-a-Bouts


Intersections

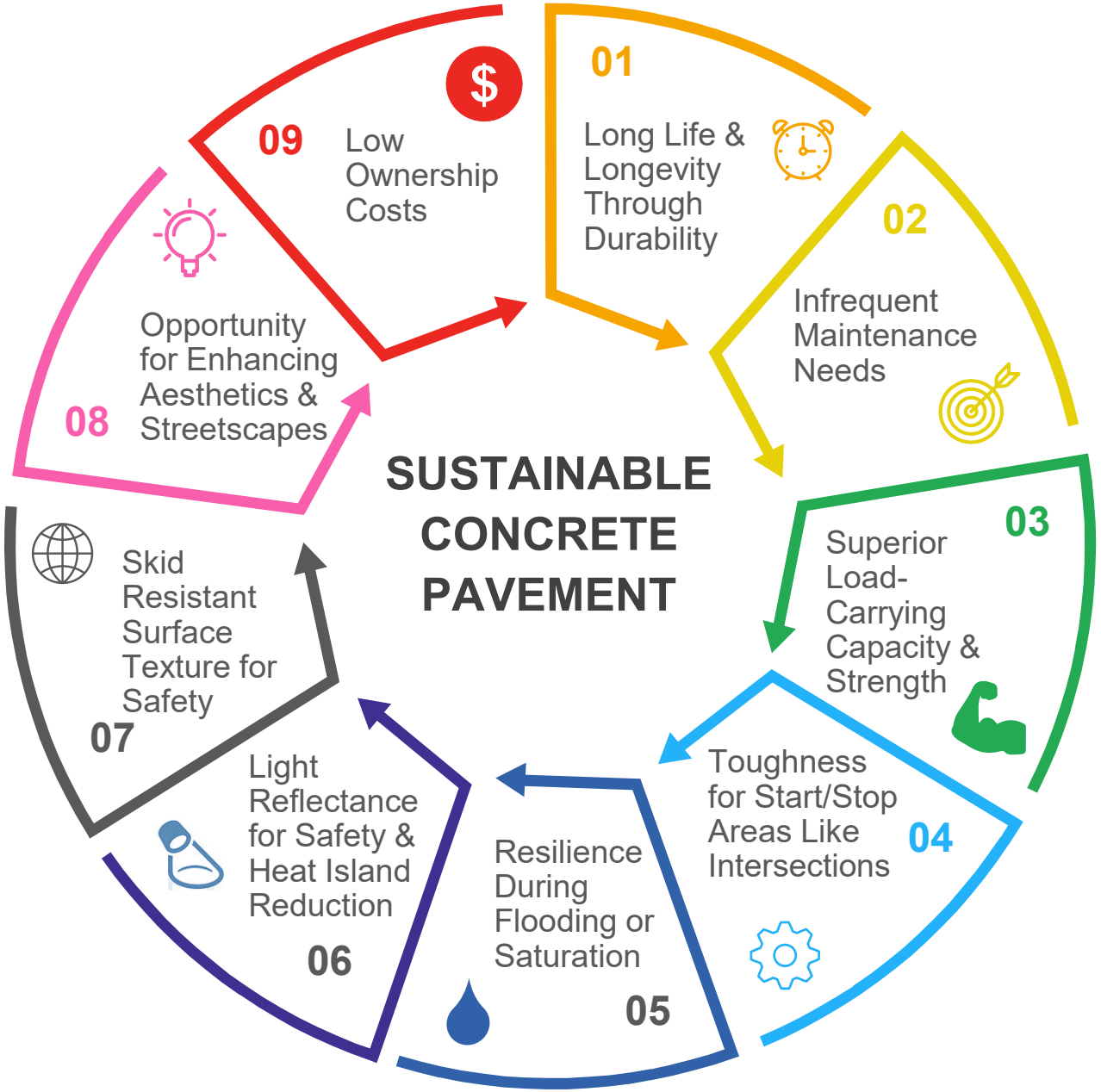
Purposely Written…

- Tells a story!
- Provides basic technical info
- Easy read - not overwhelming for a new audience
- Sections:
  - Introduction
  - Benefits
  - Implementation Considerations
  - Implementation Steps
  - Resources
  - Case Studies



Benefits

Nine value points of concrete pavements…



Long Life & Longevity…



Common to achieve 30-50 years service

Achievable with quality materials, appropriate design, good construction practices, and periodic preservation treatments



Expected with modern specifications

Specifications using modern PEM principles ensures quality materials are used in construction

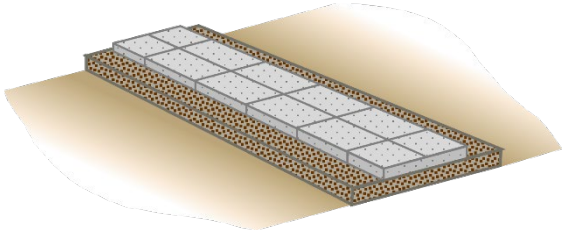


Long Life is “Sustainability”

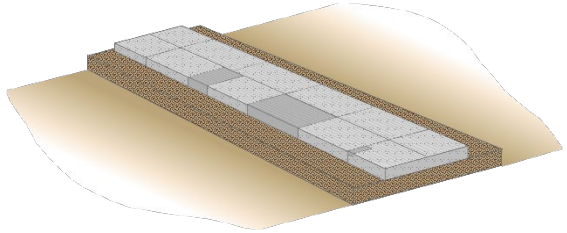
Enhances economic and social contributions by its very nature

Concrete Pavement Life Stages…

STAGE 1
Long-Term Performance

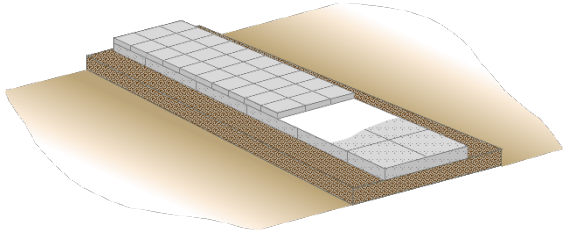


STAGE 2
Repair & Preservation(s)



Pavement may receive multiple preservation (patching, diamond grinding and joint resealing) treatments to extend life

STAGE 3
Structural Overlay(s)



Pavement may receive one or more concrete overlays to improve structure and extend service life

STAGE 4
End of Life

End of life occurs when it is no longer cost effective to improve the pavement's functional or structural condition and complete reconstruction is warranted.

20-30 yrs (Typical Time to First Rehabilitation)

40-50 yrs (Typical Time to Condition Requiring Structural Overlay Interventions)

60-90 yrs (Typical Time to Condition Requiring Complete Reconstruction)

Superior Load Carrying Capacity & Strength…



- Beneficial Load Distribution
  - Low pressure on the subgrade makes pavement less sensitive to subgrade variations and enables load carrying capacity even on weaker soils
- Resistance to Bending
  - Fatigues slowly under heavy vehicle loads even in extreme temperatures
- Enhanced Structural Resilience
  - Inherent strength provides reserve load-carrying capacity, critical for managing heavy traffic and ensuring longevity

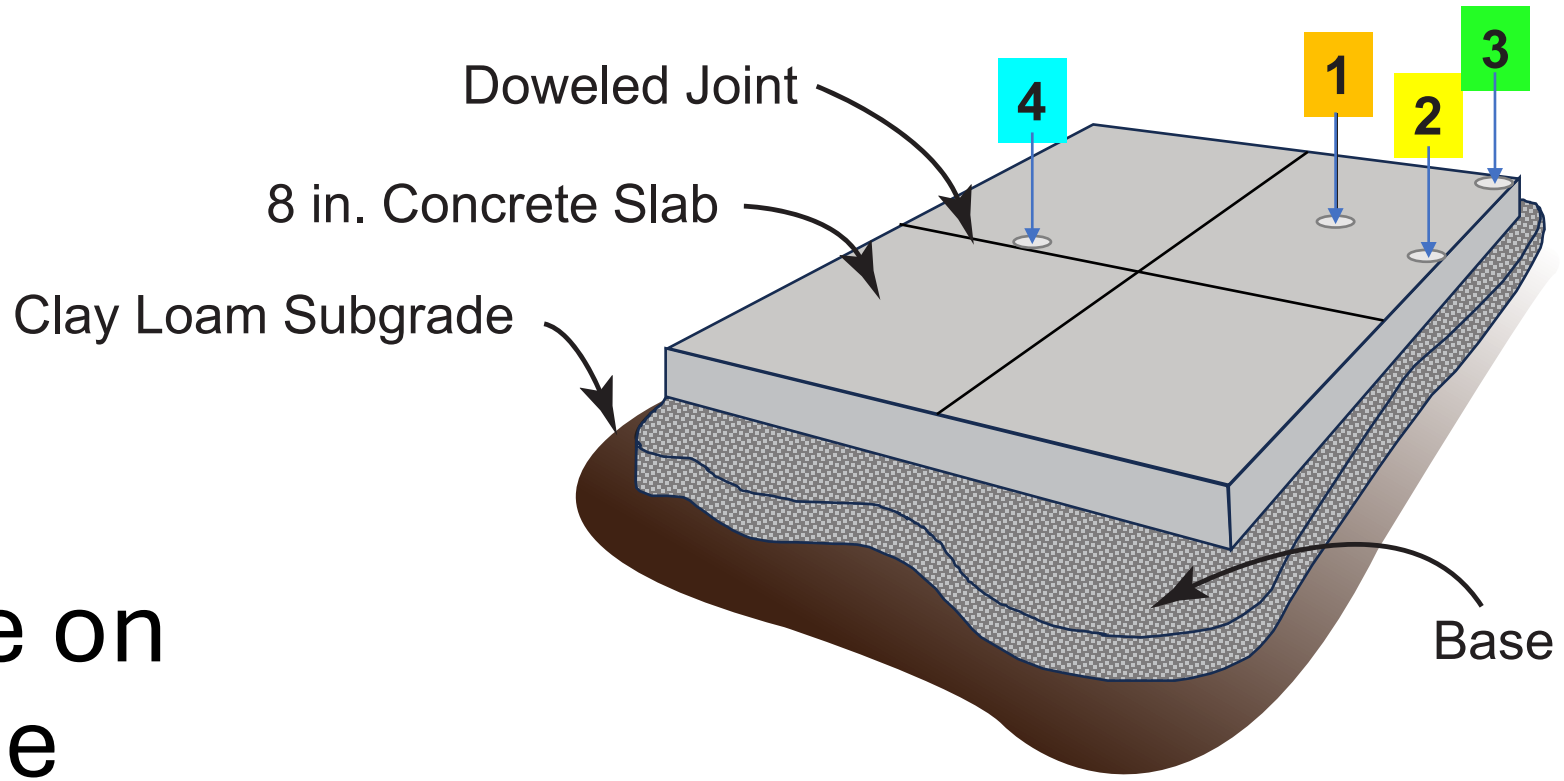
Superior Load Carrying Capacity & Strength…



Concrete

Concrete's Load Distribution Induces Minimal Pressure on Subgrade

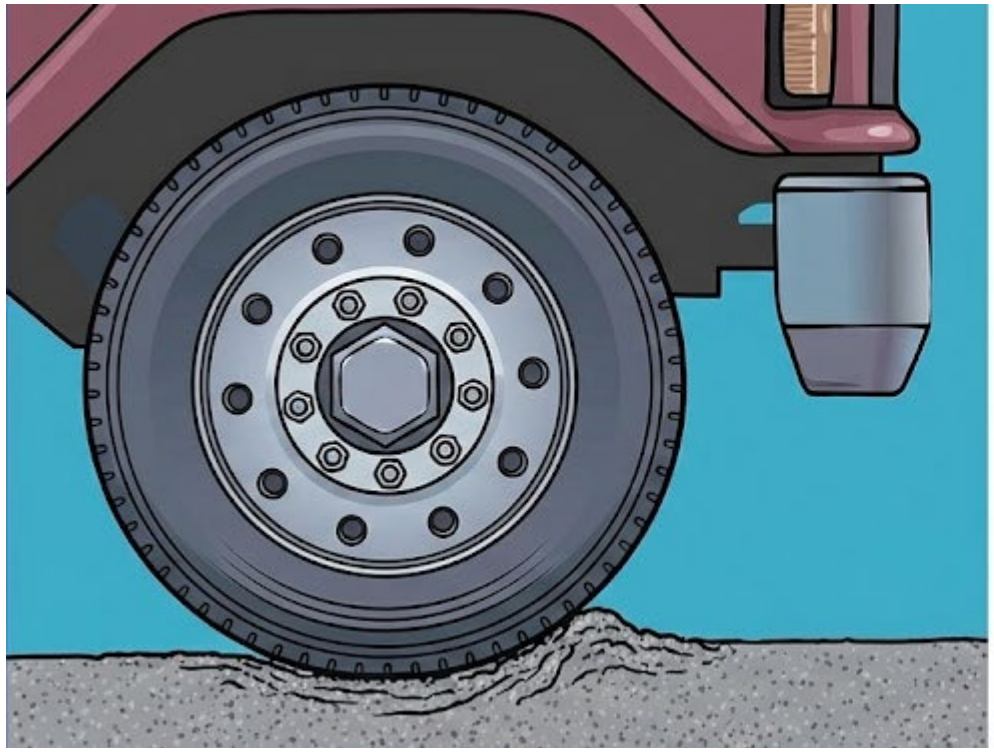
Minimal Pressure on Subgrade



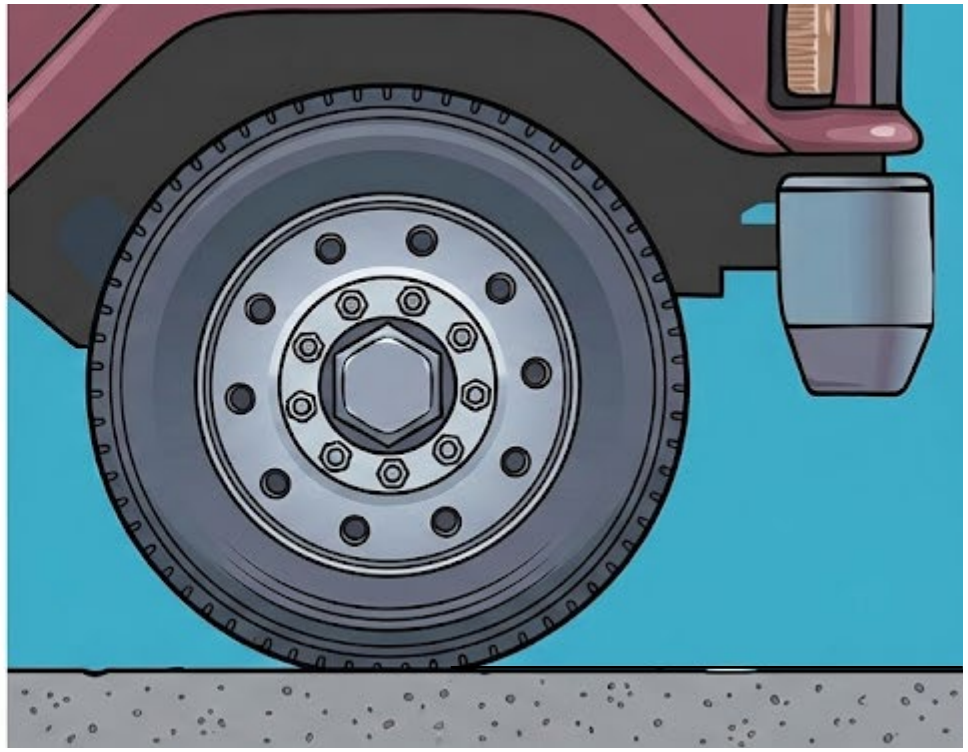
A 12,000 lb load on a 12 in. plate induces a pressure of 106 psi on pavement surface and minimal subgrade pressures:

1. Slab Interior = 3 psi
2. Outside Edge = 6 psi
3. Outside Corner = 7 psi
4. Transverse Joint Edge = 4 psi

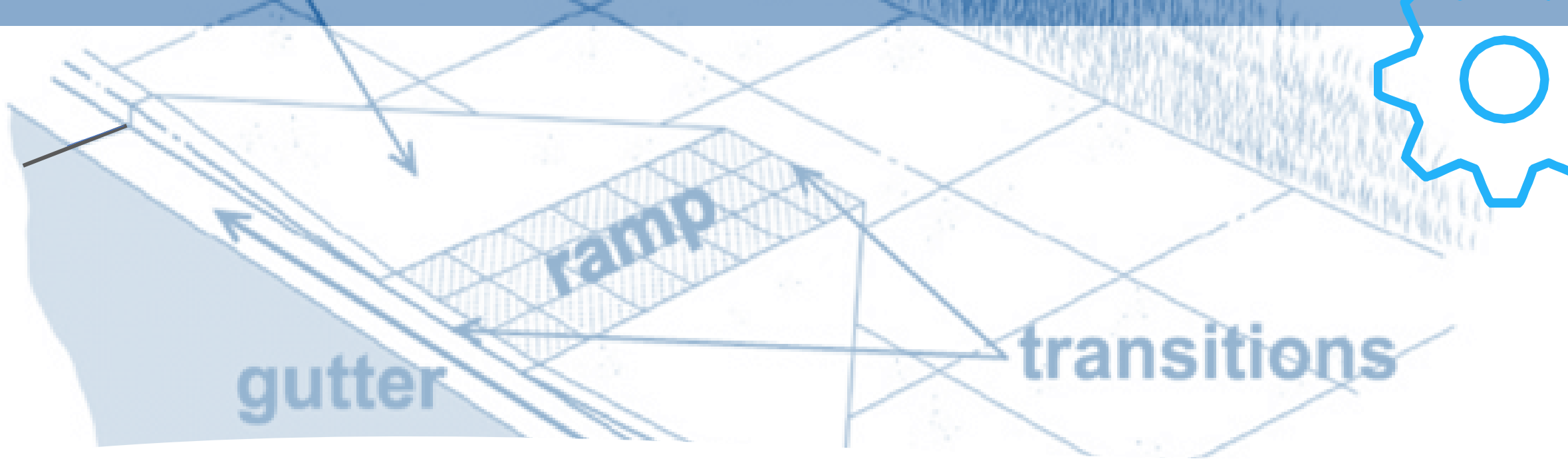
Toughness in Start/Stop Areas



Deforming Surface



Non-Deforming Surface



Concrete Toughness for ADA Compliance

1. **Provides Surface Stability**: ensures long-term compliance with ADA requirements.
2. **Provides Uniformity**: critical for wheelchair users and individuals with mobility aids.
3. **Provides Long-Lasting Texture**: ensuring safe and accessible surfaces for all users.
4. **Provides Consistent Cross Slopes:** do not challenge people with mobility aids.
5. **Provides Aesthetic and Functional Designs** enhance community integration.

The Value for ADA Compliance



Non-Compliant



Compliant

Resilience During Flooding - Inundation





Near Burleigh Street - Wauwatosa, WI (2025)

<u>Inundation</u> – The most common flooding condition affecting roads. Studies find concrete pavements do not exhibit significant damage or strength loss after inundation.

Effects of Flooding on Pavement Foundations



Saturation reduces density and strength of granular base and subgrade layers.



Reduced support decreases pavement load-carrying capacity.



Traffic over weakened foundations can accelerate structural damage.



Support layers may require up to a year to fully regain strength after saturation.

Structural Advantages of Concrete Pavements for Resilience

- Studies show structural performance remains relatively stable during subgrade weakening.

- Why?
  - Loads distributed over a large area
  - Support layers typically remain relatively uniform

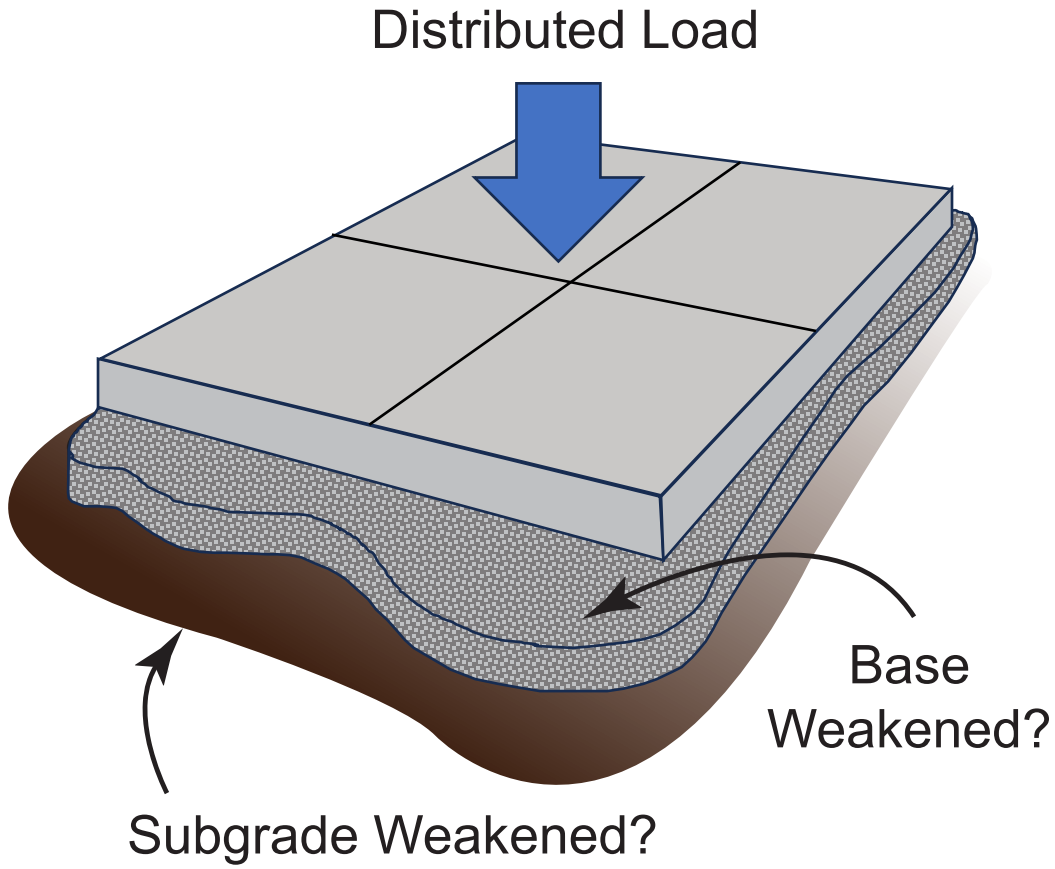


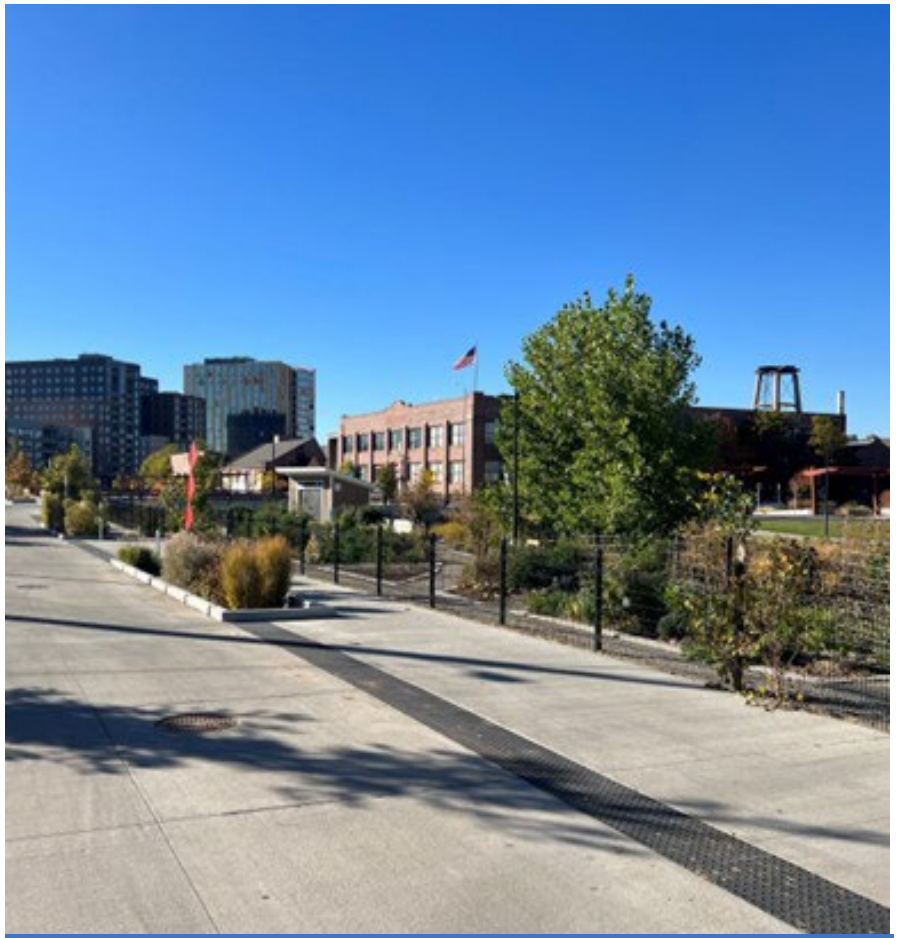
Image Source: ACPA

Light Reflection Impact on Driver Reaction Time

- Drivers gain additional time to recognize hazards
- Improved reaction time can reduce the risks of nighttime crashes.
- Visibility improvements are especially important in urban and suburban areas.



Opportunity for Aesthetics & Streetscapes



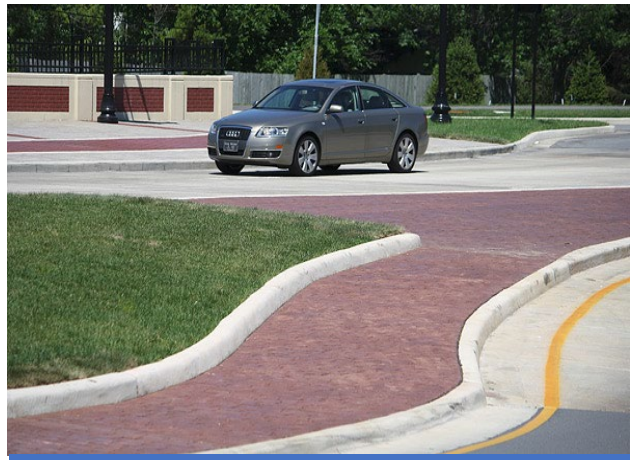
Beautification



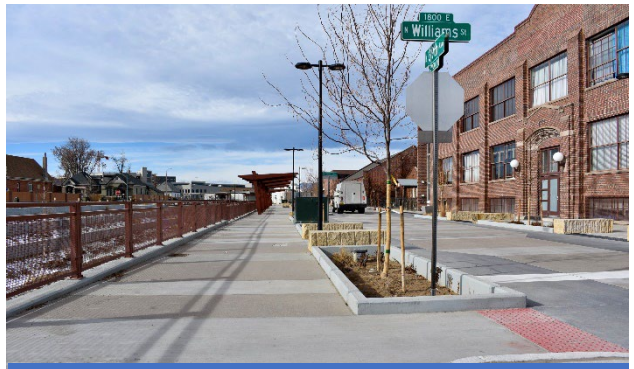
Crosswalks



Roundabouts



Streetscaping



Streetscaping



[Image: Waupaca County Post]

RIGID PAVEMENT HOLDS ITS SHAPE

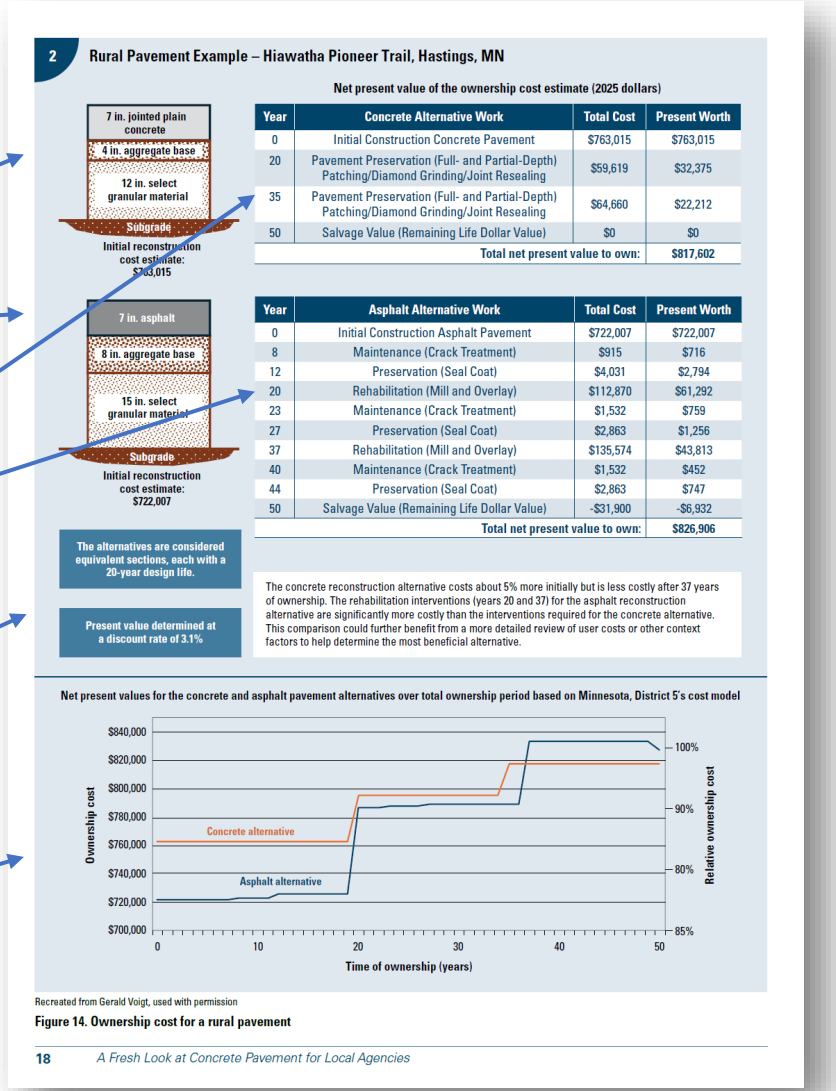
Real-World Ownership Cost Examples

Equivalent Pavement Cross-Sections

Maintenance Schedules

Discount Rate

Ownership Costs over Time



2 Rural Pavement Example – Hiawatha Pioneer Trail, Hastings, MN

Net present value of the ownership cost estimate (2025 dollars)

Initial reconstruction cost estimate: $763,015

Year	Concrete Alternative Work	Total Cost	Present Worth
0	Initial Construction Concrete Pavement	$763,015	$763,015
20	Pavement Preservation (Full- and Partial-Depth) Patching/Diamond Grinding/Joint Resealing	$59,619	$32,375
35	Pavement Preservation (Full- and Partial-Depth) Patching/Diamond Grinding/Joint Resealing	$64,660	$22,212
50	Salvage Value (Remaining Life Dollar Value)	$0	$0
		Total net present value to own:	$817,602

Initial reconstruction cost estimate: $722,007

Year	Asphalt Alternative Work	Total Cost	Present Worth
0	Initial Construction Asphalt Pavement	$722,007	$722,007
8	Maintenance (Crack Treatment)	$915	$716
12	Preservation (Seal Coat)	$4,031	$2,794
20	Rehabilitation (Mill and Overlay)	$112,870	$61,292
23	Maintenance (Crack Treatment)	$1,532	$759
27	Preservation (Seal Coat)	$2,863	$1,256
37	Rehabilitation (Mill and Overlay)	$135,574	$43,813
40	Maintenance (Crack Treatment)	$1,532	$452
44	Preservation (Seal Coat)	$2,863	$747
50	Salvage Value (Remaining Life Dollar Value)	-$31,900	-$6,932
		Total net present value to own:	$826,906

The alternatives are considered equivalent sections, each with a 20-year design life.

Present value determined at a discount rate of 3.1%

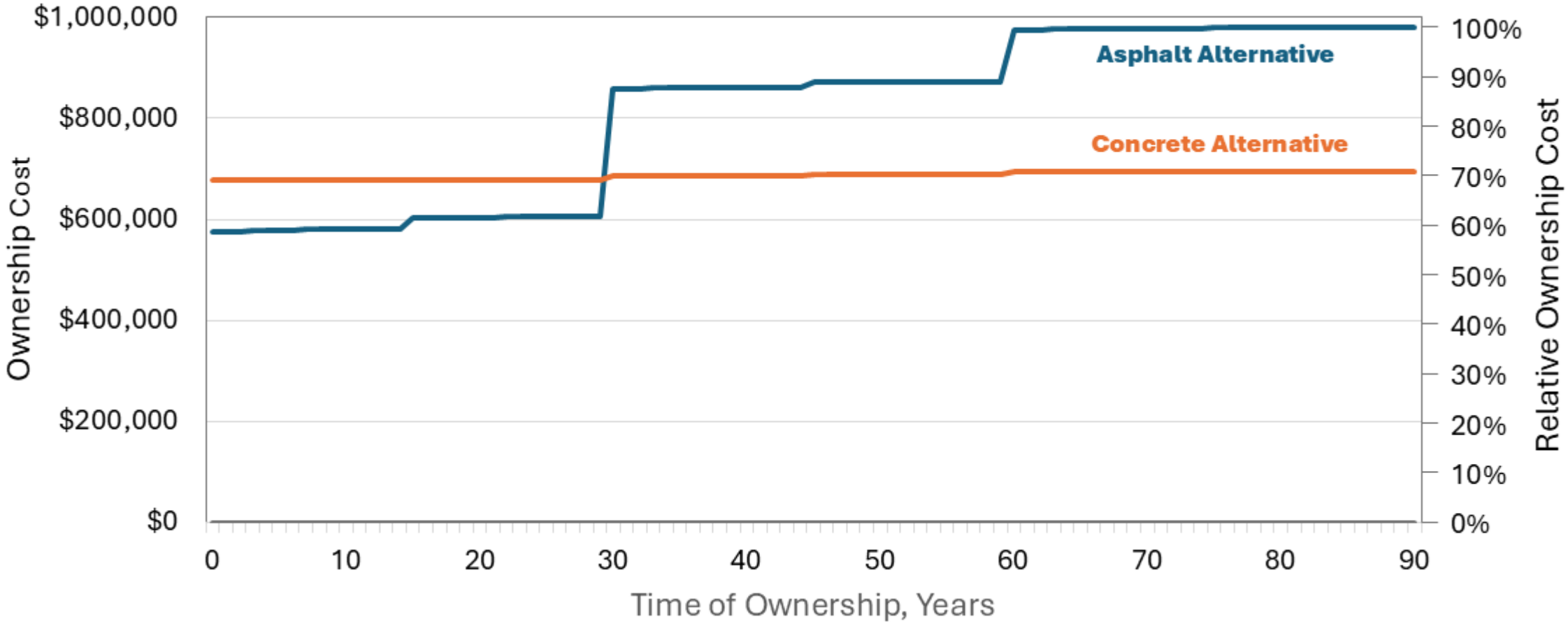
The concrete reconstruction alternative costs about 5% more initially but is less costly after 37 years of ownership. The rehabilitation interventions (years 20 and 37) for the asphalt reconstruction alternative are significantly more costly than the interventions required for the concrete alternative. This comparison could further benefit from a more detailed review of user costs or other context factors to help determine the most beneficial alternative.

Net present values for the concrete and asphalt pavement alternatives over total ownership period based on Minnesota, District 5's cost model

Recreated from Gerald Voigt, used with permission

Figure 14. Ownership cost for a rural pavement

Urban Street Example
Diversey Avenue, Whitefish Bay, WI

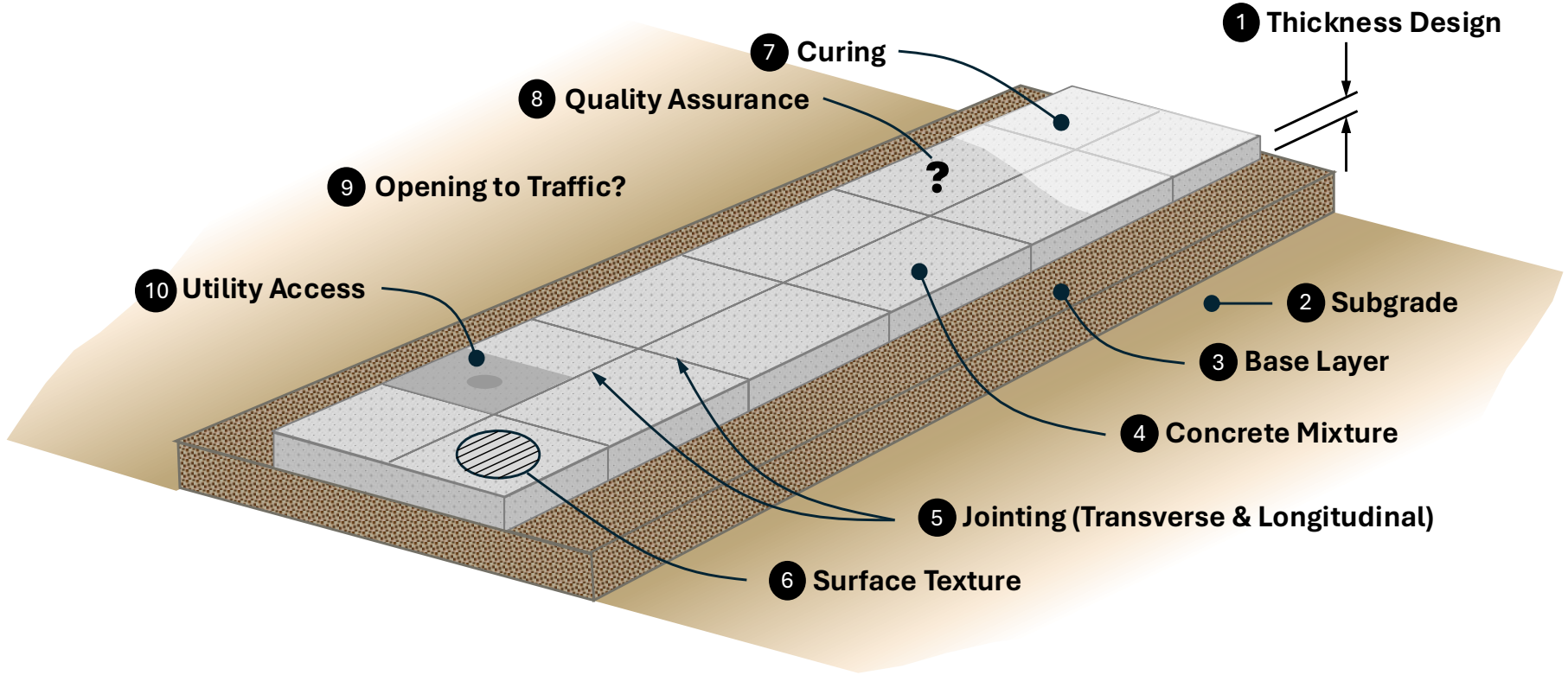


Is There Anything Else?

A Fresh Look at Concrete Pavement for Local Agencies

Design & Construction Basics

Overview of items to consider in 10 different aspects of planning and constructing concrete pavements (JPCP)



Standard Details for Adoption (SUDAS)

Formats:

.PDF

.DGN

.DWG

Table 5. Other standard details and jointing guidance useful for implementing concrete pavements

Feature	Useful Resources and links to SUDAS* CAD files
Joint Types and Load Transfer Details	• ACPA Wikipave Entry on Joints (ACPA 2021) • FHWA Technical Advisory T 5040.30 (FHWA 2019) • SUDAS Details (pdf format) / (dgn format) / (dwg format)
Intersection Joint Layout Guideline	• ACPA Intersection Joint Layout Method (ACPA 2007c) • SUDAS Detail (pdf format) / (dgn format) / (dwg format)
Curb and Gutter Details and Drawings	• SUDAS Details (pdf format) / (dgn format) / (dwg format)
Manhole Boxout Details	• SUDAS Details (pdf format) / (dgn format) / (dwg format)
Ramped Median Nose Details	• SUDAS Details (pdf format) / (dgn format) / (dwg format)
Pavement Widening – Jointing Detail	• SUDAS Details (pdf format) / (dgn format) / (dwg format)
Longitudinal Joint Placement Detail	• SUDAS Detail (pdf format) / (dgn format) / (dwg format)
Pavement Widening Details	• SUDAS Details (pdf format) / (dgn format) / (dwg format)
Railroad Crossing Approach Detail	• SUDAS Detail (pdf format) / (dgn format) / (dwg format)
Cul-de-sac Joint Location Details	• SUDAS Details (pdf format) / (dgn format) / (dwg format)
Median Details	• SUDAS Details (pdf format) / (dgn format) / (dwg format)
ADA Accessible Ramp Details and Drawings	• SUDAS Details (pdf format) / (dgn format) / (dwg format)

** SUDAS is the Iowa Statewide Urban Design and Specifications program, a nonprofit program in the state of Iowa providing uniform design guidelines and construction specifications for the state's urban public improvement projects. The organization's details are used by cities and counties to promote uniformity in road design and construction and are considered an excellent resource for any agency.*

Preservation Overview

Guidance / direction on preservation and rehabilitation methods



Table 6. Common pavement preservation techniques

Crack and Joint Sealing	IGGA, used with permission	Sawing, power cleaning, and sealing cracks (or resealing joints) using high-quality sealant materials. Preparation is required to establish clean reservoir sidewalls, which promote sealant adherence. This noninvasive procedure protects the pavement against moisture and incompressible material infiltration.
Cross-Stitching	Gerald Voigt, used with permission	Placement of deformed tie bars into holes drilled at an angle through longitudinal cracks (or, in some cases, longitudinal joints) in an existing concrete pavement. The bars are alternated from either side of the crack or joint. This noninvasive procedure improves the pavement's structural integrity.
Diamond Grinding	ACPA, used with permission	Removal of a thin layer of concrete (typically 0.12 to 0.25 in.) from the pavement surface using special equipment fitted with a series of closely spaced diamond sawblades that cut away bumps and leave a corduroy-like texture. This process improves the pavement's functional capacity.
Dowel Bar Retrofit	Highway Materials, LLC, used with permission	Placement of dowel bars across transverse joints or cracks in an existing concrete pavement to restore load transfer at the joint locations. This procedure improves the pavement's structural integrity.
Full-Depth Repair		Cast-in-place repairs that extend through the full thickness of the existing concrete panel to remove cracked or broken segments or panels down to the base layer. This is an invasive preservation procedure that improves the pavement's structural and

Implementation Steps

Plan & Collaborate

01

Set clear objectives and communicate a roadmap.

Grow Competency

02

Choose smaller projects to test selection criteria and specs.

Prepare Specifications

03

Apply standards and tolerances tailored to agency needs.

Address Traffic

04

Consider all MOT options and rely on contractors for best approaches.

Invest in Staff Training

05

Staff and consultants are key to quality assurance.

Scale Up Success

06

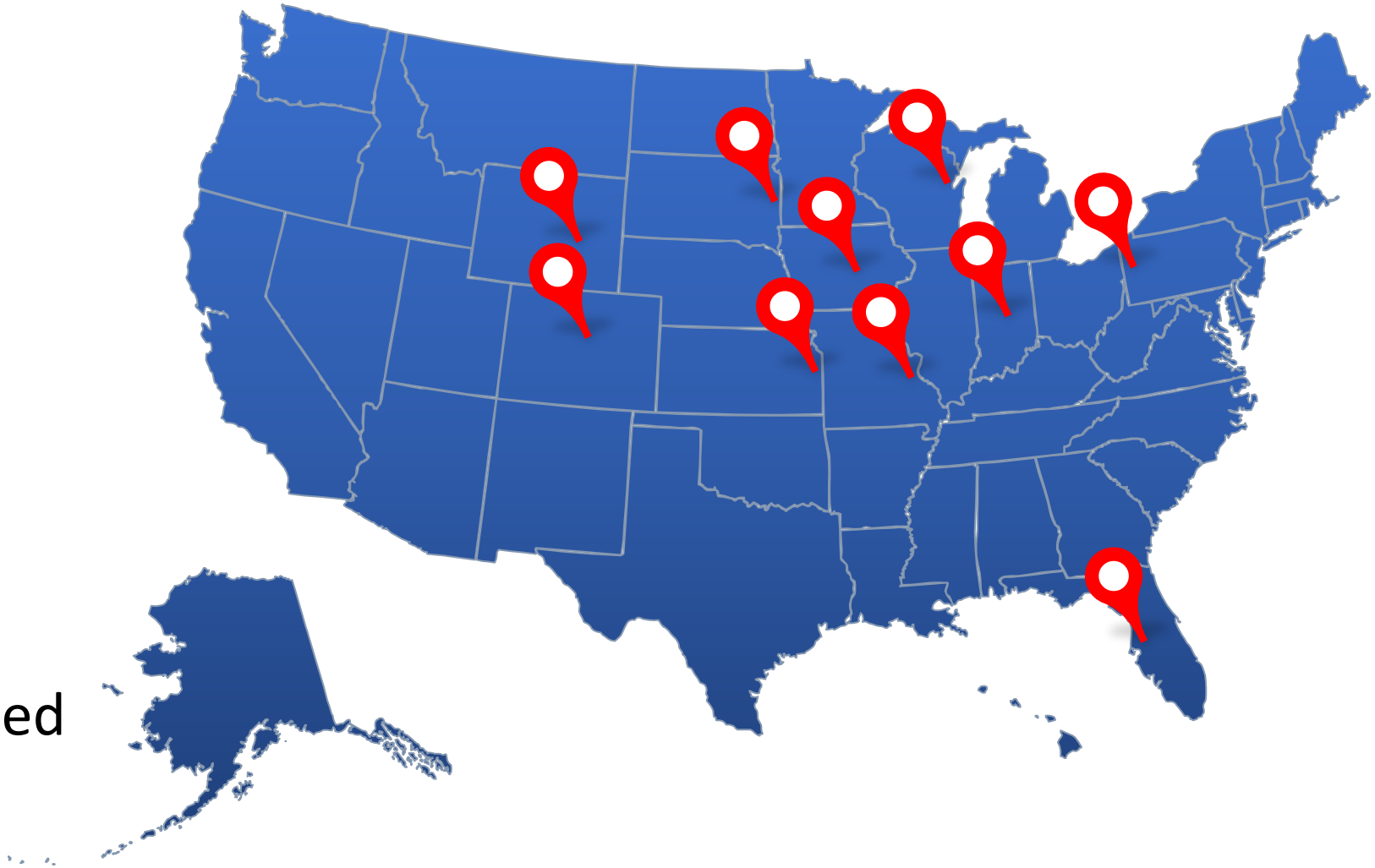
Start with pilot projects and learn from them to build a program.



Ten Case Studies

10 unique project stories from local agency projects around the U.S.

Each story demonstrates a benefit and technology presented in the guide!



01 CASE STUDY

Residential Street Replacement

Fairoyal Drive Reconstruction, Des Peres, MO

- **Scope**: Largest street replacement effort for the municipality in decades
- **Accomplishment**: Balanced modern infrastructure upgrades with community-focused construction



Image Source: ACPA

KEY FACTS:

Population: 9,145

Project Size: 0.4 mi long - 9100 SY

Cost: $688,500 (project) $585,600 (paving)

Timeline: June 7 – Sept 27, 2021 (112 days)

02 CASE STUDY

Advanced Urban Reconstruction

West 7th and 8th Avenue Reconstruction, West Homestead, PA

- **Scope:** Reconstruct urban pavement with three distinct zones: Central Business District, residential, and near water park.
- **Accomplishment:** Applied modern technology and sustainable practices.



Image Source: ACPA

KEY FACTS:

Borough in Allegheny County, PA
Population: 1,872
Project Size: 1.0 mi long - 22,700 SY
Cost: $5,722,750 (project); $2,764,020 (paving)

03 CASE STUDY

Urban Revitalization

Intersection of Front, Church & Main in Mishawaka, IN

- **Scope:** Enhancing a city center with a functional and decorative concrete pavement solution.
- **Accomplishment:** Applied modern technology and sustainable practices.

KEY FACTS:

Population: 51,063
Project Size: 0.33 mi - 5,550 SY
Cost: $2,851,916 (total) $880,165 (paving)
Timeline: March 15 to November 16.
Traffic Volume: 25,000 vehicles per day.



Image Source: ACPA

08 CASE STUDY

Singer Island Resilient Roadway

Riviera Beach, FL



A model for sustainable coastal infrastructure and flood mitigation!

Image Source: Erdman Anthony

10 CASE STUDY

One Hundred Percent Concrete Streets

Kimberly, WI

Story of a community's strategic transition to durable infrastructure



Image Source: ACPA

The Guide Provides Answers to the Challenges!

Thanks…

We Look Forward to Providing this New Guide Soon!

