A fresh Look at Concrete Pavements for Local Agencies

Concrete Pavement for Local Agencies Seminar

Lawrence Tech University, MI | April 25, 2025

IOWA STATE UNIVERSITY
Institute for Transportation

National Concrete Pavement Technology Center

Leif G. Wathne, P.E.

CP Tech Center

Our Role…

- Serve as a hub of concrete pavement research and technology transfer for agencies, industry, and academia.
- Primary Role
  - Education and training
  - Provide state of the art guidance
  - Implementing best practices
- Affiliated with Iowa State University
  - Independence as third party experts
  - Leverage funding

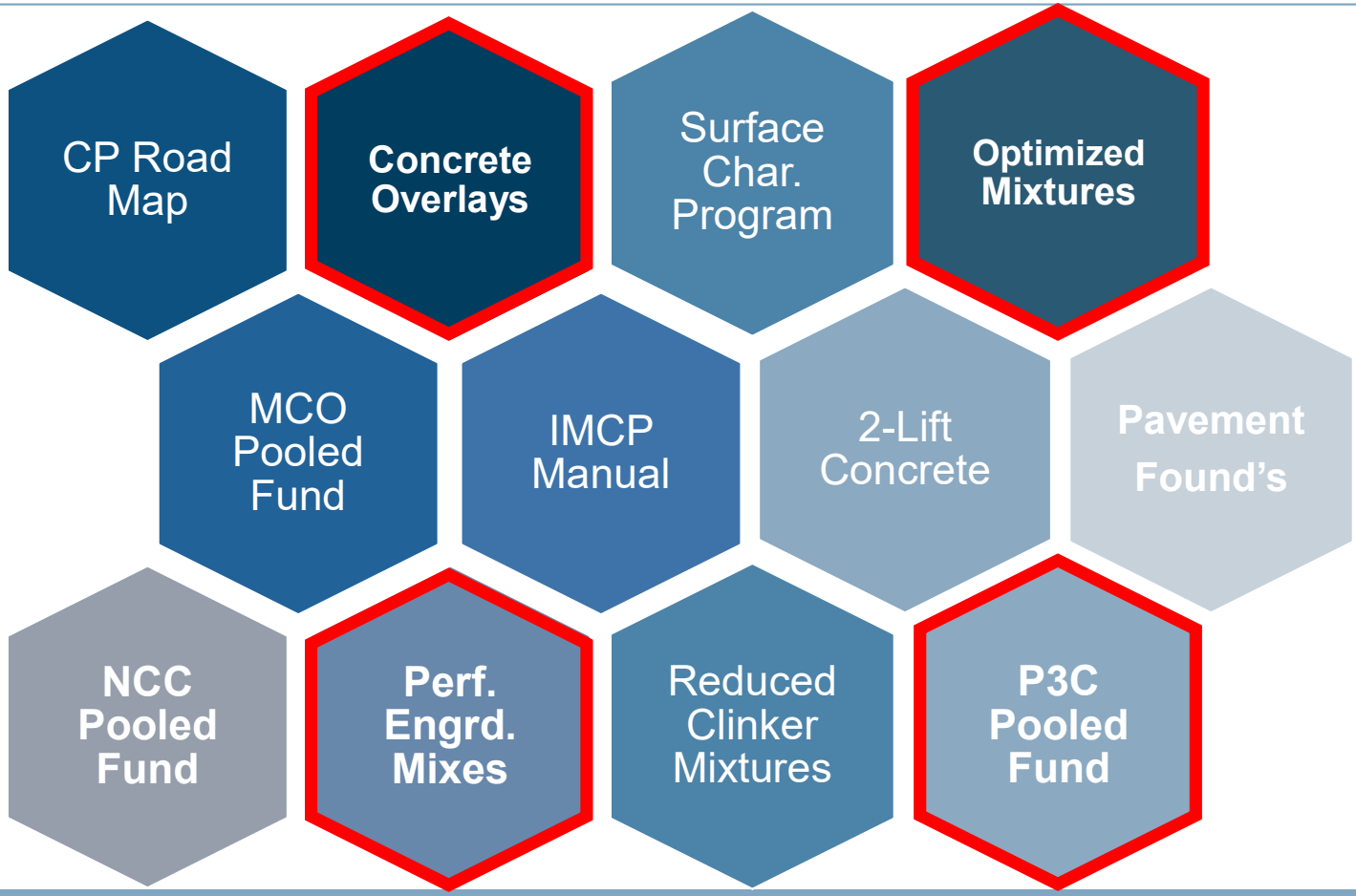
www.cptechcenter.org

CP Tech Center Celebrates 25 Years!

INNOVATION

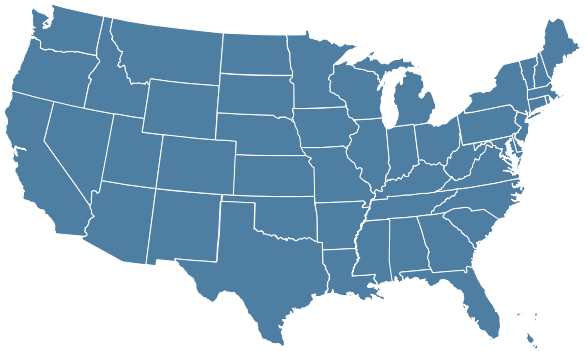
U.S. Department of Transportation
Federal Highway Administration

ACPTP
Airport Concrete Pavement Technology Program



Broad Stakeholder Engagement…

…. over the last 25 years the CP Tech Center has worked with all 50 U.S. states, 23 universities and 27 different consultants.



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23

27

RECENT PUBLICATIONS (2024)

- AASHTO T413 with Worksheet
- AASHTO T 358/402 Interlaboratory Study
- MAP Briefs:
  - Understanding EPDs
  - Sustainable pavements: CRCP Across TX
  - Toward Performance Engineered Curing
  - Webinar on Concrete Pumping and Air Testing
- Others on the way…

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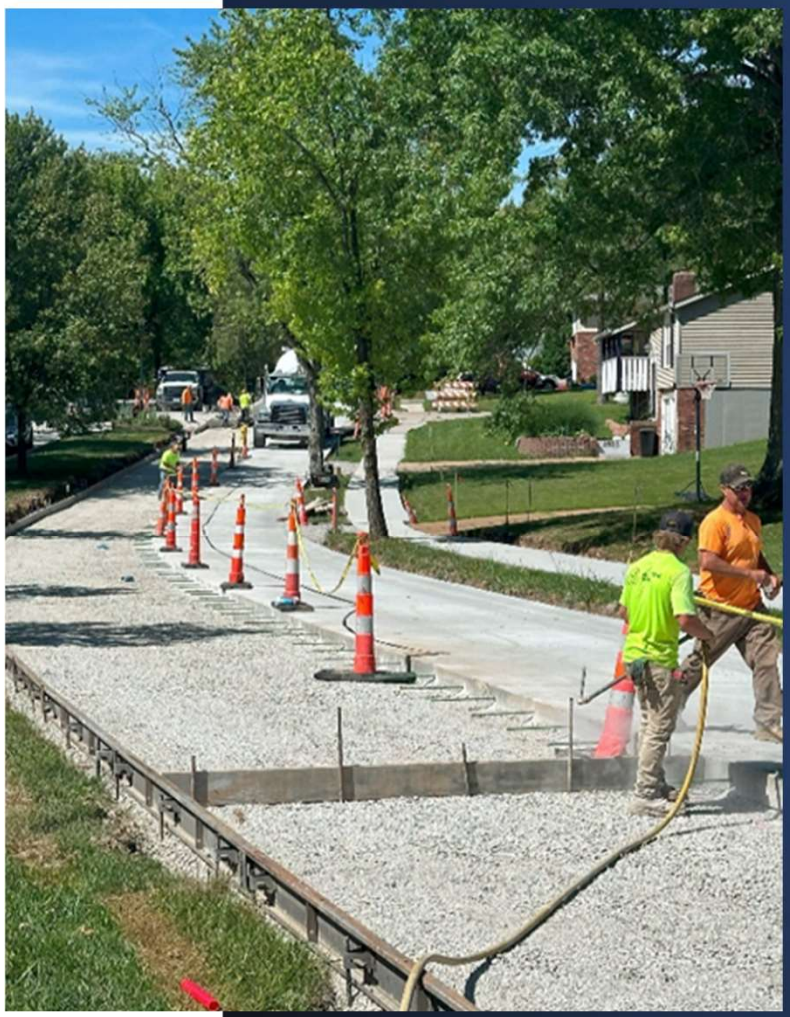
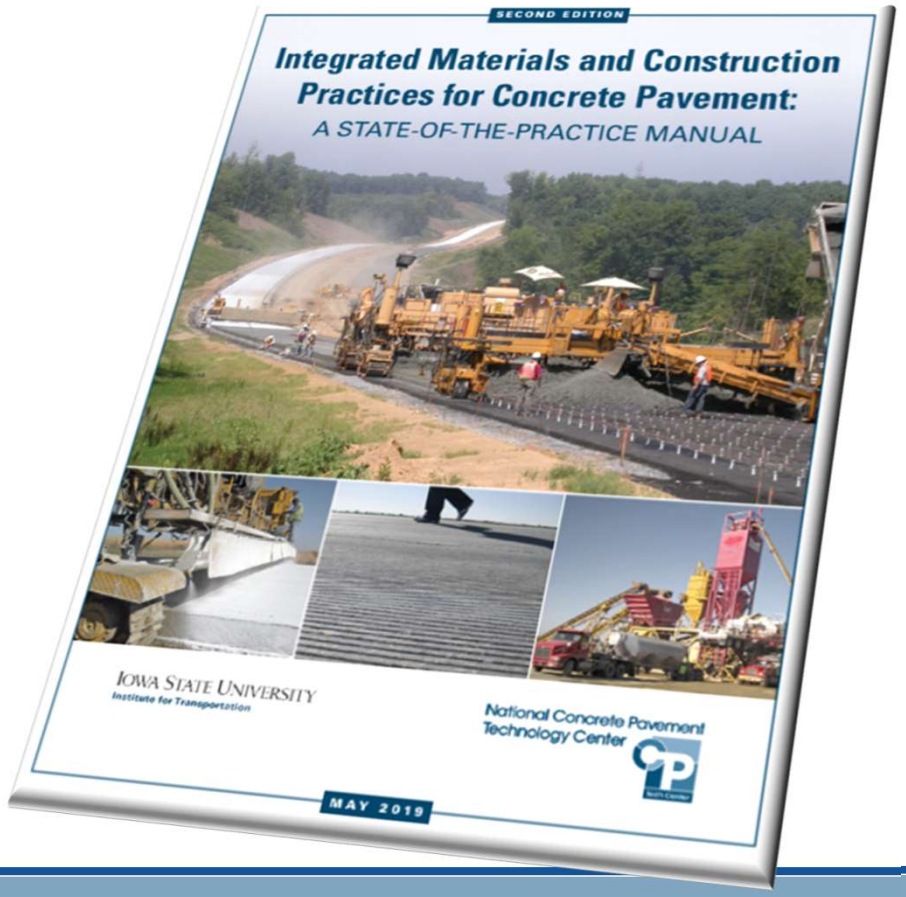
Concrete Pavement Guide for Local Agencies

- “New introduction” of concrete pavement
- Encourages “Take a fresh look!”
- Shows applications of concrete pavements
- Provides ideas on how to implement concrete pavements
- Gives basic technical information with references to CP Tech and other documents
- Driven by FHWA



Jesse Jonas

For Deeper Technical Resources - IMCP Manual…



Look’ Scope Covers

Park Roads

Bike Paths

Neighborhood Streets

County Roads

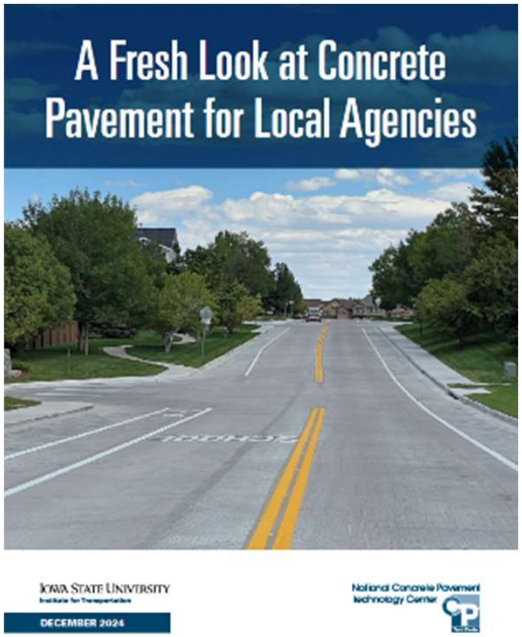
Urban Arterials

Local Roads

Roundabouts

Intersections

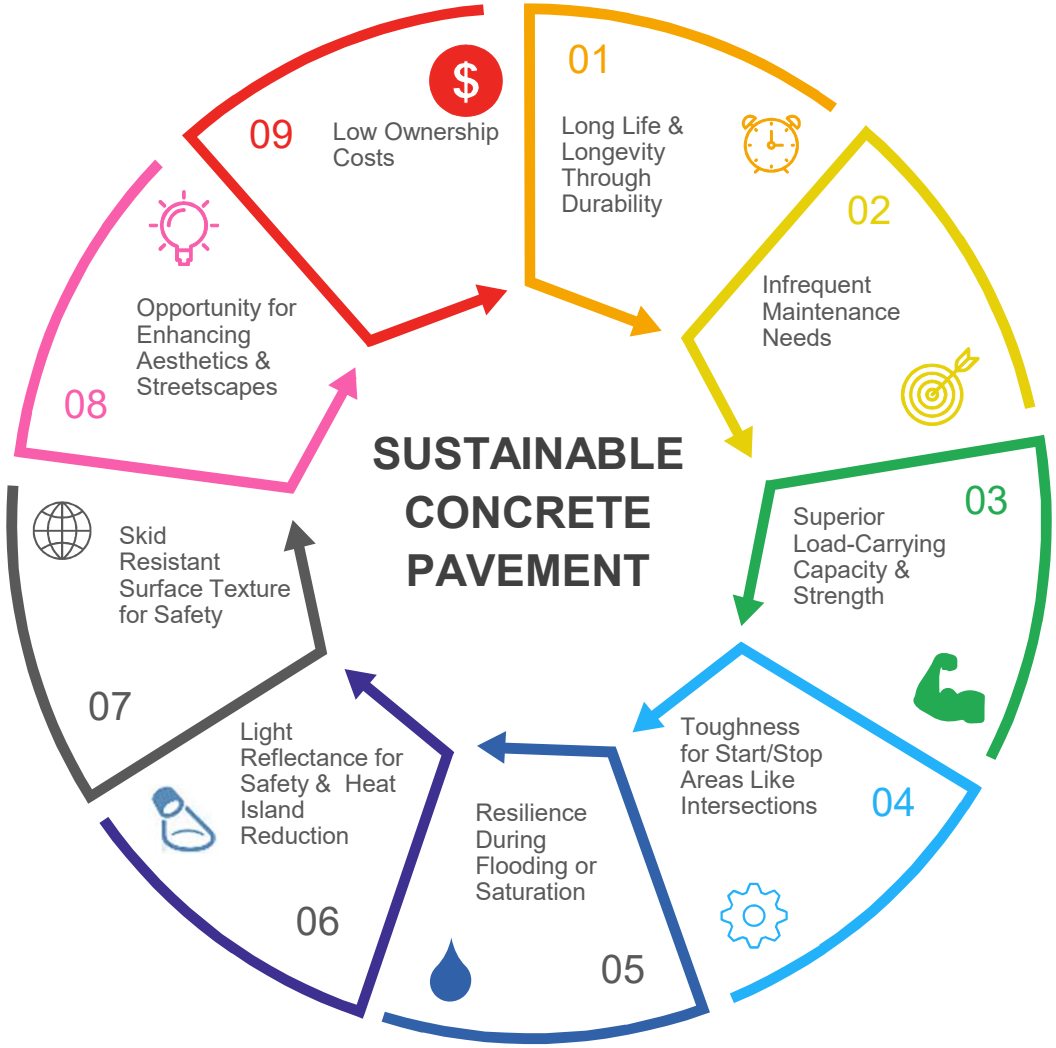
Contents



- Section 1 – A Fresh Look – The Key Benefits
- Section 2 – Solutions to Common Project Challenges
- Section 3 – Implementation Considerations
- Section 4 – Implementation Steps
- Section 5 – Preservation
- Section 6 – Where to Find Resources

Highlights of Key Benefits

Nine value points of (economically) sustainable concrete pavements...



Improving Sustainability & Performance

Performance Engineered Mixtures (PEM)

- Focuses on reducing cement content and increasing the use of supplementary cementing materials

Type IL Cements

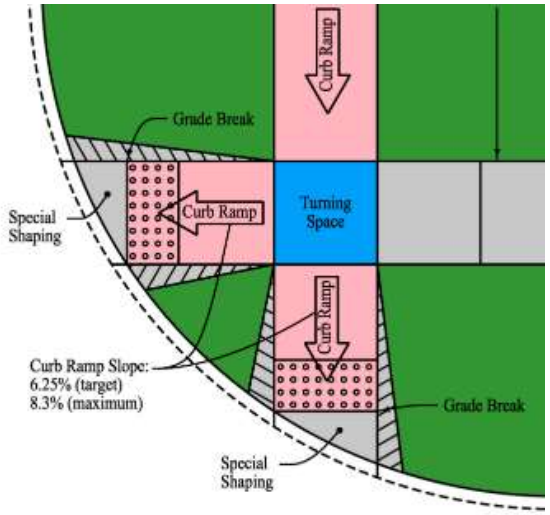
- Lower footprint compared to traditional cement

Optimized Material Selection and Proportioning

- Careful selection and proportioning of materials

U.S. Access Board Issues Final Rule on Public Right-of-Way Accessibility Guidelines

August 08, 2023

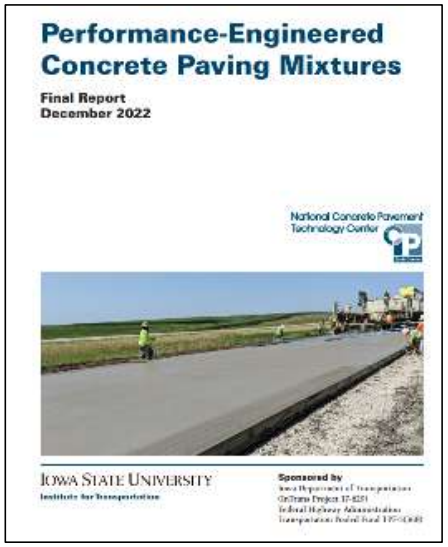


The Value for ADA Compliance

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

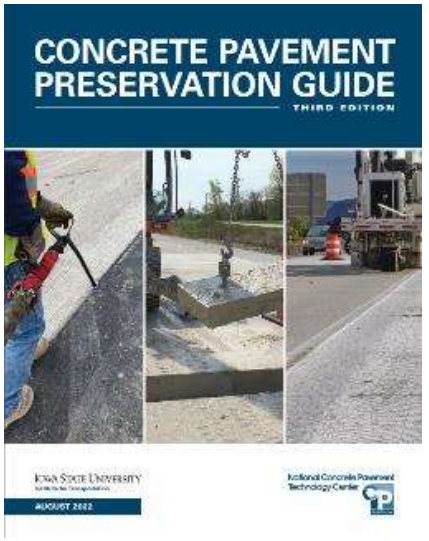
Long Life & Longevity…

- Common to achieve over 30 years service
  - Achievable with quality materials, appropriate design, good construction practices, and periodic preservation treatments
  - Long life is sustainability (and cost effectiveness)
- Expected with modern specifications
  - Specifications using modern PEM principles ensures quality materials are used in construction



Infrequent Maintenance Needs…

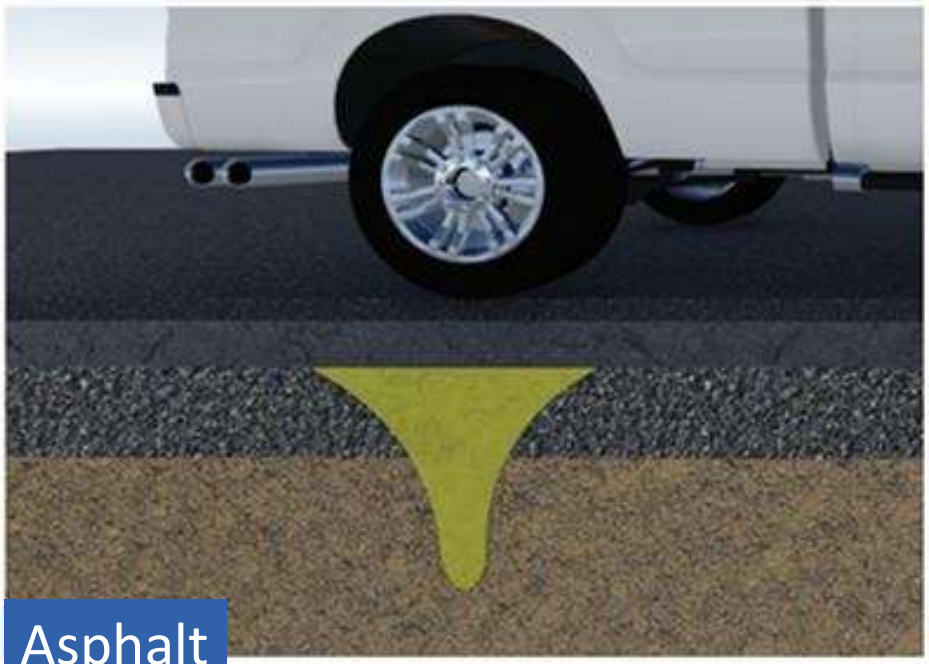
- Long Service Life with Minimal Interventions
  - Decades of life with few interventions…if quality materials, appropriate design, and periodic preservation treatments
- Routine Maintenance and Preservation
  - System of techniques available that work well when applied right and at the right time
  - Fewer maintenance cycles compared to alternatives, requiring fewer disruptions – lowering maintenance costs



Superior Load Carrying Capacity & Strength…

- Resistance to Deformation
  - Resistance to rutting and fatigue under heavy vehicle loads or extreme weather
- Wide Load Distribution
  - Low pressure on the subgrade makes pavement less sensitive to variations in subgrade and ensures stability even on weaker soils

Superior Load Carrying Capacity & Strength…



Load Distribution through the Pavement Layers
(Concrete is less sensitive to the strength of supporting layers)

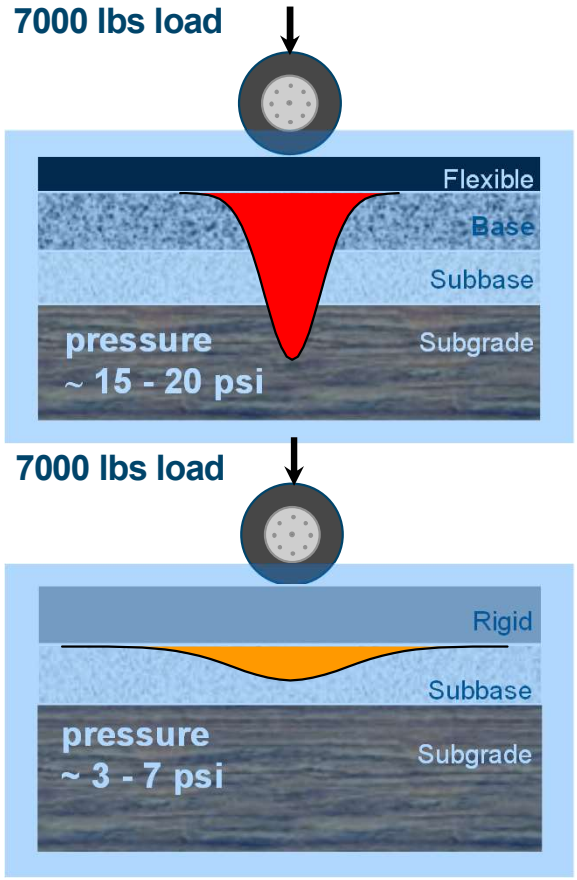
Toughness in Start/Stop Areas & Intersections

- Durability Under High Stress
  - Withstands the intense stresses caused by braking, turning, and accelerating in intersections and start/stop areas
- Reliable
  - It is a reliable and durable product that is an effective solution for intersections and other areas with frequent vehicular traffic and loading

Resilience During Flooding or Saturation

- Retention of Structural Integrity
  - Do not experience significant damage or loss of strength after exposure to flooding or prolonged inundation
- Emergency Operations & Reduced Secondary Damage
  - Remain usable for emergency responders and heavy equipment immediately after flooding events
  - Minimizes the need for extensive repairs or reconstruction after floodwaters recede

Rigid and Flexible Pavement Transmit Loads Differently



Flexible Pavement Structure

- Lowered subgrade strength & reduced modulus
  - Reduced load carrying capacity and >1 year recovery time
- Loading accelerates pavement damage / deterioration
  - Consumes fatigue life faster → Reduced pavement life

Rigid Pavement Structure

- Maintains high level of strength / stiffness
- Subgrade is weak, but still uniform
- Spreading of the load means subgrade is not overstressed
- Little impact on the serviceability / life

Flooding does not impact concrete's load carrying capacity to the same degree as asphalt's

Resilience During Flooding or Saturation

Studies find concrete pavements that have been flooded do not exhibit significant damage or loss of strength.

Climate Change, Resilience, and Concrete Pavements (King, 2023)

Light Reflectance for Safety & Heat Island Mitigation

- Enhanced Visibility and Safety
  - Reflects light better than other surfaces – improving nighttime visibility and giving drivers more reaction time

- Mitigation of Urban Heat Island Effects
  - Reflects sunlight better than other surfaces – reducing surface temperatures and combatting the urban heat island effect

City of Phoenix

Source: Heat Island Group, Berkeley

Skid Resistant Surface Texture for Safety

- Skid Resistance
  - Concrete textures provide excellent tire grip and reduce the risk of skidding, especially in wet or adverse conditions

- Long-Lasting Texture
  - Abrasion resistance helps maintain skid resistance over a pavement's lifespan, reducing need for costly interventions

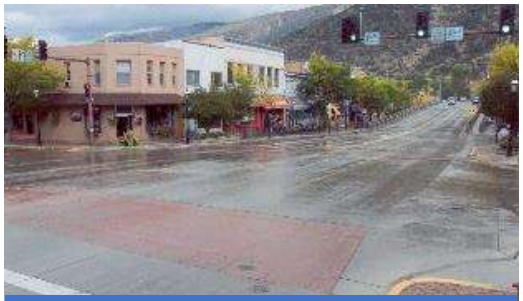
Opportunity for Aesthetics & Streetscapes

- Revitalization of Urban Areas
  - Transforms distressed neighborhoods with clean lines, bright surfaces and decorative enhancements
- Support for Context-Sensitive Designs
  - Allows for integration of local symbols and patterns, creating streetscapes tailored to the character of a community
- Fosters Lasting Civic Pride
  - Maintains structural and aesthetic qualities ensuring decorative streetscapes remain attractive and functional for long-term value

Angela Folkestad, CO/WY Chapter ACPA

Opportunity for Aesthetics & Streetscapes

Beautification



Crosswalks

Roundabouts

Streetscaping

Streetscaping

Low Ownership Costs

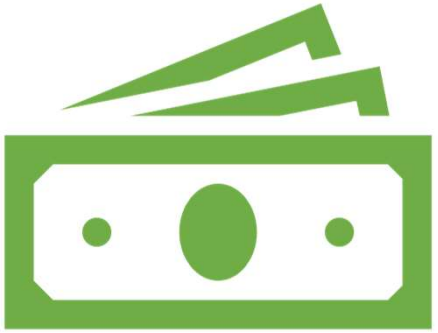
- Competitive Initial Costs
  - Up front costs are on par or lower than alternatives
- Durability and Minimal Maintenance
  - Infrequent repair interventions means lower ongoing expenses
- Life-Cycle Cost Efficiency
  - Competitive construction and lower maintenance costs spread over a long life
- Price Stability
  - Costs for constituent materials are more predictable and not subject to oil price volatility

Concrete Pavements…Common Misperceptions

"Takes too long"

"Too inconvenient"

"Too hard to repair"



"Cost too much"

Solutions to Some Common Challenges….

- Lets examine **four key issues** commonly associated with concrete pavements and highlight **actionable strategies** the new document presents to mitigate concerns…

1. Maintaining Access to Residents & Businesses

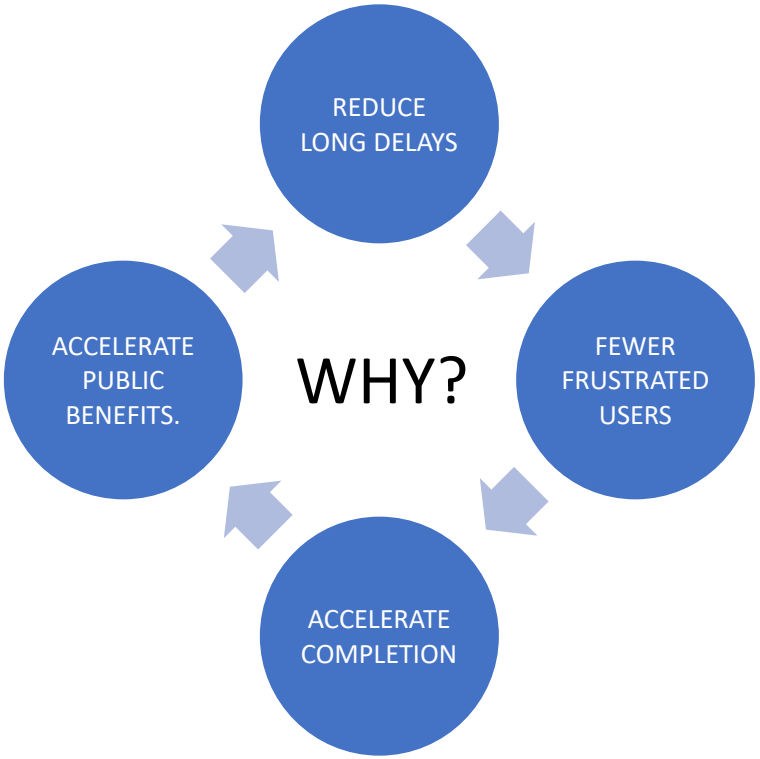
Solutions/Opportunities:

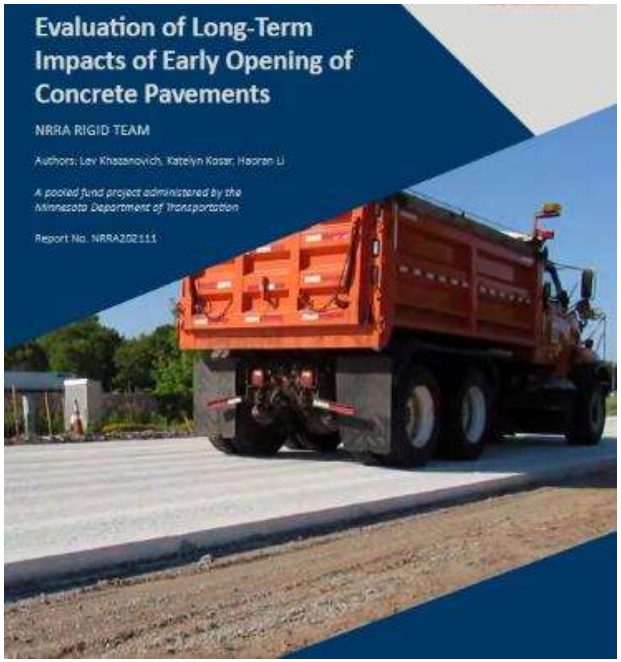
- **Phased closures** and scheduling creativity
- **Temporary access ramps** for driveway, business, pedestrian access
- **Rapid construction techniques** to shorten closure period (<48 hr.)
- **Stakeholder coordination** to plan around critical needs
- **Alternative Access Solutions** like shuttles or golf carts for residents
- **Allow Contractor Flexibility**

2. Time Required to Open Pavement to Traffic

Solutions/Opportunities:

- **Strength-based opening criteria** allows opening pavements at as low as 1,800 psi
- **High early-strength concrete** designed for rapid strength gain & long-term durability
- **Real-time monitoring** to track strength using “maturity method”
- **Optimized project construction** techniques such as only accelerating last construction stage(s)



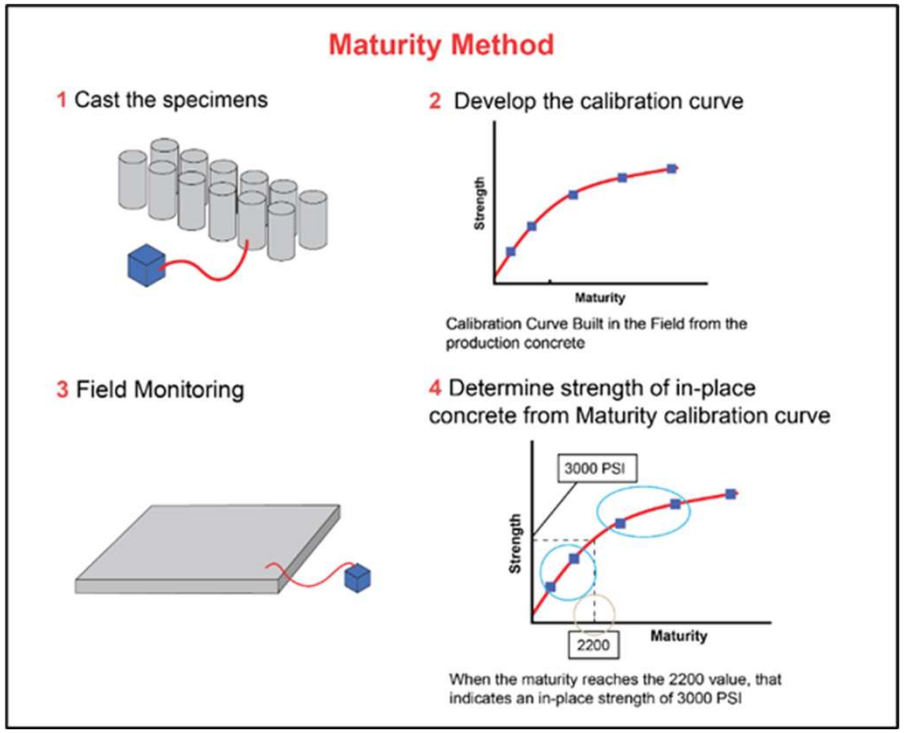


Time Required to Open Pavement to Traffic

MnDOT Study - TPF-5(341), Evaluation of Long-Term Impacts of Early Opening of Concrete Pavements

Time Required to Open Pavement to Traffic

- AASHTO T413 – Maturity Method
- Minimum 2 samples at 4 ages
- First test within 24 hours, as early as 18 hours
- First test must be less than 85% of design strength
- CP Tech Webinar: Estimating Opening Strength for Concrete Pavement Using Maturity



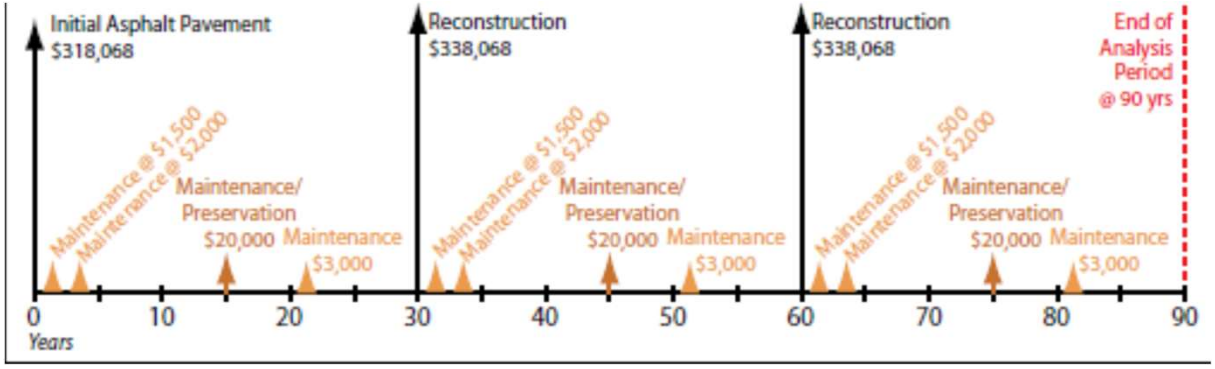
3. Concrete Pavement Costs

Solutions/Opportunities:

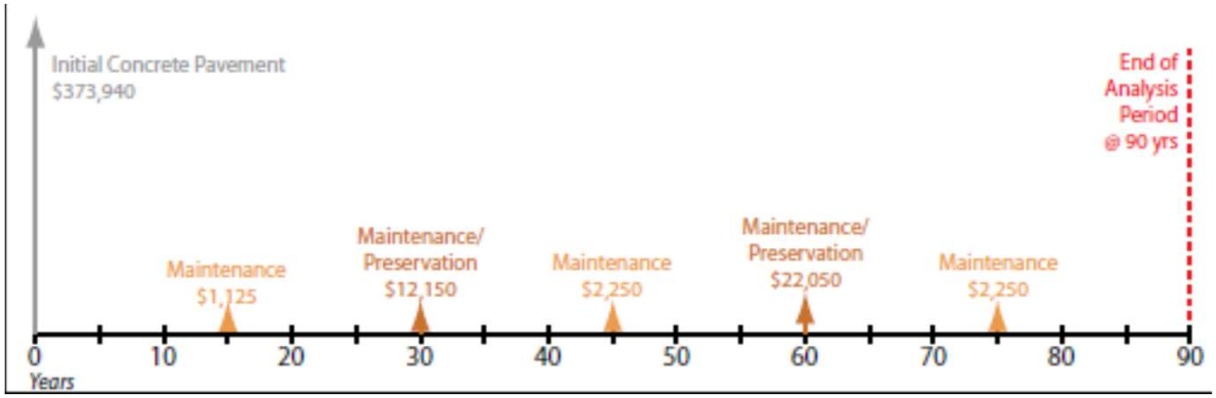
- **Life-Cycle Cost Analysis** to show the long-term savings of low maintenance
- **Equivalent Comparisons** to ensure alternatives are fairly evaluated and capable of handling similar loads and traffic volumes
- **Educational Outreach** to share successful project stories with decisionmakers

False perceptions of higher initial costs can discourage adoption

Evaluating Pavement Costs (LCCA)



Flexible



Rigid

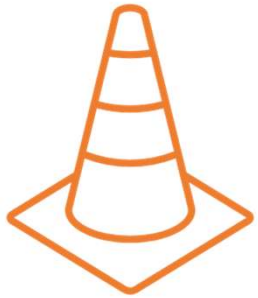
Account for the full spectrum of costs associated with pavement construction, maintenance, preservation and replacement

4. Utility Access

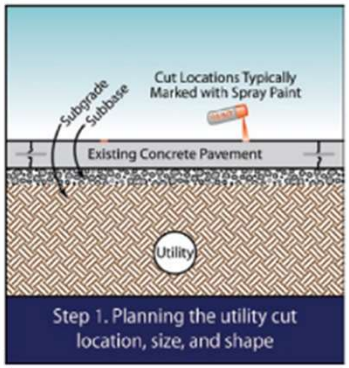
Solutions/Opportunities:

- **Efficient repair methods** employing flowable backfill and ready-mix concrete for repairs, even in cold weather
- **In-house capability** is easy to develop to reduce reliance on external contractors
- **Detailed educational resources**

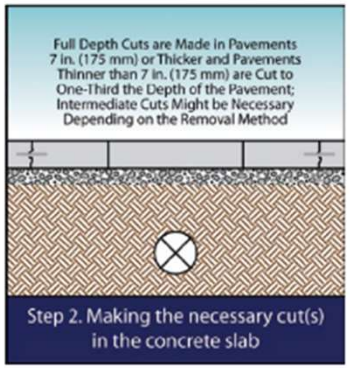
  (*Concrete Pavement Preservation Guide*)



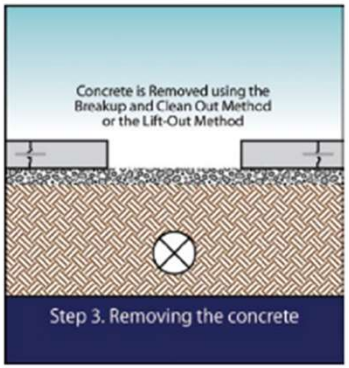
Perceived difficulty in accessing utilities under concrete pavements can falsely discourage agencies



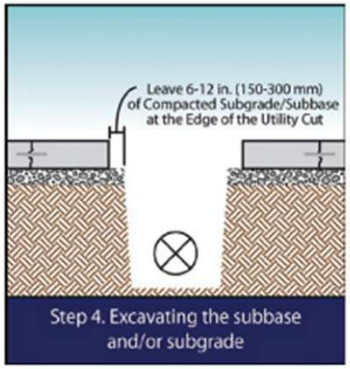
Step 1. Planning the utility cut location, size, and shape.



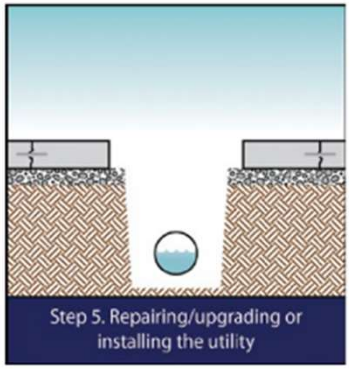
Step 2. Making the necessary cut(s) in the concrete slab.



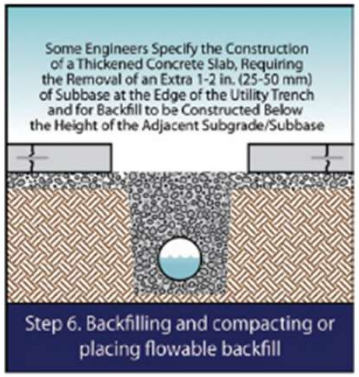
Step 3. Removing the concrete.



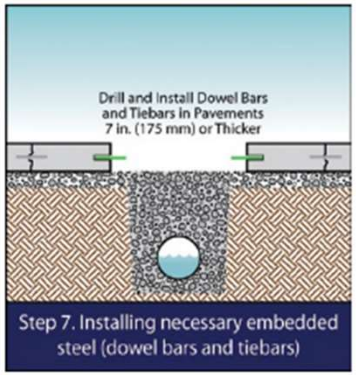
Step 4. Excavating the subbase and/or subgrade.



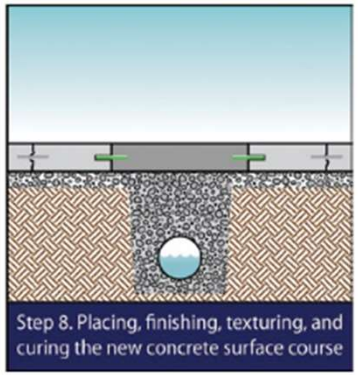
Step 5. Repairing/ upgrading or installing the utility.



Step 6. Backfilling and compacting or placing flowable backfill.



Step 7. Installing necessary embedded steel (dowel bars and



Step 8. Placing, finishing, texturing, and curing the new concrete

Step 9. Jointing and joint sealing, and Step 10. Opening to traffic.

Source: ACPA

Implementation - Features Discussed

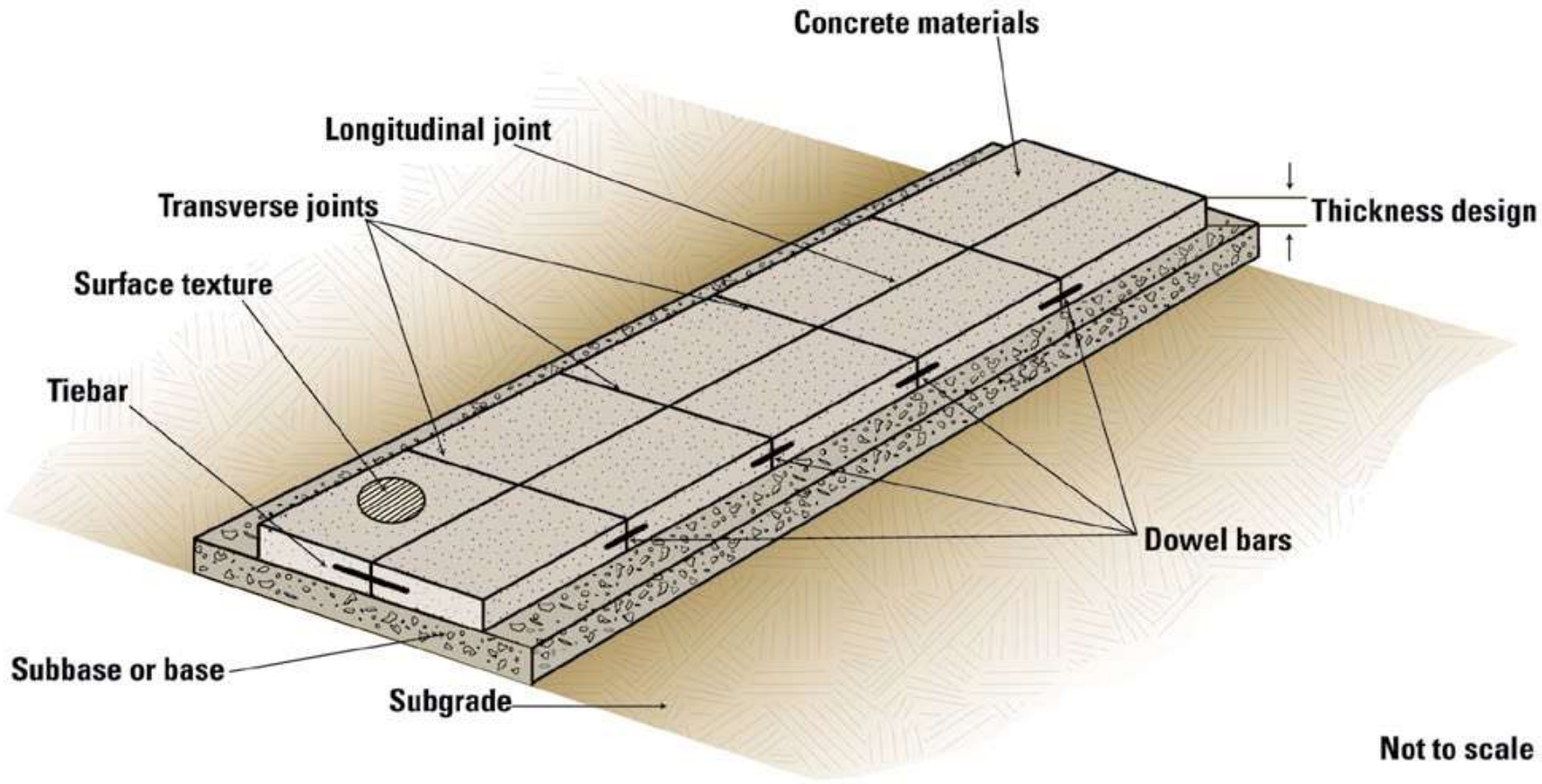


Image: ACPA

Implementation – #1 Thickness Design

- Suggest design analysis for each project
- Optimize design to avoid excess material use
- Recommend tools tailored for local agencies
- PavementDesigner.org benefits:
  - Free
  - Simple to use
  - Embedded help information
  - Simple reports

Implementation – #2 Subgrade

Proof Rolling Recommended

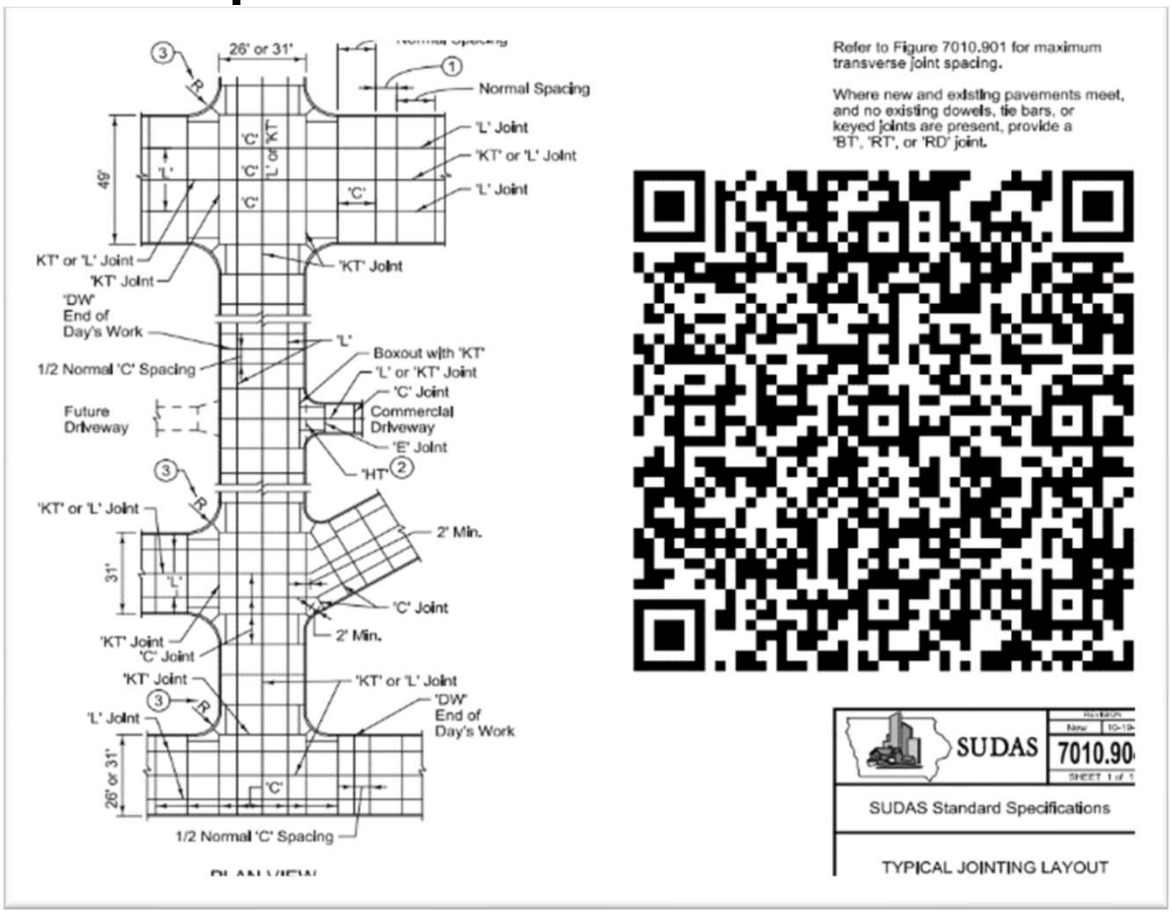
- Ensure subgrade is **uniform**
- Address if prone to heaving or swelling
- Stabilize using:
  - Cement
  - Fly ash
  - Lime, or
  - Polymer grid with a stone

Image: ACPA

Implementation – #3 Base Layer

- Consider using an 4-6 in. aggregate base
- Provides uniform support
- Stable as construction platform
- Useful for temporary traffic access
- Improves drainage

Implementation – #4 Jointing



- Describes types (contraction, construction, and isolation)
- Explains that proper jointing controls cracking
- Ensures load transfer between panels
- Details available from SUDAS

Construction Considerations…

- Paving methods
- **Batching** and Delivery
- **Finishing**
- Texturing
- **Curing**
- Sawing & Sealing

Implementation Steps

Plan & Collaborate
Set clear objectives and communicate a roadmap.

01

02

Grow Competency
Choose smaller projects to test selection criteria and specs.

Prepare Specifications
Apply standards and tolerances tailored to agency needs.

03

04

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

Invest in Staff Training
Staff and consultants are key to quality assurance.

05

06

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

Case Studies

City of Overland Park, KS

Determined that over a **15-to-20-year period, over 220 lane miles would be subject to chip seal maintenance** if they continued to maintain asphalt pavements. In 2023, the City made the decision that **all new residential and collector pavements will be constructed with concrete**. By making the change to concrete, these streets bring additional environmental benefits, including 1) less maintenance cycles, 2) fewer materials or fossil fuels required in maintenance, and 3) reduced pavement surface temperatures.

City of Overland Park

Village of Kimberly, Wisconsin

ACPA recognized the village for achieving the milestone of **100 percent concrete roads**, reflecting the village administration's long-standing policy to build streets and roads to last, and to **pass along these benefits to the taxpayers** through quality pavements, lower street maintenance costs and a better quality of life through other village services.

Leslie Ashauer, Wisconsin Concrete Pavement Association

FINAL DRAFT – PENDING

PUBLICATION/REVIEW PROCESS – UNDERWAY

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NATIONAL WORK ZONE AWARENESS WEEK

https://www.nwzaw.org/


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Institute for Transportation
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