Accelerating the Delivery of Concrete Paving Projects

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IOWA STATE UNIVERSITY
Institute for Transportation

National Concrete Pavement Technology Center

Tech Center

Accelerating the Delivery of Concrete Paving Projects

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- FHWA
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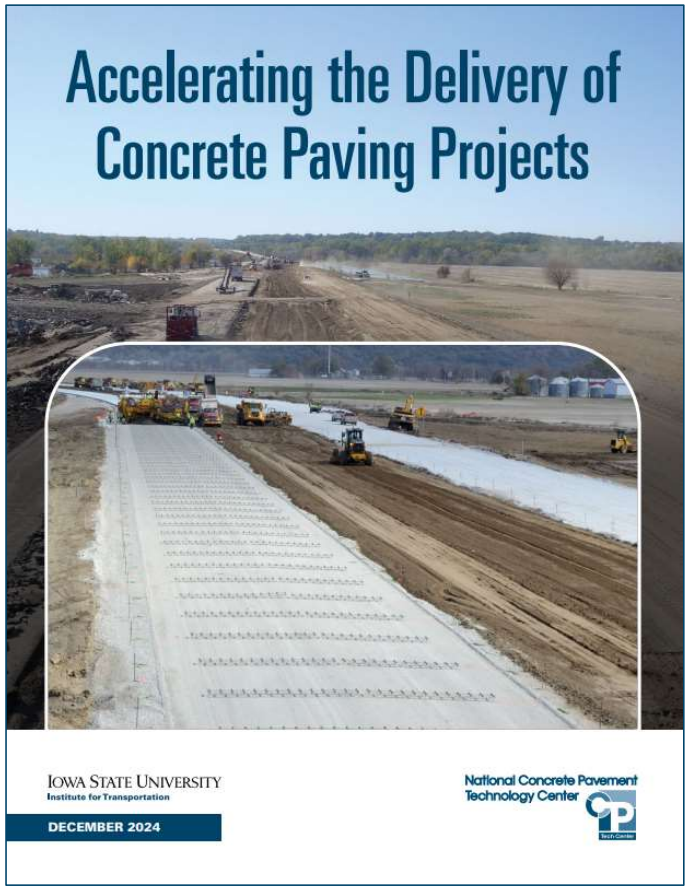


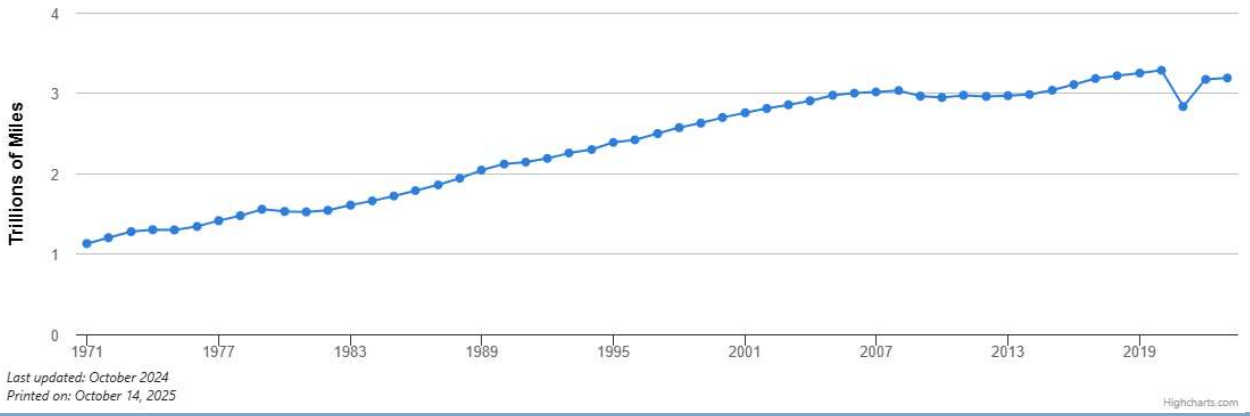
Learning Objectives

- Describe the Benefits of Accelerated Delivery
- How to Create an Efficient Project Delivery Process
- Techniques for Accelerated Concrete Pavement Construction

Introduction

Why is it important to consider accelerating the delivery of concrete pavement projects?

- Increasing demand on state highway agencies
- Deteriorating infrastructure, higher traffic, limited staff
- Public expectations to minimize disruptions



What we will cover

- Benefits of Accelerated Delivery
- Creation of an Efficient Project Delivery Process
- Acceleration of Concrete Pavement Construction
- Case Studies

Benefit: Increased Efficiency in Project Development

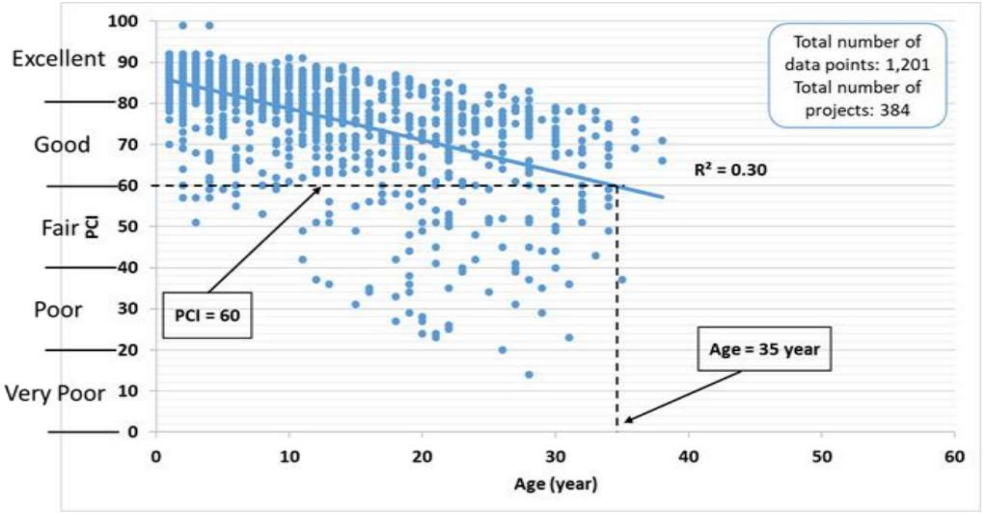
- Time and cost savings
- Define acceleration goals early
- Well defined scope, scheduling, and team communication

Insert gantt chart for design schedule

Benefit: Flexibility in Concepting

- Consider overlays, inlays, or other preservation rather than full replacement

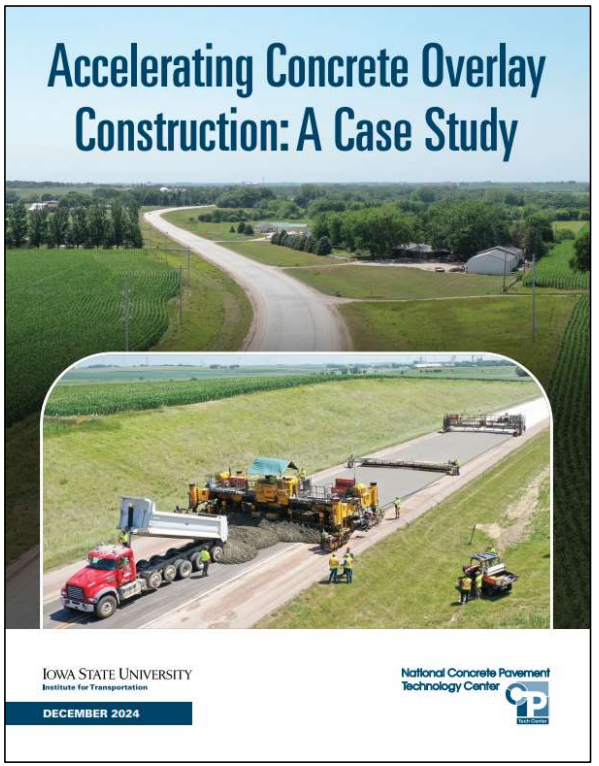
- Tailor solutions to minimize work and time
  - Detour vs. open to traffic



Benefit: Minimized Disruption to Public

- Faster construction means less disruption

- Strategies to re-open traffic quickly
  - AASHTO T413



Benefit: Improved Safety

- Shorter exposure to construction for motorists and workers

- Fewer traffic control operations

Benefit: Increased Competition & Innovation through Alternative Concrete Solutions

- Cost savings for the agency
  - Competition between paving industries
  - Alternative concrete solutions
    - Reconstruction
    - Concrete overlays
    - Concrete inlays

Benefit: Credibility with Public

- Publicize the program
  - Develop a CIP
- Advance project notice
- Ability to quickly turn a need into a completed project builds credibility and trust with the public

Public Input Meetings

Creating an Efficient Project Delivery Process

- Need for systematic capability vs. one-off acceleration

- Parallel activities, minimizing rework, integrating innovations

Creation of an Efficient Project Delivery Process

- Long-life solutions that can be delivered in a streamlined manner is safer and more economical than frequent traffic disruption.
- An efficient project delivery process that minimizes rework, allows parallel work activities to occur, and incorporates the latest technological and transportation innovation allows more to be accomplished with the talent available within the SHA.
- Helpful for agencies to retain on-call consultants that can be utilized on short notice to address unexpected demands

Organizational Strategies

- Maintain core competencies internally
  - Agencies/owner training
- Supplement with outside services as needed
  - Consultants, subs – production work

Increased Efficiency in Project Development

- Communication is essential
  - Reoccurring meetings
- (Work outside the silos)

•Concurrent workflows vs. linear silos

•Effective communication is crucial across planning, design, construction

Planning and Scoping

- Because of the importance of this decision, it is beneficial to have experts from across project planning, right-of-way (ROW), utilities, design, and operations involved in the process.
- Rehabilitating existing pavements with concrete overlays and inlays can address pavement condition needs effectively without triggering the need for additional ROW and utility considerations by providing a long-life solution within the existing footprint of the pavement.
- The traffic management approach is also a crucial decision to be made at the time of project scoping. Traffic management impacts how the project will be designed.

Design Considerations

- Environmental Clearances
- Consider Constructibility
  - •Simplicity, minimal staging, uniform widths
  - •Jointing plans to fit slip-form paving
- Utility Impacts
- Right-of-Way Design
  - Think rehabilitative options, avoid triggering new ROW
- Innovative Survey Technologies
  - •Use LiDAR, scanning tech to reduce survey time
  - •Create richer data sets for design and construction
- Earthwork
  - •Use chemical stabilization, geotextiles
  - •Reduce need for drying or complete removal of weak soil

Plan Development

- Engineer should consider providing the contractor with digital design files and three-dimensional (3D) models developed during the project design.
- A formalized schedule where the consultant and agency meet at a regularly scheduled intervals should be considered.
  - Digital files, 3D models
  - Open design to contractor suggestions, use AMG (automated machine guidance)

Procurement / Letting

- Design-Bid Build
- Construction Manager / General Contractor
- Design-Build
- Design-Build-Operate-Maintain

Alt. Contracting Methods (potential for 40-60% time savings)

Recreated from FHWA 2018

Figure 13. Traditional and alternative contracting methods

Procurement Letting (cont.)

- A+B bidding allows the agency awarding a project to consider both cost and time to construct.
- Incentives / Disincentives
  - Incentives based on milestones

Scheduling Strategies

- Avoid letting schedule conflicts
- Advertise projects adequately in advance
- Provide flexibility between award and start date

Special Considerations in Bidding

- Use pre-bid meetings
- Addenda cut-off days
- Plan for lead time for specialty items

Accelerating Concrete Pavement Construction

- General Strategies

Accelerated Concrete Paving Techniques

Table 1. Accelerated concrete paving techniques

Project Component	Possible Changes
Planning	• Implement partnering-based project management • Consider use of alternative contracting methods • Allow night construction • Allow contractors to use innovative equipment or procedures to expedite construction (e.g., minimum-clearance paving machines, dowel bar and tie bar inserters) • Provide staging criteria and schedule milestones for contractors; allow contractors to propose a staging plan to meet the criteria and schedule • Use time-of-completion incentives and disincentives
Concrete Materials	• Evaluate mixture design incorporating performance-engineered mixtures (PEM) (AASHTO R 101) • Consider use of alternative cementitious materials for rehabilitation projects • Specify more than one concrete mixture for varied strength development or allow contractors to submit a concrete mixture • Consider admixtures to improve mixture performance • Use well-graded aggregates to optimize gradation • Keep the water-to-cementitious materials (w/cm) ratio below 0.43
Jointing	• Allow use of early-entry saws
Concrete Curing and Temperature	• Consider blanket curing to aid strength gain • Apply curing agent to surface and sides of new slab as soon as possible after finishing • During cold weather, heat aggregates and mix water
Strength Testing	• Use the maturity method or other nondestructive technology to replace or minimize use of cylinders and beams for strength testing and to predict opening strength
Traffic Opening Criterion	• Revise from a time criterion to a strength criterion • Channel early loads away from the slab edges

Adapted from ACI Committee 325 2019, Table 1.2

Accelerated Construction Tools

- Contractor-driven innovations
- Stringless paving
- Longitudinal drag texture
- Early entry saws
- Open pavement based on real-time strength
  - Tools such as the maturity method (AASHTO T 413) can be used to provide real-time data.
  - Four-year research study, PITT|RISE (Khazanovich et al. 2021)

Accelerated Construction Tools (cont'd)

- MIT-SCAN, MIT-Dowel-Scan

Project Staging & Traffic Management Options

- Full closure work vs lane by lane
- Iowa DOT example: 10 mi overlay completed in 25 days

Pavement Design & Material Selection

- Use alternative cementitious materials (CAC, CSA, MPC, etc.)
- Focus on early strength and durability (AASHTO T 413)

Strategies Specific to Emergency Projects

- Legal and procedural flexibility
- Pre-approved procedures
- Use of emergency declarations for expedited work

Case Studies

Type of Project	State	Route	Description
New Construction	Iowa	US 20 in Woodbury & Ida Counties	This project involved the use of 1.7 million yd^2 of concrete to pave the final segment of a four-lane corridor on US 20 in western Iowa.
	Pennsylvania	I-376	The I-376 airport expressway is a limited-access freeway that is the main access to the Pittsburg International Airport.
Rehabilitation	Missouri	US 65	This fast-paced rebuild project involved replacing approximately 90,000 yd^2 of 10 in. pavement along the highly traveled US 65 in Springfield, Missouri, in just 32 days.
	North Carolina	I-85	A 20 mi long section on I-85 in rural North Carolina was designed to leave existing asphalt repairs in place on an over 40-year-old concrete pavement that had faulted and cracked over the years due to extremely high truck volumes. The design specified a 10 in. PCC pavement on top of an asphalt interlayer.
Overlay	Minnesota	SR 63	A 12 mi long fiber-reinforced concrete overlay was constructed in 24 working days.
	Oklahoma	I-44	This Oklahoma Turnpike Authority (OTA) project involved overlay placement and widening of 7.5 mi of turnpike
Emergency	Colorado	US 6	Flooding in 2013 caused extensive damage to northeast Colorado. One area affected by the flood was US 6 in the city of Sterling. Floodwaters overtopped that highway for an extended period, causing irreparable damage to an already weathered asphalt roadway. The US 6 Sterling Improvements Project was created to repair the roadway and provide against future floods.
	Iowa	I-680	This project reconstructed 2.6 mi of I-680 mainline (four total lanes) and 0.8 mi of interchange ramp due to flooding of the Missouri River in the summer of 2011. Emergency repair of this important corridor was essential to restore traffic, support regional recovery efforts, minimize the extent of damage, and protect what remained.

Conclusion

- Accelerated concrete pavement delivery is feasible without compromising safety or quality
- SHAs should build capacity, adopt best practices, and continuously improve delivery timelines

Thank you

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