



Accelerated Bridge Construction (ABC) Using Precast Concrete

ABCD Bridge Technical Conference

September 10, 2026



I-78 Under-clearance Project
Berks County, PA

ACCREDITATION INFORMATION

PDH Credit (1.0 PDH)

Precast/Prestressed Concrete Institute (PCI) has met the standards and requirements of the Registered Continuing Education Program (RCEP).

Credit earned on completion of this program will be reported to RCEP at RCEP.net.

A certificate of completion will be issued to each participant. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the RCEP.



TODAY'S PRESENTERS



Greg Gorman, PE
ggorman@pennstress.com

Greg Gorman, PE, President & Chief Operating Officer
PennStress, A Division of MacInnis Group LLC, Roaring Spring, PA

Greg has over 40 years of experience in the construction industry, with the 25 most recent years in the prestressed/precast concrete sector at PENNSTRESS and Newcrete Products.

In addition to precast, he has been fortunate to experience construction from multiple vantage points, including project management and business development with a general contractor; engineering and construction management with a consulting firm; and an owner representative as a US Naval Officer.

TODAY'S PRESENTERS



Russell Dickson, PE *Vice President of Engineering*

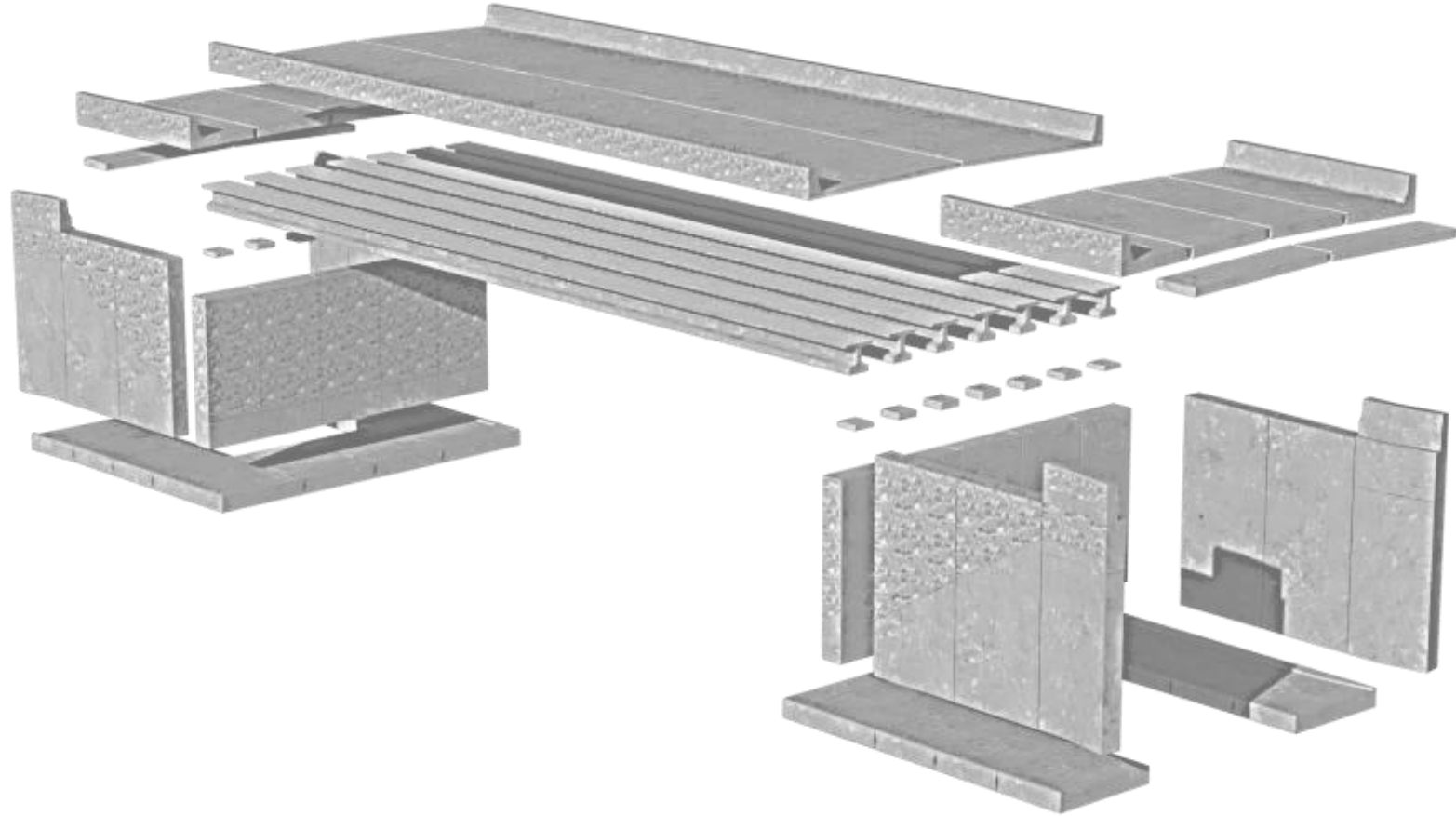
PennStress, A Division of MacInnis Group LLC, Roaring Spring, PA

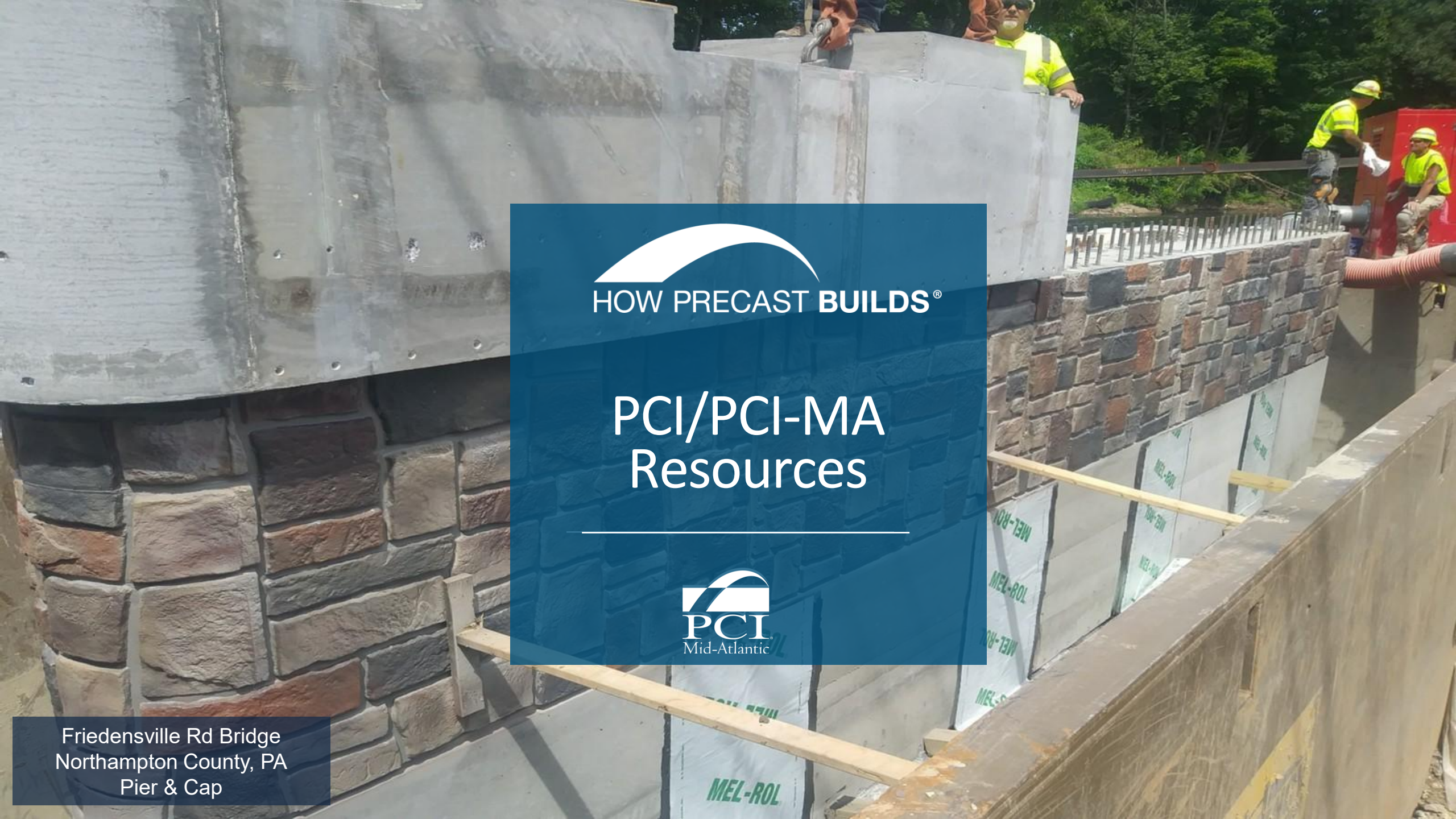
Russell has 26 years of design, innovation and production experience in both the commercial and transportation prestressed/precast concrete industry, at PENNSTRESS and Newcrete Products.

He pioneered much of the engineering, production and erection efforts for implementing total precast bridge structures in Pennsylvania and authored a patent related to modular precast concrete prison cell modules. Leading the Engineering Group at PENNSTRESS, he provides all detailing and design support for transportation and commercial products, research & development, CNC work, information reporting and 3D printing utilizing Trimble (Tekla Systems) Building Information Modelling (BIM) and additional structural applications.

PRESENTATION OUTLINE

- PCI Transportation/Bridge Resources
- ABC Advantages
- Types of ABC Structures
- Engineering & Detailing – 3D BIM
- Substructures
 - Footings and Abutment & Wing Walls
 - Piers & Abutment / Pier Caps
 - Sleeper & Approach Slabs
- Superstructures
 - Prestressed/precast Concrete Beams
 - Deck Panels: Partial & Full-Depth
 - Beam-Deck Integral Modular Systems
- Quality Assurance & Control
- Delivery & Erection
- Ultra-High Performance Concrete (UHPC)





HOW PRECAST BUILDS®

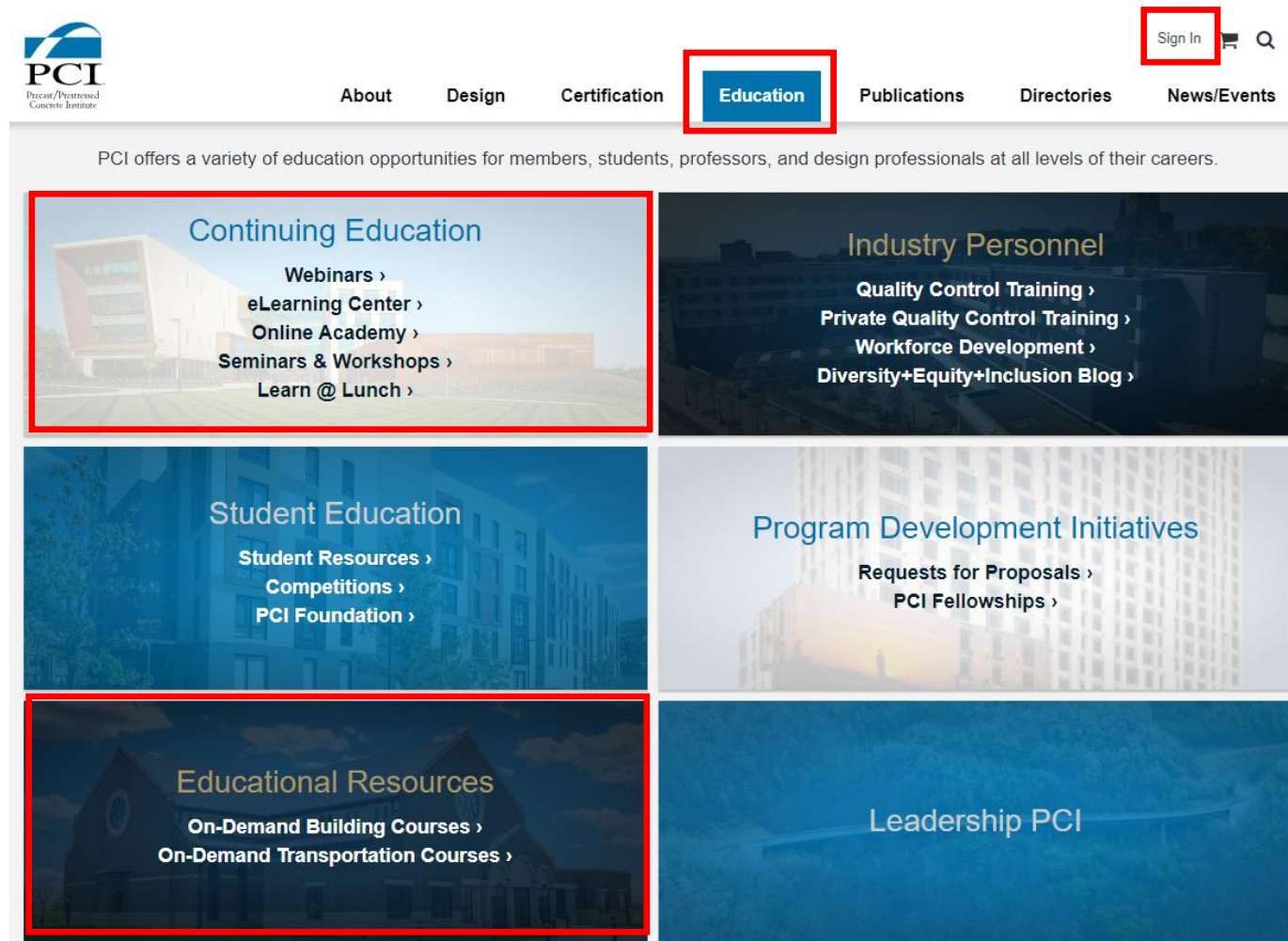
PCI/PCI-MA Resources



Friedensville Rd Bridge
Northampton County, PA
Pier & Cap

PCI Education Resources and Programs

www.pci.org/PCI/Education



Available Education Resources

1. **Webinars:** Transportation-related and many other topics.
2. **Online Academy:** Live multi-week school held in the evenings; these have a charge for attendance.
3. **eLearning Center:** recorded, virtual, on demand training that is free.
4. **Learn@Lunch Presentations:** offered by every PCI Chapter (me) and often with producer members. Live and virtual options. Free.
5. **Plant Tours locally**

PCI Education – eLearning Center: www.pci.org

The screenshot shows the PCI Education – eLearning Center website. The PCI logo is in the top left. The navigation bar includes links for About, Design, Certification, Education (highlighted with a red box), Publications, Directories, and News/Events. A 'Sign In' button is in the top right. Below the navigation bar, a banner states: 'PCI offers a variety of education opportunities for members, students, professors, and design professionals at all levels of their careers.' The main content area is divided into six sections: Continuing Education (with links to Webinars, eLearning Center (highlighted with a red box), Online Academy, Seminars & Workshops, and Learn @ Lunch), Industry Personnel (with links to Quality Control Training, Private Quality Control Training, Workforce Development, and Diversity+Equity+Inclusion Blog), Student Education (with links to Student Resources, Competitions, and PCI Foundation), Program Development Initiatives (with links to Requests for Proposals and PCI Fellowships), Educational Resources (with links to On-Demand Building Courses and On-Demand Transportation Courses), and Leadership PCI.

The screenshot shows the PCI eLearning Center course catalog. A welcome message at the top states: 'Welcome to the PCI eLearning Center, a tool dedicated specifically to precast concrete and prestressed concrete. Whether you want to enhance your knowledge of the design aspects of precast concrete, advance your quality control skills, or learn about cornices, reveals, and other aspects of architectural precast concrete, the PCI eLearning center is for you. Be sure to bookmark and visit this page often, as we add more, easy-to-access courses.' Below the welcome message is a search bar and a 'Transportation' filter. A list of courses is displayed, including 'PCI eLearning Course T624: Overview of PCI's Recommended Practice for Prestressed Concrete', 'PCI eLearning Course T626: Application of PCI's Recommended Practice to Building Piles', 'PCI eLearning Course T505: Bridge Geometry-Fundamentals of Roadway Geometry', and 'PCI eLearning Course T510: Bridge Geometry-Working with Horizontal Alignments'. A red arrow points to the 'On-Demand' button for the first course. Each course entry includes a 'Free' button and a 'More' icon.

- 33 Transportation Courses – Free
- 117 PDH available across topics
- Need a PCI account to sign in

PCI Publications: www.pci.org/bookstore

The screenshot shows the PCI Bookstore website. At the top is the PCI logo (Precast/Prestressed Concrete Institute) and a navigation menu with links: About, Design, Certification, Education, Publications (highlighted with a red box), Directories, and News/Events. Below the menu is a dark blue header with the word "Bookstore" in white. On the left is a sidebar with "Subject Types" (Building / Architectural, Transportation / Infrastructure (highlighted with a red box), Parking Structure, Field Construction, Quality Assurance, Workforce Development) and "Document Types" (Standards, Manuals, Reports, Guides, Free Resources, Designer's Notebooks, Publication Errata). The main content area features a search bar with "TAE" and a "Go" button. Below the search bar are three featured publications: "SD01 - Report on Seismic Design of Precast Br" (State-of-the-Art Report on Seismic Design of 2013, 1st Edition, Free PDF Download, https://doi.org/10.15554/SD-01-13), "SG92 - Precast/Prestr" (State-of-the-Art Report on Seismic Design of 1992, 1st Edition, https://doi.org/10.15554/SG-92-13), and "ASPIRE" (SIMPSON GUMPERTZ & HEGER THRIVES ON CHALLENGING PROJECTS). On the right is a large image of the "BRIDGE DESIGN MANUAL" (MNL 133 4th Edition, 2023).

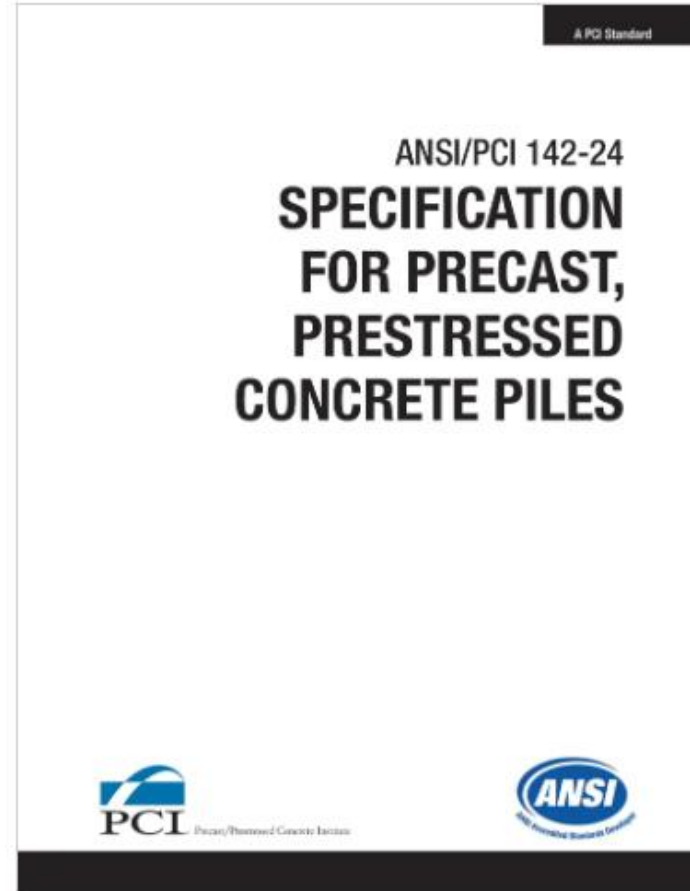
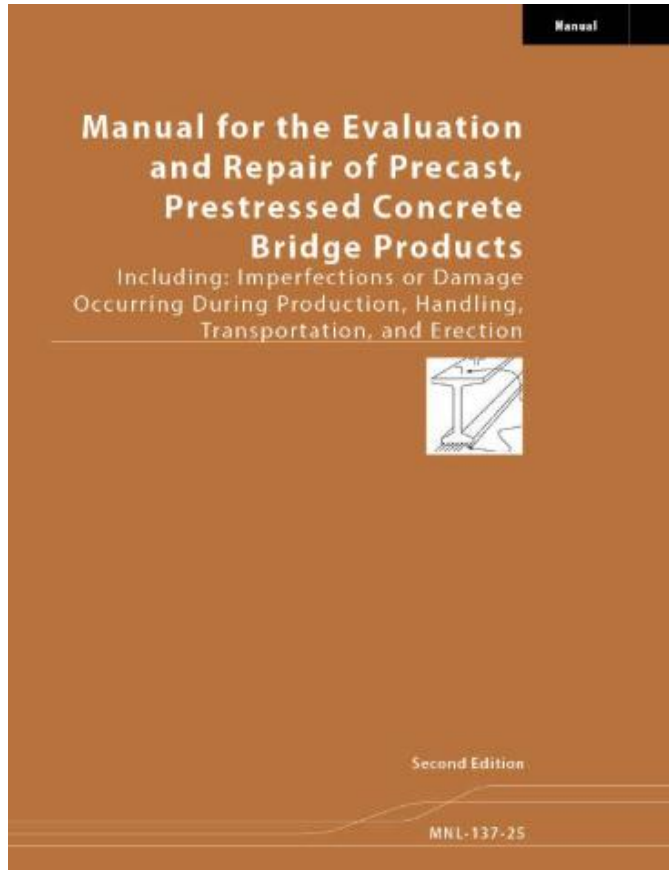
From Left Menu, Select
Transportation/Infrastructure

- Bridge Design Manual, 4th Edition, MNL-133-23H
- Bridge Geometry Manual
- Pile Design Manual
- Full Depth Deck Panel Manual
- Pile Interaction Curves
- Tolerance Manual
- Curved Precast Bridges
- State of Art Integral Bridges
- State of Art Seismic Design
- Splice Girder Bridges
- Adjacent Box Beam

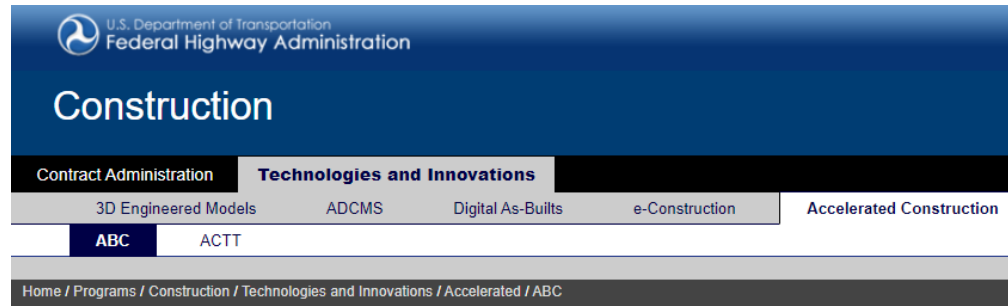


Quarterly
Publication

Other PCI Publications and Periodicals



FHWA Website: www.fhwa.dot.gov/Bridge/ABC/



Accelerated Bridge Construction

- [Project Planning](#)
- Geotechnical Solutions
- Structural Solutions
 - [Prefabricated Elements & Systems](#)
 - [Structural Placement Methods](#)
 - [Ultra-High Performance Concrete Connections for Prefabricated Bridge Elements](#)

What is ABC?

ABC is a paradigm shift in the project planning and procurement approach where the need to minimize mobility impacts which occur

Intrinsic benefits of the ABC approach include improvements in:

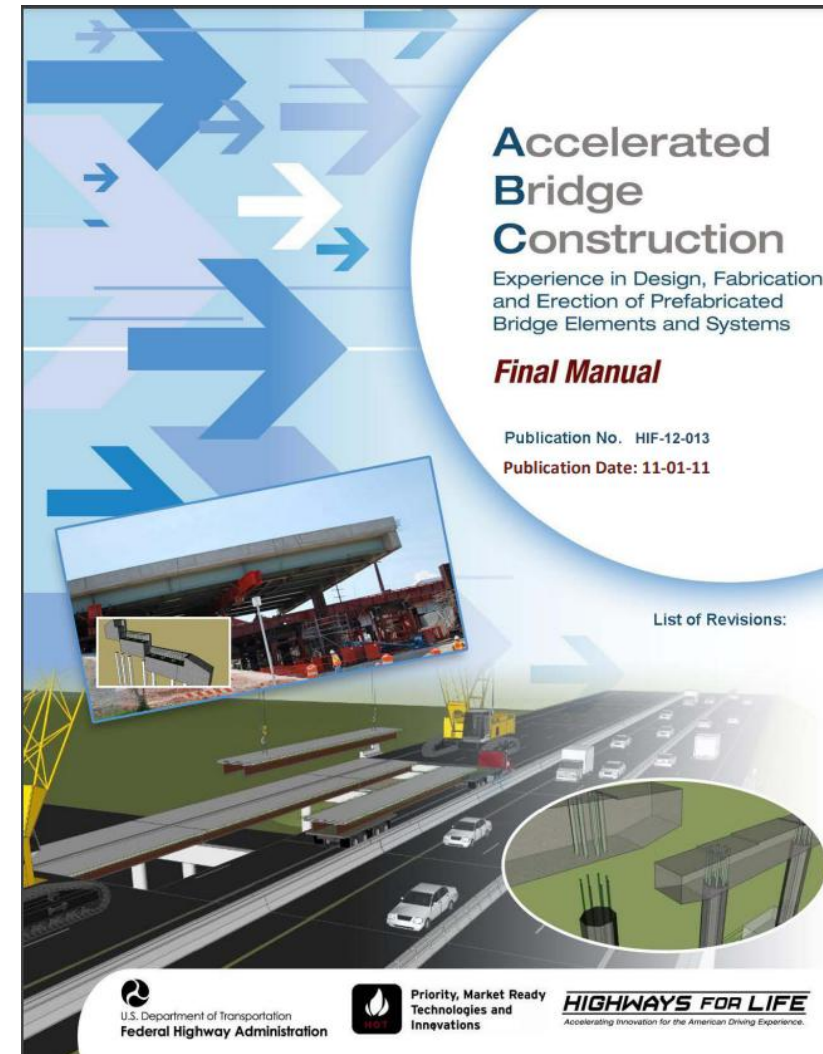
- Safety
- Quality
- Durability
- Social costs and
- Environmental impacts.

From the Owner Agency perspective ABC may require a change in how a project is approached and how it is justified.

As such, Project Planning tools with innovative solutions are provided to help streamline the development process and ensure success.

Accelerated Bridge Construction (ABC):

ABC is bridge construction that uses innovative planning, design, materials, and construction methods in a safe and cost-effective manner for replacing and rehabilitating existing bridges.



ABC-UTC Center Website: abc-utc.fiu.edu/resources/



ACCELERATED BRIDGE CONSTRUCTION
UNIVERSITY TRANSPORTATION CENTER



FLORIDA
INTERNATIONAL
UNIVERSITY

HomeResearchEducationWebinarsResourcesConferenceNewsEvents

Resources

The ABC-UTC is a resource center for ABC-related materials. Links on the left menu provide extensive information:

- **Project & Research Databases.** The ABC-UTC is working in cooperation with FHWA, bridge owners, and other bridge professionals to accumulate available completed construction projects in which ABC technologies are used, for posting in the *ABC Project Database*, and also completed, ongoing, and proposed research projects investigating ABC technologies, for posting in the *ABC Research Database*.
- **ABC-UTC Guides.** A short document for each research project as part of the deliverables to provide essential information needed to put research results into practice.
- **Contractor Workshop.** The contractor workshops bring together regional engineers and their construction contractor partners to explore common interests related to ABC and how to better design, specify, build, and pay for ABC projects in the region.
- **State DOTs.** ABC-related materials are available from a number of State DOTs.
- **Implemented Advanced Technologies.** Proprietary and non-proprietary innovations that have at least one project included in the *ABC Project Database* and have been presented in an *ABC-UTC monthly webinar* featured presentation are described in detail.
- **Industry.** The concrete, steel, and composites bridge industries are partners as ABC technologies are implemented nationwide.
- **FHWA.** The Federal Highway Administration provides national ABC leadership and has a number of ABC-related products.
- **SHRP2 Implementation.** An AASHTO / FHWA / TRB partnership, SHRP2 produced several ABC-related products now being implemented nationwide.
- **TRB ABC Joint Subcommittee.** The focal point for Transportation Research Board (TRB) ABC activities was the ABC Joint Subcommittee under the Bridges and Structures Section (AKB00) and Construction Section (AKC00) of the Highway Infrastructure Group (AK000) in the Technical Activities Division of TRB. The Subcommittee completed its work and was sunset in June 2022.

UPCOMING EVENTS

April 18, 2024
Ultra-High Performance Concrete Link Slab Design and Construction

April 26, 2024
Insights into the Pull-Off Strength of Polymer Concrete and the Effect of Nanomodification

June 3, 2024 – June 5, 2024
2024 International Bridge Conference - San Antonio, TX

October 20, 2024 – October 23, 2024
ASBI 36th Annual Convention and Committee Meetings - Atlanta.

Resources

Project & Research Databases

ABC-UTC Guides

Contractor Workshop

State DOTs

Implemented Advanced Technologies

Industry

FHWA

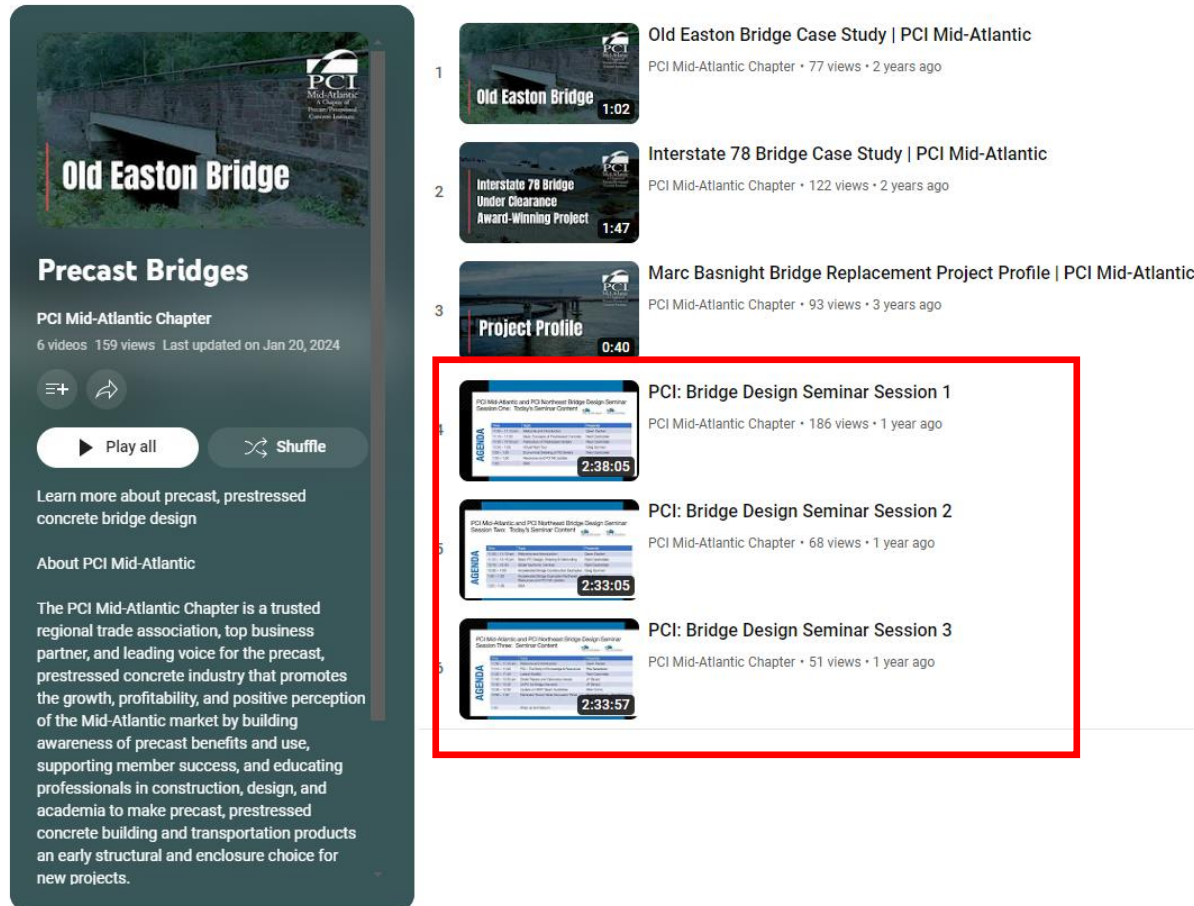
SHRP2 Implementation

TRB ABC Joint Subcommittee

Links provide information

- Project & Research Databases
- ABC-UTC Guides
- State DOT Resources
- Implemented Advanced Technologies
- Bridge industries
- FHWA
- SHRP2 implementation

PCI Mid-Atlantic YouTube Playlist: Precast Bridges

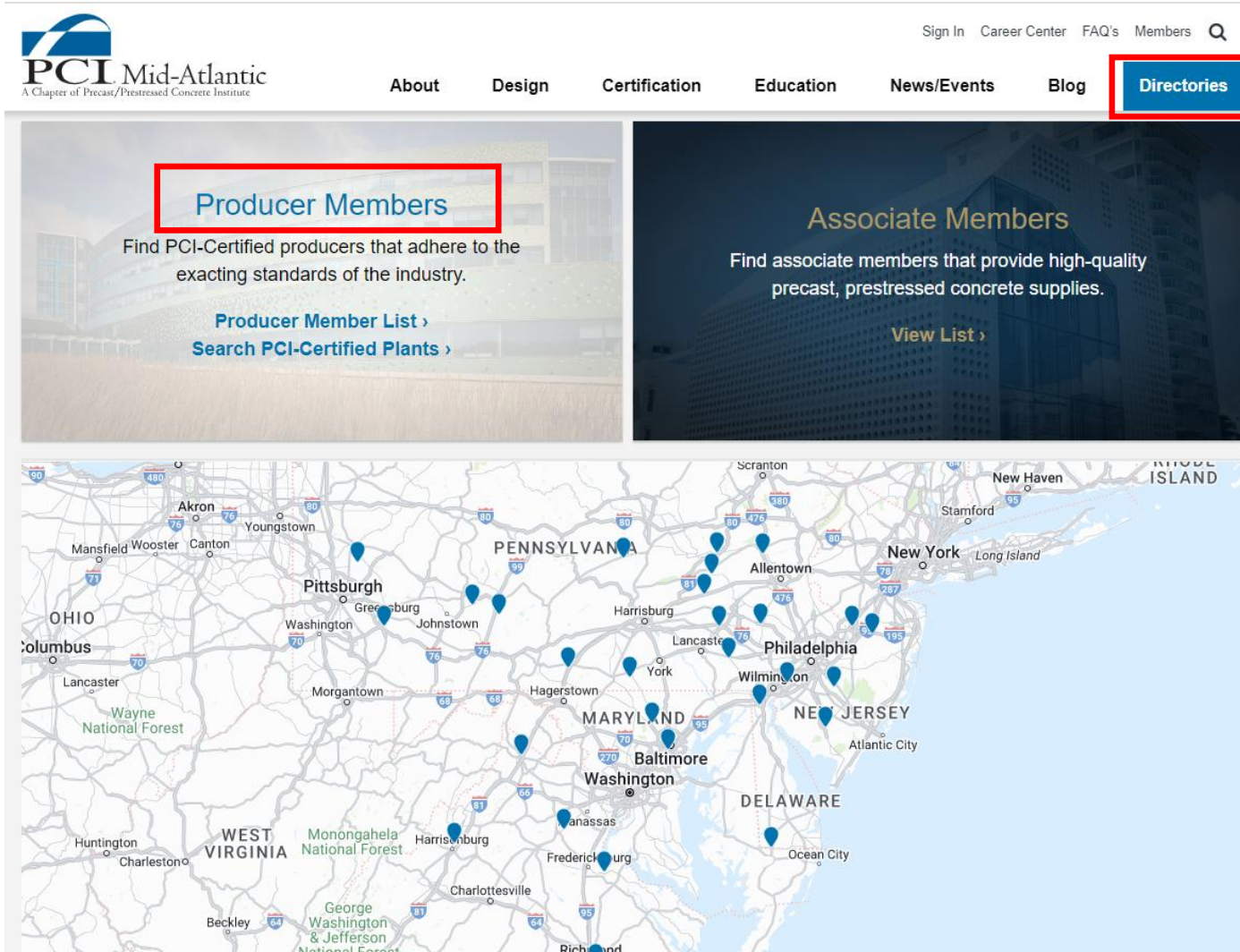


3-Part Bridge Design Seminar

- Regional and Industry Experts
- Basic Concepts of Prestressed Concrete
- Fabrication of Prestressed Girders
- Virtual Plant Tour
- Economical Detailing of PS Girders
- Basic PC Design; Draping & Debonding
- Girder sections; Camber
- Accelerated Bridge Construction Examples
- Lateral Stability
- UHPC for Bridge Elements
- Fabricator Roundtable Discussion Panel

www.youtube.com/@pcimidatlantic

Contact a Regional Fabricator www.pci.org/PCIMidAtlantic



From Top Menu, Select **Directories**, then **Producer Members**

- NJ, PA, VA, Washington D.C., DE, MD (producers in NJ and PA also do projects in the NYC market)
- Design assistance, schedule planning, budget development, value engineering assistance



PENNSTRESS manufacturing facility and storage yard



HOW PRECAST BUILDS®

ABC Precast Advantages



Ashcom Bridge over Cove Creek
Bedford County, PA

*“America is building again,
at the Department of Transportation,
that means getting back to basics:*

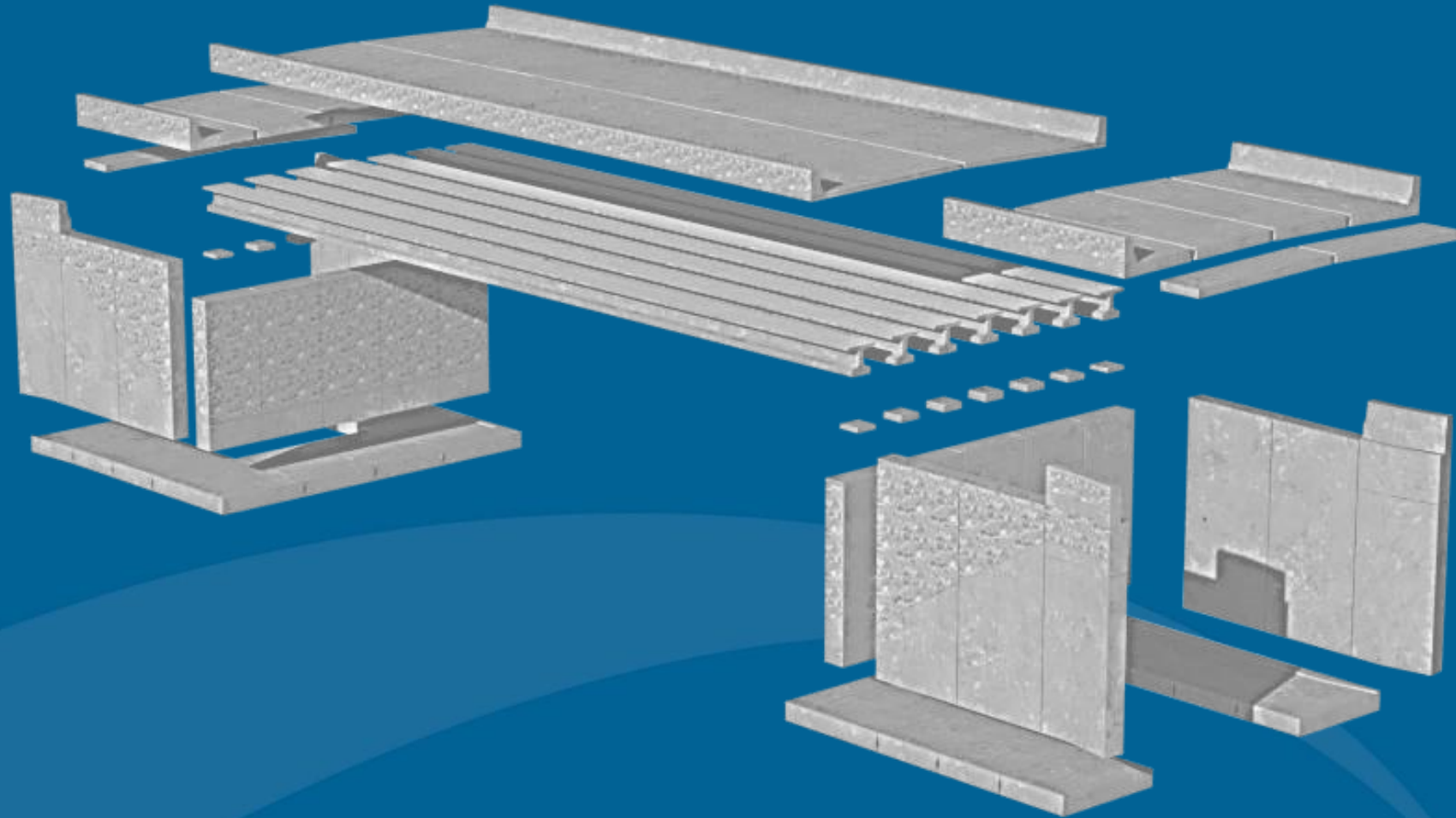
*Building **More**, Building **Efficiently** and
Building **Quickly**.”*

*U.S. Transportation Secretary
Hon. Sean P. Duffy*

ABC **ADVANTAGES**

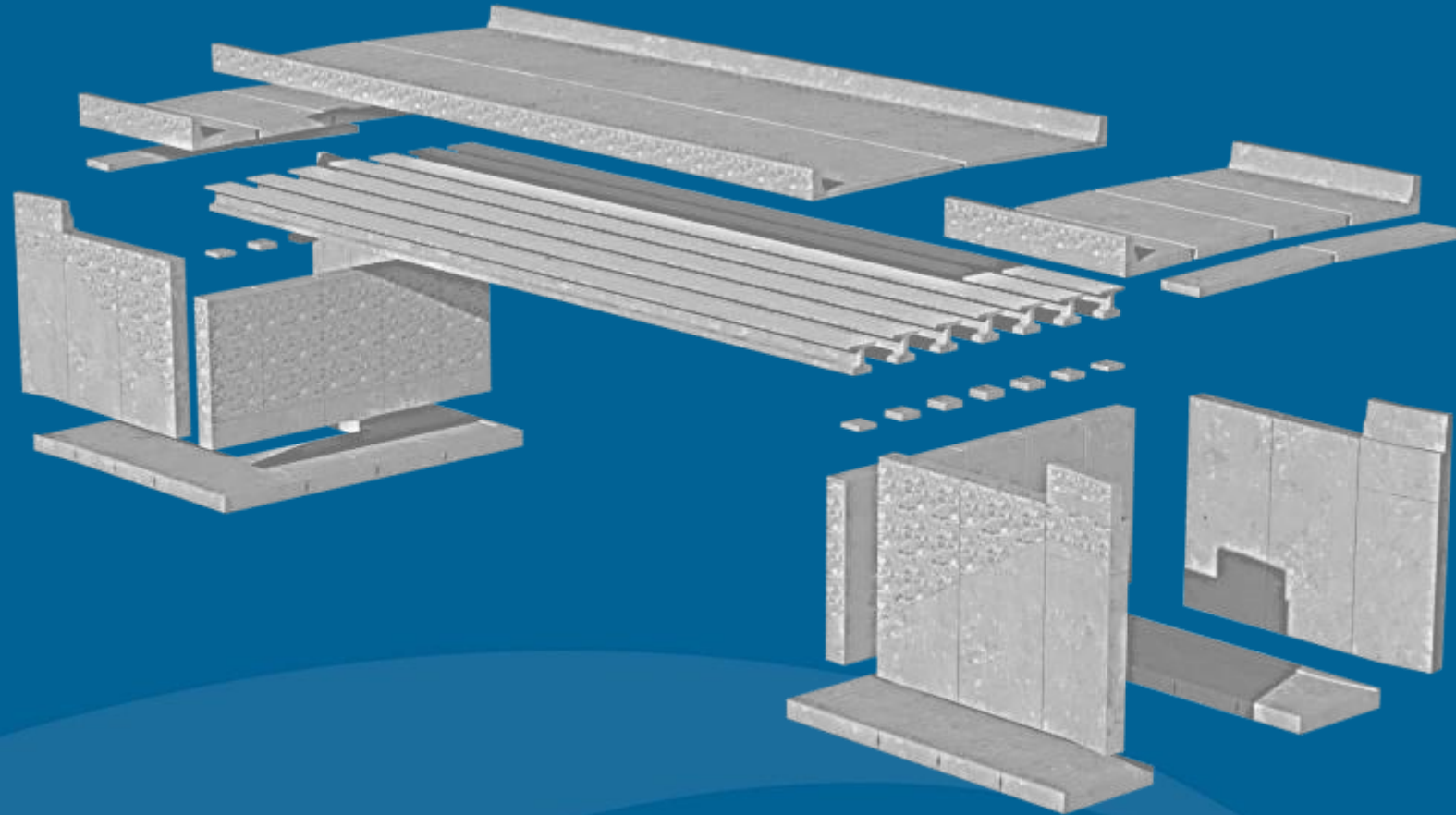
- Building **MORE**
- Building **EFFICIENTLY**
- Building **QUICKLY**
- Building **BETTER QUALITY**
- Building **SAFELY**

Prefabricated Bridge Elements & Systems (PBES)



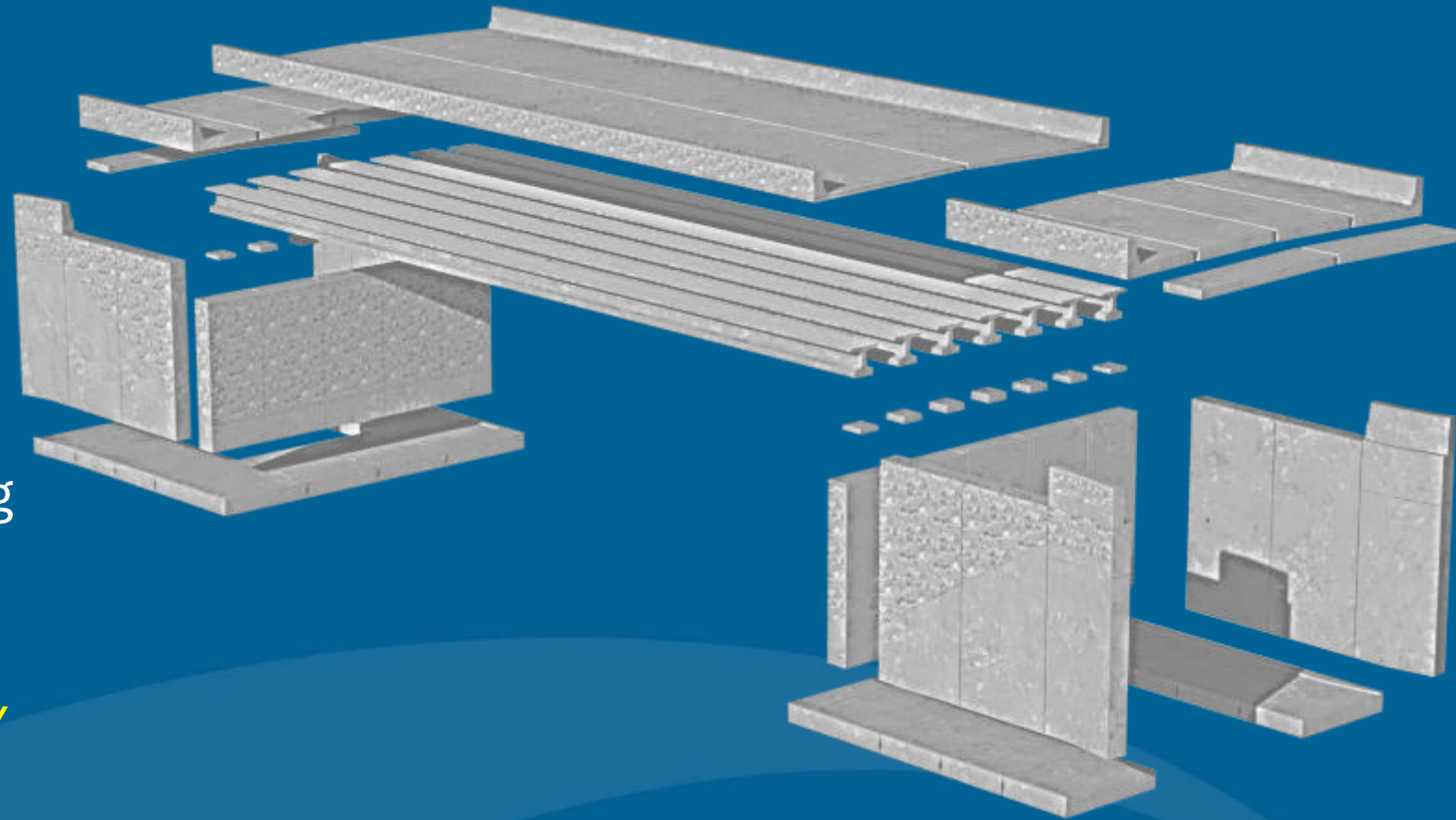
BUILDING MORE

- Since it is faster, more bridge construction in less time
- Not seasonally weather dependent
 - Extending the construction season to more bridges “all year long”



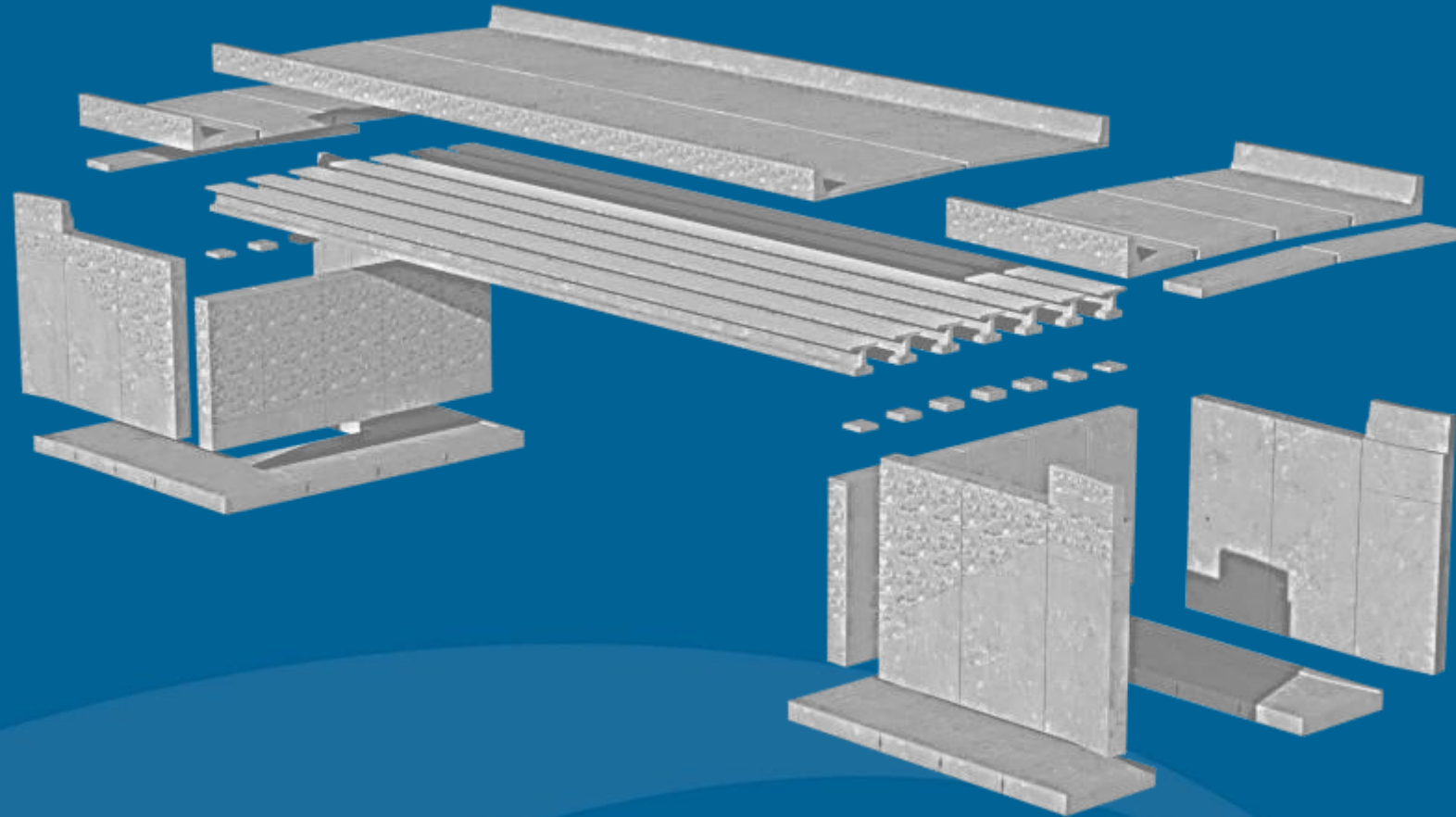
BUILDING EFFICIENTLY

- Optimize equipment & human resources
- Total bridge fabrication concurrent with site work
- Reduced environmental impacts
- Significantly smaller site staging area footprint
- Short-term detours, *accelerated construction safety routes* (ACSRs), safer, less disruption & \$
- Less daily weather impact



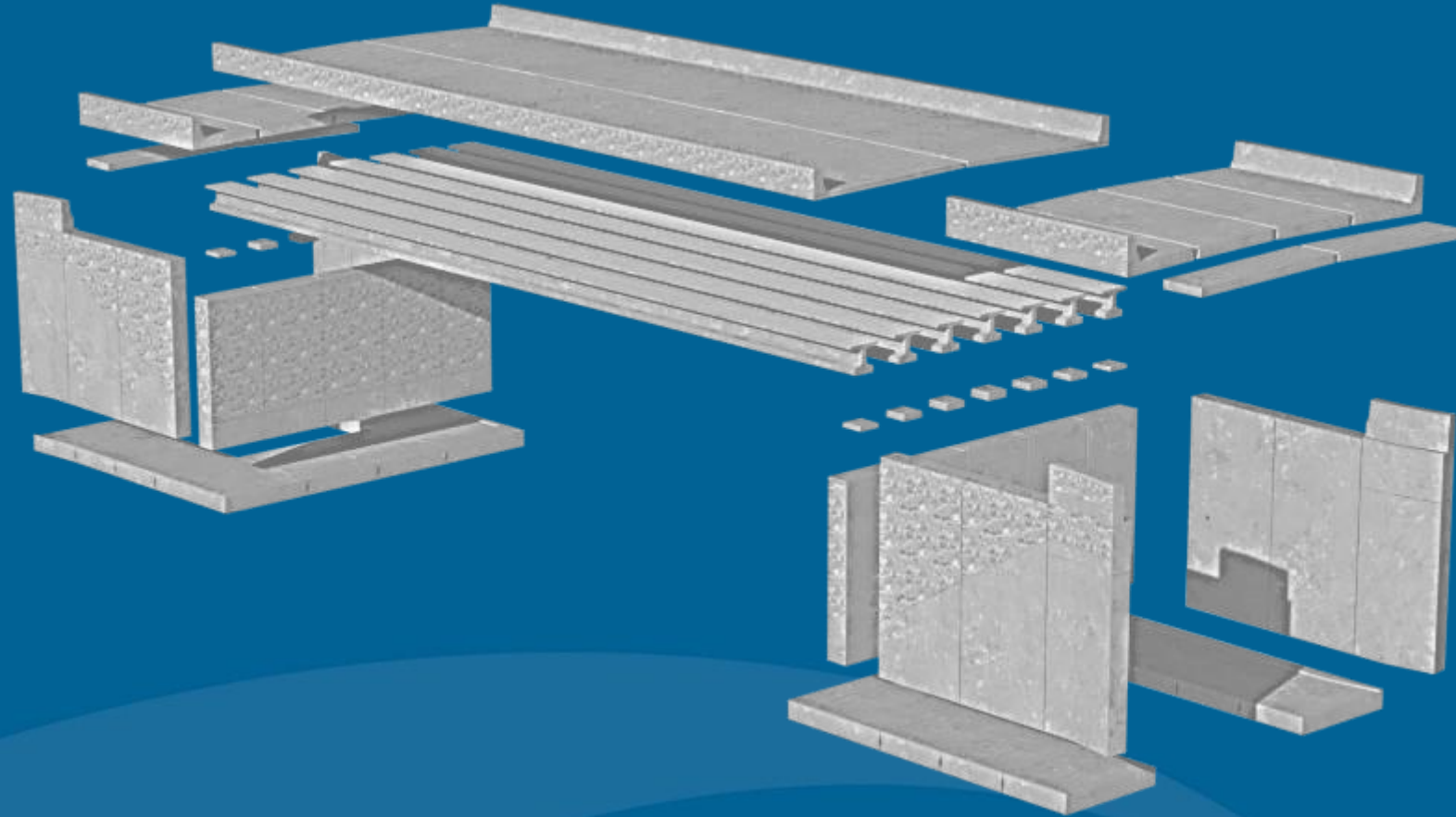
BUILDING QUICKLY

- Overall project schedule reduction
 - the total bridge structure fabrication is concurrent with site work
- **85%** reduction to the on site construction schedule
- All other **advantages** directly related to the **speed of ABC**



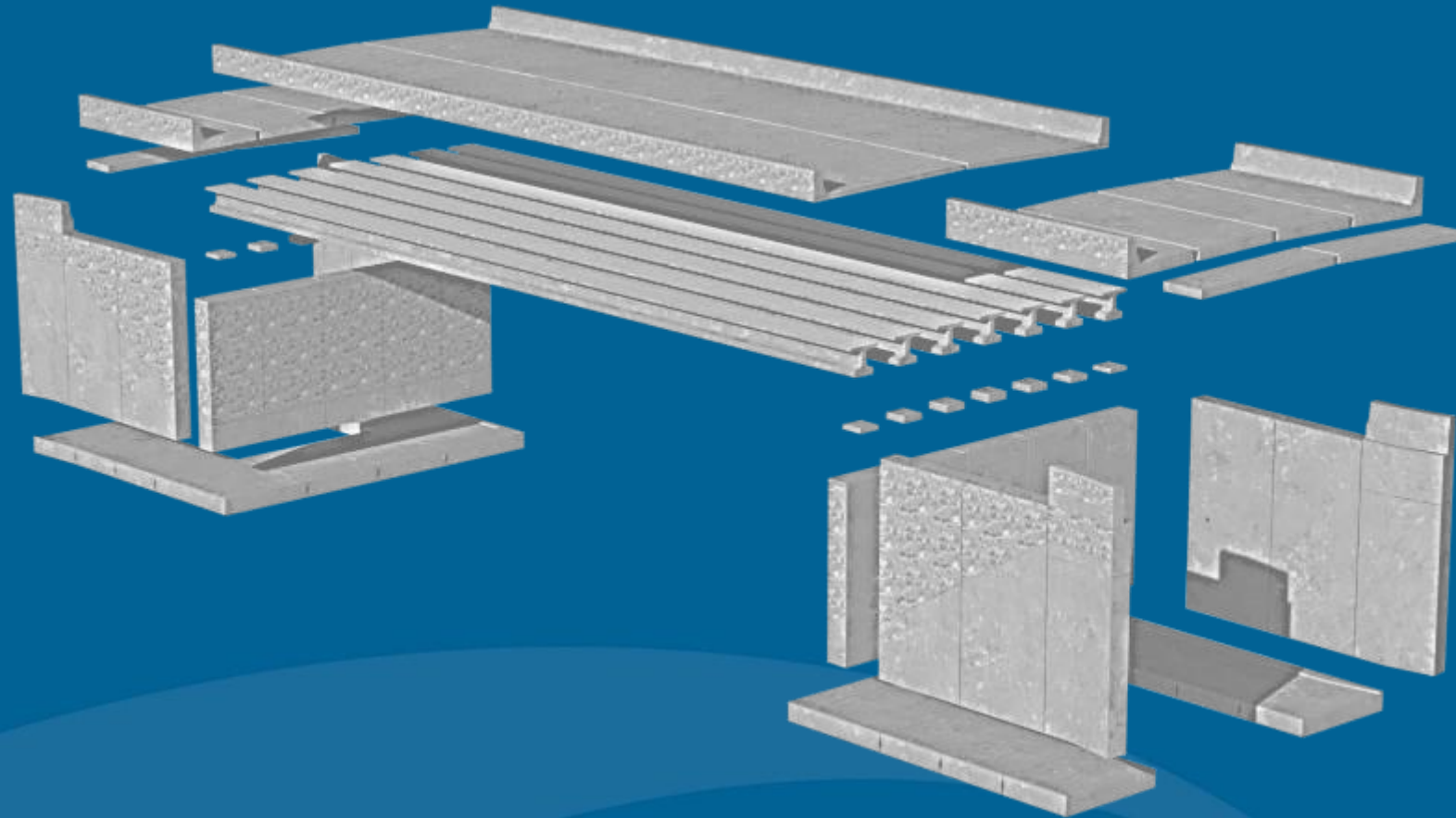
BUILDING **BETTER** QUALITY

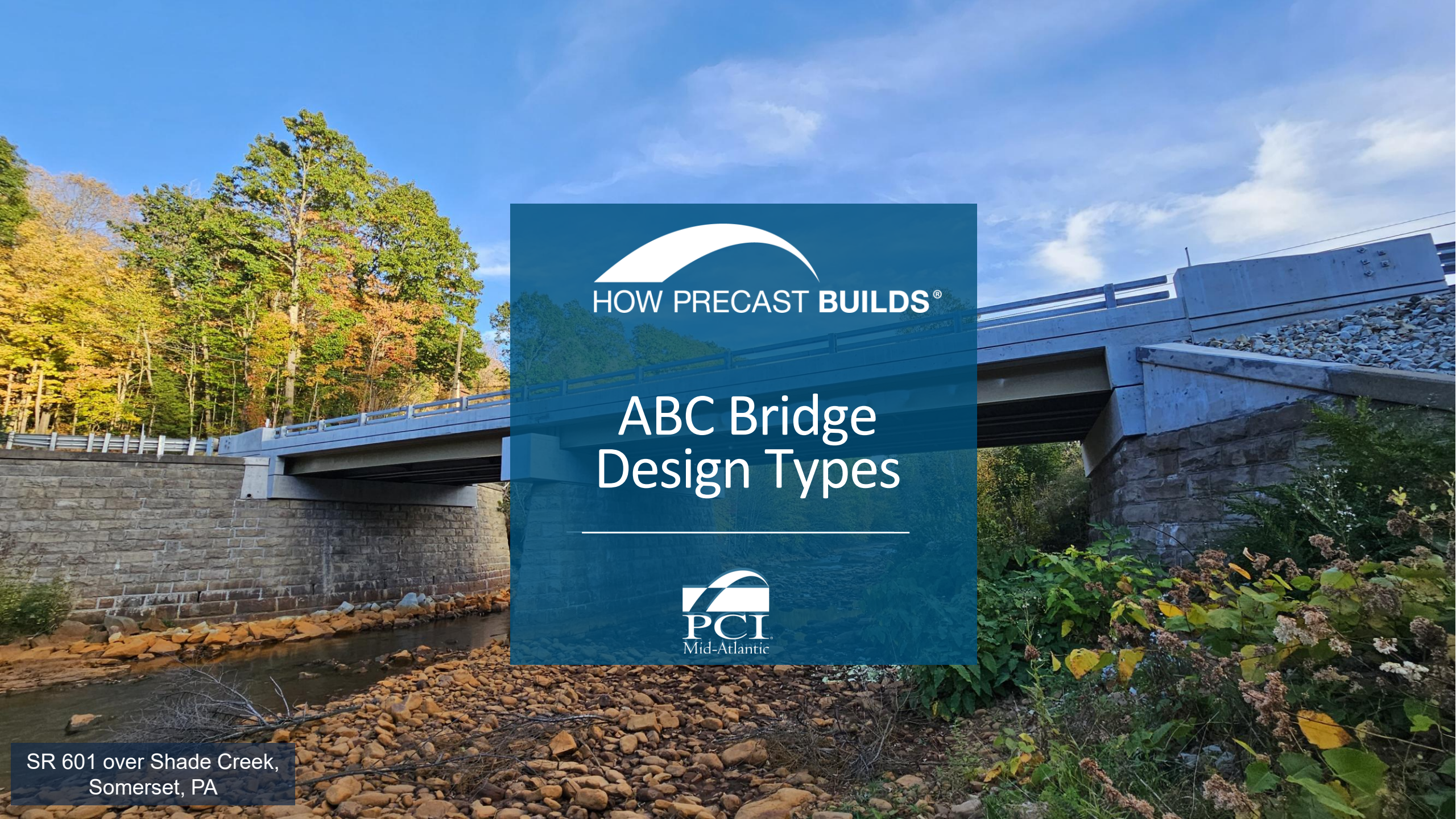
- High performance concrete components cast in PCI-certified, climate-controlled facility
- **BIM** generated drawings
- DOT & PCI tolerances with “**dry fit**” to ensure final fit
- ACI & PCI certified QA/QC inspection professionals
- Built to last, resilient low maintenance structures



BUILDING SAFELY

- Bridge components produced off-site in a safe, controlled setting
- **85%** less time on site with smaller workforce results in less exposure to risk of injuries
- Short-term detours, (ACSRs), in lieu of long duration on-site phasing patterns, separate traffic and workers, **safer for both**





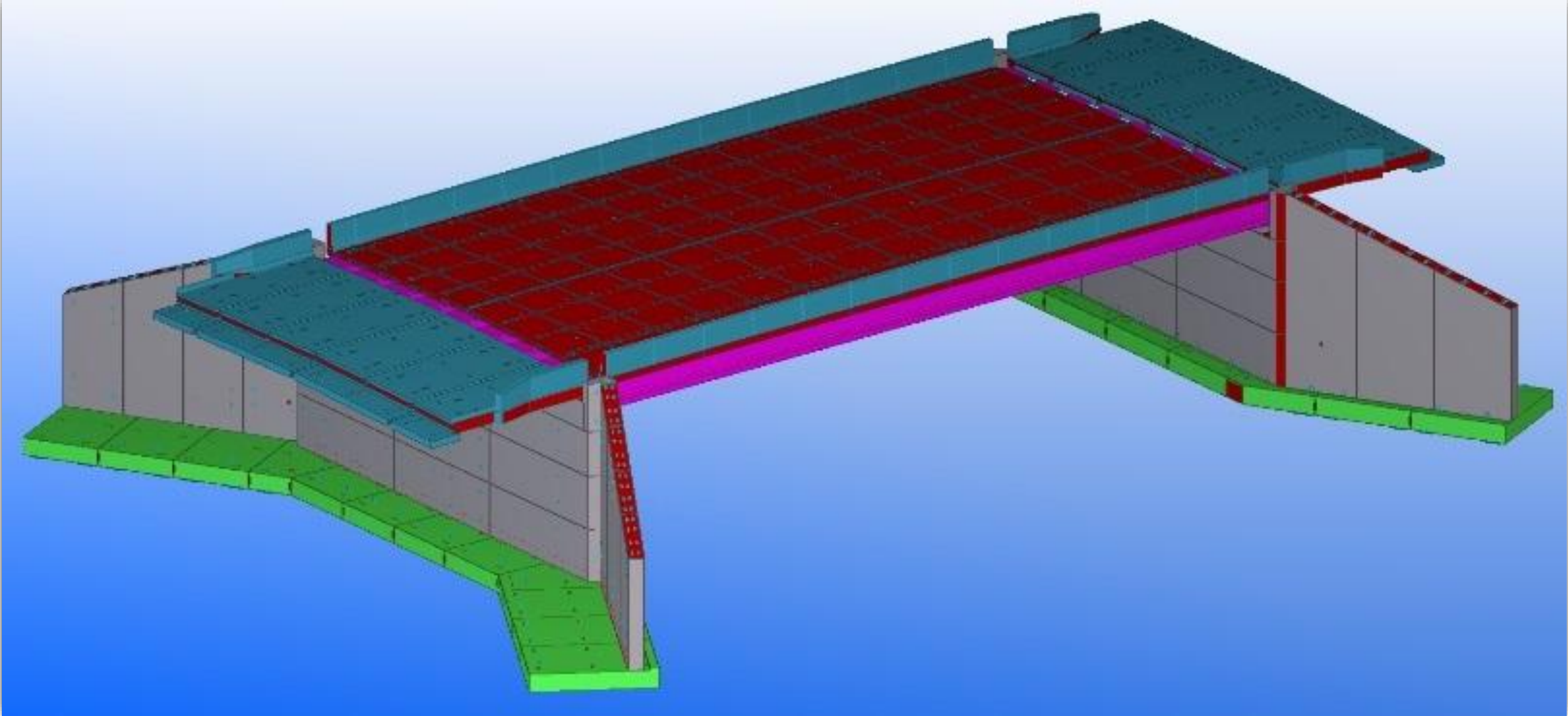
HOW PRECAST BUILDS®

ABC Bridge Design Types



SR 601 over Shade Creek,
Somerset, PA

AS DESIGNED (Standards)

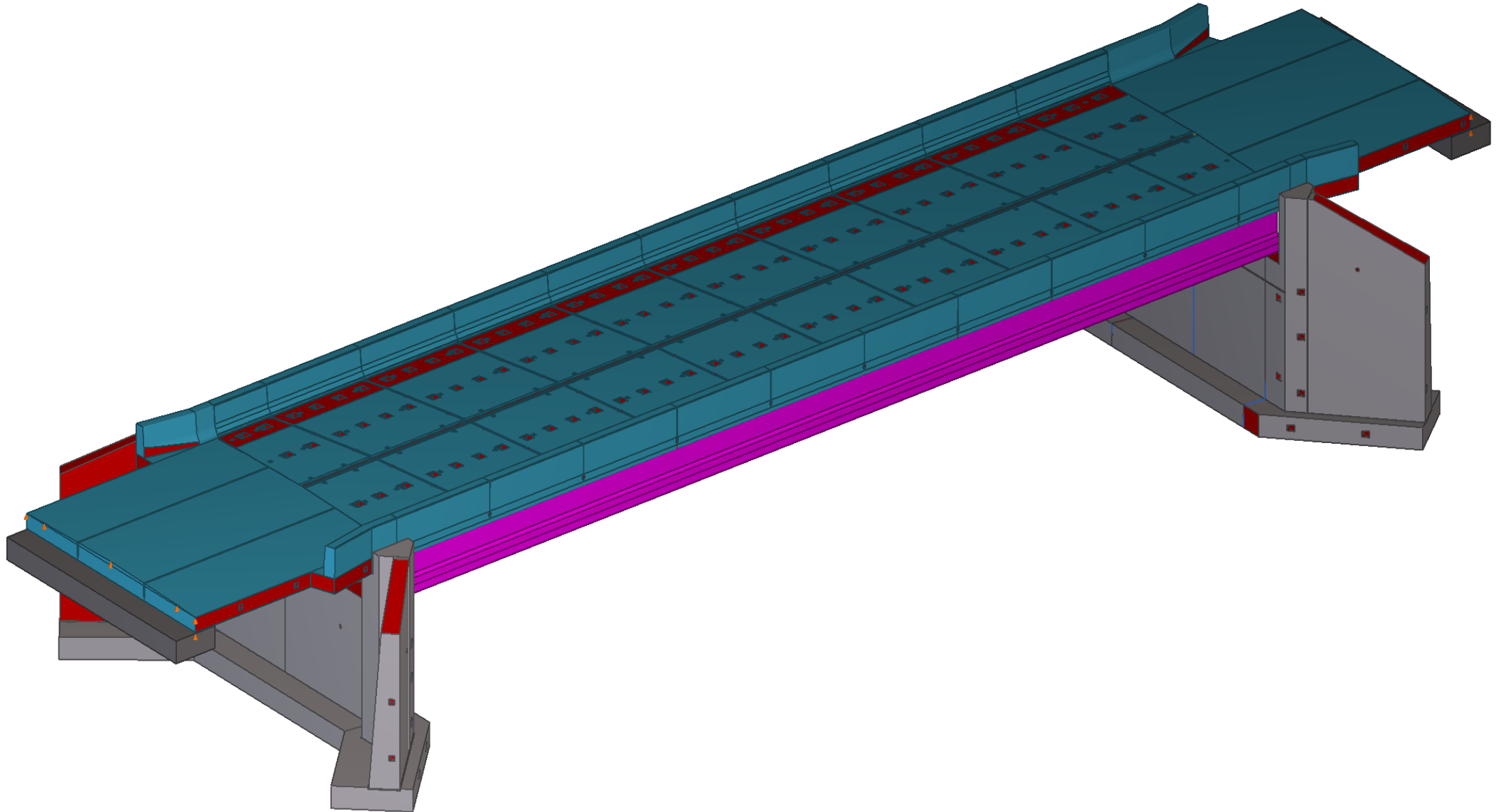


Golden Key Rd. Over I-78, Lehigh County



Bridge Constructed (Road close to Road open) in 30 Calendar Days

EMULATIVE DESIGN (Alternate from CIP to Precast)



S.R. 1004 SEC. 001 over Cove Creek in Bedford County, PA



Constructed 54 Days

Design with Prefabricated Elements

ACI 550.1R-01

Emulating Cast-in-Place Detailing in Precast Concrete Structures

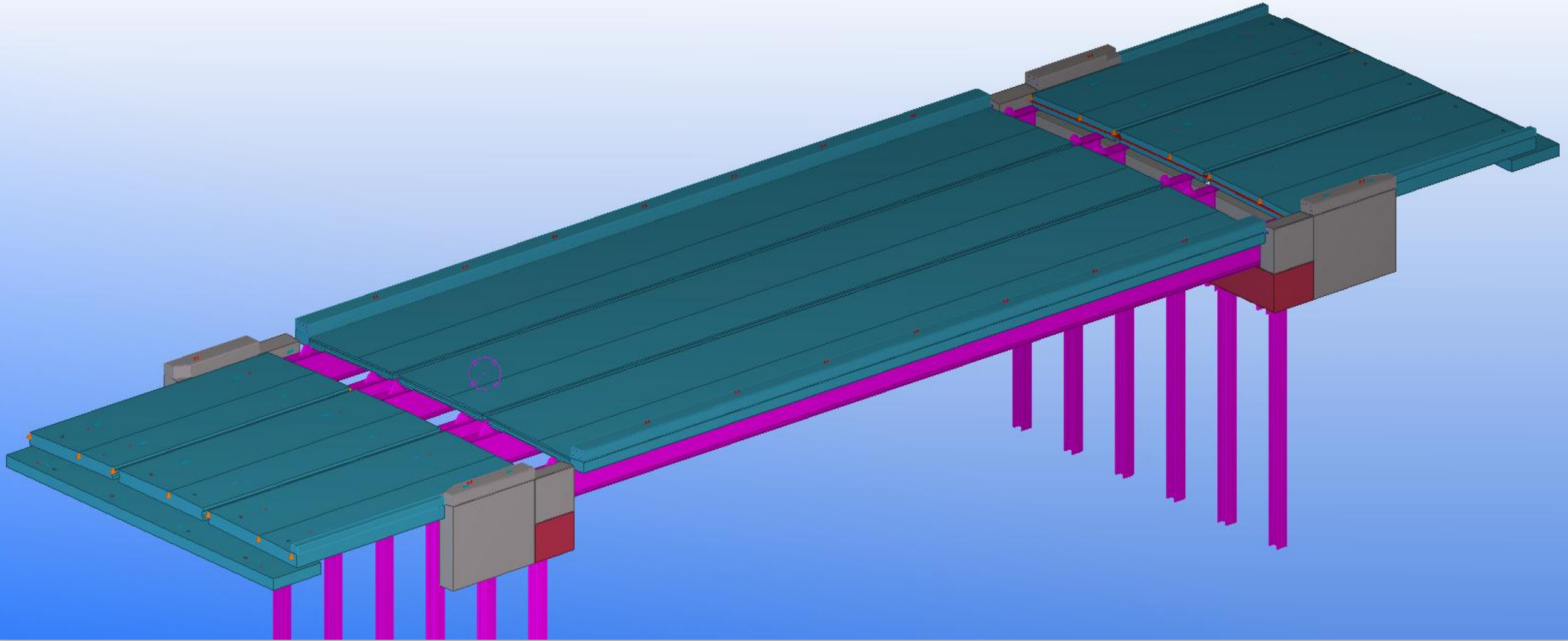
Reported by Joint ACI-ASCE Committee 550



american concrete institute

P.O. BOX 9094
FARMINGTON HILLS, MICHIGAN 48333-9094

MODULAR DESIGN (Integral Beam & Deck)



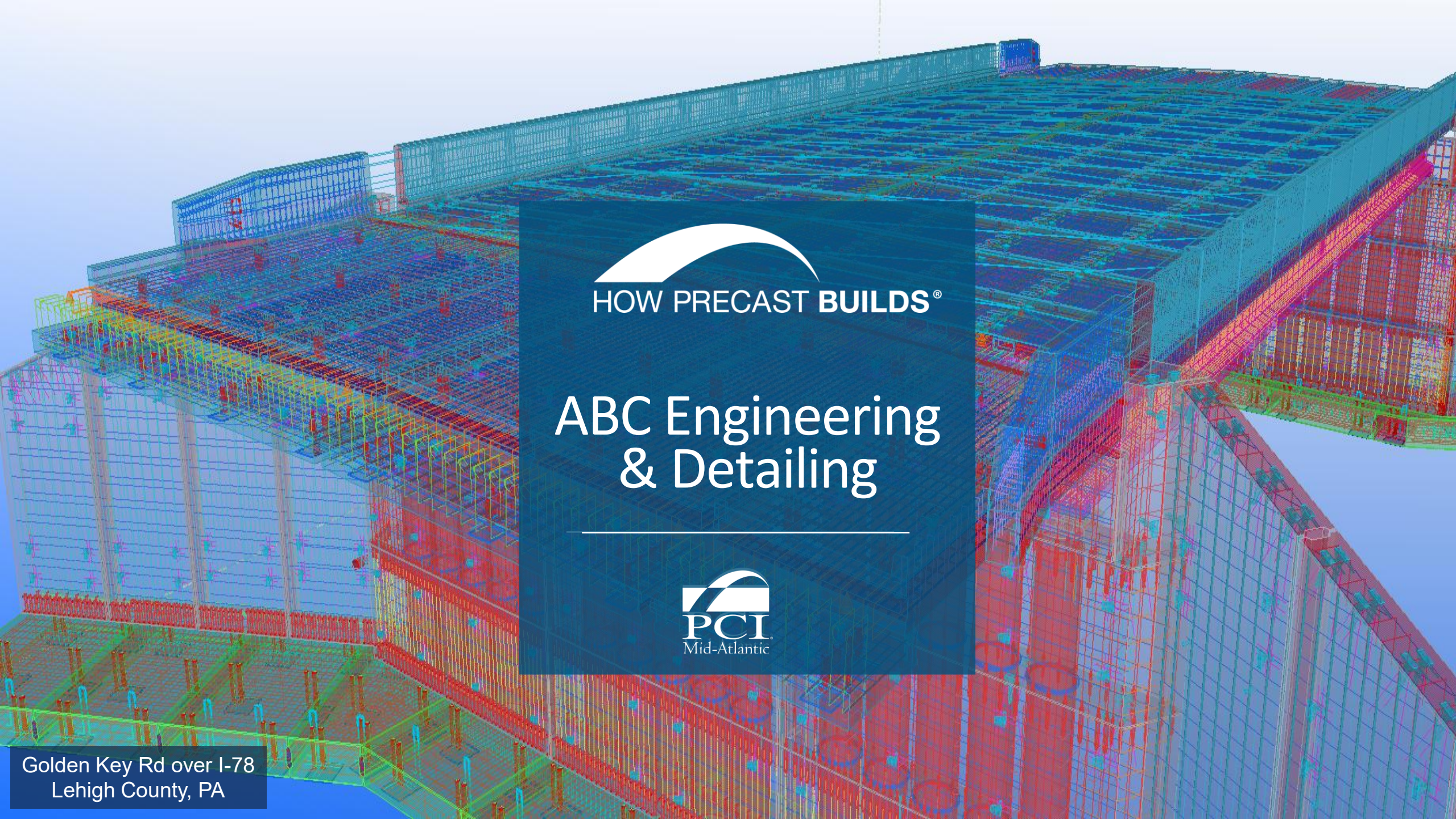
S.R. 0288 SEC. L10 over Wampum Run in Lawrence County, PA



Constructed – 7 Days





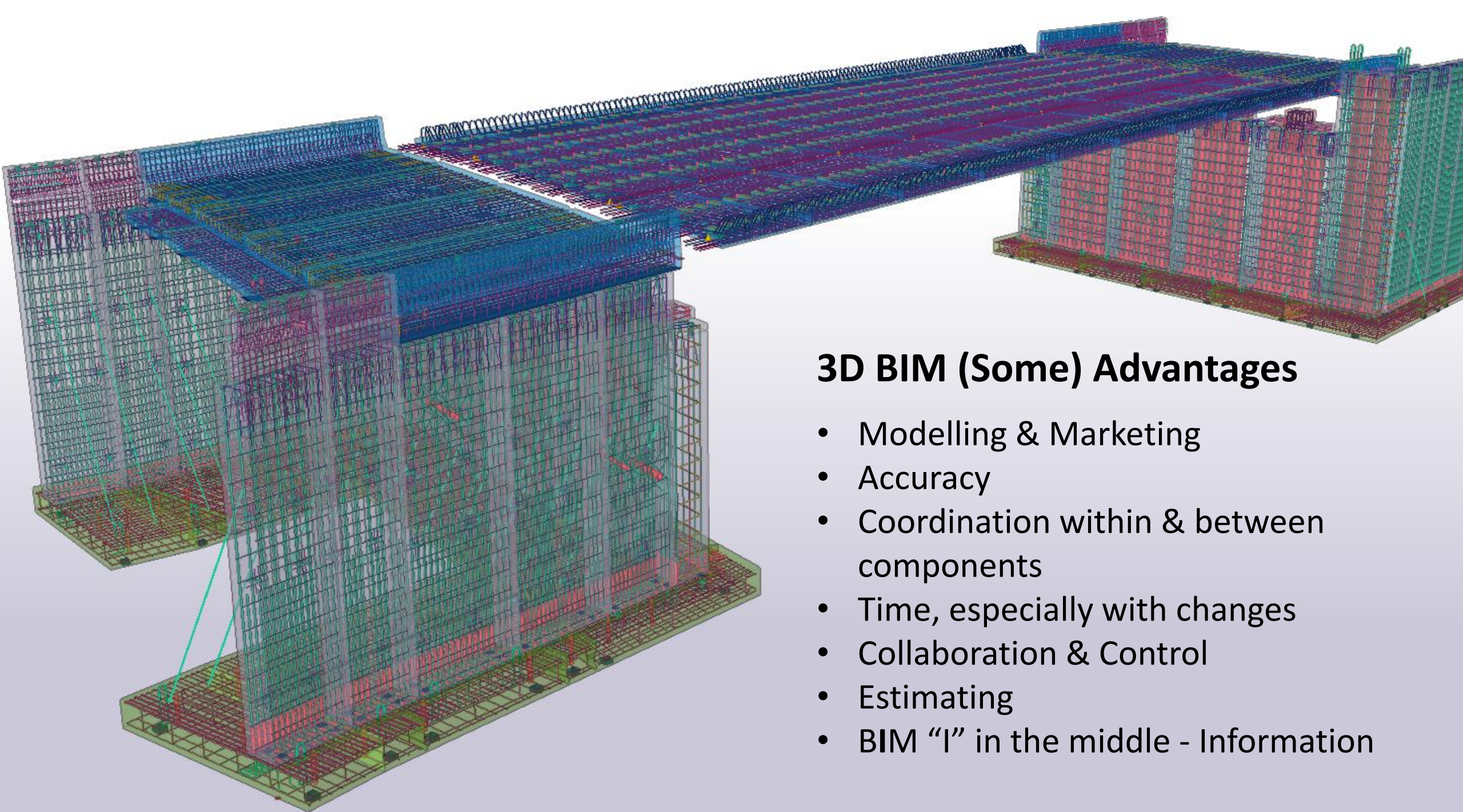


HOW PRECAST BUILDS®

ABC Engineering & Detailing

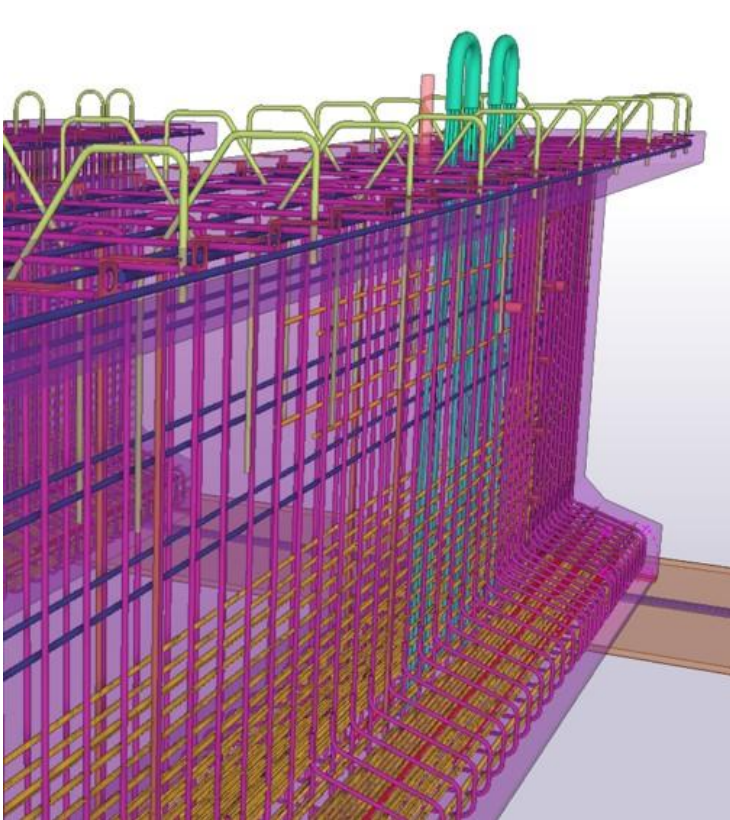


Golden Key Rd over I-78
Lehigh County, PA

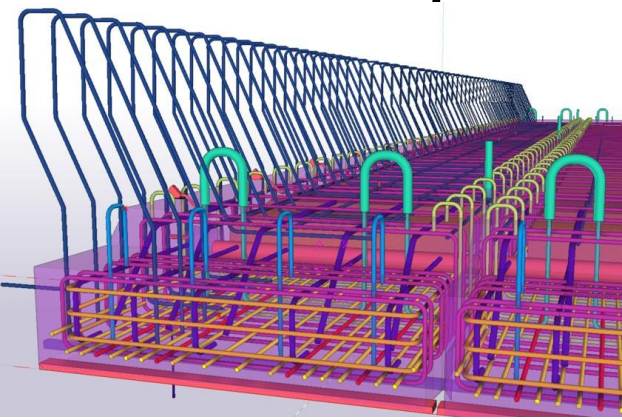


3D BIM (Some) Advantages

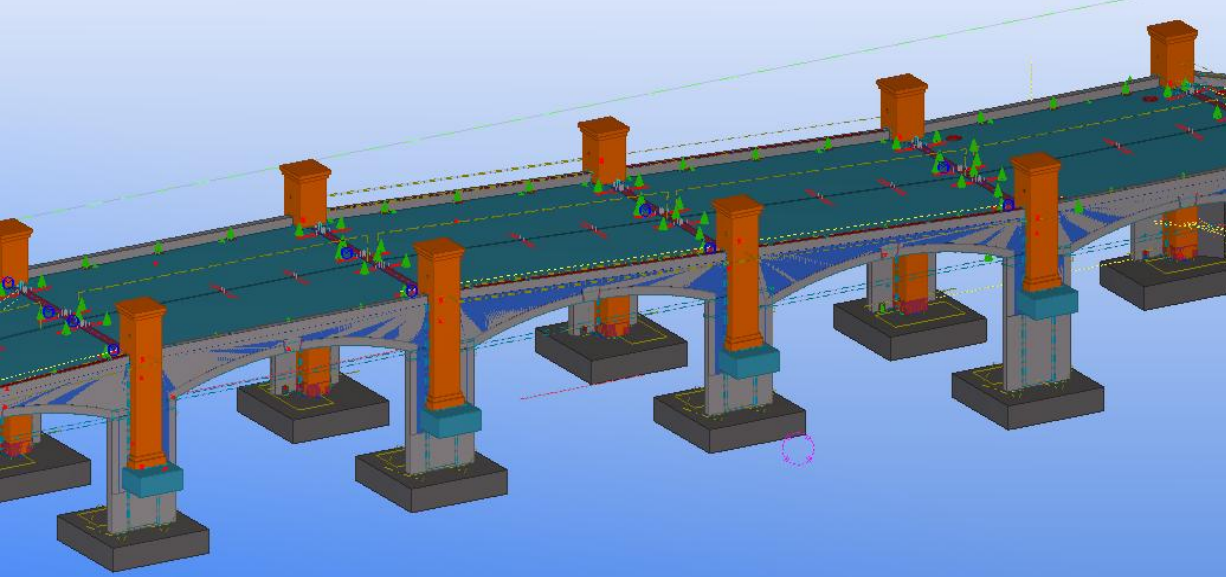
- Modelling & Marketing
- Accuracy
- Coordination within & between components
- Time, especially with changes
- Collaboration & Control
- Estimating
- BIM “I” in the middle - Information



From
Concept



To Reality

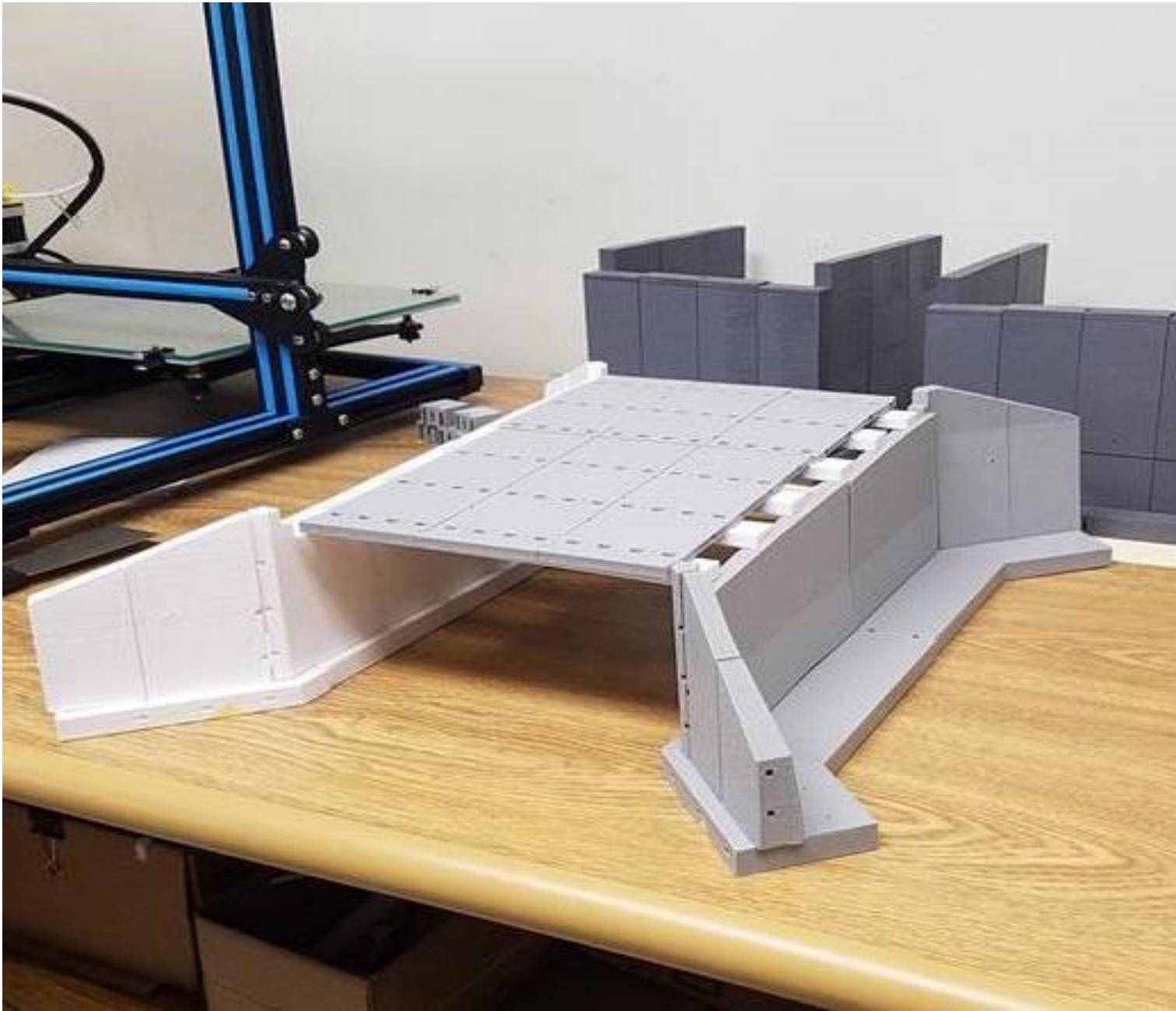


From
Concept

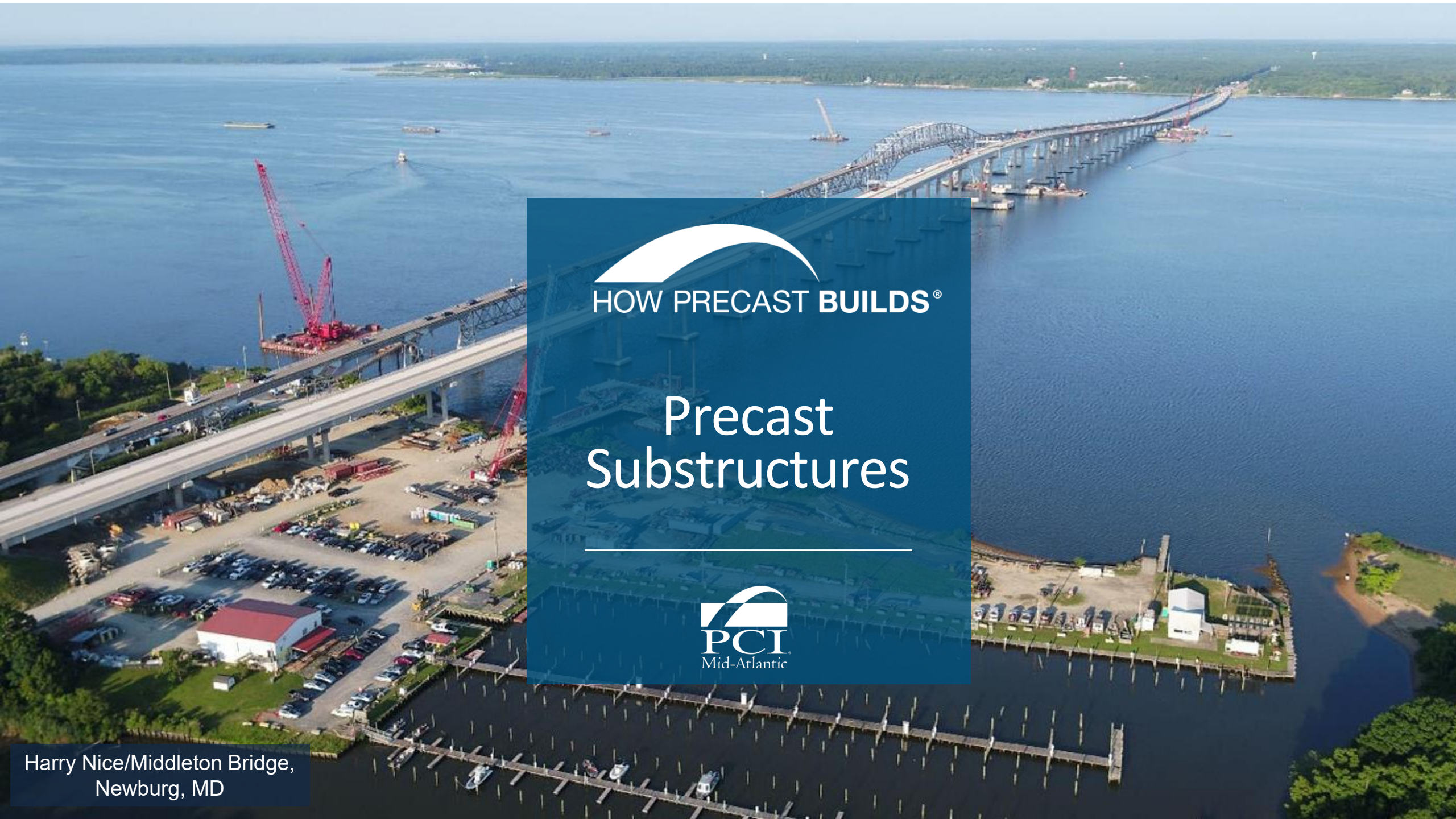


To
Reality

3D PRINTED MODELS



3D printed model – Golden Key Bridge over I-78 Lehigh County & Tower of Voices




HOW PRECAST BUILDS®

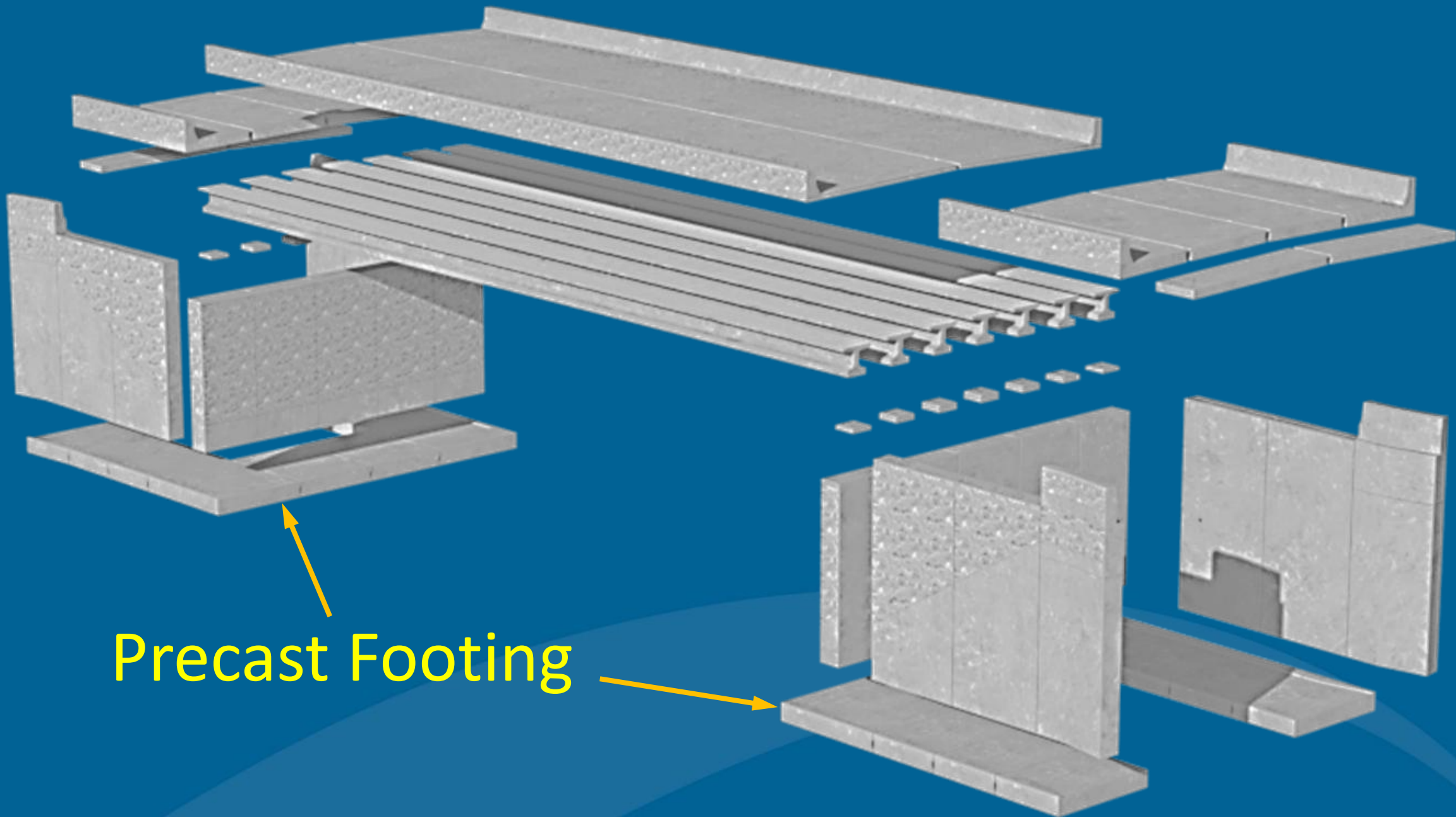
Precast Substructures



Harry Nice/Middleton Bridge,
Newburg, MD

Substructure Design Considerations

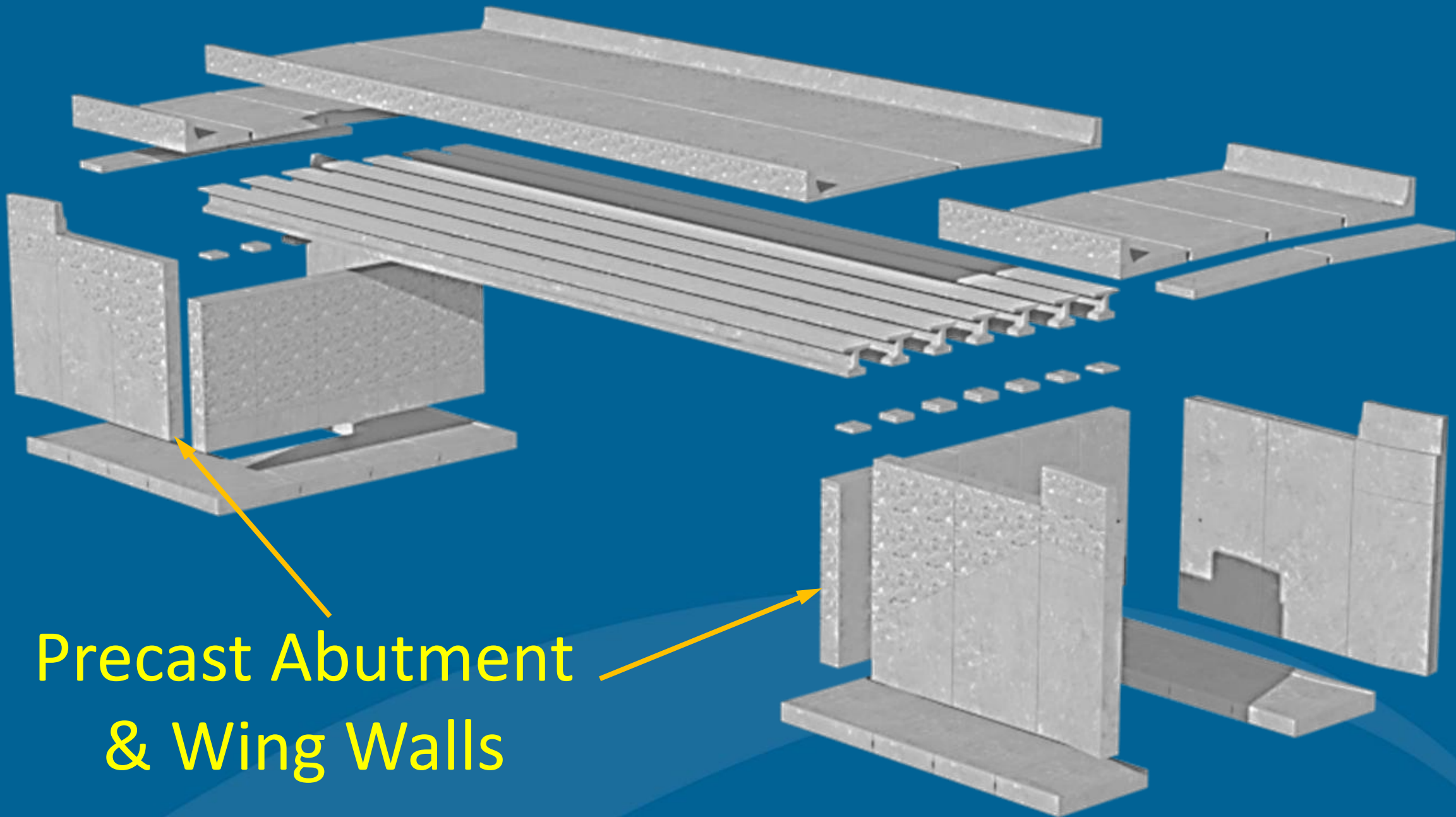
- Max weight - consideration of fabricator, erector & jobsite limitations
- Max height, width & length to accommodate fabrication, shipping & erection stability and limitations.
- Repetition of pieces if possible
- Concrete Mix Design
- Connections – Vertical & Horizontal (Slice sleeves, Shear key grouted, Post tensioning, Bolted, Welded)
- Aesthetics – Architectural treatments (Formliner, Coatings)
- Project Bridge Closure Period (BCP)



Precast Footing





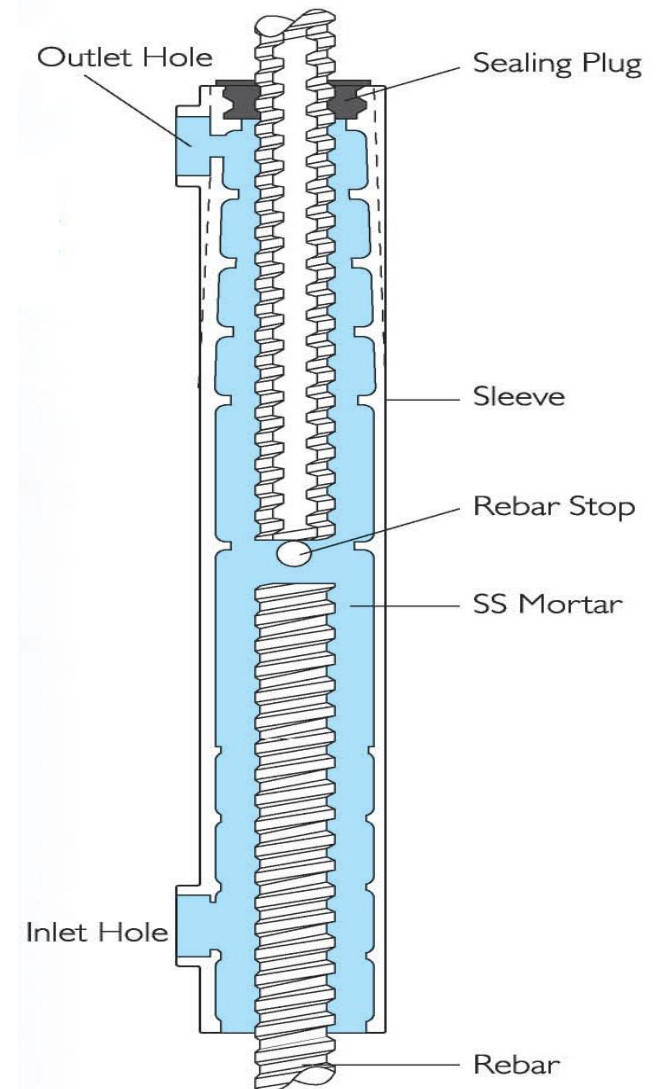


Precast Abutment
& Wing Walls



Match cast abutment wall – to column

NMB Splice Sleeve – www.splicesleeve.com





Abutment wall – Ashlar stone form liner



Abutment wall – set-up ready to pour



Finished abutment walls in the yard awaiting transport to the jobsite

Dry-Fitting a Splice Sleeve Connected Wing Wall to a Footer



NON-SHRINK, HIGH STRENGTH, NON-METALLIC
READY-TO-MIX GROUT
EXCLUSIVELY DESIGNED FOR
THE HMO SPICE-SLEEVE® SYSTEM

Net Weight: 55 lbs. (25 kg)

Water / bag: 1 gal +/- 4 fl. oz.

Mixing Time: 2.5 minutes

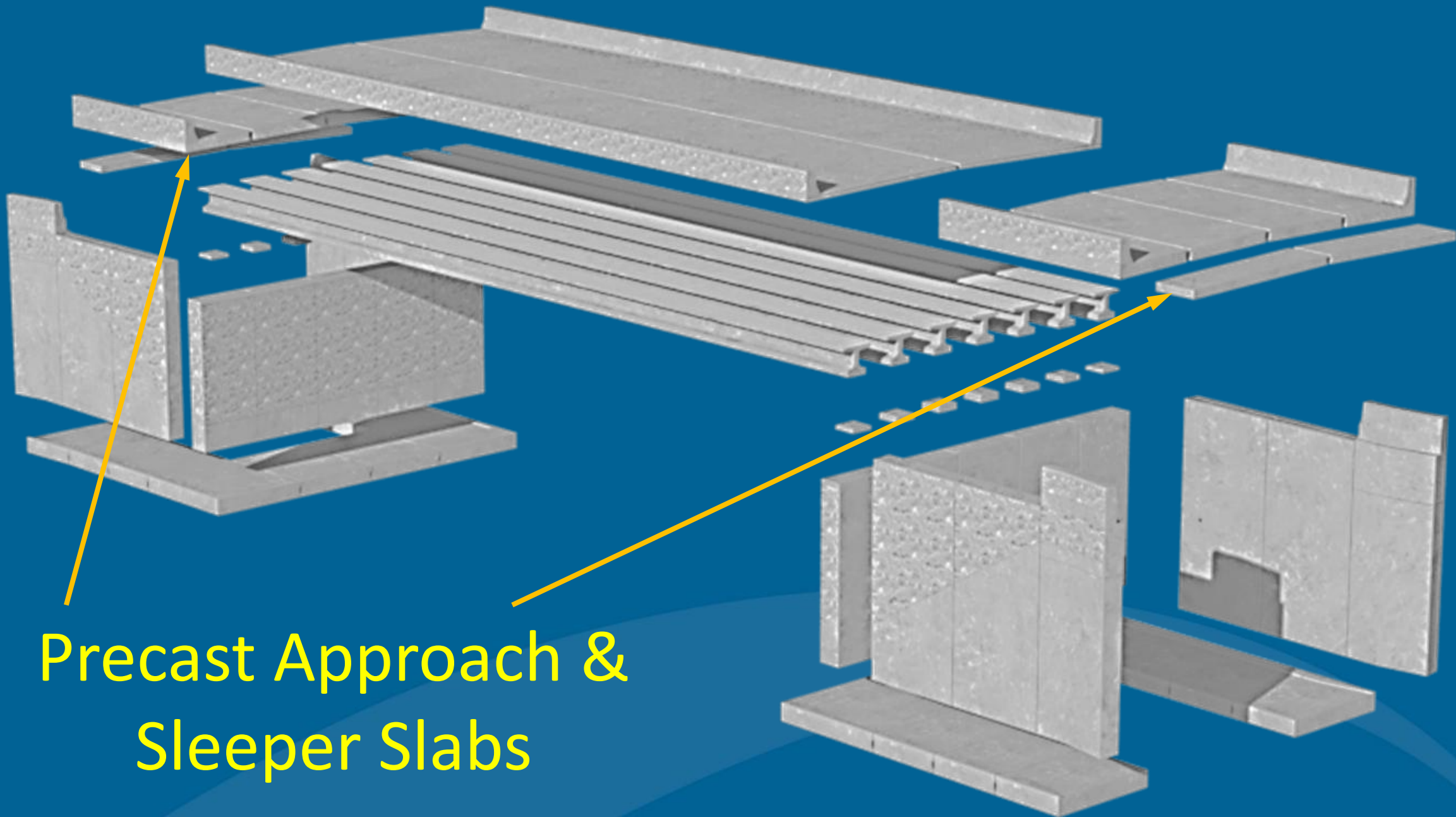
Mixer Speed: 600 - 1,000 rpm

Mixer Paddle: HMO Paddles recommended

Flow Guide: 8.0" - 12.0" (200mm - 300mm)

Manufactured by:
SPICE SLEEVE NORTH AMERICA, INC.
20771 E. 1st Ave., Suite 200, Aurora, CO 80012 U.S.A.
Tel: (303) 688-1000 www.spicesleeve.com

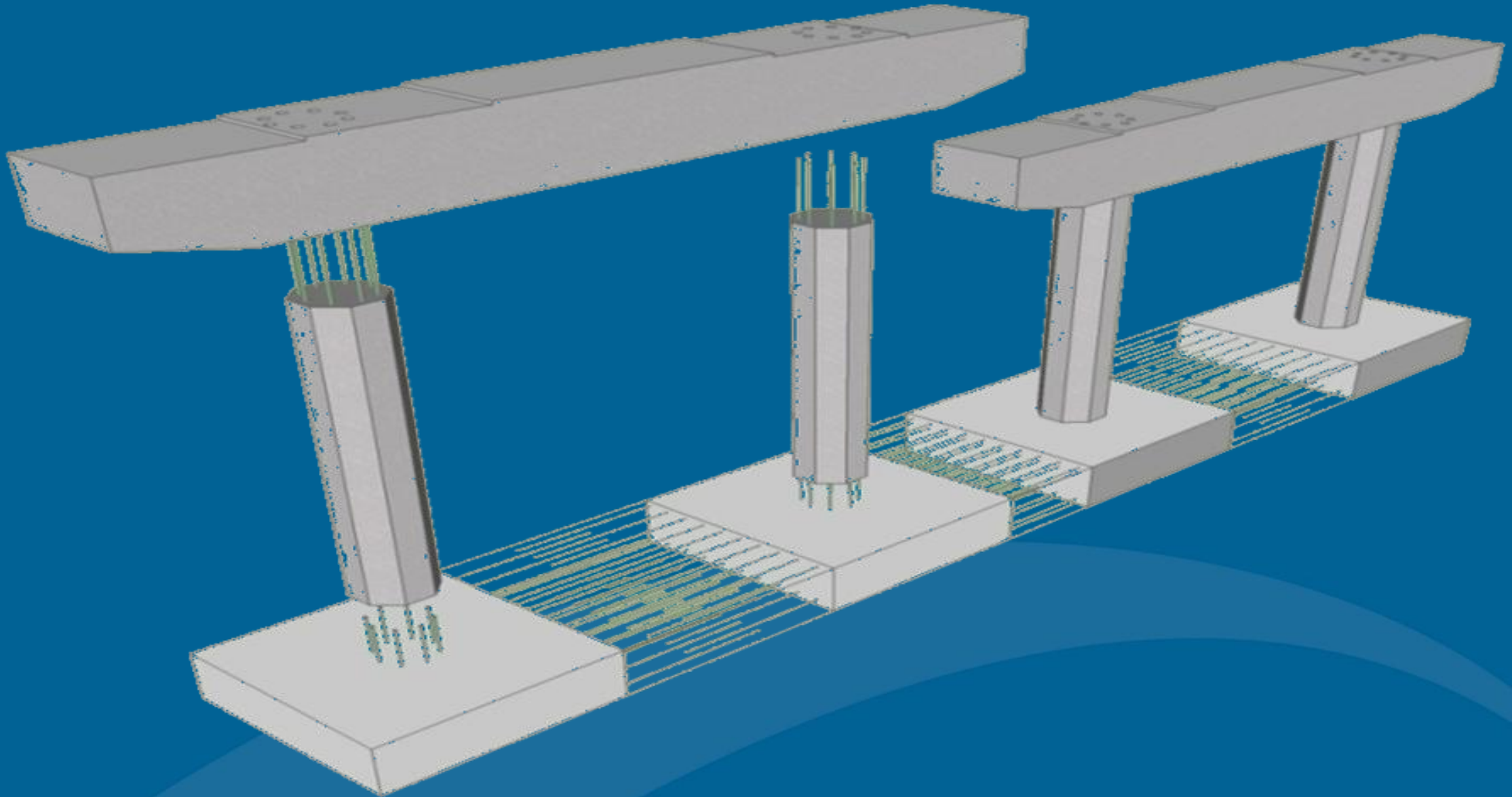
MADE IN THE U.S.A.



Precast Approach &
Sleeper Slabs



Piers & Pier Caps



Pier Section & Footing



Abutment & Pier Caps



Abutment Cap – Corrugated Void Pockets



Corrugated Void Pockets can be used with Concrete or Steel Piles to Lighten Cap



Pier Wall with a Cap – Architectural Treatment

Inverse Splice Sleeve Grouting of a Large Bridge Pier in Atlanta, Georgia





HOW PRECAST BUILDS®

Precast Superstructures

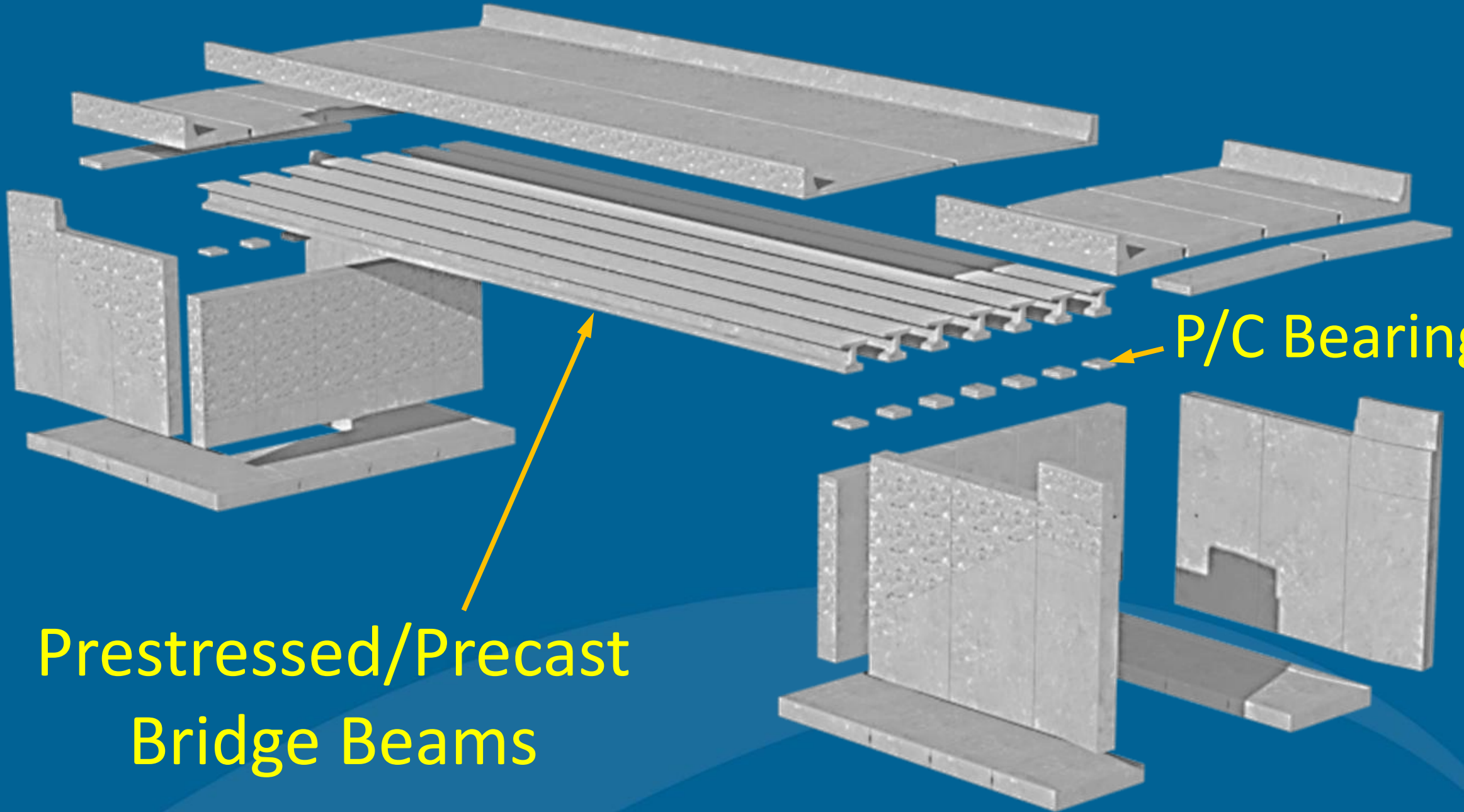


Arlington Memorial Bridge,
Washington, DC

PRECAST SUPERSTRUCTURES

1. BULB TEES (REGULAR & DECK)
2. BOX BEAMS (ADJACENT & SPREAD)
3. NEXT BEAMS (DECK AND FORM)
4. DECK PANELS (PARTIAL & FULL DEPTH)
5. DECK MODULES (STEEL & CONCRETE)





P/C Bearings

Prestressed/Precast
Bridge Beams

Bulb Tee Girder

- Up to 180 ft Span
- Multi-Piece Splice Girders
Up to 250 Ft span
- Trucking routes, state regulations and job site conditions will affect shipping spans
- Straight strand preferred over draped



Bulb Tee Girder



Deck Beams & Box Beams

Short – Medium Span Projects

- Spread or Adjacent
- Solid or Voided
- Transverse Post Tensioning for adjacent
- Straight Strands

Deck Beam
Depth 15 - 21"
Span 30-50 FT



Box Beam
Depth 24"– 60"
Span 50 – 120 FT

NEXT (Northeast Extreme Tee) Beam

- Three “Deck Type” variations
- Width varies: 8' - 12'
- Depth: Up to 36"
- Span : Up to 80' +/-
- Stem spacing: 5 feet Fixed





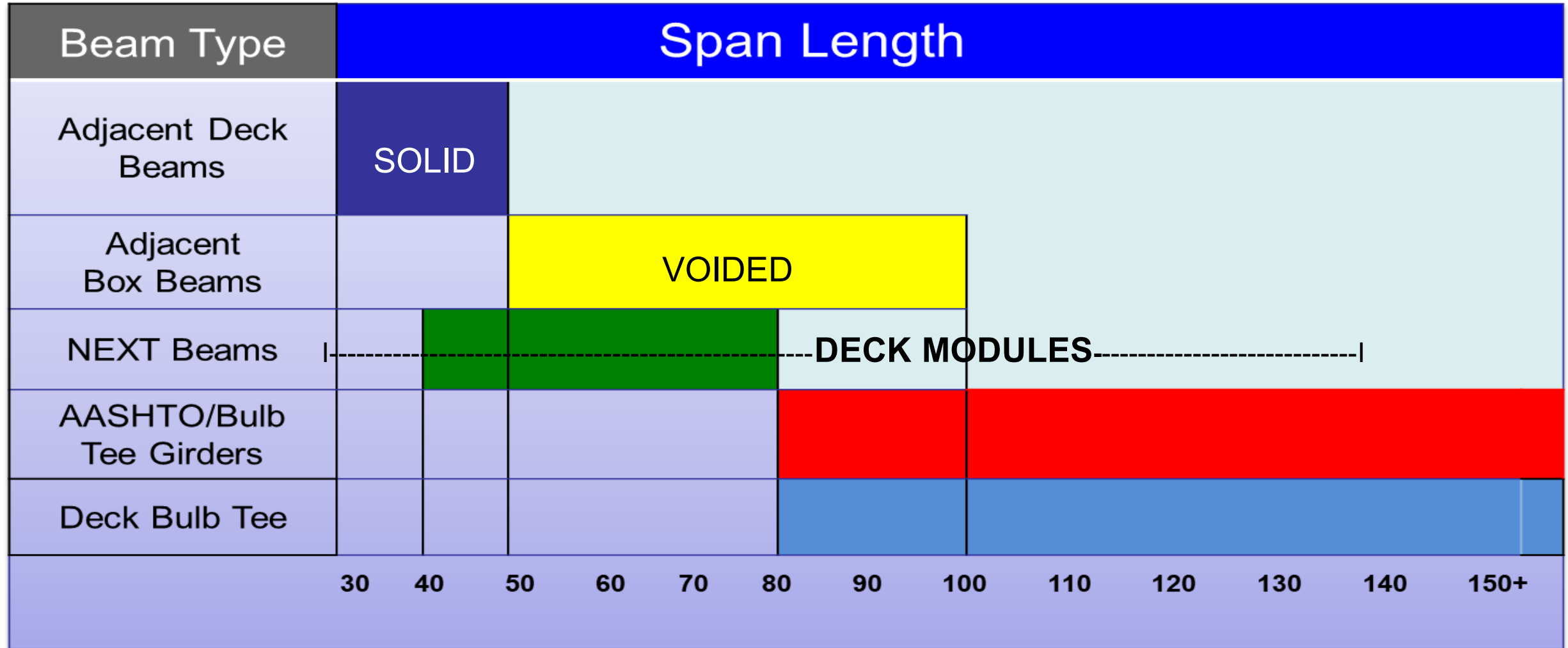
Specialty Beams

Architectural
Truss

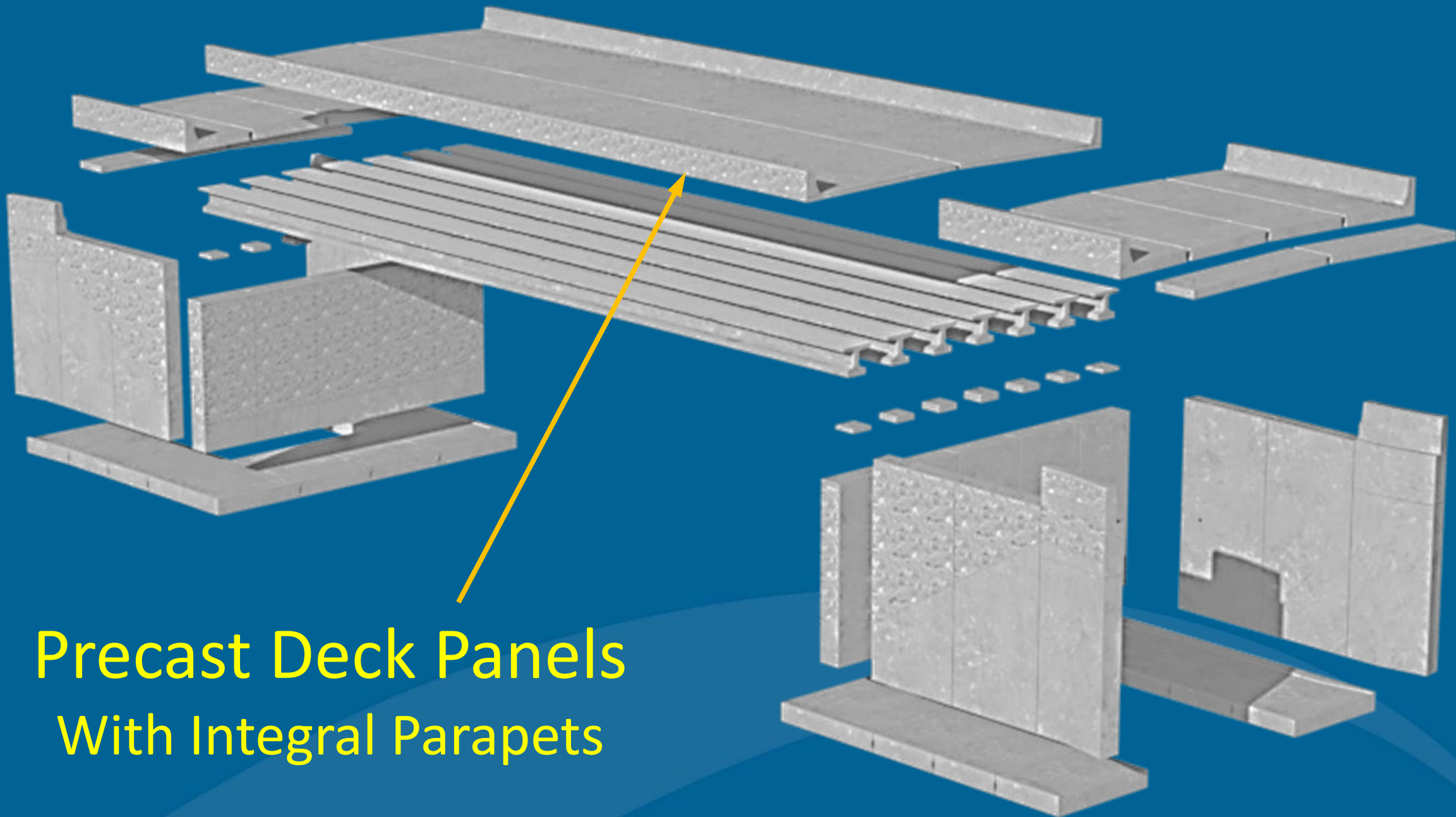


Precast Superstructures

Examples of Prestressed Beam Options



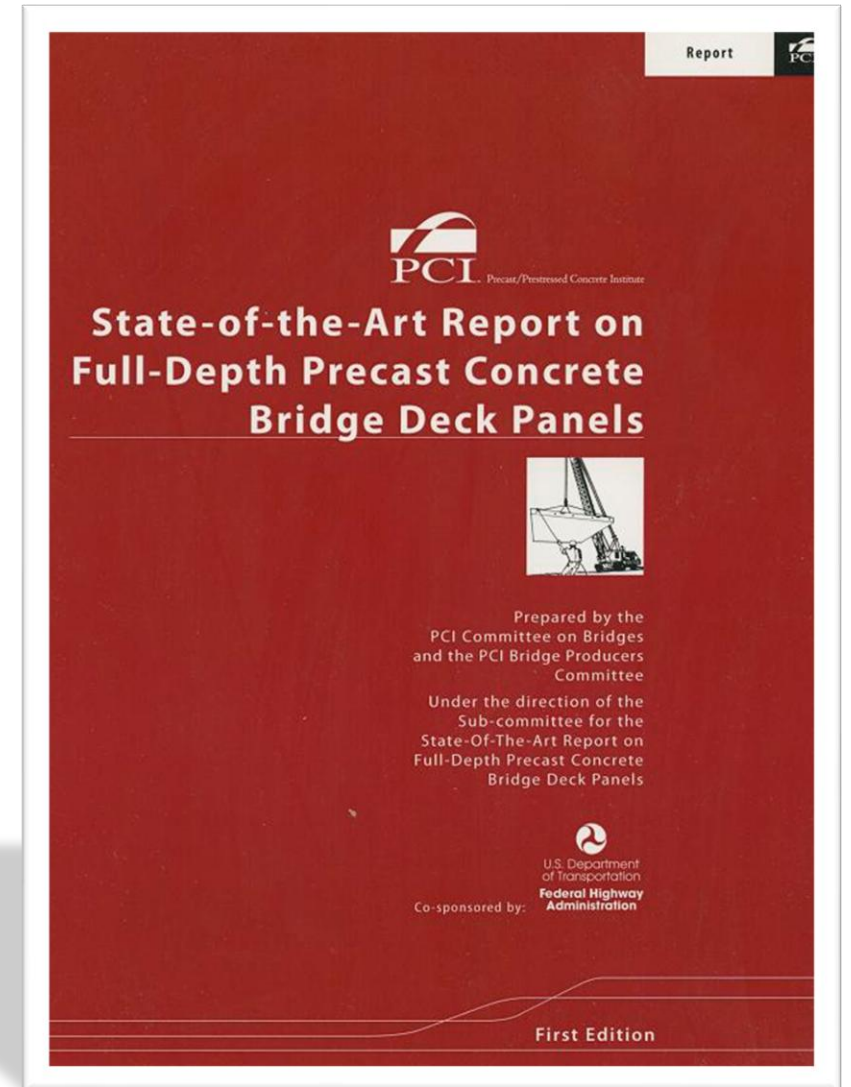
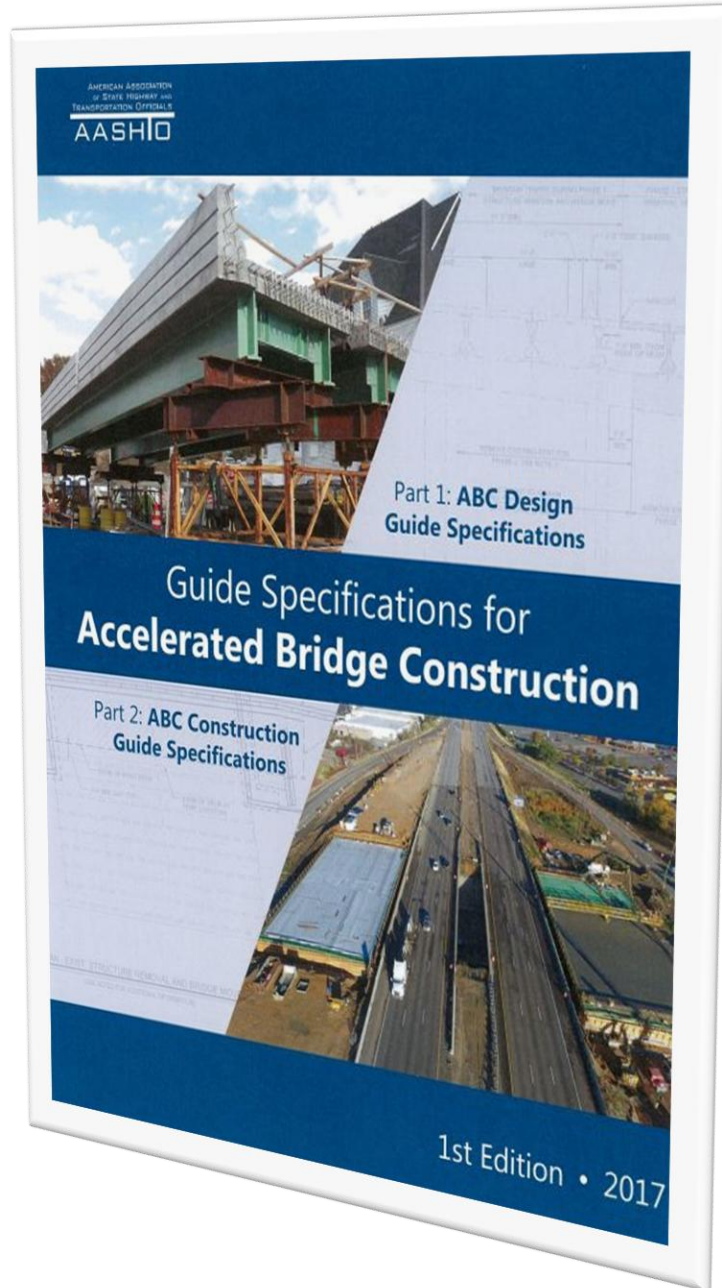
Always follow States Standards for Beam/Girder selection



Precast Deck Panels
With Integral Parapets

Full Depth Deck Panels

AASHTO ABC
Guide Specifications
cover the design of
deck panels (2017)



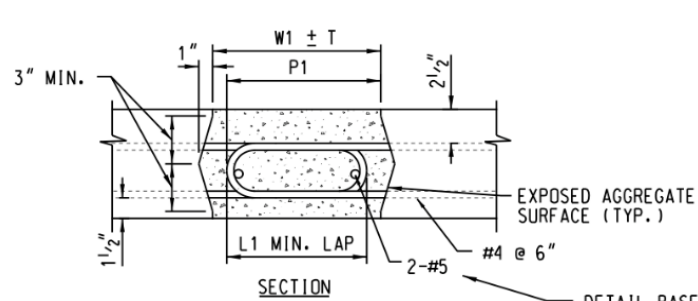
State-of-the-Art Report on Full-Depth
Precast Concrete Bridge Deck Panels
(SOA-01-1911)



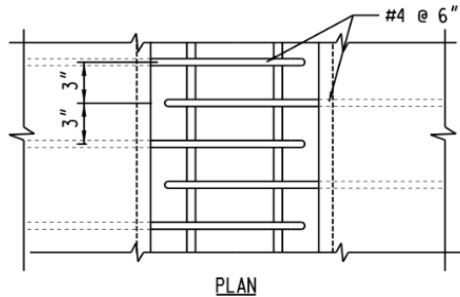
Full Depth Deck Panels with Integral Parapets on Bulb Tee Girders

Closure Joints Design Options: AASHTO ABC Specification

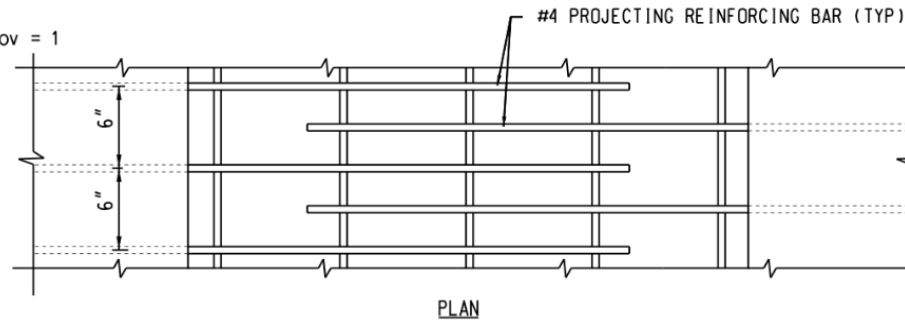
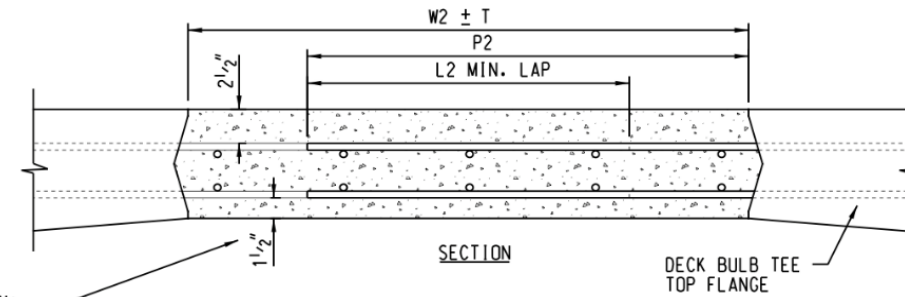
Hooked Bars
Normal Strength Concrete
Section 3.6.6.2



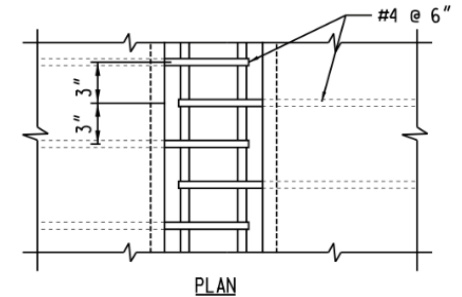
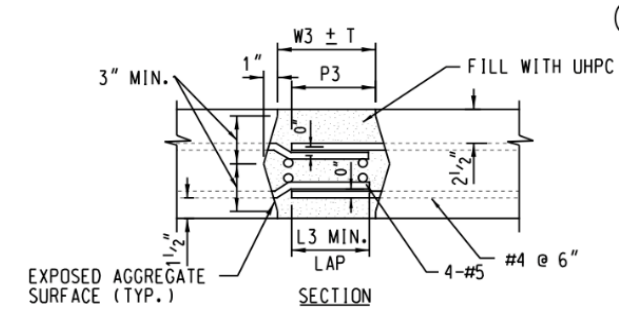
DETAIL BASED ON:
 $f'c = 4$ ksi
 $fy = 60$ ksi
EPOXY COATED
#4 BARS
As req/As prov = 1



Lapped Bars
Normal Strength Concrete



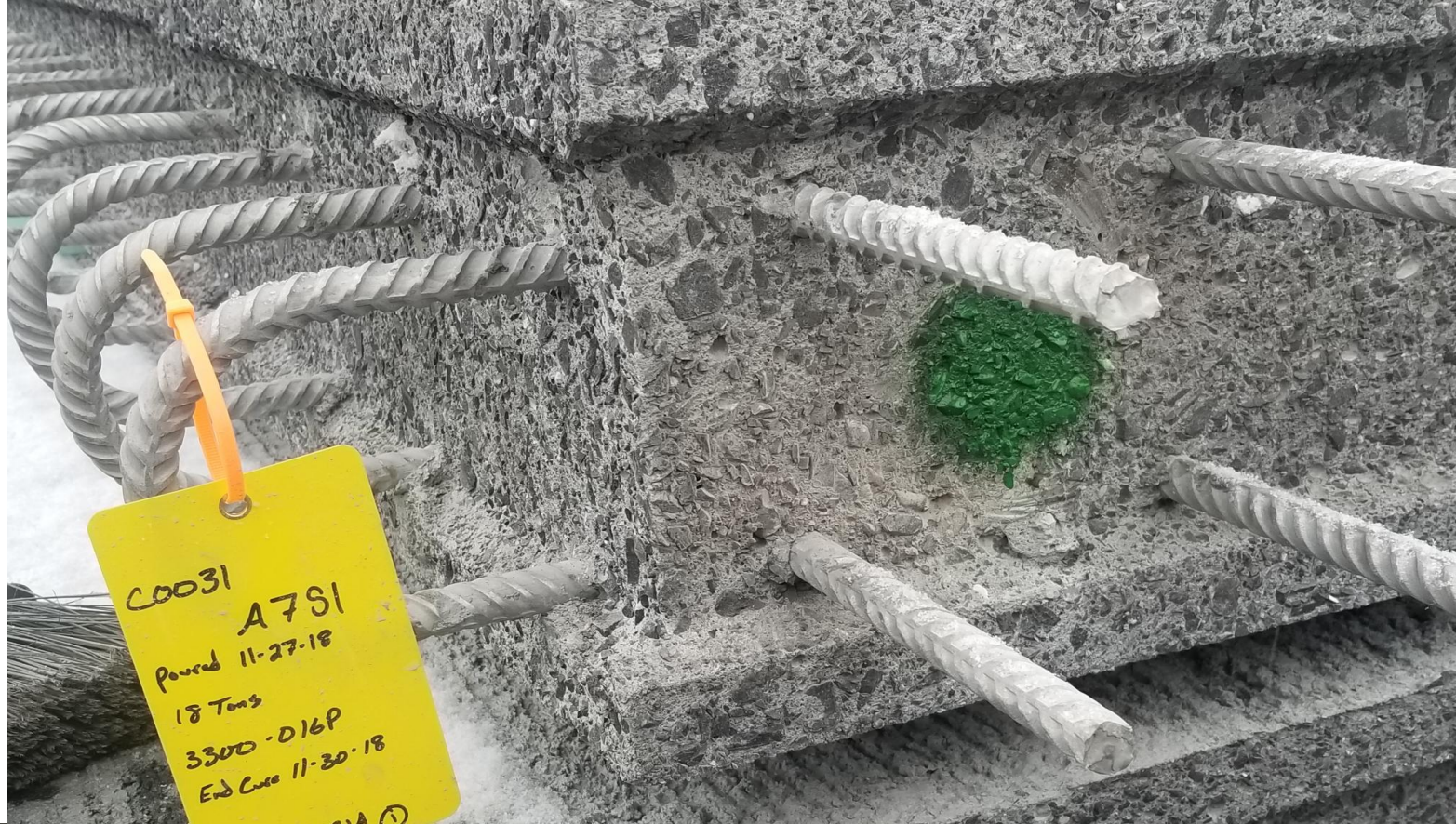
Straight Bars
UHPC
Section 3.6.2.4.2



Closure Joints UHPC Connection

Exposed aggregate surface at
closure pour for bond to the
precast decks

Hooked/loop and straight bars →
UHPC closure pour



Straight bars
Normal Concrete
closure pour



Steel Beam Deck Module





Modular decks on Bulb Tee Girders



Large Modular Deck project – 136' Bridgeville, PA



Modular deck Architectural Fascia piece




HOW PRECAST BUILDS®

Quality Assurance / Quality Control & Delivery



Delgrosso Amusement Park Bridge
Tipton, PA

PCI Quality Control and Quality Assurance

Plant Certification

- DOT & PCI Quality Systems
- Bi-Annual PCI Audits

Personnel Certification

- 3 PCI levels of certification

PCI QC Manual
MNL 116





Quality Control inspection – Every step, cradle to grave



Complete Bridge "Dry Fit"





HOW PRECAST **BUILDS**®

Delivery and ABC Erection



Fern Hollow Bridge Replacement,
Pittsburgh, PA





ABC Precast Erection



DAY 1

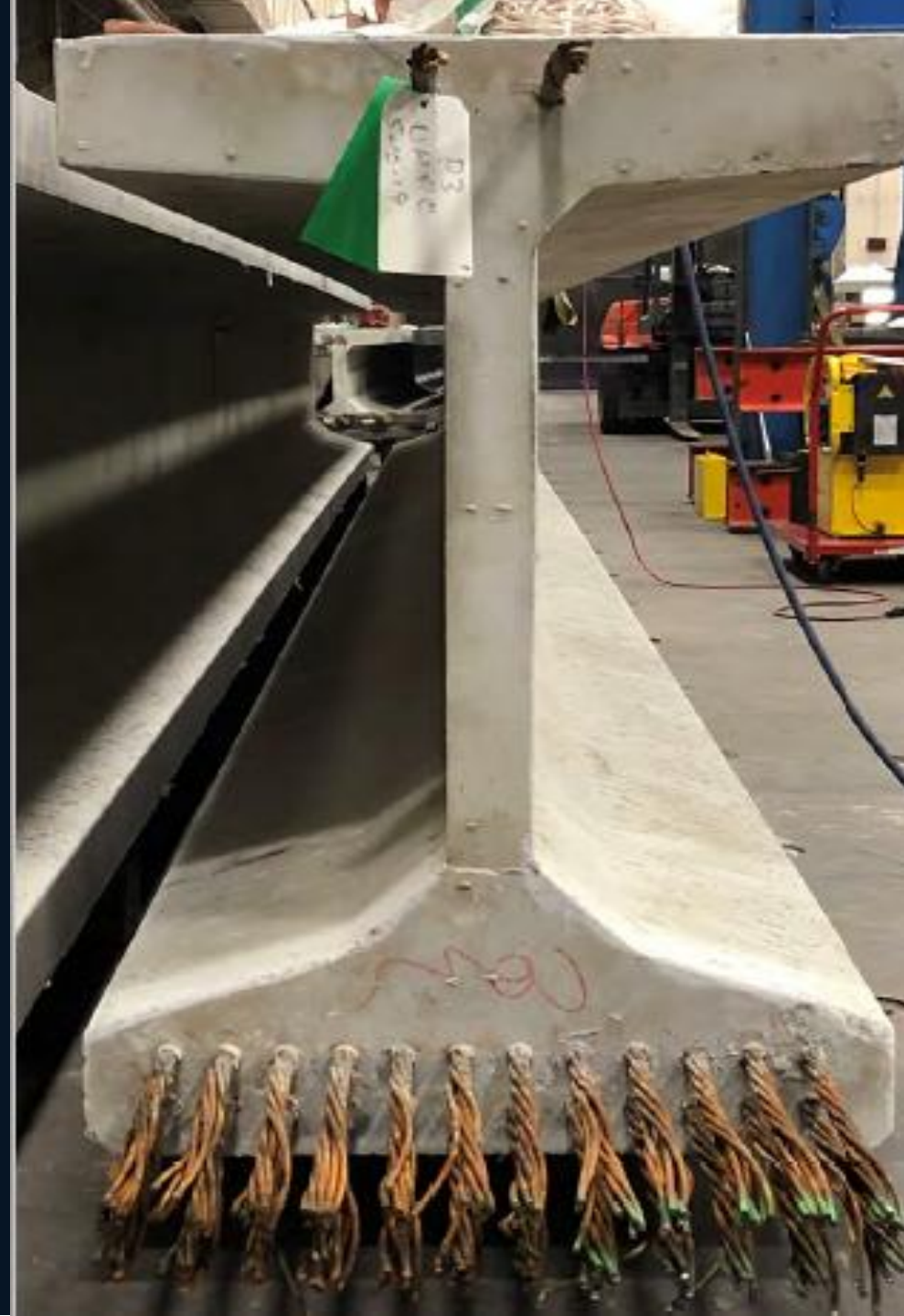




I-78 Underclearance Project – Berks County

UHPC

ULTRA HIGH-PERFORMANCE
CONCRETE (UHPC)



Guidelines



Precast/Prestressed Concrete Institute

Guidelines for the Use of Ultra-High-Performance Concrete (UHPC) in Precast and Prestressed Concrete



PCI Concrete Materials
Technology Committee

TR-9-22

e.construct
Structural Engineering Consultants



e.construct
Structural Engineering Consultants

WJE



Implementation of Ultra-High Performance Concrete in Long-Span Precast Prestensioned Elements for Concrete Buildings and Bridges

Phase II Report

September 15, 2021

Prepared for:

Precast/Prestressed Concrete Institute

8770 W. Bryn Mawr Ave.
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Louisiana Tech University

201 Mayfield Ave
Ruston, LA 71270

The University of Nebraska-Lincoln

1110 S 67th Street
Omaha, NE 68182

FHWA – UHPC Publications

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UHPC FAQs

Benjamin Graybeal

Benjamin Graybeal
Team Leader, Bridge
Engineering Team
Turner-Fairbank Highway
Research Center
Turner-Fairbank Highway
Research Center

Ultra-High Performance Concrete Publications

Expand All

Collapse All

Topic: UHPC State of the Art



Topic: UHPC Program Overview



Topic: UHPC Structural Performance



Topic: UHPC Material Characterization and Behavior



Topic: UHPC for Bridge Preservation and Repair



Topic: Field-Cast UHPC Connections for Modular Components



Topic: UHPC Mix Design



Topic: Computational Modeling of UHPC



Additional Publications that Include Discussion of UHPC





UHPC Federal Highway Research Project – September 2022



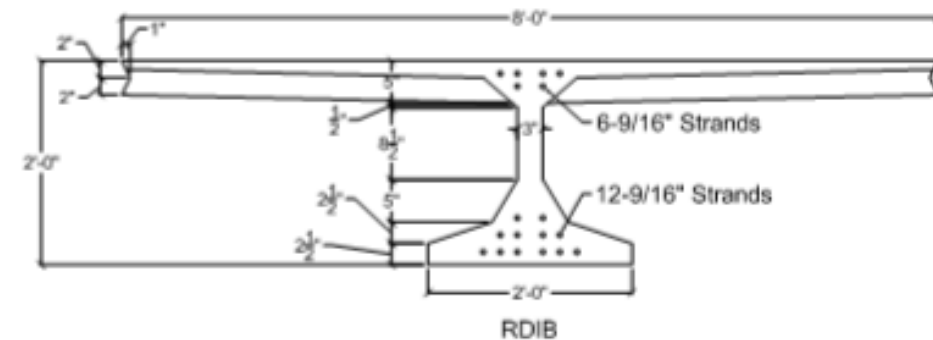
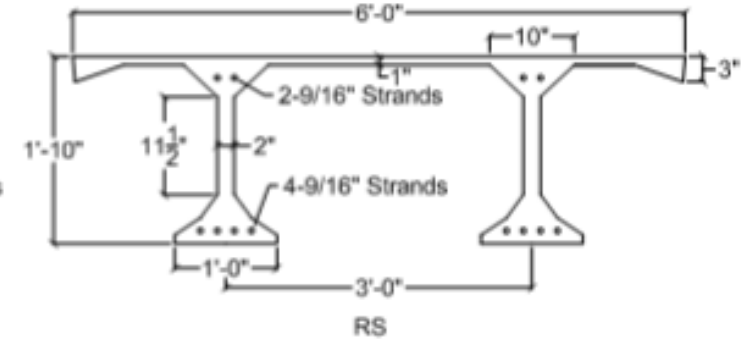
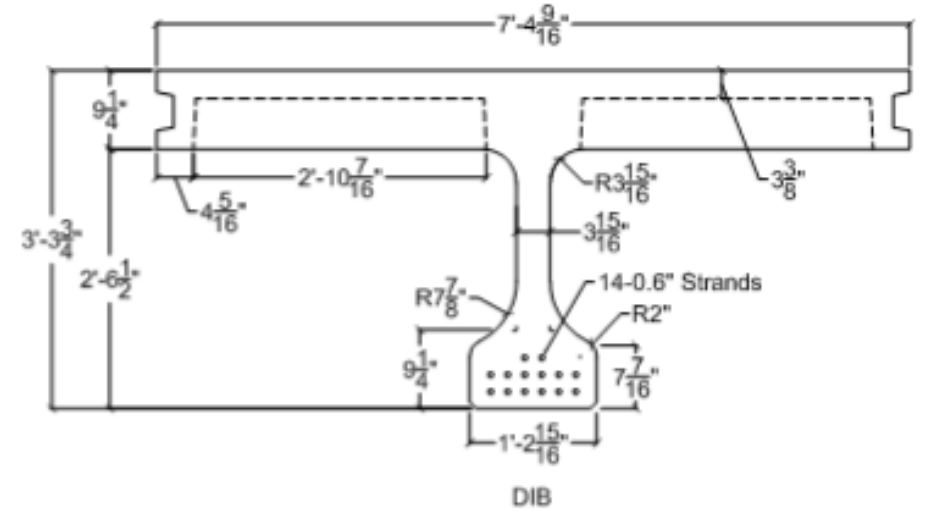
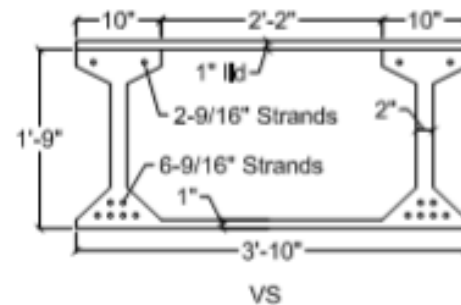
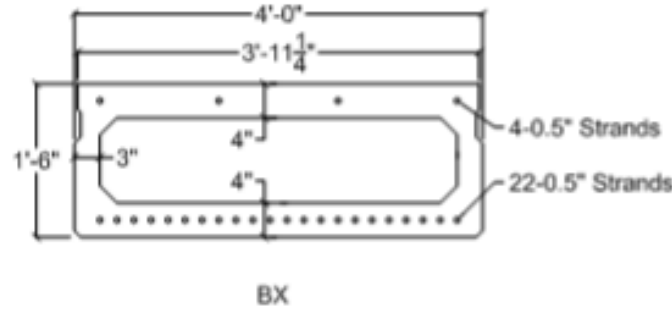
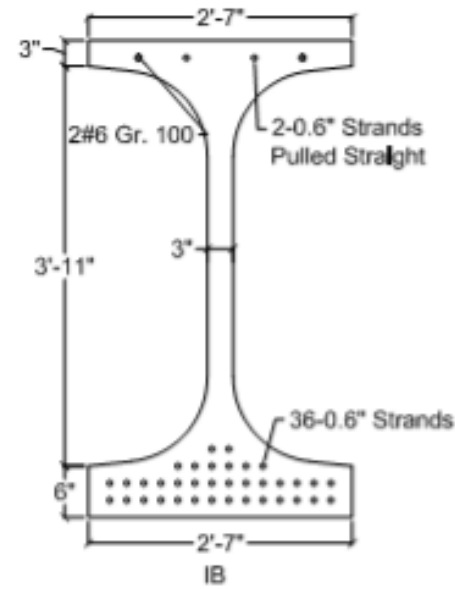
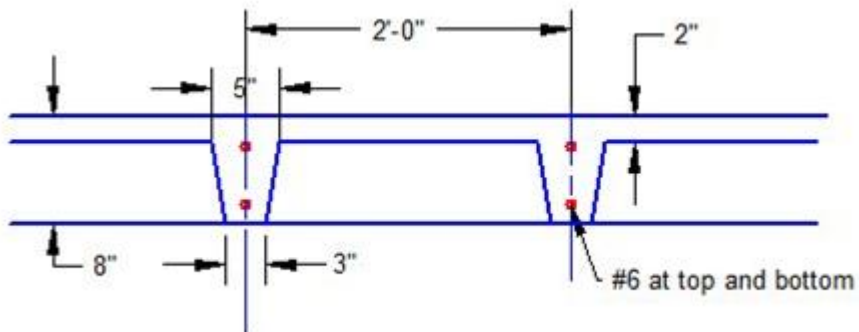
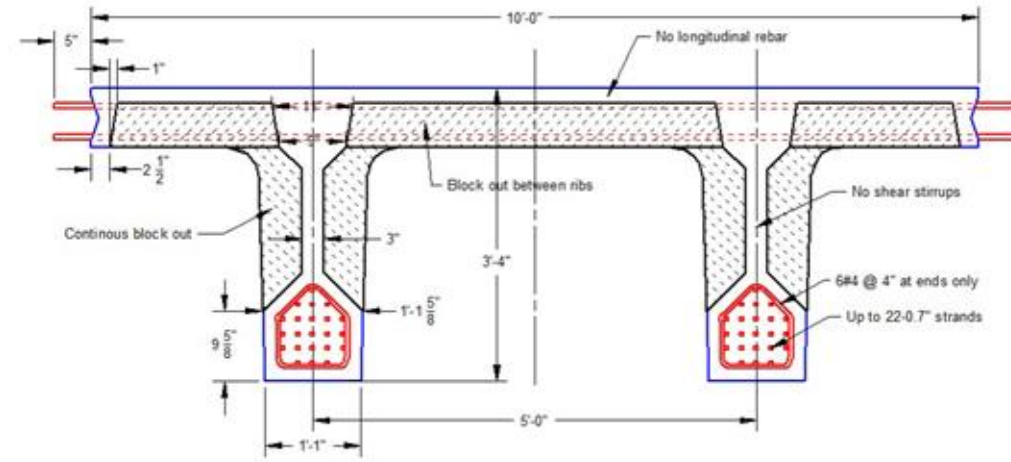
The Future of Prestress – UHPC

- UHPC Bulb Tee

UHPC Volume (yd ³)	Conventional Concrete (yd ³)
3.5	8.9



Potential UHPC Bridge Applications





THANK-YOU
QUESTIONS?