A look inside the Precast/Prestressed Concrete Industry in Pennsylvania

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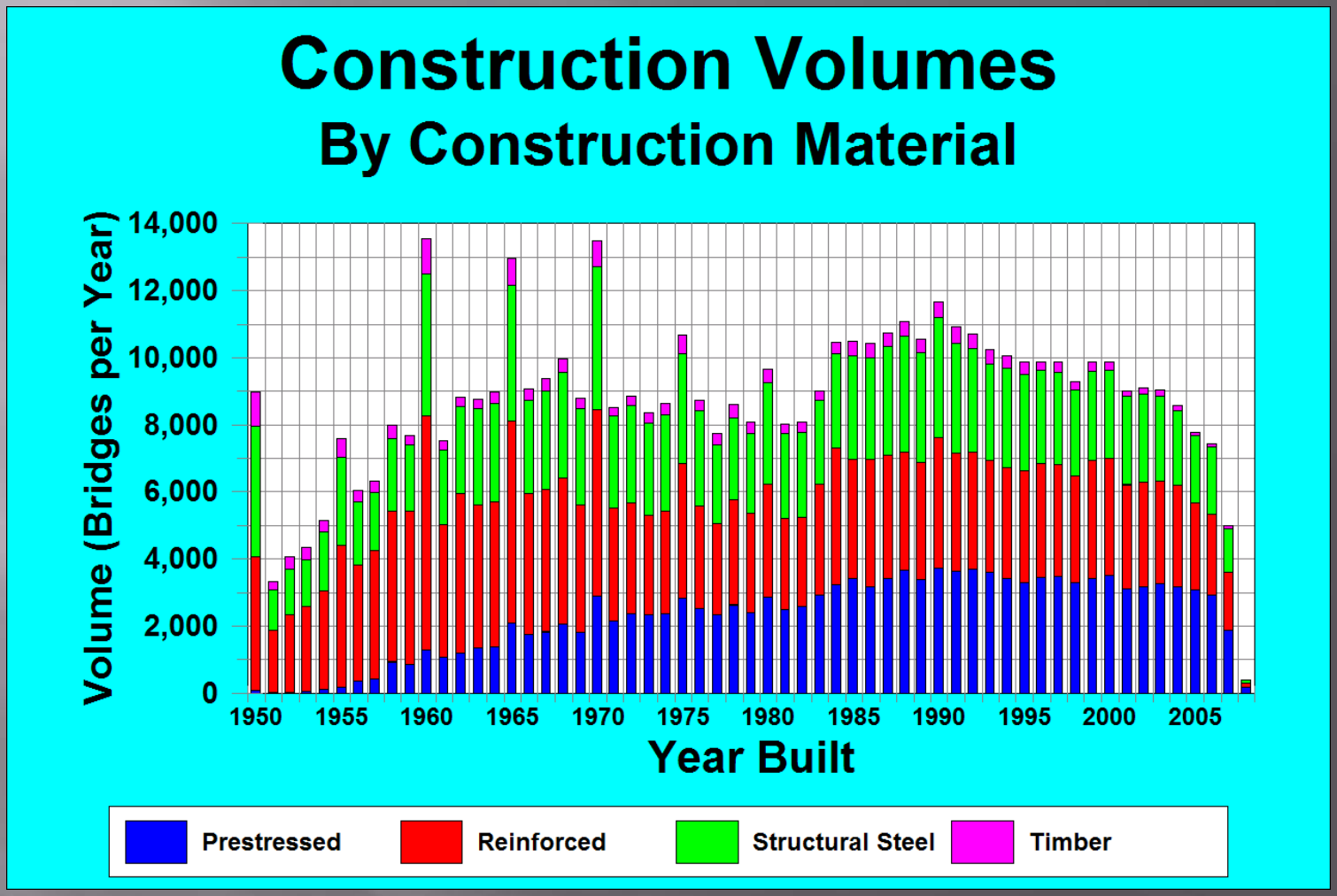
BRIEF HISTORY OF PRECAST PRESTRESSED CONCRETE BRIDGES

The single most important event that led to the dramatic launch of the precast prestressed concrete industry in North America was the construction of the technically innovative, historically fascinating Walnut Lane Memorial Bridge in Fairmont Park in Philadelphia, Pennsylvania in 1950.

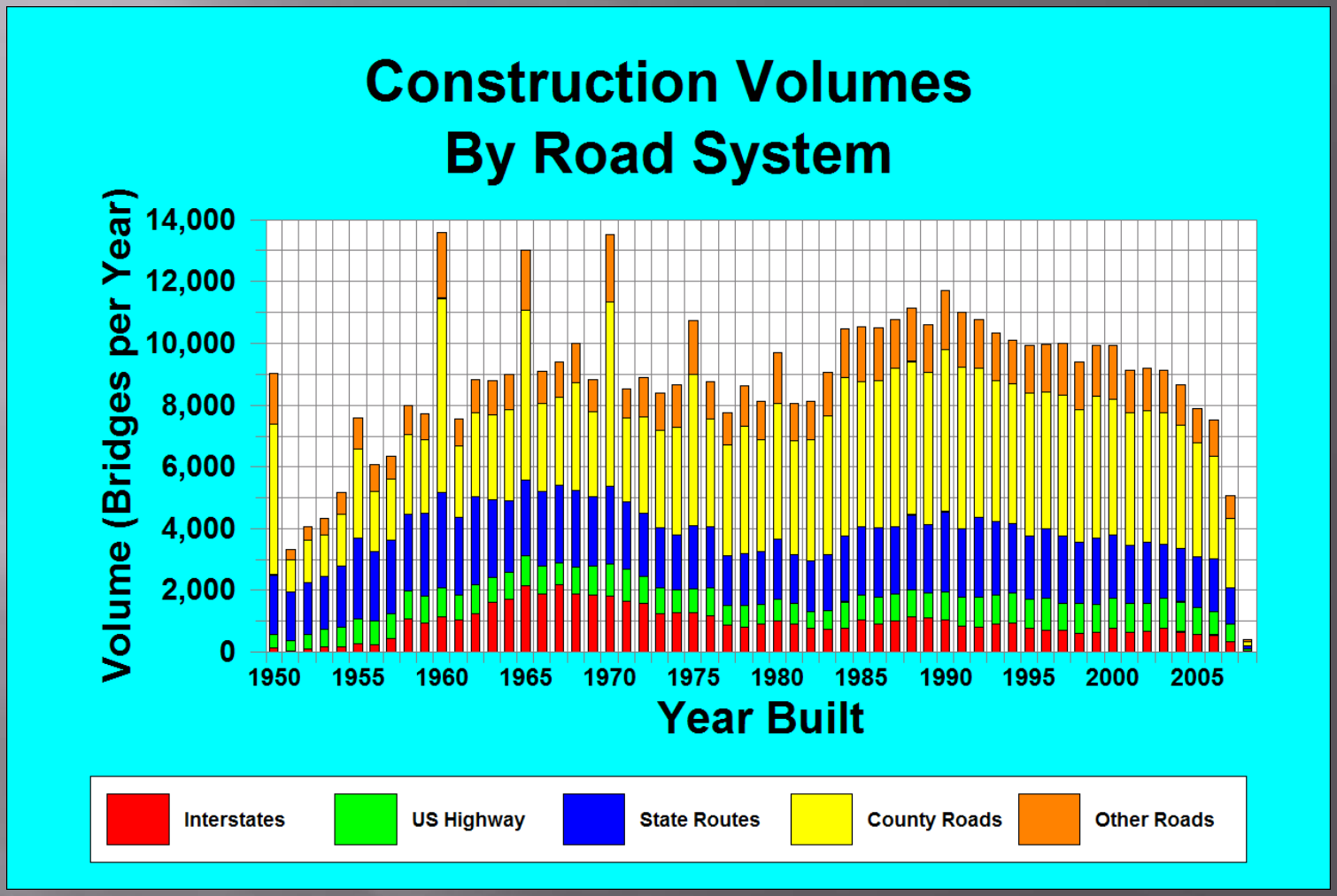
BRIEF HISTORY OF PRECAST PRESTRESSED CONCRETE BRIDGES

At that time, manufacturers had no experience with prestressing, and little published information was available. This prestressed concrete bridge became a reality because of the vision, persistence and courage of a few extraordinary individuals.

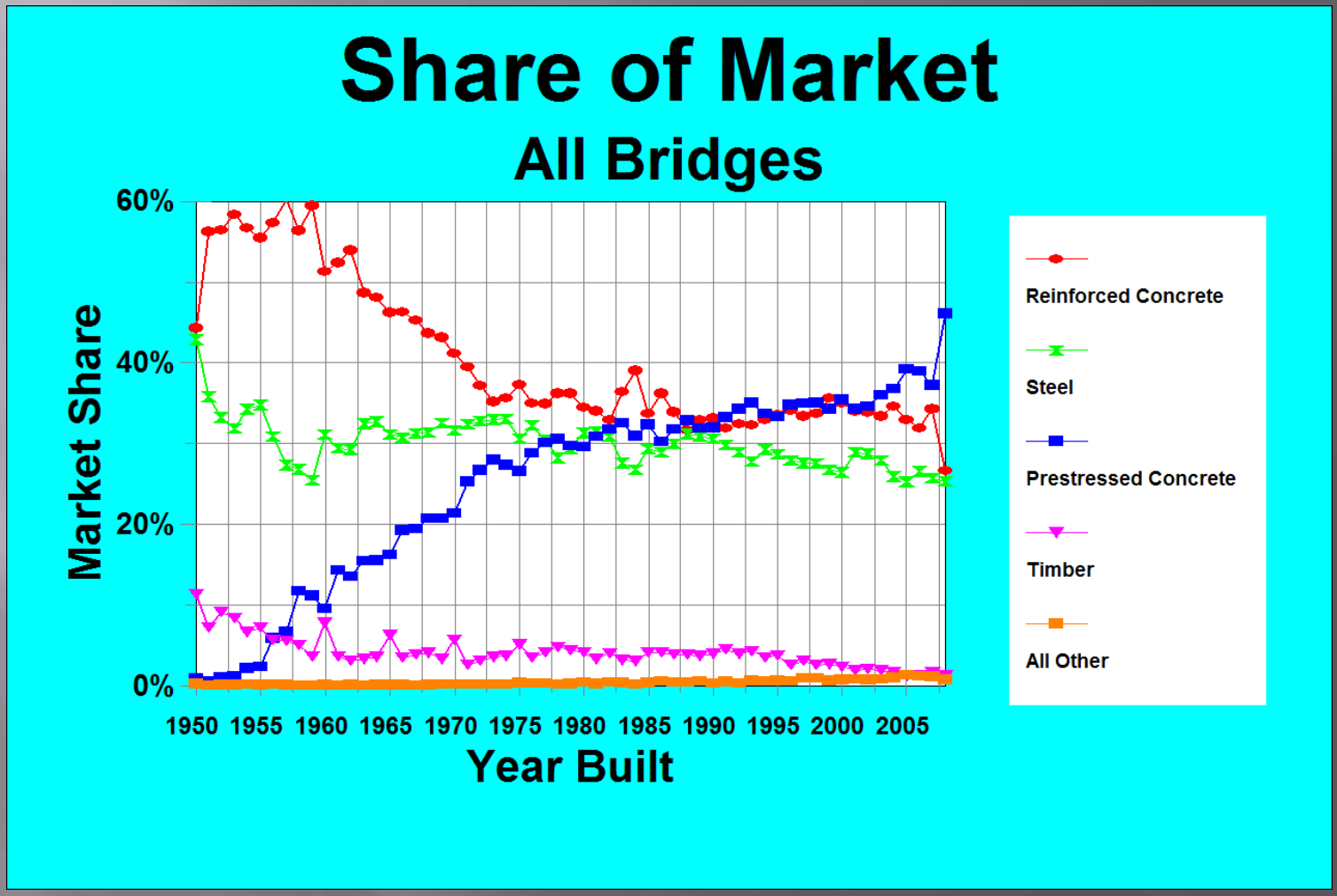
SINCE THEN: P/S CONCRETE BRIDGES PLAYED INCREASING ROLE



SINCE THEN: NATIONAL BRIDGE INVENTORY



SINCE THEN: MARKET SHARE INCREASED STEADILY



PRESTRESSED CONCRETE BRIDGES TODAY

- P/S Concrete bridges differ in the 66 years since the Walnut Lane Bridge
- Still strong similarities
- Concrete has matured as construction material
- But it still has potential to be explored

PRESTRESSED CONCRETE BRIDGES TODAY

Basically same materials -but refinements and new materials provide:

- Much higher strengths
- Easily flow into congested areas
- Achieve high strengths quickly
- Significantly reduced permeability
- Longer service life
- Longer Spans

THE FUTURE IS NOW

Material properties, such as corrosion resistance, fire resistance and durability are being continuously improved and exploited.

These inherent qualities of p/c p/s concrete and its design flexibility also make it ideal for a wide variety of other applications: poles, piles, culverts, storage tanks, retaining walls, sound barriers and even railroad ties.

THE FUTURE IS NOW

The benefits of High Performance Concrete are already being applied. These include reduced initial construction costs that result from wider girder spacing and longer spans as well as reduced long-term costs due to fewer replacements and fewer repairs. High Performance Concrete is being specified for the nation's bridges and structures.

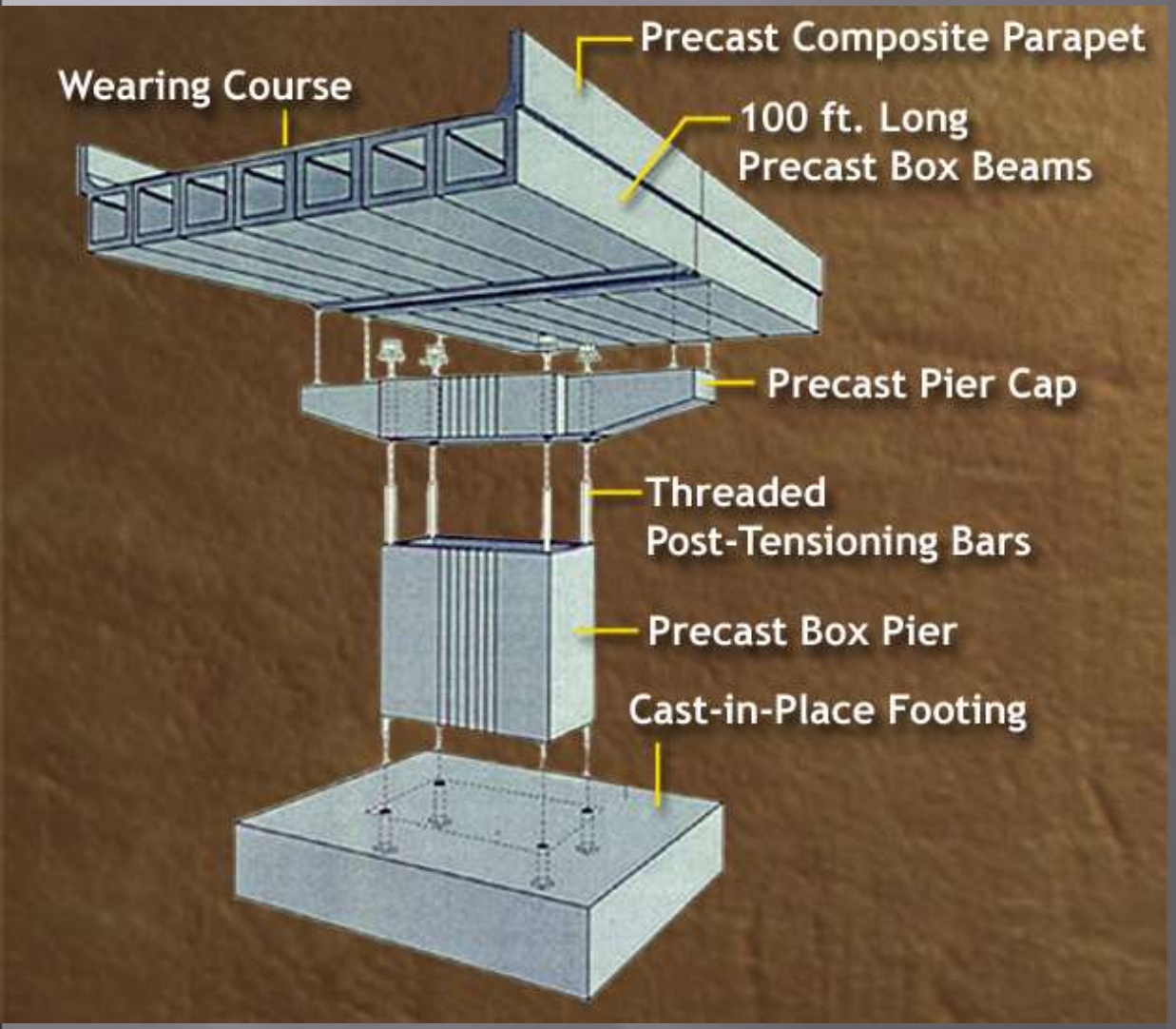
THE FUTURE IS NOW: P/C SEGMENTAL

THE FUTURE IS NOW: P/C SEGMENTAL

THE FUTURE IS NOW – SPLICED GIRDERS

Spliced girders give prestressed concrete girders the ability to reach further and longer

TOTAL PRECAST BRIDGES



With the push toward modular and off-site construction--precast components are one way to put a bridge together quickly.

TOTAL PRECAST BRIDGES – BENEFITS TO CONTRACTORS

- ✓ Reduced exposure to traffic
- ✓ More work – less time
- ✓ Fewer weather delays
- ✓ Less skilled labor
- ✓ Stockpiled components
- ✓ Lower costs (less formwork, scaffolding, shoring, cranes)

TOTAL PRECAST BRIDGES – BENEFITS TO OWNER AGENCIES

- ✓ Reduction in the duration of work zones
- ✓ Reduced traffic handling costs
- ✓ Reduced accident exposure risks
- ✓ Less inconvenience to travelling public (fewer delays)
- ✓ Fewer motorist complaints
- ✓ Quality control of plant produced components

TOTAL PRECAST BRIDGES – PILE CAPS

Pile caps can be precast concrete, reducing exposure, forming and curing in the field.

TOTAL PRECAST BRIDGES -- PIERS

Piers can be made of precast concrete pieces quickly assembled in the field.

TOTAL PRECAST BRIDGES – PIER SECTIONS

Erecting Pier Sections

TOTAL PRECAST BRIDGES -- ABUTMENTS

Abutments can also be made of precast.

TOTAL PRECAST BRIDGES - Harsh Winters in PA

Confederation Bridge
New Brunswick, Canada

Total precast bridge systems may be the only viable solution in harsh field conditions. For example, The *Confederation Bridge* connecting Canada's Prince Edward Island to mainland New Brunswick.

The bridge spanned the 8-mile-wide Northumberland strait, which experiences severe winters and is covered with ice floes for five months of the year.

TOTAL PRECAST BRIDGES

Confederation Bridge

Even in such harsh conditions, precast concrete was able to meet the owner's requirements of a 100-year service life, and attractive design.

TOTAL PRECAST BRIDGES – Hot summers in PA

Edison Bridge
Florida

It makes economic sense to evaluate conversion of cast-in-place to precast concrete. This was done for the *Edison Bridge* in Florida. Precast piers and beams were spliced to produce tall pier bents.

TOTAL PRECAST BRIDGES

Sunshine Skyway Bridge
Florida

Another famous bridge is the *Sunshine Skyway Bridge* over Tampa Bay. The piles, piers and pier caps were constructed of precast concrete elements connected together with post-tensioning thread bars.

THE FUTURE IS NOW - HPC

HPC

High strength concretes are commonplace today

A strength of 14,000 psi was specified here for the beams of the Louetta Road Bridge, a demonstration project in Houston, Texas. High strength concrete was also used in this bridge for the stay-in-place deck panels, the cast-in-place concrete deck and precast segmental piers.

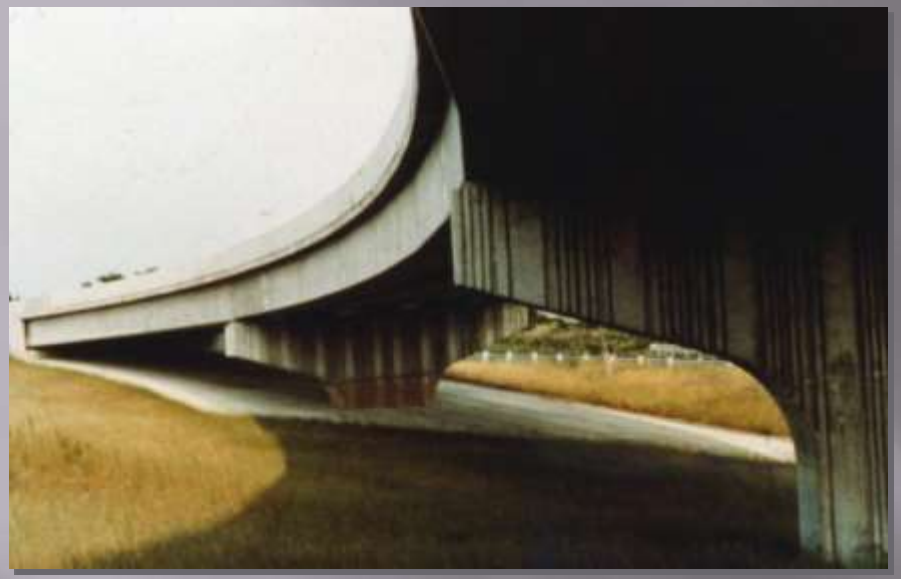
THE FUTURE IS NOW – HAUCHED GIRDERS

THE FUTURE IS NOW- P/C DECK PANELS

Precast deck panels used as stay-in-place forms reduce labor for field placement of reinforcing steel and concrete for bridge decks

The panels become composite with the field-placed concrete for live loads. They're made of high-quality, plant-produced concrete and contain the primary tensile reinforcement between beams. They remain crack-free, protecting this important reinforcing steel.

THE FUTURE IS NOW – HORIZONTAL CURVE



The development of horizontally curved precast concrete bridges creates exciting new options in contemporary bridge designs.

This technique involves post-tensioning precast elements together in the plants before shipment or in the field after erection.

THE FUTURE IS NOW – ACCELERATED BRIDGE CONSTRUCTION

THE FUTURE IS NOW – ABC / FULL DEPTH PRECAST PANELS

Accelerated Bridge Construction

Full-depth precast deck panels for deck replacement. The technique applies to new construction as well.

Benefit = speed up lane widenings and reduce traffic closures and detours.

THE FUTURE IS NOW – ACCELERATED BRIDGE CONSTRUCTION

PRESTRESSED BRIDGES NOW

Prismatic Spliced Girder Standard

Haunched Spliced Girder Standard

NEXT Beam Standard

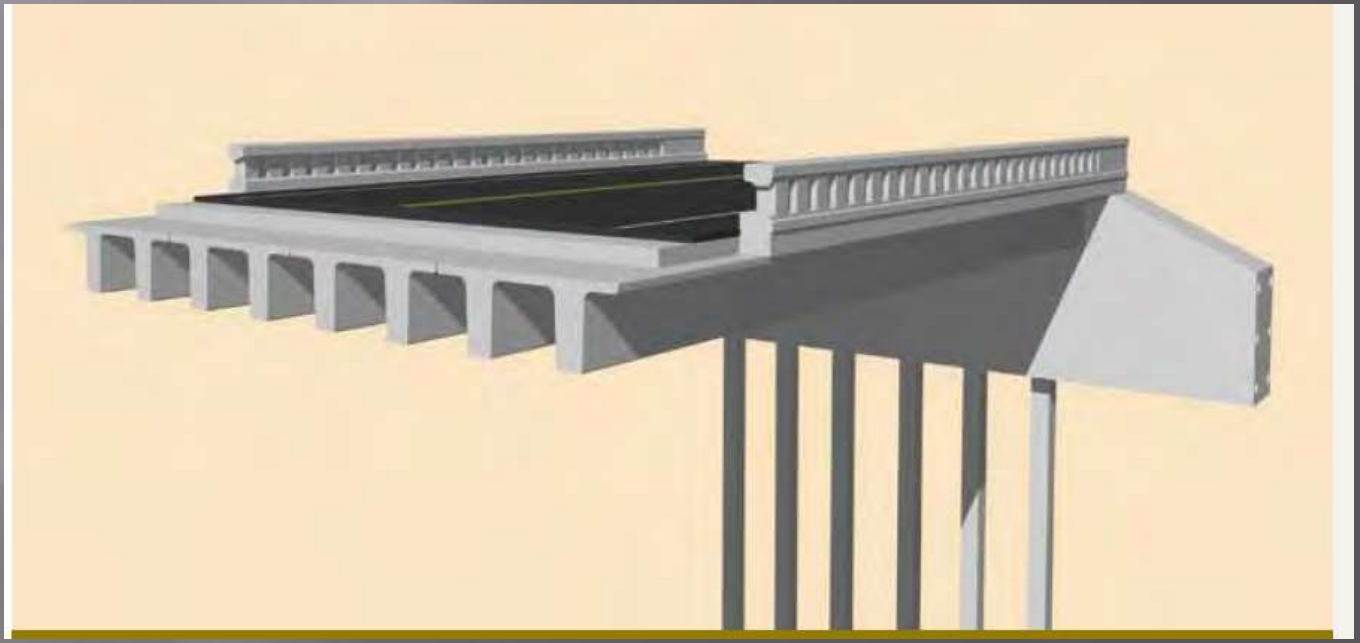
Accelerated Bridge Construction

- Full Depth Deck Panels
- Approach Slabs

Precast/Prestressed Concrete Pavements

NEXT Beams

Additional fabricators
Bulletin 15 approved



THE FUTURE IS NOW

Larger strand diameters and higher strengths are becoming more common as higher strength concretes are used and the demand for higher tensile force increases.

When 0.6 inch diameter strands are used in conjunction with high strength concrete, in the 10,000 to 12,000 psi range, standard I-beams and other products are able to reach significantly longer spans never thought possible before.

THE FUTURE IS NOW

Photo curtesy of Summit Engineering

U-Girder Standard was approved by PennDOT in May, 2016

THE FUTURE IS NOW

Night time Hauling and Mega-Beams are more common now

THE FUTURE

Today, it still gives the public extremely good value for its money. The reputation of the precast prestressed concrete industry has been built on the strength, imagination, consistency and integrity of its people and products alike. In the future, it will continue to be the solution of choice.

PENNSYLVANIA ACT 89

November 2013 signed Act 89 into law creating comprehensive PA transportation legislation

With total bridge inventory >25,000 bridges and adding hundreds of aging spans each year to the deficient category

Have to maintain >300 structurally deficient bridge projects to stay above water

Working on the hit list of deficient bridges

Rapid Bridge Replacement Project and P3

ACCELERATED BRIDGE CONSTRUCTION

The goals for ABC cannot be met without the input of the PC/PS industry and others who make prefabricated bridge elements

It is in the best interest of all that industry is involved early on in non-standard projects

NON-STANDARD PROVISIONS

The PC/PS industry met with PennDOT to review the process for non-standard provision projects.

Ultimately we are all working to shorten project delivery times

There are always unique conditions that warrant non-standard approaches. In the spirit of partnering, we believe that communication among the districts, engineering consultants (you?!) and the p/c p/s industry, well in advance of project bid letting, makes for the best solution.

North Union Township, PA 339 over Catawissa Creek

NON-STANDARD PROVISIONS

The 6-month letting schedule communicates planned projects but does not contain sufficient information regarding special conditions.

If a bridge deviates from standard p/c p/s concrete design, in necessitates sufficient time to purchase forms or other ancillary equipment to meet project schedules.

Without it, there are fewer interested bidders, increased costs to PennDOT and it is more difficult to perform the work as specified.

Involve P/C P/S manufacturer at TS&L stage!!

SCHEDULE

Accelerated Bridge Construction is changing the way PennDOT does business.

Long term planning for innovation, cost reduction and speed of project delivery are made possible with prefab bridge elements. The goal is limited road closures and shorter installation schedules

Often the accelerated part of the process is pushed down to the fabricator w/o the necessary time for mandated design reviews, shop drawing and unique material entered into the design.

SCHEDULE

Consultation with a p/c manufacturer throughout the design process also embodies the spirit of innovation and partnering that PennDOT and FHWA are fostering.

With the cooperation and collaboration of consultants, agencies, manufacturers – then we can all fulfill the responsibility of Act 89 and to the tax payers of Pennsylvania.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PennDOT Leads the way
Specifications Promoted

PennDOT

- Streamlining of DM4 and Publication 408
- Revised Span to Depth Ration Limits
- Use of 0.6 inch Strand in design
- Use of 10 Ksi Concrete in design
- Use of Non-Air Entrained Concrete
- FHWA Stewardship requirements for QC and QA controls

Other DOTs

- Product tolerances
- Repair Procedures

Beam Setting

Misconceptions about Capacity

Capacity is influenced by:

- Current facility
- Current backlog
- Project schedules

Capacity can be increased:

- Build new facility
- Purchase new forms
- Add batch plant capacity
- Purchase steerable trailers to bolster transportation fleet
- Increase yard storage
- Purchase additional mobile crane

Misconceptions about Capacity

P/C Box culvert Capacity is also very subjective

- Impacted by project delays
- Initial P3 projects had approval delays
- Some precasters were slow during the winter when they could have been casting
- Additional precasters have become Bulletin 15 approved

PRECAST BOX CULVERT Update

Box Culvert task force has been meeting with PennDOT

Addressing issues and working toward improving efficiencies

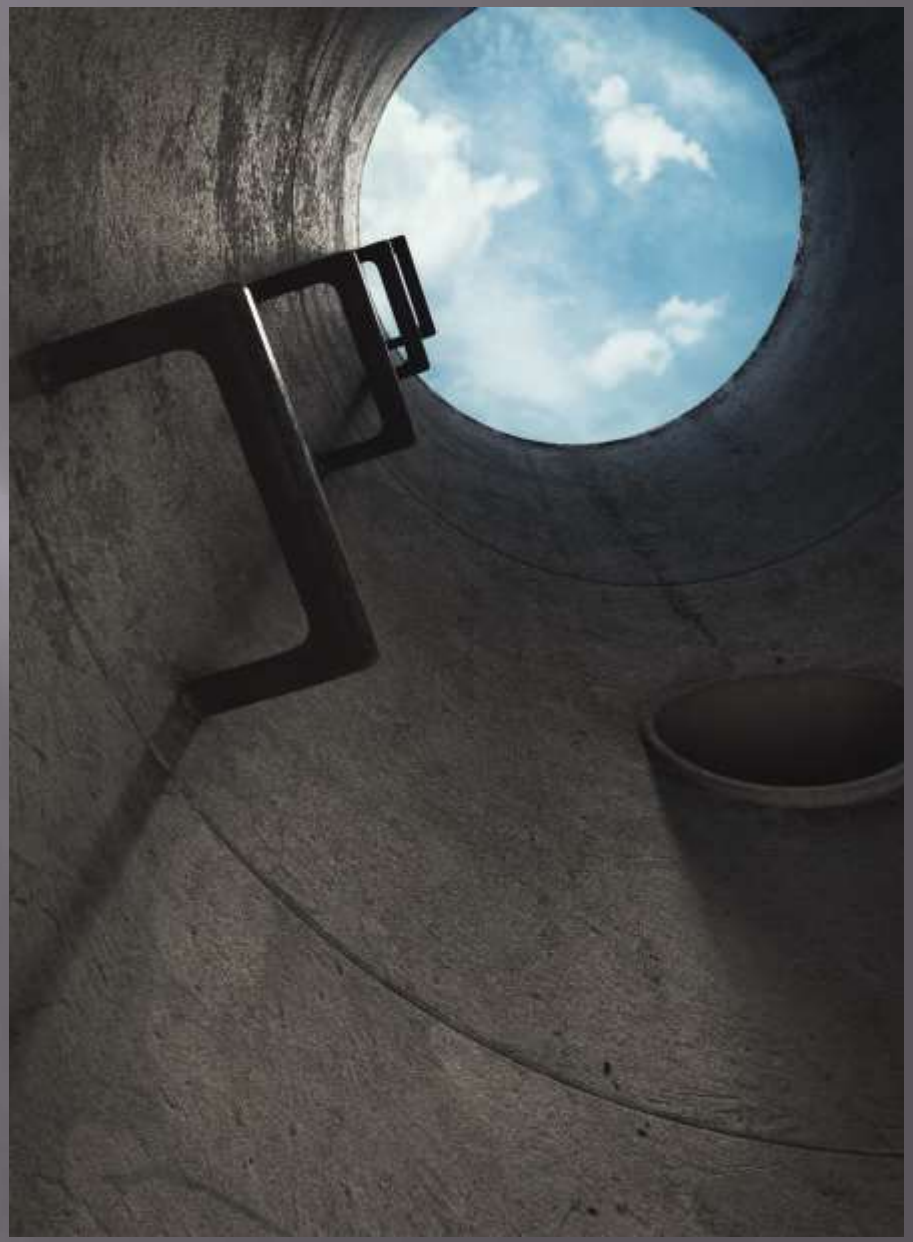
Discussion regarding tolerances, P/T ducts, Skews and Scheduling

PRECAST MANHOLE Update

LRFD Manhole Standards (RC38 and RC39) have been updated

Waiting for FHWA final approval.

PennDOT will provide 6 month grace period to Precasters to use up existing inventory



PRECAST CONCRETE INDUSTRY UPDATE

Buy American Update

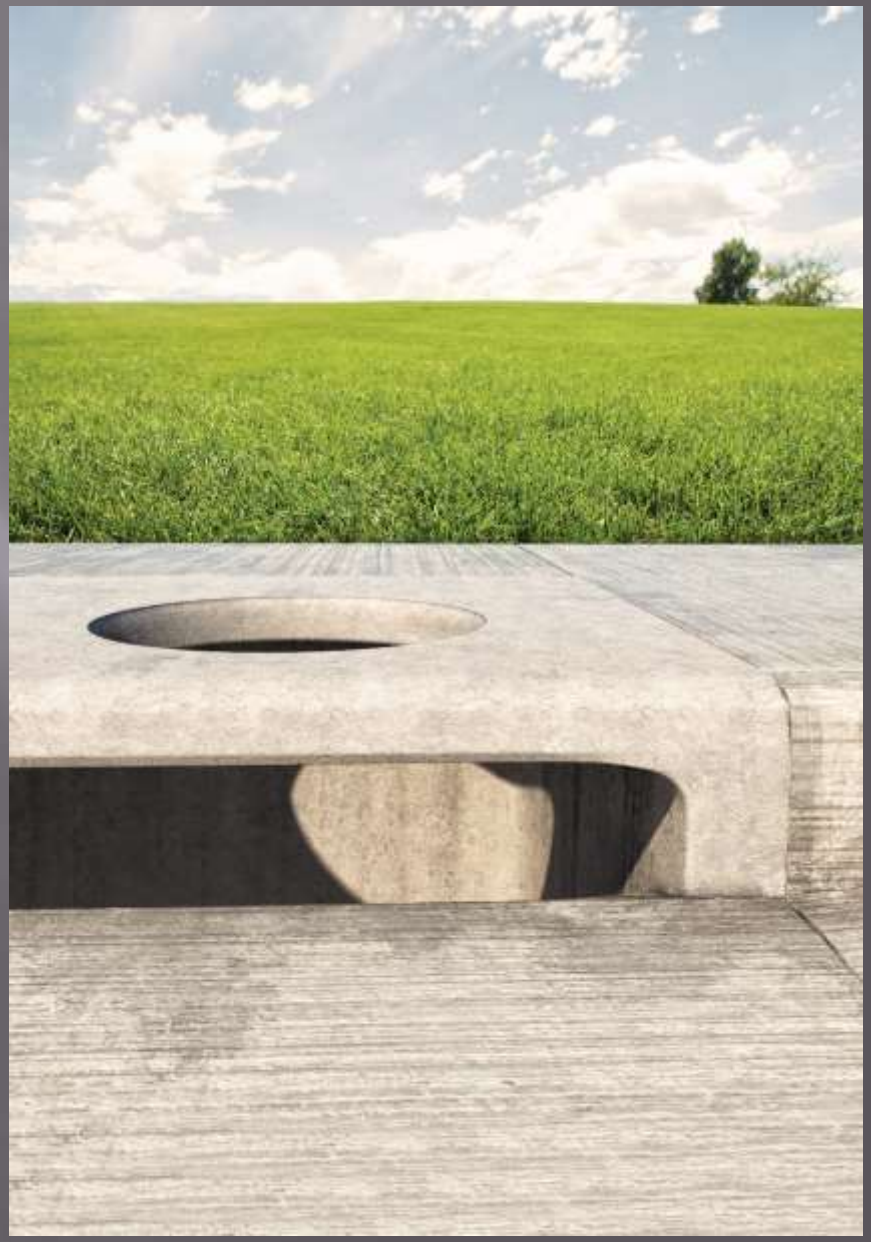
Miscellaneous Steel- especially tie wire affects productivity and efficiency

PRECAST CONCRETE INDUSTRY UPDATE

OSHA Silica Dust Update

OSHA has changed standards for exposure to crystalline silica dust.

Major impact on precast industry and construction industry as a whole



Industry Moving Forward

- Improved Owner Relations
- Education and Knowledge Transfer
- Technical Developments – Quality Improvements

- Defend the market share in Commonwealth
- Find new applications for plant produced concrete
- Further penetrate the market as opportunities present themselves

QUESTIONS?