Accelerated Bridge Construction
With Concrete Segmental Bridges

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Outline

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• Precast Segmental Bridges
  - Balanced Cantilever
  - Span-by-Span
  - Substructure
• Connections
  - PTI/ASBI Grouted Post-Tensioning Specification
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Introduction

ADVANTAGES OF CONCRETE SEGMENTAL BRIDGES

• Redundancy
• Overload Capacity
• Insensitive to Fatigue
• Fire Resistance
• Deflection Control
• Durability
Precast Balanced Cantilever Construction
Four Bears Bridge
Ft. Berthold Indian Reservation, North Dakota
Opened September 2005
4,500’ Bridge
482 superstructure segments
Casting yard near one end of the bridge
Indoor casting facility

Superstructure Precasting
Casting Operations

Prefabricated reinforcing cage placed in segment form
Casting Operations

Concrete placement using overhead crane and bucket
Casting Operations

Segment move to storage
Segment Transport
Segment Delivery
Pier Table Erection
Typical Segment Erection
Typical Closure Joint
Typical Erection of 4 to 6 segments per day (40’ - 60’)

Four Bears Bridge:
10 Segments (100’) erected in 1 day maximum
 Entire 316’ span in 9 days
Four Bears Bridge
Ft. Berthold Indian Reservation, North Dakota
Balanced Cantilever Erection

Segments Can Be Erected using:

• Barge-mounted cranes
• Ground based cranes
• Beam and Winch on cantilever end
• Overhead Gantry
New I-35W Bridge
Minneapolis, Minnesota

Opened in Sept 2008
1,214’ long, 504’ Mainspan
Superstructure Precasting

Long Line Method
New I-35W Bridge
Minneapolis, Minnesota

120 segments placed in 47 days
NTP to close of main span
was 9 months
Victory Bridge over Raritan River
Sayreville, New Jersey

Opened in 2005
Twin 3,971’ Bridges

FIGG
Rt. 36 Highlands Bridge
New Jersey
Opened in 2010
Twin 1600’ Bridges
Precast Span-By-Span Superstructure Construction
Susquehanna River Bridge
Near Harrisburg, Pennsylvania

November 2004 - NTP
Open in May 2007 - 5,910’ Twin Bridges
Casting Yard

Penn Turnpike Commission

Bridge

Susquehanna River Bridge
Near Harrisburg, Pennsylvania

Precasting
Typical Segment - Susquehanna

Maximum Length: 13 Feet
Maximum Weight: 104 Tons
Precasting – Susquehanna

1040 – Total Segments
(958 Typical, 82 Pier)

3 - Typical Casting Cells

1 - Specialty Casting Cell
Core Form – easily inserted and withdrawn

Precasting – Susquehanna

Casting Bed
Casting Bed

Transverse PT in Deck
Casting Yard  Storage
Susquehanna River Bridge
Near Harrisburg, Pennsylvania
Susquehanna River Bridge
Near Harrisburg, Pennsylvania
Susquehanna River Bridge
Near Harrisburg, Pennsylvania

Superstructure Erection

FIGG
Susquehanna River Bridge
Near Harrisburg, Pennsylvania
Susquehanna River Bridge
Near Harrisburg, Pennsylvania

Superstructure Erection
Susquehanna River Bridge
Near Harrisburg, Pennsylvania

Erected Rate -
3 Days Per Span
Susquehanna River Bridge
Near Harrisburg, Pennsylvania
Garcon Point Bridge
Pensacola, Florida

Opened in May 1999
18,425’ Bridge
Garcon Point Bridge
Pensacola, Florida
Selmon Expressway
Tampa, Florida

“Feeling: George Jetson. For real. By the time I’m at my destination, it’s been 12 minutes suburb to city. They charge a dollar for toll. It should cost two.”

Ben Montgomery, Reporter, St. Petersburg Times, July 19, 2006 (opening day)

“It’s probably the best thing that’s ever happened here... There’s no way I’d get there as fast as I do without it.”

LaSchael Parks, Commuter, Tampa Tribune, July 16, 2007 (1 year after opening)
Span-by-Span Erection

Segments Can Be Erected using:

• Under Slung Truss
• Overhead Gantry

Segment Delivery can be from above or below.
Precast Segmental Substructures
Victory Bridge over Raritan River
Sayreville, New Jersey

Opened in 2005
Twin 3,971’ Bridges
Victory Bridge over Raritan River
Sayreville, New Jersey

Precast Substructure
First segment cast 6 weeks after NTP
Victory Bridge over Raritan River
Sayreville, New Jersey

Precast Substructure

FIGG
Victory Bridge over Raritan River
Sayreville, New Jersey

Typical Precast Pier Details

PRECAST PIER

EPOXY COATED STRANDS INTERNAL TO CONCRETE AND GROUTED
SECONDARY FOOTING POUR
BLOCKOUT
WATER LEVEL
FOOTING
SINGLE PIECE SCHEDULE 40 PIPE (DUCT)

PT TENDON
DUCT COUPLER STAINLESS STEEL CLAMPS GROUT
DUCT FROM FOOTING

TENDON DUCT
BLOCKOUT EXTENTS TO BE POURED BACK
SECONDARY FOOTING POURED
TOP OF FOOTING

4”
6” RECESS

DETAIL A
Victory Bridge over Raritan River
Sayreville, New Jersey

Precast Pier Erection
Victory Bridge over Raritan River
Sayreville, New Jersey

Precast Pier Erection

FIGG
Victory Bridge over Raritan River
Sayreville, New Jersey

Precast Pier Erection

FIGG
Victory Bridge over Raritan River
Sayreville, New Jersey

Precast Pier Erection

FIGG
Completed Precast Piers

100’ tall piers erected in one day
Rt. 36 Highlands Bridge
New Jersey

Precast Cofferdam

McNary Bergeron
Precast Pier Shells

Pier Table Erection
Precast Pier Shells

Pier Table Erection
Connections
PTI / ASBI Grouted Post-Tensioning Specifications

Guide Specification for Grouted Post-Tensioning
The Joint Task Group

Designers, Contractors, Suppliers, Academia, Owners

[Image of various logos and brands associated with the Joint Task Group]
Why Do We Need a Grouted Post-Tensioning Specification?

• To Create a Uniform Standard for the Application of Grouted Post-Tensioning

• To Create Uniform Acceptance Standards for Post-Tensioning Systems
Specification Highlights

- Designer establishes PT System Protection Level
- Quality Assurance and Quality Control Requirements
- Personnel Qualifications
- Grouting Operations
Personnel Training

Post-Tensioning Institute
- Level 1 Bonded PT – Field Installation
- Level 2 Bonded PT Field Specialist

American Segmental Bridge Institute
- Certified Grouting Technician

Information: www.post-tensioning.org
www.asbi-assoc.org
Conclusions

Precast Concrete Segmental Bridges Advantages:

- Reduced Construction Time
- Environmental Protection
- Maintain Traffic
- Provide Aesthetics
- Local Labor and Materials
- Quality Control
- Minimum Maintenance
- Reduced Cost