Post Tensioning Lessons Learned

Presented by Brian Frederick, PE and Jay Ridens, PE
Post Tensioning Project Examples
Post Tensioning Project Examples

- US 31 over Kern Road
Post Tensioning Project Examples

- US 31 over Kern Road
Post Tensioning Project Examples

- **US 31 over Kern Road**
Post Tensioning Project Examples

- Northbound SR 37 over I-69
Post Tensioning Project Examples

- Northbound SR 37 over I-69
Post Tensioning Failures
Post Tensioning Failures

Anchor Head

Trumpet area
Post Tensioning Failures

- Partially Filled Grout
- Strands with Pitting Corrosion
- Duct Tape
- Grout Leakage
Post Tensioning System
Post Tensioning System

[Diagram of Post Tensioning System]

NOTE: Other requirements not shown for clarity.

NOTE: Other requirements not shown for clarity.

NOTE: Other requirements not shown for clarity.

NOTE: Other requirements not shown for clarity.
Post Tensioning System
Post Tensioning System

Anchor Casting

Spiral Reinforcement

Trumpet
Post Tensioning System

Design
# Post Tensioning System

## SOUTHBOUND PIER 2 – POST TENSIONING GEOMETRY SCHEDULE

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### Notes:
- Distances from left end of pier cap.
- Location of 0.00 is defined as mid-length of pier cap to centerline of deck.
- Distances from left end of pier cap.
- Locations from 0.00 to 54.5' are shown.

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**UNIONED Consulting**

1625 N. Post Road
Indianapolis, Indiana 46219

Phone: 317-805-2958
Fax: 317-805-2999
Web: www.scholly.com

**INDIANA DEPARTMENT OF TRANSPORTATION**

POST TENSIONING DETAILS

U.S. 31 OVER KERN ROAD
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**Southeast Pier - Post Tensioning Geometry Schedule**
Construction Sequencing
Construction Sequencing
Beam Erection
Construction

- Beam Erection
Installing Ducts

- Connection for Grout Port
- Coupling with Heat Shrink Sleeve
Installing Ducts
Installing Reinforcing
Installing Reinforcing
Installing Reinforcing
Thermal Control Plan
Tendon Installation

**TENDON TRANSITIONS**
Scale: $\frac{1}{2}'' = 1'-'0''$

- Contingency Duct
- Dead Load Tendons
- Live Load Tendons
Tendon Installation
Tendon Installation
Tendon Installation
**Tendon Installation**

---

**Dywidag Systems International USA Inc.**

### JACK CALIBRATION FORM

**JACK TYPE:** Tenna 2600Kn  
**THEO. RAM AREA:** 65.21  
**JACK ID:** 00109  
**COMPUTED RAM AREA:** 84.35

**PRESSURE GAUGES:**  
**MASTER GAUGE:** 5719868  
**SERVICE GAUGE CALIBRATION STANDARD:** ANSI 45.2

**SERVICE GAUGES:** GAUGE 1: 6-20754  
GAUGE 2: 6-20735  
GAUGE 3: GAGE 4:

**LOADCELL:**  
**CALIBRATION STANDARD:** ASTM E4 AND E74

**METER NUMBER:** DS800K-01  
**METER MFG:** U of I

**CONVERSION EQUATION:** AVG. X 1 + 0

**Temperature:** 68  
**Humidity:** 58%

**Calibration Location:** DYWIDAG SYSTEMS INTERNATIONAL, INC.

**Calibrated By:** Greg Wilkinson  
**Calibration Firm:** DYWIDAG SYSTEMS INTERNATIONAL, INC.

**Verified By:** Gary Smith  
**Verification Firm:** DYWIDAG SYSTEMS INTERNATIONAL, INC.

**Customer:** Reth - Riley Construction Co  
**Job Number:** J088716

---

### GAUGE CALIBRATION FORM

**GAUGE TYPE:** 6" 10000 PSI GAUGE  
**CAL ID:** 12085  
**GAUGE ID:** 6-20754  
**DATE:** 1/13/2014

**Special Note:**  
**TEMP:** 68

---

**MASTER**  
**TEST RUN 1**  
**TEST RUN 2**  
**TEST RUN 3**  
**AVG. READING**

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**CUTOMER:** Reth - Riley Construction Co  
**JOB NUMBER:** J088716

**METER INSTRUMENT ID NO.:** 96609

**DESCRIPTION:** DEADWEIGHT TESTER

**ALTHOUGH RAM/GAUGE COMBINATIONS ARE CALIBRATED AS A UNIT, GAUGES ARE CALIBRATED INDEPENDENTLY, AND ARE USABLE ON OTHER DYWIDAG SYSTEM RAMS, WHEN THIS DOES NOT CONFLICT WITH PROJECT SPECIFICATIONS.**

**INSTRUCTIONS:**

- 1. Each gauge must be calibrated to a master instrument that has been calibrated and traceable to NIST Standards.
- 2. Each gauge must be calibrated to meet or exceed ASME STD. 40.1.
- 3. Each gauge will be used in a jack calibration.
- 4. Each gauge will be calibrated before being sent to the customer as a replacement gauge.
- 5. Connect the gauge to the testing machine.
- 6. Pressure the gauge in 10 increments throughout it’s entire range, 3 times.
- 7. Record the gauge and test standard readings.
- 8. If gauge is in need of adjustment, consult the manufacturers product manual contained in the DSI equipment calibration and standards book.
- 9. Form is to be used by Equipment Dept. staff in the calibration of hydraulic gauges that will be used by the customer.
- 10. Form is to be completely filled out.
- 11. Form is to be filled in the gauge calibration file according to it’s I.D. No. and with any associated equipment file. One Copy to customer.

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Report Created By: Russell Galazinski  
Report Number: 11-3-EDTS-R3 Revised Date: 4-8-00
Tendon Installation

- Stressing Tendons
Tendon Installation

- Measuring Elongations
### Stressing Tendons – Field Form

#### Stressing Record

**Customer Name:** RIETH - RILEY  
**Project Name:** US 31 OVER KERN RD.  
**Area:** SOUTH BOUND RAMP  
**Drawing Number:** PT. 11  
**Project Number:** J088710  
**Overstressed Gauge Pressure:**
- **Cap 1:** 20% = 1100 PSI  
- **Cap 2:** 20% = 1200 PSI  
- **Cap 3:** 20% = 5000 PSI  
**Strand/Bar Size:** (19) 0.6"  
**Jack Number:** DS1 2308 / 6-20051 / 6-20050  
**Jack Ram Travel (in.):** 138.31

#### Computed Elongation Table

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#### Actual Elongation

- **Before:**  
- **After:**  
- **Total:**
Tendon Installation

Safety
Failed Strand
Grouting Operation
Keys To Successful Grouting

– Communication

– HAVE A PLAN – Grout Plan

  • Contractor to submit a Grout Plan before work starts
  • What does that include?
Grouting Operation

- Grout Plan
  - What’s in the Grout Plan?
    - Materials used in grouting
    - Equipment
Grouting Operation

– What’s in the Grout Plan?

• Grout mixing and pumping procedures
• Direction of grouting
• Inlet and Outlet sequence
Keys To Successful Grouting
Keys To Successful Grouting

- Pre-grout meeting with all parties involved
- Know what to do if there are issues during grouting
  - Vacuum grouting
  - Drilling ducts and inspecting for voids.
  - Flushing with water
  - Use of the contingency tendons
Grouting Operation

- Ready to Grout
Keys To Successful Grouting

- Grout Testing

- Flow Cone Test
Keys To Successful Grouting

- Mud Balance Test
- Strength Test
Keys To Successful Grouting

- Be prepared
  - Testing Equipment
  - Plenty of 5 gallon buckets and rope
Keys To Successful Grouting

- Readily available water source
- Walkie-talkies
Grouting Operation

- Grouting Conditions
## Grout Field Records

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<td>CAPS &amp; VENTS</td>
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<td>GROUT MIX</td>
<td>W/C RATIO</td>
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<td>Temperature</td>
<td>Efflux Time</td>
<td>Inspection</td>
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<td>Efflux Time (in)</td>
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<td>10.6 on backsides</td>
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**Remarks:**
- **Using Euclid Cable Grout PTFE.**
- **Water Tolerance: 1.5-1.7 Gal/Bag**
- **5 Bag Batches:** 7.5 - 8.5 Gallons Per Batch.
- **H.O. Temp:** ~46°F
- ~50 PSI Working Pressure.
- **Cap 3:** 14 batches, 9 tendons = 17.5 bags/ton
- **Cap 2:** Same on Cap 2.
Issue prior to grouting live load tendons
Pour Back
References

– Post Tensioning Institute “Specification for Grouting of Post Tensioned Structures”

Thank You!

For additional questions, please contact:

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