POST-TENSIONING CONVENTION

2023 PROCEEDINGS

APRIL 30 - MAY 3, 2023

Hilton Miami Downtown, Miami, FL

For more information, please visit post-tensioning.org.

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2023 Technical Sessions

Links to the technical session presentations are available from the following pages. Navigate to the session of interest and select "presentation" to view. Please note that not all sessions were approved for publication.

Technical Session 1: PT Bridges & Multistrand PT

Moderator: Tommaso Ciccone, Tensa International

International PT Technology Exchange - Findings and Recommendations

Reggie Holt, FHWA

An International post-tensioning technology exchange was held in Austin TX on Nov. 3, 2022. This exchange was attended by 58 post-tensioning experts which represented 33 technical organizations across 7 countries and 3 continents including 9 bridge owners/agencies (domestic and international). This exchange focused on topics to improve infrastructure intelligence, resilience, and service life. Through these discussions, needs and gaps to improve PT bridge performance as well as promising technologies and processes to address these needs were identified.

This presentation will provide a summary of the presented material and the bridge owner round table discussion. In addition, the significant findings and recommendations from this exchange will be presented. The intention of this exchange is to identify and provide the next steps that the domestic and international bridge community can follow to improve the state of practice for post-tensioned bridges.

Video | **Presentation**

Development and Implementation of Epoxy Coated Strands in Bridge Post-Tensioning

Shahid Islam, DYWIDAG

There is a growing demand to use un-bonded and replaceable external tendons in bridges. One option is to use flexible filler tendons. However, the cost associated with the application of flexible filler is significantly higher. A better approach is to use tendons with epoxy coated strands. Epoxy coated strand which is coated outside and filled in between wires is very durable and provides enhanced fatigue resistance. The system allows easy replacement of strands in the future. It will reduce the labor cost and duration of construction since there will be no filling of the duct. Epoxy-coated strands are widely used as external tendons in box girder bridges, cable stays, and ground anchors. There have been many bridges where the epoxy coated strands were used in bonded internal tendons for additional corrosion protection against severe environments. This presentation will describe the usages of internal bonded and external unbonded tendons using epoxy coated strands.

Video | **Presentation**

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Technical Session 1: PT Bridges & Multistrand PT Cont.

Another Look at Creep and Shrinkage Models for Prestressed Concrete Bridges

Hani Nassif, Rutgers University

Recent developments in concrete and fibers technology produced mixes with reduced porosity resulting in higher compressive strength. However, the long-term performance of such concretes and the effects of pozzolanic material, such as fly ash and silica fume, on shrinkage and compressive creep behavior are not clearly addressed in the literature. Moreover, available prediction models are developed based on data obtained from conventional concrete that has constituents different than modern concrete mixes especially with added fibers.

The objective of this presentation is to share results of a study employed to identify the drying shrinkage and compressive creep of various types of concrete mixes. The study included an experimental program and a comparison of available analytical models such as B3, GL2000, ACI 209 R-92, and CEB MC90-99 for Self-Consolidating Concrete (SCC) and High-Performance Concrete (HPC) mixes with and without fibers. Experimental data was obtained by loading concrete samples as described by ASTM C512. Experimental results showed reduced and consistent creep compliance for both concrete mixes with and without fibers. However, SCC showed a significant variance and higher creep compliance. Moreover, current creep and shrinkage prediction models need to be revised to accommodate various types of concrete mixtures.

Presentation Not Released For Distribution

Coupling Solutions for Polymer Ducts in Bonded Post-Tensioning in Accordance to fib Bulletin No. 75

Klaus Lanzinger, GTI

Polymer duct systems for internal bonded post-tensioning enjoy growing popularity as one of the key components for corrosion-resistant, durable, and sustainable concrete bridges. In 2002 already Florida Department of Transport (FDOT) released the document "New Directions for Florida Post-Tensioned Bridges" and with subsequent specifications allowed only the use of polymer ducts in post-tensioned bridges.

As for transport reasons the delivery length of the polymer ducts usually is less than the tendon length, coupling of the ducts is required on almost every project whereas a professional execution of the coupling is of crucial importance for the quality and durability of the entire system.

This presentation will highlight the requirements for durable post-tensioning structures with reference to fib bulletin no. 33 "Recommendations for the durability of post-tensioning tendons " and PTI/ASBI M50.3-19 "Specification for Multistrand and Grouted Post-Tensioning". An overview will be provided on current solutions for coupling plastic ducts and new developments from the industry in compliance with fib bulletin no. 75 "Polymer-duct systems for internal bonded post-tensioning".

Video | **Presentation**

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Technical Session 2: PT Bridges and Multistrand PT

Moderator: Hani Nassif, Rugers University

Post-Tensioned Bridge Maintenance and Repair in the United States: Lessons Learned from NCHRP Synthesis

Natassia Brenkus, Ohio State University

This session will present data gathered on the practices used by bridge owners to repair and maintain post-tensioned (PT) bridges as a part of NCHRP Project 20-05, Topic 51-14. This presentation will: 1) facilitate knowledge transfer across industry stakeholders and bridge owners, and 2) present effective repair and maintenance practices identified in the study that extend the useful life of PT bridges. Results of a literature review and a survey completed by state Departments of Transportation (DOTs) will be presented.

Presentation Not Released For Distribution

Multi-Point Synchronous Lifting Systems for Heavy Lift Projects

Bart Hays, GTI

Post Tensioned members can be compromised if they are not handled correctly when lifting, lowering, or positioning them after they have been Post Tensioned. Large complex multi-point lifting applications can be accomplished with the use of a Motion Controlled Hydraulic Lifting System, avoiding damage to the Post Tensioned members. These Synchronous Lift systems can be used for the lifting of Bridges, Decks, and other large structures. The system utilizes hydraulic cylinders in combination with digital actuation and feedback utilizing a PLC controlled system. Synchronized lifting reduces the risk of bending, twisting, or tilting due to uneven weight distribution or load-shifts between the lifting points. With the advantages listed above, added or reduced tension loads to the post-tensioned strands can be controlled. The general theory of how the system functions and basic setup will be discussed as well as the advantages the system provides compared to manually controlled applications.

Video | **Presentation**

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Technical Session 3: PT Buildings

Moderator: Carine Magalhaes Leys, Odeh Engineers

Parking Structures for Multi-Family

Sandeep Patel, SEDG

Multifamily projects requiring parking garages tend to be compact and have design constraints due to their integration with residential structures. The developer continuously flip-flops between cast in place and precast construction. The presentation will discuss design optimization opportunities for cast in place structures. The PTI members are always at a disadvantage because of the delivery mechanism. The presentation will discuss how to overcome difficulties and make the playing field level. The speaker will also present additional information regarding the cost components of the parking structure and design flexibility.

Video | **Presentation**

Current State-of-the-Art for Barrier Cable Systems

Khaled Abdelmoula, GTI

The presentation will demonstrate the current state-of-the-art for Barrier Cable Systems for parking structures. It will highlight advantages and expected benefits of using Barrier Cables Systems as well as basic idea about related design criteria and specifications.

It will provide essential information about different Barrier Cable Systems and will explain the importance of the proper choice of barrier cable system for different situations/scenarios.

The presentation will give basic idea about Corrosion Protection and repair of Barrier Cable Systems too.

Presentation Not Released For Distribution

Pour Strips - Designing for Construction Productivity and Safety

Jared Reigstad, Reigstad Engineers

Pour strips are designed to control shrinkage, creep, and elastic shortening in post-tensioned and cast-in-place concrete but they add extra costs, construction delays, and safety issues. Engineers can reduce these problems, provide for higher quality, and increase productivity by being mindful of forming, shoring, reshoring, and back shoring when designing pour strips.

In this presentation, we will discuss best practices for designing pour strips in post-tensioned and cast-in-place concrete. We will demonstrate how to pour strip placement and design can be done to reduce costs, accelerate construction, and improve safety, which increases overall project productivity. We will also discuss different slab-to-slab connectors on the market that eliminate pour strips.

Video | **Presentation**

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Technical Session 4: PT Buildings

Moderator: Carine Magalhaes Leys, Odeh Engineers

Ko'ula - Expressed Structure as Architecture

Steve Baldridge and Anantha Chittur, BASE

This 41-story mixed-use development features 865,000 SF of built area including a 566-unit residential tower, common and amenity spaces, 58,300 SF of retail space, mechanical and support space, and six stories of above-grade parking.

The tower is highlighted by undulating sculpted columns at its exterior façade. Behind the striking exterior, the structure primarily consists of thin, post-tensioned concrete floor plates and reinforced concrete columns and shear walls. One of the first discussions revolved around whether post-tensioning would result in any significant shortening in the post-tensioned slab affecting the formwork for the expressed columns. Detailed shrinkage models were developed to consider the effects of shortening from post-tensioning, change in temperature and drying shrinkage. This information was used by the contractor to adjust for anticipated horizontal movements during construction. Post-tensioning was also essential in creating large terraces at the second-floor retail that cantilever almost 16 feet from the supporting columns.

Video | **Presentation**

Future Trend in Unbonded PT Projects

Carine Leys, Odeh Engineers

One of the most difficult challenges in the construction industry has been the resistance to new technology and new methods for the construction of post-tensioned concrete. This includes technologies that would make the workplace more efficient.

This presentation is intended to address the coordination required to ensure that the information submitted on a project's drawings is translated to the job site and to present a new technology that has been proven to improve the accuracy of this process. Areas of special concern include the installation and inspections of post-tensioning and elongation records.

Where construction difficulties or problems occur on a project, questions can arise regarding the conformance of the approved shop drawings to the project specifications and drawings as prepared by the structural engineer.

To ensure that a project's design intent is met, emphasis must be placed on the importance of accurate installation, the calculation of forces, and the role of elongation records in the construction process. While these fundamental elements are the basis of the design, they are often overlooked during the construction process.

During this session, the material will be presented demonstrating successful technology and procedures implemented to streamline installation and communication between disciplines.

Video | **Presentation**

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Technical Session 4: PT Buildings Cont.

10 Scary Construction Contract Provisions (and What to Do About Them)

Alex Barthet, The Barthet Firm

Construction contracts are sometimes intimidating and complex. In this presentation, Alex will explain 10 of the most common "scary" provisions so you understand how to better negotiate around them. He will also provide sample terms you can use later, as well as tools to make the contract review process easier.

Video | **Presentation**

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Technical Session 5: PT Buildings

Moderator: Asit Baxi, Baxi Engineering

Seismic Behavior of Multi-Story Building with Post-Tensioned Transfer Plate System

Thomas Kang and Byeonguk Ahn, Seoul National University

Applying the post-tensioning (PT) technique to transfer plates can effectively reduce the thickness and reinforcement as an economical design method. Currently, a simplified model is used for numerical modeling of transfer plate, which does not consider the interaction of the plate and the upper structure. To observe the actual behavior of PT transfer plate under seismic loads, it is necessary to model whole parts of the structure and tendons to precisely include the interaction and the secondary effect of PT tendons in the results. Three-dimensional finite element models of the whole structure were developed, which includes tendon elements. The results showed that, in some cases, excluding PT tendons from the model leads to an unrealistic estimation of the demands for shear walls sit on transfer plate and transfer columns due to excluding the secondary effect of PT tendons. Based on the results, generally, the secondary effect reduces shear force demand and axial-flexural demands of transfer columns but increases the shear force demand of shear walls. Additionally, results of punching shear stresses were examined, as the design of a post-tensioned transfer plate is typically controlled by shear force - in particular, punching shear at the slab-column connection.

Video | **Presentation**

Mechanical Splice Using Clamped Headed Bar in Precast Concrete Structures (with Post-Tensioning)

Thomas Kang and Han Suk Sung, Seoul National University

Precast concrete (PC) structure is emerging as a key point of the innovative construction process. PC has a complementary relationship with the prestressed and/or post-tensioned (PT) concrete. It is easy to apply prestressing (pretensioning) forces and enable superior quality control. The deflection of long-span members and their cracking are minimized. Segmented precast concrete elements are often integrated using post-tensioning. The research team devised a clamped headed bar connection system utilizing mechanical splice for PC joint. It is connected in a straight line with the reinforcement along with axial load transfer. Shear force can be transmitted by the headed bar clamped so that friction resistance is maintained on the head surface. It can be applied to various joint parts and combined with other connecting methods such as splice sleeves and/or post-tensioning. Structural performance was verified through several experimental studies. Each joint absorbed external forces flexibly, and overall seismic performances were all satisfactory.

Video | **Presentation**

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Technical Session 6: Slab-on-Ground

Moderator: David Sparks, Felten Group

An Update to the Understanding of PTI DC10.8 – 18 (Guide for Performance Evaluation of Slab-on-Ground Foundations)

Tony Childress, Childress Engineering Services

Mr. Tony Childress, P.E., S.E. will be discussing the Post-Tensioning Institute (PTI) publication DC10.8-18, Guide for Performance Evaluation of Slab-on-Ground Foundations. In his presentation, Tony will explain how the publication is intended to be used in the evaluation of slab-on-ground foundations along with examples. Tony will also discuss examples of improper use of this guide and how to avoid those mistakes. The publication is intended for use in evaluating the performance of low-rise buildings with slab-on-ground foundations for residential and similar construction. The guidelines, in the publication, are appropriate for use in the evaluation of post-tensioned and non-post-tensioned slab-on-ground foundations constructed on any soil condition. The publication only briefly addresses the cause and mitigation of the foundation movement, areas where Tony has an extensive background. A deeper discussion relative to cause and mitigation will be available, based on available time.

Video | **Presentation**

Comparison of PTI vs. Finite Element Method of Design and Performance for a Typical 40' x 70' Slab-on-Ground Project under Different Soil Conditions

Florian Aalami, PT Structures, Inc. and Anna Olveda, Wafflemat

This presentation reviews the results of a parametric study that was conducted to determine the calculated performance variations between the traditional PTI method of a slab-on-ground foundation design vs a 3D finite element analysis (FEA) approach implementing the latest computer software. We will review and discuss the variations between a traditional ribbed slab foundation based on the PTI Method, a traditional ribbed slab based on a FEA model, a modified permanent, plastic void form foundation using the traditional PTI method, and the modified permanent, plastic void form foundation using a FEA model. Additionally, each one of these methods will be modeled with a 2" PVR soil design parameter and a 4.5" PVR soil design parameter to review the effects of the soil recommendations provided by the Geotechnical engineer. We will further review how the provided geotechnical design values impact the performance and design of the foundation.

Video | **Presentation**

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Technical Session 7: PT Repair and Strengthening

Moderator: Tim Gregor, Wiss, Janney Elstner Associates

Broken Tendon in New Construction: What to Do?

Fabrice Brugere, PT Tech

Almost every new construction with an unbonded single-strand tendon experiences a broken tendon during construction. What to do about it? This presentation covers the following phases of the process. The investigation, repair submittal, and then the repair itself. In the investigation phase, safety is discussed and the importance of gathering facts and doing the on-site investigation is covered in detail. In the repair submittal phase, safety is once again a top priority, and then structural code requirements and engineering analysis are explored and highlighted. Lastly during the repair phase, this presentation examines procedures, options, long term durability and final documentation.

Video | **Presentation**

Post-Tensioning Systems for Repairs, Strengthening, and Modifications

Albert Delgado, GTI

Repair, strengthening, and modification of existing structures is becoming increasingly important due to aging infrastructure. This is especially relevant for parking structures where the use of deicing salts was recognized to be the primary cause of reinforcing steel and post-tensioning systems deterioration. Thus, Post-Tensioning Tendons oftentimes require repair due to corrosion, impact or even overloading. The corrosion protection of the repaired tendons in these areas needs to be restored as there are cases where the corrosion protection level is not reestablished.

Post-Tensioning Tendons in building structures may also require repair, strengthening, or modifications to reintroduce strength from damaged tendons, allow for an increase in loading, or introduction of openings, due to changes in occupancy requiring additional service loads or services. Using unique post-tensioning systems allows these to be performed efficiently and economically.

The intent of this presentation is to provide an overview of the post-tensioning systems used for repair, strengthening, and modification applications in building/parking structures and current practices, as well as new developments with enhanced corrosion protection to restore the tendon protection levels.

Video | **Presentation**

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Welcome Packet & Awards Booklet

Thank you for joining us in Miami!

The Post-Tensioning Institute Staff and our Board of Directors would like to thank you for taking the time out of your schedule to join us in Miami, Florida, for the 2023 PTI Convention. Your input and participation is key to making both this convention and the Post-Tensioning Institute a success.

Over the next 4 days, you will have the opportunity to attend Technical Sessions, participate in PTI Committee Meetings, meet with Exhibitors, and network at Special Events. I encourage you to actively participate at all events and take advantage of engaging with your colleagues in the post-tensioning industry. The more you engage, the more you speak up, the more value you will provide to the industry, and the more rewarding your experience will be.

Please be sure to join us on Sunday evening for the Welcome Reception in the Exhibit Hall. Here you will be able to visit with your industry's top suppliers and service providers while engaging with fellow attendees, renewing old friendships, and making many new connections.

On Monday evening, the Post-Tensioning Institute will hold its biannual Project Awards. We hope that you will join us for the reception beginning at 6:00 p.m. in the Exhibit Hall, followed by dinner and presentation of the Membership Contributions and Project Awards in the Met Ballroom 2 & 3 beginning at 7:00 p.m. (note, seperate registration and payment is required to attend).

Be sure to join the PTI Industry on Tuesday night for the PT Research Fundraising Mixer, sponsored by Martin Specialty Products. Have some fun and join other convention attendees for food, drinks, and games on the 19th Floor of the JW Marriott Marquis Miami (note, seperate registration and payment is required to attend). All proceeds will be used specifically for PT-related research.

If you need to document your participation for obtaining continuing education credits, tracking forms are available at registration. Lastly, in this packet you will find a:

- Listing of Convention Sponsors
- Convention Meeting Map
- Exhibit Hall Map
- Committee Meeting Schedule
- Technical Session Schedule

Again, thank you for participating in the 2023 PTI Convention.

Sincerely,

Tony Johnson
Executive Director

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POST-TENSIONING CONVENTION

PTI 2023
AWARDS PROGRAM

MAY 1, 2023
JW Marriott Marquis Miami | Miami, Florida, USA

For more information, please visit post-tensioning.org.

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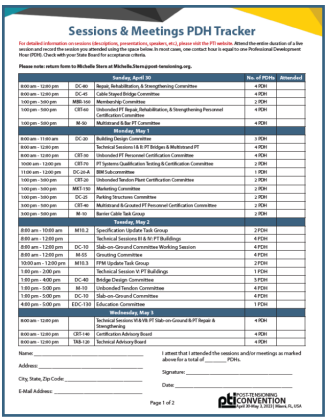
PDH Tracker Form



Sessions & Meetings PDH Tracker

For detailed information on sessions (descriptions, presentations, speakers, etc.), please visit the PTI website. Attend the entire duration of a live session and record the session you attended using the space below. In most cases, one contact hour is equal to one Professional Development Hour (PDH). Check with your State Board for acceptance criteria.

Please note: return form to Michelle.Stern@post-tensioning.org.

		Sunday, April 30	No. of PDHs	Attended
8:00 am – 12:00 pm	DC-40	Repair, Rehabilitation, & Strengthening Committee	4 PDH	
8:00 am – 12:00 pm	DC-45	Cable Stayed Bridge Committee	4 PDH	
1:00 pm – 3:00 pm	MBR-100	Membership Committee	2 PDH	
1:00 pm – 5:00 pm	CBT-60	Unbonded PT Repair, Rehabilitation, & Strengthening Personnel Certification Committee	4 PDH	
1:00 pm – 5:00 pm	M-50	Multistrand & Bar PT Committee	4 PDH	
		Monday, May 1		
8:00 am – 11:00 am	DC-20	Building Design Committee	3 PDH	
8:00 am – 12:00 pm		Technical Sessions I & II: PT Bridges & Multistrand PT	4 PDH	
8:00 am – 12:00 pm	CBT-50	Unbonded PT Personnel Certification Committee	4 PDH	
10:00 am – 12:00 pm	CBT-70	PT Systems Qualification Testing & Certification Committee	2 PDH	
11:00 am – 2:00 pm	DC-20-A	BIM Subcommittee	1 PDH	
1:00 pm – 3:00 pm	CBT-20	Unbonded Tendon Plant Certification Committee	2 PDH	
1:00 pm – 3:00 pm	MKT-110	Marketing Committee	2 PDH	
1:00 pm – 3:00 pm	DC-25	Parking Structures Committee	2 PDH	
1:00 pm – 5:00 pm	CBT-40	Multistrand & Grouted PT Personnel Certification Committee	2 PDH	
3:00 pm – 5:00 pm	M-10	Barrier Cable Task Group	2 PDH	
		Tuesday, May 2		
8:00 am – 10:00 am	M110.2	Specification Update Task Group	2 PDH	
8:00 am – 12:00 pm		Technical Sessions III & IV: PT Buildings	4 PDH	
8:00 am – 12:00 pm	DC-10	Slab-on-Ground Committee Working Session	4 PDH	
8:00 am – 12:00 pm	M-55	Grouting Committee	4 PDH	
10:00 am – 12:00 pm	M110.3	FPM Update Task Group	2 PDH	
1:00 pm – 2:00 pm		Technical Session V: PT Buildings	1 PDH	
1:00 pm – 4:00 pm	DC-40	Bridge Design Committee	3 PDH	
1:00 pm – 5:00 pm	M-10	Unbonded Tendon Committee	4 PDH	
1:00 pm – 5:00 pm	DC-10	Slab-on-Ground Committee	4 PDH	
4:00 pm – 5:00 pm	EDC-130	Education Committee	1 PDH	
		Wednesday, May 3		
8:00 am – 12:00 pm		Technical Sessions VI & VII: PT Slab-on-Ground & PT Repair & Strengthening	4 PDH	
8:00 am – 12:00 pm	CBT-140	Certification Advisory Board	4 PDH	
8:00 am – 12:00 pm	TAB-120	Technical Advisory Board	4 PDH	

Name: _____

Address: _____

City, State, Zip Code: _____

E-Mail Address: _____

I attest that I attended the sessions and/or meetings as marked above for a total of _____ PDHs.

Signature: _____

Date: _____

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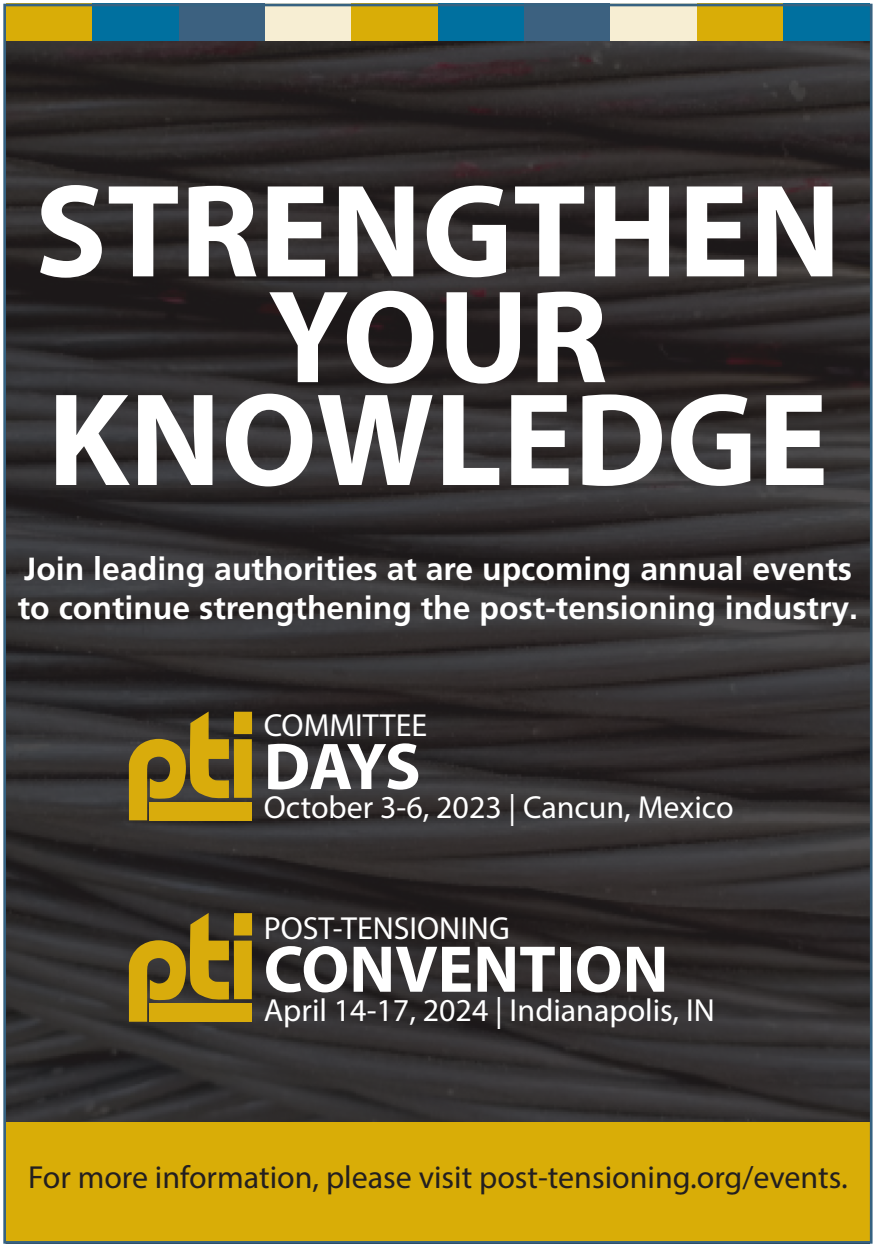
Upcoming PTI Events



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Have Post-Tensioning Questions? We Have Reinforced Answers.

PTI has engineering staff available to assist you with any post-tensioning related technical questions you might have about a document or a project.

If you have a technical question, issue, or challenge to be met with post-tensioning, our team can provide assistance and answer. Contact us via e-mail at *technical.inquiries@post-tensioning.org*.

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