



POST-TENSIONING
INSTITUTE®

2019 CONVENTION

Dates: May 5-8, 2019 | Hyatt Regency Seattle | Seattle, WA, USA



Table of Contents

2019 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: Opening Session/PT Bridges	3
Technical Session 2: Multistrand PT	4
Technical Session 3: PT Buildings	5
Technical Session 4: Pacific Coast PT Buildings – Design & Construction	6
Technical Session 5: PT Building Design.....	8
Technical Session 6: PT Building Design & Construction.....	9
Program Book/Awards Book	11
PDH/CEU Form.....	11
Exhibitors & Sponsors.....	12
Upcoming PTI Events.....	13

Technical Session 1: Opening Session/PT Bridges

Moderator: Tony Johnson, Post-Tensioning Institute

PTI Executive Director's Vision for Your Institute

Tony Johnson, Post-Tensioning Institute

PTI's new Executive Director Tony Johnson will recap his vision and directions for PTI. Now 4 months into his tenure at PTI, Tony has spent considerable time listening to the needs, wants, and complaints of the membership as had begun to develop a vision of the moving the Institute forward. Tony will also discuss the efforts kick off a new strategic plan for PTI including the deliverable deadline prior to the October Committee Days.

[Video](#) | [Presentation](#)

Pensacola Bay Bridge: Stay Cables Design, Testing, and Installation

Tommaso Ciccone, Tensa

The new Pensacola Bay Bridge is now being built with two arch bridges for the pedestrian part provided with vertical hangers designed and tested as per PTI DC45.1-12. This is the first application of galvanized waxed HDPE-coated strand for stay cables in the United States. The presentation covers the design, testing, and installation aspects of these new stay cables for this project.

[Video](#) | [Presentation](#)

Post-Tensioning Innovation: Strengthening the I-90 Floating Bridge

Jacob Myer, Schwager Davis, Inc.

The State of Washington will soon claim an engineering first: a commuter train installed over a floating bridge (atop the I-90 spanning Lake Washington). However, to accommodate the train's increased load, the East Link Light Rail Extension project included a massive post-tensioning strengthening of the floating bridge. Core-drilling holes through the existing pontoons provided a route to install anchorage frames for twenty 3600 ft long PT tendons, some of the longest bridge PT installations ever attempted.

[Video](#) | [Presentation](#)

Current State-of-the-Art Stay Cable Technologies Overview

Roger Frenn, Dywidag-Systems International

There are increased requirements/expectations regarding the performance of stay cables in signature structures.

Referencing the New Champlain Bridge in Montreal as a showcase project, this presentation explores some of the latest technologies introduced in relation to topics such as safety, aesthetics, and force monitoring of the stay cables.

[Video](#) | [Presentation](#)

Technical Session 2: Multistrand PT

Moderator: Jose Luis Quintana, Mexpresa

PT Can Take the Shake: LA Rams Stadium PT

Meghan Stotts, Kiewit Infrastructure West Co.

The new LA Rams Stadium in Inglewood, CA is located adjacent to the Newport-Inglewood Fault and within the glide path of the LAX airport, therefore lowering the stadium field level approximately 100 ft below ground due to airport height restrictions. The canopy-style roof is held up by a combination of cast-in-place and precast concrete columns, encompassing over 7.6 million linear feet of post-tensioning strand.

[Video](#) | [Presentation](#)

In-Line Density Monitoring during Grouting

Andrea Schokker, University of Minnesota Duluth

Cementitious grout has proven to be an effective corrosion protection method in post-tensioning systems. While successful grouting has been used in numerous post-tensioned (PT) bridges, quality control of the material and placement in the field remains a challenge. During the grouting process on site, ensuring that the grout being placed in the tendon is representative of the intended grout design is critical for the performance of the system. Inconsistencies in the placed grout can be attributed to varying mixing procedures used in the field (such as the addition of water above the design value). In some cases, grout passing the laboratory tests may differ significantly from grout placed in the field. To alleviate these discrepancies, it is critical that the PT industry improves quality control during tendon grouting to ensure materials and products meet project requirements throughout production and placement; not just during the grout's initial qualification. Advancements in the quality of in-place grouts can be made by refining specifications and developing a procedure to continuously measure the density of the grout as it is pumped into the tendon. This presentation focuses on the results of testing of an in-line flow meter for nearly continuous monitoring and recording of grout density and temperature.

[Video](#) | [Presentation](#)

PT Bridge Evaluation Challenges

Brian Merrill & Josh White, WJE

Post-tensioned bridge systems offer tremendous advancements to bridge engineers and have provided safe and efficient construction solutions. Although significant cost savings can be attributed to the use of such systems, failed tendons due to deterioration conditions may reduce safety and load capacity and incur costly rehabilitation actions and traffic disruption if repairs are not performed properly and in a timely manner. This presentation focuses on the current state-of-the-practice regarding PT inspection and assessment, as well as state-of-the-art nondestructive evaluation methods. Case studies will be reviewed that discuss practical limitations and advantages of various evaluation methods.

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Santa Fe Soil Anchor Retention, Mexico City

Jose Luis Quintana, Mexpresa

A group of mid-rise apartment buildings was developed over a “cliff” of cohesive soil and had behaved well for years, until water appeared in a section, thus forcing geotechnical studies which in turn recommended stressed anchors. When the work was going on, a 7.1 Richter earthquake started small slides in another section of the cliff, and new studies and monitoring defined two new families of stressed anchors. The installation work was very delicate, requiring non-conventional actions, which are described in this presentation, along with the design details of every type of anchor, and the care prescriptions given to the residents. So far, no movements or slides have shown up, which indicates the solutions adopted were appropriate. But new building construction is announced for the base of the cliff, for what new groups of anchors will be required.

[Video](#) | [Presentation](#)

Technical Session 3: PT Buildings

Moderator: Asif Baxi, Baxi Engineering, Inc.

Performance Evaluation of Existing Slab-on-Ground Foundations

Brian Eubanks, Paragon Structural Engineering, LTD

Provide an overview of guidelines for evaluation, explain performance standards as well as common mis-applied standards, provide performance evaluation examples, discuss real-world case study performance evaluation examples, discuss various structural and non-structural remediation techniques, as well as provide real-world remediation case study examples.

[Video](#) | [Presentation](#)

Demolition of Historic PT Systems

Aaron Sterns, Pivot Engineering

Lessons learned from demolition projects involving unanticipated and historic PT systems.

[Video](#) | [Presentation](#)

Inside the Structure of the Hyatt Regency Seattle

Brett Gourley, Magnusson Klemencic Associates

The Hyatt Regency Seattle is a 45-story, 1.47 million square foot convention hotel completed in December 2018. The project consists of a 520-foot hotel tower with 1260 rooms (the largest in the Pacific Northwest); a nine-level podium containing meeting rooms, prefunction space, and ballrooms; and seven levels of underground parking for 450 cars. Presented with a host of different building functions and spaces, the engineers employed a full toolkit of structural elements including post-tensioned and conventional concrete, steel framing, multi-story long-span trusses, concrete shear walls, buckling-restrained braces, several unique transfer elements, and an above-grade seismic joint separating the concrete hotel tower from the steel convention podium. The project’s structural engineer, Brett Gourley of Magnusson Klemencic Associates, will present a look inside the Hyatt’s structure and discuss some of the many challenges, design decisions, and innovations that went into engineering and constructing Seattle’s newest hotel and convention space.

[Video](#) | [Presentation](#)



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ACI 318-19 Code Changes Pertaining to Post-Tensioned Concrete

Asif Baxi, Baxi Engineering, Inc.

Presentation will cover revisions to the prestressed concrete code provisions pertaining to post-tensioning in the upcoming ACI 318 Building Code.

[Video](#) | [Presentation](#)

Technical Session 4: Pacific Coast PT Buildings – Design & Construction

Moderator: Cary Kopczynski, Cary Kopczynski & Company

Pacific Coast Concrete Towers: Solving Design Challenges with Post-Tensioning

Cary Kopczynski, Cary Kopczynski & Company

Tall concrete towers on the Pacific Coast present unique design challenges. The major metropolitan areas are highly seismic, requiring that the structural engineer control building dead load and create a robust lateral force-resisting system, and simultaneously provide the long spans and open space that contemporary buildings demand. This presentation will discuss and illustrate these topics with recent award-winning towers in Seattle, San Francisco, and Los Angeles. The use of post-tensioning to solve common design challenges will be spotlighted. The presentation will also include recommendations on detailing concrete buildings for buildability and construction efficiency.

[Video](#) | [Presentation](#)

High-Rise with Height Restrictions: Feeling the Squeeze

Steve Baldrige, BASE Structural Engineers

This presentation highlights unique aspects of several high-rise projects in Honolulu, HI, where the project goals could not have been achieved without post-tensioning. Unique aspects of designing buildings in Honolulu include strict height restrictions, high cost of construction, and limited resources.

In order to get projects to “pencil out,” developers typically have to squeeze as many floors within the project’s local land use-mandated height restrictions. Compared to other systems, post-tensioned concrete slab framing allows for thinner floor systems, providing the potential to add floors to a project. The thinner slabs also help squeeze cost out of the construction budget.

The squeeze is not all beneficial, though, and requires coordination. The appropriate use of post-tensioning helps maintain deflection and serviceability requirements. And not unique to post-tensioning, the trend toward more and larger conduit and plumbing being embedded in slab systems creates additional challenges.

[Video](#) | [Presentation](#)



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Pacific Coast PT Construction: Creating Success through Designer, Fabricator, and Installer Teamwork

Bryan Collons & Shane Williams, The Conco Companies

Creating a collaborative team to address all elements and stages of a PT project is the most effective way to achieve success. This presentation will highlight the importance of cooperation and teamwork between engineering design, material fabrication, and PT installation, and provide examples of how collaboration can be fostered for project success.

We will also examine the PT manufacturing and fabrication process (including sheathing extrusion, anchor installation, and cable identification for field use), systems that are relevant to every member of the team.

[Video](#) | [Presentation](#)

Experiences and Observations from Post-Tensioning Stressing Pocket Investigations and Repairs

Pete Barlow, Contech Services

The presentation will provide observations and experiences in the removal, preparation, and re-grouting of post-tensioning stressing pockets. The experiences come from providing engineering support services to forensic engineers in various states along the Pacific Coast. These examples focus on one of the key elements of post-tensioned concrete construction and proper steps that should be taken to promote long-term durability of these structures. Most of the experience and examples shown will come from structures less than 15 years old. Observations regarding the variety of conditions of grout found, the condition of grease cap protective systems, length of tendon ends found, and wedge/anchorage conditions will be discussed. Photos of each condition will be shown along with the corrective actions taken once the stressing pockets were re-grouted.

[Video](#) | [Presentation](#)

Pacific Coast PT Buildings: Design & Construction Panel Discussion

Cary Kopczynski, Cary Kopczynski & Company

Steve Baldridge, BASE

Bryan Collons, The Conco Companies

Shane Williams, The Conco Companies

Pete Barlow, Contech Services

These five speakers will join forces in a round-table panel discussion to collaborate with responses to frequently asked questions and new questions posed by the session attendees.

[Video](#) | Presentation not available

Technical Session 5: PT Building Design

Moderator: Bryan Allred, Seneca Structural Engineering, Inc.

Diaphragm Design Using Unbonded Post-Tensioning

Bryan Allred, Seneca Structural Engineering, Inc.

In our review of post-tensioned building design and in speaking with other engineers, there are differing approaches to the design of diaphragms to distribute lateral forces. Many firms have used a more traditional steel/wood building methodology. The presentation will offer a design approach that models the diaphragm as a concrete element while utilizing the pre-compression from unbonded strands to reduce the amount chord and drag reinforcing.

Video not available | Presentation not available

Behavior of Unbonded PT Continuous Beams with Internal Tendons

Thomas Kang, Seoul National University

Experiments on flexural behavior of two-span unbonded post-tensioned beams were conducted under four-point static loading condition. A detailed investigation on internal moment and secondary moment at critical sections was carried out and reported in *PTI Journal* (Kim and Kang, 2008), which will be presented in this Convention for further discussion given the impact of the topic in the PT industry. Observations conducted as part of this experimental research surprisingly revealed that the experimentally obtained secondary support reaction in the specimens became significantly larger than that predicted using indeterminate frame analysis and the load-balancing method, as the applied loading increased. Details will be provided in the presentation.

[Video](#) | [Presentation](#)

49-Story ACRO Seoul Forest: Application of PT Slabs and PT Outrigger Walls for Lateral Load Resistance

Jang Keun Yoon & Jeong Mo Koo, Daelim Industrial Co., LTD

This presentation will introduce an iconic 49-story-tall residential building named “ACRO Seoul Forest” currently under construction by DAELIM in Seoul, South Korea. The post-tensioned flat slab systems for typical floors are used to satisfy the need for long-span architectural plan, and post-tensioned outrigger wall systems are used to satisfy the lateral load demands from seismic and wind forces. To evaluate the seismic performance of the 49-story building, a series of nonlinear time history analyses are carried out for the Maximum Considered Earthquake (MCE). From the nonlinear analyses results, it is found that the overall seismic performance of the 49-story building satisfies the Life Safety (LS) under the MCE level earthquakes.

[Video](#) | [Presentation](#)

Post-Tensioned Diaphragms: Evaluating Principal Methods of Analysis

Fabio Albino de Souza, EBPX/Unicamp

Basically, diaphragms typically are horizontal or nearly horizontal planar elements that serve to transfer lateral forces to vertical elements of the lateral-force-resisting system. Concrete diaphragms can be conventionally reinforced or prestressed, and can be cast-in-place concrete, precast concrete, or interconnected precast concrete without topping, and others. Diaphragm in-plane stiffness affects not only the distribution of forces within the diaphragm but also the distribution of displacements and forces among the vertical elements, then reasonably classifies them as rigid and flexible. Regarding the principal methods of analysis of the diaphragm can be envelope analysis (beam method) and finite element, but strut-and-tie, equivalent lateral load, and modal response spectrum can also be used. This article presents a case study of a post-tensioned slab with a lateral load where the beam method (Ftool Software) and finite element analysis (ADAPT Floor Pro) were performed, and the magnitude of differences between them. Verified the necessary reinforcement in the tension chord and the importance of the pre-compression in post-tensioned slab as well the shear and the reinforcement in the collectors.

[Video](#) | [Presentation](#)

Technical Session 6: PT Building Design & Construction

Moderator: Marc Khoury, CCL USA

Upside Down Glass Building: Reston Station OB1, Virginia

Jennifer Greenawalt, Thornton Tomasetti

Srini Neelamegam, CCL USA

Reston Station OB1 is a new mixed-use building located in Reston, VA. Visible to thousands of people who travel to Dulles International Airport each day, this striking project consists of a 16-story office tower showcasing a unique lateral system with a diagonalized, exposed concrete exoskeleton. The tower's floors are constructed of two-way, post-tensioned, 10-inch-thick concrete slabs with 6-inch drop panels; the PT tendons were crossed within the slab to coordinate with the exoskeleton column locations along the building edges and some PT tendons were used as tie reinforcement to resist the thrust of the diagonalized column structure. The exoskeleton columns slope at 11 degrees from vertical, matching the building's north and south edges. A five-story, open-air plaza on the north side of the building is supported by "tree columns," which start at the base and splay out like a tree to support the overhang above the plaza. Thornton Tomasetti provided structural engineering for the project along with CCL who provided engineering for the post-tensioning, working in collaboration with owner Comstock Partners, architect JAHN, contractor DAVIS, and concrete subcontractor Miller & Long.

[Video](#) | [Presentation](#)

PT Elongations Best Practices: PT Supplier

Marc Khoury, CCL USA

PT suppliers are continuously being called on to review and approve out of tolerance elongations. This often puts suppliers in a tough position because they must resolve the issue fast but do not have all the information and resources to complete this in a timely matter. There is often a complete misinterpretation of what a PT supplier can and cannot do to help his client.

In this presentation, we will discuss the PT supplier's responsibilities towards their client, the LDP, and the construction team. We will detail the process from the shop drawings phase all through the elongation approval letter and provide best practices to minimize delays. These delays can cause frustration and often lead to cost implications and back charges. Examples, photos, and actual case studies will be presented for the benefit of the audience.

[Video](#) | [Presentation](#)

PT Elongations Best Practices: Structural Engineer

Don Kline, Kline Engineering & Consulting

The process of documenting, reviewing, and approving post-tensioning stressing records is often misunderstood by the project team members, and in many instances, this confusion leads to frustration and delays on the project. This presentation will focus on how the Licensed Design Professional (LDP) fits into this process. Specifically, this presentation will review the responsibilities of the LDP with respect to review and approval of the post-tensioning stressing records. Code requirements related to elongations and approvals will be covered. ACI 318 requirements are somewhat confusing and this topic will be reviewed and clarified. Elongations that are outside of the $\pm 7\%$ range can cause delays on projects. Acceptance criteria for approval of the stressing records will be covered, and practical methods of reviewing and accepting elongations that fall outside of this range will be reviewed. The LDP's responsibility with respect to timing of review will also be covered.

[Video](#) | [Presentation](#)

PT Elongations Best Practices: PT Installer

Robert McKiernan, Commercial Metals Company

The installation of unbonded monostrand post-tension tendons is well defined by ACI and PTI documents. However, some of those best practices are often challenged by the complexity of some projects and the congestion with reinforcing steel and embeds of all sorts, sometimes resulting in last-minute changes with direct consequences on the elongations measurements. This presentation will focus on the most common field changes that impact PT stressing results and also the composition and role of the stressing crew. Specifically, this presentation will review the key points for a proper tendon installation, the management of changes at the field level with PTI Level 2 personnel and the various steps of the stressing operation. It will emphasize the safety concerns and work flow disruption caused by out of tolerance elongations and how the stressing crew deals with them.

[Video](#) | [Presentation](#)

PT Elongations Best Practices: General Contractor

Justin Doll, Mortenson

Reinforced post-tensioned buildings are very common in the United States. The use of PT allows for lighter structures and a faster building schedule. The stressing operation is extremely time sensitive, with any delay having direct consequences on the project's work flow and overall schedule. This presentation will outline the timing of the stressing operation in a typical multi-story building and the various steps involved in the measurements of the elongations. In particular, this presentation will review the flow and cycle of the formwork and how to minimize any schedule's disruption, due to elongation's approval issues. We will also consider the owner's position in this and the overall impact on the acceptance of the project.

[Video](#) | [Presentation](#)

PT Elongations Best Practices: Panel Discussion

Marc Khoury, CCL USA

Don Kline, Kline Engineering & Consulting

Robert McKiernan, Commercial Metals Company

Justin Doll, Mortenson

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