

# 2016 PTI Convention Long Beach, California

## Technical Session 5 PT Buildings II

Thornton Tomasetti



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# Post-Tensioning Codes Vs Practices

– a need for trained engineering  
professionals

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[www.ThorntonTomasetti.com](http://www.ThorntonTomasetti.com)



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# Presentation Goals:

- Reasons For **Delegation** of Post-tensioned Concrete.
- An Over View is Presented of the Building **Codes** Including ACI, South Florida Building Code on Requirements on Delegation of Design.
- **Benefits** of Having a Well-Trained Engineers from the Universities.
- Suggestions on **PTI Initiatives** to Increase the Number of Trained **PT Design** Professionals.



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## Our Locations

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1200 Engineers, Architects and Professionals

38 Offices Projects in 54 Countries

## Reach





# Post-Tensioning – Codes Vs Practices; a need for trained engineering professionals

## Author Credentials:

Sivakumar Munuswamy Ph.D.,  
Senior Project Engineer at **Thornton Tomasetti**

Dr. Munuswamy Earned his Ph.D., from Florida Atlantic University. He has 34 Years of Experience in Structural Engineering Including More Than 12 Years of Prestressed Concrete Structures and Currently Work with Thornton Tomasetti, Fort Lauderdale, FL.

His Areas of Expertise include Prestressed Concrete, Post-tensioned Floor Systems, Punching Shear Behavior of Flat Plates, Inspection and Evaluation of Existing Reinforced Concrete Structures , Steel Structural Systems, Creep and Shrinkage Behavior of Concrete Structures, Material Testing, and Computer Applications.

As an Adjunct Faculty at Florida Atlantic University, He Teaches Concrete and Steel Design Courses, and Structures for Architects.



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- Typically in a Design-Bid-Build Projects, The **Structural Engineer of Record (SEOR)** Designs all Aspects of Project.



Construction Cost, Competitive Design Fees, Hectic Design and Construction Schedules may Pressure SEOR, to **Delegate Design Responsibilities** of Even **Primary Structural Components**, such as **Floor Systems**.

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What are “**Primary Structural Components**”?

Council of American Structural Engineers (**CASE**)  
National Guidelines Define the **Primary Structural System** as: “The Completed Combination of Elements Which **Serve to Support** the Building’s Self Weight, the Applicable Live Load Which is Based Upon the Occupancy and Use of the Spaces, the Environmental Loads Such as Wind, Seismic, and Thermal”.

(ref: Structural Design Delegation – David J Hatem and Matthew P Tuller – Structure Mag Nov 2009)



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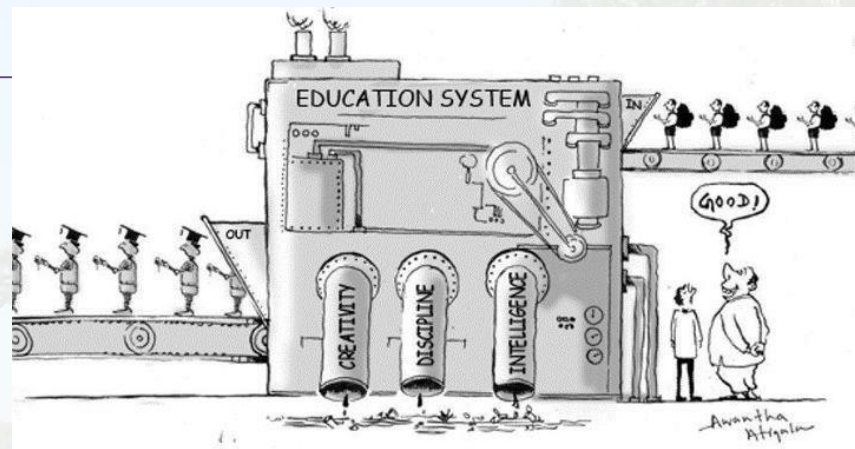
- Lately, Post-tensioning Floor Systems, a Widely Recognized Structural System for its Efficiency and Durability, a Primary Structural System is Delegated to the **Specialty Structural Engineers (SSE)** To Perform Design.



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## Why?

- **Deficient U.S. Educational System\*** Leading to **Lack of Trained Engineers**
- **Cost and Time effectiveness**



\* The State of Post-Tensioned Concrete Education

Are universities in the United States missing opportunities to advance this important technology?

by Kenneth B. Bondy, October 2014 Concrete international

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**Some Structural Engineering Firms Believe That the Liability and Responsibility can be Divested, by Delegating Design Responsibilities, Contrary to Many Professional Engineering Board's Requirements.**



[www.ereimedia.com](http://www.ereimedia.com)

“You can delegate authority, but you cannot delegate responsibility”



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**Local Building Codes,  
Regulations, and  
Professional Licensure  
Requirements Limit  
Delegation of Design  
Elements.**



**Surprisingly the Engineering Boards Align  
with the Market Trend and Industry Practices.**

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## Building Code Requirements for Structural Concrete (ACI 318-11)

An ACI Standard

### and Commentary

#### 1.2 — Contract documents

1.2.1 — Contract documents for all structural concrete construction shall bear the seal of a licensed design professional. These contract documents shall show:

(h) Magnitude and location of prestressing forces;

(l) Minimum concrete compressive strength at time of post-tensioning;

(m) Stressing sequence for post-tensioning tendons;



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An ACI Standard

Building Code Requirements  
for Structural Concrete  
(ACI 318-14) and Commentary  
(ACI 318R-14)

Reported by ACI Committee 318

## 1.7—Licensed design professional

1.7.1 All references in this Code to the licensed design professional shall be understood to mean the person who is licensed and responsible for, and in charge of, the structural design or inspection.

## 1.8—Construction documents and design records

1.8.1 The licensed design professional shall provide in the construction documents the information required in Chapter 26 and that required by the jurisdiction.



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## 26.10—Additional requirements for prestressed concrete

### 26.10.1 Design information:

- (a) Magnitude and location of prestressing forces.
- (b) Stressing sequence of tendons.



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## 1999 BROWARD COUNTY EDITION

Effective date: January 1, 1999

### THE SOUTH FLORIDA BUILDING CODE

#### 308 STATEMENTS OF THE STRUCTURAL RESPONSIBILITY OF ARCHITECTS AND PROFESSIONAL ENGINEERS

**Structural Engineer of Record:** The Florida Registered Professional Engineer who develops the structural design criteria and structural framing concept for the structure, performs the analysis and is responsible for the preparation of the Structural construction Documents. The Structural Engineer of Record is cautioned that the delegation of design does not necessarily relieve the Structural Engineer of Record of any responsibility in the design of the structure. These procedures are a reminder to Professional Engineers that, in affixing their seal to structural drawings of the structural entity they have accepted responsibility for the design of the structural entity.

#### 2510.2 STATEMENT OF RESPONSIBILITIES OF ARCHITECTS AND PROFESSIONAL ENGINEERS ON THE DESIGN OF CAST- IN PLACE POST-TENSIONED CONCRETE STRUCTURAL SYSTEMS:

(a) The structural construction documents shall show the magnitude and location of all prestressing forces and all design assumptions.

(b) The Structural Engineer of Record and/or the Architect of Record shall require the submission of calculations and installation drawings from a Specialty Engineer for post-tensioning systems for review by the Structural Engineer of Record's and/or the Architect of Record's review as an indication that his or her intent has been understood and that specified criteria have been used. The installation drawings shall provide full details of materials to be used including necessary accessories and instructions for construction and shall identify the specific project and shall bear the impressed seal, signature and date of the Specialty Engineer who prepared them.

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## CHAPTER 61G15-31 RESPONSIBILITY RULES OF PROFESSIONAL ENGINEERS CONCERNING THE DESIGN OF STRUCTURES

### 61G15-31.004 Design of Cast-in-Place Post-Tensioned Concrete Structural Systems.

[(2) If the engineer of record elects to delegate the responsibility for preparation of calculations and installation drawings to a delegated engineer for the post-tensioning system(s), the Engineer of Record shall require the submission of installation drawings for review by the engineer of record. Calculations shall also be submitted by the delegated engineer which show sufficient information to confirm that the number and size of tendons provided are adequate to **provide the prestressing forces shown on the structural engineering documents.** ]

*Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g) FS. History—New 1-26-93, Formerly 21H-31.004, Amended 9-28-10. (FBPE)*



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## POST-TENSIONING SHOP DRAWING AFFIDAVIT

Rev. 04-27-2015

Project Name / Address: \_\_\_\_\_

Master Permit Number: \_\_\_\_\_

Plan Title / Date of Issue / Pages Identified: \_\_\_\_\_

Delegated Engineer: \_\_\_\_\_  
Name Address License No.

**City of Miami**  
BUILDING DEPARTMENT



I, \_\_\_\_\_, the Engineer of Record for the project identified above, HEREBY CERTIFY that I have reviewed the shop drawings for the post-tension cables for said project, and that said drawings are in conformance with my design.

Conformance means that all applied post-tensioning loads, mild reinforcement and shear reinforcement are in accordance with my design drawings.

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## Post-Tensioning – Codes Vs Practices; a need for trained engineering professionals

- The Codes of Practices (Example: **AISC** and **SJI**) have Explicit Specifications on Delegation.



*"The priest heard you finished the Functional Specification Document and wanted to witness the miracle."*

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### AISC Code of Standard Practice – 2010 # 3.1.2 - 2010

AISC Code of Standard Practice (COSP, AISC 303-10)

**Delegate connection design to a licensed engineer** working for fabricator.

Three options available:

1. Provide complete connection design
2. Connections be selected or completed by a steel detailer (using tables from AISC Manual?)
3. Delegated to a licensed professional engineer working for the fabricator.

Though this provision (3) is introduced in 2010, the **practice existed since the 1960s.**

*Modern Steel Construction March 2015, Cynthia J Duncan and Charles J Carter.*

**Delegation is only for connections not the entire flooring system.**



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[T]he **Steel Joist Institute (SJI)** 2010 Code of Standard Practice for Steel Joists and Joist Girders (#2.3) requires that the SEOR shall “Calculate and Provide the Magnitude and Location of **ALL JOIST** and **JOIST GIRDER LOADS**”. The Term “**ALL**” Implies a Level of Completeness that Might not be Achievable by the **SEOR**.

**What is Delegated?**

Delegated Design By Case Guidelines Committee Structure Magazine Sep, 2013



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## Post-Tensioning – Codes Vs Practices; a need for trained engineering professionals

- **Licensing Boards Amend the Duties and Responsibilities of the Structural Engineer of Records (SEOR) to Reflect the Industry Practices, Latest Being the FBPE.**



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## Post-Tensioning – Codes Vs Practices; a need for trained engineering professionals

61G15-31.004 Design of Cast-in-Place Post-Tensioned Concrete Structural Systems.

(1) Structural engineering documents shall show the complete structural configuration and loading requirements of the post-tensioned system including: member sizes, type of post-tensioning system, location of all prestressing tendons (in plans and elevation), magnitude of all prestressing forces, and all design assumptions.....

(2) If the engineer of record (EOR) elects to delegate the responsibility for preparation of calculations ..... Calculations shall also be submitted by the delegated engineer which show sufficient information to document that the number and size of tendons provided are adequate to carry all loads shown on the structural engineering documents. ....

(3) It is the responsibility of the EOR for the structure to review the post-tensioning system installation drawings.....

(4) The effect of post-tensioning on other parts of the structure is the responsibility of the EOR.

Rulemaking Authority 471.033(2), 471.008 FS. Law Implemented 471.033(1)(g), (j) FS. History-New 1-26-93, Formerly 21H-31.004, Amended 9-28-10, 2-28-16.



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**(61G15-31.004 - 2) If The Engineer Of Record (EOR) Elects To Delegate The Responsibility;**

**Calculations Shall also be Submitted by the Delegated Engineer which Show Sufficient Information to Document that the **Number and Size of Tendons Provided are Adequate to Carry All Loads** Shown on the Structural Engineering Documents.**

FBPE; amended 9-28-10, **2-28-16.**



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## What Should We Do?

As an Institution, **PTI** Should

- Increase its Participation in **Education** Through Funding Professorships, **Research**, and Doing More **Design Seminars** for Practicing Engineers.
- Sponsor “**Professor’s Seminar\***,” Similar to PCA Seminars.



*“I expect you all to be independent, innovative, critical thinkers who will do exactly as I say!”*

\* The State of Post-Tensioned Concrete Education

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- As an Institution, **PTI Needs to Take an Initiative** to Convince the Universities Through ABET of the Urgency to Include **Prestressed Concrete** Design as A Fundamental Design Topic as Part of the **Undergraduate** Structural Engineering Curriculum.

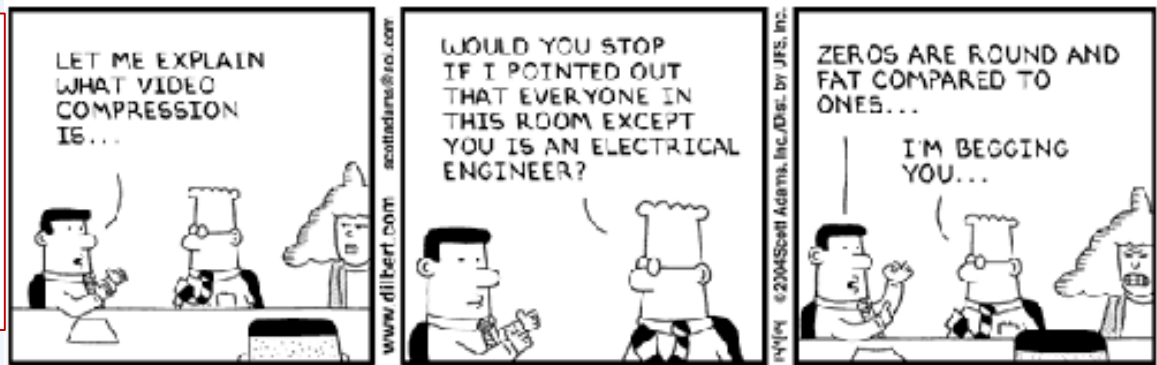


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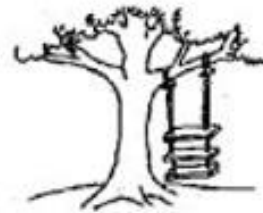


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- Well Trained Engineers Provide Best Possible Solutions, More **Efficient and Optimized PT** Design for Successful Project Development and Outcome.
- Both the **Structural Engineering Firms** and **Vendors** Benefit from Well-Trained Engineers from the Universities With an Added Advantage of **Expertise** in the Competitive Market Place.

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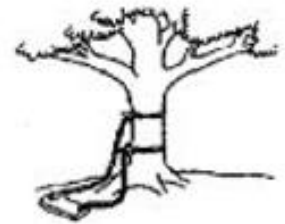
**THANK YOU !**



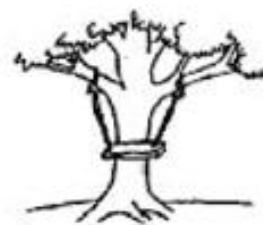
As proposed  
by the project  
sponsor.



As specified  
in the project  
request.



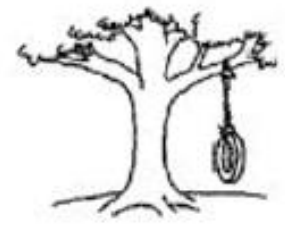
As designed  
by the senior  
architect.



As produced  
by the  
engineers.



As installed at  
the user's  
site.



What the  
customer  
really wanted.

**DISCUSSIONS !**



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