



Imperial College  
London  
Consultants

# Post-Tensioning

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Design and Construction

A 2 Day Programme **11 - 12 June 2008**

Optional Hands-on Computer Workshop **13 June 2008**

**Course Director**

**Dr Bijan O. Aalami**

Professor Emeritus  
of San Francisco State University

A Centre for Professional Development Programme

## Purpose and Background

This course provides the know-how and tools for efficient and economical designs of post-tensioned structures. It presents the latest developments in construction technology, code provisions, design procedures, and software tools. After a brief introduction to current post-tensioning systems and construction practice, the course continues with the economics of both grouted and unbonded options, and covers the practical design concepts and design procedures for beams, one-way and column supported two-way flat slab construction. Each step is supplemented with well-documented literature, examples, and computer simulations.

The course continues with the state-of-the-art methods for graphical modelling of structures for analysis and design of floor systems, including the efficient use of AutoCad drawings, Revit Structure © and ADAPT's model generation tools. It presents an integrated and seamless process for generating structural calculations, post-tensioning and reinforcement drawings, shop (fabrication) drawings and the estimates of quantities. It demonstrates the efficient integration of analysis results, obtained from third party software, such as ETABS, for the overall stability of a structure under wind and earthquake, with the gravity design using ADAPT software system.

## Learning Objectives

This programme will include:

- Current post-tensioning systems and construction practice in buildings and parking structures
- Economic advantages of post-tensioning in building construction
- Design concepts, procedures and detailing of post-tensioned structures
- Latest design code provisions for design of post-tensioned structures (BS110, EC2, ACI 318-2008, International Building Code-2007)
- Overview of TR43 Report
- Efficient tendon layout and detailing
- Detailed long hand calculations for post-tensioning design and design verification
- Equivalent Frame method for post-tensioned design
- Finite element application to design of post-tensioned buildings
- Structural modelling of post-tensioned buildings and design, using ADAPT software system, AutoCad and Revit Structure ©
- Time-dependent behaviour and creep analysis of pre-stressed concrete beams/slabs
- Hands-on software and design training workshop

## Course Benefits

Course attendees will receive comprehensive course notes and reference material including detailed design examples.

- Find out about the latest developments in post-tensioning systems, its construction practice, and economical advantages
- Understand the requirements of EC2, BS8110, ACI, IBC (International Building Code) building codes, TR43 Report, and their impact on your design
- Learn how to avoid costly errors by using an integrated approach in design from architectural drawings to structural documents
- Become skilled in tendon layout and detailing for good construction practice
- Examine the possibilities of using powerful software tailored for the design of post-tensioned and conventionally reinforced concrete, including modelling and design through ADAPT software system and Revit Structure ©
- Learn to optimize the design process for efficiency and economy
- Learn how to integrate effectively the lateral analysis of buildings with the gravity design of their floors

## Content

### Day 1 - 11 June 2008

- Introduction to post-tensioning, post-tensioning systems, and post-tensioning hardware
- Construction technology of post-tensioned structures; preferred construction practice
- Economics of post-tensioned construction and quantities
- Review of design concepts of concrete floors with specific reference to post-tensioning
- Building Code Requirements of BS8110, EC2, ACI, IBC and TR43 Report, and their impact on design of post-tensioned structures
- Long hand design example of a post-tensioned column supported floor structure
- Equivalent Frame Method and computer applications for design of post-tensioned floor systems and beam frames (using ADAPT-PT)
- Questions and discussion

### Day 2 - 12 June 2008

- Time-dependent behaviour and creep analysis for pre-stressed members
- Structural modelling of post-tensioned members for analysis and design
- Finite element design of post-tensioned floor systems using ADAPT-Floor Pro; a case study of design of a flat slab floor system; efficient use of AutoCad drawings and Revit Structure ©
- Design for restraint and crack mitigation in post-tensioned structures
- Selected topics - friction and elongation calculations, stress losses in post-tensioned tendons, construction detailing and tendon layout
- Questions and discussion

### Day 3 - 13 June 2008 (Optional Hands-On Computer Workshop)

#### Purpose and Format

The workshop is for those interested in hands-on training in design of post-tensioned buildings. Each participant will be working on a dedicated computer with the latest ADAPT analysis and design software. Starting with an architect's drawing, participants will be guided through the design process to the creation of the construction and fabrication drawings. They will learn how to start to design a project that, in a short time, will conclude with an efficient design. Each participant will receive a CD with the educational versions of ADAPT software.

#### Workshop Benefits:

- Obtain hands-on experience and exposure to the efficient design of post-tensioned buildings
- Become closely familiar with the latest design tools and methods
- Receive detailed information, literature and design examples of common post-tensioned buildings.

### Who Should Attend?

- Structural engineers engaged in concrete and/or post-tensioning design
- Contractors interested in the design of post-tensioned structures
- Engineers responsible for the review of post-tensioned designs
- Academics and students having an interest and background in concrete design
- Building officials and city plan checkers
- Engineers charged with retrofit of post-tensioned buildings
- Forensic engineers who deal with post-tensioned structures



## The Presenters



**DR. BIJAN O. AALAMI**, a Life Member of the Post-Tensioning Institute and ASCE, is Professor Emeritus of San Francisco State University, Chartered Engineer, and CEO and Founder of ADAPT Corporation - a structural engineering firm in California specialising in the design of concrete structures. He has been actively engaged in the design and construction of numerous notable post-tensioned buildings, bridges and special structures. A renowned world leader and teacher in the design of concrete buildings, bridges, special structures and post-tensioning, through his worldwide educational seminars, Dr. Aalami has enriched the practice of many engineers in North and Latin America, Far East, Europe and the Middle East. His extensive publications on concrete design, in particular post-tensioning, are regarded as primary resources for practical design of post-tensioned buildings and bridges. For over twenty years, Dr. Aalami has been the project leader of the ADAPT software suite of programs that are serving concrete design engineers in over 75 countries worldwide.



**DR. FLORIAN AALAMI** earned a bachelor's degree in civil engineering from the University of California, Berkeley and both a master's degree in structural engineering and a doctoral degree in construction technology from Stanford University. Florian's extensive career in AEC software development began at Stanford's Center for Integrated Facility Engineering and extended to his founding of BuildPoint Corporation, where he served as CTO and Vice President of Business Development. As a specialist in construction technology, his interest and involvement in post-tensioned structures, is driving ADAPT's global activities as a leading provider of software and specialty consulting services for the concrete design industry.



**DR. NEIL TSANG** is a graduate of the University of Sheffield, worked for the Babite Group, and became a Chartered Structural Engineer before moving to Imperial College London. Here he undertook research on problems associated with the time dependent behaviour of concrete structures and integral bridges. He was the recipient of both a Mott McDonald PhD Scholarship and a Croucher Foundation Fellowship, and was awarded a PhD degree in 1998. Following a period as a lecturer at the University of Strathclyde, he returned to Imperial College London where currently he is a lecturer teaching prestressed concrete structures to both undergraduate and postgraduate students. He has published papers on the time and temperature dependent behaviour of concrete structures and mechanics of granular soil. He is also co-author of a book on Integral Bridges.



**DR. TONY JONES** leads the "Structural Development and Support" team with Arup. He is responsible for providing day to day guidance to Engineers constructing some of the most exciting structures in the world; his area of expertise is structural concrete including all aspects of prestressing. He is Chairman of the Concrete Society Design Committee and was an active member of the group that redrafted Concrete Society Technical Report 43, "Post Tensioned Concrete Floors: Design Handbook". He also sits on the BSI committee responsible for the structural concrete design codes and is head of delegation for the UK on the equivalent Eurocode committee. Prior to joining Arup in 1997, Tony worked for the British Cement Association carrying out and managing research projects in various aspects of concrete construction; The University of Birmingham, where he worked as a Research Assistant investigating structural deterioration in concrete; and for Costain as a Site Engineer, where he gained first hand experience of the need for good design.

## Participating Organisations

Organisations that have been represented on previous courses include:

- Buro Happold ■ WSP Buildings ■ Bovis Lend Lease Ltd ■ ODIN Consulting Engineers Ltd
- JSA Consulting Engineers ■ CTT Stronghold ■ Atkins ■ Robinson Consulting Ltd
- FaberMaunsel ■ Finnmap Consulting ■ JLE Eng ■ Halcrow ■ Campbell Reith
- Jacobs GIBB Ltd ■ Nolan Associates ■ Alan Baxter & Associates ■ Cameron Taylor Bedford
- Appleby Group Ltd ■ Arab Enterprise ■ Esteyco ■ Elliott Wood Partnership ■ Skanska
- Bunyan Meyer & Partners Ltd ■ Clarke Nicholls & Marcel ■ Gyoury Self Partnership ■ MLM

## General Information

### Registration

Booking in the first instance can be made by PHONE: +44 (0)20 7594 6882, FAX: +44 (0)20 7594 6883, EMAIL: cpd@imperial.ac.uk, and then by completing and returning the attached registration form to the address shown. Detailed instructions, including a map, will be sent to all participants 10-14 days prior to the commencement of the course. Places on the course are limited, EARLY BOOKING IS ADVISED.

### Fees

The full fee, for the first 2-days is £700 + VAT and all 3-days is £930 + VAT with a discount for early registration before 11 May 2008 (see registration form). The fee covers tuition, a comprehensive set of notes, lunches and light refreshments. Please note all fees must be received before the course start date.

### Team Attendance

A 20% discount on the course fee (applicable at the time of the booking) is available for the third and any subsequent applicants from the same organisation who enrol together for the same duration.

### Venue & Schedule

The course will be held at Imperial College London, South Kensington, located in a pleasant part of London, close to Hyde Park, the Royal Albert Hall and world-renowned museums.

Course Schedule: 9:00am - 5:00pm with refreshments and lunch breaks.

### Accommodation

Single bedroom accommodation is available in local hotels within easy access to the College. Minimum cost of a room with shower/bath will be in the region of £85 per night. This is additional to the course fee, and participants are responsible for payment of their hotel bills. For further details and reservations, please contact:

Accommodation Link,  
Imperial College London,  
Sherfield Building,  
South Kensington Campus  
London SW7 2AZ.

Tel: +44 (0)20 7594 9507/11; Fax: +44 (0)20 7594 9504/5;

Information is available at <http://www.imperial.ac.uk/conferences>

### Cancellations

A 10% administration fee will be levied for cancellations made up to two weeks prior to the start of the course. Cancellations thereafter will be liable to the loss of the full fee. Notice of cancellation must be given in writing by letter or fax and action will be taken to recover, from the delegates or their employers, that proportion of the fee owing at the time of cancellation.

Imperial College Consultants reserves the right to cancel an advertised course at short notice. It will endeavour to provide participants with as much notice as possible, but will not accept liability for costs incurred by participants or their organisations for the cancellation of travel arrangements and/or accommodation reservations as a result of the course being cancelled or postponed. If a course is cancelled, fees will be refunded in full. Imperial College Consultants also reserves the right to postpone or make such alterations to the content of a course as may be necessary.

### Queries

- Queries regarding registration and other administration matters should be directed to:

#### **Bang Nong,**

Centre for Professional Development,

58 Prince's Gate,

Exhibition Road, London SW7 2PG

Tel: +44 (0)20 7594 6882; Fax: +44 (0)20 7594 6883;

Email: cpd@imperial.ac.uk

- Queries regarding the technical content of the course should be directed to:

#### **Dr. Bijan Aalami,**

CEO, ADAPT Corp

Tel: +1(650)306-2400

Email: bijan@adaptsoft.com

Website: <http://www.adaptsoft.com>

# Registration Form

## POST-TENSIONING DESIGN AND CONSTRUCTION 11 - 13 JUNE 2008

Please reserve a place on this course (Photocopy for additional applicants)

Delegate's Details: (Please let us know if this address is **NOI** for joining information)

TITLE	FIRST NAME(S)	SURNAME	
JOB TITLE			
ORGANISATION		WORK ADDRESS	
TELEPHONE			
FAX	POSTCODE	COUNTRY	
EMAIL			

Course Fees: \*\*Please note all fees must be received BEFORE the course start date\*\*

- Booking for 2 Days 11 - 12 June 08 BEFORE 11 May 08  £600 + VAT  
Booking for 3 Days 11 - 13 June 08 BEFORE 11 May 08  £830 + VAT  
Booking for 2 Days 11 - 12 June 08 AFTER 11 May 08  £700 + VAT  
Booking for 3 Days 11 - 13 June 08 AFTER 11 May 08  £930 + VAT

Methods of Payment: OVERSEAS DELEGATES SHOULD EITHER PAY BY STERLING BANK DRAFT DRAWN ON A UK BANK, OR ADD £25 TO COVER BANK CHARGES

- CHEQUE: I / We enclose the fee of: £  \* PLEASE MAKE DRAFT/ CHEQUES FOR COURSE FEES  
PAYABLE TO "IMPERIAL COLLEGE LONDON CONSULTANTS"
- CREDIT CARD: Please charge the following credit card for the total fee of: £   
Type of card:  VISA  MASTERCARD  SWITCH  DELTA (these cards ONLY)

CARD NO.	<input type="text"/>	EXPIRY DATE	SECURITY CODE
NAME ON CARD		SIGNED	

- INVOICE: Please invoice the following person/organisation for the sum of: £

INVOICE / PO NUMBER	VAT NUMBER
ORGANISATION	ADDRESS
FOR THE ATTENTION OF	
POSITION	TELEPHONE NO.

Other information: PLEASE DELETE AND TICK AS REQUIRED

- I will/will not require special meals (e.g. vegetarian). Please give details
- I will/will not need special facilities for a disability. Please give details
- I heard of this course from (please specify)
- For accommodation booking please contact Imperial College London Accommodation Link on +44 (0)20 7594 9507/9511  
Website: [www.imperial.ac.uk/conferences](http://www.imperial.ac.uk/conferences)

I agree that if payment is not received from the above organisation, I will be personally liable for the full fee:

APPLICANT'S SIGNATURE	DATE
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Please send completed form (or original if faxed) to:

Bang Nong, Centre for Professional Development,  
Imperial College London Consultants, 58 Prince's Gate, Exhibition Road, London SW7 2PG, UK.  
Tel: +44 (0)20 7594 6882 Fax: +44 (0)20 7594 6883 Email: [cpd@imperial.ac.uk](mailto:cpd@imperial.ac.uk)

