

pt news

NEWSLETTER No 3 – 2008

POST TENSIONED CONCRETE – ECONOMY & SUSTAINABILITY

Post-tensioned concrete continues to be the preferred method of constructing new building structures such as Office Developments, Apartments, Industrial Complexes, Carparks and Shopping Centres. The reason for this becomes apparent when we consider two critical factors; economy and sustainability.

The economic performance of post-tensioned building structures versus other forms of construction is well known and continues to be tested in the marketplace every day. In particular, the use of a banded slab structural scheme incorporating permanent metal deck formwork is the system of choice for most buildings.

Sustainability and Green Star Ratings continue to be crucial to the construction industry. The new Green Star Office requirements (V3, 2008) aims to encourage and recognize the reduction of embodied energy and resource depletion occurring through the use of concrete. As post-tensioned concrete uses both less concrete and less steel, the Green Building Council recognises the environmental benefits of this technique and has developed separate criteria to reward replacement of Portland Cement throughout a project. To this end, post-tensioned concrete buildings can assist to increase the number of credit points available for the Green Star Rating.

Post Tensioning – an alternative solution

As the PTIA passes its second birthday much has been achieved of our objectives. However, there remains a lot to achieve if we are to aspire to the level of recognition that our American cousins in the PTI have reached.

In the past few months we have completed a series of Training Courses (Post Tensioning Design Workshops) run by Cement and Concrete Services and sponsored by the PTIA. These courses have been well attended and feedback has been excellent. We will be running further courses during the year and encourage Consultants to send their designers to these courses. Consultants who are members of the PTIA receive subsidies which make the courses excellent value for money. I would take the opportunity to thank TTW and Hyder for their support of the PTIA.

Training does not end at the design stage. Last year we commenced a series of courses for “on site” workforce of the corporate members. The PTIA made the decision earlier this year to appoint a dedicated Training Officer. Since the appointment we have substantially updated the Training Manual which now includes information from the PTI in the USA. The manual is now in use and there is a rigorous testing regime in place both at the training courses and via on site assessments of the Corporate Members’ workforce.

Our ultimate aim is for the course to become nationally accredited. We encourage Builders and Contractors to use only accredited Post Tensioning Contractors.

The PTIA recently sponsored a “Top 50 Builders luncheon” organized by MBA in Sydney at which we were given the opportunity to promote our organisation. The feedback was again very positive. We hope that the Builders now have a better understanding of our objectives and will support the PTIA in raising the standards in the Industry.

The PTIA’s Corporate members are determined that the organisation will reach these objectives.

IAN STUART
Vice-President

PROJECT REPORT

Location: Townsville Queensland

Client: Toll Holdings

Project Manager: Toll Holdings

Design: Structural Systems

Townsville Rail Facility Rectification



Structural Systems have constructed various container pavements throughout Australia, with the Townsville Rail Facility being one of the largest of these projects. The 50,000m² rail facility was originally completed in May 2005, with all external hardstand pavements originally constructed with Asphalt.



Failed asphalt pavement prior to slab rectification

Due to problems with the hardstand after the original construction phase, including wearing failure of the surface, large areas of the facility became inoperable, thus the clients new facility could not handle the required traffic as planned.

It was decided in May 2006, only 1 year after operation, that the entire surface required replacement. After consultation with Structural Systems, Toll Holdings decided a Post tensioned hardstand to be the most cost effective and durable solution.

The Hardstand area consisted of three '640m long channel' running parallel to the existing rail lines. Each slab was approximately 25m wide x 80m long, thus the entire facility was constructed in 24 No. pours.

Structural Systems scope of works included Post tensioning design and documentation of the hardstands, installation of Post tensioning and conventional reinforcement, and

certification of works of the completed works.

Due to the nature of works and the need for the facility to become operational prior to the Christmas freight surge, it was decided construction would be done in two phases. Two thirds of the facility was to be built prior to Christmas, with construction starting in the middle of September 2006, with 16 pours complete by the end of November. The initial channel was in use during December, allowing the client enough access to manage the freight logistics during this period.

The second phase was done during February 2007, and completed over a three week period. Structural Systems were able to install the post-tensioning to ensure a four-pour per week cycle, effectively completing 50,000m² of concrete hardstand within a 10 week period.

The success of this project has resulted in Toll also constructing a 15,000m² upgrade to the Rockhampton Rail Facility, again with the assistance of Structural Systems, and it is expected Toll will continue to construct facilities using post tensioned concrete slabs, due to the efficiency of design, speed of construction and long term durability of the hardstand, which dramatically reduces long term maintenance and rectification, as was experienced with the original asphalt solution.



PTIA SLABS ON GRADE FOR INDUSTRIAL LOADING

While the use of post tensioning in suspended structures is well established, the use of post tensioning in slab on grade has been not as well as accepted. This is despite the fact that in over 40 years of construction of post tensioned slabs in Australia post-tensioned slabs have performed well.

As in a reinforced slab where steel reinforcement and mesh are used to control shrinkage, temperature and slab integrity, post tensioning can do the same with additional benefits.

Benefits

1 Large Pours.

2,500m² is a common occurrence with PT slabs.

2 Speed of Construction.

Large pours accelerate the construction program. A chequerboard pattern of casting is not required.

3 Reduced Jointing.

Larger pours without expansion, construction or sawn joints make the slab more homogenous and improve future performance. Reduction in jointing makes the access of water under the slab more difficult and improves the performance of the subgrade.

4 Reinforcement Content Reduced

Edge reinforcement only is generally required.

5 Thinner Slab.

A post-tensioned slab will be thinner than a reinforced concrete slab resulting in a saving in concrete. A thinner slab is more flexible. This enables the subgrade to carry a larger share of the concentrated load and the slab itself a smaller share. Even under large overloads, which may produce cracking, the prestress ensures the slab returns to its previous position after removal of the load. This is in contrast to a reinforced slab where a weak spot is more likely to remain, leading to continued deterioration.

6 Crack Control.

Post tensioning dynamically controls cracking by precompressing the concrete. Reinforcing steel on the other hand cannot stop the formation of shrinkage cracks but endeavours to limit the crack widths. Resistance to moisture penetration from above or below is better achieved through a precompressed slab. A common use of post-tensioned slab is in the base for water tanks as the slab is designed not to crack.

7 Reduced Maintenance.

Fewer joints will significantly reduce the need for future maintenance. Studies have shown that the major cost in the overall life of a structure involves joint maintenance. With a PT slab not only is the cost of joint repair and cracking reduced but also the damage on plant caused by the breakdown of joints.

Detailing and Design

The design criteria for post tensioned concrete slabs is tensile stress in the concrete. The effects of wheel or post loads, subgrade reaction, temperature, shrinkage, creep and subgrade friction are all considered in turn and sufficient prestress is applied to keep tensile stresses within prescribed limits. The prestress applied by the tendons supplements the allowable bending tensile strength of the concrete. An important consideration in design is the number of repetitions of load, which will occur during the life of a structure.

A post-tensioned slab is axially loaded by tendons usually running in both directions, and located at the centroid of the slab. The post-tensioning has an ability to compress the concrete section to a greater stress level than the applied loads will create in tension. There is often an edge thickening to accommodate anchorages as well as helping to support concentrated loads near the edge of the slab.



Construction

Many of the requirements for a post-tensioned slab are similar to a reinforced concrete slab. Two variations of construction requirement are the following.

As the length of the slab is much greater than a reinforced concrete slab the stresses generated by subgrade friction can be significant. The slab needs to be on a surface, which minimizes friction. The slab is often cast on a suitable foundation with a thin sliding layer of sand and plastic membrane between the concrete and foundation to achieve this requirement.

The early application of some initial prestress serves to control initial shrinkage cracking. The entire slab contracts under the prestress by sliding. It is of utmost importance that prevention of cracking by stressing occurs as soon as practicable to prevent formation of these shrinkage cracks.

PRESTRESSED CONCRETE DESIGN WORKSHOPS – 2008

PTIA is sponsoring a series of Prestressed Concrete Design workshops to be presented by Cement and Concrete Services (CCS). For consulting engineering firms who are Associate Members of the PTIA, there are significant subsidies on the fees for these courses – details are available from CCS at www.cementandconcrete.com. Registrations for workshops are to be made through CCS.

These two day workshops are developed for engineers who are familiar with reinforced concrete but who have little experience with prestressed concrete and who wish to gain an understanding of the principles of analysing and designing statically determinate prestressed beams. An optional third day workshop on computer aided design for prestressed concrete is also available.

City	Venue	Dates
Melbourne	Hotel Grand Chancellor	17 & 18 September, 2008
Sydney	Stamford Grand Hotel, North Ryde	15 & 16 October, 2008
Brisbane	Mercure Hotel	12 & 13 November, 2008

SEMINARS AND OTHER EVENTS SCHEDULE - 2008

Location	Event	Dates
Newcastle	Latest developments in post-tensioned concrete structures Jointly with CIA & Eng Aust	20 August, 2008
Brisbane	Seminar with CIA	24 September, 2008
Sydney	Seminar with CIA	September, 2008

PTIA SKILLS TRAINING COURSES SCHEDULE - 2008

Following the significant upgrading of the Training Manual and the appointment of a Training Officer as described in the President's report on page 1, training in Sydney has recommenced. On the completion of the first round of courses in Sydney by mid July, a series of courses will be conducted for member companies in Melbourne.

Further courses will continue to be offered in Sydney. Courses will also be offered in Brisbane later this year, following completion of the first round of courses in Melbourne.

Member companies will be advised directly of dates and venues for training courses.

Member Companies

Corporate Members

Australian Prestressing Services Pty Ltd (founding member)
Austress Freyssinet Pty Ltd (founding member)
Structural Systems Group (founding member)
VSL Australia Pty Ltd (founding member)



Associate Members – suppliers

Ajax Foundry Pty Ltd
Cemex Pty Ltd
CMC (Australia) Pty Ltd
Haggie Reid Pty Ltd
OneSteel Wire Pty Ltd



Associate Members – consulting engineers

Hyder Consulting Pty Ltd
Taylor Thomson Whitting



TaylorThomsonWhitting

PTIA welcomes its new members

- Refobar Australia as an Associate member



Post-Tensioning Institute of Australia Limited

ABN 86 121 218 228
PO Box 861, Five Dock NSW 2046
Phone 02 8765 6199
Fax 02 9743 4013
Email info@ptia.org.au

Please visit the PTIA web site www.ptia.org.au for details about membership, membership benefits and membership application forms. If you have questions about membership, please contact PTIA through this web site and our office will contact you to discuss your questions.



POST-TENSIONING INSTITUTE
OF AUSTRALIA LIMITED

“ensuring excellence and accreditation for the post-tensioning industry”

www.ptia.org.au