

PTA Guidance Note GN02

CONCRETE STRESS LIMITS

FOR PT SLAB DESIGN

Scope

This is a guidance note is intended for Engineers engaged in the design and specification of post-tensioned slabs in building structures. It sets out the appropriate concrete stress limits which should be adopted in the design of such structures. The guide also explains the relative status and applicability of the 1st and 2nd Editions of Concrete Society Technical Report 43⁽¹⁾.

Background

The design of post-tensioned slabs in the UK could feasibly be undertaken to comply with any internationally recognised national standard however currently the British Standard BS 8110-1:1997 Part 1⁽²⁾ is generally used for UK based projects. The British Standard provides only limited guidance for the design of post-tensioned slabs and BS 8110-1:1997 cl. 4.4.2 makes specific reference to “appropriate specialist literature for the design of flat slabs”, for which the Concrete Society Technical Report 43 (1st Edition) is the generally accepted reference text.

BS 8110-1:1997 is to be withdrawn in early 2010 and will be replaced by the Eurocode Standard EC2⁽³⁾. This provide a greater degree of information for the designer of post-tensioned structures however in order to bring their guidance in line with the requirements of EC2 the Concrete Society has updated their Technical Report 43 to the 2nd Edition. The 2nd Edition has been published for some time.

The existence of both the 1st and 2nd Edition of Concrete Society Technical Report 43 has created some confusion with designers and specifies as the design guidance particularly with respect of concrete stress limits differs between the two editions. This guidance note is intended to explain these differences and provide advice to designers on the appropriate stress limits to adopt and specify.

Concrete Stress Limits

The design of post-tensioned slabs involves checks on the performance of the structural elements at both the Serviceability and Ultimate Limit States. At the Serviceability Limit state it is important that the structure performance adequately and that excessive cracking does not occur. In both the British Standards and the Eurocodes the designer is permitted to consider the hypothetical stresses with the structure to provide an indication of acceptable performance in terms of cracking.

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The hypothetical stresses are the stresses that would result from an un-cracked analysis of the structure. These stresses are termed “hypothetical” in that they will not occur in reality as the actual applied stresses are unlikely to be uniform throughout the section of the structure being considered. This approach does however give a convenient and well tested approach to allow a design to be progressed.

The Concrete Society guidance has been developed from experience through the years and sets stress limits which correspond to the method of analysis namely either equivalent frame analysis or finite elements methods. In truth the method of analysis is not the important factor in setting the stress limits. What is more relevant is the distribution of the stresses across the section of the structure being considered. This is explained in more detail in the 2nd Edition of Concrete Society Technical Report 43.

In addition the stress limits are also related to the design standard with which they are used. This is the case because when designing to BS8110 or EC2 the load factors etc are different. Therefore it is not acceptable or safe for design limits from 2nd Edition of Concrete Society Technical Report 43 to be used in conjunction with designs which otherwise complies with BS8110.

The 2nd Edition of Concrete Society Technical Report 43 does however contain the updated guidance and recommendations in terms of general workmanship and good practice with respect of post-tensioned structures and should be adopted and followed more generally.

Summary

The 2nd Edition of Concrete Society Technical Report 43 was prepared to complement the requirements of EC2 and should be taken as a comprehensive update to the 1st Edition in respect of general workmanship and good practice with respect of the design and construction of post-tensioned structures.

With respect to the design concrete stress limits in particular, the 2nd Edition of Concrete Society Technical Report 43 should be used only in conjunction with designed prepared in accordance with EC2.

For designs adopting BS 8110-1:1997 the concrete stress limits outlined in the 1st Edition of Concrete Society Technical Report 43 should continue to be used until such time as the British Standard is withdrawn and no longer in use.

The Post-Tensioning Association; Promoting Perfect Post-Tensioning

This Guidance note has been produced with help from the following members

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