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SRIA CONTRIBUTION TO CECAR 5 & ASEC 2010, UPCOMING TECHNICAL NOTE 7 & PUBLICATION OF RESEARCH ON CLASS L MESH SLAB TESTS

The Steel Reinforcement Institute of Australia (SRIA) is a national non-profit organisation providing high-quality technical support and information services to the Australian building industry. SRIA co-authored three papers for the recent CECAR 5 & ASEC 2010 Conference held from 9 – 12 August 2010, at the Sydney Convention and Exhibition Centre, Australia. The papers were subjected to a full peer review, accepted for publication and presented orally at the conference. The information presented is important not just for those who attended the conference, but for the whole building industry. SRIA has prepared this abstract summary as an introduction to the material presented.

The full papers and presentation slides are now available on the SRIA website at **www.sria.com.au**. (Paper numbering below is in accordance with the conference proceedings.)

Paper 230: New Design Tables For 500 MPa Reinforcement Development And Lap Splice Lengths In Accordance With AS 3600–2009

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Design rules for stress development by end anchorage or lap splicing are fundamentally important when detailing deformed steel reinforcing bars in concrete structures. They determine the amount of additional steel required to maintain the effectiveness of tensile or compressive bars, and thus can significantly affect detailing and economy.

A recent survey of the typical standard tables of minimum development and lap splice lengths for straight D500N bars included by different consulting engineering companies on their general notes structural drawing showed relatively large variations in values for the same design options, when determined using the development length formula in AS 3600-2001. Development length and lap length have often been assumed equal despite the effect clear distance “a” between planar parallel bars developing stress can have in the formula, which should have included upper and lower bounds on “a”.

With the advent of AS 3600-2009, new formulae are provided for computing basic or refined development or lap lengths, which incorporate new design variables and factors that account directly for transverse pressure and/or reinforcement, and whether or not lapped bars are in contact with each other, staggered, or in regions of high or low tensile stress. Therefore, the need is even greater to assist consulting engineers to develop accurate, condensed design tables. Comprehensive sets of general, bar-cover-controlled and bar-spacing-controlled design tables are developed in accordance with AS 3600-2009, and their application to general design problems is demonstrated. A unified approach for preparing project-specific design tables and notes for structural drawings is also described.

Paper 231: A Review Of Recent Australian Bond Test Results And The New Stress Development Design Rules Of AS 3600–2009

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While important new design rules for stress development of straight D500N reinforcing bars by end anchorage or lap splicing were being written for inclusion in Section 13 of Australian Concrete Structures Standard AS 3600-2009, bond test series were independently being undertaken at three Australian universities. One test series focussed on lap splices in slabs, which are characterised by widely-spaced bars, supposedly without the adverse influence of edge effects which can occur in beams. Transverse reinforcement was absent, and lap lengths were deliberately made short enough to ensure bond failure occurred.

Another test series used wide concrete blocks in unconventional pull-out tests, again with large side cover to the laps, while transverse bars were included in some of the specimens. The Steel Reinforcement Institute of Australia (SRIA) funded the third test series, which also involved widely-spaced bars, but the lap splices in the large-scale flexural specimens were designed and detailed in accordance with AS 3600-2001. Otherwise, the SRIA specimens were very similar to a wide specimen tested decades ago in America, included in the large data base involving test specimens without transverse reinforcement, on which the ACI 318 design rules are partly based. The SRIA tests, which also included rigorous strength proof testing to AS 3600, are described in detail. The results from all three test series are examined statistically in relation to the large body of published data obtained from flexural bond tests. The old and new AS 3600 design rules are also reviewed with respect to strength and ductility requirements.

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Paper 232: Review Of Australian Support - Settlement Tests On Continuous One - Way Reinforced - Concrete Slabs Incorporating Low - Ductility Reinforcement

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Without movement joints present, differential vertical settlement or displacement of permanent members such as walls, columns or beams supporting continuous concrete slabs can increase the ductility demand on critical regions. This is due to additional amounts of moment redistribution, which might be overlooked or ignored in normal structural design practice.

Over the past six years, independent test series have been undertaken at three Australian universities, to primarily examine the detrimental effect support settlement could have on the load-carrying capacity of continuous one-way reinforced-concrete slabs incorporating low ductility (Class L) welded mesh. All peak moment regions of the slabs were under-reinforced, and tensile fracture of main bars ultimately occurred. Despite inducing large amounts of moment redistribution by imposing significant differential support settlement before loading the slabs to failure, these had little effect on their load-carrying capacity.

This capacity was estimated either analytically or preferably from a test on a companion slab effectively tested in its original position without support settlement. When designing statically indeterminate members for strength to Australian Concrete Structures Standard AS 3600–2009, the elastically determined bending moments at any support may be redistributed, provided an analysis shows that the rotation capacity of critical moment regions is enough for the assumed distribution of bending moments to be achieved. However, undertaking such an analysis is beyond normal structural design practice. Accordingly, the results from the three independent tests series are used to develop a practical design method that suitably accounts for the effects of support settlement in this form of construction.

Upcoming SRIA Releases

Soon SRIA will be releasing a useful new publication Technical Note 7 incorporating the comprehensive sets of general, bar-cover-controlled and bar-spacing-controlled design tables that have been developed in accordance with AS 3600-2009. Their application to general design problems is also explained with worked examples. A unified approach for preparing project-specific design tables for structural drawings is also described.

As reported earlier this year, SRIA commissioned a major experimental research project with Curtin University of Technology, WA. The university reporting stage is close to reaching completion, and soon SRIA will have a very detailed report on Class L Mesh Slab Tests. The scope of the tests includes nine single-span one-way (SSOW) slabs, four double-span one-way (DSOW) slabs and a two-way (TW) slab, all reinforced with Class L mesh and some with additional Class N bar reinforcement.

As soon as the SRIA Peer Review Panel (PRP) comprising technical experts and industry representatives overseeing this work completes its final review later this year, the Curtin University report volumes and a supplementary PRP-06 joint report will be published.

The supplementary PRP-06 joint report compliments the Curtin research report and describes:

- the design of the test slabs in accordance with AS 3600–2009; and
- the calculation of a load ratio equal to the ultimate applied test load to cause collapse divided by the ultimate design live load.

SRIA looks forward to disseminating these important publications and research results to the whole industry. SRIA's independent research results will make a significant contribution to the national test database concerning the use of Class L mesh in suspended floor slabs.

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