THE JOINT AUSTRALIA/NZ STANDARD FOR REINFORCING STEEL What's it all about?

For many years the manufacture of reinforcing steel in New Zealand has been dictated by two standards, NZS 3402 and NZS 3421. These Standards are this month being withdrawn to be replaced with a joint Australia/New Zealand Standard, AS/NZS 4671:2001 "Steel Reinforcing Materials".

AS/NZS 4671 covers the new Grade 500 reinforcing steels which are being introduced to the market to replace the old Grade 430 reinforcing steel. The new steel has a higher strength but lower ductility than its predecessor.

This change has created a lot of debate and some confusion in the market place. To assist in this transition period we have summarised some of the key issues raised and proposed some recommendations.

More detailed discussion and explanation of these issues can be sourced in the following papers, both of which are downloadable from the CCANZ website WWW *(www.cca.org.nz/pubs/Study_Reports.htm):*

"Potential problems with the use of Grade 500 Reinforcement", Richard Fenwick

"L, N and E Grade 500 Reinforcing Steel", D Bull and C Allington.

Issue

NZS 3402 and NZS 3421 are about to be withdrawn.

Recommendation

All specifications should now refer to AS/NZS 4671:2001 – Steel Reinforcing Materials.

Issue

Grade 430 reinforcing steel is not covered in AS/NZS 4671 and will be withdrawn from the market in April 2002. It will be replaced with Grade 500 reinforcement.

Recommendation

No longer specify the use of Grade 430. If specifying Grade 500, understand the issues outlined below.

Issue

AS/NZS 4671 covers three ductility classes: Class L (low ductility), Class N (normal ductility), and Class E (high ductility, earthquake-prone regions). Which is correct for my project?

Recommendation

The specification of ductility class is only an issue for Grade 500 reinforcement. For Grade 300 only Class E is covered by AS/NZS 4671, and therefore specifications should nominate Grade 300E. For Grade 500 options of Class L, N and E exist. We recommend the specification of Class E in any situation, both seismic and non-seismic, where ductility, moment redistribution, or yielding of the reinforcement can reasonably be expected during the design life of a structure.

Issue

Building flexibility when using Grade 500 reinforcement. The stiffness of a member is a function of the area of the longitudinal tension reinforcement. The use of Grade 500 in place of Grade 430 has economic advantages in that the volume of reinforcement can be reduced to achieve a desired strength. However, reducing the reinforcement volume will reduce the effective stiffness of the member, resulting in increased deformation.

Recommendation

Where deformation considerations govern the design, it is recommended that the assumed effective stiffness used in the analysis be reviewed. The values of effective moment of inertia, I_e, in the current Table C3.1, NZS 3101, may not apply to members reinforced with Grade 500 bars. Until the revision of NZS 3101 is complete, designers will need to make their own allowances for I_e.

Issue

The potential for bond failure of Grade 500 beam bars passing through interior beam-column joints in frames where plastic hinging occurs in the beam at the column face. Some research suggests that the beam bar size limitation provided in NZS 3101 is not sufficiently restrictive to prevent this. Tests are underway at the University of Auckland to review appropriate limitations of longitudinal beam bar diameter when using Grade 500. Results are expected in the later half of 2002.

Recommendation

Until research is completed it is recommended that where plastic hinges can form adjacent to column face of an interior joint, limitations are placed on the flexural tension steel contents. Existing test results indicate that adequate ductility can be achieved using the limitations provided in NZS 3101, if the Grade 500 longitudinal tension reinforcement content does not exceed the expression:

$$\rho_w = 0.08\frac{f'_c}{f_y}$$

Issue

At this time, there are no firm recommendations for the overstrength factor, ϕ_o, for Grade 500. A very limited study has indicated that ϕ_o may be as high as 1.4, not the 1.25 taken for Grade 300 and 430. Pacific Steel has commissioned a detailed study to be completed on ϕ_o, due for completion by April 2002.

Recommendation

Monitor the CCANZ website. Results of the testing will be posted as they become available.