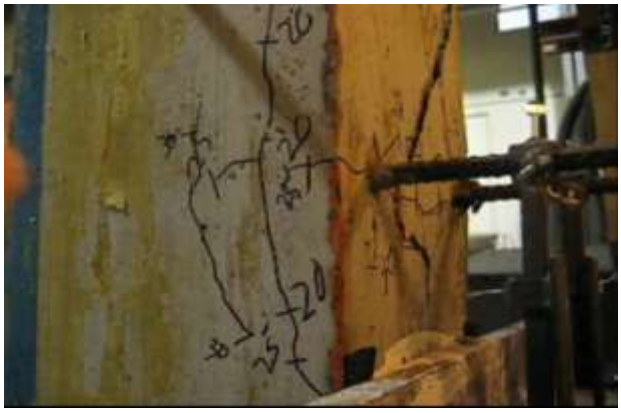
New Nuclear Plants Could Benefit from Higher-Strength Rebar in Concrete Structures

EPRI research examining rebar strength will be used to inform concrete codes and specifications for new nuclear plant construction.

The use of higher strength rebar in the design and construction of safety-related concrete structures and containment structures could reduce costs and improve concrete quality for new nuclear power plants by increasing the spacing between steel rebar rods, thereby reducing the quantity of rebar required and avoiding the formation of honeycombs and voids. Moreover, by replacing standard hooks with higher-strength headed rebar anchors, new nuclear plants can:

- Alleviate wall congestion to facilitate quality concrete placement
- Simplify fabrication of rebar forms, including cages and curtains
- Allow pre-assembly of rebar forms where conditions are generally more favorable for these activities

Test block form ready for concrete



Test block after the failure of the far bar showing stress fracture in the concrete.

Current nuclear industry reinforced concrete design practice uses 60 ksi rebar for both hooked and headed rebar. The applicable American Concrete Institute (ACI) codes, however, do not allow the use of higher-strength rebar. The current provisions in the *ACI 318 Building Code, ACI 349 Code Requirements for Nuclear Safety-Related Concrete Structures, and AASHTO Bridge Specifications* are based on tests from 1977 using reinforcing steel with yield strengths of 64 and 68 ksi, and concrete compressive strengths between 3,750 and 5,100 psi. Since then, the use of reinforcing steel with yield strengths of 75-80 ksi has become common, and concrete with compressive strengths between 10,000 to 15,000 psi is now used for many applications. Currently, bars with yield strengths up to 120 ksi are available.

EPRI research is advancing understanding of the variation in hook and head strength as a function of bar size, concrete strength, group configuration, geometry, and transverse reinforcement. Emphasis in the tests will be on bar stresses of 60, 80 and 100 ksi. A limited number of bars will be tested at stresses as high as 120 ksi. Concrete compressive strengths of 5,000, 8,000, 12,000, and 15,000 psi will be used. Results from the testing will be used to inform ACI consideration of updates to ACI 349 and 359.

For more information, contact Ron King at 650.595.2188 or rking@epri.com.

Electric Power Research Institute
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com