A Comparison of ASTM A615 Grade 60 and Grade 80 Reinforcing Bars in Tilt-up Panels

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Recent years have witnessed the advent of many innovative materials to the construction industry. When used in proper applications, these materials often offer benefits to the projects. Among these new materials is high-strength reinforcing steel for use in reinforced concrete structural elements. This material is not new from the perspective of chemical composition, but rather the selected application of use is new. The evaluation of the use of high-strength steel reinforcing bars in the design of reinforced concrete tilt-up panels and a comparison of these designs to standard strength reinforcement will be presented. The research object is to determine if the use of ASTM A615 Grade 80 reinforcement is more economical than ASTM A615 Grade 60 reinforcement for solid, slender reinforced concrete walls, tilt-up panels, used as load-bearing exterior walls of a warehouse type building in wind governing regions in the United States of America with ground snow loads of 20 psf or less.

A parametric study involving the design of 120 panels for both high-strength and standard strength reinforcement and the resulting spacing of the reinforcing steel is compared for multiple variables: panel height, panel thickness, location of reinforcement within the thickness of the panel, and concrete compressive strength. All panels have a constant width of 20 feet. The design of the panels is based on American Concrete Institute (ACI) 318-14 Building Code Requirements for Structural Concrete and ACI 551 Design Guide for Tilt-Up Concrete Panels. The results of the designs are compared.

Based on the results found within this study, it can be concluded that for a majority of panel designs, the substitution of ASTM A615 Grade 80 reinforcement for ASTM A615 Grade 60 reinforcement does not provide substantial reduction in steel reinforcing tonnage. Of the 120 unique panels that were designed using both standard reinforcement and high-strength reinforcement, 72 yielded designs that met the limitations of the applicable body of code, ACI 318-14. Of these, 80% demonstrated no reduction in volume of steel reinforcement or an increase in the volume of necessary steel reinforcement. These panels considered a variety of commonly varied parameters, including panel height, thickness, concrete compressive strength and bar size. The strongest relationships between any given parameter and the resulting volume of steel were found to be panel height and panel thickness. This study provides data from which designers and contractors can improve their ability to provide quality tilt-up panel designs when selecting Grade of reinforcement.

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