

Discussion

High-Strength Bolting

Paper presented by W. H. MUNSE (January, 1967, issue)

Discussion by GEOFFREY L. KULAK

PROFESSOR MUNSE's comprehensive paper generally covered in parallel the use of ASTM A325 and A490 bolts. One important exception, however, was the lack of any comment on the reinstallation of A490 bolts. Since this is a question of considerable practical importance, it should be noted that, unlike the A325 bolt, the A490 fastener is not suitable for reuse. Tests recently reported showed that A490 bolts with threads in the "as-received" condition were able to consistently achieve proof load only on the first installation.¹ Tightening cycles after the first generally showed a marked decrease in installed load and a marked increase in installation time. The specimens averaged only four cycles until failure occurred. (Bolts were installed by the turn-of-nut method.) In all respects, the behavior of as-received alloy steel bolts under repeated torquing is more critical than that of A325 bolts.

In his comments on the effect of joint length upon joint strength, the author states that it may be desirable either to permit higher allowable fastener shear stresses for bolts used in relatively short bearing-type connections or to require a decrease in allowable fastener shear stress when connections are long. The reference cited by the author (Reference 4) advocates quite clearly, however, the use of higher allowable fastener shear stresses for all joint lengths.

The desirable goal in joint behavior is to have a minimum acceptable factor of safety against joint failure and one which is reasonably constant with joint length. Reference 4 points out that present stress levels in plate and fastener material² result in joint proportions giving a large variation in factor of safety with joint length and one which is unnecessarily high at shorter joint lengths. These studies showed that at longer

lengths, the factor of safety is relatively insensitive to changes in allowable fastener shear stress. At the same time, the large variation in factor of safety is greatly reduced if higher allowable fastener shear stresses are used. The use of fastener shear stresses of 30 ksi (A325 bolts) and 40 ksi (A490 bolts) is shown to provide a satisfactory minimum level of the factor of safety (2.0 at a joint length of 80 in.) and one reasonably constant with length when these fasteners are used in grades A36 or A440 steels.

REFERENCES

1. Christopher R. J., Kulak, G. L., and Fisher, J. W. Calibration of Alloy Steel Bolts, *Journal of the Structural Division, ASCE*, Vol. 92, No. ST2, April 1966.
2. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, *American Institute of Steel Construction*, New York, N. Y., 1963.

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