

“Tension Control Bolts: Strength and Installation”

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This is a summary of a paper submitted for publication by ASCE in January 1997, and which was published as part of the Journal of Bridge Engineering, Vol. 3, No. 1, February 1998, paper no. 14964. This summary was prepared by Wayne Wallace, and is correct and accurate to the best of his ability.

Readers of this summary should consult the complete paper to read the entire context and to review the data presented.

Purpose of the Paper:

To investigate the pretension achieved by as-produced tension control bolts as it varies from manufacturer to manufacturer and under different aging, weathering, and thread conditions. The pretensions are expressed as a ratio of the measured value at break-off to the minimum value required for correct clamping force. For example, a pretension ratio reported at 1.05 means the pretension measured was 5% higher than the minimum needed.

What was Done:

13 lots of “as-manufactured” bolt sets were obtained in “new” (read “unused”) condition, and were then tested for pretension achieved at break-off in various conditions from as-delivered and stored in kegs, exposed to weather for two or four weeks (Condition 1), and installed in steel connections loose and exposed to weather for two or four weeks (Condition 2). The weather varied from February through the summer to September in Alberta, Canada, and has been reported at 62% relative humidity.

The author reminds the reader that turn-of-nut and calibrated wrench installation produce a mean pretension ratio of 1.35 and 1.13 respectively, at least in laboratory tests, as reported in the “Guide”. The author considers 1.13 as a desirable minimum pretension ratio.

What was Found:

In weathered Condition 1 (exposed to weather for two or four weeks), 5 out of 23 sets showed mean pretension ratios less than 1.0, and 11 out of 23 showed mean pretension ratios less than the calibrated wrench value of 1.13. In weathered Condition 2 (installed loose and exposed for two or four weeks), 8 out of 23 sets showed mean pretension ratios less than 1.0, and 16 out of 23 sets showed mean pretension ratios much less than the calibrated wrench value of 1.13.

Because of these findings, the author considers that 27 out of 46 sets demonstrated unsatisfactory pretension ratio after rather mild weathering. The author specifically concludes that “... almost one-third of the bolt lots tested (in Condition 2) gave preloads that were less than the specified minimum value ...”