

Development and Implementation of New Specifications for Anchor Bolt Tightening

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Across the United States, various state departments of transportation (DOT) are finding that the base anchor bolt nuts on critical support structures for traffic signals, overhead signs and high mast light towers are coming loose. Re-tightening loose nuts imposes a significant drain on State DOT time and money, which is then transferred to the taxpayer. More importantly, the loosening of these nuts increases the failure risk of tall and overhanging structures, possibly endangering the public.

This study is funded by the Minnesota Department of Transportation (MnDOT). In many of the observed cases with MnDOT, the anchor nuts were loose immediately after installation. Even after tightening by MnDOT personnel, it was found that anchor bolt nuts had come loose just two years after re-tightening. There were also variable methods of nut tightening depending on the worker completing the installation, creating inconsistencies. Seeing these observations, along with extensive lab analysis, led to the conclusion that new tightening specifications were required to ensure the uniformity and longevity of all bolted connections.

Therefore, the first goal of this study is to develop new specifications, which were created around the importance of lubrication, bringing the nut to snug tight, proper torque application, and tightening order. All four of these aspects were found to be vital to the repeatability of proper installation procedures. Lubrication on the nut reduces the friction between the nut and the bolt, lowering the required amount of torque to properly tension the bolt. Bringing the nut to snug tight properly was found to have an impact on the final torque achieved. Following the angles and torque values specified in a table returned more accurate tension values for the final installation than turn of nut. Finally, the pattern that the bolts are tightened in will dictate the uniformity of the tension in each bolt.

Another goal of this study is for verification and implementation of the created specifications. Testing the new methods for accuracy is vital for the quality of a statewide implemented specification. With the new nut tightening processes verified, deliverables will be created to assist with implementation, such as videos and pamphlets. All deliverables will be geared toward workers in the field featuring common sense methods and efficient graphics. In addition, the methods will be tested in the Iowa State University Structures Laboratory to ensure the instructions are clear and concise.

Keywords: anchor bolt; tightening; luminare and sign support structures; loose anchor rod nuts; new specifications