The effect of tightening torque on anchor bolts embedded in concrete

Author(s)
Runyoro Joseph

Abstract
The use of steel anchor bolts is common in concrete structures for holding down steel structures and equipment. The mechanical and chemical properties of concrete differ to that of steel necessitating them to be used with care. They anchor bolts suffer from corrosion formed in concrete, and their failure depends on concrete quality. Work was carried out to ascertain the suitability of anchor bolts for supporting the power generating plant after being in the structure, exposed to the weather for more than five years. Study was also carried out on anchor bolts which failed during installation. During the study, the mode and cause of failure was determined.
The study shows that tightening of the bolts by the use of torque wrench imposes torsion stress on the bolts. It was found out that the tensile strength of concrete is low and is the function of compressive strength. A formula for calculating tensile strength based on the quality of concrete has been proposed and is proportional to the square root of compressive strength.
A relationship between applied torque and elongation during tightening of the anchor bolts in concrete foundation follows a polynomial curve, and it has been observed that it is difficult to relate the applied torque with the tensile strength of the bolt. The profile of the pulled out concrete due to tightening of anchor bolt is in form of logarithmic curve before recessing at the surface. There exists a threshold of torque required before the bolt start elongating. Steel anchor bolt tightening torque in concrete foundation is almost half to that of steel to steel. In testing number of bolts, the R-squared value and constants of each plotted graph of a bolt test values may be used to quantify the quality of bolt/concrete connection.

Keywords
Anchor bolt,
Concrete strength,
Adhesive cement,
Tightening torque.