LABORATORY AND FIELD STUDY OF TACK-WELDED ANCHORAGES PERFORMANCE AND RETROFITTING METHODS

Erfan Alavi¹, Joobin Khanshaghaghi¹, and Behnam Sohrabiani¹

ABSTRACT

Anchor bolts play important role in transferring loads from a super structure or equipment to the foundation and in stability of the system especially against earthquake forces. Anchorages are usually made of steel materials or alloys and can be used as cast-in-place or post-installed types. However, design and installation of anchor bolts are sometimes complicated depending on the number, type, and dimensions of the rods, etc. Where, if anchor bolts are of the cast-in-place type, a part of the anchor rod is usually embedded in concrete and the remained length is to pass through some small holes in the base plate. This common procedure might complicate the erection process if the rods were not situated in right positions. The misalignment of the anchor bolts can have several root-causes and might happen in huge pedestals with numerous anchorages. In this regard, sleeves might be somewhere prescribed to facilitate the erection and minor adjustment of anchor bolts. Sleeves are often made of steel and tack-welded to the bolts, and they are partially utilized in the top level of the foundation to allow small horizontal adjustment of anchor bolts during the installation by applying some forces. In the studied samples here, sleeves were connected to anchor bolts by means of tack-welds. During the erection, it was observed that a number of anchor bolts of heavy equipment and structures, even the big-size ones (Dia.> 42 mm), were fractured at the location of sleeve connection to the anchor. Thus, a series of laboratory tests and field experiments were arranged and performed to analyze causes of the failures occurred in the anchorages and to find appropriate retrofitting solutions for improvement and assurance of the anchorages performance during the operation phase. Mechanical behavior of the anchor bolts with sleeves

¹ Structural Engineering Department, Sazeh Consultants

under tensile and flexural forces are obtained. A stress relieving method is employed for reduction of the thermal stresses on the embedded rods due to the tack-welding effects on the alloyed steel. The field test has been done by means of a hydraulic jack for examining the used rehabilitation procedure. The testing results and root-causes of the fractures are discussed, and the examined retrofitting methods are presented. Furthermore, some recommendations are drawn based on the observations and findings for preventing such failures in anchor bolts and reducing heat affected zone effects on the anchor bolts mechanical behavior due to the tack-welding.