
Strengthening of the Frame Structure at the Timisoreana Brewery, Romania

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Abstract: Many structures built in Romania before 1970 were designed for gravity loads with inadequate lateral load resistance because earlier codes specified lower levels of seismic loads. Some of these structures are still in service beyond their design life. Also, some deterioration was observed in existing structures due to the actions of different hazard factors. This paper presents the case study of a brewery with reinforced concrete framed structure of five storeys and a tower of nine storeys, which has been assessed and strengthened. The brewery and the tower were built in 1961 and an extension in 1971. An assessment performed in 1999 showed up local damages at slabs, main girders, secondary beams, and columns; concrete carbonation; concrete cover spalled over a large surface; complete corrosion of many stirrups and deep corrosion of main reinforcement; and some broken reinforcement. Such damage was caused by salt solution, CO₂, relative humidity RH \approx 80%, and temperatures over 40°C. Also, inadequate longitudinal reinforcement was deduced from the structural analysis. The initial design, done in 1960, was according to the Romanian codes of that time with provisions at low seismic actions. The structural system weakness is due to present-day high seismic actions. The rehabilitation of the reinforced concrete structure was performed by jacketing with reinforced concrete for the main and secondary beams and columns. In 2003, due to continuous operation and subsequent damage of the structure, a new assessment was required. It was found that some beams and one column were characterized by inadequate main and shear reinforcement as well as corrosion of many stirrups at beams. The strengthening solution adopted was based on carbon fibre reinforced polymer composites for beams and column.

Keywords: existing reinforced concrete structures; reinforcement corrosion; seismic action; assessment and rehabilitation; structural analysis; strengthening solutions.