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STRUCTURAL BEHAVIOR OF REINFORCED LEGS WITH APPLICATION TO LATTICE COMMUNICATION TOWERS

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Abstract. Nowadays wire-less communication lattice towers have become of extensive use, due to economical reasons. The design of these structures is, in general, carried out following the standard codes and simplified models and dynamic actions, as wind and earthquakes, are exceptionally taken into account, despite their adverse impact. Radio and television employ structures that range between 100 m and 600 m, and those structures for telephone signals are around 60 m, though higher structures are also constructed. Both self-supported and guyed towers are employed to support the antennas. For large heights, guyed masts are indicated with the favorite location in the countryside while self-supported structures are the preferred in the urban areas. The increase of more accurate and reliable communication systems poses higher structural demands, since the signal technology sometimes requires minimizing the motions of the supporting structures, so as to obtain a high quality transmission. Also, and due to public opposition for environmental reasons, the existing towers are very frequently shared by various companies giving place to the so-called "co-localizations". New antennas and ancillaries are added as well as more guyed masts are installed in the countryside. In the first case, the structures must be verified for the new loads and in case that the stresses or displacements are beyond the admissible limits (both from the structural and the operational viewpoints), a retrofit or reinforcement should be performed. In the present days, in Argentina, the reinforcement of the tower legs is made through internal or external steel elements, linked to the original tower through horizontal members with various configurations. This practice would require consideration in the standard codes. In order to understand the behavior of the reinforced towers, the detail computational study of such members is addressed in this work. A mechanical event simulation is carried out using a finite element method and an existing tower data is employed for these purposes. The different parts of the reinforced members are joined with bolts, which are simulated with a tool that simplifies their modeling. First, a single span between diagonal members is studied. Then, a larger portion of the tower is considered. From the analysis of the results, modifications of the design of the reinforcements may be proposed and recommendations or limitations derived for a new dedicated code. Also, the computational results will serve as a reference to design future physical experiments.

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