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RELIABILITY STUDIES OF WOOD UTILITY POLES WITH STOCHASTIC WIND LOAD AND PROPERTIES

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Abstract. Hazards, as extreme winds, can produce damage in constructions, structural elements and other urban facilities that can put at risk either their security or serviceability. Thus, a reliability analysis is appropriate to assess the vulnerability of a certain structure. In particular, this study addresses wood utility poles used to support overhead power lines in urban environments. Several tools are available to tackle this problem. One of them is the fragility curve which is a statistical tool representing the probability of exceeding a given damage state (or performance) as a function of an engineering demand parameter (in this case, wind velocity). In order to evaluate the vulnerability, it is necessary to have information about the structural system, materials, geometry, adjacent constructions, etc. Representative characteristic are assumed random through some statistical model. These are: geometry of the pole, material properties (modulus of elasticity-MOE, presence of knots). The MOE was considered both as a random variable and a random field by means of the Non Gaussian Karhunen Loève Expansion and the Weak Zone Model to account for the knots presence. Additionally, the wind load is first modeled with the quasi-static model suggested by the standards (CIRSOC 102, Argentina) and second, as a random load using the Spectral Representation Method. Also, different failure criteria for dynamic loads are explored and contrasted them with the results of a pole under quasi-static deterministic wind load. The criteria are the first passage, the dwell time above the failure threshold, the extreme values distribution, the crossing rate and the cumulative proportion of displacements above the threshold of all the realizations. A comparison is carried out by means of the fragility curves to assess the suitability of each approach.