THE EFFECT OF STRUCTURAL STEEL PARAMETER AND QUALITY OF CONSTRUCTION UNCERTAINTIES ON SEISMIC PERFORMANCE OF A SPECIAL MOMENT RESISTING FRAME

Behrouz ASGARIAN
Associate Professor, K. N. Toosi University of Technology, Tehran, Iran
asgarian@kntu.ac.ir

Moein MOAYERI
M.Sc. in Earthquake Engineering, K. N. Toosi University of Technology, Tehran, Iran
mmoayeri@mail.kntu.ac.ir

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Seismic excitations are one of the most hazardous loadings encountered during the life time of structures. Seismic evaluation of Steel Moment Frames, which are used often as lateral seismic system subjected to earthquake must account for the structural steel parameter and workmanship uncertainties, is of high importance (Asgarian et al., 2010).

In this study, the uncertainties ,which involve the quality of workmanship (Quangwng and Ellsingwood, 2008) (quality of construction and weld fabrication) that is affected in the behavior of the beam-to-column connections (Foutch and Yun, 2002; Gross, 1998), as well as mechanical properties such as Young modulus and yield-strength, are parameters for considering those associated with structural steel framing parameters. Incremental dynamic analysis is utilized to assess the structural dynamic behavior of the frames and to generate the required data for performance based evaluations (Vamvatsikos and Cornell, 2002).

A probabilistic framework for seismic assessment of a structural system (Jalayer and Cornell 2003),which takes into account the uncertainty in the mentioned variables, is used to examine the variation of the probability of exceeding a limit state capacity under seismic excitations (FEMA, 2001). In this study, seismic evaluation of structure has been done in two modes, before construction (the designed structure with no uncertainty) and after construction (the structure with uncertainty). The given assessment is accomplished based on the mentioned reliability framework that originally was proposed by Cornel and Jalayer and then was presented as a practical framework in the FEMA350 instructions. According to the mentioned refrences, it is possible to evaluate the building performance by determining a level of confidence in the building's ability to meet any desired performance objectives. This confidence level is determined through evaluation of the factored demand-to-capacity ratio given by the equation below :

$$\lambda = \frac{\gamma\gamma_2 \upsilon}{\phi C} \tag{1}$$

Prior to the construction of structure and with no uncertainties arising from the material properties or construction of structure, the value of λ is:

reliability parameter	CP	Landa CP	0.619338
	IO	Landa IO	0.950555

The given histograms present the distribution of λ parameter for the stage of after construction of the structure as affected by the mentioned uncertainties at the assumed performance level.

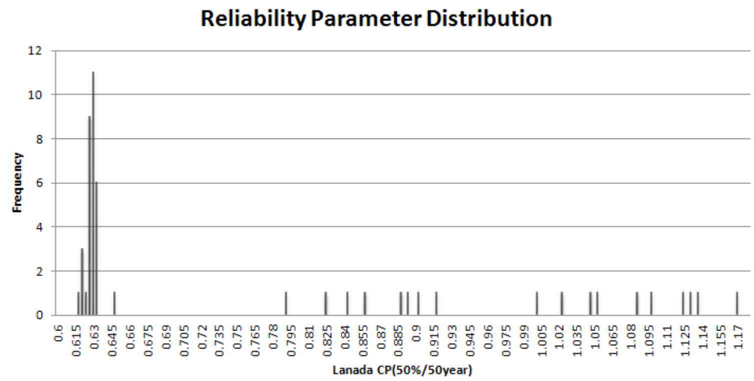

Figure 1. The λ histogram for the collapse prevention against 2/50 hazard level

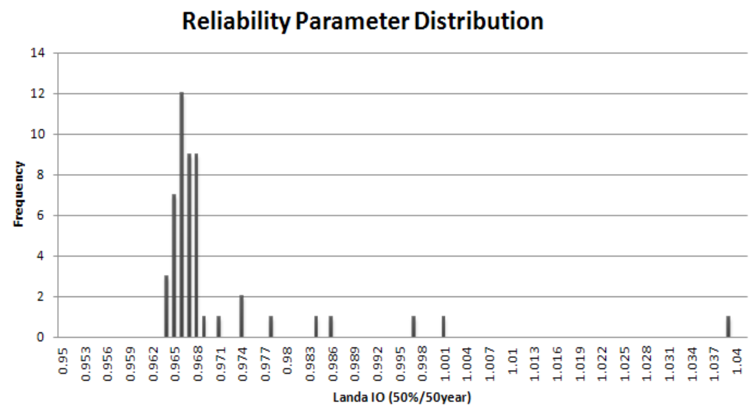

Figure 2. The λ histogram for the immediate occupancy against 50/50 hazard level

DCFD parameter for the IO performance level, as affected by uncertainties, shows few changes in comparison to the structure with no uncertainty. In IO performance level, structure is located within the linear behavior and effects of the introduced uncertainties have been insignificant, so the DCFD shows few changes. The DCFD of CP performance level, as affected by different uncertainties, shows lots of changes in comparison to the structure with no uncertainty. Finally it is shown that by using the above mentioned procedure for performance based evaluation, the DCFD parameter of special moment frames with uncertainties for the mentioned parameter in some cases, will be increased to 40%, which demonstrates the difference between the structure before and after the construction based on the accomplished seismic assessment. According to the relation between DCFD and confidence level (The annual frequency of exceeding the limit state),by increasing the DCFD value confidence level of the structure is reduced therefore ,the confidence level for CP is very diverse and has large reduction in comparison to the structure with no uncertainty. In IO limit state the confidence level has light difference.

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