

Study of the effects of uplift on seismic behavior of steel structures resting on rigid bases

Abstract:

In this research under the title "Study of the Effects of Uplift on Seismic Behavior of steel Structures resting on rigid bases ", we study the uplift phenomenon from various aspects. Since the possibility for occurrence of uplift phenomenon is only due to the effect of lateral loads such as wind and earthquake, in this dissertation we have made effort to Study the effects of this phenomenon as a result of earthquake forces, even though naturally, a similar behavior will be created due to the wind force. In seismic designing, essentially it is supposed that the foundation and the support that soil (stone) exists under it, have been closed to each other, but this supposition during the strong earthquakes is dubious, so due to the reason of forces distribution during the uplift and even attenuation effects in earthquake forces, we study seismic response accompanied by the possibility of uplift in the foundation of the structures. At first with introducing the investigated models during the past decades and review of literature for the engineering of uplift phenomenon that is not regarded in analysis and design these days, 2-dimensional modeling strategies have been studied and these methods have been put for criticism. The next step in 3-dimensional analysis of uplift is selecting several samples for modeling in SAP2000 software. With performing parametric researches and derivation of applied diagrams for the initial guess in uplift phenomenon, the constructions with much importance in uplift have been selected. In the next step for the selected structures and their foundation have been analyzed and designed based on the existing Codes for the 2 systems of steel moment resistance frame (MRF) with intermediate elasticity and Concentric Brace Frame (CBF) in the state of fixed support. In designing of the foundation, some studies have been performed regarding convergence coefficient of the analysis in removing tension spring for exact designing. The manner of modeling the uplift and this matter that in case of creating tension force in the columns, the structure can be uplifted, has been performed by the element of "Gap". In other words, the manner of connecting the foundation to the ground that is the same structure support is performed by this element. In this modeling the foundation body has been added to the mathematic model of the structure in contrast with the common methods. Performance of non-linear analysis has been carried out on the basis of regulations for instruction of optimum oscillation. Therefore, with existing three elements of structure, foundation and support within the framework of 3-dimensional model, it is expected that the uplift phenomenon to be studied exactly. In order to study the effects of uplift on the structures, all the models with uplift and without it have been brought for comparison, and finally

it has been suggested that for performing analysis and designing, actions are made for modeling uplift phenomenon in the structures, and even the short structures due to the reason of considering real facts in distribution of forces.

Key words:

Seismic uplift modeling, base shear diagram displacement, effective period, non-linear static analysis.

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