Research Note: An investigation on the effect of gusset plate connection rigidity on the seismic behavior of special concentrically braced frames

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ABSTRACT

Special concentrically braced frames (SCBFs) are commonly used to resist lateral loads in buildings. The bracing system sustains large deformations due to inelastic behavior in bracing members (buckling and yielding in tension). Generally, in the conventional modeling strategy, the effect of gusset plates in providing beam-column connections rigidity and hence, improving the post-buckling performance of these frames is not taken into account. This paper deals with the effect of gusset plate rigidity on the seismic behavior of SCBFs using Roeder's proposed model in the literature. In this paper, four 3, 6, 9 and 12-story SCBFs were designed and modeled using two distinct methods: conventional method with hinged connections and Roeder's method with semi-rigid connections. Then, the models behavior was investigated with both pushover analysis and nonlinear time-history analysis using OpenSees software. The results showed that lateral load capacity of the frames modeled with the Roeder's proposed model are about 10% larger than the conventional method's capacity. Also, it was found that the semi-rigid model leads to a less drift ratios and more overstrength factors.

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Comparison of designing simple steel frames and coaxial brace systems by contrast of blast using two methods of load & resistance coefficients and performance surfaces

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ABSTRACT

Nowadays, because of the increasing terrorist attacks around the urban areas, designing buildings by contrast of resulted loads of blast came into consideration particularly in some sensitive buildings & vital arteries. When a blast occurs, the resulted emissions in environment leads to appearance of several penalties and endangers to the human life. Steel structures generally are designed on the basis of standard seismic and gravity loads. It is necessary to investigate the implantation of these structures under the impact of the loads originated from blast. This article presents numerical studies of two-dimensional structural models with 2 and 5 stories which are including simple steel frame system in addition to CBF. The models were analyzed by nonlinear dynamic analysis method using the instruction UFC 3-340-02 in two adverse levels of blast loads by SAP 2000 software. In this study structural models are designed and analyzed using two designing methods: the basic performance design, and Load and Resistance Factor Design (LRFD). Finally, two set of results are compared in detail.

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Study on the effect of Shahin-Dezh green Tuff on the mechanical characteristics of roller compact concrete

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ABSTRACT

Due to the growing popularity of concrete structure and increasing use of them, especially Roller compacted concrete, applying Pozzolan and replacing cement with Pozzolan is very important. Nowadays, the use of the additive for cement replacement is common in RCC mix design due to its technical advantages and economic benefits as there is large quantity of Pozzolan mineral resources in Iran. In this paper the impact of produced concrete has been fully considered as well as the effect of this Pozzolan on the compressive strength, tensile strength and permeability by using green Tuff obtained from available Pozzolan in western Azarbaijan. The due results prove that Shahin-Dezh green Tuff improves concretes quality.

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Stress intensity factors and crack propagation path under mixed mode conditions

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ABSTRACT

Use of crack propagation principles based on SIFs (stress intensity factors) is among the most common methods of fracture mechanic engineering. SIF is an important parameter in fracture analysis. In analyzing elastic fracture, SIF reveals the stress near the crack tip and substantial information about crack propagation. When loading or geometry of a structure is not symmetrical around a crack, rupture occurs with combined loading and the crack does not propagate on a straight line. Therefore, to determine the new direction of facture propagation use of twist angle criteria is necessary. The objective of this research was to propose a numerical model of crack propagation under combined loading conditions. In each crack with increased length the twist angle is assessed as a function of SIFs. This research aimed to determine SIFs for the crack propagation problem and to determine the crack development path through linear elastic fracture analysis. This study was primarily based on examination of the propagation and development of cracks on a plane under tensile loading and combined mode loading conditions. The ANSYS finite element software and FRANC3D crack propagation software were used to simulate crack propagation and to calculate the stress and SIFs.

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Evaluation of seismic behavior of steel braced frames with controlled rocking system and energy dissipating fuses

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ABSTRACT

The self-centering rocking steel braced frames are new type of seismic lateral-force resisting systems that are developed with aim to limiting structural damages, minimizing residual drifts on systems and creating easy and inexpensive reconstruction capability after sever earthquakes. In Steel braced frames with controlled rocking system, column bases on seismic resisting frame are not attached to the foundation and the frame allowed to move freely. The task of restoring the rotated frame to its initial location is on post-tensioned cables, which attaches top of the frame to foundation. The design of post-tensioned stands and braced frame members is such that during earthquakes they remain in elastic region. Seismic energy, dissipates by plastic deformations in replaceable elements on each rock of frame. In current research work, the seismic behavior of this type of lateral resisting systems is evaluated. The research conducted on a one bay steel braced frame with controlled rocking system that is analyzed using nonlinear dynamic time history analysis (NLTHA) procedure. The frame is subjected to JMA-Kobe and Northridge ground motions records that are scaled to unit, 1.2 and 1.5 times of maximum considered earthquake (MCE) ground motion level intensity. Extracted results show that seismic behavior of this type of lateral force resisting systems are so desirable even under MCE ground motion levels. The only anxiety is about occurring fatigue in post-tensioned strands that endangers overall stability of system.

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Dynamic behaviour of different types of cable-stayed bridges due to earthquake loads

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ABSTRACT

Construction of large-scale structures has been considered as one of the human's main achievements. With their suitable view and high economical aspects, High-strength steel cables have been developed for analysis and erection of cable-stayed bridges in light of high speed development in computer technology. This type of bridges, while providing different behavior due to cable flexibility, has been recognized as one of the most practical choices for mid to large span bridges. This paper studies the non-linear dynamic behavior of cable bridges and the effect of some parameters (such as cable arrangement and shape of pylon) on them. For this purpose, CSI Bridge software with the direct integration method of dynamic analysis has been used and the behavior of structure under different earthquake components has been analyzed for various conditions of cable arrangements and pylon shapes. Results indicate that the most suitable behavior would be for cable bridges with H-shape pylons arranged in series and also with A-shape pylons in radial arrangement.

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Probabilistic seismic performance model for tunnel form concrete building structures

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ABSTRACT

Despite widespread construction of mass-production houses with tunnel form structural system across the world, unfortunately no special seismic code is published for design of this type of construction. Through a literature survey, only a few studies are about the seismic behavior of this type of structural system. Thus based on reasonable numerical results, the seismic performance of structures constructed with this technique considering the effective factors on structural behavior is highly noteworthy in a seismic code development process. In addition, due to newness of this system and observed damages in past earthquakes, and especially random nature of future earthquakes, the importance of probabilistic approach and necessity of developing fragility curves in a next generation Performance Based Earthquake Engineering (PBEE) frame work are important. In this study, the seismic behavior of 2, 5 and 10 story tunnel form structures with a regular plan is examined. First, the performance levels of these structures under the design earthquake (return period of 475 years) with time history analysis and pushover method are assessed, and then through incremental dynamic analysis, fragility curves are extracted for different levels of damage in walls and spandrels. The results indicated that the case study structures have high capacity and strength and show appropriate seismic performance. Moreover, all three structures subjected were in immediate occupancy performance level.

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Study of the arrangement effect of units on the shear strength masonry walls in Meso-scale

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ABSTRACT

Masonry is one of the oldest building materials which have been used in most heritage structures and new construction. In this study by using a meso-scale finite element model, the behavior of masonry walls is investigated under monotonic loading by Abaqus software. The most important factor in determining the behavior of masonry structures is discontinuity joints which are interface between unit and mortar. In most previous studies cohesive element is used for modeling of interface element. But in this study, by ignoring cohesive elements that represents the interface element between unit and mortar in masonry structures, it can be seen that while reducing the computational requirements, the results are in good agreement with experimental studies. Another important factor in the behavior of masonry walls is the arrangement of masonry units. In this study the overlapping effect of rows of units on the shear strength and failure mode of masonry walls have been investigated. As a result, it was observed that by increasing overlap, shear resistance of masonry walls increased.

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Effect of the soil-structure interaction on performance assessment of the energy-based cumulative damage index in concrete reinforced frames

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ABSTRACT

In most of the conventional design methods, the soil beneath the structure is assumed to be rigid, but this assumption is not true in reality. Up to now, many studies have been performed concerning the interaction effect on the structure response but the effect of this phenomenon on the structure damage has not been considered seriously. In this research the effect of Kratzig non-cumulative damage index which is an energy-based damage index is investigated for target ductility levels of 3, 4 and 5 in the 5, 7, 10, 12, 15, 18 and 20-story concrete moment resisting frames and under 7 different accelerometers. The soil beneath the structure is also modeled using the cone models. The results show that in the low-rise frames, which have lower slenderness, ignoring the effect of soil-structure interaction is on the behalf of safety, but with increase in the height of frames (increase in slenderness) together with increased ductility, the effect of soil-structure interaction causes increased damage at some stories and this increase in some points reaches to 14%, especially at the upper stories and this issue indicates the importance of taking into account the soil-structure interaction in slender structures. For medium soils, in most cases the responses are very close to that of the rigid case. But investigating the overall damage criterion in the frame, the effect of soil-structure interaction causes reduced damage index. With the energy-based cumulative damage index, the effect of soil-structure interaction on the damage index is greater in the beam element than the column element.

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Laboratory and field study of the performance of helical piles in sandy soil

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ABSTRACT

Developing different method in construction of deep footing plays a major role in optimized and economized performing of civil projects especially in problematic soils. One of the common types of deep footing is helical piles which have several advantages such as fast procedure, useful in different soil types, performing without noise and vibration, effective in pressure and tension and etc. In this paper, the performance of 1-helix & 2-helixes and 3-helixes in an un-grouted and grouted with the field and laboratory studies are discussed. Field studies include of helical piles behavior in sand. Laboratory tests with physical FCV modeling is also carried out on the soil of the site. Grouting effect on helical piles resistance is evaluated. Comparison load test results with analytical method were compared. Results show that performance cylindrical in sandy soils in helical piles is not suitable and increasing helical number pile capacity is decreases. Also, after grouting helical pile with three helixes increases more resistant compare to one helix and double helixes.

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