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Abstract

An accurate material quantity take-off and estimation are vital issues in various construction projects. Such an accurate estimating and material quantity take-off is required prior to initiating a project for tendering and bidding purposes, and during the construction phase for procurement and project control purposes. Thus, a number of Building Information Modeling (BIM) applications have been utilized recently not only for efficient material quantity take-off and estimating purposes, but also for other construction engineering and management commitments (e.g., visualization, clash detection, 4D 5D planning, and virtual reality). The most common BIM applications can be named as "Autodesk Revit" and "Tekla Structures" for integrated modeling (e.g., structure, architectural, and MEP modeling) and "Autodesk Navisworks Manage" for site management and 4D Planning purposes. In this research, the accuracy of automatic quantity take-off, using aforementioned BIM applications, has been investigated. First, such an exercise is performed on simple steel and reinforced concrete elements modeled using Revit structural extension. Furthermore, this exercise is extended to steel and reinforced concrete 3D structures, modeled in both TEKLA and Revit structures. By recognizing the points of weakness of such BIM applications, some practical recommendations are provided to enhance the accuracy of automatic quantity take-off and estimation. Another side product of knowing the accuracy of automated material quantity take-off is providing a realistic estimate based on the utilized estimating approach and employing BIM software to avoid unplanned mistakes in estimating and quantity take-off.

Key Words: Construction management, quantity take-off, material estimating, building information modeling.

ments such that increasing structure height can reduce the allowable differential settlements up to 50%. The results of this research also revealed that the geometrical shape and properties of building plan affect the amount of allowable differential settlements, such that moment-resisting structures with rectangular plan tolerate higher differential settlement values compared with the structures with square plan shape. According to the results of the present study the allowable angular distortion at life safety performance level of moment-resisting steel frame structures is suggested to be limited to 1/94 in the buildings with maximum five stories, and 1/200 in five to ten-story buildings. The results indicate that the height of structure should be taken into consideration in the allowable differential settlement criteria.

Key Words: Allowable differential settlement, moment resisting steel frame, pushover method, life safety performance level.

A COMPARATIVE OVERVIEW OF THE MOST RELIABLE METHODS OF ESTIMATING THE LONG-TERM BEHAVIOR OF CONCRETE UNDER CONVENTIONAL ONE-STEP AND NONLINEAR SEQUENTIAL ANALYSIS

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Abstract

In recent years, the need for consistency between the practical implementation steps of construction process and the design stage of high-rise concrete structure through the use of nonlinear sequential construction analysis has been strongly recommended by researchers. Besides, it is known by research and experiment that concrete structures are subjected to larger displacements and stresses because of the long-term behavior and the time-dependent parameters of concrete such as creep and shrinkage. This brings about the increase in beam deflections, expansion of tensile cracks in members, excessive column shortenings, differential displacements of horizontal structural members, such as beams, caused by unequal and increasing axial displacements in adjacent frame members and considerable redistribution of stress in structure. All these outcomes, which affect structure's response directly or indirectly, must be considered in the nonlinear and time-dependent sequential analysis of multi-story buildings. In this paper, the most important methods of predicting the long-term behavior of concrete, stating the advantages and disadvantages of each, has been introduced, and the proposed equations to describe the manner of applying certain features of the aforementioned methods in the updated version of the common analysis and design software for structures are presented. In addition, for getting familiar with the manual method of calculation of creep and shrinkage effects, the exact implementation of the Fintel and Khan's model is expressed by establishing the tables of before and after the casting of concrete and considering the changes that illuminate the obscure aspects of the corresponding method. Proper compliance of the obtained results with the corresponding values of the similar method, named PCA, which has the finite-element modeling functionality, indicates the possibility of providing a reliable sample for error calibration and validation process. For vivid understanding of the effects of time-dependent parameters of the concrete on the axial deformation of the vertical elements of the structures, the invoked example of Fintel and khan has been applied similarly to all the studied methods under conventional one-step and nonlinear staged analyses. Moreover, the column shortening results have been compared after 1,000 days of construction time.

Key Words: Nonlinear sequential analysis, conventional analysis, column shortening, creep, shrinkage, modulus of elasticity.

INVESTIGATING THE PRECISION OF QUANTITY TAKE-OFF IN BIM APPLICATIONS

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Abstract

The phenomenon of negative skin friction (NSF) is a friction force downward on the pile surface which occurs as a result of the settlement of the surrounding soil and causes extra load on the pile. Hence, bearing capacity of pile decreases and its settlement increases. Therefore, NSF is considered one of the problems in the design of piled foundations in soft soils. On the other hand, by the advancement of geotechnical engineering science, a new type of piles was introduced called tapered piles.

In this type of piles, by the increase of the depth, their section area decreases, and finally, the bottom of the pile will have a smaller cross-section compared to its top side. Hence, in this research, by using ABAQUS finite-element software, a single pile with a uniform section is modeled in a clayey layer under the effect of NSF phenomenon. Afterward, by tapering the pile under various tapering angles and comparing the obtained results, the effect of pile tapering on the NSF phenomena and also neutral plane location have been examined. In addition, in order to validate the numerical modeling, an in-situ pile load test with the measured negative skin friction value on a uniform pile in Bangkok was simulated. Besides, in order to investigate the influence of the pile cross-section shapes on the NSF, modeling of three type piles with a constant volume has been conducted using different shapes including circular, triangular and square cross-sections. The obtained results indicated that using tapered piles is economically beneficial, unlike the granular soils; in cohesive soils, the NSF values and neutral plane location are increased which can noticeably reduce the bearing capacity of piles. In addition, using the tapered piles with triangular cross-section causes a decrease in soil settlement around tapered piles compared to other cross-sections and consequently the NSF could also be decreased. Indeed, using piles with a triangular cross-section which has more contact surface with soil, because of more creation of friction between soil and pile compared to other piles, soil settlement in the vicinity of tapered pile is decreased; following that, the negative skin friction also decreases.

Key Words: Negative skin friction (NSF), neutral plane, tapered piles, cohesive soils, numerical method.

DETERMINATION OF TOLERABLE DIFFERENTIAL SETTLEMENTS IN MOMENT-RESISTING STEEL FRAMES BASED ON PERFORMANCE LEVEL OF STRUCTURE

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Abstract

Knowledge of allowable differential settlement is necessary for foundation design. Differential settlements may cause additional stresses and strains in structural members. The stresses induced by differential settlements are not conventionally considered in designing superstructure. The differential settlements are generally determined from separate analysis of foundation slab overlaid on soil by applying the structural loads onto it. Then, the calculated settlements are limited to the allowable values. The allowable differential settlements in construction codes are not strongly hooked on the type, design method, and application of structures. The current applied criteria are mainly based on the observations on actual problematic buildings. It is necessary to numerically determine the limiting values of differential settlements which endanger the performance of structures. In this research the allowable settlements of steel moment resisting frames are determined based on seismic performance level. Four moment-resisting steel structures were analyzed and designed according to conventional methods without applying any differential settlements. Then, different patterns of differential settlements (point, axial, and block patterns) were applied to the structures and the structures were analyzed by nonlinear finite-element method. Based on the analysis results, the limiting values of differential settlements at life safety performance level were calculated according to FEMA-356 code. The results of this research revealed that the height of structure considerably affects the allowable differential settle-

that needs more accuracy be clear, it can greatly reduce the computational complexity with an appropriate process. In this paper, energy norm of error method and refinement of enrichment-displacement, using the optimization algorithm of charged system search, are presented to improve the accuracy of the two-dimensional linear elasticity. Problems simultaneously use two methods of enrichment and displacement techniques. At first, replacing the points would reduce the predominant error of the problem. Moreover, in the event of failure to reach an allowable error, in the next step, elements that have a higher error than permissible one using enrichment method of new nodes enter the domain of problem, and new meshing is offered. Enrichment-displacement method continues to obtain the desired accuracy. The proposed method with achieving a suitable layout for finite-element network, in addition to solving the problem of some nodes occurring in conventional enrichment methods, improves the accuracy of answers as well. Furthermore, the approximate answers will be provided with the lower number of degrees of freedom than the compared methods. A comparison of result for the present method by other researchers show the efficiency and acceptable accuracy of the method.

Key Words: Optimization, finite element, mesh generation, charged system search.

ESTIMATING SHEAR STRENGTH OF RECTANGULAR SHORT REINFORCED CONCRETE COLUMNS USING GENETIC PROGRAMMING

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Abstract

The numerous collapse of reinforced concrete (RC) buildings reported during destructive earthquakes, happening around the world, are pertaining to short column failure. Shear collapse mode is the most devastating causes of failure in short RC columns due to intensive seismic cyclic loads. Since the code-based design equation for estimating the strength of these structural elements is basically based on pragmatic models, they cannot appropriately estimate the resistance over a wide range of involved variables. Evaluating collapse capacity of these structural elements has been an attractive topic of research for the last few decades. The major goal of this paper is to propose a model for shear strength of beam-column with shear span-to- depth ratio less than 2.5. To complete few available experimental samples, the purposed ABAQUS general finite-element method software is used to model 52 numerical samples to cover a wide range of various parameters involved in shear resistance. According to the performed experimental works, the effective shear strength parameters are axial force, transverse and longitudinal reinforcement, column aspect ratio, concrete compressive strength, and ductility. The finite-element models are validated against experimental data. To develop a closed form solution for evaluating shear strength, Genetic Programing (GP) is used. GP is an automated method for creating a working computer program from a high-level problem statement of a problem. GP starts from a high-level statement and automatically creates a computer program to solve the problem. This method is successfully used in various fields, including symbolic regression, image processing, network protocol design, patching buggy codes and robot control.

The proposed GP model is compared against shear strength provided by the existing relations of two major codes, e.g., ACI and EC2. Compared with experimental results, the average errors from the application of GP, ACI and EC2 are %15, %45, and %43, respectively. This shows that the proposed equation using GP is a precise relationship for the prediction of the shear capacity of rectangular short RC columns.

Key Words: Shear strength, short reinforced concrete column, genetic programing, finite- element method, code.

NUMERICAL STUDY OF NEGATIVE SKIN FRICTION PHENOMENON ON TAPERED PILES IN COHESIVE SOILS

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Key Words: Reinforced soil wall, geosynthetic, fine-grained, saturated, centrifuge.

VULNERABILITY EVALUATION OF BURIED STEEL PIPELINES UNDER SEISMIC WAVE PROPAGATION

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Abstract

Lifelines are essential for human life and economic development. Buried steel pipelines are the sort of lifelines that their strength under extreme events, such as earthquakes, is very essential. One of the causes of failure of buried pipelines is seismic wave propagation. Buried steel pipelines are vulnerable in extreme events such as earthquakes. In this study vulnerability of buried steel pipelines was evaluated using the results of incremental dynamic analysis (IDA). Several IDA analyses of three buried steel pipe models with a different diameter to thickness and burial depth to diameter ratios and different soil properties, were performed using far-field earthquake ground motion records. The models were designed based on American Lifeline Alliance (ALA) guidelines. The finite-element method was used in the analyses. The buried pipeline and the surrounding soil were modeled using beam, spring, and damper elements. The peak axial compression strain at the critical section of pipe was used as an engineering demand parameter of buried pipe and peak ground velocity (PGV) was considered as a ground motion intensity measure. Then, limit states for buried pipelines were proposed and fragility curves of pipes were developed based on IDA results for the limit states. In addition, a relation for damage ratio of buried pipelines in term of axial compression strain of pipe was proposed. The results of this study show that the maximum axial compressive strain of pipeline, due to seismic wave propagation, becomes 5.7 times with doubling the PGV. It was found that the predicted number of repairs increases by a factor of about 1.87 when PGV is double. The seismic damage probability of pipeline increases with increasing natural frequency of vibration of the pipe-soil system. It seems that the ALA guidelines are not enough for seismic design of some steel buried pipelines especially the soil-pipe systems with high natural frequency. This requires a more comprehensive study.

Key Words: Vulnerability, finite-element method, buried steel pipeline, fragility curve, incremental dynamic analysis.

AN OPTIMAL MESH GENERATION IN FINITE-ELEMENT BY CHARGED SYSTEM SEARCH ALGORITHM

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Abstract

Finite-element method is a famous and robust numerical method like other numerical methods. Due to the use of pre-defined and standard form of shape functions, this method will face a difficult situation and without any accuracy for exact modeling of the areas. The process of the finite-element network generation, with the appropriate number and type of elements, is one of the future challenges to this approach; its aim is to reduce the computational costs in order to discretize and solve the predominant equations of the problem. The derivatives of answer usually need the refinement operations to achieve acceptable accuracy in network-based methods. For this purpose, the methods of the enrichment-displacement refinement, refinement of enhancing element order and refinement of increasing the number of elements, and the combination methods can be used. The refinement in numerical methods is an efficient tool to reduce the computational costs and increase the accuracy of the results obtained. If the parts of the area of solving problem

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Abstract

Nonlinear time history analysis is the most accurate method for seismic response analysis of structures, and performing it for designing and evaluating purposes is inevitable in some cases. The most important issue in nonlinear time history analysis is the scaling method of ground motion records in order to have an accurate estimation of structural responses. In this paper, a new method for scaling of ground motion records is proposed, in which the nonlinear behavior of structures is considered. In the proposed method named SNSP (Scaling based on Nonlinear Structural Properties), the scaling factor of each record is determined in a way that the peak displacement of the equivalent single degree of freedom (SDOF) system subjected to the scaled record matches the target displacement. The target displacement is determined by averaging the values of the peak displacement of the equivalent SDOF system subjected to a large number of unscaled ground motion records. The characteristic parameters of the equivalent SDOF system are determined based on the modal pushover analysis, in which the load pattern is derived from the modal story shear profile of the structure. Thus, in the equivalent SDOF system, the effect of higher modes and the interaction between them in the inelastic phase are considered. Furthermore, the characteristics of the selected ground motion records are also considered using their response spectra in the proposed scaling procedure. The accuracy and efficiency of the proposed method were verified through four 4-, 8-, 14- and 20-story buildings under 21 near-fault records and was compared with the scaling method of the Iranian code of practice for the seismic resistant design of buildings, Standard No. 2800. Results show that the structural responses obtained from the proposed scaling method are close to the average responses considering site-specific records and the dispersion of responses is low.

Key Words: Nonlinear time history analysis, ground motion scaling, nonlinear structural properties.

FINE-GRAINED INFLUENCE ON THE BEHAVIOR OF REINFORCED SAND WALLS UNDER SURCHARGE LOAD USING CENTRIFUGE

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Abstract

Modern methods of reinforcing walls were used in the 60s by Henry Vidal. Reinforced soil wall is an alternative to retaining walls and traditional embankments. The use of geosynthetics as reinforcement in reinforced soil walls has been significant in recent years. Reinforced soil walls have been used in Iran since 70s. Accordingly,in some areas, due to the lack of access to suitable materials and high cost of material supply from far zones, fine-grained soils may be used for wall backfill. Reinforced slopes and walls come with various applications, including its use in bridge abutment. In this study, the effect of fine-grained soils, strip surcharge, and wall angle on behavior of geosynthetic reinforced soil walls using centrifuge modeling has been studied. In this study, a set of 8 centrifuge testes on saturated fine-grained walls reinforced with geotextile was performed using the geotechnical research center of Iran University of Science and Technology centrifuge, and behavior of physical models using digital image processing technique was studied. The comparison between place of rupture on geotextile and slid surface obtained from digital image processing was a good matched. Therefore, combination of centrifuge modeling with digital image processing is a good way to study the behavior of geosynthetic reinforced soil walls.

The results showed that with increasing load of strip footing, the amount settlements of top of wall increased, and this effect on vertical walls is more than the battered walls. Moreover, stains of reinforced layers and deformation of facing wall also increase when fines in backfill increased from %10 to %20. It was observed that slide surfaces were entry from behind of strip footing and developed to the toe of the walls. With increasing percent of fine-grained in backfill from %10 to %20, sliding surfaces were deeper. In addition, with the decreasing of angle of face, the models were stable. In addition, existence of %10 fines in sand backfill improves performance of geosynthetic reinforced soil wall (GRSW). If fines in the backfill increased to %20, GRSW would have poor performance.

by more cracks; consequently, the strength and strain of the HPFRCC specimens are increased significantly compared to those of normal concrete. The strength of HPFRCC specimens is between 5 to 8 times greater than that of normal concrete. In addition, the ultimate strains of the specimens are 70 to 100 times higher than that of normal concrete. Furthermore, toughness factor of HPFRCC specimens is 5 to 9 times higher than that of normal concrete. It is revealed that the mechanical properties of HPFRCCs have been considerably enhanced compared to normal concretes. HPFRCCs can be applied as an appropriate technique to restrain the reinforcement congestion, decrease the high value of transverse reinforcements at beam-column joints, and also improve the shear capacity and ductility of the members.

Key Words: High performance fiber reinforced cementitious composite (HPFRCC), straight tension test, strain hardening, bending toughness factor.

LABORATORY MODELING OF OIL CONTAMINATION PROPAGATION EFFECT ON SUBGRADE REACTION MODULUS OF FINE GRAINED SAND

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Abstract

The presence of oil in the soil media, by changing the interaction between soil particles, reduces the shear strength of the soil compared with clean soil. Finally, oil pollution, reduces permeability, internal friction angle and bearing capacity and increases volumetric strain and the resulting settlement of the structure. On the other hand, most of the foundation analysis methods require the use of subgrade reaction modules as a basic parameter to assess elastic situation of the subgrade and determination of the stiffness and load-deformation behavior of the soil. It should be noted that, subgrade reaction modulus is obtained mainly through field plate loading testing. In this study, using physical modeling with plate loading, deformation behavior and stiffness of oil-contaminated sand and reaction modulus for the different percentages of oil contamination will be reviewed. The results can present a more appropriate estimate of the amount of elastic settlement of the structures rested on the contaminated soils, also refine the amount of footing's flexibility on this group of soils. The most effective parameters on the soils stiffness in this field include the soil classification, relative density, type of contamination and the amount of contamination in the soil. These variables can be effective in the process of the possible changes of stiffness and soil reaction modulus. Gas oil, crude oil and kerosene have been used as contamination materials. These liquids have been added into the sand in three different percent rates, 2, 4 and 6. The sand has been compacted in three different situations; loose, medium and dense. Based on this research, oil contamination causes substantial decrease in soil stiffness and more greasy oil contamination is even more effective in reducing the soil subgrade reaction. In addition, dense soils stiffness is less sensitive to oil contamination effects. These results can be used for investigating the sites in which there is a possibility of oil leakage to layers of the land. Results have been presented in the form of empirical equations.

Key Words: Subgrade reaction modulus, anzali sand, oil contamination, physical modeling.

SCALING OF GROUND MOTION RECORDS BASED ON THE NONLINEAR BEHAVIOR OF STRUCTURES

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Abstract

Impact damper is considered as a passive control system. Experimental and analytical studies have shown that this group of non-linear dampers has a better performance than linear vibratory neutralizers in terms of reducing structural vibrations. The main factor influencing this type of damper in controlling vibrations is that the small forces, created by moving masses of impact dampers reduce sharp vibrations by creating disruption in the oscillation range of the structure.

So far, modeling of the impact damper has been conducted solely through MATLAB software. Naturally, the functional aspects of this software are limited in research and development aspects compared to the common programs such as SAP2000 and ETABS. In this study, using SAP2000 software in modeling impact dampers, relatively tall building models are used to compare the performances of impact damper in high-rise buildings, and the seismic performance of such buildings with impact damper is investigated. The purpose of this study is to evaluate the performance of impact damper in tall buildings and to determine the best placement of damper in reducing the amplitude response of the system under vibration.

In order to achieve favorable results for tall buildings under seismic vibration, both near- and far-field earthquakes are selected and applied to 10- and 25-story steel buildings. The analysis used in this study is of nonlinear time-history kind, and the design of structural elements is performed considering AISC360-10 Code requirements. One of the main results of this study is the decreased amplitude response of 10 and 25-story steel buildings under vibration due to the placement of impact damper on the roof up to 14% and 16% under far- and near-field earthquakes, respectively. It is also observed that if the height and number of openings increase, the effect of the placement of impact damper in the middle floors will become closer to the placement of damper on the roof due to the combination of vibration modes.

Key Words: Non-linear damper, impact damper, MDOF system, SAP2000 software.

EXPERIMENTAL EVALUATION OF HIGH-PERFORMANCE FIBER REINFORCED CEMENT COMPOSITES BEHAVIOR

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Abstract

High-performance fiber cementitious composites are new materials in construction industry. Investigation into their behavioral characteristics needs experiments due to the lack of data. In this study, tensile, compressive and bending behavior of this material is examined using experimental tests .High-performance fiber reinforced cementitious composites (HPFRCC) have strain hardening response under straight tension after cracking. Numerous cracks are formed before the crack widening occurrence when these composites show hardening behavior. HPFRCC are basically integrated with two main components including fiber and mortar. These two ingredients are interactively affected due to interfacial bonding which develop a strong composite. The advantages of HPFRCC in comparison with normal and fiber reinforced concrete (FRC) are ductility, durability, and high-energy absorption capacity. In this paper, evaluation of strain hardening behavior in HPFRCC is conducted using straight tension and tensile strain-stress curve. Moreover, bending behavior, load-displacement curve, and toughness factor of this material are evaluated using four-point bending test, and the performance is compared with bending behavior of normal concrete. In these tests, three fiber types, including hooped steel fiber, corrugated steel fiber, and poly propylene fiber, are used in the mortar separately and in combination with each other by volume percentage of 1.5%. To achieve a proper strain hardening behavior, different mix ratios are investigated and the best mix design is determined. The results showed that all specimens mixed with fibers have strain hardening behavior accompanied

displacement-restraint bracing and thin infill panels are examined. Steel plate shear wall systems have attracted more attention in the past few years as one of the major lateral-load resisting system in steel buildings. In this context, many investigations have been conducted in different countries. In this study, to eliminate the abovementioned disadvantages, a SW-TB system is used to retrofitting of a steel frame. Recent researches indicate that this type of shear walls has a very good performance in comparison to its traditional form (i.e., SSW= Steel Plate Shear Wall). For this purpose, the Finite-Element Model (FE) of steel frame retrofitted with steel shear walls and tension-bracing has been made. The obtained results of this model are compared with Laboratory data. The comparison shows that the finite-element model produces similar results to those of the proposed method in the laboratory. After the experimental validation, this method is compared with three other methods. The FE analysis results show that using this method causes the lateral resistance of the structure to increase as much as 50 percent with good ductility, and the need to enhance the lateral columns and foundations will be limited.

Key Words: Steel moment frames, steel shear walls, steel plate shear wall with tension bracing, tension bracing, retrofitting of steel moment frames.

SIZE EFFECTS FOOTING ON THE SEISMIC PERFORMANCE OF THE MID-RISE BUILDING CONSIDERING THE DYNAMIC SOIL-FOUNDATION-STRUCTURE INTERACTION AND COMPARED WITH CONE MODEL

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Abstract

Shallow foundations are among the most common types of foundations used to support mid-rise buildings in areas with high seismic hazard. Recent studies have indicated that dynamic interaction of soil-foundation and building can affect the seismic response of structures during an earthquake. Therefore, the foundation features can also change the dynamic characteristics, such as natural frequency and damping of the soil-foundation-structure system. In this research, a 14 story moment resistant frame building built on shallow foundations with various dimensions has been considered and the three dimensional prototype of all three components of soil-foundation-structure system has been modeled by ABAQUS finite element software. Also modal analysis was performed to calculate the natural frequencies of each model. In the present study, infinite boundaries were applied in order to simulate free field condition and appropriate contact elements were used to model the slip and separation phenomena between foundation and soil elements. To do so, finite element direct models were developed. Cone model, as one of the approximate methods that considers SFSI with practical engineering precision was verified and then applied in the series of simulations. An assessment procedure was applied to check the accuracy of Cone model as an approximate method in comparison with direct method. Structural responses including lateral deformation, drift, rotation and shear force distribution were studied for all cases including fixed-base, cone model and SFSI direct models. Modal analysis implies that SFSI can reduce the natural frequencies of the building. The results show that shallow foundation size, due to the interaction between soil, foundation and structure, influences the dynamic characteristics and seismic response of building. As a result, engineers should carefully consider these parameters to ensure the safety and economic seismic design. Cone Model with an appropriate engineering precision, functionality and high analysis speed is capable of assessing dynamic stiffness of soil due to the soil-foundation-structure interaction phenomena.

Key Words: Dynamic soil-foundation-structure interaction, Cone model, ABAQUS software, dynamic response.

EVALUATING BEHAVIOR OF HIGH-RISE STRUCTURES EQUIPPED WITH IMPACT DAMPER UNDER NEAR- AND FAR-FIELD EARTHQUAKES

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Abstracts of Papers in English

APPLICATION OF STEEL PLATE SHEAR WALL AND TENSION-BRACING IN RETROFITTING OF STRUCTURES

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Abstract

A rehabilitation technique that utilizes a thin steel plate as a supplemental shear wall system for steel moment frames is described. In the proposed system, the plate and surrounding boundary elements are installed in the middle of the bay, separate from existing columns (SW-TB =Steel Plate Shear Wall with Tension-Bracing). This geometry intends to reduce the forces transferred to the existing columns. In this paper, the behavior of steel moment frames using the proposed system is investigated. Among the methods of retrofitting of the steel frames, application of steel bracing system has been studied by some researchers. The results of these studies show that retrofitting of steel frames by adding braces has disadvantages such as increasing axial forces in adjacent columns, brittle behavior in the frame joints, buckling the bracing member, and creating a permanent deformation on the frame. In order to remove these disadvantage researches such as the use of non-compression brace, buckling-restrained braces, dissipative bracing systems,