REDUCTION OF POTENTIAL COLLAPSE

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Abstract

Iran is a country with unstable soil. If soil classes, characteristics and structures are not identified properly, railroads or roads that are to be built can face significant problems, as the soil becomes saturated. Some soils in our environment cannot undergo the normal tension they encounter, and by the slightest increase in the ratio of humidity, will encounter high settlement. These kinds of soil, mainly found in hot and dry regions, like deserts, are called collapsible soils. In this article, to correct the soil of these regions, some items, like the behavior of lime injected materials in the presence of clay in cementitous soil, for creating suitable adhesion among grains and micro-silica as porosity filling materials, are studied separately.

In this study, to investigate and stabilize soil, reduce collapse potential and increase its strength properties, the use of limestone injection technology has been considered. Then, the collapse potential of the soil under injection has been compared with that of natural state soil. The results indicate the good performance of the injection method compared with existing methods. These results show that the injection of lime will reduce the potential for soil collapse. The soil shear strength parameters improved after injection, and the value of ϕ_u after injection reached an amount of approximately 2.15 times the initial internal friction angle. Parameter ϕ' increased up to 1.62, which, considering the fixed amount of tension in both tests on soil in normal state, and the injected soil, was associated with an increase in internal friction and a reduction in the adhesion of soil grains. The results of field and laboratory tests reveal that according to clay cementation among soil grains on site, the injection of lime would result in a considerable reduction in the collapsibility potential of soil in a saturated condition. Therefore, it can be suggested as a suitable solution.

Key Words: Problematic soils, potential collapse, lime injection, soil shear strength, soil cohesion.

DEVELOPMENT OF ANALYTICAL FRAGILITY CURVES FOR IRAN'S MASONRY SCHOOL BUILDINGS

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Abstract

Earthquakes are undoubtedly a most important natural disaster and, therefore, in recent decades, the seismic vulnerability assessment of existing buildings has become an important issue. One of the latest achievements in seismic vulnerability assessment is the seismic fragility curve. Fragility curves describe how the reliability of a structure changes over a range of loading conditions to which a structure may be exposed. Approaches to developing fragility curves can be classified into four main categories: judgmental, empirical, analytical, and hybrid. Fairly extensive studies have been done for concrete and steel structures and also for different types of bridges, while, for masonry buildings, only limited studies are available. Iran is in a high seismicity area in the world where a large number of masonry buildings have been constructed. In this study, an analytical approach was used to develop fragility curves for 1 story, 2 story and 3 story masonry school buildings on different soils. In order to achieve more realistic fragility curves, 24 analyses were performed for each building. The following conditions were considered in these analyses: applying lateral force in 2 main axes (x and y) and 2 main directions (positive and negative), eccentricity, applying lateral force in 2 cases (first mode and mass). The computer program, Tremuri, and the design spectrum of Standard No. 2800 have been used in this study. Finally, by assuming a log-normal distribution probability function, fragility curves were obtained. It is worth noting that the peak ground acceleration (PGA) is selected as a parameter that represents the intensity of seismic ground motion.

Key Words: Seismic vulnerability assessment, fragility curves, masonry buildings, peak ground acceleration (PGA).

Tunnel form concrete structures are not often mentioned and discussed in present codes, especially Iranian codes. Thus, the seismic behavior of this structural system, designed and constructed with present codes, is the main query of this study.

In this study, eighteen tunnel form concrete structures, as representatives of low- to medium-rise structures (6 different plans with 6, 9 & 12 stories), were structurally analyzed and designed. Section properties, such as thickness, reinforcement ratio and boundary element length of shear walls, were calculated, and essential parameters of the seismic behavior of structures, such as ductility, overstrength, base shear ratio, roof drift and response modification factor, have been derived.

It was determined that the first mode shape of tunnel form structures has a high probability of being torsion. In low rise structures, the code's minimum design requirements, compared to calculative design needs, are dominant in the structural design of shear wall sections and the overstrength factor is relatively high. Thus, the tunnel form system is not economically justifiable for low-rise buildings. The failure mode in tunnel form structures could be failure in steel or concrete. In cases where the length in one direction in the plan is high, the failure is more probably in concrete. In low-rise structures, energy absorption is realized by overstrength, but in high-rise structures, it is realized by ductility. Increase in the number of parallel shear walls has no effect on the strength and base shear ratio of tunnel form structures.

Key Words: Tunnel form concrete building, shear wall, response modification factor, ductility, overstrength, pushover analysis.

PERFORMANCE ANALYSIS OF DEEP SOIL NAIL WALLS BASED ON EXCAVATION-INDUCED DAMAGE

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Abstract

Response assessment of buildings to excavation-related ground movement is an important design aspect of support systems in urban areas. This is even more important if the adjacent structure be old or have low strength parameters. Frame distortion and crack generation are signs of building damage by excavation-induced ground movement, and are a challenge in projects involving deep excavations. These highlight the importance of the evaluation of building responses in excavation projects.

The aim of estimation and evaluation of building response is to establish limiting criterion for excavation support system design to certify structural safety against undesirable damage. Thus, the limiting criterion prepares a framework to determine the damage level of buildings based on excavation induced ground movement. Limiting criterion is also known as damage criterion or damage models. Damage models are too practical before design progress of nailing wall. Based on the uncertainty of data from excavation projects and the variability of the many factors that contribute to the response of nearby structures, existing damage models are rare and generally need special instrumentation of the excavation wall and nearby structures. So, they cannot prepare a simple framework for use in practical situations.

This paper describes a study of building responses to excavation-related ground movement and provides a procedure for damage assessment of buildings near excavation projects. This study uses field data based on 10 case studies and calibrated FEM models, in addition to probabilistic analysis, to establish new simple damage criteria for design consideration of excavations supported by a soil nail wall technique. The presented damage model simply relates the damage level of the structure to the maximum displacement of the excavation wall.

The deflection mode of a soil nail wall for two types of nail distribution and 23 types of soil, in addition to the results of free field analysis, are also topics presented in this paper to achieve the damage model.

Key Words: Excavation, nailing, performance, damage model.

SOIL STABILIZATION WITH LIME FOR THE IMPROVEMENT OF STRENGTH PARAMETERS AND

EFFECT OF LATERAL FORCE RESISTING SYSTEM ON SEISMIC PERFORMANCE OF SPECIAL STEEL FRAMES UNDER PROGRESSIVE COLLAPSE

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Abstract

Progressive collapse first attracted the attention of engineers from the structural failure of a 22-story apartment building at Ronan-Point, London, UK, in 1968. The terminology of progressive collapse is defined as "the spread of an initial local failure from element to element, eventually resulting in the collapse of an entire structure or a disproportionately large part of it". Any weakness in design or construction of structural elements can induce progressive collapse in structures during seismic loading. The modeling of building responses to progressive collapse has interested more and more researchers during the past two decades. The aim of this study is to investigate the seismic performance of special steel buildings including, moment resisting frames, moment resisting with concentrically braced frames and moment resisting with eccentrically braced frames, designed based on seismic codes with damaged members, and their ability to resist progressive collapse under earthquake loading. For this purpose, nonlinear dynamic analysis on 3-D structures using PERFORM 3D software was carried out, and seismic performance with a progressive collapse potential of 5 and 15 story buildings with 4 bays, applying an alternate load path method proposed on GSA2003 and UFC2009, was assessed. In this paper, plastic hinge generation in elements, story drift and the performance level of frames for various locations of column removal and lateral force resisting systems are investigated. Considering the response of the structures, it can be observed that the seismic behavior of structures basically depends on the location of the eliminated column and the type of lateral load resisting system, indicating the advantage of special moment resisting frames equipped with eccentric bracings. The reported results give better insight into understanding the effect of the type of lateral load resisting system on the dynamic response and seismic safety of special steel frames under progressive collapse. The results also state that when local damage occurs in the lower stories of steel frames designed according to special seismic requirements, no potential for progressive collapse exists.

Key Words: Progressive collapse, special steel frame, lateral force resisting system, seismic safety, nonlinear-dynamic analysis.

EVALUATION OF EFFECTIVE PARAMETERS ON SEISMIC BEHAVIOR OF TUNNEL-FORM RC BUILDINGS USING NONLINEAR STATIC ANALYSIS

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Abstract

Tunnel form construction is a new method in industrialized construction that could be broadly used in mass construction projects, thereby decreasing construction time and having appropriate performance against lateral forces. Reduction of material consumption and, therefore, decrease in expense, are the advantages of this method. This leads structural designers to choose tunnel form systems because of limited natural and financial resources in their countries. Nevertheless, lack of sufficient guidelines and codes for structural design and construction are among the defects of tunnel form concrete buildings. Moreover, the modular shape of this system creates some restrictions in architectural design.

The presence of subsurface structures has static and dynamic interaction with their environment and adjacent constructions. Recently, the effect of underground structures on the acceleration response of the ground surface has attracted the attention of researchers, since it has been concluded that the presence of these subsurface structures also affects the seismic response of nearby ground.

There are many parameters affecting the presence of underground structures on the acceleration response at the ground surface. These parameters include soil medium characteristics, excitation frequency and amplitude, tunnel diameter, depth of construction, and flexibility ratio of the lining.

In this paper, a nonlinear numerical model was first verified against dynamic centrifuge test results performed at the Korean Advanced Institute of Science and Technology (KAIST) on an underground subway tunnel and, then, the effect of underground structure lining flexibility on the acceleration response at the ground surface was investigated. In this regard, the acceleration response at ground surface for three different materials of the lining was studied. From parametric studies, it was concluded that the same values of flexibility ratio for two tunnel systems with different lining material resulted in the same acceleration response at the ground surface. The flexibility of the lining affects the acceleration response at the ground surface; however, it depends on the frequency content of the input motion and the natural frequency of the system. Stiffer lining resulted in amplification of motions with short periods, which threatens short buildings, whereas, softer lining amplifies motion with longer periods, which can be dangerous for tall buildings. Therefore, the flexibility of the lining plays an important role in acceleration response at the nearby ground acceleration response.

Key Words: Underground structure, flexibility ratio, ground surface, acceleration response, FLAC 2D software.

RESPONSE MODIFICATION FACTOR FOR DUAL SYSTEM OF MEDIUM DUCTILITY STEEL MOMENT FRAME CONCENTRIC BRACED WITH PALL FRICTION DAMPER

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Abstract

The response modification factor in analysis and design standards, used to reduce design forces, represents seismic energy absorption from the time of creating the first plastic hinge until the collapse mechanism. Various parameters are effective in the determination of Such reduction factor, the strength factor and the redundancy factor. Dampers act, as means of seismic retrofit, induce energy dissipation, and the use of such dampers is proposed in order to reduce structural damage during an earthquake. Much research has been done on the response modification factor; but the role of the friction damper and its effects on the parameters of such factors have not been fully investigated.

In this paper, by considering a pall friction damper in stories using nonlinear analysis, the impact of dampers on the response modification factor of two-dimensional 3, 6 and 9-story steel moment frames, with 3, 5 and 7 bays (designed based on Standard No. 2800 (Ver. 4), the latest version of the 6th and 10th Iranian codes and the 1st revision of Standard No. 361), is investigated. The side frame structure studied here has a span of 5 meters and a story height of 3 meters. The next step is to consider concentric braces in the middle bays of the frame with medium ductility, followed by re-analysis and design.

For the damper model, plastic elements (WEN) are used in SAP2000 software. In this study, first, nonlinear static analysis is undertaken, and to check the actual behavior of structures and for better assessment of results, Nonlinear Incremental Dynamic Analysis (IDA) is used, considering step by step increasing acceleration until reaching the life safety limit. In all cases, the force displacement curve of increasing dynamic analysis indicates compatibility with the results of static analysis.

Based on obtained results, considerable improvements in the response modification factor up to 100% are observed in the dual system of the steel moment frame and concentric brace with a pall friction damper. Finally, a strength factor of 3.55, ductility factor of 3.37 and response modification factor of 12 are proposed for the frame systems with dampers studied here, due to a high energy absorption capacity, based on a minimum amount.

Key Words: Response modification factor, pall friction damper, steel dual system, concentric brace, nonlinear static analysis, nonlinear dynamic analysis.

Key Words: Steel plate shear wall, performance-based seismic design, displacement-based seismic design, yield mechanism, plastic design, yield displacement, yield drift.

OPTIMUM SELECTION OF YIELD DISPLACEMENT OF METALLIC-YIELDING DAMPERS IN STEEL MOMENT RESISTING FRAMES

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Abstract

A metallic yielding type of damper is one of the oldest and most widely used passive energy dissipation devices to decrease the dynamic response of buildings subjected to strong ground motion, such as Added Damping and Stiffness (ADAS) elements. The proper selection of design parameters of these devices has an important effect on the structural inelastic behavior. One of these parameters is yield displacement. Previous studies have shown that the yield displacement of ADAS elements is a more effective factor than other design parameters in controlling the ductility demand of a structure. In this paper, a new method for optimum selection of this design parameter of metallic yielding dampers, in different stories of a moment resisting building frame, is proposed, using the concept of the uniform distribution of ductility demands. Three frame models, including 3, 5, and 10-story moment resisting frames, were used for nonlinear dynamic analyses. The obtained results showed that using a fixed amount of yield displacement of dampers for all stories might not lead to uniform distribution of the ductility demand. Therefore, the employment of such distribution for this design parameter does not guarantee the optimum use of dampers in the nonlinear range of behavior. In the modeling of the frames, it was assumed that all elements remained elastic and behaved linearly except damper devices. The nonlinear behavior of the damper devices was modeled with a bilinear elastic-plastic shear spring with kinematic hardening behavior. Using the proposed method, it was demonstrated that a great decrease in damage index occurred after the optimization procedure for the device yield displacement. In all models, the coefficient of variation (cov) of the ductility demand distribution along the building height, in the initial step, is large, indicating that the distribution of story ductility demand is not uniform. However, after the optimization procedure, the cov becomes small enough and a state of rather uniform height-wise distribution of ductility demand prevails. Furthermore, damper hysteretic behavior is improved and all dampers participate in the earthquake input energy dissipation after the optimization.

Key Words: Steel moment resisting frames, metallic-yielding dampers, earthquake, nonlinear analysis, optimization, yield displacement.

EFFECT OF UNDERGROUND STRUCTURE LINING FLEXIBILITY ON ACCELERATION RESPONSE AT GROUND SURFACE

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Abstract

Fast population growth in urban areas has resulted in a significant shortage of aboveground spaces and has led to an increase in underground structures. Different types of underground spaces and structures, including underground utility tunnels, subway tunnels, subway stations, underground shelters, culverts and etc., may exist in any large city.

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Abstract

Significant differences between specifications of structural damage occurrence for buildings subjected to near-field and far-field earthquakes have been observed in recent years. According to recent experiences, there has been extensive damage occurrence in structures subjected to near-field earthquakes compared to far-field ones. The adopted approach in existing design codes is the consideration of coefficients, to take into account the effects of near-field earthquakes in evaluating the design base shear of structures.

The aim of the present paper is the development of structural design methods for more adequate simulation of near-field earthquakes effects in the structural design process in order to take into account an increase in the seismic demand of structural systems. In this method, the effects of near-field earthquakes are not limited to only consideration of additional design base shear demands, but extra capacity, in addition to the ultimate strength of the structure is demanded also. In the present study, the proposed development of current Iranian seismic design provisions for estimating near-fault earthquake effects in the structural design process of buildings is investigated. In this manner, some near-field coefficients are proposed for some of the near-fault areas of the country, based on the results of seismic hazard analysis. It should be noted that in this investigation, both deterministic and probabilistic approaches are followed in the seismic hazard assessment procedure and various attenuation relationships have been considered with judgmental weighting factors and the obtained results have been combined in a logic tree. In addition, the proposed modifications and corresponding results are compared with the current code-conforming seismic demands for two special cases; the Imam Reza holy shrine site and Ahwaz oil field. The obtained results lead to a significant increase in design base shear, especially for structures with low and medium natural periods in near-fault areas, when compared with corresponding structures located on far-field sites.

Key Words: Near-field, seismic demand, near-fault design spectrum.

DESIGN OF STEEL PLATE SHEAR WALLS, BASED ON INELASTIC DISPLACEMENT DEMAND

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Abstract

Over the past few years, unstiffened steel plate shear (SPSW) has been used as a lateral load resisting system, due to its proper behavior against earthquake. The designing procedure in seismic codes for these systems is still based on the elastic force-based method. Nowadays, the inelastic behavior in these methods is gradually being replaced with performance-based seismic design (PBPD) methods. One of these methods is performance based plastic design (PBPD). The design concept in this methodology is based on performing a desired yield mechanism in the structure and an inelastic target displacement. In this procedure, determination of the inelastic design base shear structure requires basic assumptions and an iterative process to achieve the intended performance (target displacement). One important basic design parameter is to determine the initial structure yield drift which has been associated with some inadequacy in most studies.

In this paper, the design methodology for an unstiffened steel plate shear wall system has been developed, and a simple method to determine the amount of structure yield drift has also been proposed.

This design methodology had already been checked for 6 structures with five and ten stories and 3 different target ductility values (2 , 3 and 4) under a design level earthquake, based on the Iranian earthquake code (Standard 2800). Inelastic static analysis (Pushover) of designed structures based on this method reveals that the actual ductility of structures is close to the assumed target ductility and the actual yield mechanism is the same as the assumed yield mechanism. Based on the test results, the yield drift value is different in each structure, and, to achieve the correct design, iteration methods are essential to yield drift convergence in the design process. In addition, results showed that the proposed method for determination of structure yield drift is very quick and reliable for use in the design procedure.

oxidation of the dye solution excites an electron from the valence band to the convention band, and so, makes an electron-hole as a charge carrier. An important issue is the fast recombination of this new formed electron-hole, which can emit energy, otherwise scavengers are used. Using scavengers will retard the recombination of the pair electron-hole and will enhance the photocatalytic process efficiency. Scavengers are classified into three groups: 1) electron scavengers such as O_2, $S_2O_8^2-$, Fe^3+, IO_4^- and BrO_3^-2) hole scavengers such as formic acid, salicylic acid, oxalic acid, methanol, ethanol, sucrose, peroxide hydrogen, nitrate, nitrite, chlorite, chlorate, potassium iodide, sulfate, phosphate and EDTA and 3) is radical, like alcohol. In this research, the accelerating photocatalytic removal of DB 71 was investigated with scavengers, including hydrogen peroxide, sodium hypochlorite and EDTA. The process was done with immobilized TiO_2 nano-particles on a cementitious bed as a photocatalyst. In order to determine the optimum conditions, scavenger dose, pH, initial dye concentration and intensity of UV-C radiation were investigated. After 20 minutes, 100 mg/L dye was decolorized at pH 8 under 90W irradiation of UV-C, and with 0.006 M H_2O_2; 15 times faster than a system without H_2O_2. Also, 0.01 M NaOCl was decolorized at 100 mg/L DB 71 at pH 11 under 90W irradiation; 35 times faster, and 75 mg/L dye was decolorized by 0.03 M EDTA at pH 6 under 60W irradiation; 2.5 times faster. For comparison, hydrogen peroxide, as a good scavenger, which is environmental friendly with no undesirable intermediate compounds, was chosen as optimum scavenger.

Key Words: Hydrogen peroxide, sodium hypochlorite, EDTA, concentration, pH.

ON THE INFLUENCE OF ENGINEERED INFILLS ON SEISMIC BEHAVIOR OF STEEL STRUCTURES, COMPARED WITH SHEAR WALLS, RC INFILLS AND ISOLATED INFILLS

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Abstract

Infill panels are used in buildings for architectural purposes. It is proven that they change the stiffness, strength and damping of a building, but they are ignored in the analysis and design phases, because of many uncertainties and complications. They have a lack of ductility, which is normally required in earthquakes, and, therefore, scientists have focused on new types of infill panel with high ductility. One of these infills has recently been proposed, which has a frictional sliding fuse at mid-height. This type of infill is called an engineered infill panel, and its high strength and ductility have been confirmed by experimental and numerical research. The strength of engineered infill panels rises by increasing the sliding strength of their fuses, which can be adjusted for different values easily through some bolts.

The effects of applying such infill panels are investigated on the seismic behavior of the buildings and compared with regular concrete infills, isolated infills and shear walls. For this, moment frame structures of 1, 3, 5 and 7 story buildings, designed on the basis of Iranian codes, are considered. Then, nonlinear time history analyses are carried out for one frame of each building. IDARC 2D Version 7.0 is applied for the analyses.

Five earthquake records, including Kobe, Tabas, Elcentro, Northridge and Manjil, are applied in the analyses and the damage indices of the buildings are compared. The Park and Ang formula is chosen for the damage index. The results show that application of the fused infill panels improves the seismic behavior of the buildings and are superior to other considered elements e.g. shear walls, regular infills and isolated walls.

Key Words: Engineered infill panel, shear wall, earthquake, stiffness, strength, ductility.

DEVELOPMENT OF IRANIAN SEISMIC DESIGN PROVISIONS FOR ESTIMATING NEAR-FAULT EARTHQUAKE EFFECTS- CASE-STUDY: IMAM REZA HOLY SHRINE AND AHWAZ PETROL-FIELD

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ability of exceedence from the upper performance level, i.e. "near collapse", when PGA, PGV, and Ia are chosen as intensity measures, are 46%, 51%, and 40% percent, respectively.

Key Words: Fragility curves, performance-based design, caisson quay wall.

NUMERICAL ANALYSIS OF GEOCELL REINFORCED ROAD EMBANKMENTS AND EVALUATION OF EFFECTIVE PARAMETERS ON THE PERFORMANCE OF GEOCELL REINFORCING SYSTEM

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Abstract
The use of reinforced soil has been considered since long ago. Due to the improvement in technology, different kinds of reinforcement, including geosynthetic and steel types, have emerged. Geocells, as a special type of geosynthetic, have recently been used for soil improvement. Their three dimensional geometry causes extreme lateral confinement for infill soil. This phenomenon leads to increased soil deformability and strength properties. The geocell reinforcement system is in the process of practical development due to its several advantages.
Based on literature reviews in this field, theories and design methods are far behind applications in the field, especially roadway applications, due to a lack of understanding of their mechanisms and influencing factors.
There are rather extensive laboratory studies in the field of geocell reinforcement, but because of its complexity, numerical modeling of geocell reinforcement has rarely been performed and most numerical studies are based on equivalent composite models for representing the strength and stiffness of geocell confined soil. In a composite model, the geocell reinforced soil is replaced with a soil with higher parameters. These parameters are selected based on limited test results performed on geocell reinforced soil. Therefore, generalizing them to other kinds of soil could be accompanied by further errors. In this numerical study, geocell and soil were simulated separately in 3D. Hence, this numerical modeling has no composite assumptions and errors. Also, all key behaviors of the geocell were included completely.
In this paper, geocell reinforced road embankments are simulated using the Finite Difference Method (FDM) of FLAC3D. Geocell was simulated using geogrid structural elements, and the elastic-perfectly plastic Mohr-Coulomb model was used for modeling the behavior of soil. In order to verify the modeling, results were compared with the results of a laboratory test, and, then, different factors influencing reinforced embankment performance, including soil properties and the placement of geocell layers, were investigated.

Key Words: Reinforced soil, road embankment, geosynthetic, geocell, FDM, FLAC3D.

SCAVENGER EFFECTS ON ACCELERATING PHOTOCATALYTIC REMOVAL OF DIRECT BLUE 71 DYE WITH NANO TIO2 IMMOBILIZED ON A CEMENTITIOUS BED

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Abstract
Prevention of textile industry wastewater discharge into bodies of water is an important matter to save the environment from carcinogenic aromatic non-biodegradable compounds. It is, therefore, essential to utilize a new cost effective technique which completely mineralizes these organic pollutants. The photocatalytic process, with semiconductors such as TiO_2, is a new technology that has been used in recent years. The most important fact is that TiO_2 nano-particles are more stable, cost effective, and non-carcinogenic. They also use solar irradiation as an exciting agent. The primary step of photo-

Abstracts of Papers in English

PROBABILISTIC SEISMIC VULNERABILITY OF CAISSON QUAY WALLS: CASE STUDY OF KOBE PORT

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Abstract

Ports and marine facilities play important roles in global transportation and commercial activities. Earthquakes can create significant damage to ports and other marine facilities because such systems commonly rely on geological units containing problematic soils. Several sections of the quay walls constructed in Kobe Port were reportedly damaged during the catastrophic Kobe 1995 earthquake. This paper deals with the seismic vulnerability of a damaged section of this port via the results of fully nonlinear numerical analyses and subsequent probabilistic analysis. Numerical analyses were carried out using the finite difference method, contributing a constitutive model capable of simulation of liquefaction occurrence. Results of the preliminary numerical analyses were compared with those observed in the field, as well as the findings of previous researchers in terms of lateral and vertical permanent displacements. This preliminary benchmark analysis provided satisfactory results in order to confirm the numerical modeling for the subsequent runs. Several subsequent analyses were then performed using many input motions recorded during different earthquakes. To investigate the seismic vulnerability of the wall subjected to several input motions, probabilistic analyses were carried out on the pool of the numerical results for evaluation of system fragility curves. Fragility curves for different levels of damage; "serviceable", "repairable", and "near collapse", were drawn, based on various intensity parameters including PGA, PGV, and Ia. It is shown that different damage probability can be obtained from various seismic parameters in every earthquake. A fragility curve based on a single intensity measure cannot appropriately represent the probability of failure in such structural-geotechnical systems. According to the results of this study, the prob-