at 28 days can, thus, be overcome through the use of ternary mixes. At later ages, ternary mixes have excellent durability and can even outperform binary mixes containing equal amounts of silica fume. Using an appropriate combination of slag and silica fume, it is possible to obtain ternary mixes with 28 day strength comparable to the control mix, and with considerably improved durability, particularly in the long term.

Key Words: ternary concrete, slag, silica fume, durability, RCPT, RCMT.

APPLICATION OF AXIS TRANSLATION TECHNIQUE FOR MEASURING INITIAL MATRIX SUCTION OF COMPACTED SOIL ON WETTING PORTION OF SWCC

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 127-136, Research Note

- Received 12 September 2011; received in revised form 1 May 2012; accepted 15 October 2012.

Abstract

The axis translation technique is the most commonly used technique of controlling suction. Nevertheless, the axis translation is not diversely utilized for measuring soil suction, due to many difficulties concerning the application of this technique, such as lengthy test procedure, evaporation and condensation, air diffusion, soil volume changes, change of soil pore water distributions, and the interface of soil and measuring equipment. In this paper, the applicability of the axis translation technique is determined in measuring the initial matrix suction of a variety of compacted soils, including sand, silt, and clay. Elaborate experimental laboratory equipment is set up to minimize the occurrence of common errors associated with the application of axis translation techniques for suction measurement. The cell of the apparatus was equipped with porous stones and five bar ceramic disks in its bottom pedestal and top cap to minimize the lengthy procedure time and possible change in soil pore water distribution associated with controlling and measuring soil matrix suction using the axis translation technique. Additionally, the pressurized air entering the cell was passed through a closed container, half filled with water, before going to the cell, to minimize the loss of soil water content during the test. Soil samples were statically compressed inside a load frame in different compaction states with standard proctor optimum water content. The degree of saturation of samples was increased during the compression stage. Therefore, the compacted soil samples would be expected to locate on the wetting portion of the soil-water characteristic curve. After the compaction stage, soil samples were installed inside the apparatus and confined with a lateral pressure of 20 kPa to provide good contact between the end sides of specimens and the surfaces of the matrix suction measuring devices. Consequently, pore air and net confining pressure were identically and gradually increased to 300 and 320 kPa to shift the sample negative pore water pressure to a positive measurable value. Analogous positive pressures were stabilized in both ends of the samples within four to eight hours. Additionally, the wetting portion of the soil-water characteristic curve of the soil under study was measured with the testing equipment to validate the values of initial matrix suction measurements. The comparison of results shows that the sample soil suction measurements are located on their wetting soil-water characteristic curve.

Key Words: unsaturated soils, compressibility, matrix suction measurement, axis translation technique, soil-water characteristic curve.

• Received 8 May 2011; received in revised form 19 February 2012; accepted 22 September 2012.

Abstract

Poorly graded clean sand sediments formed on coastal zones are usually in a loose state, especially at shallow depths and when saturated, show low strength values even under static loading. This is because under cyclic loading, like seismic excitations, excess pore water pressure undergoes a sudden rise and, hence, decreases the strength to reach a condition near initial liquefaction or excessive settlement. One of the most important reasons behind intensifying the cyclic loading effect is indeed stress reversal, or, when after loading in a compressive manner, a reverse loading equal to twice the compressive amplitude will be applied in such a way that the soil element experiences an extension. In the latter case, the major principal stress direction will rotate from vertical to horizontal direction or the α change of 0 to 90 degrees will occur. Furthermore, under many monotonic loading/unloading conditions, the major principal stress may also change its direction, with respect to the vertical direction and the stress path on the soil element after from, for example, compression to extension. Therefore, it can be simply concluded that knowing the values of strength in monotonic compression and extension loading and a study of soil behavior in these cases, would be useful in design applications.

Portland cement can be mixed with sand to improve its mechanical characteristics. Many studies are reported in literature on this topic, but the effect of principal stress rotation has not been investigated yet. Considering the inherent anisotropy of most sands, it is not clear whether the added cement will contribute to an equal increase in strength and stiffness in vertical and horizontal directions or not.

In this study, the effects of adding Portland cement to clean sand on strength and stiffness characteristics are investigated through experimental investigation using undrained triaxial compression and extension tests. Different mixtures of Portland cement (1.5, 3 and 5 %) have been added to Firuzkooh sand and the specimens have been cast using the wet tamping method.

Test results revealed that while adding Portland cement will increase strength and elastic modulus (stiffness) in both stress paths, in most cases the percent of strength and stiffness increases, due to cement addition in extension loading is higher than compression. In other words, Portland cement addition tends to decrease strength and stiffness anisotropy. This is a noticeable point for attention in practical applications when compared to other soil improvement methods.

Key Words: anisotropy, Portland cement, stress path, triaxial compression and extension test, rotation of principal stresses.

MECHANICAL AND DURABILITY PROPERTIES OF TERNARY CONCRETES CONTAINING BLAST FURNACE SLAG AND SILICA FUME

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 117-126, Research Note

• Received 8 May 2011; received in revised form 16 May 2012; accepted 22 September 2012.

Abstract

In this paper, the potential of using a combination of the blast furnace slag of an Isfahan steel work, and silica fume to achieve concrete with high durability and appropriate rate of strength gain has been investigated. The performance of the ternary concrete is compared with control and binary mixes. The binary concrete studied includes mixes containing slag at cement replacement levels of 15, 30 and 50 percent, and mixes containing silica fume at cement replacement levels of 2.5, 5, 7.5 and 10 percent. The ternary concrete includes a combination of silica fume and slag at various cement replacement levels. The w/b ratio and total cementitious material content was kept constant for all mixes at 0.38 and 420 Kg/m^3, respectively. Concrete mixes were evaluated for compressive strength, electrical resistance, rapid chloride permeability (ASTM C1202 RCPT test) and rapid chloride migration (AASHTO TP64 RCMT test), at various ages up to 180 days.

Combined use of silica fume and slag resulted in reduced water demand, compared to mixes containing silica fume. Using ternary mixes, it was also possible to reduce water demand compared to the control concrete. Use of slag at a 15% replacement level of cement did not cause a considerable reduction in strength properties. For slag at 30% and 50% replacement levels of cement, strength properties were considerably lower than control at all ages.The results show that simultaneous use of silica fume has only a moderate effect in improving the slow rate of strength gain of binary mixes containing slag. Therefore ternary mixes with high slag content have considerably lower strength than control at all ages. The durability of ternary mixes, even at the age of 28 days, was better than the control mix, and the problem of the lower durability of binary mixes containing slag

Therefore, while increased strength is achieved by cement treatment, high percentages of cement should be used with caution in field applications. In addition, results showed that cohesion increased significantly by variation of cement content, but internal friction angle increased initially and remained constant at higher percentages. Eventually, it is found that the failure envelope trend of cement treated samples is non-linear, and the use of Mohr-coulomb criteria has led to a number of anomalies. Some failure criteria, such as the modified Griffith theory (1962), and the criterion suggested by Johnston (1985), based on mean squared error (MSE) analysis, can satisfactorily describe the soil-cement behavior.

Key Words: soil-cement, difficult soils, coastlines of Caspian Sea, unconfined compressive strength, consolidated-drained triaxial.

EPSILON AS AN INDICATOR OF GROUND MOTION SPECTRAL SHAPE

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 109-116, Research Note

- Received 8 May 2011; received in revised form 18 December 2011; accepted 5 March 2012.

Abstract
From the various intensity measures that may be applied to evaluation of the seismic risk of structures, the acceleration response spectrum, Sa(T), is the most famous. As a key assumption in usual risk assessment procedures, such as PEER methodology, the structural response depends only upon the applied intensity measures, and not on any other properties of ground motion. This required condition is termed the "sufficiency" of the used intensity measure. The limited "sufficiency" of Sa(T) has been emphasized in recent research and, as a result, different methods have been proposed to modify structural response analysis. In this paper, the problem has been re-defined and then recent studies have been surveyed. The inelastic displacement response spectrum is another alternative for Sa(T). The intensity measure vector, as an innovative approach for bias reduction, has been also reviewed.
This paper is mainly focused on the spectral shape concern. It has been discussed how the spectral shape of ground motion affects the structural nonlinear response. Epsilon, as a well known seismological parameter, is introduced as a convenient indicator of spectral shape. It has been shown that epsilon has significant effects on the nonlinear response of structures. As a convenient approach for reliable ground motion selection, the hazard related target epsilon is calculated first, and then the compatible ground motion is selected. A convenient procedure has been introduced in this paper, in order to find the target epsilon and eta values at different hazard levels.
In the second half of this paper, the current code conformed approach for ground motion selection has been discussed. All seismic design codes and guidelines require scaling of a number of selected ground motions so that they match or exceed a target spectrum, i.e. uniform hazard spectrum (UHS). The recent findings show that application of the UHS for analysis of structures leads to a conservative estimation of structural response. Finally, a new generation of response spectrum, named the conditional mean spectrum (CMS), has been introduced. The CMS presents the expected response spectrum, conditioned on occurrence of a target spectral acceleration value at the period of interest. It has been shown that this is a more realistic target spectrum for ground motion selection in comparison with UHS.

Key Words: hazard, risk, intensity measure, response, bias, selection.

EFFECT OF PORTLAND CEMENT ADDITION ON ANISOTROPIC STRENGTH OF SAND UNDER COMPRESSION AND EXTENSION TRIAXIAL TESTS

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 107-115, Research Note

BOT is a most popular way for private-public partnership that encourages private finance while the owner maintains strategic control. However, improper allocation of risks builds serious barriers against development of BOT projects. Due to multiparty involvement, large investment, long term concession and the influences of national factors; risk management within a BOT project is very complicated. It is, thus, the subject of many studies. However, an integrated model for risk management is rarely reported in the literature review. In an integrated model, each phase of risk management (i.e. identification, allocation and response of risks) is developed based on a prior phase and a defined guideline derived for different decision makers through project accomplishment. Furthermore, most of these studies do not cover all scopes of the project and consider the conflicting interests of project participants. Therefore, their results do not establish a comprehensive and balanced framework.

In this paper, an integrated model is introduced that covers the entire scope of a BOT life cycle and balances the interests of project participants with decisions of how risks are identified and allocated or responded to. The proposed model develops a conceptual framework that links the cost of risk management to how it covers the scope of the project and the interests of parties. This model ensures the decision maker that the risks are controlled safely and with minimum cost. Applying the proposed model to a specific project, as we did for Iranian power plants projects, simplifies attracting private investment and public interest for constructing infrastructure projects through BOT projects.

Utilizing expert knowledge through the Delphi method, the proposed model (applied to cases of power plant BOT projects of Iran and a guideline for risk management; from identification to allocation and handling of risks) is established. Utilizing the proposed model, the owner can compromise on risk allocation at lower cost and time and encourage the participants to bear the higher level of risks, while these are the main problems again the development of BOT projects in Iran.

Key Words: Risk management, BOT projects, risk identification, risk allocation, risk handling.

EFFECT OF CEMENT TREATMENT ON SHEAR STRENGTH PARAMETERS OF DIFFICULT SOIL FROM SOUTHERN COASTLINES OF THE CASPIAN SEA

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 97-108, Original Article

- Received 29 October 2011; received in revised form 15 February 2012; accepted 28 February 2012.

Abstract

Many attempts have been made by civil engineers to improve and optimize the use of existing soils. The distribution and extent of problem soil pose many difficulties for construction projects. All improvement techniques seek a solution for an increase in density and shear strength, providing stable conditions and reduction of soil compressibility, in order to control ground water flow and accelerate the rate of consolidation. Experience shows that the use of additives, such as cement, lime, fly-ash, bitumen and polymer stabilizers, leads to an improvement in the engineering properties of natural soil deposits. The choice and effectiveness of an additive depends on the type of soil and its field conditions. Nevertheless, knowledge of the mechanical behavior of treated soil is as important as selecting the appropriate stabilizer.

This study has made a comprehensive examination of the effectiveness of cement treatment on the shear strength parameters of soil encountered in the southern coastline of the Caspian Sea, including Gorgan Loess, Rasht Clay and Anzali Sand. Cement was added in percentages of 2.5, 5, and 8 by dry weight of the soil. A series of laboratory tests comprised of Atterberg limits, standard proctor, unconfined compressive strength and consolidated-drained triaxial tests were performed on non-treated soil as well as on cement treated samples.

The addition of cement was found to improve the workability and compaction characteristics of the soil. Moreover, significant improvements in unconfined compressive strength and modulus of elasticity were observed. The improvement is dependent on the type of soil. Triaxial test results indicated that while cement treatment improved shear strength remarkably, the type of failure varied greatly from ductile to brittle behavior. Non-treated, 5%, and 8% cement treated soil displayed ductile, planar, and splitting types of failure, respectively.

state of stress and the seepage forces must be considered as dependent parameters, because of the remarkable permeability variations induced by the development of the plastic zone around the tunnel. elasto-plastic

Key Words: tunnel, analytical-numerical solution, seepage, strain-dependant permeability.

TIME-DEPENDENT EFFECTS EVALUATION OF COMPOSITE INTEGRAL ABUTMENT BRIDGES

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 77-86, Original Article

- Received 9 October 2011; received in revised form 30 May 2012; accepted 14 July 2012.

Abstract

Construction of integral bridges solves difficulties due to the maintenance of expansion joints and bearings during serviceability, hence, causing the integral bridge to become more economical compared with conventional bridges. However, there is some ambiguity in the design of integral bridges, which has led to some limitations in construction design. Some ambiguities are time-dependent effects, such as creep, shrinkage, superstructure thermal change, backfill pressure and soil-bridge interaction.

In this paper, to investigate the above effects, two different models were made for sub and superstructures. Time-dependent internal forces obtained from the superstructure analysis, as well as deck positive thermal change effects, were applied to the substructure.

Integral abutment bridges should be designed under vertical and lateral loads. Also, during the design procedure, gradually, a stage construction mode should be considered. For composite integral bridges, in which the deck is made of concrete and steel, three stages of construction should be considered: First, when the concrete has not yet been hardened and there is no composite function. Second, when the composite function exists, but by considering time-dependent effects, the concrete modulus of elasticity is about 0.33 its ultimate value, and, finally, when the concrete has completely hardened and the composite function has been achieved.

The maximum length of integral bridges is limited by temperature changes. Seasonal temperature change causes expansion and contraction on a superstructure. This causes a pressure subjected to abutments from backfill. When the temperature increases, a passive pressure is created behind each abutment, whereas, when the temperature decreases, an active pressure is created behind each abutment. For the second case, a gap is created between the backfill and abutment. In the construction of skewed integral bridges, non-uniform force distribution will exist and lead to additional internal forces. Therefore, for skewed integral bridges with a skew angle greater than 25 degrees, the temperature and time-dependent effects should be considered .Superstructure analysis results, for a case study, showed that the passing of time caused a negative bending moment increase in supports and decreasing positive bending moment in the middle of the spans. ACI and AASHTO coefficients were used to calculate time-dependent effects and considerable differences were observed in the results. Using AASHTO coefficients gave bigger changes in moment amount. It can be said that for calculating the amount of time -dependent deck bending moment using AASHTO coefficients, about 30% change will be obtained in results compared with ACI code.

Key Words: integral bridge, time-dependent effects, substructure and superstructure, pushover analysis.

INTEGRATED RISK MANAGEMENT MODEL FOR BOT PROJECTS: DEVELOPING THE SCOPE-INTEREST CONCEPTUAL FRAMEWORK

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 87-96, Original Article

- Received 12 October 2011; received in revised form 11 June 2012; accepted 6 August 2012.

Abstract

In recent decades, many developing countries have invited private investors to develop infrastructure projects.

records given for a specific site soil condition. But, except for a few regions in the world, in most cases, limited numbers of seismic records are available. Designers overcome this limitation by using artificial records that may be constructed by combining sine waves with different phase and amplitudes, or matching spectra with a specific design spectrum. Although, these procedures are acceptable from a mathematical overview, they are not satisfactory procedures for the designer to obtain the best or even probable acceleration records for the considered region. So, these procedures, by generating a lot of artificial records, solve the designer's problem. But, using these acceleration records to evaluate the earthquake response of a structure in order to design, rehabilitate or strengthen may lead the designers or clients to make a wrong decision.

In this paper, a new innovative method, based on the wavelet transform to generate artificial acceleration records for a specific area, is presented. First, each seismic record is decomposed to its basis signals. Each basis signal, besides the specific limited frequency domain, includes the unique physical phenomenon of the area. In other words, each basis signal inherently defines specific characteristics of the region. This is based on the number, type, and mechanical, geotechnical and seismic properties of the soil layers in the region, and also probable scenarios of the passing seismic waves. Hence, as a second step, by randomly combining these basis signals, we obtain other possible seismic records of that area. Therefore, we can generate many artificial seismic records using only limited site specific recorded ground motion. In order to explain the method, the acceleration earthquakes of the Smart1 earthquake network station of Taiwan, recorded during a 5.8 magnitude earthquake on the Richter scale, in 1985, are used. Similar and different features of the artificial records are compared with that of the real seismic records. Finally, the performance of a 10-story steel frame against artificial and real acceleration records is compared together. Artificial records may or may not be stronger than real accelerograms, but they, specifically, are the probable acceleration records of that particular area.

Key Words: Wavelet transform, Smart1 network, acceleration record, artificial record, basis signal.

ANALYSIS OF UNDER-WATER TUNNELS CONSIDERING SEEPAGE FORCES

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 65-76, Original Article

- Received 29 August 2011; received in revised form 1 July 2012; accepted 26 August 2012.

Abstract

Tunnels below a groundwater table can be either sealed or drained. Sealed tunnels do not influence the groundwater regime; however, the lining has to undertake the full water pressure. On the other hand, in a drained tunnel, a seepage flow will be developed. The seepage flow and pore water pressure developed around the tunnels affect the responses of the lining and of the rock mass, significantly. Thus, the design of underwater tunnels must be based on a powerful analysis, in which the hydro-mechanical aspects are taken into account. In a tunnel with permeable lining, the induced seepage forces can be the most important issue in the design and construction of the tunnel. In this condition, the applied inward seepage body forces are generated by pore-water pressure gradients, which are dependent on rock-mass permeability. On the other hand, the permeability of the fractured plastic zone around the tunnel depends upon deformations induced by excavation and applied seepage forces (strain-dependent permeability). A theoretical solution is proposed, in this paper, for analysis of underwater tunnels, excavated in an elasto-plasti, strain-softening and Hoek Brown rock material, considering strain-dependant permeability. The problem is considered under axial symmetric conditions; thus, the initial stress state is assumed to be hydrostatic. For the plastic zone, as the derived analytical equations do not have closed form solutions, a computer program has been prepared for solving the corresponding equations numerically and examining the analysis. On the other hand, the governing equations for the elastic zone are solved, analytically. The results obtained with the analytical solution are compared with results obtained with the hydro-mechanical option in a commercial finite difference code. The proposed solution is also used to obtain results and explain the behavior of the tunnel under different hydro-mechanical conditions, when the ground is assumed to behave elasto-plastically. The results show that when a pervious lining is used or a drainage system is employed for the tunnel, the effects of seepage flow and pore water pressure must be taken into account. Application of the proposed method to several tunnel problems showed that in the case of drained tunnels, seepage flow causes the in situ effective stress to increase (i.e. a decrease in stability). Furthermore, it is shown that the

been examined in order to optimize the design approach. Results indicate that using disconnected piles, the ratio of pile load to total load decrease and the neutral plane (the plane of maximum structural force in piles) shifts to lower depths. Also, reducing gap height leads to an increase in the maximum axial stress of the piles and the pile load to total load ratio. Moreover, concentration of piles at the center of the raft reduces settlement and pile stress.

Key Words: Piled raft foundations (PRF), disconnected piles, numerical modeling, optimization, gap.

EVALUATION OF NONLINEAR BEHAVIOR OF CIRCULAR TUNNELS UNDER STATIC AND DYNAMIC LOADING

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 45-54, Original Article

- Received 23 May 2011; received in revised form 22 April 2012; accepted 21 July 2012.

Abstract
The effect of different parameters on the static and dynamic behavior of tunnels has been one of the main concerns in previous studies. The effects most investigated are as follows: Soil type and thickness, tunnel depth and shape of tunnel section, coarse grain layers around the tunnel, interaction of twin tunnels and the distance between them, and method of tunnel construction. Generally, the investigations have been followed using physical and numerical methods. Using these methods, the effects of the mentioned parameters on the values of axial forces and lining moments, the relation between depth and settlement variations around the tunnels, the shape of the distribution profile of the surface settlements and etc, have been investigated.
In this paper, the behavior of circular tunnels in Tehran coarse grain alluvium has been investigated using Mohr-Coulomb and Duncan-Chang constitutive models under static and dynamic loading. In addition to the evaluation of nonlinear behavior and soil type effects, a parametric study has been performed on the coefficient of the lateral soil pressure and tunnel depth, due to their significant effects on deformations and forces. Numerical modeling has been performed for tunnels with 15, 20 and 25 meter depths and 10 meter diameter. The Loma Prieta earthquake has been used for dynamic loading. Numerical modeling has been performed based on the finite difference method using Flac 2D software .
Numerical results show an increase in the effects of nonlinear soil behavior on the moments and settlements with a decrease in the coefficient of lateral soil pressure. Nonlinear soil behavior effects have been increased with an increase in depth or confinement pressure. The maximum and residual moments of dynamic loading have been increased with an increase in depth for low values of lateral pressure coefficient, but, for high values of lateral coefficient, the increase in depth has no significant effect on moments. In contrast, moment variations of static loading show a similar trend for all values of lateral pressure coefficient. In static and dynamic loading, increasing the lateral pressure coefficient will result in more axial forces and less moment values in the tunnel lining .

Key Words: Circular tunnel, nonlinear behavior, static analysis, dynamic analysis, coefficient of lateral soil pressure.

GENERATION OF ARTIFICIAL ACCELOGRAMS FOR A SPECIFIC AREA USING WAVELET TRANSFORM

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 55-64, Original Article

- Received 6 August 2011; received in revised form 4 March 2012; accepted 28 July 2012.

Abstract
The successful time history analysis mostly depends on the accessibility of the adequate ground acceleration

Abstract

Fiber-Reinforced Polymer (FRP) bars can be used as a reinforcing material by nature corrosion resistant. These bars have high tensile strength and appropriate durability but are linear elastic up to failure and not ductile. Also, the bond strengths of lap-spliced concrete beams reinforced with steel and GFRP bars are different because of the elastic modulus and the surface conditions of these bars. These parameters affect the non-uniformity of bond stress along the spliced length of lap-spliced concrete beams reinforced with GFRP bars. Different studies show that by using an appropriate amount of transverse reinforcement, satisfactory bond strength and ductility response can be obtained. Some studies concluded that the bond strength of FRP bars is less than that of steel bars and the modulus of elasticity is the most significant parameter in the reduction of bond strength. In this paper, a previous proposed equation which accounts for the modulus of elasticity of reinforcing bars in bond strength is modified for FRP bars. The modified equation is compared with experimental results and ACI440.1R-03 provisions. The results show that the bond strengths calculated with the modified equation correlate well with the experimental values. In the experimental part of the study, seven beam specimens were manufactured and tested. Laboratory specimens were designed with different parameters of splice length, concrete compressive strength, amount of transverse reinforcement along the splice length and the diameter of longitudinal bars. Static test is carried out for causing damage in different levels of loading. The cracks of the specimens were mapped and test observation was recorded during loading steps and at the time of failure. Also, the relationships of force versus mid-span displacement were obtained using the static tests. Then the bond strength and the ductility of specimens were analyzed. At each step of loading, a modal test was carried out to obtain the dynamic parameters of the specimens. Changes in the dynamic parameters are evaluated by modal test results between different steps of loading.

The results show that the ductility is increased by increasing of transverse reinforcement and splice length and concrete compressive strength. The bond failure mode alters from splitting to pullout due to an appropriate amount of transverse reinforcement. This alteration controls the slip of bars and increases the ductility. Frequency reduction of specimens with splitting failure is lower than that of specimens with pullout failure. Also, frequency reduction increases with increase in transverse reinforcement along splice length of lap-spliced beams. The spliced specimens with an appropriate amount of transverse reinforcement are more ductile than non-spliced specimens. This is mainly due to the slip of spliced bars in the lap-spliced specimens. In addition, frequency reduction of ductile specimens is more than that of brittle specimens in different loading steps.

Key Words: modal test, bond strength, ductility, splice length, frequency, transverse reinforcement, GFRP bars.

GEOTECHNICAL PERFORMANCE OF PILED RAFT FOUNDATIONS WITH DISCONNECTED PILES AND EFFECTS OF VARIOUS DESIGN FACTORS

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 37-44, Original Article

- Received 9 March 2011; received in revised form 6 March 2012; accepted 14 July 2012.

Abstract

In the conventional design of deep foundations, it is usually assumed that the entire design load of the structure is carried by the piles, and the entire system acts as a pile group. Pile groups are conventionally designed by adopting a relatively high factor of safety to the piles, and the major design criterion is the bearing capacity of the group. The piled-raft foundation (PRF) is a recent design concept, which is used as an effective method of foundation design to reduce settlements of structures. Recently, the use of settlement reducer piles in the design of piled raft foundations has led to the reduction in number or dimension of the piles. However, the system may involve high axial stresses to be induced in a relatively small number of piles; or in the occurrence of damage to structural connections. Therefore, an alternative approach is to disconnect the piles from the raft. This system is known as the disconnected or non-connected piled raft foundation (DCPRF or NCPRF).
The use of numerical analyses using finite element techniques has become popular in recent years in the field of foundation engineering. Because of rigorous interaction for piled raft foundation elements, physical modeling measurements and case history records have been considered to justify numerical modeling results. Finite element modeling using ABAQUS software, with emphasis on determination of settlement, contact pressure and axial stress of piles, has been carried out. Also, effects of gap height-distance between the raft and the disconnected pile heads, and pile group arrangements, have

the code limit are shown. As a result, the buildings investigated are evaluated as weak under these earthquakes, meaning that damage is beyond allowable limits and that even collapse is observed in certain cases. To modify the behavior and enhance seismic safety, it is proposed to decrease the allowable story drift for structures subjected to near-field earthquakes. An equation for calculating the modified drift limit is proposed based on regression analysis. The suggested equation gives the value of a reduction factor, as a function of number of stories, to be multiplied to the code-based drift limit. Evaluating the structures designed, according to the reduced drifts, shows a satisfactory seismic behavior, to the extent that rotations of plastic hinges remain below acceptable limits for each performance level. In addition, where nonlinear behavior may not occur, the section forces do not exceed the member capacities.

Key Words: Seismic behavior, moment-resisting steel structure, Iranian building codes, near field, Tabas, Bam, and Northridge earthquakes.

EXPERIMENTAL MODELING OF LOCAL BUCKLING OF CORRODED OFFSHORE PIPELINES UNDER AXIAL CYCLIC LOADINGS

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 17-24, Original Article

- Received 10 May 2011; received in revised form 2 May 2012; accepted 10 September 2012.

Abstract
Repetition of start-up/shutdown and temperature changes in an offshore pipeline will generate cycles of compression/relaxation in the line. This might lead to wrinkling and local or plastic buckling in the line. On the other hand, offshore pipelines are commonly exposed to corrosion attacks from sea water and chemically corrosive fluids inside the pipe.
In the current study, the effect of corrosion defects on the tubes ratcheting response under cyclic axial loadings is investigated. The experimental modeling was aimed at providing comparisons between the behavior of intact and corroded tubes under small amplitude wrinkles and subsequent persistent cycles of axial stress ranges. The specimens were all first subjected to monotonic axial compressions to attain an initial pre-defined non-linear axial strain. The subsequent cyclic axial load was introduced to the specimen in a load control mode. The mean and amplitude values for the cyclic stress remained constant in each test but varied with different tests. The physical shape caused by the metal loss in a corroded tube is irregular in depth and in surface.
Results obtained from specimens IC1(I) and IC2(I) indicated that the increase in the cyclic stress amplitude had a major effect on the ratcheting response. Ratcheting strain responses suggested that the shape of the initial non-linear path, the constant ratcheting rate (or the slope of the linear part of the response and the number of cycles to the failure) were substantially affected by variations in the amplitude of the cyclic stress.
It was observed that surface imperfections had more detrimental effects on the axial ratcheting response of the defected tubes, as compared to the corresponding monotonic responses. It was noticed that the ratcheting problem, or the possibility of progressive plastic failure, was substantially exacerbated by the presence of corrosion defects.

Key Words: Ratcheting, cyclic loading, corroded pipe, wrinkling, circular tubes.

STUDY ON BEHAVIOR OF LAP-SPLICED CONCRETE BEAMS REINFORCED WITH GFRP BARS BY STATIC AND MODAL TESTS

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 25-36, Original Article

- Received 11 April 2011; received in revised form 10 August 2011; accepted 17 September 2011.

Abstracts of Papers in English

BEHAVIOR OF IRANIAN CODE-BASED MOMENT RESISTING STEEL STRUCTURES UNDER NEAR-FIELD EARTHQUAKES: PROPOSING A MODIFIED DESIGN DRIFT

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Sharif Civil Engineering Journal
Volume 29, Issue 4, Page 3-15, Original Article

- Received 28 August 2010; received in revised form 9 April 2012; accepted 21 July 2012.

Abstract

Iran, as a vast country, has frequently witnessed destruction of many of its cities due to earthquake. Many times the occurrence of a short-duration ground motion has affected a society, economically, socially, politically, and culturally, and essentially changed the destiny of generations. The near-field earthquakes of a Tabas, Bam and Northridge, which displayed destructive effects, differed from other seismic events, and acted as an incentive for many researchers to focus on such kinds of earthquakes. Due to the proximity of active faults to populous regions, the possibility of occurrence of near-field earthquakes is high in Iran, justifying special consideration of this type of earthquake in the design or retrofit of structures. In this research, to assess the safety provided through a code-based design for moment resisting steel structures, first, structures 4, 6, 8, and 10 stories tall are designed for Standard 2800 and Chapter 10 of National Building Regulations. Second, the same buildings are nonlinearly analyzed and evaluated under Tabas, Bam and Northridge earthquakes, for hazard levels with 475 and 2475 return periods. The method of Spectral Balancing is used to scale the time histories of the ground motion for the two levels of seismic risk. In this method, the response spectrum is displaced vertically to a position where the area between the design and 1.4 times the response spectra are the same between periods 0.2T and 1.5T, with T being the natural period of the building under study. Tables of beam and column responses are provided, in which the number of plastic hinges in each member and the number of hinges with rotations over