be undertaken with special care. In this research, decreasing the cost of construction of soil nailed walls, while ensuring their global, sliding and internal stability, is investigated as an optimization problem. A number of factors, such as the inclination, length, size and spacing of the nails, affect the stability of a slope with a specific geometry (i.e. height and slope angle). Furthermore, the influences of these parameters on the safety factor vary with the shear strength parameters of soils.

The abovementioned parameters cause this optimization problem to be multi-objective. Therefore, in order to arrive at a specific factor of safety (F.S.) for a particular slope, utilizing the minimum volume of material, a computer program is written in MATLAB language, in which the Genetic Algorithm is used for optimization. In order to examine the accuracy of the written program, a number of soil nailed wall design examples that have been presented in reliable publications, are redesigned by this program and it is shown that the last design results stand in noticeable savings in the use of the required material, while the desired safety factor is maintained at a constant.

Finally, the influence of some important cost parameters, such as the cost of drilling holes for nails, shotcreting and steel price, and the effect of each item on total cost, are analyzed using this program and compared with each other.

Key Words: Optimization, soil nailing, genetic algorithm, global stability, internal stability.

and the ones obtained by previous related studies, which provides the possibility of optimal design of the damper through a simple iterative process. Also, the effectiveness of the optimum TMD in a nonlinear structure has been investigated. It was shown that when the structure behaves nonlinearly, the effectiveness of the TMD in reducing the peak response decreases, but, it provides damage reduction, and, for more severe input, protects the structure from collapsing compared to an uncontrolled structure.

Key Words: Passive control, tuned mass damper, optimum parameters, energy balance, nonlinear behavior.

STRENGTHENING STEEL SHEAR WALL AFTER OPENING CREATION

A. Arabzade(corresponding author)
arabzade@modares.ac.ir
M. Shafiee
shafieemehrdad@yahoo.com
Department of Civil and Environmental Engineering
Tarbiat Modares University

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 117-124, Research Note

- Received 15 February 2014; received in revised form 22 December 2014; accepted 4 January 2015.

Abstract

In recent years, structures are becoming taller, and high stiffness lateral load resisting systems are needed. Therefore, more attention has been paid to shear walls. In this paper, steel plate shear walls are investigated, which are appropriate in terms of construction speed, cost, high initial stiffness, strength and ductility.

A feature of these walls is the capability of being able to create an opening at any location of the wall, due to architectural demands, and some equations have been proposed for estimating the effect of these openings on wall behavior. In this study, the behavior of one-story walls due to monotonic loading has been investigated. At first, we tend to find more complete relations for stiffness and strength reduction. So, walls with moment resisting frames, with minimum stiffness of the boundary elements of the panel (based on AISC's recommended equation), with 8 different thicknesses for the plate, 5 different panel aspect ratios and 5 different opening percentages (square opening in the middle of the panel) that have been modeled in finite element software, Abaqus, and relations for estimating stiffness and strength reduction due to that opening are proposed.

The other purpose of this research is to present a method for strengthening these walls to reach the stiffness and strength of walls without openings after creating the opening; which is mandatory when we decide to create it after its design and construction. So, walls with variable panel openings and dimensions, modeled in software, and their effects, were investigated.

It can be concluded from the results that in the case of strengthening a wall with an opening based on the recommended method in this research, the existence of the opening can be ignored and conventional modeling methods for walls without openings can be used. These results are based on monotonic loading of one-story walls, but the cyclic behavior of walls and the effect of moments resulted from multiple stories need further study.

Key Words: Steel plate shear wall, Opening, Numerical analysis, Non-linear finite element.

OPTIMIZATION OF SOIL NAILED WALLS BASED ON THE GENETIC ALGORITHM

A. Komakpanah(corresponding author)
a_panah@modares.ac.ir
E. Amoozesh
eh_amoozesh@yahoo.com
Dept. of Civil and Environmental Engineering
Tarbiat Modares University

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 125-137, Research Note

- Received 14 April 2014; received in revised form 1 November 2014; accepted 15 November 2014.

Abstract

During recent decades, soil nailing, as a method for increasing the stability of slopes and excavations, has been of interest to engineers, due to its flexibility, rapid construction, ease of construction and its economical aspects, compared with other conventional stabilization methods. In other word, soil nailing is a reinforcing method, using the shear strength of in-situ ground and the pullout resistance of soil nails inserted into the ground, and other word inter-act with the ground through grouting.

Cost effectiveness is one of advantages of soil nailed walls. Hence, the optimized design of such systems should

ANALYTICAL STUDY OF THE MAXIMUM ROTATIONAL DUCTILITY OF BEAMS IN STEEL MOMENT RESISTANT FRAMES CONSIDERING HIGHER MODE EFFECTS

M. Gerami(corresponding author)
mgerami@semnan.ac.ir
Dept. of Civil Engineering
Semnan University
F. Daneshjoo
danesh_f@modares.ac.ir
Dept. of Civil Engineering
Tarbiat Modarres University
N. Siah. Polo
n.siahpolo@mjdkh.ac.ir
Dept. of Civil Engineering
Semnan University

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 97-106, Research Note

- Received 15 March 2014; received in revised form 6 October 2014; accepted 25 November 2014.

Abstract

Information regarding the nonlinear dynamic response of steel moment resistant structures affected by earthquake should be as complete and integrative as possible to insure the fulfillment of pre-determined limitations in design. Meanwhile it should be simple enough for implementation by professional engineers. To this end, the main objective of this study is to increase awareness of the nonlinear dynamic response of steel moment resistant frames (SMRF) and to provide methods for measuring the maximum load seismic demands of these structures using maximum global (roof) and interstory (intermediate) demands (which can be estimated by SDOF system demands). A further objective of this study is to provide a relation between interstory drift and the maximum local demand of beams. To this end, a considerable number of SMRF, short, mid and high rise structures, with a different number of stories and bays, were modelled in DRAIN2DX and analysed using nonlinear time history (NTHA) and conventional pushover analyses (CPO). The results of studies showed that beam ductility values are significantly higher than interstory and global ductility. Furthermore, higher mode effects on the increase of rotational ductility in the upper stories of high-rise buildings are completely sensible. This was seen on the distribution of force and deformation demands in CPO and NTHA analysis states. It is possible to calculate maximum beam ductility, in respect to target ductility, the number of bays and the foundamental period of frame, with acceptable precision, by the proposed equation of the models in this study.

Key Words: Rotational ductility, higher mode effects, target ductility, pushover analysis, nonlinear time history analysis .

PASSIVE CONTROL USING OPTIMUM TUNED MASS DAMPER AND ITS EFFECTIVENESS IN A NONLINEAR STRUCTURE

R. K. Mohammadi(corresponding author)
rkarami@kntu.ac.ir
A. S. Ziarani
asalehi@mail.kntu.ac.ir
Dept. of Civil Engineering
K.N. Toosi University of Technology

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 107-115, Research Note

- Received 15 March 2014; received in revised form 26 October 2014; accepted 8 November 2014.

Abstract

A passive control strategy is the use of Tuned Mass Dampers (TMD). In a simple form, the TMD consists of 1 to 10 percent of the structure effective mass connected to the main structure through a spring and a dashpot (viscous damper). The design is based on tuning the frequency of the TMD to the predominant frequency of the structure. So, when the structure is excited, the secondary mass vibrates in resonance with the structural motion, with 90 degrees of phase shift, and the TMD damping dissipates the input energy; consequently, a significant reduction in the response of the structure is achieved. Although the design process of the TMD, which includes determining its parameters, i.e., mass, stiffness and damping, is simple, finding optimum parameters has always been a challenging area in its analysis and design. In most optimization studies on tuned mass dampers, tuning and damping ratios are optimized and the damper mass is a pre-assumed parameter in design, because its optimum value is large and economically unjustifiable in real structures. In this paper, on the basis of the structure energy balance equation for a single-degree-of-freedom model and an iterative formula that tends to minimize the kinetic energy of the structure, a wise (targeted) method has been developed to find the optimum mass of the damper that reduces the maximum response of the system under harmonic and earthquake base accelerations. Eventually, good agreement was seen between the results of the present study

• Received 22 June 2014; received in revised form 30 November 2014; accepted 6 December 2014.

Abstract

This paper describes the reinforcing effects of multiple layers of a rubber-soil mixture in sand, using small scale and large scale static plate loading tests, respectively, at diameters of 113 mm and 300 mm. The small scale test and large scale plate load tests were conducted in a testing tank measuring 800×800×800 mm, and in an outdoor test pit dug in natural ground measuring 2000×2000 mm in plane and 700 mm in depth, respectively. According to previous studies of Moghaddas Tafreshi et al.[12], the optimum embedded depth of the first layer of the rubber-soil mixture was found to be approximately 0.2 times the footing diameter, and the optimum percentage of rubber replacement was found to be around 8% the weight of the soil mixture. The thickness of the rubber-soil mixture, hrs, in terms of h_rs/D (D: the loading surface diameter), the vertical spacing of the rubber-soil mixture layers, h, in terms of h/D, and multiple layers of rubber-soil mixture (N) in the foundation bed were the main parameters affecting the bearing capacity and settlement of the foundation bed. The optimum thickness of the rubber-soil mixture and the optimum vertical spacing of the rubber-soil mixture layers were 0.4 and 0.2 times the loading plate diameter (*i.e.*, $h_rs/D = 0.4$) and h/D=0.2). Results show that reinforcement efficiency decreases as the number of rubber-soil mixture layers increases. For example, in the small scale loading plate at a settlement ratio of 4%, the bearing capacity was obtained at about 89, 102, 110 and 112 kPa for the unreinforced and reinforced beds with one, two and three layers of rubber-soil mixture, respectively. Furthermore, the reinforced bed with two layers of the rubber-soil mixture with optimum thickness located at optimum vertical spacing, shows more efficiency than one layer of the rubber-soil mixture in increasing the bearing pressure of the foundation bed, whereas the total thickness of the mixture is the same.

Key Words: Rubber-soil mixture layer, large and small scale, bearing pressure, settlement, plate load test.

EVALUATION OF DETERMINANT PARAMETERS FOR THICKENING THE ENGINEERED FILLS LAYERS

A. Eslami(corresponding author)
afeslami@aut.ac.ir

P. Yarbakhti
parna.yarbakhti@aut.ac.ir
Dept. of Civil and Environmental Engineering Amirkabir University of Technology

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 89-96, Research Note

• Received 12 May 2014; received in revised form 5 November 2014; accepted 25 November 2014.

Abstract

Roller Compaction is one of the most common methods for modifying soil behavior when constructing road embankments, railway tracks and earth dams. Using the compaction approach for achieving optimized engineered fill, the major factor is the thickening of soil lift, which is always considered by the relevant engineers. It leads to a reduction in project cost, timing, and energy. In this research, effective parameters regarding determination of the thickness of engineered embankments are explored, and then a 2D numerical modelling is carried out in order to evaluate the effect of these parameters on lift thickness. The modelling is based on some assumptions, e.g., the material of the embankment and subgrade have optimum moisture content and the underground water level is below the subgrade zone, so that no excess pore pressure is exerted on the model as the result of additional loading. The effects of subgrade conditions, roller energy, loading cycles and etc. were evaluated for a single layer embankment with four thicknesses of 15, 30, 45 and 60 cm. Four types of roller, steel wheel, pneumatic tyre, sheepsfoot and vibrator were modeled on the cross section of the road. Dynamic analysis was performed for the vibratory steel wheel rollers only, while static analysis was chosen for other cases due to the low roller speed. Results indicated that due to their special performance, if either sheepsfoot rollers with a high contact pressure, or vibratory rollers, while providing the suitable subgrade stiffness, were used, the thickness of the embankment lifts could be increased to approximately twice the common thicknesses of 20-25 cm, i.e., 40-50 cm. Case studies in which the maximum embankment lift was increased to 45 cm are also in agreement with the above mentioned results. According to the obtained results, increasing subgrade stiffness that causes limited lift displacement, allows for an increase in lift thickness. Increasing the applied energy can lead to an upgrade in the relative density of the embankment layer. This is due to the increase in the effective depth of stress. Therefore, a combination of treated subgrades, due to their higher stiffness, and an increase in roller energy, will allow for an increase in the thickness of the embankment lifts.

Key Words: Thickening, engineered fill, roller compaction, subgrade stiffness, roller energy, numerical modeling.

velocity and the liquefaction resistance of clean sand, and combinations of this sand with non-plastic fines up to 25%, have been measured. A simple, semi-empirical, semi-analytical method is proposed to establish a correlation between shear wave velocity and liquefaction resistance. The effects of non-plastic fines on the shear wave velocity and liquefaction resistance of silty sands have been examined in this study, and the effects of non-plastic fines on the correlations between these two parameters are considered. The results in this study show that an increase in the ratio of silt to sand will result in a decrease in shear wave velocity and liquefaction resistance. Based on these results, it is argued that the correlation between the shear wave velocity and liquefaction resistance of various combinations of sand and non-plastic fines is soil specific. Also, based on the results of this study, it is found that existing methods of liquefaction potential evaluation based on shear wave velocity may underestimate or overestimate the liquefaction resistance of silty sands.

Key Words: Liquefaction resistance, shear wave velocity, non-plastic fines, bender element tests, cyclic triaxial tests.

INVESTIGATION OF THE EFFECT OF BOUNDARY CONDITIONS ON THE RESULTS OF BIAXIAL TEST SIMULATION USING THE DISCRETE ELEMENT METHOD

S.M. H. Hoseini
m.hoseini@sutech.ac.ir
S.M. Binesh(corresponding author)
binesh@sutech.ac.ir
Dept. of Civil and Environmental Engineering
Shiraz University of Technology

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 67-78, Original Article

- Received 18 June 2014; received in revised form 4 October 2014; accepted 22 October 2014.

Abstract
In present paper, a biaxial test on a granular soil sample is simulated by the discrete element method. An ambiguous subject in the modeling of this test is the effect of boundary conditions on the micro and macro behavior of the sample. In this context, four different types of boundary condition have been considered for the lateral boundaries across which the confining pressure maintains a constant. The first type of lateral boundary condition is rigid boundary that uses rigid plates for the imposition of stress. The second and third types of boundary condition are flexible boundary, in which a string of particles acts as a plastic membrane and external forces imposed onto the string's particles. The last type of boundary condition used in present paper is that the outer particles of the samples are considered as the boundary particles and the external load imposed on them. The obtained results from the analyses show that the rigid boundary condition provides higher shear strength, with respect to the flexible ones, and there is also no considerable softening in the stress-strain behavior. However, as the constraints are imposed onto the sample's particles by rigid plates, no shear band is detected. On the other hand, under all flexible boundary conditions, shear band formation is obvious, but they suffer from an instability problem. It has been observed that under the boundary condition wherein particles of the sample themselves act as the boundary, instability is inevitable. However, for boundary conditions in which strings of particles are used, orientations of external forces have a significant influence on the stability of the sample. When the external force acts normal to the deformed shape of the boundary, no considerable instability has been observed, but when the external force acts in a constant direction from the beginning to the end of the test, instability occurs. It has been also observed that at micro scale, the sparseness of force chain distribution results in the global instability of the sample.

Key Words: Boundary conditions, biaxial test, discrete element method.

INVESTIGATION INTO FOOTING BEHAVIOUR OF LAYERED GRANULATED RUBBER-SOIL MIXTURE: EXPERIMENTAL STUDY ON SMALL AND LARGE MODELS

N. Joz Darabi
naser_darabi@yahoo.com
S.N. Moghaddas Tafreshi(corresponding author)
nas_moghaddas@kntu.ac.ir
Dept. of Civil Engineering
K.N. Toosi University of Technology

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 79-88, Original Article

S. S. Yasrobi
yasrobis@modares.ac.ir
Department of Civil Engineering
Tarbiat Modares University
M. H. Baziar
baziar@iust.ac.ir
Dept. of Civil Engineering
Iran University of Science and Technology

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 43-55, Original Article

- Received 10 May 2014; received in revised form 19 October 2014; accepted 8 November 2014.

Abstract

The pressuremeter test can be considered one of the most important in situ tests in geotechnical engineering projects. The pressuremeter consists of two main elements: a radially extendable cylindrical probe, which is placed inside the borehole at the desired test depth, and a monitoring unit, which remains on the ground surface. These two parts are connected by cables and hoses. Coarse grained alluvium layers are major subsurface layers in urban areas, such as Tehran, the capital of Iran. Prediction of the behavior of these layers in geotechnical engineering problems is very important. Based on this, and for better predicting the constitutive behavior of coarse grained alluvium with cementation, physical modeling has been undertaken. For this evaluation, we used the pressuremeter test (PMT) in a laboratory chamber designed and constructed for this purpose. In-situ tests play an important role in any geotechnical engineering investigation. This test is capable of properly estimating the geotechnical and deflection parameters of soil. These parameters are the elasticity modules (E), the shear modules (G), the in situ horizontal stress (σ_h), limit pressure (PL), undrained shear strength (C_u) for clay, over the consolidated ratio (Em/PL) and the reaction modules (K_s).

Furthermore, the number of parameters of these constitutive models (in many cases) inhibits their incorporation into general purpose numerical codes, thus, restricting their usefulness in geotechnical engineering practice. There are several different kinds of pressuremeter that differ mainly by the way the probe is placed in the ground. These pressuremeter tests have been done using a preboring method. Then, for assisting the cementation effect on the behavior of these layers, some pressuremeter tests have been undertaken in a laboratory chamber constructed for this purpose. This instrument was constructed for modeling under in situ conditions without cementation to inspect the effects of cementation on the coarse grained alluvium layers. Afterwards, the results of the pressuremeter tests on the chamber are compared with each other and the geotechnical parameters of the coarse grained alluvium are reported. These pressuremeter stress-strain curves are compared with the field test curves, and the constitutive parameters have been recalculated. Based on these curves, the elasticity modules and limit pressure were presented. Other parameters have been calculated in this paper. Finally, the results of the pressuremeter tests in the field and the PMT in the chamber are compared with each other and the cementation effect is reported.

Key Words: Coarse grained alluvium, pressuremeter test, cementation effect, chamber, physical modelling.

CORRELATION BETWEEN LIQUEFACTION RESISTANCE AND SHEAR WAVE VELOCITY OF SAND CONTAINING NON-PLASTIC FINES

N. Akbari Paydar
akbari_paydar@yahoo.com
M. M. Ahmadi(corresponding author)
mmahmadi@sharif.edu
Dept. of Civil Engineering
Sharif University of Technology

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 57-65, Original Article

- Received 17 May 2014; received in revised form 1 November 2014; accepted 15 November 2014.

Abstract

Soil liquefaction is one of the most complex and destructive geotechnical phenomena and, therefore, several methods have been used for the evaluation of liquefaction potential, among which the simplified method is mostly used. In this method, which is mainly based on the standard penetration test (SPT), cone penetration test (CPT) and shear wave velocity (V_s) measurement, a boundary curve is provided to separate liquefiable and non-liquefiable soil zones.

Shear wave velocity measurement is a good alternative method to penetration-based methods (SPT and CPT tests). This is especially true in micro-zonation of the liquefaction potential. Although relatively large studies have been carried out to establish the correlation between shear wave velocity and liquefaction resistance for sands; there are uncertainties about the effects of non-plastic fines on the correlation.

The objective of this research is to study the effects of fines on the correlation of shear wave velocity and liquefaction resistance. In this regard, cyclic triaxial and bender elements tests have been performed, and shear wave

lining. This can be particularly troublesome to structural and functional components of the tunnel and can often lead to structural failure.
In this paper, an axi-symmetric circular tunnel under the groundwater table is modeled using finite difference software, and different conditions, such as an impermeable tunnel, a permeable tunnel and a lining drainage system with varying permeability are investigated. The structural behaviour of the lining and flow through the tunnel lining were modelled using a combination of beam and solid elements. The effects of tunnel parameters, such as depth and diameter and variation of underground water levels, on the effectiveness of the lining drainage system are examined. Moreover, the deterioration of a drainage system caused by clogging is investigated and the importance of giving careful consideration to lining permeability and hydraulic boundary conditions is highlighted.
As a result of coupled analysis, a lining drainage system in a shallow tunnel with small diameter is more efficient, and effective drainage conditions reduce pore water pressure loads, which decreases the bending moments and tensile stresses of the tunnel lining. By performing a parametric study for a tunnel with different lining permeabilities, a design curve to evaluate pore water pressure loads on the lining has been proposed. It is shown that the hydraulic deterioration of the drainage system significantly develops a magnitude of pore water pressure load on the tunnel lining.

Key Words: Tunnel lining, drainage system, pore water pressure, clogging.

DETERMINING THE ELASTIC PROPERTIES OF LIGHTWEIGHT EXPANDED SHALE AND CLAY AGGREGATES OF IRAN

M. Baghi
mostadab14@gmail.com
M. Yazdani(corresponding author)
mahyaz@gmail.com
Dept. of Civil and Environmental Engineering
Tarbiat Modares University
A. Ardakani
a.ardakani@eng.ikiu.ac.ir
Dept. of Engineering and Technology
Imam Khomeini International University, Qazvin

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 33-42, Original Article

- Received 24 February 2014; received in revised form 3 March 2015; accepted 11 April 2015

Abstract

Due to application of artificially lightweight aggregates in various industries, the property of these aggregates is very important. According to their physical nature and the lack of bedrock, the elastic properties of artificially lightweight aggregates have a special complexity. At present, lightweight expanded shale aggregates or Liapor and expanded clay aggregates or LECA are the most important artificially lightweight aggregate in Iran. Expanded shale or Liapor is produced using expansible shale by a dry process, and expanded clay or Leca is produced using expansible clay by a wet process and by cooking in horizontal rotary kilns. The major difference between these two types of aggregate production is in the method of their agglomeration, which causes significant differences in the final product. Products often contain zero to 25 mm diameters, increase porosity by increasing diameter, and their densities are reduced. Since the standard for the direct determination of the elastic properties of the aggregate is absent, a combination of experimental methods and a theory of composite materials are used to determine these parameters.

In the section of the theory of composite materials, using the micromechanical method and the inverse Mori-Tanaka homogenization model, the elastic properties of the inclusion of the according to matrix and composite material properties are determined. Paying attention to nature of the aggregates, their shape is assumed to be a complete sphere in this research. In the laboratory work, two groups of quaternary ordinary and structural Leca, and one group of trinary Liapor aggregates, each group being produced under identical conditions, are used. By a combination of each type of aggregate with cement sand mortar, and by building standard cylindrical samples of composite materials, the elastic properties of the matrix and composite samples are determined. Then, using experimental results and relations obtained from the Mori-Tanaka model, the elastic properties of the aggregate are determined. The results show an exponential relation between the elastic modulous and particle density, and a linear relation between the elastic modulous and the crushing resistance for LECA and Liapor aggregates.

Key Words: Liapor, LECA, elastic properties, homogenization, mori-tanaka model.

EVALUATION OF COARSE GRAINED ALLUVIUM BEHAVIOR BASED ON PRESSUREMETER TESTS

M. Emami(corresponding author)
r_m_emami@yahoo.com

tively. On the contrary, the special moment-resisting frame cannot resist against progressive collapse, and several column removals lead to collapse. In fact, this may suggest that a special seismic design, while more ductile compared to an ordinary design, does not necessarily have a better performance under a column removal scenario.

Key Words: Progressive collapse; ductility; dynamic analysis; analysis of pushdown; reinforced concrete moment frame.

INFLUENCE OF THE MASS ECCENTRICITY ON THE MARGIN OF SAFETY AGAINST THE COLLAPSE OF RC-SMF BUILDINGS UNDER EXTREME EARTHQUAKES

R. K. Badri(corresponding author)
ramin.badri@gmail.com
Dept. of Structural Engineering
Science and Research Branch
Islamic Azad University
A. S. Moghadam
moghadam@iiees.ac.ir
International Institute of Earthquake Engineering and Seismology
M. Nekooei
nekooei@iiees.ac.ir
Dept. of Structural Engineering
Science and Research Branch
Islamic Azad University

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 11-23, Original Article

- Received 20 January 2014; received in revised form 19 November 2014; accepted 29 November 2014.

Abstract

Safety assessment of a building is important in recognition and control of seismic hazards in high earthquake risk areas. The margin against collapse and the probability of failure are important indicators, which are mostly used to examine building safety against collapse. Evaluation of these indicators in a building is part of its collapse assessment under strong ground motion that may cause more modern buildings to collapse. Collapse assessment studies have often been carried out on symmetric buildings. Most research into plan-asymmetric buildings tries to introduce methods to control undesirable demands due to torsion-induced motion, or to suggest a proper design strategy in order to reduce torsional effects on structural responses. However, such studies are often carried out using simple building models and are inadequate for modelling realistic multi-story buildings in the inelastic range. So, this study tries to examine the influence of plan-asymmetry on the collapse performance of buildings that have been designed based on building codes. 5, 10 and 20% mass eccentricities are proposed as plan-asymmetric building models and collapse safety is investigated on 5- and 10-story reinforced concrete special moment frame buildings by assessing collapse probability and the collapse margin ratio. The inelastic behavior of the frame elements is modeled using lumped-plasticity hinges at the ends of each element. The parameters of the inelastic behavior model of these hinges are calculated by empirical calibration equations regarding the design details of structural elements. According to the results, the probability of collapse reduces as the mass eccentricity increases. The trends of the collapse margin also show that the increase of mass eccentricity improves the collapse safety of the proposed buildings. This is because the building models show torsionally stiff behavior as the mass eccentricity increases. Although the collapse capacity decreases by increasing building height, it does not considerably influence the variation of the proposed safety measures.

Key Words: Collapse margin ratio, mass eccentricity, special moment frame.

EFFECT OF DRAINAGE CONDITIONS ON PORE WATER PRESSURE DISTRIBUTION AND LINING STRESSES IN TUNNELS UNDER GROUNDWATER TABLE

M. Soori
milad.soori@modares.ac.ir
M. Olyaei(corresponding author)
m.olyaei@modares.ac.ir
Dept. of Civil and Environmental Egineering
Tarbiat Modares University

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 25-32, Original Article

- Received 22 February 2014; received in revised form 22 December 2014; accepted 10 January 2015.

Abstract

Tunnelling in a saturated soil often produces a long-term interaction between the tunnel lining and the surrounding soil. Infiltration and external pore-water pressures are often important factors that must be considered in the lining design. Development of pore water pressure may accelerate leakage and cause deterioration of the

Abstracts of Papers in English

PROGRESSIVE COLLAPSE RESISTANCE OF RC FRAMED BUILDINGS WITH DIFFERENT DUCTILITES

R. Abbasnia
abbasnia@iust.ac.ir
A. yoosefpooravandari(corresponding author)
a.yousefpoor70@gmail.com
Faculty of Civil Engineering
Iran University of Science and Technology

Sharif Civil Engineering Journal
Volume 32, Issue 2.2, Page 3-10, Original Article

- Received 15 May 2016; received in revised form 9 Ausust 2016; accepted 14 September 2016.

Abstract

The reliability of structures under different loading conditions is the main objective of civil engineers. Experiments show that buildings may be vulnerable to blast air pressure and localized failures that occur in them. The cause of the explosion could be accidental or intentional, e.g., happened by terrorist attacks on public or private buildings. Progressive collapse is a catastrophic phenomenon which has been of greatest interest to many researchers and engineers during the last decade. Therefore, in this study, RC framed structures designed in accordance with Iranian design codes are evaluated using the GSA guidelines in order to investigate their progressive collapse potential. A five-story building is used to evaluate the impact of structural ductility on the progressive collapse that has a regular plan. The building blocks are designed for low, medium, and high ductile moment frames. In this study, the performance evaluation of progressive collapse conducted on buildings, and it shall include three different locations for removal of columns in the building plan. In addition to assessing the impact of locating columns in different locations, column removal is performed in stories 1, 3, and 5. In fact, in every building, there are 9 column removal scenarios; all these scenarios are analyzed for both methods of static and dynamic analyses. The structures are designed according to the conventional Iranian design codes, and afterwards evaluated using both nonlinear dynamic and nonlinear static analyses following different column removals. The column removals' static and dynamic analyses to assess the buildings are designed by different ductilities; it is concluded that the potential progressive collapse of the special moment frames is very much more than intermediate and ordinary moment frames. Based on the load combination specified by the GSA, ordinary and intermediate frames can withstand collapse up to overload factors of 1.8 and 1.33, respec-