Abstract

Low temperature cracking is the main distress in asphalt pavements in winter. Use of modifiers or additives in the asphalt mixture is a suitable and common method for improving its mechanical properties, especially under high temperature service conditions. However, for cold climates, where road pavement usually experience subzero temperatures, the overall failure mechanism of asphalt layers may occur mainly due to elastic brittle fracture and the growth of initiated cracks inside the pavements. Hot mix asphalt (HMA) concrete is perhaps the most complicated material in flexible pavement systems since its properties depend upon temperature and loading conditions. Fracture toughness is the most important parameter for characterizing crack growth and the failure of cracked materials and structures such as asphalt pavements. Cracked semi-circular specimens subjected to three-point bending have been recognized as appropriate test specimens for conducting fracture tests in brittle materials. The manufacturing and pre-cracking of the specimen are simple. A non complicated loading fixture is also required for a fracture test. Hence, the main aim of this research is to study the effect of different additives, including Poly phosphoric acid (PPA), Styrene butadiene styrene (SBS), Anti striping agent (ANTI), Crumb rubber (CR) and FT-paraffin wax (sasobit), on the low temperature mode I fracture resistance of asphalt mixtures. A series of asphalt samples with different percentages of the mentioned additives were manufactured in the shape of semi circular specimens containing vertical edge cracks. The test samples were then loaded monotonically using a symmetric three-point bend fixture at a constant subzero temperature of -15oC. The value of mode I fracture toughness (KIC) was determined by recording the critical fracture loads of tested specimens. It is shown that all the investigated additives can increase the low temperature fracture toughness of the asphalt mixture, and maximum increase in the value of KIC occurs when the sasobit and CR additives are used.

Key Words: Fracture toughness,SCB, additives, mode I.

EVALUATING FACE MINIMUM PRESSURE FOR URBAN TUNNELING USING AN EPB MACHINE AND ANALYTICAL AND NUMERICAL METHODS CASE STUDY: TUNNEL FOR LINE 7, TEHRAN SUBWAY (EAST-WEST SECTION)

H.Bakhshandeh Amnieh(corresponding author)
hbakhshandeh@ut.ac.ir
School of mining, College of Engineering
University of Tehran
M.S. ZamZam
mohammad_saber_zamzam@yahoo.com
E.Mousavi
mousavi.miningeng@yahoo.com
Dept. of Mining Engineering
University of Kashan

Sharif Civil Engineering Journal
Volume 31, Issue 3.1, Page 137-145, Research Note

- Received 15 June 2013; received in revised form 8 January 2014; accepted 22 January 2014.

Abstract

Tunnel face support during boring operations is gaining more interest as tunneling development expands towards geo-technically less appropriate zones with heavy traffic. Good tunnel face support is a pre-requisite for successful safe boring, and evaluating optimum pressure is an important factor in the performance of the Earth Pressure Balance (EPB) machine in urban tunneling. Applying pressures lower than equilibrium results in face subsidence, while higher than equilibrium causes an uplift in ground surface, leading in either case, to operation disruption, floor subsidence and damage to nearby buildings. Optimum pressure for face support is evaluated here using analytical and numerical methods, and parameters such as soil physical and mechanical characteristics, height of over-burden, water table level, tunnel geometry, and traffic and structural loads. As the tunnel for line 7 of the Tehran subway (Eastern-Western piece) was excavated in an urban zone, in this work, the Jancsecz analytical method was used to measure the required pressure for the tunnel face support. The tunnel was bored using a 9/164m diameter ground pressure balancing machine. The final tunnel cover was tetragonal in geometry, 35cm thick and 1.50m wide, making an outside diameter of 8.85m for the tunnel. Data obtained for this study was obtained from 13 boreholes and 5 wells excavated deliberately along the tunnel. The flow direction of underground water about the tunneling zone was found to be north-east to south-west. Considering the average water level obtained from the boreholes, only 35% of the tunnel remains above water and 65% is below water level. To illustrate water pressure fluctuation, this was considered in the analytical method, but ignored in the numerical one, which employed $PLAXIS^{3D}$ software. When comparing the results, a pressure difference of 20-25 kPa was noted, indicating acceptable conformance of the data.

Key Words: Face optimal pressure, PLAXIS 3D, EPB, line No. 7 Tehran subway.

and do not reduce flexibility. However, when large displacements occur in the frame, this system is activated, which, hence, increases the ductility and stability of the moment frame.
In this paper, for investigating the Y-shaped cable bracing system operation, in order to keep all cables under tension, and the effect of geometrical parameters on system behavior, a program was written in MATLAB software. Considering there was no possibility of having limit points in the force-displacement curve of the system, this program was written based on the Newton-Raphson incremental-iterative method for non-linear analysis of structures, which can draw the pushover curve of the bracing system and apply its various geometric parameters as a variable. The results of system modeling in this program indicate that the arrangement causes high flexibility, and changing system stiffness is easily possible (by changing the length of the connecting cable and cable diameter). It was also observed that with a specific amount of geometric parameter, the system had maximum lateral stiffness and the most durability against any incidence of cable slacking.

Key Words: Y-shaped cable arrangement, non-linear analysis, lateral stiffness, cable slacking.

EVALUATION OF THE RUTTING PERFORMANCE OF HOT MIX ASPHALT MIXTURES PREPARED BY BENTONITE MODIFIED BITUMEN

H. Ziari
h.ziari@iust.ac.ir
R. Babagoli(corresponding author)
rezvan_babagoli@yahoo.com
Dept. of Civil Engineering
Iran University of Science and Technology

Sharif Civil Engineering Journal
Volume 31, Issue 3.1, Page 123-128, Research Note

- Received 29 May 2013; received in revised form 21 December 2013; accepted 4 January 2014.

Abstract
Permanent deformation is an important factor in flexible pavement design. Through increasing traffic load and tire pressure most permanent deformation occurs in the upper layer rather than in subgrade. Wheel tracking is a popular HMA test, since it simulates the permanent deformation resistance of mixtures. The basic similarity of these devices is in using a cyclic wheel passing through the surface of specimens, and the cumulative rut after the proposed cycles is used as a measure of rutting potential. The wheel tracking test is undertaken using the Iran University of Science and Technology, ABRC Wheel Track machine, by applying 8000 cycles of wheel load of 50kg that turns around an axis and applies the wheel load to specimens. The test was done at $60°C$.
In this study, the rutting performance of hot mix asphalt specimens made with bentonite as bitumen modifiers were studied. 10%, 15%, 20%, 25% and 30% bentonite content by weight of asphalt cement were used as its modifier. A propeller mixer was used for blending the bentonite and asphalt cement. In this study, the rutting performance of modified asphalt mixtures was evaluated through various laboratory tests, such as Marshall stability and permanent deformation The test methods used in this evaluation were the dynamic creep test and wheel tracking tests. The results demonstrated that the use of bentonite can enhance Marshall stability and resistance to permanent deformation of mixtures. The mixtures also show good resistance to permanent deformation, evaluated by means of wheel tracking tests.

Key Words: Modified binder, bentonite, marshal stability, permanent deformation, asphalt mixtures.

EVALUATION OF FRACTURE RESISTANCE OF MODIFIED ASPHALT MIXTURES USING SEMI-CIRCULAR BENDING TEST

H. Behbahani
behbahani@iust.ac.ir
M.R.M. Aliha
mrm_aliha@iust.ac.ir
S. Aghajani shahrivar(corresponding author)
s_aghajani@civileng.iust.ac.ir
H. Asayesh zarchi
asayesh@civileng.iust.ac.ir
Dept. of Civil Engineering
Iran University of Science and Technology

Sharif Civil Engineering Journal
Volume 31, Issue 3.1, Page 129-135, Research Note

- Received 8 June 2013; received in revised form 11 April 2014; accepted 30 April 2014.

CLAYS USING THE FINITE DIFFERENCE METHOD

M. M. Ahmadi(corresponding author)
mmahmadi@sharif.edu
B. Mofarraj Kouchaki
b.mofarraj@outlook.com
Dept. of Civil Engineering
Sharif University of Technology

Sharif Civil Engineering Journal
Volume 31, Issue 3.1, Page 105-113, Original Article

- Received 7 August 2013; received in revised form 25 November 2013; accepted 7 January 2014.

Abstract

This paper applies the finite difference method, using FLAC, to evaluate the undrained bearing capacity of rigid strip footings resting on two-layered clay deposits. For modeling the soil elastic-perfect plastic constitutive model, the Mohr-Coulomb failure criterion is used. Firstly, some numerical analyses are carried out and the results are compared with theoretical solutions in order to determine the accuracy of the model. In these analyses, values for elastic modulus, Poisson ratio, undrained soil shear strength, foundation width, element dimensions, boundary dimensions and loading velocity are changed, in order to identify the effect of each parameter on the final result and to free the modeling from numerical inaccuracies. Next, the ratio of depth of the upper layer to the width of the foundation (H/B) are varied from 0.15 to 3, while the ratio of undrained soil shear strength of the upper to the lower layer (c_{ut}/c_{ub}) is varied from 0.2 to 5, in order to model and analyze the most probable cases that could be encountered in practice. Results of analyses show that whilst, in the case of soft over strong clay, general failure usually occurs, in the case of strong over soft clay, as the top soil gets stronger, the soil will most likely experience punching failure, which is associated with a high amount of plastic settlement, before reaching its ultimate bearing capacity.

Afterwards, the results of analyses are compared with the results obtained by other researchers using limit analysis, FEM, empirical and semi-empirical solutions.

In the end, an equation is presented for each case (strong over soft clay and soft over strong clay), which represents the bearing capacity of two-layered clays, and their precision when describing the numerical results is examined. A comparison between the results of analyses and those given by the presented formula in this paper shows strong agreement between numerical results and the formula provided for each case ($R^2 > 0.99$). This proves how reliable these equations are in determining the undrained bearing capacity of strip footings placed over two-layered clays, without needing to consult charts and figures.

Key Words: Bearing capacity, strip footings, numerical modelling, clays, two-layer.

THE EFFECT OF GEOMETRICAL PARAMETERS ON THE BEHAVIOR OF Y-SHAPED CABLE BRACING SYSTEMS

H. Tofighi
h.tofighi90@ms.tabrizu.ac.ir
M. Barghian(corresponding author)
barghian@tabrizu.ac.ir
Dept. of Civil Engineering
Tabriz University

Sharif Civil Engineering Journal
Volume 31, Issue 3.1, Page 115-122, Original Article

- Received 3 September 2013; received in revised form 8 December 2013; accepted 7 January 2014.

Abstract

In earthquake-prone regions, steel moment frames are a desirable choice for constructing structures, due to their appropriate ductility and high energy dissipation capacity. The main weakness of moment frames is the possibility of excessive displacement when subjected to forces resulting from powerful earthquakes, which may lead to total destruction of a structure. In recent years, using cable as a bracing system for moment frames has become an issue of interest to many researchers. Cable bracings, unlike steel bracings, are not subjected to complex phenomenon such as inelastic buckling and, due to their high tensile strength and the possibility of high pre-tensioning, create considerable stiffness. The main weakness of this system is the occurrence of slacking phenomenon in the cables when redirecting the lateral force, which has a dynamic impact on the system. Researchers have proposed solutions, including the use of special tools and connections, and different arrangements of cables and dampers in the cable bracing system. Using these methods, it is possible for the system to use its total capacity at the same time. Also, by keeping all cables stretched, slacking would be prevented when redirecting the lateral force.

Studies on Y-shaped cable bracing systems show that all cables in this system participate in providing the lateral resistance of the frame, without requiring any special tools and connections. Moreover, Y-shaped bracing systems are not active in small displacements; they do not affect the elastic behavior of the moment frame

Abstract

A major issue facing structural engineers is assessing the effects of dynamic loads on structural systems, including beams. The importance of this matter arises from moving vehicles, such as cars and trains, on bridge structures, which are usually simulated by beam structures. Hence, in several studies, in order to explore the dynamic response of beam structures under excitation of dynamic loads, various analytical and numerical methods have been utilized. In this study, to examine easier and faster procedures for finding the dynamic response of Euler-Bernoulli, Timoshenko and Higher-Order beams, a simple semi-analytical method, based on characteristic orthogonal polynomials and trigonometric functions compatible with boundary conditions, is presented. To this end, discrete equations of motion are derived for the three mentioned theories, due to a moving mass, according to the Hamilton principle. Then, the governing equations are transformed into ordinary differential equations in the time domain, and by applying an approximate method, the displacement field of the beam is achieved. In order to consider the efficiency, convergence rate and accuracy of this method, two numerical examples are provided to compare the results of this paper with those presented by other researchers. In this regard, in the former, the free vibration frequencies of the beam with various theories for different boundary conditions were obtained, and it is shown that the results of all three theories give a good convergence rate and high accuracy. Furthermore, in the latter example, the dynamic response of the beams subjected to a moving mass for different values of base beam slenderness was achieved and compared with other studies. Analysis of the maximum dynamic response of the beam and the time history diagrams Showed that the obtained results are in close agreement with those obtained from the numerical method; despite using the lower number of shape functions.

Key Words: Characteristic orthogonal polynomials, moving mass, euler-bernoulli beam, shear deformable beams, dynamic response.

A COMPARATIVE STUDY AND PROPOSAL FOR ENHANCEMENT OF RAPID SEISMIC EVALUATION OF MASONRY BUILDINGS

F. Behnamfar(corresponding author)
farhad@cc.iut.ac.ir
R. Shahgholian
rasol.shahgholian@yahoo.com

Dept. of Civil Engineering
Isfahan University of Technology

Sharif Civil Engineering Journal
Volume 31, Issue 3.1, Page 93-103, Original Article

- Received 18 August 2013; received in revised form 3 November 2013; accepted 30 December 2013.

Abstract

Among the most suitable methods to obtain building seismic data, in order to specify the level of its seismic vulnerability and prioritize it for undertaking detailed seismic assessment studies, is the use of a qualitative evaluation method. Qualitative evaluation, from this perspective also known as rapid assessment, is usually scheduled for a large number of buildings. Since a huge volume of information has to be collected in such a study, filling special forms and checklists for the studied buildings is necessary. In this paper, considering the great number of masonry buildings and their common weakpoints, this type of building is examined. Two different methodologies, including FEMA154 and Publication No. 376 of the Management and Planning Organization, are used for rapid and detailed evaluation of a large number of school masonry buildings, with emphasis on Publication No. 376, and a detailed study is accomplished. Actual cases of buildings located in Khuzestan province are considered. The existing condition of these buildings is identified by field surveys and strength-of-material experiments. In addition, two dimensional models of roofs, using the finite element method, and theoretical models for the walls of masonry buildings, are constructed. The joists are modeled with beam elements. For brick arch and joist-and-block roofs, use is made of shell elements. No considerable tensile stresses are observed in the roofs. Then, the lateral loads distributed from the roofs are applied to the walls. For the walls, four failure modes are considered, including mortar joint slippage, overturning, diagonal over-tension, and toe over-compression. It is shown that the rapid and comprehensive evaluation procedures are consistent with Publication No. 376. Moreover, suggestions are offered to modify the fundamental relationship of rapid assessment in Publication No. 376, which leads to evaluation results similar to FEMA154.

Key Words: Rapid evaluation, masonry building, FEMA154, FEMA356, Publication No 376.

FORMULATING THE BEARING CAPACITY OF STRIP FOOTINGS PLACED OVER TWO-LAYERED

material through the hoop action of a cell, thereby increasing the shear strength of the composite system. This paper presents a new analytical method, based on the theory of pavement layers and the theory of multi-layered soils, for estimating the pressure-settlement response of circular footings resting on a reinforced sand bed with a single layer of geocell. The elastic modulus of the unreinforced layers and geocell reinforced soil layer (geocell and soil inside the geocell pockets) as a composite material, was evaluated by an equivalent composite material, which was developed from triaxial compression tests on unreinforced and geocell-reinforced soil samples. Comparisons of the present analytical results with plate load test results show favorable agreement, and thus, indicate the accuracy and appropriate performance of this method. Also, parametric studies are carried out to investigate the influence of the dimensionless soil stiffness modulus, stiffness geotextile used in constructing the geocell, the height of the geocell layer and diameter plate loading, on the pressure settlement variations of the footing.

Key Words: Bearing capacity, geocell, settlement, analytical method, elastic modulus.

EXPERIMENTAL STUDY OF THE TRIAXIAL BEHAVIOUR AND CBR VALUE OF PLASTIC WASTE-SOIL MIXTURE

L. Najafzadeh Shavaki
l.najafzadeh.shavaki@gmail.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 31, Issue 3.1, Page 73-81, Original Article

- Received 21 July 2013; received in revised form 24 December 2013; accepted 6 January 2014.

Abstract
Bottled water is the fastest growing beverage industry in the world, and recycling their plastic waste has become a major challenge worldwide. The present study provides an approach for using waste p lastic strips as reinforcement material in soil backfill. The experimental tests investigate the behaviour of soil alone, and plastic waste-soil mixtures using static triaxial tests and CBR tests. The triaxial tests were carried out on the unreinforced soil samples and plastic-soil mixture samples at three confining pressures of 50, 100, and 150 kPa. The effect of small and large sizes of waste plastic was examined by three waste plastic strip contents of 0.5%, 1% and 1.5% (by total weight of the sample). The CBR tests were performed by standard CBR apparatus with a load rate of 1.27 mm/min on unreinforced and reinforced samples (i.e., waste plastic-soil mixture), with a large size of waste plastic particles, at four plastic contents of 0.5, 1, 1.5, and 2%. The results of the triaxial tests show that the strength of reinforced samples increases with increasing the size and percentage of plastic particles. For example, for the plastic content of 1.5%, at confining pressure of 50 kPa and strain level of 6%, a maximum improvement in the strength of the plastic-reinforced sample was obtained as 1.25 times the unreinforced sample. The results of CBR tests depict that the provision of waste plastic particles reduces the penetration of shaft into the sample and increases its CBR value. Overall, the results of CBR and triaxial tests demonstrate that the inclusion of waste plastic strips in soil with appropriate amounts improves the strength and deformation behavior of foundation beds substantially. The proposed technique can be used to advantage in bearing capacity improvement and settlement reduction in the design of shallow footings, embankments and road construction.

Key Words: Waste plastic particles, triaxial test, penetration, CBR value.

VIBRATION ASSESSMENT OF THE BEAMS VIA CHARACTERISTIC ORTHOGONAL POLYNOMIALS

R. Jafari
r.jafari@usc.ac.ir
A. Farazandeh(corresponding author)
a.farazandeh@usc.ac.ir
A. Nikkhoo
nikkoo@usc.ac.ir
Dept. of Civil Engineering
University of Science & Culture
F. R. Rofooei
rorooei@sharif.edu
Dept. of Civil Engineering
Sharif University of Technology

Sharif Civil Engineering Journal
Volume 31, Issue 3.1, Page 83-92, Original Article

- Received 29 July 2013; received in revised form 11 November 2013; accepted 11 January 2014.

found to be a function of the percentage of lime and BOS slag addition, as well as the curing period.

Key Words: Lime, basic oxygen slag, swelling, compressive, strength, stabilized.

ANALYTICAL EVALUATION OF PRESSURE ACTING OVER A BURIED CONDUIT IN REINFORCED GRANULAR SOIL

N. Afshar Kaveh
n.afsharkaveh@gmail.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 31, Issue 3.1, Page 51-62, Original Article

- Received 21 July 2013; received in revised form 20 January 2014; accepted 22 January 2014.

Abstract

Underground conduits, voids or buried pipes have been since ancient times for carrying oil, water, gas, sewage, slurry, and similar materials from one location to another. A conduit placed in a relatively narrow ditch is known as a ditch conduit, and it is often covered with locally available unreinforced earth fill. Designing a buried conduit covered with granular soil backfill requires that the vertical load acting on the conduit is estimated. A vertical load that develops above a buried pipe/ buried conduit often differs from free-field stress. The arching action of a granular soil mass overlying buried conduits can reduce the vertical pressure on them. Reduction in the load on the conduit occurs due to mobilization of the shear resistance along the walls of the ditch during settlement of the backfill within the ditch. However, in some cases, designers need more reduction in pressure acting over the conduit, which is possible by placing a geosynthetic layer within the soil backfill. This paper represents an analytical method to evaluate stress reduction on a buried conduit reinforced with a single reinforcement layer. Vertical pressure acting on the buried conduit is estimated, due to the simultaneous effects of soil arching action and the geosynthetic layer. A numerical example to evaluate vertical pressure over the conduit is explained. The effects of various parameters, such as tensile stiffness of reinforcement, elastic modulus of soft material, burial depth of conduit on the pressure over the conduit, and efficiency, are investigated and discussed. Comparison results of reinforced and unreinforced backfill shows the significant effect of reinforcement in decreasing stress acting on the conduit. This reduction is more highlighted when the depth of the buried conduit is increased. Comparisons of acting pressure on the conduit with the present approach shows satisfactory agreement with those obtained from other studies, under the same conditions, irrespective of unreinforced and reinforced backfill.

Key Words: Arching, reinforcement, buried conduit, vertical pressure, geosynthetic layer.

ANALYTICAL INVESTIGATION OF PRESSURE-SETTLEMENT RESPONSE OF FOOTING SUPPORTED BY A GEOCELL REINFORCED BED

T. Shaghaghi
tahereh.shaghaghi@gmail.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 31, Issue 3.1, Page 63-72, Original Article

- Received 21 July 2013; received in revised form 24 December 2013; accepted 6 January 2014.

Abstract

Geosynthetic materials, such as geotextile, geogride and geocell (as 3D-inclusion reinforcements), have been widely used in geotechnical engineering applications for, e.g., road construction layers, stable embankments over soft soil, longer-lasting road construction layers and expedient access over soft ground. An additional, possible, use would be to improve the bearing capacity of footings. Although analytical solutions on the bearing capacity of planar reinforcements have often been studied, there is a major lack of study into the bearing capacity of footings when supported on geocell-reinforced soil. Thus, according to the widespread use of geocell-reinforced beds, providing an analytical approach to the design of shallow foundations and to explain their stress-settlement behavior could be very useful. Due to the three-dimensional mechanism of a geocell, the cell walls of geocell reinforcement keep the encapsulated soil from being displaced from the applied load by confining the

Dept. of Civil Engineering
Amirkabir University of Technology

Sharif Civil Engineering Journal
Volume 31, Issue 3.1, Page 31-37, Original Article

- Received 1 July 2013; received in revised form 8 December 2013; accepted 29 January 2014.

Abstract

A common reason for uneven settlement of existing structures, founded on pile foundations, is negative skin friction (NSF) developed along the piles. As a result of fill placement, the soil surrounding the piles in soft ground settles more than the piles. In that case, negative skin friction occurs, producing pile settlement (down drag) and additional compressive force (down drag), due to the hanging effect around the pile.

(NSF) is usually mobilized up to the shear strength of soil in most cases, except at very close proximity to the neutral plane. The relative displacement between the settling subsoil and the pile shaft surface should not be more than a few millimeters to have even total settlement. Disregarding the effect of down drag forces on piles, due to consolidation of the surrounding soil, leads to damage in buildings and foundations. Many methods, especially numerical simulation methods, have been proposed to calculate the drag load on single piles. However, much less work has been done on drag load on a batter pile. Batter piles are commonly used to support marine structures and deep foundations. Based on the experimental data from Hanna & Nguyen (1986), shaft resistance decreases by the increase of angle of inclination for both compression and tension forces. On the other hand, it was found from full scale results reported by Mayerhof (1973) that the shaft resistance capacity for the pile increases due to an increase in the inclination angle. In this study, the effect of negative skin friction on vertical piles and batter piles is investigated. The analysis was undertaken using Abacus software, which is based on the Finite Element Method (FEM).

A single vertical end-bearing and one skin friction pile under different earth surface loadings were analyzed and the drag load force was studied. Subsequently, the performance of the single batter end-bearing and friction pile, with different inclination angles between 0-300 ,was analyzed. After different combinations of the existed loadings in both surrounded areas of pile drag loading, considering different cases .The vertical pile was modeled and its results were compared to those of previous studies for model validation. Then, single batter piles with different angles were modeled using the results.

Key Words: Batter pile, down drag, negative skin friction, drag load.

INFLUENCE OF BASIC OXYGEN SLAG (BOS) ON STRENGTH AND VOLUMETRIC STABILITY CHARACTERISTICS OF LIME STABILIZED KAOLINITE

M.R. Abdi(corresponding author)
abdi@kntu.ac.ir
Dept. of Civil Engineering
K.N. Toosi University of Technology
N. Bohlooli
navidbohlooli@gmail.com
Dept. of Civil Engineering
Azad University, Zanjan Branch

Sharif Civil Engineering Journal
Volume 31, Issue 3.1, Page 39-50, Original Article

- Received 8 July 2013; received in revised form 7 December 2013; accepted 28 December 2013

Abstract

Rapid development and industrialization has produced large quantities of waste. Much of this waste does not have any effective use, and its disposal has become more difficult and expensive because of the increasingly stringent environmental regulations and the shortage of suitable nearby disposal sites. It has been observed that some of this waste has high potential and can be gainfully utilized in other industries. To use industrial waste will not only help in solving environmental pollution problems associated with its disposal but also help in the conservation of natural resources.

Blast furnace slag and steel making slag is produced during the iron and steel making process. These materials are widely utilized in construction industries all over the world. Use of these by-products depends on their chemical composition and physical properties. Despite some industrial uses of blast furnace slag in Iran, it is still considered a by-product requiring storage. In this article, the effect of basic oxygen slag (BOS) on the swelling and shrinkage characteristics of clay soil has been investigated. Kaolinite samples have been treated with 1, 3 and 5% lime and 10, 15 and 20% BOS slag. Samples have been cured at$35°C$ for periods of 1, 7, 28 and 90 days, after which, they were subjected to swelling, unconfined compressive strength, and liquid limit, plastic limit and shrinkage limit tests. Results showed that the concurrent addition of lime and BOS slag to kaolinite, compared to lime treated kaolinite samples, significantly reduces their swelling potential. The unconfined compressive strength of lime/BOS slag treated kaolinite samples also showed a significant increase when compared to lime only treated samples. The amount of swelling reduction or the increase in unconfined compressive strength was

der Reliability Method (FORM), and the Random Finite Difference Method (RFDM) were adopted to investigate the probability of failure. The latter was invoked by a combination of random field theory with the finite difference method through Monte-Carlo simulations by FISH programming in FLAC software.

The results show that considering heterogeneity causes variability in results. The coefficient of variation and the scale of fluctuation have been found to have the most effect on the probability of failure. When the coefficient of variation of shear strength parameters increases, the mean factor of safety decreases, and the probability of failure increases. The vertical scale of fluctuation of parameters induces an increase in variance function, due to its increase up to a critical value. Furthermore, it seems that cross correlation has less effect on variations of the factor of safety of natural slopes.

Key Words: Heterogeneity, natural slopes, scale of fluctuation, cross correlation, factor of safety.

EXPERIMENTAL AND ANALYTICAL BEHAVIOR OF ACCORDION METALLIC DAMPERS BY INCREASING THE NUMBER OF LAYERS

F. Nateghi-Alahi
nateghi@iiees.ac.ir
International Institute of Earthquake Engineering & Seismology
M. Torbat Esfahani(corresponding author)
mehdi.torbat@yahoo.com
Dept. of Civil Engineering
Tafresh University

Sharif Civil Engineering Journal
Volume 31, Issue 3.1, Page 19-29, Original Article

- Received 27 May 2013; received in revised form 18 November 2013; accepted 11 January 2014.

Abstract

Over the last three decades, structural control systems have developed into three categories: Passive, Active and Semi active. The hysteretic metallic damper is among one of the most popular supplemental energy dissipation devices, as a type of passive control system. The accordion metallic damper (AMD) was suggested to be the best hysteretic metallic damper because of its high capacity to absorb energy and its desirable behavior characteristics, including convenient fabrication and installation. The efficiency of AMD to control and mitigate the response of structures under seismic loading is established, both experimentally and analytically.

In this research, for the purpose of improvement, the effect of increasing the number of accordion tube layers on the damping behavior of AMD is investigated using experimental, analytical and parametric studies. Experimental studies were conducted on single layer and two layer specimens under axial loading by a dynamic Roell-Amsler actuator. Analytical studies, based on the finite element method, and inelastic dynamic analysis have been carried out on a series of single and multi-layer AMD models, which have been verified by experimental results. Also, the effect of changing geometrical parameters on the damping behavior, by increasing the number of layers, was evaluated, and an ideal geometric model is made available. Finally, an analytical study has been performed to determine the effectiveness of a multilayer damper on the tolerability of low-cycle fatigue.

The results show that increasing the number of layers has a great influence on the amount of dissipated energy, loading capacity and elastic stiffness, due to greater stable behavior. This includes improving the buckling mode, preventing destructive modes of buckling and interaction effects between the layers. Parametric study shows that the combination of geometric parameters, such as thickness of layer, radius of tube, length of tube and radius of corrugation, will provide ideal model geometry with optimal energy absorption. A fatigue study shows that increasing the number of layers has good effects on increasing the number of cycles tolerated, and reduces the damage damper coefficient by decreasing the stress focus on critical areas of the damper wall.

Key Words: Energy absorption, experimental studies, finite element method, multilayer accordion metallic damper, parametric studies, low-cycle fatigue.

AN INVESTIGATION OF NEGATIVE SKIN FRICTION ON SINGLE VERTICAL AND BATTER PILE USING NUMERICAL MODELING

M. M. Hajitaheriha
mahdi_hajitaheri@yahoo.com
M. Hassanlourad(corresponding author)
hassanlou@eng.ikiu.ac.ir
Dept. of Civil Engineering
Imam Khomeini International University
A. Eslami
afeslami@aut.ac.ir

Abstracts of Papers in English

INVESTIGATION INTO THE EFFECT OF THE INHERENT HETEROGENEITY OF SOIL ON THE LONG TERM STABILITY OF EARTH SLOPES

R. J. Chenari(corresponding author)
jamshidi_reza@guilan.ac.ir
H. Kamyab Farahbakhsh
hasan.kamyab@gmail.com
M. zamanzadeh
masoud_zamanzadeh@yahoo.com
Dept. of Engineering
University of Guilan

Sharif Civil Engineering Journal
Volume 31, Issue 3.1, Page 3-17, Original Article

- Received 28 May 2013; received in revised form 11 January 2014; accepted 26 January 2014.

Abstract

Soil strength properties are inherently variable, due to the nature of their formation. Slope stability problems are among the most important issues in geotechnical engineering, and they are investigated in this study considering the effect of heterogeneity and anisotropy of soil strength properties in long term behavior. To this aim, the random field theory combined with the finite difference method has been adopted in the frame of Monte-Carlo simulations. The factor of safety of the slope has been calculated by the $C-\phi$ reduction method and the probability of failure has then been investigated through Monte-Carlo simulations.

Different stochastic parameters were considered in order to study their effect on the stability of natural slopes in long term schemes or under drained conditions. The coefficient of variation of the cohesion and internal friction angle representing strength properties, scale of fluctuation of the parameters, cross correlation between strength parameters and heterogeneity anisotropy, are among all stochastic parameters investigated in this study. Three different values of 10, 50 and 90 for the CoV of parameters were considered, in order to cover both low and high variability. Different vertical correlation lengths, ranging from 0.1 to 50m, are considered to cover a wide range, from fully uncorrelated to fully correlated parameters.

The First Order Second Moment (FOSM), the First Or-