SCOD removal efficiency of about 95% was observed at an OLR of 8.1 to 9.7 kg SCOD/m^3-d. At the maximum OLR of 24.9 kg SCOD/m^3-d, the leachate was pumped into the reactor without any dilution and a SCOD removal efficiency of 76.3% was obtained. Based on observations during the operation, the system described in this paper has an ability to treat leachate without using additives to adjust pH. A comparison between conventional UASB systems and the system used in this study shows that not only does the current system have a higher OLR capacity, but it can also reduce the biomass loss.

Key Words: Anaerobic treatment, leachate, municipal solid waste, anaerobic hybrid reactor.

INVESTIGATION OF UNSTEADY EFFECTS OF FRICTION LOSS AND TRANSIENT FLOW USING 1D ENERGY RELATIONS

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Abstract

Leaks in pipes and water distribution systems might occur for various reasons, such as poor quality of pipe material, errors in operation and maintenance, corrosion, and internal or external high pressure. As a result, loss of water, environmental problems, extra energy consumption and unnecessary pump capacity could be observed. To avoid all these consequences, it is essential to provide advanced monitoring methods to observe resulting problems and their extent, and then to find and implement solutions for water transportation and distribution systems to reduce loss and increase energy efficiency. Several leak detection methods have been introduced up to now, such as inverse transient analysis, to overcome these problems.

Application of the energy concept to fluid transients in closed conduits leads to an alternative description of unsteady flow behavior. In this interpretation, a transient in a pipe system can be viewed as a sequence of energy transformations, which moves the system from some initial hydraulic conditions to some other final states. During this conversion, mechanical energy is dissipated and work is done on the fluid. When the rate of flow in a closed conduit is changed, large-scale conversions of mechanical energy often occur, particularly if the pipeline is carrying water or any other slightly compressible liquid.

It is obvious that the side-flow volume flux has a marked effect on the unsteady frictional dissipation component of the fluid. Mathematical expressions describing these transient energy transformations are first derived from main principles and then the governing continuity and momentum equations are mathematically manipulated to provide the final set. Those various terms, which must be accounted for in the analysis, include the energy dissipated by fluid friction, the work done at the upstream and downstream ends of the pipe and the kinetic energy carried into and out of the conduit. In this paper, the leakage term is added into continuity and momentum equations and, therefore, the energy relation for the dissipated energy due to leakage could be derived. Then, in order to determine the appropriate condition for modeling the detection methods, based on transient flow simulation, the effects of the time of valve closing in laminar and turbulent flow, with low Reynolds numbers, have been investigated.

The results show that by using lower Reynolds numbers and longer durations of valve closing, appropriate results could be obtained for leak detection. In this manner, not only is the reliability of the results increased, but those sharp fluctuation indemnities caused by the fast transient flow are also avoided.

Key Words: Leak, transient flow, valve closing speed, unsteady effects of friction factor.

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Abstract

Construction industry in the developed countries has passed the traditional state and has become industrial decades ago. During this process, it was tried to use stylistic qualities, resistance, incorporation, insulation, speed in installation, performance facility, etc. in the consumed materials. Iran requires basic changes in using construction materials and industrial system of house production due to its particular climatic conditions such as being located on the earthquake belt and social conditions such as lack of house. 3D panel is one of the best options for industrial construction and especially mass building. The 3D panels consist of a polystyrene core (EPS) with a thickness ranging from 40 to 100 mm sandwiched between two plane-parallel welded wire mesh sheets (cover meshes) and inclined diagonal wires in between that go through the EPS core and that are welded to the cover mesh's line wires. Despite the plethora of researches on 3D shotcrete prefabricated panels, not many researched have been conducted on the connections of these structures. Consequently, the researches on the structures constructed with this system still continue, because the components behavior individually differs with their behavior in a single system. This new construction system came to Iran from Europe and earthquake forces in Europe is very negligible. Hence, the seismic behavior of the connections in these structures has not been studied sufficiently and the conducted works on the issue have been in Iran. In this research, different suggested designs for L & T shaped wall to wall connections of 3D panel under lateral-cyclic and gravity loading were modeled and analyzed by ANSYS software. Numerical analysis indicates that concrete vertical tie beam and welded wire mesh WWF-3/3/50/50 have positive effect on the ultimate strength and ductility of the connection. Hence, the most appropriate design for the connections is the one with welded wire mesh WWF3/3/50/50 and concrete vertical tie beam.

Key Words: 3D panel, 3D panel connections, shotcrete, L-shaped connection, T-shaped connection, ductility, gravity loading, cyclic loading.

PERFORMANCE OF AN ANAEROBIC HYBRID REACTOR TREATING MUNICIPAL SOLID WASTE LEACHATE

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Abstract

The growth in world population, improvement of public welfare and increase in the production of consumer goods, has resulted in increased quantities of solid waste generation. As in other developing countries, in Iran, landfilling is the main method of waste disposal. This preference, in terms of lower costs and simple technology, is justified, as long as measures are undertaken to protect waterways and soil contamination due to leachate discharge. Leachate usually contains high concentrations of organic compounds, such as ammonia N, heavy metals and inorganic salts, thus, necessitating treatment prior to discharge into the environment.

In this study, Kahrizak landfill leachate treatment was investigated using a 159 L anaerobic hybrid reactor. In addition, an external system (sedimentation tank + recirculation pump) was used for maintaining sludge in the reactor. A heat exchanger was used from the beginning until an organic loading rate (OLR) of 8.1 kg SCOD/m^3-d to keep the reactor temperature in the range of 33-37^{o}C. Because of malfunction, no auxiliary heating was provided after the above-mentioned OLR, and the system was operated at summer room temperature so that the wastewater temperature was 28-31^{o}C. Hydraulic retention time (HRT) was maintained at a constant value of 2.7 days, and the inlet soluble chemical oxygen demand (SCOD) was gradually increased from 9.2 to 67.2 g/L by diluting the leachate. The recirculation system decreased the actual HRT to 13.9 hr and a nominal HRT of 2.7 days. The set up level of flexibility for hydraulic shock loads was decreased, as such, but the recirculation system enabled the system to operate at an increased solids retention time (SRT).

According to the results, pH was in a range from 7.0 to 7.8. This level of pH resulted in a considerable amount of precipitation in the reactor, so that there was an increase of 13.7 kg in total suspended solid mass, while the volatile part increased just 2.5 kg during the study. This precipitation caused some clogging problems. Maximum

decrease collapse settlement in the compacted material, soil mass must be well compacted and prepared in a wet state.

Key Words: Collapse settlement, shear strength, clean gravel, saturation, large scale direct shear test.

EVAPORATION STUDY OF SAVEH DAM RESERVOIR USING MODIFIED ENERGY BUDGET METHOD

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Abstract
Evaporation is generally regarded as the most significant contributor to water loss from reservoirs in semi-arid regions of the world, such as Iran, and a precise estimate of this parameter is increasingly required for several agency functions, particularly water agencies. Monthly summer evaporation from the Saveh Dam reservoir, which accounts for around 50% of yearly water loss, was determined using the Bowen Ratio Energy Budget (BREB) method, and then compared and verified by results obtained by an automatic weather station and net radiometer placed near the dam reservoir site.
In order to assess the data obtained from the adjacent weather station of the reservoir (Shah Abbasi weather station) and experimental equations, an automatic weather station (AWS) and a net radiometer were located near the reservoir for collecting parallel data, during four months of 2008 (July-October). With these data, all Shah Abbasi weather station data have been adjusted and the BREB method was modeled again for all of the study period. These four months were divided into 12 energy budget intervals, and, for two thirds of them, the modified BREB results (MBREB) were larger than BREB. Furthermore, the largest difference between them occurred from the 9th to the 15th of July, with 11.2 mm, and there was at least 1.7 mm difference for the 8th to the 22nd of October interval. The maximum and minimum differences between results of evaporation using these two sets of data for these four months of field study were 15 and 3 percent, respectively, and the total evaporation difference was equal to 75 mm. Also, the yearly average BREB evaporation rate, using field study data (MBREB), was equal to 1620 mm, and the result was 1560 mm with Shah Abbasi station data. In addition, the accumulated volume of evaporation rate using field study data (MBREB) was equal to 83.7 MCM and the result was 87.0 MCM with Shah Abbasi station data for these 163 months. A sensitivity analysis for MBREB results showed that parameters, such as longwave and shortwave radiation, reflected longwave radiation from the water surface, air temperature, and water surface temperature variations have large effects on evaporation rates from this small reservoir. However, changes in stored energy in reservoir water, reflected longwave and shortwave radiation, Bowen Ratio and atmospheric pressure, caused small sensitivity in MBREB evaporation rates. Results of this study could explain the importance and sensible contribution of evaporation rates as a fundamental parameter in the hydrological cycle of lake ecosystems in the arid regions of Iran.

Key Words: free water surface evaporation, energy budget method, automatic weather station saveh reservoir or saveh dam.

DUCTILITY ANALYSIS OF L & T SHAPED WALL TO WALL CONNECTIONS OF 3D PANELS SUBJECTED TO LATERAL & GRAVITY LOADING

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retrofitting, from the perspective of plasticity and energy depreciation capacity. In the frames retrofitted by a cornerstone, because of the bracing function and a significant increase in the axial force of columns, the need to reinforce the columns and foundation is greater. Due to buckling of the compressive member in this type of retrofit, permanent deformation occurs in the frame. In retrofitted frame using cross cables, cables from the early stages of loading begin to pull, which increases the frame's initial stiffness compared to the stiffness of flexural frames. In this case, ultimate load increases and failure displacement reduces. In this frame, the cable brace converts frame behavior from ductile to brittle. Being narrow and unstable in hysteresis cycles shows the meager capacity of this frame to resist lateral forces. In this method of retrofitting, the required reinforcement of columns and foundation is considerable.
The initial stiffness of the frame with a cable brace with sheath and the flexural frame is the same. Up to the fixed amount of displacement and the brace being straight, the cable is ineffective in flexural frame behavior, and, after that, if lateral forces invade lateral forces, the brace contributes with a delay in frame behavior. By adding the brace to these frames while maintaining the plasticity of the frame, its resistance will increase. In this case, the increase in the axial force of the column is less than other methods of bracing, and the existing possible overload in columns and foundation can be responsive to the increase in axial force in columns, or, if retrofitting is needed, the amount of reinforcement is slight .

Key Words: flexural steel frame, cable bracing, nonlinear behavior, cyclic loading, base shear.

EFFECT OF SATURATION ON THE SHEAR STRENGTH AND COLLAPSE SETTLEMENT OF GRAVELLY MATERIAL USING DIRECT SHEAR TEST APPARATUS

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Abstract
Dried granular material subjected to saturation under certain vertical stresses, results in collapse settlement, due to sliding in the grain contacts, particle rearrangement and breakage. In this research, the effects of saturation on shear strength parameters and the collapse behavior of clean gravels are investigated via a large scale direct shear test. For instance, first, all physical properties of the gravelly material were evaluated via some specific laboratory tests, including grading analysis, specific gravity of soil solids, unit weight of soils and Los Angeles abrasion tests. Maximum and minimum densities were determined in order to provide samples in a specific relative density. The materials, which were selected for collapse tests were classified as GP and SP, due to their potential for collapse during saturation. In order to compare the shear strength parameters in dry and wet states, large-scale direct shear test apparatus with a sample dimension of $30 \times 30 \times 15 cm$ was used, and strain control tests were done on the saturated and dried samples. Vertical stresses of 1, 3 and 5 Kg/cm^2 were applied to the samples and shearing continued until 4.5 cm shear displacement. Collapse tests were done by the direct shear apparatus on the initially dry samples, which were flooded during shearing at the specific strain or in the specific shear stress levels. Result of laboratory tests showed that in most samples, shear strength parameters decreased with inundating the material, whereas the parameters in collapse and saturated tests were close to each other.
An important part of this paper is studying the effect of different parameters on the collapse phenomenon in gravelly material. Specific parameters were selected as vertical stress, soil density, coarseness or fineness of particles, initial water content, and shear displacement or shear stress level. Vertical stress and shear stress levels had a direct effect on the collapse settlement; in fact, an increase in vertical and shear stress levels results in more collapse settlement and more stress release during saturation. Another factor is sand content in the whole sample. It was shown that although sand particles were not prone to crack due to their small size, the collapse potential in the sand samples was much higher than gravelly material. In fact, particle rearrangement was the fundamental cause of collapse in sandy soils, while particle breakage in gravelly material is another reason for the collapse. Also, experimental results indicated that addition of moisture content, even in small amounts, would cause a high reduction in collapse settlement. Furthermore, the effect of soil density was studied in the collapse settlement and it was observed that collapse decreases with an increase in relative density. Thus, in order to

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Abstract

Estimation of evapotranspiration (ET) is needed for many applications in diverse disciplines, such as meteorology, hydrology and agriculture. Quantifying ET from irrigated projects is important for water rights management, water resources planning, water regulation and irrigation system performance. A common way of describing irrigation system performance is by comparing water supply and demand. Estimation of water supply is a straightforward exercise in most cases. However, estimation of water demand has proved to be much more difficult. Data are required on irrigated areas, types of crop, cropping calendars and specific crop water demand. Given these data, it becomes possible to calculate the total crop water requirements for each system. However, estimation of water demand proves to be more difficult, due to the absence of data on irrigated areas and cropping patterns. Remote Sensing (RS) algorithms are currently used to spatially estimate surface energy fluxes, e.g., evapotranspiration. Many of these energy balance models use information derived from satellite imagery, such as MODIS, AVHRR, and Landsat, to estimate regional ET. The RS approach to estimate ET provides advantages over traditional methods. One of the most important advantages is that it can provide regional estimates of actual ET at low cost. Compared with traditional point measurement methods (e.g., lysimeters and weather station data), this approach captures the spatial variability between and within agricultural fields.

The Surface Energy Balance Algorithm for Land (SEBAL) is an image processing model for calculating ET as a residual of the surface energy balance, which was developed in the Netherlands by Bastiaanssen. In this paper, a new algorithms was developed to use synopthic weather station data in large areas faced with lack of data, into a surface energy balance, coupled with remote sensing satellite-based mutispectral images, AVHRR, called, the Sharif University of Technology SUT-SEBAL, built on the same theoretical basis as its predecessor, SEBAL, to estimate spatial ET and actual water use in agriculture in the Varamin Plain (South of Tehran), from 2002-2005.

The results show that agricultural water use in this irrigation system is around 400 MCM annually. Their results were comparable with conventional methods, including CROPWAT. The results also can be used for accurately estimating ET for large populations of field and water users, and to quantify net ground-water pumpage in this area, since water extraction from underground is not measured. ET estimates that satellite images using SUT-SEBAL may ultimately replace current procedures used by the Tehran Water Company and other management entities that rely on field visits and simple ground measurements.

Key Words: SUTSEBAL, remote-sensing, energy balance, evapotranspiration, Varamin plain.

RETROFITTING OF FLEXURAL STEEL FRAMES USING CABLE BRACING

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Abstract

In this paper, the behavior of flexural steel frames using cable bracing is investigated. X bracing with angle profiles, X bracing with a cable, and bracing with two cables passing cylindrical steel sheaths at the intersection of the cables, are the three types of retrofitting of flexural steel frames studied in this paper. The finite element model of a steel frame, with and without the three types of retrofitting has been made. Non-linear analysis of frames under cyclic loading with increasing oscillations has been undertaken. Comparison of the results from the finite element model with experimental data shows that the finite element model has acceptable accuracy. By determining shear base, the axial force of columns, and the cyclic behavior of force-displacement, the failure mechanism of frames and the advantages and disadvantages of each type of retrofitting have been investigated .

According to results, using the Cornerstone profile for retrofitting steel flexural frames increases remarkably the initial stiffness and ultimate load of the frame compared to flexural frame and reduces ultimate displacement. Reduction in plasticity and frame energy absorption capacity shows the unacceptability of this type of

perature), on specific ammonium oxidation rate can be eliminated using the Taguchi method. Based on this method, it was demonstrated that abrupt cold shock caused a significant reduction in the process rate; up to 25, 55 and 78% for temperature reduction, from 30 to 25, 20 and 15^{o}C, respectively. Therefore, the temperature correction factor was calculated about 1.0965 by elimination of other factors except temperature. The temperature correction factor was also estimated to be about 1.106 using direct comparison.

Key Words: abrupt cold shock, ammonia oxidizing bacteria, temperature correction factor, Taguchi method.

PROBABILISTIC STUDY OF NONLINEAR BEHAVIOR OF MASONRY WALLS WITH OR WITHOUT TIE BEAMS

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Abstract

Masonry buildings are some of the most popular structures in Iran. Unfortunately this type of building is very vulnerable during earthquakes. Masonry walls are the basic elements providing strength and stiffness to masonry structures. Experimental results of masonry prisms show significant variations in the strength and stiffness of the units. The purpose of this paper is to study the effects of variations in the properties of masonry units in the behavior of masonry walls. In view of the lack of material data, Monte Carlo simulations are used in the analysis of walls. Statistical data collected on real materials are used in the analysis. These include compression strength, tensile strength and modulus of elasticity. These basic parameters are modeled as random variables. A finite element model of the wall is used, along with the said random variables. The validity of the finite element model is established by three different checks: Comparison with closed form solutions, experimental results and code formulas. From the Monte Carlo simulation, two parameters were obtained; ultimate displacement and maximum strength. These were extracted from a pushover, nonlinear analysis .

A parametric study was conducted in order to establish the effect of various parameters on the behavior of walls. The parameters included wall thickness (with two values 22 and 35cm), gravity load, based on the tributary area of the roof (roofs with 2 or 4 m spans), quality of material (fair, good), and type of lateral load simulating earthquake (with uniform, stepped and triangle accelerations, as well as displacement of a point of the roof). The last parameter was in the presence or absence of tie beams. The results show that gravity load will affect the maximum strength of the wall, as well as the final displacement. The type of lateral load will affect maximum strength, final displacement and their distribution probabilities. This is a noteworthy result, because the pattern of lateral load is a significant factor in pushover analysis. In masonry walls without tie beams, the strength of the wall increases with the use of good material. However, for the same type of wall, the final displacement is reduced with the use of good material. This is despite the fact that the use of good material increases both strength and final displacement in walls with tie beams. In other words, in the latter, wall ductility is increased. Another conclusion is that the coefficient of variation of the final displacement is larger than that of the maximum strength. This discrepancy can be up to 20 times. Therefore, when designing a masonry wall, it is much more difficult to reach a target displacement than a specific value of strength.

Key Words: Masonry Walls, Probabilistic Study, Material Uncertainty, Monte Carlo Simulation, Nonlinear Finite Elements.

APPLICATION OF THE ENERGY BALANCE ALGORITHM (SUTSEBAL) FOR ESTIMATING THE AMOUNT OF WATER USED IN THE VARAMIN PLAIN

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Abstract

An open region in Euclidean space containing thermoelastic transversely isotropic material is considered, wherein the axes of material symmetry from both mechanical and thermal points of view are identical. The coupled equations of motion and energy equation are considered as governing equations for the problem involved in this paper. The governing equations are a system of partial differential equations that cannot be analytically solved using classical methods. The related boundary value problem may be solved, either with completely numerical methods such as finite element methods, or with semi numerical methods such as the boundary element method. In the latter case, the related Green's functions are needed, which may be determined by solving the governing equations analytically. To do so, the system of partial differential equations governing the boundary value problems should be transformed into some separated partial differential equations. The method of potential functions is the best way to catch the separated partial differential equations. In this paper, based on a systematic method, a set of potential functions is introduced, which transforms the system of coupled partial differential equations into two separated equations. The order of the governing partial differential equations for one of the potential functions is six, and for the other is two. The uniqueness and non-uniqueness of the proposed potential functions are discussed and based on the non-uniqueness rule of the potential functions; two other sets for the potential functions are also introduced. In addition, the two dimensional case of the problem is discussed separately and the related potential functions are introduced. Applications of the results of this paper are seen if one determines the displacements and the temperature Green's function for the related initial boundary value problems, which, themselves, may be used in transient boundary element methods.

Key Words: Thermoelastodynamics;transversely isotropic; potential functions; equations of motion; energy equation; non-uniqueness of potential functions.

ABRUPT COLD TEMPERATURE SHOCK EFFECT ON NITRIFICATION RATE

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Abstract

Biological processes are known as temperature-sensitive in wastewater treatment. Nitrification and, especially, partial nitrification (first step of nitrification) are the most temperature-sensitive among biological processes. Factors such as dissolved oxygen, ammonia concentration, MLVSS, and etc, may influence two steps of the nitrification and organism growth rate, so nitrification should be done by controlling some of these factors.

In this study, biomass acclimation in a side stream partial nitrification sequencing batch reactor (SBR) under optimum conditions (e.g. T=30°C) for biological nitrogen removal (BNR) has been examined. In order to show the superiority of ammonia oxidizing biomass (AOB) over nitrite oxidizing biomass (NOB), excess sludge for solid retention time (SRT) regulation was added to another batch reactor, which had been performed under different conditions (e.g. T=25, 20 and 15°C) for specific ammonium oxidation rate (sAOR) evaluation and cold shock effect consideration.

Results of the side stream, partial nitrification, sequencing batch reactor showed that the specific ammonium oxidation rate at the end of any cycle and after steady state conditions was about 16.4 mg $N - NH_4{}^+$ gr VSS / hr. Primary results of main stream batch tests after analysis by the Taguchi method displayed that the percent influence of consideration factors includes temperature, initial ammonium, MLVSS and time, whose specific ammonium oxidation rates were about 98.5, 0.09, 0.06 and 1.3%, respectively. So, temperature is an important factor that affects the specific ammonium oxidation rate. More analysis on the results has shown that the effects of other factors, except the considered factor (e.g. tem-

frame structures, designed using DBD, are more than those designed using the force method. It is due to using a ductility capacity instead of a response modification factor (R) in reducing elastic demand spectra. Also, results indicate improvement in the ductility, load-carrying capacity and performance of frame structures designed by the DBD method, because of the increased percentage of longitudinal and stirrup reinforcements and increased section dimensions.
Frame Structures designed using the force method become inelastic under earthquake with smaller acceleration than design acceleration and experience large displacements; whereas this is unlike the objective of design of essential buildings in the code. Evaluation of frame structures, designed by the force method, indicates that they are not appropriate for desired performance levels (Immediate Occupancy), unlike the frames designed by controlled displacement. It could be concluded that the displacement-based method could be a suitable substitute for the force-based (traditional) method in the seismic design of essential buildings.

Key Words: Displacement-based seismic design, Iranian Seismic Code (IS 2800-05), seismic behavior, nonlinear static analysis, ductility capacity.

THE EFFECT OF FINES TYPE ON THE PORE PRESSURE GENERATION CHARACTERISTICS OF SATURATED SAND

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Abstract
Sands in nature generally contain plastic and non-plastic fines. Previous research has been mainly focused on the cyclic behavior of saturated clean sand. Recent studies, however, reveal that the cyclic behavior of saturated sand containing plastic fines is quite different from that including non-plastic fines. Moreover, most liquefaction studies have concentrated on stress-controlled cyclic triaxial testing of clean sand, while strain-controlled testing allows a more fundamental assessment of pore pressure generation. It is due to the strong relationship between shear deformation and pore pressure generation. In this study, the effects of plastic and non-plastic fines on the pore water pressure behavior of saturated sand are studied by means of a strain controlled cyclic triaxial tests. To this aim, all specimens are prepared by moist tamping using the undercompaction technique. Specimens are subjected to 50 sinusoidal cycles of axial strain at a loading rate of 0.1 Hz. Furthermore, shear strain levels are applied in the range of 0.003% to 0.3%, and pore pressure is directly measured in the specimens. The results demonstrate that the specimens with up to 15% non-plastic fine (silt) content generate a lower value of pore water pressure than that of clean sand. Increasing silt content to 30% leads to a pore pressure close to that of clean sand. On the other hand, in sand specimens with up to 20% plastic fines (kaolinite), generated excess pore water pressure is more than that of clean sand. Up to this plastic fine content, sand grains still get in touch with each other, and clay particles play a role like a lubricant film between them. The result is a more collapsible fabric as the sand-skeleton tries to rearrange itself into a more stable structure. By increasing plastic fines up to 30%, the excess pore water pressure noticeably decreases to a level that is less than that of clean sand. This could be attributed to the fact that at larger fine content, the sand-skeleton void ratio is larger than the maximum void ratio for clean sand. Therefore, the sand grains are no longer in contact, floating in the kaolinite matrix. Thus, the specimen shows a clay-like behavior. Consequently, the behavior of the specimen is controlled by the fines, so that the specimen indicates cyclic mobility behavior. This investigation reveals that the conventional criteria for liquefaction assessment, such as the standard penetration test (SPT), do not consider the effect of the plasticity of fines. Therefore, to evaluate the liquefaction potential of sands containing fines, one should resort to other precise tests, such as cyclic triaxial tests.

Key Words: Pore water pressure, plastic and non-plastic fines, cyclic triaxial tests,liquefaction.

THERMOELASTODYNAMIC BOUNDARY VALUE PROBLEMS IN TRANSVERSELY ISOTROPIC MATERIAL WITH POTENTIAL FUNCTIONS

STUDYING CURRENT PROVISIONS FOR INTERMEDIATE LINKS IN EBFS

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Abstract
Among different link types, short links are always considered the best alternative due to their better energy dissipation capacity and ductility. But, architectural limitations, in some cases, leave no choice other than intermediate and long links. Furthermore, the results of recent studies have revealed some non-conservative behavior of intermediate links, i.e. they do not satisfy the provisions. To investigate the validity of the current provisions for intermediate links, some separated link beams are modeled here, and the effect of different parameters on their performance are studied. The boundary conditions of models are selected so they could realistically reflect link behavior in a real structure. The concerned links are modeled using the finite element method in the ANSYS program. Verifying the modeling approach with previous experimental, as well as analytical, works, stiffener spacing, thickness, slenderness ration of web and flange, link length, section, and other significant parameters on link performance, are inserted in the study, and their role in link behavior are investigated. Considering the intended aim of the paper, monotonic loading is not suitable, and cyclic loading according to protocols prescribed by codes like AISC2005, ATC24, etc, were applied to the models. By analyzing model outputs, the hysteretic behavior of the links is extracted and the plastic rotation capacity of links, that is, the main parameter utilized to judge link behavior, is deduced. Also, the graphical outputs of models, such as displacement, and elastic and plastic strains, at different load steps, are used to support the results. Stiffener spacing and position (whether they are provided on one or two sides of the web) and the web slenderness ratio are discerned as the most effective parameters on the behavior of intermediate links. The current plastic rotation capacity considered for intermediate links is shown to be unreliable for specified length ratios of these links. Finally, some design suggestions have been provided for these types of link.

Key Words: Link ductility, eccentrically braced frames, shear moment interaction, intermediate links, finite element method in steel structures.

STUDY ON DISPLACEMENT-BASED AND FORCE-BASED DESIGN METHODS FOR SEISMIC DESIGN OF ESSENTIAL BUILDINGS

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Abstract
In recent years many research efforts have been undertaken in order to develop design methods and structural performance-based evaluation. One of the most recent methods for the design and evaluation of structures at different levels of earthquake and performance, using nonlinear analyses, is displacement-based design.
The main issue in displacement-based design is the development of simple and accurate methods for the analysis and design of new buildings, and evaluation of existing buildings at different performance levels. In this paper, the new and simple displacement-based design method (DBD) (Ghorbanie-Asl and Humar, 2007) is introduced. The main characteristics of this method concern higher mode effects in design, with no need to estimate or calculate the fundamental period of the buildings.
In this paper, two reinforced concrete frame structures (essential building, hospital) were designed using the traditional force method (linear static method of standard No. 2800) and the new DBD method, and then frame sections, weight and fundamental periods were compared. Then, the seismic performance of the mentioned frames was compared using nonlinear static analysis. In this regard, inelastic rotation of plastic hinges, ductility and load-carrying capacities, performance levels and story drifts of both designed frames were compared.
The results indicate that design base shear, dimension of structural members and weight of reinforced concrete

a function of main parameters of earthquakes, soil mass, and geometry of the structure. To do so, among the important factors of earthquakes (maximum acceleration (a_{max}), predominant period (T_p), effective time (t), magnitude (M)), the predominant period, and, among geotechnical and geometrical characteristics, (height of structure (H), length of nails (L), horizontal and vertical distance between nails (S_H&S_V), geotechnical properties of soil (F_S), angle of slope (α)), the height of the structure, have been picked up as primarily parameters. To choose appropriate coefficient for specific earthquake records, and geotechnical and geometrical characteristics, the behavior of soil nailed walls in two modes of dynamic and pseudo-static seismic behavior have been synchronized for wall horizontal displacements. Afterwards, the pseudo-static coefficient is defined as a function of predominant period and height of structure. Obtained results demonstrate the great impact of the height of structures and the predominant earthquake period on the pseudo-static seismic coefficient. They include the fact that an increase in height will bring a decrease in the pseudo-static coefficient, and the highest of coefficients and its variation yields, by the natural period of the structure. This highlights the importance of investigating the seismic behavior of soil nailed walls for their natural periods.

Key Words: Soil nailed wall, seismic performance, pseudo-static coefficient.

EXPERIMENTAL AND NUMERICAL STUDY OF SOIL-REINFORCEMENT EFFECTS ON THE BEARING CAPACITY OF SHALLOW FOUNDATIONS NEAR THE RETAINING WALL

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Abstract

A comprehensive set of laboratory model tests were carried out to investigate the behavior of reinforced sand and flexible retaining wall under strip foundation loading. A model box with inner dimensions of $0.4 \times 1m$ in the plane and 0.5m in height was used. One side of the test box was a transparent plexiglas plate for observation, and for photographing soil deformation and failure mechanism during the test. Three linear variable displacement transducers (LVDTs) were used to measure the horizontal displacement of the wall. The strip footing was made of a steel box; 0.399 m in length, 0.06 m in width and 0.03 m in thickness. The length of the footing was made almost equal to the width of the tank model in order to maintain the plane strain conditions. For modelling the flexible retaining wall, factory-trimmed aluminium of thickness 5mm was used. All tests were conducted with a wall height of 0.42 m and geotextile reinforcement. Displacement (Settlement) of the model footing was measured using two LVDTs, located on each side of the centre line of the footing. The sand raining technique was used to prepare the model backfill and the model footing was loaded using a hydraulic jack. Relationships between the bearing capacity and wall deflection versus geotextile parameters, such as depth of geotextile layer, number and spacing of geotextile layer and linear footing position to the wall face, were studied. A series of finite element analyses was additionally carried out using the PLAXIS program, and the results were compared with test results. Both experimental and numerical studies indicated that the bearing capacity increases with an increasing number of reinforcement layers, and the wall deflection decreases also with an increasing reinforcement layer. The use of multiple layers of reinforcement is beneficial only if the spacing between the reinforcement layers gives a better result for the bearing capacity and the wall deflection. Inspection of reinforcement and soil behaviour with the PIV (particle image velocimetry) method and the PLAXIS program indicate that increasing reinforcement layers causes a large, wide failure zone rather than unreinforced backfill. For the first, second and third reinforcement layer, the optimum spacing obtained 0.12H improvement in bearing capacity or wall deflection. However, this did not depend solely on the spacing of the reinforcement layers; the number of these layers and the footing location were also important. With the footing near the wall face (b/B=1.17), bearing capacity and wall deflection increased more than in the other cases. For two different footing positions, the wall deflection decreased as the geotextile number and spacing increased, and the bearing capacity reached maximum value at a depth of d/H=0.33.

Key Words: Strip footing, reinforced sand backfill, flexible retaining wall, PIV.PLAXIS.

Abstracts of Papers in English

EVALUATION OF PSEUDO-STATIC COEFFICIENT FOR SOIL NAILED WALLS IN COARSE GRAINED ALLUVIUM OF TEHRAN ON THE BASIS OF SEISMIC BEHAVIOR

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Abstract

Soil nailing is an in situ soil reinforcement technique used for enhancing the stability of slopes, retaining walls and excavations. The technique involves installation of closely spaced, relatively slender structural elements, i.e., soil nails, into the ground to stabilize the soil mass.

Flexibility, ease of construction, and economical justification of soil nailing, with respect to other stabilizing methods, has gained much attention during the last three decades. Moreover, the increase in application of this method in seismic prone areas for permanent stabilization has established a need to investigate the seismic behavior of soil nailed walls. While time history dynamic analysis consumes lots of time and money, the pseudo-static method achieved a high and specific rank, despite its inherent lack of accuracy. The independency of the pseudo-static method from factors affecting the seismic behavior of structures, and the dependency of the seismic behavior of geotechnical structures, specifically soil nailed walls, to the primary parameters of earthquakes, geotechnical parameters and geometrical configurations are the main deficiencies of this method.

In this study, in order to modify the pseudo-static method, on the basis of seismic behavior of soil nailed walls, it has been endeavored to define the pseudo-static coefficient as