seismic analysis is performed by using Newmark time integration scheme. The pine flat dams in California are selected as a case study, and EL Centro, San Fernando, and North Ridge earthquakes is applied for the model. According to the obtained results of the probabilistic analysis model, which shows the sensitivity of the dam seismic responses to the rubber damper dimensions, a suitable range of the rubber damper dimensions to the safe and optimum design has been proposed.

Key Words: Concrete gravity dam, interaction, monte carlo, optimization.

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Abstract

Considering the vulnerabilities of elevated water tanks, as the most important and necessary potent water supply structures in cities, during the previous earthquakes, the need to maintain their operability after earthquake is of great importance. Design of seismic isolators and their application in specific structures, including elevated air tanks, is one of the innovative technologies in the field of structural and earthquake engineering. Installed at the building foundation, at different floors, or under bridge decks, this system can provide damping and depreciate lateral forces in order to decline their adverse effects. In fact, by adding this system to different structures, we can decrease the energy exerted on the structures as a result of earthquake. Therefore, by reducing demands, we can prevent damages to structural elements, development of plastic hinges, and finally failure of structural elements. In tank structures, bulk of the mass is placed at a considerable distance from the foundation. Analysis of these structures under the lateral forces exerted on them is of great importance, especially for securing these structures and maintaining their efficiency. Using time history dynamic analysis and taking into account the effect of interaction between fluid and structure, a concrete-foundation elevated water tank both with and without seismic isolators is analyzed at different water levels and earthquake acceleration records. In this model, the seismic isolator was used in the junction of tank and concrete columns. The results show that application of isolators in elevated concrete tanks will damp the adverse earthquake energies. The damping process increases the natural period of structure and significantly decreases the extent and acceleration of forces exerted on the building. An increase in natural period of the structure will in turn decrease the tank displacements base and shear forces in the tank, which will lead to the stability of the structure both during and after earthquake and will maintain the post-earthquake operability of the tanks that is the final goal of the present study.

Key Words: Elevated water tank, dynamic time history analysis, damper, elasto meters, earthquake.

SEISMIC OPTIMIZATION OF CONCRETE GRAVITY DAM WITH RUBBER DAMPER USING PROBABILISTIC ANALYSIS

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Abstract

In designing engineering systems, achieving the desired goals with low cost is the ultimate aim. Therefore, minimizing cost and optimizing engineering designs have been considered in the engineering sciences for a long time. The optimization process is important in building concrete dams due to the large volume of concrete used in the dam body. Much of the dynamic force acting on the dam caused by the hydrodynamic force is generated through the interaction between the dam and reservoir, which increases the amount of seismic responses of the dam. Therefore, hydrodynamic dampers with different materials were used for the upstream of the dam body to reduce the effect of the dam and reservoir interaction on seismic response. The use of hydrodynamic dampers, in addition to reducing the hydrodynamic pressure against the dam, the economic aspect of the design is also less expensive than other designs. In this paper, in order to increase the efficiency of hydrodynamic dampers, the optimized dimensions through Monte Carlo probability analysis as a modern method of optimizing structures, were studied. ANSYS software that is based on finite element method is used for modeling and analysis. Flexibility of foundation is considered in modeling and Sommerfeld boundary condition is used for far field reservoir boundary. The water is taken as an inviscid, compressible and irrotational fluid with small displacements. According to governing equations and geometrical shape of dam, the problem is considered two-dimensional, and

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Abstract

Seismic loads may damage municipal solid waste landfills (MSWLF) through the relative movements within the waste, bottom-lining system, cover system, foundation, and interfaces. These movements can disrupt the performance of drainage and gas collection systems, thereby resulting in environmental pollutions. The smooth synthetic materials might be placed beneath the structures to provide seismic protection by absorbing the imparted energy of earthquakes through the sliding mechanism. It has been found that a high-strength geomembrane placed over the other smooth and lubricated geomembrane sheets (e.g., geomembrane/geomembrane) constitutes a liner that is well suited for this application. In the present study, experimental investigations were conducted in order to evaluate the role of in-soil base isolation on seismic response of the Kahrizak MSW landfill with more than 7000 tons waste disposal daily in Tehran, Iran.

Results of geophysical and geotechnical investigations in the landfill site are presented in detail. Shaking table tests were conducted on the MSW embankment isolated by semielliptic shaped liners and subjected to harmonic sinusoidal base excitations. Two types of base isolation system were employed in the experiments. The results of the isolated and non-isolated cases are compared in terms of permanent displacement and seismic response. It has been observed that, at all elevations, the spectral accelerations within the waste decreased by base isolation, especially for the more intense excitations.

Although the fundamental period of the embankments significantly increased by increasing the amplitude of input motion, the base isolation mechanism did not affect the system period. In fact, isolation liners can significantly reduce the seismic shear forces and accelerations transmitted to the landfill crest. The sliding displacement that is required to provide efficient soil isolation is in the range of permissible displacements for MSW landfills. Results of the present study demonstrate a suitable application of geosynthetic liners for seismic retrofitting of landfills.

Key Words: Seismic response, municipal solid waste landfill, base isolation, geosynthetic liner, permanent displacement.

EVALUATING THE EFFICIENCY OF FEM TO STUDY THE EFFECT OF PLATE WIDTH AND HOLE ON THE STRESS INTENSITY FACTOR IN CRACKED PLATE

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Abstract

One of the important parameters in fracture mechanics is the stress intensity factor (SIF) which is used to predict crack growth and residual life of the cracked member. The SIF represents the stresses field around the crack tips. One of the effective factors on stress intensity factor is the crack length (to plate width) ratio, which has been studied by researchers with different close form methods such as the Laurent expansions method. This article aims at studying the qualification of finite element method (FEM) to evaluate the effect of width of plates with displacement controlled loading on SIF. For this purpose, plates with different aspect ratios and crack lengths are modeled by FEM using singular elements at the crack tips and the SIFs are calculated by crack extension technique. The present study represents that the results from this technique are in good agreement with the results from other close form techniques available in references. In addition, the effect of holes existing with different distances from the crack tip on SIF is examined. Results show that this effect is very small for the holes located over 10 percent of plate width away from the crack tip.

Key Words: Central cracked plate, stress intensity factor, finite element method, singular elements, crack extension technique.

EFFECT OF ISOLATOR ON SEISMIC BEHAVIOR OF ELEVATED WATER TANK

as the best wavelet function. In the second step, dimensionality reduction is applied to reduce amount of data. Principal component analysis (PCA) is used to reduce data. PCA is an effective technique that has proved its ability when the amount of data is large. It maps linearly correlated data points called 'principal components' based on the highest variance. By using PCA the wavelet coefficients of sixteen sensors are reduced to only one signal. Energy of the reduced coefficients is considered as a damage index. Results show that the proposed algorithm has a good capacity to identify damage in the investigated structure.

Key Words: Damage detection, signal processing, energy index, discrete wavelet packet, dimensionality reduction.

FEASIBILITY STUDY OF FROZEN SOIL WALL APPLICATION TO SUPPORT THE EXCAVATIONS- A CASE STUDY OF TABRIZ SUBWAY

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Abstract
Artificial Ground Freezing is a novel, advanced, economic and eco-friendly technique in order to improve soil properties and support soil bulk. The pure water within the soil freezes and becomes a strong and waterproof material. Therefore, the frozen soil is so strong which can be used as a temporary soil support system in underground construction. In this paper, three-dimensional finite element method for frozen soil wall was simulated through modified Mohr-Coulomb constitutive modeling method. This model was verified by numerous triaxial compression tests in geotechnical laboratory of the University of Tabriz, and parametric study of frozen soil wall was performed. It is worth mentioning that this research was implemented as a case study of line 2, Tabriz urban subway and all of the specimens obtained from line 2 boreholes. Also, to verify numerical model precisely, one physical testing model was built after inducing boundary condition and parametric analyzing. In this study, the effect of temperature of frozen soil, surcharge intensity and depth of excavation on the stability of frozen soil wall were investigated. All of the simulations were performed via ABAQUS software. Results show that, lateral displacement of the wall inward excavation reduces with frozen soil wall temperature, and this reduction at wall supports is more than the middle. Increasing of surcharge in the middle of the wall leads to increase in lateral displacement of frozen soil wall inward excavation which is larger in the middle. Also, increase in depth of the excavation leads to increase in lateral displacement of the frozen soil wall inward excavation, especially in the middle of the wall. Moreover, according to results, surcharge intensity and excavation depth are more effective parameters than frozen soil wall temperature. In addition, frozen soil structures can have high ductility by accurate design. As a conclusion, this technique is recommended as an elaborate and reasonable method of temporary soil support system.

Key Words: Artificial ground freezing (AGF), finite element method, triaxial compression test, tabriz subway.

EVALUATING SEISMIC IN-SOIL ISOLATION OF MSW LANDFILL USING GEOSYNTHETIC LINERS IN SHAKING TABLE TEST: CASE STUDY OF TEHRAN KAHRIZAK LANDFILL

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Abstract

Secondary currents are important mechanisms in open channels, having major contribution in flow field and its corresponding parameters including boundary shear stress and depth-averaged velocity. Compound open channels involve extra plan form vortices in the flow field. Curved open channels generate especial vortices due to the effects of centrifugal force. Precise modeling of secondary currents in curves and meanders is a very important issue in practical applications. Using open source "OpenFOAM" software, the flow field in a meandering channel with compound cross section is simulated herein. Reynolds averaged Navier-Stocks equations (RANS) are solved. Applying appropriate boundary conditions over the free-surface, the simpleFoam solver has been used to model the two-phase air-water flow interface, assuming a steady flow condition, and a symmetry boundary condition. The experimental data from FCF belonging to University of Birmingham is selected for verification and validation of the present numerical results. Two turbulent models of Realizable $k-\varepsilon$ and SST $k-\omega$ are applied. Lateral velocity profiles at the cross sections indicate that at each wavelength of a meander, a vortex forms in the main channel at the apex, directing towards the outer bank near the bed and towards the inner bank near the water free-surface. The secondary current patterns, achieved for curved compound open channels differ from those of the simple channels. This is partly due to the interaction of shear stresses occurring at the interfaces between the main channel and the floodplains. Deviation of paths of the main channel and floodplains, downstream of each apex, results in entering the flow from inner bank to the main channel and exiting the flow from the main channel to the outer bank. These flow patterns shift the flow from inner- to the outer bank, downstream of each apex. Therefore, a helicoidally secondary current pattern forms, growing in size and strength farther downstream of the apex region.

Key Words: Secondary currents, meander, compound channel, reynolds averaged navier-stocks equations.

DAMAGE DETECTION OF STRUCTURES USING WAVELET PACKET ANALYSIS AND DIMENSIONALITY REDUCTION

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Abstract

Detection of damage in structures is a main concern in many areas of civil engineering. In recent years, developments in sensor technology and signal processing techniques has attracted researches toward signal-based methods. In this study a damage detection algorithm is proposed for structures based on signal processing and dimensionality reduction. IASC-ASCE health monitoring benchmark structure is utilized for analysis. This building is a 12-DOF frame with braces at each level. Six damage cases are defined which cover a range of extensive to slight damages. It is assumed that each story is instrumented by four sensors. A random excitation is applied on the structure to simulate earthquake load. 10% noise is considered to model real condition signals. First, wavelet packet decomposition (WPD) is utilized to decompose sensor outputs. In comparison to discrete wavelet transform (DWT), WPD decomposes both approximations and coefficients to form a full tree. Each sensor output is extracted separately. To separate noise from the actual vibration, signal is decomposed and then reconstructed. Best tree is evaluated to estimate decomposition levels using the Shannon entropy criterion. Since sensor outputs are different, best tree for each signal differs. Therefore extraction is made on one level. Coefficients of the first level are considered as the signal features. Next, several wavelet functions are examined to find the most appropriate one for this study. Twelve functions are compared and Bior 3.3 is selected

Abstract

One of the most popular isolators is Friction Pendulum System (FPS). Recent studies and tests have revealed that using these isolators in near-field earthquakes leads to amplified responses. Recently, passive adaptability characteristics have been introduced in these isolators to remove resonant responses. In adaptable sliding isolators, the restoring force is reduced. Hence, base displacement increases. In this paper, two variable curvature isolators, Variable Curvature Friction Pendulum System (VCFPS) and Variable Frequency Pendulum Isolator (VFPI), are employed in the base-isolated benchmark building. The earthquakes are applied bi-directionally on the horizontal plane, ignoring the vertical ground motion component. The shear type base-isolated benchmark building is modeled as a three-dimensional linear elastic structure with three degrees of freedom at each floor level. Time domain dynamic analysis of the benchmark building is carried out by means of the constant average acceleration Newmark-Beta method. The base-isolated benchmark building is investigated for uniform isolation through the performance criteria and time history response. It is observed that variable sliding isolators performed better than conventional FPS due to their varying characteristic properties that enable them to alter the isolator forces depending upon their isolator displacements, thus improving the performance of the structure. To reduce the displacement of the seismic base isolator, semi-active control method with magneto-rheological damper (MR damper) and wavelet neural network controller are employed. MR damper voltage is calculated by the control algorithm to generate the optimum control force of structure. This controller is optimized by genetic algorithm. Numerical results prove that the use of semi-active control systems performs more successfully in reducing the seismic isolator displacement, in comparison to the increasing coefficient of friction of isolators and passive control.

Key Words: Variable curvature friction pendulum system (VCFPS), variable frequency pendulum isolator (VFPI), base-isolated benchmark building, semi-active control, wavelet neural network.

EFFECT OF TENSILE STRENGTH CONSIDERING SIZE EFFECT AND LOADING RATE ON OPTIMUM DESIGN OF ARCH DAM

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Abstract

Unreinforced mass concrete tensile strength is the most important parameter in concrete dams design. Actually, concrete strength is affected by several factors such as section size, type and rate of loading, and material and mixture properties. As is well known, concrete member tensile strength tends to decrease when its size increases. Obviously, in concrete dams with large sections, this effect is more pronounced. In this study, we aimed to investigate the major changes in the shape and volume of optimal arch dams designed taking into account the factors mentioned above, especially the structural section size effect on concrete resistance. To this end, the apparent tensile strength proposed by Dungar on the basis of Bazant size effect law was used. The results obtained were compared with the designs based on classic or Raphael tensile resistance criterion. To design the dams, CADSO, the software for optimization of arch dam shape, was used, and its design improved in order to apply the aforementioned resistance equations. The new software is able to determine the optimized shape of dam by meeting various constraints, such as tension limitations, resulting from loading combination conditions including body weight, water pressure, and seismic status while considering sections size and type and rate of loading. The results of studies on the great Shahid Rajaee Dam suggest that the optimized design based on the principles of fracture mechanics increases the thickness of sections, especially in the tensile stress concentration positions near the foundation. The process changes the optimal shape pattern of the dam body shell increasing its volume, for the case studied. According to the results mentioned, it appears that there is a serious concern with the conventional design of concrete dams; size effect has to be taken into account for the safe design of concrete dams shape.

Key Words: Size effect, rate of loading effect, tensile strength of concrete, shape optimization of concrete dam.

NUMERICAL MODELING OF FLOW IN MEANDERING COMPOUND OPEN CHANNELS

Results of this research show that the amount of lateral earth pressure on the wall is dependent on changes of soil shear wave velocity, seismic excitation frequency and geometric parameters of system and response of system is different from homogenous soil. Distribution of inhomogeneous soil lateral pressure expresses that by increasing shear wave velocity at soil surface to shear wave velocity at soil base, location of maximum horizontal stress change from 0.55H to 1H (H: height of retaining wall). In addition, by increasing the damping coefficient of the soil, the lateral pressure exerted on the structure decreases. In the case where the damping coefficient is equal to zero, the amount of horizontal stress increases significantly. The vertical stress of soil is maximum in the wall toe while the amount of horizontal stress is minimum at the same point. Critical vertical pressure distribution occurs in a specific excitation frequency and at the same frequency maximum amount of lateral pressure is applied on the wall. Results also show that lateral earth pressure on retaining wall makes it similar to the behavior of cantilever beam. Thus, implementing the inhomogeneous properties of soil presents a more realistic image of retaining structures and improves design of these types of structures.

Key Words: Retaining wall, inhomogeneous soil, lateral earth pressure, seismic analysis, elastic method.

INTEGRATION OF RISK MANAGEMENT AND FUZZY INFERENCE SYSTEMS IN ORDER TO PROJECT TIME ESTIMATION IN GAS REFINERIES CASE STUDY: CONSTRUCTION OF KHANGIRAN PARDIS COMPLEX

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Abstract
Nowadays the importance of time management in the field of construction projects is well known for everyone. Time management can be effective in a project when the project schedule is based on reasonable, sustained and comprehensive time estimation. In the industries with complex processes such as gas refineries, considering limitations and risks involved in the project implementation and also many uncertainties that affect the implementation of project activities, the importance of the Time Management will be more significant. As the ongoing projects are directly or indirectly linked with continuous production in the gas refineries, operational musts and site classification based on the HSE risks besides limitations of the project implementation in normal condition, increases excess uncertainties to the project schedule. Considering the very low reliability of the planning with certainty and project control by this approach, using more secure models for control and interact with uncertainty to be placed on the agenda. This article aims to present a new model based on the integrated risk management & fuzzy expert systems in order to provide accurate and comprehensive project time estimation in the gas refineries of the IRAN and in this regard reviews the results of implementation of this model in a case study.

Key Words: Time management, time estimation, uncertainty, risk, fuzzy expert systems.

SEMI-ACTIVE OF BASE-ISOLATED BUILDING WITH VARIABLE CURVATURE SLIDING ISOLATORS

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clusions are also drawn from different perspectives: the transferred model to Qazvin has a better Transfer Rho-Square, Transfer Index, Root-Mean-Square Error, and Relative Aggregate Transfer Error than the transferred model to Eslamshahr.

Key Words: Spatial transferability, trip production, ordered logit.

A COMPARISON OF SITE SHEAR WAVE VELOCITY PROFILE USING TWO METHODS OF INVERSION OF MAXIMUM ELLIPTICITY AND SPECTRAL ANALYSIS OF SURFACE WAVES, CASE STUDY OF KERMANSHAH CITY

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Abstract

Shear wave velocity profile of construction site is one of the most important parameters that is requested for evaluation of seismic strength of sub-surface layers and their effects on the seismic design of surface structures known as site effects. There are several known methods to extract the shear wave velocity profile of ground. Amongst, some methods were developed based on analysis of surface waves from active or passive sources. This study focuses on the comparison of two of these methods; the inversion of maximum ellipticity of Rayleigh wave and the spectral analysis of surface wave (SASW). The former is based on the microtremor measurements of ambient vibrations in three components and construction of the spectral ratio of horizontal to vertical components, and the latter, is based on the recording of phase delay between vertical vibrations of ground level due to an active source like hammer impact. In this study, microtremor measurements at 21 stations of Kermanshah city, which has been done in the project of world bank 4697-IRN, are used to determine the shear wave velocity profile using inversion of their ellipticity peak. Accordingly, shear wave velocity profile, are determined by using four models of 3, 5, 7 and 10 layers and finally the best shear wave velocity profiles resulted from inversion of microtremor ellipticity peak are compared with the results of spectral analysis of surface waves which were obtained at the same stations. The importance of current study is that the initial shear wave velocity profiles are suggested without considering the results of SASW, for considering the thickness and velocity limit of each layer. Comparisons reveal that good correlations are obtained between shear wave profiles of current study and results of SASW. Furthermore, the similarities of shear wave profiles obtained by two methods improve with increasing the number of considered layers of initial models from 3 to 10.

Key Words: Shear wave velocity profiles, microtremor, inversion of ellipticity peak, spectral analysis of surface waves.

ANALYTICAL STUDY OF SEISMIC RESPONSE OF RETAINING WALL IN INHOMOGENEOUS SOIL

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Abstract

Results obtained from geotechnical studies show that the amount of shear wave velocity in various parts of soil is dependent on location of each particle. Therefore, changes of shear wave velocity in soil depth introduce soil as an inhomogeneous material. This research studies the seismic performance of retaining wall in inhomogeneous soil through presenting a proper model which considers mechanism of soil-wall system. In this study, analytical studies have been done in plane strain with rigid retaining wall and linear viscoelastic soil. In order to understand seismic performance of retaining wall, lateral pressure of soil on wall, shear force of retaining structure and bending moment on the wall are presented.

formed in clay layers, yet on an enormous scale. Some giant desiccation cracks are large enough to be mistaken for earth fissures that are caused by subsidence from groundwater pumping. These cracks are formed deep in the earth and, eventually, work up to the surface by collapse of the roof of the cavity due to subsurface erosion. The most common form of a desiccation crack on the surface is one of linear collapse features. The controlling factors in the formation of the giant mudcracks in the area are geological conditions, mineralogy, topography, and hydrology, along with the climate. Based on field studies, the main development of crack in the study area occur at the toes of alluvial fan that are inundated by sheetflow during heavy rain. In addition, based on in-situ and laboratory geotechnical tests, the soil in the areas has low dry density, and the clay minerals are dispersion potential. Dispersion of clay by water that enters the crack system causes enlarged desiccation crack and makes an opening for materials to collapse into.

Key Words: Mudcracks, earth fissures, collapsibility, dispersion potential, clay flat.

A QUANTITATIVE AND MULTI-ASPECT TRANSFERABILITY ANALYSIS OF THE ORDERED LOGIT MODEL FOR TRIP PRODUCTION BETWEEN QAZVIN AND ESLAMSHAHR CITIES

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Abstract

The cost of collecting data for travel demand modeling is very high with an increasing trend. Data collection costs could easily surpass the annual budget of a metropolitan planning organization (MPO) in small or medium-sized area. Spatial transferability of travel forecasting models, or the ability to transfer models from one area to another, can potentially ease important cost and time savings for areas that cannot invest in extensive data-collection and model development procedures. Furthermore, transferability is critical to evaluate the validity of behavioral models. Without transferability in time and space, the use of the model will be compromised due to either over or under-estimating demand, which will lead to an inaccurate assessment of the associated transportation needs and poor allocation for infrastructure investment. Moreover, trip generation has special importance in travel demand modeling, because it is the first step in the classic four-step approach, and any error in this step leads to the transmission of the error to other steps.

This study includes two primary research objectives. The first is to test the appropriateness of transferring ordered Logit model for trip production between two cities of Qazvin and Eslamshahr. The second is to determine the best transfer direction (Qazvin to Eslamshahr or Eslamshahr to Qazvin) according to the transferability criteria. The analysis focuses on work trips at the household level. The models are estimated for Qazvin and Eslamshahr cities based on data from the Travel OD Surveys of Qazvin (2008) and Eslamshahr (2013). The surveys collected detailed personal and household characteristics, as well as travel diary information from households in the two cities. Trip production model estimation was conducted in the statistical software package Stata.

The measures of spatial stability consist of an analysis of how well the estimated models predict observed shares by stratification and a comparison of model parameters. Various transferability tests are conducted at both aggregate and disaggregate levels. Transferability Test Statistic (TTS) is conducted to test the stability of the model coefficients. Transfer Index (TI) is a measure of predictive accuracy of transferred model relative to a locally estimated model. Transfer Rho-Square is a measure of goodness of fit index and statistical methods such as Root Mean Square Error (RMSE) and Relative Aggregate Transfer Error (RATE) are measures of the aggregate prediction error.

The selection of final models is based on different criteria like logical coefficient signs, chi-squared statistics, F-statistic, pseudo R2, and t-statistics. Qazvin and Eslamshahr final models include two explanatory variables: number of employees and car ownership. Models coefficients have correct sign and are all significant at the level of 5 percent.

Research results show that Transfer Index rejects the null hypothesis of the equality of the parameters of the two cities. Results also indicate that the transferred models to Eslamshahr and Qazvin have Transfer Rho-Square of 0.06 and 0.15, Transfer Index of 0.50 and 0.71, Root-Mean-Square Error of 0.35 and 0.24, and Relative Aggregate Transfer Errors of 17.5 and 12.0 respectively, indicating multiple aspects of transferability. Other con-

Abstracts of Papers in English

INVESTIGATION OF THE GEOLOGICAL AND GEOTECHNICAL EFFECTS ON THE ORIGIN AND EXTENT OF EARTH FISSURES IN THE EAST SEMNAN

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Abstract

In this study, in order to clarify the main cause of earth fissures development in the East region of Semnan, various factors affecting the earth fissure, including geotechnical properties of sediments and geological conditions of the area along superficial and deep patterns of the fissures, have been studied. Based on the results of these studies, the cracks developing in the area are affected by natural causes that exist in the region. The previously studies introduced subsidence due to groundwater pumping as the main reason of the earth fissures in the East region of Semnan. The cracks pattern that is readily apparent from the satellite (google earth) images of the area indicated a significant difference of these cracks from induced cracks by subsidence. The earth fissures in the study area form polygonal blocks that look identical to the shape of mudcracksare. In fact, these giant cracks are the same desiccation mudcracks or large soil cracks