off" method is an in-situ method in which an aluminum probe sticks to the surface of the concrete under test, using epoxy adhesive; after setting and hardening of the epoxy, torquemeter is used to determine the concrete strength by measuring the maximum or failure torque. The newly developed method for permeability consists of a portable permeability measuring device that can be used under both laboratory and site conditions. In this method, an aluminum base ring sticks to the surface of concrete under test using epoxy adhesive; a cylindrical chamber is attached to the base ring after hardening the epoxy resin. The chamber is filled with water and its air bubbles are released by opening a valve designed for this purpose. The permeability of the concrete surface is measured by applying 5- bar pressure to the chamber water.

Key Words: Channel, irrigation, concrete, strength, permeability.

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Abstract

Development of Tabriz metropolis on marl layers and increased tendency to build high-rise buildings have resulted in deep excavations in these layers. Restrictions of work space have resulted in using soil reinforcement methods in excavations, including grouted anchors. Tabriz Marl is a lacustrine carbonate sedimentary outcrop that surrounds eastern, northern, and southern regions of city in the East Azerbaijan Province of Iran and classified as clayey or silty soil with high plasticity. The objectives of this study were to evaluate the load carrying capacity of tension type grouted anchors implemented in Tabriz marl, their behavior against creep tests and long-term monitoring against lock-off tensile loads. To this purpose, ten full-scale similar anchors were constructed with free length of 4 meters, injected (bonded) length of 3 meters and diameter of 11 cm in marl soil in experimentation site with an area of 800 m^2 located in University of Tabriz. Pull-out load tests including creep tests were conducted on four anchors using their results, ultimate load of anchors, maximum friction resistance between anchor grout and marl, load of failure creep rate, and critical creep tension were estimated. Ultimate bond friction was 2.8 kg/cm^2 to 3.1 kg/cm^2 and empirical reduction factor of marl layer was measured 0.61 to 0.67 and they were compared with the results obtained by different authors. Factor of safety for design load was obtained to be 1.31 against the ultimate load, 1.33 against the failure load, and 1.2 against the critical creep tension. Finally, the amount of creep over one log cycle of time for design load of anchors was estimated to be 0.46 mm on average, assuming to be constant over time, equaling 3.5 mm for 100 years. For long-term relaxation survey of anchors and estimating the load decrease over time, six anchors were locked off and their residual load was read for 6 months. It was tried to model and predict anchor movement and relaxation over time by creep test results, using mathematical relationships along with comparing them with real data on site and finally obtaining long-term behavior of grouted anchors implemented in Tabriz marl. The amount of force reduction in these anchors was 54% on average that reduces to about 20%, assuming the removal of settlement of concrete pad as head seating. These values demonstrate time-dependent settlement over seating pad of anchor in marl soil of Tabriz and its high effect on reducing locked force.

Key Words: Grouted anchors; tabriz marl; pull-out resistance; creep; long-term observation.

ASSESSING THE INFLUENCE OF CONCRETE STRENGTH ON ITS PERMEABILITY OF CONCRETE CHANNEL USED FOR IRRIGATION IN QAZVIN PROVINCE

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Abstract

The open channels, which provide the optimum sections, have been mostly used in irrigation systems in Iran, in recent years. Irrigated agriculture has been playing a vital role in the growth in crop production in IR of Iran. An open channel is a conduit in which water flows with a free surface. The free surface is subjected to atmospheric pressure .among the gravity systems used for transfer water with open surface flow and it is necessary that hydraulic structures, such as spill ways floodgate, etc., be the most popular irrigation systems for use in Iran. Therefore, in this paper, the strength and permeability of concrete lining of an ancient open channel are presented, while the strength of the concrete is determined by the “Twis-off” method. , The newly developed “Silindrical Chamber” method is used for measuring the permeability of the concrete lining. The results obtained show that a meaningful and positive correlation appears to exist between the two parameters studied. The ”twist

ductility using High Strength Self-Compacting Concrete (HSSCC) in indeterminate post-tensioned unbonded continuous (full scale of 9m span) members. To do so, first, in the fresh phase, such concrete was designed and cast successfully based on the international criteria. Then the application of such concrete consisting of $f_c^{'} = 95$ MPa was investigated on the design and constructed continuous beam, having two unbonded post-tensioned cables of variable eccentricity. The monitored results are compared and evaluated by six different Standards results. The theoretical higher and lower percentages (25 and 15) moment redistribution were achieved using CEB-FIP and EC2, DIN, respectively. The the of experimental moment redistribution value of %24.1, is almost the same as theoretical higher value while it is %61 lesser than the lower theoretical value. However, the ACI 318 and BS 8110, predict %15 of moment redistribution for such members.

It was found that the bonded steel reinforcement in unbonded post-tensioned beam casted with HSSCC plays an important role in the ultimate flexural strength, especially while considering the crack distribution and ductility. The tensile bonded steels (at negative and positive moment regions) reached their yield stress; by increasing the load, a large deflection occurs and, finally, at the ultimate load, the strands were broken at a stress of 1367 MPa with huge noise. At beam failure, different types of cracks (flexural and flexural-shear cracks) occurred and the beam experienced a deflection ductility index of 14, which is more than the suggested value of 3.5 for RC members.

Key Words: Continuous beams, unbonded post-tensio, ned, hsscc, monitoring, moment redistribution and ductility.

EFFECT OF FIBER ON COMPRESSIVE AND TENSILE STRENGTH OF AUTOCLAVED AERATED CONCRETE

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Abstract

Nowadays, new technologies and advanced producing technique materials result in reducing weight and cost of construction. Aerated concrete was first developed as a lightweight material consisting of combinations of cement and quicklime silica sand, slag, pulverized fly ash, or other siliceous fine aggregates, in the form of a fine powder. The powder is mixed with water to form a slurry, and air or other gas (usually hydrogen) is introduced into the slurry. Due to initial hydration of the cement, accelerated by the heat produced by the quicklime, the mixture sets acquired a uniform cellular structure. Air entraining can be used to reduce the density of concrete. In recent years AAC is one of the most popular building materials for infill panels and structural system of low-rise masonry building. It has many advantages. The advantages that made this building material are lightweight, energy saving, environmentally friendly, and cost effective, but this material still has some disadvantages, such as low mechanical properties which need to be improved. In this paper, the effects of fibrous additives of Carbon, Polypropylene, A-Glass and E-Glass on mechanical properties of Autoclaved Aerated Concrete (AAC) have been investigated experimentally. Due to the fact that fiber additives could improve mechanical properties, in this study, fibrous additives (such as Carbon, Polypropylene, A-glass, and E-glass) are used in making AAC. The results show that adding fibers have effects on fluidity and swelling of mixtures, which decrease by adding more fibers to the mixtures especially in the mixtures containing A-Glass and E-Glass. Adding 0.3% of carbon and polypropylene fibers could improve mechanical properties of AAC. However, the effect of carbon fibers is much higher than polypropylene fibers. Using A-glass fibers leads to reducing compressive and tensile strength. Adding 0.4% of A-glass reduces compressive amount to 32% and tensile strength amount to 29%: this could happen owing to the fact that the glass fiber reacts with alkaline environment and prevents the hydrogen release in the mix.

Key Words: Autoclaved aerated Concrete, carbon fiber, PP fiber, glass fiber, compressive strength, tensile strength, fractural strength.

PULLOUT PERFORMANCE OF GROUTED ANCHORS IN TABRIZ MARL BY FULL-SCALE TESTS

incorporate the highest and the lowest costs imposed on the users, respectively. Furthermore, road user costs in the year of 1393 were approximated around 291.7 Billion Tomans which accounts for roughly 70 percent of the 5-year construction costs of this freeway to which can be paid especial attention in the economic analysis of the road projects.

Key Words: Road user cost, operation vehicle cost, work zone cost, value of time.

EFFECT OF ANISOTROPY ON THE DYNAMIC PROPERTIES OF THE LOOSE BABOLSAR SAND WITH CYCLIC HOLLOW CYLINDER APPARATUS

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Abstract
Direction of loading and magnitude of the intermediate principal stress have significant effect on the soil responses. In many of in-situ loading, the direction of major principal stress does not coincide with the deposition direction of the soil. In addition, the magnitude of the intermediate principal stress should be exerted in the three dimensional loading condition. A reliable assessment of the soil behavior and good estimation of the soil parameters need to do tests in similar condition with in-situ. Therefore, the testing apparatus should be able to control the loading direction in various stress paths. Typical equipment used in the geotechnical laboratory does not the ability to control the magnitude and direction of principal stresses. The cyclic hollow cylinder apparatus can control the magnitude and direction of the principal stresses and impose minimum non-uniformity on the specimens. The hollow cylinder apparatus used in this study is fully automated and can simultaneously control five loading axe (i.e., the vertical load, torque, inner cell pressure, outer cell pressure and back pressure). The main specifications of the specimens are as follows: 100mm outside diameter, 60mm inner diameter, and 200mm height. The consolidation control options allow various isotropic and anisotropic consolidation statuses. Moreover, the load could be exerted as cyclic or monotonic. The test material used in this study was Babolsar sand, obtained from the South coast of the Caspian Sea. A total of 30 undrained cyclic torsion shear tests were performed in a cyclic hollow cylinder apparatus in order to specifically investigate the effect of mean confining stress, $\sigma_{0m}^{'}$, intermediate principal stress ratios, as indicated by b=$(\sigma_2-\sigma_3)/(\sigma_1-\sigma_3)$ and principal stress directions α. Results showed that the dynamic shear modulus is minimum and the material damping ratio is maximum asα is close to 45°. This observation is contrary to the current understanding in which progressively weaker responses are to be expected as the major principal stress aligns itself toward the weaker horizontal direction. The intermediate principal stress ratio had no significant effect on the dynamic shear modulus and material damping ratio. The effects of loading direction or intermediate principal stress ratio on the dynamic shear modulus and material damping ratio were magnified by increasing confining stress.

Key Words: Shear modulus, damping ratio, sand, major principal stress direction, intermediate principal stress ratio.

MOMENT REDISTRIBUTION AND DUCTILITY (THEORETICAL AND EXPERIMENTAL) OF CONTINUOUS UNBOUNDED POST-TENSIONED I-BEAMS CONSISTING HSSCC

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Abstract
The main aim of this research is to investigate, mode of failure, determination of moment redistribution, and

POUNDING AND SOIL-STRUCTURE INTERACTIONS

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Abstract

In order to reduce the cost and time of seismic analyses, due to lack of correct understanding of structural characteristics and the forces acting on, usually simplified assumptions are applied in the structural modeling that could lead to unrealistic responses. One of these simplified assumptions in bridge modeling is ignoring the pounding phenomenon and soil-structure interaction. Nowadays, the bridges are considered as a vital component in urban and inter-urban transportation systems that the disruption in their operation due to partial or full collapses could lead to disruptions in the transportation system and heavy costs and consequences. One of the major factors, which is considered by the researchers after some earthquakes such as Northridge, Kobe and Chi Chi and their destructive effects on bridges in recent decades, is the pounding phenomenon. This phenomenon is a result of a collision between two parts of the deck and/or deck and lateral piers (abutments) in the gaps during the earthquake. The pounding in bridges could cause damage in the deck and abutment or the dislocation of deck from the pier. In conventional bridge designs with a few centimeters gap, pounding in severe earthquakes will be unavoidable. Therefore, in this study, with modeling two- and three-span bridges with different periods and considering the gaps of 2.5, 5, 7.5, 10, 12.5 and 15 cm, the effects of the gap size on seismic parameters, including maximum absolute displacement of the deck, the maximum pier bending moment, the maximum pounding force, and the number of pounding, are analyzed. The bridges are subjected to 8 far-field and 8 near-field accelerograms. The results show that increasing the size of gap reduces the number of poundings and increases the maximum deck displacement. However, the trend of changes in maximum pounding force is subject to the bridge period and applied earthquake specifications. In addition, the near-field earthquakes lead to greater seismic responses than that of the far field ones.

Key Words: Bridge, gap, pounding, near-field and far-field earthquakes, Q-hyst model.

ANALYSIS INCURRING COST ON USERS IN ROAD TRANSPORTATION SYSTEM

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Abstract

Road user costs as one of the factors inherent in the road costs, because of being financed by road users and not the government, are sometimes neglected in Iran during feasibility studies and technical justification of road projects. While this cost could be helpful in the cost-benefit analysis of road project for the selection of optimal option. The cost of road users shall be classified in the following groups: operation vehicle cost, value of time and work zone cost. Therefore, this research aims at estimating the costs of users of Rasht-Qazvin freeway as one of the most important routes of North-South corridor. Following this attempt, operation vehicle costs (VOC) are estimated by collecting traffic and construction information of the target route in line with World Bank models (HDM III, HDM IV). Moreover, Saipa and Iran Khodro models (Advisor software) were used to assess the fuel cost due to the high importance of the problem. Stated Preference method and Eveiws econometric software were also used to approximate the value of time of the people and create the Utility models, respectively. The estimation of the extra consumed resources in the work zone as a result of traffic disruption was preformed while taking advantage of Aimsun simulation software to determine delay and fuel consumption resulting from road closure. Analyzing the data, the cost associated with every single parameter of road users separately and for each of vehicle types are presented. According to the results, depreciation and work zone costs

on composite shear wall behavior. Firstly, a composite shear wall, which was tested at Berkeley University, was simulated with finite-element software Abaqus in order to verify numerical modeling. Appropriate conformity between the experimental and numerical results was observed.
Then, the effects of the existence of square opening have been studied. Primarily, the location effects were investigated. For this purpose, the model with a central opening defined as the main model. Then, two other models with the same opening area were simulated to compare with the main model: one with opening near the column and the other with that near the beam. As a general result, by moving the opening location from the center of the wall, the wall stiffness decreases and opening near the beam has the least stiffness. For evaluating the effects of number of openings on composite shear wall behavior, a model with one opening was compared with two models with two openings. It should be noted that the opening area in these three models is the same; one with two vertical openings and the other one with two horizontal openings. Consequently, the model with two horizontal openings made more reduction in strength and stiffness of the wall. Finally, the changes in the stiffness of a composite shear wall without opening were investigated and observed that changes in stiffness are due to steel plate buckling and wall elements yielding. For each model, force-displacement curve, strength, stiffness, the produced stresses, energy absorption and failure mode of the models are presented.

Key Words: Composite shear wall, the opening location effect, the number of opening effect, strength, stiffness.

WEB BREATHING OF STEEL PLATED GIRDERS IN BRIDGES UNDER TRAFFIC LOAD

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Abstract

Since road and railway bridges are under repeated service loading, fatigue analysis and design of such structures' components are imperative. Limit state design method allows web panels of steel plate girders to be loaded beyond the elastic shear buckling load to make use of tension field reserve of strength. Under repeated load in excess of the elastic shear buckling load, due to initial imperfections, repeated out-of-plane deformations result in the web panel which, in turn, leads to relatively high secondary bending stress ranges at panel borders where the panel intersects flange and vertical stiffener. This phenomenon is known as web breathing effect. High secondary stress range in combination with membrane stress causes fatigue cracking and premature failure at the web panel borders. Stress states at critical regions of the panels play an important role in fatigue crack initiation. Therefore, in the present study, an extensive numerical analysis on steel plated girders was performed to explore the state of stresses in breathing webs. Postbuckling of web panels was simulated using a FE procedure incorporating both material and geometrical nonlinearities, and it was shown that maximum principal surface stresses occur at corner borders of web panels where the tension field is anchored. In these critical regions, fatigue cracks initiate, and it is in agreement with experimental evidences. In this numerical study, the influences of various geometrical parameters, including slenderness ratio, imperfection factor, and boundary members' stiffness, on the stress response of panels were investigated. It was observed that by increasing slenderness ratio, the rate of increase in maximum principal stresses for very slender panels is much higher than stockier panels. Moreover, in small imperfections, the response curves of maximum principal stresses versus applied load become nonlinear, whereas, for large imperfection factors, the curves are almost linear. The effect of the boundary members' stiffness on the stress response of breathing web panels becomes more pronounced in higher imperfection scale factors. In most codes of practice, no specific detail based on nominal stress is available to predict fatigue life of breathing webs. In this study, the method of geometric stress at critical regions adjacent to the weld toe is employed to predict fatigue life of breathing webs.

Key Words: Web breathing, finite-flement method, fatigue, steel plated girder.

EVALUATING THE GAP SIZE IN BRIDGE STRUCTURES BY CONSIDERING THE EFFECTS OF

Rasht might not solve the probability of choosing walking mode versus choosing motorized modes.

Key Words: Mixed logit, random coefficient analysis, walking time, car ownership.

A HYBRID META-HEURISTIC ALGORITHM FOR OPTIMUM DESIGN SKELETAL STRUCTURES

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Abstract

This study proposes a new hybrid algorithm for optimum design of skeletal structures using a search method inspired by such meta-heuristic algorithms as GA, CSS, and PSO. In the proposed method, the exploration space is searched via moving points. Each design in the design space corresponds to a moving point in the exploration space. Collectively, these moving points form a population. By moving within the exploration space, these moving points create an evolutionary process for successive populations while moving towards the optimal point. The movement and displacement of the moving points in the exploration space is consistently based on the factors and characteristics of the previous population. To this end, similar to other meta-heuristic algorithms, the first population is created randomly. Then, the positions of the points in the next population are determined based on the geometric center of the previous population, the geometric center of the selected points, and the positions of the selected points in the previous population. In this way, the points form a new population by moving within the design space towards the collective center of the points, the collective center of the selected points, and the respective positions of the selected points in the previous population. The average quality of the present population points, the average quality of the set of the selected points, and the quality of each selected point affect the displacement of the moving points. Other significant factors affecting the formation of points in a new population include variation as well as displacement of individual points in the previous population, acting independent parameters in specifying a new position for each point. To evaluate the efficiency of the proposed algorithm, we used a number of the benchmark examples. To this end, we plotted the optimization process convergence diagram for each example to study the method used in the proposed algorithm for obtaining the optimum point. On the other hand, we determined the average number of successive runs obtained for the proposed algorithm for each example. Our results showed that the best and the average run convergence trends calculated for different examples were in good agreement, which is a sufficient proof that the proposed algorithm possesses the required efficiency in obtaining the optimum point.

Key Words: Optimization, skeletal structures, meta-heuristic algorithm, hybrid algorithm.

EFFECT OF LOCATION AND NUMBER OF OPENINGS ON PERFORMANCE OF COMPOSITE SHEAR WALL

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Abstract

Application of composite shear wall as a seismic resistant structural system has increased recently to improve the steel shear wall behavior and ultimate capacity by means of controlling the out-of-plane buckling shape of the steel plate. One of the most important fields in shear wall performance study is the effects of providing an opening on wall surface. These openings may be needed for some reasons including architectural and installation requirements .The aim of this research is to investigate the effects of the location and number of openings

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Abstract

In this paper, effective period and damping of structures connected to an embedded strip footing are evaluated by consideration of soil structure interaction effect. Incompressible soil mass which may account for undrained behavior of saturated clay is modeled as a homogeneous and isotropic semi-infinite medium by using boundary element method. Boundary element method is suitable tool to model such media including infinite or semi-infinite boundaries. Incompressible soil medium has Poisson's ratio of 0.5. However, in this case the dilatational wave velocity approaches to infinity. Therefore, displacement and traction fundamental solutions in frequency domain which are utilized by boundary element method have to be expressed independent of dilatational wave velocity to prevent from numerical instability. These modifications have been performed using equalities relations.

Having obtained the fundamental solutions of the incompressible soil medium, different problems considering soil structure interaction effect can be solved. Impedance functions of embedded strip footing rest on incompressible soil medium are obtained using boundary element method. In order to evaluate the components of impedance functions, three boundary value problems including unit displacement in horizontal, vertical and rotational directions of the footing have to be solved separately. The results are presented as a function of dimensionless frequency. There are good agreement between the obtained results and those of solution in the literature. The components of impedance functions are complex numbers. Real and imaginary parts represent respectively, stiffness and radiation damping of the semi-infinite soil medium. Impedance functions depend on excitation frequency, width of strip footing, shear wave velocity and Poisson's ratio. A single degree of freedom structure with flexible basement is replaced by an equivalent fixed base structure and its effective period and damping are then computed. Dimensionless parameters suitable for strip footing are introduced in this paper. The effective period and damping of structures with different heights are then obtained using an iterative procedure and compared to each other.

Key Words: Boundary element method, soil-structure interaction, embedded strip footing, impedance functions, effective period and damping.

THE JOINT ROLE OF DISTANCE AND CAR OWNERSHIP ON CHILDREN' SCHOOL TRAVEL

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Abstract

The present research used a sophisticated model (mixed logit model) to estimate children's school travel mode use instead of last simpler analysis (more confined models) and other statistical analysis. In the past school travel studies, heterogeneity around the mean of variables in the decision maker's behavior has not been identified. Hence, this study attempted to identify parental taste variation on their children mode choice. The study area was in Rasht, Iran. A questionnaire was designed and 1078 questionnaires were distributed among parents of students from grade one to three in nine elementary schools (including public and private boys and girls schools) in all districts of Rasht' education department and all socio-economic status of the city in January 2014 (Return Rate: 80%). Based on valid observation (712 individual) from a field survey, results showed that mixed logit (ML) model has better goodness of fit compared with multinomial logit (MNL) model in 99% confidence interval. In ML model, the effect of home to school distance had a heterogeneity with normal distribution (mean= -0.24 and SD= 0.08) instead of a mean (-0.12) in the MNL model. One percent increase in distance reduces the probability of walking mode by around 0.78 and 0.86 in MNL and ML models, respectively. Furthermore, ML results showed that households, with two or more owned cars, had more sensitivity to walking mode in children's school trip. Some possible parts of the difference in taste variation towards perceived distance of walking from home to school in the walking utility function could be explained by the number of vehicles owned by households. Further, by increasing the walking time from home to school, the probability of choosing walking mode to school will be reduced over school service and household private car. Thus, the existence of high quality school (e.g., well-educated teachers) in all areas of

ular concrete was designed based on ACI 318-08 code including diagonal and spiral reinforcement, while the other specimens made with HPFRCC include, no spiral at the second specimen and no diagonal and spiral at the third specimen. Special instrumentation was used in the experimental specimens to measure the stain, displacement, and loads and rotations.
The results showed that HPFRCC increased tensile capacity of concrete, prevented increasing the crack widths, increased absorbed energy and rigidity compared to plain concrete specimen; shear-tensile failure was changed to shear-slippage failure. Even though the spiral reinforcement was not used at the second HPFRCC specimen, the capacity and ductility were increased 20 and 37 percent respectively compared to the first specimen and casting the concrete was facilitated.

Key Words: Coupling shear wall, coupling beam, ductility, high-performance fiber reinforced cementitious composites, HPFRCC.

THREE- DIMENSIONAL MODELING OF A TUNNEL INTERSECTION AND ITS EFFECT ON LINING DISPLACEMENTS AND INTERNAL FORCES (CASE STUDY: HAKIM TUNNEL -TEHRAN)

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Abstract
In recent years, lots of soft ground tunnels, including subway and road tunnels, have been constructed in many cities in Iran. Nearly all tunnels have cross passages between twin tube tunnels. This study presents a 3-D numerical analysis of the static behavior at Hakim tunnel's intersection. Hakim tunnel, a double-line tunnel with a length of 1km, is located in 22th quarter Hakim highway-Iran. The tunnel has three lines on each side, each of which consists of two distinct pathways. The modeling has been done using finite-element software ABAQUS. An elasto -plastic model with Mohr-coulomb failure criteria was used to present the stress-strain soil and an elastic model was considered for shotcrete behavior. The NATM tunneling method was considered in numerical analyses. Extreme care taken during excavation and immediate application of support media prevent unnecessary loosening of media. The effect of elasticity coefficient, which increases with depth, was also considered. Due to the excavation of the child tunnel, the surface settlement over the intersection area and deformation of crown intersection were studied. Results showed that the upper area of shotcrete in the main tunnel, near to intersection, and near to the side's area in the child tunnel, is a critical section for designing the support. In order to verify the accuracy of finite- element model, some results are compared with field measurement. The results showed that creating an opening in the main tunnel causes the surface settlement increase to 29%. The results showed that with opening of the main tunnel, moments and axial forces in the tunnel lining significantly increase. In the circumferential direction, half of the section close to the opening was more heavily affected than the other part. In the longitudinal direction, the lengths of the scopes of influence were about 1.5 times the diameter of the child tunnel. Also, the results showed that by an increase in the coefficient of lateral pressure, moments and axial force increase only in the area of two tunnel junctions. It is proposed that local thickening combined with an improvement in the bearing capacity should be undertaken to increase the stability of the intersection.

Key Words: Hakim tunnel, 3-D numerical analysis, intersections area, surface settlement, lining internal forces.

EVALUATION OF EFFECTIVE PERIOD AND DAMPING OF STRUCTURES CONNECTED TO EMBEDDED STRIP FOOTING OVER INCOMPRESSIBLE SOIL

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EXPERIMENTAL INVESTIGATION OF BEHAVIOR OF COUPLED SHEAR WALL WITH HPFRCC CONNECTING BEAM WITH DIFFERENT DIAGONAL REINFORCEMENT CONFIGURATIONS

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Abstract

Coupling beam is as the first line of defense in the coupling shear walls and it acts as a shear fuse and is important to improve the seismic behavior of any structure. Coupling beams made of high performance fiber reinforced cementinous composite (HPFRCC) are capable alternatives compared to traditional concrete and result into increasing capacity and ductility and also reducing the congested amount of longitudinal and transverse and diagonal reinforcement. The design of coupling beams, with span-to-depth ratios that often range between 1.5 and 3.5, requires a special attention due to the large inelastic rotations and shear stress coupling beams can be subjected during a strong earthquake. In order to ensure adequate seismic performance, ACI Building Code (318-08) provisions for coupling beams in regions of high seismicity include the use of diagonal reinforcement designed to resist the entire shear demand, together with special column-type transverse reinforcement confining either the diagonal bars or the entire member.

This paper investigates an experimental study on cyclic behavior of three concrete coupling beams with span to height ratio equal two. The first specimen with reg-