STEEL STRUCTURES UNDER POST-EARTHQUAKE FIRE

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Abstract

It is clear that steel structures are severely vulnerable to fire since the yield strength and the elastic modulus of the steel decease when the temperature increases, causing a reduction in the load-bearing capacity of the steel member. There are different methods for a steel element to reach required fire resistance rating. One of the most current methods in the world is the use of spray-applied mineral fire protective coatings. It is obvious that after a severe earthquake, the probability of the occurrence of the fire is high, e.g., because of the rupture of gas pipes. Unfortunately, there are not enough research pieces and reports on the performance of these coatings during an earthquake. However, we know that during a severe earthquake, the structure of the building will sustain significant deformations and it can cause the damage and delamination of the installed fire protective coating. Therefore, in this research, the post-earthquake fire performance of a mineral based spray-applied fire protection coating was studied. The type of this fire protection coating was cement based. Different application details of this mineral based spray-applied coating including coating thicknesses and reinforcing steel mesh details were investigated. First, four fire protected steel columns were subjected to cyclic lateral load tests. The type of the connection of these columns was a stiffened extended end-plate moment connection. This connection type was used for special steel moment frames. The thickness of the fire protection coating for steel specimens was determined for fire resistance rating of three hours. Then, these columns together with two reference columns were subjected to fire resistance tests to make a comparison between results. By using the qualitative and quantitative results of these tests, the type and amount of seismic damage of fire protection coating were determined in earthquakes with two different intensities. Also, it became clear that reinforcing the fire protective coating with a steel mesh in the region of formation of seismic plastic hinge in a steel element could reduce the seismic damage of the coating sufficiently.

Key Words: Steel structures, sprayed mineral fire protection coatings, earthquake, fire resistance.

punching shear failure and the post-punching behaviour of flat slabs is ignored. This can reduce accuracy in progressive collapse analysis.This paper validates analytical methods previously proposed by the authors to simulate post-punching behaviour a multi-panel flat plate system. Then, the progressive collapse potential of a three-story flat slab building was evaluated using the proposed analytical model. The effect of factors such as column removal position, structural member damage due to previous seismic loads on subsequent failures, floor load intensity, and boundary conditions (slab expansion around the building) on flat slab structural behaviour were investigated. The analysis results showed that the building internal column removal would cause the punching failure in the adjacent slab-column connections, but due to the post-punching resistance of the connections, overall failure did not occur. Therefore, ignoring the effect of post-punching resistance on slab-column connections can lead to an error in the evaluation of the progressive failure potential of flat slab structures. The analysis results revealed that the internal column removal of the building is the most critical. In the structure, with the slab expansion around the building, the removal of the edge column is the most critical scenario. The Dynamic Amplification Factor (DAF) was calculated by comparing static and dynamic vertical displacements for model structures. The analysis results showed that DAF could be greater than 2 in the flat plate slabs.

Key Words: Flat slab building, slab-column connection, post-punching resistance, progressive collapse.

MODELING DRIVERS' NATURAL BEHAVIOR WHEN OVERTAKING ON UNDIVIDED RURAL ROADS (CASE STUDY: MAZANDARAN PROVINCE)

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Abstract

Traffic accidents between two cars when overtaking on undivided rural roads are considered as one of the unpredictable events. They reduce road safety and cause severe head-to-head accidents or deviations. It can be overwhelming with appropriate suggestions and solutions to reduce the interaction between the two cars and decrease the number of drivers' accidents and fatalities. This study tried to identify the effective factors, especially those associated with the natural behavior of drivers, in the overtaking process. In order to collect the required information, 6 undivided rural roads in the northern province of Iran (Mazandaran province) were selected as the study sites; thirty participants were considered for driving and their performance and behaviors were studied using three in-car cameras .Finally, by examining 34 factors in the driving behavior of participants from video X-ray and data extraction from camera films, 327 inter-vehicle interactions were recorded. By analyzing the recorded videos, the data for each variable were recorded as numeric codes in Excel software. After data collection, the dual logit model in SPSS software was used because of the bi-directionality of the target variable (Overtaking or not overtaking). Prior to data modeling, dependent variables were examined and the related variables were removed from the modeling process. Next, the data were modeled in three simultaneous, forward, and backward methods and by evaluating the models, the concurrent model was selected as the best model for the obtained data. Accuracy of 89% in this study showed that male gender, driving distance, and listening to music increased the chance of overtaking drivers. Also, distance to front vehicle, driver-talk time, vehicle speed, poor pavement surface, and lack of knowledge of safety in overtaking time reduced the likelihood of overtaking.

Key Words: Overtaking, car-vehicle interaction, undivided rural roads, logit model, driver's behavior.

EXPERIMENTAL INVESTIGATION OF PERFORMANCE OF SPRAYED FIRE RESISTIVE MATERIAL ON

At this frequency spacing, the root mean square deviation of modal damping estimations between enhanced frequency domain decomposition (EFDD) and curve-fit frequency domain decomposition (CFDD) with the corresponding reference values was 0.02.

Key Words: Double-layer grid, damping, output-only identification methods, frequency spacing, frequency-domain methods.

A STUDY OF CYCLIC PERFORMANCE OF FRAMES EQUIPPED WITH INNOVATIVE DIAMOND-SCHEME BRACING SYSTEM INCLUDING A CIRCULAR YIELDING DAMPER

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Abstract

Various solutions have been proposed to enhance the ductility of the bracings system in recent years. Accordingly, the development of steel rings as structural fuses could be counted as one of the successful attempts which need to be further studied. In this respect, this paper addresses a novel diamond-scheme bracing system equipped with a steel ring whose function is to act as a sacrificial fuse. This system has been majorly developed to improve ductility and energy absorption of the conventional bracing system that is known as the prime shortfalls of this system. In this system, diagonals and ring are arranged in such a way to act in parallel. to conduct the analyses, a test specimen with pinned and semi-rigid connections was studied using ABAQUS software. Furthermore, numerical analyses were carried out on large-scale models once including the ring with varying thicknesses and also, on the bracing system without the ring (i.e. a link element with high rigidity was replaced for the ring) and lastly, the results were compared with the performance of a concentrically-braced frame (CBF). The results indicate that promisingly, the presence of the link enhances the load-carrying capacity of the system by 9 and 1.75 greater than that of the semi-rigid model and CBF. In general, it was concluded that despite adequate reparability, the proposed system benefits from sufficient ductility and energy absorption capacity.

Key Words: Diamond-Scheme bracing system, circular energy dissipater, structural fuse, yielding damper, cyclic performance.

PROGRESSIVE COLLAPSE ANALYSIS OF FLAT SLAB BUILDINGS WITH POST-PUNCHING EFFECT

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Abstract

The reinforced concrete flat slab is one of the types of floor systems used to construct residential, office and parking buildings. Because of the direct transfer of floor loads to columns, flat slabs are susceptible to punching failure in slab-column connections. The punching failure in one column can initiate failure in adjacent columns and cause progressive punching shear failures resulting in the progressive collapse of the entire structure. Using the post-punching capacity of the connections can prevent or minimize the likelihood of such failures. The post-punching resistance of slab-column connections in the absence of shear reinforcements is provided by the dowel action and vertical component in flexural and integrity bars when they deflect after punching. Most studies of flat plate performance were attended to

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Abstract

In this study, the relationship between different definitions of duration with peak ground acceleration, focal depth, and soil conditions of the site using accelerometer records in Iran was calculated and presented. Then, 1054 three-component records of 197 seismic events recorded with a moment magnitude greater than or equal to 5.0 were used. All data for this study were obtained from the Road, Housing, and Urban Development Research Center (BHRC) in Iran. All records were for sites with focal depths and shear wave velocities within the first 30 m of depth. After preparing the records, the baseline correction was performed on them using Fortran programming and durations with g0.05 acceleration thresholds, uniform durations with g0.05 acceleration thresholds, significant durations 5-95% were calculated. Then, according to the Iranian 2800 earthquake code, soil type was grouped and the data were classified into three categories according to soil type. The data with soil group 4 were very low and unreliable. The results showed that with increasing peak ground acceleration, bracketed and uniform duration increased, while for significant durations, records with high significant durations generally have minor peak acceleration. Mathematical relationships were also shown for variations in any durations with peak ground acceleration and focal depth and soil type variations. Also, with softer soil, the slope of the bracketed and uniform duration relationship with PGA increased. Increasing the focal depth decreased the durability with different definitions. After a focal depth of 20 km, a threshold of 0.05g is usually less than 10 seconds. The relationship between shear wave velocity at 30 m depth and significant duration indicated that with increasing shear wave velocity, significant duration decreased. The relationship between the duration and maximum amplitude of earthquake ground motions was important for the seismic design of structures, especially reinforced concrete structures, which suffered from stiffness and reduced strength in successive earthquake cycles.

Key Words: Earthquake duration, peak ground acceleration, amplitude, local site conditions.

EFFECT OF THE FREQUENCY SPACING ON MODAL DAMPING ESTIMATION OF A DOUBLE-LAYER GRID

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Abstract

Although natural frequencies and mode shapes can be accurately measured by dynamic tests, error bounds in values of damping estimation can be large. Since damping strongly influences the design and control of structures, efforts are made to find the damping that has the least error. The random and bias errors are the two important types of error in damping estimation of structures via frequency domain methods. These errors can be reduced by choosing appropriate frequency spacing. In this study, the frequency spacing leading to the least bias and random errors for estimation of modal damping is determined. The complexity of the damping phenomenon on the one hand and complexity of the structural behavior of a double layer grid, on the other hand, led to this study. For this purpose, a double layer grid constructed from ball joint system was tested. the modal damping ratios related to the first 6 modes of a double layer grid with the ball jointed system were identified for different frequency spacing via two output only modal identification techniques; namely enhanced frequency domain decomposition (EFDD), curve fit frequency domain decomposition (CFDD). The modal damping ratio estimations identified through the two methods were then compared with the results of the input output identification method of Ibrahim time domain (ITD) as the reference value. The results showed that there is an almost linear relationship between the modal damping ratio estimations and the frequency spacing in each mode. At the frequency spacing of 0.0625 Hz, the modal damping ratios obtained from the output only methods showed the least difference (between 0 to 21.43%) with the reference values.

a reliable and stable technique in damage prognosis in structures.

Key Words: Damage detection, model updating method, modal parameters, objective function, teaching-learning-based optimization.

IMPACT OF FLY ASH ON THE PROCESS OF CEMENT-BASED SOLIDIFICATION OF HEAVY METAL CONTAMINATED BENTONITE

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Abstract

Cement-based Stabilization/Solidification (S/S) process is one of the best technologies available for the treatment of heavy metal contaminated soils. This method has been very popular among researchers in field application. Two mechanisms of solidification and stabilization in this method include the formation of cementation products (such as C-S-H) and achievement of alkaline condition for development of pozzolanic interactions. The pH variation range directly affects the heavy metal ion precipitation. On the other hand, environmental factors and soil-cement-contaminant interaction affect the cement hydration products and pH range of solidified contaminated soil. Therefore, this interaction process controls the immobilization of metal ions in solidified/stabilized sample. The main objective of this paper is to evaluate the effect of fly ash on the heavy metal retention in cement-based solidification/stabilization in a long-term process. In order to investigate the effect of fly ash on the optimum amount of required cement at different concentrations of contaminants, several mixtures of fly ash and cement were applied to solidified contaminated bentonite. In these series of experiments, 75-25 and 50-50 wt% mixtures of Portland cement and flay-ash (class F) were mixed and were added to contaminated bentonite samples. The bentonite samples were laboratory contaminated with Pb(NO3)2 in the concentration range of 5 to 100 cmol/kg-soil. The prepared samples were kept for 7 to 90 days. Different experiments which include TCLP, XRD, pH measurement, and solubility evaluation in different alkaline and acidic conditions were performed on samples. Furthermore, the trend of pozzolanic reactions of the samples in the short and long terms was evaluated by determining the setting time of solidified/stabilized samples. The results were analyzed based on the effect of pH variation upon concentration of released lead ions from samples. The results indicated that the use of 10% binder, despite common recommendations in geotechnical stabilization, would not be suitable for S/S of contaminated bentonite soil at all studied Pb concentrations. Moreover, the results indicated that in contaminated samples with 50 and 100 cmol/kg-soil lead nitrate, due to the high precipitation of lead hydroxide, a reduction in C-S-H formation and an increase in the setting time occurred. In addition, replacing cement with fly ash in samples reduced the pH and decreased the concentration of released Pb in TCLP test. According to the achieved results due to the precipitated Pb ions in stabilized/solidified contaminated bentonite, an appropriate quantity of the cement-fly ash binder is when the pH of the stabilized/solidified samples is in a safe zone that occurs in the pH range of 8 to 12. According to the results of this paper, the use of fly ash in the S/S process helps achieve this safe range of pHs.

Key Words: Portland cement, fly ash, stabilization/ solidification, TCLP, heavy metal contaminant.

RELATIONSHIPS BETWEEN SIGNIFICANT, BRACKETED AND UNIFORM DURATIONS WITH EARTHQUAKE INDICES AND SITE CONDITIONS USING IRANIAN SEISMIC DATA

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the implication of these primary methods may lead to overestimated responses that are usually conservative. The massless foundation is one of the most important simplifying assumptions in the analysis process of the dam-reservoir-foundation system, which has been considered broadly by dam designers based on its simple application. However, the obtained results during recent years have indicated that the massed foundation assumption has profound effects on structure dynamic responses and should be considered in the analyses. In this study, the far-end boundary condition of foundation (Lysmer Boundary Condition) and semi-infinite element for the foundation have been investigated for the analysis of the dam-reservoir-foundation system. In the proposed method, although the mass of foundation has been considered, the seismic load would be imposed on dam body of concrete gravity dam. The analyses have been carried out under different time histories including broadband of Peak Ground Acceleration (PGA). The dam responses due to massless foundation assumption have been investigated for comparison. The comparison of the obtained results and those of the traditional method clearly indicates the capability and efficiency of the proposed method. Furthermore, the far-end boundary condition of foundation and semi-infinite elements considerably reduced the time and cost of the analysis; therefore, these could be practical approaches to preliminary analyses that might be useful for engineers and researchers.

Key Words: Dam-reservoir-foundation system, massed foundation, far-end boundary condition (lysmer boundary condition), semi-infinite element.

DAMAGE IDENTIFICATION AND QUANTIFICATION OF STRUCTURES BY VIBRATION-BASED MODEL UPDATING METHOD USING TEACHING-LEARNING-BASED OPTIMIZATION

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Abstract

Engineering structures are prone to damage over their service life as a result of natural disaster so that damage spreading may lead to many casualties. In order to prevent these catastrophic events, early damage detection must be carried out. By considering these issues, numerous structural damage detection methods have been proposed by many researchers in the last few decades. Among all sorts of methods developed for damage detection in structures, vibration-based methods due to their simplicity and applicability are highly favored by many researchers. The basic conceptual of the vibration-based methods is that modal parameters (natural frequencies and their associated mode shapes) are functions of the physical properties of the structure (mass, damping, and stiffness). Therefore, changes in the physical properties will cause changes in the modal properties. A class of vibration-based methods is identified and damages are quantified using the model updating approach. In these methods, an objective function defined in terms of the discrepancies between the analytical model and real structural system is minimized as an optimization problem. In this paper, a novel model updating method is presented based on a structure's main modal parameters (natural frequencies and their corresponding modal shapes). For this purpose, a hybrid vibration-based objective function is proposed to minimize the differences between the structure's properties and the analytical model. A penalty function is integrated into the objective function to reduce the effects of noise in damage detection and uncertainties in the assessment procedure. The Teaching-Learning-Based Optimization (TLBO) algorithm is applied to solve this problem as an optimization problem. This algorithm is inspired by the traditional learning process of students in school. The two main stages of this algorithm are the effect of the teacher's knowledge on student learning by the convergence strategy and students learning from each other by the divergence strategy. To evaluate the applicability of the proposed objective function in detecting the location and intensity of the damage, three numerical cases are considered. These cases include an 8-story shear frame, a continuous beam, and a spatial truss. Different challenges such as the effect of noise on measured data and the effect of the penalty-function on results of damage detection were considered. Furthermore, a comparative study is investigated between the proposed objective function and three other objective functions developed based the main model parameters. The results demonstrated that the proposed method is

THE EXPERIMENTAL ASSESSMENT OF THE EFFECT OF PAPER WASTE ASH AND SILICA FUME ON IMPROVEMENT OF CONCRETE BEHAVIOR

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Abstract

The idea of using paper wastes in concrete to reduce environmental pollution and Silica fume to improve the properties of concrete is a huge transformation in the building industry. In this study, the effect of waste paper ash along with silica fume on mechanical properties of concrete was investigated experimentally. The cement was replaced with different percentages of paper waste ash (0, 2.5, 5, 7.5, and 10%) and Silica fume (0, 2.5, 5, 7.5, and 10%). Then, 25 mix designs were prepared. Compressive strength, indirect tensile strength, flexural tensile strength, slump, ultrasonic pulse velocity, and impact tests are performed for all concrete specimens at different ages. Also, creep was presented for concrete-containing waste paper ash and silica fume based on existing equations and they were compared with the concrete code of USA and concrete code of Iran. These equations were suggested to predict the behavior of concrete-containing waste paper ash and silica fume. It was also observed that at a constant water cement ratio and for all ages, Silica fume and paper waste ash increased. Also, based on the results of this study, empirical relationships were presented for the relationship among indirect tensile strength and 28-days compressive strength of concrete, tensile strength due to flexural and 28-day compressive strength of concrete specimens, compressive strength and specific weight. Thus, these equations could be used to predict the behavior of concrete-containing paper waste ash and Silica fume. The tensile strength/compressive strength ratio of ordinary concrete was about 10. However, this ratio was between 13.55 and 17.79 in concrete specimens containing waste paper ash and silica fume. The compressive strength ratio of 28 days to 90 days was between 0.67 and 0.81. However, this ratio was between 0.55 and 0.65 in ordinary concrete, which indicates the higher initial strength of specimens containing waste paper ash and silica fume.

Key Words: Concrete mix design, silica fume, paper waste ash, cement.

THE INVESTIGATION OF DAM FOUNDATION INTERACTION CONSIDERING THE EFFECT OF FOUNDATION MASS

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Abstract

Dams as one of the most important and massive engineering structures demand more attention due to their complex analysis. The enormous dimension of the dam and its interaction with the foundation and reservoir domain make it difficult to fully consider all analytical aspects. In order to study the whole system, researchers usually try to develop simplifying methods to consider the real conditions of dam-reservoir-foundation systems. The obtained results in recent years have indicated that the proposed methods are complicated and time consuming. Considering these limitations, design codes usually propose some simple assumptions for analysis, especially for the initial study phases. However,

Abstract

Although steel plate shear walls have been used to resist lateral loads in recent decades, its complex behavior has brought about difficulties in employing this system. In this study, the lateral behavior of unstiffened steel plate shear walls is investigated via nonlinear static analysis (i.e., pushover analysis). Three different special steel moment frames having 1, 5, and 10 stories are designed based on the codes criteria. Then, the finite element models incorporating both the plastic behavior of steel material and large displacement of the steel plate due to buckling are developed as exact models. In addition, simplified equivalent strip models are created as a more practical code-based approach to modeling for comparison against the exact method. The effects of different parameters including applying gravitational loads, the lateral loads distribution pattern, modeling technique, and rectangular opening in shear wall panel are evaluated. Results of the analyses show that in monotonic loading, results of the strip model are consistent with those of the more rigorous finite element model; of note, results of the former were achieved faster than the latter. Also, it is observed that use of the design method promoted by the design code results in the formation of plastic hinges first on the columns rather than walls. When the wall contains rectangular openings, it is shown that they must be accompanied with perimeter stiffeners on the edges of the opening. Otherwise, a large stress concentration would occur at the corners of the opening. Even with the peripheral stiffeners, the presence of an opening reduces the lateral stiffness and strength of the wall system more or less linearly with regard to variation in the opening size. Eventually, semi-analytical relations are proposed to estimate the lateral stiffness and strength reduction due to the presence of an opening.

Key Words: Steel plate shear wall, opening, stiffness reduction, lateral strength, nonlinear static analysis.

STUDY OF THE EFFECT OF RICE HUSK ASH BASED GEOPOLYMER ON SANDY SOIL STABILIZATION

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Abstract

Portland cement is one of the most common materials for improving the mechanical properties of soils; however, it has a lot of detrimental effects on the environment. Cement production releases million tons of carbon dioxide gas (CO_2) to the air and uses million tons of raw material such as clay and limestone. For this purpose, geotechnical engineers are looking forward to using a new friendly environment material instead of cement. Geopolymers are new alternative materials that have some advantage such as high resistance, friendly environment, long durability, and low cost. Two materials need to make a geopolymer matrix. First, any materials have silicate and Aluminium oxide and Second Alkaline activators. In this study, a geopolymer based on rice husk ash and iron ore tailings (IOT) are used for sandy soil stabilization. Two types of alkaline activators are used: 1) Type I sodium hydroxide and 2) Type II carbide calcium residue. Various parameters such as type of material consumed, percentage of compound composition, type of alkaline activator, and processing time are considered as influencing factors in the behavior of the stabilized specimens. Unconfined Compressive Strength (UCS) and splitting tensile strength tests (Brazilian test) are the main criteria for a comparison of the specimens to evaluate the effect of a geopolymer on the mechanical behavior of the specimens. X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM) analyses are performed to investigate the microstructures of the stabilized soil. The results show that by adding the optimum amount of additives and handling the specimens under ambient conditions, the unconfined compressive strength of the specimens increased. The optimum percentage of selected specimens is a combination of 10% of rice husk ash and 24% of iron ore tailings for activator I and 18% of iron ore tailings for activator II. The use of type I activator indicates that it is highly effective in the formation of aluminosilicate gels in geopolymer compounds.

Key Words: Soil stabilization, rice husk ash, iron ore tailings, portland cement, geopolymer.

defining the cumulative fatigue index, for the critical beam of structures, the maximum value of this index was observed at the WUF-W, which was obtained for 0.059 3-storey structure and was increased by 0.24 with the increasing structural height. The index for the critical column in the WUF-W junction in the 15-storey structure was 0.042, while in the other structures, the maximum value was up to 0.197. Also, the fatigue index values for WUF-W binding were higher than those obtained for RBS, indicating that the first connection performance was weaker. Maximum rate of cumulative fatigue index in beams on WUF-W to RBS was 1.29 and for columns, this rate was 1.34. The results indicated the need for greater attention to the effect of low cycle fatigue on connections of steel moment frames, especially on the WUF-W.

Key Words: Low cycle fatigue, prequalified connections, steel structures, earthquake.

IMPACT OF CONGESTION PRICING POLICY CHANGE ON MODE CHOICE: THE CASE OF TEHRAN

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Abstract

Transportation demand management policies are among the most important ways to reduce traffic congestion in cities and make transport infrastructures more efficient. One of the important policies in this field is congestion pricing that has been considered by various researchers to estimate and predict its effects including modal shift. In the present study, the effects of a new pricing policy on the traffic area of Tehran city, namely the acquisition of hourly basis tolls from personal vehicles entering this area, are studied. In this regard, the stated preference information was received through in-person interviews from 1588 users of this city-wide area who use personal vehicles for traffic in the area. In order to model their behavior in the face of the new pricing policy (hourly basis), multiple logit model was used. According to the results of the calibrated models, following the implementation of the 2000-Tomans hourly scenario, about 22% of the people entering the area by personal vehicles are going to shift their traveling mode to other modes including public (metro / bus), taxi, snap, and motorcycle. Of this, about 12% of people prefer the public transportation and will increase the share of this mode on daily trips. The Traffic Estimator's Elasticity Analysis showed that with a 1% increase in the average cost of the traffic plan in the utility function of the alternatives to change the way of travelling and other changes (cancellation of travel, change of destination to outside the range, and travel deferring to the weekend), the probability of choosing these alternatives increases by 0.77% and 0.61%, respectively. Furthermore, based on the analysis of the marginal effects of the traffic plan price variable, with the increase of 1,000 Tomans to the average cost of the traffic plan in the utility function of alternatives to change the way of travel and other changes, the probability of choosing these alternatives increases by 0.013 and 0.005, respectively.

Key Words: Congestion pricing, modal shift, elasticity, cordon, discrete choice models.

EVALUATION OF THE NONLINEAR STATIC BEHAVIOR OF UNSTIFFENED STEEL PLATE SHEAR WALLS WITH/WITHOUT OPENINGS

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EVALUATION OF SEISMIC LOW CYCLE FATIGUE ON WELDED UNREINFORCED FLANGE-WELDED WEB AND REDUCED BEAM SECTION ON STEEL MOMENT FRAME

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Abstract

The effect of fatigue on the behavior of steel structures has long been the focus of researchers. However, with the widespread damage of steel structures after the Northridge earthquake, it is important to investigate the issue of low cycle fatigue. The bylaws attempted to address the weaknesses of the connections and introduced prequalified connections. In the present study, the behaviors of two prequalified welded unreinforced flange-welded webs and reduced beam section under low cycle fatigue were investigated. The behavior of high cyclic fatigue was the focus of many researchers, while there is only a limited scope of experimental data available for LCF. In this study, the S-N-curve was used to obtain the Nastar method and available experimental data. This curve was developed using the available experimental results for the low cycle region. Four buildings with different heights were analyzed using linear time history analysis and their behavior under low cycle fatigue was considered. Then, the cumulative fatigue damage was investigated by the Palmgren-Miner fatigue analysis method for the above two connections. Rainflow method was also used for counting cycles. By