practical methods is estimating maximum inelastic displacement from maximum linear elastic displacement. Recent codes for the evaluation and rehabilitation of existing buildings are suah as FEMA273 (1997), FEMA356 (2000), FEMA440 (2005), ASCE-41-06(2006).
Code360 introduced a simplified analytical method called the coefficient method for estimating the inelastic displacement of structures from equivalent SDOF systems. In the coefficient method, maximum inelastic displacement of a structure is calculated from maximum elastic displacement, using 4 coefficients. FEMA 440 proposed new coefficients in the coefficient method based on 100 California earthquake records. These new coefficients are used in the latest code of the rehabilitation of existing buildings, ASCE41-06. The goal of this paper is a presentation of the statistical study of the inelastic displacement ratio for elastic perfectly plastic SDOF systems (according to the C_1 factor of coefficient method), based on Iranian earthquake records. Results of this study are restricted to firm soils. In this paper, results of the statistical study of inelastic displacement ratios related to the C_1 factor in the target displacement equation of seismic rehabilitation methods, based on Iranian earthquake ground motions, are presented. These ratios are calculated for single degree of freedom systems with an elastic perfectly plastic behavior model and various strength reduction factors subjected to 204 earthquake ground motion records. Earthquake records are selected recorded on soil condition types 1, 2 and 3, based on the spectral ratio H/V method. Using nonlinear regression analysis, a simplified equation based on mean results is calculated. Finally, the proposed equation is compared with the C_1 factor in Code360 and the ASCE41-06 standard, and it is realized that this factor should be revised and changed in Code360.

Key Words: single degree of freedom, elastic perfectly plastic behavior model, target displacement, C_1 factor.

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A NECESSARY INVESTIGATION INTO THE CONCEPT OF MOMENT REDISTRIBUTION AND ITS EXPERIMENTAL AND THEORETICAL DETERMINATION IN UNBONDED POST TENSIONED CONTINUOUS SLABS CONSISTING OF SELF COMPACTING CONCRETE

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Abstract

To achieve acceptance for the use of high strength self compacting concrete, HSSCC, in pre and post tensioned elements, this study was conducted. Investigation into the mechanical property effects of the fairly new concrete generation of HSSCC was performed by the first author and, for the designed HSSCC mix, the fresh properties (Slump Flow, L-box, V-funnel and J-ring tests), as well as hardened properties, such as compressive and flexural strength, modulus of elasticity, shrinkage and swelling, were measured at different ages and reported elsewhere. However, it was concluded that while producing HSSCC, it is possible to reduce the amount of shrinkage and swelling by 69% and 30%, respectively, when compared with ordinary self compacting concrete, SCC. In other words, by applying high strength SCC in prestressed elements, it is possible to reduce the total amount of prestress losses. Therefore, as a general conclusion, current knowledge of HSSCC shows that there are definite advantages, both technical and economical, in using a higher concrete strength in prestressed concrete structures. Greater strength per unit cost and per unit weight, increased modules of elasticity and reduced shrinkage and creep are some of these advantages. Theoretical and experimental research is required to understand the effects of concrete strength on unbonded post tensioned continuous slabs consisting of SCC. As no research work is available on the structural behavior of HSSCC used on post tensioned continuous bridge decks, a research program was conducted at Shahid Bahonar University of Kerman under the first author. For this purpose, first, a review is made on the concept of moment redistribution from the point of view of different standards, based on normal (vibrated) concrete. The relations for normal concrete are evaluated by casting and experimentally load testing two unbounded continuous post tension HSSCC slabs, having 7.5m length, 1.0m width and 0.2m height. The theoretical and experimental results indicated that it is safe to make use of available standards on vibrating concrete for moment redistribution calculations of tested slabs consisting of this type of non vibrating concrete. With the obtained range of results, it was found that HSSCC will consolidate exceptionally well under its own weight, even for elements containing high amounts of reinforcement.

Key Words: high strength self compacting concrete, unbonded post tensioned, moment redistribution, slabs.

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EVALUATION OF C_1 FACTOR IN TARGET DISPLACEMENT OF CODE 360, BASED ON IRAN EARTHQUAKE RECORDS FOR FIRM SOIL AND FAR-FAULT SITES

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Abstract

In recent years, performance based design and assessment methods are commonly used. Structural and non-structural earthquake damage is mainly due to imposed lateral displacements. Therefore, in recent methods, design criteria are based on displacement instead of force, as used in old methods. In fact, in these methods, displacement presents the performance of structures subjected to earthquakes. On the other hand, using performance based methods, in practical cases, needs simplified procedures to estimate the inelastic displacement of structures subjected to earthquakes. In general, nonlinear time history analysis presents an appropriate estimation of the imposed displacement of a structure subjected to a specific acceleration time history, but, results of this dynamic analysis are very sensitive to chosen acceleration time history. Thus, more reliable and practical methods are needed for the seismic evaluation and rehabilitation of existing buildings. One of the most

mation, and prevent leaks through adjacent cracked or distressed zones. To address these concerns, a new test apparatus has been developed to evaluate filter performance, when both the filter and the core are cracked. In the case of successful filters, they slump to fill the crack, flow rate decreases, and head water pressure increases to earlier pressure. In the failed filters case, the flow rate does not decrease and remains high, also a very low head water pressure take place. In this research, variations of pressure, fines content of filter soils, compaction time and amount of eroded materials were evaluated. Results showed that the prime flow rate increased as the hydraulic gradient increased, but decreased in a little time and reached a stable value. A filter with 15% non-plastic fine content, had the ability to slump to fill the crack, but its coefficient of permeability decreased significantly, and, hence, cannot be used as a filter in embankment dams.

Key Words: embankment dam, cracking, piping, filter test.

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TO STUDY AND REVIEW THE DIFFERENCE BETWEEN THE GENERAL CONDITION OF CONTRACT OF IRAN AND THE REQUIREMENTS OF INTERNATIONAL CONTRACTS

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Abstract

Time is an extremely important issue in construction. Together with cost and quality, it is a primary objective of project management, and a major criterion by which the success of a project is judged. In practice, projects are required to be completed by a certain date, and, in the case of commercial projects, this usually means as soon as possible. Time is also of fundamental importance to the contractor in that he must assess his performance capabilities and resources in order to carry out and complete the work within a given time. Whilst both the employer and the contractor would prefer the certainty of a fixed completion date, delays are an inevitable part of the construction process. With regard to the importance of time for project parties, most construction contracts include provisions for delay to oblige the responsible party to pay damages. Contractors would normally want to be paid as much as possible, and for as little risk as possible. Conversely, owners will want to pay as little and as late as possible, and possibly, and/or forcibly, transfer all risk, expense and cost to the contractor. In the event of one of the party incurring those costs, he will certainly look for reimbursement from the other party. For years, there have been a number of construction disputes involving delay in construction projects. So, most standard-form international construction contracts currently in use contain detailed provisions, under which the contractor can claim against the employer for any losses suffered if the work is disrupted due to certain specified causes. From the viewpoint of indemnifying damages, Iranian General Conditions of Contracts have shortcomings, and the risks of increasing costs for delays are not apportioned fairly in its provisions. For renovation, indemnifying damage provisions, and a fair apportioning of incurring costs, a comparative comparison between the general conditions in Iran and international conditions are used in this article. The general purpose of this paper is to discuss and compare conditions of contract provisions for recovering delay damages in Iran and international standards (JCT, ICE and FIDIC). In particular, the paper focuses on the shortcomings of the Iranian General Conditions of Contracts, regarding the recovery of delay damages. The result of research shows that reconsideration of the indemnifying contractor and owner damage provisions of Iranian General Conditions of Contracts is necessary. One of the most important results of the research is the high level risk of Iranian General Conditions of Contracts in the case of owner delays, since few events for recovery of owner damage are predicted in the Iranian General Conditions of Contracts. Also, no mechanism for claiming recovery of owner damage from the contractor is predicted in the Iranian General Conditions of Contracts.

Key Words: delay, general conditions of contract, claim.

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Abstract

The development of self compacting concrete, SCC, began in Japan (Tokyo University) in the mid 1980s, with the aim of reducing durability problems in complicated and heavily reinforced concrete structures, due to lack of skilled workers and poor communication between designers and construction engineers. Even though previously (and still today) conventional (vibrating) concrete in some applications was cast without any compaction, this new concrete was deliberately designed to be able to fill every corner of the form and encapsulate all reinforcements with maintained stability, only under the influence of gravitational forces.

Since that time, Japanese contractors have used SCC in different applications. In contrast with Japan, research in Europe, American and Iran started later. The advantages of SCC offer many benefits to construction practices. Elimination of compaction work results in reduced costs in placement, equipment needed for construction, shortening of construction time and improved quality control.

In recent years, there have been a number of significant developments in SCC, from either the viewpoint of concrete technology or reinforced concrete structural elements. However, very limited reports are available on prestressed concrete elements, while using high strength self compacting concrete, HSSCC. Also, more research is urgently needed in order to understand the use of HSSCC in precast prestressed lightweight slabs (hollow core slabs) to formulate design rules.

The deficiencies of industrial precast prestressed constructional members, such as the lack or unbundling of concrete covers on prestressing strands, weakness in holding prestressed jacking forces in precast prestressed end supports in industry, the loss of high amounts of prestressed jacking forces of strands before transferring the forces into the members, and etc., can cause irreparable damage. For better investigation of such cases, therefore, for the first time in Iran, three precast prestressed hollow core HSSCC slabs, with dimensions of 2.0m in length, 1.2m in width and 0.2m in height, are industrially cast and, then, experimentally load tested up to failure. Their ultimate state and experimental deflection and curvature ductility are measured, and the results are compared theoretically. The results show that producing such industrially deficient products is unsafe and uneconomic.

Key Words: self compacting concrete, precast prestressed hollow core slab, prestressed losses, deficiencies, ductility.

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INVESTIGATION OF EFFECTIVE PARAMETERS ON FILTER ABILITY TO STOP EROSION THROUGH SIMULTANEOUS CRACKING OF THE CORE AND FILTER OF EMBANKMENT DAMS

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Abstract

Investigations have shown that the main reason for embankment dam failure is piping through the embankment or foundation. The Balder Head dam in England, the Teton and Baldwin Hills dams in the US, and the Nanak Sagar dam in India are some dams which have failed due to a filter disability in stopping washed materials. The central core of embankments and gravel dams consists of deposits that have significant amounts of fine content. Therefore, filters in the embankment dams are designed to retain eroded fine particles from this kind of soil, to make the core and whole dam structure safe. In other words, the filter layer must be so fine that it is able to stop the erosion of protected soil and be so coarse that it has a sufficient discharge capacity to prevent excessive pore pressure. In successful filters, only in the first moment of flow, particles of base material completely pass through the filter layer and are washed. Subsequently, coarser particles of the base material clog pores of the filter and these particles hold the finer particles, so, a stable condition is formed on the whole common surface of the filter and core. In fact, the most important unanswered question regarding filter performance concerns the ability to resist crack for-

Abstract

In this study, the behavior of viscous dampers as energy absorbing devices in structures subjected to seismic excitations is investigated. Perform-3D software is used to numerically model a typical 5-span steel frame of, approximately, a 50 meter building. The model is representative of an existing building which incorporates viscous dampers to improve seismic performance. The frame model was analyzed using different acceleration time series. An evaluation was performed to examine effects of various damper arrangements on the seismic performance of the building; the number of dampers at each level, damper locations in various spans of the steel frame, and the distribution of various dampers in spans and levels of the frame. Based on the results of the current study and a meta-analysis of the findings of previous research, an optimal arrangement of dampers for improving the seismic performance of the structure is proposed. The most significant research results are as follows:

1. Increasing the number of viscous dampers at each level has no considerable effect on the seismic behavior of the structures.
2. Changing the direction of the dampers at each span has a considerable effect on analysis results.
3. Locating dampers at lower levels is more efficient than at higher levels.
4. Locating dampers at the middle span of each level is better for improvement of the seismic behavior of the structure.

Key Words: viscous damper, seismic rehabilitation, nonlinear dynamic analysis, performance based seismic design, inelastic deflection.

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INVESTIGATION OF LATERAL RESISTANCE OF SINGLE PILE LOCATED NEAR GEOGRID REINFORCED SLOPE

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Abstract

It is sometimes possible for a structure resting on vertical piles to be placed near natural or human-made slopes. The behavior of pile foundations that are located near slopes is different from their behavior when they are located at ground level, as piles not only may induce failure in the slope (especially at shallow depths) but also the lateral bearing capacity of the piles themselves may decrease to a great extent due to the nearby slope. There have been many numerical and experimental studies on single or group piles subjected to lateral loads and founded on flat horizontal ground. Whereas there are many studies on single and group piles near sandy slopes reinforced by geogrids, the effect of using slope reinforcement techniques on the behavior of vertical piles subjected to lateral loads near reinforced slopes has not yet been investigated. Consequently, the lack of study in this field, concerning the real behavior of piles in such situations and the effects of soil reinforcement on the lateral resistance of piles near slopes still exists.

The main purpose of this investigation is to examine the effect of reinforcing elements on the lateral behavior of a single vertical pile near a sandy slope, and also how to use an appropriate reinforcing layout in a practical way. Therefore, a broad series of conditions, including unreinforced cases, were tested by varying parameters such as: arrangement of geogrid reinforcements, pile distance from the slope crest, relative density of sand, angle of slope, embedded length, shaft roughness and cross section of pile. The results indicate that an improvement in the lateral resistance of the pile intensively depends on the arrangement of geogrid reinforcements. The optimum length and width values of geogrid layers (i.e. the one leading maximum lateral resistance of a single pile) were 31d and 24.6d (d=pile diameter) and 2.82d, 1.64d for the depth of the first layer and spacing between geogrid layers, respectively.

Key Words: pile, lateral load, sand, reinforced slope, geogrid.

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EXPERIMENTAL AND THEORITICAL PERFORMANCE OF PRESTRESSED HOLLOW CORE SLABS WITH HIGH STRENGHT SELF COMPACTING CONCRETE

considering the current conditions of the sand, such as void ratio and mean effective stress. As a result, the model must be recalibrated when the state of the soil changes. In this paper, it has been attempted to modify the original model by adding different state parameters to it, in order to assess the effects of these parameters on the constitutive model predictions .Several state parameters have been introduced by some investigators, but there are three common ones used widely in a large number of papers. These state parameters (ψ ,I_s , RSR), in three different ways, were added to the main model formulation, and the capabilities of the modified model were evaluated by the results of laboratory data on Toyoura sand.

Key Words: state parameter, constitutive model, bounding surface.

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PROPOSING A RESPONSE REDUCTION FACTOR FOR APPLICATION OF ADDED VISCOELASTIC DAMPERS IN SPECIAL STEEL MOMENT RESISTING FRAMES AND ITS EVALUATION

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Abstract

The response reduction factor (R) is employed in different seismic design and analysis codes to reduce the level of design forces and utilize the existing capacity of structures in dissipating the seismic input energy caused by the nonlinear behavior of structural systems. Different parameters are involved in finding this factor, among which the ductility related reduction factor, ($R\mu$), the overstrength related reduction factor, (Ω_0), the redundancy related reduction factor, (R_r), and etc., could be named. On the other hand, application of energy dissipation systems, especially added dampers, has gradually become an essential part of the seismic design of structures. The design guidelines of buildings equipped with these devices have already been provided in a number of seismic design codes, such as ASCE7-05. In this paper, a so-called "Response Reduction Factor" is introduced to take into account the effect of added viscoelastic dampers in dissipating input seismic energy in special steel moment resisting frames, (R_ξ). In that regard, a number of 2-D SSMRF models, with a different number of bays and floors, are selected. The viscoelastic dampers are uniformly distributed along the height of the structural models, employing a Kelvin arrangement, in their mathematical modeling. Nonlinear static analyses (pushover analyses) are used to determine the "added damping related" response reduction factor, (R_ξ), for these structural models. Nonlinear dynamic time history analyses are performed to investigate the obtained results using seven far-field earthquake components recorded on soil type C (dominant period of 0.4 to 0.7 second), based on the ASCE7-05 code. The results show an increase in the ductility related reduction factor, (R_μ), as well as the overstrength reduction factor, (Ω_0), by increasing damping ratios of structural systems caused by added viscoelastic dampers. Also, on average, the response reduction factor, (R_ξ), is determined to be equal to 1.09, 1.15 and 1.28 for added damping ratios of structural systems equal to 5%, 10%, and 15%, respectively. The OpenSees program is used for numerical analyses.

Key Words: viscoelastic dampers, response reduction factor, nonlinear static analysis, nonlinear dynamic analysis.

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IMPROVEMENT OF SEISMIC PERFORMANCE OF STRUCTURE BEHAVIOR UTILIZING VISCOUS DAMPERS AND OPTIMAL VISCOUS DAMPER ARRANGEMENTS IN STEEL FRAMES

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IDEAL SUCCESS EVALUATION OF MULTI OBJECTIVE MODEL FOR BOT PROJECTS; STRUCTURE AND APPLICATION

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Abstract

Due to inadequate public funding and an increasing demand on infrastructure facilities, many governments worldwide are exploring new arrangements through public private partnerships (PPP), among which the BOT (build-operate-transfer) type model of procurement is a popular option. The BOT arrangement offers host governments an opportunity to accelerate infrastructure development without incurring large public expenditure and borrowing. Since the frequent use of the BOT approach has had relative success in developing countries (usually a long list of projects have budget restrictions), they are candidates for implementation through this model. Due to some failures, we are aware that not all projects are suitable for the BOT approach, and there is an urgent need to choose a suitable model for the project. In this paper, a decision support system model was made based on a multi criteria decision making model (MCDM). The technique for order preference by similarity of ideal solution (TOPSIS) model assesses the success of a BOT project as a computer program. This program gets the specifications of a project and delivers its opportunity of success as the output. To construct this model, the success appraisal indexes of the project were defined in two groups: Critical success factors and risks allocation. BOT projects encounter many situations that are inconvenient risk allocations in dealing with these situations, which probably result in failure to achieve the project's purpose. So, the success of a BOT project depends on the assignment of a proper risk allocation between different participants. Thus, a comprehensive structure was proposed for identifying critical success factors and risks, and a framework for appropriate risk allocation to project participants was defined. It aims to support decision making as a priority to see which project is more appropriate to be delivered by the PPP approach, as well as selecting which incentive should be granted to private parties by governments (and when), to increase the projects chances of success. Consequently, disadvantages can be controlled or mitigated with risk measurement tools.

Key Words: PPP projects, BOT, success evaluation, risk allocation, MCDM model.

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EVALUATION OF DIFFERENT STATE PARAMETER EFFECTS ON MODIFICATION OF A BOUNDING SURFACE ELASTO-PLASTIC MODEL

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Abstract

Laboratory equipment is progressing, alongside advancements in technology, day by day. Along with these advancements in laboratory studies, the requirement to provide an appropriate model which can accurately predict soil behavior is felt more than at any other time. A great advancement was evolved in soil engineering by introducing the critical and steady state concept to geotechnical problems. This evolution was accompanied by an introduction to constitutive models in a critical state framework. In spite of successful predictions for clayey soil behavior, presented models failed to represent the behavior of granular soils. This weakness was significantly compensated for by introducing the concept of a state parameter in laboratory findings, and also by proposing the use of this parameter in constitutive models. In this paper, the effect of different state parameters on the improvement of model predictions has been shown by modifying an elasto-plastic model from the family of bounding surface models.

For this purpose, the model of Manzari (1994) has been chosen. This model, which was developed in a bounding surface framework, is one of the elastoplastic constitutive models developed to predict sand behavior. The critical state concept was ignored by this model. In other words, the model of Manzari (1994) does not involve the concept of critical state and state parameters. Accordingly, this model predicts soil behavior without

Abstract

One of the main challenges in structural analysis is the reliable definition of structural loading; especially the loading pattern due to earthquake input acceleration at the base of the structure. During the past four decades, in spite of the fact that six components—three translational and three rotational—are needed to describe strong ground motion (SGM) and excitation due to rotational motion, which are mainly associated with failures of some tall and long structures in the course of past earthquakes, like Kobe and Northridge, structural analysis procedures are still based on the principles of classical earthquake engineering, and the effects rotational components on the seismic loading of structures are ignored. One reasons for such assumption is the complexity of the derivation of simple seismic loading patterns for structures subject to rotational loading.

This study addresses research on the effects of earthquake rotational components on the seismic loading patterns of engineering structures, due to spatial variations of earthquake ground motion (SVEGM). To achieve this objective, at first, a new method is derived to obtain the power spectral density function of the rotational ground motion in free-fields in terms of translational components, by modifying the Kanai-Tajimi SDF. Next, a new procedure is presented using a coherency function to obtain the SVEGM pattern in the time domain. The presented technique is applicable for the earthquake loading of multiple support structures, such as bridges, pipelines, and buildings, supported on spread foundations, etc. Moreover, a simple relation is derived in order to estimate the input rotational and translational motions of rigid mat foundations, by considering the effects of kinematic soil structure interaction. The numerical results show that ignoring the effects of kinematic soil structure interaction in the seismic excitation of extended structures may lead to the unsafe loading of these structures.

Key Words: earthquake rotational components, phase velocity, principal axes, phase delay, coherency, multiple support excitations.

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EVALUATION OF THE EFFECTS OF KINEMATIC SOIL STRUCTURE INTERACTION ON SEISMIC LOADING OF STRUCTURES PART II: FOUNDATION INPUT MOTIONS

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Abstract

As seismic waves pass through foundations, high frequency waves of free-field motions will be filtered by them. To obtain these filtered motions, called foundation input motions (FIMs), the effects of kinematic interaction between the foundation and surrounding medium, due to the spatial variation of earthquake ground motion (SVEGM), should be considered. For the structures supported on the large mat foundations, considering the effects of kinematic soil structure interaction may lead to filtering of the high-frequency components of the translational response and significant rotational motions. Therefore, the contribution of rotational components may be detrimental in the seismic response of structures, such as vertically irregular structures, short-period (stiff) structures such as nuclear reactors, and even secondary systems or equipment mounted on structures that are sensitive to high frequency components of motion.

The main objective of this paper is to present a new procedure for evaluating all six input components of structures supported on two foundation systems: rigid mat and single foundations. To achieve this objective, at first, the transfer functions of foundation input motions are derived. Then, a parametric study is performed on the rigid mat foundation system, in order to estimate the effects of the geometrical shape of such a foundation system on the foundation input motion. Moreover, a numerical study is performed on the two different foundation systems; mat and single, in order to compare relations between input rotational and translational components in the structural loading. The results imply that the input translational and torsional accelerations of structures with rigid floor diaphragms, which are supported on the single foundation system, are approximately equal to the same structures with rigid mat foundation systems.

Key Words: rotational components, phase velocity, principal axes, coherency, kinematic interaction.

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width, type of road, train speed, presence of road curves in crossings, sight distances and the presence of humps are significant and are introduced in the negative binomial model. Considering the estimated coefficient for each factor, and expected changes in the future, a new outlook for the safety situation of grade crossings and the severity of accidents can be imagined. Based on the produced model, using humps and an improvement in sight distance, significant impact on accident severity has occurred. For instance, the use of hump reduces about 38% of accident severity at crossings. Use of this method is suggested for prioritization of grade crossing security, and prediction of future crossing situations, by improving characteristics, resource allocations, etc. in Iranian railway systems.

Key Words: railway-highway grade crossings, prediction severity model, negative binomial model.

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EXACT ANALYTICAL SOLUTION OF INTERFACIAL STRESSES IN STRENGTHENED RC BEAMS USING SOFFIT PLATES

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Abstract

This paper introduces an exact method to calculate interfacial shear and normal stresses in strengthened reinforced concrete (RC) beams by fiber reinforced polymer (FRP) sheets or steel plates (e.g. a soffit plate). As the combination of maximum interfacial shear and normal stresses is localized at the end of the soffit plate, the debonding phenomena initiates at that position and may produce a sudden failure of the structure. The effects of shear deformations are perfectly considered in the RC beam, adhesive layer and soffit plate. Thus, the composite RC beam is assumed as a Timoshenko beam. Application of shear deformations in the Timoshenko beam ends in a pair of simultaneous fourth-order and second-order ordinary differential equations. These equations in engineering literature are called coupled differential equations. These coupled equations are solved in an analytical form, without omitting any part of them. In a strengthened Timoshenko RC beam, the shear curvature should be added to the bending curvature. The Timoshenko beam assumption makes it possible to use this solution for both ordinary beams and short-span beams (while considering the shear deformations). In order to reduce the shear rigidity, especially in short-span beams, the equivalent flexural rigidity should be used instead of the actual flexural rigidity. Disregarding this reduction coefficient leads to incorrect results in short-span beams with a span-to-depth ratio less than five, and to an inaccurate solution in ordinary beams. In beams with a sandwich-like construction, the increase in deflection due to the shear deformation effect may be as great as 50 percent. An increase in the deformation before debonding causes a significant rise in the interfacial shear and the normal stresses, particularly between sandwich layers. The present paper helps to realize the effects of interfacial stresses on the behavior of strengthening RC structures by FRP sheets or steel plates. Finally, the concordance of the obtained and existing results proves that the accuracy of the proposed approach towards predicting interfacial shear and normal stresses is quite acceptable.

Key Words: interfacial shear and normal stresses, soffit plates (FRP sheet or steel plate), RC beam, coupled differential equations.

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EVALUATION OF THE EFFECTS OF KINEMATIC SOIL STRUCTURE INTERACTION ON SEISMIC LOADING OF STRUCTURES PART I: SEISMIC LOADING PATTERNS OF STRUCTURES

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ACCIDENT SEVERITY MODEL FOR IRAN RAILWAY-HIGHWAY GRADE CROSSINGS

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Abstract

Interfaces of two different transportation systems of rail and road are among the most hazardous points for traffic safety annually. Accidents not only bring about casualties of road and rail users but also cause stops in road and rail services and ruin equipment. Among the variety of accidents, train-vehicle crashes are some of the most severe types. Identification of effective factors in accident severity is vital for reduction programs. Usage of statistical models is a determining method for identifying black spot crossings. Such models are developed based on the relationship between accidents, on the one hand, and geometric design, control devices and traffic attributes on the other, which help to compute the amount and consequences of damage in particular places. In Iran, no model has been prepared for predicting accident severity so far. In this study, with the aid of grade crossing characteristics and accident histories from 1381-1385, such a predictive model has been developed using generalized linear regression (Poisson and Negative Binomial) methods. Modeling is performed with SAS 9.1 software. Model coefficients in generalized linear regression methods are estimated via maximum likelihood (ML) methods. In analysis, the confidence levels are set at the 90th percentile. In the provided severity prediction model, six important factors are distinguished that are similar to the other prediction models, which are compatible with engineering presumptions. Road