mid-rise and tall buildings. Combining framed tube systems with mega brace elements causes a better performance in terms of the vulnerability index compared to application of large ordinary arranged bracing systems. The illustrated outputs of the analyzed structural models contain the maximum base shear, the maximum acceleration, and velocity of all stories as well as the maximum inter-story drift. Mega braced framed tube structures, which are designed based on "limitations on relative seismic displacement of the story levels" and the "strong column - weak beam" rules, have a more convenient performance under powerful earth movements in near-fault zones.

Key Words: Near field earthquake records, non-linear time history, long period pulse, steel buildings, seismic behavior.

BARRIERS OF IMPLEMENTATION OF "INTEGRATED PROJECT DELIVERY" IN IRAN

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Abstract

Management and Implementation of projects highly depend on the contract type chosen at the beginning of the project. This will affect all the project performance measures such as cost, schedule, and quality. Thus, choosing a proper contract type as the first step in implementation of any project is so important. The fragmented nature of conventional contracts hinders collaboration among project key parties. Integrated Project Delivery (IPD), a new method in implementation of construction projects, seeks to improve project outcomes through a collaborative approach of aligning the incentives and goals of the project team through shared risk and reward, collaborative decision making, early involvement of all parties, and a multi-party agreement. Although Integrated Project Delivery (IPD) is a relatively new method, at least, six different standard contracts have been published to date addressing this method. This paper introduces Integrated Project Delivery (IPD) by its important elements according to the AIA Document C191 - 2009 (a standard form of multi-party agreement). In this paper, Integrated Project Delivery (IPD) will be introduced firstly, and then barriers to utilizing it in Iran will be discussed. For the purposes of this paper, 19 Iranian construction industry experts were interviewed once to rank importance of IPD implementation barriers, and after that, to suggest and find practical solutions to resolve the identified problems. Lack of a domestic IPD standard contract & lack of Building Information Technology (BIM) and experts in this field in Iran ranked as the most important precludes. The problems are categorized in four main groups: legal issues, financial issues, cultural issues, and technology related issues. Researchers believe that the results of this research will help to recognize the prerequisite of IPD implementation in Iran.

Key Words: Integrated project delivery, ipd, building information modeling, bim, new construction contracting method.

ASSESSMENT OF NONLINEAR DYNAMIC RESPONSE OF MEGA BRACED TUBE STRUCTURAL SYSTEMS UNDER STRONG GROUND MOTIONS

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Abstract

This paper discusses the effect of physical characteristics of near-field earthquake records on response parameters of braced tube structural systems. The structural systems were selected and designed in 20- and 30-story steel models. The studied structures are located in Tehran based on the soil type II. The models have been designed using the lateral load distribution which is specified in the Iranian seismic code 2800. The section profiles of members and connections of all structural models have been designed according to the Iranian national building code (steel structures - division 10). In this research, the dynamic response parameters of the studied models, have been assessed and presented based on conducting a number of non-linear time history analyses. The selected strong ground motions have been recorded in both near- and far-fault areas, containing a variety of pulse type features in their time history. The main characteristic item in selection of strong ground motions for performing non-linear time history analyses is the existence of high amplitude and long-period pulse or pulses in the ground velocity time history.

Braced tube structural systems are, in fact, one of the most efficient structural forms used for multi-story, especially tall buildings. Studying the manners of the seismic behavior of mega brace elements under influence of strong near-field records, is a research subject to improve the design parameters of innovative bracing systems in

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Abstract

Earthquake accelerograms, recorded in near-fault areas, indicate severe vertical ground motion. The near-fault earthquakes, due to their destructive effects, are distinguished from the far-fault ones. The importance of this issue will be more noticeable in case of long span frames. The use of long span frames, in addition to making it possible to have open areas in buildings, can help the creation of more beautiful architectural spaces. However, these frames are highly vulnerable subjected to earthquake. In this study the effect of vertical earthquake component on the long-span frames is investigated by modeling two structures with different spans, and using Sap and Perform software. First, the structures are analyzed under the effect of horizontal earthquake components and the values of moment, shear, and axial force of columns, as well as mid-span deflection of long span beams are obtained. In the next stage, the vertical earthquake component is added to the input, and the abovementioned responses are obtained again. By comparison, it is concluded that the vertical earthquake component has a very increasing effect on the mentioned structural responses.

Key Words: Horizontal and vertical components of earthquake, Near-fault earthquakes, Long span frames.

POUNDING RESPONSE OF THREE ADJACENT BUILDINGS UNDER NEAR-FAULT STRONG GROUND MOTION AND ITS EFFECT ON SEISMIC BEHAVIOR OF INTERIOR AND EXTERIOR BUILDINGS

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Abstract

In this investigation, a simple model of building in series, including 3-, 2-, and 3-story adjacent buildings, excited by the horizontal and vertical components of fault-normal pulse and fault-parallel displacement with different magnitudes and time lags, is considered. Each story of the buildings consists of a rigid beam connected to two axially rigid mass-less columns by nonlinear rotational springs and linear rotational dashpots. To determine the pounding force, the non-linear viscoelastic model was chosen. The ground motion was described by fault-normal pulse and fault-parallel permanent displacement, and their amplitudes and duration were selected consistent with the variables that described near-fault motions. An important physical characteristic of the selected pulse and displacement is large initial velocity associated with onset of these motions, and it is proportional to the stress drop on the fault. It is assumed that the buildings are near the fault, and that the longitudinal axis of the buildings (x-axis) coincides with the radial direction (r-axis) of the propagation of waves from the earthquake source, so the absolute displacements of the bases of columns are different due to the wave passage. The system of equations of motion was solved by the fourth-order Runge-Kutta method due to its self-starting feature and the long-range stability. For the considered model, the results indicate: (1) impact force can lead to increasing the maximum storey shear force. This amplification can be seen predominantly in exterior or end buildings which experience one-sided impacts, compared with interior building which experiences two-sided impacts; (2) by increasing initial gap size, the maximum impact force will not decrease necessarily. Depending on the period of buildings, initial gap size, and material nonlinearity, the maximum impact force can occur between the left and middle buildings or between the middle and right buildings; (3) for linear material under fault-normal pulse with magnitudes 5, 6, and 7, the expected maximum impact force and the minimum distance required to avoid pounding would be equal to 10, 58, 100 MN, and 10, 30, 50 cm, respectively; (4) for nonlinear material, the corresponding values would be equal to 10, 40, 45 MN, and 10, 20, 30 cm, respectively.

Key Words: Pounding, near-fault ground motion, forward directivity, fling-step, building in series.

and the cultivation processes take place inside the soil in all stages. But, the second method is based on adding the bacteria to the soil and all growth stages of bacteria and the cultivation processes are performed in the laboratory by using a special fermenter. In this method, necessary nutrients must be provided to survive the bacteria and other materials are required to create the chemical reaction of urea and calcium chloride. In this way, deposition of calcium carbonate and adherence of grains together are created and soil engineering properties increase. For this purpose, the best ways is the injection of Calcium chloride into the Bacillus Pasteurii background. Cementation of particles together with calcite precipitation increases soil strength. Although the strength of this kind of samples increases remarkably, environmental conditions can reduce this kind of strength. However, the remarkable point that has not been considered so far is the effect of disturbance on the structure of this kind of cementation, which can be tremendously effective in method performance. The disturbance can be carried out directly by disturbing the structure of a stabilized soil or by environmental temperature changes. This paper aims to assess these types of disturbances in the soil stabilized biologically. For this purpose, several stabilized samples were made via a biological method. These samples were then subjected to structural disturbance and also the disturbances, caused by freeze and thaw cycle, in order to investigate the effect of such factors on decreasing the resistance of the biologically stabilized soil.

Key Words: Disturbance, freeze and thaw cycle, biological cementation, bacillus pasteurii.

DETECTION OF THE PLASTIC HINGE IN SIMPLE BEAM DURING AN EARTHQUAKE BY OBTAINING CURVATURE DIAGRAM

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Abstract

This paper presents a new method for detecting damage of simply-supported beam. This method is based on the using deference of curvature vectors. The plastic hinges throughout the beam, were determined during an earthquake using deference of curvature vectors.

At first, artificial crack applied in the form of cuts in some parts of the flange and web section of a simple steel beam was detected by obtaining different mode shapes vectors and performing Continuous wavelet transform. Then, the same artificial crack was detected in the beam that was exposed to a net bending of 30 KN M using difference between slope vectors in the damaged and undamaged beam.

Then, an undamaged beam was modeled, and plastic zones were created by applying push loads, and not artificial cracks, to the beams and created plastic hinges under the push load were detected.

An important point to consider is that the damage caused by an earthquake to a structure is mostly nonlinear so it is necessary to detect plastic hinges after an earthquake in order to improve the structure. The modeled beam was exposed to the accelerations of Chichi earthquakes (1999), and the curvature vectors of the beam were calculated using the accelerometers output data at each time step.

In this paper a criterion is developed by which we can easily identify the critical time step. The plastic hinges were detected through curvature vectors at the critical steps. A sudden increase in curvature values at the critical step and the observation concerning the values exceeding the yielding curvature are used as indicators of the formation of a plastic hinges. Moreover, the proposed method determines the length and depth of plastic hinges as well as their location in the beam. Finally, the accuracy and advantage of the mentioned method were compared to the conventional signal processing methods such as Continuous wavelet analysis.

Key Words: Damage detection; plastic hinge; plastic curvature; wavelet transform.

THE EFFECT OF VERTICAL COMPONENT OF EARTHQUAKE ON THE LONG SPAN FRAMES IN STEEL BUILDINGS

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EFFECT OF INORGANIC MATERIAL AND NON-UNIFORM ELECTROKINETIC ON SOLIDIFICATION/STABILIZATION OF LEAD, ZINC AND ARSENIC

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Abstract
In this study, the effects of fly ash (X_1), kaolinitic clay (X_2), micro-silica (X_3) content and water-to-solid ratio (X_4), electrical potential gradient (X_5) and polarity reversal period (X_6) on the solidification and stabilization of Synthetic waste containing lead, zinc and arsenic were investigated. The data were analyzed using the central composite design which is the most commonly used response surface methodology RSM design (using a mixture design of a constrained triangular surface) and ANOVA. Optimum formulations were simulated using a desirability function. pH and compressive strength tests were performed on 86 specimens. The specimens with the highest and lowest compressive strengths were selected for Toxicity characteristics leaching procedure (TCLP) and scanning electron microscopy (SEM) to evaluate the leaching behavior of lead, zinc and arsenic and monitoring hydration progress, respectively. The experiments were arranged according to a full factorial design, which also allowed deriving predictive models for unconfined compressive strength and pH as affected by Synthetic waste content as well as variables type and dosage. Among the variables tested, polarity reversal period (less than 32.5min) and micro-silica (more than 7.5 % wt.) were found to affect mechanical strength far more positively compared to the other species used, at the same time ensuring low metal release from the material. On the other hand, the use of polarity reversal period more than 32.5 min and micro-silica less than 7.5% wt. were observed to cause a significant increase in metal leaching. The result indicates that the extensive accumulations of calcium aluminate hydrates (CAH) which are the main products of tri-calcium aluminate (C3A) and calcium silicate hydrate (CSH) were identified as the main hydration products. The formation of $NaCaAsO_4.7.5H_2O$ and portlandite were the main phase controllingAs^{5+} and heavy metal solubility in cement-treated Synthetic wastes. The optimal conditions obtained from the compromise of the two desirable responses, pH and compressive strength of specimens, were lead, zinc and arsenic concentration in TCLP leachate 0.4 mg/L, 0.393 mg/L and 0.146 mg/L, respectively. pH and compressive strength of specimens in the optimal condition were 57.56 Mpa and 9.82, respectively.

Key Words: Solidification/stabilization, non-uniform electro-kinetic, heavy metals, industrial waste, TCLP.

THE EVALUATION OF STRUCTURAL DISTURBANCE AND TEMPERATURE EFFECTS ON THE RESISTANCE OF BIOLOGICAL CEMENTED SOIL

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Abstract
The necessity of using suitable methods of soil stabilization is of great importance, regarding the increasing growth of population. Soil stabilization by microbiological sedimentation of calcium carbonate is an appropriate method, which has been recently evaluated all around the world, and is known as a method compatible with the environment used in some places of the world. There are two methods of remediation of sandy soils by use of microorganisms. The first method is based on microbiological bacterial stimulation. In this method, nutritious material is added to the soil for the growth of bacteria

more accurate attitude involving the effective parameters such as ductility, over-strength, redundancy, seismic hazard level, performance levels, etc. The results showed high capacity and resistance of system and good seismic performance of structures under the current study. Thereby, choosing behavior factor of 5 for initial design ensures the immediate occupancy performance level for all three structures under high earthquake intensity considered in seismic design code of Iran.

Key Words: Tunnel form system, response modification factor, demand r-factor, supply r-factor.

RELIABILITY AND SENSITIVITY ANALYSIS OF STEEL AND CONCRETE PILES USING SIMULATION METHODS

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Abstract

In this paper, reliability and sensitivity of steel and concrete piles for cohesive and cohesion less soils considered. For this purpose, Monte Carlo simulation, Importance Sampling and first order methods used for evaluating reliability index, moreover sensitivity of related limit states obtained by finite difference using Monte Carlo simulation and first order method. Comparison between results indicated that first order methods are appropriate for evaluation reliability of piles in cohesive soil and sensitivity analysis using theses method can be trusted as accurate results. But for sensitivity of piles in cohesion less soils, because of complexity and high nonlinearity of their limit states finite difference method must be used and also reliability result in first order methods is not accurate. Also it has been founded that cohesive factor and piles dimensions are sensitive parameter in cohesive soils, but for cohesion less soils, soil related parameters have a significant effect in reliability of piles.

Key Words: Pile, reliability, sensitivity, simulation.

EFFECT OF BIOLOGICAL CEMENTATION ON SANDY SOIL BEHAVIOR

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Abstract

Population increase in the world has caused the cities to develop. There is a definite link between this development and availability of soil quality and stability. One of the latest methods for stabilization of soils is the use of calcium carbonate microbiological sediment as a suitable injection material. This method, not only is a compatible method with the environment, but also is a suitable method for stabilization of sandy soils. Although, there are a few studies on this topic, most of them are about construction conditions and parameter variations. Also, there is no research on soil behavior models after stabilizing sandy soils. Therefore, in this study, the effects of using a bacterium spore called Bacillus Pasteurii and production of biological deposition of calcium carbonate on improvement of the technical characteristics of sandy soils through the production of sandstone have been investigated and the effects of biological cementation on sandy soil behavior models are assessed.

Key Words: Biological cementation, sand behavior, sprosarcina pasteurii, soil model.

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Abstract

Geological studies indicate that many tropical regions of the planet, including the southern part of Iran, are covered by calcareous sediments. Despite the high risk of seismicity and strategic position as well as the enormous resources of oil and gas in southern Iran, dynamic behavior of calcareous soils of these regions has not been much considered. Therefore, assessing dynamic behavior of calcareous soils is a vital step for engineering projects located in these regions. Maximum shear modulus is one of the most important properties of soil deposit used in the dynamic analysis.

In this study, shear modulus of Boushehr calcareous sand is investigated in the range of small strains using resonant column tests. Bulk samples of Boushehr sand were collected from the North bank of the Persian Gulf near the Boushehr port. The effects of mean confining pressure and void ratio on the maximum shear modulus of the calcareous sand are investigated. Moreover, for evaluating the effect of stress anisotropy on the small-strain shear modulus of the calcareous sand, resonant column tests were conducted under both isotropic and anisotropic conditions.

The experimental results confirm that the increase of the mean confining pressure and decrease of the void ratio increases the maximum shear modulus of the sand, as previously reported for the other sands. Also, the results of resonant column tests indicated that the increase of stress anisotropy leads to the increase of maximum shear modulus. By increasing mean confining pressure, the effect of initial stress anisotropy on the maximum shear modulus increases. Based on the tests results, predictive equation for estimating the maximum shear modulus of calcareous sand is presented in this study. It is demonstrated that the proposed model has great capability for prediction of the experimental shear modulus at small strains, compared with the models recommended for silicate soils. Finally, to capture the influence of stress anisotropy on the maximum shear modulus equation, a relationship is presented as a function of initial shear stress ratio. The relationship presented in this study can be employed to evaluate the maximum shear modulus of Boushehr calcareous sand under both isotropic and anisotropic conditions.

Key Words: Maximum shear modulus, calcareous sand, silicate sand, stress anisotropy, resonant column.

MULTI-LEVEL R-FACTOR DETERMINATION FOR RC TUNNEL-FORM BUILDINGS

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Abstract

Despite unique seismic resistance characteristics of reinforced concrete tunnel form buildings, a literature review surveyed rare research works found for this type of buildings. Unfortunately, no special seismic code is published for reinforced concrete wall-slab system with tunnel form, and there is only little information on the seismic behavior of this structural system type in technical and research docs. Therefore, based on reasonable numerical results, seismic behavior and performance of structures constructed with this technique, considering the effective factors in response, is highly noteworthy in a seismic code of development process. The behavior factors in the seismic design codes are based on engineering judgment and are provided based on observations of various performances of structural systems against past strong earthquake shakings. For reinforced concrete tunnel-form buildings, due to lack of enough information and observations of damages induced by past earthquakes, using the behavior factor of reinforced concrete bearing wall system in the current seismic design process appears as notable concerns which are the main challenges in designing these structures based on the equivalent lateral force method. This type of structural system has recently innovated and used in mass production houses, so there is rare information pertaining to its behavior under strong earthquakes. Since including the behavior factors in seismic codes are based on engineering judgment from observing its past seismic performance, developing these factors for this new system needs more research works.

The most distinctive feature of this study with respect to similar studies is multi-level definition of behavior factors, their extraction with respect to seismic intensity, and the accepted damage level as expected performance levels in designing structure. Hence, the demand/capacity behavior factors are determined with a

panels with an opening in an arbitrary position and tries to find a mathematical relationship (if any) between the percentage of decrease in strength of the wall and its correspondence with the position of the opening with the aid of a series of finite element analyses using ANSYS. At the beginning, the unstiffened panel was modeled by comparing the results of the analysis with the related classical equations and experimental tests and having calibrated the errors, the process of creating holes in different positions went on for up to fifteen models, and finally, the corresponding equations for the percentage of decrease in strength of panels were obtained which were independent from the dimensions of the panel. Ultimately, the validity of the proposed equations was examined by some re-modeling within the examined plate, and the results confirmed the proposed equations in a very favorable manner.

Key Words: Steel plate shear wall, effective shear strength, diagonal tension field, opening.

INVESTIGATING VIBRATION IN BRIDGE STRUCTURES CAUSED BY VERTICAL EARTHQUAKE EXCITATION AND MOVING MASS EMPLOYING PASSIVE PIPE DAMPERS

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Abstract

Dynamics of beam structures subjected to various loads have been investigated for over a century. The importance of such a problem arises in the structural design of bridges in which the nature of loading could affect the design parameters substantially. It has been observed that as a bridge structure is subjected to moving masses and earthquake loading, the dynamic deflection and stresses can be significantly higher than those observed in the static case. Although only the horizontal component of earthquake excitation is taken into account in the modeling of bridges and parallel beams sustaining the bridge deck loads. there exist several pieces of evidences showing that some of the failure modes are in direct relation to the vertical one. Generally, in comparison with the horizontal component of earthquake, however, the vertical one has less power and most part of its influence occurs in a particular frequency domain that could be so destructive to the structures with natural frequency in these domains. In addition, there are clearly many problems of great physical significance in which the load inertia is not negligible and can significantly alter the dynamic behavior of the system; therefore, moving mass is the another important and affective dynamic loads in design of these routine bridges. In this article, the seismic effect of vertical earthquake on the bridges is studied aiming to explore the necessity of simultaneous acts of this force and the moving masses. By proving the intensifying effects of these loads combination via the obtained results, by employing a passive damper system, it is attempted to decrease the mentioned influences on the studied structure. Dampers are used in two ways. and the best one is chosen based on its performance in suppression of the beam deflection. Finally, through analyzing and comparing the results, a simple algorithm is introduced for reducing the sections' dimensions of the bridge structures under this type of loading.

Key Words: Bridge structure, vertical component of earthquake excitation, moving mass, passive damper, vibration suppression.

LABORATORY STUDY ON THE MAXIMUM SHEAR MODULUS OF BOUSHEHR CALCAREOUS SAND

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uation for both AASHTO LRFD and AASHTO formulas. Moreover, simple equation which was suggested in previous studies is conservative in calculation of bending moments to some extents, compared to results of finite-model. Generally, it can be concluded that both AASHTO and Iran's standards overestimate the maximum bending moment skewed bridge, where AASHTO is a little more conservative in estimation.

Key Words: Continuous bridges; composite bridges; girder bridges; skew bridges.

EFFECT OF FREEZE-THAW AND WET-DRY CYCLES ON CLAY SOIL WITH SULFATE STABILIZED BY ION EXCHANGE CBR^{+4} SOLUTION

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Abstract

Freeze-thaw and wet-dry cycles influence the geotechnical properties of soils, and it leads to the change of strength parameter of soil. During these processes that occur in the nature, one type of the soil with enormous damage-inflicting capability is sulfate clay soil; in these cycles, soil loses its strength swell.

The sulfate clay soil cannot be stabilized by using Lime and totally by calcium based stabilizer. Because the alumina of clay can react to the sulfate existing in soil and also calcium existing in lime, leads to producing an expansive mineral which is called Ettringite and is so expansive in the vicinity of water, causing many problems in the surface of road in the foundation of buildings.

In the present study, in order to decrease the destructive effects natural process, sulfate clay soil is stabilized by CBR+4 ion exchange soluble. At first the CBR value of non - stabilized is measured and after that, this soil is subjected to freeze-thaw and wet-dry cycles, and the amount of its swelling and strength is measured.

In the following research, the sulfate clay soil was stabilized by the ion exchange soluble CBR^{+4} ; after that, the stabilized soil like the non- stabilized soil was firstly measured for the amount of its CBR strength and swelling of stabilized samples to be determined under freeze-thaw and wet-dry cycles.

Key Words: Sulfate soil, CBR strength ,swelling, stabilization, CBR^{+4}.

EFFECT OF DIFFERENT POSITIONS OF CONCENTRATED OPENINGS ON THE SHEAR CAPACITY OF STEEL PLATE SHEAR WALLS

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Abstract

The great efficiency of steel plate shear walls (SPSW) and their deformability have caused them, by coercion, to be very thin in thickness in order to resist the lateral seismic loads, especially in upper stories of the building which may be a fraction of a millimeter, and this steel plate thickness meeting the design requirements may not be available on the market. On the other hand, using the thicker plate than the designed ones would increase the shear capacity of the wall, and ultimately increase the transferred load to surrounding members so that the beams and columns would need to be bigger in section. Hence, one of the rational solutions is to use the thicker plate while improvising the opening in plate in order to reduce the stiffness of the panel. On the other hand, embedding windows and openings are inevitable due to architectural requirements. According to several research studies and experiments, concentrated circular opening located in the center of the plate has the greatest effect on reducing the stiffness and the shear resistance capacity of the panel and use of this amount of decrease in resistance to other openings would be conservative. This paper investigates the shear behavior of steel plate shear

Abstracts of Papers in English

COMPARING EFFECTS OF SKEW ANGLE ON CONTINUOUS COMPOSITE GIRDER BRIDGES ACCORDING TO IRAN AND AASHTO CODES

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Abstract

In many projects, there are bridges with skewed construction due to river or junction condition. In this paper, the effect of the skew angle on continuous composite girder bridges is discussed using three-dimensional finite-element analysis. Seventy-two models of two-span bridges with various span/width ratios (N = 1, 1.55, and 1.82), skew angles (0-60°), and various arrangements of intermediate transverse diaphragms are analyzed. Iran's Standard Truck and AASHTO HS20 44 loading are applied to all models, then the reactions for skewed bridges are compared with the reference non skewed bridge, according to the AASHTO standard specifications. The results show that as the skew angle increases, the support moment in interior and exterior girders decreases. It decreases about 8% when the skew angle is less than 20° and dramatically rises to 30% for a 45° skew angle, when these numbers are 10% and 37% for AASHTO loading in similar situation. The shear force of girder increases in pier support for the exterior girders and decreases at the interior ones with increasing skew angle. The overestimation of shear force for internal bridges is about 18% for a skew angle of 45° which increases up to about 23% for exterior girders according to Iran loading standard, when these changes are about 22% and 31% for AASHTO standard for that specific angle. Furthermore, diaphragms' arrangement has direct influence on result and decreases the overestimation of moment from 30% to about 7% for Iran and from 37% to 7% for AASHTO code, when internal diaphragms are perpendicular to girders and are parallel to skew angle. Previous studies support this conclusion in similar sit-