Abstract

Delay in construction projects is a major and challenging problem occurring between owners and contractors. It may happen for different reasons and several researchers have investigated its influencing factors. Determining a project's final cost and its completion date is important for all parties involved in project execution. Using project control methods, including continuous assessment of the schedule, determining progress percentages and using the earned value method, deviations from schedule can be found. In such circumstances, conflicts might arise between contractor and owner, as restoring the original schedule of a project requires double expenditure by the contractor. Also, continuation of the previous procedure and late completion of the project will cause damage to the owner.

In this research, and by using game theory, a mathematical model has been presented. Through bargaining and by a step by step approach, the behavior and strategies of the parties involved in the delayed project have been investigated. This model helps owners and contractors gain a deeper understanding of the given delay problem, obtain a fairly accurate analysis of their situation and consider possible strategies when they confront such circumstances. In a given case study, points upon which both parties can agree rationally have been proposed.

With model analysis, it can be found that parameters involved in the problem can be effective in changing the range width of negotiations. In special cases, such as a disproportionate delay penalty, these parameters even make the negotiations neutral. Step by step analysis of the model showed which features can threaten negotiation, and, according to these analyses, suggestions for strategies of both sides are presented. The proposed model can help the parties reach a rational and realistic decision about the completion date of the project without wasting time.

Some assumptions regarding the model have been included, which are possible for others to extend.

Key Words: Construction management, delay in construction projects, game theory, bargaining.

DIRECT DISPLACEMENT-BASED DESIGN CONSIDERING THE EFFECTS OF SOIL-STRUCTURE INTERACTION

F. Behnamfar(corresponding author)
farhad@cc.iut.ac.ir
Dept. of Civil Engineering
Isfahan University of Technology

M. Eidini
eydini@yahoo.com
International Institute of Earthquake Engineering and Seismology
S.M. Taherian
mtaher_326n@yahoo.com
Dept. of Civil Engineering
Islamic Azad University

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 137-144, Research Note

- Received 21 April 2013; received in revised form 27 July 2013; accepted 18 August 2013.

Abstract

Displacement-based design is a procedure for attaining an acceptable level of damage during earthquakes, which provides a new tool for performance-based design. In this paper, a method of direct displacement-based design considering the effects of soil-structure interaction is proposed. The suggested method is in two stages. First, the base of the structure is assumed to be rigid. In a sequence of different steps, the base shear is calculated for the assumed fixed-base condition. In these steps, first, the yield displacement of the system is estimated using empirical relations. Then, the basis displacement, which is the maximum displacement of an equivalent single degree of freedom system that will be subsequently used for calculation of the lateral displacement profile, is determined. The ductility factor is calculated using the yield and basis displacements and an equivalent damping ratio is computed next. The effective mass of the system is determined using the displacements profile. Using a design displacement spectrum, the effective period and then the effective lateral stiffness are calculated. The fixed-base base shear comes as the effective lateral stiffness multiplied by the basis displacement. In the second stage, the base shear is modified due to the flexibility of the base. For this purpose, the additional displacement due to rotation at the base is calculated and added as a modification to the basis displacement. This modified deformation is used in a similar way as above to compute the modified base shear. In this method, the design displacements can be selected based on the design needs and expected performance levels, and seismic damage control is directly applicable. For clarity of presentation, the steps of the method are explained through an illustrative example, and the results are compared with those of a conventional design code. It is shown that the proposed displacement-based design method can result in heavier or lighter structural members compared with the code-based sections based on the structural dynamic properties.

Key Words: Displacement based design, performance level, soil-structure interaction, displacement spectrum.

to increase the accuracy of the analyses. "Temperature-displacement" and "displacement-force" curves were derived from these analyses.
The results show that increasing the size of castellated beams reduces displacement at the mid-span of the beam due to its increase in stiffness. The stiffness of mild steel, as well as the load bearing capacity of composite beams at elevated temperature, decreases, which causes large displacement at mid-span. The results show that castellated beams cannot withstand temperatures over $800°C$.

Key Words: Elevated temperatures, castellated beam, composite floor beam.

EFFECTS OF RECYCLED CONCRETE AGGREGATE, WASTE GLASS AND PLASTIC ON THE DURABILITY AND MECHANICAL PROPERTIES OF CONCRETE

M. Nili(corresponding author)
nili36@yahoo.co.uk
Dept. of Civil Engineering
Bu-Ali Sina University, Hamedan
N. Biglarijoo
nader.biglari@gmail.com
Dept. of Civil Engineering
K.N. Toosi University
M. Razmara
mehrdaad.razmara@gmail.com
Dept. of Civil Engineering
Bu-Ali Sina University, Hamedan

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 111-119, Research Note

- Received 6 April 2013; received in revised form 21 July 2013; accepted 8 September 2013.

Abstract
Considering the advancement of technology and the growth in population, recycling waste material is a practical solution. Waste material can be obtained from demolished and destroyed buildings, or the debris of buildings damaged in destructive earthquakes, floods, and wars. Recycling waste material, besides saving energy and natural resources, and improving environmental conditions, could also decrease the cost of these materials when disposed in landfills.
This research is focused on evaluation of the concrete made by recycled concrete, crushed waste glass and plastic. These materials are used as a substitute for natural aggregates in concrete. In order to consider the effects of these waste materials, recycled concrete was used as fine and coarse aggregate, and plastic and glass were substituted by fine aggregate. The substitution percent for waste material was 0, 5, 10, 15, and 20. For better observation, some physical and mechanical properties were considered. These tests consist of workability, compressive strength, flexural strength, tensile strength (splitting), electrical resistivity, hardened unit weight and natural frequency in a modulus of elasticity test.
By substituting waste glass with natural fine aggregate, no remarkable change was observed in the mechanical properties, while water absorption and electrical resistivity were modified. In addition, recycled fine and coarse aggregates had an acceptable performance in mechanical properties, although water absorption and electrical resistivity was not as expected. In contrast, waste plastic decreased the mechanical properties dramatically, as in some cases, this mixture is not recommended at all. Of course, electrical resistivity and water absorption were modified noticeably. As a whole, crushed glass and recycled concrete play a neutral role as aggregate in concrete, and even in some cases, enhances the properties. The substituted plastic had insufficient effects on concrete and is recommended when high strength concrete is not.

Key Words: Recycled concrete, waste glass, waste plastic, mechanical properties, durability.

OPTIMAL STRATEGIES APPLIED BY CONTRACTORS AND EMPLOYERS FOR DELAYED PROJECTS: GAME THEORY APPROACH

E. Eshtehardian(corresponding author)
eshtehardian@modares.ac.ir
Dept. of Project & Construction Management
Tarbiat Modares University
R. Abbasnia
abbasnia@iust.ac.ir
J. Mohammadi Taghiabad
j.mohammadi.t@gmail.com
A. Chalekaee
a.chalekaee@gmail.com
Department of Civil Engineering
Iran University of Science and Technology

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 121-135, Research Note

- Received 6 April 2013; received in revised form 13 October 2013; accepted 28 October 2013.

THE EFFECT OF POLYPROPYLENE FIBERS ON BOND STRENGTH BETWEEN CONCRETE AND STEEL IN SELF-COMPACTING CONCRETE

S.H. Hashemi(corresponding author)
h-hashemi@araku.ac.ir
S.E. Hossini
ehsanhoseini65@gmail.com
Dept. of Civil Engineering
Arak University

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 97-104, Research Note

- Received 6 March 2013; received in revised form 21 October 2013; accepted 4 November 2013.

Abstract

Self-Compacting Concrete (SCC) is a highly fluid yet stable concrete that can flow consistently under its own weight, pass between bars, and fill in formwork without the need for compaction. Fiber reinforcement can extend the technical benefits of SCC by also providing a crack bridging ability, higher toughness, and long-term durability. The use of polypropylene fibers, however, is known to alter the flow properties of fresh concrete. To maintain a self-consolidating ability, the fiber length and total volume must be controlled, which can restrict the gain in toughness imparted by the fibers. Thus, fibers intended for use in SCC need to be carefully optimized. The study analyzes the impact of polypropylene fibers on SCC performance under fresh conditions, as well as its mechanical properties under hardened conditions. For the mechanical properties of SCC, the study has been conducted as follows: compressive strength with elapsed age, tensile strength, bond strength, all of which were measured after the sample being cured for 28 days.

The bonding strengths of reinforcing bars were measured using cubic specimens of SCC. The SCC specimens were cast without applying compaction.

A total of 5 SCC mixtures were made with combinations of fibers in varying proportions from 0 to 1.8 kg/m3. All specimens from these five mixtures are cured under two different conditions: (1) in a water tank of $25 \pm 2°c$, and (2) in air in the laboratory. At the end of each curing period, three specimens out of each concrete combination and curing condition were tested for compressive, tensile and bond strengths, and the average of the three values was taken.

Applying $1.8kg/m^3$ polypropylene fiber to the SCC resulted in 23% reduction in the slump flow (from 690 mm to 530 mm). Polypropylene fibers did not influence the compression of SCC. However, applying these fibers at their maximum percentage volume, determined through this study, increased the tensile strength by 25% in the splitting tensile strength test, and 7% in the bond strength test.

Key Words: Self-compacting concrete, bond strength, polypropylene fibers, nano silica.

BEHAVIOUR OF CASTELLATED COMPOSITE FLOOR BEAMS IN FIRE

M. Yahyai
yahyai@kntu.ac.ir
B. H. Ghamsari(corresponding author)
banafshehasanpour@sina.kntu.ac.ir
N. Khashayar
nima.khashayar@live.com
Dept. of Civil Engineering
K.N.Toosi University

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 105-110, Research Note

- Received 6 April 2013; received in revised form 23 September 2013; accepted 5 October 2013.

Abstract

Every year, immense economic and personal costs are imposed as a result of fire damage. It is unlikely that we will ever be able to completely prevent fires from occurring, so, the aim of fire engineering is to reduce the risk presented by fire to acceptable levels. The mechanical strength and stiffness of unprotected steel reduces drastically at elevated temperatures, and the behavior of steel structures is of particular concern. Castellated composite floor beams have been used in structures in Iran for many years, because of their simplicity and economic advantages. Thus, it is important to further work on this topic in Iran.

In the present study, finite element models of the composite beams are developed by the FE code, ABAQUS, and the results of the models are compared to that of experimental tests under standard fire conditions to verify the finite element models. Fair agreement was achieved between the model and the experiment, confirming that the finite-element model used is capable of predicting the behavior of the connections at elevated temperatures. Four different sizes of castellated beam were chosen to study the effect of high temperature on the mid-span displacement of composite beams. Also, four different levels of temperature are studied on the load capacity of the beams. Since the behavior of the beam and concrete floor is studied under static and thermal loading, coupled temperature-displacement analysis is used

Dept. of Civil Engineering
Islamic Azad University
Roudsar and Amlash Branch

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 75-85, Research Note

- Received 22 January 2013; received in revised form 28 October 2013; accepted 10 November 2013.

Abstract

Speed limit signs are posted alongside roads, based on their geometric characteristics, except for driver behavior and possible environmental conditions, to reduce traffic hazards. This study summarizes the results obtained by 527 questionnaires that were given to the drivers of vehicles moving on the Chaboksar-Ramsar road, north of Iran, from December to January. About 9.5% of the drivers are female. The research is of a theoretical-practical type. The data is collected by random selection in statistics. The drivers answered questions voluntarily for about ten minutes. First, we did descriptive statistics. In the second step, using a classification and regression tree (CART) technique, the most important factors affecting driver behavior, and attracting their attention to the 50km/hr speed limit sign, among the 16 such factors identified, including age, gender, education, income, marital status, occupation, driving speed, driving time, driving hours, vehicle type, number of accidents over the previous 5 years, driving certificate type, driving experience, the years of driving certificate taken, and sunglasses used, were found to be driver education, monthly income, and type of vehicle. The CART is a nonparametric model and capably used for categorical variables in various sciences. The parameters are known from most past studies. The results indicated that three parameters are the most important (not that other parameters are unimportant) in driving behavior. To validate the results, a speed limit sign near the study location was used. The speeds of a sample of 414 vehicles were observed by the speedometer installed on the asphalt pavement at this location. The results show that the drivers do not pay sufficient attention to the posted speed limit sign. We suggest that researchers evaluate other models in the same zones and compare the results.

Key Words: Traffic signs, speed limit, decision tree, regression model.

EFFECT OF CONCRETE AND BOND STRENGTH ON THE BEHAVIOR OF REINFORCED BEAMS STRENGTHENED WITH FRP SHEETS

M. Naderi(corresponding author)
naderi-m@ikiu.ac.ir
S.V. Tabatabaei
shahriarvt@yahoo.com
Dept. of Civil Engineering
Imam Khomeini International University

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 87-96, Research Note

- Received 2 March 2013; received in revised form 22 June 2013; accepted 3 August 2013.

Abstract

There are many concrete structures that need to be strengthened, due to such reasons as changes in codes of practice, design or construction error, damage from earthquakes or such events and/or changes in their usage. Among retrofitting systems, the use of FRP sheets in the concrete retrofitting industry is attracting more attention worldwide. Since the retrofitted concrete structures have concrete with different strengths, the behavior of FRP sheets can be different in different structures. Therefore, in this paper, the behavior of reinforced concrete beams with different concrete and bond strength, retrofitted with FRP sheets, is reported. Experimentally obtained results are compared with those obtained from ABAQUS. For related research, using five different concrete mixes, 15 reinforced concrete beams were constructed. For each concrete strength comparison, two beams were strengthened using FRP sheets and one beam was left to be tested as a control beam. The bond strengths of the FRPs used were measured using a new twist-off method. This new method is a partially destructive test that can be used under laboratory and site conditions. Preparation of concrete surfaces and the application of epoxy resin glue were undertaken so that the best adhesion could be achieved. In order to assess the FRP/concrete bond strength, partial cores were made using a diamond tipped coring drill. The depth of the partial cores was such that they penetrated about 5mm into the substrate concrete. The damaged caused by the twist-off method is very trivial and can be repaired by hand if required. The results tend to indicate that an increase in concrete strength and the bond between the FRP layer and the concrete increases the ultimate load (capacity) of the retrofitted reinforced concrete beams. Therefore, when opting for retrofitting with FRP sheets, the surface strength and the interfacial adhesion of FRP/concrete should be given enough consideration.

Key Words: FRP, concrete strength, RC beam, flexural behavior, bond.

load bearing capacity of the brace elements is the same as the ring, they can be designed in such a way to prevent braces from buckling.
In this paper, the effect of the steel ring on the response of the system is described using modeling and the nonlinear analysis of braced frames; once under an existing earthquake and once again on a synthetic earthquake generated based on the wavelet method.
In this order, two cases including, ten and fifteen-story moment braced frames with and without steel rings were selected. The results in the orginal records show that by application of the steel ring, the relative displacement of the frame increases in the stories, especially the middle ones. Also, the base shear of the frame decreased. The percentages of decrease in the base shear for 10 and 15 story frames are 31% and 21%, respectively. The results of the base shear of two frames in the artificial records by application of the steel ring, showed the same tendency as in the initial records. However, the percentages of decrease in the base shear of the artificial earthquakes obtained for 10 and 15 story frames are 17% and 28%, respectively. In fact, the steel ring controlled the earthquake by absorbtion of energy, reduction of base shear and an increase in relative displacement.

Key Words: Concentrically brace, ductility, steel ring, base shear, wavelet.

CALCULATION OF DYNAMIC DEBRIS IMPACT LOAD ON STEEL BUILDINGS IN COLLAPSE LIMIT STATE

M. Safi
m_safi@sbu.ac.ir
Dept. of Civil and Environmental Engineering
Shahid Beheshti University
M. Tehranizadeh(corresponding author)
dtehz@yahoo.com
Dept. of Civil and Environmental Engineering
Amir Kabir University of Technology

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 65-73, Research Note

- Received 13 February 2013; received in revised form 14 October 2013; accepted 10 November 2013.

Abstract
An important task in the design of buildings against progressive collapse is to account for the dynamic impact effect of falling debris loads caused by extreme abnormal loading conditions. Extreme loads such as explosions may generate primary debris like bombs or vehicle fragments or secondary debris consisting of blast-borne debris or debris from failed structures near the source. It is necessary to consider this debris in the structural design to reduce hazards to the occupants and prevent the loss of key structural components. Casualty mitigation and fatality prevention is achieved by preventing collapse and by limiting debris caused by the local failure of structural and non-structural elements. Debris reduction is achieved by proper detailing and the provision of ductility in the structure. Generally, since inelastic behavior is permitted in elements subjected to these loads, performance is deformation controlled; i.e., some allowable rotation or ductility (based on minimizing debris) is specified for each structural member type for blast loads. For progressive collapse, deformation limits are specified to ensure some residual capacity exists. Presently, recently published deformation criteria or "response limits" for blast loads are restricted, as contained in the UFC manual. Progressive collapse criteria are presently unrestricted and contained in the GSA Progressive Collapse Guidelines and in UFC. This paper employs elastic dynamic analysis and contact mechanics to determine dynamic impact load factors for a variety of debris loading scenarios possible for beam members in buildings. Parametric studies are performed to investigate the effect of different parameters on dynamic load factor values, and some graphs are proposed as design aids for estimating such factors for engineering applications. The effect of nonlinear inelastic material behavior on impact factor values is discussed through numerical examples. The results show that in some cases, the realistic loads imposed on the structure due to falling debris are much more that the load values proposed by the codes to prevent progressive collapse in building structures.

Key Words: Debris impact load, nonlinear contact dynamics, extreme load, progressive collapse.

FACTORS AFFECTING TRAFFIC SIGN OBEDIENCE: CASE OF SPEED LIMIT SIGNS

A.M. Rahimi(corresponding author)
amrahimi@znu.ac.ir
Dept. of Civil Engineering
University of Zanjan
M. Kazemi
mojtaba.kazemi.r@gmail.com

rule is not employed. Moreover, some recommendations are provided regarding a steel with specific cyclic hardening behavior.

Key Words: Plasticity models, cyclic loading, combined hardening, kinematic hardening, isotropic hardening, steel structures.

PROGRESSIVE COLLAPSE RESISTING CAPACITY OF TUBES IN TUBE STEEL STRUCTURES UNDER SEISMIC LOADS

J. Keyvani(corresponding author)
jkeyvani@khu.ac.ir
M. Mansoori
mansoori303@yahoo.com
Dept. of Civil Engineering
Kharazmi University

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 47-54, Original Article

- Received 6 August 2013; received in revised form 1 October 2013; accepted 13 October 2013.

Abstract

During the recent decade, there have been many studies undertaken regarding progressive collapse in steel frame structures.

Progressive collapse is a phenomenon wherein the local damage or failure of an element spreads through other adjacent elements, leading to the eventual failure of the structure.

Past studies have mainly focused on progressive collapse in frame structures by removing specific columns located in the first story.

In this paper, progressive collapse of a steel tube in the tube structures under seismic loads has been evaluated. For this purpose, three types of steel tube in the tube structures have been modeled, with 2, 2.67, and 3.2 meter distances between the columns, and 30, 45, and 60 stories in height. The structures have been analyzed using time-history dynamic analysis.

Because of the formation of plastic hinges under seismic loads at the height of this type of structure, the elements removed were modeled with hinges that had not been placed in the first story but had spread to the other stories.

The plastic hinges formed under increased seismic loads in the elements have been modeled by elements with hinges that can resist a portion of the bending moment. Results show that by increasing the distance between columns in the 30 and 45-story tube in the tube structure, the chance of progressive collapse increases. It is due to the formation of a plastic hinge in the lower story, and development of a negative shear lag in the upper stories.

In contrast to 30 and 45-story tubes, increasing the distances between columns in the 60-story tube in the tube structure results in a reduction of the chance of progressive collapse. It occurs because of the distribution of plastic hinges at the height of the structure, and also lack of negative shear lag in this type of structure.

The results indicate that the tubes in tube systems are efficient in the very high structures.

Key Words: Progressive collapse, tube in tube steel structure, operation levels of structure, time-history nonlinear analysis.

EFFECT OF STEEL RING IN CONCENTRICALLY BRACES FRAME WITH WAVELET BASED ARTIFICIAL EARTHQUAKE

M. Mirzahosseini(corresponding author)
m.mirzahosseini65@gmail.com
M. A. Kafi
mkafi@semnan.ac.ir
R. Vahdani
rvahdani@semnan.ac.ir
Faculty of Civil Engineering
Semnan University

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 55-63, Research Note

- Received 25 February 2013; received in revised form 29 July 2013; accepted 18 August 2013.

Abstract

Concentrically braced frames are a lateral resistant system in steel structures that is used more than any other structural system, because of ease of implementation, high stiffness and economic viability. However, they have less ductility compared to moment frames. In the past two decades, extensive research has been undertaken to increase their ductility. One of these methods is using energy dissipation fuses. There are several types of these elements designed for flexure, shear and torsion. A steel ring is a new flexural fuse that can be installed in concentric braced frames. The steel ring has been studied experimentally, showing a high energy absorption capability and high ductility. Since the maximum

Abstract

Ground motion close to a ruptured fault, resulting from forward directivity, contains strong coherent dynamic long periods that cause it to be significantly different from other ground motion. Current PSHA (Probabilistic Seismic Hazard Analysis) methods are not able to capture such effects well and, therefore, are not able to predict these effects on spectral shape. Tabriz is an ancient and industrial city with many industrial factories and financial centers in North-Western Iran. In this region, the North-Tabriz Fault passes through at a close distance to urban areas and controls the seismic hazard scenario in the city. To ignore the directivity effect in PSHA may possibly lead to an underestimation of, in particular, the nonlinear demand. Herein, a PSHA analysis is carried out using appropriate relationships to consider near field directivity effects. Uniform seismic hazard curves of several points around Tabriz city are calculated using ordinary and modified PSHA, and the pulse effects on these curves are discussed. To depict the pulse effect in this city, iso acceleration maps of spectral periods of 2 and 4 seconds, for return periods of 475 and 2475 years, are calculated in accordance with ordinary and modified PSHA. Moreover, iso amplification maps of these two periods for the return period of 2475 years are calculated for better depiction of pulse effects in the Tabriz city region. Furthermore, the results disaggregated for better assessment of the effect of seismic sources, in terms of distance and magnitude. These calculations are carried out for 1 and 3 second spectral periods and for two return periods of 475 and 2475 years. The results show that accounting for pulse like effects in PSHA increases the relative contribution of close distances and low values of epsilons (□) to spectral acceleration exceedance. Moreover, the contributions of each earthquake scenario to long period spectral acceleration shift to larger magnitudes by including the effects of near fault directivity. The results confirm that due to the contribution of close distances at higher values of ground acceleration, consideration of near-field directivity effects is inevitable.

Key Words: Near-field, pulse, probability seismic hazard analysis, disaggregation, tabriz city.

EFFECT OF STEEL CYCLIC HARDENING HYPOTHESES ON THE BEHAVIOUR OF STEEL JOINTS

S. S. Dezaki
sajad.sadeghi@modares.ac.ir

S. Shahbeyk(corresponding author)
shahbeyk@modares.ac.ir
Faculty of Civil Engineering
Tarbiat Modares University

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 35-45, Original Article

- Received 16 March 2013; received in revised form 3 September 2013; accepted 14 September 2013

Abstract

Exact determination of loading conditions and the mechanical behavior of constituent materials are among key elements in the safe and economical design of structures. In practice, economic considerations do not allow structures to be designed for their elastic range of behavior. That is, under imposed loads, elements of a typical structure normally undergo irreversible deformation. Thus, accurate numerical estimation of structural responses crucially depends on the accuracy of the nonlinear constitutive models of the materials. Nowadays, the conventional plasticity approach, if carefully employed, can confidently estimate the nonlinear response of various materials. Steel, as the most commonly used metal in the building industry, has been shown to have complex cyclic strain hardening properties, including cyclic creep (ratcheting), relaxation, cyclic hardening or softening, and etc. However, it is frequently observed that elastic-perfectly plastic assumptions or very simple linear isotropic or kinematic forms are adopted in practice. Hence, in order to evaluate how these incorrect hypotheses influence the numerical results of cyclically loaded steel connections, various simplified hardening models used by engineers are identified. These include three kinds of isotropic hardening and two kinds of kinematic hardening model. Then, a moment-resisting beam-to-column connection, previously tested under near fault excitations, is nominated. Using a reliable combined nonlinear isotropic-kinematic model (reference model), a representative FE model is generated and validated against the empirical results. In the next stage, the analysis has been carried out for six different types of steel with different plastic properties, under both near and far fault excitations, whose results are compared to those of the reference models (models with the combined hardening hypothesis). Three variables of maximum tolerable load before failure, plastic energy dissipated, and the critical equivalent plastic strain are introduced for the strength, energy dissipation, and onset of cracking criteria, respectively. It needs to be noted that the micromechanically based cyclic void growth model (CVGM) is employed to calculate the critical equivalent plastic strain associated with the onset of cracking. The results show that, regardless of the type of excitation, considerable errors may arise if the combined hardening

behavior in the reduced section were studied. Parameter studies were included as the shape of cutting in the beam flange and the height of the web in double beams. Results from the studied connections show that AW-RBS has the least resistance and stiffness decrease; 8models have acceptable behavior in cyclic loads. In double beam sections, the existence of two webs as folded plates in the reduced region causes the delay of lateral buckling and lateral torsional buckling, which makes the workability of the connection increase.

Key Words: RBS connection, accordion effect, double beam, plastic hinge, hysteresis behavior.

GROUND MOTION PREDICTION (ATTENUATION) RELATIONS FOR SPECTRAL ACCELERATION IN IRAN

N. Hassani(corresponding author)
hassani@pwut.ac.ir
Abbaspour College of Engineering
Shahid Beheshti University
G.G. Amiri
ghodrati@iust.ac.ir
Dept. of Civil Engineering
Iran University of Science & Technology
M. Barania
majidbararnia@stud.pwut.ac.ir
Abbaspour College of Engineering
Shahid Beheshti University
F. Sinaeian
sinaiean@yahoo.com
Building and Housing Research Center
H. Jahanian
civil.hassanjahanian@gmail.com
Dept. of Civil and Environment Engineering
Amirkabir University

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 11-21, Original Article

- Received 4 March 2013; received in revised form 22 June 2013; accepted 3 August 2013.

Abstract

The design spectrum is an important input data for seismic design. Currently, elastic design spectra are used in seismic codes. The most usual methods for providing design spectra are probabilistic and deterministic, in which ground motion prediction equations (attenuation relations) are employed. In scientific societies, research into ground motion prediction equations is being undertaken to increase their accuracy. Iran also needs such accurate relations, due to its high seismicity. Considering the promotion of the national seismic acceleration network and the improved past earthquake acceleration records in Iran, it is necessary to develop new ground motion prediction relations based on new records with more accuracy.

A ground motion prediction equation (GMPE) for spectral acceleration is proposed for Iran. The proposed relations are supported by analyses of 806 acceleration records from 330 earthquakes that occurred in the past. Each of the selected records has been modified separately. The modifications on acceleration records include filtering and base-line correction. The moment magnitudes of the selected earthquakes range from 4 to 7.3 and almost 98% of them have epicenter distances less than 200 Km. Based on tectonic conditions, 3 relations are introduced for Iran including the Zagros region and the Alborz central Iran region. These relations relate spectral acceleration to parameters like earthquake magnitude, distance between sites and seismic sources and site conditions. The sites are classified as rock, and hard and soft soils, based on average shear wave velocities up to 30 meters in depth. The data used in this research includes records until 2010, and an effort is made to increase the accuracy of the proposed relations by disregarding low accurate data. Based on all these data, 3 simplified and practical relations are presented for acceleration spectra in Iran. In addition, the results of this research are compared with similar results by other researchers.

Key Words: Attenuation relation, acceleration spectra, Zagros, Alborz, Iran.

NEAR-FIELD EFFECT IN PROBABILISTIC SEISMIC HAZARD ANALYSIS AND DISAGGREGATION OF TABRIZ CITY

M. Yousefi(corresponding author)
masood.yousefi.civil@gmail.com
T. Taghikhany
ttaghikhany@aut.ac.ir
Dept. of Civil and Environmental Engineering
Amirkabir University of Technology

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 23-34, Original Article

- Received 25 February 2013; received in revised form 17 August 2013; accepted 26 August 2013.

Abstracts of Papers in English

MODELING AND ASSESSMENT OF REDUCED BEAM SECTIONS IN MOMENT RESISTANT CONNECTIONS OF IRANIAN DOUBLE I-BEAMS

M. Naghipour
m-naghi@nit.a.ir
S. M. E. Sepasgozar(corresponding author)
civil_saleh65@yahoo.com
Dept. of Civil Engineering
Babol Noshirvani University of Technology

Sharif Civil Engineering Journal
Volume 31, Issue 2.1, Page 3-10, Original Article

- Received 3 February 2013; received in revised form 20 August 2013; accepted 18 November 2013.

Abstract

Today, steel moment resistance connections are the most common type of connection widely used in steel structures, and they certainly play a significant role in retrofitting, reliability and economic benefits. Their use also improves the quality and useful life cycle of buildings. Considering their basic importance, and after the Northridge earthquake, the invention of RBS connections was a turning point in resistant steel moment connections. In RBS connections, a reduction of the beam flange at the end of the beam causes the plastic modules of the section to be reduced and the plastic hinge of the beam to be far from the column. This research observes the seismic behavior of the RBS connection, with a reduced section of the flange and a new AW-RBS with a reduced section of the web in a double section beam, which is particularly applicable in Iran. Double sections of I-beams have high torsional stiffness and are used in steel moment resistance frames. The seismic behavior of these frames needs to be investigated when conjugated with high performance AW-RBS connections. These observations are undertaken using ABACUS nonlinear finite element software. Experimental data from the literature were used for verification of our modeling in the finite element method. Many models were put under cyclic loads and ductility, and energy absorption and plastic