OMB No. 5382700146843

Impulsive Loading On Reinforced Concrete Slabs

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Impulsive Loading On Reinforced Concrete Slabs *OMB No. 5382700146843 edited by*

JORDYN NORRIS

Direct Shear Failure in Reinforced Concrete Beams Under Impulsive Loading FIB - Féd. Int. du Béton

A finite element method is presented to analyze the effects of airblast-induced ground shock on shallow-buried, flat-roofed, reinforced concrete structures. A finite element based on Timoshenko beam theory is adopted. Material properties are defined in terms of nonlinear stress-strain relations in each of several layers through the thickness of the element. Elastic, ideally plastic constitutive properties for plain concrete are cast in terms of shear-stress/normal-stress variables. Elastic, strain-hardening constitutive properties are assumed for steel. Dynamic explicit and implicit and static solution algorithms are available. This analysis method is applied to simulation of static beam-column tests reported by ACI Committee 318-77. It is then applied to simulation of structural

response of experimentally tested shallow-buried box structures subjected to airblast loads in which shear, flexure and combined shear-flexure damage was observed. (Author).
The Shock and Vibration Digest FIB - International Federation for Structural Concrete
Designing for hazardous and abnormal loads has become an important requirement in the design process of most major buildings and civil engineering structures, ranging from tall buildings to bridges, power plants to harbour and coastal installations. This state-of-the-art volume was compiled by the Institution of Structural Engineers' informal study group Model Analysis as a Design Tool and City University's Structures Research Centre. It contains a series of papers on the design and analysis of structures through full scale and numerical modelling including the crucial areas of hazard identification and risk assessment of structures. This book will be essential reading for civil and structural engineers, designers and researchers.
Fracture of Concrete and Rock Springer Science & Business Media
This conference is the first in a series of conferences dedicated to Fracture Mechanics of Concrete Structures. Due to the recent explosion of interest in research on fracture in concrete, the conference has brought together the world's leading researchers in fracture of concrete and this book contains the proceedings.
Simplified Analytical Tools for Impact and Impulsive Loading Analysis of Reinforced Concrete Structures CRC Press
The International Conference on Fracture of Concrete and Rock was organized by the Society for Experimental Mechanics (SEM) subdivision on Fracture of Concrete and Rock and RILEM Committee 89-FMT Fracture MechanicS of Concrete; Test Methods. The venue was Houston, Texas on June 17-19, 1987 and cooperation was provided by ACI 446, Fracture Mechanics and RILEM 90-FHA Fracture Mechanics of Concrete; Applications. The conference co-chai rmen were Professor S. P. Shah, Northwestern Uni versity and Professor S. E. Swartz, Kansas State University with the able assistance of Professor K. P. Chong, University of Wyoming. The conference theme was Fracture Mechanics Applications to Cracking and Fracture of Concrete (plain or reinforced) and Rock Subjected to Uniaxial or Complex Stress States with Static- or Dynamic-Loading Rates. This theme was chosen in recognition of parallel efforts between the rock mechanics community and researchers working in the application of fracture mechanics methods to the problem of cracking and fracture of concrete.
Energy Research Abstracts CRC Press
This book gathers the latest advances, innovations, and applications in the field of environmental and construction engineering, as presented by international researchers at the XXV International Scientific Conference "Construction: The Formation of Living Environment", held in Moscow, Russia on April 20-22, 2022. It covers highly diverse topics, including sustainable innovative development of the construction industry, building materials, reliability of buildings and constructions and safety in construction, modelling and mechanics of building structures, engineering and smart systems in construction, climate change and urban environment. The contributions, which were selected by means of a rigorous international peer-review process, highlight numerous exciting ideas that will spur novel research directions and foster multidisciplinary collaborations.
Development of Improved Timoshenko Beam and Mindlin Plate Theories for the Analysis of Reinforced Concrete Structures Subjected to Impulsive Loads CRC Press
Reinforced concrete slab systems are widely used in protective structures designed to resist blast events. Blast events subject structures to high pressure and impulse loads. The magnitude of blast load experienced by a structural element is directly related to the exposed area. Hence protection of reinforced concrete slabs and walls, which constitute the maximum exposed area of a structure when subjected to blast loads, is of great importance. The main purpose of the project is to study the non-linear response of reinforced concrete slabs when subjected to impact and blast loading. Blast loading comprises of impulsive, dynamic and quasi-static loading conditions. And the performance of reinforced concrete slabs subjected to these loads is highly dependent upon the reinforcing steel provided in the slab. Hence a comprehensive analysis is performed on a representative slab panel with varying reinforcement. Due to the nature of the blast loading analysis method used influences the slab response significantly. Hence the slab response was predicted and compared using finite element (FE) and single degree of freedom (SDOF) methods. An advanced finite element modeling tool, LSDYNA and a commonly used SDOF analysis tool, SBEDS are employed for the purpose of analysis. A parametric analysis is conducted to develop Pressure-Impulse (PI) curves for different damage levels. Curve fit analysis was performed to characterize the PI curves generated from FE method. Conclusions and future work recommendations are presented for design of reinforced concrete slabs for blast protection based upon the research are presented and discussed.abstract.
Studies in atomic defense engineering Concrete Structures Under Impact and Impulsive LoadingThe Response of Reinforced Concrete Structures Under Impulsive LoadingA finite element method is presented to analyze the effects of airblast-induced ground shock on shallow-buried, flat-roofed, reinforced concrete structures. A finite element based on Timoshenko beam theory is adopted. Material properties are defined in terms of nonlinear stress-strain relations in each of several layers through the thickness of the element. Elastic, ideally plastic constitutive properties for plain concrete are cast in terms of shear-stress/normal-stress variables. Elastic, strain-hardening constitutive properties are assumed for steel. Dynamic explicit and implicit and static solution algorithms are available. This analysis method is applied to simulation of static beam-column tests reported by ACI Committee 318-77. It is then applied to simulation of structural response of experimentally tested shallow-buried box structures subjected to airblast loads in which shear, flexure and combined shear-flexure damage was observed. (Author).Impulsive Loading on Reinforced Concrete SlabsEffects of Impulsive Loads on Fiber-reinforced Concrete BeamsThis report describes an investigation of the effect of a destructive impulse load upon fibre reinforced concrete beams. Concrete develops tension cracks as a result of minute flaws that are inherent in its nature. A method of arresting these cracks by placing short lengths of randomly spaced fine wire within the concrete mix is described. The results of the studies indicate that (1) the fibres increase the tensile strength of the concrete by as much as 100 percent for static loading, and (2) the material exhibits considerable post-cracking strength. These two effects increase the ability of the material to absorb energy.Simplified Analytical Tools for Impact and Impulsive Loading Analysis of Reinforced Concrete StructuresThe analysis of reinforced and prestressed concrete elements under blast and impact loading is drawing the interest of many researchers due to increasing number of natural or human-

made hazards that require attention. The analysis methods used are mainly based on either simplified single degree-of-freedom methods or highly sophisticated and complex hydrocodes. Although single degree-of-freedom methods are commonly used by designers for practical reasons, they are incapable of providing detailed results such as deformed shapes and crack maps. Additionally, since they require simplification of the structure to a single degree-of-freedom system, they are difficult to apply to complex geometries. On the other hand, hydrocodes overcome the limitations associated with the simplification of the structure. However, they require highly detailed models which require significantly increased modelling and computational time. Moreover, the accuracy of blast and impact analyses with hydrocodes heavily relies on the material input parameters which are not commonly known. Thus, there remains a need for accurate, simplified and reliable tools for analysis of reinforced and prestressed concrete subjected to blast and impact loading. The VecTor family of nonlinear finite element programs, using a macro-element smeared rotating crack approach, has been shown to be accurate in predicting the response of shear-critical structures under quasi-static conditions. In this study, two members of this suite, VecTor3 and VecTor6, were adapted for the blast and impact analyses of reinforced and prestressed concrete structures in 3D and axisymmetric conditions, respectively. The results obtained from the simulations were close to those experimentally observed. Additionally, a semi-analytical formula for the prediction of perforation velocity from missile impact was developed. The formula, which is based on the Modified Compression Field Theory, considers the influence of longitudinal and shear reinforcement in the target differently from other commonly used empirical formulae. The formula was validated with numerous missile impact data available in the literature, and good accuracy was found.Developments in Mechanics of Structures & Materials

The use of precast concrete is a well-established construction technique for beams, floors, panels, piles, walls and other structural elements. The advan tages of precasting include excellent quality control, economical large scale production, improved construction productivity (especially in adverse weather conditions) and immediate structure availability. These advantages have been recognized for precast concrete raft pavement units (raft units) since their introduction in the 1930s. In the last ten years there has been a considerable increase in the use ofraft units, especially in their range of applications, their analysis and their design. However, the description of these developments has been published in academicjournals and conference proceedings which are not readily available to practising raft unit pavement design engineers. Pavement design engineers are underincreasingpressure to produce raft unit designs that are inexpensive, long lasting and able to allow reorganization to accommodate changing use and uncertainty offuture loading requirements. This is the first book devoted to raft unit pavements, and will become a standard work of reference.

Applied Mechanics Reviews John Wiley & Sons

While the static behavior of concrete has been the subject of numerous works, the same cannot be said for the dynamic behavior. This book sets out to remedy this situation: it begins by presenting the most frequently used experimental techniques in the study of the dynamic behavior of concrete, then continues by examining seismicity and seismic behavior, soil behavior, models of concrete structures subject to seismic activity, seismic calculation methods of structures, and paraseismic engineering.

Pressure-impulse Diagrams Using Finite Element Analysis for Reinforced Concrete Slabs Subjected to Blast Loading Springer Science & Business Media

This report describes an investigation of the effect of a destructive impulse load upon fibre reinforced concrete beams. Concrete develops tension cracks as a result of minute flaws that are inherent in its nature. A method of arresting these cracks by placing short lengths of randomly spaced fine wire within the concrete mix is described. The results of the studies indicate that (1) the fibres increase the tensile strength of the concrete by as much as 100 percent for static loading, and (2) the material exhibits considerable post-cracking strength. These two effects increase the ability of the material to absorb energy.

Studies in Atomic Defense Engineering CRC Press

Despite tremendous advances made in fracture mechanics of concrete in recent years, very little information has been available on the nature of fracture processes and on reliable test methods for determining parameters for the different models. Moreover, most texts on this topic discuss numerical modeling but fail to consider experimentation. This book fills these gaps and synthesizes progress in the field in a simple, straightforward manner geared to practical applications.

Journal of the American Concrete Institute

Springer Nature

The EURO-C conference series (Split 1984, Zell am See 1990, Innsbruck 1994, Badgastein 1998, St. Johann im Pongau 2003, Mayrhofen 2006, Schladming 2010, St. Anton am Arlberg 2014, and Bad Hofgastein 2018) brings together researchers and practising engineers concerned with theoretical, algorithmic and validation aspects associated with computational simulations of concrete and concrete structures. Computational Modelling of Concrete Structures reviews and discusses research advancements and the applicability and robustness of methods and models for reliable analysis of complex concrete, reinforced concrete and pre-stressed concrete structures in engineering practice. The contributions cover both computational mechanics and computational modelling aspects of the analysis and design of concrete and concrete structures: Multi-scale cement and concrete research: experiments and modelling Aging concrete: from very early ages to decades-long durability Advances in material modelling of plain concrete Analysis of reinforced concrete structures Steel-concrete interaction, fibre-reinforced concrete, and masonry Dynamic behaviour: from seismic retrofit to impact simulation Computational Modelling of Concrete Structures is of special interest to academics and researchers in computational concrete mechanics, as well as industry experts in complex nonlinear simulations of concrete structures.

Concrete Structures Under Impact and Impulsive Loading CRC Press

This volume contains the peer-reviewed papers accepted for presentation at the 18th Australasian Conference on the Mechanics of Structures and Materials held in Perth, 2004. Papers contained describe significant advances in a large number of diverse areas, indicating the range of applications of the basic principles and techniques of mechanics from traditional areas such as steel and concrete structures, through to modern areas such as structural health monitoring and structural rehabilitation using carbon fibre composites. With topics ranging from foundation piles to shaken baby syndrome, this volume reports the results of countless thousands of hours of research and

millions of dollars of research funding.

Modern Protective Structures Elsevier

In today's world, reasonably predictable military operations have been replaced by low intensity conflicts-less predictable terrorist activities carried out by determined individuals or small groups that possess a wide range of backgrounds and capabilities. Because of the threats posed by this evolving type of warfare, civil engineers and emergency personnel face new challenges in designing facilities to protect lives and property and in conducting effective rescue operations and forensic investigations. Addressing these needs, Modern Protective Structures develops realistic guidelines for the analysis, design, assessment, retrofit, and research of protected facilities. After introducing a comprehensive risk management approach, the author provides a general background on explosive devices and their capabilities as well as explosive effects and the processes that generate them. He then discusses the effects of conventional and nuclear explosions. The book subsequently considers the significant design differences between conventional and nuclear loads and between existing design procedures and state-of-the-art information from recent research. It also summarizes existing blast-resistant design approaches and describes the dynamic responses of structural systems to blasts, shocks, and impacts. Additional coverage includes the behavior of specific structural connections, the traditional concept of P-I diagrams, and progressive collapse. The book concludes with a systematic and balanced protective design approach. Tackling the analytical, design, assessment, and hazard mitigation issues associated with short-duration dynamic loads, this book examines how impulsive loads affect various types of buildings and facilities. It provides the necessary material to help ensure the safety of persons, assets, and projects.

Innovations in Impact and Blast Protections Springer Nature

Advances in Concrete Slab Technology documents the proceedings of the International Conference on Concrete Slabs held at Dundee University on April 3-6, 1979. This book discusses the influence of steel fiber-reinforcement on the shear strength of slab-column connections; sulfur-treated concrete slabs; yield line analysis of orthotropicaly reinforced exterior panels of flat slab floors; and behavior of flat slab/edge column joints. The design of multiple panel flat slab structures; structural behavior of floor slabs in shear wall buildings; shrinkage and cracking of concrete at early ages; and slab construction for HAB system modules are also elaborated. This text likewise covers the direct finishing of concrete slabs using the early age power grinding technique; application of vacuum dewatering to in-situ slab production; retexturing of concrete slabs; and fatigue resistance of composite precast and in situ concrete floors. This publication is a good reference for students and individuals concerned with the practices and research relating to slab technology.

Precast Concrete Raft Units CRC Press

Concrete Structures Under Impact and Impulsive LoadingThe Response of Reinforced Concrete Structures Under Impulsive Loading

Abnormal Loading on Structures

Reinforced concrete is one of the prime building materials widely used to construct protective structures. One of the purposes of this project is to study the non-linear response of reinforced concrete structures when subjected to impact and blast loading. The study is conducted at two levels: material level and structural level. At the material level, the strength enhancement of three material models of LS-DYNA subjected to high strain rates is studied. The effects of strain rate and lateral inertial confinement on the strength enhancement are investigated. Recommendations are made to improve the accuracy of the results of future numerical simulations for reinforced concrete structures subjected to loads having high strain rates. At the structural level, Pressure-Impulse diagrams for reinforced concrete columns that have four configurations of transverse reinforcement are developed. Finite element modeling in LS-DYNA is used to analyze the structures and calculate the damage level for each blast event. The developed Pressure-Impulse diagrams are used to study the effect of confinement on the reduction of damage level at impulsive, dynamic, and quasi-static loading conditions.

Developments in Mechanics of Structures & Materials

The analysis of reinforced and prestressed concrete elements under blast and impact loading is drawing the interest of many researchers due to increasing number of natural or human-made hazards that require attention. The analysis methods used are mainly based on either simplified single degree-of-freedom methods or highly sophisticated and complex hydrocodes. Although single degree-of-freedom methods are commonly used by designers for practical reasons, they are incapable of providing detailed results such as deformed shapes and crack maps. Additionally, since they require simplification of the structure to a single degree-of-freedom system, they are difficult to apply to complex geometries. On the other hand, hydrocodes overcome the limitations associated with the simplification of the structure. However, they require highly detailed models which require significantly increased modelling and computational time. Moreover, the accuracy of blast and impact analyses with hydrocodes heavily relies on the material input parameters which are not commonly known. Thus, there remains a need for accurate, simplified and reliable tools for analysis of reinforced and prestressed concrete subjected to blast and impact loading. The VecTor family of nonlinear finite element programs, using a macro-element smeared rotating crack approach, has been shown to be accurate in predicting the response of shear-critical structures under quasi-static conditions. In this study, two members of this suite, VecTor3 and VecTor6, were adapted for the blast and impact analyses of reinforced and prestressed concrete structures in 3D and axisymmetric conditions, respectively. The results obtained from the simulations were close to those experimentally observed. Additionally, a semi-analytical formula for the prediction of perforation velocity from missile impact was developed. The formula, which is based on the Modified Compression Field Theory, considers the influence of longitudinal and shear reinforcement in the target differently from other commonly used empirical formulae. The formula was validated with numerous missile impact data available in the literature, and good accuracy was found.

Fracture Mechanics of Concrete Structures

The effects of air blast from high explosives detonation on selected power plant structures and components are investigated analytically. Relying on a synthesis of state of the art methods estimates of structural response are obtained. Similarly blast loadings are determined from compilations of experimental data reported in the literature. Plastic-yield line analysis is employed to determine the response of both concrete and steel flat walls (plates) under impulsive loading. Linear elastic theory is used to investigate the spalling of concrete walls and mode analysis methods predict the deflection of piping. The specific problems considered are: the gross deformation of

reinforced concrete shield and containment structures due to blast impulse, the spalling of concrete walls, the interaction or impact of concrete debris with steel containments and liners, and the response of exposed piping to blast impulse. It is found that for sufficiently close-in detonations and/or large explosive charge weights severe damage or destruction will result. This is particularly true for structures or components directly exposed to blast impulse.

The Response of Reinforced Concrete Structures Under Impulsive Loading

This book develops several novel foam-filled structures and steel-concrete-steel (SCS) sandwich structures, which provides more alternatives for ensuring the safety of buildings and infrastructures under extreme loading, like impact and blast. In the first part of this book, the aluminium foam- and polyurethane foam-filled structures have been developed for dissipating impact and blast energy. Experimental and numerical studies have been conducted to obtain their behaviours under impact loading. In addition, analytical models have also been proposed to assess their energy absorption performances and facilitate the impact and blast design when using the proposed foam-filled structures. In the second part of this book, SCS sandwich structures with novel shear connectors have been developed and their behaviours under impact and blast loading have been experimentally, numerically and analytical studied. Analytical models for predicting the impact and blast responses of SCS sandwich structures have also been developed. In the third part of this book, a new steel-polyurethane foam-steel-concrete-steel (SPUFSCS) panel (i.e. the combination of foam material and SCS panel) has been developed to achieve a higher impact resistant capacity. Owing to the increasing impact and blast threats on buildings and infrastructures, the studies presented in this book are of significant importance for providing several new solutions for impact and blast enhancement.

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