Shear Behavior Of Circular Concrete Members Reinforced

Reinforced Concrete Structures
Non-Linear Mechanics of Reinforced Concrete
Machanics of Structures and Materials
XXIVTensile and Shear Behaviour of Fin-plate Connections to Hollow and Concrete-filled Steel Tubular Columns at Ambient and Elevated Temperatures
Seismic Performance of Circular Reinforced Concrete Columns Under Varying Axial Loads
Shear Behavior of Structural Elements Made of Steel Fiber Reinforced Concrete
Steel & Composite Structures
Structural Concrete Structural Failure and Plasticity
ACI 318-08 and Commentary
Experimental Investigation of the Shear Resistance of Circular Concrete-filled Steel Tubes (CFTs) Subjected to Transverse Loading
Modern Mechanics and Applications
Shear Response of Concrete Steel Counterparts
This has been well defined for flexural and axial behavior; however, few studies have been done to assess the shear carrying capacity of these members. For design, most provisions either reference one of the two materials, steel and concrete, or some combination of the two, without acknowledging the increased capacity that comes from their interaction. Past research has been performed on small diameter CFTs (~ 6 in.) that has shown these methods greatly underestimate shear resistance. This program extends this knowledge with the experimental testing of larger-scale CFTs (~20 in. in diameter) and the development of a finite element model, validated against these tests, that was used for further parametric studies. The experimental study varied parameters including aspect ratio (a/D), diameter-to-thickness ratio (D/t), concrete compressive strength, tube type, tail length, internal reinforcement, and interface condition.

Parameter studies then expanded this data set to include variation in tube steel yield strength and axial load ratio. The results from these investigations, and prior research studies, were used to develop limit state criteria and quantify shear capacity with a new design expression incorporating the composite nature of all components and enhanced properties due to axial load.

This book presents the results of a Japanese national research project carried out in 1988-1993, usually referred to as the New RC Project. Developing advanced reinforced concrete building structures with high strength and high quality materials under its auspices, the project aimed at promoting construction of highrise reinforced concrete buildings in highly seismic areas such as Japan. The project covered all the aspects of reinforced concrete structures, namely materials, structural elements, structural design, construction, and feasibility studies. In addition to presenting these results, the book includes two chapters giving an elementary explanation of modern analytical techniques, i.e. finite element analysis and earthquake response analysis. Contents:

- RC Highrise Buildings in Seismic Areas (H Aoyama)
- The New RC Project (Hchiraiishi)
- New RC Materials (N Abe & N Shiohara)
- New RC Structural Elements (K Kaminosono)
- Finite Element Analysis (N Moguchi)
- Structural Design Principles (N Teshigahara)
- Earthquake Response Analysis (T Kabeyasawa)
- Construction of New RC Structures (Y Masuda)
- Feasibility Studies and Example Buildings (H Fujitani)

Readership: Civil, ocean and marine engineers.
Concrete Members Reinforced

Concrete-filled steel tubes (CFTs) and reinforced concrete-filled steel tubes (RCFTs) are used throughout the world in building and transportation structures. While the axial and flexural properties of CFTs have been well-researched, little research has been performed on their shear strength and behavior. Currently accepted methods for calculating their shear capacity significantly underestimate the effectiveness of the composite section, potentially increasing undesirable conservatism and cost. The purpose of this research was to study the shear behavior of CFTs subjected to transverse shear load. This book contains the proceedings of the fib Symposium “High Tech Concrete: Where Technology and Engineering Meet”, that was held in Maastricht, The Netherlands, in June 2017. This annual symposium was organised by the Dutch Concrete Association and the Belgian Concrete Association. Topics addressed include: materials technology, modelling, testing and design, special loadings, safety, reliability and codes, existing concrete structures, durability and life time, sustainability, innovative building concepts, challenging projects and historic concrete, amongst others. The fib (International Federation for Structural Concrete) is a not-for-profit association committed to advancing the technical, economic, aesthetic and environmental performance of concrete structures worldwide.

As mankind continues to push back the boundaries and begins to explore other worlds and the ocean depths, a thorough understanding of how structures behave when subjected to extremes in temperature, pressure, and high loading rates will be essential. This symposium provided the perfect forum for presenting research into structures subjected to such extreme loads. There were a large number of papers presented under topics of impact, blast and shock loading, indicating a strong research interest in high rates of loading. Similarly new topics have been added to the traditional symposium list such as fire loading, earthquake loading, and fatigue and connection failures. It is clear now that fundamental knowledge of plastic deformation of structures to various extreme loads is coming of age. Each full paper was peer reviewed by at least two experts in the field.

Self-Compacting Concrete: Materials, Properties and Applications presents the latest research on various aspects of self-compacting concrete, including test methods, rheology, strength and durability properties, self-compacting concrete in elevated concrete structures, SCC manufacturing and storage, and industrial by-products. Written by an international group of contributors who are closely associated with the development of self-compacting concrete, the book explores the main differences between SCC and normal concrete in terms of raw materials, fresh properties and hardened properties. Other topics discussed include the structure and practical applications of fiber reinforced SCC. Researchers and experienced engineers will find this reference to be a systematic source to SCC with its accounting of the latest breakthroughs in SCC technology. Includes mix design procedures, test standards, rheology, strength and durability properties. Explores the properties and practical applications of SCC.

This book is concerned with the dynamic behavior of reinforced/prestressed concrete structures, such as buildings and bridges. It discusses how to predict or check the real inelastic behavior of concrete structures subjected to dynamic loads, including fire, equipment loads, earthquake motions, seismic interactions and missile impacts. A number of techniques have recently been developed to assist in evaluating such occurrences. This book is intended to apply structural dynamics to concrete structures and is appropriate as a textbook for an introductory course in dynamic behavior of concrete structures at the upper-undergraduate or graduate level as well as for practicing engineers.

Self-Compacting Concrete Reinforced with FRP offers a depth of coverage ideal for senior-level undergraduate, master’s-level, and doctoral-level graduate civil engineering courses.

This book contains the proceedings of the fib Symposium “High Tech Concrete: Where Technology and Engineering Meet”, that was held in Maastricht, The Netherlands, in June 2017. This annual symposium was organised by the Dutch Concrete Association and the Belgian Concrete Association. Topics addressed include: materials technology, modelling, testing and design, special loadings, safety, reliability and codes, existing concrete structures, durability and life time, sustainability, innovative building concepts, challenging projects and historic concrete, amongst others. The fib (International Federation for Structural Concrete) is a not-for-profit association committed to advancing the technical, economic, aesthetic and environmental performance of concrete structures worldwide.

As mankind continues to push back the boundaries and begins to explore other worlds and the ocean depths, a thorough understanding of how structures behave when subjected to extremes in temperature, pressure, and high loading rates will be essential. This symposium provided the perfect forum for presenting research into structures subjected to such extreme loads. There were a large number of papers presented under topics of impact, blast and shock loading, indicating a strong research interest in high rates of loading. Similarly new topics have been added to the traditional symposium list such as fire loading, earthquake loading, and fatigue and connection failures. It is clear now that fundamental knowledge of plastic deformation of structures to various extreme loads is coming of age. Each full paper was peer reviewed by at least two experts in the field.

Circular Economy in the Construction Industry is an invaluable resource for researchers, policymakers, implementers and PhD and Masters-level students in universities analyzing the present status of Construction and Demolition Wastes (CDW) management, materials development utilizing slag, fly ash, HDPE fibre, geo-wastes, and other wastes, green concrete, soil stabilization, resource circulation in construction sectors, success in experimentation & commercial production, future needs, and future research areas. While huge CDW is wasted by dumping, there is potential of recycling preventing greenhouse gas (GHG) emissions and environmental pollution as well as creating business opportunities. Circularity of resources in the construction industry can contribute to a more secure, sustainable, and economically sound future through proper policy instruments, management systems, and recycling by selecting the following: Supply chain sustainability and collection of CDW Wastes, Appropriate separation and recycling technology, Enforcement of policy instruments, Productivity, quality control of recycled products and intended end use, Economic feasibility as business case, commercialization, generating employment. This book addresses most of the above issues in a lucid manner by experts in the field from different countries, which are helpful for the related stakeholders, edited by experts in the field.

Self-Compacting Concrete: Materials, Properties and Applications presents the latest research on various aspects of self-compacting concrete, including test methods, rheology, strength and durability properties, self-compacting concrete in elevated concrete structures, SCC manufacturing and storage, and industrial by-products. Written by an international group of contributors who are closely associated with the development of self-compacting concrete, the book explores the main differences between SCC and normal concrete in terms of raw materials, fresh properties and hardened properties. Other topics discussed include the structure and practical applications of fiber reinforced SCC. Researchers and experienced engineers will find this reference to be a systematic source to SCC with its accounting of the latest breakthroughs in SCC technology. Includes mix design procedures, test standards, rheology, strength and durability properties. Explores the properties and practical applications of SCC.

This book is concerned with the dynamic behavior of reinforced/prestressed concrete structures, such as buildings and bridges. It discusses how to predict or check the real inelastic behavior of concrete structures subjected to dynamic loads, including fire, equipment loads, earthquake motions, seismic interactions and missile impacts. A number of techniques have recently been developed to assist in evaluating such occurrences. This book is intended to apply structural dynamics to concrete structures and is appropriate as a textbook for an introductory course in dynamic behavior of concrete structures at the upper-undergraduate or graduate level as well as for practicing engineers.

Concrete-filled steel tubes (CFTs) and reinforced concrete-filled steel tubes (RCFTs) are used throughout the world in building and transportation structures. While the axial and flexural properties of CFTs have been well-researched, little research has been performed on their shear strength and behavior. Currently accepted methods for calculating their shear capacity significantly underestimate the effectiveness of the composite section, potentially increasing undesirable conservatism and cost. The purpose of this research was to investigate the shear resistance and deformation of CFT and RCFT members subjected to large shear stresses, and to develop an improved, more accurate method for their prediction. To do so, an experimental study of large-scale CFTs subjected to transverse shear load was undertaken, and high-resolution finite element models
will be employed to extend the experimental results. The experimental and analytical results will then be combined to recommend office-ready design expressions for shear resistance, stiffness, and deformation capacity.

Sets out basic theory for the behavior of reinforced concrete structural elements and structures in considerable depth. Emphasizes behavior at the ultimate load, and, in particular, aspects of the seismic design of reinforced concrete structures. Based on American practice, but also examines European practice.

This volume consists of papers presented at the International Workshop on Concrete Shear in Earthquake, held at the University of Houston, Texas, USA, 13–16 January 1991.

Following recent events such as the World Trade Center building collapse and the Cardington large scale structural fire research program, the fire behavior of connections has now become an important research subject. This thesis presents the results of experimental, numerical and theoretical studies into the behavior of simple welded fin-plate to concretereinforced tubular (CFT) columns loaded by tensile or shear force. Such connections represent a simple single-sided joint solution to steel CFTs which are considered an attractive and robust structural element. Extensive tests have been performed at both ambient and elevated temperatures against the results of which numerical finite element models have been validated. The ranges of parameters encompassed by the tests include column cross-section shape; column and finplate thickness; concrete in-fill; elevated temperatures and connection lever arm. The observed failure modes include fracture of the fin-plate and tearing out of the tube around the welds. By considering the results of previously published research, the current design method for similar connections under purely tensile load, in CIDECT Guide 9, based on a deformation limit of 3% of the tube width is shown to be inadequate when evaluating the ultimate strength of such connections. By comparing the results from the current test program which failed in the fin-plate with Eurocode guidance for failure of a fin-plate alone under shear and bending load it is shown that a total static shears the overall connection strength regardless of failure mode. Concrete in-fill is observed to significantly increase the strength of connections over empty specimens, and circular column specimens were observed to exhibit greater strength than similarly proportioned square columns. When validating the numerical model against elevated temperature tests it was found that the strength reduction factors suggested by Eurocode for steel at elevated temperature are inappropriate. The numerical models developed have been used to perform extensive parametric studies from which simple hand calculation methods have been developed for evaluating the strength of the column component of square CFTs under either tensile or shear load imparted through a fin-plate connection. The simple hand calculation procedures are based upon defining a rigid plate deformation pattern for the connection and then applying the internal work principle. For connections under shear loads a method is presented for combining the column failure load with the fin-plate failure derived from existing Eurocode guidance. Both simple hand calculation methods are compared favorably with available test results. A limited numbers of tests and numerical validation have also been performed for reverse channel to CFT connections loaded in shear at both ambient and elevated temperatures.

This report is the first in a series of reports on the seismic performance of lightweight concrete bridge structure elements. Through a discussion of experimental studies on two test units and analytical investigations, the shear capacity of lightweight concrete bridge columns subjected to cyclic loading is presented. Also presented in this report is a revised model for quantifying the contribution of transverse steel to shear strength that is applicable to both lightweight and normal weight concrete. An alternative method for the evaluation of shear deformation for design and assessment purposes is presented which is also applicable to lightweight and normal weight concrete members.

Behavioral equations were developed for reinforced concrete deep beams, especially in the realm of shear capacity. A series of static and dynamic beam tests was performed to aid in the development of this objective. Static shear behavior equations for deep beams were derived on the lower boundary of reinforced concrete deep beam data represented by research from this report and other research comprising 73 tests. Equations for a total static shear capacity are given which conservatively predict shear capacities of the beam tests considered. (Author).

This book sheds light on the shear behavior of Fiber Reinforced Concrete (FRC) elements, presenting a thorough analysis of the most important studies in the field and highlighting their shortcomings and issues that have been neglected to date. Instead of proposing a new formula, which would add to an already long list, it instead focuses on existing design codes. Based on a comparison of experimental tests, it provides a thorough analysis of these codes, describing both their reliability and weaknesses. Among other issues, the book addresses the influence of flange size on shear, and the possible inclusion of the flange factor in design formulas. Moreover, it reports in detail on tests performed on beams made of concrete of different compressive strengths, and on fiber reinforcements to study the influence on shear, including size effects. Lastly, the book presents a thorough analysis of FRC hollow core slabs. In fact, although this is an area of great interest in the current research landscape, it remains largely unexplored due to the difficulties encountered in attempting to fit transverse reinforcement in these elements.

This book describes the application of nonlinear static and dynamic analysis for the design, maintenance and seismic strengthening of reinforced concrete structures. The latest structural and RC constitutive modelling techniques are described in detail, with particular attention given to multi-dimensional cracking and damage a posteriori at their practical implementation in performance-based design. Other subjects covered include 2D/3D analysis techniques, bond and tension stiffness, shear transfer, compression and confinement. It can be used in conjunction with WCMOD and COM3 software Nonlinear Mechanics of Reinforced Concrete presents a practical methodology for structural engineers, graduate students and researchers concerned with the design and maintenance of concrete structures.

These proceedings contain research papers that were accepted for presentation at the 14th International Conference Inter-Eng 2020 , Interdisciplinarity in Engineering, which was held on 8–9 October 2020, in Târgu Mureş, Romania. It is a leading international professional and scientific forum for engineers and scientists to present research works, contributions, and recent developments, as well as current practices in engineering, which is falling into a tradition of important scientific events occurring at Faculty of
Concrete Members Reinforced

Engineering and Information Technology in the George Emil Palade University of Medicine, Pharmacy Science, and Technology of Târgu Mureș, Romania. The Inter-Eng conference started from the observation that in the 21st century, the era of high technology, without new approaches in research, we cannot speak of a harmonious society. The theme of the conference, proposing a new approach related to Industry 4.0, was the development of a new generation of smart factories based on the manufacturing and assembly process digitalization, related to advanced manufacturing technology, lean manufacturing, sustainable manufacturing, additive manufacturing, and manufacturing tools and equipment. The conference slogan was “Europe’s future is digital: a broad vision of the Industry 4.0 concept beyond direct manufacturing in the company”.

The contents of this book have been chosen with the following main aims: to review the present coverage of the major design codes and the CIRIA guide, and to explain the fundamental behaviour of deep beams; to provide information on design topics which are inadequately covered by the current codes and design manuals; and to give authoritative review

Emphasizing a conceptual understanding of concrete design and analysis, this revised and updated edition builds the student’s understanding by presenting design methods in an easy to understand manner supported with the use of numerous examples and problems, clear and concise, intuitive, easy-to-understand language, it includes SI unit examples in all chapters, equivalent conversion factors from US customary to SI throughout the book, and SI unit design tables. In addition, the coverage has been completely updated to reflect the latest ACI 318-11 code.

This proceedings book includes a selection of refereed papers presented at the International Conference on Modern Mechanics and Applications (ICOMMA) 2020, which took place in Ho Chi Minh City, Vietnam, on December 2–4, 2020. The contributions highlight recent trends and applications in modern mechanics. Subjects covered include biological systems; damage, fracture, and failure; flow problems; multiscale multi-physics problems; composite (bi-) hybrid structures and morphing structures; lighting; structural dynamics; numerical methods and intelligent computing; additive manufacturing; natural hazards modeling. The book is intended for academics, including graduate students and experienced researchers interested in recent trends in modern mechanics and application.

Exceptional loads on buildings and structures may have different causes, including high-strain dynamic effects due to natural hazards, man-made attacks, and accidents, as well as extreme operational conditions (severe temperature variations, humidity, etc.). All of these aspects can be critical for specific structural typologies and/or materials that are particularly sensitive to external conditions. In this regard, dedicated and refined methods are required for their design, analysis, and maintenance under the expected lifetime. There are major challenges related to the structural typology and material properties with respect to the key features of the imposed design load. Further issues can be derived from the need for risk mitigation or retrofit of existing structures as well as from the optimal and safe design of innovative materials/systems. For these cases, new design procedures are available and, thus, experimental investigations can have a key role within the overall process. In this Special Issue, original research studies, review papers, and experimental and/or numerical investigations are presented for the structural performance assessment of buildings and structures under various extreme conditions that are of interest for design.

This book offers a clear and comprehensive overview of both the theory and application of fundamental aspects of concrete-filled double steel tubes (CFDST). Many analysis and design applications are presented, which involve mechanical components and structural members often encountered in engineering practice. This monograph is written for practicing structural and civil engineers, students, and academic researchers who want to keep up to speed on the latest technologies for concrete-filled steel tube (CFST).

fib Bulletin 35 is the first bulletin to publish documentation from an fib short course. These courses are held worldwide and cover advanced knowledge of structural concrete in general, or specific topics. They are organized by fib and given by internationally recognized experts in fib, often supplemented with local experts active in fib. They are based on the knowledge and expertise from fib’s ten Commissions and nearly fifty Task Groups. fib Bulletin 35 presents the course materials developed for the short course “Retrofitting of Concrete Structures through Externally Bonded FRP, with emphasis on Seismic Applications”, given in Ankara and Istanbul in June 2005. The course drew on expertise both from outside Turkey and from the large pool of local experts on this subject. In most countries of the world, the building stock is ageing and needs continuous maintenance or repair. Moreover, the majority of existing constructions are deficient in the light of current knowledge and design codes. The problem of structural deficiency of existing constructions is especially acute in seismic regions, as, even there, seismic design of structures is relatively recent. The direct and indirect costs of demolition and reconstruction of structurally deficient constructions are often prohibitive; furthermore they entail a substantial waste of natural resources and energy. Therefore, structural retrofitting is becoming increasingly widespread throughout the world. Externally bonded Fibre Reinforced Polymer (FRP) is rapidly becoming the technique of choice for structural retrofitting. They are cleaner and easier to apply than conventional retrofitting techniques, reduce disruption to the occupancy and operation of the facility, do not generate debris or waste, and reduce health and accident hazards at the construction site as well as noise and air pollution in the surroundings. fib Bulletin 35 gives state-of-the-art coverage of retrofitting through FRPs and presents relevant provisions from three recent standardisation milestones: EN 1998–3:2005 Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings”, the 2005 Draft of the Turkish seismic design code, and the Italian regulatory document CNR-DT 200/04, “Instructions for Design, Execution and Control of Strengthening Interventions by Means of Fibre-Reinforced Composites” (2004).

Mechanics of Structures and Materials: Advancements and Challenges is a collection of peer-reviewed papers presented at the 24th Australasian Conference on the Mechanics of Structures and Materials (ACMSM24, Curtin University, Perth, Western Australia, 6–9 December 2016). The contributions from academics, researchers and practising engineers from Australasian, Asia-pacific region and around the world, cover a wide range of topics, including: Structural mechanics • Computational mechanics • Reinforced and prestressed concrete structures • Steel structures • Composite structures • Civil engineering materials • Fire engineering •
Coastal and offshore structures • Dynamic analysis of structures • Structural health monitoring and damage identification • Structural reliability analysis and design • Structural optimization • Fracture and damage mechanics • Soil mechanics and foundation engineering • Pavement materials and technology • Shock and impact loading • Earthquake loading • Traffic and other man-made loadings • Wave and wind loading • Thermal effects • Design codes Mechanics of Structures and Materials: Advancements and Challenges will be of interest to academics and professionals involved in Structural Engineering and Materials Science.

This book compiles state-of-the-art information on the behavior, analysis, and design of concrete beams containing transverse openings. Discussions include the need, effects, and classification of openings as well as the general requirements for fulfilling design pure bending, combined bending, and shear - illustrated with numerical examples torsion alone or in combination with bending and shear large rectangular openings as well as varying and locating beam behavior methods for analyzing ultimate strength and serviceability requirements effects of torsion in beams large openings in continuous beams and their effects on possible redistribution of internal forces as well as guidelines and procedures for the design of such beams effect of prestressing on the serviceability and strength of beams with web openings design against cracking at openings and ultimate loads Concrete Beams with Openings serves as an invaluable source of information for designers and practicing engineers, especially useful since little or no provision or guidelines are currently available in most building codes.

The behavior of concrete members reinforced with fiber reinforced polymer (FRP) bars has been the focus of many studies in recent years. Nowadays, several codes and design guidelines are available for the design of concrete structures reinforced with FRP bars under flexural and shear loads. Meanwhile, limited research work has been conducted to examine the axial behavior of reinforced concrete (RC) columns with FRP bars. Due to a lack of research investigating the axial behavior of FRP reinforced concrete columns, North American codes and design guidelines do not recommend using FRP bars as longitudinal reinforcement in columns to resist compressive stresses. This dissertation aims at evaluating the axial performance of RC compression members reinforced with glass FRP (GFRP) and carbon FRP (CFRP) bars and stirrups through experimental and analytical investigations. A total of twenty seven full scale circular RC specimens were fabricated and tested under compressive axial load. The columns diameters were 300 mm and 800-12 code requirements. The specimens were divided to three series; series I contains three reference columns; one plain concrete and 2 specimens reinforced with steel reinforcement. Series II contains 12 specimens internally reinforced with GFRP longitudinal bars and transverse GFRP stirrups, while series III includes specimens totally reinforced with CFRP reinforcement. The experimental tests were performed at the structural laboratory, Faculty of Engineering, University of Sherbrooke. The main objective of testing these specimens is to investigate the behavior of circular concrete columns reinforced with GFRP or CFRP longitudinal bars and transverse hoops or spirals reinforcement. Several parameters have been studied; type of reinforcement, longitudinal reinforcement ratio, the volumetric ratios, diameters, and spacing of spiral reinforcement, confinement configuration (spirals versus hoops), and lap length of hoops. The test results of the tested columns were presented and discussed in terms of axial load capacity, mode of failure, concrete, longitudinal, and transverse strains, ductility, load/stress-strain response, and concrete confinement strength through four journal papers presented in this dissertation. Based on the findings of experimental investigation, the GFRP and CFRP RC columns behaved similar to the columns reinforced with steel. It was found that, FRP bars were effective in resisting compression until after crushing of concrete, and contributed on average 8% and 13% of column capacity for GFRP and CFRP RC specimens, respectively. Also, the use of GFRP and CFRP spirals or hoops according to the provisions of CSA S806-12 yielded sufficient restraint against the buckling of the longitudinal FRP bars and provided good confinement of the concrete core in the post-peak stages. The axial deformability (ductility) and confinement efficiency can be better improved by using small FRP spirals with closer spacing rather than larger diameters with greater spacing. It was found that, ignoring the contribution of FRP longitudinal bars in the CAN/CSA S806-12 design equation underestimated the maximum capacity of the tested specimens. Based on this finding, the design equation is modified to accurately predict the ultimate load capacities of FRP RC columns. New factors [alpha] [indice inférieur g] and [alpha] [indice inférieur c] were introduced in the modified equation to account for the effect of FRP confinement and confinement model was presented to predict the axial stress-strain behavior of FRP RC columns confined by FRP spirals or hoops. The model takes into account the effect of many parameters such as; type of reinforcement, longitudinal reinforcement ratio; transverse reinforcement configuration; and the volumetric ratio. The proposed model can be used to evaluate the confining pressure, confined concrete core stress, corresponding concrete strain, and stress-strain relationship. The results of analysis using the proposed confinement model were compared with experimental database of twenty four full-scale circular FRP RC columns. A good agreement has been obtained between the analytical and experimental results. Proposed equations predict both strength and strain behavior of confined columns by FRP reinforcements demonstrate good correlation with test data obtained from full-scale specimens.

The behavior of four circular reinforced concrete bridge columns, with different axial load regimes, is investigated. The first unit was tested under constant compressive axial load corresponding to an axial load ratio of 0.35. The second specimen was subjected to a constant tensile axial force equivalent to 0.087 axial load ratio. Two specimens were tested under varying regime of axial load, ranging between the two previous load limits, in order to simulate realistic seismic conditions of multi-column bents. Extended comparison between experimental and predicted shear response, from different current equations, is provided.

This book offers a collection of 17 scientific papers about the computational modeling of fracture. Some of the manuscripts propose new computational methods and/or how to improve existing cutting edge methods for fracture. These contributions can be classified into two categories: 1. Methods which treat the crack as strong discontinuity such as peridynamics, scaled boundary elements or specific versions of the smoothed finite element methods applied to fracture and 2. Continuous approaches to fracture based on, for instance, phase field models or continuum damage mechanics. On the other hand, the book also offers a wide range of applications where state-of-the-art techniques are employed to solve challenging engineering problems such as
fractures in rock, glass, concrete. Also, larger systems such as fracture in subway stations due to fire, arch dams, or concrete decks are studied.

The quality and testing of materials used in construction are covered by reference to the appropriate ASTM standard specifications. Welding of reinforcement is covered by reference to the appropriate AWS standard. Uses of the Code include adoption by reference in general building codes, and earlier editions have been widely used in this manner. The Code is written in a format that allows such reference without change to its language. Therefore, background details or suggestions for carrying out the requirements or intent of the Code portion cannot be included. The Commentary is provided for this purpose. Some of the considerations of the committee in developing the Code portion are discussed within the Commentary, with emphasis given to the explanation of new or revised provisions. Much of the research data referenced in preparing the Code is cited for the user desiring to study individual questions in greater detail. Other documents that provide suggestions for carrying out the requirements of the Code are also cited.