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Non-Destructive Evaluation of Reinforced Concrete Structures Evaluation of Reinforcing Steel Systems in Old Reinforced Concrete Structures Non-Destructive Evaluation of Reinforced Concrete Structures Analysis and Evaluation of Reinforced Concrete Buildings During Construction Probabilistic Sesmic Evaluation of Reinforced Concrete Structural Components and Systems Evaluation of Reinforced Concrete Failure Modes Design and Evaluation of Reinforced Concrete Bridges for Seismic Resistance Non-destructive Evaluation of Reinforced Concrete Structures: Non-destructive testing methods Assessment of Nonlinear Static (pushover) Procedures for Seismic Evaluation of Reinforced Concrete Structures Strength Evaluation of Existing Reinforced Concrete Bridges Reconstruction Algorithms to Improve Nondestructive Evaluation of Reinforced Concrete Capacity Evaluation of Reinforced Concrete Bridges Evaluation and Assessment of Reinforced Concrete Building by Incremental Dynamic Analysis Evaluation of Reinforcing Bars in Old Reinforced Concrete Structures Assessment, Evaluation, and Repair of Concrete, Steel, and Offshore Structures Monitoring and Safety Evaluation of Existing Concrete Structures Seismic Assessment and

Retrofit of Reinforced Concrete Buildings Nondestructive Evaluation of Reinforced Concrete Via Infrared Thermography Condition Control and Assessment of Reinforced Concrete Structures Exposed to Corrosive Environments (carbonation/chlorides) Evaluation of Reinforced Concrete Beams Using Cyclic Load Test, Acoustic Emission, and Acousto-ultrasonics Axial-shear-flexure Interaction Approach for Displacement-based Evaluation of Reinforced Concrete Elements Evaluation of Metamodels Performance in Investigating Debonding Fragility Assessment of Reinforced Concrete Beams Strengthened with FRP Sheets Seismic Performance Evaluation of Reinforced Concrete Shear Wall Seismic Force Resisting Systems Seismic Capacity Evaluation of Reinforced Concrete Buildings Using Pushover Analysis Evaluation Procedure for Reinforced Concrete Box Culverts Under Airfield Pavements Ultimate Capacity Evaluation of Reinforced Concrete Slabs Using Yield Line Analysis Evaluation of Software for Analysis and Design of Reinforced Concrete Structures Strength Evaluation of Existing Reinforced Concrete Bridges Strength Evaluation of Existing Reinforced Concrete Bridges Report on Evaluation of Service Behavior of Plain Versus Reinforced Concrete Pavement Non-destructive Testing and Evaluation of Civil Engineering Structures Evaluation of Non-metallic Fiber Reinforced Concrete in PCC Pavements and Structures An Evaluation Method for the Earthquake Resistant Capacity of Reinforced Concrete and Steel Reinforced Concrete Columns Seismic Assessment and Retrofit of Reinforced Concrete Columns Seismic Evaluation of Existing Reinforced Concrete Building Columns Evaluation of Continuously Reinforced Concrete

Pavement Evaluation of Reinforced Paper Matting for Erosion Control An Evaluation of ICES STRUDL-II ; Reinforced Concrete Design Capabilities Evaluation of Fiber Reinforced Concrete Evaluation of Anchor Wall Systems' Landmark Reinforced Soil Wall System with T.C. Mirafi's Miragrid and Miratex Geogrid Reinforcement

Reinforced concrete columns play a very important role in structural performance. As such, it is essential to apply a suitable analytical tool to estimate their structural behaviour considering all failure mechanisms such as axial, shear, and flexural failures. This book highlights the development of a fiber beam-column element accounting for shear effects and the effect of tension stiffening through reinforcement-to-concrete bond, along with the employment of suitable constitutive material laws. Due to age and increased loading on buildings, structural assessment and repair is routinely required with accuracy and professionalism. Our target is to have a building durable along its life time. The typical causes of structural failure and their mechanisms will be presented in this book for all types of structure, and further addressed by numerous case studies and engineering calculations. The up-to-date methods for evaluation and assessment the existing structure will be discussed. It will also examine different codes related to structural assessment and will present project management strategies from the feasibility stage through operations and maintenance. The study was conducted to evaluate the physical properties of plastic and hardened fiber reinforced concrete using three basic types of fibers: steel, fiberglass and polypropylene. Fibers have been shown to increase flexural and tensile strength, ductility and toughness of concrete. In the study, air content and water/cement ratio were varied to keep slump in a workable range (2 to 4 in.) and air contents at 5% +/- 1%. Mixes with fly ash and superplasticizers were also tested. The same cement and aggregate were used for all mixes. When used, fly ash and admixture type were the same also. Both 6 and 8 bag mixes were examined. While most airfield pavement are periodically evaluated to determine their structural capacity, often little thought is given to the structural capacity of the culverts and other drainage structures beneath the pavement. The Department of Defense has never had a standard means of evaluating box culverts under airfields or landing strips. This capacity has been needed on several occasions, particularly overseas where landing strips are sometimes built into the local highway system. The research reported herein evaluated several different methods for performing the structural evaluation of reinforced concrete box culverts under aircraft loads, selected two computer programs (CANDE-1980 and CORTCUL) for detailed testing, and then developed a culvert evaluation methodology based on the CORTCUL program. To assist in determining the aircraft loads, an additional computer program was developed. This program, CULVERT, uses elastic layer theory and predefined aircraft data to calculate the vertical stress acting on the top of the culvert due to the aircraft and also provides output and plotting capabilities. Stress is then applied to the culvert model along with the member loads, soil loads, and other loads such as internal water. The CORTCUL program evaluates the culvert based on the requirements of ACI 318, Building Code Requirements for Reinforced Concrete.

Engineers have a range of sophisticated techniques at their disposal to evaluate the condition of reinforced concrete structures and non-destructive evaluation plays a key part in assessing and prioritising where money should be spent on repair or replacement of structurally deficient reinforced concrete structures. Non-destructive evaluation of reinforced concrete structures, Volume 2: Non-destructive testing methods reviews the latest non-destructive testing techniques for reinforced concrete structures and how they are used. Part one discusses planning and implementing non-destructive testing of reinforced concrete structures with chapters on non-destructive testing methods for building diagnosis, development of automated NDE systems, structural health monitoring systems and data fusion. Part two reviews individual non-destructive testing techniques including wireless monitoring, electromagnetic and acoustic-elastic waves, laser-induced breakdown spectroscopy, acoustic emission evaluation, magnetic flux leakage, electrical resistivity, capacimetry, measuring the corrosion rate (polarization resistance) and the corrosion potential of reinforced concrete structures, ground penetrating radar, radar tomography, active thermography, nuclear magnetic resonance imaging, stress wave propagation, impact-echo, surface and guided wave techniques and ultrasonics. Part three covers case studies including inspection of concrete retaining walls using ground penetrating radar, acoustic emission and impact echo techniques and using ground penetrating radar to assess an eight-span post-tensioned viaduct. With its distinguished editor and international team of contributors, Non-destructive evaluation of reinforced concrete structures, Volume 2: Non-destructive testing methods is a standard reference for civil and structural engineers as well as those concerned with making decisions regarding the safety of reinforced concrete structures. Reviews the latest non-destructive testing (NDT) techniques and how they are used in practice Explores the process of planning a non-destructive program features strategies for the application of NDT testing A specific section outlines significant advances in individual NDT techniques and features wireless monitoring and electromagnetic and acoustic-elastic wave technology Yield line theory offers a simplified nonlinear analytical method that can determine the ultimate bending capacity of flat reinforced concrete planes subject to distributed and concentrated loads. Alternately, yield line theory, combined with hinge rotation limits can determine the energy absorption capacity of plates subject to impulsive and impact loads. This method is especially useful in evaluating existing structures that cannot be qualified using conservative simplifying analytical assumptions. Typical components analyzed by yield line theory are basements, floor and roof slabs subject to vertical loads along with walls subject to out of plant wall loads. One limitation of yield line theory is that it is difficult to evaluate some mechanisms; this is aggravated by the complex geometry and reinforcing layouts commonly found in practice. A yield line evaluation methodology is proposed to solve computationally tedious yield line mechanisms. This methodology is implemented in a small PC based computer program that allows the engineer to quickly evaluate multiple yield line mechanisms. The non-destructive evaluation of civil engineering structures in reinforced concrete is becoming an increasingly important issue in this field of engineering. This book proposes innovative ways to deal with this problem, through the characterization of concrete durability indicators by the use of non-destructive techniques. It presents the description of the various non-destructive techniques and their combination for the evaluation of indicators. The processing of data issued from the combination of NDE methods is also illustrated through examples of data fusion methods. The identification of conversion models linking observables, obtained from non-destructive measurements, to concrete durability indicators, as well as the consideration of different sources of variability in the assessment process, are also described. An analysis of in situ applications is carried out in order to highlight the practical aspects of the methodology. At the end of the book the authors provide a methodological guide detailing the proposed non-destructive evaluation methodology of concrete indicators. Presents the latest developments performed in the community of NDT on different aspects Provides a methodology developed in laboratory and transferred onsite for the evaluation of concrete properties which are not usually addressed by NDT methods Includes the use of data fusion for merging the measurements provided by several NDT methods Includes examples of current and potential applications The condition assessment of aged structures is becoming a more and more important issue for civil infrastructure management systems. The continued use of existing systems is, due to environmental, economical and socio-political assets, of great significance and is growing larger every year. Thus the extent of necessary repair of damaged reinforced concrete structures is of major concern in most countries today. Monitoring techniques may have a decisive input to limit expenditures for maintenance and repair of existing structures. Modern test and measurement methods as well as computational mechanics open the door for a wide variety of monitoring applications. The need for quantitative and qualitative knowledge has led to the development and improvement of surveillance techniques, which have already found successful application in other disciplines such as medicine, physics and chemistry. The design of experimental test and measurement systems is inherently an interdisciplinary activity. The specification of the instrumentation to measure the structural response will involve the skills of civil, electrical and computer engineers. The main aim of fib Commission 5, Structural servicer life aspects, is to provide a rational procedure to obtain an optimal technical-economic performance of concrete structures in service and to ensure a feedback of experience gained to design, execution, maintenance and rehabilitation. Against this background fib Task Group 5.1 Monitoring and Safety Evaluation of Existing Concrete Structures had been established to evaluate the existing practice worldwide. The objective of this state-of-art report is to summarize the most important inspection and measuring methods, to describe the working process and to evaluate the applicability to structural monitoring. Particular emphasis is placed upon non-destructive systems, lifetime monitoring, data evaluation and safety aspects. In most parts of the developed world, the building stock and the civil infrastructure are ageing and in constant need of maintenance, repair and upgrading. Moreover, in the light of our current knowledge and of modern codes, the majority of buildings stock and other types of structures in many parts of the world are substandard and deficient. This is especially so in earthquake-prone regions, as, even there, seismic design of structures is relatively recent. In those regions the major part of the seismic threat to human life and property comes from old buildings. Due to the infrastructure's increasing decay, frequently combined with the need for structural upgrading to meet more stringent design requirements (especially against seismic loads), structural retrofitting is becoming more and more important and receives today considerable emphasis throughout the world. In response to this need, a major part of the fib Model Code 2005, currently under development, is being devoted to structural conservation and maintenance. More importantly, in recognition of the importance of the seismic threat arising from existing substandard buildings, the first standards for structural upgrading to be promoted by the international engineering community and by regulatory authorities alike are for seismic rehabilitation of buildings. This is the case, for example, of Part 3: Strengthening and Repair of Buildings of Eurocode 8 (i. e. of the draft European Standard for earthquake-resistant design), and which is the only one among the current (2003) set of 58 Eurocodes attempting to address the problem of structural upgrading. It is also the case of the recent (2001) ASCE draft standard on Seismic evaluation of existing buildings and of the 1996 Law for promotion of seismic strengthening of existing reinforced concrete structures in Japan. As noted in Chapter 1 of this Bulletin, fib - as CEB and FIP did before - has placed considerable emphasis on assessment and rehabilitation of existing structures. The present Bulletin is a culmination of this effort in the special but very important field of seismic assessment and rehabilitation. It has been elaborated over a period of 4 years by Task Group 7.1 Assessment and retrofit of existing structures of fib Commission 7 Seismic design, a truly international team of experts, representing the expertise and experience of all the important seismic regions of the world. In the course of its work the team had six plenary two-day meetings: in January 1999 in Pavia, Italy; in August 1999 in Raleigh, North Carolina; in February 2000 in Queenstown, New Zealand; in July 2000 in Patras, Greece; in March 2001 in Lausanne, Switzerland; and in August 2001 in Seattle, Washington. In October 2002 the final draft of the Bulletin was presented to public during the 1st fib Congress in Osaka. It was also there that it was approved by fib Commission 7 Seismic Design. The contents is structured into main chapters as follows: 1 Introduction - 2 Performance objectives and system considerations - 3 Review of seismic assessment procedures - 4 Strength and deformation capacity of non-seismically detailed components - 5 Seismic retrofitting techniques - 6 Probabilistic concepts and methods - 7 Case studies For the ongoing condition assessment of concrete structures, it is necessary to identify the extent, nature, cause and prognosis of any deterioration using a range of tools and methods, including prediction models. Combined with the original design and construction details, this gives a vast amount of information over a long time period. A framework concept is therefore needed to process the entirety of the information in order to make sound investment decisions on future maintenance management. To provide such a framework, fib Bulletin 59 summarizes information published infib Bulletins 17, 22, 34 and 44 relevant to the control and assessment of reinforced concrete structures, and develops a practical concept of how, when and where to control the condition of an existing concrete structure in order to facilitate structural management. Thus it gives a basis for processing relevant information in order to make decisions on the appropriate course of action for condition control. Many concrete structures and elements of concrete infrastructure have exceeded their original design lives and are deteriorating to an extent where they are becoming dangerous. The deterioration can be internal or not obvious and therefore only shows up with detailed testing. Non-destructive evaluation of reinforced concrete structures, Volume 1: Deterioration processes and standard test methods reviews the processes of deterioration and classical and standard test methods. Part one discusses deterioration of reinforced concrete and testing problems with chapters on topics such as key issues in the non-destructive testing of concrete structures, when to use non-destructive testing of reinforced concrete structures, deterioration processes in reinforced concrete, modelling ageing and corrosion processes in reinforced concrete structures, components in concrete and their impact on quality, and predicting the service life of reinforced concrete structures. Part two reviews classical and standard testing methods including microscopic examination of deteriorated concrete, the analysis of solid components and their ratios in reinforced concrete structures, the determination of chlorides in concrete structures, and investigating the original water content of reinforced concrete structures. With its distinguished editors and international team of contributors, Non-destructive evaluation of reinforced concrete structures, Volume 1: Deterioration processes and standard test methods will be a standard reference for civil and structural engineers as well as those concerned with making decisions regarding the safety of reinforced concrete structures. Provides a comprehensive discussion from examination of the components in concrete and their affect on quality through to the role of and tools required for lifetime management Experts in the field identify the testing problems associated with infrastructure considering design, build and maintenance stages Presents a guide for when to use non-destructive testing of reinforced concrete structures including the role of time in testing The structures which seem to be strong, may collapse during an earthquake. This was the case of the Pyne Gould Corporation building in New Zealand, which collapsed during the February 22, 2011, earthquake. Its collapse raised questions about the performance of the structure under seismic loading. The seismic performance evaluation of the nonlinear static analysis, or the pushover analysis, is the first choice due to its simplicity. The evaluation assumes that the structure vibrates in the first or lower mode of the vibration during a seismic event. The idealization of a multiple degree of freedom (MDOF) system to an equivalent single degree of freedom (SDOF) is the basic concept of pushover analysis. Despite these underlying assumptions, it has led to the excellent prediction of the seismic response of the multiple degrees of freedom system; which is the reason for the popularity of the pushover analysis. In this study, the pushover analysis of two multi-storied buildings in New Zealand has been done. The first building is the typical residential building, while the other is the mixed-used office building, the Pyne Gould Corporation building (PGC). The nonlinear response of the RCC buildings using the finite element analysis programs SAP2000 and ETABS under the loading has been carried out with the objective to investigate the behavior of the building. The global behavior of the structure is analyzed using the performance point of the structure while the careful analysis of the plastic hinge formation depicts the real behavior of the structure and its elements. Through pushover analysis, potential weak areas are identified with the examination of hinge state at the different steps. The application of the pushover analysis helped to verify the weak elements in the building which were the cause of the buildings collapse. The method can be implemented to understand the structural behavior of the structural members after some damage so that the designer is able to make use of the structural behavior when it receives damage to avoid total collapse. This report describes a HITEC evaluation designed to determine the basic capability and limitations of the Landmark/Mirafi System for use as a technically viable precast MSE retaining wall system. The evaluation was conducted based on the material, design, construction, performance, and quality assurance information outlined in the HITEC Protocol.

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