Durability Of Cfrp Strengthened Concrete Structures Under

Volume is indexed by Thomson Reuters CPCI-S (WoS). Following the great progress made in Computational Mechanics and Materials, the 2011 International Workshop on Computational Mechanics, Materials and Engineering Applications (CMMEA 2011) aimed at providing a forum for the presentation and discussion of state-of-the-art developments in Computational Mechanics and Engineering Applications, Building Materials, Geotechnical & Soil Engineering and Materials Science and Engineering Applications. The emphasis was placed on basic methodologies, scientific developments and engineering applications.

- Introduction - Design specification - Design process overview - Design of composite - Structural design - Implementation - Tests - Verification - Monitoring - References Reviews Fibre reinforced polymer (FRP) composites have been used for many years in the aircraft and shipbuilding industries. They are now being used in a variety of construction applications where their light weight, high strength, stiffness, durability, and ease of installation makes them cost effective. This is particularly true in the repair and rehabilitation of existing infrastructure. This book provides design guidance on the use of fibre reinforced polymer composites, based on the results of two major programmes funded by the DETR. The book demonstrates that fibre reinforced polymer composites can be used with complete confidence in structural applications. Likewise, guidance is given on short-term and long-term behaviour and how this can be interpreted within a factual design situation. Also included are case studies of projects on the London Underground network, alongside contributions from industry research groups. FRP composites can offer a performance or cost benefit over traditional solutions. As there are no official standards for this type of work, this first attempt at producing design recommendations will be a vital resource for structural engineers. Quality Concrete, October 2001

The range of fibre-reinforced polymer (FRP) applications in new construction, and in the retrofitting of existing civil engineering infrastructure, is continuing to grow worldwide. Furthermore, this progress is being matched by advancing research into all aspects of analysis and design. The Second International Conference on FRP Composites in

Strengthening Design of Reinforced Concrete with FRP establishes the art and science of strengthening design of reinforced concrete with fiber-reinforced polymer (FRP) beyond the abstract nature of the design guidelines from Canada (ISIS Canada 2001), Europe (FIB Task Group 9.3 2001), and the United States (ACI 440.2R-08). Evolved from thorough class notes used to teach a graduate course at Kansas State University, this comprehensive textbook: Addresses material characterization, flexural strengthening of beams and slabs, shear strengthening of beams, and confinement strengthening of columns Discusses the installation and inspection of FRP as externally bonded (EB) or near-surface-

mounted (NSM) composite systems for concrete members Contains shear design examples and design examples for each flexural failure mode independently, with comparisons to actual experimental capacity Presents innovative design aids based on ACI 440 code provisions and hand calculations for confinement design interaction diagrams of columns Includes extensive end-of-chapter questions, references for further study, and a solutions manual with qualifying course adoption Delivering a detailed introduction to FRP strengthening design, Strengthening Design of Reinforced Concrete with FRP offers a depth of coverage ideal for senior-level undergraduate, master's-level, and doctoral-level graduate civil engineering courses.

Eco-efficient Repair and Rehabilitation of Concrete Infrastructures provides an updated state-of-the-art review on eco-efficient repair and rehabilitation of concrete infrastructure. The first section focuses on deterioration assessment methods, and includes chapters on stress wave assessment, ground-penetrating radar, monitoring of corrosion, SHM using acoustic emission and optical fiber sensors. Other sections discuss the development and application of several new innovative repair and rehabilitation materials, including geopolymer concrete, sulfoaluminate cement-based concrete, engineered cementitious composites (ECC) based concrete, bacteria-based concrete, concrete with encapsulated polyurethane, and concrete with super absorbent polymer (SAPs), amongst other topics. Final sections focus on crucial design aspects, such as quality control, including lifecycle and cost analysis with several related case studies on repair and rehabilitation. The book will be an essential reference resource for materials scientists, civil and structural engineers, architects, structural designers and contractors working in the construction industry. Delivers the latest research findings with contributions from leading international experts Provides fully updated information on the European standard on materials for concrete repair (EN 1504) Includes an entire sections on the state-of-the-art in NDT, innovative repair and rehabilitation materials, as well as LCC and LCA information

Abstract: The use of carbon fiber reinforced polymers (CFRP) into the repair and retrofitting of concrete structures has been growing exponentially over the past two decades worldwide. The composite offers a superior strength- to- weight ratio as well as good durability in various service environments. The proper implementation of CFRP system involves a clean concrete surface, a powerful adhesive, such as epoxy resins together with compatible CFRP. However, one of the limiting factors towards the widespread of CFRP systems is attributed to its low resistance to elevated temperature and fire. Hence, efforts have been exerted to better understand and quantify this negative effect and to provide external protection for the system in order to alleviate the negative of impact of elevated temperature. This study focuses on assessing the impact of elevated temperature on the flexural strength of externally bonded CFRP with and without protection. Two sets of plain concrete beams have been prepared without protection and with a ready-to-use cementitious protective. All beams were

subjected to temperature degrees of 70, 120 and 180 °C for 1, 2, 4 and 8 hours in a furnace. The flexural strength and mode of failure have been assessed for each set. The results of this work demonstrate the CFRP strengthened beams experienced a drastic loss in strength upon exposure to elevated temperature. The extent of the drop in strength varied according to degree of exposure as well as duration. On the whole, CFRP unprotected beams were able to restore 40% of the flexural strength at 70 °C, while the CFRP strengthened protected beams restored 20% of the flexural strength of the CFRP strengthened beams. At exposure of 120 °C the CFRP strengthened beams showed increase in the flexural strength of 40% over unstrengthened unprotected beams. The CFRP strengthened protected beams surpassed the flexural strength of the CFRP strengthened beams at 120 °C by 20%. At exposure of 180 °C, the CFRP strengthened protected and unprotected beams failed to restore the lost flexural strength for the four and eight hours of exposure. This was followed by the appearance of the normal flexural crack on all the beams. Yet, the separation of the CFRP laminates from the concrete surface were noticed only at exposure to temperatures of 120 and 180 °C. The preliminary cost of the CFRP strengthened unprotected was estimated as 90% higher than the unstrengthened unprotected beams and the CFRP strengthened protected assessed as 16% higher than the CFRP strengthened unprotected. The results unveiled the ability of the CFRP strengthened beams to enhance the flexural strength upon exposure to elevated temperature along with the ability of the fire protection system to further improve this strength. Future work should be resumed to investigate wider sets of composites, various temperatures schemes, long term properties as well as applying the system to steel reinforced beams. It is also recommended to investigate the cooling effect on the performance of the strengthened and protected beams.

ABSTRACT: The load capacity of PR corroded beams strengthened with CFRP was about 30% higher than for control beams, and the stiffness was restored to the original value. Based on the results and observations, a corrosion damage rating system for reinforced concrete beams was developed.

This book presents the proceedings of an International Conference on Advances in Engineering Structures, Mechanics & Construction, held in Waterloo, Ontario, Canada, May 14-17, 2006. The contents include contains the texts of all three plenary presentations and all seventy-three technical papers by more than 153 authors, presenting the latest advances in engineering structures, mechanics and construction research and practice.

Dealing with a wide range of non-metallic materials, this book opens up possibilities of lighter, more durable structures. With contributions from leading international researchers and design engineers, it provides a complete overview of current knowledge on the subject.

The use of fiber reinforced plastic (FRP) composites for prestressed and non-prestressed concrete reinforcement has developed into a technology with serious and substantial claims for the advancement of construction materials and methods.

Research and development is now occurring worldwide. The 20 papers in this volume make a further contribution in advancing knowledge and acceptance of FRP composites for concrete reinforcement. The articles are divided into three parts. Part I introduces FRP reinforcement for concrete structures and describes general material properties and manufacturing methods. Part II covers a three-continent perspective of current R&D, design and code implementations, and technical organizations' activities. Part III presents an in-depth description of commercially-available products, construction methods, and applications. The work is intended for engineers, researchers, and developers with the objective of presenting them with a world-wide cross-section of initiatives, representative products and significant applications.
Bridge Maintenance, Safety, Management, Life-Cycle Sustainability and Innovations contains lectures and papers presented at the Tenth International Conference on Bridge Maintenance, Safety and Management (IABMAS 2020), held in Sapporo, Hokkaido, Japan, April 11–15, 2021. This volume consists of a book of extended abstracts and a USB card containing the full papers of 571 contributions presented at IABMAS 2020, including the T.Y. Lin Lecture, 9 Keynote Lectures, and 561 technical papers from 40 countries. The contributions presented at IABMAS 2020 deal with the state of the art as well as emerging concepts and innovative applications related to the main aspects of maintenance, safety, management, life-cycle sustainability and technological innovations of bridges. Major topics include: advanced bridge design, construction and maintenance approaches, safety, reliability and risk evaluation, life-cycle management, life-cycle sustainability, standardization, analytical models, bridge management systems, service life prediction, maintenance and management strategies, structural health monitoring, non-destructive testing and field testing, safety, resilience, robustness and redundancy, durability enhancement, repair and rehabilitation, fatigue and corrosion, extreme loads, and application of information and computer technology and artificial intelligence for bridges, among others. This volume provides both an up-to-date overview of the field of bridge engineering and significant contributions to the process of making more rational decisions on maintenance, safety, management, life-cycle sustainability and technological innovations of bridges for the purpose of enhancing the welfare of society. The Editors hope that these Proceedings will serve as a valuable reference to all concerned with bridge structure and infrastructure systems, including engineers, researchers, academics and students from all areas of bridge engineering.
The mechanics of fracture and fatigue have produced a huge body of research work in relation to applications to metal materials and structures. However, a variety of non-metallic materials (e.g., concrete and cementitious composites, rocks, glass, ceramics, bituminous mixtures, composites, polymers, rubber and soft matter, bones and biological materials, and advanced and multifunctional materials) have received relatively less attention, despite their attractiveness for a large spectrum of applications related to the components and structures of diverse engineering branches, applied sciences and architecture, and to the load-carrying systems of biological organisms. This book covers the broad topic of structural integrity of non-metallic materials, considering the modelling, assessment, and reliability of structural elements of any scale. Original contributions from engineers, mechanical materials scientists, computer scientists, physicists, chemists, and mathematicians are presented, applying both

experimental and theoretical approaches.

This proceedings volume for the 4th international conference CIGOS 2017 (Congrès International de Géotechnique - Ouvrages - Structures) presents novel technologies, solutions and research advances, making it an excellent guide in civil engineering for researchers, students, and professional engineers alike. Since 2010, CIGOS has become a vital forum for international scientific exchange on civil engineering. It aims to promote beneficial economic partnerships and technology exchanges between enterprises, worldwide institutions and universities. Following the success of the last three CIGOS conferences (2010, 2013 and 2015), the 4th conference was held at Ho Chi Minh City University of Technology, Ho Chi Minh City (Saigon), Vietnam on 26 to 27 October 2017. The main scientific themes of CIGOS 2017 were focused on 'New Challenges in Civil Engineering'.

This overview examines current issues of fiber reinforced polymer (FRP) composites in civil infrastructure. Part I engages topics related to durability and service life of FRP composites, and how they contribute to sustainability, while Part II highlights implementation and applications.

Carbon fiber-reinforced polymers (CFRP) have been widely used as externally epoxy-bonded reinforcement for repair and retrofit of existing concrete structures. As the use of CFRP in construction increases, it is essential to consider the long term behavior. In this study, concrete specimens with externally bonded CFRP composite systems were exposed to various accelerated ageing environments: different elevated temperature water immersion, varying relative humidity exposure, real-time solar exposure, pressurized hygrothermal exposure, and fatigue loading. Three-point loading test and direct tension test were used to evaluate the flexural and tensile strength of CFRP specimens. This research recommends that the durability strength reduction factor be defined as the ratio of the flexural strength of a test specimen after exposure for 60 days at 60C to the strength of a control specimen at the initiation of exposure. Test specimens, exposure environments, testing procedures, and field application environments are selected to assure uniform reporting, testing and application of durability strength reduction factors. Two exposure environments are recommended for design, wet and air. Water can diffuse through concrete and accumulate on the epoxy/concrete interface in a wet environment and is the default condition for design. An air environment precludes water accumulation but requires engineering design and validation to guarantee compliance. The resulting durability strength reduction factor may be used to (a) calculate the reduced strength for environmental exposure, (b) qualify a specific CFRP system, (c) compare durability reduction factors to those provided by system suppliers, and (d) confirm compliance with project specifications.

Results of tensile tests on FRP coupons indicate that both epoxy and polyurethane FRP systems do not degrade significantly under environmental exposure. However, flexural tests on the FRP strengthened concrete beams indicate that bond between FRP and concrete shows significant degradation, especially for aqueous exposure. Moreover, a protective coating suppresses the

measured degradation. Also, experimental load-displacement curves for control beams show excellent agreement with numerical load-displacement curves obtained using the proposed bond model. Finally, a bond-slip model is predicted for concrete leachate conditioned beams by matching load-displacement curves for those beams with numerical load-displacement curves.

The third International Symposium on Materials and Sustainable Development ISMSD2017 (CIMDD2017) will include a 2-day Conferences (07 & 08 November). Organized by the Research Unit: Materials, Processes and Environment and University M'hamed Bougara of Boumerdes, this symposium follows the success of CIMDD 2013-2015 and continues the traditions of the highly successful series of International Conferences on the materials, processes and Environment. The Symposium will provide a unique topical forum to share the latest results of the materials and sustainable development research in Algeria and worldwide.

This research provides a methodology for evaluation of durability related strength loss of bonded carbon fiber reinforced polymer (CFRP) systems applied to concrete beams. The report addresses test methods to establish a durability strength reduction factor, identification of corresponding field exposure conditions affecting durability, and suggestions for the application of the durability strength reduction factor for design of field applications. The durability strength reduction factor is a measure of the loss in strength over time due to environmental exposure. It is defined as the ratio of the flexural strength of a 4 in. x 4 in. x 14 in. concrete beam reinforced with CFRP exposed at 140°F and submerged in water or 100% relative humidity for 60 days to the flexural strength of a control specimen. The resulting durability strength reduction factor may be used to evaluate CFRP system performance. Two field environments are suggested: Wet and Air. In a Wet environment water accumulates at the bond surface. This is the default condition and corresponds to test results in submerged water at 140°F for 60 days. An Air environment allows drying between wetting episodes so water cannot accumulate on the bond surface. This condition corresponds to test results in 100% relative humidity at 140°F for 60 days.

Maintenance, Monitoring, Safety, Risk and Resilience of Bridges and Bridge Networks contains the lectures and papers presented at the Eighth International Conference on Bridge Maintenance, Safety and Management (IABMAS 2016), held in Foz do Iguaçu, Paraná, Brazil, 26-30 June, 2016. This volume consists of a book of extended abstracts and a DVD containing the full papers of 369 contributions presented at IABMAS 2016, including the T.Y. Lin Lecture, eight Keynote Lectures, and 360 technical papers from 38 countries. The contributions deal with the state-of-the-art as well as emerging concepts and innovative applications related to all main aspects of bridge maintenance, safety, management, resilience and sustainability. Major topics covered include: advanced materials, ageing of bridges, assessment and evaluation, bridge codes, bridge diagnostics, bridge management systems, composites, damage

identification, design for durability, deterioration modeling, earthquake and accidental loadings, emerging technologies, fatigue, field testing, financial planning, health monitoring, high performance materials, inspection, life-cycle performance and cost, load models, maintenance strategies, non-destructive testing, optimization strategies, prediction of future traffic demands, rehabilitation, reliability and risk management, repair, replacement, residual service life, resilience, robustness, safety and serviceability, service life prediction, strengthening, structural integrity, and sustainability. This volume provides both an up-to-date overview of the field of bridge engineering as well as significant contributions to the process of making more rational decisions concerning bridge maintenance, safety, serviceability, resilience, sustainability, monitoring, risk-based management, and life-cycle performance using traditional and emerging technologies for the purpose of enhancing the welfare of society. It will serve as a valuable reference to all involved with bridge structure and infrastructure systems, including students, researchers and engineers from all areas of bridge engineering.

About 77,600 bridges throughout the United States in the Federal Highway Association (FHWA) bridge database are listed as structurally deficient. This has created a need to either replace or strengthen bridges quickly and efficiently. Due to high costs for total replacement of deficient bridges, strengthening of existing bridges is a more economical alternative. A technique that has been developing over the past two decades is the strengthening of bridges using carbon fiber reinforced polymer (CFRP) sheets. The CFRP sheets are attached to the bottom of the bridge girders using structural adhesives so that the CFRP becomes an integral part of the bridge and carries a portion of the flexural loading. The CFRP sheets allow for an increase in the capacity of the bridge with minimal increase in the weight of the structure due to CFRP having a low density. Because the CFRP is expected to be an integral component and carry some of the long-term loading it is important to understand the long-term durability of the composite section. This thesis is part of a larger project, in which the long-term durability of the CFRP composite on concrete beams is investigated experimentally. The CFRP strengthened beams are exposed to fatigue testing and thermal-humidity cycling followed by failure testing. The testing scheme for this experiment allows for the investigation of the individual effects of fatigue and thermal-humidity loading as well as to explore the effects from combined fatigue and thermal-humidity loading. The investigation of the combined effects is a unique aspect of this experiment that has not been performed in prior studies. Results indicate that a polyurethane-based adhesive could provide a more durable bond for the CFRP-concrete interface than possible with epoxy-based adhesives.

Maintenance, Safety, Risk, Management and Life-Cycle Performance of Bridges contains lectures and papers presented at the Ninth International Conference on Bridge Maintenance, Safety and Management (IABMAS 2018), held in Melbourne, Australia, 9-13 July 2018. This volume consists of a book of extended

abstracts and a USB card containing the full papers of 393 contributions presented at IABMAS 2018, including the T.Y. Lin Lecture, 10 Keynote Lectures, and 382 technical papers from 40 countries. The contributions presented at IABMAS 2018 deal with the state of the art as well as emerging concepts and innovative applications related to the main aspects of bridge maintenance, safety, risk, management and life-cycle performance. Major topics include: new design methods, bridge codes, heavy vehicle and load models, bridge management systems, prediction of future traffic models, service life prediction, residual service life, sustainability and life-cycle assessments, maintenance strategies, bridge diagnostics, health monitoring, non-destructive testing, field testing, safety and serviceability, assessment and evaluation, damage identification, deterioration modelling, repair and retrofitting strategies, bridge reliability, fatigue and corrosion, extreme loads, advanced experimental simulations, and advanced computer simulations, among others. This volume provides both an up-to-date overview of the field of bridge engineering and significant contributions to the process of more rational decision-making on bridge maintenance, safety, risk, management and life-cycle performance of bridges for the purpose of enhancing the welfare of society. The Editors hope that these Proceedings will serve as a valuable reference to all concerned with bridge structure and infrastructure systems, including students, researchers and engineers from all areas of bridge engineering.

Carbon Fiber Reinforcement Polymer (CFRP) materials are widely used to strengthen reinforced concrete structures because they are light weight, have high strength, and are relatively easy to install. In strengthening applications, CFRP strips are typically attached to the concrete surface using epoxy resin with fibers oriented in the direction needing additional tensile strength. However, if CFRP strips rely exclusively on bond strength with concrete, only 40% to 50% of the CFRP tensile strength can be developed before debonding occurs. In order to fully develop the tensile strength of CFRP strips, some form of anchorage is needed. CFRP anchors can be applied with relative ease and have recently been shown to provide effective anchorage of CFRP strips to concrete members. In many cases, however, current anchorage details may resulting in fracture or failure of CFRP anchors prior to developing the full strength of CFRP strips. Many design parameters, the effects of which are not well understood, can affect the behavior and strength of CFRP anchors. Moreover, previous studies have demonstrated that the quality of installation can influence anchor strength substantially. The objectives of the study presented are to: 1) provide engineers with design guidelines for CFRP anchors, and 2) deliver a reliable test for controlling the quality of installation and materials of CFRP anchorage systems. In all, 39 tests on 6"×6"×24" rectangular concrete beams were conducted to study the influence of five parameters on CFRP anchor strength and effectiveness: 1) the width of the CFRP strip being developed, 2) the material ratio of CFRP anchor to CFRP strip, 3) the concrete strength, 4) the length/angle of anchor fan, and 5) the bond between CFRP strip and concrete (bonded/unbonded). The same tests also served to develop the test methodology for quality control of the CFRP anchorage system. Based on experimental results, guidelines for designing CFRP anchors are proposed. A test specimen and methodology are also proposed for qualifying CFRP materials and anchorage-system installations. A Finite Element (FE) formulation was selected to provide a computational tool that is suited for simulating the behavior of CFRP strips and CFRP anchors. The ability of the

selected FE formulation to reproduce the effects on behavior of varying the anchor-material ratio, concrete strength, length of anchor fan, and bond conditions was investigated. Six FE simulations were built by adjusting simulation parameters and comparing results with six experimental tests. Comparisons between experimental and numerical results indicate that the proposed FE formulation and parameter selections reproduced load-deflection and local strain behaviors with high fidelity.

The use of fiber-reinforced polymer (FRP) composite materials has had a dramatic impact on civil engineering techniques over the past three decades. FRPs are an ideal material for structural applications where high strength-to-weight and stiffness-to-weight ratios are required. Developments in fiber-reinforced polymer (FRP) composites for civil engineering outlines the latest developments in fiber-reinforced polymer (FRP) composites and their applications in civil engineering. Part one outlines the general developments of fiber-reinforced polymer (FRP) use, reviewing recent advancements in the design and processing techniques of composite materials. Part two outlines particular types of fiber-reinforced polymers and covers their use in a wide range of civil engineering and structural applications, including their use in disaster-resistant buildings, strengthening steel structures and bridge superstructures. With its distinguished editor and international team of contributors, Developments in fiber-reinforced polymer (FRP) composites for civil engineering is an essential text for researchers and engineers in the field of civil engineering and industries such as bridge and building construction. Outlines the latest developments in fiber-reinforced polymer composites and their applications in civil engineering Reviews recent advancements in the design and processing techniques of composite materials Covers the use of particular types of fiber-reinforced polymers in a wide range of civil engineering and structural applications

This book presents selected papers presented during Fatigue Durability India 2019. The contents of this volume discuss advances in the field of fatigue, durability, and fracture, and cover mechanical failure and its applications. The chapters cover a wide spectrum of topics, including design, engineering, testing and computational evaluation of the components or systems for fatigue, durability, and fracture mechanics. The contents of this book will appeal not only to academic researchers, but also to design engineers, failure analysts, maintenance engineers, certification personnel, and R&D professionals involved in a wide variety of industries.

While this proceedings volume deals primarily with the conventional areas of metal, ceramic, and polymer composites for civil construction, several of the papers report on new developments in the emerging fields of wood and nanocomposites. The 63 papers from the September 2002 workshop includes the further integration of the fabrication and function processes, aspects of the scale of components which improve the competitive position of composites relative to conventional materials and the exploitation of new types of composite such as nanocomposites which exploit a variety of new length scales to achieve their functionality. This also gives rise to multifunctional composites which have attributes other than structural properties. In this talk these aspects of the future of composites will be explored and illustrated.

Given the increasing use of fibre-reinforced polymer (FRP) composites in structural civil engineering, there is a vital need for critical information related to the overall durability and performance of these new materials under harsh and changing conditions. Durability of composites for civil and structural applications provides a thorough overview of key aspects of the durability of FRP composites for designers and practising engineers. Part one discusses general aspects of composite durability. Chapters examine mechanisms of degradation such as moisture, aqueous solutions, UV radiation, temperature, fatigue and wear. Part two then discusses ways of using FRP composites, including strengthening and rehabilitating existing structures with FRP composites, and monitoring techniques such as structural health

monitoring. Durability of composites for civil and structural applications provides practising engineers, decision makers and students with a useful and fundamental guide to the use of FRP composites within civil and structural engineering. Provides a thorough overview of key aspects of the durability of composites Examines mechanisms of degradation such as aqueous solutions, moisture, fatigue and wear Discusses ways of using FRP composites, including strengthening and rehabilitating existing structures

Volume is indexed by Thomson Reuters CPCI-S (WoS). This collection of more than 204 peer-reviewed papers on Composite Science and Technology covers: mechanics of composites, infrastructural composites, non-destructive evaluation and characterization of composites, fracture and fatigue of composites, numerical and mathematical modelling, ceramic matrices, composites, metal-matrix composites, composite manufacturing, polymer composites, smart materials and structures, nano-composites, bio-composites and structural health monitoring. This makes it a handy guide to the state-of-the-art of this field.

Fiber Reinforced Polymer (FRP) systems have gained much popularity as a method for reinforcing existing concrete structures. However a variety of sudden failure methods, such as debonding, delamination, and creep rupture have led to the development of code limitations on the strength that an FRP system can be considered to provide. The uncertainty brought on by the failure methods mentioned above has become the topic of much research. Researchers have proposed fracture and strength based methods to predict debonding. However, there are many environmental and durability issues that have not been considered in these prediction. These uncertainties make FRP strengthened concrete beams a good candidate for a health monitoring system. In this a paper a detailed look at current methods of predicting debonding is presented. Additionally, effects that the environment and durability have on debonding are presented. Finally, monitoring systems for FRP strengthened concrete beams are discussed. Two monitoring schemes are proposed.

Issues in Structural and Materials Engineering: 2013 Edition is a ScholarlyEditions™ book that delivers timely, authoritative, and comprehensive information about Computer Engineering. The editors have built Issues in Structural and Materials Engineering: 2013 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Computer Engineering in this book to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Issues in Structural and Materials Engineering: 2013 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

The Concrete Solutions series of International Conferences on Concrete Repair began in 2003, with a conference held in St. Malo, France in association with INSA Rennes, followed by the second conference in 2006 (with INSA again, at St. Malo, France), and the third conference in 2009 (in Padova and Venice, in association with the University of Padova). Now in 2011, the event is being held in Dresden in Germany and has brought together some 112 papers from 33 countries. Whereas electrochemical repair tended to dominate the papers in

earlier years, new developments in structural strengthening with composites have been an increasingly important topic, with a quarter of the papers now focusing on this area. New techniques involving Near Surface Mounted (NSM) carbon fibre rods, strain hardening composites, and new techniques involving the well established carbon fibre and polyimide wrapping and strengthening systems are presented. Seventeen papers concentrate on case studies which are all-important in such conferences, to learn about what works (and what doesn't work) on real structures. Thirteen papers are devoted to new developments in Non-Destructive Testing (NDT). Other topics include service life modelling, fire damage, surface protection methods and coatings, patch repair, general repair techniques and whole life costing. This book is essential reading for anyone engaged in the concrete repair field, from engineers, to academics and students and also to clients, who, as the end user, are ultimately responsible for funding these projects and making those difficult decisions about which system or method to use.

Inhaltsangabe:Zusammenfassung: Im Dezember 2002 wurde die erste österreichische Richtlinie bezüglich Stahlbetonverstärkungen mit aufgeklebten CFK-Lamellen veröffentlicht. Das vorrangige Ziel der vorliegenden Diplomarbeit ist, die Durchführbarkeit der neuen Richtlinie - mit speziellem Augenmerk auf Qualitätssicherung - anhand Europas größter CFK-Baustelle (die Wiener Marxerbrücke) zu überprüfen. Die Diplomarbeit enthält eine Übersicht über Eigenschaften und Anforderungen an CFK, deren gängigste Anwendungen als Verstärkung und eine Beschreibung des Hauptbezugsobjekts Marxerbrücke. Die Methoden der Qualitätssicherung nach der neuen Richtlinie werden erklärt und Resultate aus der Qualitätssicherung auf der Marxerbrücke inklusive einer Analyse von Fehlstellen und Sanierungsmethoden werden präsentiert. Anschließend werden die Resultate aus der Qualitätssicherung auf der Marxerbrücke mit denen von vier anderen CFK-verstärkten Bezugsobjekten verglichen. Abschließend werden Veränderungen bezüglich der Methoden der Qualitätssicherung vorgeschlagen und Empfehlungen für eine zukünftige Ausgabe der österreichischen Richtlinie werden geäußert.

Inhaltsverzeichnis:Table of Contents: AbstractI Deutsche KurzfassungII AcknowledgementsIII Table of contents4 1.Content and aims of the thesis7 2.Strengthening with fibre reinforced polymers8 Fibre Reinforced Polymers9 Types of fibres9 2.1.1CFRP products and their properties10 Comparison of strengthening with carbon fibre reinforced polymers and externally bonded steel12 Differences in behaviour under tension12 Advantages of carbon fibre reinforced polymers12 2.1.2Disadvantages of carbon fibre reinforced polymers14 Guidelines and reference works in Austria concerning CFRP and design of strengthening elements14 2.1.3Verifications of the strengthening system according to the Austrian guidelines15 2.1.4Design bending moment capacity17 Preliminary measures and application of CFRP19 Examination of the state of the concrete member before surface preparation19 2.1.5Surface preparation and

repair of the concrete member20 2.1.6Application of CFRP Reinforcement21 Basic techniques of strengthening with CFRP21 2.1.7Selected special techniques of strengthening with CFRP24 3.main reference object: Marxerbridge26 General description of the widening of the Marxerbridge26 Geographical position26 Arrangement of the structure of the Marxerbridge27 Division and numeration of the structure27 3.1.1Technical data [...]

"Advances in FRP Composites in Civil Engineering" contains the papers presented at the 5th International Conference on Fiber Reinforced Polymer (FRP) Composites in Civil Engineering in 2010, which is an official conference of the International Institute for FRP in Construction (IIFC). The book includes 7 keynote papers which are presented by top professors and engineers in the world and 203 papers covering a wide spectrum of topics. These important papers not only demonstrate the recent advances in the application of FRP composites in civil engineering, but also point to future research endeavors in this exciting area. Researchers and professionals in the field of civil engineering will find this book is exceedingly valuable. Prof. Lieping Ye and Dr. Peng Feng both work at the Department of Civil Engineering, Tsinghua University, China. Qingrui Yue is a Professor at China Metallurgical Group Corporation.

The repair of deteriorated, damaged and substandard civil infrastructures has become one of the most important issues for the civil engineer worldwide. This important book discusses the use of externally-bonded fibre-reinforced polymer (FRP) composites to strengthen, rehabilitate and retrofit civil engineering structures, covering such aspects as material behaviour, structural design and quality assurance. The first three chapters of the book review structurally-deficient civil engineering infrastructure, including concrete, metallic, masonry and timber structures. FRP composites used in rehabilitation and surface preparation of the component materials are also reviewed. The next four chapters deal with the design of FRP systems for the flexural and shear strengthening of reinforced concrete (RC) beams and the strengthening of RC columns. The following two chapters examine the strengthening of metallic and masonry structures with FRP composites. The last four chapters of the book are devoted to practical considerations in the flexural strengthening of beams with unstressed and prestressed FRP plates, durability of externally bonded FRP composite systems, quality assurance and control, maintenance, repair, and case studies. With its distinguished editors and international team of contributors, Strengthening and rehabilitation of civil infrastructures using fibre-reinforced polymer (FRP) composites is a valuable reference guide for engineers, scientists and technical personnel in civil and structural engineering working on the rehabilitation and strengthening of the civil infrastructure. Reviews the use of fibre-reinforced polymer (FRP) composites in structurally damaged and sub-standard civil engineering structures Examines the role and benefits of fibre-reinforced polymer (FRP) composites in different types of structures such as masonry and metallic strengthening Covers practical considerations including material

behaviour, structural design and quality assurance

Long-term durability of surface-bonded carbon fiber-reinforced polymer (CFRP) for shear strengthening of reinforced concrete (RC) bridge members remains uncertain due to the limited field experience with these materials. This paper provides experimental results from the testing of full-scale RC bridge girder specimens after exposure to prolonged environmental exposure and combined action of freeze-thaw + repeated service loads. CFRP shear contributions seen in experimental results were estimated using a refined base capacity prediction (Response-2000) and compared to predicted CFRP shear contributions (ACI-440). The IT specimens did not exhibit strength reductions due to moisture exposure, instead the presence of continuous water exposure for the relatively young concrete caused higher concrete tensile properties resulting in increased bond strength. Previous research showed CFRP strengthened T specimens with freeze-thaw exposure exhibited lower shear capacity than similar unexposed CFRP strengthened T specimen. But the current research demonstrated that if the beam is well protected against moisture infiltration at the strip termination, the beam will be less susceptible to freeze-thaw bond deterioration. The orientations of specimens during repair and during exposure are important considerations for environmental durability. The CFRP strip terminations should be focused on during installation to insure well and perhaps extra saturation even past the CFRP material to limit moisture infiltration along this edge.

Following the success of ACIC 2002, this is the 2nd International Conference focusing on the application and further exploitation of advanced composites in construction held at the University of Surrey in April 2004. With over 100 delegates the conference brought together practicing engineers, asset managers, researchers and representatives of regulatory bodies to promote the active exchange of scientific and technical information on the rapidly changing scene of advanced composites in construction. The aim of the conference was to encourage the presentation of new concepts, techniques and case studies, which will lead to greater exploitation of advanced polymer composites and FRP materials for the civil engineering infrastructure, rehabilitation and renewal.