aci 360r-10

Understanding ACI 360R-10: A Deep Dive into the Guide for Tilt-Up Concrete Construction

aci 360r-10, officially titled "Guide to Tilt-Up Concrete Construction," stands as a pivotal document for anyone involved in the design, construction, and inspection of tilt-up concrete structures. This comprehensive guide, published by the American Concrete Institute (ACI), provides essential recommendations and best practices for this increasingly popular construction method. It addresses the unique challenges and considerations inherent in lift-slab construction, from initial design and material selection to erection and finishing. This article will delve into the core aspects covered by ACI 360R-10, exploring its importance in ensuring structural integrity, safety, and efficiency in tilt-up projects. We will examine key areas such as the structural design of panels, connection details, handling and erection procedures, and quality control measures recommended by this authoritative standard.

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The Importance of ACI 360R-10 in Tilt-Up Construction

The adoption of ACI 360R-10 is crucial for several reasons, primarily centered on safety, structural performance, and project success. Tilt-up construction, where concrete wall panels are cast horizontally on-site and then tilted into their final vertical position, presents distinct engineering challenges compared to traditional cast-in-place concrete. These challenges include the stresses experienced during lifting, the necessity for robust connections, and the specific demands on the concrete mix. ACI 360R-10 acts as a roadmap, guiding engineers, architects, contractors, and inspectors through these complexities. By following its recommendations, stakeholders can mitigate risks, prevent costly errors, and ensure that the completed tilt-up structure meets all performance and safety requirements. The document serves as a consensus-based standard, reflecting the collective knowledge and experience of the concrete industry.

Key Design Considerations as Outlined in ACI 360R-10

ACI 360R-10 emphasizes a thorough understanding of the loads and stresses that tilt-up panels will encounter throughout their lifecycle. This includes not only the service loads they will bear once erected but also the significant temporary loads associated with lifting and erection. The guide details how to account for these dynamic forces, which can be considerably higher than static loads. It also stresses the importance of considering the effects of environmental factors such as wind, seismic activity, and temperature fluctuations. Proper detailing of openings, such as windows and doors, is also a critical design aspect highlighted in the document, as these can introduce stress concentrations. The overall design process, as guided by ACI 360R-10, aims to create panels that are not only structurally sound but also durable and aesthetically pleasing.

Structural Design of Tilt-Up Panels

The structural design of the individual tilt-up panels is a cornerstone of ACI 360R-10. The guide provides recommendations for determining the required thickness of the panels based on anticipated loads, span lengths, and support conditions. It delves into the analysis of stresses, including bending moments and shear forces, that occur during lifting and in their final erected state. Considerations for deflections are also paramount, ensuring that the panels do not exhibit excessive movement that could compromise their performance or the overall structural system. The interaction between the concrete panel and its supporting structure, such as the foundation and roof system, is another vital area addressed. Engineers are

guided to perform detailed analyses to ensure the stability and load-carrying capacity of each panel.

Reinforcement Requirements

Reinforcement plays a critical role in the strength and integrity of tilt-up concrete panels. ACI 360R-10 provides comprehensive guidance on the type, size, placement, and spacing of reinforcing steel. It specifies minimum and maximum reinforcement ratios to prevent brittle failure and control cracking. Particular attention is paid to the reinforcement around openings, corners, and edges, which are critical stress points. The guide also discusses the importance of adequate cover for reinforcement to protect it from corrosion and ensure proper bond between the steel and concrete. The correct detailing of reinforcement cages and their integration into the panel design are essential for resisting the forces generated during lifting and service. Proper lap splices and anchorage of reinforcing bars are also covered in detail to ensure effective load transfer.

Connections in Tilt-Up Construction

The connections between tilt-up panels and between panels and other structural elements are arguably the most critical aspect of tilt-up construction, and ACI 360R-10 dedicates significant attention to them. The guide categorizes and describes various types of connections, including lifting inserts, erection bracing connections, and permanent structural connections. It emphasizes the importance of designing these connections to safely transfer all anticipated loads, including erection loads, gravity loads, wind loads, and seismic loads. Detailed design procedures and considerations for load transfer mechanisms are provided. The guide also highlights the need for quality control during the installation of embedded items such as lifting loops and reinforcing bar dowels, as failures in these components can have catastrophic consequences. Proper connection design ensures the stability of the structure during erection and its long-term performance.

Handling and Erection Procedures

Beyond design, ACI 360R-10 offers invaluable recommendations for the safe and efficient handling and erection of tilt-up panels. This section addresses the critical phases of lifting, moving, and stabilizing the panels in their final vertical position. It outlines the importance of using appropriate lifting equipment and accessories, such as lifting inserts and spreader bars, and emphasizes the need for competent personnel to oversee these operations. The guide provides recommendations for temporary bracing systems designed to hold the panels securely until they are permanently connected and the structure is stable. Safety protocols during erection are paramount, and ACI 360R-10 stresses the need for comprehensive site safety plans to protect workers and the public. Detailed procedures for setting panels plumb and level, and ensuring

proper alignment with adjacent panels, are also discussed.

Lifting and Bracing Considerations

The selection and placement of lifting inserts are critical to the success of tilt-up construction. ACI 360R-10 provides guidance on the types of lifting inserts available, their load capacities, and the proper methods for embedding them within the concrete panels. The guide also details the requirements for lifting hardware, such as slings and shackles, ensuring they are appropriately rated for the loads involved. For bracing, the document outlines the principles of designing temporary support systems that can withstand wind loads and other environmental forces during the erection process. The stability of the panel during the entire erection sequence, from initial lift to final placement and connection, is a primary concern. Recommendations for anchorages for bracing systems to the foundation or adjacent structures are also provided.

Quality Assurance and Quality Control

Maintaining high standards of quality throughout the tilt-up construction process is essential, and ACI 360R-10 provides a framework for robust quality assurance (QA) and quality control (QC) programs. The guide recommends procedures for monitoring and verifying the quality of materials, workmanship, and adherence to the design specifications. This includes inspections of formwork, reinforcement placement, concrete placement and curing, and the installation of embedded items. Testing of concrete strength, slump, and other properties is also a vital component of the QC process. The document emphasizes the importance of documentation and record-keeping to track quality control activities and ensure accountability. A well-executed QA/QC program, as recommended by ACI 360R-10, helps prevent defects, minimize rework, and ultimately contribute to the long-term performance and durability of the tilt-up structure.

- Material testing and verification
- Inspection of formwork and reinforcement
- Concrete placement and curing monitoring
- Testing of cured concrete
- Inspection of embedded items and connections
- Documentation and reporting

Concrete Mix Design for Tilt-Up

The performance of tilt-up panels is highly dependent on the properties of the concrete used. ACI 360R-10 offers recommendations for concrete mix design tailored to the demands of tilt-up construction. This includes considerations for workability, strength, durability, and shrinkage. The guide may suggest specific admixtures that can enhance performance, such as water reducers to improve slump without adding excess water, or shrinkage-reducing admixtures to minimize cracking. The consistency of the concrete mix is crucial for predictable behavior during casting, lifting, and service. The recommendations aim to achieve a concrete that is robust enough to withstand the stresses of erection and provides the required long-term performance.

Special Considerations for Tilt-Up Concrete

ACI 360R-10 also addresses specific aspects unique to tilt-up construction that require special attention. These can include surface finishes, architectural treatments, and the integration of insulation within the panel. The guide provides insights into achieving desired aesthetic qualities, such as smooth surfaces or textured finishes, and how to manage them during the casting and finishing stages. It also discusses methods for incorporating insulation into tilt-up panels, whether through sandwich panel construction or applied insulation systems, and the implications for structural design and thermal performance. Fire resistance of tilt-up walls is another area where specific guidance may be provided, ensuring that the construction meets relevant building codes and safety standards.

Finishes and Architectural Treatments

Achieving specific architectural finishes on tilt-up panels requires careful planning and execution. ACI 360R-10 provides insights into techniques for producing a variety of surface textures, from smooth troweled finishes to exposed aggregate or imprinted patterns. It highlights the importance of proper formwork preparation and release agents to ensure clean releases and prevent surface defects. The guide also touches upon the application of coatings, stains, or other decorative treatments to the erected panels, considering their compatibility with the concrete and their durability in the intended environment. The ability to integrate complex architectural features into tilt-up panels is a significant advantage of this construction method, and the guide offers recommendations to facilitate successful implementation.

Advantages of Adhering to ACI 360R-10

Strict adherence to the guidelines set forth in ACI 360R-10 yields numerous benefits for tilt-up construction projects. Foremost among these is enhanced safety, minimizing the risk of accidents and injuries during the critical erection phases. Structural integrity is significantly improved, leading to durable and reliable buildings that perform as intended throughout their lifespan. Following the guide also promotes construction efficiency by providing clear procedures and reducing the likelihood of costly errors and rework. Projects that align with ACI 360R-10 are more likely to meet regulatory requirements and achieve successful inspections. Ultimately, embracing the recommendations within this document contributes to the overall cost-effectiveness and client satisfaction for tilt-up projects.

The application of ACI 360R-10 is fundamental to achieving successful and safe tilt-up concrete construction. By providing detailed guidance on design, materials, erection, and quality control, this document empowers construction professionals to tackle the unique challenges of this building method. Its comprehensive nature ensures that critical aspects, from the structural integrity of individual panels to the complex interactions of connections, are thoroughly addressed. Embracing these recommendations fosters a culture of safety and excellence, leading to durable, high-performing, and aesthetically pleasing tilt-up structures that stand the test of time.

Frequently Asked Questions

What is the primary purpose and scope of ACI 360R-10?

ACI 360R-10, 'Guide to Design of Slabs-on-Ground,' provides recommendations for the design of concrete slabs-on-ground intended to be supported by the subgrade and not by structural elements such as columns or walls. Its scope covers the determination of slab thickness, reinforcement requirements, joint design, and subgrade considerations for various loading conditions and intended uses.

How does ACI 360R-10 address the design of subgrades for slabs-on-ground?

ACI 360R-10 emphasizes the critical role of the subgrade. It outlines methods for characterizing subgrade support, including the use of the modulus of subgrade reaction (k-value), and discusses the importance of subgrade preparation, compaction, and the use of base or subbase materials to ensure adequate and uniform support for the concrete slab.

What are the key considerations for joint design according to ACI

360R-10?

ACI 360R-10 provides guidance on the design of control joints (contraction joints), construction joints, and isolation joints. It discusses joint spacing, depth, and reinforcement (dowels and tie bars) to effectively control cracking due to drying shrinkage and thermal effects, as well as to accommodate differential movement and prevent restraint.

How does ACI 360R-10 account for different loading conditions on slabs-on-ground?

ACI 360R-10 provides methodologies for considering various loading scenarios, including uniformly distributed loads (e.g., storage), concentrated loads (e.g., forklifts, equipment), and dynamic loads. It outlines procedures for calculating stresses and deflections to ensure the slab can safely withstand these applied forces without excessive cracking or deformation.

What role does reinforcement play in slab-on-ground design as per ACI 360R-10?

ACI 360R-10 discusses the use of reinforcement (e.g., welded wire reinforcement or rebar) primarily for controlling crack width rather than for load-carrying capacity in typical slabs-on-ground. It provides guidelines for determining the required amount, placement, and type of reinforcement based on the anticipated crack widths and the performance requirements of the slab.

Additional Resources

Here is a numbered list of 9 book titles related to ACI 360R-10, each with a short description:

1. *Reinforced Concrete Design Fundamentals*
This foundational text delves into the core principles of reinforced concrete design, covering material properties, stress-strain behavior of concrete and steel, and the development of fundamental design equations. It provides a comprehensive overview of the theoretical underpinnings necessary to understand the practical applications detailed in ACI 360R-10. Readers will gain a solid grasp of flexural, shear, and bond calculations, which are crucial for applying the ACI committee report.

2. *Design of Concrete Structures, Eleventh Edition*
A widely respected and comprehensive textbook, this book offers detailed explanations and numerous examples for the design of various reinforced concrete elements. It closely follows ACI code provisions, making it an excellent companion to ACI 360R-10. The text covers everything from basic structural analysis to complex detailing requirements, ensuring a thorough understanding of how to implement the recommendations in the ACI report.

3. *Mechanics of Materials for Civil Engineers*
This book provides a rigorous exploration of the mechanical behavior of materials, with a strong emphasis on concrete and steel. It covers concepts like stress, strain, elasticity, plasticity, and failure criteria, which are essential for understanding the material assumptions and limitations inherent in ACI 360R-10. A solid understanding of mechanics of materials is key to interpreting the rationale behind design approaches presented in the ACI document.

4. *Advanced Concrete Technology: Properties and Practice*
Focusing on the practical aspects of concrete as a material, this text explores a range of properties, from fresh concrete behavior to hardened concrete durability. It offers insights into how concrete mixtures are designed and how their properties influence structural performance. Understanding these material aspects is vital for correctly applying the guidance found in ACI 360R-10, particularly concerning the performance of concrete under various loading and environmental conditions.

5. *Structural Analysis for Engineers*
This book equips engineers with the essential tools for analyzing the behavior of structural systems under different loads. It covers fundamental concepts like statics, dynamics, and the behavior of indeterminate structures. A strong analytical background is necessary to interpret the load cases and structural responses that ACI 360R-10 aims to address, allowing engineers to apply the report's recommendations effectively to real-world scenarios.

6. *Seismic Design of Reinforced Concrete Structures*
While ACI 360R-10 focuses on general reinforced concrete, understanding seismic considerations is a critical aspect of structural engineering. This book delves into the specific design principles and detailing requirements for structures subjected to seismic forces. It highlights how ductility and energy dissipation are achieved, concepts that are implicitly or explicitly relevant to the robustness and performance expected from reinforced concrete structures, as discussed in ACI 360R-10.

7. *Durability of Concrete Structures: A Practical Approach*
This practical guide addresses the long-term performance of concrete structures, considering factors like environmental exposure, material deterioration, and maintenance. ACI 360R-10 implicitly assumes a certain level of durability, and this book provides the context for ensuring that concrete structures can meet their intended service life. Understanding durability issues is crucial for selecting appropriate materials and design strategies that align with the goals of the ACI committee report.

8. *Bridge Engineering: Hydraulics and Civil Engineering Aspects*
This specialized text focuses on the unique challenges of designing and constructing bridges, which often utilize reinforced concrete. It covers aspects like substructure design, deck design, and the integration of hydraulic considerations. Many of the principles discussed for bridge components, particularly concerning loads and structural behavior, are directly applicable to the broader scope covered by ACI 360R-10.

9. *ACI 318 Building Code Requirements for Structural Concrete and Commentary*
This is the foundational building code for structural concrete in the United States, and ACI 360R-10 is often

used as a companion document that provides further insight and rationale for specific design provisions within ACI 318. Understanding the requirements of ACI 318 is essential for comprehending the context and practical application of ACI 360R-10, as the committee report often elaborates on or provides additional guidance related to code clauses.

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ACI 360R-10: A Comprehensive Guide to Concrete Repair

Ebook Name: Mastering Concrete Repair: A Practical Guide to ACI 360R-10

Ebook Outline:

Introduction: Overview of ACI 360R-10 and its importance in the concrete repair industry.
Chapter 1: Understanding Concrete Deterioration: Causes of concrete damage, types of deterioration, and assessment methods.
Chapter 2: Repair Principles and Strategies: Selection of appropriate repair materials and techniques based on damage type and severity.
Chapter 3: Material Selection and Application: Detailed information on various repair materials, including their properties, advantages, and limitations.
Chapter 4: Repair Methods and Techniques: Step-by-step explanations of common repair methods, such as patching, overlaying, and injection.
Chapter 5: Quality Control and Inspection: Ensuring the quality and durability of repairs through proper inspection and testing.
Chapter 6: Case Studies and Examples: Real-world applications of ACI 360R-10 guidelines in different scenarios.
Chapter 7: Sustainability and Life Cycle Cost: Considering environmental impact and long-term cost-effectiveness in concrete repair.
Conclusion: Summary of key takeaways and future trends in concrete repair technology.

ACI 360R-10: A Comprehensive Guide to Concrete Repair

The American Concrete Institute (ACI) 360R-10, "Guide for Concrete Repair," is a cornerstone

document for professionals involved in the assessment, design, and execution of concrete repair projects. This guide offers invaluable insights into various aspects of concrete repair, providing a comprehensive framework for ensuring durable and cost-effective solutions. Understanding and implementing the principles outlined in ACI 360R-10 is crucial for extending the lifespan of concrete structures and maintaining their structural integrity. This article delves into the key aspects of ACI 360R-10, offering a detailed explanation of its significance and practical application.

Understanding Concrete Deterioration (Chapter 1)

Concrete, despite its strength and durability, is susceptible to deterioration over time. ACI 360R-10 emphasizes the importance of accurately identifying the causes and types of deterioration before selecting an appropriate repair strategy. Common causes include:

Chemical attack: Exposure to aggressive chemicals, such as chlorides (from de-icing salts) and sulfates (from soil and groundwater), can lead to chemical reactions that weaken the concrete matrix.
Freeze-thaw damage: Repeated cycles of freezing and thawing can cause expansion and cracking, particularly in porous concrete.
Carbonation: Reaction of carbon dioxide in the atmosphere with the calcium hydroxide in concrete, leading to a reduction in pH and decreased durability.
Alkaline-aggregate reaction: A chemical reaction between certain aggregates and the alkaline components of cement, causing expansion and cracking.
Physical damage: Impact, abrasion, and fatigue loading can cause surface damage and structural cracking.

Accurate assessment involves visual inspection, material testing (e.g., compressive strength, chloride penetration depth), and non-destructive testing methods (e.g., ultrasonic testing, ground-penetrating radar). The guide emphasizes the need for a thorough investigation to pinpoint the root causes of deterioration, preventing future damage.

Repair Principles and Strategies (Chapter 2)

ACI 360R-10 outlines fundamental principles for effective concrete repair. These principles emphasize:

Durability: Repairs must be designed to withstand environmental exposure and expected loading conditions, ensuring long-term performance.
Compatibility: Repair materials should be compatible with the existing concrete, minimizing the risk of adverse reactions or incompatibility issues.
Bond strength: A strong bond between the repair material and the existing concrete is essential for transferring loads and preventing debonding.
Workability: Repair materials should be easy to apply and achieve the desired finish.
Cost-effectiveness: Repair solutions should balance cost, performance, and longevity.

The guide suggests various repair strategies depending on the type and extent of damage. These may include:

Cleaning and sealing: Removal of loose or deteriorated concrete and application of protective coatings to prevent further deterioration.
Patching: Repairing localized areas of damage with suitable repair mortars or concretes.
Overlaying: Applying a layer of new concrete over the existing surface to improve durability and aesthetics.
Injection: Filling cracks and voids with epoxy resins or other injection materials to restore structural integrity.
Strengthening: Improving the load-carrying capacity of the concrete structure through techniques such as fiber reinforcement or externally bonded FRP (Fiber Reinforced Polymer) sheets.

Material Selection and Application (Chapter 3)

ACI 360R-10 provides detailed information on various repair materials, including:

Cements: Different types of cement, including Portland cement, blended cements, and high-performance cements, are suitable for various repair applications.
Aggregates: The choice of aggregates affects the properties of the repair material, and careful selection is crucial to ensure compatibility and durability.
Admixtures: Admixtures can be used to modify the properties of repair materials, improving workability, setting time, and durability.
Epoxy resins: Epoxy resins are commonly used for crack repair, injection, and bonding applications.
Polymer-modified mortars and concretes: These materials offer improved strength, durability, and workability compared to conventional concrete.

The guide emphasizes the importance of proper material selection based on the specific application, environmental conditions, and performance requirements. It also highlights the importance of proper mixing, placement, and curing of repair materials to ensure optimal performance.

Repair Methods and Techniques (Chapter 4)

ACI 360R-10 covers a wide range of repair methods and techniques, providing detailed guidance on the preparation of surfaces, application procedures, and curing requirements. It emphasizes the importance of following specific steps to ensure the success of the repair. For example, patching involves careful preparation of the substrate, ensuring a clean, sound surface with adequate mechanical interlock before applying the repair material. Overlay techniques require proper substrate preparation to ensure bonding and prevent delamination. Injection methods require careful selection of injection material and injection techniques to effectively fill cracks and voids.

Quality Control and Inspection (Chapter 5)

Quality control and inspection are paramount throughout the repair process. ACI 360R-10 provides guidelines for ensuring that repairs meet specified requirements and provides long-term durability. This includes:

Material testing: Verification of the properties of repair materials before and after application.
In-situ testing: Assessment of the quality of the repair work during and after completion.
Documentation: Maintaining detailed records of the repair process, including materials used, methods employed, and inspection results.

Regular inspections are crucial to monitor the performance of the repairs over time and detect any potential problems early on.

Case Studies and Examples (Chapter 6)

The guide includes case studies and examples illustrating the application of ACI 360R-10 guidelines in various real-world scenarios. This helps readers understand how the principles are translated into practice and what challenges might be encountered. Learning from past projects and successfully implemented solutions is invaluable for practitioners.

Sustainability and Life Cycle Cost (Chapter 7)

Increasingly, sustainability and life cycle cost analysis are critical aspects of concrete repair. ACI 360R-10 encourages consideration of environmental impacts, material selection, energy efficiency, and long-term maintenance costs when planning and implementing repair strategies.

Conclusion (Chapter 8)

ACI 360R-10 is an indispensable resource for anyone involved in concrete repair. Its comprehensive guidelines, coupled with best practices, ensure durable and cost-effective solutions. By following the recommendations outlined in this guide, professionals can significantly extend the lifespan of concrete structures and ensure the safety and serviceability of these important assets.

FAQs:

1. What is the difference between ACI 360R-10 and ACI 360-10? ACI 360R-10 is a guide, offering recommendations and best practices, while ACI 360-10 is a standard, providing specific requirements and specifications.
2. Is ACI 360R-10 mandatory? ACI 360R-10 is not a mandatory code but serves as a highly recommended best-practice guide. Specific requirements may be defined by local building codes or project specifications.
3. What types of concrete damage does ACI 360R-10 address? It addresses a wide range of damage types, including chemical attack, freeze-thaw damage, carbonation, alkali-aggregate reaction, and physical damage.
4. What materials are commonly used for concrete repair according to ACI 360R-10? Common materials include Portland cement, polymer-modified mortars, epoxy resins, and specialized concrete mixes.
5. How important is proper surface preparation before concrete repair? Proper surface preparation is critical to ensure a strong bond between the repair material and the existing concrete, and failure to adequately prepare the surface is a major cause of repair failure.
6. What is the role of quality control in concrete repair? Quality control ensures that the repair meets the required specifications, resulting in a durable and lasting repair.
7. What are some common mistakes to avoid when repairing concrete? Common mistakes include improper surface preparation, incorrect material selection, insufficient curing, and inadequate inspection.
8. Where can I find ACI 360R-10? The document can be purchased directly from the American Concrete Institute (ACI) website or through various technical bookstores.
9. How often should concrete structures be inspected for damage? Inspection frequency depends on factors such as environmental exposure, loading conditions, and the age of the structure, but regular inspections are crucial for detecting and addressing damage early on.

Related Articles:

1. Concrete Crack Repair Techniques: Details various techniques for repairing cracks, including injection, stitching, and patching.
2. Selecting the Right Concrete Repair Material: A guide on selecting appropriate materials based on damage type and environmental conditions.
3. Durability of Concrete Repairs: Focuses on factors affecting the long-term durability of concrete repairs.
4. Cost-Effective Concrete Repair Strategies: Explores methods for optimizing repair costs without compromising quality.
5. Non-Destructive Testing for Concrete Evaluation: Covers methods for assessing concrete condition without causing damage.
6. Concrete Repair Case Study: Bridge Deck Rehabilitation: A detailed case study of a bridge deck repair project.
7. Sustainable Concrete Repair Practices: Explores environmentally friendly methods and materials for concrete repair.
8. The Importance of Proper Curing in Concrete Repair: Highlights the significance of curing for achieving optimal strength and durability.
9. ACI 318 Building Code and its Relation to Concrete Repair: Explores the connection between structural design codes and concrete repair practices.

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aci 360r 10: Guide for Concrete Floor and Slab Construction ACI Committee 302, American Concrete Institute, 2004

aci 360r 10: Reinforced Concrete Design Abi O. Aghayere, Jason Vigil, 2024-01-30 The primary objective of Reinforced Concrete Design, 10th Edition, is to provide a basic and thorough understanding of the strength and behavior of reinforced concrete members and structural systems. Featuring updated compliance with the ACI 318-19 Building Code for Structural Concrete, it covers details of reinforced concrete materials, mechanics of bending, slab systems and an in-depth analysis of continuous one-way and two-way floor systems, shear and torsion, and serviceability. There are also comprehensive chapters on structural walls, columns, foundations, and prestressed concrete fundamentals. Instructor ancillaries are also available. FEATURES: Features frequent references to the recent ACI Code updates, making it a vital companion for design and construction Includes practice-based examples and exercises to enhance real-world applications and understanding Illustrates procedures for the design of job-built forms for slabs, beams, and columns Covers basic principles to advanced concepts like the design of deep beams and pile caps, prestressed concrete, and concrete formwork design Adds new material on pole footings and Sonutube foundations, different types of concrete floor systems, and numerous new photos and drawings

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aci 360r 10: *Fibre Reinforced Concrete: Improvements and Innovations* Pedro Serna, Aitor Llano-Torre, José R. Martí-Vargas, Juan Navarro-Gregori, 2020-11-05 This volume highlights the latest advances, innovations, and applications in the field of fibre reinforced concrete (FRC) and discusses a diverse range of topics concerning FRC: rheology and early-age properties, mechanical properties, codes and standards, long-term properties, durability, analytical and numerical models, quality control, structural and Industrial applications, smart FRC's, nanotechnologies related to FRC, textile reinforced concrete, structural design and UHPFRC. The contributions present improved traditional and new ideas that will open novel research directions and foster multidisciplinary collaboration between different specialists. Although the symposium was postponed, the book gathers peer-reviewed papers selected in 2020 for the RILEM-fib International Symposium on Fibre Reinforced Concrete (BEFIB).

aci 360r 10: *Computational Modelling of Concrete and Concrete Structures* Günther Meschke, Bernhard Pichler, Jan G. Rots, 2022-05-22 Computational Modelling of Concrete and Concrete Structures contains the contributions to the EURO-C 2022 conference (Vienna, Austria, 23-26 May 2022). The papers review and discuss research advancements and assess the applicability and robustness of methods and models for the analysis and design of concrete, fibre-reinforced and prestressed concrete structures, as well as masonry structures. Recent developments include methods of machine learning, novel discretisation methods, probabilistic models, and consideration of a growing number of micro-structural aspects in multi-scale and multi-physics settings. In addition, trends towards the material scale with new fibres and 3D printable concretes, and life-cycle oriented models for ageing and durability of existing and new concrete infrastructure are clearly visible. Overall computational robustness of numerical predictions and mathematical rigour have further increased, accompanied by careful model validation based on respective experimental programmes. The book will serve as an important reference for both academics and professionals, stimulating new research directions in the field of computational modelling of concrete and its application to the analysis of concrete structures. EURO-C 2022 is the eighth edition of the EURO-C

conference series after Innsbruck 1994, Bad Gastein 1998, St. Johann im Pongau 2003, Mayrhofen 2006, Schladming 2010, St. Anton am Arlberg 2014, and Bad Hofgastein 2018. The overarching focus of the conferences is on computational methods and numerical models for the analysis of concrete and concrete structures.

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aci 360r 10: CCNP Data Center Application Centric Infrastructure 300-620 DCACI Official Cert Guide Ammar Ahmadi, 2021-01-21 Trust the best-selling Official Cert Guide series from Cisco Press to help you learn, prepare, and practice for exam success. They are built with the objective of providing assessment, review, and practice to help ensure you are fully prepared for your certification exam. * Master CCNP Data Center Application Centric Infrastructure DCACI 300-620 exam topics * Assess your knowledge with chapter-opening quizzes * Review key concepts with exam preparation tasks This is the eBook edition of the CCNP Data Center Application Centric Infrastructure DCACI 300-620 Official Cert Guide. This eBook does not include access to the companion website with practice exam that comes with the print edition. CCNP Data Center Application Centric Infrastructure DCACI 300-620 Official Cert Guide presents you with an organized test-preparation routine through the use of proven series elements and techniques. “Do I Know This Already?” quizzes open each chapter and enable you to decide how much time you need to spend on each section. Exam topic lists make referencing easy. Chapter-ending Exam Preparation Tasks help you drill on key concepts you must know thoroughly. CCNP Data Center Application Centric Infrastructure DCACI 300-620 Official Cert Guide focuses specifically on the objectives for the CCNP Data Center DCACI exam. Leading Cisco data center technology expert Ammar Ahmadi shares preparation hints and test-taking tips, helping you identify areas of weakness and improve both your conceptual knowledge and hands-on skills. Material is presented in a concise manner, focusing on increasing your understanding and retention of exam topics. Well regarded for its level of detail, assessment features, comprehensive design scenarios, and challenging review questions and exercises, this official study guide helps you master the concepts and techniques that will enable you to succeed on the exam the first time. This official study guide helps you master all the topics on the CCNP Data Center Application Centric Infrastructure DCACI 300-620 exam. It tests your knowledge of Cisco switches in ACI mode, including • ACI fabric infrastructure • ACI packet forwarding • External network connectivity • Integrations • ACI management • ACI Anywhere CCNP Data Center Application Centric Infrastructure DCACI 300-620 Official Cert Guide is part of a recommended learning path from Cisco that includes simulation and hands-on training from authorized Cisco Learning Partners and self-study products from Cisco Press. To find out more about instructor-led training, e-learning, and hands-on instruction offered by authorized Cisco Learning Partners worldwide, please visit http://www.cisco.com/web/learning/index.html

aci 360r 10: Science and Technology of Concrete Admixtures Pierre-Claude Aïtcin, Robert J Flatt, 2015-11-12 Science and Technology of Concrete Admixtures presents admixtures from both a theoretical and practical point-of-view. The authors emphasize key concepts that can be used to better understand the working mechanisms of these products by presenting a concise overview on the fundamental behavior of Portland cement and hydraulic binders as well as their chemical admixtures, also discussing recent effects in concrete in terms of rheology, mechanics, durability, and sustainability, but never forgetting the fundamental role played by the water/binder ratio and proper curing in concrete technology. Part One presents basic knowledge on Portland cement and concrete, while Part Two deals with the chemical and physical background needed to better understand what admixtures are chemically, and through which mechanism they modify the properties of the fresh and hardened concrete. Subsequent sections present discussions on admixtures technology and two particular types of concrete, self-consolidating and ultra-high strength concretes, with final remarks on their future. - Combines the knowledge of two leading authors to present both the scientific and technology of admixtures - Explains what admixtures are from a chemical point-of-view and illustrates by which mechanisms they modify the properties of fresh and hardened concrete - Presents a fundamental, practical, and innovative reference book on

the topic - Contains three detailed appendices that can be used to learn how to use admixtures more efficiently

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overturn if they are not properly designed, installed, maintained, and loaded. In addition, goods stored on the racks may spill or topple off. Both occurrences pose a life-safety risk to the exposed shopping public. The immediate stimulus for the project that resulted in this report was a 2003 request from the State of Washington to the Federal Emergency Management Agency (FEMA) for guidance concerning the life-safety risk posed by the storage racks in publicly accessible areas of retail stores, especially the risk of rack collapse of loss of stored goods during an earthquake. FEMA asked the Building Seismic Safety Council (BSSC) to develop the requested guidance. To do so, the BSSC established a Rack Project Task Group composed of practicing engineers, storage rack designers, researchers, representatives of the Rack Manufacturers Institute (RMI) and the Retail Industry Leaders Association, and members of applicable technical subcommittees responsible for updating the NEHRP Recommended Provisions. In developing this guidance document, the Task Group focused primarily on steel single selective pallet storage racks. It reviewed available information on storage rack performance during earthquakes and the background on the development of standards and code requirements for storage racks; assessed seismic requirements for storage racks and current practices with respect to rack design, maintenance and operations, quality assurance, and post-earthquake inspections; and examined available research and testing data. Based on its study, the Task Group developed short-term recommendations to improve current practice and formulated long-term recommendations to serve as the basis for improved standards documents such as the NEHRP Recommended Provisions, ASCE 7, and the RMI-developed storage rack specification. Over the near term, the Task Group recommends that the 2003 NEHRP Recommended Provisions requirements for steel single selective pallet storage rack design be followed and that connections be checked in accordance with a procedure to be developed by RMI. The Task Group also recommends that additional guidance presented in this report be voluntarily adopted by store owners and operators. Further, given the fact that maintenance and use of storage racks is a key element to their acceptable performance during earthquakes, store owners and operators should adopt an appropriate quality assurance plan; as a minimum, the best self-imposed practices of store owners and operators should be maintained. The Task Group's primary long-term recommendation is that the RMI specification be brought into conformance with the 2003 NEHRP Recommended Provisions, which is the basis for seismic requirements found in current seismic design standards and model building codes. The Task Group also recommends that optional performance-based and limit state procedures and component cyclic testing procedures be incorporated into the RMI-developed specification. Compliance with these procedures will demonstrate that the storage racks have the capacity to resist maximum considered earthquake ground motions without collapse. It also is recommended that regulatory bodies periodically review the quality assurance programs of stores and implement any regulations needed to satisfy life-safety concerns that relate to the securing of rack contents and rack maintenance and use.