Reinforced Concrete Core Shear Wall Design Example

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OBRIEN BENTLEY

Structural and Stress Analysis Routledge
The first of its kind, Designing Tall Buildings is an accessible reference that guides you through the fundamental principles of designing high-rises. Each chapter focuses on one theme central to tall-building design, giving you a comprehensive overview of the related architecture and structural engineering concepts. Mark P. Sarkisian provides clear definitions of technical terms and introduces important equations, to help you gradually develop your knowledge. Later chapters allow you to explore more complex applications, such as biomimicry. Projects drawn from Skidmore, Owings and Merrill’s vast catalog of built high-rises, many of which Sarkisian designed, demonstrate these concepts. This book advises you to consider the influence of a particular site’s geology, wind conditions, and seismicity. Using this contextual knowledge and analysis, you can determine what types of structural solutions are best suited for a tower on that site. You can then conceptualize and devise efficient structural systems that are not only safe, but also constructible and economical. Sarkisian also addresses the influence of nature in design, urging you to integrate structure and architecture for buildings of superior performance, sustainability, and aesthetic excellence.
A Comparison Between Finite Element Analysis and the Wide Arm Analogy for Lift Core Structure in Medium Rise Reinforced Concrete Shear Wall Building Presses inter Polytechnique
This volume contains the papers presented at IALCCE2018, the Sixth International Symposium on Life-Cycle Civil Engineering (IALCCE2018), held in Ghent, Belgium, October 28-31, 2018. It consists of a book of extended abstracts and a USB device with full papers including the Fazlur R. Khan lecture, 8 keynote lectures, and 390 technical papers from all over the world. Contributions relate to design, inspection, assessment, maintenance or optimization in the framework of life-cycle analysis of civil engineering structures and infrastructure systems. Life-cycle aspects that are developed and discussed range from structural safety and durability to sustainability, serviceability, robustness and resilience. Applications relate to buildings, bridges and viaducts, highways and runways, tunnels and underground structures, off-shore and marine structures, dams and hydraulic structures, prefabricated design, infrastructure systems, etc. During the IALCCE2018 conference a particular focus is put on the cross-fertilization between different sub-areas of expertise and the development of an overall vision for life-cycle analysis in civil engineering. The aim of the editors is to provide a valuable source of cutting edge information for anyone interested in life-cycle analysis and assessment in civil engineering, including researchers, practising engineers, consultants, contractors, decision makers and representatives from local authorities.
Design and Analysis of Tall and Complex Structures Taylor & Francis
Advances in Engineering Materials, Structures and Systems: Innovations, Mechanics and Applications comprises 411 papers that were presented at SEMC 2019, the Seventh International Conference on Structural Engineering, Mechanics and Computation, held in Cape Town, South Africa, from 2 to 4 September 2019. The subject matter reflects the broad scope of SEMC conferences, and covers a wide variety of engineering materials (both traditional and innovative) and many types of structures. The many topics featured in these Proceedings can be classified into six broad categories that deal with: (i) the mechanics of materials and fluids (elasticity, plasticity, flow through porous media, fluid dynamics, fracture, fatigue, damage, delamination, corrosion, bond, creep, shrinkage, etc); (ii) the mechanics of structures and systems (structural dynamics, vibration, seismic response, soil-structure interaction, fluid-structure interaction, response to blast and impact, response to fire, structural stability, buckling, collapse behaviour); (iii) the numerical modelling and experimental testing of materials and structures (numerical methods, simulation techniques, multi-scale modelling, computational modelling, laboratory testing, field testing, experimental measurements); (iv) innovations and special structures (nanostructures, adaptive structures, smart structures, composite structures, bio-inspired structures, shell structures, membranes, space structures, lightweight structures, long-span structures, tall buildings, wind turbines, etc); (v) design in traditional engineering materials (steel, concrete, steel-concrete composite, aluminium, masonry, timber, glass); (vi) the process of structural engineering (conceptualisation, planning, analysis, design, optimization, construction, assembly, manufacture, testing, maintenance, monitoring, assessment, repair, strengthening, retrofitting, decommissioning). The SEMC 2019 Proceedings will be of interest to civil, structural, mechanical, marine and aerospace engineers. Researchers, developers, practitioners and academics in these disciplines will find them useful. Two versions of the papers are available. Short versions, intended to be concise but self-contained summaries of the full papers, are in this printed book. The full versions of the papers are in the e-book.
The Behavior of Medium Rise Reinforce Concrete Shear Wall Building Subjected to Wind Load with Different Lift Core Position Springer Science & Business Media
This book discusses the impact of long-period ground motions on structural design using the situation in Bucharest, the capital city of Romania, as a case study. The first part explores the seismic hazard situation in Bucharest, and the causes of long-period ground motions related to both the source and the site. Subsequently, it examines the current seismic design, detailing building practices in Bucharest, and discusses the impact of long-period ground motions on seismic design. Lastly, several case study buildings in Bucharest are presented and the major difficulties encountered in their design are considered. The book also includes various numerical examples that help readers understand the impact of long-period ground motions on various structural systems, that are currently used in Bucharest. This book is intended for researchers in the field of seismic hazard and risk assessment and designers of multi-story buildings in seismic areas.
Recent Progress in Steel and Composite Structures Elsevier
This book gathers peer-reviewed contributions presented at the 3rd National Conference on Structural Engineering and Construction Management (SECON’19), held in Angamaly, Kerala, India, on 15-16 May 2019. The meeting served as a fertile platform for discussion, sharing sound knowledge and introducing novel ideas on issues related to sustainable construction and design for the future. The respective contributions address various aspects of numerical modeling and simulation in structural engineering, structural dynamics and earthquake engineering, advanced analysis and design of foundations, BIM, building energy management, and technical project management. Accordingly, the book offers a valuable, up-to-date tool and essential overview of the subject for scientists and practitioners alike, and will inspire further investigations and research.
Seismic Rehabilitation of Existing Buildings CRC Press
This classic and essential work has been thoroughly revised and updated in line with the requirements of new codes and standards which have been introduced in recent years, including the new Eurocode as well as up-to-date British Standards. It provides a general introduction along with details of analysis and design of a wide range of structures and examination of design according to British and then European Codes. Highly illustrated with numerous line diagrams, tables and worked examples, Reynolds's Reinforced Concrete Designer's Handbook is a unique resource providing comprehensive guidance that enables the engineer to analyze and design reinforced concrete buildings, bridges, retaining walls, and containment structures. Written for structural engineers, contractors, consulting engineers, local and health authorities, and utilities, this is also excellent for civil and architecture departments in universities and FE colleges.
Structures in the New Millennium Elsevier
Standard ASCE/SEI 41-06 presents the latest generation of performance-based seismic rehabilitation methodology.
Tall Building Design John Wiley & Sons
This book offers a collection of 17 scientific papers about the computational modeling of fracture. Some of the manuscripts propose new computational methods and/or how to improve existing cutting edge methods for fracture. These contributions can be classified into two categories: 1. Methods which treat the crack as strong discontinuity such as peridynamics, scaled boundary elements or specific versions of the smoothed finite element methods applied to fracture and 2. Continuous approaches to fracture based on, for instance, phase field models or continuum damage mechanics. On the other hand, the book also offers a wide range of applications where state-of-the-art techniques are employed to solve challenging engineering problems such as fractures in rock, glass, concrete. Also, larger systems such as fracture in subway stations due to fire, arch dams, or concrete decks are studied.
Reinforced Concrete Designer's Handbook CRC Press
Addresses the Question Frequently Proposed to the Designer by Architects: "Can We Do This? Offering guidance on how to use code-based procedures while at the same time providing an understanding of why provisions are necessary, Tall Building Design: Steel, Concrete, and Composite Systems methodically explores the structural behavior of steel, concrete, and composite members and systems. This text establishes the notion that design is a creative process, and not just an execution of framing proposals. It cultivates imaginative approaches by presenting examples specifically related to essential building codes and standards. Tying together precision and accuracy—it also bridges the gap between two design approaches—one based on initiative skill and the other based on computer skill. The book explains loads and load combinations typically used in building design, explores methods for determining design wind loads using the provisions of ASCE 7-10, and examines wind tunnel procedures. It defines conceptual seismic design, as the avoidance or minimization of problems created by the effects of seismic excitation. It introduces the concept of performance-based design (PBD). It also addresses serviceability considerations, prediction of tall building motions, damping devices, seismic isolation, blast-resistant design, and progressive collapse. The final chapters explain gravity and lateral systems for steel, concrete, and composite buildings. The Book Also Considers: Preliminary analysis and design techniques The structural rehabilitation of seismically vulnerable steel and concrete buildings Design differences between code-sponsored approaches The concept of ductility trade-off for strength Tall Building Design: Steel, Concrete, and Composite Systems is a structural design guide and reference for practicing engineers and educators, as well as recent graduates entering the structural engineering profession. This text examines all major concrete, steel, and composite building systems, and uses the most up-to-date building codes.
Reinforced Concrete Design of Tall Buildings Wiley
The structural challenges of building 800 metres into the sky are substantial, and include several factors which do not affect low-rise construction. This book focusses on these areas specifically to provide the architectural and structural knowledge which must be taken into account in order to design tall buildings successfully. In presenting examples of steel, reinforced concrete, and composite structural systems for such buildings, it is shown that wind load has a very important effect on the architectural and structural design. The aerodynamic approach to tall buildings is considered in this context, as is earthquake induced lateral loading. Case studies of some of the world’s most iconic buildings, illustrated with full colour photographs, structural plans and axonometrics, will bring to life the design challenges which they presented to architects and structural engineers. The Empire State Building, the Burj Khalifa, Taipei 101 and the HSB Turning Torso are just a few examples of the buildings whose real-life specifications are used to explain and illustrate core design principles, and their subsequent effect on the finished structure.
Applied Mechanics Reviews Springer Nature
Along the west coast of the United States, reinforced concrete core wall systems are commonly selected as seismic force resisting systems for tall buildings. During strong ground shaking, core wall systems are intended to dissipate energy by yielding of coupling beams, followed by flexural yielding at the wall base. Although the wall behavior is governed by flexure, the wall design is often governed by shear, as the walls experience high shear demands, usually up to the ACI318-11 code limiting shear stress of 8 (f'c) psi over a significant wall height. The high shear demands are due to a lack of redundancy in tall buildings, as the wall lengths are limited to the perimeter of the elevator core. Design of tall buildings is typically conducted using performance-based design procedures recommended by Los Angeles Tall Buildings Structural Design Council (LATBSDC, 2014) or Pacific Earthquake Engineering Research Center Tall Buildings Initiative (PEER TBI, 2010). Provisions in these two documents recommend shear design per acceptance criterion Fuc i Fn,e, where Fuc is 1.5 times the mean shear demand resulting from a suite of ground motions, Fn,e is the nominal strength computed from expected material properties, i is the risk reduction factor based on risk categories, and is the uncertainty in Fn,e. The 1.5 factor applied to the mean shear demand is referred to as the demand factor, . Although shear failure can be fatal due to its sudden and brittle nature, the reliability of this shear design acceptance criterion has not yet been thoroughly researched. To assess seismic reliability of structural wall shear design acceptance criterion, dispersion in structural responses, specifically for shear demands, must be quantified. Dispersion in structural responses (referred to as engineering demand parameters, EDPs) primarily results from three sources, namely, record-to-record (RTR) variability, modeling and/or model parameter uncertainties, and design uncertainties. To study how these uncertainties contribute to dispersion in tall building EDPs, eleven input random variables (expected to be the most relevant) were selected. Specifically, uncertainties in scaled ground motions, unconfined and confined concrete compressive strengths, reinforcing

steel yield strength, shear modulus, coupling beam strength, seismic mass, dead and live gravity loads, damping, and shear wall design variations were considered. A series of 20 and 30-story nonlinear models for reinforced-concrete core wall systems were built and Monte Carlo simulations were utilized to assign values for random variables and to perform nonlinear response history analyses. Analyses were performed at five seismic hazard levels corresponding to return periods of 25, 43, 475, 2495, and 4975 years, until an adequate convergence in dispersion measure was reached. Selected EDPs (base shear, roof drifts, coupling beam rotations, and structural wall boundary element axial strains) were evaluated and statistical parameters were quantified. Results show that dispersion in EDPs was the largest for coupling beam rotations and shear wall axial strains. Total dispersion, measured in coefficient of variation, ranged between 0.15 and 0.85, considering all EDPs at all five hazard levels. The relative contributions from RTR variability and model parameter/design uncertainties accounted for 72-98% and 2-28% of the total dispersion, respectively. Fitted probability distributions were either normal or lognormal for all EDPs and using correlated random variables for model parameter uncertainties resulted in changes in dispersion of -6% to 5% compared with using independent random variables. Using the measured dispersion values, the current recommendations in Los Angeles Tall Buildings Structural Design Council (LATBSDC, 2014) were reviewed for shear design of structural walls in tall reinforced-concrete core wall buildings (Fuc i Fn,e). Both closed-form solutions using full distribution methods and Monte Carlo simulation results were used to assess reliability of the current shear design acceptance criterion. Statistical parameters were established for shear demand by using measured dispersion values from nonlinear response history analyses of tall reinforced-concrete core wall buildings, and experimental test results from shear-controlled walls were used to establish statistical parameters for shear capacity. A range of reliability results were computed for various shear demand and capacity statistical parameters. The current shear design acceptance criterion using =1.5 and =1.0 resulted in 94.2% reliability for structural walls with f'c

Computational Methods for Fracture Routledge

This second edition of Designing Tall Buildings, an accessible reference to guide you through the fundamental principles of designing high-rises, features two new chapters, additional sections, 400 images, project examples, and updated US and international codes. Each chapter focuses on a theme central to tall-building design, giving a comprehensive overview of the related architecture and structural engineering concepts. Author Mark Sarkisian, PE, SE, LEED® AP BD+C, provides clear definitions of technical terms and introduces important equations, gradually developing your knowledge. Projects drawn from SOM’s vast portfolio of built high-rises, many of which Sarkisian engineered, demonstrate these concepts. This book advises you to consider the influence of a particular site's geology, wind conditions, and seismicity. Using this contextual knowledge and analysis, you can determine what types of structural solutions are best suited for a tower on that site. You can then conceptualize and devise efficient structural systems that are not only safe, but also constructible and economical. Sarkisian also addresses the influence of nature in design, urging you to integrate structure and architecture for buildings of superior performance, sustainability, and aesthetic excellence.

Tall Buildings Amer Society of Civil Engineers

Covering the broad spectrum of modern structural engineering topics, the Handbook of Structural Engineering is a complete, single-volume reference. It includes the theoretical, practical, and computing aspects of the field, providing practicing engineers, consultants, students, and other interested individuals with a reliable, easy-to-use source of information. Divided into three sections, the handbook covers:

Impact of Long-Period Ground Motions on Structural Design: A Case Study for Bucharest, Romania MDPI

"In order to reduce the seismic risk facing many densely populated regions worldwide, including Canada and the United States, modern earthquake engineering should be more widely applied. But current literature on earthquake engineering may be difficult to grasp for structural engineers who are untrained in seismic design. In addition no single resource addressed seismic design practices in both Canada and the United States until now. Elements of Earthquake Engineering and Structural Dynamics was written to fill the gap. It presents the key elements of earthquake engineering and structural dynamics at an introductory level and gives readers the basic knowledge they need to apply the seismic provisions contained in Canadian and American building codes."--Résumé de l'éditeur.

Life Cycle Analysis and Assessment in Civil Engineering: Towards an Integrated Vision Springer

Topics covered within this set of conference proceedings include: structural analysis - theory and methods; structural design - concept, technique and codes of practice; structural forms - concept and application; and construction of structures.

Reinforced Concrete Shear Walls with Welded Wire Grids as Boundary Element Transverse Reinforcement CRC Press

The third edition of the popular Structural and Stress Analysis provides the reader with a comprehensive introduction to all types of structural and stress analysis. Starting with an explanation of the basic principles of statics, the book proceeds to normal and shear force, and bending moments and torsion. Building on the success of the prior edition, this edition features new material on structural dynamics and fatigue, and additional discussion of Eurocode compliance in design of beams. With worked examples, practice problems, and extensive illustrations, this book provides an all-in-one resource for students and professionals interested in learning structural analysis. Comprehensive overview of structural and stress analysis Numerous worked examples and end-of-chapter problems Extensively illustrated to help visualize concepts

Architecture and Construction in Steel CRC Press

Topics in Modal Analysis & Testing, Volume 8: Proceedings of the 37th IMAC, A Conference and Exposition on Structural Dynamics, 2019, the eighth volume of eight from the Conference brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Modal Analysis, including papers on: Analytical Methods Modal Applications Basics of Modal Analysis Experimental Techniques Multi Degree of Freedom Testing Boundary Conditions in Environmental Testing Operational Modal Analysis Modal Parameter Identification Novel Techniques

Tall Buildings Butterworth-Heinemann

The proceedings of the conference is going to benefit the researchers, academicians, students and professionals in getting enlightened on latest technologies on structural mechanics, structure and infrastructure engineering. Further, work on practical applications of developed scientific methodologies to civil structural engineering will make the proceedings more interesting and useful to practicing engineers and structural designers.

Simplified Design of Concrete Structures Routledge

This book provides a comprehensive guide to the successful use of steel in building and will form a unique source of inspiration and reference for all those concerned with architecture in steel.

Seismic Response Assessment of Thin Boundary Elements of Special Concrete Shear Walls CRC Press

Damage observed near the base of shear walls of reinforced concrete buildings after the Chile (2010) and New Zealand (2011) earthquakes are signs of shortcomings in the design of walls that need to be addressed. This investigation presents results of an experimental test program on ten reinforced concrete rectangular prisms representative of the flexural compression zone of flanged shear walls. The tested elements have transverse reinforcement detailing that matches or exceeds modern code requirements for special boundary elements. The main test variables were the amount and spacing (both vertical and horizontal) of the hoop and crosstie reinforcement. The elements were subjected to monotonically increasing axial compression until failure. Effects of strain gradient (both through the wall length and along the wall height) and effects of wall shear are not represented in the present tests. Nonetheless, the axial compression tests provide insights into the behavioral characteristics of actual wall boundaries. The global force shortening behavior of the specimens was commanded by a thin core which integrity was heavily compromised due to cover spalling, rebar buckling and out-of-plane instability. Measured load-displacement relations did not exhibit an acceptable ductile behavior suggesting that current building code requirements for special boundary elements do not necessarily achieve effective confinement to be protected against brittle axial failure. Enhanced detailing (increasing the volumetric ratio of confinement reinforcement and decreasing its horizontal spacing) improved behavior but did not produce ductile response in all cases. Reported damage extension concentrated over length corresponding to two-and-half times the thickness of the specimens. Compressive strain limits for stable behavior are proposed to be function of the gage length over which they are measured. Bar buckling reduced the load carrying capacity of the reinforced concrete prisms because of the strength loss suffered by the longitudinal reinforcement, but also because it prevented the effective confinement of the concrete core. An experimental campaign comprising 48 analytical specimens allowed studying the relationship between tie spacing and stiffness, and the diameter of the longitudinal bars, that influenced their response when undergoing lateral instability (inelastic buckling). The behavior of tied bars undergoing lateral instability in the inelastic range is highly influenced by the relative restrictive tie spacing over which bar buckling is forced into, and the relative stiffness of the transverse ties and the longitudinal bar. The experiments assume a rigid contact between the bar and the tie, therefore hook opening is not modeled. For the range of tie stiffness and bar geometries tested, the results indicate that the tie spacing has to be smaller than 4.5 times the bar diameter to prevent bar buckling over a large range of plastic axial strains. Empirical core stress strain curves, accounting for bar buckling, are reported for point wise strain measurements, as well as for average axial strains recorded within the damaged region. The results show that usable strain limits, to guarantee a stable core response in pure compression, are between 1.1 and 2.0%. Average empirical core stress strain curves are proposed for modeling purposes. Implication of the compressive strain limits observed are evaluated in a hazard-consistent manner by means of the Conditional Scenario Spectra (CSS). The CSS is a set of realistic earthquake spectra with assigned rates of occurrence that reproduce the hazard at a site. Structural responses are obtained by means of numerical analysis of a multistory shear wall under the seismic demand of more than eight-hundred ground motions consistent with the CSS. The case study allows estimating risk curves to evaluate the likelihood of exceeding certain threshold compressive strains in the boundary of the cross section. The single case numerical model showed that the limited strain capacity of these elements is only likely to negatively impact the behavior of the wall system at risk levels beyond the code-based expectations of good behavior.