

Reinforced Concrete Shear Wall Analysis And Design

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Performance-Based Assessment and Design of Squat Reinforced Concrete Shear Walls

Keywords: Performance-based designs. Shear-critical squat walls. Reinforced concrete (RC). Nuclear power plants (NPP). Databases. Experimental tests. Peak shear strength. Predictions. Finite element

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Reinforced Concrete Shear Wall Analysis And Design

Reinforced concrete shear wall analysis and design is a critical aspect of structural engineering that ensures buildings can withstand lateral forces, such as those from wind and earthquakes. As urban areas grow and structures become taller, the need for robust systems to resist these forces becomes increasingly important. This article will delve into the principles, methodologies, and considerations involved in the analysis and design of reinforced concrete shear walls, providing a comprehensive guide for engineers and architects alike.

Understanding Shear Walls

Shear walls are vertical structural elements that provide lateral stability to buildings. They are typically made from reinforced concrete and are designed to resist shear forces that arise from lateral loads.

Types of Shear Walls

There are several types of shear walls, each serving a specific purpose in the structural system:

- **Structural Shear Walls:** These walls carry both vertical and lateral loads and are integral to the building's stability.
- **Non-Structural Shear Walls:** Primarily used for lateral support, these walls do not significantly contribute to vertical load-bearing.
- **Core Walls:** Often located at the center of a building, these walls provide maximum stiffness and strength, especially in high-rise structures.
- **Boundary Shear Walls:** Positioned along the edges of the building, these walls help in controlling lateral deformation.

Importance of Shear Wall Analysis

The analysis of shear walls is vital for ensuring the safety and durability of a structure. The following factors highlight its importance:

1. **Earthquake Resistance:** Shear walls are essential in seismic design, helping to prevent structural failure during earthquakes.
2. **Wind Load Resistance:** In tall buildings, shear walls counteract the forces exerted by high winds.
3. **Stability and Serviceability:** Proper analysis ensures the structure remains stable under various loading conditions and maintains acceptable serviceability limits.
4. **Material Efficiency:** Analyzing shear walls helps optimize the use of materials, reducing costs while maintaining structural integrity.

Methods of Shear Wall Analysis

There are several analytical methods used in the analysis of shear walls, each suited to different scenarios:

1. Simplified Methods

Simplified methods are often used for preliminary design and consist of:

- **Equivalent Lateral Force Method:** This method distributes lateral forces to the

shear walls based on their stiffness and height.

- **Static Analysis:** Simplifies the problem by treating the structure as a static system, ignoring dynamic effects.

2. Dynamic Analysis

Dynamic analysis is essential for structures subjected to variable loads, particularly in seismic regions. This includes:

- **Response Spectrum Analysis:** Evaluates how the structure responds to various frequencies of ground motion.
- **Time History Analysis:** Simulates the response of the structure to recorded earthquake data over time.

3. Finite Element Method (FEM)

Finite Element Method is a numerical technique that allows for a detailed analysis of shear walls, taking into account:

- Complex geometries and load distributions.
- Material nonlinearity, including cracking and yielding.
- Interactions with other structural components.

Design Considerations for Shear Walls

When designing reinforced concrete shear walls, several factors must be considered to ensure safety and compliance with building codes:

1. Material Properties

The strength and durability of materials used in shear wall construction are crucial. Key material properties to consider include:

- **Concrete Strength:** The compressive strength of concrete typically used in shear walls is between 25 MPa to 40 MPa.
- **Reinforcement Steel:** The yield strength of steel reinforcement should comply with standards, often around 415 MPa or higher.

2. Structural Configuration

The configuration of shear walls affects their performance. Important considerations include:

- **Wall Thickness:** Thicker walls provide greater stiffness and strength but can

increase costs.

- **Aspect Ratio:** The height-to-width ratio influences the wall's ability to resist lateral loads.
- **Opening Locations:** Windows and doors can weaken shear walls; their placement should be carefully planned.

3. Load Combinations

Designers must consider various load combinations to ensure the wall can withstand different conditions, including:

- **Dead Loads:** The permanent loads from the structure itself.
- **Live Loads:** Variable loads from occupancy and use.
- **Wind and Seismic Loads:** Lateral loads that can significantly impact the wall's performance.

Design Codes and Standards

Adhering to recognized design codes and standards is essential for the successful design of shear walls. Some of the most widely used codes include:

- **American Concrete Institute (ACI) 318:** Provides guidelines for the design and construction of structural concrete.
- **International Building Code (IBC):** Sets forth minimum design and construction standards for buildings.
- **Eurocode 2:** A European standard addressing the design of concrete structures.

Conclusion

In conclusion, **reinforced concrete shear wall analysis and design** is a complex but crucial aspect of modern structural engineering. Understanding the types of shear walls, analysis methods, design considerations, and relevant codes ensures that engineers can create safe, durable, and efficient structures. As urbanization continues to rise, the importance of effective shear wall design will only grow, making it essential for professionals in the field to stay informed about best practices and innovations in the industry. By mastering these principles, engineers can contribute significantly to the resilience and safety of our built environment.

Frequently Asked Questions: Reinforced Concrete Shear Wall Analysis And Design

Question	Answer
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What is the primary purpose of a reinforced concrete shear wall in a building?	The primary purpose of a reinforced concrete shear wall is to resist lateral forces, such as wind and seismic loads, thereby providing structural stability and preventing excessive deformation in buildings.
What are the key factors to consider in the analysis of shear walls?	Key factors include the wall's aspect ratio, material properties, boundary conditions, load characteristics, and the distribution of reinforcement within the wall.
How do different loading conditions affect the design of shear walls?	Different loading conditions, such as axial loads, lateral loads, and moments, influence the required thickness, reinforcement detailing, and overall geometry of shear walls to ensure adequate performance under expected loads.
What is the significance of the aspect ratio in shear wall design?	The aspect ratio, defined as the height-to-width ratio of the shear wall, significantly affects its capacity to resist lateral forces; walls with a higher aspect ratio tend to behave more flexibly, while those with a lower ratio behave more rigidly.
What are common methods used for the analysis of reinforced concrete shear walls?	Common methods include linear elastic analysis, nonlinear static analysis (pushover analysis), and dynamic analysis methods, such as response spectrum analysis and time-history analysis.
How can advancements in technology improve shear wall design and analysis?	Advancements such as finite element modeling, computer-aided design (CAD) software, and Building Information Modeling (BIM) enable more accurate simulations, optimizations, and enhanced visualization of shear wall behavior under various loading conditions.

Reinforced Concrete Shear Wall Analysis And Design

Reinforced Concrete Shear Wall Analysis and Design: A Comprehensive Guide **reinforced concrete shear wall analysis and design** is a critical aspect of modern structural engineering, especially in the construction of high-rise buildings and earthquake-resistant structures. These walls serve as essential lateral force-resisting elements, helping structures withstand wind loads, seismic forces, and other lateral stresses. Understanding the principles behind their analysis and design not only ensures safety but also enhances the durability and economic efficiency of a building. In this article, weâ€™ll dive deep into

the world of reinforced concrete shear walls, exploring their function, behavior under loads, analytical methods, and design considerations. Whether you're a practicing engineer, a student, or an enthusiast, this guide aims to provide practical insights into the nuances of shear wall systems.

What Are Reinforced Concrete Shear Walls?

Reinforced concrete shear walls are vertical structural elements made of concrete and steel reinforcement designed primarily to resist lateral forces. Unlike regular walls, which mainly carry gravity loads, shear walls are specifically engineered to handle horizontal loads caused by wind, earthquakes, or other dynamic forces. Their stiffness and strength make them indispensable in buildings where lateral stability is crucial. These walls act similarly to deep beams, transferring lateral forces down to the foundation, preventing excessive sway and potential collapse. Because of their strategic importance, the analysis and design of these walls require careful consideration of materials, geometry, and load paths.

Importance of Shear Wall Analysis in Structural Engineering

Analyzing reinforced concrete shear walls accurately is fundamental to ensuring that a building can endure the stresses it encounters throughout its lifespan. The behavior of a shear wall under lateral loads is complex due to factors such as cracking, nonlinear material behavior, and interaction with other structural elements. Proper analysis helps engineers:

- Predict deflections and deformations accurately.
- Evaluate stress distribution within the wall and reinforcement.
- Determine failure modes such as flexural, shear, or sliding failures.
- Optimize the amount and placement of reinforcement.
- Ensure compliance with building codes and safety standards.

Without rigorous analysis, shear walls may either be overdesigned—leading to unnecessary costs—or under-designed, risking structural failure.

Key Parameters in Reinforced Concrete Shear Wall Analysis

Several parameters influence the performance of reinforced concrete shear walls. Understanding these factors is essential before commencing design and analysis.

1. Geometry and Dimensions

The thickness, height, and length of a shear wall significantly affect its stiffness and strength. Thicker walls generally provide higher shear capacity but at increased material cost and weight. The aspect ratio (height to length) also influences the wall's behavior; slender walls may be prone to buckling or flexural failure.

2. Material Properties

Concrete compressive strength and the yield strength of reinforcing steel directly impact the wall's capacity. Additionally, concrete's tensile strength, though minimal, is considered when evaluating cracking behavior.

3. Reinforcement Layout

The arrangement and amount of longitudinal and transverse reinforcement control the ductility and strength of the wall. Vertical bars resist flexural stresses, while horizontal ties or stirrups help prevent shear failure and control crack widths.

4. Load Characteristics

Lateral loads from wind or seismic activity vary in magnitude and direction. Dynamic loads, especially from earthquakes, require special analysis techniques like time-history or response spectrum analysis to capture the wall's response accurately.

Analytical Methods for Shear Wall Design

Several approaches exist for analyzing reinforced concrete shear walls, ranging from simplified empirical methods to advanced numerical simulations.

Simplified Equivalent Frame Method

This method idealizes the shear wall as a series of beam and column elements connected to form a frame. It allows engineers to estimate bending moments, shear forces, and axial loads using traditional frame analysis techniques. While less precise than nonlinear methods, it is widely used in preliminary design stages.

Finite Element Analysis (FEA)

FEA provides a detailed understanding of stress distribution and deformation by dividing the shear wall into small elements. This technique accounts for material nonlinearities, cracking, and complex boundary conditions. Although computationally intensive, FEA is becoming increasingly accessible due to advances in software and computing power.

Elastic and Inelastic Analysis

- Elastic analysis assumes the wall behaves linearly up to failure and is useful for serviceability checks.
- Inelastic analysis considers plastic deformations and energy dissipation, essential for seismic design. It helps predict ultimate capacity and failure modes more realistically.

Design Considerations for Reinforced Concrete Shear Walls

Designing a shear wall requires balancing strength, stiffness, ductility, and constructability. Here are some critical factors to consider:

Flexural and Shear Strength

The wall must be capable of resisting bending moments and shear forces induced by lateral loads. Reinforcement is designed to ensure adequate flexural strength, while transverse reinforcement (stirrups or ties) is provided to enhance shear capacity.

Ductility and Energy Dissipation

In seismic regions, ductility is vital to allow the wall to undergo significant deformations without sudden failure. This is achieved by detailing reinforcement to prevent brittle failure modes and by providing confinement to the concrete core.

Crack Control and Serviceability

Controlling crack widths is essential to maintain durability and aesthetics. Proper reinforcement spacing and concrete cover help limit cracking under service loads.

Interaction with Other Structural Elements

Shear walls often work in conjunction with beams, slabs, and columns. Their connections must be designed to transfer forces effectively without causing stress concentrations or failures.

Practical Tips for Effective Shear Wall Design

- **Optimize wall placement:** Positioning shear walls strategically around a building's perimeter or core improves overall stability.
- **Use high-strength materials:** Enhancing concrete and steel grades can increase capacity without excessively thick walls.
- **Incorporate openings carefully:** Doors and windows reduce shear capacity; their size and location must be considered during design.
- **Consider construction tolerances:** Accurate placement of reinforcement and concrete casting affects performance.
- **Follow relevant codes:** Standards like ACI 318, Eurocode 2, and IS 13920 provide guidelines for safe and efficient design.

Common Challenges in Reinforced Concrete Shear Wall Analysis and Design

- Engineers often encounter difficulties such as: - Accurately modeling nonlinear behavior and cracking.
- Balancing stiffness and ductility, especially in seismic zones.

Accommodating architectural requirements without compromising structural integrity. - Ensuring quality control during construction to achieve design intent. Addressing these challenges requires a combination of experience, careful planning, and use of advanced analytical tools.

Future Trends in Shear Wall Design

With the growing demand for taller and more resilient structures, innovations in reinforced concrete shear wall design are evolving: - **Performance-based design:** Moving beyond prescriptive codes to designs tailored to specific hazard levels. - **Use of fiber-reinforced polymers (FRP):** To strengthen existing walls or reduce reinforcement congestion. - **Integration with smart monitoring systems:** Embedding sensors to track wall performance in real-time. - **Advanced materials:** Incorporating ultra-high-performance concrete (UHPC) for thinner, stronger walls. These advancements promise more efficient, sustainable, and safer building designs. Understanding and mastering reinforced concrete shear wall analysis and design is crucial for any structural engineer aiming to create resilient buildings that stand the test of time and nature's forces. With the right blend of theory, practical knowledge, and innovative tools, engineers can confidently tackle the complexities of shear wall systems and contribute to safer urban environments.

Alternative Description: Reinforced Concrete Shear Wall Analysis And Design

Reinforced Concrete Shear Wall Analysis and Design: A Comprehensive Review
reinforced concrete shear wall analysis and design serves as a cornerstone in modern structural engineering, particularly for high-rise buildings and seismic-resistant constructions. This method combines the compressive strength of concrete with the tensile capacity of steel reinforcement to create walls capable of withstanding lateral forces induced by wind, earthquakes, and other dynamic loads. As urban development trends push architecture towards taller and more slender structures, understanding the intricacies of shear wall behavior becomes critical for both safety and economic efficiency.

Fundamentals of Reinforced Concrete Shear Wall Analysis and Design

At its core, reinforced concrete shear wall analysis and design revolves around assessing the wall's capacity to resist lateral loads without excessive deformation or failure. Shear walls function primarily as vertical cantilever beams embedded in the building's foundation, absorbing horizontal forces that might otherwise cause structural instability. The analysis phase involves evaluating the wall's stress distribution under various load

combinations, including dead loads, live loads, seismic forces, and wind pressures. Advanced computational methods such as finite element modeling (FEM) have become standard in capturing the non-linear behavior of shear walls, enabling engineers to predict cracking, yielding of reinforcement, and potential failure modes with greater accuracy than traditional analytical methods.

Load Types and Their Impact on Shear Wall Performance

Reinforced concrete shear walls are subjected to a complex interplay of forces:

- **Lateral Loads:** These include seismic and wind forces, which impose shear and bending stresses on the wall.
- **Axial Loads:** Vertical loads from the building's own weight and live occupancy can influence the wall's stiffness and strength.
- **Torsional Effects:** Irregular building layouts can induce twisting forces on shear walls, complicating the analysis.

Understanding how these loads interact is essential for accurate modeling, as the combined stresses often lead to failure modes that singular load considerations might overlook.

Design Considerations and Methodologies

Designing reinforced concrete shear walls requires balancing structural integrity, ductility, and constructability. Several design codes, such as ACI 318, Eurocode 2, and IS 456, provide guidelines for minimum reinforcement ratios, detailing requirements, and strength checks.

Reinforcement Detailing

One of the most critical aspects of shear wall design is reinforcement detailing, which directly influences ductility and energy dissipation during seismic events. Longitudinal reinforcement bars resist tensile stresses generated by bending, while horizontal ties or stirrups confine the concrete core, enhancing shear capacity and preventing buckling of vertical bars. Proper anchorage length and spacing of reinforcement are vital to avoid premature failure. For example, densely spaced ties at critical regions such as the base and wall ends help in resisting shear cracks and improving post-yield behavior.

Thickness and Geometry

The thickness of the shear wall impacts both strength and stiffness. Thicker walls provide higher load capacity but increase material cost and reduce usable floor space. Conversely, slender walls are more economical but may require additional reinforcement or coupling

with other structural elements to maintain stability. Wall length and height also play a role in lateral stiffness. Taller walls experience higher moments and must be designed to prevent buckling and excessive drift. Engineers often use coupled shear walls connected by beams or slabs to improve overall building performance.

Analytical Techniques and Tools

Modern reinforced concrete shear wall analysis leverages computational tools to simulate real-world behavior under complex loading conditions.

Finite Element Analysis (FEA)

FEA divides the wall into small elements, enabling detailed stress-strain evaluation. Non-linear material models capture concrete cracking, steel yielding, and post-peak softening, allowing for realistic predictions of failure mechanisms.

Equivalent Frame Models

These simplified models represent the shear wall as a combination of beams and columns, reducing computational demand while preserving key behavioral characteristics. Equivalent frame analysis is especially popular in preliminary design stages or when dealing with large-scale structures.

Challenges in Reinforced Concrete Shear Wall Analysis and Design

Despite advancements, several challenges persist in the effective design of shear walls:

- **Seismic Performance:** Achieving the right balance between strength and ductility is complex, especially in regions with high seismicity.
- **Material Variability:** Concrete and steel properties can vary due to manufacturing and environmental conditions, affecting reliability.
- **Construction Quality:** Improper placement of reinforcement or inadequate concrete compaction can lead to weaknesses not accounted for in design.
- **Modeling Limitations:** Simplifications made in analytical models may overlook localized effects such as stress concentrations near openings or irregularities.

Addressing these issues requires rigorous quality control and iterative design processes supported by testing and validation.

Comparative Analysis: Shear Walls vs. Other Lateral Force Resisting

Systems

When compared to alternatives like braced frames or moment-resisting frames, reinforced concrete shear walls offer higher stiffness and strength, resulting in reduced lateral displacements. This advantage is particularly pronounced in high-rise buildings where minimizing drift is essential for occupant comfort and structural safety. However, shear walls can be less flexible architecturally, limiting the placement of openings like windows and doors. Additionally, their mass contributes to higher seismic inertial forces, necessitating careful design to avoid excessive seismic demands.

Emerging Trends and Innovations

The field of reinforced concrete shear wall analysis and design is evolving with the integration of new materials and technologies:

- **Fiber-Reinforced Polymers (FRP):** Used for retrofitting and strengthening existing shear walls, FRP wraps enhance shear capacity without significant weight addition.
- **Performance-Based Design:** Moving beyond prescriptive codes, this approach tailors designs to specific performance goals under defined hazard levels.
- **Smart Materials and Sensors:** Embedding sensors within shear walls allows real-time monitoring of stresses and cracks, facilitating proactive maintenance.
- **Advanced Simulation Software:** AI-driven modeling tools improve prediction accuracy and optimize reinforcement layouts for cost-effectiveness.

Such innovations not only improve safety but also contribute to sustainable construction practices by optimizing material usage. Reinforced concrete shear wall analysis and design remains an indispensable discipline within structural engineering, combining fundamental principles with cutting-edge technologies to meet the demands of modern infrastructure. Continuous research and practical experience are essential to refine methods, overcome challenges, and adapt to evolving architectural and environmental requirements.

Frequently Asked Questions: Reinforced Concrete Shear Wall Analysis And Design

Question	Answer
What is the primary function of a reinforced concrete shear wall in a building structure?	The primary function of a reinforced concrete shear wall is to resist lateral forces such as wind and seismic loads, thereby providing stability and preventing excessive lateral displacement in a building structure.

Which factors are critical in the analysis of reinforced concrete shear walls?	Critical factors in the analysis include the wall's geometry (height, length, thickness), material properties (concrete strength, reinforcement yield strength), boundary conditions, load types (lateral and axial loads), and the interaction between axial load and bending moments.
How does the aspect ratio of a shear wall influence its design and performance?	The aspect ratio (height to length) affects the wall's stiffness and failure mode. Walls with low aspect ratios typically behave as flexural elements, while those with high aspect ratios may behave as slender shear walls susceptible to buckling and shear failure, influencing the reinforcement detailing and design approach.
What design codes are commonly used for reinforced concrete shear wall analysis and design?	Common design codes include ACI 318 (American Concrete Institute), Eurocode 2, IS 13920 and IS 456 (Indian Standards), and AS 3600 (Australian Standards), which provide guidelines for material properties, load combinations, detailing, and strength requirements.
What role does reinforcement detailing play in the seismic performance of reinforced concrete shear walls?	Proper reinforcement detailing ensures ductility, energy dissipation capacity, and prevents brittle failure modes during seismic events. This includes adequate confinement reinforcement, proper anchorage, spacing of ties, and ensuring continuity of vertical and horizontal reinforcements.
Which analysis methods are used for reinforced concrete shear wall design under seismic loads?	Analysis methods include linear static (equivalent lateral force) analysis, linear dynamic (response spectrum) analysis, and nonlinear static (pushover) and nonlinear dynamic time-history analyses, with the choice depending on the complexity of the structure and seismic demand.

Related Keywords: Reinforced Concrete Shear Wall Analysis And Design

- reinforced concrete design
- shear wall analysis
- structural engineering
- seismic design
- lateral load resistance
- concrete strength
- finite element analysis
- earthquake engineering
- structural stability

- load bearing walls

The Ultimate Guide to Digital Book Reinforced Concrete Shear Wall Analysis And Design — In-Depth Handbook

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Chapter 9: Balancing eBooks with Physical Books

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Chapter 10: Overcoming Common Challenges — Eye Strain, Distraction, and Retention

Digital reading introduces challenges: prolonged screen time can cause eye strain, while devices often invite distractions. Employ practical techniques: set brightness and font size for comfort, use e-ink devices for long reading sessions, and adopt the 20-20-20 rule (every 20 minutes look at something 20 feet away for 20 seconds).

To reduce distraction, switch device notifications to Do Not Disturb during reading sessions or use dedicated e-reader apps without extra features. For retention, write summaries, highlight key passages, and discuss ideas with peers or online groups. These practices turn passive reading into active learning.

Chapter 11: Designing a Sustainable Reading Routine

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eBooks are a powerful tool for continuous professional development. Many technical fields now publish digital-first manuals, practical guides, and case studies. Use curated reading

lists, microlearning eBooks, and modular content to build targeted skills over weeks and months rather than relying solely on lengthy courses.

Pair reading with practice: when learning a new programming language, follow along with code examples; when studying leadership, apply frameworks in real workplace scenarios. eBooks combined with action create measurable progress.

Chapter 14: Emerging Trends — Interactive eBooks, AI, and Gamification

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Conclusion: Integrating eBook Reinforced Concrete Shear Wall Analysis And Design into a Meaningful Reading Life

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reinforced concrete shear wall building is presented to illustrate pressure vs time curve which the building is designed to 19 9 08 EM 1110 345 419 DESIGN EXAMPLE ONE STORY SHEAR WALL BUILDING 9 08 GENERAL a Statement of Problem

1992-03-20 Forty scientists working in 13 different countries detail in this work the most recent advances in seismic design and performance assessment of reinforced concrete buildings. It is a valuable contribution in the mitigation of natural disasters. Workshop on Nonlinear Seismic Analysis of Reinforced Concrete Buildings Bled Slovenia Yugoslavia 13 16 July 1992 P Fajfar H Krawinkler LABORATORY TESTING AND MATHEMATICAL MODELING OF RC COUPLED SHEAR WALL SYSTEM FOR NONLINEAR

1974 Analysis of Coupled Shear Walls Jrnl of the ACI Proc V 59 No 8 Aug 1962 Benjamin J R Statically Indeterminate Structures McGraw Hill 1969 Benjamin J R and Williams H A Shear Walls of Uniform 89

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2009-12-14 An exploration of the world of concrete as it applies to the construction of buildings, Reinforced Concrete Design of Tall Buildings provides a practical perspective on all aspects of reinforced concrete used in the design of structures, with particular focus on tall and ultra-tall buildings. Written by Dr. Bungale S. Taranath, this work explains t of the lateral force determined for the combined shear wall frame system A lateral load analysis of a typical dual system will show that almost the entire shear is carried by the shear walls at the base whereas the frames work the

1992-01-15 This volume consists of papers presented at the International Workshop on Concrete Shear in Earthquake, held at the University of Houston, Texas, USA, 13-16 January 1991. Analysis and Design of Concrete Structures April 1990 pp 177 188 24 Shiraishi I Shirai N Murakami T Reinforced Concrete Shear Walls with an Opening Trans of the JCI Vol 11 1989 pp 401 408 30

1995 The objective of this research project is to investigate the inelastic behavior and hysteresis rules of low-rise RC perforated shear walls through a series of experimental and analytical studies based on various types of monotonic and earthquake loads. The results derived are then applied to seismic response analysis of box type structures as well as typical low-rise shear wall buildings. The studies also involve development of backbone curves of load-displacement relationship of individual walls, equivalent viscous damping of the walls, and sensitivity analysis of design parameters for building systems. By observing the failure of cracked shear wall experimentally, a set of semi-empirical equations for backbone curve of perforated shear wall is obtained. Comparison between experimental results and calculated curves is favorable. Concept of energy dissipation is used to establish hysteresis rules which are based on dissipated energy envelopes calculated from experimental data for different loading states. Analytical formulation for a perforated shear wall element model is developed by using three springs: one nonlinear equivalent shear spring; two nonlinear axial springs. Total lateral displacement of a shear wall is a result of both flexure and shear. A four-story industrial building of box type consisting of solid shear walls without boundary columns and a three-story commercial building consisting of isolated columns as well as walls with boundary columns are studied for evaluating various design parameters in building code by using monotonic static analysis. The three-story building is also studied on the basis of dynamic analysis with Lorna Prieta earthquake (1989) and six simulated earthquakes. The sensitivity study of design parameters includes ductility reduction factor, force reduction factor, overstrength factor, and ratio of displacement amplification to force reduction factor. Results are recommended for future building code development--Abstract, leaf iii. The three story building is also studied on the basis of dynamic analysis with Lorna Prieta earthquake 1989 and six simulated earthquakes

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