



Making Safety Easy Through Building Standards



CR Fence & Rail **Building Code Compliance Guide**

For Handrail Kits, Guardrail Kits, and Cable Railings

About CR Fence & Rail

CR Fence & Rail is a leading provider of handrail kits, guardrail kits, and cable railings. Our mission is to deliver top-quality products that meet the highest safety standards, ensuring the well-being of our customers and their communities.

Our Commitment to Safety

At CR Fence & Rail, safety is our priority. We understand the importance of adhering to the Building Codes to ensure that our products not only meet but exceed safety requirements. Our company slogan, "Safety, Made Easy," reflects our dedication to providing reliable and easy-to-install railing solutions.



INTERNATIONAL
BUILDING
CODE®

The International Building Code (IBC) is a comprehensive set of regulations developed by the International Code Council (ICC) that provides minimum safety standards for building construction. These standards are crucial for ensuring the safety and integrity of buildings and their components, including railings.



INTERNATIONAL
RESIDENTIAL CODE®
for One- and Two-Family Dwellings

The International Residential Code (IRC) is another set of regulations developed by the ICC specifically for one- and two-family dwellings. The IRC includes safety standards for various building components, including handrails, guardrails, and cable railings.



The Occupational Safety and Health Administration (OSHA) sets and enforces workplace safety standards to protect employees from hazards on the job. OSHA regulations cover a wide range of industries and safety aspects, including fall protection and guardrail requirements.

Importance of Compliance

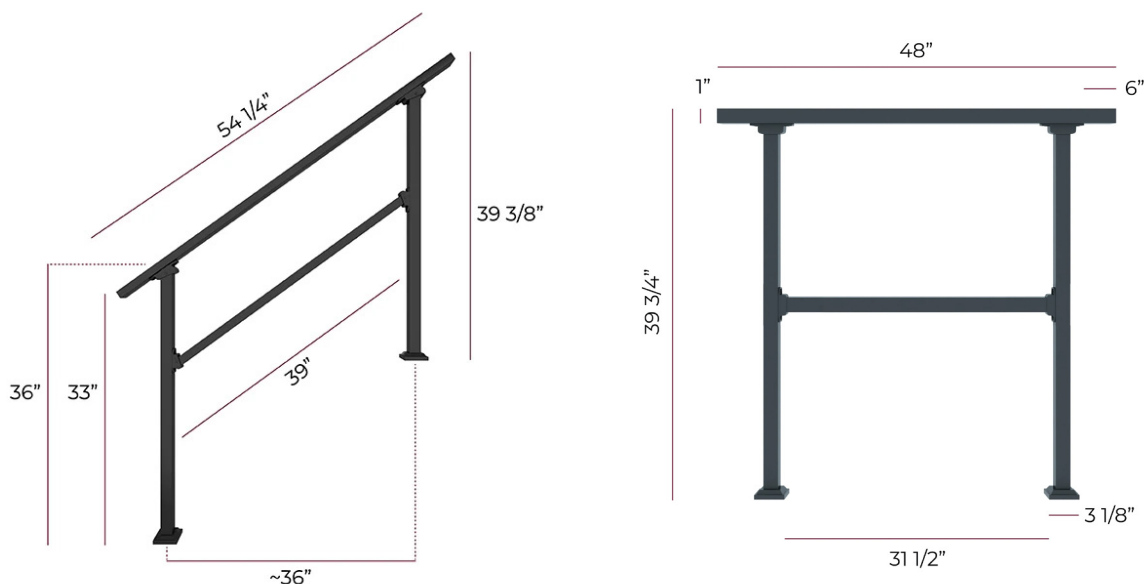
Compliance with International Building Code standards is essential for safety, obtaining building permits, avoiding legal liability, securing insurance, and maintaining higher resale values. Properly designed and installed railings prevent accidents, meet regulatory requirements, protect against lawsuits, ensure insurance coverage, and enhance property value.

Handrail Height

IBC Section 1014.2: "Handrail height, measured above stair tread nosings, or finish surface of ramp slope, shall be uniform, not less than 34 inches (864 mm) and not more than 38 inches (965 mm)."

IRC Section R311.7.8.1: "Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches and not more than 38 inches."

Our standard handrail kits are available in heights of 36 inches and 40 inches, providing flexibility to meet various building needs. Customers can customize the height by purchasing additional posts.

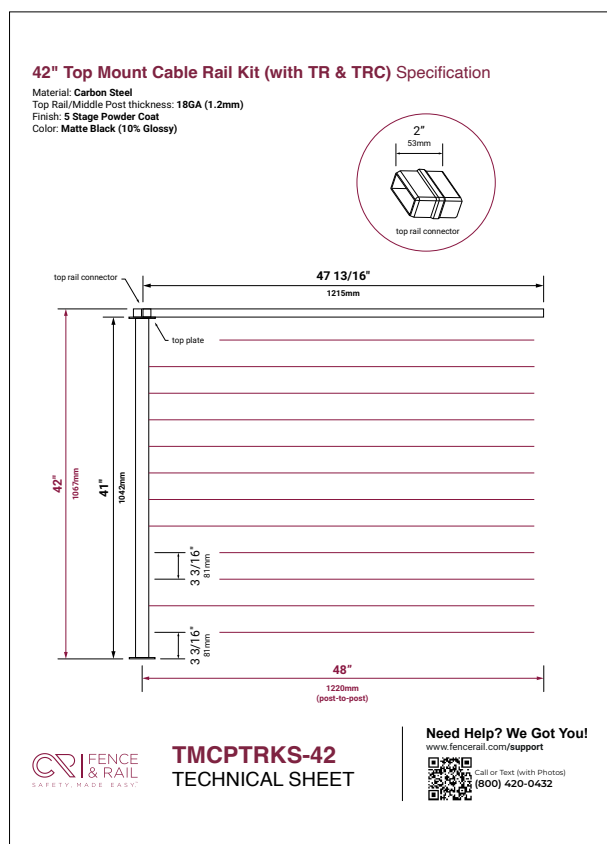
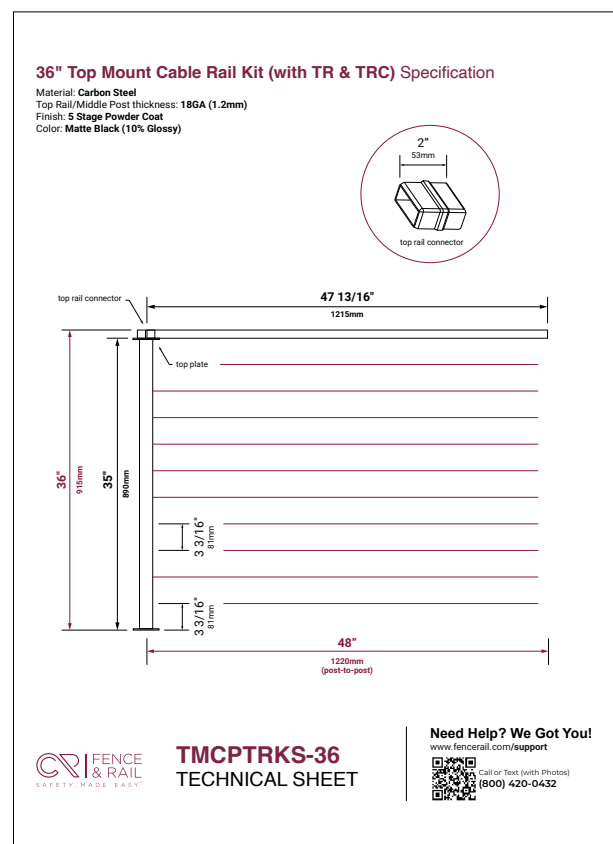


Guardrail Height and Design

IBC Section 1015.3: "Required guardrails shall be not less than 42 inches (1067 mm) high, measured vertically above the leading edge of the tread, adjacent walking surface or adjacent seatboard."

IRC Section R312.1.2: "Required guards at open-sided walking surfaces, including stairs, porches, balconies, or landings, shall be not less than 36 inches (914 mm) in height above the adjacent walking surface."

Our standard guardrail kits are designed and manufactured to a standard height of 36 inches and can be customizable in height to achieve specific code compliance. Additionally, our Cable Railing Kits are available in both 36 inches and 42 inches heights, offering versatile solutions to meet various building code requirements.



Railing Design

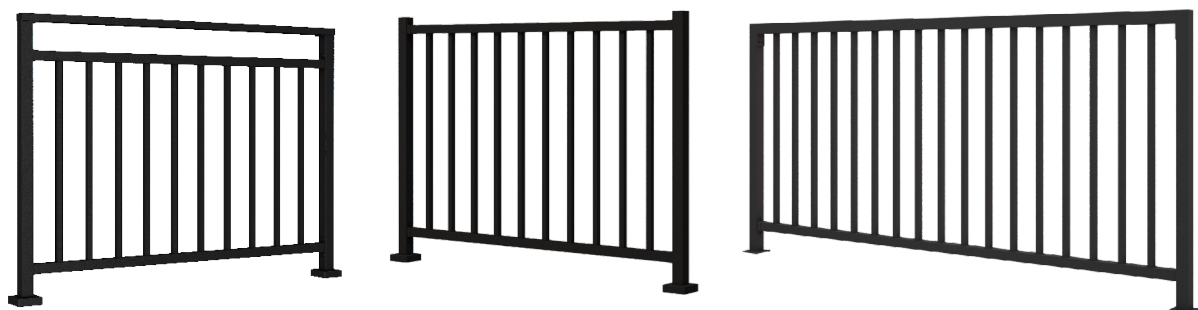
OSHA 29 CFR 1910.23

1910.23(e)(1) - A standard railing shall consist of a top rail, an intermediate rail, and posts, and shall have a vertical height of 42 inches nominal from upper surface of top rail to floor, platform, runway, or ramp level.

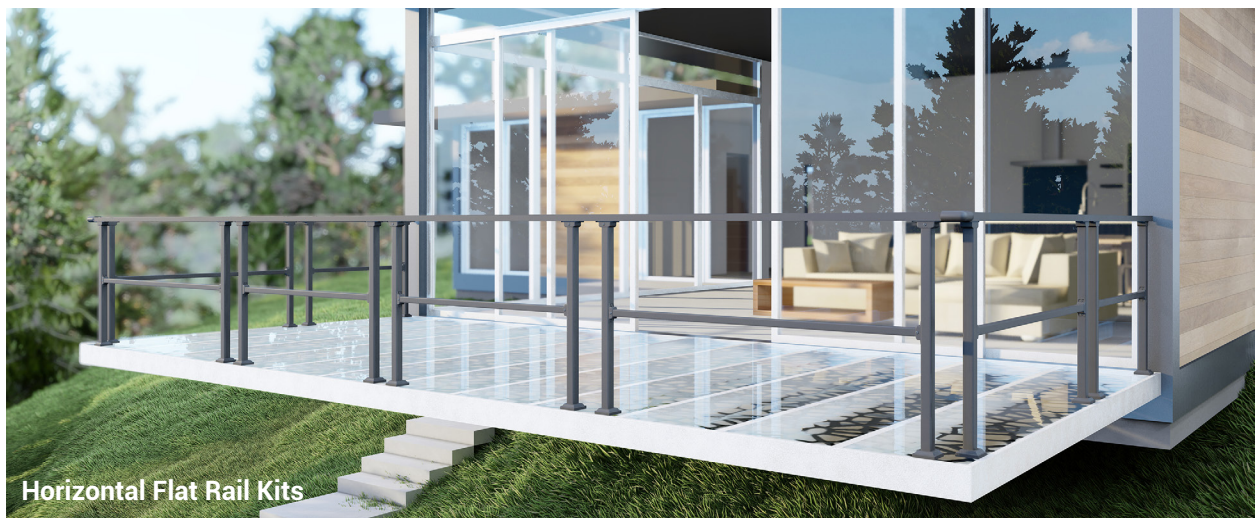
1910.23(e)(2) - The top rail shall be smooth-surfaced throughout the length of the railing.

1910.23(e)(3) - The intermediate rail shall be approximately halfway between the top rail and the floor, platform, runway, or ramp.

1910.23(e)(4) - The ends of the rails shall not overhang the terminal posts, except where such overhang does not constitute a projection hazard.



CR Fence and Rail ensures safety with our railing designs that meet or exceed OSHA's 29 CFR 1910.23 regulations. Featuring standard heights of 36, 40, and 42 inches and customizable options using CR Fence and Rail Posts, our products cater to diverse safety needs. Our Horizontal Flat Rail kits include a middle rail halfway between Top Rail and floor for stability, while our guardrail designs, such as the Horizontal Guardrail Kit with flush ends that do not overhang, prevent projection hazards.

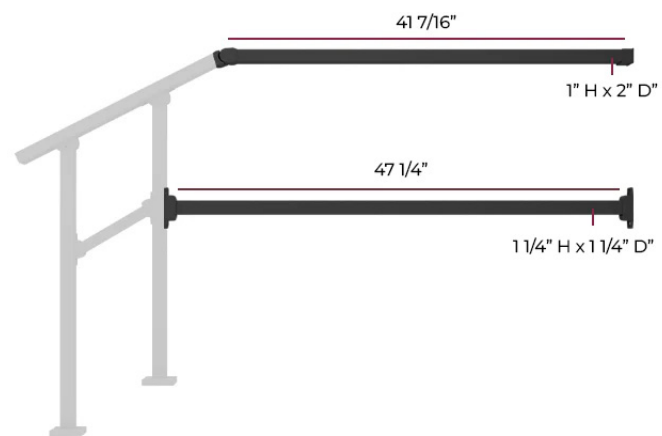


Continuity and Extensions

BC 2018: Section 1014.4: "Handrail-gripping surfaces shall be continuous, without interruption by newel posts or other obstructions."

IRC Section R311.7.8.2: "Handrails shall be continuous for the full length of the flight of stairs and shall not be interrupted by newel posts or other obstructions."

CR handrails ensure compliance with these requirements by offering a range of extension and connector options. Our Handrail Extension Kit (HRExt) allows handrails to be extended beyond the top and bottom risers. Additionally, our connectors enable multiple handrail sections to be joined together without interruptions, maintaining the necessary continuous coverage along the entire length of stairs and ramps. This design not only meets the IBC standards but also enhances safety by providing consistent handrail support throughout the entire ascent or descent.





Graspability

IBC Section 1014.3: "Handrails with a circular cross section shall have an outside diameter of at least 1.25 inches (32 mm) and not greater than 2 inches (51 mm)."

IRC Section R311.7.8.3: "Handrails shall have a circular cross section of a diameter of 1.25 inches (32 mm) to 2 inches (51 mm)."

Our handrail kits feature top rails with a 25mm x 50mm (approximately 1 inch x 2 inches) rectangular profil, designed to provide a comfortable and secure grip, meeting the graspability requirements. The dimensions ensure that our handrails are easy to grasp, promoting safety and compliance in every installation.



Projection

IBC 2018: Section 1014.8:

Handrails should not project more than 4.5 inches into the required width of the stairway or ramp.

IRC Section R311.7.8.2: "Handrails shall not project more than 4.5 inches on either side of the stairway."

Our handrails have a total width of 50mm for Top Rail and 85mm baseplate. To achieve compliance with this section, the handrail must be installed with the baseplate positioned at least 1.25 inches away from the edges. This careful positioning ensures that the total projection of the handrail, including both the top rail and baseplate, remains within the permissible limit. By maintaining this compliance, we ensure that our handrails contribute to safe and accessible passageways, meeting regulatory standards for public and residential spaces alike.





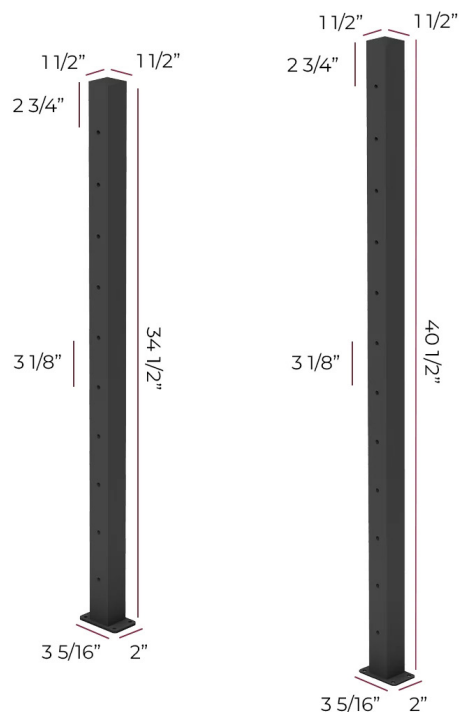


Tension and Spacing for Cable Railings

IBC Section 1015.4 (interpreted for cable railings): Cable railings must be tensioned to ensure that openings do not exceed the maximum spacing limits.

IRC Section R312.1.3 (interpreted for cable railings): Cable railings must be tensioned to ensure that openings do not exceed the maximum spacing limits.

Our cable railings utilize posts with carefully positioned cable holes, ensuring that the spacing between cables is less than 4 inches. This design detail meets the spacing requirements specified by the IBC and IRC for cable railings, maintaining safety while providing an unobstructed view. We include a comprehensive installation booklet with each kit, guiding customers through proper tensioning procedures for optimal performance and safety.



Load Requirement

IBC Section 1607.8.1: "Handrail assemblies and guards shall be designed to resist a linear load of 50 pounds per linear foot (plf) applied in any direction, and a concentrated load of 200 pounds (0.89 kN) applied at any point and in any direction."

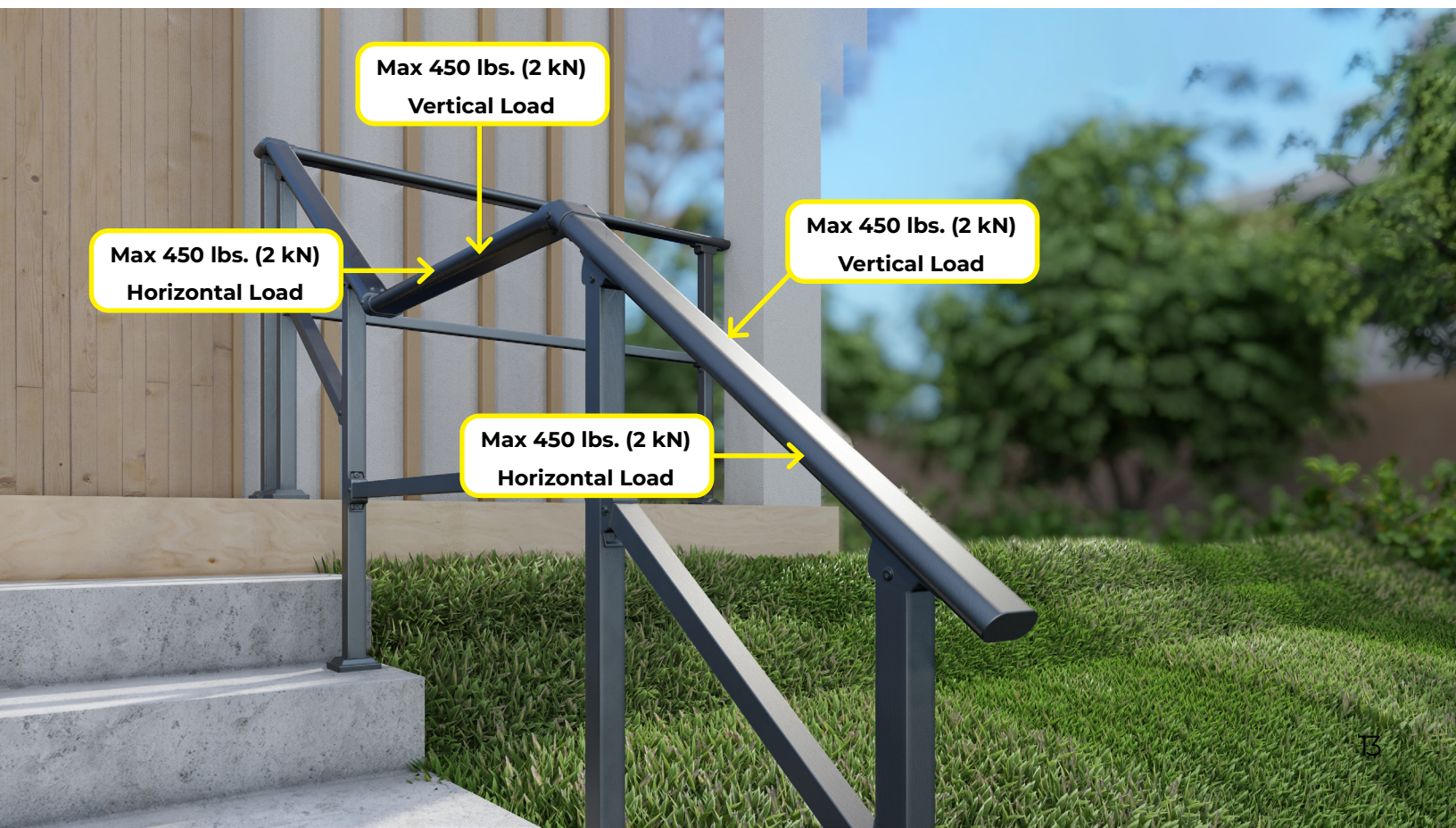
IRC Section R301.5: "Handrails and guards shall be designed to resist a concentrated load of 200 pounds (0.89 kN) applied in any direction at any point along the top."

OSHA 1910.29(b)(1): "Guardrail systems shall be capable of withstanding, without failure, a force of at least 200 pounds (890 N) applied within 2 inches (5 cm) of the top edge, in any outward or downward direction, at any point along the top edge."

OSHA 1910.29(k): "Handrails and the top rails of stair rail systems shall be capable of withstanding, without failure, a force of at least 200 pounds (890 N) applied in any downward or outward direction at any point along the handrail or top rail."

CR Fence & Rail's commitment to quality is backed by rigorous testing, as evidenced in the following test report:

The test applied a load of 450 pounds (2kN) on our handrail systems. This test exceeds the IBC, IRC, and OSHA requirement of 200 pounds (0.89kN) for concentrated loads.



Test Report

Sample Information

- Sample Name: Zinc steel railing
- Client: CR Handrail Limited
- Report Number: FT-20230720013-En
- Sample Quantity: 2
- Sample Batch: N/A
- Sample Status: Intact
- Sample Number: FT230720013

Test Details

- Conducted by: SF Testing Technology Group CO., Ltd.
- Test Category: Commission Test
- Date of Arrival: 2023.08.04
- Test Cycle: 2023.08.04 - 2023.08.15
- Standards and Methods: Refer to subsequent pages

TEST RESULTS

1. Project Overview

The products tested are exclusively developed by CR Handrail Limited. The load test was conducted by SF Testing Technology Group CO., Ltd. The baluster components include a baluster, rectangular column, connecting parts, stop rod, and stop rod frame.

2. Purpose and Content of the Test

SF Testing Technology Group CO., Ltd. was commissioned to conduct load tests on the railing to ensure safety and reliability. The test focused on the mechanical properties of railings under specific vertical and lateral loads.

3. Test Standards and Basis

3.1 Test Standards:

Referenced standards include GB 50009-2012, JG/T 558-2018, and JG/T 342-2012.

3.2 Based on Data:

1. Data and design drawings of the field test
2. The test contract

4. Test Instruments

The instruments and equipment for field testing are shown in Table 4.

Table 4: Main instruments used for testing

No.	Name of instrument	Instrument model	Instrument number	Certificate number	Effective date
1	Laser ranging	S2	2018F008889	C202109006	2024.08.31
2	Steel measuring tape	5m	G220047	G202202045	2024.02.23
3	Dialgage	(0~30)mm	80056671	SXJKY22030014	2024.01.25
4	Dialgage	(0~30)mm	9050223	SXJKY22030020	2024.01.25
5	Dialgage	(0~30)mm	9050231	SXJKY22030016	2024.01.25
6	Jack	—	—	—	—

5. Specimen Specifications and Loading Requirements

5.1 Specimen Specifications:

Rectangular face tube 25×50×1.2 mm, column 40×40×1.2mm, die rod 32×32×1.0 mm, vertical rod 19×19×1.0 mm, with the same thickness for balcony and stair railings.

5.2 Loading Requirements:

Vertical and horizontal loads of 1.0kN and 2.0kN were applied, measuring maximum relative and residual deflection, observing connection part stability.

6. Test Method and Loading Procedure

6.1 Test Method:

Two points on the railing test span were set as loading points, with dial gauges on supports to measure vertical and horizontal displacements.

6.2 Loading Procedure:

Each stage involved a total weight of 0.5kN, held for 5 minutes, recording displacements. Load was then reduced to 0.

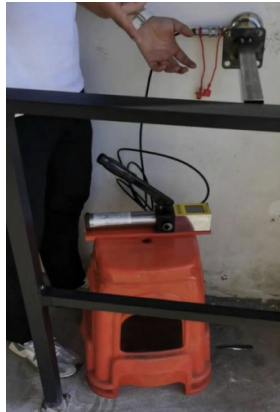


Photo 1
Load test equipment
installation position

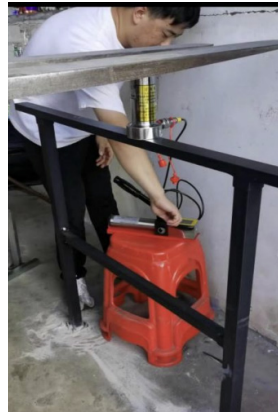


Photo 2
Load test equipment
installation and commissioning



Photo 3
Connection between
handrail and column in the test



Photo 4
Load test loading



Photo 5
Load test loading

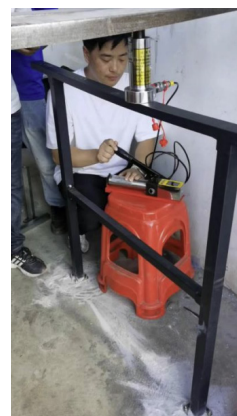


Photo 6
Fixed position of device
in load test

7. Test Results

7.1 The vertical and horizontal displacement test results of each measuring point under each vertical and horizontal load of the railings test span are shown in Table 7.

Table 7: Vertical and horizontal displacement test results of each measuring point under vertical and horizontal loads

No.	Test position	The deformation value of guardrail under standard load value (inches)		
		The displacement value after loading(inches)		
		Total load (kN)	Relative deflection (inches)	Residual deflection (inches)
1	Balcony railing horizontal load	2kN	0.162"	0.051"
2	Balcony railing vertical load	2kN	0.033"	0.004"
3	Stair railing horizontal load	2kN	0.189"	0.052"
4	Stair railing vertical load	2kN	0.049"	0.001"

Balcony Railing Horizontal Load:

Under a horizontal load of 2kN, the balcony railing showed a deformation of 4.11 mm or 0.162 inches and a residual deflection of 1.29 mm or 0.051 inches.

Balcony Railing Vertical Load:

Under a vertical load of 2kN, the balcony railing exhibited a deformation of 0.84 mm or 0.033 inches and a residual deflection of 0.09 mm or 0.004 inches,

Stair Railing Horizontal Load:

Under a horizontal load of 2kN, the stair railing displayed a deformation of 4.81 mm or 0.189 inches and a residual deflection of 1.32 mm or 0.052 inches.

Stair Railing Vertical Load:

Under a vertical load of 2kN, the stair railing had a deformation of 1.24 mm or 0.049 inches and a residual deflection of 0.03 mm or 0.001 inches.

8. Results

Balcony Railing

Under a combined vertical and horizontal load of 2kN, the maximum relative deflection of the balcony railing is 4.11 mm (0.162 inches), and the maximum residual deflection is 1.29 mm (0.051 inches).

No relaxation or falling off of connecting parts was observed. The balcony railing and its connections are in good condition and suitable for use.

According to JG/T 342-2012, when subjected to a total vertical and horizontal load of 2.0kN, the maximum deflection should not exceed $l/250$ (6.00 mm or 0.236 inches, approximately 1/4 inch) and the maximum residual deflection should not exceed $l/1000$ (1.50 mm or 0.059 inches, approximately 1/16 inch), where “ l ” is the distance between supports (1500 mm or 59 inches).

The test results indicate that with a total load of 2kN, the maximum residual deflection is within the limit of $l/1000$. The observed maximum relative deflection (4.11 mm or 0.162 inches) and maximum residual deflection (1.29 mm or 0.051 inches) comply with the JG/T 342-2012 standard requirements.

Stair Railing

Under a horizontal load of 2kN, the maximum relative deflection is 6.81 mm (0.268 inches, approximately 1/4 inch), and the maximum residual deflection is 1.32 mm (0.052 inches, approximately 1/19 inch).

The connecting parts showed no signs of slackening or falling off. The stair railing and its connections are in proper condition for normal use.

According to JG/T 342-2012, for a total horizontal load of 2.0kN, the maximum deflection should not exceed $l/250$ (6.00 mm or 0.236 inches, approximately 1/4 inch) and the maximum residual deflection should not exceed $l/1000$ (1.50 mm or 0.059 inches, approximately 1/16 inch), where “ L ” is the support distance (1500 mm or 59 inches).

The test results confirm that under a total load of 2kN, the maximum relative deflection (4.81 mm or 0.189 inches) and maximum residual deflection (1.32 mm or 0.052 inches) meet the JG/T 342-2012 standard requirements.

US Building Code Compliance Analysis

Loading Conditions:

The applied test load of 2kN (approximately 450 pounds) significantly exceeds the 200-pound (0.89kN) requirement specified by IBC, IRC, and OSHA.

This demonstrates that the railings can withstand forces far beyond the minimum requirements, ensuring robust structural performance.

Deflection Limits:

The observed deflection values are well within the acceptable limits outlined by the IBC and IRC, confirming compliance with the deflection criteria. OSHA does not specify exact deflection limits, but the structural integrity observed under high loads aligns with OSHA's emphasis on safety.

Structural Integrity:

The test results indicate no signs of relaxation, falling off, or excessive deformation in the railing components.

This ensures that the railings maintain their structural integrity and safety under load, meeting the general safety requirements of IBC, IRC, and OSHA.

Commitment to Safety, Assurance, and Transparency

By making this report public, CR Fence & Rail demonstrates our unwavering commitment to safety and transparency. The detailed tests confirm that our zinc steel railings meet stringent safety standards. Our dedication to openness and accountability is clear:

Transparency: We provide complete and accessible test data.

Integrity: We ensure our products are thoroughly tested and reliable.

Quality: We consistently exceed safety and performance expectations.

This report reflects our promise to deliver safe and dependable railing solutions.



Force Test: CR Fence & Rail Post vs Truck
CR Fence & Rail Post can withstand a force of

234 lbs.



Watch Video

Force Test: CR Fence & Rail Horizontal Handrail vs Truck

A section of CR Fence & Rail withstands a force of

474 lbs.



Watch Video



Discover Safety and Quality with CR Fence & Rail

Thank you for choosing CR Fence & Rail as your partner in safety and compliance. Our commitment to quality, innovation, and customer satisfaction drives everything we do. For more information, inquiries, or to place an order, please visit our website at fencerail.com or contact our customer service team.



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