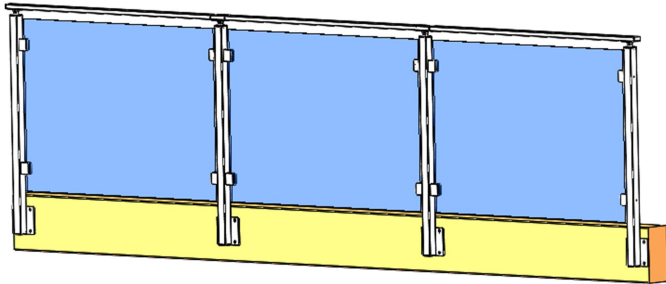


OFFICIAL TEST REPORT

(FBC, IBC: 2012, 2015, 2018, ANSI Z97.1, ASTM E2353 – E2358)



February 5, 2020

Report Number: Viewrail-04-2020

Manufacturer: Viewrail

Test Location: 2436 Dierdorf Road
Goshen, IN 46526

Product Under Test: Side Mount Post-
Universal Top

Test Witnessed By: Michael Hudson, P.E.
JJ. Johnson (Manufacturer)

The Side Mount Post-Universal Top Glass Railing System is an interior glass rail/ guard/balustrade assembly with full view glazing in-fill that is edge clamped.

Notes

This report does not purport to address all possible impact and load cases that could result in railing system or glazing failure. If additional load or impact case testing is required by the qualified licensed engineer, please contact the Manufacturer.

For external installations the wind loads and glass stress must be calculated and accounted for by a qualified licensed engineer in charge of the fixed work. Further, if the system will be installed in exterior locations, corrosion and deterioration testing is required.

The test results herein are intended to assist a qualified licensed engineer in developing a code compliant guard that meets the applicable requirements of 2012, 2015, and 2018 International Building Code and state codes adopted from the IBC codes. This report is not intended to demonstrate the code compliance of an installation but is only to be utilized by the qualified licensed engineer in charge in analyzing the glass stresses and anchorage.

Signature Page

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Nashville, NC 27856

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Referenced Codes and Standards



ASTM International

- E2353 - 16 *Standard Test Methods for Performance of Glazing in Permanent Railing Systems, Guards, and Balustrades¹*
- E935 - 13^{ε1} *Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings²*
- E2358 - 17 *Standard Specification for Performance of Glazing in Permanent Railing Systems, Guards, and Balustrades⁴*
- E2025 - 99 *Standard Test Method for Evaluating Fenestration Components and Assemblies for Resistance to Impact Energies³*

1. This standard is issued under the fixed designation E2353; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval. Current edition approved Feb. 15, 2016. Published March 2016. Originally approved in 2004. Last previous edition approved in 2014 as E2353 - 14. DOI:10.1520/E2353-16.
2. This standard is issued under the fixed designation E935; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.
 - ε1 NOTE—Section 1.2 was editorially revised in October 2013.
3. This standard is issued under the fixed designation E2025; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.
 - (Reapproved 2006)
 - NOTICE: This standard has been withdrawn, however other active standards still reference this standard.**
4. This standard is issued under the fixed designation E2358; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval. This specification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.56 on Performance of Railing Systems and Glass for Floors and Stairs. Current edition approved Aug. 1, 2017. Published September 2017. Originally approved in 2004. Last previous edition approved in 2010 as E2358 - 04(2010). DOI: 10.1520/E2358-17.



American National Standards Institute

- Z97.1-2015 *For safety glazing materials used in buildings –safety performance specifications and methods of test*



Consumer Product Safety Commission

- 16 CFR Ch. II (1-1-12 Edition) *Part 1201 – Safety Standard for Architectural Glazing Materials*



International Code Council

- 2018, 2015, and 2012 International Building Code® (IBC)*
- 2018, 2015, and 2012 International Residential Code® (IRC)*

Railing System Components and Hardware

Glazing Material

Manufacturer:	ViewRail – Goshen, Indiana
Overall Glazing Thickness:	½" (Nominal)
Glazing Type:	Tempered Transparent Glass (TTG)
Thickness Standard:	ASTM C1036
CPSC 16 CFR Part 1201 Category:	II ¹
ANSI Z97.1 Class:	A ¹

¹ Intertek Test Report Number K1004.02-119-37 (See Appendix A)

Glazing material has been tested and shown to meet the following minimum material requirements:

Category II (CPSC 16 CFR Part 1201)
Class A (ANSI Z97.1 Class)

As required by:

Section 2407.1 of IBC (2018, 2015, 2012)
Section R308.4 of IRC (2018, 2015, 2012)
Section 3.3.1 of ICC-ES AC439

Substitution Note: In accordance with ASTM E2358-17, section 8:

8. Permissible Variations and Substitutions:

8.2 Laminated glass shall be permitted to be substituted for tempered glass provided the structural loads (frame loads) are met and the nominal thickness is achieved with a minimum interlayer capable of passing ANSI Z97.1 Class A.

Components and Hardware

Component and assembly drawings contained in Appendix B. The glass rail, guard, and balustrade assembly was installed in the test fixture in accordance with the manufacturers written installation instructions as contained in Appendix C. All test specimens were conditioned as required by ASTM E2353-16 prior to testing.

Substitution Note: In accordance with ASTM E2358-17, section 8

8. Permissible Variations and Substitutions:

8.4 Larger systems shall qualify smaller systems provided there is no change to the attachment, anchoring or any other property that would decrease the structural performance of the system.

The unit under test is the largest of the Side Mount Universal Top railing system; therefore smaller systems are qualified under the testing contained in this report. Further, the material of construction for the unit under test is aluminum, thereby qualifying other materials of construction that do not decrease the structural performance of the system including but not limited to 2205 and 304 stainless steel.

ASTM System Classification

The Side Mount Post-Universal Top railing system has a classification of Type III (FIG 5b) system as defined by ASTM E2358-17

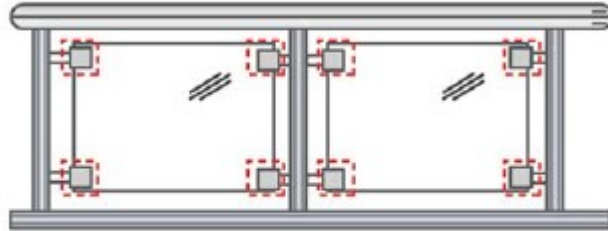


FIG. 5 b Type III: Edge Clamping Glazing System—Glazing as In-fill *(continued)*

Instrumentation

Equipment Description	Manufacturer	Model/Part Number
Load Cell	Zemic	H3-C3-1.5t-3B
Digital Readout	Scientific Industries	FB 10k
Laser Deflection Sensor	Keyence	IL-300
Actuator	McMaster-Carr	6211K74

Note

All test instruments were calibrated and are traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST) or another National Measurement Institute or through consensus standards. ViewRail calibration providers meet the requirements of ISO 17025:2005.

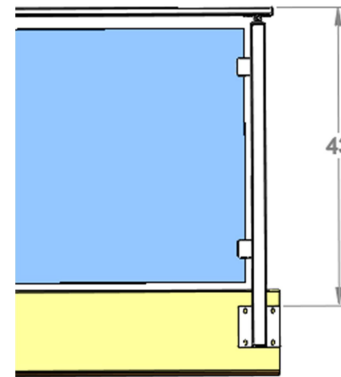
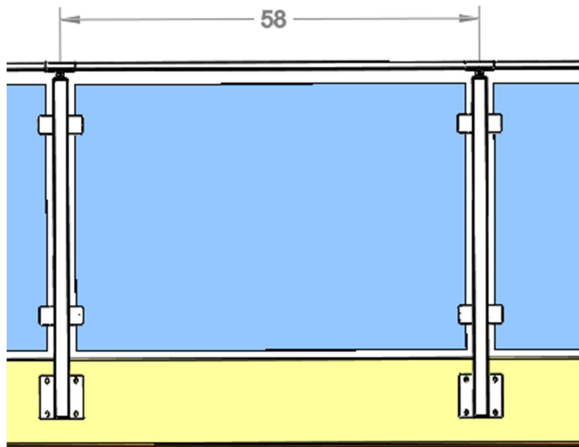
Testing Preparation

Test Sequence (All tests performed on a single specimen in the order specified by ASTM E2353-16 and ASTM E935-13)

1. Infill Load Test
 - a. Vertical Edge of Center Lite
 - i. 4" x 4"
 - ii. 12" x 12"
 - b. Top Horizontal Edge of Center Lite
 - i. 4" x 4"
 - ii. 12" x 12"
2. Concentrated Load Test
 - a. Horizontal
 - i. Mid-Span of Handrail
 - b. Vertical
 - i. Three Lite Configuration
 - ii. Two Lite Configuration (Center Lite Removed)

Calculated Permissible Deflection

Permissible deflection under load per ASTM 2358-17 calculated under worst case conditions (lowest *h* or *l* value):



Maximum Permissible Deflection

Horizontal Load Applied at Rail
Mid-Span

$$\begin{aligned} & \mathbf{h/24 + l/96} \\ & (43''/24 + 58''/96) \\ & 1.79'' + 0.60'' \\ & \mathbf{2.4''} \end{aligned}$$

Maximum Permissible Deflection

Load Applied at the Line of
Vertical Support

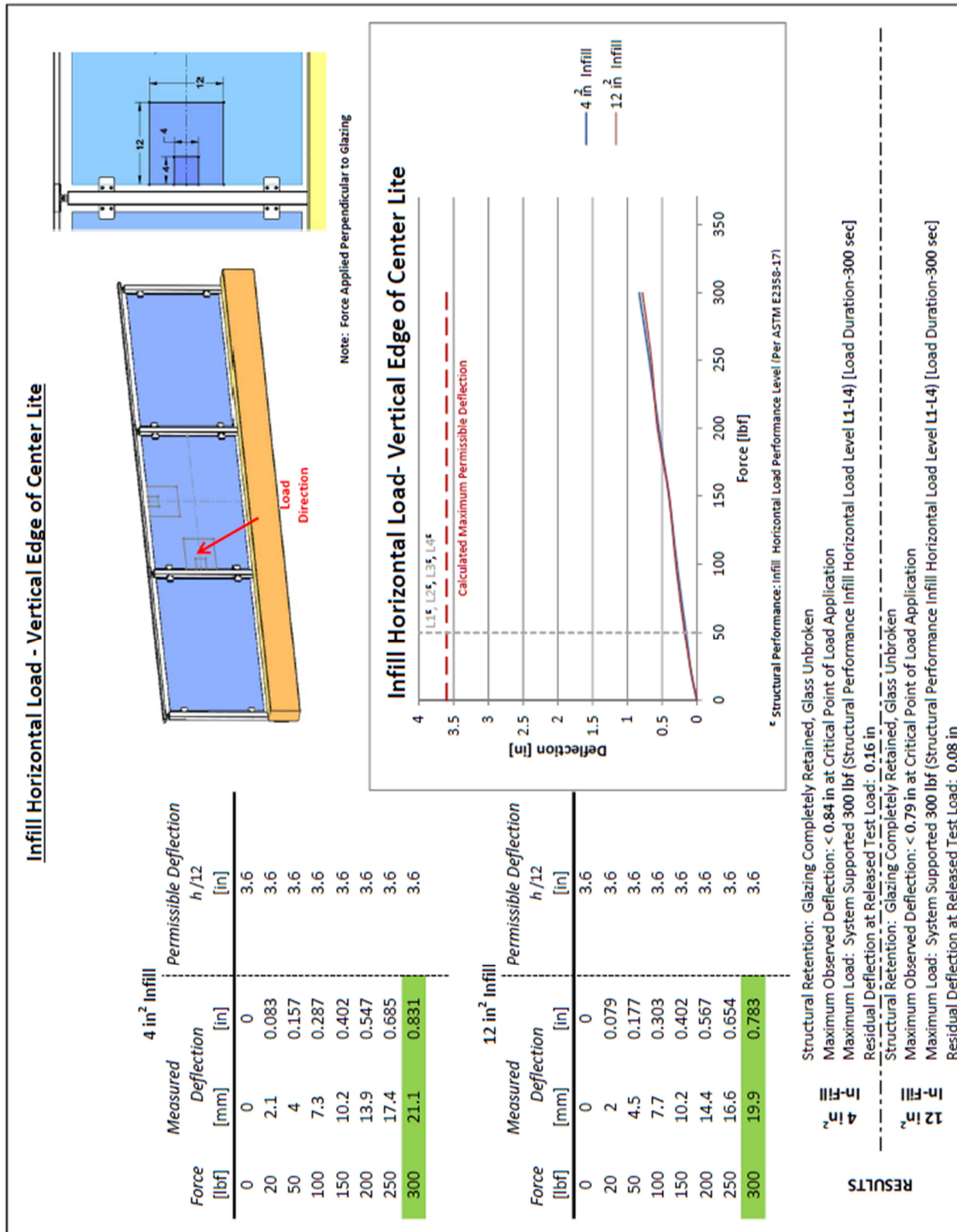
$$\begin{aligned} & \mathbf{h/12} \\ & 43''/12 \\ & \mathbf{3.6''} \end{aligned}$$

Maximum Permissible Deflection

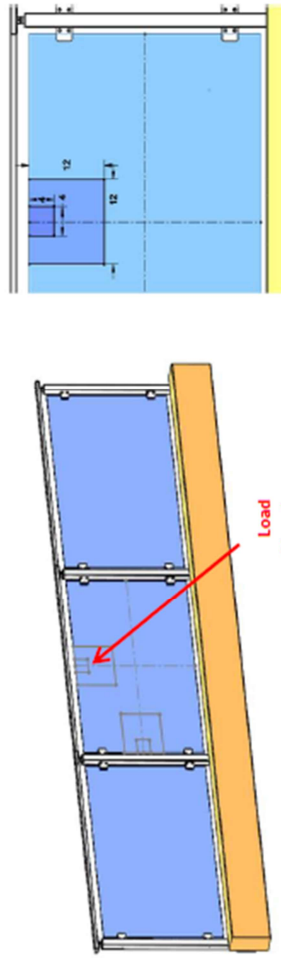
Vertical Load Applied at Rail Mid-Span

$$\begin{aligned} & \mathbf{l/96} \\ & 58''/96 \\ & \mathbf{0.6''} \end{aligned}$$

Testing: Results



Infill Horizontal Load - Top Edge of Center Lite

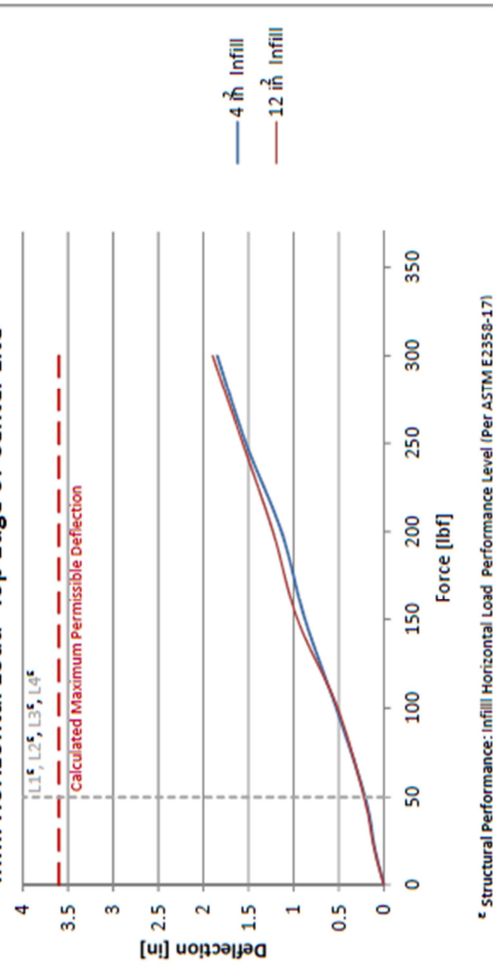


Note: Force Applied Perpendicular to Glazing

4 in ² Infill		Permissible Deflection
Force [lbf]	Measured Deflection [mm]	$h/12$ [in]
0	0	3.6
20	2.5	3.6
50	5.3	3.6
100	13.4	3.6
150	22.2	3.6
200	28.8	3.6
250	38.8	3.6
300	46.9	3.6

12 in ² Infill		Permissible Deflection
Force [lbf]	Measured Deflection [mm]	$h/12$ [in]
0	0	3.6
20	2.7	3.6
50	5.6	3.6
100	13	3.6
150	24.3	3.6
200	31.2	3.6
250	39.7	3.6
300	48.2	3.6

Infill Horizontal Load- Top Edge of Center Lite

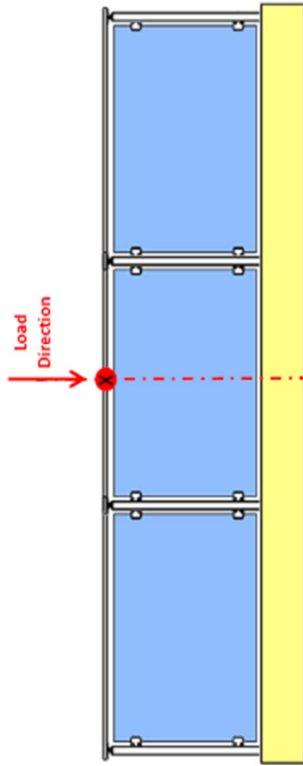


* Structural Performance: Infill Horizontal Load Performance Level (Per ASTM E2358-17)

Structural Retention: Glazing Completely Retained, Glass Unbroken
 Maximum Observed Deflection: < 1.85 in at Critical Point of Load Application
 Maximum Load: System Supported 300 lbf (Structural Performance Infill Horizontal Load Level L1-L4) [Load Duration-300 sec]
 Residual Deflection at Released Test Load: 0.12 in
 Structural Retention: Glazing Completely Retained, Glass Unbroken
 Maximum Observed Deflection: < 1.9 in at Critical Point of Load Application
 Maximum Load: System Supported 300 lbf (Structural Performance Infill Horizontal Load Level L1-L4) [Load Duration-300 sec]
 Residual Deflection at Released Test Load: 0.15 in

RESULTS

Concentrated Vertical Load: Rail Mid-span



Note: Force Applied Perpendicular to Rail at Mid-Span

Concentrated Vertical Load: Rail Mid-Span



* Structural Performance: Concentrated Load Performance Level (Per ASTM E2356-17)

Rail Center with 3 Lites Installed		
Force [lbf]	Measured Deflection [mm]	Permissible Deflection I/96 [in]
0	0	0.6
20	1.9	0.075
50	4.1	0.161
100	6.1	0.240
150	8.8	0.346
200	10.6	0.417
250	11.5	0.453
300	13.8	0.543
365	14.7	0.579

Rail Center with Middle Lite Removed		
Force [lbf]	Measured Deflection [mm]	Permissible Deflection I/96 [in]
0	0	0.6
20	1.9	0.075
50	4.1	0.161
100	6.1	0.240
150	8.8	0.346
200	10.6	0.417
250	11.5	0.453
300	13.8	0.543
365	14.7	0.579

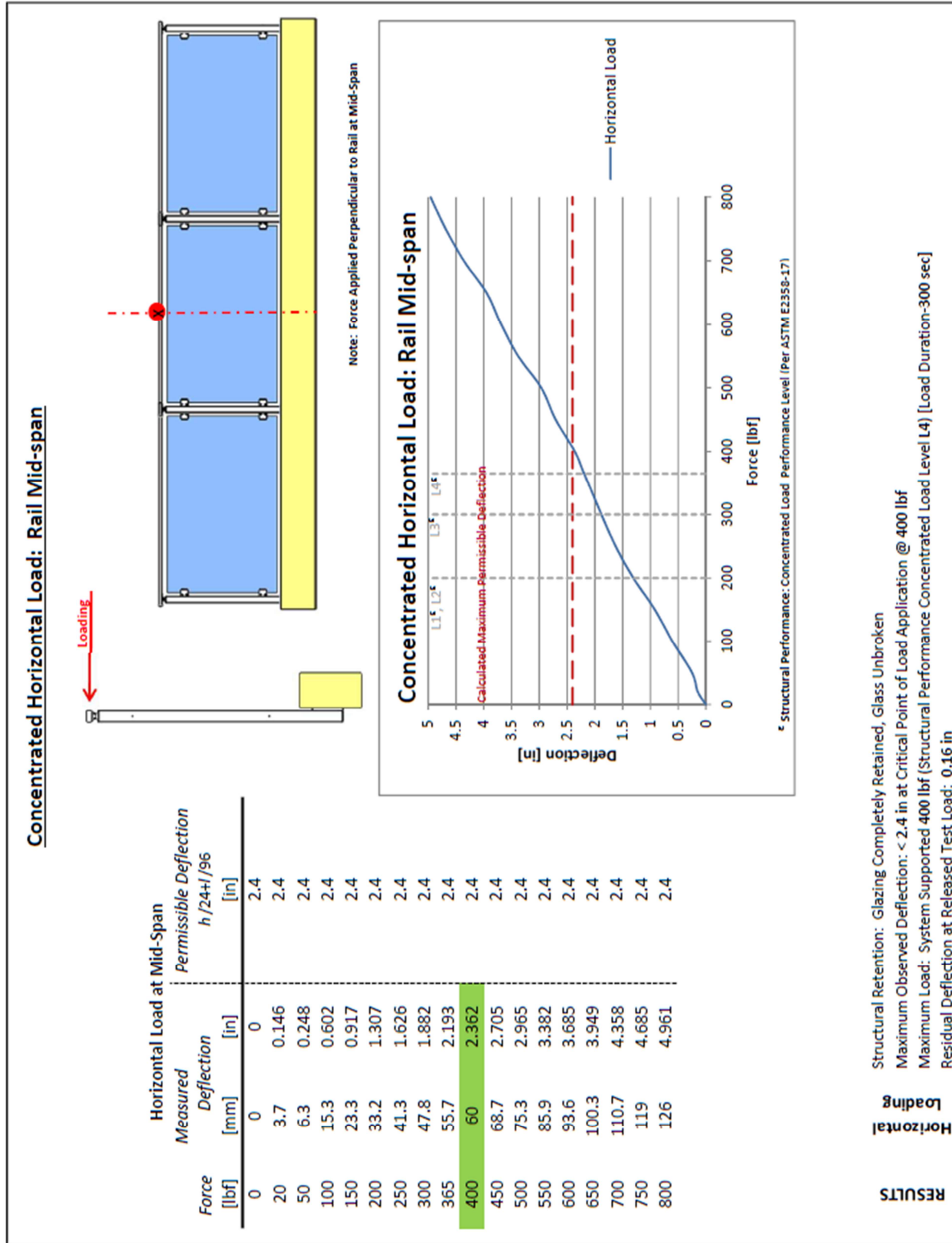
RESULTS

Center Lite Installed

Structural Retention: Glazing Completely Retained, Glass Unbroken
 Maximum Observed Deflection: < 0.58 in at Critical Point of Load Application
 Maximum Load: System Supported 365 lbf (Structural Performance Concentrated Load Level L4) [Load Duration-300 sec]
 Residual Deflection at Released Test Load: 0.08 in

Center Lite Removed

Structural Retention: Glazing Completely Retained, Glass Unbroken
 Maximum Observed Deflection: < 0.58 in at Critical Point of Load Application
 Maximum Load: System Supported 365 lbf (Structural Performance Concentrated Load Level L4) [Load Duration-300 sec]
 Residual Deflection at Released Test Load: 0.08 in





VIEWRAIL TEST REPORT

SCOPE OF WORK
IMPACT TESTING ON TEMPERED TRANSPARENT SAFETY GLAZING MATERIAL

REPORT NUMBER
K1004.02-119-37

TEST DATE(S)
08/28/19

ISSUE DATE
09/03/19

PAGES
5

DOCUMENT CONTROL NUMBER
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TEST REPORT FOR VIEWRAIL
 Report No.: K1004.02-119-37
 Date: 09/03/19

130 Derry Court
 York, Pennsylvania 17406

Telephone: 717-764-7700
 Facsimile: 717-764-4129
 www.intertek.com/building

REPORT ISSUED TO

VIEWRAIL
 1755 Ardmore Court
 Goshen, Indiana 46526

SECTION 1

SCOPE

Intertek Building & Construction (B&C) was contracted by Viewrail - Goshen, Indiana to perform safety glazing impact testing in accordance with ANSI Z97.1, CAN/CGSB 12.1, and CPSC 16 CFR 1201 on tempered transparent glass. Results obtained are tested values and were secured by using the designated test methods. Testing was conducted at the Intertek B&C test facility in York, Pennsylvania.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. Intertek will service this report for the entire test record retention period. The test record retention period ends four years after the test date. Test records, such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation, will be retained for the entire test record retention period.

SECTION 2

SUMMARY OF TEST RESULTS

SPECIMEN NUMBER	1	2	3	4
IMPACT TEST RESULTS	Pass	Pass	Pass	Pass
THICKNESS COMPLIANCE	Pass	Pass	Pass	Pass

For INTERTEK B&C:

COMPLETED BY: Todd M. Wilt
TITLE: Lead Technician

SIGNATURE: 
Digitally signed by Todd M. Wilt on 09/03/19

DATE: 09/03/19

tmw:vtm/aas

REVIEWED BY: Virgal T. Mickley, Jr., P.E.
TITLE: Senior Staff Engineer

SIGNATURE: 
Digitally signed by Virgal Thomas Mickley, Jr. on 09/03/19

DATE: 09/03/19



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TEST REPORT FOR VIEWRAIL

Report No.: K1004.02-119-37

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SECTION 3

TEST METHODS

The specimens were evaluated in accordance with the following:

ANSI Z97.1-2015, *For safety glazing materials used in buildings - safety performance specifications and methods of test*, American National Standard

CAN/CGSB 12.1-2017, *Safety Glazing*, National Standard of Canada

CPSC 16 CFR 1201, *Safety Standard for Architectural Glazing Materials*, Consumer Product Safety Commission (Version: 2012; Source: 42 FR 1441, Jan. 16, 1977)

SECTION 4

MATERIAL SOURCE

Test samples were obtained from the manufacturer. The specimens were received on 08/23/19, in good condition and suitable for testing unless noted otherwise.

SECTION 5

SAMPLE RETENTION

All test specimens were destroyed by test or by personnel and have been disposed of as trash. Representative sections of the samples will be retained for up to 30 days from the date of report issuance. After 30 days, representative samples will be automatically discarded.

SECTION 6

LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Todd M. Wilt	Intertek B&C



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TEST REPORT FOR VIEWRAIL
Report No.: K1004.02-119-37
Date: 09/03/19

**SECTION 7
TEST PROCEDURE**

Overview

All specimens were impacted once from the select drop height unless noted otherwise. Specimens which were not broken after impact from the designated drop height were broken in accordance with the Center Punch Fragmentation Test per ANSI Z97.1-2015.

Drop Height Classification

All specimens were impacted once from a drop height of 48 inches.

DROP HEIGHT CLASSIFICATION			
ANSI	CGSB	CPSC	DROP HEIGHT
Class A	Class A	Category II	48 in.

**SECTION 8
TEST SPECIMEN DESCRIPTION**

Manufacturer: Viewrail - Goshen, Indiana
Glazing Product Designation: Prototype
Overall Glazing Thickness: 1/2" (nominal)
Glazing Type: Tempered Transparent Glass (TTG)
Sample Dimensions: Impact: 34" wide x 76" high (±1/8")
Size Classification: Unlimited
Thickness Standard: ASTM C1036

**SECTION 9
TEST RESULTS**

Lab Temperature: 71°F
Duration of Pre-Conditioning @ 65 - 85°F: 24 Hours

Impact Test Results

SPECIMEN NUMBER	THICKNESS (inches)	TEST RESULTS (grams)	CENTER PUNCH (YES/NO)	ACCEPTANCE CRITERIA (grams)	RESULT (PASS/FAIL)
1	0.498	23	Yes	205	Pass
2	0.500	31	Yes	206	Pass
3	0.499	25	Yes	206	Pass
4	0.500	22	Yes	206	Pass

Acceptance Criteria: The 10 largest crack-free particles collected after specimen breakage shall weigh no more than 10 sq. in. of the original specimen.



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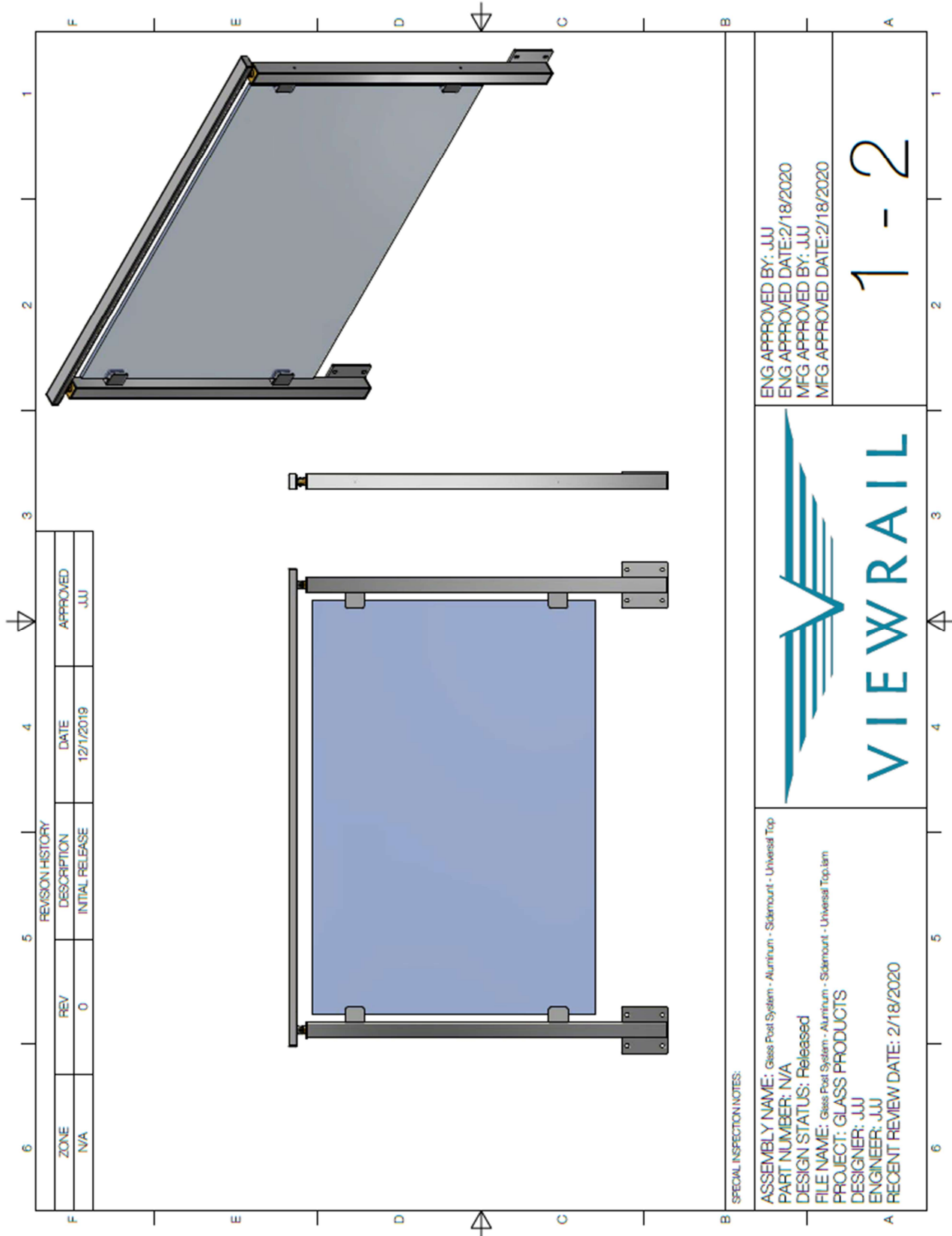
SECTION 10
CONCLUSION

The specimens meet the test requirements of the referenced standards for the size classification listed.

SECTION 11
REVISION LOG

	DATE	PAGES	REVISION
0	09/03/19	N/A	Original Report Issue

Appendix B: System Components and Drawings



Viewrail Side Mount Post-Universal Top Test Report

