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ICC-ES Evaluation Report
ESR-4405

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DIVISION: 05 00 00—METALS
Section: 05 52 00—Metal Railings
Section: 05 73 13—Glazed Decorative Metal Railings

DIVISION: 08 00 00—OPENINGS
Section: 08 81 00—Glass Glazing
Section: 08 88 00—Special Function Glazing

REPORT HOLDER:

VIVA RAILINGS, LLC.

EVALUATION SUBJECT:

SHOE GLASS PANEL RAILING SYSTEM

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015 and *2012 International Building Code®* (IBC)
- 2021, 2018, 2015 and 2012 *International Residential Building Code®* (IRC)

For evaluation for compliance with codes adopted by Los Angeles Department of Building and Safety (LADBS), see ESR-4405 LABC and LARC Supplement.

For evaluation for compliance with codes adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of State Architects (DSA), see ESR-4405 CBC and CRC Supplement.

Properties evaluated:

- Structural
- Durability

2.0 USES

The Shoe Glass Panel Railing System is a patented handrail / guard system intended for use in interior and exterior locations of all construction types.

The system may also be used in wind-borne debris regions in accordance with IBC Section 2407.1.4; a minimum either $^5/_8$-inch-thick (16 mm) or $^3/_4$-inch-thick (19 mm), laminated glass panels with a 0.06 inch, SentryGlas®Plus, SGP interlayer and a top rail is required.

3.0 DESCRIPTION

The Shoe Glass Panel Railing System consists of top rails, handrails (if applicable), glass panels, J-Shim dry glaze mechanisms, and continuous aluminum base shoes.

3.1 Top Rails:

The top rails (also known as cap rails) are manufactured from ASTM A554 304 stainless steel. The top rails are available in a U-Cap or E-Tube profile. See Figure 1.

3.2 Handrails:

The metal handrails are 1.5-inches (38.1 mm) or 2-inches (50.8 mm) in diameter and are manufactured from ASTM A554 304 stainless steel. The wood handrails are 2-inches (50.8 mm) in diameter manufactured from one of the following species with the minimum physical properties specified in the approved quality documentation: cherry, red oak, white oak or maple. See Figure 2.

3.3 Handrail Brackets:

The handrail brackets are manufactured from ASTM A276 304 stainless steel. The brackets are fabricated with a reinforced nylon isolator pad that prevents direct contact between the glass and the steel bracket. See Figure 3.

3.4 Laminated Glass Panels:

General: The laminated glass panels must comply with ASTM C1172 and Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1. The panels must consist of two lites of glass with an interlayer.

For nominal laminated glass panel thicknesses of $^1/_2$-, $^5/_8$- and $^3/_4$-inch (12, 16 or 19 mm), the minimum thickness must be as shown below:

Nominal Thickness (inch)	Interlayer Thickness (inch)	Minimum Actual Thickness (inch)
$^1/_2$	0.030	0.468
	0.035	0.473
	0.060	0.498
$^5/_8$	0.030	0.614
	0.035	0.619
	0.060	0.644

3/4	0.030	0.740
	0.035	0.745
	0.060	0.770

Lites: The lites must be Kind FT tempered glass complying with ASTM C1048 and have a minimum Modulus of Rupture (Fr) ≥ 24,000 psi (165 MPa).

Interlayer: The interlayer must be minimum 0.30-inch-thick (0.76 mm), 0.035-inch-thick (0.89 mm) or 0.060-inch-thick (1.52 mm). The interlayer may be a PVB or non-PVB interlayer.

The PVB interlayers must have a minimum shear modulus of 42.1 psi (0.3 MPa) for T ≤ 122ºF (50˚C). The PVB interlayers are limited to use with the nominal 5/8 and 3/4 inch thick laminate glass panels.

The non-PVB interlayers must have a minimum shear modulus of 1639 psi (11.3 MPa) for T ≤ 122ºF (50ºC).

3.5 Monolithic Glass Panels:

The monolithic glass panels must be fully tempered (FT) glass complying with ASTM C1048, ANSI Z97.1 Class A and Category II of CPSC 16 CFR 1201. The glass panels must have a minimum Modulus of Rupture (Fr) ≥ 24,000 psi (165 MPa).

The 1/2-inch (12 mm) nominal thickness glass panels must have an actual minimum thickness of 0.469 inch (12.5 mm). The 5/8-inch (16 mm) nominal thickness glass panels must have an actual minimum thickness of 0.595 inch (15.1 mm). The 3/4-inch (19 mm) nominal thickness glass panels must have an actual minimum thickness of 0.719 inch (18.3 mm).

3.6 Base Shoe:

The base shoes are manufactured from ASTM B221 6063-T6 aluminum. The base shoes are configured with mounting holes for either a surface mount configuration (Part # SE-69.9TD) or fascia mount configuration (Part # SE69.9FD) See Figure 5.

3.7 J-Shim Dry Glaze Mechanism:

The dry glaze mechanism is composed of three components: the nylon J-Shim supports, the aluminum pivot arm and the plastic arm pad. The dry glaze mechanism is tightened to the glass using a M6 X 20 mm (0.79 inch) set screw.

3.7.1 The nylon J-Shim supports are used to provide support to the glass panels. J-Shim dry mount mechanism part number SE-JS13.5 is required to support 1/2-inch (12 mm) glass panels, part number SE-JS17.5 is required to support 5/8 inch

3.7.2 (16 mm) glass panels, and part number SE-JS19.0 is required to support 3/4-inch (19 mm) glass panels. Each J-Shim listed is compatible for use with both the surface mount and fascia mount shoes. See Figure 6.

3.7.3 The aluminum pivot arm (part # SE-ARM100) is manufactured from ASTM B221 6063-T6 aluminum. The shape of the extrusion allows for the larger diameter feature to be inserted into the base shoe groove. See Figure 6.

3.7.4 The plastic arm pad is used to provide a continuous bearing surface between the aluminum pivot arm. The shape of the extrusion allows for the arm pad to be installed over the smaller diameter feature of the aluminum pivot arm. See Figure 6.

3.8 Durability:

The Shoe system materials supplied by Viva Railings, LLC. are inherently corrosion-resistant. The material type specified must be appropriate for the environment of the installation. Information verifying the durability must be submitted to the code official, when requested.

4.0 DESIGN AND INSTALLATION

4.1 Installation:

Installation of the guardrail system, including the handrails and top rails, must comply with the manufacturer's published instructions, this report, and the IBC, as applicable.

A top rail or handrail must be installed for all installations.

The manufacturer's published installation instructions must be available at the jobsite at all times during installation. In the event of a conflict between this report and the manufacturer's instructions, this report governs.

4.1.1 Top Rails: The maximum spans in Table 1 are based on the capacities of the top rails.

The ends of the top rail must be supported by a by a wall or post. The attachment of the top rail to a wall or post is outside of the scope of this report.

The top rails are installed to the glass panel with an EPDM rubber gasket.

4.1.2 Handrails:

4.1.2.1 General: Handrails must be installed as required per the applicable code. If no top rail is installed, the ends of the handrail must be supported by a post or wall. The attachment to the post or wall is outside of the scope of this report. Wood handrails are limited to interior locations only.

4.1.2.2 Brackets: The handrails in Table 2 and Figure 1 may be used with the bracket shown in Figure 3. The brackets are installed through holes located near the ends of the glass panels or between glass panels. See Figure 4.

4.1.2.3 Installation: Handrails are installed to glass panels using the mounting brackets shown in Figure 3. The mounting brackets are installed through holes located near the ends of the glass panels or between glass panels. The holes in the glass panels must comply with Section 4.3 of this report, as applicable. The wood handrails are attached to the brackets using N8x1 1/2-inch (38 mm) screws; the metal handrails are attached to the brackets using M5 X 10 mm (0.39 inch) bolts.

4.1.2.4 Spacing: The handrail span length is governed by the bracket spacing; the bracket spacing must be within the limits shown in Table 2.

4.1.3 Base Shoes: The connection of the base shoe to the building substrate must be designed by a registered design professional. The connection design is outside of the scope of this report, but the maximum anchorage spacing used in the design must not exceed 24 inches (61 mm) in center. Typical details of the connections of the base shoes that are either surface mounted or fascia mounted to concrete are shown in Figure 5. Alternate mounting configurations via weld plates, embedded steel angles and steel channels are also available from the manufacturer.

4.1.4 Shoe System: The Shoe Glass Panel Railing System is a dry glazing system where the glass panel is clamped inside the base shoe by the J-shim and the aluminum pivot arm with the plastic arm pad. The aluminum pivot arm is installed into groove on the interior side of the

base shoe; the plastic arm pad is installed to the other end of the pivot arm. The glass is held in place by the compressive forces created by the J-shim clamp and aluminum pivot arm with the plastic arm pad. Compressive forces are developed by tightening the M6 X 20 mm (0.79 inch) set screw to the manufacturer's specifications. See Figure 6.

The center of the J-shim supports must be spaced a maximum of 4.5 inches (114 mm) from the ends of the base shoe and a maximum of 9 inches (229 mm) on center in the base shoe. A minimum of two J-shim supports must be used to support each glass panel. Glass panels must be spaced $^1/_2$ inch (12.7 mm) apart from one another.

4.2 Design:

4.2.1 Live Loads: The following project specific live loads must be identified while limiting stresses within the glass panels to 6,000 psi (41.3 MPa) [modulus of rupture (24,000 psi) divided by a safety factor of 4] and the deflection to 1 inch (25.4 mm) or less:

A live load of 50 lb/ft applied in any direction along the top rail.

A single concentrated live load of 200 pounds (0.89 kN) applied in any direction at any point on the top of glass panel.

A horizontally applied normal live load of 50 pounds applied perpendicular to the glass panel on an area not to exceed 12 inches-by-12 inches (305 mm-by-305 mm).

4.2.2 Wind Loads: The allowable stress due to wind loading is 9600 psi (66.2 MPa). The required wind load must be determined by a qualified design professional based on the project-specific conditions, taking into account the balustrade location on the structure, and must not exceed the values shown in the tables of this report. The Shoe Glass Panel Railing System allowable wind load capacity is provided in Tables 3 through 12 of this report.

4.3 Holes and Notches:

Holes and notches are permitted for mounting handrails. Holes and notches must conform to ASTM C1048. Holes or notches must not be located within the first third of the glass panel (balustrade) height from the shoe.

4.4 Wind-Borne Debris Regions:

When installed in wind-borne debris regions, the system must be installed with either $^5/_8$-inch-thick (16 mm) or $^3/_4$-inch-thick (19 mm), laminated glass panels with a 0.06 inch, SentryGlas®Plus, SGP interlayer and a top rail. When installed as described in this section, the system is rated in accordance with IBC Section 2407.1.4 for use in wind zones 1 through 4, in which missile levels A, B, C, or D are required in accordance with ASTM E1996 as modified by Section 1609.2.2 of the 2021 and 2018 IBC (Section 1609.1.2 of the 2015 IBC).

5.0 CONDITIONS OF USE

The Shoe Glass Panel Railing System described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The product is limited to installation where it is not subject to vehicle impacts.

5.2 Drawings and design details for the Shoe Glass Panel Railing System, using the information noted in this report, must be included on construction plans submitted to the code official for approval. The drawings and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.3 The supporting structure and anchorage of the system to the supporting must be designed by a registered design professional and constructed to support the loads imposed by the guards in accordance with the applicable code. Maximum anchorage spacing used in the design must not exceed 24 inches (61 mm) on center.

5.4 When installed where the base shoe anchors are exposed to moisture, the base shoe anchors must be of a material intended for the use and identified by the manufacturer as acceptable for exterior applications.

5.5 All metals in contact with aluminum must either be an alloy approved for direct aluminum contact, or isolated from the aluminum by an approved coating.

5.6 The top rail (or handrail if no top rail is used) must be supported by a minimum of three glass panels, unless the top rail is supported by a wall or post on both ends.

5.7 Glass sand-blasted or etched on surfaces 1 (outside face) or 4 (inside face) is outside the scope of this report.

5.8 Use of the system as a grab bar is outside the scope of this report.

5.9 All monolithic glass panels must be as described in Section 3.5. All laminated glass panels must be fully tempered Type II laminated glass, with an interlayer complying with Section 3.4, and fabricated and inspected in accordance with ASTM C1172. The glass fabricator must provide certification of compliance with ASTM C1048 for fully tempered glass or ASTM C1172 for laminated glass as applicable. Glass must be procured directly from a qualified glass fabricator and is not produced or supplied by Viva Railings, LLC.

5.10 Monolithic glass panels installed on projects governed by the 2021, 2018 or 2015 IBC must be installed in accordance with the exception of 2021, 2018 and 2015 IBC Section 2407.1.

5.11 The Shoe Glass Panel Railing System components described in this report, except for the glass panels, are supplied by Viva Railings, LLC.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Glass Railing and Balustrade Systems (AC439) dated April 2019 (editorially revised August 2020), including ASTM E1996 impact tests.

7.0 IDENTIFICATION

7.1 The Shoe Glass Panel Railing System components described in this report are identified by a label on the packaging bearing the manufacturer's name; product description and/or part number; and the ICC-ES evaluation report number (ESR-4405).

7.2 The glass panels must be identified as specified in the applicable code.

7.3 The report holder's contact information is the following:

VIVA RAILINGS, LLC
151 W VISTA RIDGE MALL DRIVE
LEWISVILLE, TEXAS 75067
(972) 353-8482
www.vivarailings.com
info@vivarailings.com

TABLE 1—TOP RAIL SPAN LENGTHS
(Based on the top rail spanning over a minimum of three glass panels)

SHAPE	MAXIMUM SPAN (inches)[1,2,3,4]
U-Cap[5]	49”
E-Tube[5]	49”

For **SI:** 1 inch = 25.4 mm.

1. Based on the capacity of the top rail considering the worst case between a 50 plf uniform load and a 200 lb. concentrated load.
2. The maximum glass panel widths must not be greater than 48 inches.
3. The glass panels widths must not be less than the minimum glass panel width noted in Tables 3 through 12.
4. The ends of the top rails must be attached to a wall or a post.
5. See Figure 1, the top rails must be used with the compatible glass thickness, as applicable.

TABLE 2—HANDRAIL SPAN LENGTHS

SHAPE	MAXIMUM BRACKET SPACING (inches)[1,2,3]	
	Center to Center Spacing for Brackets Installed Between Panels	Spacing of Adjacent Brackets (La) for Brackets Installed Through Holes in Panels[4]
2” dia. Red Oak	48”	61”
2” dia. White Oak	48”	61”
2” dia. Cherry	48”	61”
$1^1/_2$” Stainless Tube	48”	61”
2” Stainless Tube	48”	61”

For **SI:** 1 inch = 25.4 mm.

1. Based on the capacity of the handrail considering the worst case between a 50 plf uniform load and a 200 lb. concentrated load.
2. The maximum glass panel widths must not be greater than 48 inches.
3. The glass panels widths must not be less than the minimum glass panel width noted in Tables 3 through 12.
4. See Figure 4 for adjacent bracket spacing definition (La).

TABLE 3—MONOLITHIC GLASS PANEL STRENGTH[5,6]

Nominal Glass Panel Thickness (in.)	Minimum Glass Panel Thickness	$M_{all\ wind}$ (lb-in./ft)	ALLOWABLE WIND PRESSURE ($w_{all\ wind}$[4]), psf FOR PANEL HEIGHT (H_c[2]), in.					LIVE LOAD OF 50 lbs/ft^3 Maximum Height (H_c[1,2]) inches based on:	
			36	42	48	60	72	Stress	1” Deflection
$^1/_2$	0.469	4233	71.0	52.2	39.9	25.5	17.7	52.7	39.7
$^5/_8$	0.595	6797	114.4	84.0	64.3	41.1	28.6	84.9	50.4
$^3/_4$	0.719	9925	167.0	122.7	93.9	60.1	41.7	124.0	60.9

For **SI:** 1 inch = 25.4 mm; 1 ft = 305 mm; 1 lb = 4.45 N

1. Based on an allowable live load stress of 6000 psi.
2. Glass height above top of base shoe H_c.
3. Other loads listed in Section 4.2.1 must be considered.
4. $w_{all\ wind}$ is based on an allowable wind load stress of 9600psi.
5. J-Shim dry mount mechanism part number SE-JS13.5 is required to support $^1/_2$-inch (12 mm) laminated glass panels, part number SE-JS17.5 is required to support $^5/_8$-inch (17 mm) laminated glass panels, and part number SE-JS19.0 is required to support $^3/_4$-inch (19 mm) laminated glass panels.
6. Panel width must be no less than 12 inches (305 mm).

TABLE 4—NOMINAL 1/2" (12MM) LAMINATED TEMPERED GLASS PANEL STRENGTH[3,6] (1/4" x 0.060" x 1/4")

Glass Panel Width (in.)	Eff. Defl. Thick. (in.)	Eff. Stress Thick. (in.)	$M_{all\ wind}$ (lb-in./ft)	ALLOWABLE WIND PRESSURE ($w_{all\ wind}$[5]), psf FOR PANEL HEIGHT (H_c[2]), in.					Live Load of 50 lbs/ft[4]	
	Hef;w[7]	hmin;ef;σ[8]		36	42	48	60	72	Maximum Height (H_c[1,2]) inches based on:	
Interlayer Shear Modulus, G ≥ 1639 psi for T ≤ 122°F									Stress	1" Defl.
12	0.3648	0.4062	3169	53.3	39.2	30.0	19.2	-	39.6	30.9
24	0.4343	0.4612	4084	68.7	50.5	38.6	24.7	17.1	51.0	36.8
36	0.4635	0.4793	4412	74.2	54.5	41.7	26.7	18.5	55.1	39.2
41	0.4635	0.4793	4412	*	*	*	*	*	55.1	39.2
48	0.4635	0.4793	4412	*	*	*	*	*	55.1	39.2

TABLE 5—NOMINAL 1/2" (12MM) LAMINATED TEMPERED GLASS PANEL STRENGTH[3,6] (1/4" x 0.035" x 1/4")

Glass Panel Width (in.)	Eff. Defl. Thick. (in.)	Eff. Stress Thick. (in.)	$M_{all\ wind}$ (lb-in./ft)	ALLOWABLE WIND PRESSURE ($w_{all\ wind}$[5]), psf FOR PANEL HEIGHT (H_c[2]), in.					LIVE LOAD OF 50 lbs/ft[4]	
	Hef;w	hmin;ef;σ		36	42	48	60	72	Maximum Height (H_c[1,2]) inches based on:	
Interlayer Shear Modulus, G ≥ 1639 psi for T ≤ 122°F									Stress	1" Defl.
12	0.3775	0.4118	3257	54.8	40.2	30.8	19.7	-	40.7	32.0
24	0.4340	0.4515	3914	65.8	48.4	37.0	23.7	16.4	48.9	36.7
36	0.4532	0.4626	4109	69.1	50.8	38.9	24.9	17.2	51.3	38.4
41	0.4532	0.4626	4109	*	*	*	*	*	51.3	38.4
48	0.4532	0.4626	4109	*	*	*	*	*	51.3	38.4

TABLE 6—NOMINAL 1/2" (12MM) LAMINATED TEMPERED GLASS PANEL STRENGTH[3,6] (1/4" x 0.030" x 1/4")

Glass Panel Width (in.)	Eff. Defl. Thick. (in.)	Eff. Stress Thick. (in.)	$M_{all\ wind}$ (lb-in./ft)	ALLOWABLE WIND PRESSURE ($w_{all\ wind}$[5]), psf FOR PANEL HEIGHT (H_c[2]), in.					LIVE LOAD OF 50 lbs/ft[4]	
	Hef;w	hmin;ef;σ		36	42	48	60	72	Maximum Height (H_c[1,2]) inches based on:	
Interlayer Shear Modulus, G ≥ 1639 psi for T ≤ 122°F									Stress	1" Defl.
12	0.3816	0.4137	3286	55.3	40.6	31.1	19.9	-	41.0	32.3
24	0.4341	0.4495	3880	65.3	47.9	36.7	23.5	16.3	48.5	36.8
36	0.4511	0.4591	4048	68.1	50.0	38.3	24.5	17.0	50.6	38.2
41	0.4511	0.4591	4048	*	*	*	*	*	50.6	38.2
48	0.4511	0.4591	4048	*	*	*	*	*	50.6	38.2

For **SI:** 1 inch = 25.4 mm; 1 ft = 305 mm; 1 lb = 4.45 N

1. Based on an allowable live load stress of 6000 psi.
2. Glass height above top of base shoe H_c.
3. * Allowable load is equivalent to the last value above.
4. Other loads listed in Section 4.2.1 must be considered.
5. $w_{all\ wind}$ is based on an allowable wind load stress of 9600psi.
6. J-Shim dry mount mechanism part number SE-JS13.5 is required to support 1/2-inch (12 mm) laminated glass panels, part number SE-JS17.5 is required to support 5/8-inch(17 mm) laminated glass panels, and part number SE-JS19.0 is required to support 3/4-inch (19 mm) laminated glass panels.
7. Hef;w is the effective thickness for calculating deflection in accordance with ASTM E1300-16 (ASTM E1300-12ae[1] for 2018 and 2015 IBC and IRC).
8. hmin;ef;σ is the effective thickness for calculating stress in accordance with ASTM E1300-16 (ASTM E1300-12ae[1] for 2018 and 2015 IBC and IRC).

TABLE 7— NOMINAL $^5/_8$" (16MM) LAMINATED TEMPERED GLASS PANEL STRENGTH[3,6] ($^5/_{16}$" x 0.060" x $^5/_{16}$")

Glass Panel Width (in.)	Eff. Defl. Thick. (in.)	Eff. Stress Thick. (in.)	$M_{all\ wind}$ (lb-in./ft)	ALLOWABLE WIND PRESSURE ($w_{all\ wind}$[5]), psf FOR PANEL HEIGHT (H_c[2]), in.					LIVE LOAD OF 50 lbs/ft[4]	
	Hef;w	hmin;ef;σ		36	42	48	60	72	Maximum Height (H_c[1,2]) inches based on:	
Interlayer Shear Modulus, G ≥ 1639 psi for T ≤ 122°F									Stress	1" Defl.
12	0.4591	0.5127	5047	84.9	62.4	47.8	30.5	21.2	63.0	38.9
24	0.5471	0.5860	6595	111.0	81.5	62.4	39.9	27.7	82.4	46.3
36	0.5892	0.6138	7234	121.7	89.4	68.5	43.8	30.4	90.4	49.9
41	0.5892	0.6138	7234	*	*	*	*	*	90.4	49.9
48	0.5892	0.6138	7234	*	*	*	*	*	90.4	49.9
Interlayer Shear Modulus, G ≥ 42.1 psi T ≤ 122°F									Stress	1" Defl.
12	0.3716	0.4174	3346	56.3	41.6	31.6	20.2	-	41.8	31.5
24	0.3821	0.4300	3550	59.7	43.9	33.6	21.5	-	44.3	32.3
36	0.3975	0.4479	3852	64.8	47.6	36.4	23.3	16.2	48.1	33.6
41	0.3975	0.4479	3852	*	*	*	*	*	48.1	33.6
48	0.3975	0.4479	3852	*	*	*	*	*	48.1	33.6

TABLE 8— NOMINAL $^5/_8$" (16MM) LAMINATED TEMPERED GLASS PANEL STRENGTH[3,6] ($^5/_{16}$" x 0.035" x $^5/_{16}$")

Glass Panel Width (in.)	Eff. Defl. Thick. (in.)	Eff. Stress Thick. (in.)	$M_{all\ wind}$ (lb-in./ft)	ALLOWABLE WIND PRESSURE ($w_{all\ wind}$[5]), psf FOR PANEL HEIGHT (H_c[2]), in.					LIVE LOAD OF 50 lbs/ft[4]	
	Hef;w	hmin;ef;σ		36	42	48	60	72	Maximum Height (H_c[1,2]) inches based on:	
	Interlayer Shear Modulus, G ≥ 1639 psi for T ≤ 122°F								Stress	1" Defl.
12	0.4791	0.5263	5319	89.5	65.7	50.3	32.2	22.3	66.4	40.6
24	0.5566	0.5837	6542	110.1	80.9	61.9	39.6	27.5	81.7	47.1
36	0.5863	0.6016	6949	116.9	85.9	65.8	42.1	29.2	86.8	49.6
41	0.5863	0.6016	6949	*	*	*	*	*	86.8	49.6
48	0.5863	0.6016	6949	*	*	*	*	*	86.8	49.6
	Interlayer Shear Modulus, G ≥ 42.1 psi T ≤ 122°F								Stress	1" Defl.
12	0.3733	0.4193	3376	56.8	41.7	31.9	20.4	-	42.2	31.6
24	0.3881	0.4363	3656	61.5	45.2	34.6	22.1	-	45.7	32.9
36	0.4087	0.4590	4043	68.0	50.0	38.2	24.5	17.0	50.5	34.6
41	0.4087	0.4590	4043	*	*	*	*	*	50.5	34.6
48	0.4087	0.4590	4043	*	*	*	*	*	50.5	34.6

For **SI:** 1 inch = 25.4 mm; 1 ft = 305 mm; 1 lb = 4.45 N

1. Based on an allowable live load stress of 6000 psi.
2. Glass height above top of base shoe H_c.
3. * Allowable load is equivalent to the last value above.
4. Other loads listed in Section 4.2.1 must be considered.
5. $w_{all\ wind}$ is based on an allowable wind load stress of 9600psi.
6. J-Shim dry mount mechanism part number SE-JS13.5 is required to support $^1/_2$-inch (12 mm) laminated glass panels, part number SE-JS17.5 is required to support $^5/_8$-inch (17 mm) laminated glass panels, and part number SE-JS19.0 is required to support $^3/_4$-inch (19 mm) laminated glass panels.
7. Hef;w is the effective thickness for calculating deflection in accordance with ASTM E1300-16 (ASTM E1300-12ae[1] for 2018 and 2015 IBC and IRC).
8. hmin;ef;σ is the effective thickness for calculating stress in accordance with ASTM E1300-16 (ASTM E1300-12ae[1] for 2018 and 2015 IBC and IRC).

TABLE 9— NOMINAL $^5/_8$" (16MM) LAMINATED TEMPERED GLASS PANEL STRENGTH[3,6] ($^5/_{16}$" x 0.030" x $^5/_{16}$")

Glass Panel Width (in.)	Eff. Defl. Thick. (in.)	Eff. Stress Thick. (in.)	$M_{all\ wind}$ (lb-in./ft)	ALLOWABLE WIND PRESSURE ($w_{all\ wind}$[5]), psf FOR PANEL HEIGHT (H_c[2]), in.					LIVE LOAD OF 50 lbs/ft[4]	
	Hef;w	hmin;ef;σ		36	42	48	60	72	Maximum Height (H_c[1,2]) inches based on:	
Interlayer Shear Modulus, G ≥ 1639 psi for T ≤ 122ºF									Stress	1" Defl.
12	0.4855	0.5305	5404	90.9	66.8	51.1	32.7	22.7	67.5	41.1
24	0.5592	0.5834	6536	110.0	80.8	61.8	39.6	27.5	81.7	47.4
36	0.5858	0.5991	6891	116.0	85.2	65.2	41.7	29.0	86.1	49.6
41	0.5858	0.5991	6891	*	*	*	*	*	86.1	49.6
48	0.5858	0.5991	6891	*	*	*	*	*	86.1	49.6
Interlayer Shear Modulus, G ≥ 42.1 psi T ≤ 122ºF									Stress	1" Defl.
12	0.3740	0.4201	3389	57.0	41.9	32.0	20.5	-	42.3	31.7
24	0.3905	0.4388	3697	62.2	45.7	35.0	22.4	-	46.2	33.1
36	0.4128	0.4628	4113	69.2	50.8	38.9	24.9	17.3	51.4	34.9
41	0.4128	0.4628	4113	*	*	*	*	*	51.4	34.9
48	0.4128	0.4628	4113	*	*	*	*	*	51.4	34.9

TABLE 10— NOMINAL $^3/_4$" (19MM) LAMINATED TEMPERED GLASS PANEL STRENGTH[3,6] ($^3/_8$" x 0.060" x $^3/_8$")

Glass Panel Width (in.)	Eff. Defl. Thick. (in.)	Eff. Stress Thick. (in.)	$M_{all\ wind}$ (lb-in./ft)	ALLOWABLE WIND PRESSURE ($w_{all\ wind}$[5]), psf FOR PANEL HEIGHT (H_c[2]), in.					LIVE LOAD OF 50 lbs/ft[4]	
	Hef;w	hmin;ef;σ		36	42	48	60	72	Maximum Height (H_c[1,2]) inches based on:	
Interlayer Shear Modulus, G ≥ 1639 psi for T ≤ 122ºF									Stress	1" Defl.
12	0.5399	0.6037	6999	117.8	86.5	66.2	42.4	29.4	87.4	45.7
24	0.6416	0.6914	9179	154.5	113.5	86.9	55.6	38.6	114.7	54.3
36	0.6951	0.7280	10176	171.3	125.8	96.3	61.6	42.8	127.2	58.9
41	0.6951	0.7280	10176	*	*	*	*	*	127.2	58.9
48	0.6951	0.7280	10176	*	*	*	*	*	127.2	58.9
Interlayer Shear Modulus, G ≥ 42.1 psi T ≤ 122ºF									Stress	1" Defl.
12	0.4507	0.5062	4921	82.8	60.8	46.6	29.8	20.7	61.5	38.2
24	0.4608	0.5181	5154	86.7	63.7	48.8	31.2	21.6	64.4	39.0
36	0.4759	0.5356	5508	92.7	68.1	52.1	33.1	23.1	68.8	40.3
41	0.4759	0.5356	5508	*	*	*	*	*	68.8	40.3
48	0.4759	0.5356	5508	*	*	*	*	*	68.8	40.3

For **SI:** 1 inch = 25.4 mm; 1 ft = 305 mm; 1 lb = 4.45 N

1. Based on an allowable live load stress of 6000 psi.
2. Glass height above top of base shoe H_c.
3. * Allowable load is equivalent to the last value above.
4. Other loads listed in Section 4.2.1 must be considered.
5. $w_{all\ wind}$ is based on an allowable wind load stress of 9600psi.
6. J-Shim dry mount mechanism part number SE-JS13.5 is required to support $^1/_2$-inch (12 mm) laminated glass panels, part number SE-JS17.5 is required to support $^5/_8$-inch (17 mm) laminated glass panels, and part number SE-JS19.0 is required to support $^3/_4$-inch (19 mm) laminated glass panels.
7. Hef;w is the effective thickness for calculating deflection in accordance with ASTM E1300-16 (ASTM E1300-12ae[1] for 2018 and 2015 IBC and IRC).
8. hmin;ef;σ is the effective thickness for calculating stress in accordance with ASTM E1300-16 (ASTM E1300-12ae[1] for 2018 and 2015 IBC and IRC).
9. Interior use only.

TABLE 11— NOMINAL $^3/_4$" (19MM) LAMINATED TEMPERED GLASS PANEL STRENGTH[3,6] ($^3/_8$" x 0.035" x $^3/_8$")

Glass Panel Width (in.)	Eff. Defl. Thick. (in.)	Eff. Stress Thick. (in.)	$M_{all\ wind}$ (lb-in./ft)	ALLOWABLE WIND PRESSURE ($w_{all\ wind}$[5]), psf FOR PANEL HEIGHT (H_c[2]), in.					LIVE LOAD OF 50 lbs/ft[4]	
	Hef;w	hmin;ef;σ		36	42	48	60	72	Maximum Height (H_c[1,2]) inches based on:	
Interlayer Shear Modulus, G ≥ 1639 psi for T ≤ 122°F									Stress	1" Defl.
12	0.5649	0.6231	7456	125.5	92.2	70.6	45.1	31.3	93.2	47.8
24	0.6595	0.6957	9294	156.4	114.9	88.0	56.3	39.1	116.1	55.9
36	0.6990	0.7202	9960	167.6	123.1	94.3	60.3	41.9	124.5	59.2
41	0.6990	0.7202	9960	*	*	*	*	*	124.5	59.2
48	0.6990	0.7202	9960	*	*	*	*	*	124.5	59.2
Interlayer Shear Modulus, G ≥ 42.1 psi T ≤ 122°F									Stress	1" Defl.
12	0.4525	0.5082	4959	83.4	61.3	46.9	30.0	20.8	61.9	38.3
24	0.4671	0.5249	5290	89.0	65.4	50.0	32.0	22.2	66.1	39.5
36	0.4880	0.5479	5764	97.0	71.2	54.5	34.9	24.2	72.0	41.3
41	0.4880	0.5479	5764	*	*	*	*	*	72.0	41.3
48	0.4880	0.5479	5764	*	*	*	*	*	72.0	41.3

TABLE 12— NOMINAL $^3/_4$" (19MM) LAMINATED TEMPERED GLASS PANEL STRENGTH[3,6] ($^3/_8$" x 0.030" x $^3/_8$")

Glass Panel Width (in.)	Eff. Defl. Thick. (in.)	Eff. Stress Thick. (in.)	$M_{all\ wind}$ (lb-in./ft)	ALLOWABLE WIND PRESSURE ($w_{all\ wind}$[5]), psf FOR PANEL HEIGHT (H_c[2]), in.					LIVE LOAD OF 50 lbs/ft[4]	
	Hef;w	hmin;ef;σ		36	42	48	60	72	Maximum Height (H_c[1,2]) inches based on:	
Interlayer Shear Modulus, G ≥ 1639 psi for T ≤ 122°F									Stress	1" Defl.
12	0.5730	0.6291	7600	127.9	94.0	71.9	46.0	31.9	95.0	48.5
24	0.6643	0.6970	9329	157.0	115.3	88.3	56.5	39.2	116.6	56.3
36	0.7001	0.7187	9918	166.9	122.6	93.9	60.1	41.7	123.9	59.3
41	0.7001	0.7187	9918	*	*	*	*	*	123.9	59.3
48	0.7001	0.7187	9918	*	*	*	*	*	123.9	59.3
Interlayer Shear Modulus, G ≥ 42.1 psi T ≤ 122°F									Stress	1" Defl.
12	0.4532	0.5089	4974	83.7	61.5	47.1	30.1	20.9	62.1	38.4
24	0.4696	0.5275	5343	89.9	66.0	50.5	32.3	22.4	66.7	39.8
36	0.4925	0.5524	5859	98.6	72.4	55.4	35.5	24.6	73.2	41.7
41	0.4925	0.5524	5859	*	*	*	*	*	73.2	41.7
48	0.4925	0.5524	5859	*	*	*	*	*	73.2	41.7

For **SI:** 1 inch = 25.4 mm; 1 ft = 305 mm; 1 lb = 4.45 N

1. Based on an allowable live load stress of 6000 psi.
2. Glass height above top of base shoe H_c.
3. * Allowable load is equivalent to the last value above.
4. Other loads listed in Section 4.2.1 must be considered.
5. $w_{all\ wind}$ is based on an allowable wind load stress of 9600psi.
6. J-Shim dry mount mechanism part number SE-JS13.5 is required to support $^1/_2$-inch" (12 mm) laminated glass panels, part number SE-JS17.5 is -required to support $^5/_8$-inch (17 mm) laminated glass panels, and part number SE-JS19.0 is required to support $^3/_4$-inch (19 mm) laminated glass panels.
7. Hef;w is the effective thickness for calculating deflection in accordance with ASTM E1300-16 (ASTM E1300-12ae[1] for 2018 and 2015 IBC and IRC).
8. hmin;ef;σ is the effective thickness for calculating stress in accordance with ASTM E1300-16 (ASTM E1300-12ae[1] for 2018 and 2015 IBC and IRC).

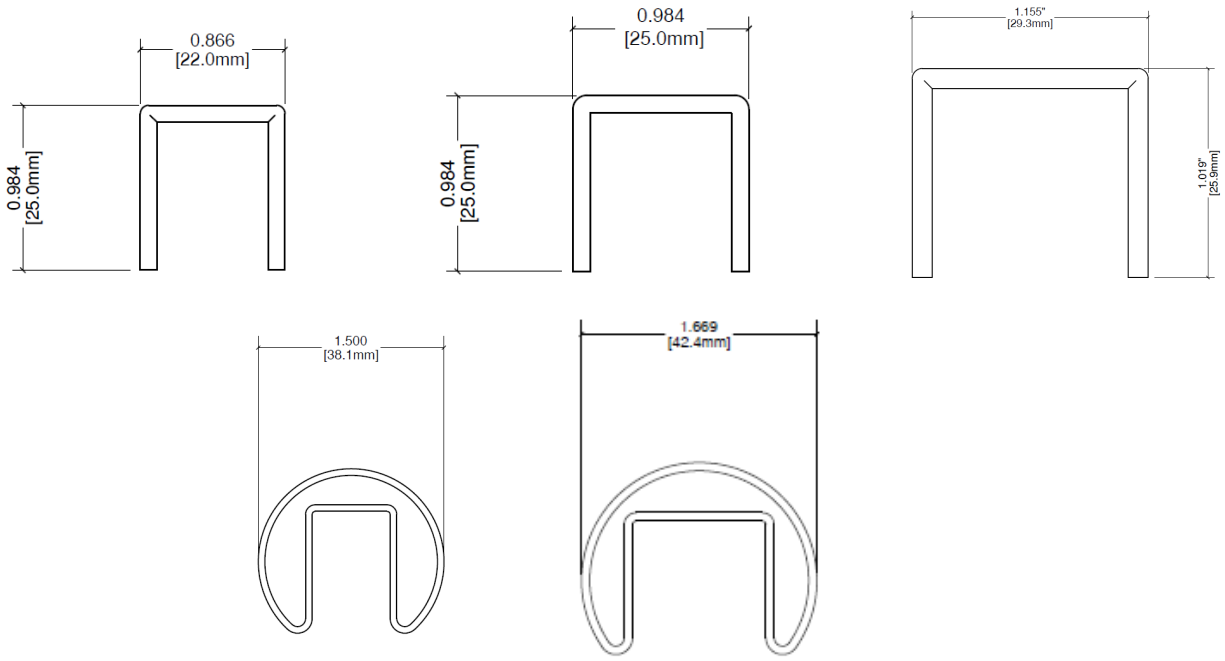

FIGURE 1—TOP RAIL PROFILES; 1/2" U-CAP (TOP LEFT), 5/8" U-CAP (TOP MIDDLE), 3/4" U-CAP (TOP RIGHT), 1/2" E-TUBE (BOTTOM LEFT), 5/8" and 3/4" E-TUBE (BOTTOM RIGHT)

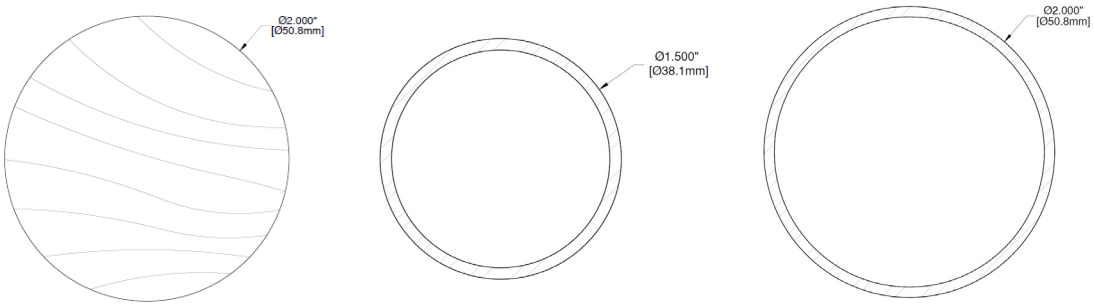

FIGURE 2—HANDRAIL PROFILES; WOOD (LEFT), 1 1/2" STAINLESS TUBE (MIDDLE) AND 2" STAINLESS TUBE (RIGHT)

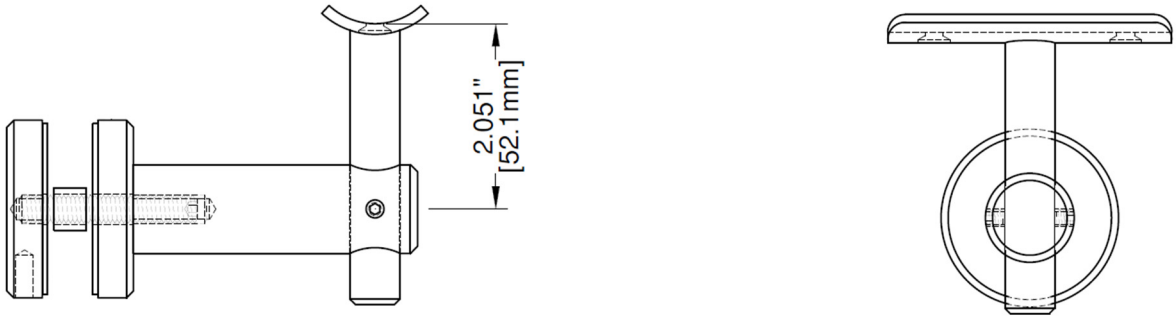

FIGURE 3—TYPICAL HANDRAIL BRACKET (SADDLE PORTION OF CLIP IS MATCHED TO THE RADIUS OF THE SELECTED HANDRAIL)

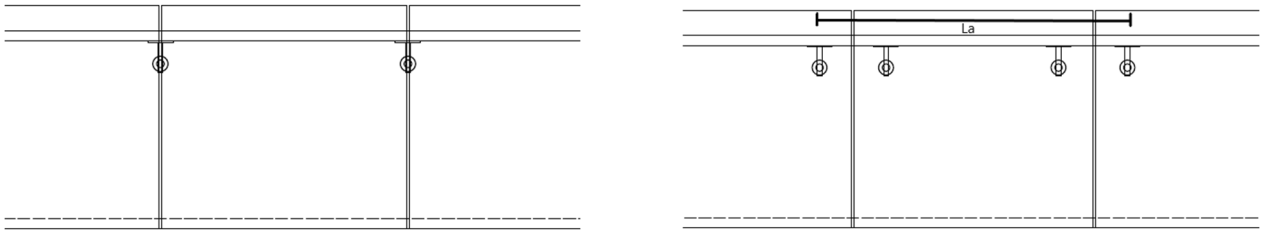

FIGURE 4—HANDRAIL BRACKET INSTALLATIONS; BETWEEN PANELS (LEFT) AND THROUGH PANELS (RIGHT)

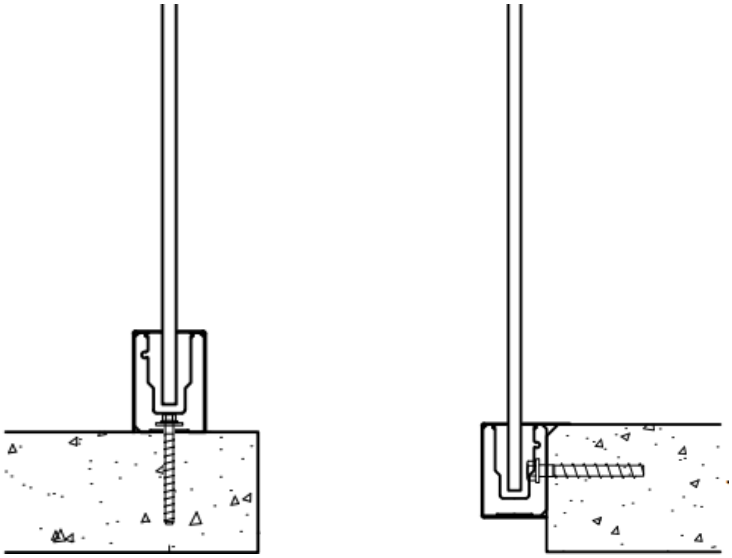

FIGURE 5— TYPICAL DETAILS; SURFACE MOUNTED (LEFT) AND FASCIA MOUNTED (RIGHT)

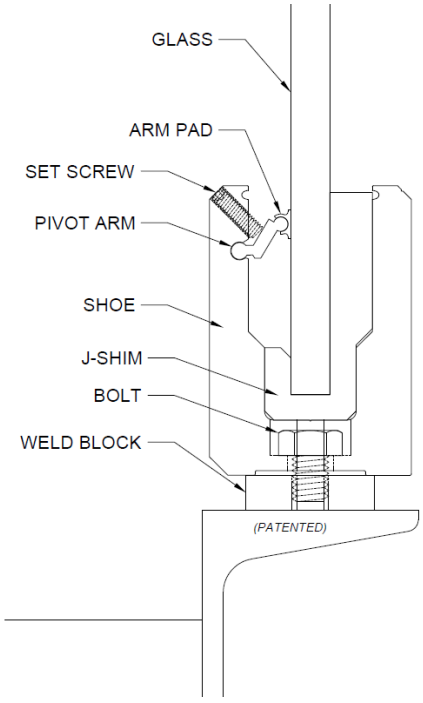

FIGURE 6—TYPICAL J-SHIM SUPPORT, BASE SHOE, AND GLASS ASSEMBLY

DIVISION: 05 00 00—METALS
Section: 05 52 00—Metal Railings
Section: 05 73 13—Glazed Decorative Metal Railings

DIVISION: 08 00 00—OPENINGS
Section: 08 81 00—Glass Glazing
Section: 08 88 00—Special Function Glazing

REPORT HOLDER:

VIVA RAILINGS, LLC.

EVALUATION SUBJECT:

SHOE GLASS PANEL RAILING SYSTEM

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Shoe Glass Panel Railing System, described in ICC-ES evaluation report ESR-4405, has also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2020 *City of Los Angeles Building Code* (LABC)
- 2020 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The Shoe Glass Panel Railing System, described in Sections 2.0 through 7.0 of the evaluation report ESR-4405, complies with the LABC Chapters 10 and 24, and the LARC, and is subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Shoe Glass Panel Railing System described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-4405.
- The design, installation, conditions of use and identification of the Shoe Glass Panel Railing System are in accordance with the 2018 *International Building Code®* (IBC) provisions noted in the evaluation report ESR-4405.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17 or LARC Chapter 3, as applicable.

This supplement expires concurrently with the evaluation report reissued August 2023.

DIVISION: 05 00 00—METALS
Section: 05 52 00—Metal Railings
Section: 05 73 13—Glazed Decorative Metal Railings

DIVISION: 08 00 00—OPENINGS
Section: 08 81 00—Glass Glazing
Section: 08 88 00—Special Function Glazing

REPORT HOLDER:

VIVA RAILINGS, LLC.

EVALUATION SUBJECT:

SHOE GLASS PANEL RAILING SYSTEM

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Shoe Glass Panel Railing System, described in ICC-ES evaluation report ESR-4405, has also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2022 and 2019 *California Building Code* (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2022 and 2019 *California Residential Code* (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The Shoe Glass Panel Railing System, described in Sections 2.0 through 7.0 of the evaluation report ESR-4405, complies with CBC Chapters 10, 16 and 24, provided the design and installation are in accordance with the 2018 and 2021 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 10, 16 and 24, as applicable.

2.1.1 OSHPD: The Shoe Glass Panel Railing System, described in Sections 2.0 through 7.0 of the evaluation report ESR-4405, complies with CBC amended Sections in Chapters 10, 16 and 24, and Chapter 16A, provided the design and installation are in accordance with the 2021 and 2018 *International Building Code*® (IBC) provisions noted in the evaluation report, as applicable.

2.1.1.1 Conditions of Use:

- All loads applied shall be determined by a registered structural engineer and shall comply with applicable loads from CBC Chapter 16 [OSHPD 3] and its applicable amendments [OSHPD 1R, 2 and 5], and Chapter 16A [OSHPD 1 and 4].

2.1.2 DSA: The Shoe Glass Panel Railing System, described in Sections 2.0 through 7.0 of the evaluation report ESR-4405, complies with CBC amended chapters 10, 16 and 24, and Chapter 16A, provided the design and installation are in accordance with the 2021 and 2018 *International Building Code*® (IBC) provisions noted in the evaluation report, as applicable, and the additional requirements in Section 2.1.2.1 of this supplement:

2.1.2.1 Conditions of Use:

- When used with means of egress under CBC Section 1014 [DSA-AC], the Shoe Glass Panel Railing System must comply with Section 11B-505 of the CBC.

- All loads applied shall be determined by a registered structural engineer and shall comply with applicable loads from applicable sections of CBC Chapter and its applicable amendments [DSA-SS/CC], and Chapter 16A [DSA-SS].

2.2 CRC:

The Shoe Glass Panel Railing System, described in Sections 2.0 through 7.0 of the evaluation report ESR-4405, complies with CRC Chapter 3, provided the design and installation are in accordance with the 2021 and 2018 *International Residential Code*® (IRC) provisions noted in the evaluation report and the additional requirements of CRC Chapter 3.

This supplement expires concurrently with the evaluation report, reissued August 2023.

ICC-ES Evaluation Report

ESR-4405 FBC Supplement

Reissued August 2023

This report is subject to renewal August 2025.

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DIVISION: 05 00 00—METALS
Section: 05 52 00—Metal Railings
Section: 05 73 13—Glazed Decorative Metal Railings

DIVISION: 08 00 00—OPENINGS
Section: 08 81 00—Glass Glazing
Section: 08 88 00—Special Function Glazing

REPORT HOLDER:

VIVA RAILINGS, LLC.

EVALUATION SUBJECT:

SHOE GLASS PANEL RAILING SYSTEM

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Shoe Glass Panel Railing System, subject of ICC-ES evaluation report ESR-4405, has also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2020 *Florida Building Code—Building*
- 2020 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Shoe Glass Panel Railing System, described in Sections 2.0 through 7.0 of ICC-ES evaluation report ESR-4405, complies with the 2020 *Florida Building Code—Building* or the *Florida Building Code—Residential.* The design requirements must be determined in accordance with the *Florida Building Code—Building* or the *Florida Building Code—Residential,* as applicable. The installation requirements noted in ICC-ES evaluation report ESR-4405 for the 2018 *International Building Code®* meet the requirements of the *Florida Building Code—Building* or the *Florida Building Code—-Residential,* as applicable, with the following conditions:

Use of the Shoe Glass Panel Railing System has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* or the *Florida Building Code—Residential*. Installation must be in accordance with the Windborne Debris Region requirements noted in ICC-ES evaluation report ESR-4405.

For products falling under Florida Rule 61G20-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report, reissued August 2023.