ADVANCED GLAZING SYSTEM DESIGN

PROTECTING THE BUILDING ENVELOPE

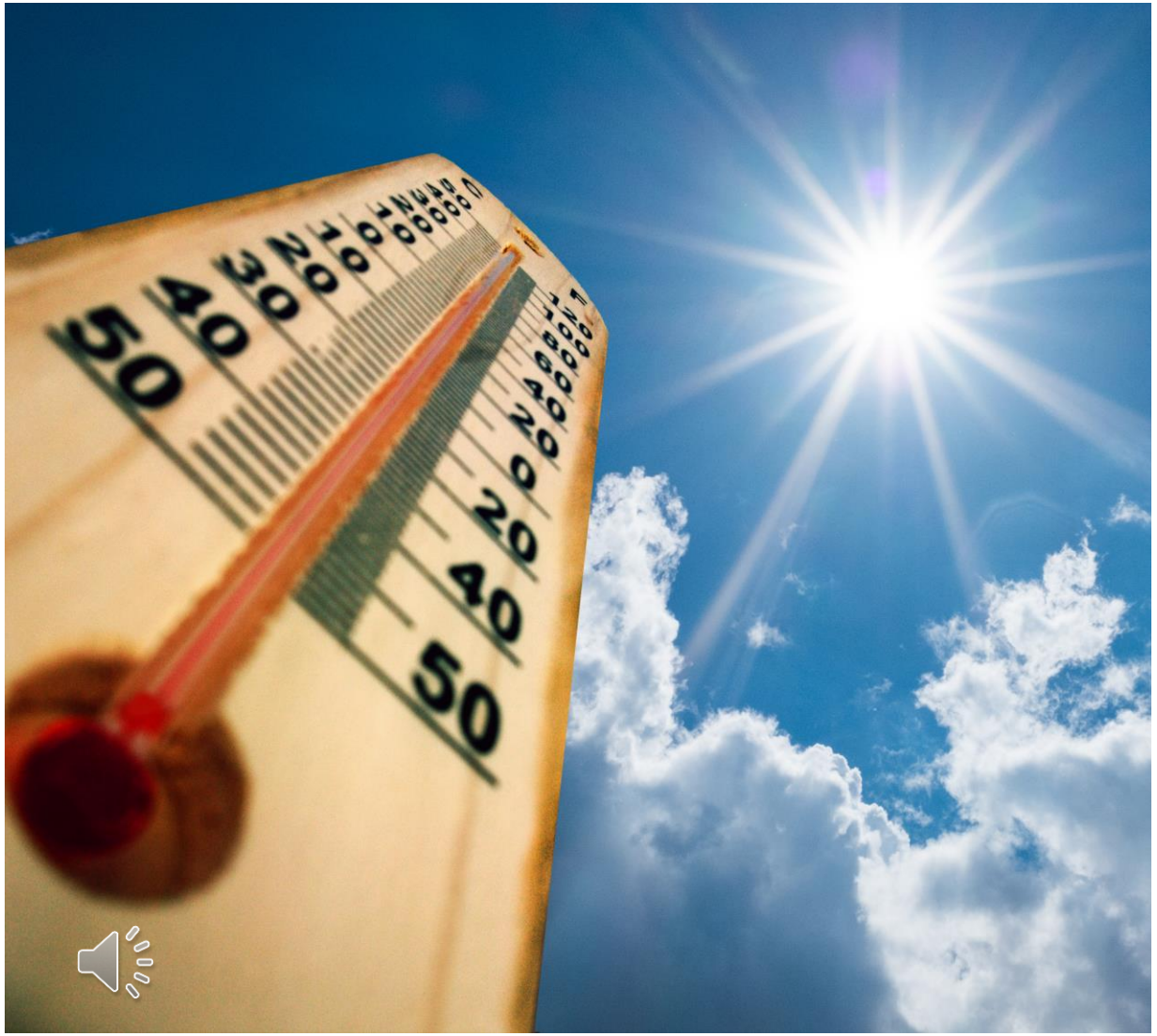
PRESENTED BY: RAY CRAWFORD, CRAWFORD-TRACEY CORPORATION

DESIGN EVOLUTION

- Energy Performance
- Light Penetration
- Outdoor/Indoor Integration
- Smart and Automated Technology
- Taller/Wider Spans
- Complex Designs

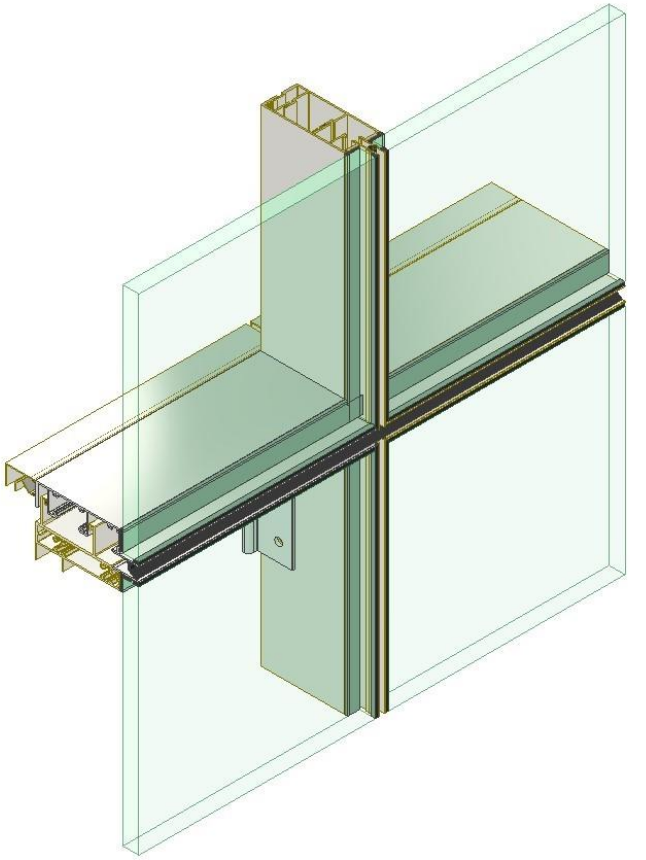
The Gherkin: London, England
Architect: Norman Foster

FLORIDA WEATHER



PERFORMANCE CONCERNS

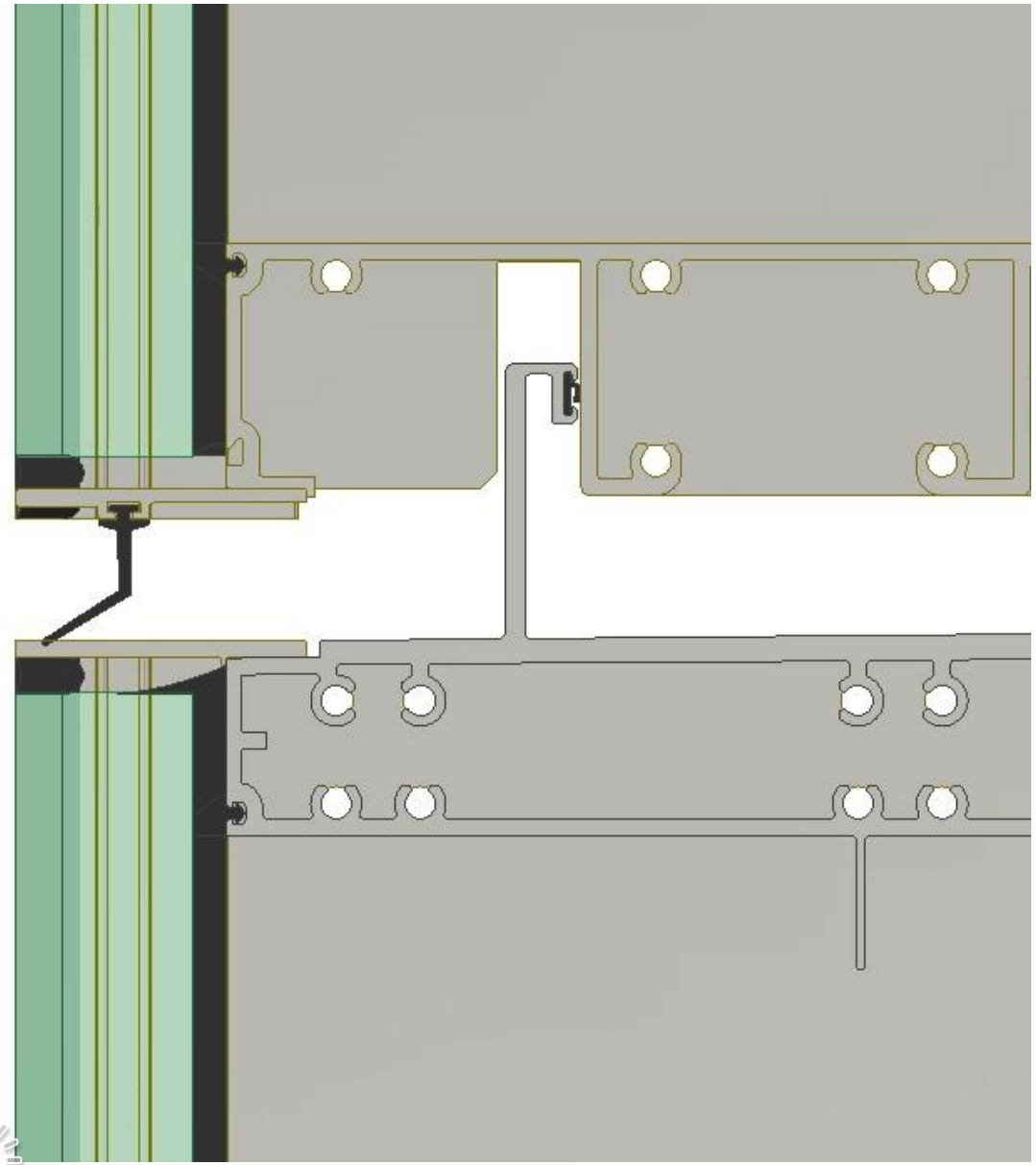
- Water/Air Infiltration
- Wind Speed (based on project location
- Impact Resistance (based on project location)
- Thermal/Energy Performance

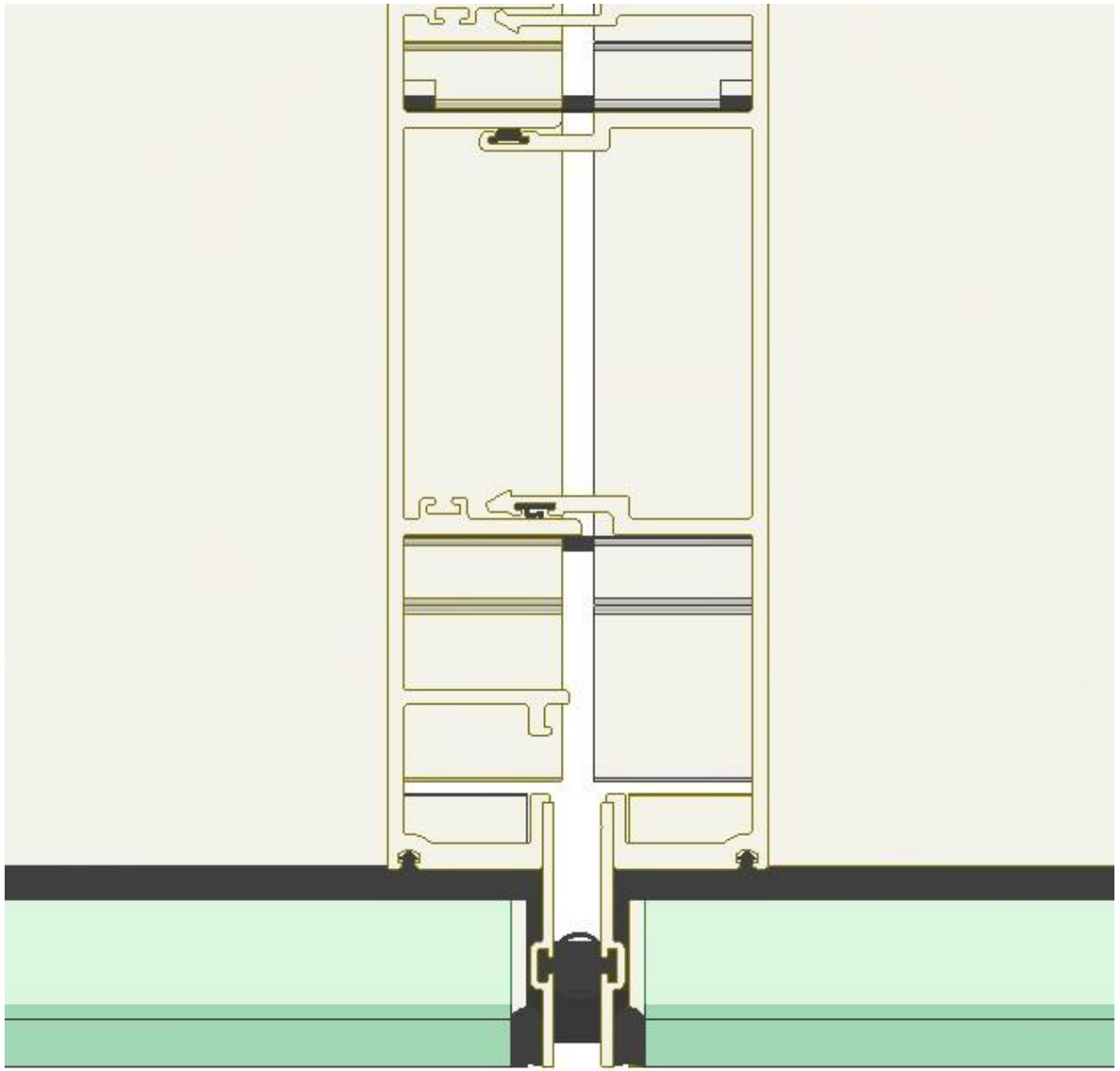


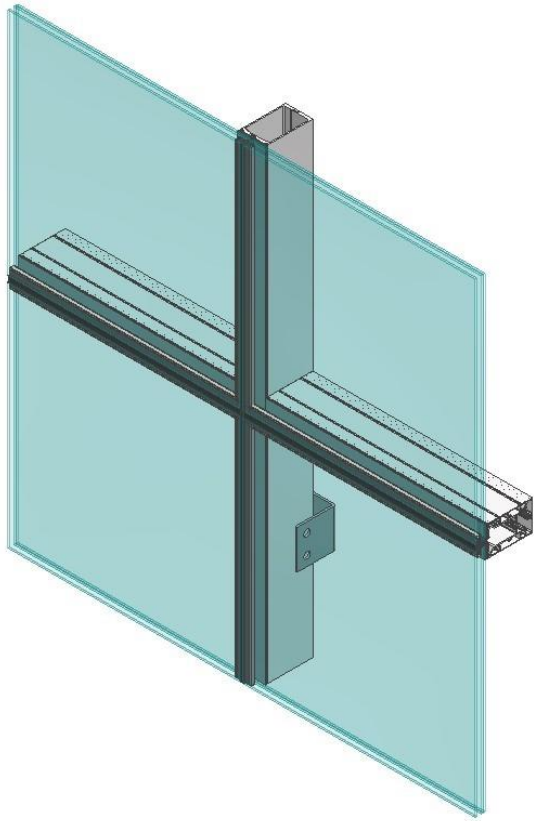
SYSTEM DESIGN FOR WATER/AIR RESISTANCE

PRESSURE-EQUALIZED

- This system relies on pressure equalization, using gaskets, seals and weeps to control pressure-driven moisture infiltration by naturally regulating the pressure within the cavity of the frame. The interior interface of the glass and the frame establishes the difference between the wet and dry side.



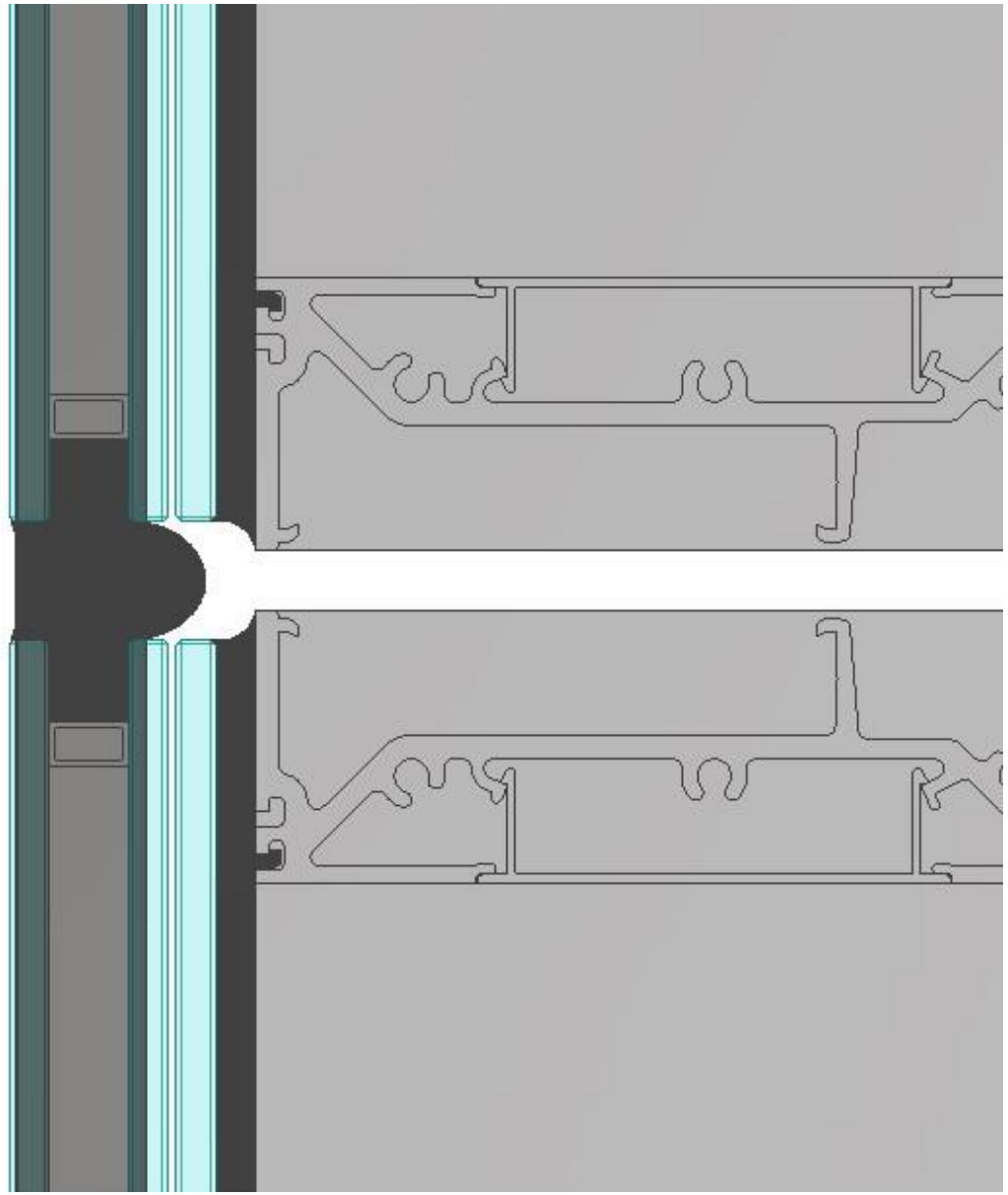


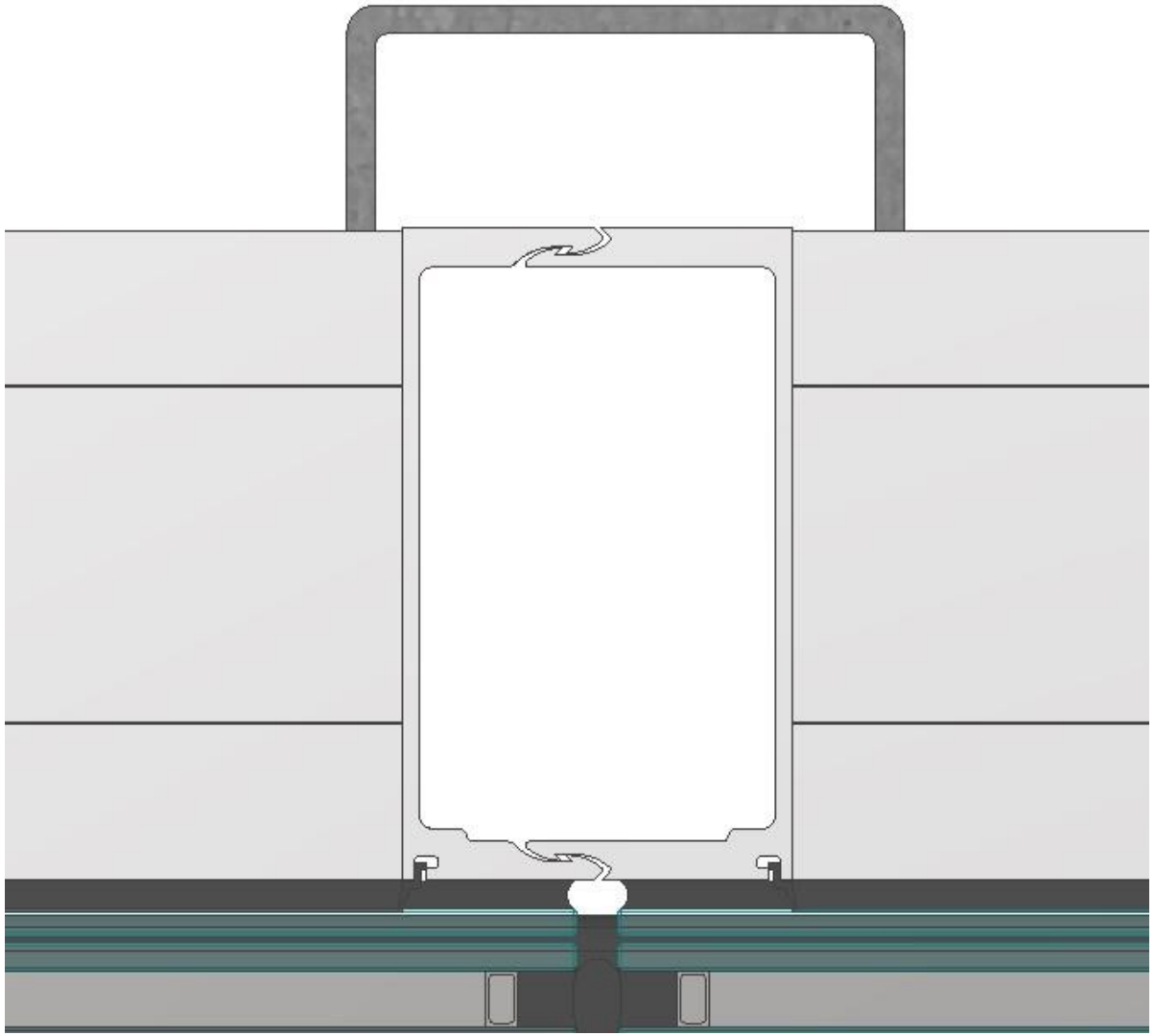


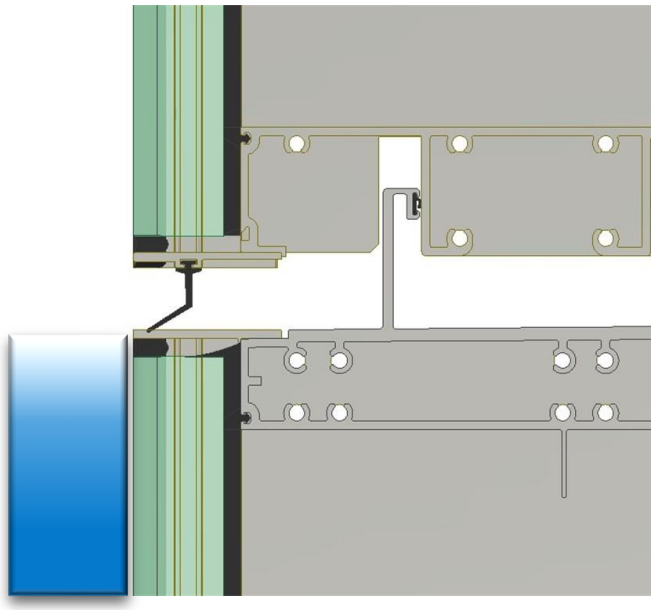
SYSTEM DESIGN FOR WATER/AIR RESISTANCE

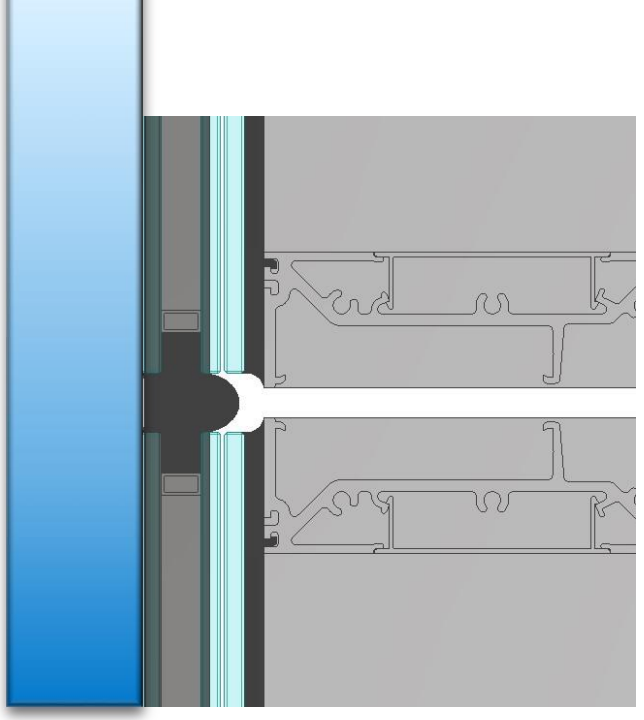
FACE-SEALED BARRIER WALL

- This 4-sided structurally glazed, face-sealed barrier wall design has its framing components entirely on the dry side of the system. The glass and silicone sealant at the exterior face serve as the principal drainage plane – no weeps, joints or pressure bars, just silicone and glass.





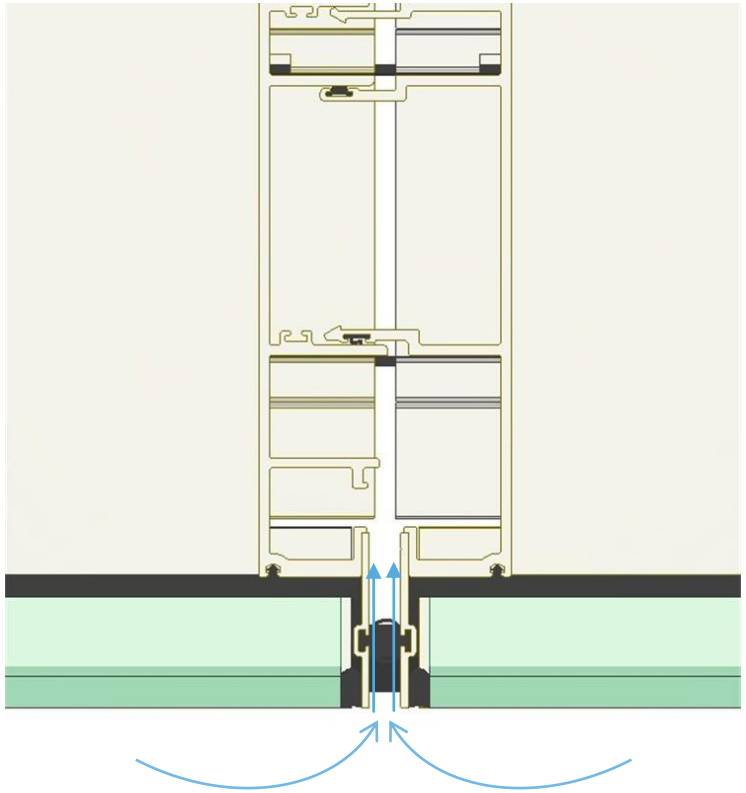


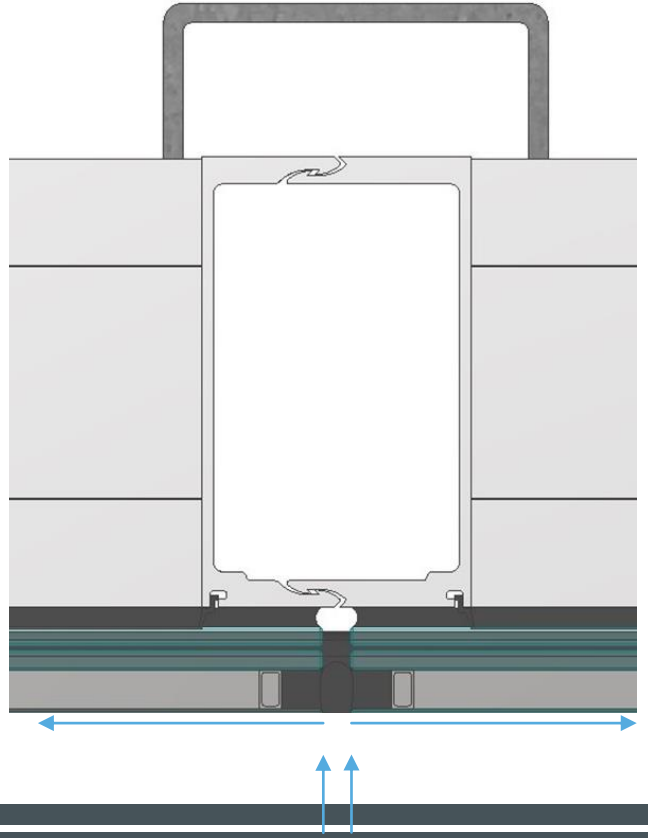


SYSTEM DESIGN FOR WATER/AIR RESISTANCE

PRESSURE-EQUALIZED VS. FACE-SEAL BARRIER WALL

- The pressure-equalized system is designed to allow water in and divert it from the "dry" side of the system.
- The face-seal barrier wall system does not allow water past the exterior plane.





SYSTEM DESIGN FOR WATER/AIR RESISTANCE

PRESSURE-EQUALIZED VS. FACE-SEAL BARRIER WALL

- Pressure-equalized systems are meant to block all forces to keep the building interior air and watertight. However, both air and water have the potential to enter through the gasket, gasket joinery and frame joinery.
- The structurally glazed, face-sealed barrier wall system creates an actual “barrier” against both water and air, resisting their entry.

WATER TESTS AND CODES

LAB TESTS:

- **ASTM E331** – Unified Static Air Pressure
- **ASTM E547** – Cyclic Static Air Pressure Difference
- **TAS 202** - a more stringent testing standard, to qualify systems for use in both Florida and HVHZ (High Velocity Hurricane Zone, i.e. Broward and Miami-Dade Counties.)

TESTS AND CODES

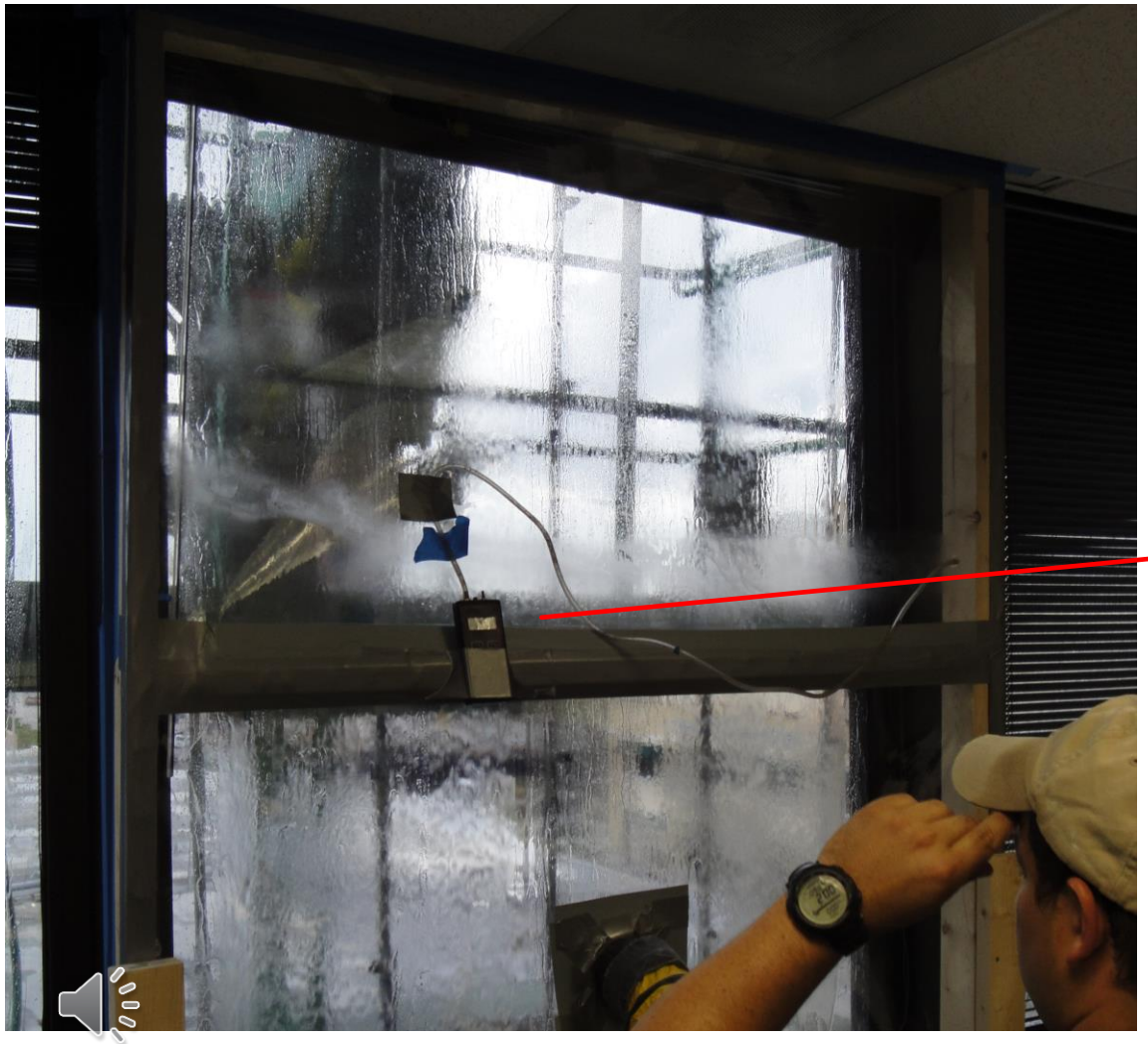
FIELD TESTS:

- **AAMA 502-90** – voluntary specifications for field testing newly installed fenestration products
- **ASTM E 1105 METHODS A OR B** – **A** tests under uniform static air pressure difference (continuous 15min). **B** tests cyclic, static air pressure difference (5 min. duration cycle)
- **AAMA 501.2-94 –** spot check (PICTURED)

GLAZING SYSTEM	MIN. PSF	EQUIVALENT WIND-DRIVEN RAIN SPEED
Residential Single Hung Window	3.75	38MPH
Center Flush-Glazed Storefront	6.24	49MPH
Commercial Ribbon Window System	12.0	68MPH
Pressure-Bar Curtain Wall	15.0	76MPH
Structurally Glazed Curtain Wall	20.0	88MPH

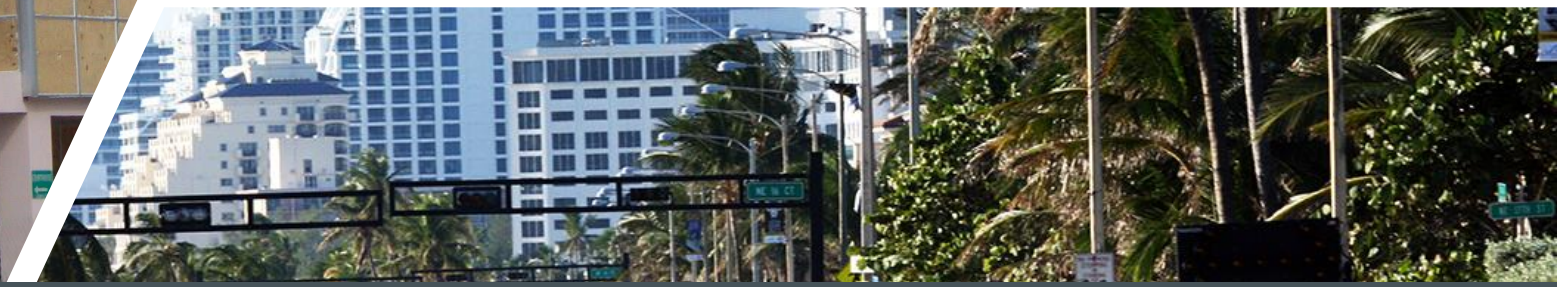
STATISTICS

- Water resistance is typically calculated at 20% of structural design pressures (positive) for commercial glazing – subject to a minimum pressure of 6.24psf.
- Based on this information, commercial glazing systems tested between 6psf to even 15psf do not guarantee water resistance. Generally, this level will protect from water infiltration by wind-driven rain of medium intensity (~60-70mph).



ASTM E 1105

- Test early in the installation process and require testing of an onsite or in-place mock-up



FLORIDA BUILDING CODE

- Risk Categories
- Wind Speed
- Impact Resistance Requirements
- Energy Performance

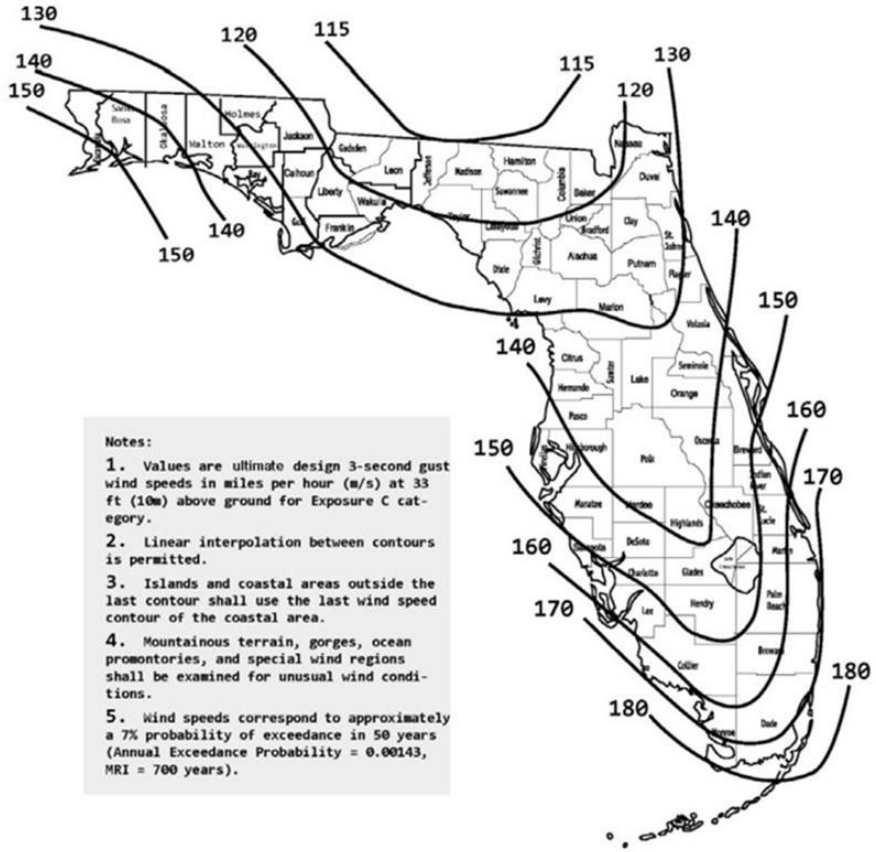
RISK CATAGORIES

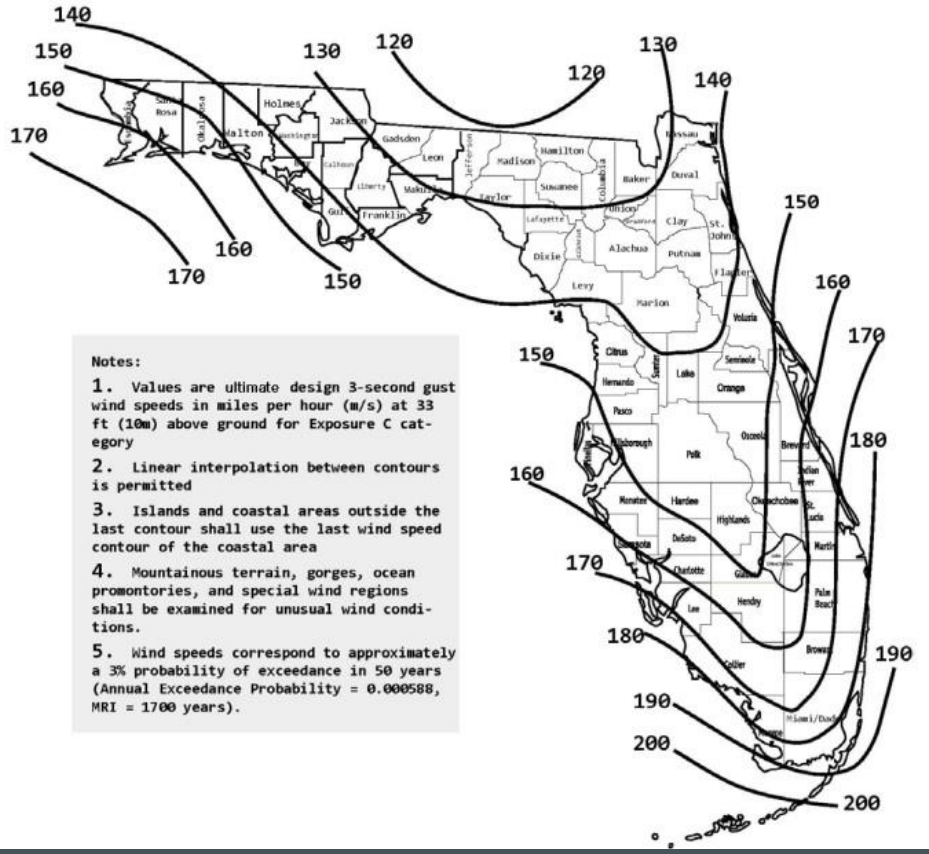
- **CATEGORY I:**
  Buildings and other structures that represent a low hazard to human life in the event of failure.

- **CATEGORY II:**
  Buildings and other structures except those listed in Risk Categories I, III and IV

- **CATEGORY III:**
  Buildings and other structures that represent a substantial hazard to human life in the event of failure.

- **CATEGORY IV:**
  Buildings and other structures designed as essential facilities.





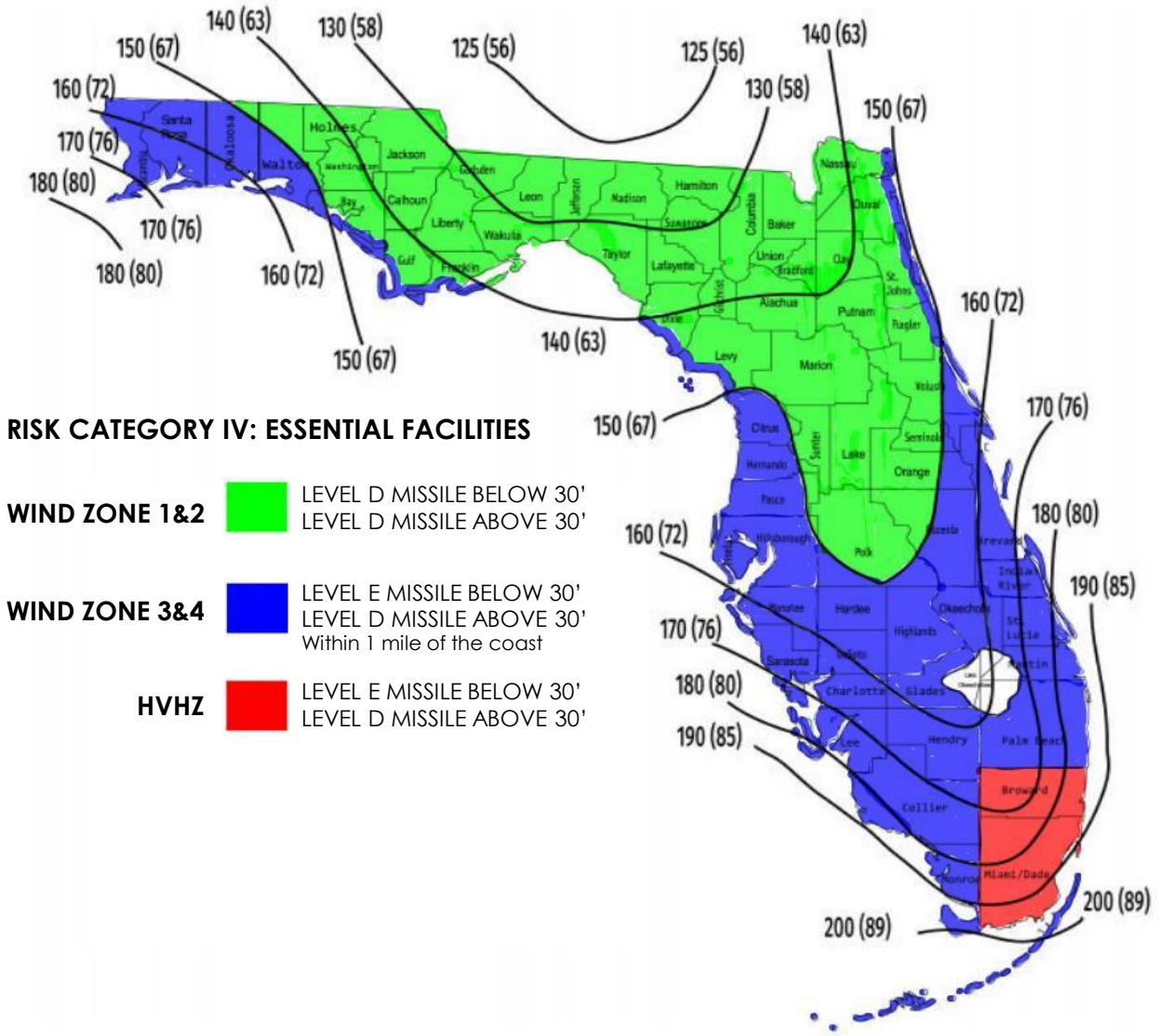
CATEGORY II & III ULTIMATE DESIGN WIND SPEEDS:

- Each category has its own Wind Speed map that structural engineers use to convert site specific wind speeds to project specific wind pressures

IMPACT REQUIREMENTS

- Risk categories - building use and capacity indicate the required impact resistance

- The minimum site-specific design requirement for any project will vary depending on site location (map), exposure, and project specific details related to building height and shape



APPLICABLE MISSILES

Missile Level	Missile	Impact Speed (f/s)
A	2g Steel Ball	130 f/s
B	2lb 2X4	50 f/s
C	4.5lb 2X4	40 f/s
D	9.5lb 2X4	50 f/s
E	9.5lb 2X4	80 f/s

- **Large Missile Impact:** The large missile shall impact the surface of each test specimen at a speed of 50 feet per second (15.2 m/s); 80 feet per second (24.38 m/s) for Risk Category IV–Essential Facility buildings or structures.
- **Small Missile Impact:** This test shall be conducted on three test specimens in accordance with test protocols TAS 201 and TAS 203. This test shall be applicable to the construction units, assemblies, and materials to be used above 30 feet (9.1 m) in height in all structures; Risk Category IV–Essential Facility buildings or structures shall follow the large missile impact testing in Section 1626.2.4 at 50 feet per second (15.2 m/s).


1

9520.2	b-Series Protech 7SG Aluminum Structurally Glazed Curtainwall with Sunshade - LMI / SMI	Series Protech 7SG Aluminum Structurally Glazed Curtainwall with Sunshade - LMI / SMI
Limits of Use **Approved for use in HVHZ:** Yes **Approved for use outside HVHZ:** Yes **Impact Resistant:** Yes **Design Pressure:** +160/-160 **Other:** See charts for sizes and approved pressures.		**Installation Instructions** FL29520_R9_II_DS_DWG 2.pdf Verified By: Frank Bennardo 82328 Created by Independent Third Party: Yes **Evaluation Reports** FL29520_R9_AE_DS_EVAL 2 (7SG).pdf Created by Independent Third Party: Yes

FLORIDA PRODUCT APPROVAL

- FL product approval number assures the system complies with FL building codes and meets or exceeds state requirements

ENERGY PERFORMANCE

- VISIBLE LIGHT TRANSMITTANCE (0-100%: percent of visible light transmitted through glass; visible light is the only portion of the solar spectrum visible to the human eye
- SOLAR HEAT GAIN COEFFICIENT (SHGC): Portion of directly transmitted and absorbed solar energy entering the building's interior
- U-VALUE: A measure of heat gain or loss through glass due to the difference in indoor and outdoor temperatures

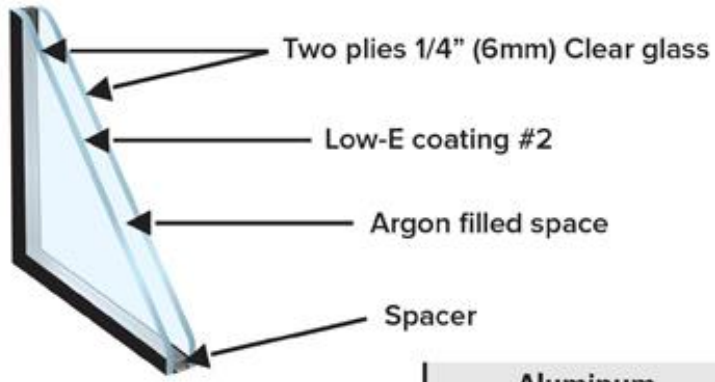
ARCHITECT: ATMOSPHERE

FLORIDA PRESCRIPTIVE ENGERY CODE

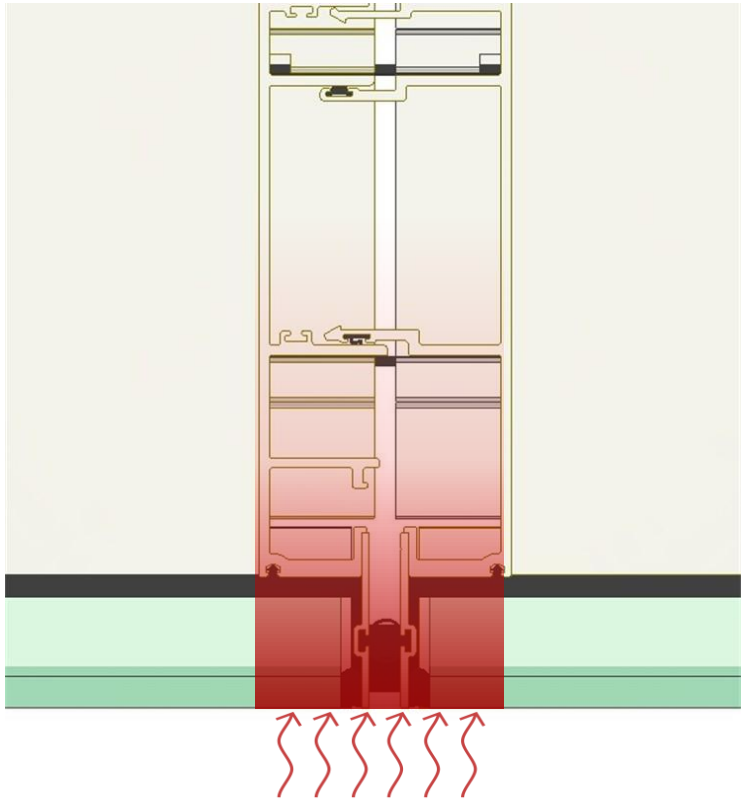
- Requires SHGC 0.25 Fixed Glazing
- Requires 0.50 U-value for Fixed Glazing - Requires an insulated glass unit to achieve 0.50 U-Value

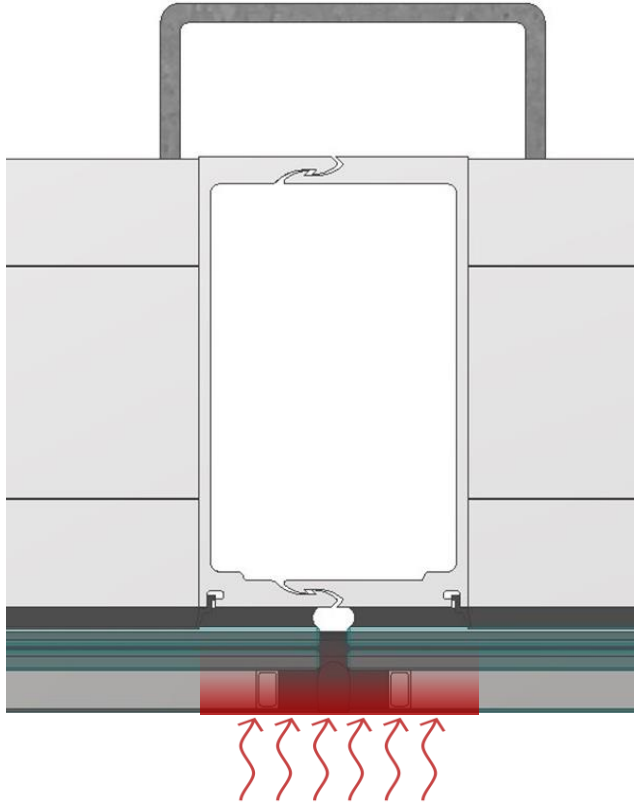
FRAME SYSTEM U-VALUE COMPARISON

IMAGE COURTESY OF VIRACON



1" Low-E Insulating	Center of Glass U-Value[1]	Aluminum Spacer 1/2" (13.2mm)	Stainless Steel Spacer 1/2" (13.2mm)	VTS™ Spacer 1/2" (13.2mm)
		Rough Opening U-Value[2]		
Conventionally Glazed Framing System	.25	.391	.379	.371
		CR[3] 48	*CR[3] 52*	*CR[3] 55*
2-Sided Structurally Glazed Framing System	.25	.354	.334	.319
		CR[3] 53	*CR[3] 57*	*CR[3] 60*
4-Sided Structurally Glazed Framing System	.25	.336	.312	.293
		CR[3] 56	*CR[3] 60*	*CR[3] 66*





SYSTEM DESIGN FOR THERMAL CONDUCTIVITY

PRESSURE-EQUALIZED VS. FACE-SEAL BARRIER WALL

- Pressure-equalized systems typically require a thermal break in order to reduce heat transfer through exposed joinery.
- The structurally glazed, face-sealed barrier system is thermally isolated, thus significantly reducing conductivity

ARCHITECT: STANLEY BEAMAN & SEARS PHOTOGRAPHER: NY PHOTO

What designates a healthcare facility as an essential facility?

- Facility location, function
- Emergency Departments, Ambulatory Surgical centers, overnight stay, full-service hospitals – all specify as essential facilities
- FM Global/AHCA/Facility specific standards

ARCHITECT: HUNTON BRADY

ARCHITECT: ESA

ARCHITECT: LITTLE DIVERSIFIED

ARCHITECT: GRESHAM SMITH & PARTNERS


Joe DiMaggio Children's Hospital

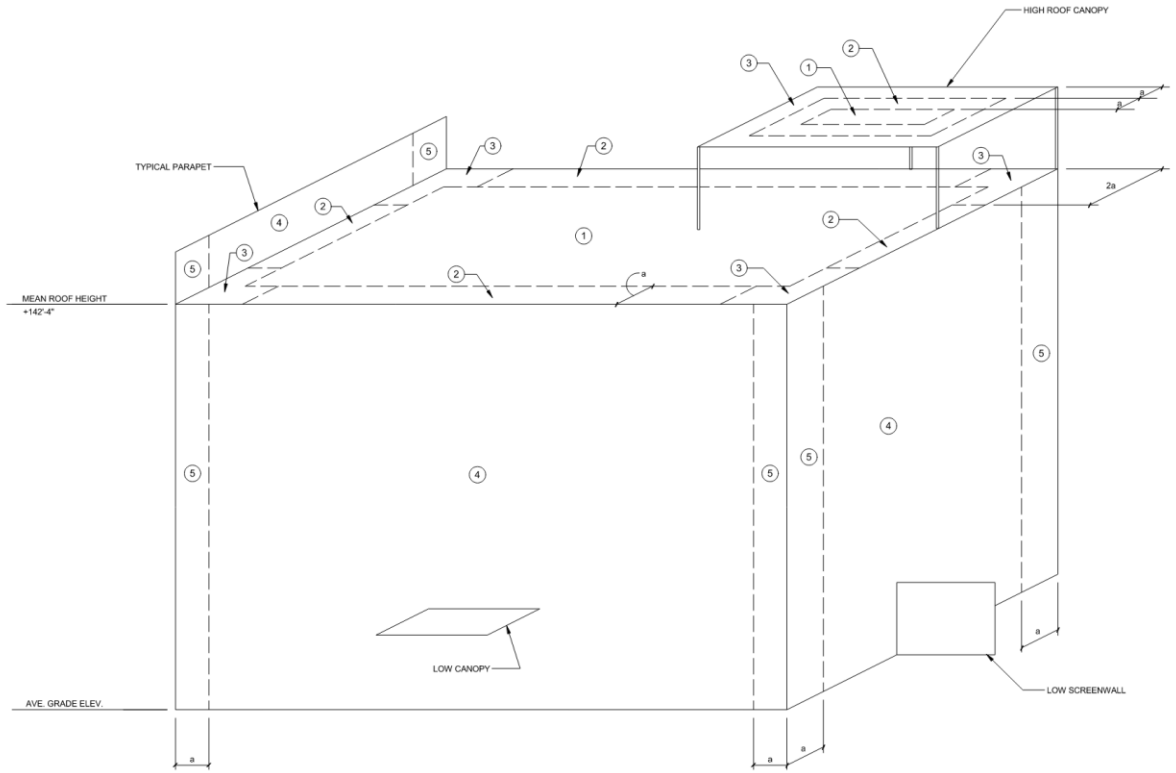
ARCHITECT: MGE

CASE STUDY: Florida Hospital Executive Tower Orlando, FL

DESIGN ELEMENTS

- Category II – Non-impact
- Large Panels
- 30” Sunshades
- Vertical Fins

Architect: Little Diversified Architects



OFFICE TOWER

WIND LOADS:

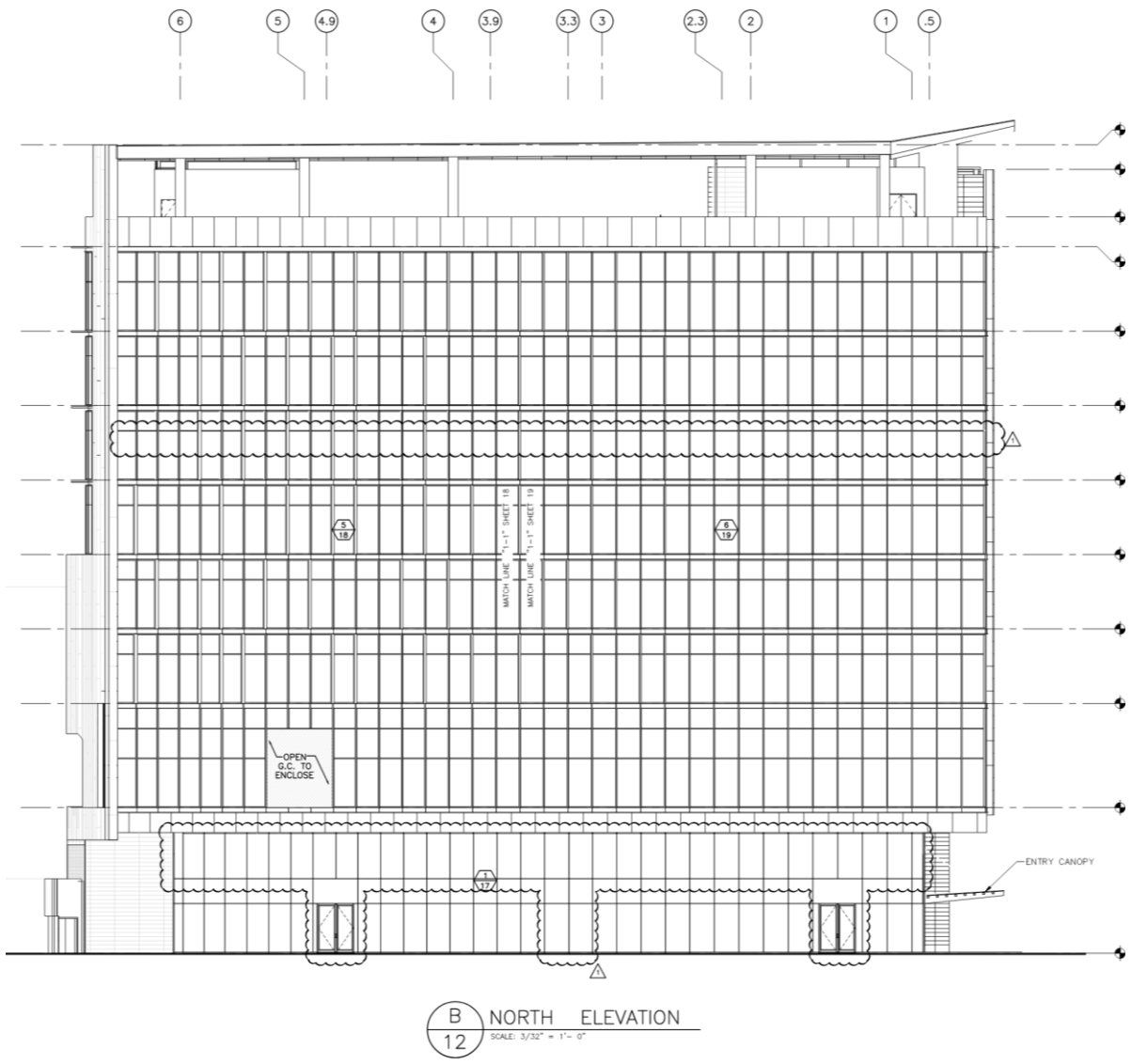
ULTIMATE DESIGN WIND SPEED	V = 139MPH
NOMINAL DESIGN WIND SPEED	V = 108MPH
RISK CATEGORY	II
2 EXPOSURE	B
ENCLOSURE	ENCLOSED BUILDING
INTERNAL PRESSURE COEFICIENT	GCpi = ±0.18
STAND ALONE CANOPIES	GCpi = ±0.00

SEE SHEET S001 FOR COMPONENTS AND CLADDING DESIGN WIND PRESSURES.

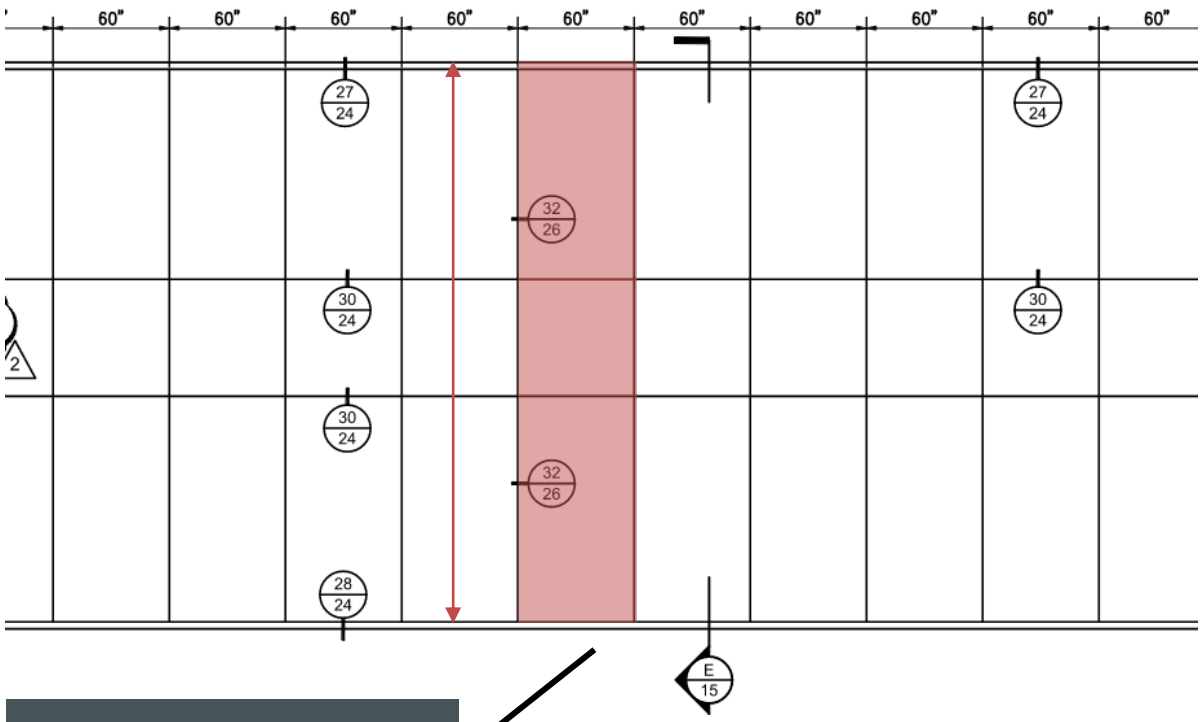
ULTIMATE OR ALLOWABLE?

WALL COMPONENTS AND CLADDING DESIGN PRESSURES @ OFFICE TOWER			
LEVEL	EFFECTIVE WIND AREA	ZONE 4	ZONE 5
GROUND THROUGH LEVEL 2	10 ft^2	+35 psf/-50 psf	+35 psf/-91 psf
	20 ft^2	+35 psf/-50 psf	+35 psf/-91 psf
	50 ft^2	+33 psf/-47 psf	+33 psf/-81 psf
	100 ft^2	+31 psf/-45 psf	+31 psf/-73 psf
	500 ft^2	+26 psf/-41 psf	+26 psf/-54 psf
LEVEL 2 THROUGH LEVEL 5	10 ft^2	+44 psf/-50 psf	+44 psf/-91 psf
	20 ft^2	+44 psf/-50 psf	+44 psf/-91 psf
	50 ft^2	+40 psf/-47 psf	+40 psf/-81 psf
	100 ft^2	+38 psf/-45 psf	+38 psf/-73 psf
	500 ft^2	+32 psf/-41 psf	+32 psf/-54 psf
LEVEL 5 THROUGH ROOF	10 ft^2	+50 psf/-50 psf	+50 psf/-91 psf
	20 ft^2	+50 psf/-50 psf	+50 psf/-91 psf
	50 ft^2	+46 psf/-47 psf	+46 psf/-81 psf
	100 ft^2	+43 psf/-45 psf	+43 psf/-73 psf
	500 ft^2	+36 psf/-41 psf	+36 psf/-54 psf
PARAPETS (NOTE 7)	10 ft^2	152 psf	152 psf
	20 ft^2	146 psf	146 psf
	50 ft^2	134 psf	134 psf
	100 ft^2	125 psf	125 psf
	500 ft^2	105 psf	105 psf

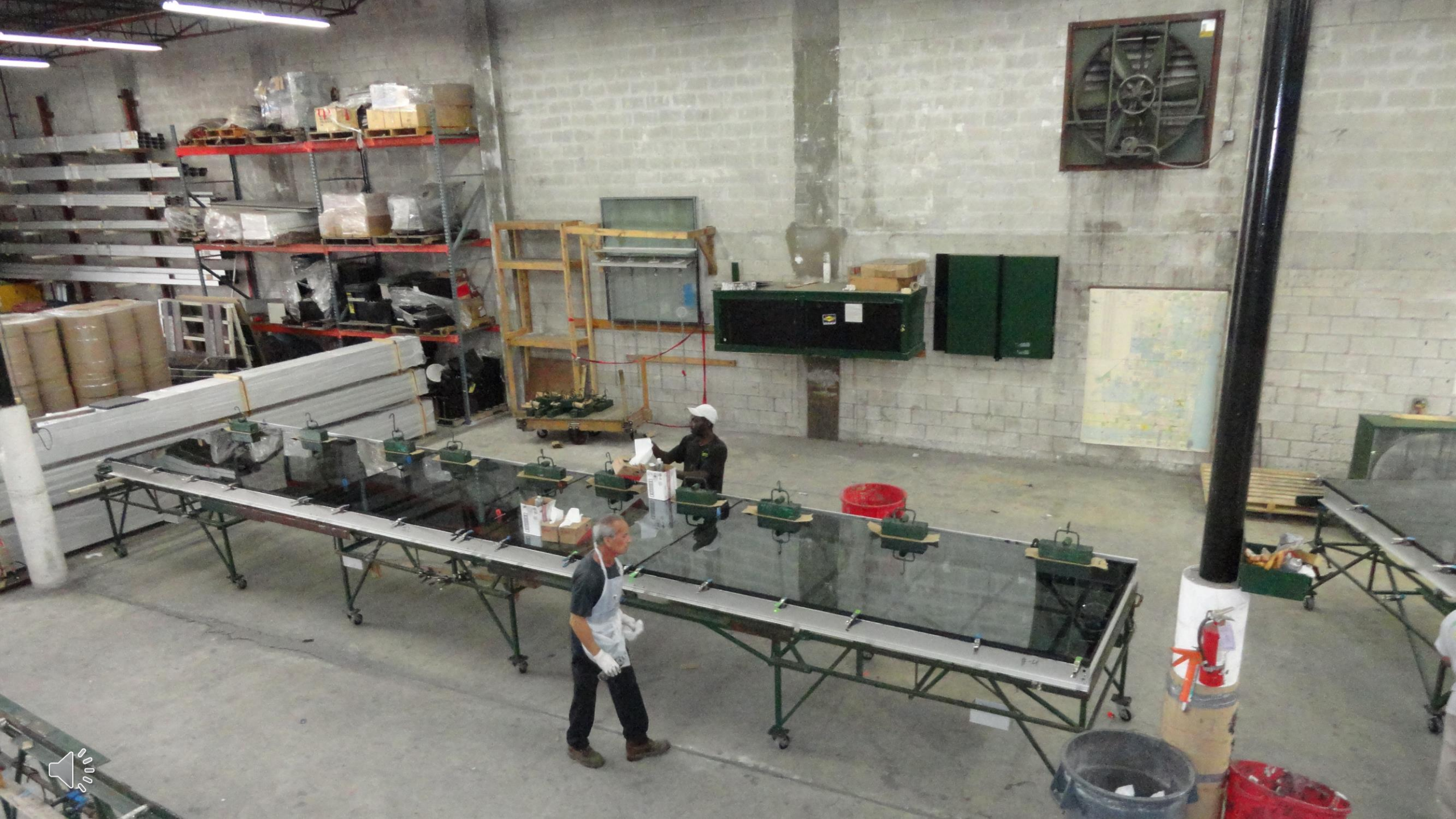
If ultimate is shown, with a product approved system, you can reduce allowed by 40%

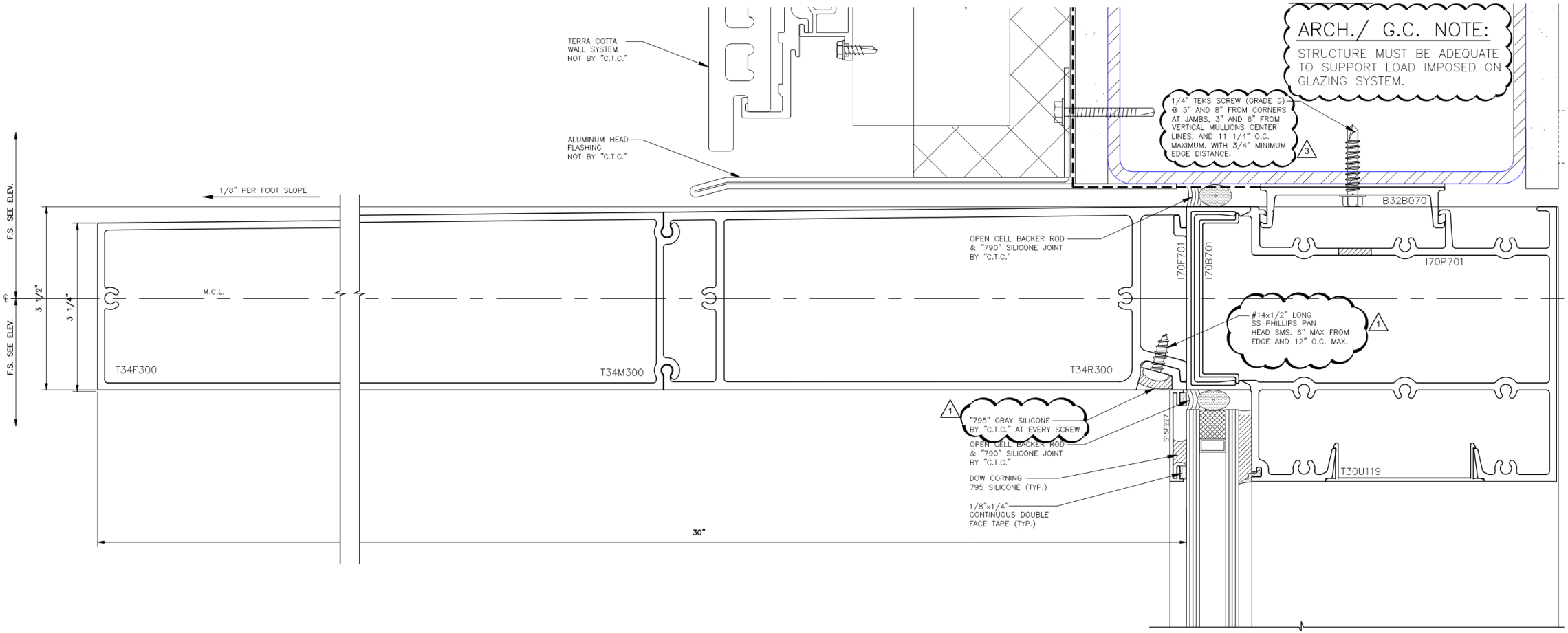


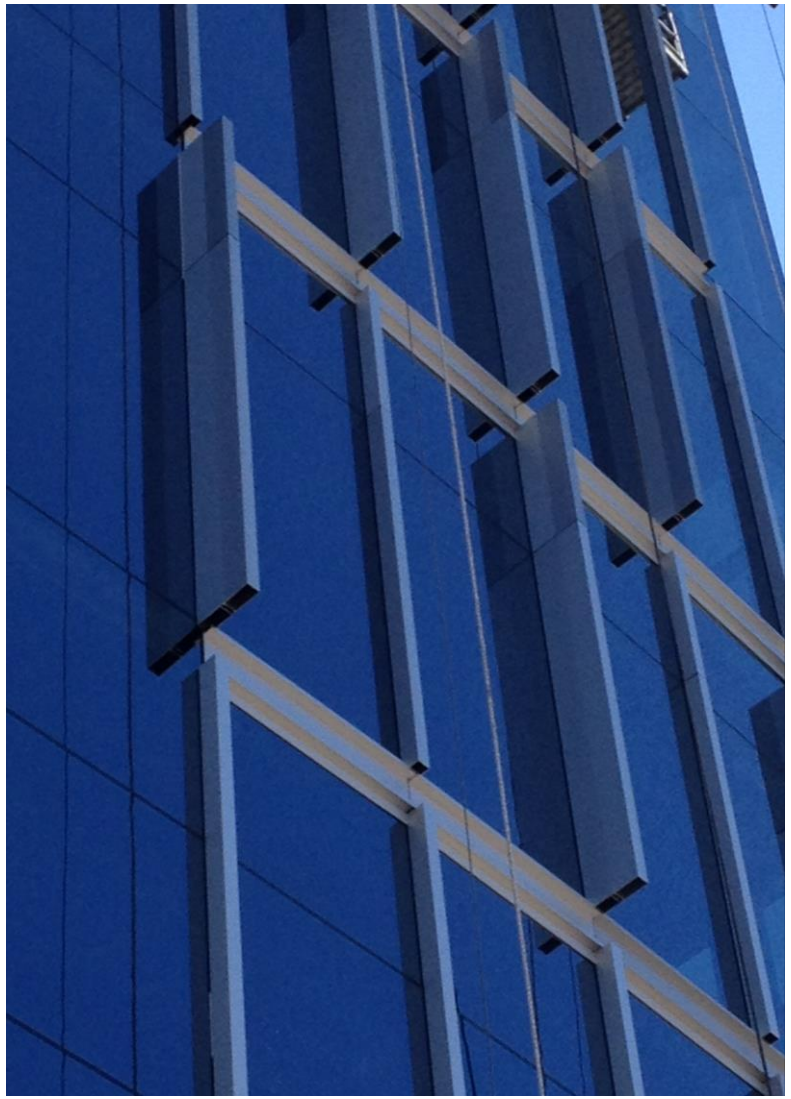
Measure frame height and mullion spacing



Measure glass size (DLO)

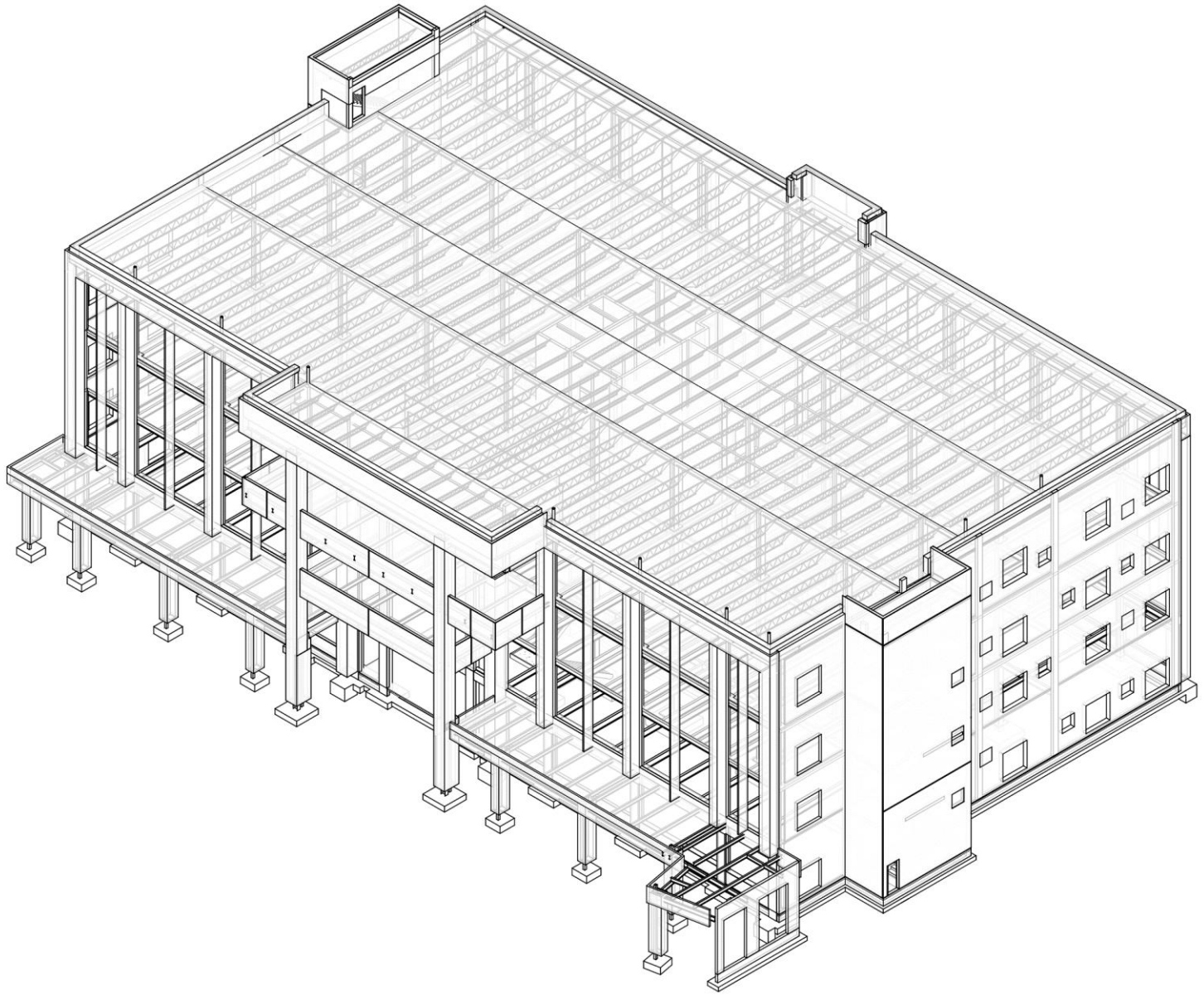



TERRA COTTA WALL SYSTEM NOT BY "C.T.C."
ALUMINUM HEAD FLASHING NOT BY "C.T.C."
ARCH./ G.C. NOTE:
STRUCTURE MUST BE ADEQUATE TO SUPPORT LOAD IMPOSED ON GLAZING SYSTEM.
1/4" TEKS SCREW (GRADE 5) @ 5" AND 8" FROM CORNERS AT JAMBS, 3" AND 6" FROM VERTICAL MULLIONS CENTER LINES, AND 11 1/4" O.C. MAXIMUM. WITH 3/4" MINIMUM EDGE DISTANCE.
3
1/8" PER FOOT SLOPE
F.S. SEE ELEV.
3 1/2"
3 1/4"
M.C.L.
F.S. SEE ELEV.
T34F300
T34M300
T34R300
OPEN CELL BACKER ROD & "790" SILICONE JOINT BY "C.T.C."
B32B070
I70F701
I70B701
I70P701
#14x1/2" LONG SS PHILLIPS PAN HEAD SMS. 6" MAX FROM EDGE AND 12" O.C. MAX.
1
"795" GRAY SILICONE BY "C.T.C." AT EVERY SCREW
OPEN CELL BACKER ROD & "790" SILICONE JOINT BY "C.T.C."
DOW CORNING 795 SILICONE (TYP.)
1/8"x1/4" CONTINUOUS DOUBLE FACE TAPE (TYP.)
S15F227
T30U119
30"



5” and 14” Vertical Fins

CASE STUDY: JM Family Deerfield Beach, FL



DESIGN ELEMENTS

- Impact Resistant – Category II
- Electrochromic Glass
- Large vertical fins

Architect: PGAL

INFORMATION COURTESY OF VIEW GLASS

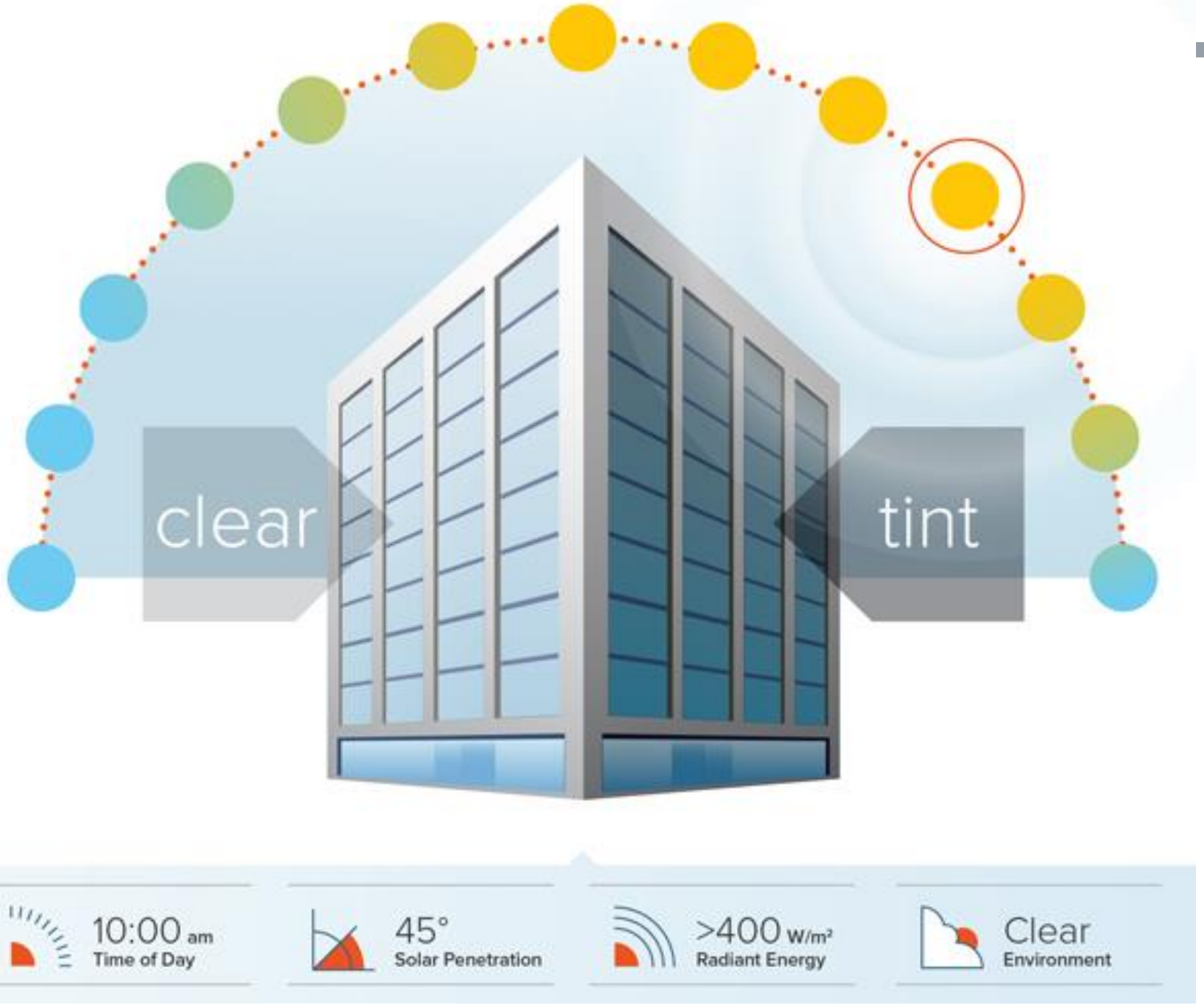
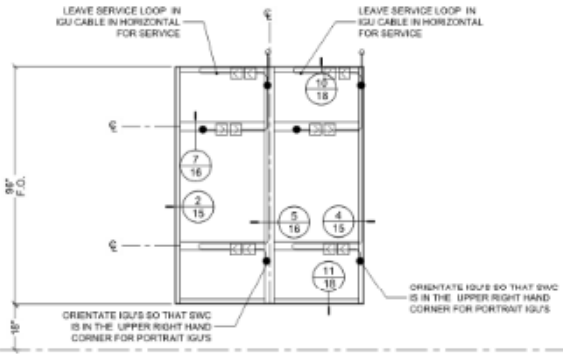


IMAGE COURTESY OF VIEW GLASS

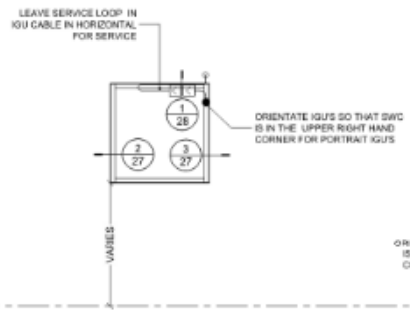


W3 / 11 ELEVATION GROUND; EAST

(7) :REQUIRED

A. CRAWFORD TRACEY CORPORATION:

SERIES PRO-TECH 7SG, ALUMINUM CURTAIN WALL SYSTEM
PRODUCT APPROVAL, FBC (2017): #FL29520.2 - R4 [L.M.I.]

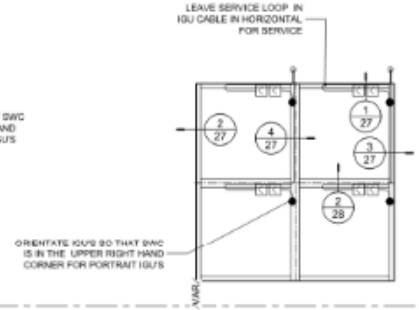


W1 / 11A VIEW SMART GLASS ELEVATION 2ND TO 4TH; EAST GROUND TO PARAPET; WEST

(24) :REQUIRED

A. CRAWFORD TRACEY CORPORATION:

SERIES PRO-TECH 7SG, ALUMINUM CURTAIN WALL SYSTEM
PRODUCT APPROVAL, FBC (2017): #FL29520.2 - R4 [L.M.I.]

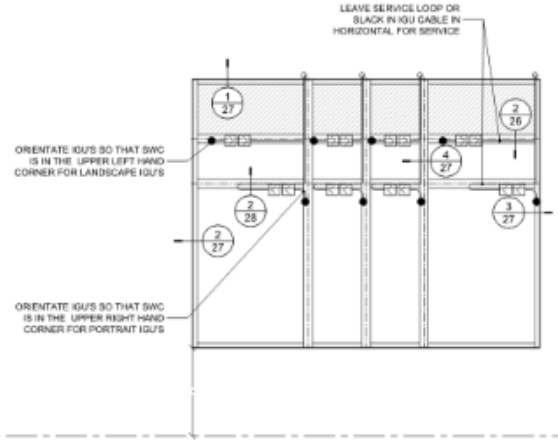


W2 / 11A VIEW SMART GLASS ELEVATION 2ND TO 4TH ; EAST GROUND TO 4TH; WEST

(28) :REQUIRED

A. CRAWFORD TRACEY CORPORATION:

SERIES PRO-TECH 7SG, ALUMINUM CURTAIN WALL SYSTEM
PRODUCT APPROVAL, FBC (2017): #FL29520.2 - R4 [L.M.I.]



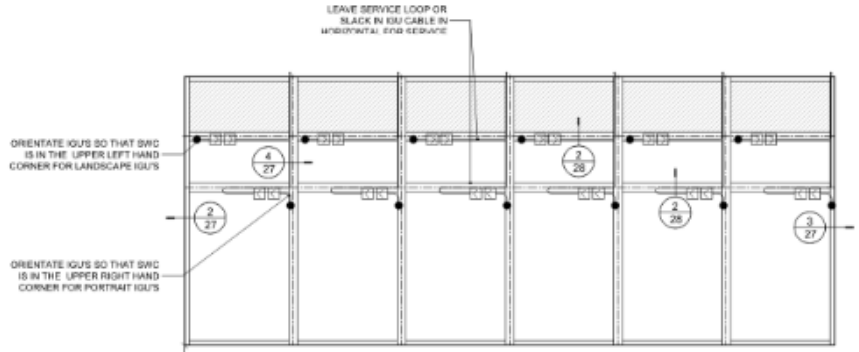
C11 / 11A VIEW SMART GLASS ELEVATION GROUND; NORTH & SOUTH

(4) :REQUIRED

A. CRAWFORD TRACEY CORPORATION:

SERIES PRO-TECH 7SG, ALUMINUM CURTAIN WALL SYSTEM
PRODUCT APPROVAL, FBC (2017): #FL29520.2 - R4 [L.M.I.]

T.O. FIN. FLR.
ELEVATION: + (VARIES)

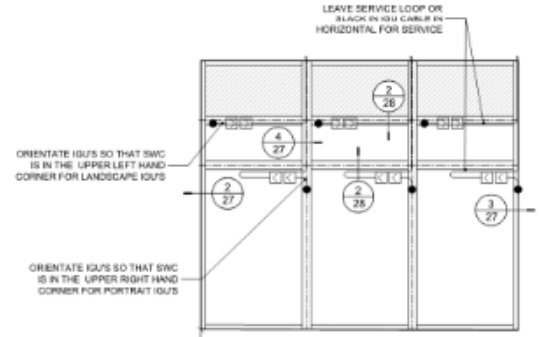


C12 / 11A VIEW SMART GLASS ELEVATION GROUND; NORTH & SOUTH

(10) :REQUIRED

A. CRAWFORD TRACEY CORPORATION:

SERIES PRO-TECH 7SG, ALUMINUM CURTAIN WALL SYSTEM
PRODUCT APPROVAL, FBC (2017): #FL29520.2 - R4 [L.M.I.]



C13 / 11A VIEW SMART GLASS ELEVATION GROUND; SOUTH

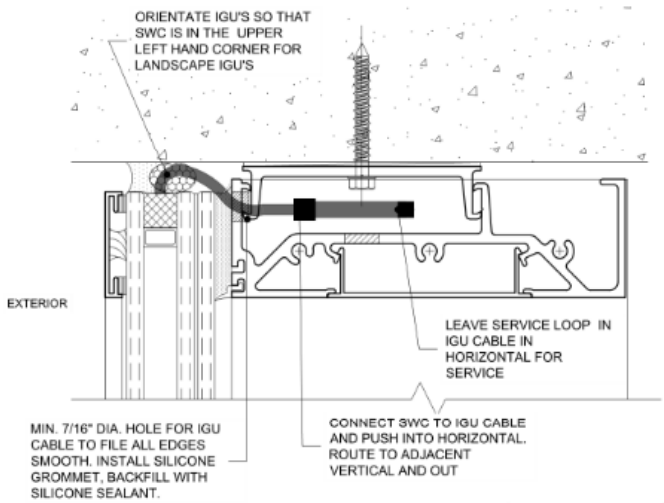
(2) :REQUIRED

A. CRAWFORD TRACEY CORPORATION:

SERIES PRO-TECH 7SG, ALUMINUM CURTAIN WALL SYSTEM
PRODUCT APPROVAL, FBC (2017): #FL29520.2 - R4 [L.M.I.]

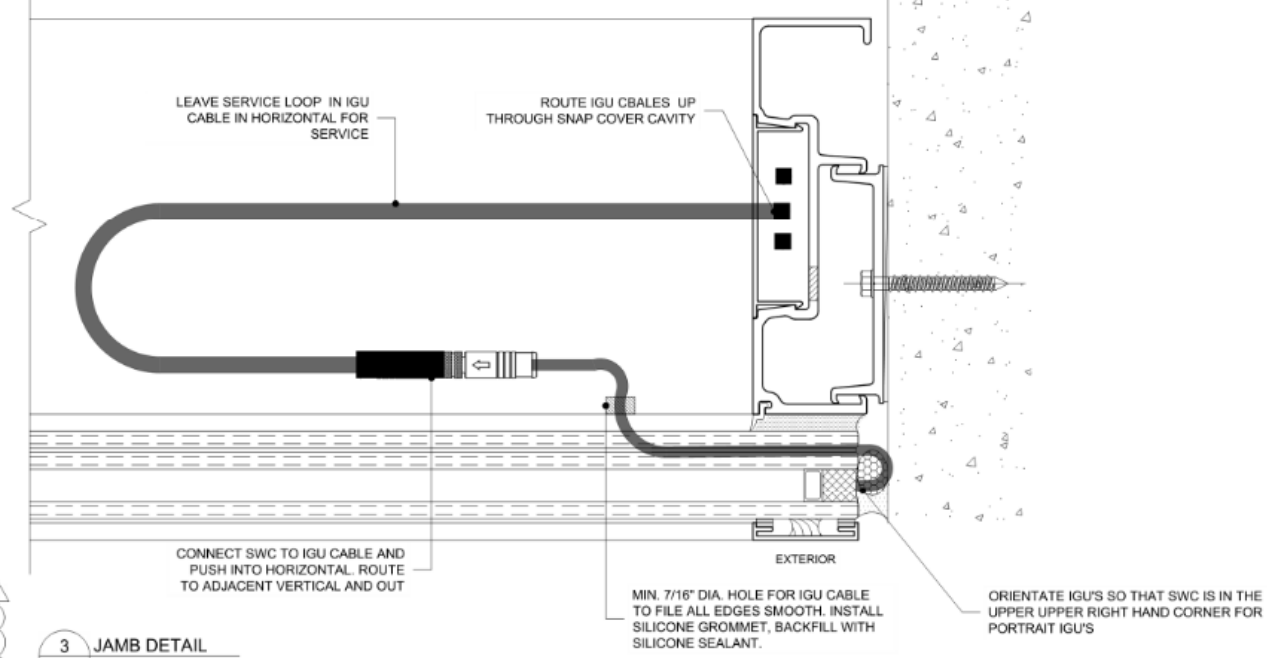
T.O.S. GROUND LEVEL
ELEVATION: + 0'-0"

NOTES:
1. ELECTRICAL HARDWARE AND CABLES NOT INCLUDED UNDER THIS CERTIFICATION. ELECTRICAL HARDWARE, CONNECTIONS, AND ALL OTHER ELECTRICAL WORK SHALL MEET THE APPLICABLE REQUIREMENTS PER THE FLORIDA BUILDING CODE 5ITH EDITION (2020).
2. ELECTRICAL HARDWARE SHOWN FOR REFERENCE ONLY.

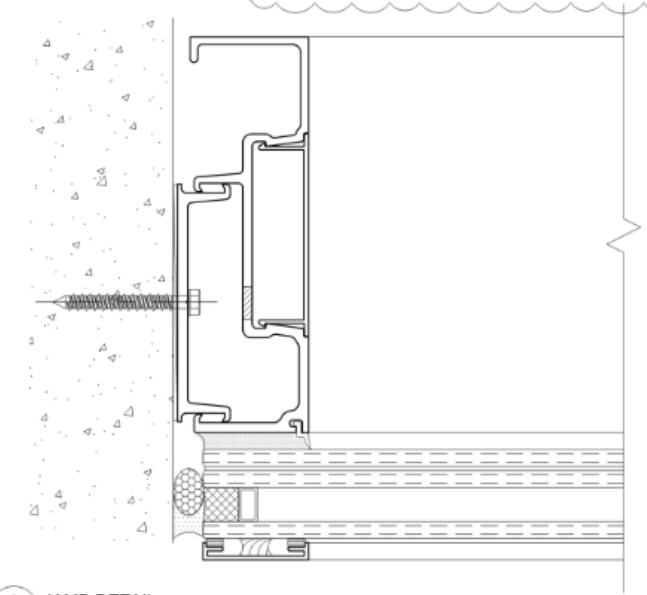


1/27 HEAD DETAIL @ SLAB
PRO-TECH 7 SG

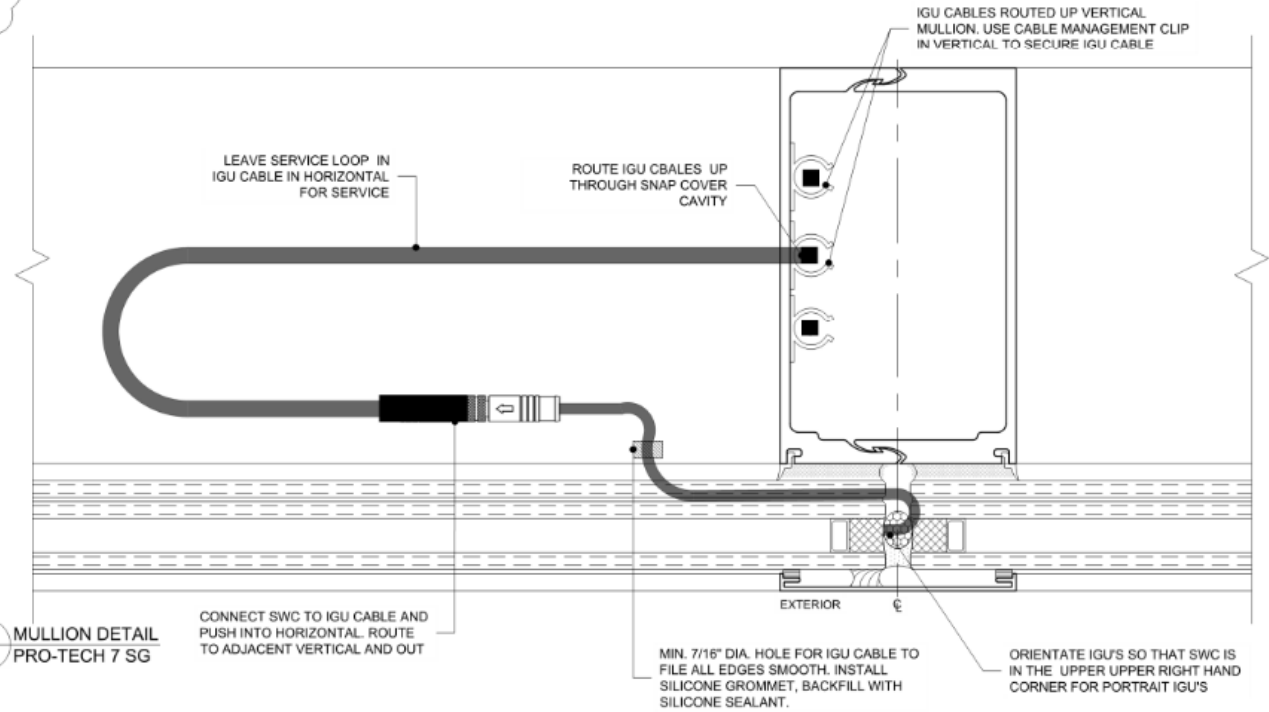
NOTES:
1. ELECTRICAL HARDWARE AND CABLES NOT INCLUDED UNDER THIS CERTIFICATION. ELECTRICAL HARDWARE, CONNECTIONS, AND ALL OTHER ELECTRICAL WORK SHALL MEET THE APPLICABLE REQUIREMENTS PER THE FLORIDA BUILDING CODE SITH EDITION (2020).
2. ELECTRICAL HARDWARE SHOWN FOR REFERENCE ONLY.



3/27 JAMB DETAIL
PRO-TECH 7 SG



2/27 JAMB DETAIL
PRO-TECH 7 SG



4/27 MULLION DETAIL
PRO-TECH 7 SG


DUCT DESIGN

PHOTOGRAPHER: EMILIO COLLAVINO

CASE STUDY: 801 Lincoln Rd. Miami, FL

DESIGN ELEMENTS

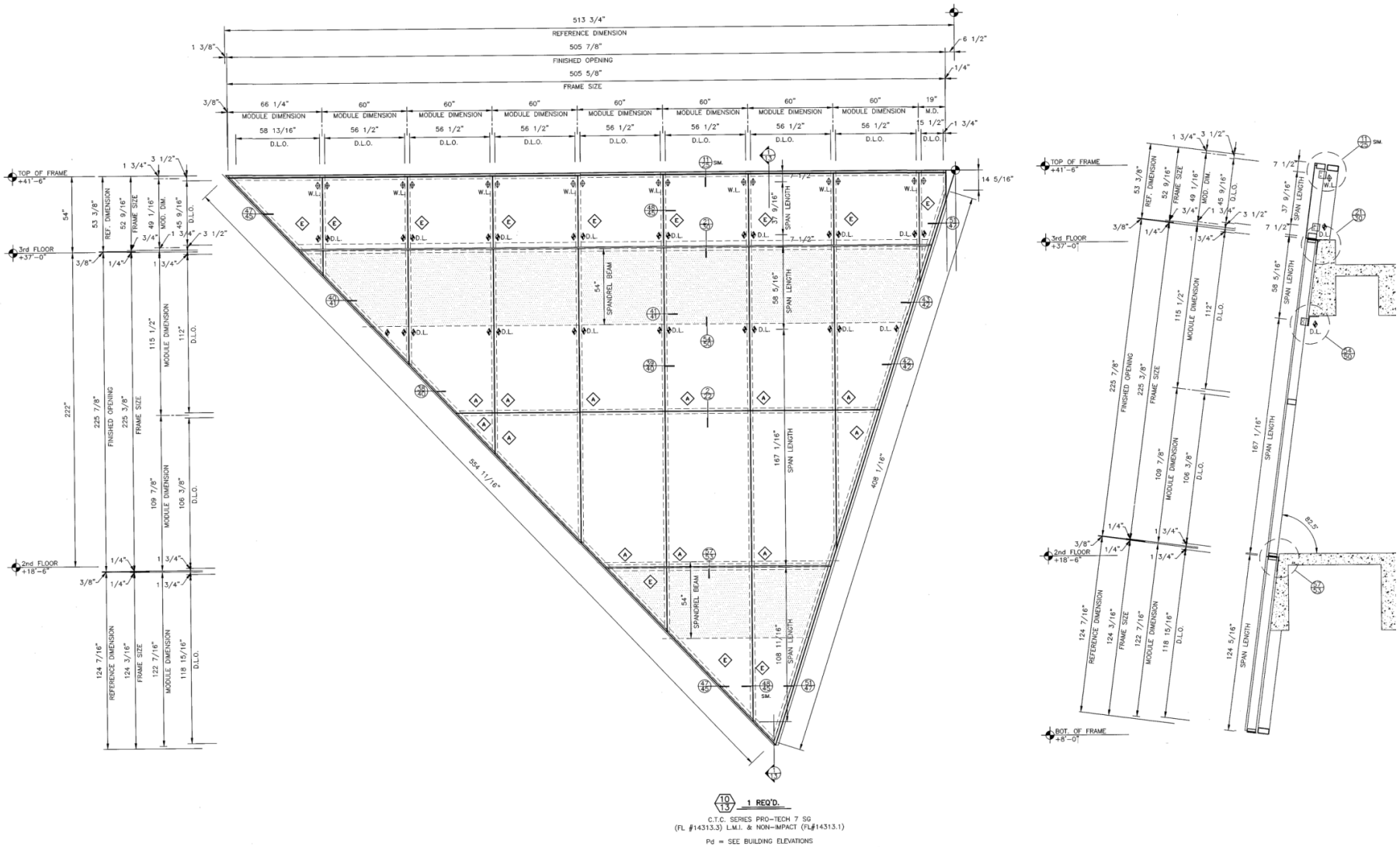
- Butt-Glazed
- Impact Resistant
- Pattern Glass
- Symmetry/Compatibility
- Intersecting Components
- Exposed Parapet Conditions

Architect: Shulman + Associates/
Wolfberg Alvarez

PHOTOGRAPHER: EMILIO COLLAVINO

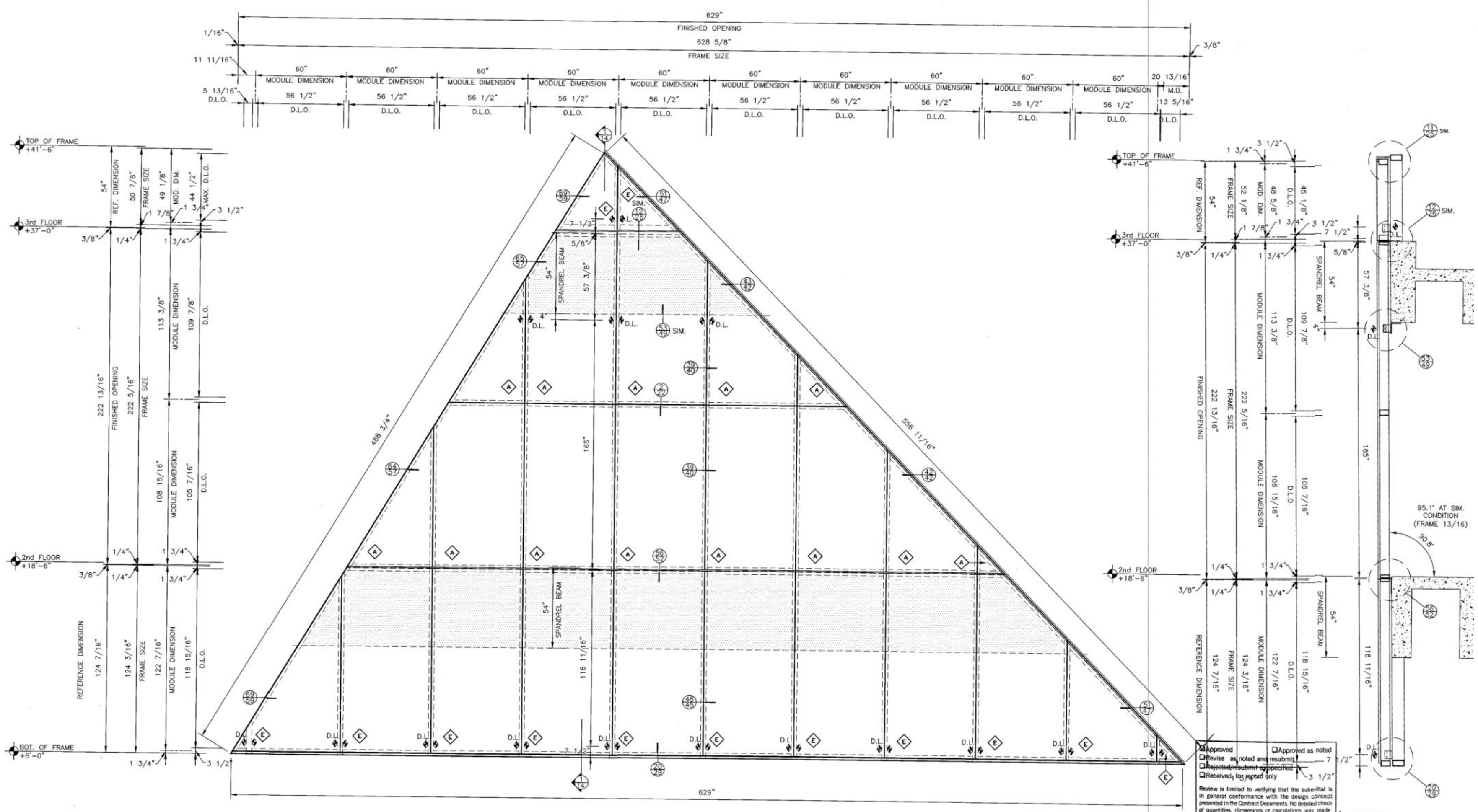
CURTAIN WALL ELEVATIONS

SCALE: 3/8"=1'-0"



CURTAIN WALL ELEVATIONS

SCALE: 3/8"=1'-0"



1 REQ'D.

C.T.C. SERIES PRO-TECH 7 SG
(FL #14313.3) L.M.I. & NON-IMPACT (FL#14313.1)

Pd = SEE BUILDING ELEVATIONS

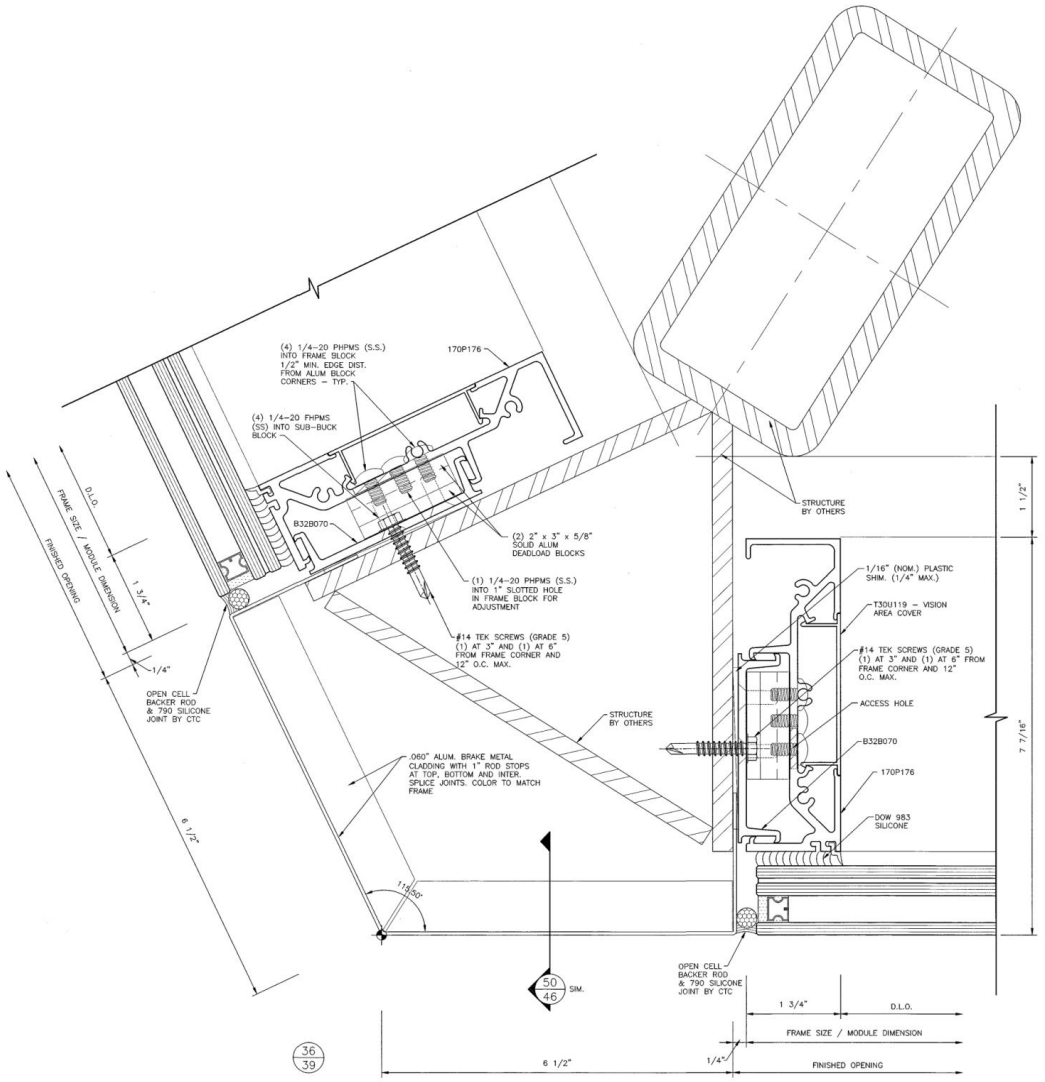
☐Approved ☐Approved as noted
☐Revise as noted and resubmit
☐Rejected/resubmit as specified
☐Received for record only

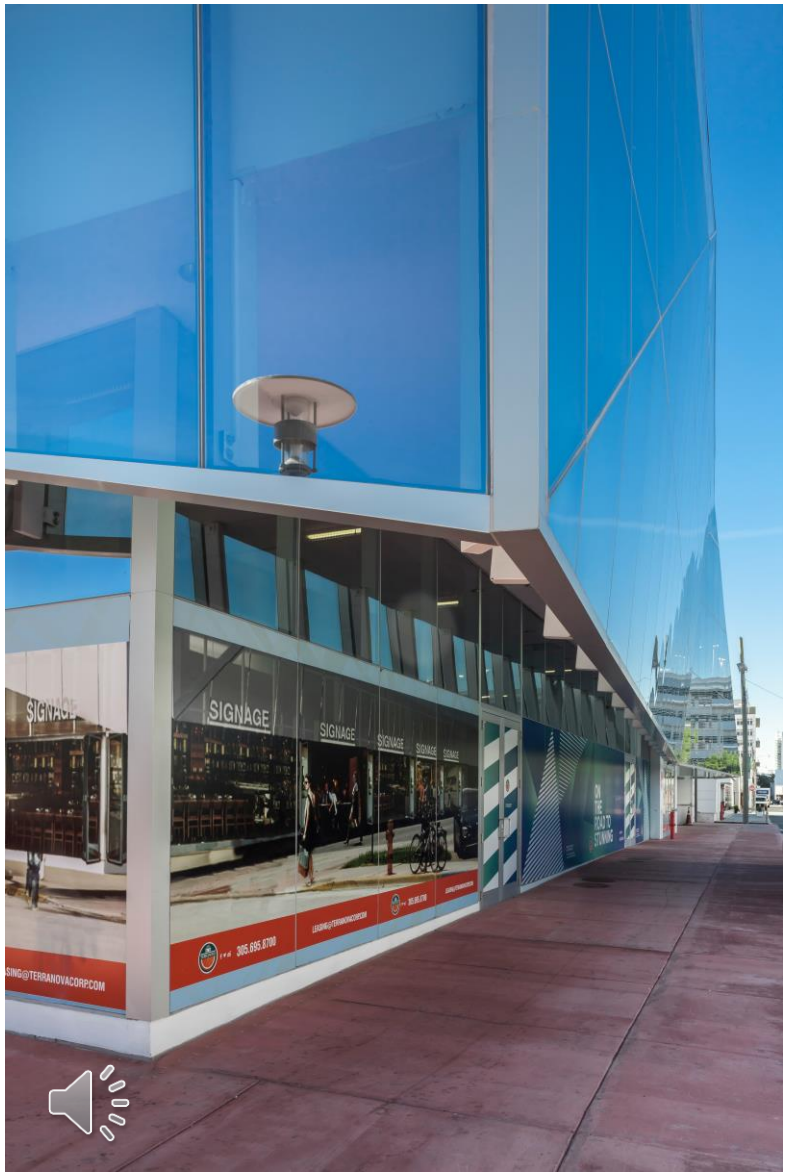
Review is limited to verifying that the submittal is in general conformance with the design concept presented in the Contract Documents. No detailed check of quantities, dimensions or calculations was made. Notations on the submittal do not constitute a Change Order. Refer to Structural Notes and Project Specifications for detailed review responsibilities.

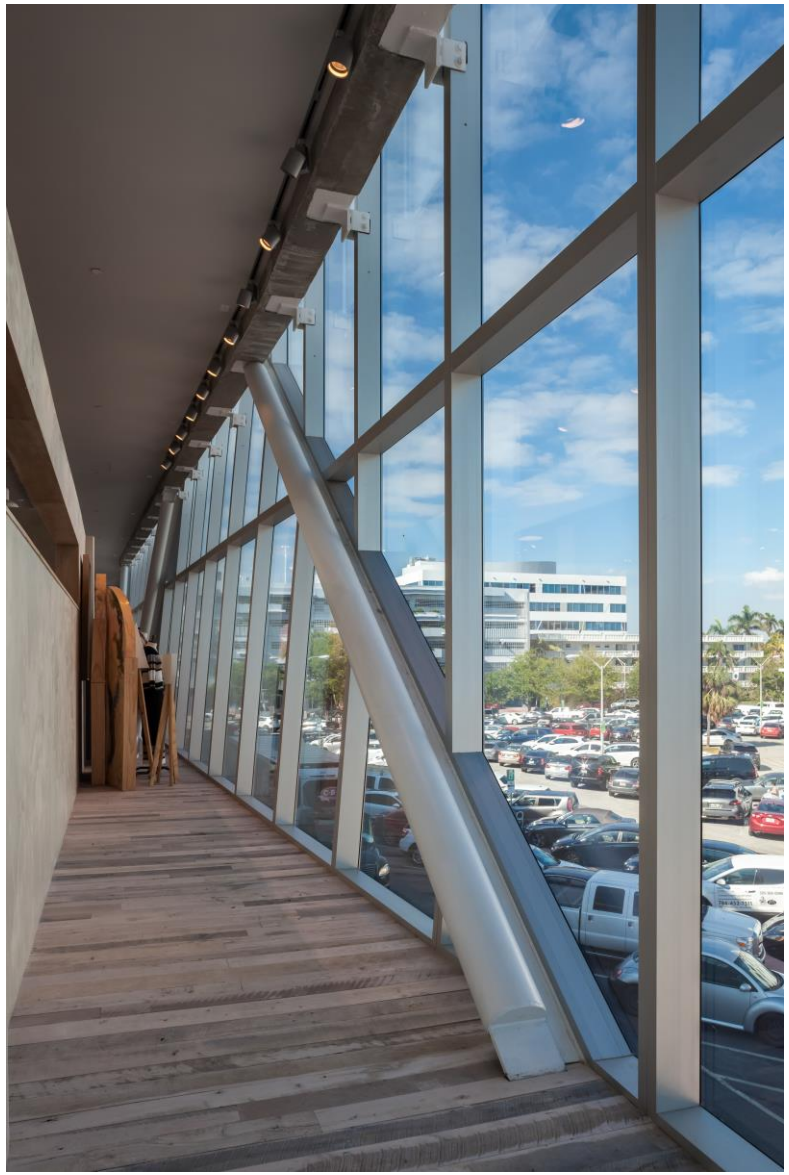
12/15/16 K. Olsin
Date Reviewed by

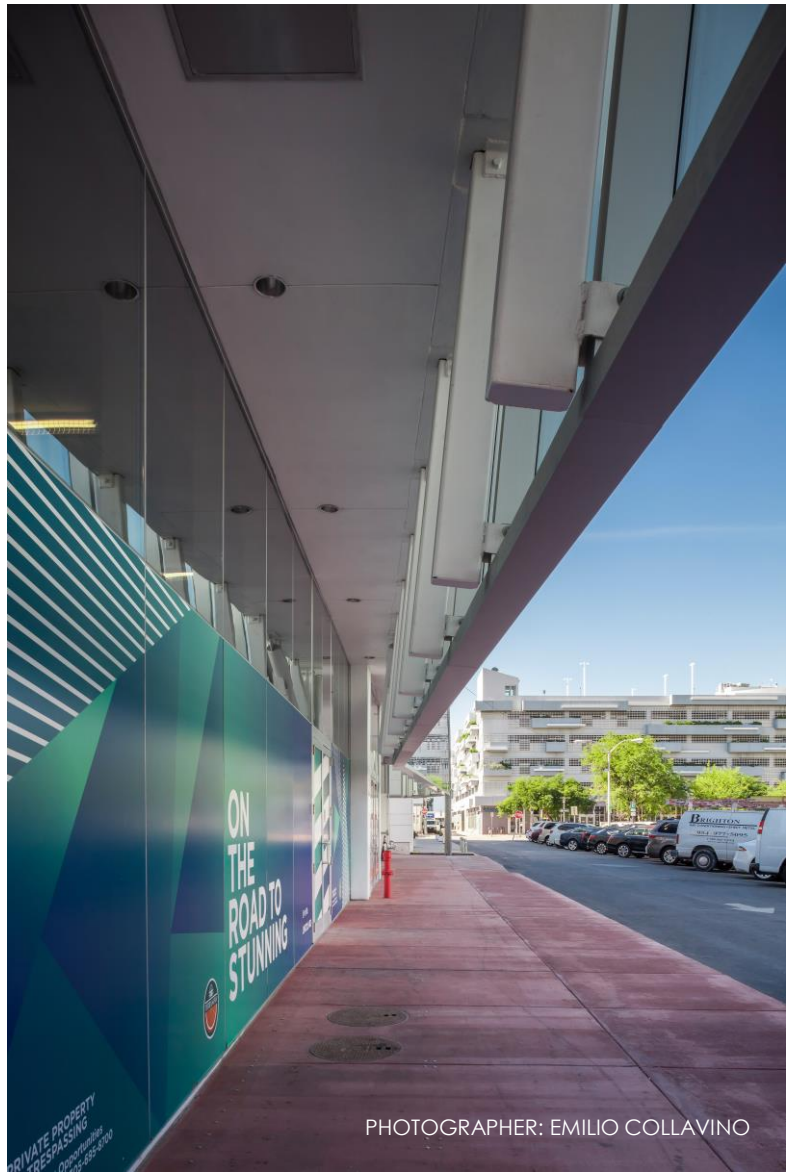
Bliss & Nyitray, Inc. Structural Engineers


TERRANOVA
NOW LEASING
305.695.8700
Leasing@Terranovacorp.com
www.Terranovacorp.com
Text LincolnLane to 33733
WARNING
This is a designated CONSTRUCTION SITE
Miller Construction Company
NO DUMPING
MOT PLANS
YODOCK

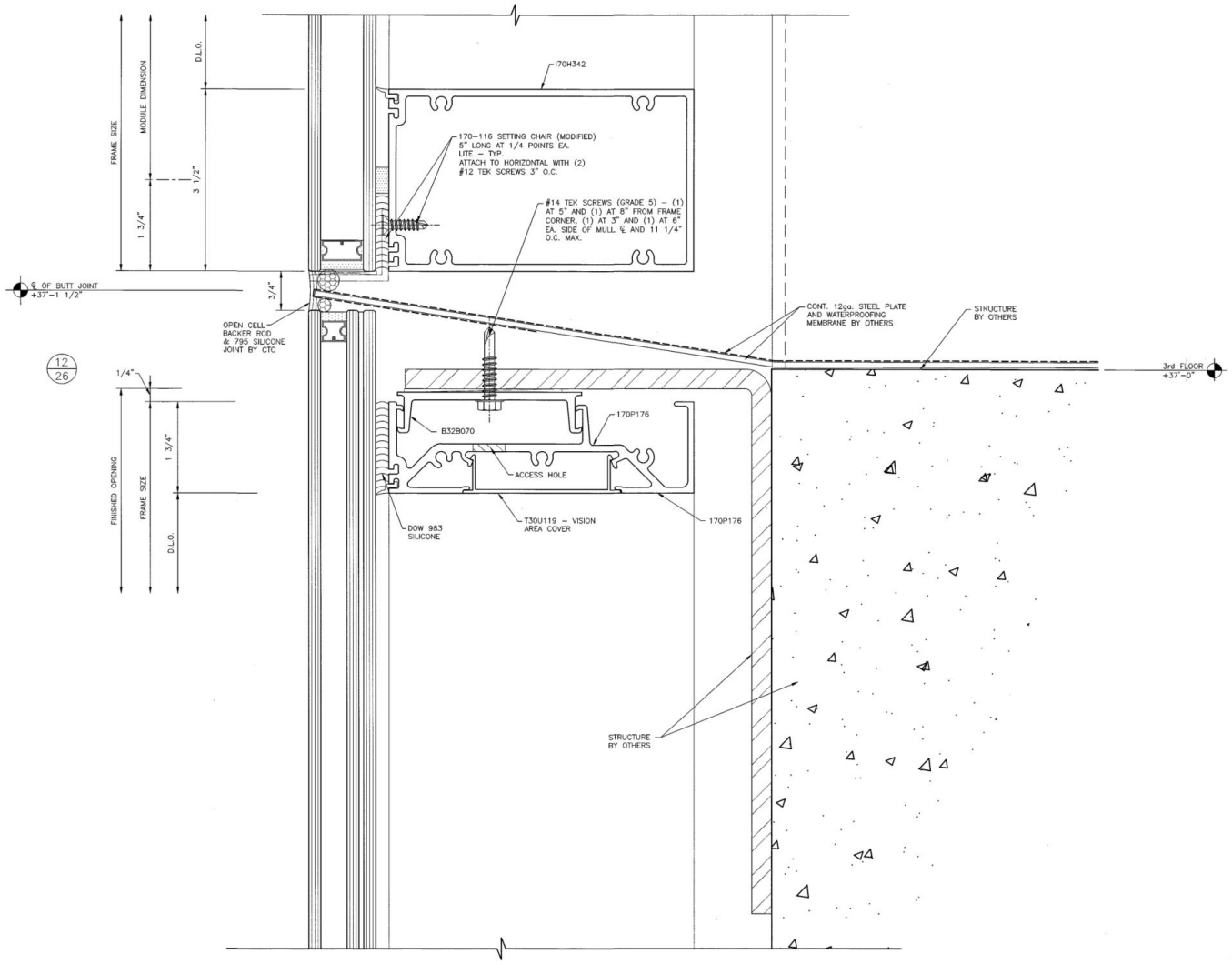

(4) 1/4-20 PHPMS (S.S.) INTO FRAME BLOCK 1/2" MIN. EDGE DIST. FROM ALUM BLOCK CORNERS - TYP.
170P176
(4) 1/4-20 FHPMS (SS) INTO SUB-BUCK BLOCK
B32B070
(2) 2" x 3" x 5/8" SOLID ALUM DEADLOAD BLOCKS
(1) 1/4-20 PHPMS (S.S.) INTO 1" SLOTTED HOLE IN FRAME BLOCK FOR ADJUSTMENT
#14 TEK SCREWS (GRADE 5) (1) AT 3" AND (1) AT 6" FROM FRAME CORNER AND 12" O.C. MAX.
STRUCTURE BY OTHERS
D.L.O.
FRAME SIZE / MODULE DIMENSION
FINISHED OPENING
1 3/4"
1/4"
OPEN CELL BACKER ROD & 790 SILICONE JOINT BY CTC
.060" ALUM. BRAKE METAL CLADDING WITH 1" ROD STOPS AT TOP, BOTTOM AND INTER. SPLICE JOINTS. COLOR TO MATCH FRAME
6 1/2"
114.50°
50/46 SIM.
36/39
1/16" (NOM.) PLASTIC SHIM. (1/4" MAX.)
T30U119 - VISION AREA COVER
#14 TEK SCREWS (GRADE 5) (1) AT 3" AND (1) AT 6" FROM FRAME CORNER AND 12" O.C. MAX.
ACCESS HOLE
B32B070
170P176
DOW 983 SILICONE
1 1/2"
7 7/16"







PHOTOGRAPHER: EMILIO COLLAVINO


FRAME SIZE
MODULE DIMENSION
D.L.O.
1 3/4"
3 1/2"
℄ OF BUTT JOINT
+37'-1 1/2"
3/4"
OPEN CELL
BACKER ROD
& 795 SILICONE
JOINT BY CTC
12
26
1/4"
FINISHED OPENING
FRAME SIZE
1 3/4"
D.L.O.
170H342
170-116 SETTING CHAIR (MODIFIED)
5" LONG AT 1/4 POINTS EA.
LITE - TYP.
ATTACH TO HORIZONTAL WITH (2)
#12 TEK SCREWS 3" O.C.
#14 TEK SCREWS (GRADE 5) - (1)
AT 5" AND (1) AT 8" FROM FRAME
CORNER, (1) AT 3" AND (1) AT 6"
EA. SIDE OF MULL ℄ AND 11 1/4"
O.C. MAX.
CONT. 12ga. STEEL PLATE
AND WATERPROOFING
MEMBRANE BY OTHERS
STRUCTURE
BY OTHERS
3rd FLOOR
+37'-0"
B32B070
170P176
ACCESS HOLE
T30U119 - VISION
AREA COVER
DOW 983
SILICONE
170P176
STRUCTURE
BY OTHERS


CLIP COURTESY OF PHI CUBED

THANK YOU

For additional information on commercial glazing systems,
Please visit: www.crawfordtracey.com