NGA GLASS CONFERENCE[™] MILWAUKEE

AUGUST 6-8, 2024





United States Department of Energy

Collaboration and Update



3 Case Studies: Milwaukee High-performance Building Innovations





3 Case Studies: Milwaukee High-performance Building Innovations



Nick Yule, technical services manager, Viracon





Steve Panaro, P.E., associate, Thornton Tomasetti

Kyle Sword, R&D director North America, NSG Pilkington



Northwestern Mutual

- Project Info:
 - Glazing Contractor: Benson
 - Architect: Pickard Chilton
 - Development Manager: Hines
 - 32 Floors
 - 390,000 sq ft of Insulating Glass
 - 12,600 IG Units
 - Glass Type: GL-1
 - 1-1/8" VRE1-59 Insulating Glass
 - 3/8" Clear, heat strengthened or fully tempered heat soak
 - VRE-59 #2, edge deletion
 - 1/2" airspace black SST, Argon fill
 - Sightline: 13/16"
 - 1/4" Clear, heat strengthened or fully tempered heat soak



Photo Credit: JHVEPhoto



Northwestern Mutual

- Project Highlights:
 - NWM and Milwaukee desired local impact
 - Benson transformed rail car factory to unitizing facility
 - Developer used Riverpoint Chicago as a basis of design
 - Architect selected the coating to emphasize building curvature and SHGC
- Project Challenges:
 - High wind loads on building design and proximity to lakefront
 - 2SSG application deeper sightlines
 - Heavy exterior glass
 - 30 Glass Types
 - Heat Soaking
 - Printed Glass





Northwestern Mutual



Photo Credit: Tony Savino



ASCENT + EDISON

A Case Study of Mass Timber in Milwaukee

Steve Panaro, P.E.

Thornton Tomasetti



OUR LOCATIONS

1,700 ENGINEERS, ARCHITECTS, SCIENTISTS AND OTHER PROFESSIONALS

150 COUNTRIES WORKED IN

 \bigcirc

45+

5 continents

Thornton Tomasetti



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STEVE PANARO, P.E.

MSOE B.S. IN ARCHITECTURAL ENGINEERING STRUCTURAL ENGINEERING FOCUS

SPECIAL INTERESTS ALUMINUM & GLASS DESIGN "SPECIAL" STRUCTURES SUSTAINABLE DESIGN ARTIFICIAL INTELLIGENCE + MACHINE LEARNING

Thornton Tomasetti





ASCENT



CREDIT: KORB + ASSOCIATES



Ascent

TEAM:

Architect – Korb + Associates (now Korb Architecture) Structural Engineer – Thornton Tomasetti Contractor – CD Smith Developer – New Land Enterprises Envelope – Klein Dickert Glass

Height – 284 ft, 26 stories Gross Area – 456,000 sf Housing – 259 apartments

Structural Topping Out – December 2021



Ascent

ENVELOPE TEAM:







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151

- Contractory

SHEET NOTES

P88 •

P87

P86 • P85

P84 •

P76 +

P68 •

P88 +

P87

P84 •

P83 P79 • P78 • P77 •

P76 •

P75 P71 • P70 • P69

P68 +

P67 P63

P61

P60 +









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TYPICAL LEVELS DEFLECTION CONTROL POINTS

CONTRICE LVL 9 POI V/2 V/2 P1 V/2 V/2 P2 V/2 V/2 P3 V/2 V/2 P4 V/2 V/2 P3 V/2 V/2 P4 V/2 V/2 P5 V/2 V/2 P6 V/2 V/2 P7 V/2 V/2 P8 V/2 V/2 P1 V/2 V/2 P12 V/2 V/2 P13 V/2 V/2 P14 V/2 V/2 P15 V/2 V/2 P14 V/2 V/2 P15 V/2 V/2 P16 V/2 V/2 P17 V/2 V/2	NY NY LY LY <thly< th=""> LY LY LY<!--</th--><th>HIAGE BUTLUE HIAGE BUTLUE HIAGE <</th><th>LYL LYL LYL LYL LYL MOST 1109 104 24 2 2 2 1109 104 104 2 2 2 2 1109 104 104 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 2 2 2 2 2 2 2 3 2 2 2 3 2 2 3 2 3 2 3 2 3</th><th>VI VV VV<</th><th>L <thl< th=""> L <thl< th=""> <thl< th=""></thl<></thl<></thl<></th><th>IV. U. <thu.< th=""> U. U. U.<</thu.<></th><th>UN UN UN<</th><th>Way Way Way<th>Here U Let U Let <thlet< th=""> <thlet< th=""> <thlet< th=""></thlet<></thlet<></thlet<></th><th>TERM (NUCLUSE LIVE (V) (V)</th><th>LOUG AT EACH LVL. LVL LVL</th><th>VI VI VI VI VI VI 24 24 37 67 7 309 48 49 7 7 42 439 49 7 7 42 439 492 7 7 42 437 492 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 44 49 493 7 7 410 493 493 7 7 411 493 493 7 7</th><th>K LVL <thlvl< th=""> <thlvl< th=""> <thlvl< th=""></thlvl<></thlvl<></thlvl<></th><th>COURT UNI <thuni< th=""> <thuni< t=""></thuni<></thuni<></th><th>IVI IVI <thivi< th=""> <thivi< th=""> <thivi< th=""></thivi<></thivi<></thivi<></th><th>H H</th><th>CONTROL VE RCON VE RCON VE RCON VE POINT <t< th=""><th>N</th><th>IATIONAL GLA</th><th>ISS ASSOCIAT</th><th>10N with GANA</th></t<></th></th></thly<>	HIAGE BUTLUE HIAGE BUTLUE HIAGE <	LYL LYL LYL LYL LYL MOST 1109 104 24 2 2 2 1109 104 104 2 2 2 2 1109 104 104 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 2 2 2 2 2 2 2 3 2 2 2 3 2 2 3 2 3 2 3 2 3	VI VV VV<	L L <thl< th=""> L <thl< th=""> <thl< th=""></thl<></thl<></thl<>	IV. U. U. <thu.< th=""> U. U. U.<</thu.<>	UN UN<	Way Way <th>Here U Let U Let <thlet< th=""> <thlet< th=""> <thlet< th=""></thlet<></thlet<></thlet<></th> <th>TERM (NUCLUSE LIVE (V) (V)</th> <th>LOUG AT EACH LVL. LVL LVL</th> <th>VI VI VI VI VI VI 24 24 37 67 7 309 48 49 7 7 42 439 49 7 7 42 439 492 7 7 42 437 492 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 44 49 493 7 7 410 493 493 7 7 411 493 493 7 7</th> <th>K LVL <thlvl< th=""> <thlvl< th=""> <thlvl< th=""></thlvl<></thlvl<></thlvl<></th> <th>COURT UNI <thuni< th=""> <thuni< t=""></thuni<></thuni<></th> <th>IVI IVI <thivi< th=""> <thivi< th=""> <thivi< th=""></thivi<></thivi<></thivi<></th> <th>H H</th> <th>CONTROL VE RCON VE RCON VE RCON VE POINT <t< th=""><th>N</th><th>IATIONAL GLA</th><th>ISS ASSOCIAT</th><th>10N with GANA</th></t<></th>	Here U Let U Let Let <thlet< th=""> <thlet< th=""> <thlet< th=""></thlet<></thlet<></thlet<>	TERM (NUCLUSE LIVE (V) (V)	LOUG AT EACH LVL. LVL LVL	VI VI VI VI VI VI 24 24 37 67 7 309 48 49 7 7 42 439 49 7 7 42 439 492 7 7 42 437 492 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 439 492 7 7 7 44 49 493 7 7 410 493 493 7 7 411 493 493 7 7	K LVL LVL <thlvl< th=""> <thlvl< th=""> <thlvl< th=""></thlvl<></thlvl<></thlvl<>	COURT UNI UNI <thuni< th=""> <thuni< t=""></thuni<></thuni<>	IVI IVI <thivi< th=""> <thivi< th=""> <thivi< th=""></thivi<></thivi<></thivi<>	H H	CONTROL VE RCON VE RCON VE RCON VE POINT VE POINT <t< th=""><th>N</th><th>IATIONAL GLA</th><th>ISS ASSOCIAT</th><th>10N with GANA</th></t<>	N	IATIONAL GLA	ISS ASSOCIAT	10N with GANA
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P27 41% 11% P28 107 11% P29 -01% -01% P30 11% 11%	18 308 308 10° 18 308 10° 500 118 108 10° 300 118 308 10° 500	P1	1/16"	1/8"	1/8"	3/16"	1/4"	5/16"	5/16"	3/8"	7/16"	1/2"	1/2"	9/16"	9/16"	5/8"	5/8"	11/16"	11/16"	3/4"	0"
P31 -UN* UNF P32 -UN* UNF P33 UN* UN* P34 UN* UN*	187 3397 3397 197 1987 197 3397 197 3987 197 5398 398 5987 3987 197 192	P2	0"	1/8"	1/8"	3/16"	3/16"	1/4"	5/16"	3/8"	3/8"	7/16"	7/16"	1/2"	1/2"	9/16"	9/16"	5/8"	5/8"	11/16"	0"
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P56 σ σ σ P57 σ σ σ σ P58 σ σ σ σ P50 σ σ σ σ	159° 159° 159° 159° 149° 159° 159° 159° 159° 159° 359° 159° 159° 159° 159°	P8	-1/16"	1/16"	1/8"	3/16"	3/16"	1/4"	1/4"	5/16"	3/8"	7/16"	7/16"	1/2"	1/2"	9/16"	9/16"	9/16"	9/16"	0"	0"
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P35 0" 0" P96 0" 0" 0" P160 0" 0" 0" P161 0" 0" 0" P162 0" 0" 0"	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	P17	1/16"	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	1/2"	9/16"	5/8"	5/8"	11/16"	11/16"	3/4"	3/4"	3/4"	13/16"	3/4"
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1 SCALE: 1" = 20'-0"

(M.1) P57 P56 P55 P51 P50

SHEET NOTES FLOOR LIVE LOAD DEFLECTION IS INSTANTANEOUS LIVE LOAD DEFLECTION INVESPECTIVE OF TWE OF LOADING
 POSITIVE MOVEMENT INDICATES POINT ABOVE THEORETICAL LEVEL HEIGHT
 NEGATIVE MOVEMENT INDICATES POINT BELOW THEORETICAL LEVEL HEIGHT





				PF	REDICTED TOWE	R VERTICAL MOV	EMENTS												Λ
AT FACADE INSTALLATION LVL LVL <th< th=""><th>AL LVL LVL LVL ROOF 2 23 24 25 ROOF 8' 11:18' 11:19' 34' 0'</th><th>WE EVE EVE EVE E 8 9 10 11 1 107 1387 1287 5387 1</th><th>AT CONSTRI VL LVL LVL LVL LV 12 13 14 15 19 19" 111" 113" 15</th><th>CTION COMPLETITION LVL LVL LVL LVL 17 18 19 20 15" 15" 15" 15" 15"</th><th>LVL LVL LVL LVL LVL 21 22 23 24 1F 1F 31F 31F</th><th>LVL ROC 8 9</th><th>TOTAL LOI VL LVL LVL LVL LV 10 11 12 13 1 18 48 48 48 48 3</th><th>NG TERM (INCLUDES LIVE VL LVL LVL LVL LVI 14 15 16 17 18 17 317 112 317 317 317</th><th>LOAD AT EACH LVL) LVL LVL LVL LVL 19 20 21 22 14* 510* 610* 610*</th><th>LVL LVL LVL LVL ROOF 23 24 25 ROOF 575 37 37 7</th><th>LVL LVL LVL LVL L 8 9 10 11 1 0 0 0 0 0</th><th>FLOOR LIVE LOAD VL LVL LVL LVL LVI 12 13 14 15 16 7 7 7 7 7 7</th><th>DEFLECTION (SEE NOTE LVL LVL LVL LVL 17 18 19 20 0 1° 0° 0°</th><th>1) LVL LVL LVL LVL 21 22 23 24 0 0 0 0</th><th>LVL ROOF 25 ROOF POINT 0 0 P1</th><th>1</th><th>NATIONAL GL</th><th>ASS ASSOCIA</th><th>ATION with GANA</th></th<>	AL LVL LVL LVL ROOF 2 23 24 25 ROOF 8' 11:18' 11:19' 34' 0'	WE EVE EVE EVE E 8 9 10 11 1 107 1387 1287 5387 1	AT CONSTRI VL LVL LVL LVL LV 12 13 14 15 19 19" 111" 113" 15	CTION COMPLETITION LVL LVL LVL LVL 17 18 19 20 15" 15" 15" 15" 15"	LVL LVL LVL LVL LVL 21 22 23 24 1F 1F 31F 31F	LVL ROC 8 9	TOTAL LOI VL LVL LVL LVL LV 10 11 12 13 1 18 48 48 48 48 3	NG TERM (INCLUDES LIVE VL LVL LVL LVL LVI 14 15 16 17 18 17 317 112 317 317 317	LOAD AT EACH LVL) LVL LVL LVL LVL 19 20 21 22 14* 510* 610* 610*	LVL LVL LVL LVL ROOF 23 24 25 ROOF 575 37 37 7	LVL LVL LVL LVL L 8 9 10 11 1 0 0 0 0 0	FLOOR LIVE LOAD VL LVL LVL LVL LVI 12 13 14 15 16 7 7 7 7 7 7	DEFLECTION (SEE NOTE LVL LVL LVL LVL 17 18 19 20 0 1° 0° 0°	1) LVL LVL LVL LVL 21 22 23 24 0 0 0 0	LVL ROOF 25 ROOF POINT 0 0 P1	1	NATIONAL GL	ASS ASSOCIA	ATION with GANA
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UNP 510° 10° 5	-1/16"	-1/16"	-1/16"	-1/16"	-1/16"	-1/16"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-3/16"	-1/4"
V V	-1/4"	-1/4"	-5/16"	-5/16"	-5/16"	-5/16"	-3/8"	-3/8"	-3/8"	-3/8"	-3/8"	-3/8"	-3/8"	-7/16"	-7/16"	-7/16"	-7/16"	-3/8"	-3/8"
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SHEET NOTES FLOOR LIVE LOAD DEFLECTION IS INSTANTANEOUS LIVE LOAD DEFLECTION INVESPECTIVE OF TWE OF LOADING
 POSITIVE MOVEMENT INDICATES POINT ABOVE THEORETICAL LEVEL HEIGHT
 NEGATIVE MOVEMENT INDICATES POINT BELOW THEORETICAL LEVEL HEIGHT

POINT





AT FAC	CADE INSTALL	LATION			AT CONS	STRUCTION COMPLETITION	PREDICTED TOW	ER VERTICAL MO	OVEMENTS TOTAL	LONG TERM (INCLUDES LI	VE LOAD AT EACH LVL)			FLOOR LIVE LOA	D DEFLECTION (SEE NOT	E 1)	CONTROL				
LVL LVL LVL L 13 14 15 5 5% 5% 3% 7 17 5% 3% 37 2	LVL LVL LVI 16 17 18 NH* 12* 12* 28* 318* 216	IL LVL LVL LVL L 8 19 20 2 2 7 9/97 9/97 9/97 5 8" 12" 12" 9/2 9/2	AL LVL LVL LVL LVL LVL AL	LVL LVL <thlvl< th=""> <thlvl< th=""> <thlvl< th=""></thlvl<></thlvl<></thlvl<>	LVL LVL <thlvl< th=""> <thlvl< th=""> <thlvl< th=""></thlvl<></thlvl<></thlvl<>	LVL LVL LVL LVL LVL LVL I 16 17 18 19 18 18 18 18 18 18 18 18 18 18 18 19 18 18 18 19 18 18 18 18 18 18 18 <td< th=""><th>VL LVL <thlvl< th=""> <thlvl< th=""> <thlvl< th=""></thlvl<></thlvl<></thlvl<></th><th>L LVL ROO 8 9 7 336 0 408 408 7 336 0 408 408</th><th>LVL LVL LVL LVL LVL 10 11 12 13 ·</th><th>LVL LVL LVL LVL LVL I 14 15 16 17 3017 3017 414 414 3017 3017 414 414</th><th>VL LVL <thlvl< th=""> <thlvl< th=""> <thlvl< th=""></thlvl<></thlvl<></thlvl<></th><th>L LVL LVL LVL 23 ROOT 2 23 24 25 ROOT 5 597 38 38 38 17 7 58 398 597 7</th><th>VL EVE EVE</th><th>EVE EVE EVE<th>AL LVL LVL LVL LVL LVL 6 17 18 19 20 7 0' 1' 0' 0' 8' 4.1' 4.1' 4.1' 4.1'</th><th>LVL LVL <thlvl< th=""> <thlvl< th=""> <thlvl< th=""></thlvl<></thlvl<></thlvl<></th><th>LVL 25 ROOF POINT 0" 0" P1 -tus" 0" P2</th><th></th><th>NATIONAL GL</th><th>ASS ASSOCIA</th><th>TION with GANA</th></th></td<>	VL LVL LVL <thlvl< th=""> <thlvl< th=""> <thlvl< th=""></thlvl<></thlvl<></thlvl<>	L LVL ROO 8 9 7 336 0 408 408 7 336 0 408 408	LVL LVL LVL LVL LVL 10 11 12 13 ·	LVL LVL LVL LVL LVL I 14 15 16 17 3017 3017 414 414 3017 3017 414 414	VL LVL LVL <thlvl< th=""> <thlvl< th=""> <thlvl< th=""></thlvl<></thlvl<></thlvl<>	L LVL LVL LVL 23 ROOT 2 23 24 25 ROOT 5 597 38 38 38 17 7 58 398 597 7	VL EVE EVE	EVE EVE <th>AL LVL LVL LVL LVL LVL 6 17 18 19 20 7 0' 1' 0' 0' 8' 4.1' 4.1' 4.1' 4.1'</th> <th>LVL LVL <thlvl< th=""> <thlvl< th=""> <thlvl< th=""></thlvl<></thlvl<></thlvl<></th> <th>LVL 25 ROOF POINT 0" 0" P1 -tus" 0" P2</th> <th></th> <th>NATIONAL GL</th> <th>ASS ASSOCIA</th> <th>TION with GANA</th>	AL LVL LVL LVL LVL LVL 6 17 18 19 20 7 0' 1' 0' 0' 8' 4.1' 4.1' 4.1' 4.1'	LVL LVL <thlvl< th=""> <thlvl< th=""> <thlvl< th=""></thlvl<></thlvl<></thlvl<>	LVL 25 ROOF POINT 0" 0" P1 -tus" 0" P2		NATIONAL GL	ASS ASSOCIA	TION with GANA
516" 516" 36" 1 14" 14" 616" 5 516" 38" 116" 5	38° 318° 10° 918° 38° 278 10° 918° 918	7 12 916 9 8 7.16 12 1 8 58 1159 15	11" 58" 58" 58" 1118" 1 12" 12" 978" 978" 978" 1 10" 1118" 34" 11191" 1	7 -1.98° 1.98° -1.98° 1.98° 7 -3.98° -3.88° -3.88° -3.88° 7 -3.98° -5.88° -5.88° -5.88°	0 118° 0 118° 338° 338° 338° 338° 338° 348° 348° 358° 358° 358°	118" 118" 118" 118" 318" 318" 318" 318" 318" 4 4318" 4318" 4318" 4318" 4 4 4	246 948 946 946 946 948 948 948 948 948 948 948 948 948 948	r 335 0 -138 -336 r 4 0 -336 -336 r 536 0 -438	(338) (338) (36) (36) (36) (15) (15) (16) (16) (16) (16) (16) (16) (26) (26) (26) (26)	···· ···· <th< th=""><th>18° 38° 378° 378° 42 18° 38° 378° 378° 378 19° 318° 3198° 378° 378</th><th>r -92* 4935* 4936* 47 r -5976* -5978* -0* -1* 66* -1718* -152* 0* -1*</th><th>925, 926, 928, 926, 98, 936, 938, 938, 0, 0, 0, 0, 0,</th><th>9.16 <td< th=""><th>7 0 1 1 0 0 8 18 18 18 18 18 18 31 18 31 31 31</th><th>0. 0.0 0.0 0.0 0.0 1 0.0 0.0 0.0 0.0 0.0 1 0.0 0.0 0.0 0.0 0.0</th><th>σ σ P3 σ σ P4 σ σ P5</th><th></th><th></th><th></th><th></th></td<></th></th<>	18° 38° 378° 378° 42 18° 38° 378° 378° 378 19° 318° 3198° 378° 378	r -92* 4935* 4936* 47 r -5976* -5978* -0* -1* 66* -1718* -152* 0* -1*	925, 926, 928, 926, 98, 936, 938, 938, 0, 0, 0, 0, 0,	9.16 9.16 <td< th=""><th>7 0 1 1 0 0 8 18 18 18 18 18 18 31 18 31 31 31</th><th>0. 0.0 0.0 0.0 0.0 1 0.0 0.0 0.0 0.0 0.0 1 0.0 0.0 0.0 0.0 0.0</th><th>σ σ P3 σ σ P4 σ σ P5</th><th></th><th></th><th></th><th></th></td<>	7 0 1 1 0 0 8 18 18 18 18 18 18 31 18 31 31 31	0. 0.0 0.0 0.0 0.0 1 0.0 0.0 0.0 0.0 0.0 1 0.0 0.0 0.0 0.0 0.0	σ σ P3 σ σ P4 σ σ P5				
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12" 916" 918" 5 114" 518" 518" 5 38" 316" 12" 1	58° 1118° 34° 38° 318° 12° 12° 938° 58°	r 34° 34° 13 7 12° 936° 9 7 1136° 1136° 1	në 1318 1318 1318 1318 1	7 118 18 118 118 7 AM AN AM AM	436 438 48 48 AB 338 308 338	18 318 318 14 1	14 14 14 817 81 19 19 89 89 89	r 387 7 -1187 -118 - 1197 - 11 - 1197 - 1197 - 1198	318 -14 38 318 	12 68 1118 34 1 1000 100 100 110 1	198° -78° -7898° -7° - 7.19 198° -768° -7998° -79	8° 418° 4398° 418° 8°	0 0 0 0 10 00 10	7 7 7 7 1 m m m m m	7 0 8 0 0 8 18 18 18 18	C C 7 C	σ σ P13				
14° 518° 38° 1 38° 318° 102° 1 14° 14° 518° 1 38° 316° 18° 1	38° 318° 12° 12° 918° 58° 38° 318° 216 12° 12° 918	7 12 915 0 7 58 1116 1 6 12 12 12 5 7 58 58 1	TOTAL LONG TERM (INCLUDES LIVE LOAD AT EACH LVL)												_)						
14" 816" 36" 1 -516" -516" 516" 5 516" 516" 516" 5 516" 516" 516" 38" 1 516" 516" 516" 16" 1	38° 338° 12 38° 38° 38° 38° 38° 338° 38° 38° 38° 338° 12°	2 12 12 1 1 319 14 1 1 716 318 1 2 12 918 1 1 319 318 3	LVL 8	LVL	LVL	LVL	LVL	LVL	LVL 14	LVL	LVL	LVL	LVL	LVL 10	LVL 20	LVL 21	LVL 22	LVL 23	LVL 24	LVL 25	ROOF
18" 18" 518" 3 518" 518" 38" 3 18" 18" 518" 3 518" 18" 518" 3	216 14 14 26 216 12 27 216 12 28 216 12	F 14F 516F 5 F 12F 916F 5 F 12F 14F 9	-1/16"	-1/16"	-1/8"	-1/8"	-1/8"	-1/8"	-3/16"	-3/16"	-1/4"	-1/4"	-1/4"	-1/4"	-5/16"	-5/16"	-5/16"	-5/16"	-3/8"	-3/8"	0"
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38" 318" 12" 1 12" 940" 941" 1 310" 14" 14" 5 38" 38" 378" 1	12" 918' 918 58" 1118" 1128 516" 58" 58" 58" 12" 12" 12"	r 58 58 5 8 34 34 5 7 316 316 3 7 316 316 3	-1/16"	-1/16"	-1/8"	-1/8"	-3/16"	-3/16"	-1/4"	-1/4"	-5/16"	-5/16"	-3/8"	-3/8"	-7/16"	-7/16"	-1/2"	-1/2"	-9/16"	-9/16"	0"
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378° 14° 14° 5 14° 558° 38° 7 378° 14° 14° 5 178° 18° 18° 3	516 516 30 206 316 10 516 30 30 316 14 14	r 38 376 1 2 976 976 1 r 276 376 3	-11/16"	-3/4"	-13/16"	-13/16"	-7/8"	-15/16"	-1"	-1 1/16"	-1 1/8"	-1 3/16"	-1 1/4"	-1 1/4"	-1 5/16"	-1 3/8"	-1 7/16"	-1 7/16"	-1 1/2"	0"	0"
0 536 18 1 18 336 538 1 18 336 538 1 336 18 538 5 337 336 34 3	18" 319" 318 19" 14" 14" 19" 14" 518 518" 38" 38" 19" 519" 528	8 14 14 5 1 14 507 5 1 507 507 1 1 507 507 1 1 507 308 1 1 307 307	-1/16"	-1/8"	-1/4"	-5/16"	-3/8"	-7/16"	-1/2"	-5/8"	-11/16"	-3/4"	-13/16"	-7/8"	-15/16"	-1"	-1 1/16"	-1 1/8"	-1 3/16"	0"	0"
18° 338° 318° 1 18° 338° 338° 1 188° 338° 338° 1 188° 188° 338° 3	97 58 58 97 58 58 98 58 58 58 58 58	r 510 510 5 r 510 510 5 r 310 310 5 r 310 310 5	-5/8"	-11/16"	-3/4"	-3/4"	-13/16"	-7/8"	-15/16"	-1"	-1 1/16"	-1 1/8"	-1 3/16"	-1 1/4"	-1 1/4"	-1 5/16"	-1 3/8"	-1 7/16"	-1 1/2"	0"	0"
318" 14" 518" 5 18" 318" 318" 1 18" 318" 318" 1 18" 318" 318" 1 118" 118" 118" 1	517 38 38 517 518 518 517 518 518 518 518 518 518 518 518	r 716' 718' F 516' 516' 1 F 510' 510' 5 r 310' 310' 5 r 310' 310'	-5/16"	-5/16"	-3/8"	-3/8"	-7/16"	-1/2"	-1/2"	-9/16"	-9/16"	-5/8"	-11/16"	-11/16"	-3/4"	-3/4"	-13/16"	-13/16"	-7/8"	0"	0"
-518° 518° 518° 5 318° 14° 14° 5 11° 14° 518° 5 518° 518° 34° 5	18" 319" 318 518" 38" 38" 518" 38" 38" 38" 319" 12	F 34° 34° 3 7 736° 336° 7 736° 336° 7 737° 336° 7 12° 12° 3	-1/16"	-1/8"	-1/8"	-3/16"	-1/4"	-1/4"	-5/16"	-5/16"	-3/8"	-3/8"	-7/16"	-7/16"	-1/2"	-1/2"	-9/16"	-9/16"	-5/8"	-5/8"	0"
310° 310° 14° 1 18° 318° 14° 1 14° 14° 518° 5 518° 518° 38° 1	94" 535" 34" 94" 535" 538 536" 346 236 247 235 102 248 235 102	r 38 316 3 8 38 39 3 8 92 12 12 1 7 92 996 9	-1/2"	-1/2"	-9/16"	-9/16"	-5/8"	-11/16"	-11/16"	-3/4"	-3/4"	-13/16"	-7/8"	-7/8"	-15/16"	-15/16"	-1"	-1"	-1 1/16"	-15/16"	0"
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18" 355" 54" 5 16" 14" 558" 5 558" 558" 38" 1 358" 359" 54" 5	94° 535° 538 536° 38° 738 38° 338° 122 94° 535° 538	11 311 317 3 11 127 127 1 12 127 9317 3 11 312 9317 3 12 317 317 3 11 317 317 3	-1"	-1 1/16"	-1 1/8"	-1 3/16"	-1 1/4"	-1 5/16"	-1 3/8"	-1 7/16"	-1 1/2"	-1 1/2"	-1 9/16"	-1 5/8"	-1 11/16"	-1 3/4"	-1 3/4"	-1 13/16"	-1 7/8"	-1 5/8"	0"
14° 516° 556° 1 14° 516° 516° 1 516° 516° 516° 1 316° 516° 516° 1 316° 316° 14° 1 18° 336° 14° 1	38° 338° 338° 338° 338° 338° 338° 338°	1 12 12 1 1 1 1	-1/16"	-1/16"	-3/16"	-1/4"	-3/8"	-7/16"	-1/2"	-5/8"	-11/16"	-3/4"	-13/16"	-7/8"	-15/16"	-1"	-1 1/16"	-1 1/8"	-1 3/16"	-1 1/4"	0"
10° 10° 500° 5 500° 500° 300° 3 300° 14° 500° 5 300° 14° 500° 5 300° 14° 500° 5	519' 34' 216 34' 716' 12' 516' 54' 716 12' 916' 54'	F 739 12 1 7 12 939 9 F 739 12 1 F 58 1136 1	-15/16"	-15/16"	-1"	-1 1/8"	-1 3/16"	-1 1/4"	-1 5/16"	-1 3/8"	-1 7/16"	-1 1/2"	-1 9/16"	-1 5/8"	-1 11/16"	-1 11/16"	-1 3/4"	-1 13/16"	-1 7/8"	-1 1/2"	0"
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v v v v v v v v v v v v v v v v v v v	- E 0 0 E 0 0 E 0 0 E 0 0 E 0	· · · · · · · · · · · · · · · · · · ·	-11/16"	-3/4"	-13/16"	-7/8"	-15/16"	-1"	-1 1/16"	-1 1/8"	-1 3/16"	-1 1/4"	-1 1/4"	-1 5/16"	-1 3/8"	-1 3/8"	-1 7/16"	-1 1/2"	-1 1/2"	-1 3/8"	-1 1/4"
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TYPICAL LEVELS DEFLECTION CONTROL POINTS

D. P53

P52



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		PREDICTED TOWER VERTICAL MOVEMENTS																			
POINT		AT FACADE IN	ISTALLATION	LVL LVL LVL LVL	LOOF LVL LVL LVL LVL	AT CONS	TRUCTION COMPLETITION	N LVL LVL LVL LVL LV	L LVL ROOF LVL LVL		ING TERM (INCLUDES LIV	LOAD AT EACH LVL)	LVL LVL LVL ROC		FLOOR LIVE LOAD D	EFLECTION (SEE NOTE 1)		CONTROL POINT			
P1	8 9 10 11 12 118 18 18 318 14 18 18 18 18 18	13 14 15 16 1 5nit 5nit 38 7nit 11	7 18 19 20 21 7 12 919 919 59 91 100 919 919 59	22 23 24 25 58° 1118° 1118° 34°	0" -108" 118" 118" 11	1 12 13 14 15 C 11C 11C 11C 11C 15 C 11C 11C 11C 15C 15C	16 17 18 19 18 18 18 18	20 21 22 23 29 18 18 18 318 318 19 19 19 19 19 19	7 316 7 -116 -126	10 11 12 13 -18 -18 -18 -18 -	14 15 16 17 19 917 319 41 41 41 41 41	19 29 21 22 11 19 29 21 22 11 19 618 618 618	23 24 25 -518 38 38 F	3 9 10 11 13 7 7 7 7 7 7	2 13 14 15 16 · · · · · · · · · ·	17 18 19 20 0 1° 0° 0° 10 10 10 10	21 22 23 24 23 C C T T T T	r P1	NA	TIONAL GLASS	S ASSOCIATION with GANA
P3	18. 18. 18. 2.8. 18. 2. 18. 28. 28. 28.	510° 510° 30° 30° 31° 31	6 10 12 12 916 916 6 10 12 12 916	50° 50° 50° 1110°	0° -1/10° 115° -1/10° 11	e a ne ar ar	236, 236, 236, 256, 1	17 108 07 108 45	r 110 0 410 400	-18, -18, -238, -238, - 286, -286, -528, -228, -	or or or or or o	1 98 98 98 98 98	-07 -016 -016 - 1	0 0 0 0 0 0	• <u>v</u> v v v	0 F 0 0	0 0 0 0 0 0	r P3			
P4 P5	126, 126, 126, 226, 136, 126, 126, 126, 236, 136,	117 117 5187 5187 31 5117 318 1187 127 51	F 216F 216F 12F 12F	12" 916" 916" 0" 1110" 34" 1110" 0"	0° 398° 48° 398° 39 0° 498° 498° 498° 49	8 338 338 338 338 338 8 4.8 4.8 4.8 4.8	378° 378° 378° 378° 4 478° 478° 478° 478° 4	218 218 218 218 21 218 218 218 218 21	r r r m anr anr	-1515. 9.8, 938, - 151519.8, -19.8, -	68° 68° 4118° 38° 39 4° 4198° 418° 4388° 41	r 38 4398 38 38 r 458 4598 438 439	-1576° -1518° -0° - 0° - 0° - 0° - 0°	18° -18° -18° -18° -11 18° -18° -18° -18° -11	8 18 18 18 18 18 8 38 38 38 38 38	78. 78. 78. 78. 7	236, 726, 726, 726, 0, 28, 78, 78, 78, 0,	e P4 e P5			
P6 P7	187 1.47 3.17 7.187 1.127 1987 1987 1987 3.197 197	587 1110 347 1310 31 507 387 337 337 33	r 1510° 1° 1110° 1110°	1100 1100 1100 0	7 117 117 118 11	C 110 -110 -110 -110 C AE AE AE AE	-1187 -1187 -1187 -1187 - 11887 -1187 -1187 -1187 -1	-187 -187 -3187 -187 -18 1887 -1887 -387 -387 -38	7 7 7 -118 -18 7 7 7 AR 110R	-147 - 4517 - 387 - 3197	12 48 4118 48 43 88 2 438 49 43	e ar ane a ane	-118 -1318 0° 0° -1318 -1318 0° 0°	0 0 0 0 0 0	• v v v v	0 8 0 0	0 0 0 0 0 0	7 P6 7 P7			
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P9 P10	116, 116, 116, 216, 218, 116, 16, 18, 216, 19,	510° 510° 30° 30° 31° 14° 14° 516° 38° 31	6° 12° 12° 936° 936° 6° 736° 12° 12° 936°	915° 58° 58° 1115° 915° 915° 916° 58°	0 -010 0 -010 0 0 -010 -010 -010 -01	e an an an an an	-118° -119° -119° -119° - -114° -119° -114° -1198° -	017 AN7 AN7 AN7 AN AF AN7 AN7 AN7 AN	7 -1197 7 -1117 -117 7 -1197 7 -112 -112	-18° -518° -54° -54° -5	598° 499° 498° 499° 4998° 49	7 335 327 427 435 7 336 3507 3536 -1	-810° -58° -58° -6° -1° -1.118° -1518° -6°	0° 0° 0° 0° 0° 18° 18° 18° 18° 18	8 -18 -18 -18 -18	0' F 0' 0' -18' -18' -18' -	0° 0° 0° 0° 0° 18° 18° 18° 18° 18	0 P9 0 P10			
P11 P12	197 18 18 397 18 297 -197 -197 197 18	518° 518° 38° 38° 31° 318° 318° 118° 518° 51	8° 12° 12° 938° 938° 8° 38° 739° 338° 12°	919° 59° 59° 1119° 12° 12° 12° 59°	0 498 4 498 40 0 488 48 48 40	8 438 438 438 438 8 438 438 438 438	-118° -518° -118° -118° - -12° -12° -12° -12° -1	08 48 48 48 48	1 438 F 438 48 1 447 F 4 438	318° 318° 418° 4188° 4	998° 498° 498° 498° 498° 498° 498° 498°	r 42° 42° 499° 499° r 450° 4100° 430° 430°	68° 68° -1128° 8° 4.1288° -4.78° -4.58° 8° -4	0° 0° 0° 0° 0° 516° 516° 516° 516° 516° 516	· · · · · · ·	0 F 0 0	e e e e e e	r P11			
P13	18 14 518 38 319	12" 916" 916" 56" 11	8 34 34 34 1318	238, 138, 138, 138,	0° 118° 18° 118° 11	6 118 118 118 118	-18" -318" -318" -34" -	ar ar ar 810 61	r ar r an an	318 14 38 318	12 58 1118 34 13	8 48 4918 4 4118	418 4318 418 8			a 1. a a		or P13			
P15	197 197 299 198 39 197 197 2997 197 59																				
P16 P17	-07 -016 118 118 118 50 118 118 318 118 50											OTION		NOTE	4)						
P18 P19	or or or or or						- FL	.00R			CLE	CHON	(366	NULE	1)						
P20	618° 118° 118° 318° 11								//			//	//								DOINT
P21 P22	ar an an ar an a								LVL			LVL	LVL							DOOOO	POINT
P23 P24	198° 18° 18° 398° 19	Q	٥	10	11	12	12	1/	15	16	17	10	10	20	21	22	22	24	25	ROOH	
P25 P26	-07 -097 -097 597 59	<u> </u>	3			14	13	14	15	10	11	10	13	20	<u> </u>		23	24	<u> </u>		
P27	118 118 118 319 31	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	P1
P29	-18118118118118118118118118118118118118118118118118118118	U	0	U U	U U	U	0	0	U	0	0	0	0	0	0	0	U U	0	Ŭ	0	
P30 P31	136, 136, 136, 336, 13 136, 18, 18, 336, 13																				D 0
P32 P33	-18° 118° 118° 118° 31 118° 118° 118° 118° 31	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/16"	0"	P2
P34	18° 18° 598° 38° 25																				
P36	118° 118° 318° 118° 11 118° 118° 318° 114° 51	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	P3
P37 P38	0.04, 7.05, 704, 204, 20 0, 7.05, 705, 204, 20 0, 7.05, 205, 204, 20	Ľ	Ŭ	Ľ	Ľ	Ŭ	Ŭ	Ŭ		Ŭ				Ľ.	Ľ		Ľ		Ľ	Ľ	
P39 P40	236, 726, 736, 326, 32 236, 73, 736, 326, 73	4/01	4 (0)	4.00	4.00	4/01	4 (0)	4 (0)	4 (0)	4 (0)	4 (0)	4 (0)	4 /01	4/01	4 101	4 (0)	4/01	4 /01			D4
P41	197 197 197 197 39	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	0"	0"	P4
P43	7 7 118 18 31																				
P44 P45	0 F -10F 50F 10 7 F -10F -10F -11	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	0"	0"	P5
P46 P47	7 7 398 48 43 7 7 98 597 1	0/10	0/10	0,10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	Ľ	Ů	
P48 P49	0 7 0 110 10	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	DG
P50	1 1 11 11 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	FU
P01 P52	0 F 10 10 10																				
P53 P54	7 7 39 39 39 33 7 7 39 39 39	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	0"	0"	P7
P55 P56	7 F 118 18 18																				
P57	7 F 118 517 1	1/0"	1/0"	1/0"	1/0"	1/0"	1/0"	1/0"	1/0"	1/0"	1/0"	1/0"	1/0"	1/0"	1/0"	1/0"	1/0"	1/0"	0"	0"	DQ
P50	0 P 198 38 1	-1/0	-1/0	- 1/0	- 1/0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0	0	0	FO
P60 P61	0 F 31F 4F 4																				
P62 P63	0" 108" 108" 18" 30 198" 18" 198" 398" 19	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	P9
P64	187 - 1187 - 1187 - 118 1887 - 1187 - 1187 - 118																				
P66	0.07 1.00 1.00 1.00 1.0	-1/8"	-1/8"	_1/8"	_1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	-1/8"	1/8"	_1/8"	-1/8"	_1/8"	_1/8"	-1/8"	_1/8"	0"	P10
P67 P68	-08108118118118118118118118118118118118118118118118118118	-1/0	-1/0	- 1/0	- 1/0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0	-1/0	- 1/0	-1/0	- 1/0	-1/0	- 1/0	0	
P69 P70	198° 18° 18° 398° 18 0° 198° 18° 398° 39																				544
P71 P72	18° 18° 18° 318° 18	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	P11
P73	2007 -107 -1007 10																				
P75	236, 18, 18, 238, 19 738, 738, 78, 22	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-5/16"	-3/16"	0"	P12
P76 P77	28, 78, 78, 238, 7 28, 438, 6, 238, 7	-0/10	-0/10	-0/10	-0/10	-0/10	-0/10	-0/10	0/10	-0/10	0/10	0/10	0/10	-0/10	-0/10	-0/10	-0/10	-0/10	-0/10		
P78 P79	0° 138° 138° 339° 33 339° 138° 138° 339° 13	C	c			c	c "	c "	<u></u>	c "	c "	<u></u>	.	<u></u>	<u> </u>	c	<u> </u>	c "		.	D40
P80	-07 -017 -017 117 11	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	P13
P82	118 118 118 118 31																				
P83 P84	-08036, 1080809 108080809 108080809	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/4"	-1/8"	0"	P14
P85 P86	198° 18° 398° 18° 59 58° -598° 198° 198° 18	., .		.,,																L	
P87 P88	198° 198° 198° 398° 39	0"							0"		0"	<u>^"</u>	0"	0"		0"		0"	0"		D15
P90	7 7 7 7 8	0"	U"	U., N., N., N., N., N., N., N., N., N., N	U., N., N., N., N., N., N., N., N., N., N	0"	0"	0"	0"	U"	0"	0"	0"	U	U., N.	0"	U.,	0"	U.,	U"	гıэ
P971 P92	7 7 7 7 7 7 7 7 7																				
P93 P94	a a a a a	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	-3/16"	P16
P95 P96	a a a a a																				
P100	7 7 7 7 8	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	P17
P102	* * * * *	U	0			U U	0	U U	U	0	U	U	U			U		U		U U	
P103 P104	a a a a a	-																	i		
P105 P106	7 7 7 7 7 7 7 7 7	0 0 0 0 0	· · · · · ·	0° 6° 0° 34°	1158° 0° 4° 0° 0 918° 0° 4° 0° 0	v v v v	a a a a	r o o e o	- 438° -54° 0° 0° - 438° -548° 0° 0°	v v v v	a e a a e	0 0 0 0 0	0° 0° -30° -4* 0° 0° -30° -4.93°	a a a a a	· · · · · ·	0 F 0 0	e e e e e	er P105 -0107 P106			
P110 P111	7 7 7 7 7 F	0 0 0 0 0 0	· · · · · · ·	0 F 0 1115 0 F 0 58	58° 0° 0° 0° 0 918° 0° 8° 0° 0		0 0 0 0 0	r 0 0 0 0	-94 -515 0 0 -94 -516 0 0	v v v v	a e e a e	0 0 0 0 0	0 0 -1 -114 0 0 -1508 -1	0 0 0 0 0 0 0 0 0 0 0		0 F 0 0	e e e e e e	-010" P110 0" P111			
P112 P113	7 7 7 7 7	0 0 0 0 0	0 7 7 0 7 7 7 7	0 F 0 1995	58 0 8 0 0		0 0 0 0	r v v r v	-54 -350 0 0 ME 380 0 M	v v v v	a e a a e	0 0 0 0	7 7 7 4W	7 7 7 7 7 7 7 7 7 7	v v v v	0 F 0 0	e e e e e	-017 P112			
P114	7 7 7 7 7	0 0 0 0 0		0 F 0 1118	0 0 7 0 0		0 0 0 0	r o o e o	5n° 7 7 7	0 0 0 0	0 0 0 0 0	0 0 0 0	0° 0° 1516 1°	0 0 0 0 0		0 1 0 0	e e e e	r (r 19114			

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(M.1) P57 P56 P55 P51 P50









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CREDIT: TIMBERLAB



Architect – HPA Structural Engineer – Thornton Tomasetti Contractor – CD Smith Developer – The Neutral Project Envelope – Reflection Window & Wall

Height – 364 ft, 32 stories Gross Area – 535,000 sf Housing – 383 apartments

Pursuing Passive House Certification (PHIUS Core 2024)









Edison vs Ascent





Ascent

The Edison



Edison vs Ascent





Ascent

The Edison









- Quiet
- High indoor air quality & ventilation
- Energy efficient
- Comfortable
- Humidity control

KBTU/SF.YR

- Resilient
- Low maintenance
- Odor Control



Multifamily Residential Building Energy Intensity Targets Thornton Tomasetti





Heating Demand = **6.2 kBtu/ft2/yr** Cooling Demand = **7.9 kBtu/ft2/yr** Peak Heating Load = **5.9 Btu/ft2/hr** Peak Cooling Load = **2.8 Btu/ft2/hr** Source Energy = **5,225 kWh/person/yr**

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				Visible	Solar	U-Value		Shading	Relative Heat	Exterior Solar	Interior Visible	Exterior Visible	
Name	Glass Type	Coating	Argon	Transmittance	Transmittance	(Winter)	SHGC	Coefficient	Gain	Reflectance	Reflectance	Reflectance	UV Transmission
Triple VE1-2M (2 + 4)	Clear	VE-2M	No	56.0%	22.3%	0.16	0.3	0.35	71	31.9%	13.6%	12.9%	2.3%
Triple VE1-2M (2 + 4)	Clear	VE-2M	Yes	56.0%	22.3%	0.12	0.3	0.34	70	31.9%	13.6%	12.9%	2.3%
Triple VE13-2M	Starphire Low Iron	VE-2M	No	60.5%	27.3%	0.16	0.33	0.38	78	41.6%	15.2%	12.7%	4.2%
Triple VE13-2M (2 + 4)	Starphire Low Iron	VE-2M	Yes	60.5%	27.3%	0.12	0.33	0.38	78	41.6%	15.2%	12.7%	4.2%
Triple SB60 Clear (2 + 4)	Clear	Solarban 60	No	56.0%	22.8%	0.16	0.31	0.36	74	29.3%	14.3%	12.4%	5.9%
Triple SB60 Clear (2 + 4)	Clear	Solarban 60	Yes	56.0%	22.8%	0.12	0.31	0.35	73	29.3%	14.3%	12.4%	5.9%
Triple SB60 Acuity (2 + 4)	Acuity Low Iron	Solarban 60	No	59.4%	25.9%	0.16	0.32	0.37	77	38.1%	14.5%	12.7%	7.3%
Triple SB60 Acuity (2 + 4)	Acuity Low Iron	Solarban 60	Yes	59.4%	25.9%	0.12	0.32	0.37	76	38.1%	14.5%	12.7%	7.3%
Triple SB60 Starphire (2 + 4)	Starphire Low Iron	Solarban 60	No	60.4%	27.0%	0.16	0.33	0.38	78	43.0%	14.6%	12.9%	7.9%
Triple SB60 Starphire (2 + 4)	Starphire Low Iron	Solarban 60	Yes	60.8%	27.6%	0.12	0.33	0.38	77	43.0%	14.8%	12.9%	8.2%
Triple SB67 Acuity (2 + 4)	Acuity Low Iron	Solarban 67	No	35.1%	14.6%	0.16	0.21	0.24	50	45.9%	19.2%	23.9%	2.8%
Triple SB67 Acuity (2 + 4)	Acuity Low Iron	Solarban 67	Yes	50.1%	16.9%	0.12	0.21	0.25	51	50.0%	17.0%	16.1%	1.2%
Triple SB72 Acuity (2)	Acuity Low Iron	Solarban 72	No	61.3%	23.0%	0.21	0.26	0.3	62	49.8%	19.7%	17.0%	7.1%
Triple SB72 Acuity (2)	Acuity Low Iron	Solarban 72	Yes	61.3%	23.1%	0.18	0.25	0.29	61	23.1%	19.7%	17.0%	7.1%
Triple VRE1-54 + VE-85 (2 + 4)	Clear	VRE-54 (2) + VE-85 (4)	No	40.7%	19.1%	0.17	0.26	0.29	61	38.0%	19.1%	33.1%	7.9%
Triple VRE1-54 + VE-85 (2 + 4)	Clear	VRE-54 (2) + VE-85 (4)	Yes	40.7%	19.1%	0.13	0.25	0.29	60	31.9%	19.2%	33.1%	7.9%





Questions?

Steve Panaro, P.E. Thornton Tomasetti



Vacuum Insulated Glazing (VIG)

Kyle Sword

NSG Pilkington

R&D Director, North America



Introduction to VIG



VIG is a double glazed IG unit where all the air between the two panes of glass has been extracted, therefore creating a partial vacuum.

Many new solutions manage heat transfer through windows. **Vacuum insulated glazing** (VIG) – 1st patent in 1913. 1st commercial product – 1997 – University of Sydney, NSG Ultra thin form factor and vacuum make unique solution.



Introduction to VIG

Typical IGU – 1" Thick Float Glass



VIG – ¼" Thick



- VIG benefits
 - No gas for convection/conduction
 - Thin (fits existing sash)
 - Light weight Operable windows
 - Avoids known issues with organic IG seal failure
 - Sound reduction Vacuum = STC
 - Fully reversible





IGU versus VIG construction





Milwaukee County War Memorial project





- National Landmark, designed by famed Finnish architect Eero Saarinen (pictures preconstruction).
- Steel frame construction Maintained structure, design.
- Monolithic wire glass. Restored 2017.



Video – Project link

The Bird Cage: Renovation Project - Period Homes (period-homes.com)



• Thick, steel sash

Other alternatives

- Re-glaze, monolithic
 v.
- Re-tap glazing bars
- Restoration w/ VIG
 - Lower cost and kept historic facade v. curtainwall replacement
 - Met energy targets





- Glazed using Pilkington **Spacia**[™] in April 2017
- Monolithic Pilkington Energy Advantage[™] on Clear in small, shaped parts (below)
- Allowed restoration of existing frame and stops without re-tapping glazing bars.





Project detail

- Glazing contractor, Nal Vogel, Restoric, LLC
- Architect Hammel, Green, and Abrahamson, Inc.
 Russell Drewry, AIA
- Preservation consultant Donna Weiss
- Milwaukee County DAS Julie Bastin, PE, M. Arch









Carbon reduction & reuse

The Kahn



• 1931

8/6/2024

- 11 story
- 320,000 ft² building, 17,500 ft² glazing area
- 700 bronze, double-hung windows, monolithic 1/4" glass

	(metric tons CO2 eq)							
				-				
		Storm	Al storm					
	Reglazing	window	windows	Al replacement				
	with VIG	(1/4")	(1/4")	windows				
Embodied carbon total (metric tons CO2 eq)	25	41	59	99				
Operating carbon annual savings (metric tons CO2 eq)	-226	-161	-161	-233				
Total Y1 carbon impact (metric tons CO2 eq)	-201	-120	-102	-134				
Embodied carbon debt payback (months)	<mark>1</mark>	3	3	5				
Breakeven point - Years payback for embodied carbon				11				

Current operating carbon



- 13% energy savings
- <u>1 month</u> carbon payback₄₂







Monolithic v. VIG (cold day)







Event/meeting

45





46







Video – Project link

The Bird Cage: Renovation Project - Period Homes (period-homes.com)

Articles

- The Bird Cage Stair: Pilkington Spacia[™] Restoration Project Traditional Building
- Pilkington Spacia[™] transforms "Bird Cage" staircase from replacement project to restoration project (archpaper.com)
- <u>Pilkington Spacia[™] transforms "Bird Cage" staircase from replacement project to restoration project (archpaper.com)</u>
- Video on Winston Salem Union Train Station <u>https://www.traditionalbuilding.com/product-report/winston-salem-union-station-restoration</u>
- Video explaining VIG and Pilkington Spacia[™] <u>https://www.period-homes.com/buying-guides/pilkington-spacia-innovation-for-historic-restoration</u>
- Intelligent Glass Solutions magazine Glass and window history, VIG for restoration/retrofitting https://igsmag.com/videos/glass-and-window-basics-vig-for-historic-restoration-kyle-sword/
- Albert Kahn restoration case study <u>https://mailchi.mp/thekraemeredge/kdg-historic-project-spotlight-the-albert-kahn-building?e=81c7f13bd3</u>
- Fine Homebuilding magazine Jan 2021
- <u>https://www.finehomebuilding.com/2020/11/06/insulating-glass-keeps-getting-better</u>





GROUP

NGA GLASS CONFERENCE[™] MILWAUKEE

AUGUST 6-8, 2024





United States Department of Energy

follaboration and Update