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National Institute of Building Sciences

Challenges of Replacing the Historic Glass Facades at the United Nations Headquarters

Robert A. Heintges, FAIA, Founding Principal, Heintges

January 10, 2018





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United Nations Headquarters

Client – United Nations Capital Master Plan

Architect (Facades) – Heintges

Facade Consultant – Heintges

Architect (Interiors) + Structural Engineer – HLW

Construction Manager – Skanska

Mechanical Engineer – Syska Hennessy Group



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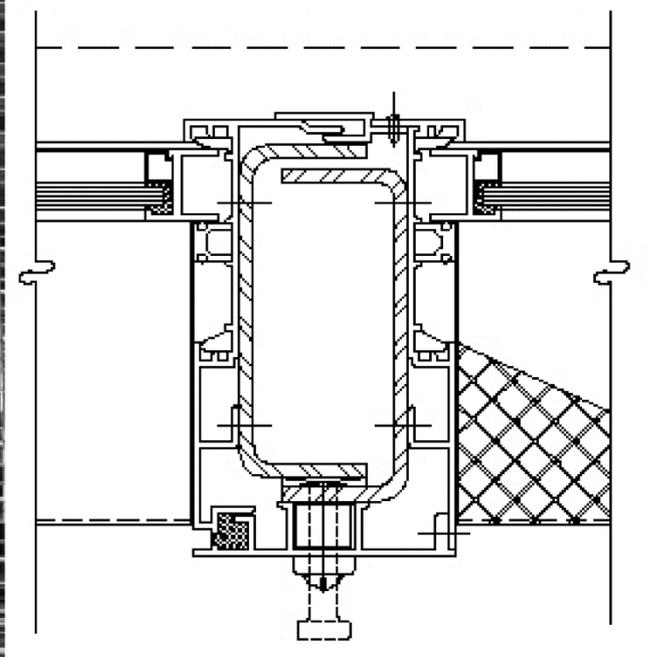
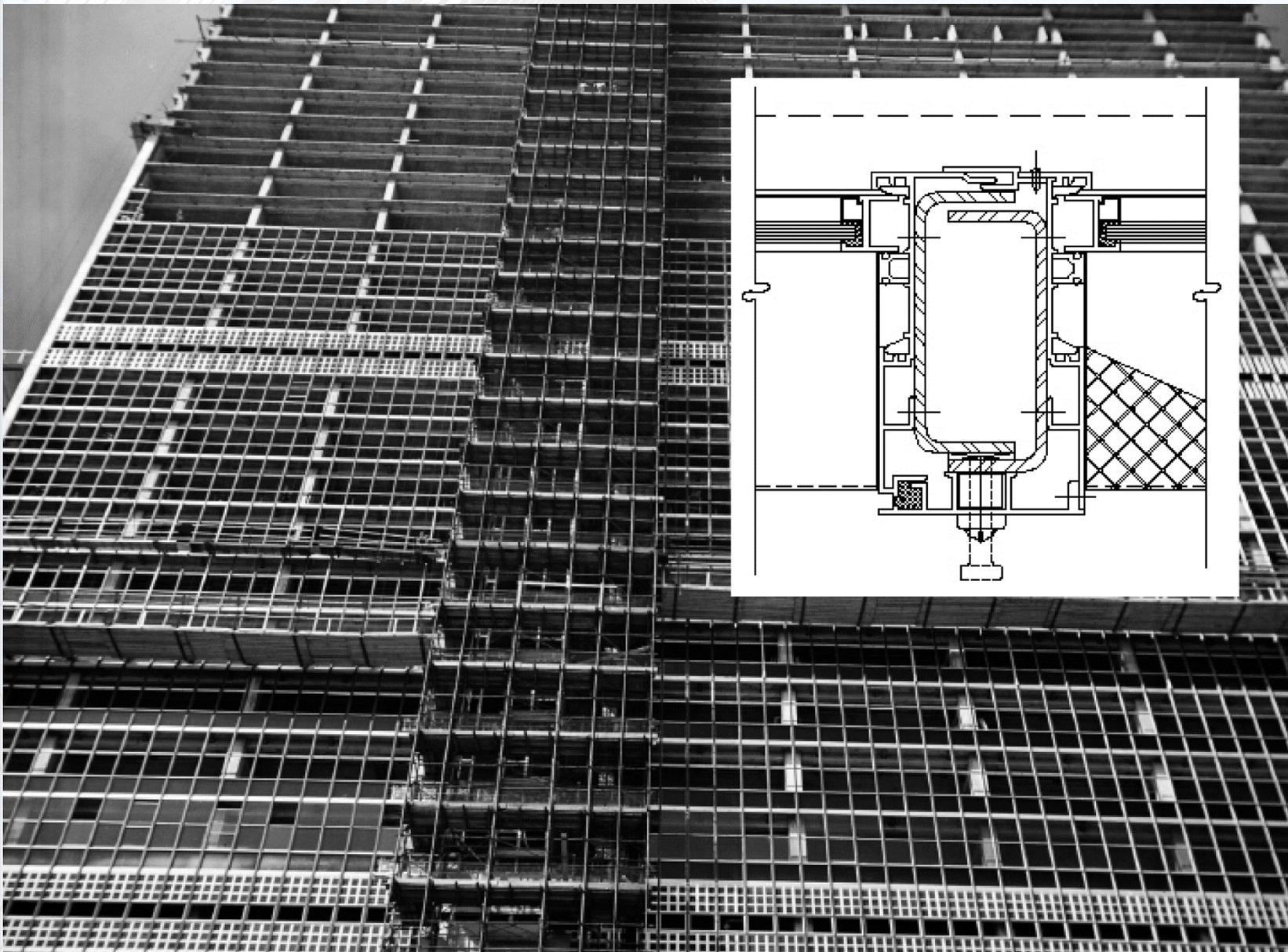




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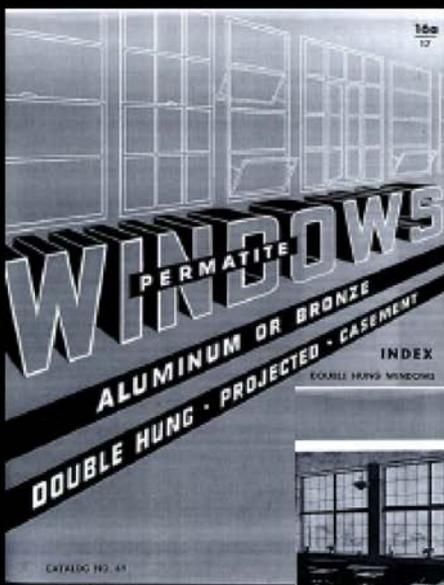




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PERMATITE INSTALLATIONS

16c 17

GENERAL BRONZE CORPORATION

PERMATITE ALUMINUM OR BRONZE

DOUBLE HUNG - PROJECTED - CASEMENT

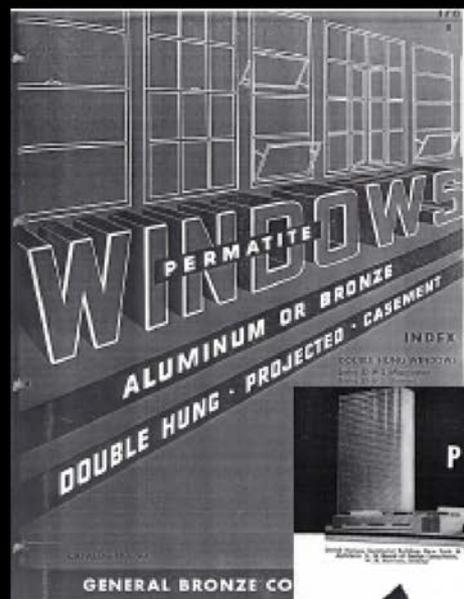
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GENERAL BRONZE 1949 CATALOG



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For America's finest buildings

The selection of PERMATITE windows for the United States Government Building, the new department office building at 110 Park Ave., New York City, the Kings County Tuberculosis Hospital in Brooklyn, N. Y., and a line of other new buildings from coast to coast has set new standards for PERMATITE windows for General Bronze windows for their most outstanding design and construction features—their beauty, ease of operation, freedom from periodic painting, and other maintenance expenses.

PERMATITE windows, in other designs, frames, finishes and in other construction materials, are used for use in schools, hospitals, apartments, commercial and institutional buildings.

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Whether eye register double-hung, casement or projected type windows you will find PERMATITE an investment that will prove to be an ultimate economy for your client.

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When such an aluminum window is required for the use of the window in a residential building, the window is made in a special design for residential construction, which makes them well suited for residential use.

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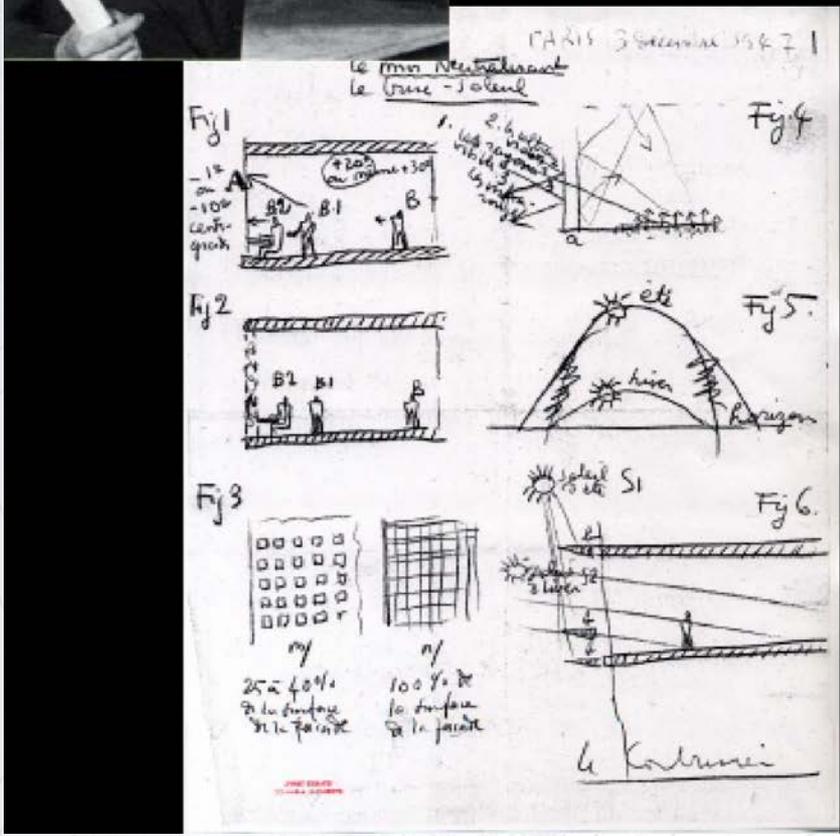
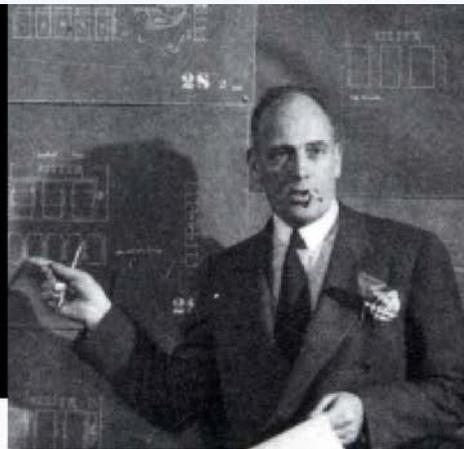
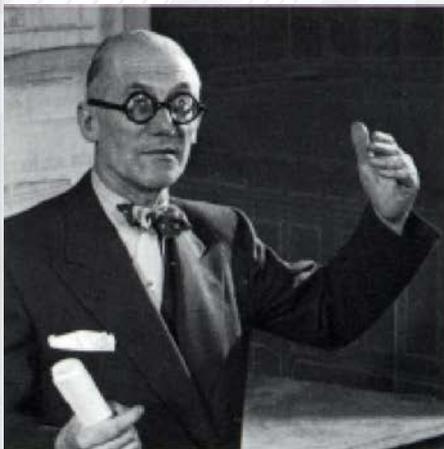
GENERAL BRONZE 1950 CATALOG



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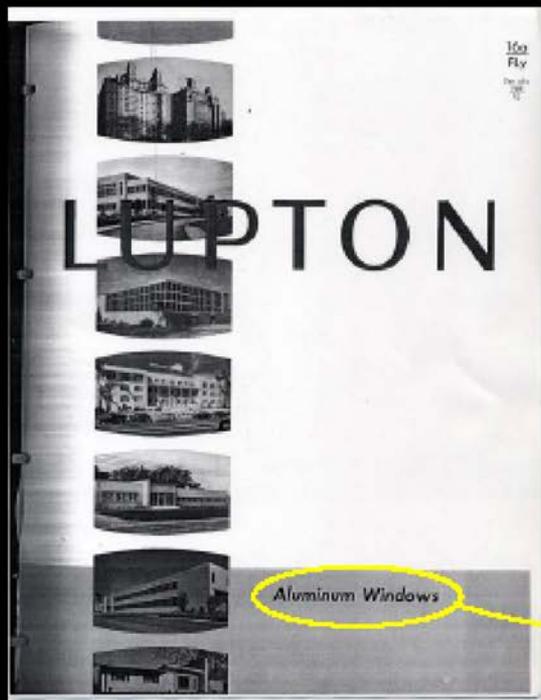




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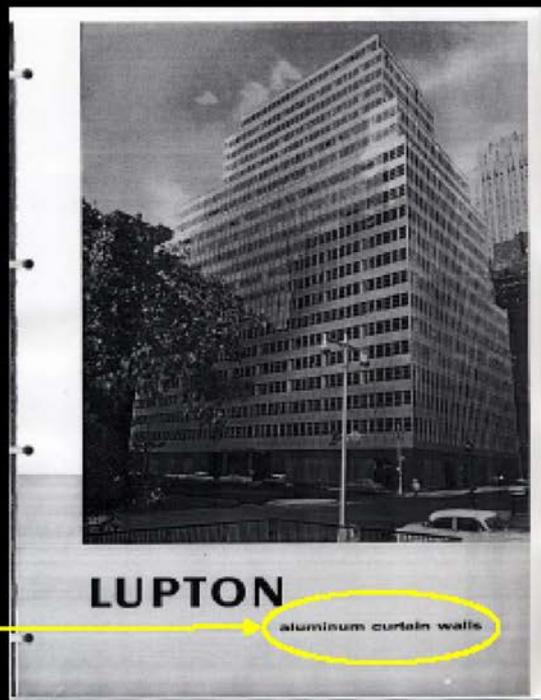
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1954 CATALOG



1955 CATALOG



1956 CATALOG



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SHADOWS CHASED BY U.N. ARCHITECTS
 One East 42nd Street (1937) Courtesy: Max Pe. 1941, Post-Quest Historical Newspapers The New York Times
 Pg. 12

SHADOWS CHASED BY U. N. ARCHITECTS

Planners Build a Mock-Up Facade of the Secretariat Building on East Side

United Nations site planners spent some time yesterday, chasing shadows.

Using what architects described as a mock-up, they studied the effect of daylight upon the design and materials contemplated for the projected thirty-nine-story Secretariat Building in East midtown Manhattan.

The mock-up, actually a full-scale model, represents a facade showing roughly how the windows will look. It stands four stories high on the flat roof of the Manhattan Building, in East Forty-second Street, and is supported against inclement weather by pipe-scaffolding. Pale blue translucent glass features the spandrel, that portion of the building between the head of the window of one floor and the window sill of the floor above.

"We're checking shadows and lines, then observing how it looks from two to three hundred yards," Deputy Planning Director Max Abramovitz explained. "We may tear it down in time and redesign the detail."

While a glass spandrel is not original or unique, he pointed out, it has not been employed on so large a scale. Rockefeller Center buildings feature stone spandrils, while others have been built of aluminum. There is no certainty that in the United Nations structure glass will predominate, he said.

"Generally," he continued, "architects use a mock-up to study portions of things, then we refine it before we build it. We examine the subtleties of some of the lines, of the wood, the plaster and the glass. Our designers will give the matter further attention, perhaps for a couple of months."

The present mock-up, about fifty feet high and eighteen feet wide, was completed late Wednesday, according to Glenn Bennett, executive officer of the planning division. Supervising its erection were Wallace K. Harrison, planning director, and James Dawson, coordinator of construction.

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THE SECRETARIAT'S ORIENTATION

—why architects sited the building as they did, and how this affected its mechanical features

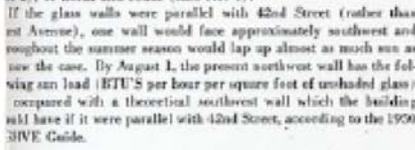
If all architectural criticism directed against the UN Secretariat, not vehement in that opposed to a great glass wall facing the western sun. Out-of-towners who have lived through one of New York's muggy hot summers are torn with pity for unsuspecting foreigners who, in years to come, may roost behind a thin protection of glass and venetian blinds.

The cudgel against the present design was originally taken up by a Co-builder who protested to Warren Austin: "My strong belief is that it is senseless to build in New York, where the climate is terrible in summer, large glass areas which are not equipped with 'brise-soleil.' I say this is dangerous, very seriously dangerous."

A few American architects have been equally critical of the great glass facade and the building's orientation. "Air conditioning and venetian blinds are pitted against the powerful sun," said one. "Some the answer could have been found for the west wall and the office sun," sums up many opinions. Critics point out that while a western sun is a summer fireball, simply turning the existing sign 90° would put a blank wall to the west and glass walls to the north and south—an ideal combination.

The concern would have an unassailable position except for two items: 1) the efficiency of modern air conditioning which could take an inside office in hell quite comfortable, and 2) the little appreciated fact that Manhattan island does not lie due north and south. New-York's so-called north-south avenues run 29° east of north. So the Secretariat's much-lamented west wall actually faces due nearly northwest than west—and receives much less sun heat as might be imagined.

The orientation study above, made for the UN Planning Office by engineers Syka & Hennessy, clearly shows the difference between a orientation which exists (case No. 1) and what the air conditioning load might be if the building were turned 90° (as in case No. 3) or if its glass walls were parallel with 42nd Street (rather than 41st Avenue), one wall would face approximately southwest and throughout the summer season would lap up almost as much sun as now the case. By August 1, the present northwest wall has the following sun load (BTU'S per hour per square foot of unshaded glass) compared with a theoretical southwest wall which the building will have if it were parallel with 42nd Street, according to the 1939 SIVE Guide.

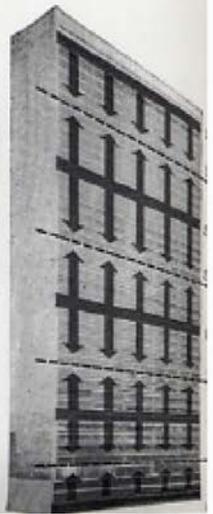


Time	Northwest Wall	Southwest Wall
8 a.m.	14	14
9 a.m.	15	15
10 a.m.	16	16
11 a.m.	18	22
12 noon	16	62
1 p.m.	14	110
2 p.m.	30	144
3 p.m.	76	156
4 p.m.	122	147
5 p.m.	141	118
6 p.m.	106	62
7 p.m.	28	6

Above: Plan No. 1 is existing orientation. Curves show air conditioning load for each of four possible sitings.



Secretariat has four pipe galleries plus added equipment in basement, each supplying floors as shown at right. Buildingwide rows of louvers at each mechanical floor are used for fresh and exhaust air. Photo above shows part of a mechanical floor, which permits concentration of most heating, air conditioning, electrical, telephone and other such equipment.





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GLAZING & SHADING ANALYSIS

GLAZING & SHADING	AIR CONDITIONING	
	INITIAL COST	OPERATING COST
1/8" COMMON GLASS	\$828,000	5,920
& ROLLER SHADE	480,000	0,000
& INSIDE VENT'N. BLINDS	507,000	4,030
& OUTSIDE	316,000	1,480
& ROOL SHADE	328,000	1,600
1/8" TREAT THERMO GLASS	540,000	4,320
& ROLLER SHADE	304,000	1,300
& INSIDE VENT'N. BLINDS	486,000	2,340
& OUTSIDE	316,000	1,480
1/8" 1/4" THERMO PANE	760,000	5,320
& ROLLER SHADE	482,000	2,240
& INSIDE VENT'N. BLINDS	583,000	3,790
& OUTSIDE	316,000	1,480
1/8" 1/4" TREAT THERMO PANE	500,000	3,140
& ROLLER SHADE	416,000	2,370
& INSIDE VENT'N. BLINDS	447,000	2,660
& OUTSIDE	282,000	1,150
GLASS BLOCK	472,000	2,790
EXTERIOR LOUVRES		
HORIZONTAL - FIXED		
VERTICAL - FIXED		
VERTICAL - FIXED & HORIZONTAL - MOVABLE		
FIXED INTERIOR LOUVRES		
VENETIAN BLINDS - GLASS ENCLOSED		
INTEGRAL VENETIAN BLINDS & GLASS		

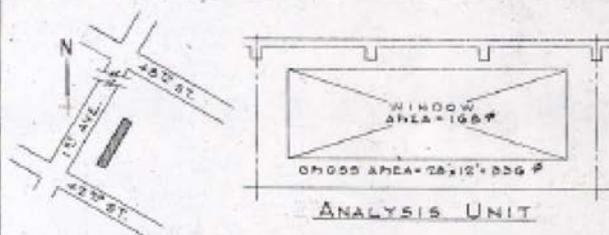


Figure No. 4-AC

ORIENTATION AS AFFECTING AIR CONDITIONING

ORIENTATION	TONS		APPARENT INITIAL COST		APPARENT OPERATION ONLY	
	GROSS	SUN	GROSS	SUN	GROSS	SUN
①	2200	805	1,695,000	604,000	15,000	4,030
②	2100	743	1,645,000	597,000	14,000	3,720
③	2200	898	1,718,000	674,000	15,300	4,480
④	1830	620	1,370,000	468,000	12,200	3,320

INITIAL COST COMPARISON

ORIENTATION	SUN	GROSS
①	\$604,000	\$1,695,000
②	① LESS 47,000	① LESS 50,000
③	① PLUS 70,000	① PLUS 23,000
④	① LESS 159,000	① LESS 325,000

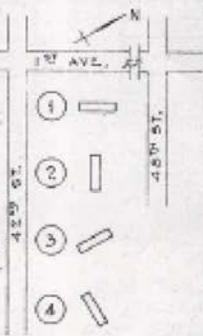


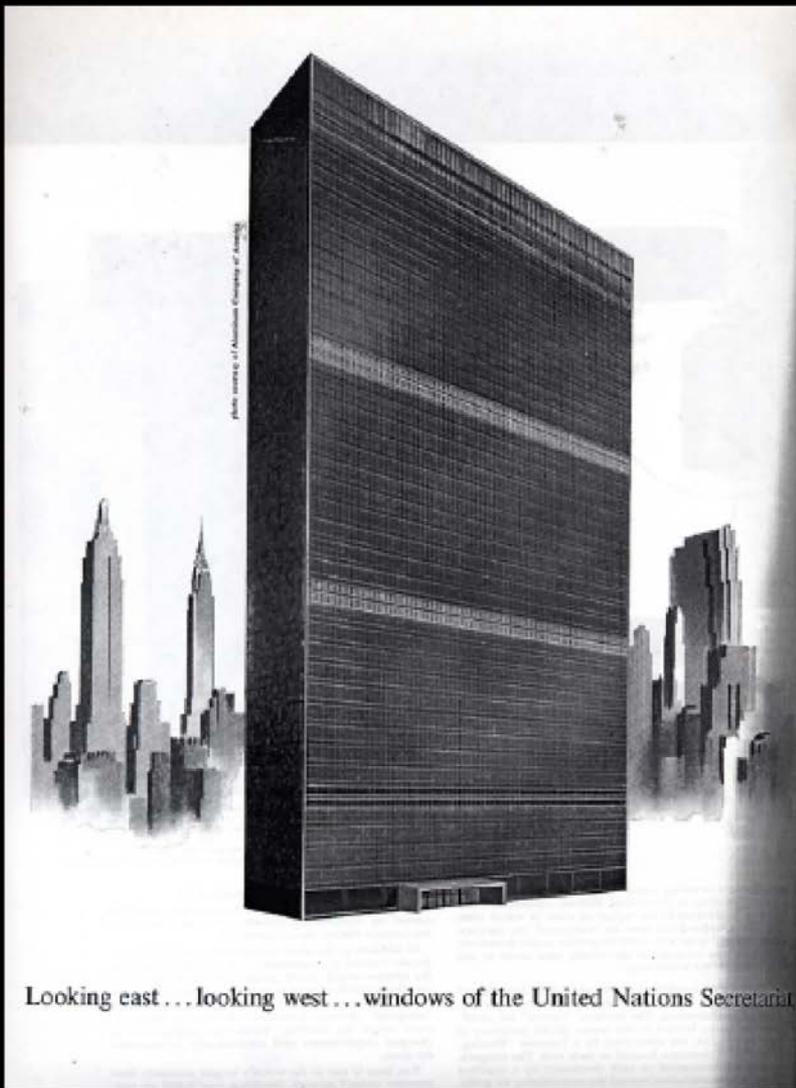
Figure No. 5-AC



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Looking east... looking west... windows of the United Nations Secretariat Building, numbering 4739, are fitted with venetian blinds



© 1994 LEVOLOR CORPORATION, INC., NEW YORK

... manufactured with **LEVOLOR** enclosed metal heads and bottom bars



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"See, it's *Thermopane* ...you'd never have to fuss with storm windows."

MAKES YOU FEEL LIKE A KING!
 You don't have to worry about...
 weather...
 noise...
 heat...
 cold...
 insects...
 or anything else that can get in through a window.

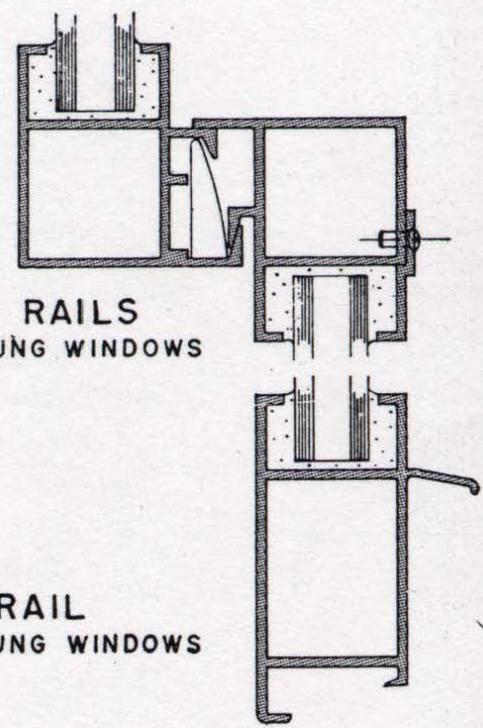
Thermopane windows are made of two panes of glass with a special air space between them. This space acts as a natural insulator, keeping the heat in your home in winter and the heat out in summer. It also keeps the noise out and the insects out. Thermopane windows are the only windows that can be used in any climate.



Thermopane
 INSULATION

LIBERTY-EMERY-FORD
 is Great Home in Glass

MEETING RAILS
 OF DOUBLE HUNG WINDOWS



SILL RAIL
 OF DOUBLE HUNG WINDOWS

NOTE:
 THIS SASH MEMBER
 MAY BE USED FOR SASH
 2'-0" X 5'-0" MAXIMUM.





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Secretariat

Glass & Glazing

Par. 20-06 (Cont'd.)

(b) Heat-Absorbing Glass: (See Alternate 20-a). All heat-absorbing glass shall be polished plate glass, 7/32 to 1/4 inch thick, of a cool "light bluish" or light "greenish" color, of special chemical composition that will absorb a high percentage of the infra-red rays of the sun and effect a net reduction of the solar heat projected through the glass. Visible light transmission shall not be reduced more than 30 percentum. In general, heat-absorbing glass shall be the equivalent in kind, quality, function and characteristics, but ~~is~~ not restricted to "Solex", as made by the Pittsburgh Plate Glass Company, or "L-O-F Heat-Absorbing Glass", as made by the Libbey-Owens-Ford Glass Company.

(c) Spandrel Glass Panels: Of clear crystal sheet glass, 7/32 to 1/4 inch thick, upon which a selected ceramic color is fused at high temperature on the back of each sheet, each sheet being then fired at a temperature not less than 1190 degrees F. and tempered by reducing the temperature sharply within established periods of time. Color fused on back shall be permanent, non-fading, uniform throughout in texture and coverage, free from blisters or pin holes, and acid-resistant and not subject to deterioration in any form as a result of constant exposure to variable changes of light, heat or cold. A slight "bowing" of each sheet is admissible, but in no event shall same exceed 1/8 inch in the longest dimension of each sheet. Full-size samples of this material to be submitted for approval to the Director prior to initiation of coloring process.

(d) Polished Plate Glass: Polished plate glass shall be Type "A," glazing quality, nominal thickness 1/4 inch.

(e) Wire Glass: Wire glass shall be Type "E", Welded Wire, Square Mesh, 1/4 inch thick, clear, polished two sides.



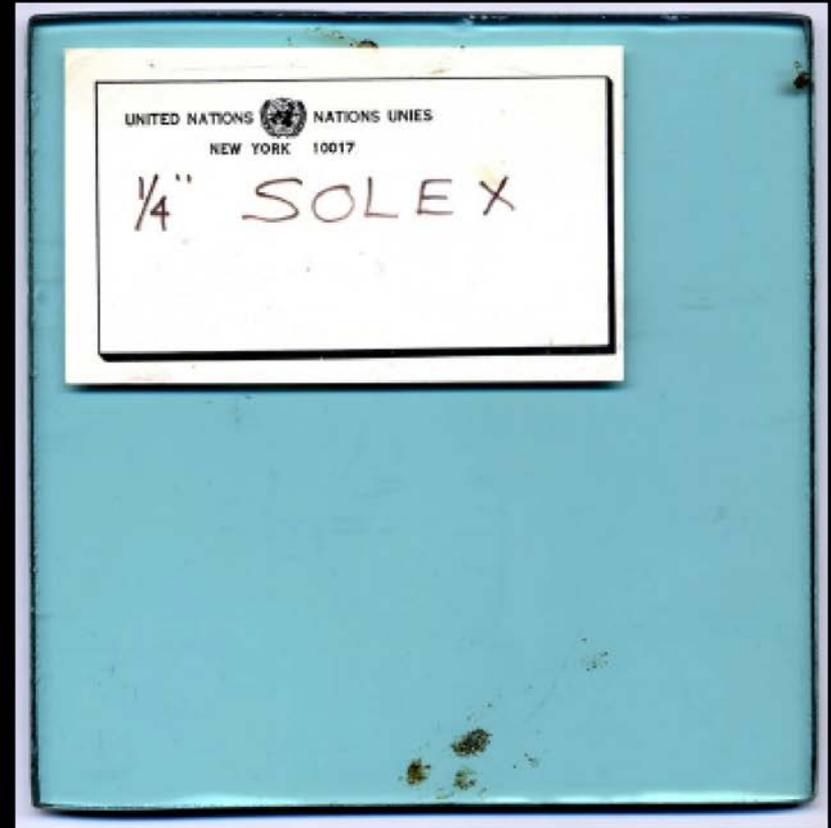
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CORNING (ASG) AKLO®



UN ARCHIVAL SAMPLE OF VISION GLASS
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June 11, 2007



April 17, 1951



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West Facade (1998, no film)



East Facade (2001, film)



West Facade (2004, film added)



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Optics

File Edit Database View Tools Graph Help

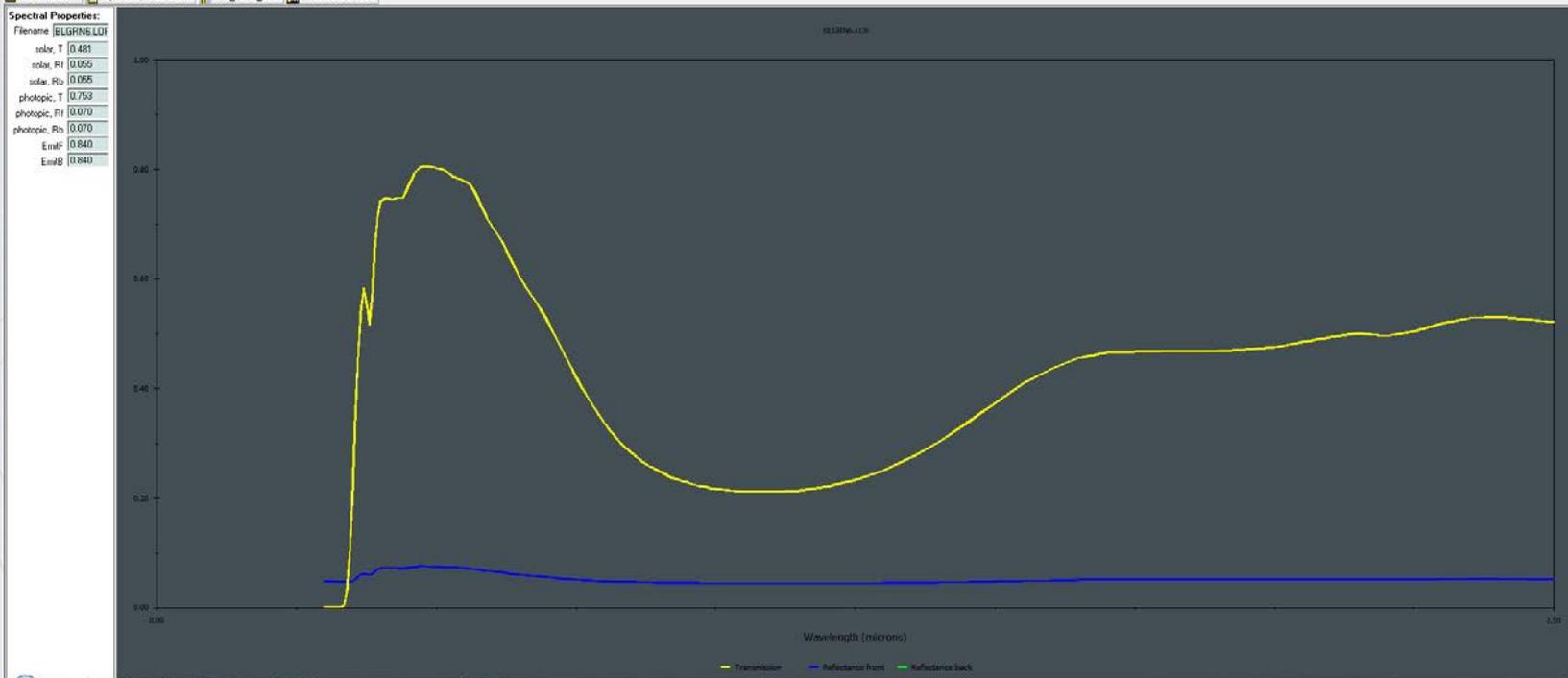
Main Database (IGDB)

Glazing System Laminated Add Glazing Edit Glazing System View All Schematic

Layer	#1	#2	#3	System	Type /	Manufacturer /
Filename	BLGRN6			BlcSys1		
solar, T	0.481					
solar, RI	0.095					
solar, Rb	0.095					
photopic, T	0.753					
photopic, RI	0.070					
photopic, Rb	0.070					
EmisF	0.840					
EmisB	0.840					

Type	File Name	Product Name	Nominal (m)	Nominal (in)	Thickness	Manufacturer	NFRC ID	Acceptance	Appearance	Material	Coated Side	Coating	Film	Substrate	Cond	TiR	EmisF	EmisB	TSol	RSol	RSol	TVis	RVis	RbVis	T_Ci	T_Ci	T_Ci
Monolithic	ARCBL10.LOF	Arctic Blue™	10 mm	3/8"	9.4400	Pikington N...	9606	#	Arctic Blue	Glass	Neither	N/A	N/A	N/A	1.000	0.000	0.840	0.840	0.215	0.046	0.046	0.409	0.052	0.052	35.500	41.840	5.9
Monolithic	ARCBL4.LOF	Arctic Blue™	4 mm	5/32"	3.937	Pikington N...	9682	#	Arctic Blue	Glass	Neither	N/A	N/A	N/A	1.000	0.000	0.840	0.840	0.453	0.054	0.054	0.850	0.063	0.063	59.213	85.648	7.9
Monolithic	ARCBL6.LOF	Arctic Blue™	6 mm	1/4"	5.910	Pikington N...	9604	#	Blue	Glass	Neither	N/A	N/A	N/A	1.000	0.000	0.840	0.840	0.320	0.049	0.049	0.520	0.057	0.057	47.070	53.332	0.6
Monolithic	ARCBL8.LOF	Arctic Blue™	8 mm	5/16"	7.87	Pikington N...	9665	#	Dark Blue	Glass	Neither	N/A	N/A	N/A	1.000	0.000	0.840	0.840	0.250	0.046	0.050	0.424	0.052	0.057	37.388	43.332	6.0
Monolithic	BLGRN10.LOF	Optifast™ Blue-	10 mm	3/8"	9.355	Pikington N...	9676	#	Blue-Green	Glass	Neither	N/A	N/A	N/A	1.000	0.000	0.840	0.840	0.355	0.050	0.050	0.667	0.065	0.065	59.116	67.055	7.4
Monolithic	BLGRN6.LOF	Optifast™ Blue-	6 mm	1/4"	5.918	Pikington N...	9674	#	Blue-Green	Glass	Neither	N/A	N/A	N/A	1.000	0.000	0.840	0.840	0.481	0.055	0.055	0.753	0.070	0.070	58.423	75.583	8.3

BLGRN6.LOF Optifast™ Blue-Green V5_NFRC_2003 IGDB version 53.0





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2007 Photograph



1951 Model



Proposed Model

2:30pm



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2007 Photograph



1951 Model



Proposed Model

6:30 pm



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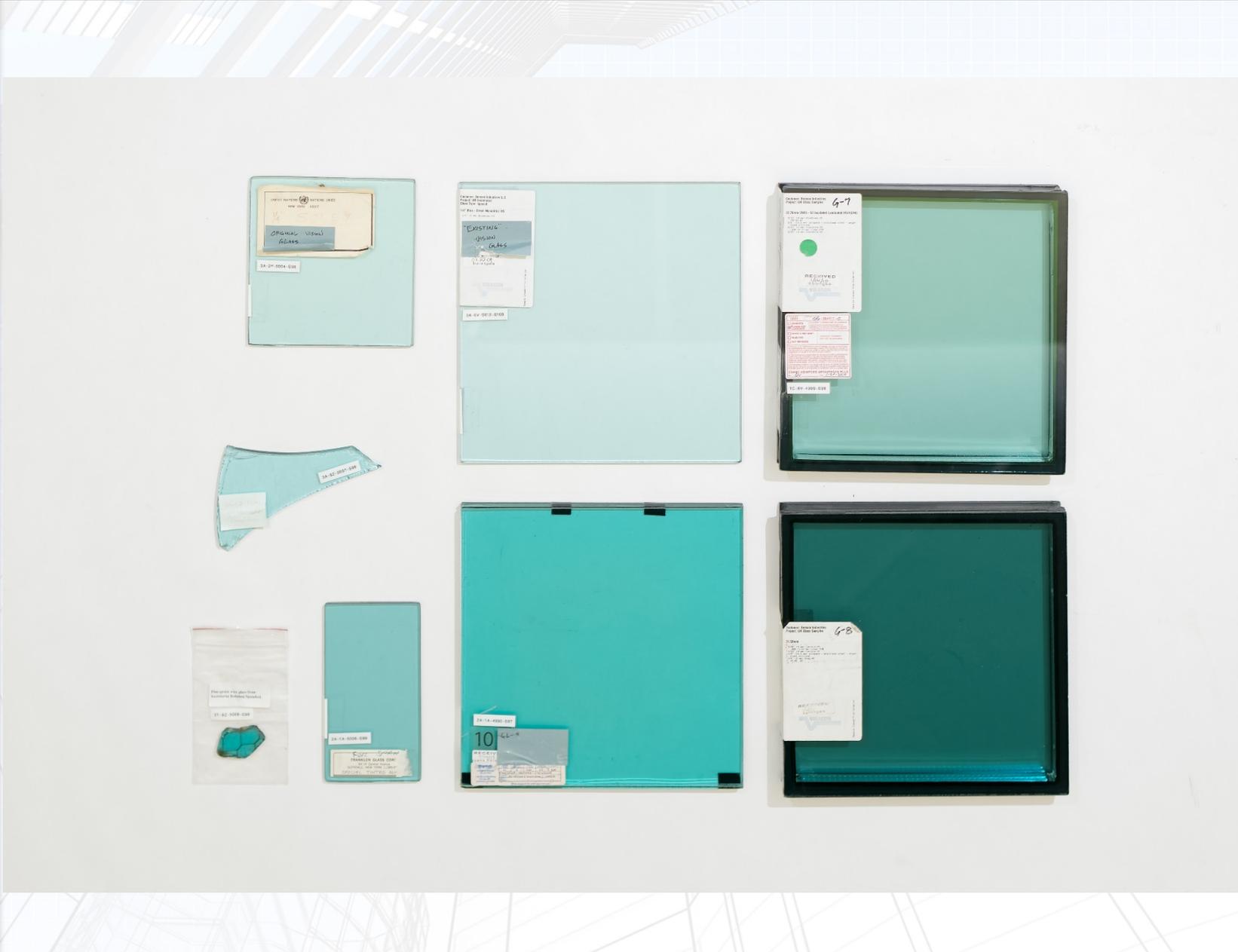




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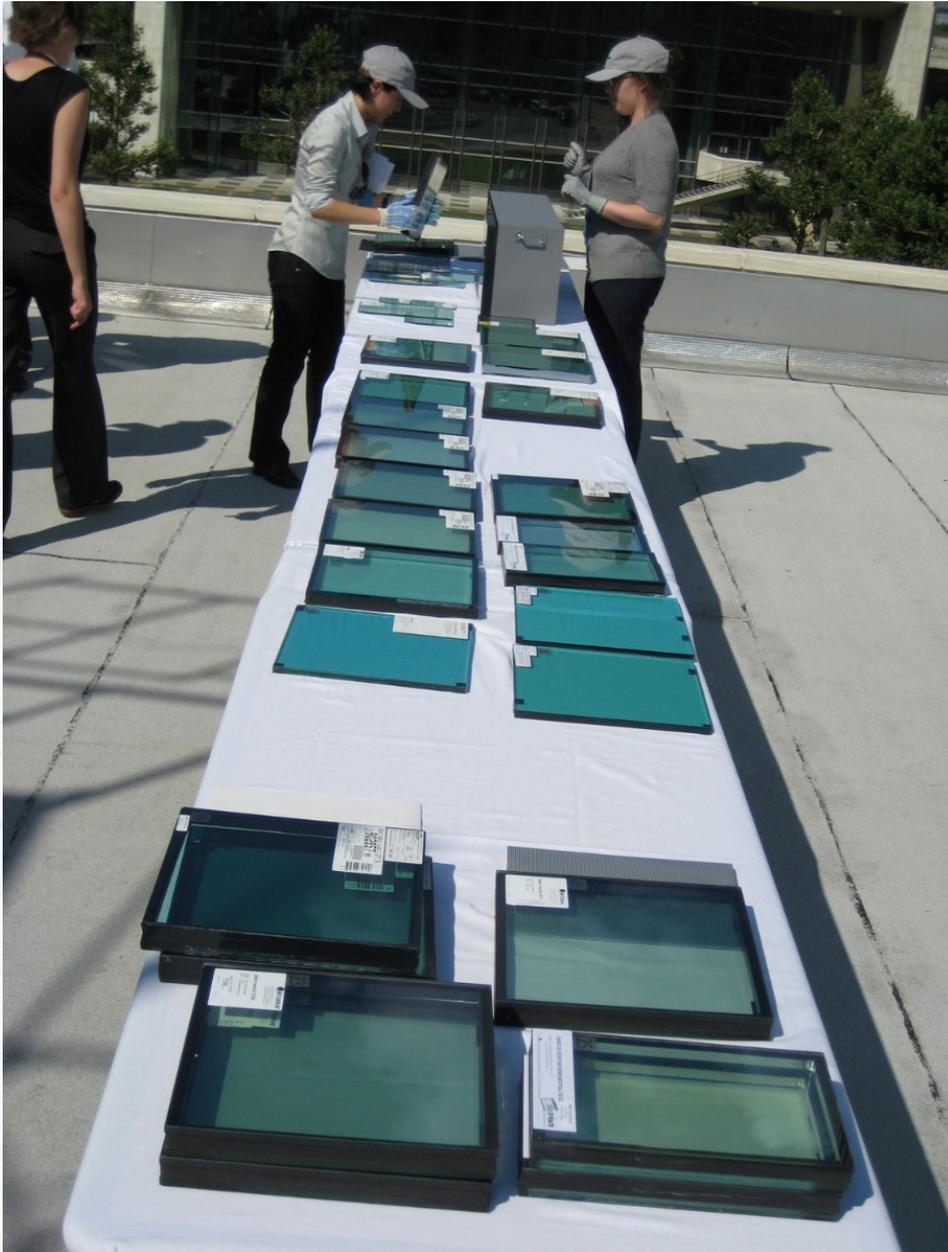




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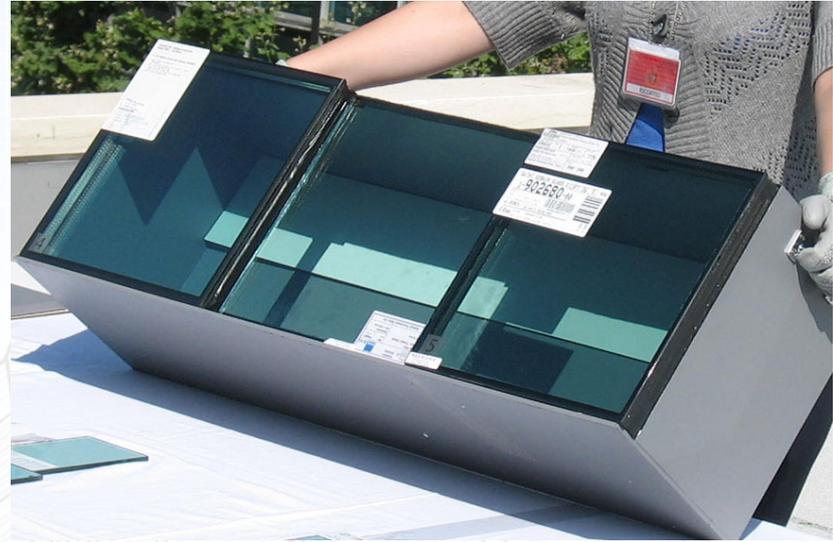




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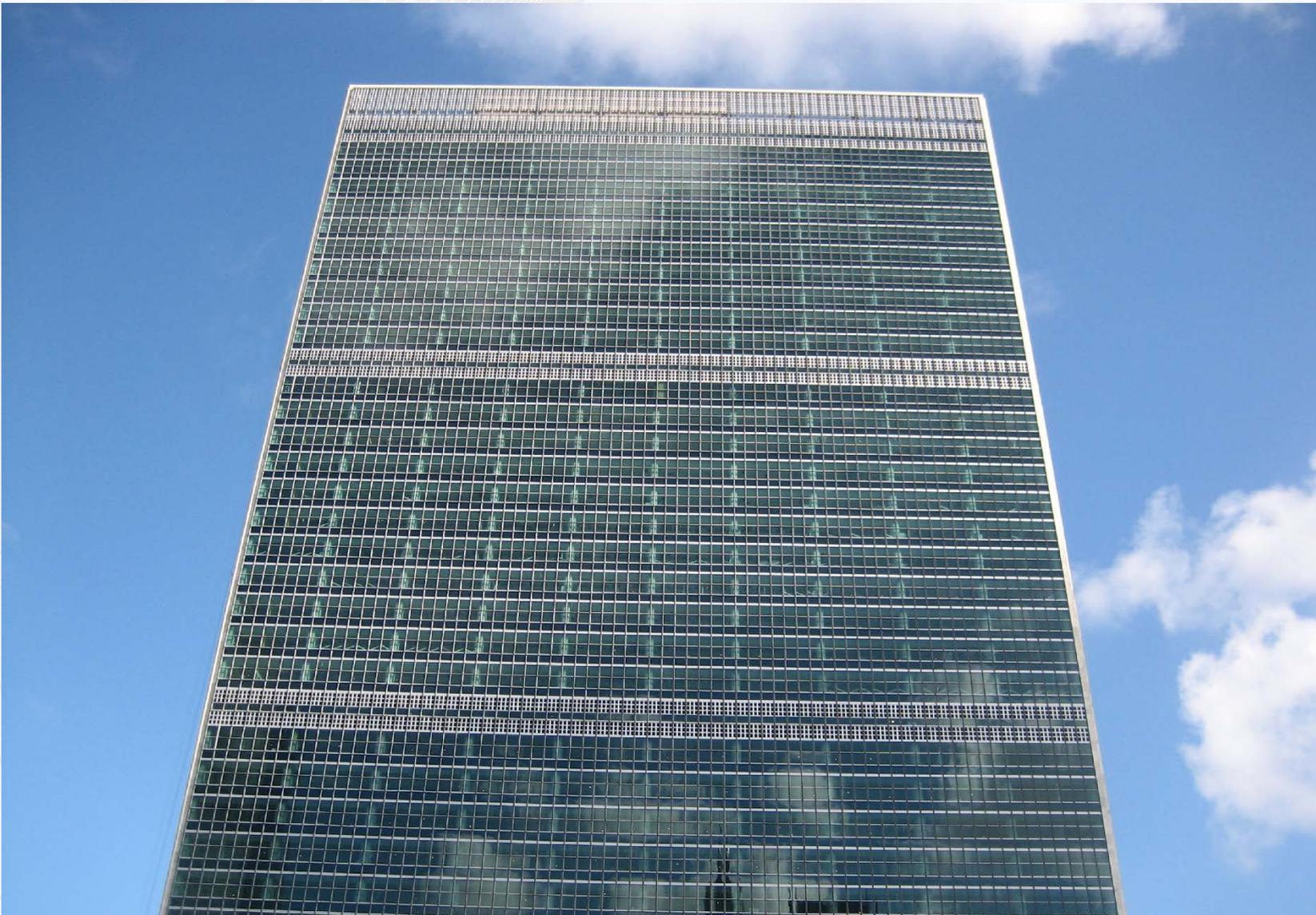




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Photograph by Whitney Boykin