

HISTORY AND PRESERVATION OF DEPRESSION ERA STRUCTURAL GLASS

FACADES

by

JONATHAN MICHAEL CASSIDAY

(Under the Direction of Mark Reinberger)

ABSTRACT

Structural glass was originally sold as a utilitarian material for use in sanitary areas. It originally was used to replace stone slabs, but soon found use in commercial architecture due to the characteristics of the material. Structural glass also gained prominence due to the Great Depression, the Art Deco style, the Modernize Main Street program sponsored by the Federal Housing Administration, and the advantageous marketing technique of the manufacturers of structural glass to take advantage of all these factors. Due to the effective marketing structural glass can be found as remodeled storefronts in many towns, small and large, across the country. Structural glass is a very durable material, meaning that many of these storefronts still exist but due to age are in need of repair. The purpose of this thesis is to determine the best methods of repair and in cases of renovation whether to keep a replacement glass façade or to return to an older one.

INDEX WORDS: Structural Glass, Vitrolux, Vitrolite, Carrara Glass, Extrudalite, Novus sanitary glass, Pittco, Pittsburgh Plate Glass, Libbey-Owens-Ford, Federal Housing Administration, Modernize Main Street, Store Façade,

HISTORY AND PRESERVATION OF DEPRESSION ERA STRUCTURAL GLASS
FACADES

by

JONATHAN MICHAEL CASSIDAY

AS Agriculture, Abraham Baldwin Agricultural College, 2009

BA Rural Studies, Abraham Baldwin Agricultural College, 2010

A Thesis Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment
of the Requirements for the Degree

MASTER OF HISTORIC PRESERVATION

ATHENS, GEORGIA

2013

© 2013

Jonathan Michael Cassidy

All Rights Reserved

HISTORY AND PRESERVATION OF DEPRESSION ERA STRUCTURAL GLASS
FACADES

by

JONATHAN MICHAEL CASSIDAY

Major Professor: Mark Reinberger

Committee: Bruce Ferguson
Doug Pardue
Scott Messer

Electronic Version Approved:

Julie Coffield
Interim Dean of the Graduate School
The University of Georgia
August 2014

DEDICATION

I would like to dedicate this thesis to my mom and dad, LoEda K. Cassidy and H. Michael Cassidy, as well as my sister, Pam Cassidy for all the encouragement and support they have given to me these many years. Whenever I doubted myself or had a problem they were there to provide encouragement and guidance. Their belief in me made this possible.

ACKNOWLEDGEMENTS

I would like to acknowledge Dr. Reinberger and Scott Messer for their assistance in researching and writing this thesis. I would like to acknowledge Tim Dunn for his time in answering questions about the renovation and repair of structural glass. And finally, I would also like to mention Dr. Robinson, Dr. Reddick, Dr. Galt-Brown, Rebecca Cofer and Brenda Doss at Abraham Baldwin Agricultural College for all their support and encouragement, and their repeated advice that I should go on to graduate school.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	v
LIST OF FIGURES	viii
CHAPTER	
INTRODUCTION	1
1 HISTORY	3
Historical Background	3
Modernize Main Street	8
2 TECHNICS	33
Material Qualities and Manufacture	33
Installation of Structural Glass as a Veneer	36
3 CASE STUDIES	40
Crump Theatre	42
Tift Theatre	45
40 Watt Club	49
Simmons Funeral Home	53
Case Study Conclusion	57
4 RENOVATION AND REPAIR	58
Common Modes of Failure	58
Repair of structural glass facades	61
Preservation of structural glass facades	62
Structural glass substitution	64

Addressing Brief 12	69
5 CONCLUSION.....	71
REFERENCES	73

LIST OF FIGURES

	Page
Figure 1: Vitrolite Color Sampler	6
Figure 2: Pittco Store Front ad.....	10
Figure 3: Pittco Store Front Ad.....	12
Figure 4: 1935 LOF ad.....	16
Figure 5: Modernize Main Street competition announcement	17
Figure 6: Examples of structural glass in storefronts.....	20
Figure 7: Pittco storefront sash illustrations	23
Figure 8: LOF Vitrolite Ad.....	24
Figure 9: Announcement of LOF Modernize Main Street Competition winners.....	27
Figure 10: Modernize Main Street Competition winner Drug Store category	28
Figure 11: Modernize Main Street Competition winner Apparel category	29
Figure 12: Modernize Main Street Competition winner Food Store category	30
Figure 13: Modernize Main Street Competition winner Service Station category.....	31
Figure 14: Physical Characteristics of Carrara Glass	35
Figure 15: Details of installation of Carrara glass facade.....	38
Figure 16: Crump Theatre.....	43
Figure 17: Tift Theatre Post Card	46
Figure 18: Tift Theatre.....	47
Figure 19: Washington St. looking East, Athens GA. postcard	50
Figure 20: 40 Watt Club today.....	50

Figure 21: 40 Watt Club detail.....	51
Figure 22: Simmons Funeral Home today	54
Figure 23: L.M. Thompson	55
Figure 24: Hemperley Undertaking Company	55
Figure 25: Brittle daub of mastic	59
Figure 26: Structural glass damage from impact or vandalism	59
Figure 27: Decision Tree	72

INTRODUCTION

Carrara Glass and Vitrolite, two of the trade names of structural glass, were often used to cover older storefronts in remodeling of buildings in downtown areas during the late 20's through the mid 40's. The Great Depression afforded an opportunity to companies such as Pittsburgh Plate Glass (PPG) and Libbey-Owens-Ford (LOF) to advertise and promote such new products, with aid from the Federal Housing Administration (FHA), as a way to recover lost business. The Art Moderne and Art Deco styles were also influential in the use of structural glass in the construction and renovation of facades as they encouraged the use of streamlined design and smooth shiny surfaces. The advent of structural glass represented a great technological improvement developed by the glass industry over time. PPG and LOF used these opportunities to sell their structural glass products as a solution to revitalizing main streets across America. These advertising campaigns were successful in the significant dispersal of structural glass facades throughout America during the 1930's and 1940's. Little research has been done on the use of structural glass in this era, and in particular, not much research has been done on the importance of the Modernizing Main Street Movement of the Great Depression, which was a major booster of the use of structural glass for store front renovations.

It is the goal of this research to develop context for determining whether to save a structural glass façade or to remove the structural glass façade and return the building to its original appearance. We have come to a point in time where many buildings with structural glass facades have two important and distinct historical identities, but we can only save one façade for the public. While many buildings were renovated using structural glass for their facades, some

buildings (mainly theatres) were built using structural glass as their façade material. In this case, since it is the original façade, in restoration there is no option but to save the structural glass façade.

Structural glass was advertised as a method of updating run-down facades during the Great Depression, resulting in some cases in the destruction of the original façade to facilitate the installation of structural glass components. While the structural glass façade is not original, it has become historically significant and in many cases is the façade that has been on the building the longest. Many factors will help to determine whether to keep the structural glass façade or to return the building to its original façade. Some of these factors are as follows.

1. Is there evidence of a previous façade on the building? In the case of many theaters structural glass was the original cladding material.
2. How much damage has the structural glass façade received? Is there enough glass remaining to be restored?
3. Has another material been placed over the structural glass façade?
4. Has the installation of structural glass over the original façade significantly damaged the original façade?

CHAPTER1- HISTORY

Historical Background

Structural glass was manufactured from about 1900 through the 1960's. First developed around 1900, opaque structural glass slabs were created as a sanitary alternative to marble slabs used for table surfaces and wainscoting.¹ These materials were highly valued for their sealed glass surfaces which were easy to maintain and naturally sanitary. They were originally manufactured to substitute for marble in situations where it was difficult to keep the porous surfaces of marble stain free. The first structural glass was produced by the Marietta Manufacturing Company of Indianapolis, Indiana and sold under the trade name of Sani-Onyx.² PPG Company started producing Carrara Glass by 1906 in two colors, black and white. The Penn-American Plate Glass Company also began producing structural glass under the trade name of Novus Sanitary Structural Glass around this same time.³ LOF purchased the Vitrolite Company of Chicago in May of 1935 so as to enter into competition with PPG's Carrara Glass.⁴ Over time eight different American companies began producing structural glass, but the two companies that led the market were PPG and LOF.

¹ Jester, Thomas. Twentieth-Century Building Materials. Washington D.C.: McGraw-Hill Companies, 1995,201.

² Jester, Thomas, 201.

³ Jester, Thomas, 201.

⁴ Esperdy, Gabrielle M. 2008. Modernizing Main Street : Architecture and Consumer Culture in the New Deal. Chicago: University of Chicago Press, 2008, 116.

Structural glass was used early on as a counter top material and as a lining in medical cabinets and early refrigerators before designers began to experiment with its use in restrooms as stall partitions and in lobbies as a replacement for more costly materials. The naturally smooth surface, along with integrated coloring throughout the material, made it easy to maintain in sanitary conditions. Other attributes of structural glass include its resistance to abrasion and warping.⁵ These qualities led to the use of structural glass in utilitarian locations during the first two decades of the twentieth century.⁶ These utilitarian areas required materials that were not only easily cleaned and non-staining but also durable. Previously, stones such as marble, granite or soapstone were used, but these materials were porous and prone to staining. The ability to produce glass in large slab-like sheets allowed for the replacement of stone in applications such as wainscoting, flooring, refrigerator linings, lavatories, tabletops and countertops, bank coupon desks and electrical switchboards.⁷ Structural glass also had another beneficial quality, the ability to diffuse light. This light-diffusing quality was put to use in corridors, operating rooms and laboratory settings.⁸

Structural glass was successfully repositioned from being a sanitary, utilitarian product to a decorative material.⁹ About the time of the Great Depression,⁹ companies that produced structural glass began to push for its use in a new realm: exterior cladding. The United States production of opaque structural glass exceeded 5 million square feet by 1929.¹⁰ LOF's 1935 catalogue for its glass products titled "Glass In Architecture" lists uses for its Vitrolite panels. These uses for Vitrolite include the following :

⁵ Jester, Thomas, 201.

⁶ Jester, Thomas, 203.

⁷ Jester, Thomas, 203.

⁸ Jester, Thomas, 203.

⁹ Esperdy, Gabrielle M. ,107.

¹⁰ Jester, Thomas, 201.

Modernization of storefronts.

Facing of exteriors of buildings.

Lobbies of hotels and office buildings.

Wainscoting and partitions for corridors.

Washrooms, shower baths and toilets in public buildings.

House walls and wainscoting for bathrooms, kitchens, breakfast rooms, as well as work tables and splash backs.

Walls, ceiling and wainscoting of laboratories, bakeries, dairies.

Hospital operating rooms, diet kitchens, laboratories, and bathrooms.

Barber shops, meat markets and other shops.

Lunch counters, bars, soda fountains, table tops in restaurants, confectionaries and taverns.¹¹

Originally the materials were available in either black (onyx) or white (Carrara), but by the 1930's the material was produced in more colors, including but not limited to blue, ocher, jade green, forest green, beige and burgundy. The material was extremely versatile and its use as a façade material was boosted by the design trends of the Art Deco era. In the Art Deco mode structural glass was primarily sold as a product for the modernization of one and two story commercial storefronts.¹² Rarely one will find a building whose original façade material was structural glass.

¹¹ Libbey-Owen-Ford, Glass In Architecture, 34.

¹² Yorke, Douglas A. Jr. "MATERIALS CONSERVATION FOR THE TWENTIETH CENTURY: THE CASE FOR STRUCTURAL GLASS." APT Bulletin 13, no. 3 (September 1981): 18-29. America: History and Life with Full Text, EBSCO host (accessed December 3, 2013)., 21.



13

Figure 1 Vitrolite Color Sampler

The manufacture of structural glass panels was similar to the production of plate glass, but in the case of structural glass other additives were included to incorporate color and opacity to the panels. The manufacturing process of Carrara Structural Glass, as explained in literature

¹³ LOF poster “52 Designs to Modernize Main Street”

distributed by PPG, was similar to the process of manufacture of polished plate glass. The surface of the glass was mechanically ground before being polished. The grinding process removed the fire finish, or crude, of the glass leaving a homogenous uniform surface. The glass then underwent a second grinding process to polish it to a fine finish.¹⁴ The panels of glass could be cut into any dimension needed and could also be etched and bent into many different forms. One example of etched structural glass is the mural in the Cloud Room of the Chrysler Building in New York. The use of structural glass as a façade for commercial structures began in the mid-1930's with programs aimed at revitalizing downtown business districts.

The Great Depression was a time of exponential growth for the use of structural glass. In 1934 when the FHA sought manufacturers of building products to aid in modernization programs, PPG agreed to promote through its advertising of its products the importance and benefits of modernizing business façades. Previous to 1934, both PPG and The Vitrolite Company had not advertised their structural glass products for exterior applications.¹⁵ A critical point in the promotion of modernizing business facades was the repositioning of Carrara Glass from its primary use as an interior finish product to its use as an exterior façade product that made modernization of outdated facades feasible.¹⁶ By 1935, when the FHAs Main Street modernization efforts had commenced, PPG began to feature what it considered outstanding store front installations of Carrara Glass in its advertising of Pitco Store Fronts.¹⁷ PPG recognized the complexity of store-front modernizations around 1934. While PPG's main product produced for store fronts was plate glass, there was also the need for metal framing and bulkhead materials (bulkhead in this text refers to the lower wall under the display windows) that

¹⁴ Pittsburgh Plate Glass Company, "Glass and Store Front Products." 28.

¹⁵ Esperdy, Gabrielle M. , 108.

¹⁶ Esperdy, Gabrielle M. , 107.

¹⁷ Esperdy, Gabrielle M. , 108.

were also required. PPG had been distributing metal frames which were manufactured by the Kawneer Company, but they realized that they were missing out on two-thirds of the products used in store-front construction.¹⁸

Modernize Main Street

Programs such as the “Modernize Main Street“ competition sponsored by *Architectural Record* in 1935 encouraged the use of structural glass as a cladding to modernize one and two-story commercial storefronts in downtown areas across the country.¹⁹ The “Modernize Main Street” competition had four categories of competition which consisted of drug stores, apparel shops, food stores, and service stations. The “Modernize Main Street” competition was sponsored by LOF and was an effective advertising campaign for the versatility and utility of structural glass products.²⁰ PPG also had a design program which integrated all design aspects of retrofitting existing facades with their products.

In 1935, the United States Bureau of Statistics reported that Main Street was made up of 482,000 food stores, 257,000 automotive garages and filling stations, 134,000 restaurants, 114,000 apparel shops, 104,000 variety stores, 59,000 household retailers, 58,000 drug stores, 55,000 lumber yards and hardware stores, 53,000 stores dealing in general merchandise, 15,000 second hand stores, and another 210,000 miscellaneous stores such as book stores, candy shops and jewelry stores, for a total of 1,541,000 individual shops and retailers.²¹ It was estimated at

¹⁸ Esperdy, Gabrielle M. , pg 109

¹⁹ Yorke, Douglas A. Jr. , pg 21

²⁰ Yorke, Douglas A. Jr. , pg 21

²¹ “Reviving Main Street,” *The Architectural Forum*, July 1935, 51

the time that between 75 and 95 percent of these buildings were in need of structural or surface improvement, and that all of these buildings were eligible under the FHA extension of building remodeling loans. This played a key part in President Roosevelt's plan for stimulating the economy, as it was determined that if an average of \$500.00 were spent per building, that it would generate between \$7,500,000,000 and \$9,000,000,000 (in the creation of construction-related jobs.²² With this information in mind, the FHA pushed further its plan for the Modernize Main Street movement, and started to advertise effective modernization plans in magazines geared toward both architectural professionals and retailers.

With the FHA pushing the idea of modernizing store fronts, a new market for complete modern store fronts was created and PPG took the lead. Starting in 1935, PPG introduced and began to manufacture extruded metal frames of its own design which could accommodate its plate glass window products and its line of Carrara Glass for bulkhead facing. This complete line of store front façade products was marketed by PPG as its Pittco line of store fronts beginning in 1935. The ads for Pittco store fronts appeared in many different forms. Ads featuring testimonials about ease of installation and durability of the material were found in retail and design magazines and would feature the personal statements of satisfied Pittco customers. Many of these ads also included testimonials from storeowners that their modernization efforts had led to increased sales and improved business. Some advertisements from PPG appeared as editorial in nature, with page layouts resembling editorial content which would engage the reader's full attention with three-column advertising format, densely worded ad copy, and headlines inspired by the FHA's modernization programs.²³

²² “Reviving Main Street,” 51.

²³ Esperdy, Gabrielle M. , 109.

WHEN THEY CALL YOU IN TO
"Modernize Main Street"
 SPECIFY **PITTCO** STORE FRONTS

PITTCO Store Front Products are all of proven quality, all unusually well fitted to assist you in doing exceptional work in store front remodeling. Satisfactory to your client . . . who will be proud of his store and will not regret his investment when he sees the improvement a Pittco Front produces. And satisfactory to you . . . because Pittco Store Front Products permit such freedom of design, are so versatile, so adaptable, so easy to utilize in planning distinctive, sales-building store fronts.

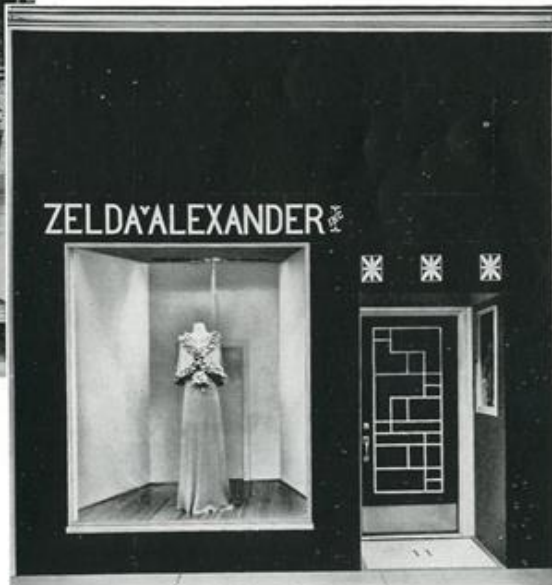
To your remodeling prospects . . . to the merchants and property owners in your community, we are recommending the retention of a local architect to help them in modernizing their store properties. When these prospects call you in to help them "Modernize Main Street" . . . tell them how Pittco Store Fronts increase business volume, rentals, property value. And then specify Pittco Store Front Products on the job.

You'll want our new booklet containing complete facts about Pittco Fronts, as well as many pictured examples of Pittco-remodeled properties, construction costs, resulting business increases, detail drawings, etc. Clip the coupon for your copy . . . now.



BEFORE: The site of the present Zella Alexander Shop in Roanoke, Va., as it looked before being modernized. The property stood vacant for two years prior to remodeling.

AFTER: And here's how Architect Douglas Orr of New Haven, Conn., and Martin Brothers, contractors of Roanoke, transformed the old property into a modern, productive one with a new Pittco Store Front, Black Carrara Glass, with sand-blasted, aluminum-painted inscription and decoration, combines with aluminum metal and a smartly designed, indirectly-lighted vestibule to make an outstanding installation.



Carrara Structural Glass

Pittco Store Front Metal

Pittsburgh Mirrors

PITTCO
 STORE FRONTS
glass...metal...paint
 PRODUCTS OF
PITTSBURGH
 PLATE GLASS COMPANY

Pittsburgh Paint Products

Polished Plate Glass

Tapestry Glass

Pittsburgh Plate Glass Company,
 225A Grant Building, Pittsburgh, Pa.

Please send me, without obligation, your new book entitled "How Modern Store Fronts Work Profit. Magic".

Name _____

Street _____

City _____ State _____

OCTOBER • 1935

69

Figure 2 Pittco Store Front ad

²⁴ PPG ad, Architectural Forum, October 1935, 69.

These ads used nearly every sales pitch of the FHA to help convince merchants that Pittco store-front products could transform outmoded stores into new and attractive properties.²⁵ As can be seen in Figures 2 and 3, PPG advertising for Pittco storefronts often utilized pictures of before and after conversions. These images illustrated how a “boring” and rundown store front could be transformed into a sleek and modern storefront, with contact information on how to obtain more information on Pittco products. Advertisements for PPGs Pittco Store Fronts were aimed at both architects and merchants. PPG initiated customer service programs aimed at making it easier for merchants to purchase a complete storefront to fit their needs, with the ability to pay over time with the Pittsburgh Time Payment Plan which was introduced in 1936.²⁶ The goal of PPG was to make the purchase of a complete new storefront by a merchant or building owner as easy as the purchase of a car or refrigerator. The National Emergency Council, a committee created by executive order in 1933 by Franklin Roosevelt, drafted The Modernization Credit Plan in 1934.²⁷ This proposal was drafted into Title I of the National Housing Act and was similar to several pre-Roosevelt property improvement finance schemes that encouraged the modernization of privately funded buildings to economically stimulate the local economy.²⁸ It was the Modernization Credit Plan that made possible the easy financing of store front renovations that included the installation of Structural Glass.

²⁵ Esperdy, Gabrielle M. , 111.

²⁶ Esperdy, Gabrielle M. , 111.

²⁷ Esperdy, Gabrielle M. , 54-55.

²⁸ Esperdy, Gabrielle M. , 55.



AFTER:
 Here is how Architect Karl H. Snyder and Contractor E. S. Yeager utilized Pittco Store Front Products to carry out a modern store front idea in Bethlehem, Pa.

BEFORE:
 And this is the way the store property looked before it was transformed with a new Pittco Store Front.



PITTCO STORE FRONT PRODUCTS

offer new possibilities in store front design

THIS complete line of store front products . . . glass, paint and metal . . . is especially designed to help you carry out, exactly, your ideas for distinctive, original store fronts. Pittco Products are all of high quality, all extremely versatile, giving you a new freedom in design.

Also, in furthering the "Modernize Main Street" movement, we are helping you to get

store remodeling jobs in your community. In our extensive advertising to your prospective clients, we recommend that they retain a local architect to design their store fronts for them. When these prospects call you in, show them how Pittco Store Fronts can improve their business, increase revenue for property-owners, add to property value. And then, to assure them a satisfactory, quality installation, specify Pittco Store Front Products.

We invite you to send the coupon below for our interesting booklet on Pittco Store Fronts. It contains complete information, price data, and many pictures of Pittco installations.

Carrara Structural Glass
Pittco Store Front Metal
Pittsburgh Mirrors

PITTCO
 STORE FRONTS
glass...metal...paint
 PRODUCTS OF
PITTSBURGH
 PLATE GLASS COMPANY

Pittsburgh Paint Products
Polished Plate Glass
Tapestry Glass

Pittsburgh Plate Glass Company,
 2298A Grant Building,
 Pittsburgh, Pa.

Please send me, without obligation, your new book entitled "How Modern Store Fronts Work Profit Magic."

Name _____
 Street _____
 City _____ State _____

Figure 3 Pittco Store Front Ad

²⁹ PPG ad, Architectural Forum, December 1935, 59.

With the backing and encouragement of the FHA, PPG began to merchandise building materials the same way as consumer goods. To make sure that local architects were not left out of the local market for the modernization of store fronts on Main Street, PPG included a provision in its Pittsburgh Plan for an architect's fee and encouraged local architects that the storefront design should not come from the manufacturer of the glass products but from the architect's own design abilities.³⁰ PPG also maintained a "special staff of store front experts" for merchants who chose not to use an architect. This staff of experts was available for field consultations and was associated with PPG's nationwide distribution system to assist individual merchants with the creation of a single store front or corporate retailers who sought matching store fronts for a chain of stores.³¹

PPG introduced *How Modern Store Fronts Work Profit Magic, a helpful handbook of storefront facts* in the fall of 1934.³² This sales literature included product information, price lists, statistics related to how businesses increased their business after PPG store front improvements as well as before and after photographs to show potential clients how they could improve their stores.³³ This sales literature was given to both individual business and shop owners as well as architects. PPG began a *Design of the Month* series in 1936. The *Design of the Month* series was a direct mailing to architects to keep PPG Carrara Glass store fronts and Pittco store front systems in mind in hopes that the repetition would lead to the specification of Pittco products.³⁴ These direct mailings to architects offered style suggestions and advice on construction along with plans and sketches of new store front designs.³⁵ These designs, while

³⁰ Esperdy, Gabrielle M. , 111.

³¹ Esperdy, Gabrielle M. , 111-112.

³² Esperdy, Gabrielle M. , 112.

³³ Esperdy, Gabrielle M. , 112.

³⁴ Esperdy, Gabrielle M. , 112.

³⁵ Esperdy, Gabrielle M. , 112.

credited by PPG to a team of Pittco store front designers, were actually designed and prepared by Walter Dorwin Teague who was on retainer with PPG as a design and research consultant in 1935.³⁶

Walter Dorwin Teague was a prominent industrial designer, architect, graphic designer writer, and entrepreneur who was referred to as the “Dean of Industrial Design.” He helped to establish industrial design as a profession and was recognized as playing a key role in the spread of mid-century modernism across the United States. Teague was an early adopter of the use of structural glass, and as an employee of PPG, had the opportunity to explore the full opportunities that structural glass gave to the architect in the design of modern storefronts. Walter Teague’s architectural firm had completed three-dozen designs by 1936 for a variety of different commercial establishments of typical main streets across the nation, a list which included drugstores, bakeries, “five and dime stores”, shoe stores, grocery stores, and cocktail lounges.³⁷ Out of the three-dozen designs, twelve were selected for use in the monthly direct mailings, while others appeared in PPG literature and advertisements in magazines typifying the “modern store front.”³⁸

In September of 1936, PPG launched the Store Front Caravan, which exhibited scale model examples of Walter Teague’s façade designs. The tour began in New York City and was scheduled to go on a 50,000 mile tour for two years, visiting major towns and cities east of the Rocky Mountains.³⁹ This tour was aimed at encouraging retailers and building owners to modernize their store fronts, with the plans but not the specifications of the designs available at the request of those who were interested. Making only the plans available to the interested shop

³⁶ Esperdy, Gabrielle M. , 112.

³⁷ Esperdy, Gabrielle M. , 112.

³⁸ Esperdy, Gabrielle M. , 113.

³⁹ Esperdy, Gabrielle M. , 113.

and building owners allowed PPG to avoid conflict with local architects, with PPG making fully clear that the aim of the tour was not to supplant the services of local architects but to support the services and cooperate with local architects.⁴⁰ For the “Store Front Caravan,” Walter Teague and his staff fabricated scale models of their store front designs using Pittco metal, polished plate and Carrara Glass to illustrate the possibilities of designing with structural glass. The models were built at one-seventh scale and were complete with fully detailed interiors stocked with miniature merchandise, very much like the samples that traveling salesmen carried with them.⁴¹

PPG promoted the “Store Front Caravan” and the models built from the designs of Walter Teague as being the latest development in storefront design, color, lighting, and construction. Each model displayed the four essential elements of store-front design- entrance, bulkhead (the lower wall under the display windows), window and signboard. The layout of each design was tailored to suit certain retail needs and could be adapted to a variety of uses through alterations to window size, color scheme or typeface.⁴² Most of these designs had flat facades with off-center entrances that were flush with the façade, while still others had recessed entryways with curving bulkheads, two-sided display cases, or a shadowbox signboard.⁴³ The overall goal of the storefront models was to demonstrate how the use of Pittco products could be tailored to any retail establishment and be used in a variety of architectural effects to modernize the local Main Street. The “Store Front Caravan” promotion was considered a huge success for PPG and gained favorable press and photographs in numerous publications, within both the building and retail

⁴⁰ Esperdy, Gabrielle M. , 113.

⁴¹ Esperdy, Gabrielle M. , 113.

⁴² Esperdy, Gabrielle M. , 113.

⁴³ Esperdy, Gabrielle M. , 113.

G L A S S

DOMINATES DESIGNS FOR MODERNIZATION

Premiated drawings in Modernize Main Street Competition suggest the effective use of Libbey-Owens-Ford Polished Plate, both plain and colored, Vitrolite, Tuf-Flex and Blue Ridge Figured and Wire Glass.

● The architectural profession generally acclaims the Modernize Main Street Competition recently sponsored by Libbey-Owens-Ford one of the most interesting and helpful efforts of its kind in many years.

To make the results even more far-reaching, the 52 prize-winning designs have been published in book form and are now being distributed to logical prospects for modernizing. This should result in even more business for architects, for, while floor plans, specifications and other pertinent data are included,



there are no working drawings and each store operator or real estate owner is urged to retain an architect in working out his individual problem.

A generous use of glass dominated practically all designs submitted by the 3,000 and more architects and designers who entered the competition. Since there is a Libbey-Owens-Ford product for almost every purpose where flat glass can be employed, architects specifying it are assured of one undeviating standard of higher quality throughout. The L·O·F label on every light guarantees your client's satisfaction, as well as your own. Look for it. It is advisable to instruct contractors and builders to leave the labels on until final inspection has been made.

LIBBEY · OWENS · FORD GLASS COMPANY . . . TOLEDO, OHIO.

LIBBEY · OWENS · FORD
Quality Glass

Figure 4 1935 LOF ad

⁴⁴ LOF ad, Architectural Forum, December 1935, 50.



LEST YOU FORGET



"MODERNIZE
 MAIN STREET"
 Competition
 ★
 Sponsored by
**LIBBEY • OWENS • FORD
 GLASS COMPANY**
\$11,000 in Cash Prizes
52 PRIZES—\$11,000 TOTAL
 4 FIRST PRIZES—(one in each classification)—\$1,000 each—\$4,000
 4 SECOND PRIZES—(one in each classification)—\$750 each—\$3,000
 4 THIRD PRIZES—(one in each classification)—\$500 each—\$2,000
 In addition, there will be 40 Honorable Mentions of \$50 each. These will be awarded for meritorious designs, the number of awards in each class depending on the number of worthy designs in each class as determined by the Jury.



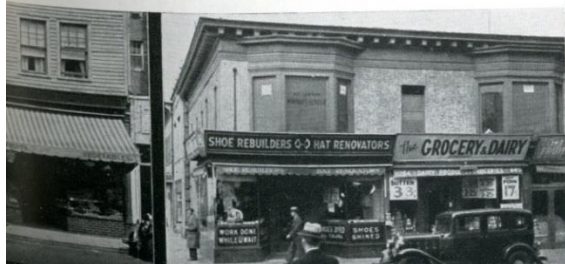
● On June 15, the Program for the "Modernize Main Street" Competition was distributed to architects throughout the country. This Competition, sponsored by the Libbey-Owens-Ford Glass Company and conducted by the Architectural Record, with Kenneth K. Stowell, A. I. A., as Professional Advisor, is in reality four simultaneous competitions, each calling for the modernization of a particular type of shop or store—(1) A Food Store; (2) A Drug Store; (3) An

Apparel Shop; (4) An Automotive Sales and Service Station. A photograph of each shop to be modernized, together with all necessary data, is published in the Program. If you have

(Competition closes 5 P. M. August 12, 1935)

misaid your copy of the Program or if, for any reason, you failed to receive one, the entry blank below will bring you the Program, the printed title to be pasted on each design and all necessary data and instructions. The competition closes August 12; the Jury meets August 26, 1935.

USE THIS ENTRY BLANK



KENNETH K. STOWELL, A. I. A., Professional Advisor,
 "Modernize Main Street" Competition
 The Architectural Record, 119 West 40th Street, New York, N. Y.
 Gentlemen: I desire to enter the "Modernize Main Street" Competition sponsored by the Libbey-Owens-Ford Glass Company. Please send me the Program of the Competition, the title-paster and all necessary data and information.

Name _____
 Profession or occupation _____
 Street _____
 City _____ State _____

45

Figure 5 Modernize Main Street competition announcement

⁴⁵ LOF ad, Architectural Forum, July 1935, 41.

industries. The FHA also featured the “Store Front Caravan” in its *Clip Sheet* in January of 1937, emphasizing that it had been a promotion that had been planned in conjunction with the Modernize Main Street Campaign.⁴⁶

Libbey-Owens-Ford was formed through the merger of Libbey-Owens Sheet Glass and Edward Ford Plate Glass in 1930.⁴⁷ Despite being a relatively young company, it was the second largest manufacture of glass in the United States, although it did not fare well in the early years of the Great Depression, with profits declining every year after the crash and hitting bottom in 1934.⁴⁸ During this time, LOF had been cooperating with the FHA, as had PPG, which in 1934 had seen a 44% increase in profits while LOF had seen only a negligible increase in profits during the same time. LOF's participation with the FHA had mainly been through internal promotion, while PPG had been doing outside promotions thus boosting its profits.⁴⁹ LOF had noted that PPG's tie's to the FHA in its Modernize Main Street campaign was most likely the source of its boost in sales and decided to utilize the same methods. Figure 4 is an LOF ad from 1935 touting the use of glass in modern store front architecture and Figure 5 is LOF's announcement of the Modernize Main Street competition it was sponsoring in conjunction with the FHA. The competition from PPG motivated LOF to establish a new-uses department in March of 1935, with the intention to tie in with the FHA's work to increase building and storefront modernization.⁵⁰ Also in the spring of 1935, LOF bought the cash-strapped Vitrolite Company of Chicago, effectively establishing itself in the business of structural glass facades.⁵¹ Figure 6 is an illustration from the LOF catalogue illustrating the use of Vitrolite in architectural

⁴⁶ Esperdy, Gabrielle M. , 115

⁴⁷ Esperdy, Gabrielle M. , 116.

⁴⁸ Esperdy, Gabrielle M. , 117.

⁴⁹ Esperdy, Gabrielle M. , 117.

⁵⁰ Esperdy, Gabrielle M., 117.

⁵¹ Esperdy, Gabrielle M. , 117.

designs of typical downtown store fronts, including movie theatres, automobile service stations, and typical small store fronts and five and dime stores. These illustrations demonstrate the influence of the Art Deco movement in store design and show the architect or shop owner the ability to use Vitrolite in ways to update outmoded store fronts or how to use Vitrolite in new construction.

The “Modernize Main Street” competition sponsored by LOF in 1935 coincided with the \$50,000(\$869,585.82 in 2014) expansion of government-insured modernization credit, greatly expanding the use of Vitrolite in modernization of store fronts.⁵² Even though PPG had used the FHA slogan of “Modernize Main Street” in its advertisements prior to the entry of LOF into the structural glass market, LOF co-opted the slogan for their competition. This push for modernization of downtown areas engrained structural glass as a common architectural product by the end of the 1930’s. LOF was able to gain an official endorsement from the FHA agency head, Stewart McDonald, who wrote of Libby-Owens-Ford’s “Modernize Main Street Competition:”

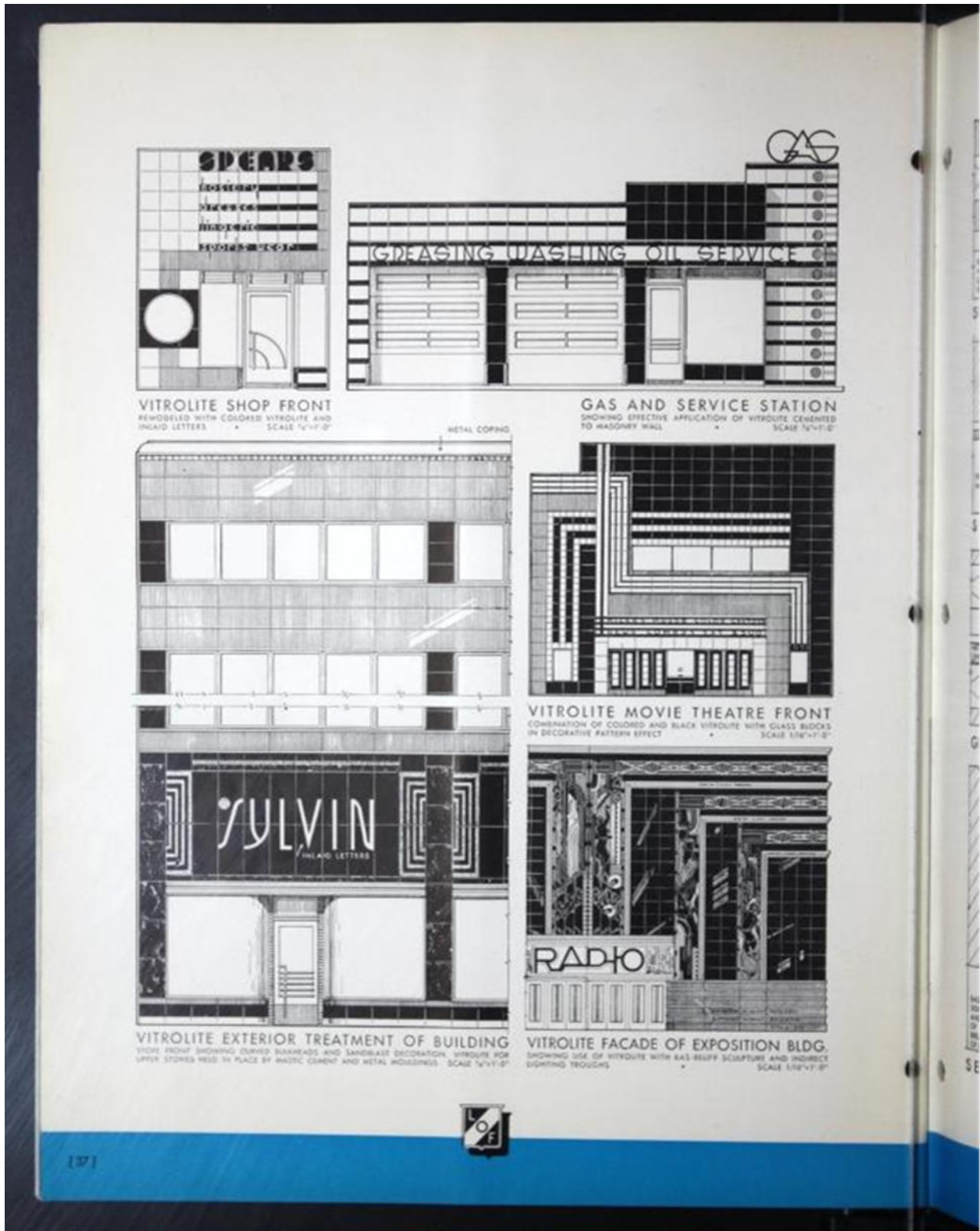
Your new “Modernize Main Street” Architectural Competition is the most constructive and timely development in the growing interest in modernization and reviving construction. Your plan will stimulate the interest of many architects and builders and will encourage the specific action of business property owners throughout the country.⁵³

McDonalds letter appeared alongside the competition brief that was published in *Architectural Record*, which conducted the competition for LOF under the direction and guidance of Kenneth K. Stowell, AIA.⁵⁴ In its advertisements for the Modernize Main Street competition, LOF strived

⁵² Esperdy, Gabrielle M. , 118.

⁵³ Esperdy, Gabrielle M. , 118.

⁵⁴ Esperdy, Gabrielle M. , 119.



⁵⁵Figure 6 Examples of uses of structural glass in storefronts

⁵⁵ LOF "Glass In Architecture" catalog, 37.

to establish that they were not only trying to sell said glass products but also working to encourage national recovery. In respect to the four categories, LOF's ad stated:

The Main Street of every city, town, village, and community has at least these four business establishments (drug stores, apparel shop, food store, automotive service station). Better merchandising demands the modernization of thousands of them and better financing makes it possible.⁵⁶

The advertisements for the Modernize Main Street Competition never explicitly stated the use of Vitrolite in the ad copy, as LOF wanted the competition to appear as a corporate contribution to the national recovery rather than a public relations promotion.⁵⁷ The Modernize Main Street competition would award \$11,000 (\$191,308.88 in 2014) in cash awards, with four first place awards of \$1000(\$17,391.71 in 2014) each for the best modernization of the interior and exterior of a drugstore, apparel shop, food store, and automotive service station.⁵⁸

By 1936, the LOF New Uses Department had been renamed the Architectural Services Department and began traveling around the country advising merchants and architects on the uses of Vitrolite in modernization.⁵⁹ This team of agents provided technical data and sales information to architects as well as design ideas through visual demonstration. Around this same time, LOF introduced additional colors which included veined agates in gold, orchid, jade, emerald, royal blue, and walnut (See figure 8 for an ad from LOF illustrating a storefront utilizing its unique colors). The offering of Vitrolite in agates distinguished LOF from PPGs Carrara glass which in 1936 was available in only five standard colors and 4 trim colors.⁶⁰

⁵⁶ Esperdy, Gabrielle M. , 119.

⁵⁷ Esperdy, Gabrielle M. , 119.

⁵⁸ Esperdy, Gabrielle M. , 119.

⁵⁹ Esperdy, Gabrielle M. , 128.

⁶⁰ Esperdy, Gabrielle M. , 128-129.

Besides the new colors of Vitrolite, LOF also offered more finish options which included high polish (which was the standard structural glass finish), chipped, mirrored, and matte finishes generally referred to as suede.⁶¹ It was not until 1939 that PPG would offer Carrara in a matte suede finish.

Also in the spring of 1936, LOF established a glass-bending department, partially due to its publication, *52 Designs to Modernize Main Street*, which featured store-front designs utilizing curved Vitrolite bulkheads and plate glass windows. This department was in operation by summer, and a year later the company installed two additional bending furnaces due to the increased demand for curved glass panels.⁶²

In 1937, LOF took the lead in sales of structural glass from PPG, since Vitrolite and Vitrolux had such a well-established name prior to its purchase by LOF. However, even though it had the lead in the sales of structural glass, PPG was still the leader in the sales of metal sash components since it had established its Pittco line two years earlier.⁶³ The profiles and installation details of the Pittco sash system are illustrated in figure 7. This led LOF to develop its own line of metal trim to tie its store front packages together. LOF had designers ,Dean Lowery and Robert Pinney, develop an extruded-metal sash for their own line, which was released in spring of 1937.⁶⁴ LOF patented a pressure-controlled, shock-absorbing extruded aluminum sash under the trade name, Extrudalite, and claimed that their new Extrudalite sash systems were revolutionary for both their mounting mechanism and the profiles, which were representative of the streamlining of traditional molding profiles.

⁶¹ Esperdy, Gabrielle M. , 129.

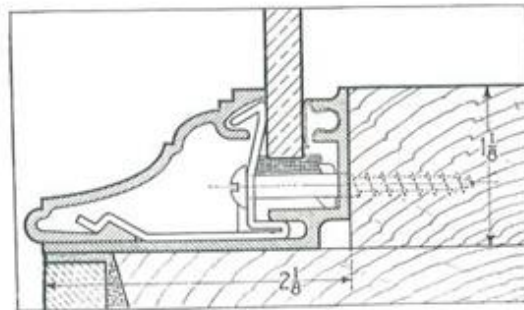
⁶² Esperdy, Gabrielle M. , 129.

⁶³ Esperdy, Gabrielle M. , 133.

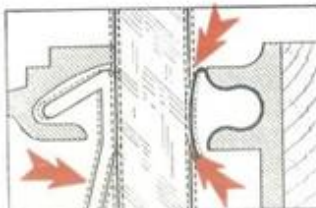
⁶⁴ Esperdy, Gabrielle M. , 133.

EIGHT

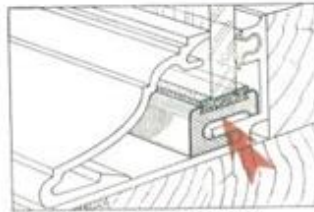
DISTINCTIVE FEATURES OF PITTCO STORE FRONT SASH



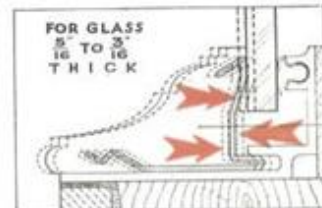
Full size cross-section



1. CUSHION GRIP ON GLASS
The metal surfaces which contact the sides of glass act as a yielding cushion, absorbing dangerous shocks and jars.



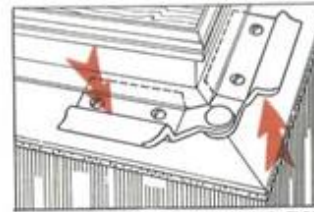
2. FIXED SUPPORTING BLOCK
Non-ferrous metal supporting blocks are heavily wedged in groove, thus preventing tipping, rocking or sliding out of line during setting of glass.



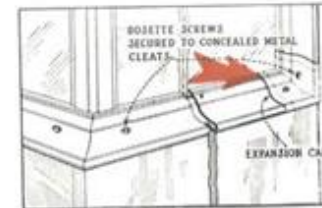
3. ADJUSTABLE TO VARIOUS GLASS THICKNESSES
Glass-holding units and face members are self-adjusting to various glass thicknesses without tilting inward or outward.



4. INSTALLATION OPERATIONS ALL FROM OUTSIDE
Both glass and sash are set from outside by standard wood or machine screws. No special keys or tools required.



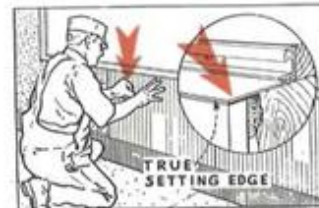
5. CORNER CLEAT TO ASSURE TIGHT MITRE
Heavy Metal Cleats are used at the corners to secure mitres against spreading due to expansion or contraction.



6. EXPANSION IS CONTROLLED
Expansion in long lengths of aluminum is controlled by combining expansion cap, cleats and rosette screws. See also 5.



7. PROTECTION FOR CARRARA
A sturdy, square-cut, continuous metal flange projects over edge of Carrara, shielding the area which is most vulnerable.



8. TRUE SETTING EDGE
The outer edge of inner member serves as a true, unvarying line to which face of Carrara or similar materials are set.

PITTCO
STORE FRONT METAL

STANDARD PITTCO SHAPES

There is a Pittco shape for practically every architectural or decorative need which might arise in connection with store front work. The warehouses of the Pittsburgh Plate

Glass Company carry complete stocks of many of these mouldings for prompt shipment, no matter where your job may be located. See back cover for list of branches and map.

Pittco PITTSBURGH *Glass*
PLATE GLASS COMPANY

Figure 7 Pittco storefront sash illustrations

⁶⁵ PPG "Glass and Store Front Products" catalog, 4.

HARMONY

Beautiful and Modernize for Permanence with VITROLITE

LIFETIME beauty, today and always—modern, brilliant, colorful—that's what Vitrolite brings to new or remodeled structures.

Sixteen beautiful colors—ten rich, solid hues, six handsome agate shades, an endless variety of sandblast, inlay-decorated, and color-decorated effects—give unlimited opportunity for development of color schemes.

The gleaming, flint-like surface of Vitrolite is ever new—impervious to water, acids, oil or grease. It will not stain. It will not check, craze, or grow dull with age. It is always bright, cheerful, clean, and sanitary. A damp cloth is the only facial treatment Vitrolite ever requires.

Vitrolite pays its own way by immediately increasing property value, by increasing ready salability or rentability of property, by attracting and increasing flow of traffic in retail establishments, by its no-upkeep cost, and by its ease and economy of installation. (Applied directly over present walls, without fuss, muss, or cost of tearing out plaster.)

Your Vitrolite Distributor has a special display easel on which he will gladly set up actual arrangements in Vitrolite to illustrate designs and color possibilities.

Vitrolite Division
LIBBEY • OWENS • FORD GLASS COMPANY

VITROLITE
A LIBBEY • OWENS • FORD PRODUCT

The Colorful
Structural Glass

Tear out and mail

Vitrolite Division, Libbey-Owens-Ford Glass Co.
208 W. Washington St., Chicago (H-12)

Please send New Vitrolite Color Chart of 16 colors—10 solid hues, 6 agate shades, and various surface effects—together with:

- Vitrolite Construction Details (Interior)
- Vitrolite Store Fronts (Colored Views)
- Vitrolite Store Fronts and Building Exteriors (Construction Details)
- Vitrolite Bathrooms and Kitchens

Name _____

66

Figure 8 LOF Vitrolite ad

⁶⁶ LOF ad, Architectural Forum, October 1935, 33

The new streamlined profiles of Extrudalite were so stylistically and significantly unique that it prompted PPG to redesign the profiles of its sash profiles in 1938.⁶⁷ LOF offered its Extrudalite sash systems in three different sizes and three different price ranges, which were designed to fit any budget and increased the competition between the two companies. LOF had taken a page from PPG's marketing of Pittco complete store-front systems to create its own line of complete store front products, however, a steep economic decline in August of 1937, combined with the expiration of the Modernization Credit Plan and Title I of the National Housing Act, caused the company to experience a substantial decline in sales. LOF's entry into the marketing of extruded metal sash systems to compete with PPG's Pittco store-front systems demonstrated how competitive the glass industry became during the Great Depression.⁶⁸

LOF's "Complete Storefront" packages featured Vitrolite, Vitrolux, and Extrudalite.⁶⁹ According to the company, these products, complete with coordinating names, were brought together "in ensemble" as a line of products that were "pacing the vogue of modern merchandising."⁷⁰ The combination of PPG's products of "Carrara Structural Glass" and "Pittco Store Front Metal" was sold as a packaged product and the company promoted its "Pittco Store Front" line as the "first complete line ever to be designed deliberately, all at one time, with a pleasing harmony and relationship of appearance, a real *unity* of design."⁷¹ Prior to the Modernize Main Street movement, LOF and PPG marketed their storefront products

⁶⁷ Esperdy, Gabrielle M. , 133.

⁶⁸ Esperdy, Gabrielle M. , 133.

⁶⁹ Esperdy, Gabrielle M. , 179.

⁷⁰ Esperdy, Gabrielle M. , 179.

⁷¹ Esperdy, Gabrielle M. , 179.

individually. By the mid 1930's, structural glass manufactures began to sell their store front products as packaged ensembles for the modernization of outdated buildings.⁷²

As illustrated in figures 9 through 13, the winners of the “Modernize Main Street” contest sponsored by LOF, the winning facades in the four categories demonstrate integral lighting designs with the glass facades to add a modern flair to the architecture. In some cases, the glass letters are backlit, while others use hidden lighting in soffits to increase night presence of the store. The winning facades also made use of recessed entryways and, depending upon store type, included large display windows. In the case of the apparel store (figure 11), the display windows are curved into the entry way leading the customer into the store, a good demonstration of the streamlined designs of Art Deco architecture and what could be done with glass panels. Figure 10 demonstrates the winning plan for the Drug Store category of the Modernize Main Street competition. This design incorporates lighting into the store front design and incorporates Vitrolite in both interior and exterior applications. This design also reconfigures the shop window to make it more effective in marketing the goods sold by the drug store. Figure 11 is the winner for the Apparel Store category of the Modernize Main Street competition. This illustration also displays the way that Vitrolite is incorporated into both interior and exterior applications and features integrated lighting and redesigned store front windows. Figure 12 is an illustration of the winner of the Food Store category of the Modernize Main Street competition. It illustrates again interior and exterior applications of Vitrolite, as well as the way that signage can be incorporated into the design of the store front. Figure 13 is the winner for the Service Station category of the competition and mainly illustrates the use of integrated windows with a Vitrolite façade.

⁷² Esperdy, Gabrielle M. , 179

ANNOUNCEMENT

of winners

"MODERNIZE MAIN STREET"

Competition



● On August 26, there met at Lake Champlain a Jury of Award composed of the following seven men representative of leading contemporary thought in architecture, design and merchandising: Professor Melvin Thomas Copeland, Harvard University; J. Andre Foulhoux, New York City; Albert Kahn, Detroit; William Lescaze, New York City; John W. Root, Chicago; F. R. Walker, Cleveland and Kenneth C. Welch, Grand Rapids, Michigan.

After a two day session in which were considered hundreds of designs submitted by the more than 3,000 entrants in the Competition, the following awards were made:

FIRST PRIZES

- To M. Righton Swicegood, New York City, \$1,000 for the best design for modernizing a drug store.
- To Suren Pilafian and Maurice Lubin, New York City, \$1,000 for the best design for modernizing an apparel shop.
- To G. Foster Harrell, Junior, New York City, \$1,000 for the best design for modernizing a food store.
- To Alfred Clauss, Knoxville, Tennessee, \$1,000 for the best design for modernizing an automotive sales and service station.

SECOND AND THIRD PRIZES

- To G. Foster Harrell, Junior, New York City, \$750 and to Nicholas B. Vassiliev, New York City, \$500, for the second and third best designs, respectively, for modernizing a drug store.
- To Lester Cohn, Chicago, \$750, and to Raoul L. Dubrul and Harry J. Trivisonne, New York City, \$500, for the same awards for modernizing an apparel shop.
- To A. Waldorf and S. T. Katz, Brooklyn, \$750, and to J. R. Sproule, Seattle, Washington, \$500, for the same awards for modernizing a food store.
- To Suren Pilafian and Maurice Lubin, New York City, \$750, and to Isadore Shank, St. Louis, Missouri, \$500, for the same awards for modernizing an automotive sales and service station.

HONORABLE MENTIONS

each award including a cash prize of \$50

- For Drug Store designs: Harry Lon Ross, Philadelphia, Pennsylvania; Michael Auer, New York City; Isadore Shank, St. Louis, Missouri; Morrison Broun, New York City; Montgomery Ferar, Detroit, Michigan; Melvin L. Wolfson, Oak Park, Illinois; Verner Walter Johnson, New York City and Phil Birnbaum, Far Rockaway, New York; Robert F. McClelland and Victor N. Jones, Seattle, Washington; William Tuntke, Hollywood, California.
- For Apparel Shop designs: J. R. Sproule, Seattle, Washington; Irwin A. Sugarman, Chicago, Illinois; Anthony S. Ciresi, Cleveland, Ohio; Herbert L. Rodde, Chicago, Illinois; Lewis Eugene Wilson, Edwin Ellison Merrill and Robert Evans Alexander, Los Angeles, California; Joseph M. Hirshman, New York City; Orlo Heller, New York City; John Hironimus, New York City; Max Feldman, Ralph E. Lef and Harry Gottesman, New York City; J. Gordon Carr, Brooklyn, New York; George E. Recher, Chicago, Illinois; Donald M. Douglass, Georgetown, Connecticut.
- For Food Store designs: Sigismund J. Von Rosen, New York City; Nowland Van Powell, St. Louis, Missouri; Maurice Lubin and Suren Pilafian, New York City; Royal Barry Wills and Hugh A. Stubbins, Boston, Massachusetts; Charles DuBose, New York City; Maitland C. Harper, Woodside, Long Island, New York; J. Gordon Carr, Brooklyn, New York; H. K. Brig, Chicago, Illinois; Edward Hedberg, Homewood, Illinois; Carl Maas, New York City; Theo. B. Voyvodick and Jos. J. Pankuch, New York City.
- For Automotive Sales and Service designs: Thomas D. Taro, East Orange, New Jersey; G. McLaughlin, S. C. Reese and L. Berg, Knoxville, Tennessee; Henry T. Aspinwall and Paul F. Simpson, Great Neck, Long Island, New York; Charles DuBose, New York City; J. R. Sproule, Seattle, Washington; A. Albert Cooling, Los Angeles, California; Horace Hartman and George Wright, Detroit, Michigan; Victor Spector, Chicago, Illinois.

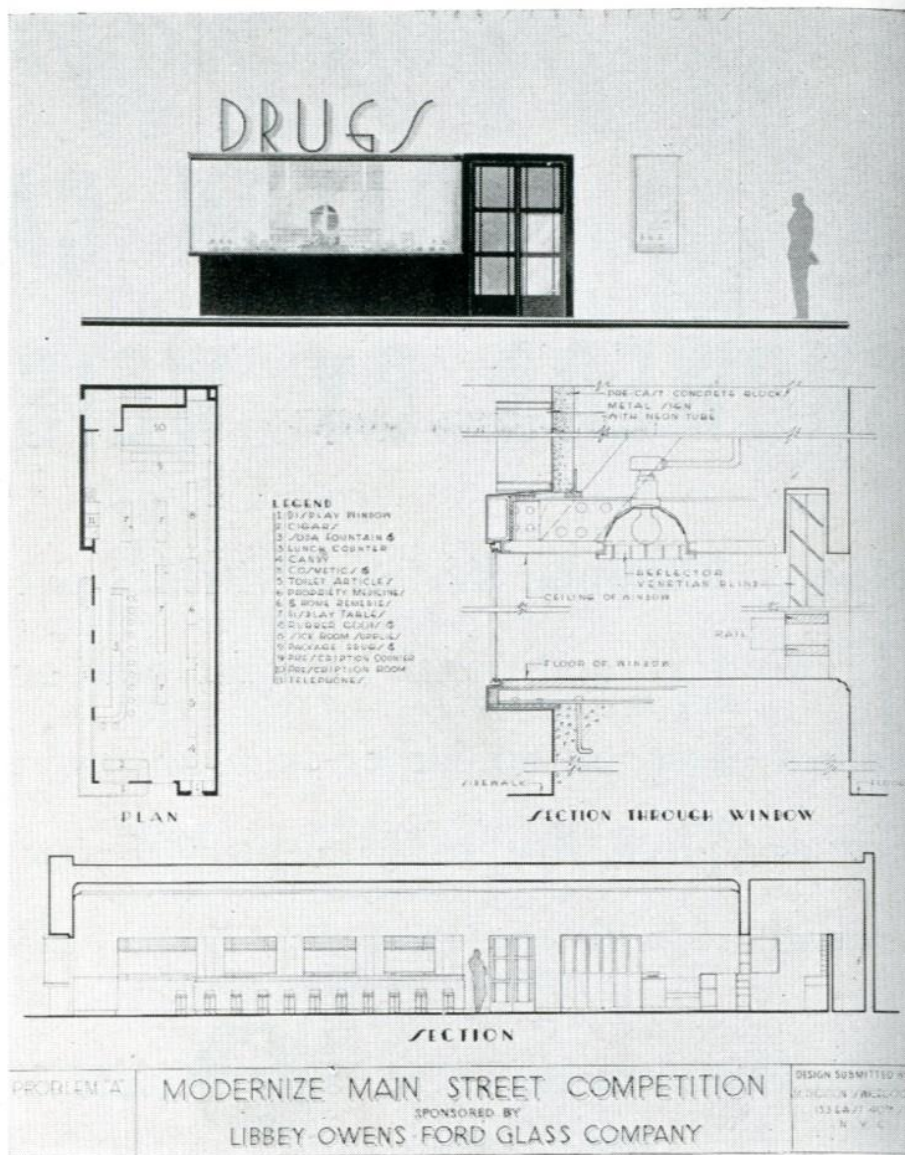
The uniformly high quality of the designs submitted was most gratifying to the sponsors, to the jury, and to the Architectural Record, which conducted the competition with Kenneth K. Stowell, A.I.A., as professional advisor. The widespread interest shown was considered particularly significant, for it presages new and profitable architectural activity in the several representative fields covered by the competition program. We extend our sincere congratulations to the winners and our equally sincere appreciation of the effort expended by all competitors. The winning designs are reproduced in the October Architectural Record and will be released for general publication shortly thereafter. Checks have been mailed to all winners.

LIBBEY · OWENS · FORD GLASS COMPANY, TOLEDO, OHIO

Figure 9 Announcement of LOF Modernize Main Street Competition winners

⁷³ LOF ad, Architectural Forum, October 1935, 32.

FORUM OF EVENTS

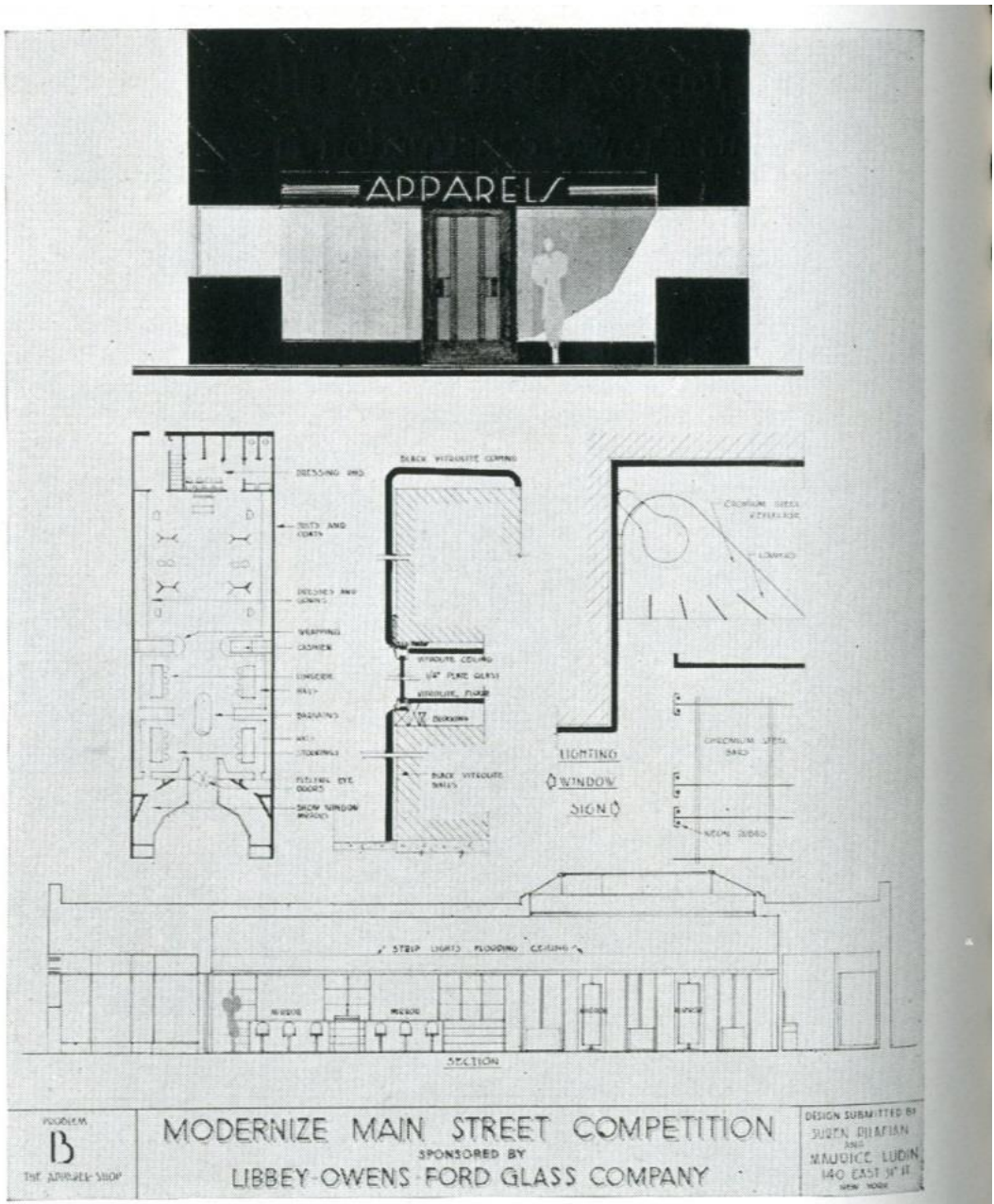


Winners in the Modernize Main Street Competition sponsored by Libbey-Owens-Ford Glass Co. conducted by *The Architectural Record*. Above: Drug store by M. Righton Swicegood, New York City. Below: Apparel shop by Suren Pilafian and Maurice Lubin, New York City. Judges: Melvin Thomas Copeland, J. André Fouilhoux, Albert Kahn, William Lescaze, John W. Root, F. R. Walker, Kenneth C. Welch. Winners in the other two classes on page 81.

74

Figure 10 Modernize Main Street Winner Drug Store Category

⁷⁴ LOF ad, Architectural Forum, October 1935, 78.



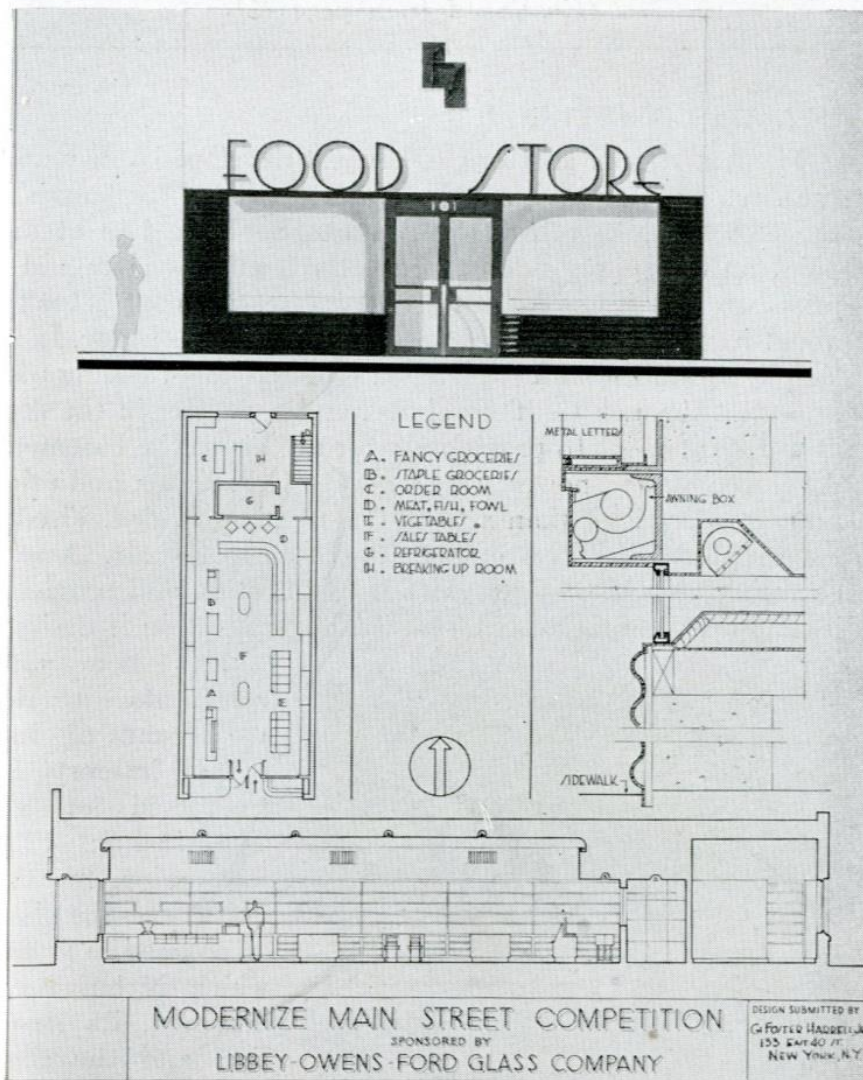
THE • ARCHITECTURAL • FORUM

75

Figure 11 Modernize Main Street Completion winner Apparel category

⁷⁵ LOF ad, Architectural Forum, October 1935, 78.

FORUM OF EVENTS



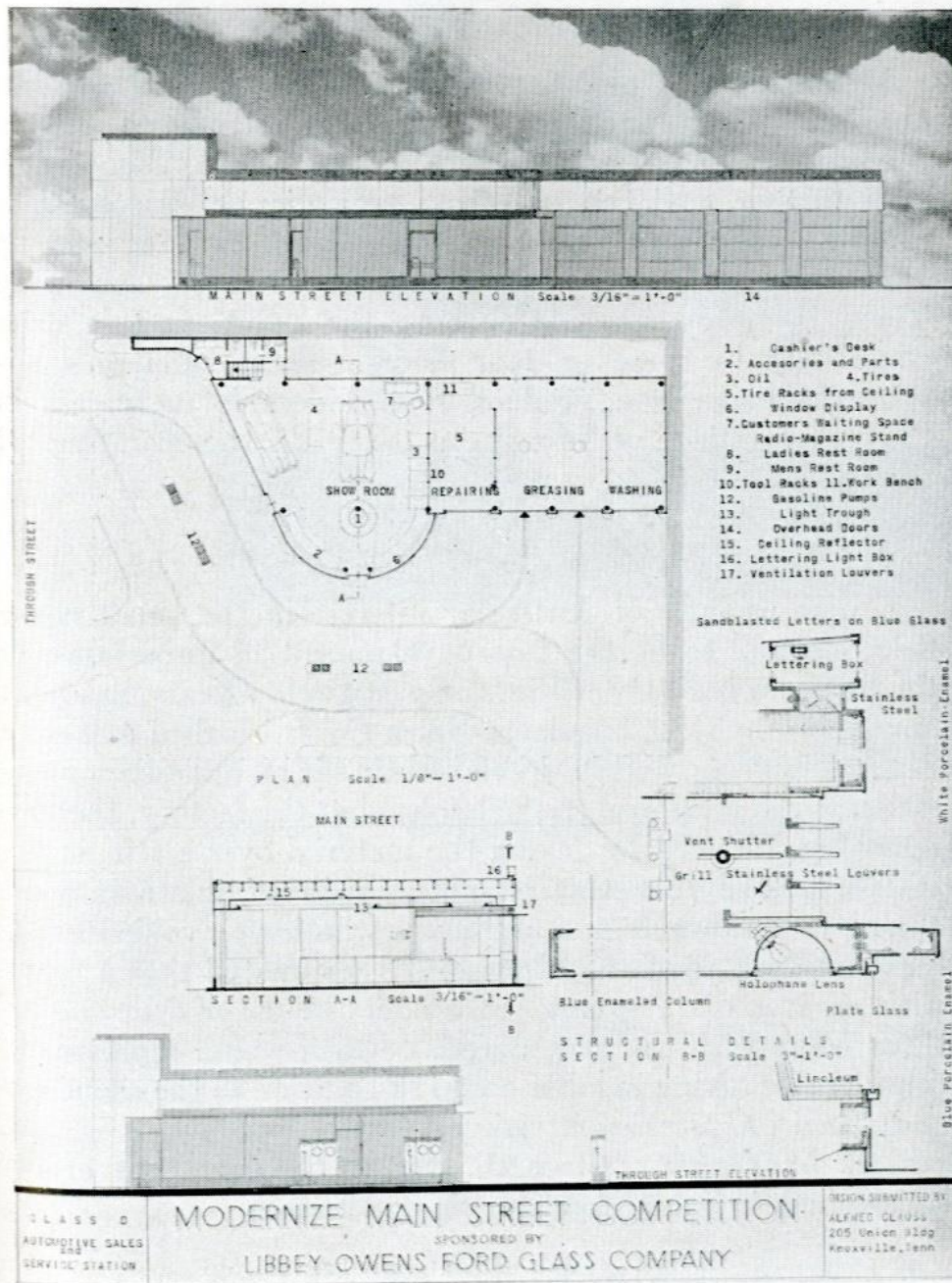
Competition winners. Above: Food Store by G. Foster Harrell, Jr., New York City. Below: Service station by Alfred Clauss, Knoxville, Tenn. Other winners and names of jury on page 78.

76

Figure 12 Modernize Main Street Competition winner Food Store category

⁷⁶ LOF ad, Architectural Forum, October 1935, 81.

Competition winners. Above: Food Store by G. Foster Harrell, Jr., New York City. Below: Service station by Alfred Clauss, Knoxville, Tenn. Other winners and names of jury on page 78.



77

Figure 13 Modernize Main Street Competition winner Service Station category

⁷⁷ LOF ad, Architectural Forum, October 1935, 81.

By the mid 1950's, structural glass began to fall out of favor for commercial facades, as porcelain-enameled steel panels rose in popularity. Structural glass was still used as filler panels in office buildings and skyscrapers. Production of structural glass products began to wane in the early 1950's as the market for structural glass products declined from what it had been in the 1940's. Part of the reason for the decline in popularity of structural glass was its price. Originally intended as a low-cost replacement for marble, other materials such as tempered hardboard, known under the brands of Masonite or Marlite, began to take its place.⁷⁸ Competition from other materials such as porcelain-enamel steel panels, new plastic laminates, along with changing design palates led to its declining use in storefront architecture.⁷⁹ By the mid 1950s, structural glass products were once again being advertised for use in utilitarian spaces such as kitchens and bathrooms.⁸⁰ Today, there is no production of Vitrolite or Carrara glass in the United States. A similar material is still produced in Europe but is only available in beige, black and white and is not as thick as the original material. Currently produced materials are used in full glass facades such as seen in skyscrapers as the covering material between floors.

⁷⁸ The Heritage Canada Foundation, "[Technote No.6 Structural Glass Repair and Replacement.](http://www.icomos.org/~fleblanc/documents/mainstreet_technotes/technote06.pdf)" Accessed January 28th 2014, http://www.icomos.org/~fleblanc/documents/mainstreet_technotes/technote06.pdf, 1.

⁷⁹ Jester, Thomas, 202.

⁸⁰ Jester, Thomas, 202.

CHAPTER2- TECHNICS

Material Qualities and Manufacture

Structural glass was developed to replace more costly materials such as marble and granite. The advantage that structural glass had over natural stone materials was that it had a vitreous sealed surface, making it very sanitary. This sealed surface also made it resistant to staining, spalling, warping and absorbing water, or other liquids. Its slick, polished surface played a role in its popularity in Art Deco and Art Modern architecture.⁸¹ Its use in streamlined architecture played a vital role in its popularity during the “Modernize Main Street” movement of the Great Depression and in the abundance of structural glass facades on the main streets of America.

Structural glass is composed of many of the same elements that make up traditional plate glass. Structural glass consists of silica, feldspar, fluorspar, China clay, cryolite, manganese, and other materials vitrified with approximately 3,000 degree Fahrenheit heat.⁸² The opacity of structural glass is provided by the inclusion of fluorides, which upon annealing (a controlled cooling process) create a dense mass of particles suspended in the clear matrix of the glass.⁸³ The color of the glass comes from the addition of different minerals and metals to the glass in the vitrification process.

The glass batches are vitrified in tanks or pots, with the molten glass poured into sheets which were then rolled to the desired thickness, a process similar to the production of traditional

⁸¹ “The preservation of historic pigmented structural glass (Vitrolite and Carrera glass)” [electronic resource]. n.p.: Washington, D.C. : Technical Preservation Services, National Park Service, U.S. Dept. of the Interior, [1984], 1984. Government Printing Office Catalog, EBSCO host (accessed November 14, 2013).

⁸² Dyson, Carol J. and Floyd Mansberger. “Structural Glass: Its History, Manufacture, Repair, and Replacement.” CRM bulletin (1995): 15-19 accessed January 28th 2014, 15.

⁸³ Dyson, Carol J. and Floyd Mansberger.,15.

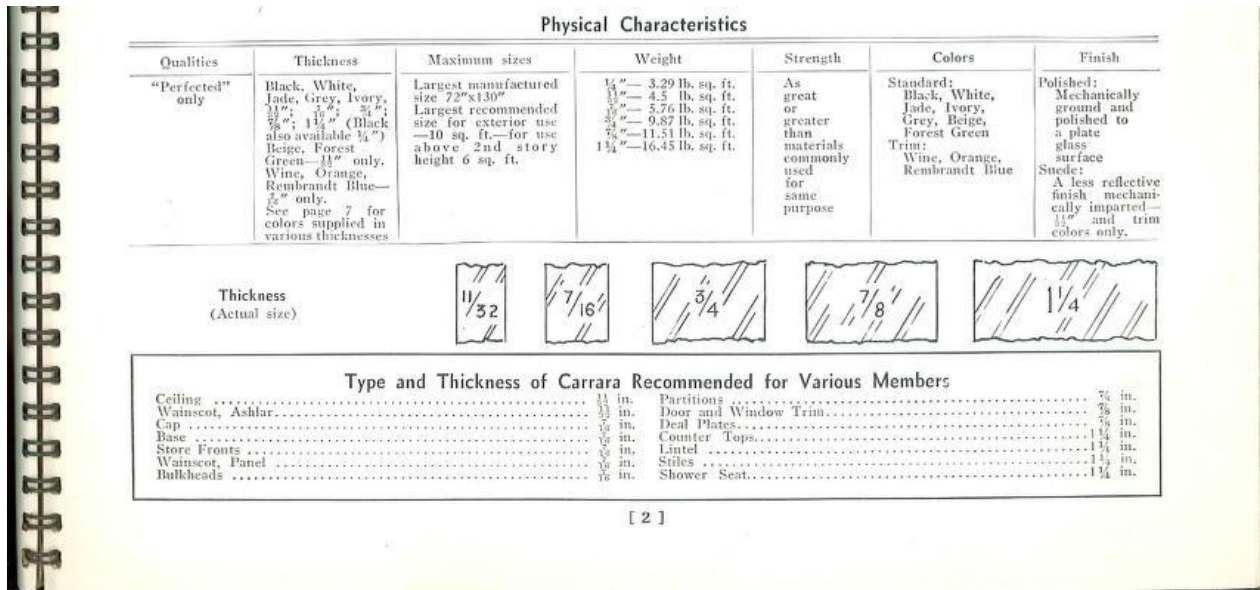
plate glass.⁸⁴ The structural glass then underwent an annealing process which took between three and five days depending on the thickness of the final product. The annealing process is the slow cooling of the glass to relieve internal stresses in the glass after it was formed. This annealing process took much longer than modern plate glass production, with the need for exact temperature control and speed to provide consistency in the finished product's opacity, color, and finish.⁸⁵ In some processes, the glass was hardened through rapid heating and cooling to give additional strength, generally referred to as tempering. The structural glass at this point would have a soft finish (referred to as fire polished) and was used in some applications this way, but to obtain a high gloss the glass surface, would be mechanically ground with fine sand and rollers, obtaining its final- mirror like finish with felt blocks and rouge, a polishing compound containing fine abrasives.⁸⁶ The final slabs of structural glass were cut after the polishing process, with the edges finished and holes drilled according to the final installation needs.

The versatility of structural glass in both interior and exterior applications comes from the nature of glass itself. Structural glass could be bent and curved, sculpted, laminated and illuminated to create unique architectural forms. Despite the delicate nature of glass in terms of breakage, the tempering process that was used in the production of structural glass produced glass panels with great strength and with great resistance to chipping and breaking. Figure 14 gives the specific physical characteristics of PPG's Carrara glass. The ability of the structural glass to be used in these ways gave the architect and the designer great ability to create a unique

⁸⁴ Dyson, Carol J. and Floyd Mansberger.,15.

⁸⁵ Dyson, Carol J. and Floyd Mansberger.,15.

⁸⁶ Dyson, Carol J. and Floyd Mansberger.,15.



87

Figure 14 Physical Characteristics of Carrara Glass

design. The capability of the glass to be used in these ways also fit well with the design elements of the Art Modern and Art Deco movements. With the advertising campaigns of PPG and LOF, along with the adaptable qualities of structural glass, it became a natural choice for store front renovations and improvements.

Installation of Structural Glass as a Veneer

Exterior storefronts generally used structural glass with a thickness of $11/32$ " and $7/16$ ". It was advised that glass not be affixed to either wood lath or paneling, but instead be mounted on a masonry substrate that was even and solid.⁸⁸ LOF specified that due to the extremes in temperature that Vitrolite would be exposed to in exterior work that precautions had to be taken

⁸⁷ PPG "Glass and Store Front Products" catalog, section 11/28, 2.

⁸⁸ Yorke, Douglas A. Jr ,22.

to insure that Vitrolite panels, which as a material has a slight degree of expansion, should be isolated from the materials adjacent or behind the panels which would have different coefficients of expansion. The mastic(an adhesive substance used in various trades including tile setting and mirror mounting) used to mount glass panels to the wall was plastic in nature to allow for the differences in expansion and contraction of the substrate and the glass façade. LOF advised that Vitrolite never come in direct contact with metal, wood, concrete or masonry, and should be installed with a space for clearance between them, with the space filled with joint cement, cork tape, or caulking materials.⁸⁹

LOF specified that when installing Vitrolite in exterior applications it should be mounted to masonry or cement/plaster walls with special mastic cement for exterior use and that the exterior panels also be given supplemental support with the installation of shelf angles.⁹⁰ LOF directed vertical joints to be 1/16” wide and horizontal joints to be 1/32” wide between Vitrolite panels, with cork tape set back from the face to allow room for all joints to be buttered with joint cement.⁹¹ The construction method of the façade, the location of the slabs in the construction of the facade, and the purpose for which the slab of glass is used determine the size of the panel. For the exterior construction of a storefront, the maximum size recommended was 6 square feet, with the maximum horizontal width being 3 feet and the maximum height being 4 feet.⁹²

Adhesion of structural glass was done through the use of asphaltic-based mastic. A recommended mastic is sold under the trade name of Palmer Mastic and is applied to the panel

⁸⁹ Libbey-Owen-Ford, “Glass In Architecture.” Accessed January 30th 2014. https://archive.org/details/GlassInArchitecture_320 ,34.

⁹⁰ Libbey-Owen-Ford, 34.

⁹¹ Libbey-Owen-Ford, 34.

⁹² Libbey-Owen-Ford, 33.

with a tool known as a hot cup.⁹³ The underlying structure would require priming with a asphaltic-based primer to help the mastic adhere to the building and to prevent premature failure of the mastic due to drying. The installation of the structural glass panels required the application of the asphaltic mastic in daubs 2 to 3 inches in diameter. The manufacturer of the mastic recommended that the glass panels receive about 50 percent coverage of the mastic for best adhesion to the building. It was also recommended that detail edges and any openings or drilled holes in the panels receive a 3-inch wide band of mastic to help in application and adhesion to the building.⁹⁴

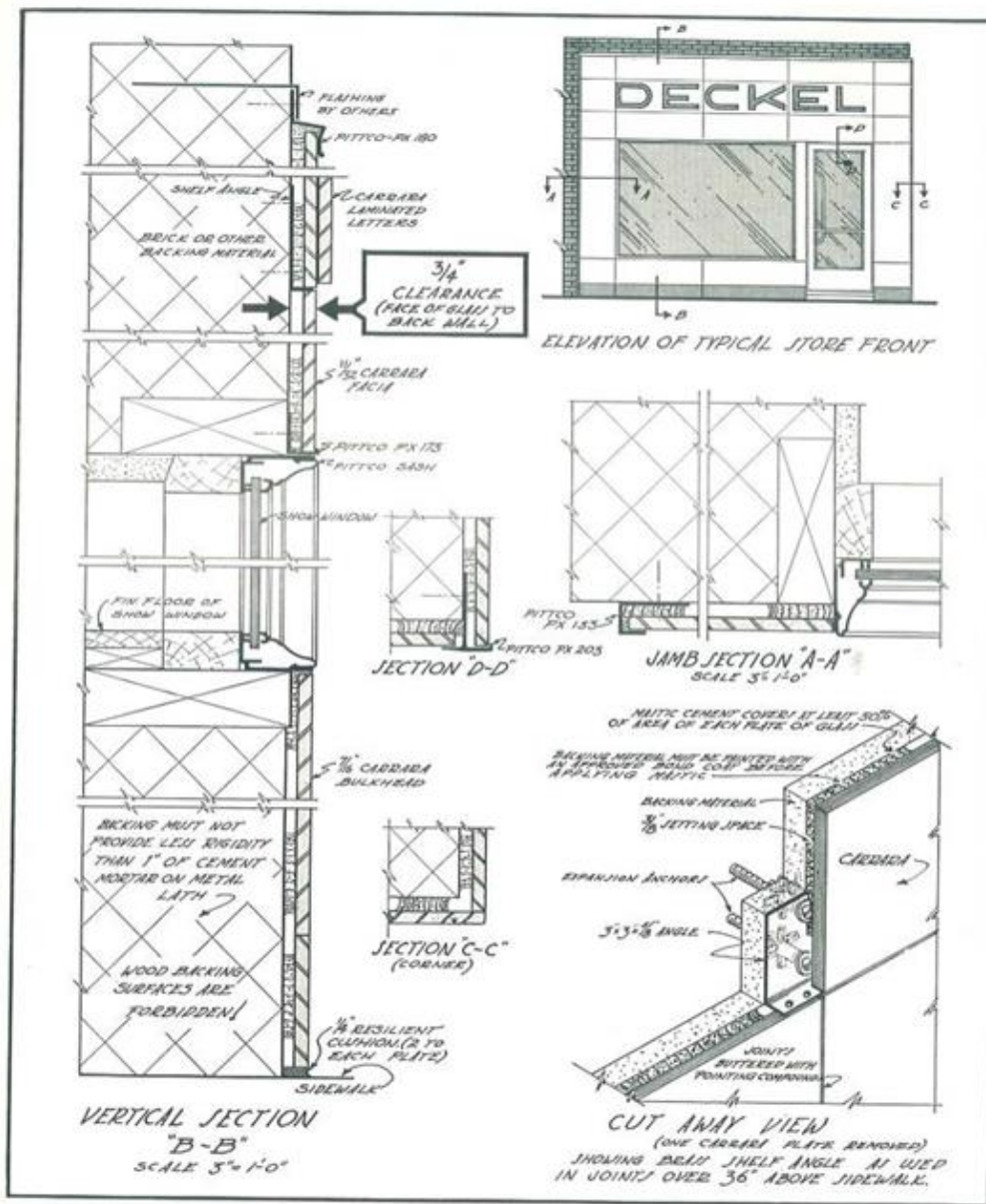
Shelf angles were used in helping to support structural glass panels on the building. These brackets were made of nonferrous metals such as brass and copper or galvanized iron to prevent corrosion. The shelf angles were made of 18 gauge metal and were generally 3 inches square with a ½ inch leg which was fastened to the masonry substrate. An illustration of this shelf angle can be seen in the cut away view in Figure 15. These angles were installed on every other vertical row of glass panels and, together with the mastic, supported the full weight of the panels. The shelf angles were installed not more than three feet apart vertically and spaced every 18 inches horizontally with at least two angles used for each individual piece of glass.⁹⁵ Structural glass generally weighs about 5 pounds per square foot and mastic alone would not be able to prevent gravity from causing the panels to slide off the building over time. Figure 15 gives illustrated details of how PPG specified the installation of Carrara glass facades in exterior applications. Essentially, the glass veneer was applied to a dry, smooth, and solid masonry or plaster-on-masonry substrate using an asphaltic masonry adhesive.

⁹³ The Heritage Canada Foundation, 3.

⁹⁴ <http://www.vitrolitespecialist.com/history/hx7.php5>

⁹⁵ <http://www.vitrolitespecialist.com/history/hx7.php5>

CARRARA for Exteriors



Simplicity of construction and installation is the keynote of structural glass. The typical store front details shown above can be used by the architect in almost all exterior Carrara work with the assurance that a trouble-free job will be the result. Structural glass as a veneer material can be applied with a mastic cement over almost any firm, true sub-wall. Wood as a backing surface is not recommended for all out-of-door glass construction.

Figure 15 details of installation of Carrara glass facade

⁹⁶ PPG "Glass and Store Front Products" catalog, section 11/28, 4.

CHAPTER3- CASE STUDIES

While structural glass was widely popular through the late 1920's through the 1940's in the United States as an exterior façade material, many of these facades have been removed or have been renovated due to damage or change in the building's usage. The factors of age and significance as well as the loss or significant change to structural glass facades overtime give reason to save those structural glass façades that remain intact regardless of condition. Many methods have been employed over the years to take care of these facades and to protect the remaining fabric that is left, but many of these facades are in need of partial or full renovation.

From the information that has been found in literature from preservation organizations and in interviews with structural glass expert Tim Dunn it has been determined that the unique character of structural glass warrants keeping most surviving facades intact. Tim Dunn of St. Louis Missouri is known as the Vitrolite specialist for the restoration of structural glass in both interior and exterior applications. He began working with structural glass in 1985 and has stockpiled over 10 tons of structural glass manufactured by all the major manufacturers, allowing him to restore or replicate almost any façade. His latest project has included the restoration of the bathroom facilities at the Hoover Dam.

Structural glass facades represent a unique period of time in American culture and architecture. The four case studies represented in this thesis were selected because they are representatives of structural glass facades that the author has personally come upon in their

travels to Tifton, Georgia and Columbus, Indiana, and because they are local examples in Athens, Georgia and Madison, Georgia. The Tift Theatre was my first experience of a structural glass façade, and is a good example of a façade that has had some replication work done on its lower façade but retains most of its original façade in a relatively unrestored condition. The Crump Theater in Columbus, Indiana is a good example of an installation of structural glass as a renovation during the Depression and as an example of mixed use of materials and methods of structural glass replication. The 40 Watt Club of Athens, Georgia is an example of a commercial store front that is in need of a full restoration of the façade, but what remains of the façade gives an excellent opportunity to examine how structural glass was installed on the façade. The Simmons Funeral Home in Madison, Georgia is an unusual example of a structural glass façade being used to create a chapel-like appearance on the front and is an example of a façade that is in extremely good condition and not in need of major attention for repair.

Crump Theater

Located in Columbus, Indiana, the Crump Theater at this location dates back to 1889, but the exterior was extensively remodeled in 1920 with a stucco front, while the current Vitrolite façade was installed during a 1941 remodeling.⁹⁷ The original façade consisted of three arched bays with three windows in each bay on the second level and the first level also having three bays from floor to ceiling with doors located in the right most bay when facing the building. The current façade of the Crump Theatre is made of both jade green Vitrolite panels and beige/white porcelain enameled steel panels with no delineation of the original three bays of the building. On the street level there are two recessed entrances which flank either side of the ticket booth. On the left side of the building stands the 45 foot -high sign with “the Crump” name spelled out in letters that match the jade green Vitrolite. The lower portion of the sign is connected to the marquee, which extends over the entrance to the theatre. The building has two distinct blocks that are created by the jade green Vitrolite that runs up from the first level to half of the third level of the building and encompasses the sign stanchion, and the second block of white or beige porcelain-enameled steel panels which also runs from the first floor to half of the third floor with an alternating angle cut at the top of the block forming a “zig-zag” along the top. The block of porcelain-enameled steel panels takes up roughly two thirds of the building’s façade, with the Vitrolite taking up the other third. The top of the building consists of what appears to be suede-finished glazed tile in an off white with evidence of crazing. The current façade is a single block that stands three stories tall with no openings above the street level.

⁹⁷ <http://www.thecrumptheatre.com/history.html>

Most of the Vitrolite is intact, with only two panels being visibly cracked from a distance. However, as you approach the building, impact damage is evident along the lower courses of Vitrolite on the building's façade. One panel has been replaced with a substitute panel of plywood or hardboard painted in a high gloss enamel paint in a jade green, and while this substitution looks compatible from a distance, as you approach it becomes more noticeable. The cracked panel that is evident from the photograph does not show signs of having been repaired to prevent further damage from water intrusion.

Overall, the suggested repairs for the building, using guidelines developed by National Park Service Preservation Brief 12 and interviews with Timothy Dunn, are that the façade needs to be cleaned, inspected for loose and failing panels, loose panels re-adhered to the building, and damaged panels replaced with similar structural glass panels or panels from higher up on the façade replacing lower panels, with other substitutes for structural glass such as painted hardboard or back-painted glass panels on the upper façade where they would be less noticeable. Despite the evidence of the previous appearance of the building's façade from historic photographs, the condition of the building's façade in its current condition qualifies it for renovation of the current façade, and the current façade is considered to be historically significant in its own right. The current façade has been in place for 73 years of the 125 year life of the building, meaning that it has been the most dominant façade, thus the current façade is worthy to be kept rather than removed.



Figure 16 Crump Theatre

1. Cracked structural glass panel
2. Replicated panel using gloss-painted hardboard or plywood panel
3. Damaged structural glass panel missing a section
4. Porcelain-enameled steel panels with some evidence of rust

⁹⁸ <http://www.thecrumptheatre.com/tour.html>

Tift Theatre

Opening in 1937, the Tift Theatre in Tifton, Georgia retains most of its original structural glass façade.⁹⁹ The original structural glass façade was three stories tall, of which only the upper two stories remain. The façade consists of four different colors of glass which are black, red, buff and jade. The façade consists of four bays with 8 windows evenly spaced, four windows on each level. The outer two bays are mirror images of one another and the inner bay split by the sign stanchion. Originally the windows were clear, but they have since been painted to try and match the colors of the façade in the bays in which they are located. There is evidence of etching of the black glass panels on the upper façade between the second and third story windows, with the post card in figure 17 illustrating what the original detail would have looked like. The marquee on the building has lost most of its original detail and the current marquee most likely dates from the late 1950's or early 1960's. The original marquee can be seen in figure 17, and the current marquee is shown in figure 18.

The lower third of the façade has been replaced with high gloss enamel paint on rough stucco. As can be seen when comparing Figure 17, the post card from 1938, with Figure 18, a recent picture of the façade, the street level façade has seen some minor modifications that required the removal of the original structural glass. The renovation of the theatre in the late 1980's replicated the missing structural glass with patterns that are close in facsimile to the original design. This replication is effective from a distance, but closer inspection of the façade reveals the roughness of the stucco. Since the lower façade is missing its original extruded sash

⁹⁹ <http://www.tifton.net/wp-content/uploads/2013/07/History-of-the-Downtown-Tift-Theater.pdf>

elements, it is difficult to determine the manufacturer of the glass panels without removing the current structural glass from the façade.

Since this is the original façade to the building there are no reasons to replace it. General maintenance of the façade is recommended , including inspecting for damaged panels, re-adhering loose panels, and caulking all the joints with a modern flexible sealant to prevent water intrusion. Removing the paint from the windows would greatly enhance the appearance of the current façade. As can be seen in figure 18, the design of the panels between the second and third floor windows can still be seen but has much wear and should be replicated. If possible, replacement of the lower third of the façade with structural glass and a return to the original lower level design as seen in figure 17 would be recommended, but at the very least, if the stucco surface were to be smoothed and repainted with high gloss enamel paint the effect would be more representative of the original façade design. A complete restoration of the façade should also include a return to the original marquee as seen in Figure 17. The Tift Theatre is the best example of Art Deco architecture in Tifton, and as such is an important part of downtown architecture.



100

Figure 17 Tift Theatre Post card

¹⁰⁰ <http://www.bobbyhobby.com/Tift%20Theatre-1938.jpg>



Figure 18 Tift Theatre

1. Detail etched in panel needs to be re painted to highlight detail
2. Replacement marquee
3. Original windows have been painted, paint should be removed
4. Lower façade has been changed and structural glass has been replicated in stucco painted in high gloss enamel

40 Watt Club

The building that currently houses the 40 Watt Club and a tattoo parlor on West Washington street in Athens, Georgia is another example of a building façade using structural glass. The structural glass on this building consists of three colors, with the major background being black, with accent bands of green and some red around the sign band, but this red may or may not be original as it is difficult to tell from the postcard in figure 19. This building originally housed the Big Star Food Store at the time of the installation of the structural glass façade, approximately dating from the mid 1930's. The building is a simple commercial façade that is a story and a half high. The façade is a simple block with its door offset to the side with large plate glass windows with extruded metal sash to match the structural glass. The façade makes use of a bulkhead below the windows. The design of the original façade was to accommodate a food store.

The current building is split between two businesses and now has an entry recessed into the original store front to allow separate entrances into the two businesses. The transom windows over the original entry to the food store have been covered up and in their place a small marquee resides. Some of the original plate glass windows have been replaced and use a different sash than the remaining original windows. This façade has many missing panels and damaged panels and the storefront has been modified since the installation of the structural glass façade, as is evident in comparing the image of the Big Star Food Store on the post card to the picture of the building as it is today. In one area of the storefront it is possible to see the mounting ledgers due to a missing panel. This missing panel also brings up a question of whether the store had been originally primed in asphaltic based mastic as was suggested in most installation literature from LOF and PPG, since no evidence of a primer coat remains on the brick.

The original structural glass installation also made use of integrated metal sash fittings for the transitions between the buildings and structural glass and window glazing. It appears that the sign band at the top of the building has been replaced with metal panels painted to match the green bands in the store façade. Some attempts at repair of the store front included painting the brick that was exposed by missing panels with matching paint, but no formal attempts at restoration are evident. The façade is in dire need for full restoration, and enough material is present to be salvaged for a restoration while still allowing two businesses to continue to occupy the single store front. Recommended restoration practices include a full cleaning of the storefront, replacement or replication of missing panels, resetting of loose panels, caulking of joints between panels, and protection of the lower panels from damage by vandalism and accidents, especially near the entrance/exit from the parking lot at the side of the building.



Figure 19 Washington St. looking East, Athens, GA. Postcard, late 30's



Figure 20 40 Watt Club today

1. Painted metal replacement panels in sign band, shows signs of rust and deterioration
2. Small marquee covers original transom windows over original opening
3. Original doorway into food store has been recessed into the building for two entrances.

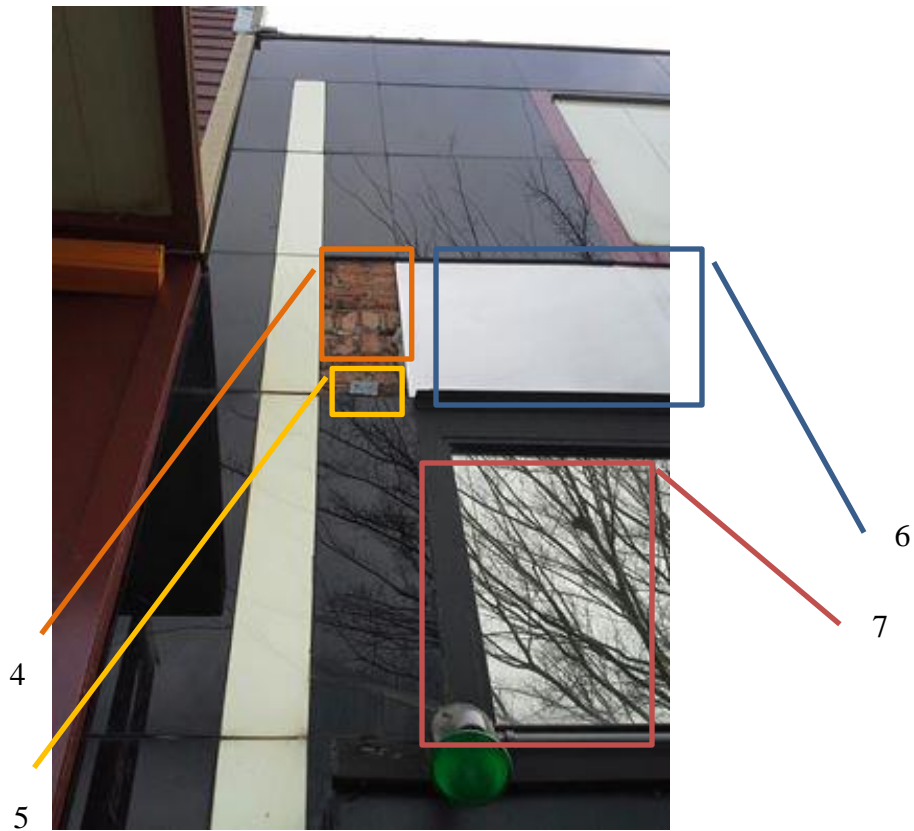


Figure 21 40 Watt Club detail

4. Substrate shows no evidence of asphaltic primer under missing panel
5. Three inch square shelf bracket used to aid in holding panels on façade
6. Part of original structural glass façade removed and replaced with sheet metal
7. Original transom windows have been replaced, new transom windows utilize non-matching sash components

Simmons Funeral Home

The Simmons Funeral Home in Madison, Georgia, has had a long history as a funeral home. As is evidenced by the photos in Figures 22, 2,3 and 24, the building has undergone many changes over the years, with the latest renovation of the façade having occurred in the late 1940's with the lower half of the façade being covered with structural glass. The building has a two-story façade with the main and secondary entrances being in the middle of the building's lower façade. The façade is asymmetrical; the left and right most windows on the first and second story facades line up, and two small narrow windows on the second story line up with the gothic arched windows that flank either side of the gothic arched doorway that forms the formal entry into the chapel. The second floor has a small balcony, which is asymmetrically placed on the building. From the photos in figures 23 and 24, it can be seen that the building has had a second-story porch , which overhangs the lower façade since its earliest inception.

The building uses a background of white structural glass with black as an accent. The main entrance of the building is set in such a way as to give the illusion of a chapel with a gothic style arched doorway which is set apart from the building with a white masonry façade with a pointed gable that juts from the main building by six inches. This façade that juts from the building creates a rather formal entrance to the building. A few feet away a second entrance to the building is framed in an art deco styled pediment. Structural glass is set along the face of the building around these two entrances. The windows on the lower façade also possess pediments but have the structural glass abutting directly to their frames. Unlike many other commercial storefronts, this façade does not use large plate glass windows or extruded metal sash for its installation. This use of structural glass seems rather unconventional in its nature, as structural glass was used in more flashy architecture, and the design of this façade is rather understated due

to the nature of the business. While the current façade is a mish-mash of styles, it is in relatively good shape with little damage to the structural glass. The current façade reflects strong art deco influence in its design and the materials used.



Figure 22 Simmons Funeral Home today

1. Second story porch asymmetrically set on building façade
2. Secondary entrance with pediment
3. Formal entrance with gothic arched door way set into chapel like façade
4. Structural glass façade which wraps first floor



Figure 23 L.M. Thompson



Figure 24 Hemperley Undertaking Company

Case Studies Conclusion

Structural glass was used in many ways and mixed with many different materials to enhance newly constructed buildings and to update older facades. Structural glass is a material with great longevity and with proper maintenance can easily last for many decades without trouble. Structural glass façades add to the variety of main street buildings and can be used in a number of ways on different types of commercial structures. Structural glass was used in the construction and renovation of many theatres for its sleek look, and many theatres retain these structural glass facades today. In many cases, structural glass facades have been on the building for the longer part of the building's life and as such have become the dominant façade in the life of the building. While structural glass is not commercially available, facades can be repaired in a variety of ways utilizing salvaged panels or through on site replication of the glass panels. Structural glass was an important material of the art deco period and as such reflects style and tastes of that time period. The examples in the case studies range in need from simple preservation of the existing materials to full restoration of the façade.

CHAPTER 4- RENOVATION AND REPAIR

When it comes to determining whether to keep a current structural glass façade or strip it to the original façade (in cases where the structural glass was installed as a modernization effort) there are many factors to consider. In the life of the building, in many cases, the structural glass façade has existed longer than the original façade. The structural glass façade has thus become historically significant and represents advancements in the production of glass and Art Deco or Art Moderne architecture. These factors, along with the damage that was caused to the original façade in the installation of structural glass components, give good reason for the renovation and repair of the structural glass façade rather than stripping the façade of structural glass. Despite the difficulties in locating structural glass to replace damaged panels, in many cases it is cheaper to renovate and repair the structural glass façade than to replicate a lost façade.

Common Modes of Failure

The failure of a structural glass façade is generally attributable to a lack of proper maintenance. The structural glass products were sold as a no-maintenance product, and while complete failure and deterioration of a structural glass façade is rare, failure of individual panels is often evident. Most failure of structural glass facades is due to the deterioration of joint cement, hardening and failure of the mastic adhesive, or impact due to accident or vandalism.¹⁰¹

Originally when the panels of structural glass were installed, the joints between panels were filled with a joint cement to create a façade with an integrated watertight surface. This joint cement was similar to glazing compound used in traditional sash window construction, and this

¹⁰¹ The preservation of historic pigmented structural glass (Vitrolite and Carrera glass) , Reasons for Damage

compound did not have the same longevity as the glass. Failure of the joint compound results from natural aging, improper installation of the joint compound, or from the thermal expansion and contraction of the glass panels over time. As a result of the deterioration the joints between panels crack leading to the intrusion of water behind the panels. The water intrusion behind the façade would then accelerate the deterioration of the mastic adhesive bond or the masonry substrate.¹⁰² Water could also cause deterioration of the metal anchoring shelves used in supporting the glass panels, causing the panels to eventually slip from their original positions.

The original mastic used in the installation of structural glass was an asphaltic-based mastic. The original installation started with the priming of the masonry substrate with an asphaltic-based primer to seal and help aid in the adhesion of the mastic to the building. Failure to adequately prime the substrate led to the premature failure of the mastic. The mastic was applied to the panels with a tool called a hot cup, and the panel was then applied to the building. The mastic allowed for the accommodation of slight unevenness of the façade. The original petroleum based mastic had an estimated 30 to 40 year lifespan. When the lifespan of the mastic is reached, the mastic starts to harden and lose its flexibility. This loss of flexibility eventually leads to slippage of glass panels.¹⁰³ An image of this type of failure can be seen in figure 25.

Impact from accidents and vandalism are difficult to prevent, and due to the nature of the material are almost always guaranteed to do some damage.¹⁰⁴ An image of this type of damage can be seen in figure 26. It is imperative that if such damage does occur steps be taken to prevent further damage to the surrounding façade and that the areas be repaired in a way to

¹⁰² The preservation of historic pigmented structural glass (Vitrolite and Carrera glass) , Deterioration of the Joint Cement

¹⁰³ The preservation of historic pigmented structural glass (Vitrolite and Carrera glass) , Hardening and Failure of Mastic

¹⁰⁴ The preservation of historic pigmented structural glass (Vitrolite and Carrera glass) , Impact Due to Accident/Vandalism



Figure 25 brittle daub of mastic



Figure 26 structural glass damage from impact or vandalism

¹⁰⁵ NPS Brief 12

¹⁰⁶ http://www.vitrolitespecialist.com/preservtn/dmg_sidewlk2.htm

prevent water intrusion. The best repair method is total replacement of the damaged panel, but if total replacement is not possible, repair of the damaged glass panel is the next best step.

Repair of Structural Glass Facades

Repair of structural glass facades should begin with an assessment of the overall condition of the façade. Missing panels should be noted and proper replacements or substitutes should be obtained. In cases where only one or two panels are damaged, it may be possible to merely replace the damaged panels and re-seal the joints with a suitable caulk. Institution of a maintenance program for the façade is highly recommended, and the façade should be checked for its adhesion to the substrate to determine if the metal anchors are present and in good condition and to check that water is being kept out of the façade.¹⁰⁷

Replacement of deteriorated joint cement is imperative in any repair of a structural glass façade. Open joints are unsightly and should be prevented and repaired whenever they are encountered.¹⁰⁸ While the original joint cement was similar to glazing compounds used in the construction of sash windows, its flexibility was limited and shortened its lifespan in façade construction. The substitute material for filling the joints should be relatively flexible and be able to be color matched to the panels in the façade. Silicone caulk and siloconized latex caulk are recommended for their flexibility, ease of application, longevity and ability to be tinted to match

¹⁰⁷ The preservation of historic pigmented structural glass (Vitrolite and Carrera glass) , Maintenance and Repair of Pigmented Structural Glass

¹⁰⁸ Yorke, Douglas A. Jr. , 27.

the façade.¹⁰⁹ It is also recommended that the nipple of the caulk tube be cut to create a small v-joint to aid in controlling the application to the narrow joints and to minimize the need to clean caulk from the finished surface. When re-sealing joints it is recommended that only caulk is used instead of both caulk and joint cement.

The failure of the mastics used to adhere structural glass to the substrate due to hardening is the most commonly-encountered failure. The evidence of this failure is demonstrated by finding the mastic dislodged from the glass surface as well as mastic still attached to the glass panels dislodged from the substrate.¹¹⁰ The original type of asphaltic based mastic is still available as Palmers Mastic and is the recommended mastic for use in repair and replacement for structural glass panels. Similar to the mastic used in attaching mirrors, it requires the use of a hot cup in the application of the daubs to the back of the panel.

Preservation of Structural Glass Facades

Four reasons for saving structural glass facades are given by The Heritage Canada Foundation in their Technote 6 article titled, “Structural Glass Repair and Replacement.” These are as follows:

1. They represent an investment in durable materials and fine craftsmanship
2. As evidence of one of the most dynamic periods of the 20th century design, they are a bold expression of the aspirations of an earlier generation
3. They contribute to the diverse look and continuity of main street; and
4. They are frequently less expensive to repair than to replace.¹¹¹

¹⁰⁹ Yorke, Douglas A. Jr. , 27.

¹¹⁰ Yorke, Douglas A. Jr. , 27.

¹¹¹ The Heritage Canada Foundation, 1.

Tim Dunn has stated that most structural glass facades are worth keeping no matter their state of condition. Most structural glass facades are considered historic if the building is considered under historic guidelines. According to Tim Dunn, the main concern is money. The owner has options in this situation; either restore the structural glass façade or leave the façade unrestored. When a building with a structural glass façade is not considered under historic guidelines, the building owner has the option of stripping the façade of the glass. This provides the opportunity to salvage structural glass to be used in the repair of other historic structural glass facades. Tim Dunn has had restoration projects in which no structural glass remained on the façade and he has recreated the historic façade with materials from his stock pile.

Many structural glass facades, while they may not be the original facades of the building, are at the very least over 50 years old. In many cases, the structural glass façade has been on the building longer than the original façade of the building. The structural glass façade has now become the historically significant façade of the building, and should be saved for many of the reasons listed in Technote 6. It is difficult to determine what may be left of any original façade under the structural glass façade, and recreation of the original building façade would be a recreation of the original façade, not the preservation of a historic façade. The construction of structural glass facades led to the inclusion of Art Deco design into downtown areas in a time where little new building in downtown areas occurred. In many cases the only Art Moderne or Art Deco building in a town is the renovated storefront. This period of architectural style is an important part of American history and reflects the changes of technology that were being seen in building materials and design.

While structural glass may not be manufactured in the United States today, there are companies in Europe and Japan that produce a similar glass that can be used for substitution of

damaged and missing panels in some colors. Other sources of glass panels may include local glass jobbers who have discontinued inventory in their warehouses and private stockpiles that have been saved by salvage companies. While it may be more difficult to find structural glass for repair purposes, it can be located or substituted in many different ways, meaning that most structural glass façades can be retained and restored. While buildings that are considered under historic guidelines should generally consider keeping the structural glass façade, if enough elements of the original façade remain and the structural glass is in poor shape then it may be best to salvage the remaining structural glass and return the building to its original appearance before the installation of structural glass.

Structural Glass Substitution

Broken panels of structural glass prove to be a serious problem in the repair and renovation of structural glass facades. While it is best practice to conserve existing materials and replace with in-kind materials, it may not be feasible to replace due to the obsolescence of structural glass. Structural glass production in the United States ceased many decades ago, and it is rare to find forgotten inventories of the material. It has been reported, but not corroborated, that from time to time white and black glass was available from the original manufacturers.¹¹² The difficulty of removing glass panels from structures being demolished without breakage has generally prevented the stockpiling of material from demolished structures and is another hindrance to supplies of readily-accessible replacement materials for restorations.

¹¹² Yorke, Douglas A. Jr. , 29.

The question of salvaging materials from other intact facades leads to the final question of what factors determine which façade to keep when structural glass has been used in the modernization of a store front. While salvaging from existing known storefronts is a short term solution to finding suitable replacement, it is not a steady or consistent source for replacement material. Structural glass should only be salvaged from storefronts that are being demolished, not considered historically significant or are not covered under historic guidelines. Structural glass was available in a select palette of colors and in a standard range of textures, meaning that it is feasible to locate replacement materials through salvaging existing exterior and interior applications. It is also of benefit that panels of two standard sizes were used in the construction of structural glass facades as this means that it should be easy to find panels to fit most applications, and even in custom applications the material is easily cut to fit using standard glass-cutting practices.¹¹³

Sources of new replacement structural glass are found in Europe where it is still produced (but only in the colors of black and white), but the new materials may not be a good match for existing applications. The newer glass is generally poor in quality in comparison to the original structural glass and is also expensive. This glass is also produced in non-standard thicknesses as compared to the original structural glass, meaning that panels would have to be shimmed in installation to match existing panels. The current production glass panels are non-standard in sheet size meaning that all panels would have to be cut to size. These factors, along with shipping delays and possibilities of damage, make it difficult to recommend as a suitable replacement.

¹¹³ Yorke, Douglas A. Jr. , 29.

A probable solution in situations in which only a few panels of the existing glass are damaged would be glass repair. While it is not the most practical solution in terms of appearance, glass repair should be considered when a panel has a relatively simple break or fracture or where full replacement is considered impossible. Repairing structural glass panels has to be decided on a case-by-case basis, and different repair methods are to be used in different cases. The use of both thermo-setting adhesives and epoxies has been made possible with advances in adhesive technologies. Both types of repair will produce a high-strength repair and good resistance to moisture, but repair of structural glass has not been extensively field tested and is not a universally viable solution.¹¹⁴ The repair to the damaged glass panel will still be evident so repair is best suited to less conspicuous panels such as panels above the street level of the façade.

Another alternative for the conservation of structural glass facades is substitution of materials. Two substitute materials for traditional structural glass include spandrel glass such as Vitrolux and Spandrelite. These two materials are similar in construction, consisting of heat strengthened glass with a ceramic frit fired onto the back of it. The frit is made up of fine particles that can be fused to the glass with heat. The frit provides color to the panel after it has been fused to the glass. While this material has a similar appearance to opaque glass, it has limitations for substituting original structural glass such as color availability. This method of substitution is most appropriate when all structural glass is replaced with spandrel glass, as it evokes the similar character and sheen of the original structural glass but when used as individual replacement panels it stands out.¹¹⁵

¹¹⁴ Yorke, Douglas A. Jr. , 29.

¹¹⁵ The Heritage Canada Foundation, 4.

Another option available today is to custom color match and paint the back of a glass panel. New technologies in paint manufacture have created coatings that can be custom tinted and painted onto glass panels to recreate the appearance of some structural glass panels. A problem with this type of panel replacement method is that the traditional mounting methods of using mastic to attach the panel to the substrate do not work, so a replacement panel created in this manner is only feasible if mechanical mounting methods are used.

Another option in replacement materials for structural glass would be the use of plastics such as Lexan™, but only in limited color availability. Lexan™ has a somewhat duller finish and a lowered resistance to abrasion than other replacement options, but can have good color match to black structural glass. Lexan™ is best considered for interior replacement applications.¹¹⁶

A more recent innovation that shows some promise in material substitution is laminated glass. The laminated glass makes use of a colored polyvinyl inner layer or layers that are color matched to the existing structural glass panels.¹¹⁷ This process provides more color options and creates the desired color opacity to match structural glass while being more damage resistant and allowing for the use of traditional mastic mounting methods. The polyvinyl inner layer is sandwiched between layers of glass and can be located 1/8" from the outer layer. By using multiple layers within the panel you can obtain an appearance closer to structural glass than with the use of spandrel glass.¹¹⁸

A final option in replacing damaged panels is the use of medium density plywood which is painted with a high –gloss enamel paint that matches the existing panels. This replacement

¹¹⁶ Yorke, Douglas A. Jr. , pg 29

¹¹⁷ Dyson, Carol J. and Floyd Mansberger. 10.

¹¹⁸ Dyson, Carol J. and Floyd Mansberger. 10.

panel would be highlighted by ½” reveals. This method is said to provide a look consistent with structural glass.¹¹⁹ Special considerations would need to be made in this type of repair to maintain the paint on the panel to prevent it from rotting over time and to prevent the paint from fading or losing the gloss appearance. A substitution method that has been suggested to the author, but has not been mentioned in any literature, is the possible fabrication of a sheet metal panel to replace missing panels of structural glass which would then be painted using automotive paint to match the color of the glass. This glass panel substitution would have a longer life than painted wood panels and the automotive finishes can produce similar high gloss sheen in a long lasting finish. This method of panel substitution would require shimming behind the panel to match the remaining glass panels. A similar approach is to use a smoothly-troweled paring coat of plaster or stucco that would receive a high-gloss coat of enamel paint matched to the remaining panels. Painting materials to resemble structural glass is best done as a total replacement, and if done as a partial replacement careful color matching is required to maintain the effect of the structural glass façade.¹²⁰ This type of repair is more durable than wood panel substitution, but would still require occasional maintenance to maintain the glossy finish to match the remaining glass façade.

Tim Dunn, when asked what materials he uses to replace structural glass panels, indicated that if no Vitrolite or Carrara glass panels are available, he will use spandrel glass first.¹²¹ If no spandrel glass can be located he uses silicone paints tinted to match the existing panels, but only in situations where he is not using mastic to attach the panel as it cannot be adhered to the building in this way. Wherever possible he replaces with structural glass of the

¹¹⁹ The Heritage Canada Foundation, 4.

¹²⁰ The Heritage Canada Foundation, 4.

¹²¹ Personal phone interview with Tim Dunn occurring on 02/11/14. Questions mainly pertained to the repair of structural glass facades, methods of replacement, methods of salvage, materials used in repair and substitution materials.

same color from his stock of glass. He has acquired over 20 tons of structural glass through salvage and remaining inventories of glass jobbers. Tim recommends that any damaged panel be replaced instead of repaired because the repair is hard to make and is quite obvious even when well done. He says that patching damaged glass panels is a temporary repair to prevent water intrusion behind glass, but the best method is full replacement of damaged panels.

Tim Dunn also noted that structural glass manufactured by different manufactures can be used together in restoration of a façade, particularly white and black which had little color variation between manufacturers. Mr. Dunn has also been called upon to replicate entire facades that were lost due to demolition or neglect and has had great success in matching colors of façade materials. When it comes to glass replacement, he has had success in replacing damaged or missing panels with actual structural glass elements, and he recommends that structural glass panels be sought first as a repair and that structural glass substitution be used only if no source of matching glass can be found.

Addressing Brief 12

In interviewing Tim Dunn about his methods of structural glass renovation and repair he noted that the methods of removal mentioned in the National Park Service Brief 12 were not the best methods and lead to unsatisfactory results. The section of Brief 12 entitled *Removal of Pigmented Structural Glass Panels* mentions the use of commercial solvents such as methyl ethyl ketone, methyl isobutyl ketone, and acetone for softening hardened mastic to make it easier to remove. It also mentions the use of piano wire to saw the mastic between the substrate and

glass panel.¹²² Another method mentioned in *Structural Glass: Its History, Manufacture, Repair and Replacement* is to use steam directed at the face of the panel for approximately 10 minutes to soften the mastic for panel removal.¹²³ According to Tim Dunn these methods are complicated and lead to a risk of damage to the structural glass panels that are being salvaged.

The tools that Tim Dunn recommends are a putty knife, a hammer and a hand saw. According to Dunn, the mastic is always still somewhat malleable, and a skin is formed on the exterior surfaces of the mastic daub and the center is still sticky. Dunn's method is to gently rap at the edge of the mastic daub and break open the skin. Once this is done he gently pries the panel away from the building. He estimates that his salvage rate is approximately 95% with this method of panel removal. According to Dunn, the history section of Brief 12 is well written, but the methods of removal, repair and installation were written by a lay person and do not reflect the best methods for repair and installation of structural glass. He recommends that Brief 12 be rewritten by a expert to reflect the best methods for repair and replacement of structural glass.

¹²² NPS Brief 12, Removal of Pigmented Structural Glass Panels

¹²³ Dyson, Carol J. and Floyd Mansberger. 18.

CHAPTER5- CONCLUSION

Structural glass facades are found throughout the United States and Canada and were abundant due to the marketing techniques of PPG and LOF and the financing extended by the FHA during the Great Depression for the modernization of Main Streets across the nation. These facades represent technological advancements in the production of plate glass, as well as the architectural stylings of the Art Deco and Art Moderne movements. The companies who produced Structural Glass, namely PPG and LOF, designed their structural glass products as systems to fill the needs of the modernization movement, which accounts for the numerous intact structural glass facades seen today. The rival relationship between PPG and LOF helped drive the marketing of structural glass products for store front façade modernization. Many of these facades have become historically significant and should be kept if at all possible. While in many cases these façades are more modern than the buildings they were applied to, they have often become significant to the building as they have fronted the building in many cases longer than the original facades.

Even though structural glass is not produced in the same quality or quantity as it was in the past in the United States, there are effective methods for replication of missing panels and in many cases it is possible to acquire replacement structural glass from salvage operations. The mastic that was originally used is still the most effective mastic for the application of structural glass and is still produced for use in repair and renovation of facades. Experts like Tim Dunn are keeping the traditions of structural glass construction alive in their renovation and repair practices. Although renovation or repair of a structural glass façade may be more time-consuming in terms of locating suitable replacement materials, it is generally far less in monetary

costs to preserve structural glass facades than to replicate a building's original façade. In many cases, the elements of the original façade have been lost due to the installation of the structural glass, making it difficult to go back to the original façade of the renovated building. While buildings that are considered under historic guidelines should generally consider keeping the structural glass façade since it is considered to be an important part of the history of the façade, if enough elements of the original façade remain and the structural glass is in poor shape then it may be appropriate to salvage the remaining structural glass and return the building to its original appearance. Buildings that are not considered under historical guidelines are easier to work with, and while keeping the structural glass façade would be more feasible they have more options in how the façade of the building can be changed. The decision tree in figure 27 helps to demonstrate the options to consider when evaluating structural glass facades. The structural glass façade adds to the history of the building and is often evidence of the progressive spirit of the Great Depression. The use of structural glass products to update a façade rather than to replace the entire building was a cost effective measure in a time of financial constraints, as it can be again today.

Decision Tree

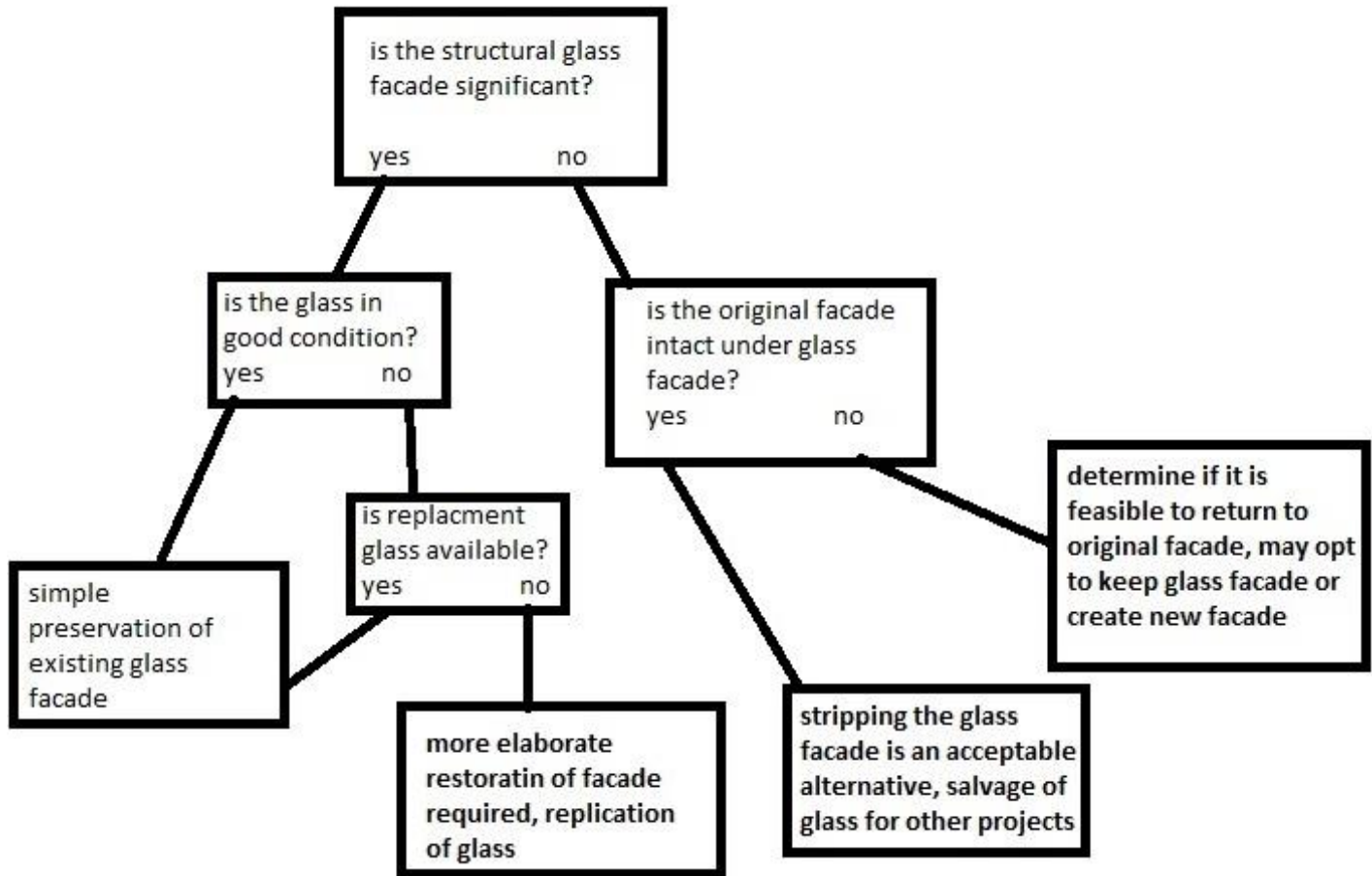


Figure 27

REFERENCES

CRM: [bulletin]Date:1995Publication Type:Academic JournalSubjects:Glass; Commercial catalogs; Structural engineering; United StatesAbstract:Examples from the 1920s to ca. 1950.Database:Avery Index to Architectural Periodicals

Esperdy, Gabrielle M. 2008. *Modernizing Main Street : Architecture and Consumer Culture in the New Deal*. Chicago: University of Chicago Press, 2008.

Dyson, Carol J. and Floyd Mansberger. "Structural Glass: Its History, Manufacture, Repair, and Replacement." CRM bulletin (1995): 15-19 accessed January 28th 2014.

http://www.dahp.wa.gov/sites/default/files/StructuralGlass_0.pdf

Yorke, Douglas A. Jr. "MATERIALS CONSERVATION FOR THE TWENTIETH CENTURY: THE CASE FOR STRUCTURAL GLASS." APT Bulletin 13, no. 3 (September 1981): 18-29. America: History and Life with Full Text, EBSCO host (accessed December 3, 2013).

Sweets Architectural Catalogue. New York: F. W. Dodge Corporation, Sweet's Catalogue Service, 1927-1928.

National Parks Service, "Standards for Rehabilitation and Guidelines for Rehabilitating Historic Structures." Accessed December 3, 2013.

http://www.nps.gov/hps/tps/standguide/rehab/rehab_standards.htm

Jester, Thomas. *Twentieth-Century Building Materials*. Washington D.C.: McGraw-Hill Companies, 1995.

Pittsburgh Plate Glass Company, "Carrera Structural Glass." Accessed July 25th 2013.

<http://archive.org/stream/CarraraStructuralGlass>

The Heritage Canada Foundation, "Technote No.6 Structural Glass Repair and Replacement." Accessed January 28th 2014,

http://www.icomos.org/~fleblanc/documents/mainstreet_technotes/technote06.pdf

"Notes on the History of Randolph County, NC." Last modified October 23, 2009. Accessed July 25th, 2013. <http://randolphhistory.wordpress.com/2009/10/23/carrara-glass/>.

DUNN, TIMOTHY J. 2009. "Vitrolite BRINGS BACK THE MAGIC." *Marquee* 41, no. 2: 12-19. *International Bibliography of Theatre & Dance with Full Text*, EBSCOhost (accessed November 14, 2013).

Hudd, Fiona. 2010. "Issues surrounding the conservation of Vitrolite glass." *Journal Of Architectural Conservation* 16, no. 2: 45-63. *Avery Index to Architectural Periodicals*, EBSCOhost (accessed November 14, 2013).

Libbey-Owen-Ford, "Glass In Architecture." Accessed January 30th 2014.
https://archive.org/details/GlassInArchitecture_320

Pittsburgh Plate Glass Company, "Glass and Store Front Products." Accessed July 25th 2013.
<http://archive.org/stream/GlassAndStoreFrontProducts/GlassAndStorefrontProducts>

1984. The preservation of historic pigmented structural glass (Vitrolite and Carrera glass) [electronic resource]. n.p.: Washington, D.C. : Technical Preservation Services, National Park Service, U.S. Dept. of the Interior, [1984], 1984. *Government Printing Office Catalog*, EBSCO host (accessed November 14, 2013).

"Reviving Main Street," *The Architectural Forum*, July 1935,