

October 18, 2023  
ICRI 2023 Fall Convention

# The Academy of Music Exterior Restoration



**Arieto Seraphin, PE**  
**Senior Project Manager**  
*Keast & Hood Co.*



*The ideas expressed in this ICRI hosted webinar are those of the speakers and do not necessarily reflect the views and opinions of ICRI, its Board, committees, or sponsors.*

# Learning Objectives

At the end of this presentation, participants will be able to:

- Understand the challenges and considerations that go into restoration projects for historic buildings, including ecological and environmental factors and designing for severe exposure categories.
- Identify different materials used in restoration projects, such as architectural precast concrete and glass fiber-reinforced concrete, and recognize scenarios in which these materials may be used individually or in combination.
- Analyze the problem-solving methods utilized by the project team to address challenges, including the development of new installation procedures and the use of pull tests to establish reliability of the anchoring design.
- Evaluate the importance of attention to detail in restoration projects for historic buildings, particularly in the context of replicating ornate details and matching colors and materials to the original design.

# Background



- Designed by Philadelphia Architects Napoleon Le Brun and Gustav Runge
- Constructed between 1855 and 1857
- Oldest opera house still in use in America

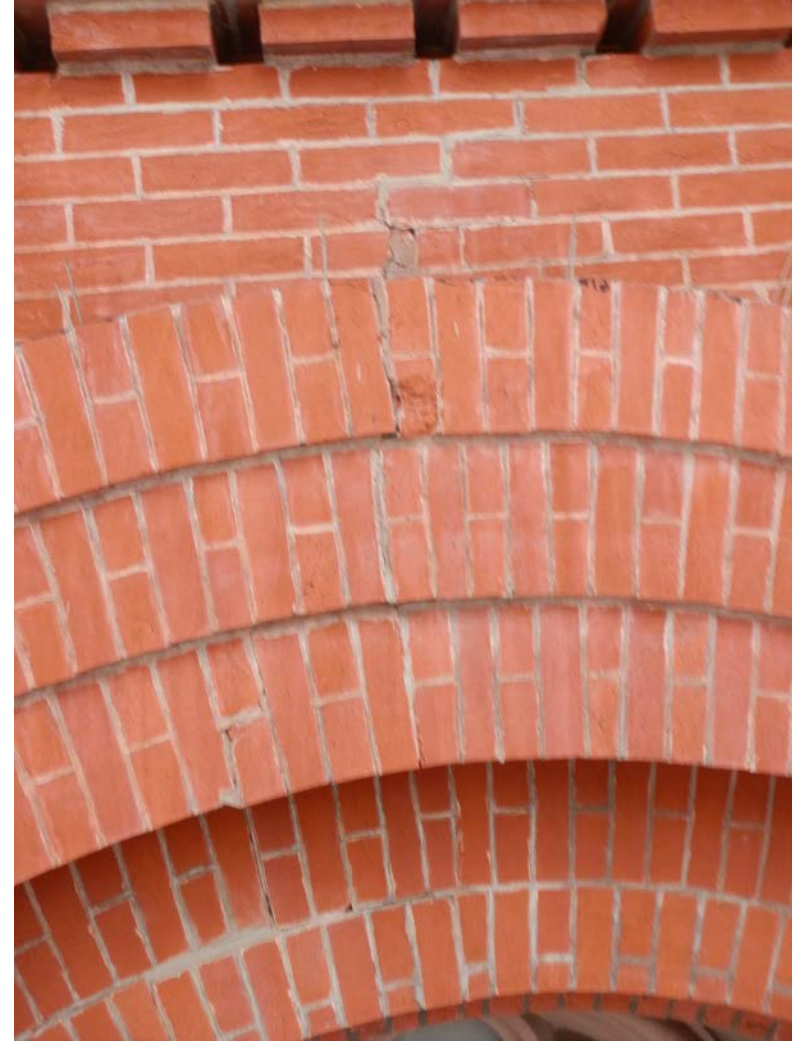
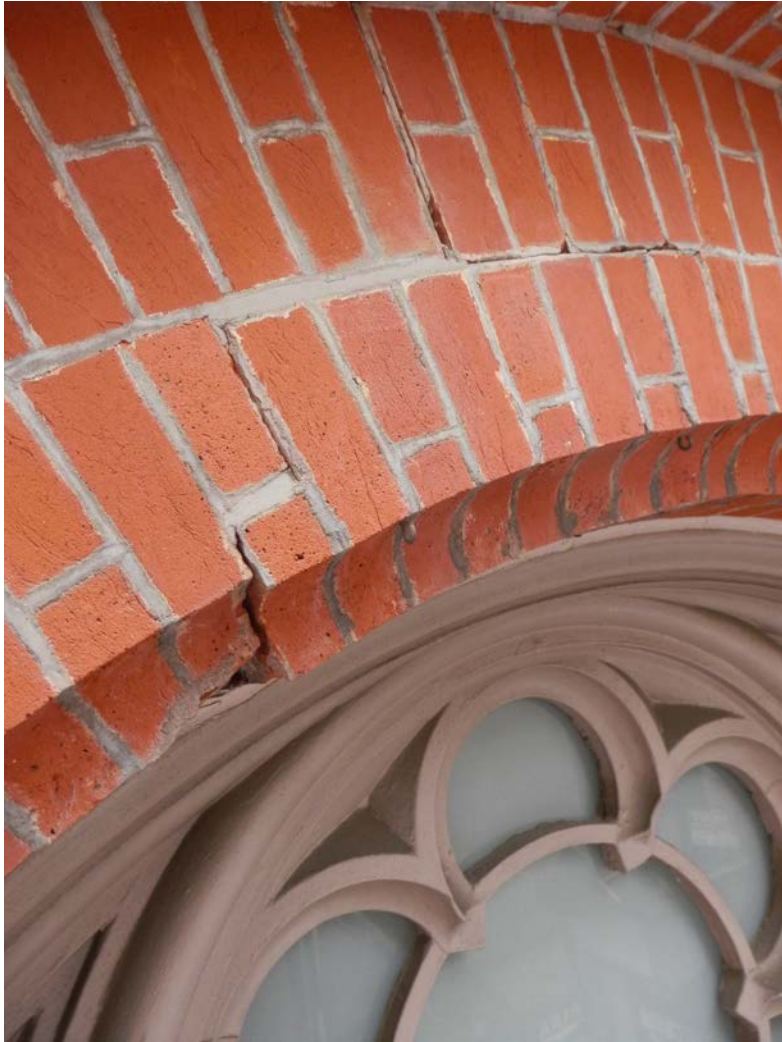
# PHILADELPHIA FAÇADE INSPECTION



# Philadelphia Façade Inspection



# Philadelphia Façade Inspection





# Philadelphia Façade Inspection



- Parapet & keystone deterioration

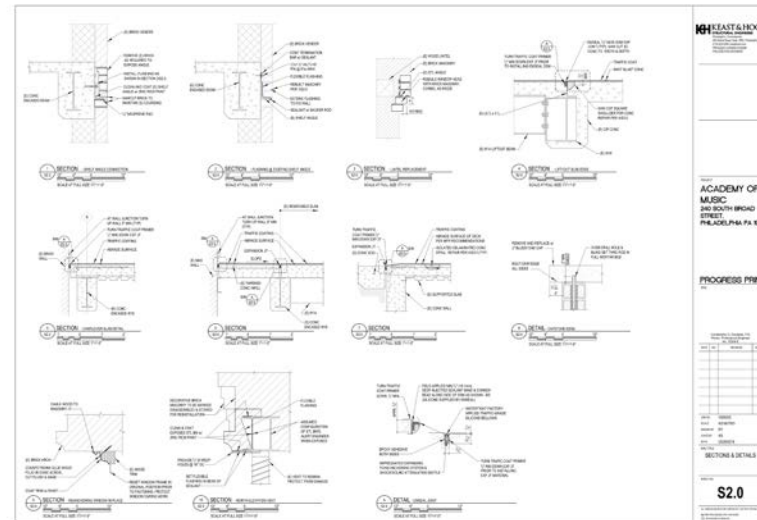
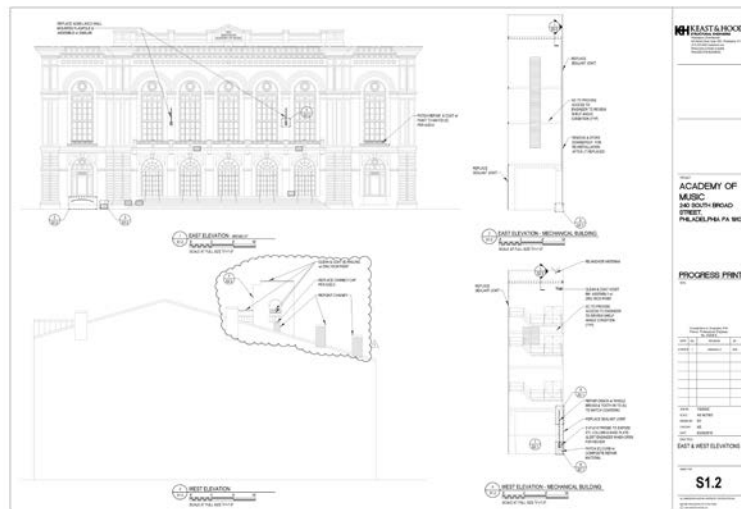
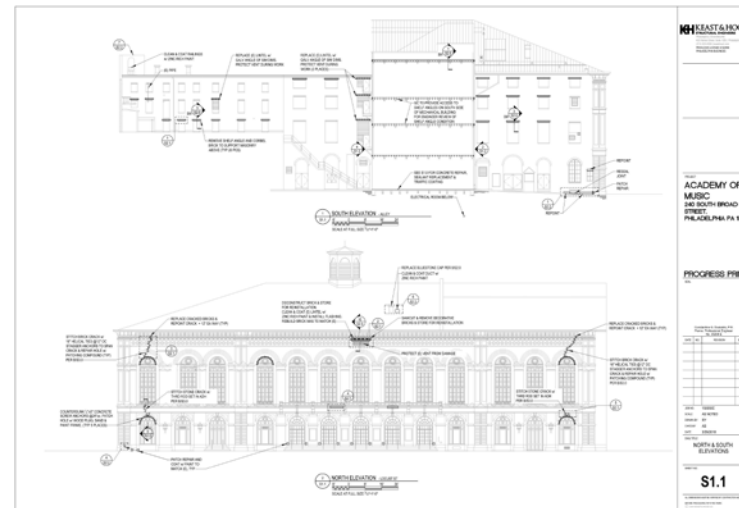
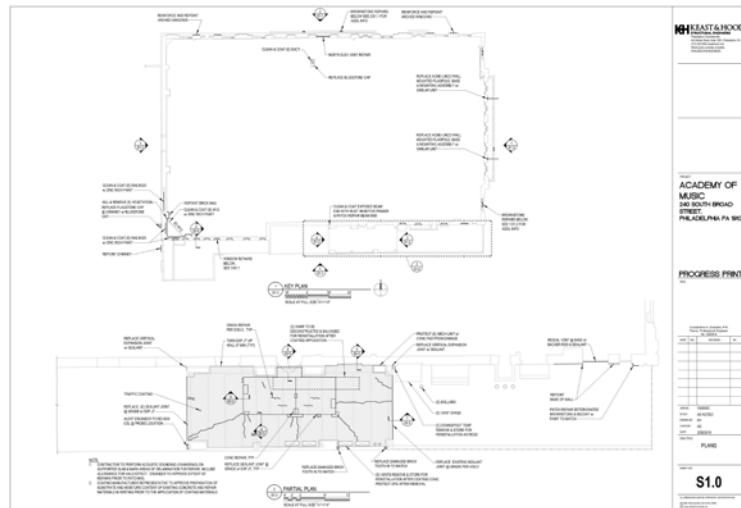
# Philadelphia Façade Inspection



# TARGETED MASONRY REPAIRS



# Philadelphia Façade Inspection



- Phased documents for targeted repairs

# Philadelphia Façade Inspection



- Executed simple repairs
- Opened probes Developed next phases



# PARAPET & KEYSTONE



# Philadelphia Façade Inspection







# Philadelphia Façade Inspection



**BALCONY**

# Restoration Project- Balcony





# Restoration Project- Balcony

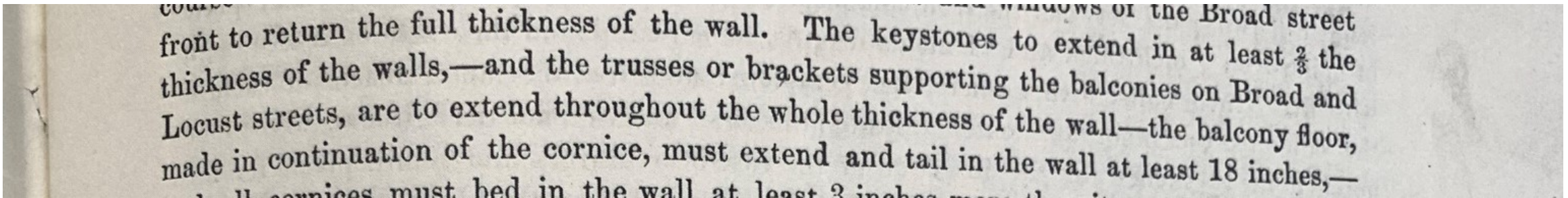
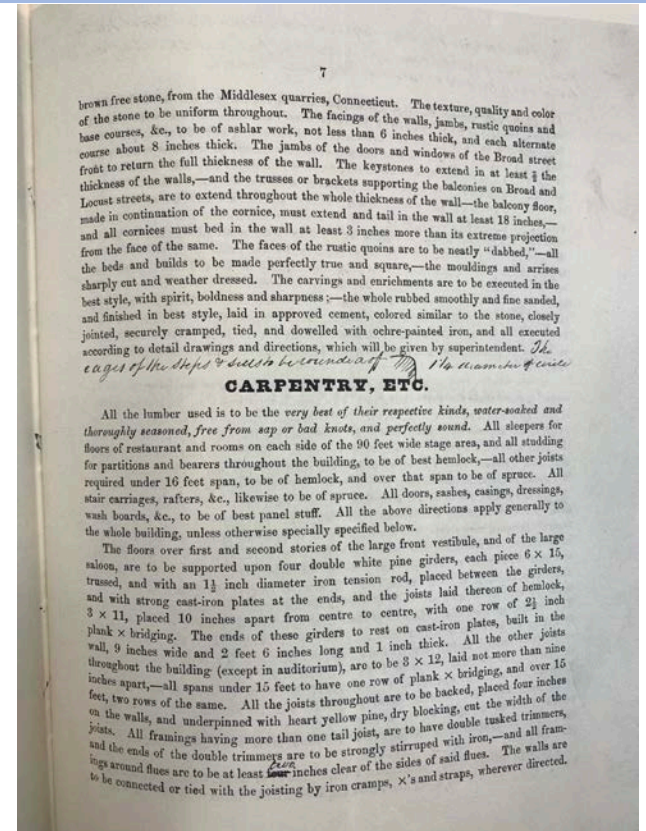
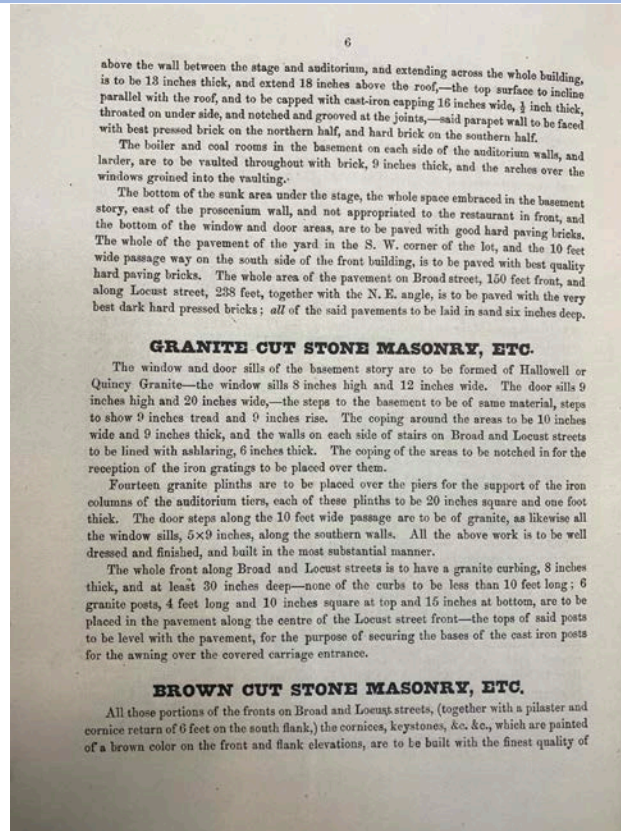
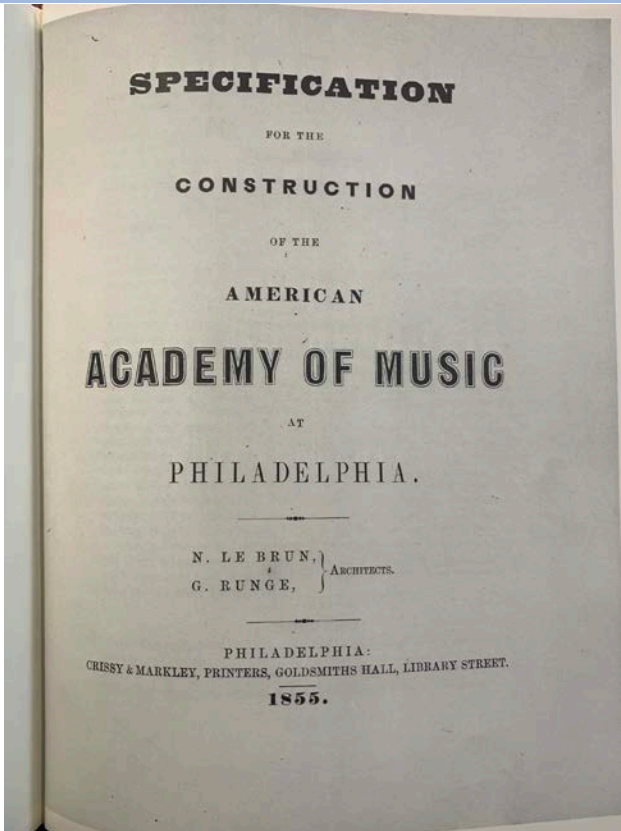


## Restoration Project- Balcony





# Restoration Project- Balcony





# Restoration Project- Balcony





# Restoration Project- Balcony



# HISTORICAL DOCUMENTATION

Atkin Olshin Schade Architects- Project Architect

Building Conservation Associates- Conservator

## Historical Documentation

- The City of Philadelphia Department of Records
- The Philadelphia Historical Commission
- The Free Library of Philadelphia
- The Athenaeum of Philadelphia
- The Historic American Building Survey
- The Pennsylvania State Historic Preservation Office
- The Historical Society of Pennsylvania
- The Academy of Music archives, including the Driscoll construction archive
- HathiTrust Digital Library
- Le Brun and Runge's original 1855 construction specifications for the Academy (digitized by the Historical Society of Pennsylvania)
- An 1857 pamphlet, "History and Description of the Opera House, or American Academy of Music, in Philadelphia" (via HathiTrust)



# Historical Documentation



1924



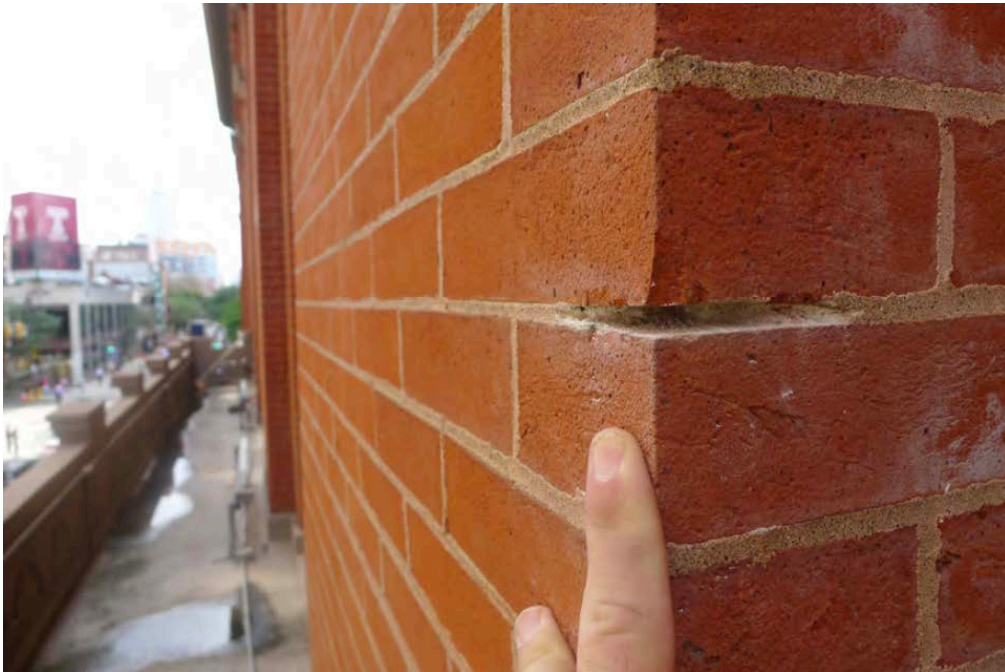
1946



1970

# MATERIAL ANALYSIS & SURVEY

# Material Analysis



- Exterior materials analysis including mortar and paint
- Paint coating removal tests
- Brick Mortar: Non-hydraulic lime mortar, white in color
- Brownstone Mortar: Portland cement mortar, pigmented and brown in color



## Field Survey



- Stringcourses between the second-story windows
- Balconies, including balustrades and supporting brackets
- Two stringcourses and the frieze at the top of the first story
- Rusticated ashlar blocks between first-story window openings
- Flat regions surrounding door and window openings (Broad Street elevation only)
- The wall base/water table

# Restoration Project- Balcony





# Balcony Restoration Project

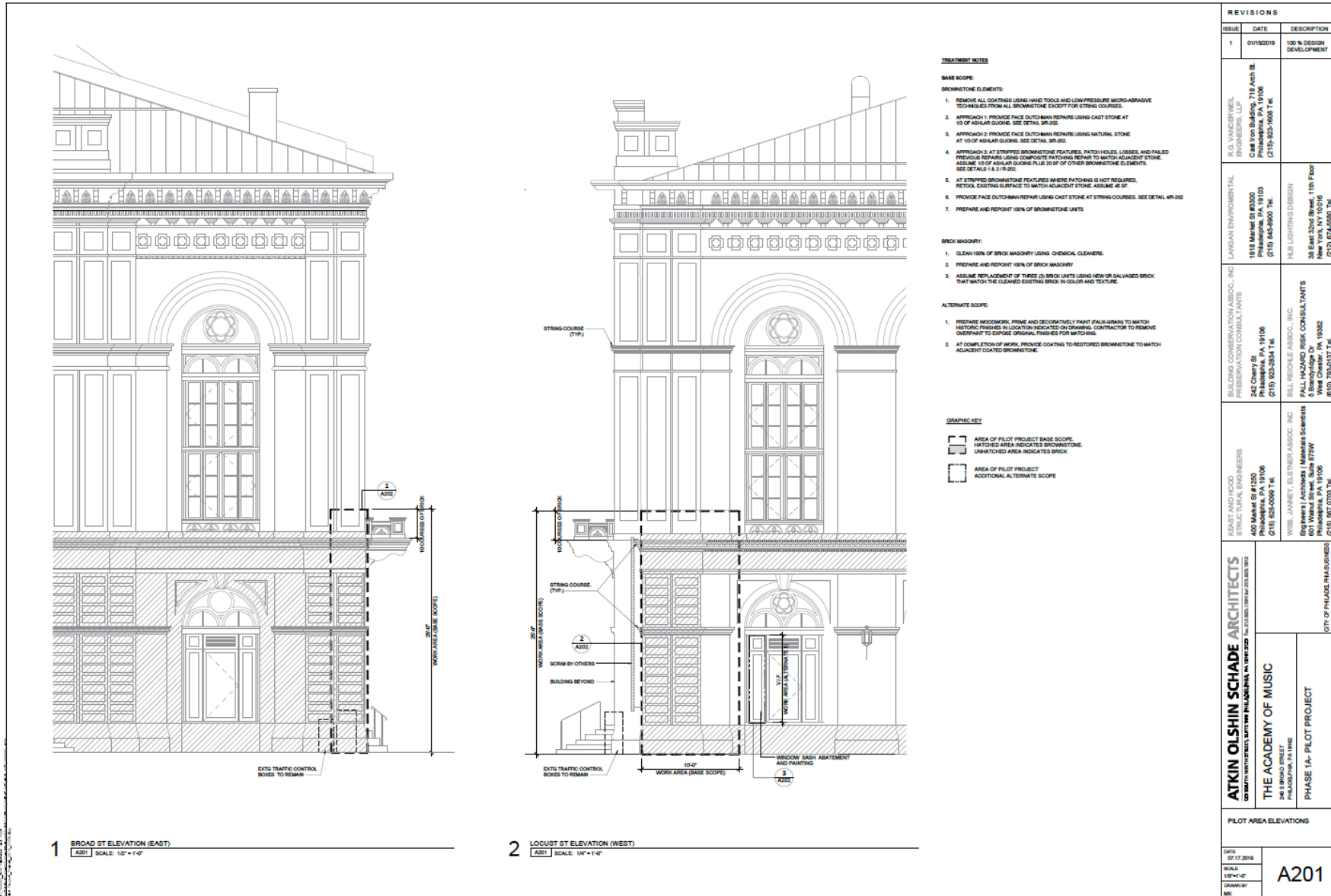




# PILOT PROJECT

Haverstick- Borthwick Company- General Contractor  
Pullman- Masonry Contractor

# Pilot Project



**1 BROAD ST ELEVATION (EAST)**  
 [ASB] SCALE: 1/2" = 1'-0"

**2 LOCUST ST ELEVATION (WEST)**  
 [ASB] SCALE: 1/4" = 1'-0"

**TREATMENT NOTES**

**BASE SCOPE**

**BROWNSTONE ELEMENTS:**

1. REMOVE ALL COATINGS USING HAND TOOLS AND LOW-PRESSURE MICRO-ABRASIVE TECHNIQUES FROM ALL BROWNSTONE EXCEPT FOR STRING COURSES.
2. APPROACH 1: PROVIDE FACE CUTO-BMAN REPAIRS USING CAST STONE AT 10 OF ASHLAR QUIONS. SEE DETAIL 3R-302.
3. APPROACH 2: PROVIDE FACE CUTO-BMAN REPAIRS USING NATURAL STONE AT 10 OF ASHLAR QUIONS. SEE DETAIL 3R-303.
4. APPROACH 3: AT STRIPPED BROWNSTONE FEATURES, PATCH HOLES, LOSSES, AND FAILED PROVIDE REPAIRS USING COMPOSITE PATCHING REPAIRS TO MATCH ADJACENT STONE. ASSUME 10 OF ASHLAR QUIONS PLUS 50 SF OF OTHER BROWNSTONE ELEMENTS. SEE DETAIL 1.6.17.P102.
5. AT STRIPPED BROWNSTONE FEATURES WHERE PATCHING IS NOT REQUIRED, REFOOL EXISTING SURFACE TO MATCH ADJACENT STONE. ASSUME 40 SF.
6. PROVIDE FACE CUTO-BMAN REPAIR USING CAST STONE AT STRING COURSES. SEE DETAIL 4R-302.
7. PREPARE AND REPORT 100% OF BROWNSTONE UNITS.

**BRICK MASONRY:**

1. CLEAN 100% OF BRICK MASONRY USING CHEMICAL CLEANERS.
2. PREPARE AND REPORT 100% OF BRICK MASONRY.
3. ASSUME REPLACEMENT OF THREE (3) BRICK UNITS USING NEW OR SALVAGED BRICK THAT MATCH THE CLEANED EXISTING BRICK IN COLOR AND TEXTURE.

**ALTERNATE SCOPE:**

1. PREPARE WOODWORK: PRIME AND DECORATIVELY PAINT PAULS GRAYS TO MATCH HISTORIC FINISHES IN LOCATION INDICATED ON DRAWING. CONTRACTOR TO REMOVE OVERPAINT TO EXPOSE ORIGINAL FINISHES FOR MATCHING.
2. AT COMPLETION OF WORK, PROVIDE COATING TO RESTORED BROWNSTONE TO MATCH ADJACENT COATED BROWNSTONE.

**GRAPHIC KEY**

- [Hatched Box] AREA OF PILOT PROJECT BASE SCOPE. HATCHED AREA INDICATES BROWNSTONE. UNHATCHED AREA INDICATES BRICK.
- [Dashed Box] AREA OF PILOT PROJECT ADDITIONAL ALTERNATE SCOPE.

REVISIONS		
NO.	DATE	DESCRIPTION
1	01/15/2019	100 % DESIGN DEVELOPMENT

R.C. VANDERKAM ARCHITECTS 216 Arch & Philadelphia, PA 19106 (215) 523-1008 Tel.	LANGRAN ENVIRONMENTAL 1818 Market St #300 Philadelphia, PA 19103 (215) 844-9900 Tel.	H.B. LORITING DESIGN 38 East 52nd Street, 11th Floor New York, NY 10018 (212) 674-0880 Tel.
BUREAU OF CONSERVATION ASSOC., INC. BUREAU OF CONSERVATION CONSULTANTS 242 Chestnut St. Philadelphia, PA 19106 (215) 625-2834 Tel.	FULL BRICKS ASSOC., INC. FULL BRICKS ASSOC. CONSULTANTS 5500 Walnut St., Suite 200 West Chester, PA 19382 (610) 730-0137 Tel.	
ADVERT AND PHOTO ARCHITECTS ARCHITECTS 403 Market St. #200 Philadelphia, PA 19106 (215) 625-0999 Tel.	WIRE JANNEY ELSTNER ASSOC., INC. 8 Scientists 801 Walnut Street, Suite 675W Philadelphia, PA 19106 (215) 957-0703 Tel.	

<b>ATKIN OLSHIN SCHADE ARCHITECTS</b> 100 SOUTH 11TH STREET, SUITE 100 PHILADELPHIA, PA 19107 TEL: 215.562.1390 FAX: 215.562.7622	<b>THE ACADEMY OF MUSIC</b> 246 S BROAD STREET PHILADELPHIA, PA 19102	<b>PHASE 1A- PILOT PROJECT</b>
PILOT AREA ELEVATIONS		
DATE: 07.17.2019 SCALE: 1/2" = 1'-0" DRAWN BY: MK	<b>A201</b>	

# Pilot Project



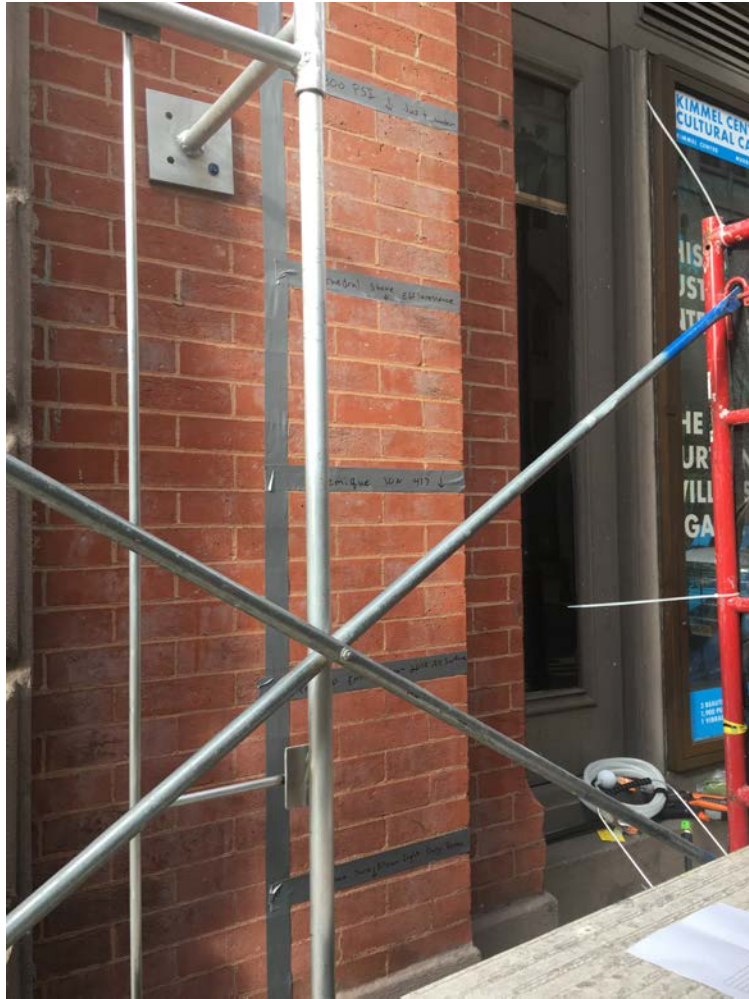


# Pilot Project



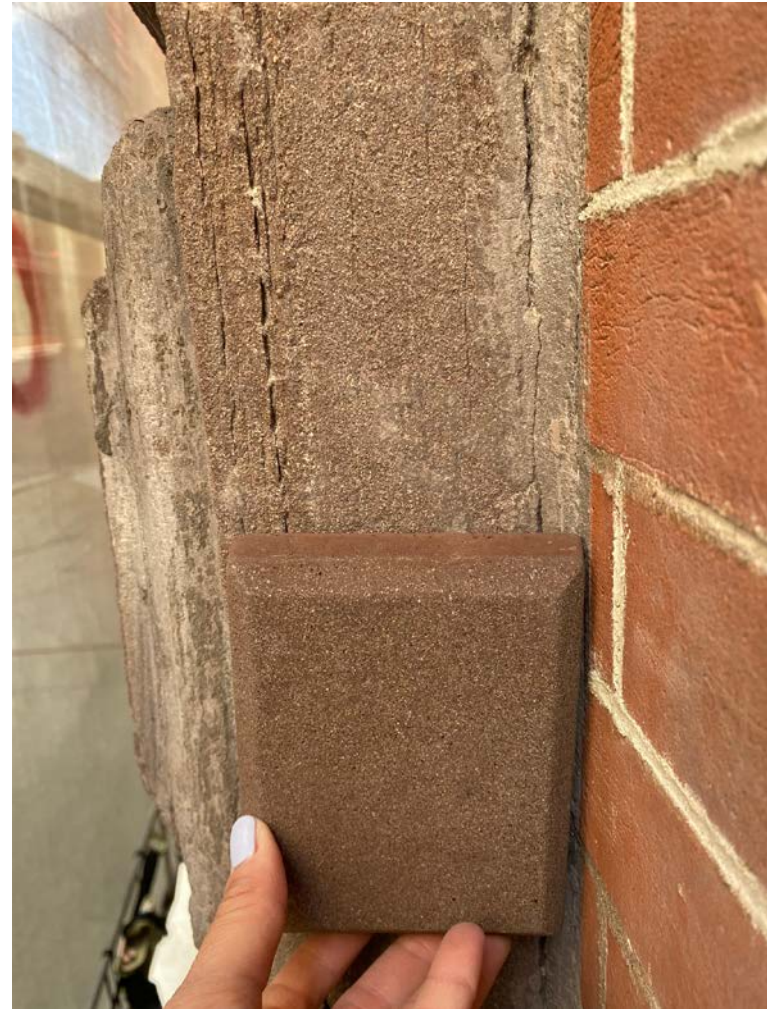


# Pilot Project





# Pilot Project



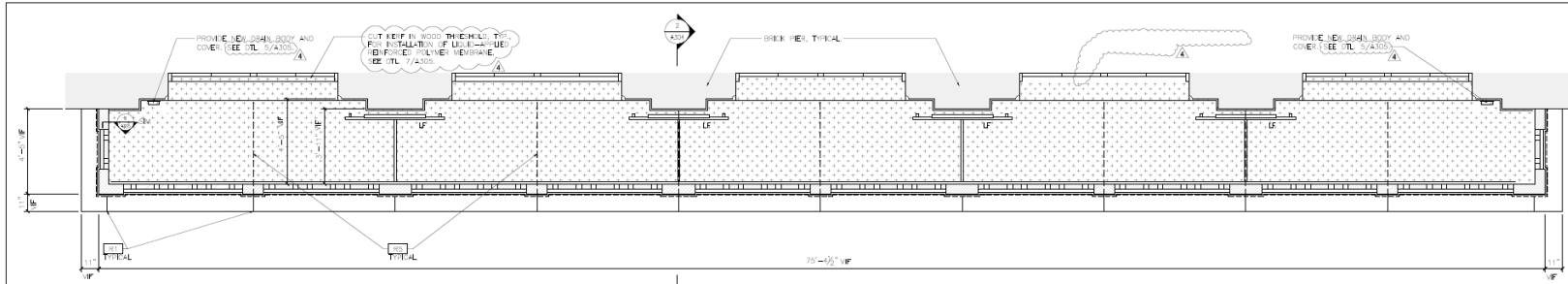


# Pilot Project

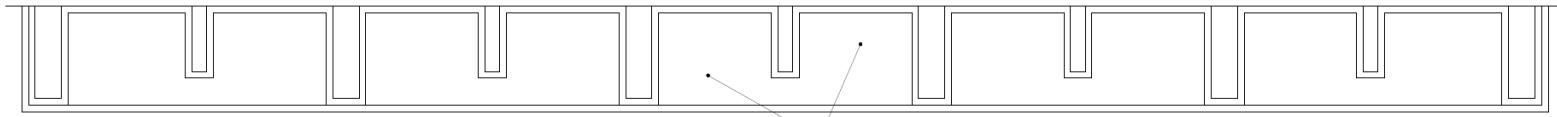


# BALCONY RESTORATION PROJECT

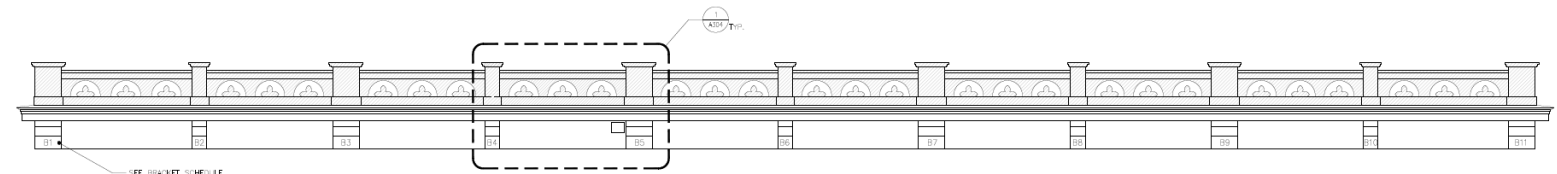
# Balcony Restoration Project



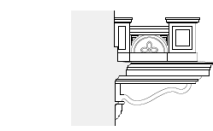
1 BROAD STREET BALCONY - PLAN  
SCALE: 3/8\"/>



2 BROAD STREET BALCONY - ELEVATED ELEVATION (ELEVATION OF BALCONY)  
SCALE: 3/8\"/>



3 BROAD STREET BALCONY - EAST ELEVATION  
SCALE: 3/8\"/>



4 BROAD STREET BALCONY - SOUTH ELEVATION  
SCALE: 3/8\"/>



5 BROAD STREET BALCONY - NORTH ELEVATION  
SCALE: 3/8\"/>

**SCOPE OF WORK**  
THE SCOPE OF MUSIC BALCONY RESTORATION PROJECT SCOPE INCLUDES WORK AT BOTH THE BROAD AND LOCUST STREET BROWNSTONE BALCONIES. THE AREA OF RESTORATION EXTENDS FROM THE TOP OF THE BALCONIES TO THE BOTTOMS OF THE BRACKETS BELOW THE BALCONY SLAB AND INCLUDES THE WORK THAT RUNS BETWEEN THE BRACKETS. SEE DET. 4 & 5/D-306.

- GENERAL NOTES**
- VIDEO SCOPE DRAIN LINE FROM BALCONY DRAINS TO INTERNAL DRAIN LINES. SEE NOTE "I" ON SHEET R-0 FOR REQUIREMENTS.
  - PREPARE AND REPAIR ALL JOINTS IN BROWNSTONE TO REMAIN.
  - PROVIDE FACE CUTOFFMAN REPAIRS AT JOINTS OF FREE MOLDING AND FLAT FREEZE USING CAST STONE TO MATCH ORIGINAL IN DIMENSIONS, PROFILE AND OVERALL APPEARANCE. SEE DET. 3/A304.
  - PROVIDE NEW CAST STONE BALUSTRADE TO MATCH ORIGINAL BALUSTRADE IN DIMENSIONS, PROFILE AND OVERALL APPEARANCE. SEE DET. 3/A304.
  - PROVIDE GALVANIZED STEEL BRACKET AND EXISTING BRICK WALL.
  - PROVIDE NEW LED-APPLIED REINFORCED POLYMER MEMBRANE (LAPPS) ROOFING SYSTEM AT BROAD STREET AND LOCUST STREET BALCONIES WITH INSULATED SURFACE. PREPARE SUBSTRATE AND PROVIDE COMMITTED TOPPING TO PROVIDE SMOOTH, UNIFORM FINISH SURFACE. SCOPE TO INCLUDE THE SATURATION OF LED-APPLIED REINFORCED POLYMER MEMBRANE MANUFACTURER. PROVIDE NEW DRAIN BODIES AND COVERS AND COPPER COUNTER FLASHING. SEE DET. 5/A305.
  - PROVIDE MINERAL STAIN TO MATCH ADJACENT STONE. ASSUME 300 SF TOTAL.
  - COORDINATE WORK WITH WORK INDICATED ON STRUCTURAL AND ELECTRICAL DRAWINGS.

- TREATMENT NOTES**
- PROVIDE NEW LEAD JOINT COVER AT JOINT IN BALCONY SLAB OUTBOARD OF BALUSTRADE. SEE DET. 4/A304.
  - PROVIDE PROFILED CUTOFFMAN REPAIR. SEE DET. 3/A304.
  - REMOVE DAMAGED AND DEGRADED BROWNSTONE AND ALSO PATCHING MATERIAL AT BRACKET TO SOUND STONE. REPAIR DEGRADATIVE BRACKETS WITH COMPOSITE PATCHING MORTAR TO MATCH ORIGINAL BRACKET. ASSUME 5,500 LB. IN. OF PATCHING FOR EACH BRACKET. SEE DET. 5 AND 6/A304.
  - PROVIDE NEW CAST STONE UNIT AT BRACKET. SEE STRUCTURAL DRAWINGS.
  - GROUT JOINTS IN BALCONY FLOOR SLAB.

**ALTERNATES**

ALTERNATE 1. IN LIEU OF USING CAST STONE FOR REPAIRS, PROVIDE NATURAL STONE TO MATCH ORIGINAL BROWNSTONE FOR REPAIRS.

ALTERNATE 2. IN LIEU OF USING CAST STONE FOR NEW BALUSTRADES, PROVIDE NATURAL STONE TO MATCH ORIGINAL BROWNSTONE FOR NEW BALUSTRADES.

ALTERNATE 3. IN LIEU OF PROVIDING SLOPE TO DRAIN USING CEMENTITIOUS MORTAR, PROVIDE INSULATION AND COVER BOARD TYPED AS NECESSARY TO ACHIEVE SLOPE TO DRAIN.

LOCATION	BRACKET NUMBER	BRACKET TYPE	APPROX. DIMENSIONS	TREATMENT
BROAD STREET	B1	A	1' 0" WIDE BY 4' 4" DEEP	R4 (SEE STRUCTURAL DWG#)
BROAD STREET	B2	B	1' 2" WIDE BY 3' 0" DEEP	R4 (SEE STRUCTURAL DWG#)
BROAD STREET	B3	A	1' 0" WIDE BY 4' 4" DEEP	R3
BROAD STREET	B4	A	1' 2" WIDE BY 3' 0" DEEP	R3
BROAD STREET	B5	A	1' 0" WIDE BY 4' 4" DEEP	R3
BROAD STREET	B6	B	1' 2" WIDE BY 3' 0" DEEP	R3
BROAD STREET	B7	A	1' 0" WIDE BY 4' 4" DEEP	R3
BROAD STREET	B8	B	1' 2" WIDE BY 3' 0" DEEP	R3
BROAD STREET	B9	A	1' 0" WIDE BY 4' 4" DEEP	R3
BROAD STREET	B10	B	1' 2" WIDE BY 3' 0" DEEP	R3
BROAD STREET	B11	A	1' 0" WIDE BY 4' 4" DEEP	R3

- KEY**
- EXISTING BUILDING I.C.
  - NEW CAST STONE BALUSTRADE. SEE GENERAL NOTE.
  - NEW LED-APPLIED REINFORCED POLYMER MEMBRANE (LAPPS). SEE GENERAL NOTE.
  - EXISTING LIGHT FIXTURE

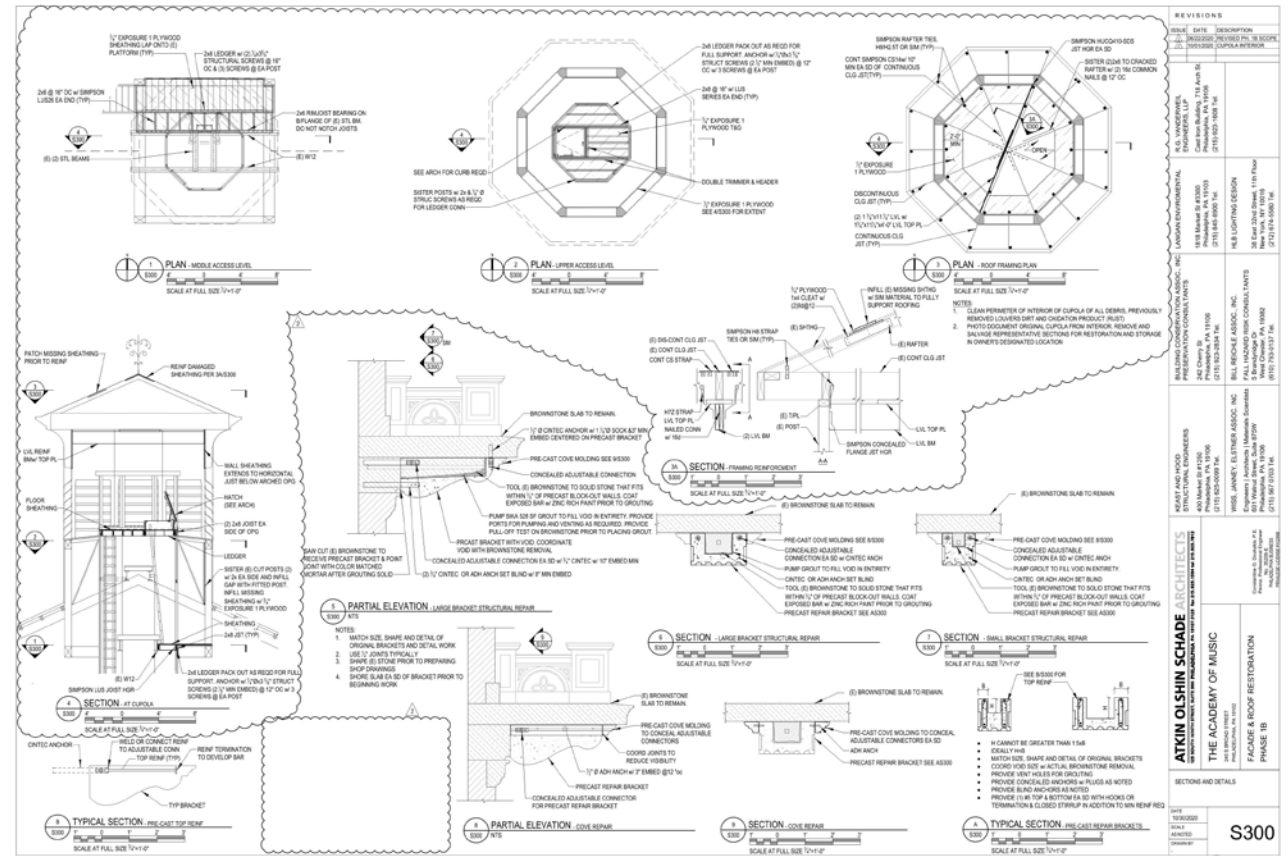
NOTE: VERIFY ALL DIMENSIONS IN FIELD.

REVISIONS		
ISSUE	DATE	DESCRIPTION
4	04/21/2021	CORRECTIONS
3	03/08/2021	CAST STONE & DETAILS

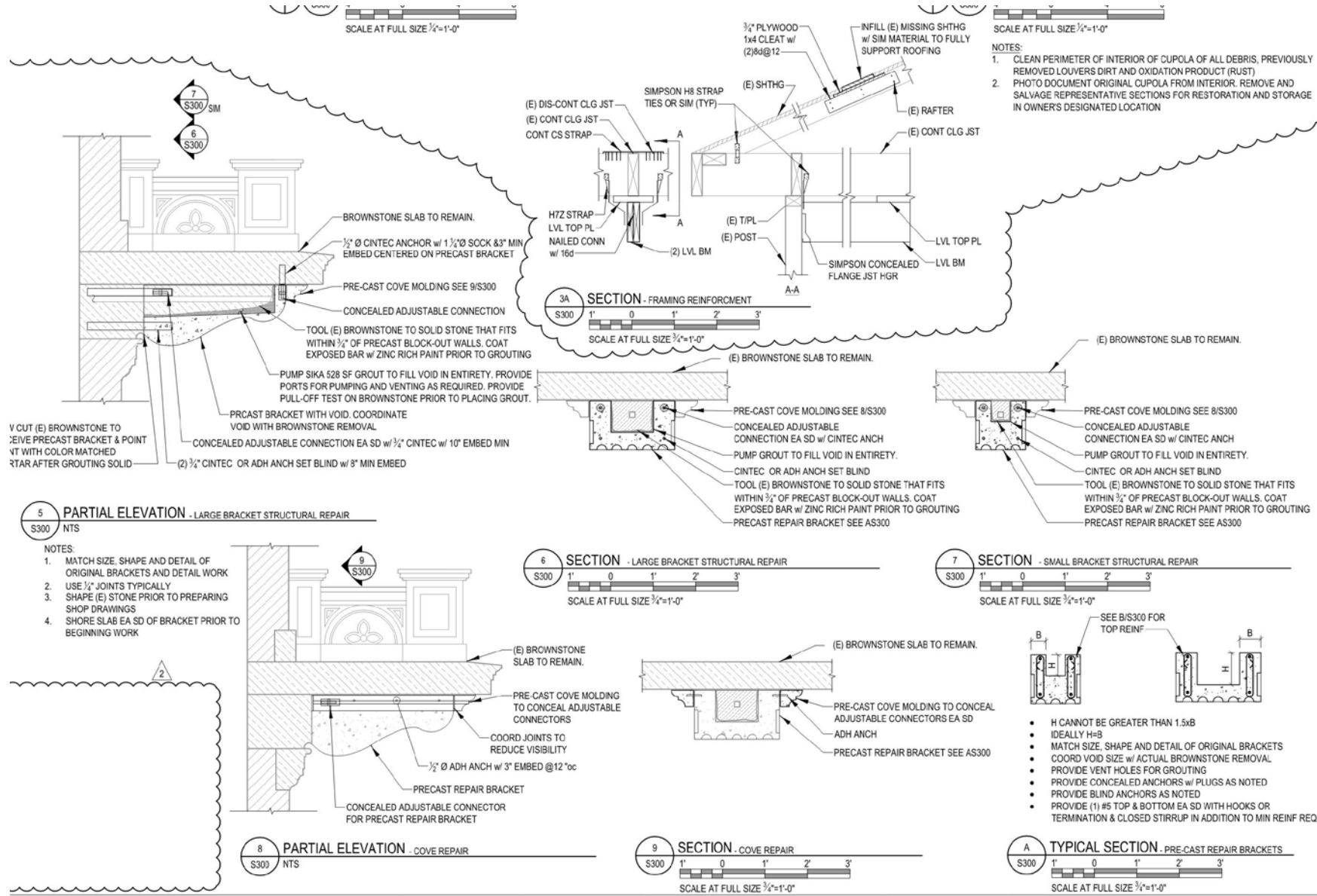
<p>R.G. VANDERBILT ENGINEERS, LLP Cast Iron Building, 716 Arch St Philadelphia, PA 19106 (215) 623-1688 Tel.</p>	<p>LANGAN ENVIRONMENTAL 1818 Market St #4300 Philadelphia, PA 19103 (215) 845-8900 Tel.</p>	<p>NLB LIGHTING DESIGN 38 East 52nd Street, 11th Floor New York, NY 10016 (212) 674-5580 Tel.</p>
<p>BUILDING CONSERVATION ASSOC. INC. PRESERVATION CONSULTANTS 242 Cherry St Philadelphia, PA 19106 (215) 625-2834 Tel.</p>	<p>BILL REICHEL ASSOC. INC. FALL LIGHTING DESIGN CONSULTANTS E. Brandywine Cr. West Chester, PA 19382 (610) 793-0137 Tel.</p>	<p>HEAST AND WOOD STRUCTURAL ENGINEERS 400 Market St #1250 Philadelphia, PA 19106 (215) 625-0090 Tel.</p>
<p><b>ATKIN OLSHIN SCHADE ARCHITECTS</b> 125 SOUTH WINTHROP STREET, SUITE 800 PHILADELPHIA, PA 19102-3225 TEL: 215.528.1500 FAX: 215.528.1672</p>		
<p><b>THE ACADEMY OF MUSIC</b> 240 BROAD STREET PHILADELPHIA, PA 19102</p>		
<p><b>BALCONIES &amp; LIGHTING RESTORATION PHASE 1C</b></p>		
<p>BROAD STREET BALCONY PLAN &amp; ELEVATION</p>		
<p>DATE: 12/23/2020 TITLE: 100'-1'-0"</p>	<p><b>A302</b></p>	
<p>DESIGNED BY: BRUNO</p>		



# Restoration Project- Balcony



# Restoration Project- Balcony



BUILDING CONSERVATION ASSO PRESERVATION CONSULTANTS 242 Cherry St Philadelphia, PA 19106 (215) 923-2634 Tel.	BILL REICHEL ASSOC., INC. FALL HAZARD RISK CONSULTANT 5 Brandywine Dr West Chester, PA 19382 (610) 793-0137 Tel.
KEAST AND HOOD STRUCTURAL ENGINEERS 400 Market St #1250 Philadelphia, PA 19106 (215) 625-0099 Tel.	WISS, JANNEY, ELSNER ASSOC. INC Engineers   Architects   Materials Scientists 601 Walnut Street, Suite 875W Philadelphia, PA 19106 (215) 567-0703 Tel.
<b>ATKIN OLSHIN SCHADE ARCHITECTS</b> 129 SOUTH NINTH STREET, SUITE 900 PHILADELPHIA PA 19107-5125 FAX 215 625-1594 TEL 215 625-7812	
<b>THE ACADEMY OF MUSIC</b> 240 S BROAD STREET PHILADELPHIA, PA 19102 <b>FAÇADE &amp; ROOF RESTORATION</b> PHASE 1B	
SECTIONS AND DETAILS DATE 10/30/2020 SCALE AS NOTED DRAWN BY <b>S300</b> (C) 2019 KEAST & HOOD	

# Restoration Project- Balcony





# Balcony Restoration Project



## Restoration Project- Balcony





# Restoration Project- Balcony





## Restoration Project- Balcony



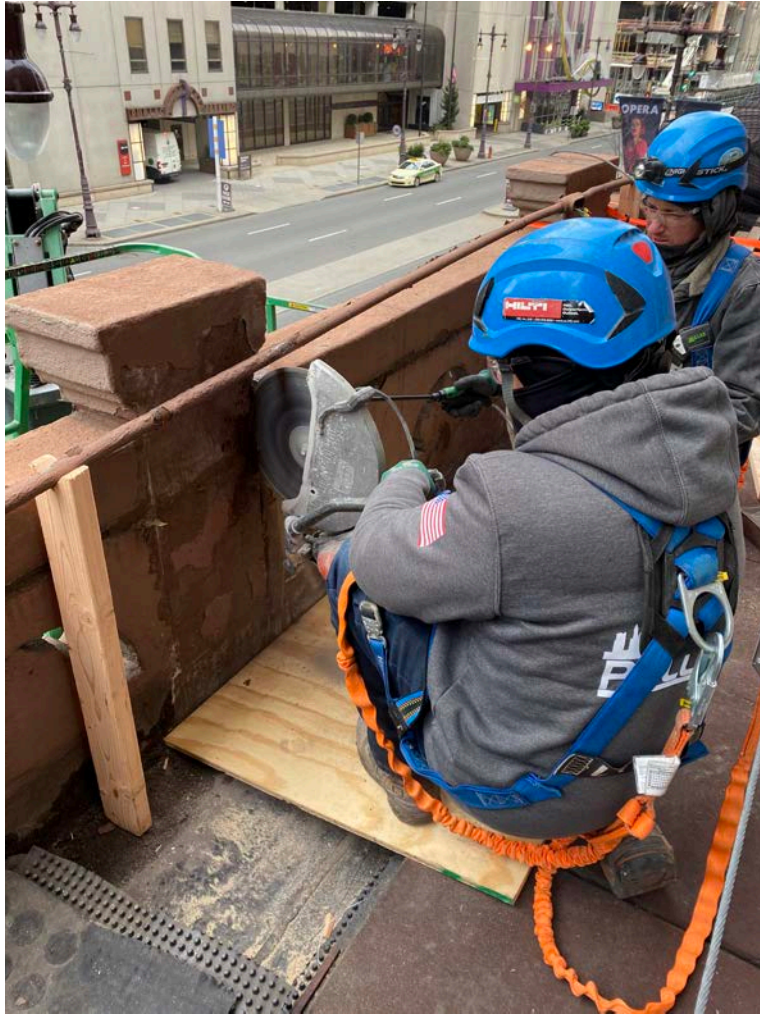


# Balcony Restoration Project



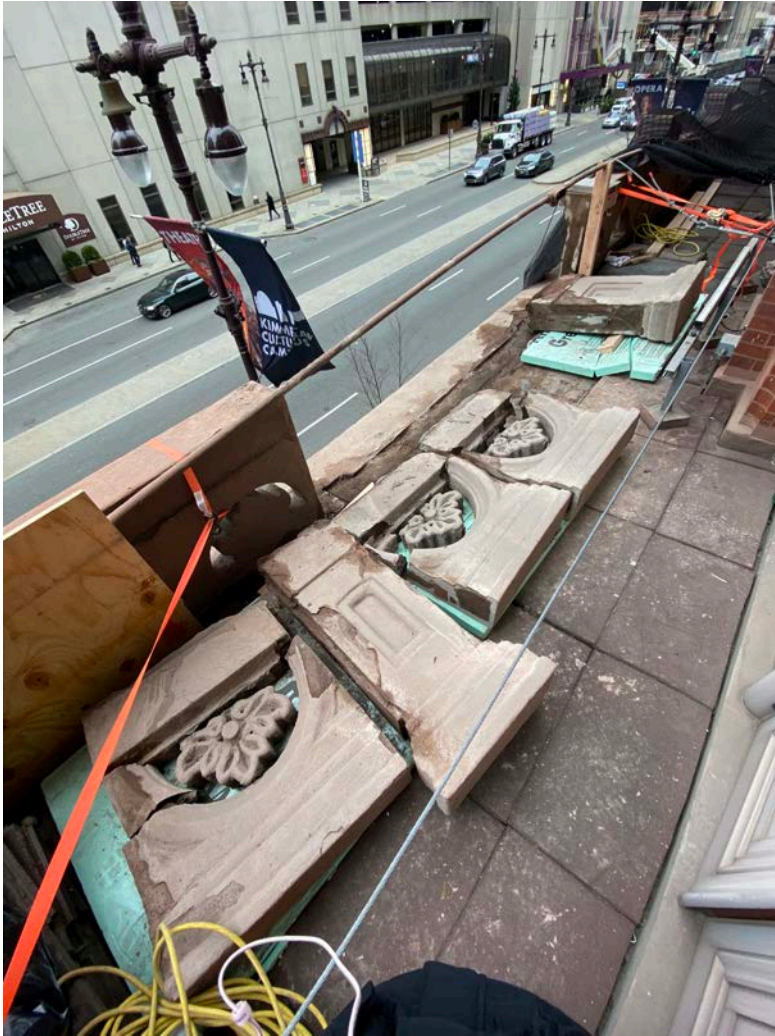


# Balcony Restoration Project





# Balcony Restoration Project





# Balcony Restoration Project



# STRUCTURAL IMPLICATIONS



# Restoration Project- Balcony



# Restoration Project- Balcony





## Restoration Project- Balcony





## Restoration Project- Balcony





## Restoration Project- Balcony

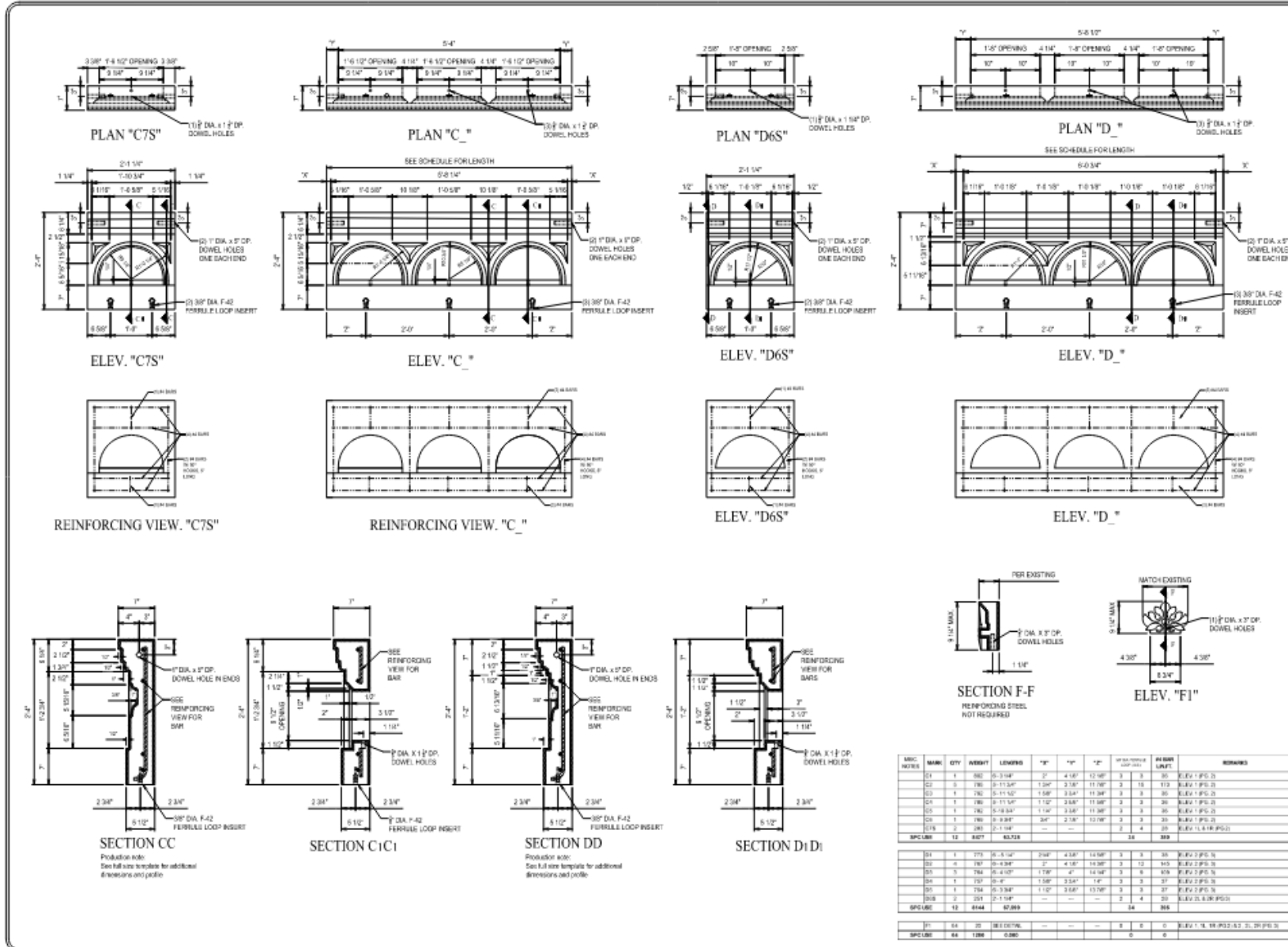






# SHOP DRAWINGS

# Restoration Project- Balcony



4591 BEGE ROAD  
SCHWEPSPRING, PA 17812  
PHONE: (717) 658-8000  
FAX: (717) 658-8008  
EMAIL: [info@sunprecast.com](mailto:info@sunprecast.com)  
[www.sunprecast.com](http://www.sunprecast.com)



ENGINEER'S SEAL/STAMP WHEN REQUIRED

A/E APPROVAL STAMP

Rev. Date: M/A App'd. Date: Dwp. App'd. Issue: Fabricator:

PROJECT: ACADEMY of MUSIC BALCONIES

SWEDESBORO, NJ

CONTRACTOR: PULLMAN SST, INC.

SWEDESBORO, NJ

PROJECT NO: 2702

PAK FILE: DETAILS C, D, & F

REV	DATE	BY	CHKD	APP'D	REASON
01					
02					
03					
04					
05					
06					
07					
08					
09					
10					
11					
12					

MISC. NOTES	MARK	QTY	WEIGHT	LENGTH	"#"	"#"	"#"	NO. OF HOLES	NO. OF HOLES	REMARKS
	01	1	180	9-3.144"	2"	4.167	12.000	3	3	REIN. 1 PIG. 2
	02	3	180	9-11.544"	1.504"	3.167	11.700	3	18	REIN. 1 PIG. 2
	03	1	180	9-11.142"	1.504"	3.047	11.300	3	3	REIN. 1 PIG. 2
	04	1	180	9-11.142"	1.127"	2.847	11.300	3	3	REIN. 1 PIG. 2
	05	1	180	9-18.844"	1.144"	3.047	11.300	3	3	REIN. 1 PIG. 2
	06	1	180	9-2.897"	2.087"	1.070"	11.700	3	3	REIN. 1 PIG. 2
	07	2	288	2-1.144"	---	---	2.4	2	4	REIN. 1.1/4" PIG. 2
	SPEL08				12	8144	87.889	---	24	309
	01	1	175	9-4.142"	2.087"	4.267	14.500	3	3	REIN. 2 PIG. 2
	02	4	180	9-3.144"	2"	4.167	14.500	3	12	REIN. 2 PIG. 2
	03	3	180	9-4.142"	1.700"	4"	14.500	3	9	REIN. 2 PIG. 2
	04	1	180	9-11.142"	1.504"	3.167	14"	3	3	REIN. 2 PIG. 2
	05	1	180	9-3.144"	1.127"	2.847	13.700	3	3	REIN. 2 PIG. 2
	06	2	288	2-1.144"	---	---	2.4	2	4	REIN. 2.1/4" PIG. 2
	SPEL08				12	8144	87.889	---	24	309
	01	64	20	081.00766	---	---	---	8	0	REIN. 1.1/4" 18.0022.63.21.20 PIG. 2
	SPEL08				64	1288	0.880	---	0	0

D2

DATE: 6/21/2017



# Restoration Project- Balcony

**PRK ENGINEERING, Inc.**  
CONSULTING ENGINEERS  
5502 NW 51st Ave.  
Tamarac, FL 33319  
(404) 474-4871

BY P.Khouri DATE 30 June 2021  
CHKD \_\_\_\_\_ DATE 01 July 2021  
SUBJECT The Academy of Music, Balconies Rehabilitation, Philadelphia, PA  
Cast Stone Panels Anchorage Evaluation

SHEET C-11 OF \_\_\_\_\_  
JOB NO. 21045  
Sun Precast Company  
Beaver Springs, PA

## Check TR-1: Cast Stone Rail Support Anchor Ref. Details 1B, 1C, 1G & 1H / Dwg. C1

Pier Panel Dimensions:  
Stone Thickness  $t_p := 4.75in$   
Max. Length  $L_p := 6.375ft$  Max.  
High of Rail  $H_p := 28in$

Panels Loads  
 $W_{s1} := 802lb/ft$  Per SUN Precast  
 $W_{w1} := L_p H_p Ww$   $W_{w1} = 462.6-lbf$   
 $W_{e1} := W_{s1} F_p$   $W_{e1} = 128.3-lbf$

Hand Rail Loads Per Code At Any point of Rail:  
 $P_r := 200lb/ft$  or  $P_{rw} := 50plf$

Distance to Panel Loads  
To CL Rail  $y_1 := \frac{1}{2}(H_p) = 14-in$

Distance to Vertical Load:  $d_r := 2.75in$

Acting Overturning Moment @ Base:

Due to Wind Load:  
 $M_{Ow} := Ww y_1 = 539.7-lbf-ft$

Due to Seismic Load:  
 $M_{Oe} := We y_1 = 149.7-lbf-ft$

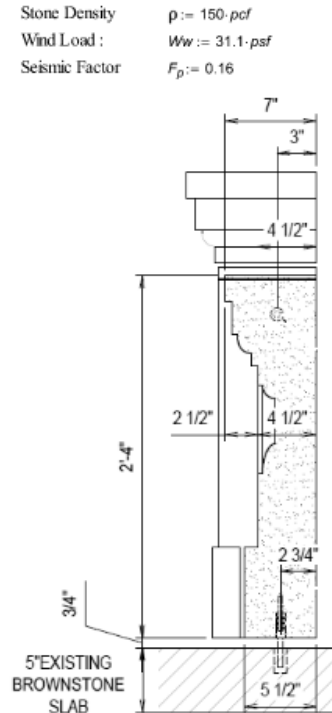
Due to Hand Rail Live Load:  
 $M_{Or} := P_{rw} L_p (H_p - 2in) = 690.6-lbf-ft$  < Control

Resisting Moment @ Base due to Weight of Panels:

Due to Weight of Panels:  $M_r := (W_{s1}) \cdot d_r$   $M_r = 183.8-lbf-ft$

Overturning Factor of Safety:

$$SF := \frac{M_r}{M_{Or}} \quad SF = 0.3 < 2.0 \quad \text{Connection Is Req'd. for Overturning}$$



**PRK ENGINEERING, Inc.**  
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(404) 474-4871

BY P.Khouri DATE 30 June 2021  
CHKD \_\_\_\_\_ DATE 01 July 2021  
SUBJECT The Academy of Music, Balconies Rehabilitation, Philadelphia, PA  
Cast Stone Panels Anchorage Evaluation

SHEET C-12 OF \_\_\_\_\_  
JOB NO. 21045  
Sun Precast Company  
Beaver Springs, PA

## Continuation of Anchor Type "TR-1"

Connection Analysis @ Cast Stone Panel

$$T_r := \frac{M_{Or} - 0.85 \cdot M_r}{d_r} \quad T_r = 2332-lbf \quad V_r := P_{rw} \cdot L_p \quad V_r = 319-lbf$$

For (3) 3/8"  $\phi$  x 2 3/4" Height Type F-42 Loop Ferrule Insert into 3,000.psi Concrete, @ 4" Edge Distance. Safe Working Load Factor of 3 to 1. Refer to Per Dayton Superior Data Sheet, @ <https://www.daytonsuperior.com/>

Assumed Adjustment Factor due to 4" Edge Dist. Vs 5" Req'd.  $F_{ne} := \frac{4.0}{5} = 0.8$   $F_{ve} := 0.50$

$$T_{all} := 3 \cdot (2000lb/ft) \cdot F_{ne} = 4800-lbf > T_r @ \quad T_r = 2332-lbf$$

$$V_{all} := 3 \cdot (1280-lbf) \cdot F_{ve} = 1920-lbf > V_r @ \quad V_r = 319-lbf$$

$$\text{At Combined Loading: } \left( \frac{T_r}{T_{all}} \right) + \left( \frac{V_r}{V_{all}} \right) = 0.65 < 1.0$$

Connection Analysis @ Brownstone Slab

For (3) 3/8"  $\phi$  Steel Thd. Rod installed using "Hilti" HIT-HY 270 Adhesive Anchorage Systems at Min. 3 3/8" Embedment Using Published Values for Grout Filled Concrete Masonry Walls. Allowable Adhesive Bond Loads Per Table 1 & 2. Refer to Hilti North American Product Tech Guide Edition 19, Load Tables and Specific Installation Requirements, as published by Hilti, Inc. @ [www.us.hilti.com](http://www.us.hilti.com). Allowable Loads Calculated Using a Safety Factor of 5.

Adjustment Factor due to 4" Edge Dist. Per Table 1 & 2.  $F_{ne} := 0.8$   $F_{ve} := 0.88$

$$T_{all} := 3 \cdot (1240lb/ft) \cdot F_{ne} = 2976-lbf > T_r @ \quad T_r = 2332-lbf$$

$$V_{all} := 3 \cdot (850-lbf) \cdot F_{ve} = 2244-lbf > V_r @ \quad V_r = 319-lbf$$

$$\text{At Combined Loading: } \left( \frac{T_r}{T_{all}} \right) + \left( \frac{V_r}{V_{all}} \right) = 0.93 < 1.0$$

Anchor Type "TR-1"

Select: 3/8"  $\phi$  x 5 1/4" Long S.S. Threaded Rod  
[ASTM A276, Type 304 @ Min. Fy = 75000-psi]  
Attached to Cast Stone Panel W/ 3/8"  $\phi$  x 2 3/4" Height F-42 Loop Ferrule Insert to & Existing Brownstone Slab @ 3 3/8" Min. Embedment, Using Hilti HIT-HY 270 Adhesive. Installed per Adhesive Manufacturer Recommendations.

Use (2) TR-1 Per Rail Panel Up to 2'-6" Long  
Use (3) TR-1 Per Rail Panel Up to 6'-6" Long











# ANCHOR TESTING



# Balcony Restoration Project





# Balcony Restoration Project

CMT

Hydraulic Jack Calibration Chart



Hydraulic Jack Calibration Date: 11/15/2022  
Calibrating machine: Forney QC-0410-D  
Calibration date: 10/6/2022

Jack: Enerpac P391  
Ram: Enerpac B4608C

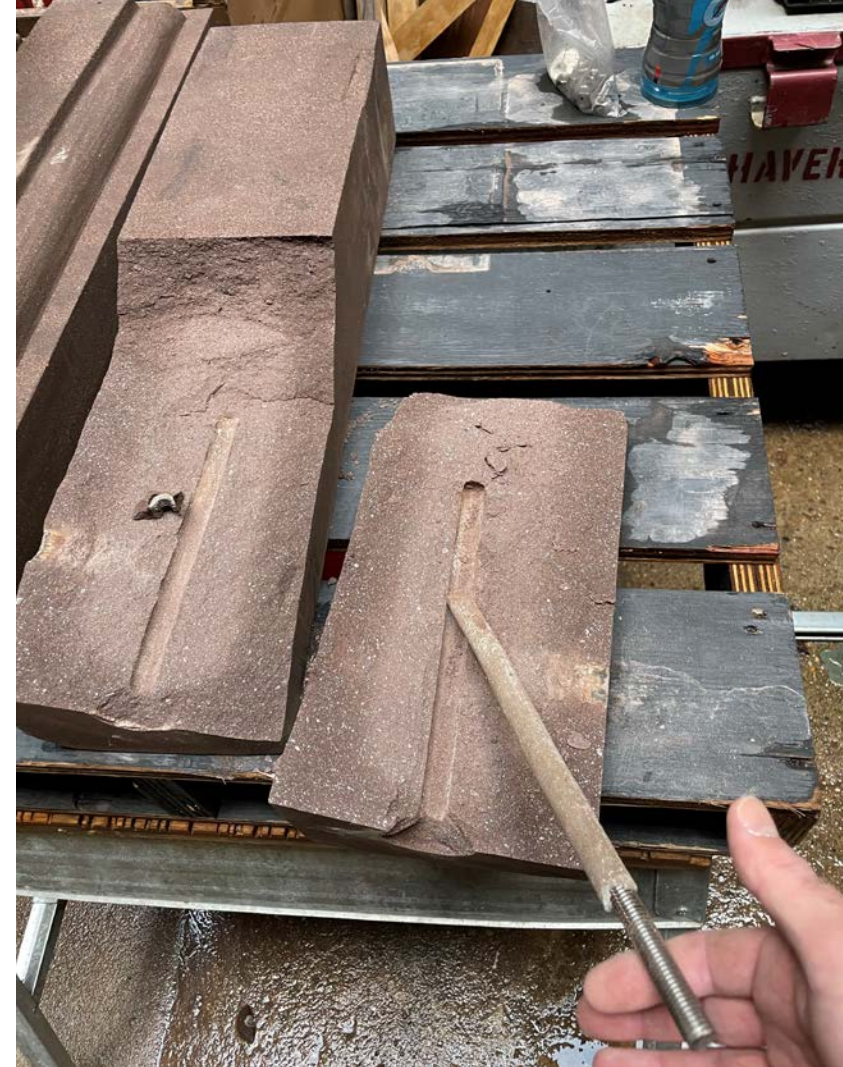
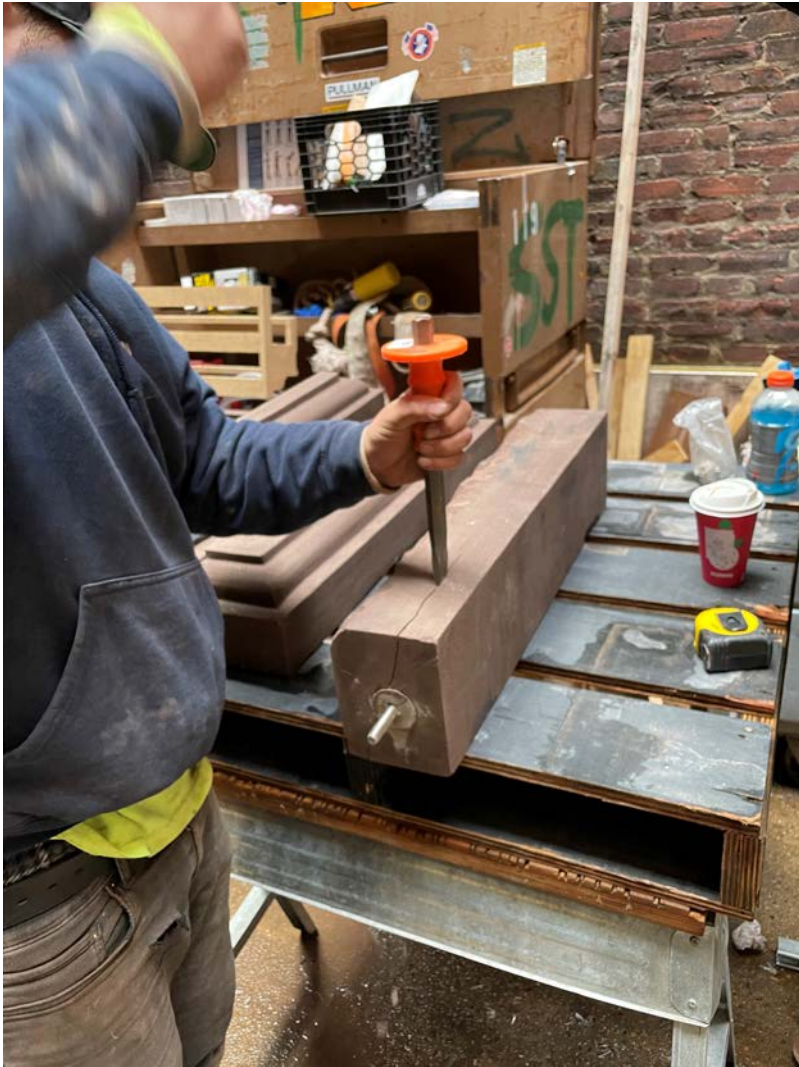
2800

Filed at 9000 lbs.





# Balcony Restoration Project





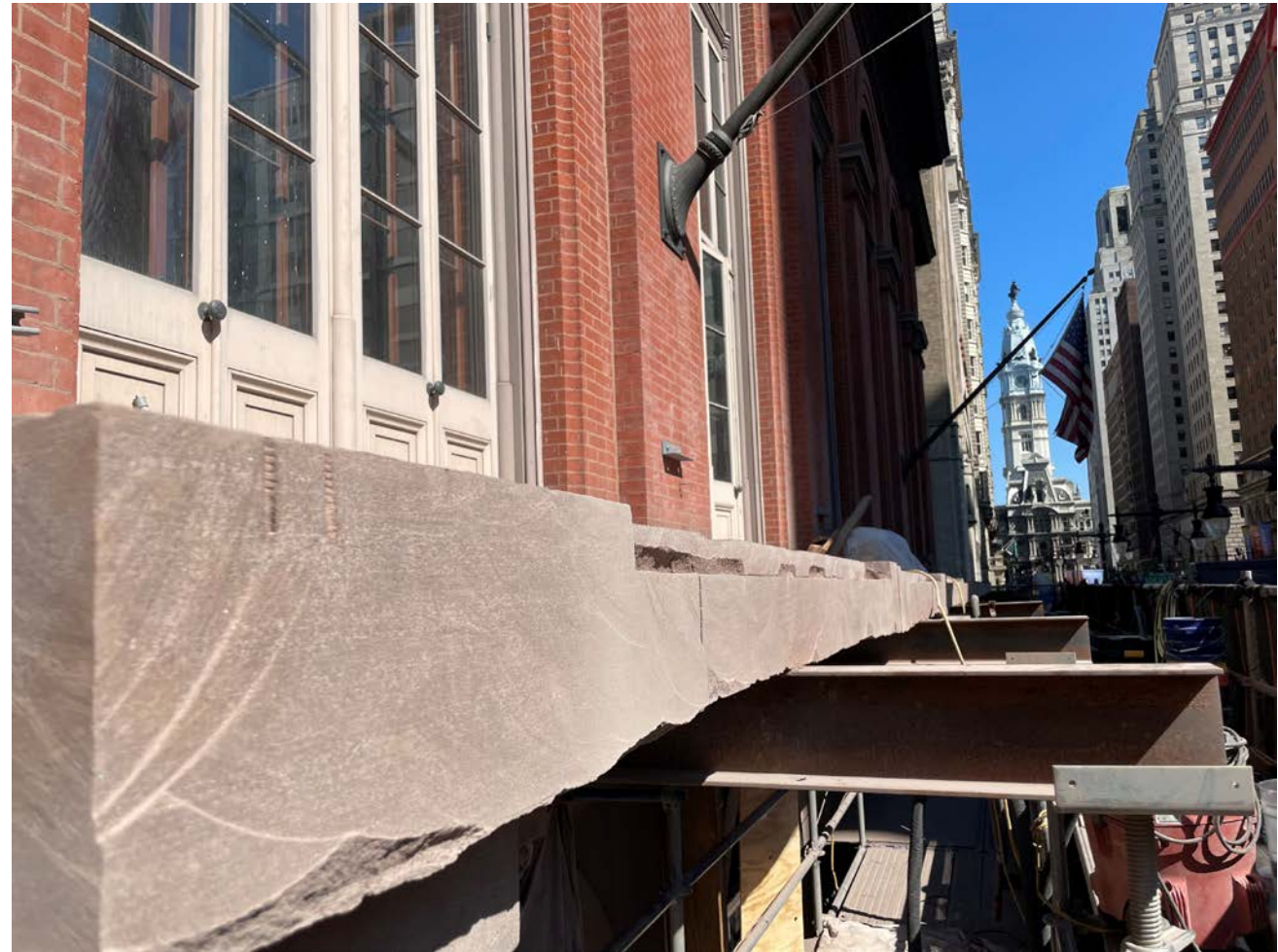
# REPAIR WORK

# Balcony Restoration Project





# Balcony Restoration Project





# Balcony Restoration Project





# Balcony Restoration Project





# Balcony Restoration Project

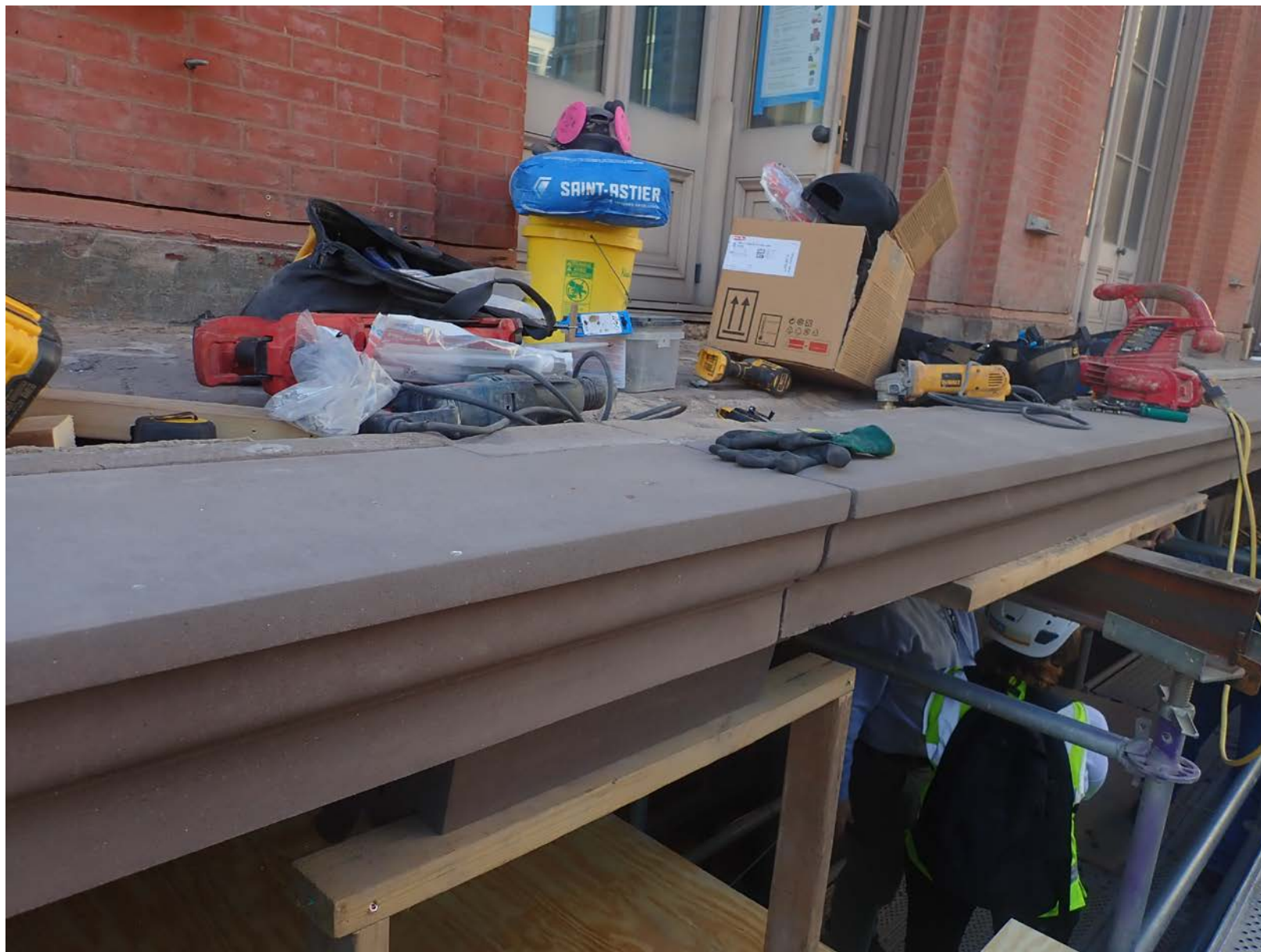




# Balcony Restoration Project

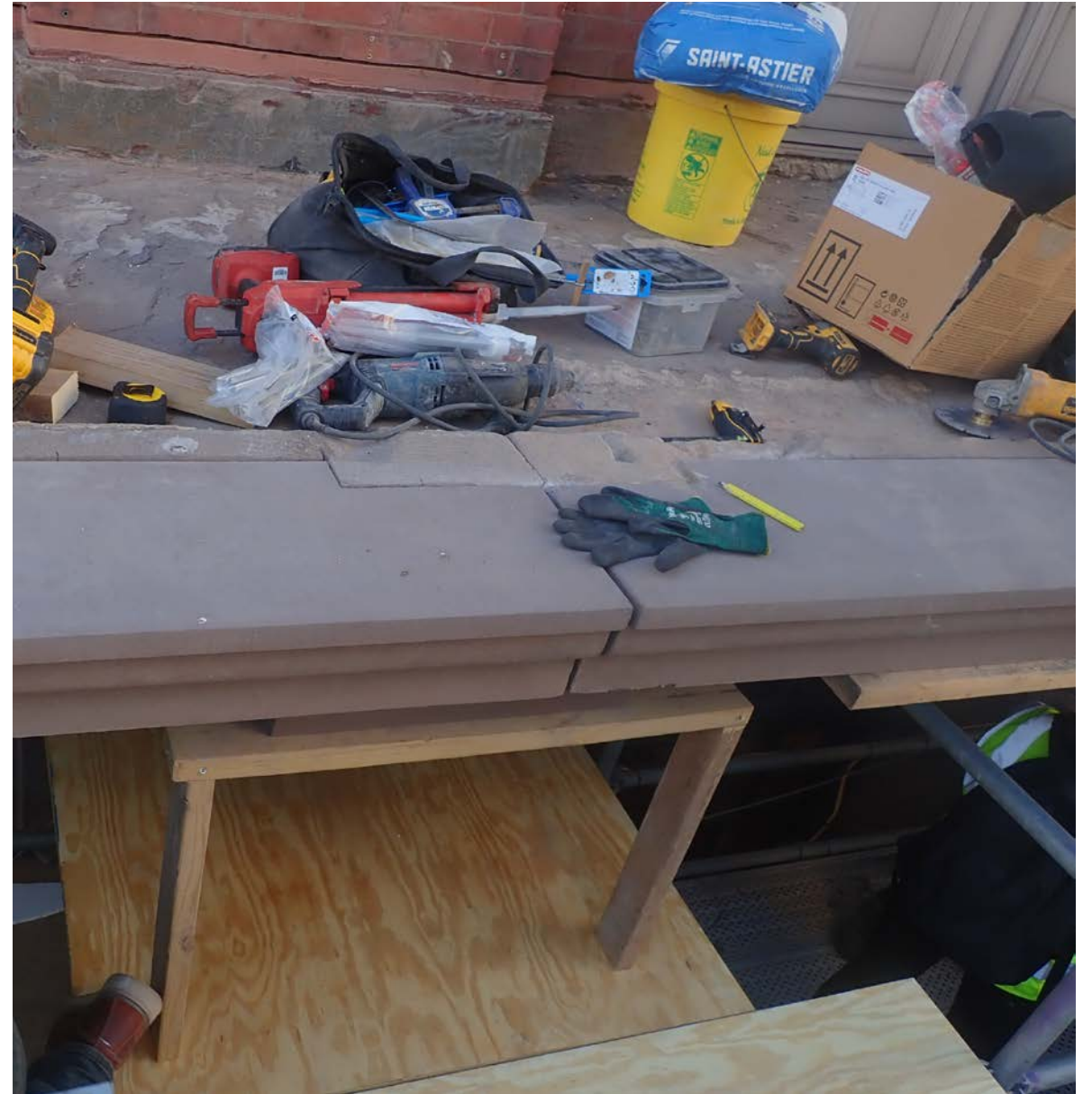


# Balcony Restoration Project





# Balcony Restoration Project





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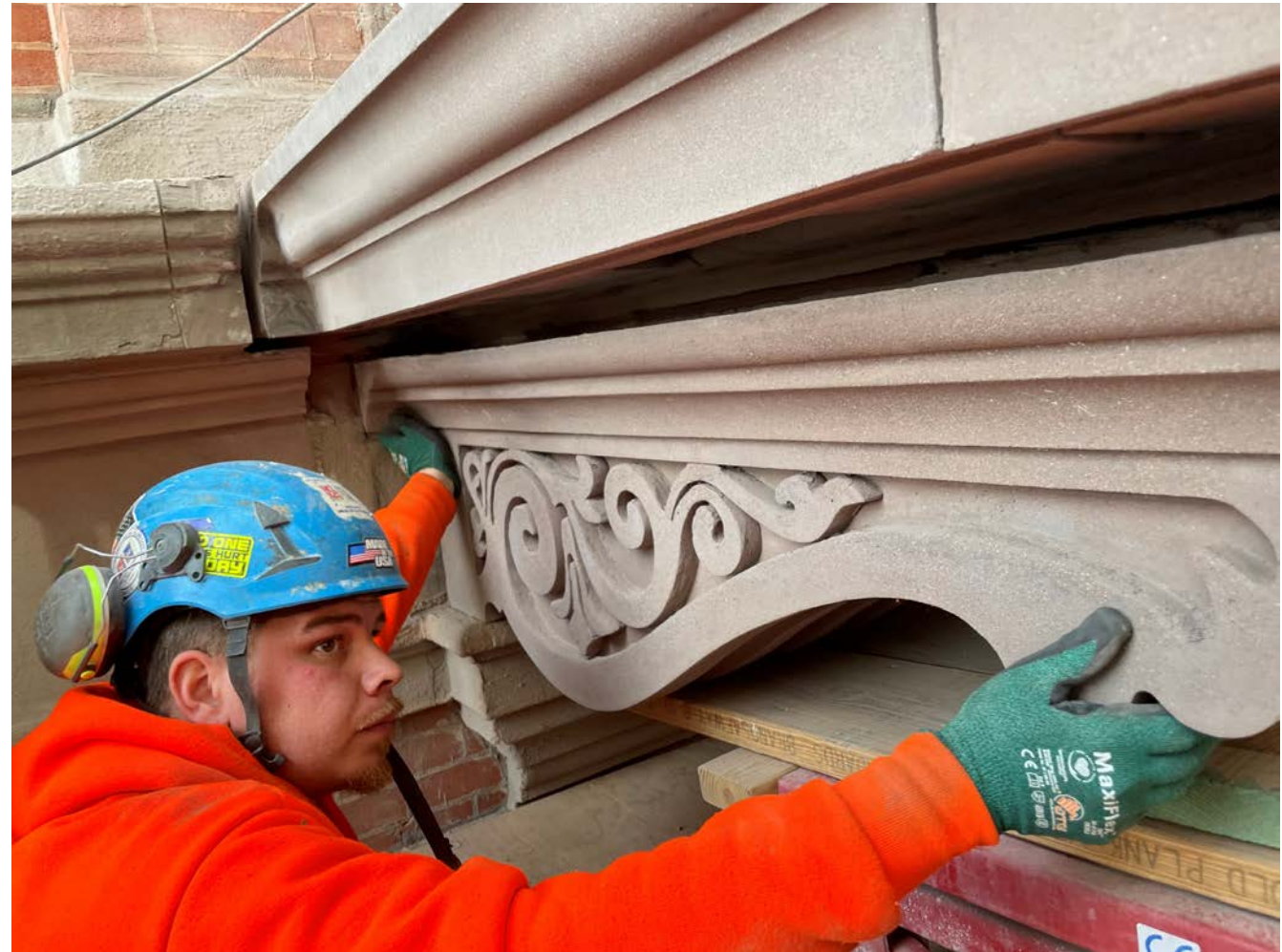


# Balcony Restoration Project





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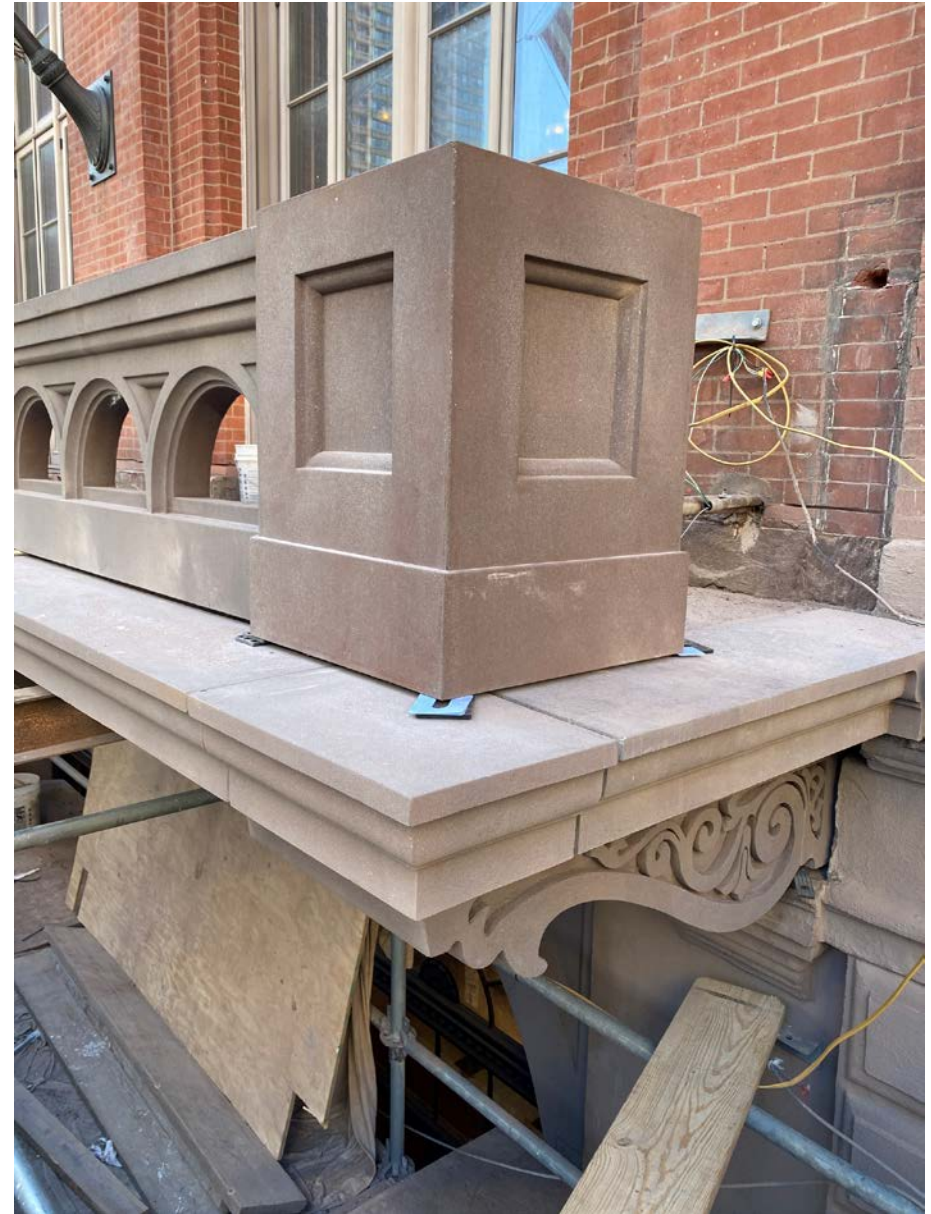
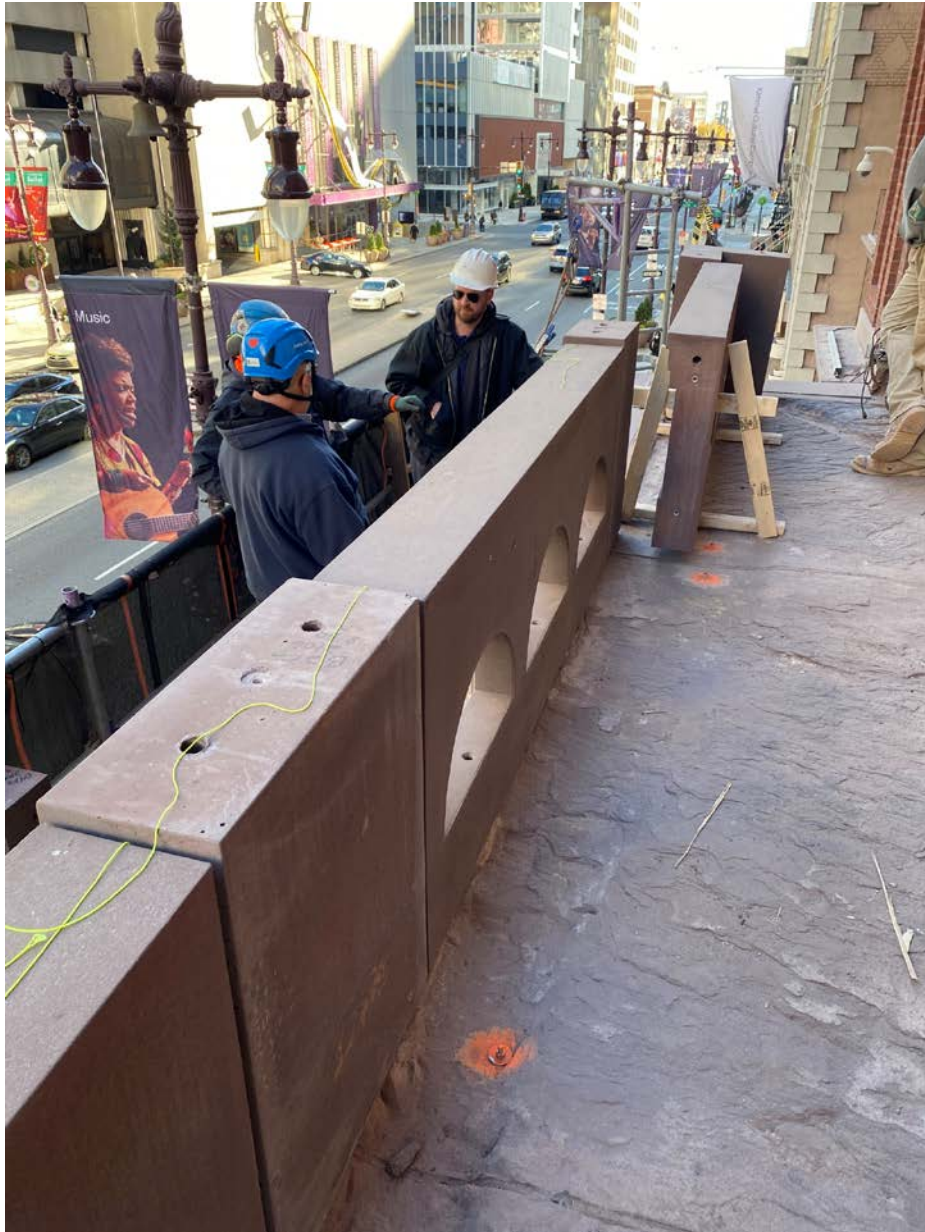


# Balcony Restoration Project





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# Balcony Restoration Project





# Balcony Restoration Project



# FUTURE PHASES









# Restoration Project- Future Phases



# Questions?

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