The Rehabilitation of Brooklyn Bridge - Approach Arches, Towers, Ramp Substructures, and Miscellaneous Repairs

New York City Department of Transportation - Division of Bridges

New York City Landmarks Preservation Commission Review

Contract No. BRC270D

June 29, 2018

Brooklyn Bridge

Reference Number: 66000523
Resource Type: Structure
Certification Date: 10/15/1966

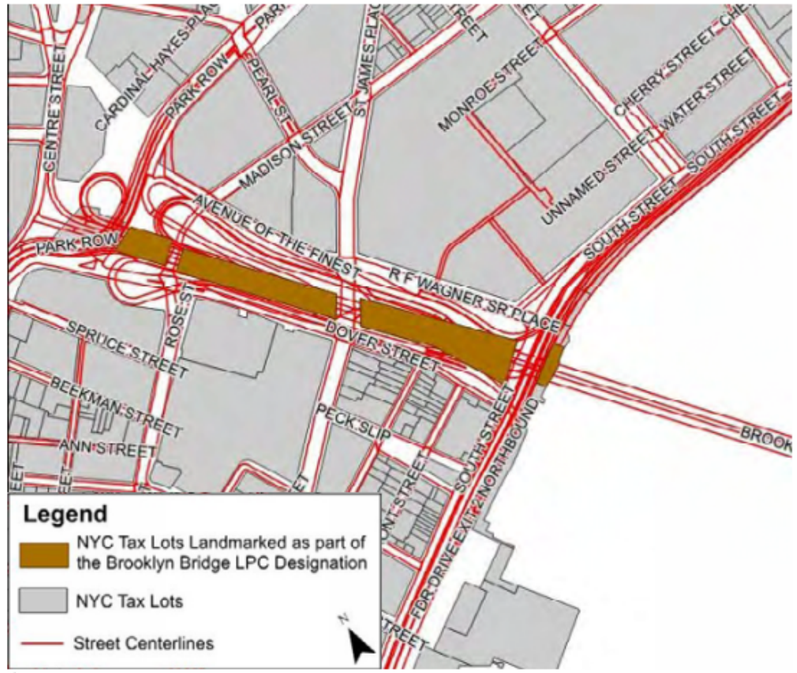
National Register

1 - Historic Arch Block B

BPS_01107-1907

"One of the other striking features of the Bridge is to be found in the design of the masonry land approaches where a series of Italian Renaissance Arches carry the roadway above. Their superior voussoirs and rusticated walls lend an air of gloomy grandeur to the structure, rarely noticed. They were filled in with brick and contain warehouses. The windows in these arches seem only to increase the colossal size of the arches."

-Landmarks Preservation Commission
August 24th, 1967, Number 1, LP-0098



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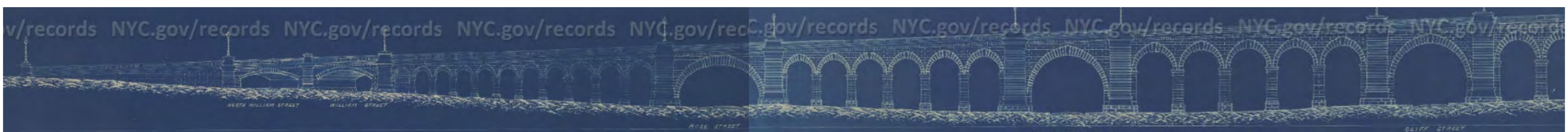


2 - Compiled Blueprint Elevation

BB_4118-1-BB_4118-2-1867-1883

Manhattan

Manhattan Approach: Exterior Approach Arches, Interior Floors, Electrical, Ventilation, Interior Transverse Walls, and Foundations (Arch Blocks A-E)

Towers & Bridge Spans: Reinforce Granite Arches, Repoint Masonry, Replace Modular Roadway Joints

Brooklyn Approach: Exterior Approach Arches, Drainage Improvements, Interior Walls and Floors.(Arch Blocks I-III)

Brooklyn

General Scope of Work - Manhattan Approach

1 - Manhattan Approach Arches

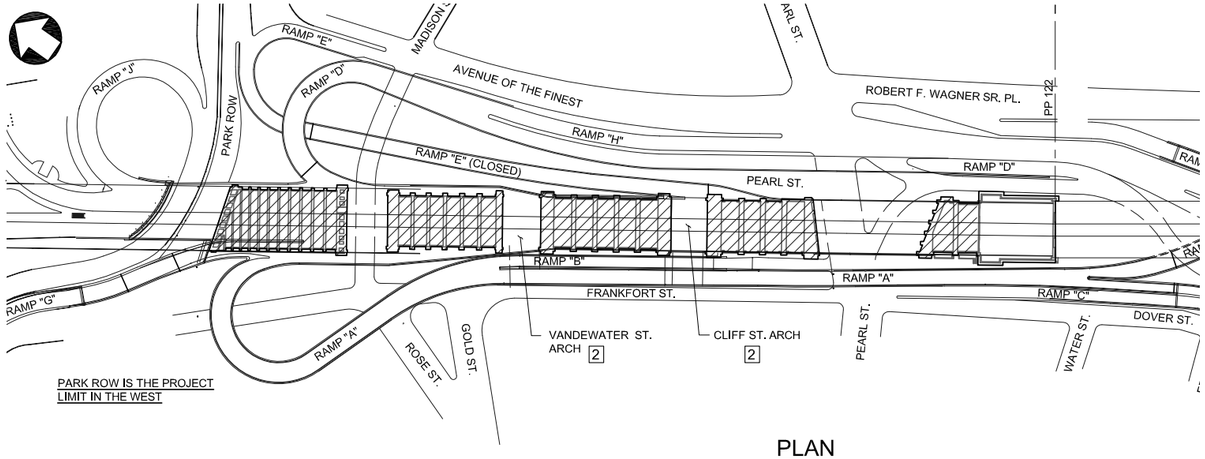
A - Remove existing brick infll walls in Arch Blocks A through D
B - Construct new reinforced concrete infll walls with bricks at the outside face in Arch Blocks A through D
C- Construct new reinforced concrete walls behind existing brick infll walls, connect new walls with existing walls in Arch Block E
D - Drainage improvements
E - Sidewalk restoration and grading

2 - Masonry cleaning and Repointing

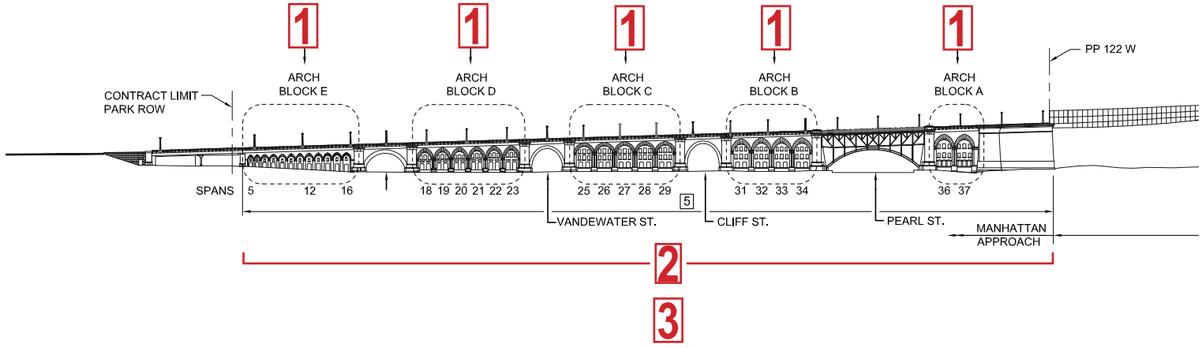
A - Clean and repoint all masonry exteriors inclusive of Arch Block E to the Manhattan Anchorage

3 - HAER Documentation

A - Salvage, store, or potentially donate any items that cannot be reinstalled on the arch block facade
B - The Contractor shall remove the existing shutters and hardware at the existing Manhattan Arch Block infll walls. While the locations and quantity of the existing shutter material to be salvaged are indicated on the Contract Drawing, the exact quantity may vary slightly from that shown.
C - Photographic Documentation Level II - Complete exterior or Arch Blocks A, B, C, D and E



PLAN



Arch Block A

Arch Block B

Arch Block C

Arch Block D

Arch Block E

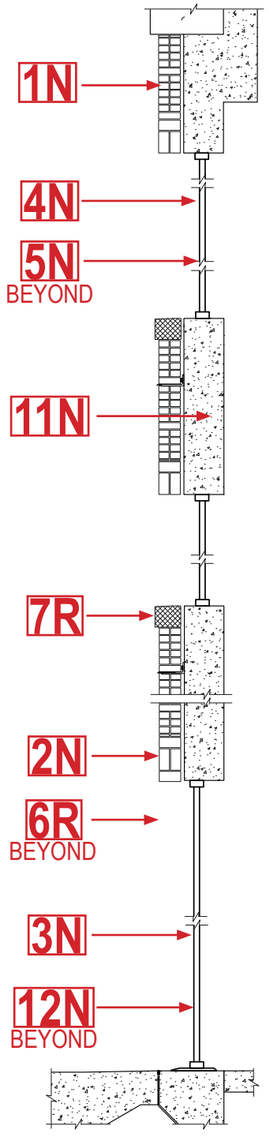
Park Row Structure | Arch Block E | Rose Street Arch | Arch Block D | Vandewater Street Arch | Arch Block C | Cliff Street Arch | Arch Block B | Pearl Street Structure | Arch Block A

Arch Block Resources

Current Photo

Historical Photo

New Wall Section



1E
2E
4E
8E
5R
5E
7E
8E
4R
9E
10R
10E
3E
6E

Existing/Historical (E)

1E. Brick Wall
2E. Soldier Brick Arch
3E. Openings - Door
4E. Openings - Window
5E. Shutters
6E. Stone Granite Block
7E. Stone Window Sill
8E. Openings - CMU Infill
9E. Openings - Steel Door
10E. Misc. Canopy Brackets, signage, etc.

REMOVED/REINSTALLED

6R. Stone Granite Block
7R. Stone Window Sill

REMOVED/STORED/CATALOG

4R. Openings - Window
5R. Shutter
10R. Misc. Elements

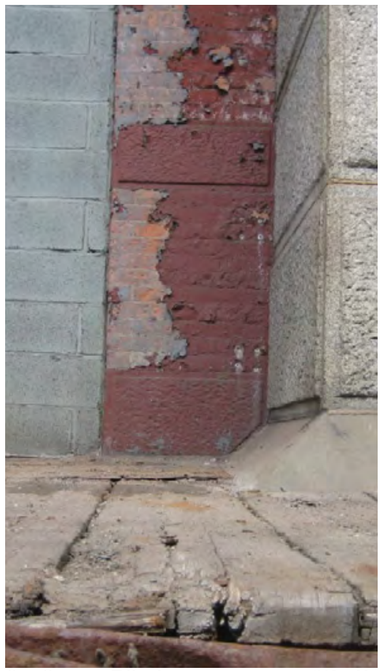
NEW (N)

1N. Brick Facade
2N. Soldier Brick Arch
3N. Proposed Door
4N. Proposed Window
5N. Proposed Shutter
11N. Concrete Wall
12N. Openings - Brick Infill

Masonry Resources Identified

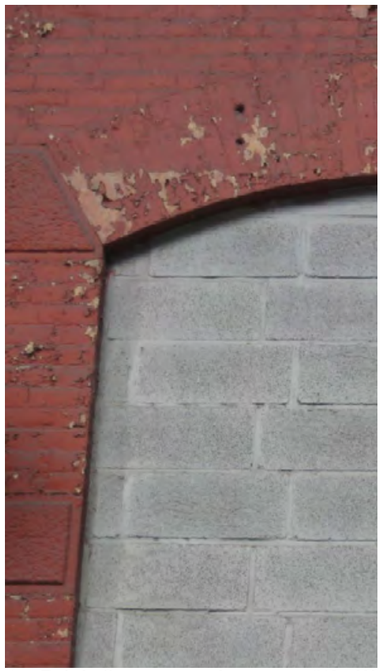
5 - Recessed Brick Frieze IMG_5879

1 - Stone Belt Course IMG_5885



2 - Stone Plinth IMG_5887

3 - Single Stretcher Course on Brick Surrounds IMG_5899



4 - Brick Segmented Arches with Bullseye Brick Voussoirs IMG_5889

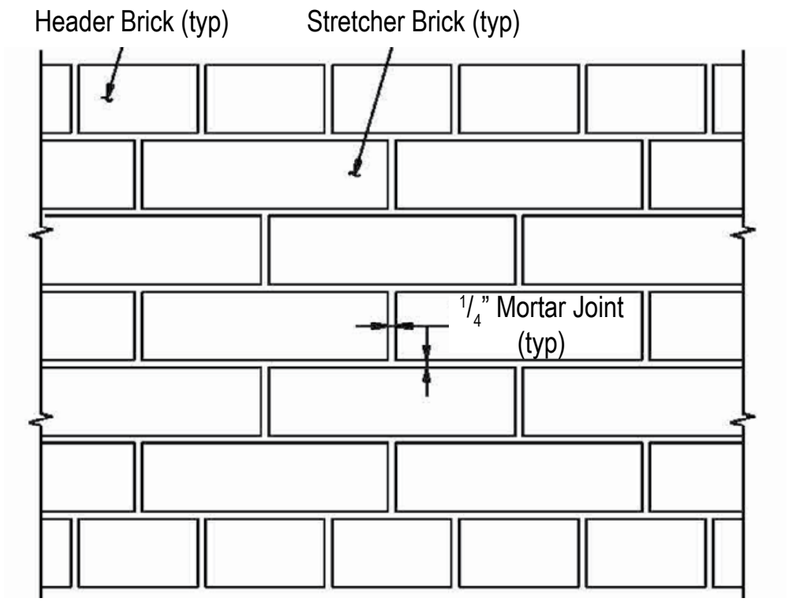
6 - Brick Round Arch with Straight Brick Voussiors IMG_5949

7 - Stone Belt Course IMG_5879

8 - Stone Springer IMG_5858

Masonry Conditions - Manhattan Approaches

"The bricks within the arch blocks walls are laid in a pattern called the Sixth Course Headers. In this pattern, the bricks in every sixth course are laid sideways to provide continuity between adjacent brick wythes."



Common Bond Brick Coursing

1 - Crumbling Brick Window Sill IMG_5876

"Generally, the fire-hardened surface of the bricks and the mortar joints has deteriorated over the 125 plus years of life of the bridge, exposing the softer interior of the bricks. Since it is exposed, the softer brick interior erodes and easily falls off as dust...Humidity in the arch block interiors is likely a major contributing factor to the degradation of the brick surfaces"

2- Deteriorated Brickwork on Exterior Arch Infill Wall IMG_5876

Data Source: *Masonry Approaches Inspection Report and Recommendations,* Parsons, June 2010

Openings - Doors and Windows : Identified

5 - Wood Shutter IMG_5863

1 - Metal Door Within Existing Opening IMG_5859

2 - Infilled Opening with Metal Security Grate IMG_5923

3 - Metal Door in Infilled Opening IMG_5922

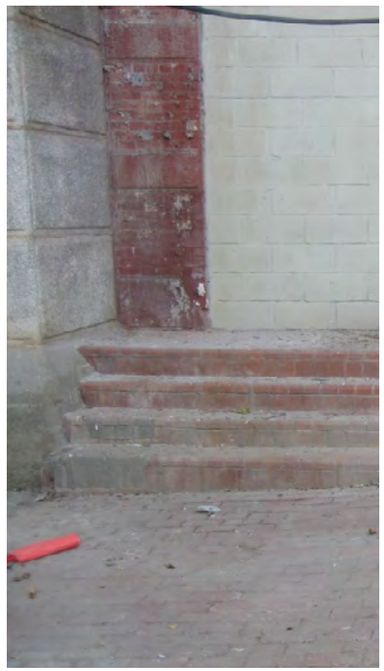
4 - Metal Window with CMU Infill IMG_5898

6 - Wood Frame Window with Gutter IMG_5862

Exterior Canopy and Entrances

10 - Shutter Attachment Brackets

5 - Canopy Bracket IMG_5890



1 - Brick Stairs IMG_5910

2 - Metal Stairs IMG_5882

3 - Brick Stair IMG_5913

4 - Brick Stair IMG_5947

6 - Wood Stair IMG_5903

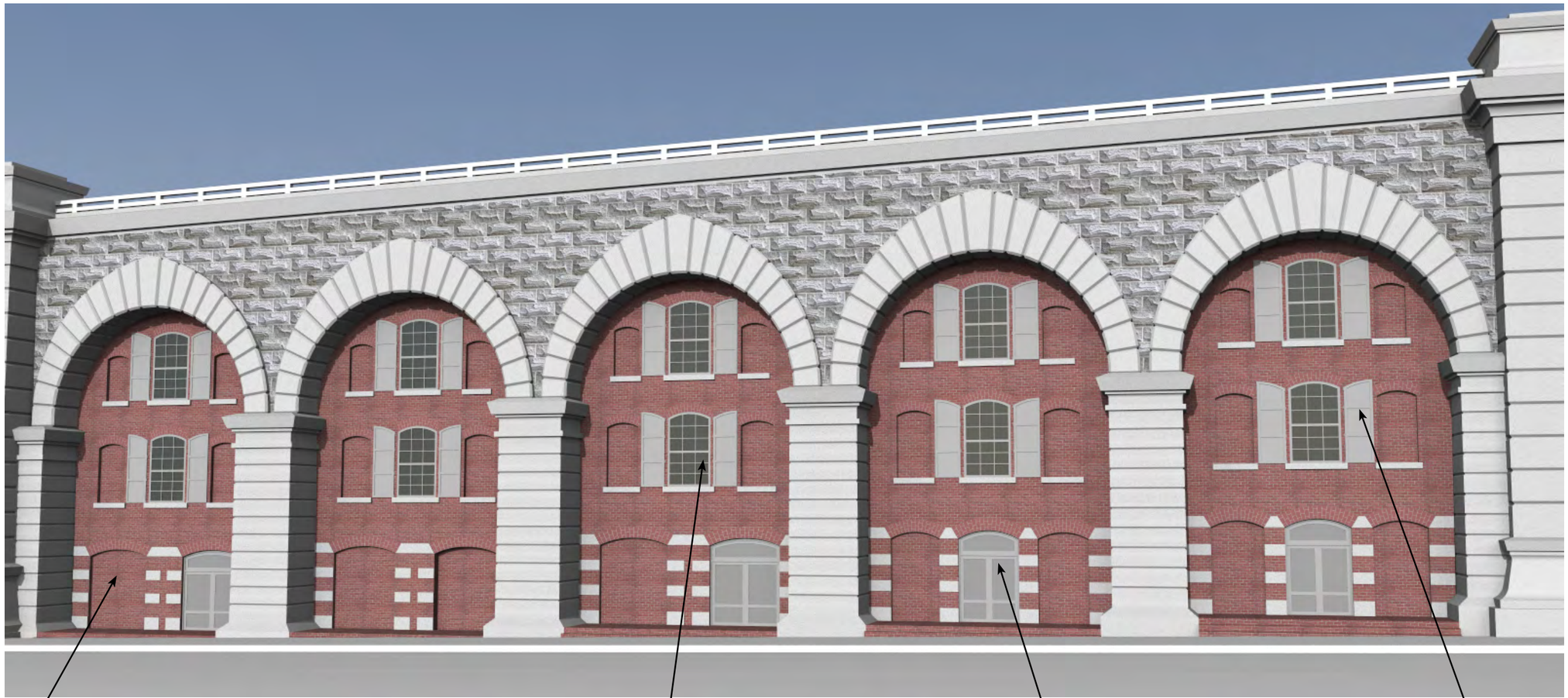
7 - Wood Loading Dock IMG_5893

8 - Metal Railing IMG_5905

9 - Step Up Entrance IMG_5874

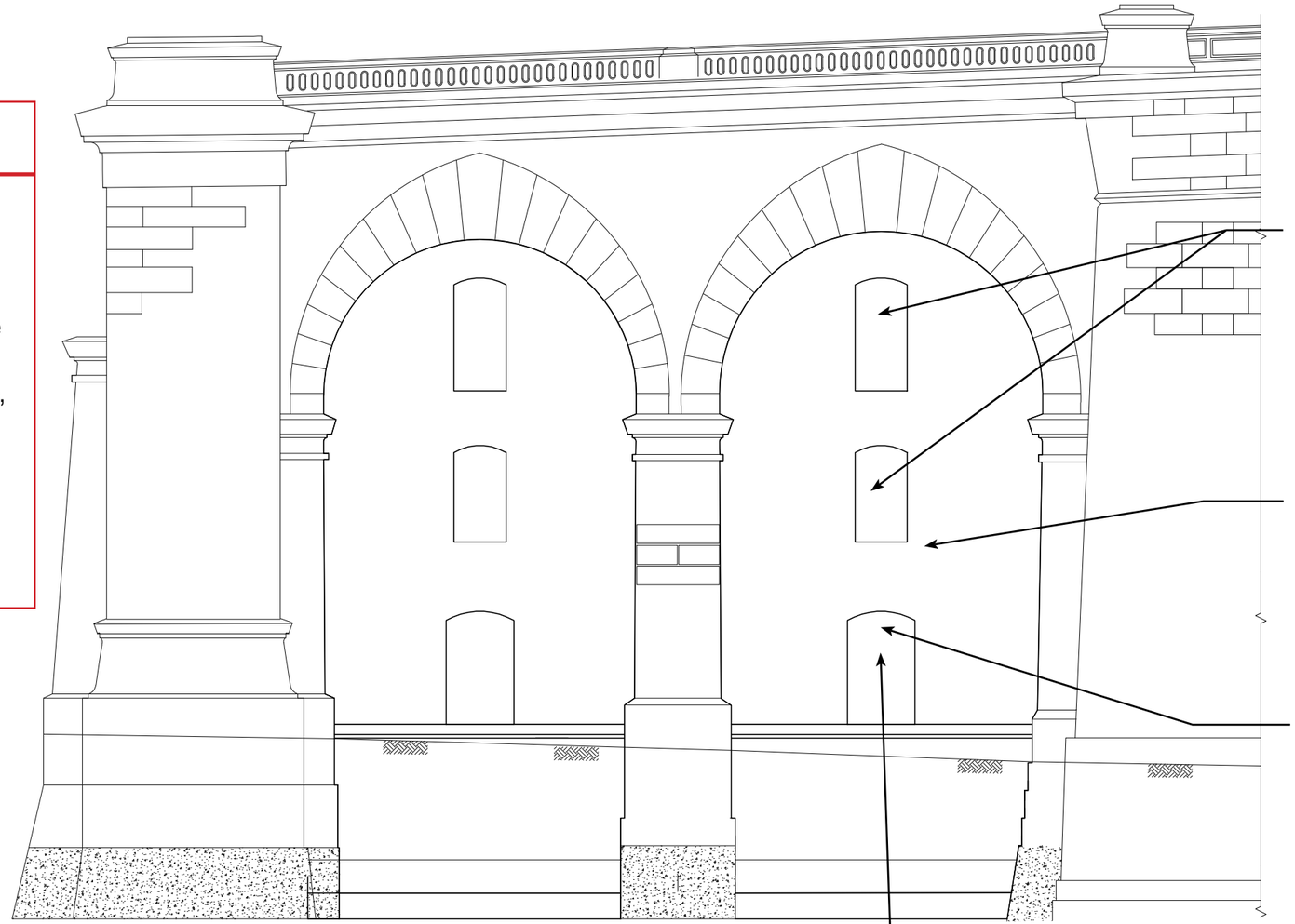
Manhattan Approach (Typical / Concept)

Typical Arch Block Rendering



Reinforced Concrete Wall

Resource	Arch Block A-D
Action - *Strengthen and Stabilize*	Scope – Provide new reinforced concrete wall unseen behind brick facade Treatment – Non-reversible, center opening sizes to be maintained and preserved (reversible/future use openings)



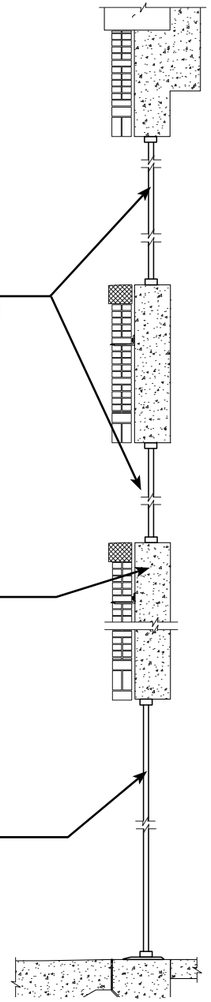
Concrete Infill Wall Elevation A Shown

Opening for louver/ proposed window in concrete wall (reversible)

Concrete infill wall to strengthen structural arch (non-reversible)

Opening for proposed door in concrete wall (reversible)

Note:
If no door proposed at least one lower opening to be maintained within concrete wall and infilled with brick (reversible/future use)



Center Opening Section

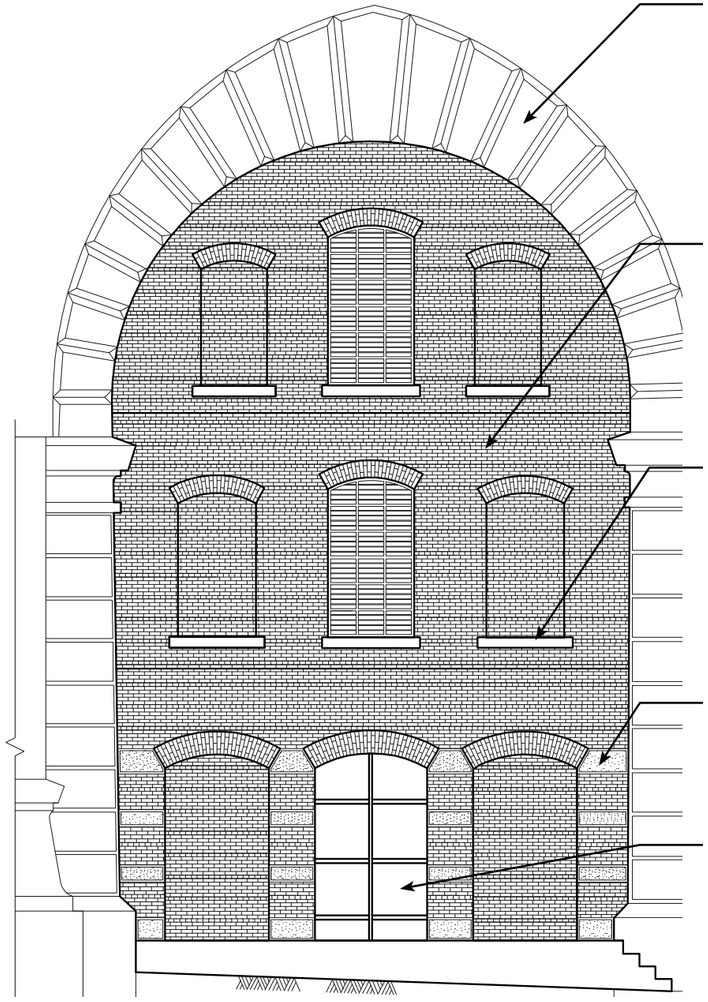
Masonry - Brick Facade

Resource	Brick Facade/Arches - Arch Blocks A-D
Action - *Replace*	Scope – Remove brick walls too deteriorated to repair using the same configuration (substitute brick facade assembly in lieu of multiple brick wythe construction) Treatment – Non-reversible, retains original character

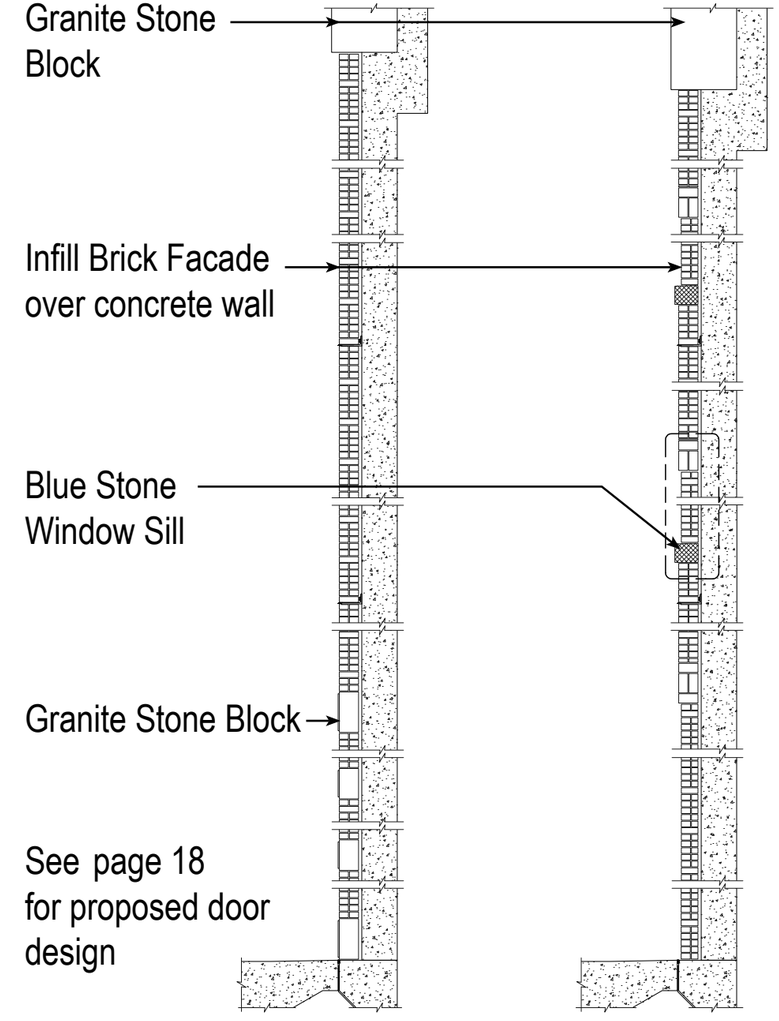
Resource	Brick Facade/Arches - Arch Block E
Action - *Protect and Maintain*	Scope – Repoint existing brick work Treatment –Reversible, preserve original resource

Resource	Misc Masonry Elements - Arch Block A-D
Action - *Replace*	Scope – Replace in-kind or re-use existing granite stone blocks around door openings and bluestone sills Treatment - Reversible, preserve original resource

Resource	Misc Canopy Elements - Arch Block A-D
Action - *Preserve/ Inventory*	Scope – Any remaining original canopy brackets, signage, railings, stairs, etc which are too deteriorated to repair are to be removed, stored and cataloged Treatment - Reversible



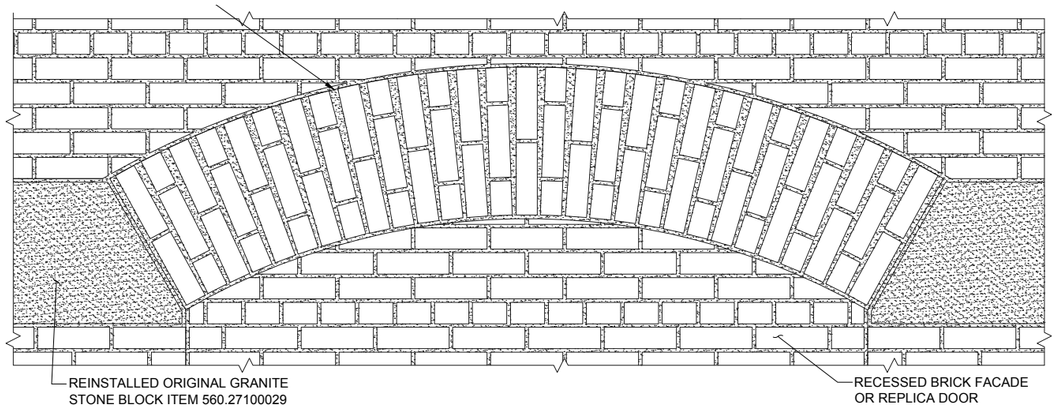
Arch Block A Elevation



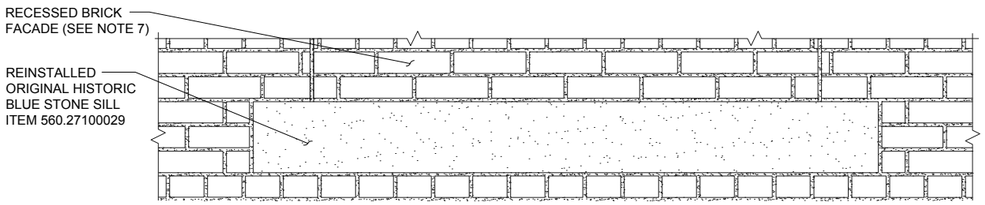
Typical Wall Section

Side Opening Section

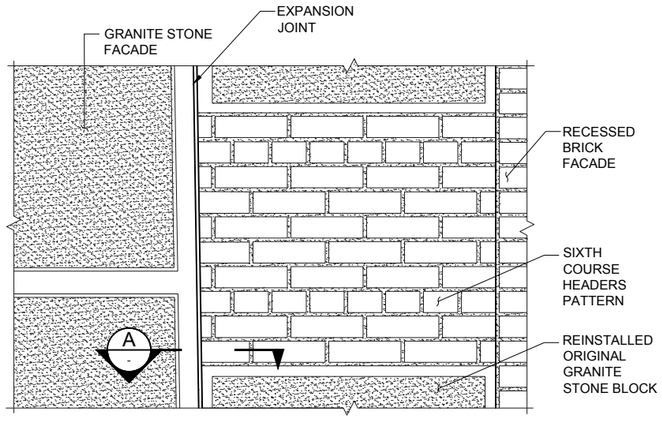
Note:
If no door proposed at least one lower opening to be maintained within concrete wall and infilled with brick (reversible/future use)



Typical Window Opening Arch (Blocks A-E)



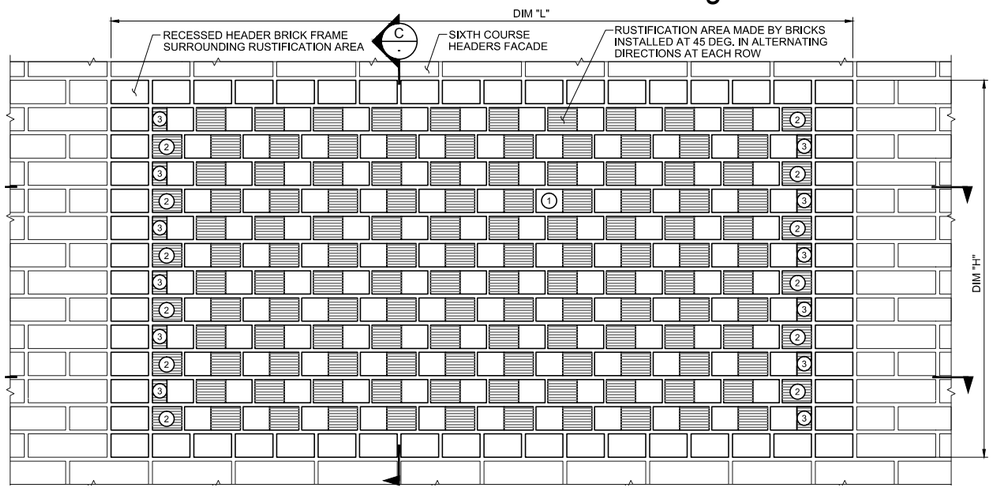
Typical Bluestone Sill (Blocks A-E)



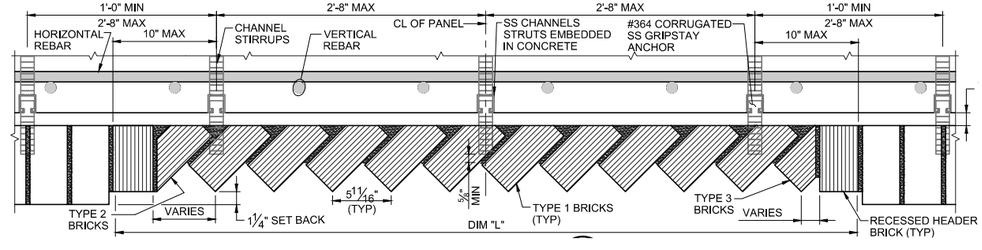
Typical Brick Coursing Pattern (Blocks A-E)

Typical Brick Facade Details

Existing Rustification Panel

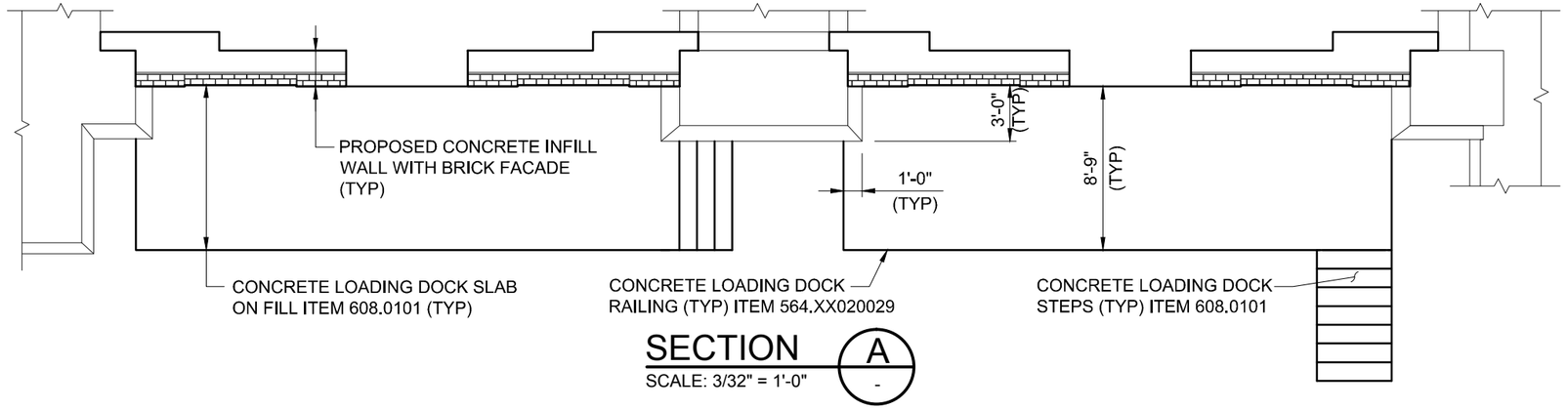


Brick Rustification Panel Elevation (Arch Block D)



Brick Rustification Panel Plan (Arch Block D)

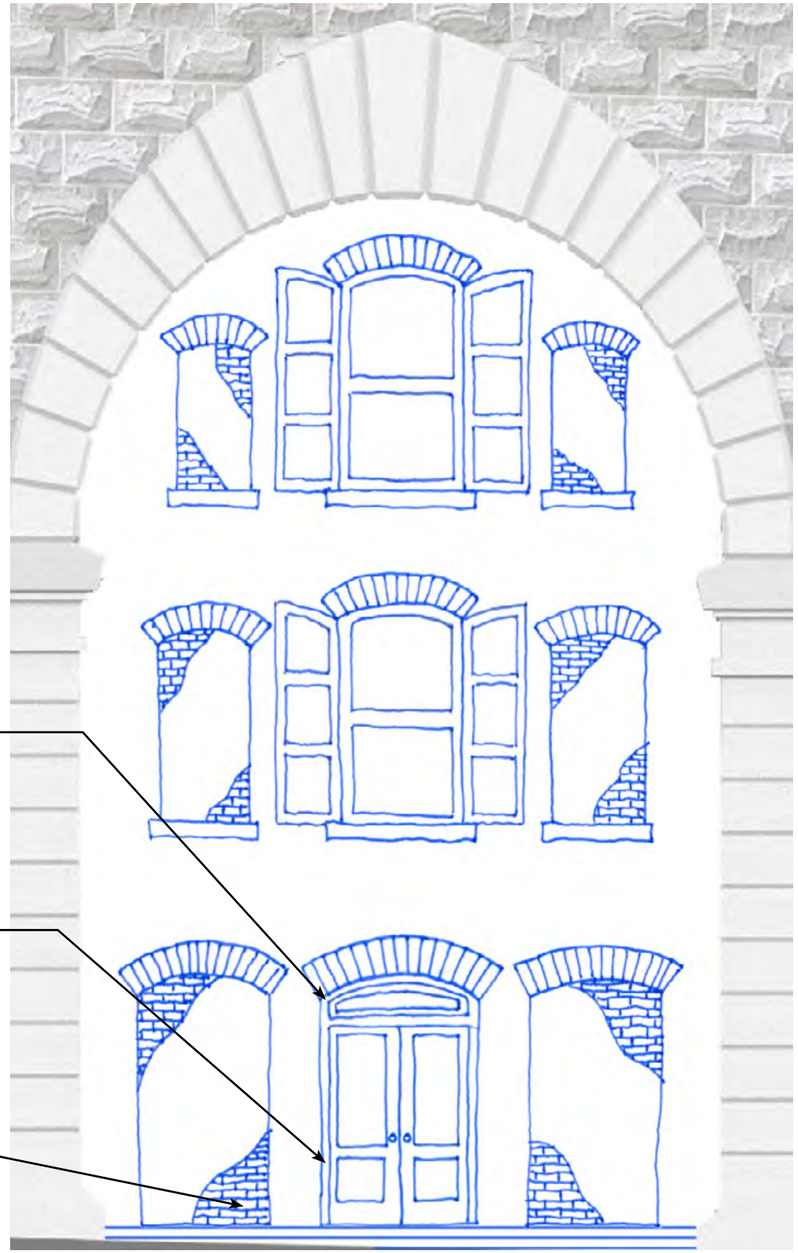
Exterior Wall Details II



Proposed Infill Wall Plan Detail

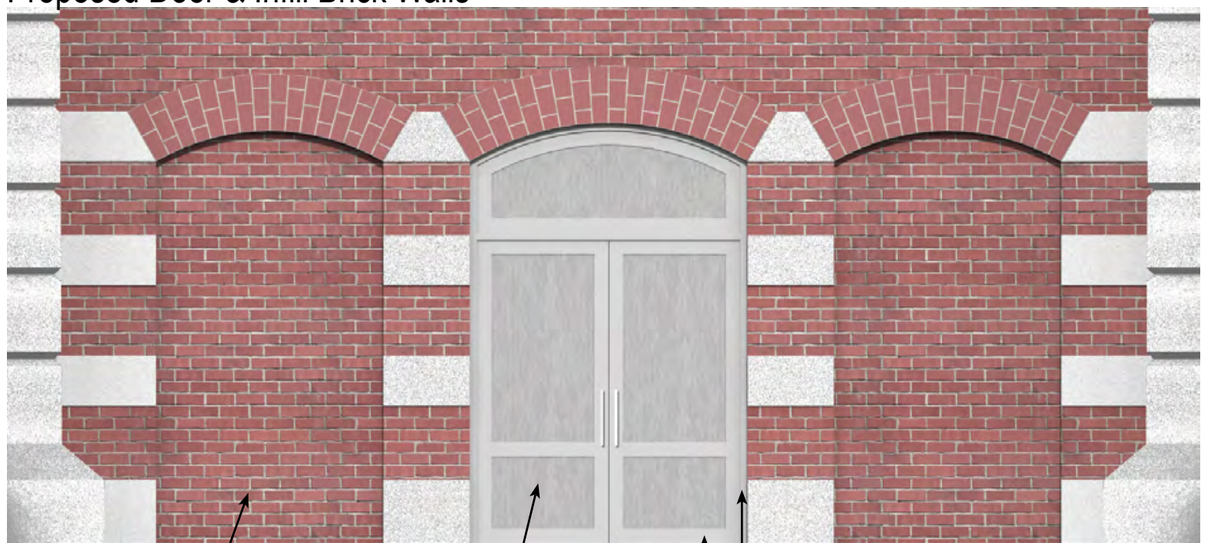
Openings - Door & Infill

Note:
If no door proposed at least one lower opening to be maintained within concrete wall and infilled with brick (reversible/ future use)



Resource	Proposed Doors
Action - *Preserve*	Scope - Remove existing doors and existing CMU infill. Maintain original door opening sizes by either recessing brick infill or providing a new door within original opening size. Current existing doors and CMU infill are not original in character or material. New doors designed to meet heightened security standards Treatment –Reversible at door openings and Non-reversible at brick infill locations, both preserve original opening sizes and character.

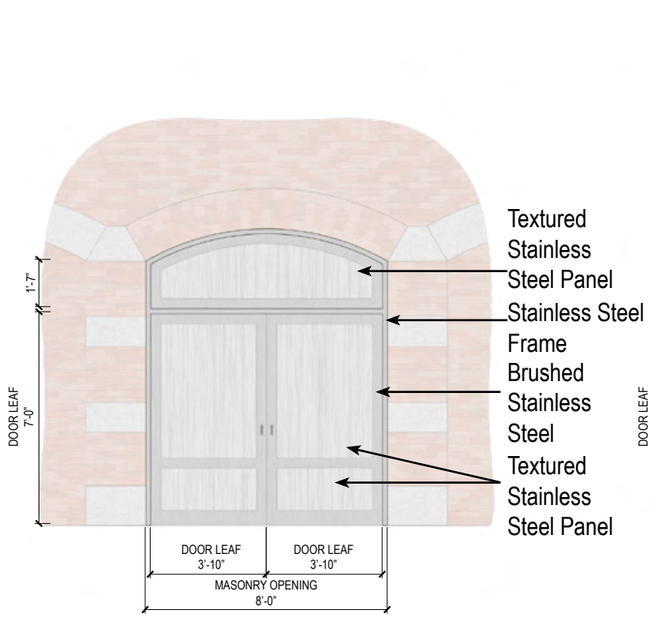
Proposed Door & Infill Brick Walls



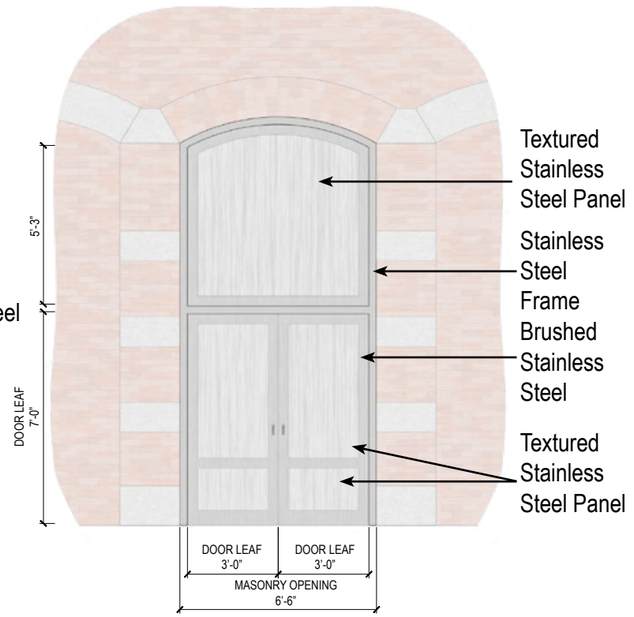
Openings - Door Variations (Typical of 3 Sizes)

Design Intent

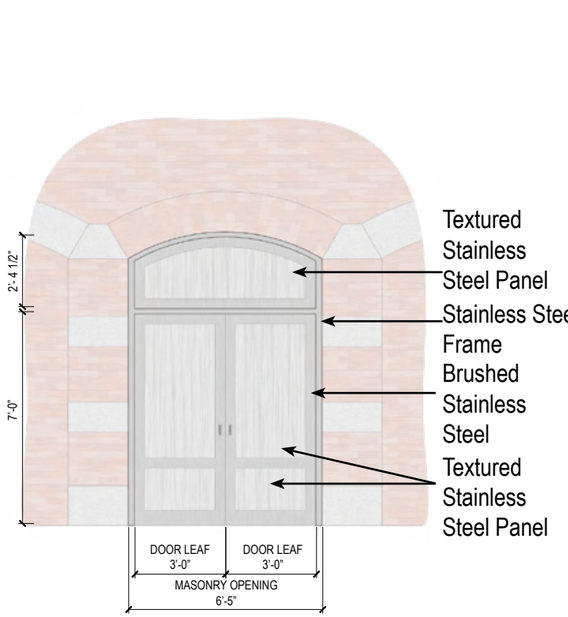
1. Door leaf dimensions to be standardized
2. Transom height will vary to accomodate different opening sizes
3. Frame width will vary to accomodate different opening sizes



Door Elevation - Typical 1

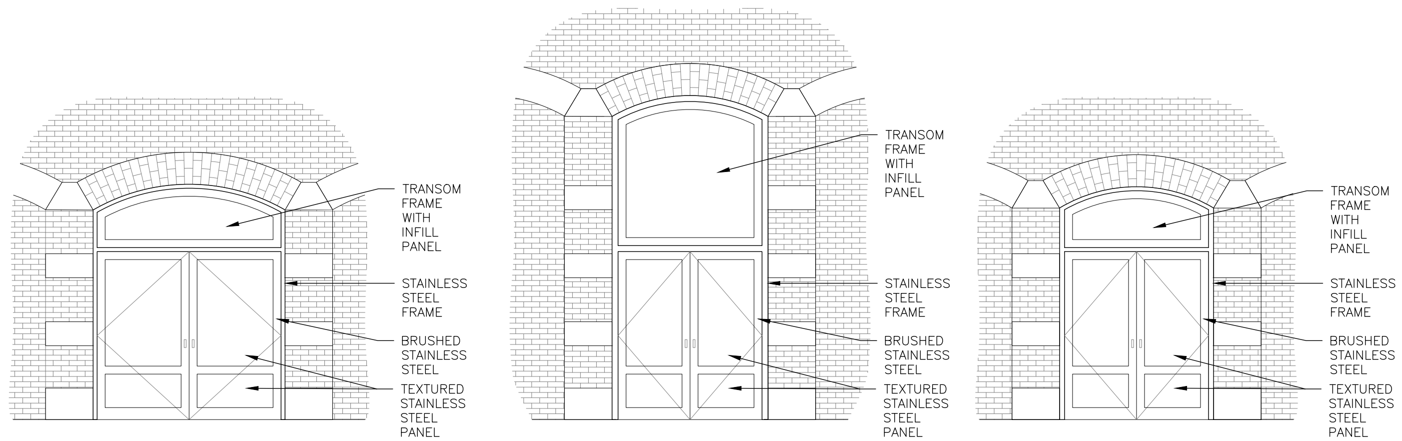


Door Elevation - Typical 2

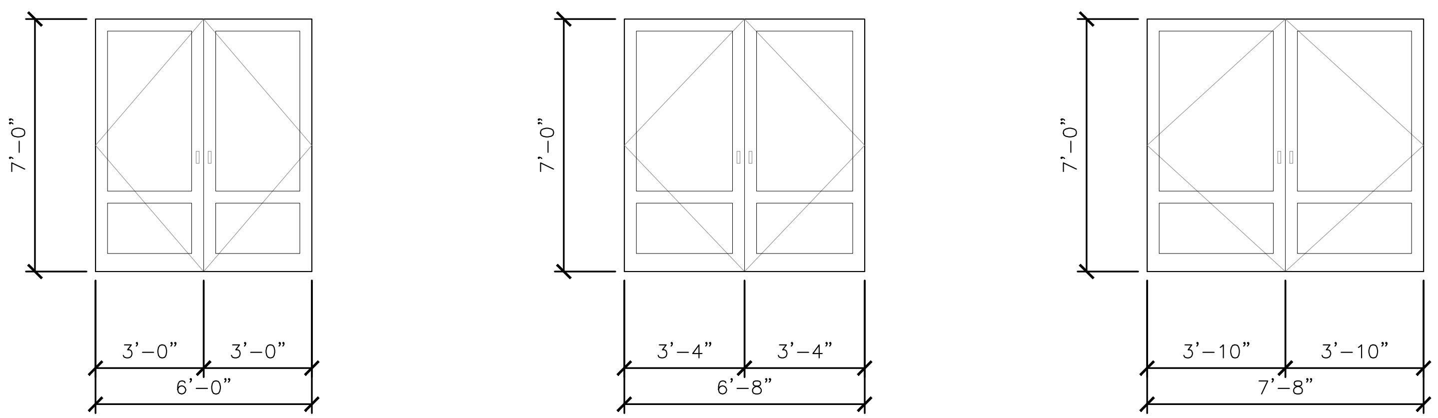


Door Elevation - Typical 3

Typical Door Details



Typical Door Elevations



Typical Door Frame Sizes

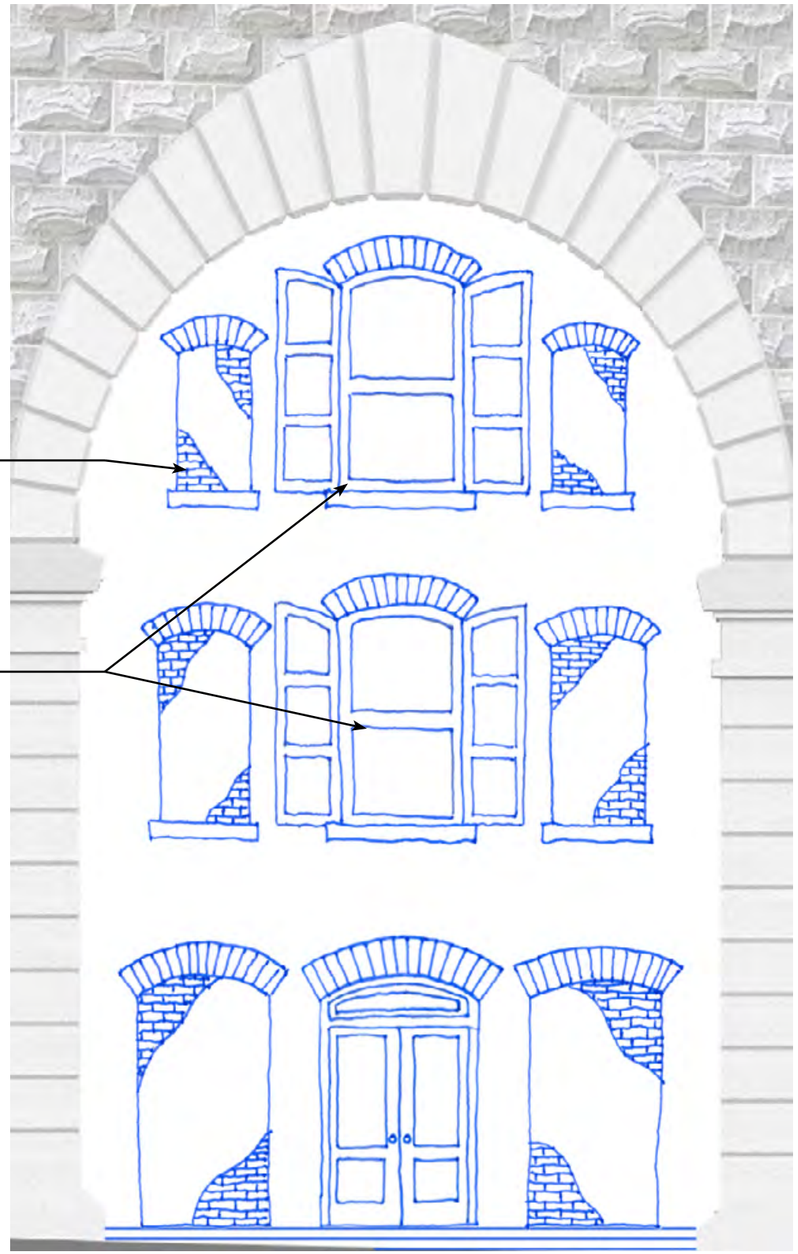
Existing Steel Doors

Historical Photography

Openings - Window/Louver & Infill

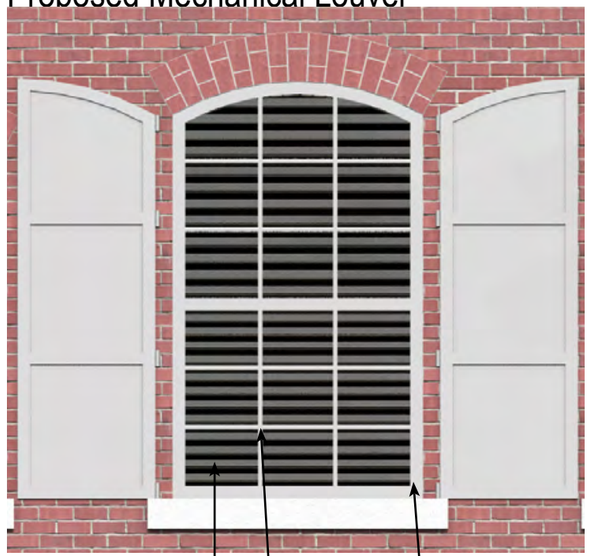
Recessed brick in lieu of window opening

Decorative Stainless steel louver/frame with open shutters to match original design.



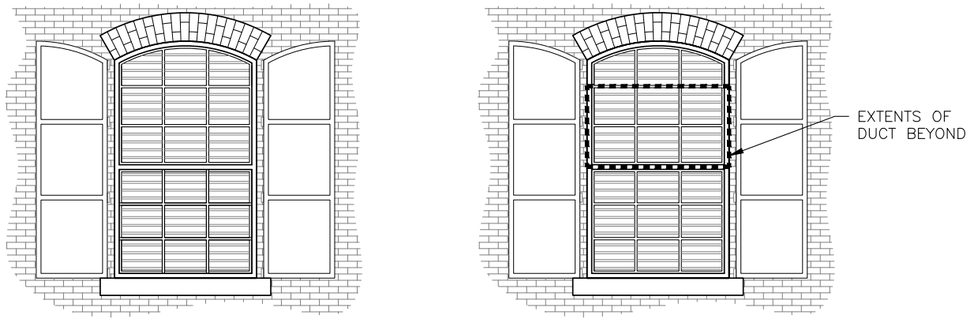
Resource	Window Openings
Action - *Preserve*	Scope - Remove existing sheathing and existing CMU infill. Maintain original window opening sizes by either recessing brick infill or providing a new window/ louver within original opening size. Current existing sheathing and CMU infill are not original in character or material. Remaining original wood frames which are too deteriorated to repair are to be removed, stored and cataloged. Treatment – Reversible at window openings and Non-reversible at brick infill locations, both preserve original opening sizes and character.

Proposed Mechanical Louver

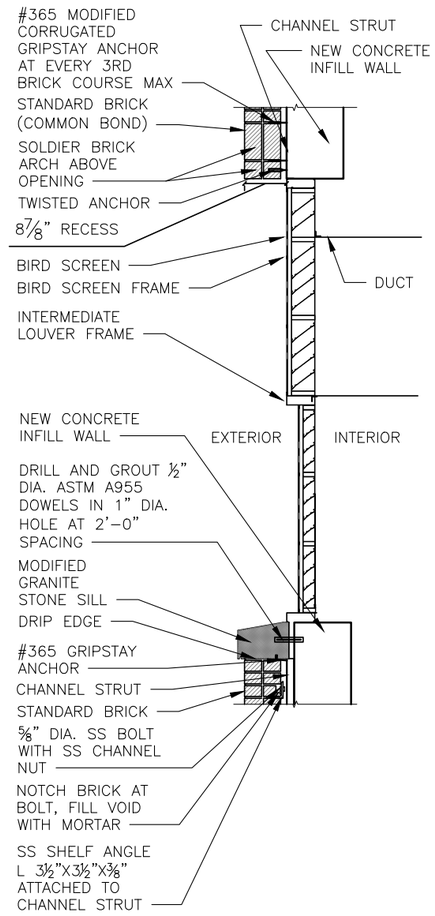


Example Louver

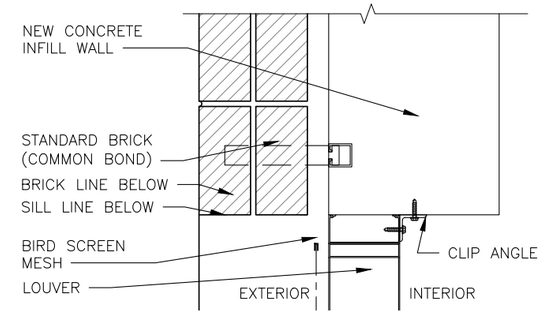
Window/Louver Details



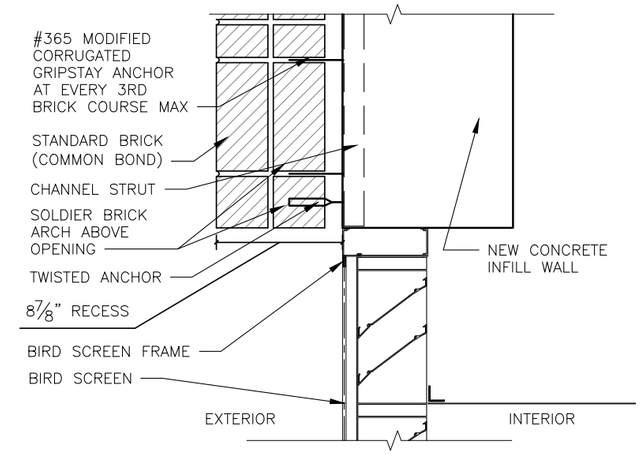
Typical Proposed Window/Louver Elevations



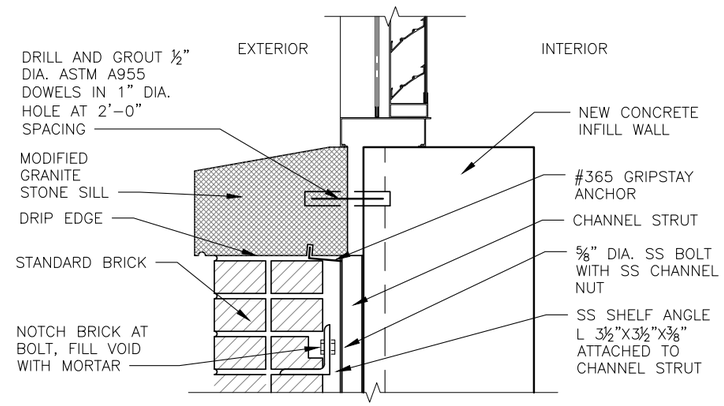
1 - Louver Section



2 - Louver Jamb Detail



3 - Louver Head Detail



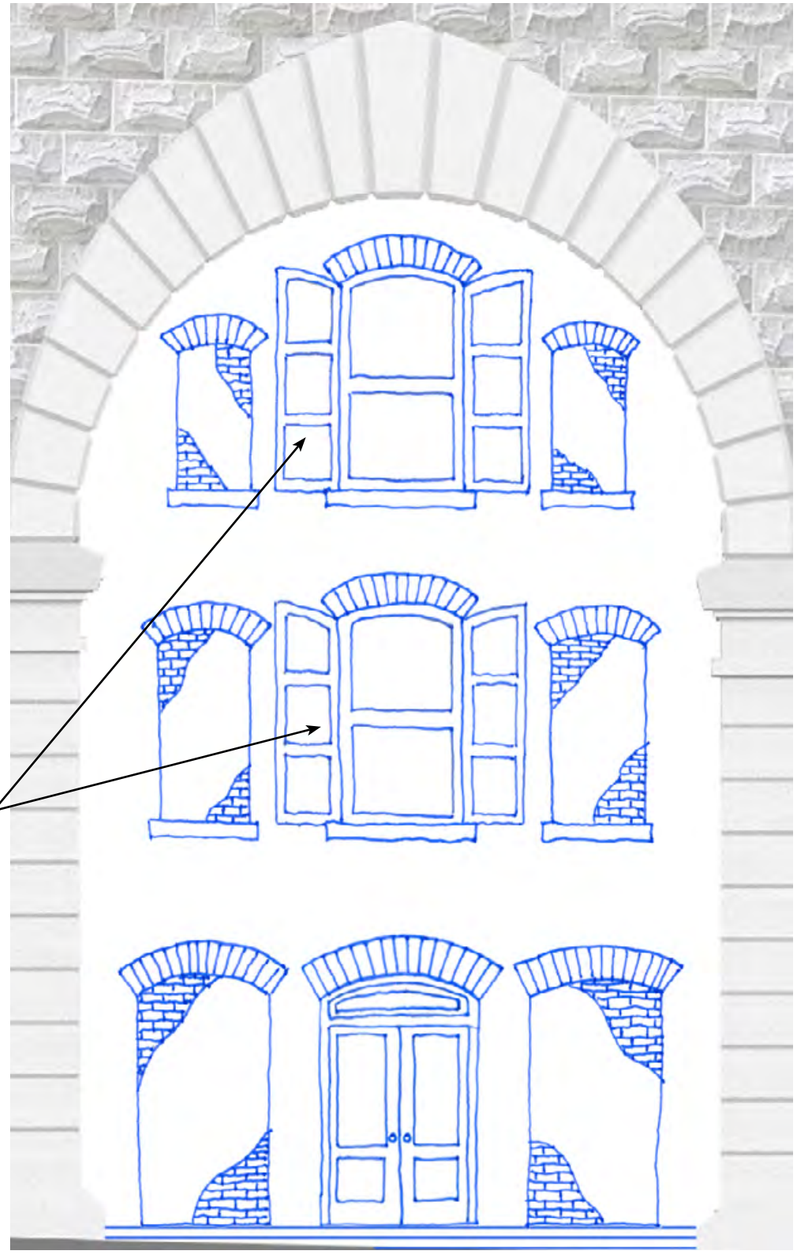
4 - Louver Sill Detail

Existing Window Openings

Historical Photography

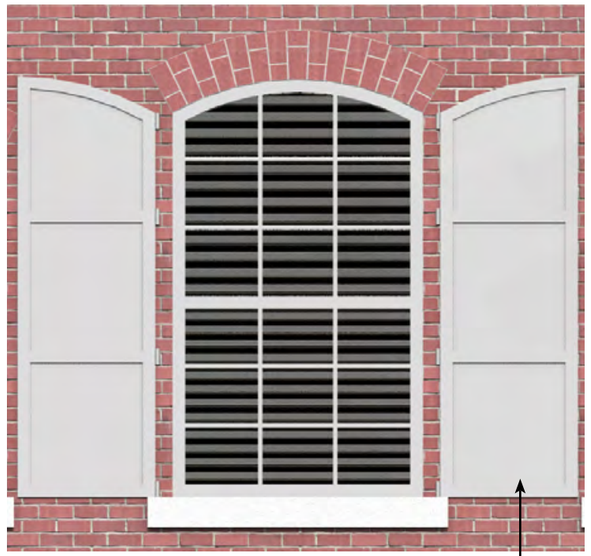
Shutters

Decorative Open Stainless Steel Shutters to match original design. Shutters to be fixed in the open position.



Resource	Proposed Shutters
Action - *Preserve*	Scope - Remaining original wood shutters which are too deteriorated to repair are to be removed, stored and cataloged. Propose shutters to match the style of the original within center openings only. Shutter materials to match door and window assembly. Treatment – Reversible

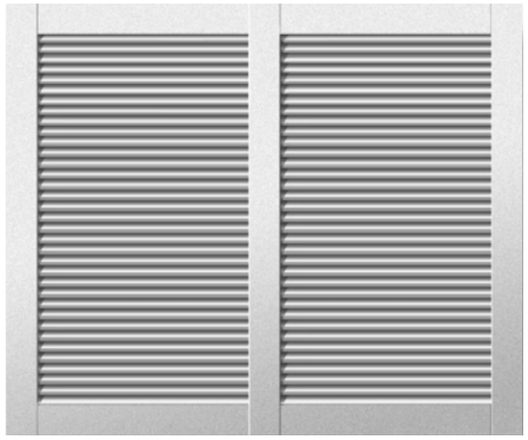
Proposed Shutter Design



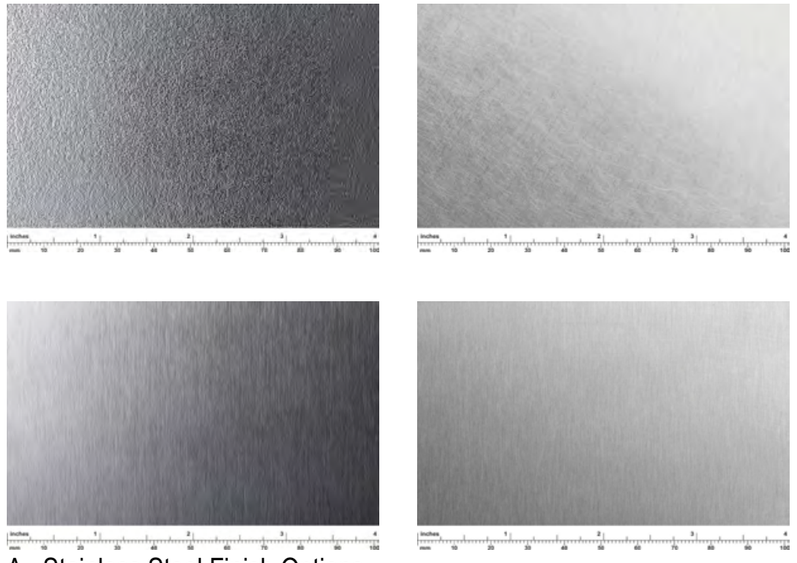
Stainless Steel Shutter

Peformance Criteria/Materials

1 - FE/BR/FR Doors*



2 - FE/BR Window/Louvers*



A - Stainless Steel Finish Options

The intended performance criteria proposed replica doors and windows is as follows:

b. Aesthetics

i. Replica of typical doors identified in historical photography

c. Durability

i. Stainless steel frame, panel, and hardware for corrosion resistance

ii. 40 year warranty

Brick Facade Wall Material Selections

a. Brick Color - To match existing

b. Mortar Color - Rosendale cement, similar to existing

c. Bluestone sills - To be removed, stored, cleaned, and reinstalled in proposed walls

d. Exterior Granite - To be cleaned

*Typical manufacturer options shown, custom configurations available to match proposed design. Samples to follow.

Manhattan Approach : Specific Arch Block Details

Arch Block A

General Information:

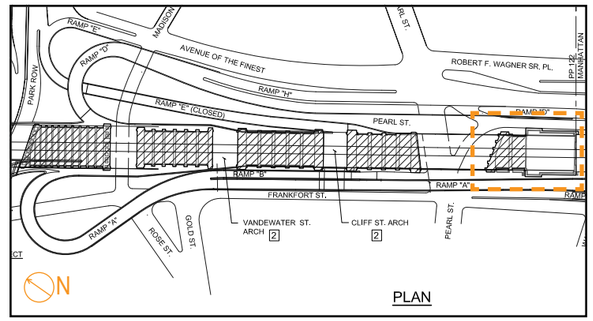
-Spans 36-37
-North Side: 1 Arch Bay
-South Side: 2 Arch Bays

Overall Architectural Layout:

-Elevation: 3 Levels
-Upper Level: 3 Window Openings
-Middle Level: 3 Window Openings
-Street Level: 2 Door Openings

Typical Architectural Features:

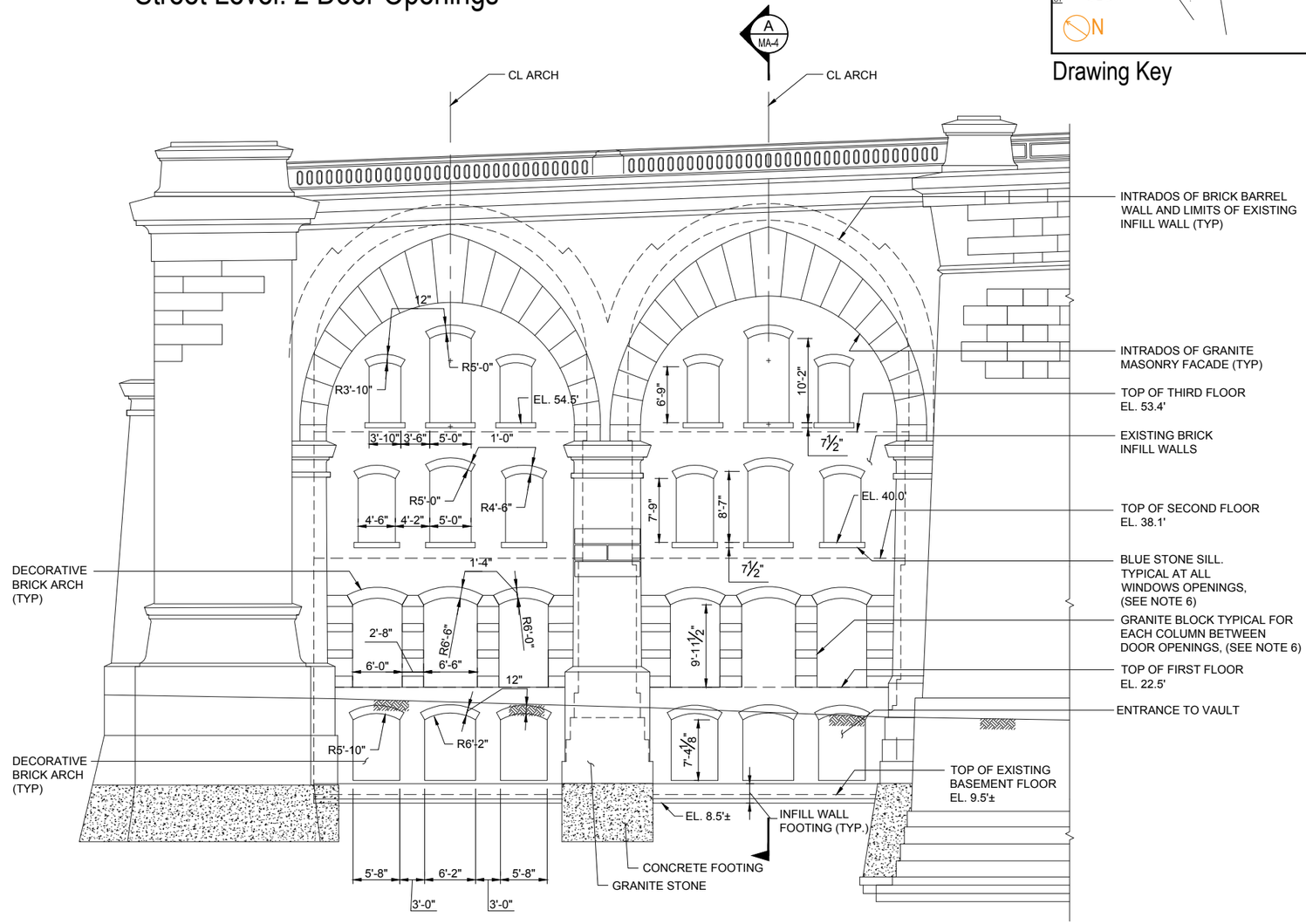
- Original Wood Shutters
- Stone Belt Course
- Stone Stringer



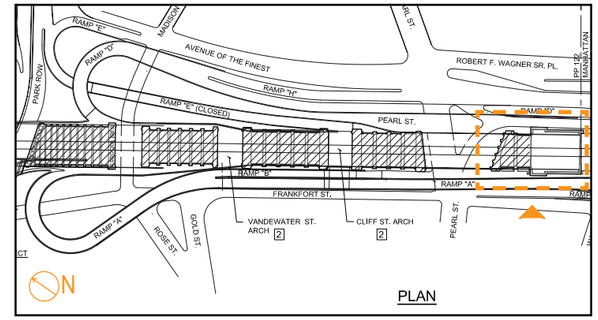
Drawing Key

Historical Photo: 1

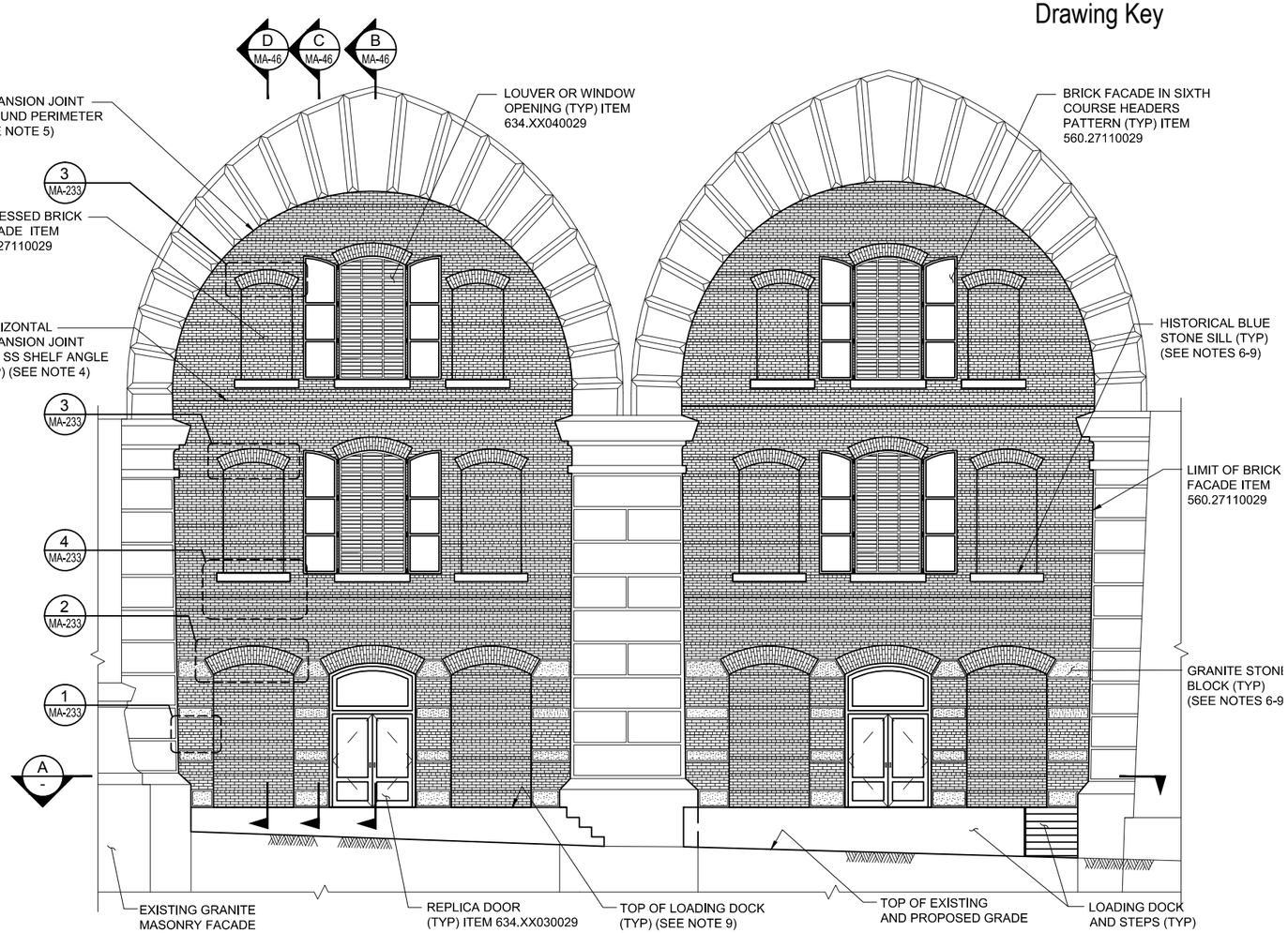
Current Photo: BPS_00383 2

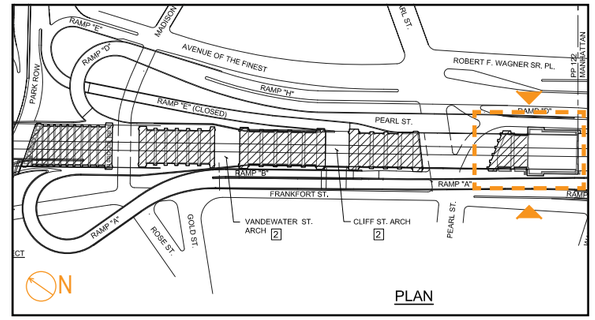


SPAN 36 SPAN 37

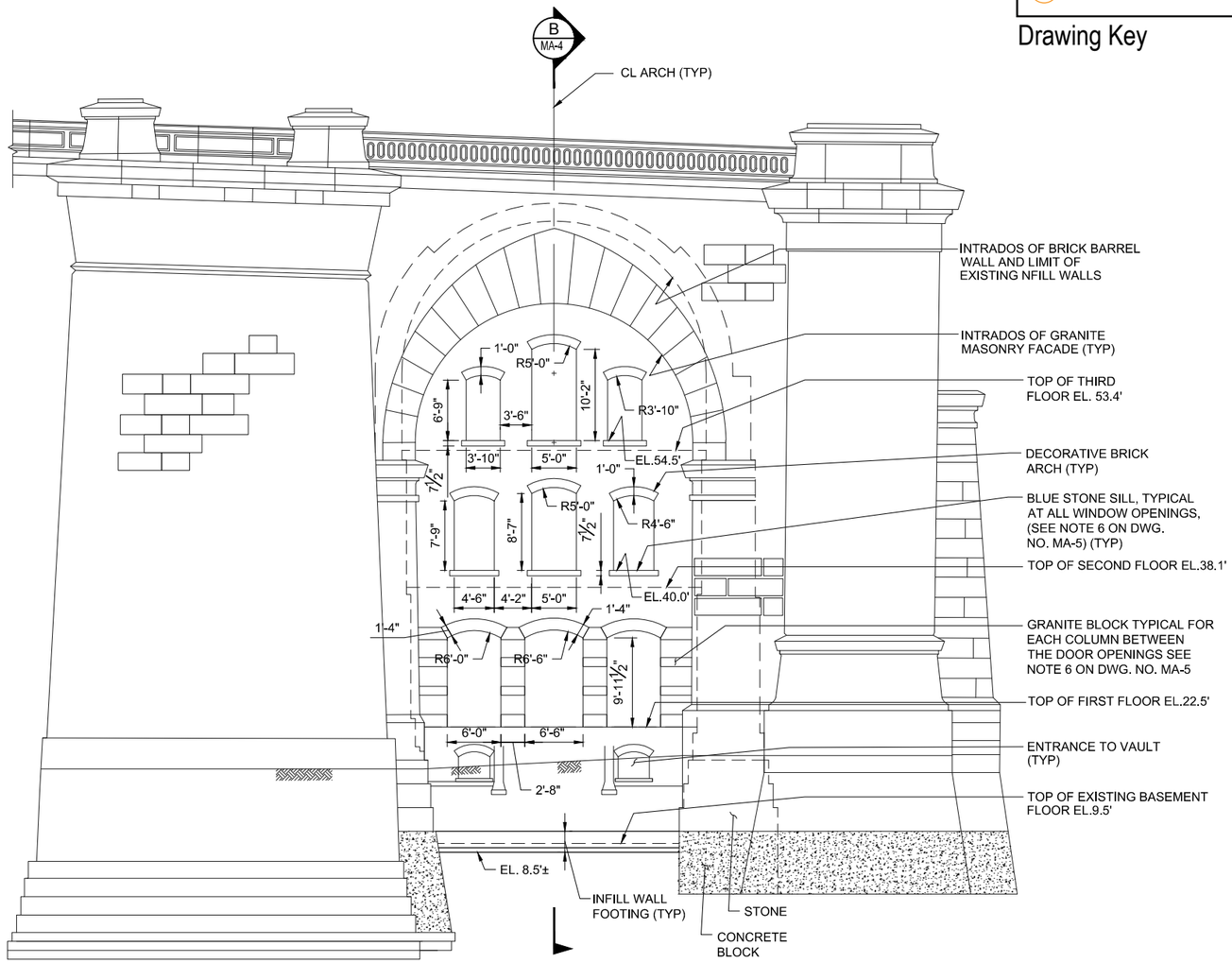

RAMP "E"
MADISON
AVENUE OF THE FINEST
ROBERT F. WAGNER SR. PL.
PARK ROW
RAMP "D"
RAMP "H"
RAMP "E" (CLOSED)
PEARL ST.
RAMP "B"
RAMP "A"
FRANKFORT ST.
VANDEWATER ST.
ARCH 2
CLIFF ST. ARCH 2
PEARL ST.
GOLD ST.
ROSE ST.
RAMP "F"
N
PLAN

Drawing Key

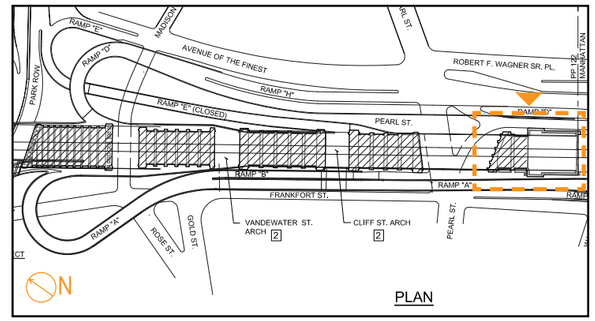

D MA-46
C MA-46
B MA-46
EXPANSION JOINT AROUND PERIMETER (SEE NOTE 5)
3 MA-233
RECESSED BRICK FACADE ITEM 560.27110029
HORIZONTAL EXPANSION JOINT AND SS SHELF ANGLE (TYP) (SEE NOTE 4)
3 MA-233
4 MA-233
2 MA-233
1 MA-233
A -
LOUVER OR WINDOW OPENING (TYP) ITEM 634.XX040029
BRICK FACADE IN SIXTH COURSE HEADERS PATTERN (TYP) ITEM 560.27110029
HISTORICAL BLUE STONE SILL (TYP) (SEE NOTES 6-9)
LIMIT OF BRICK FACADE ITEM 560.27110029
GRANITE STONE BLOCK (TYP) (SEE NOTES 6-9
EXISTING GRANITE MASONRY FACADE
REPLICA DOOR (TYP) ITEM 634.XX030029
TOP OF LOADING DOCK (TYP) (SEE NOTE 9)
TOP OF EXISTING AND PROPOSED GRADE
LOADING DOCK AND STEPS (TYP)



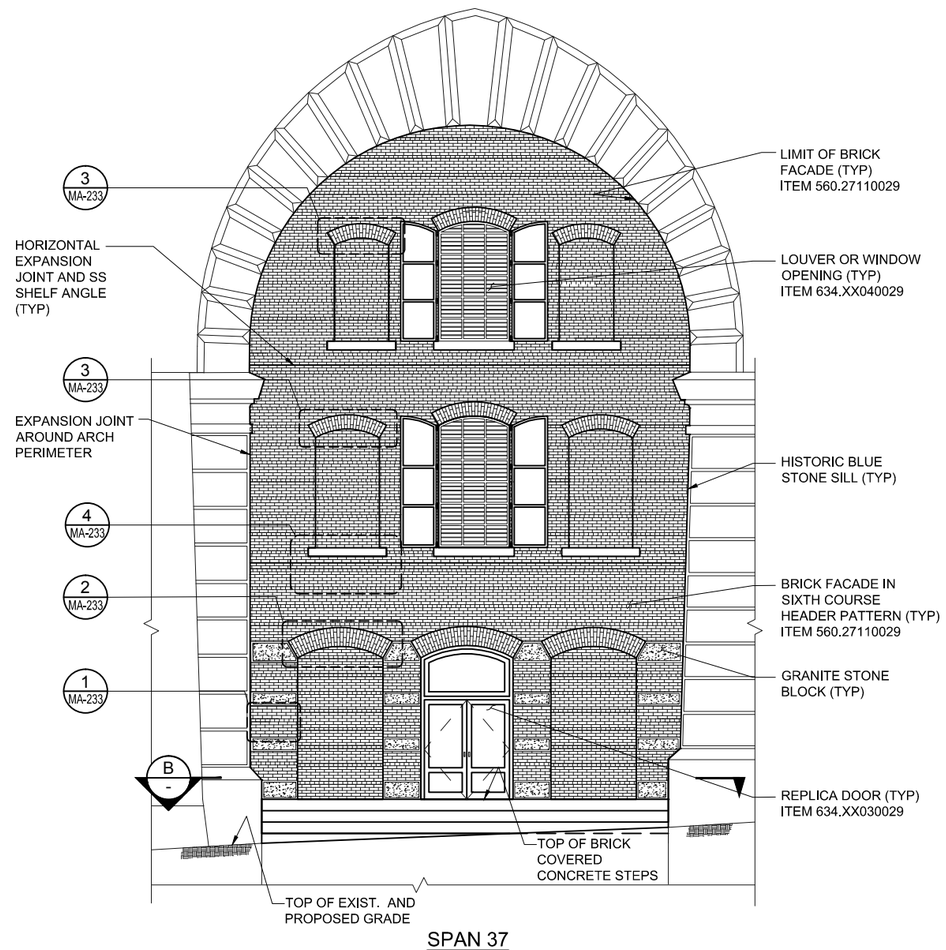
Drawing Key



SPAN 37



Drawing Key



SPAN 37

Vehicle Ramp not shown for clarity

Arch Block B

General Information:

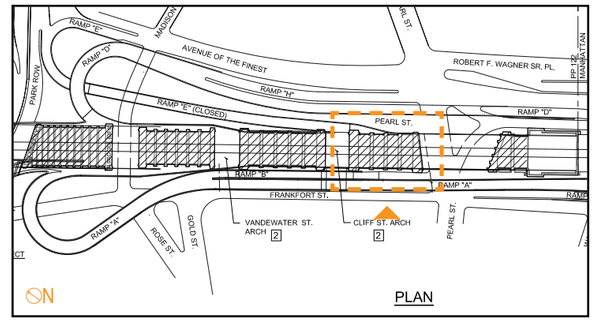
-Spans 31-34
-North Side: 4 Arch Bays
-South Side: 4 Arch Bays

Overall Architectural Layout:

-Elevation: 3 Levels
-Upper Level: 3 Window Openings
-Middle Level: 3 Window Openings
-Street Level: 2 Door Openings

Typical Architectural Features:

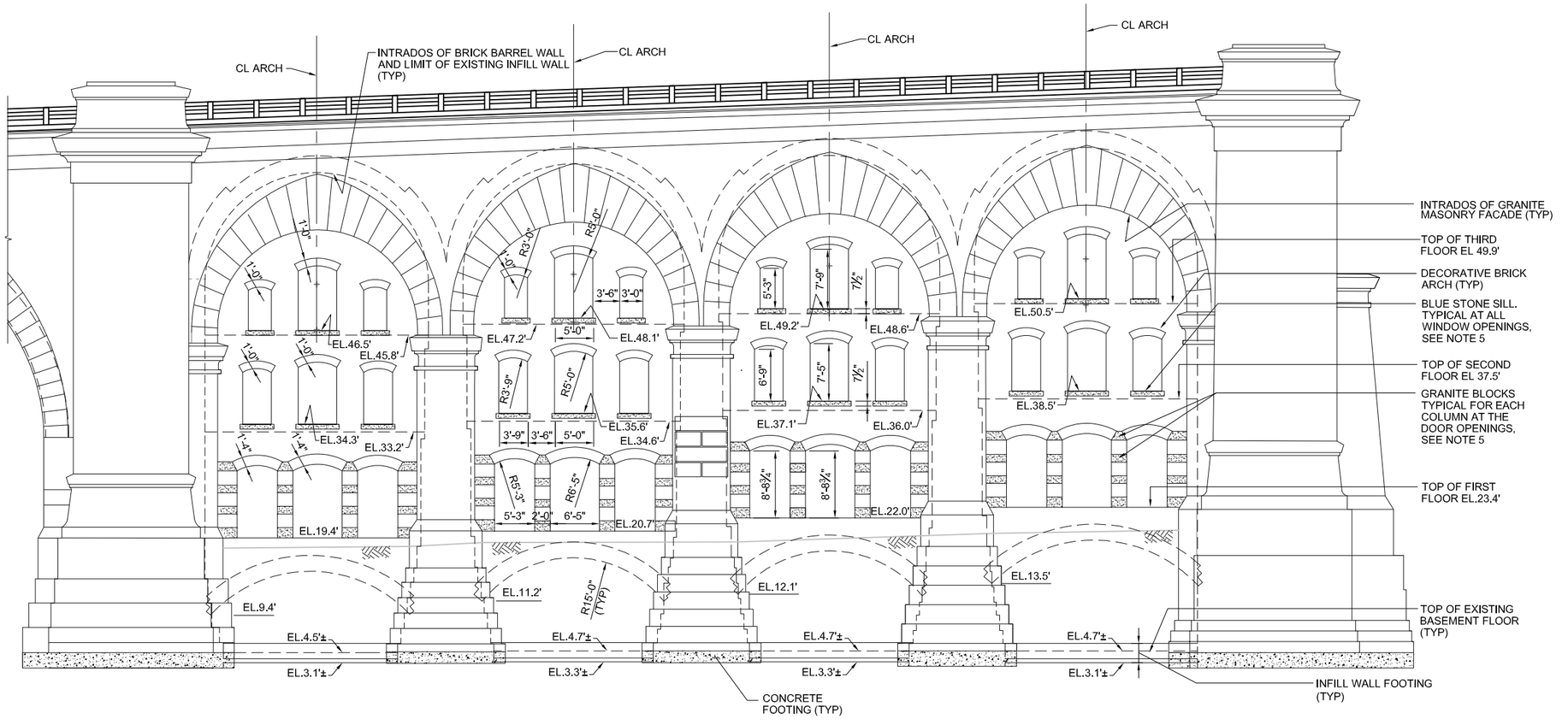
- Stone Belt Course
- Stone Stringers

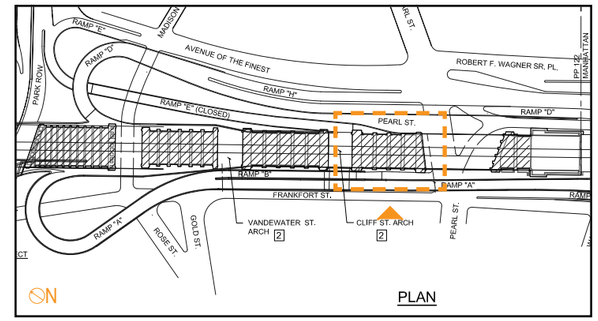


Drawing Key

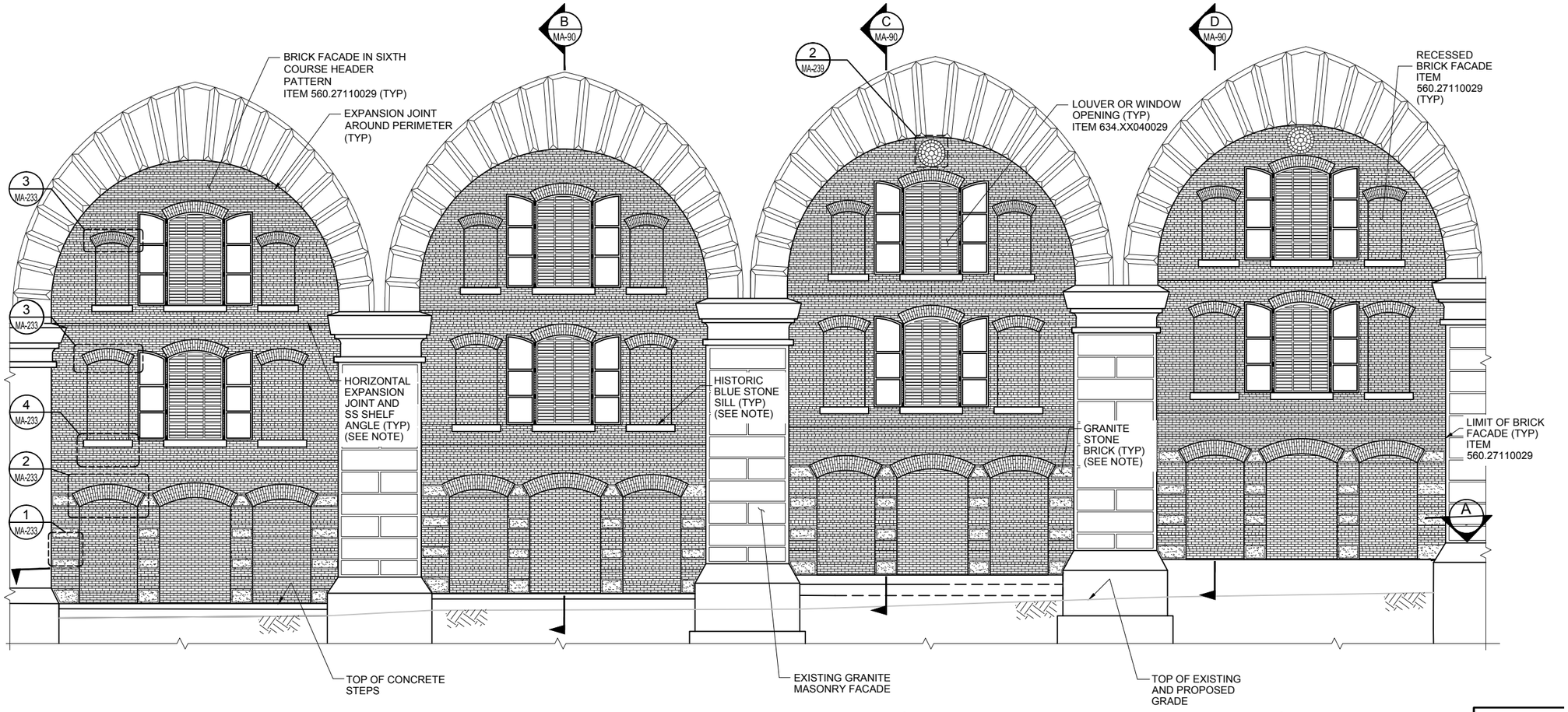
Historical Photo: BPS_01107 1

Current Photo: 2



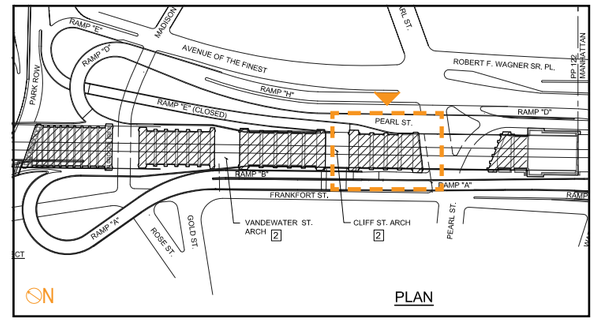


Drawing Key

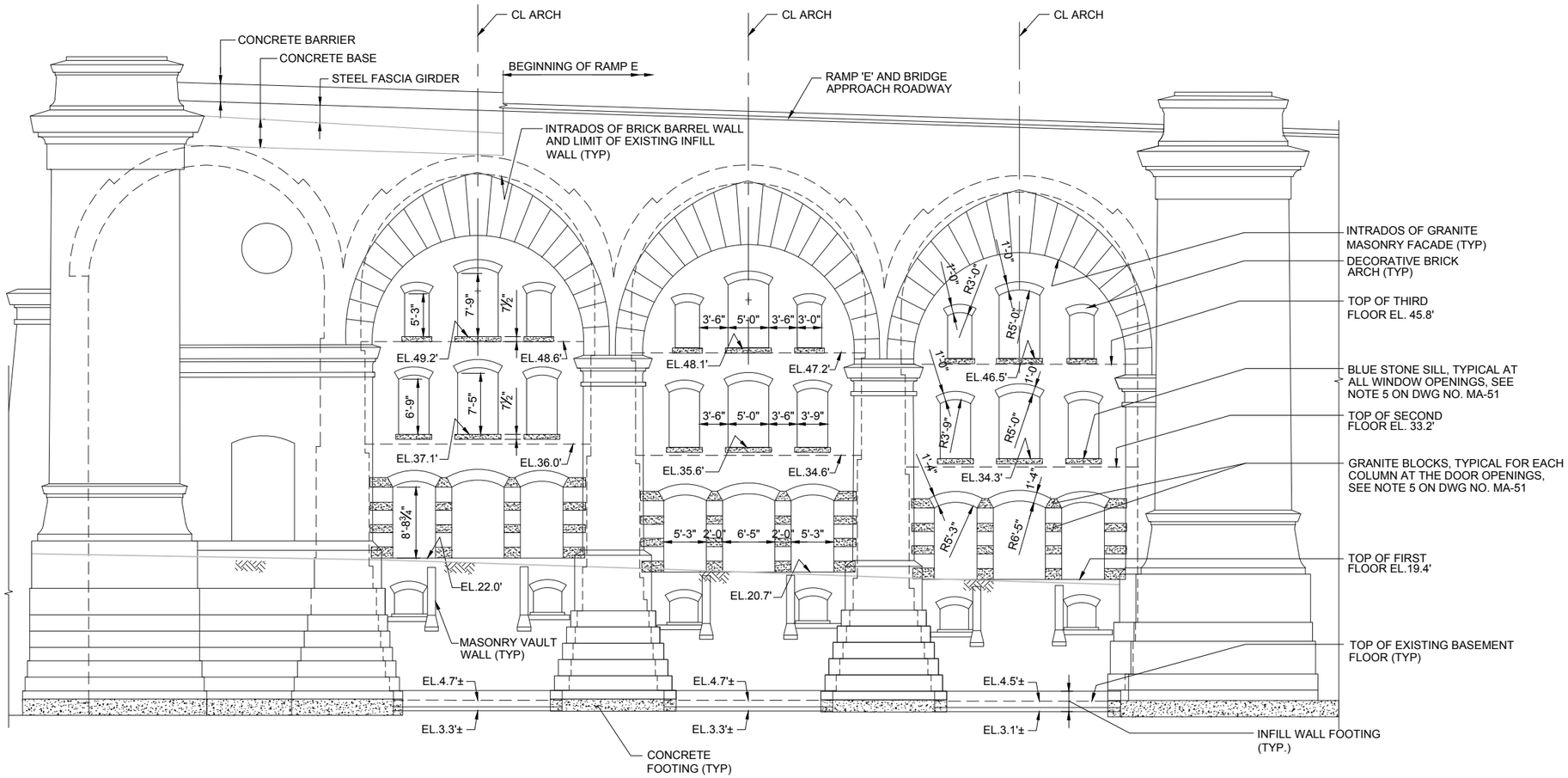


SOUTH ELEVATION

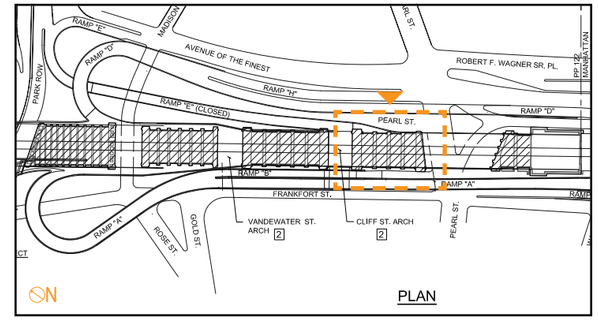
SCALE: 3/32" = 1'-0"



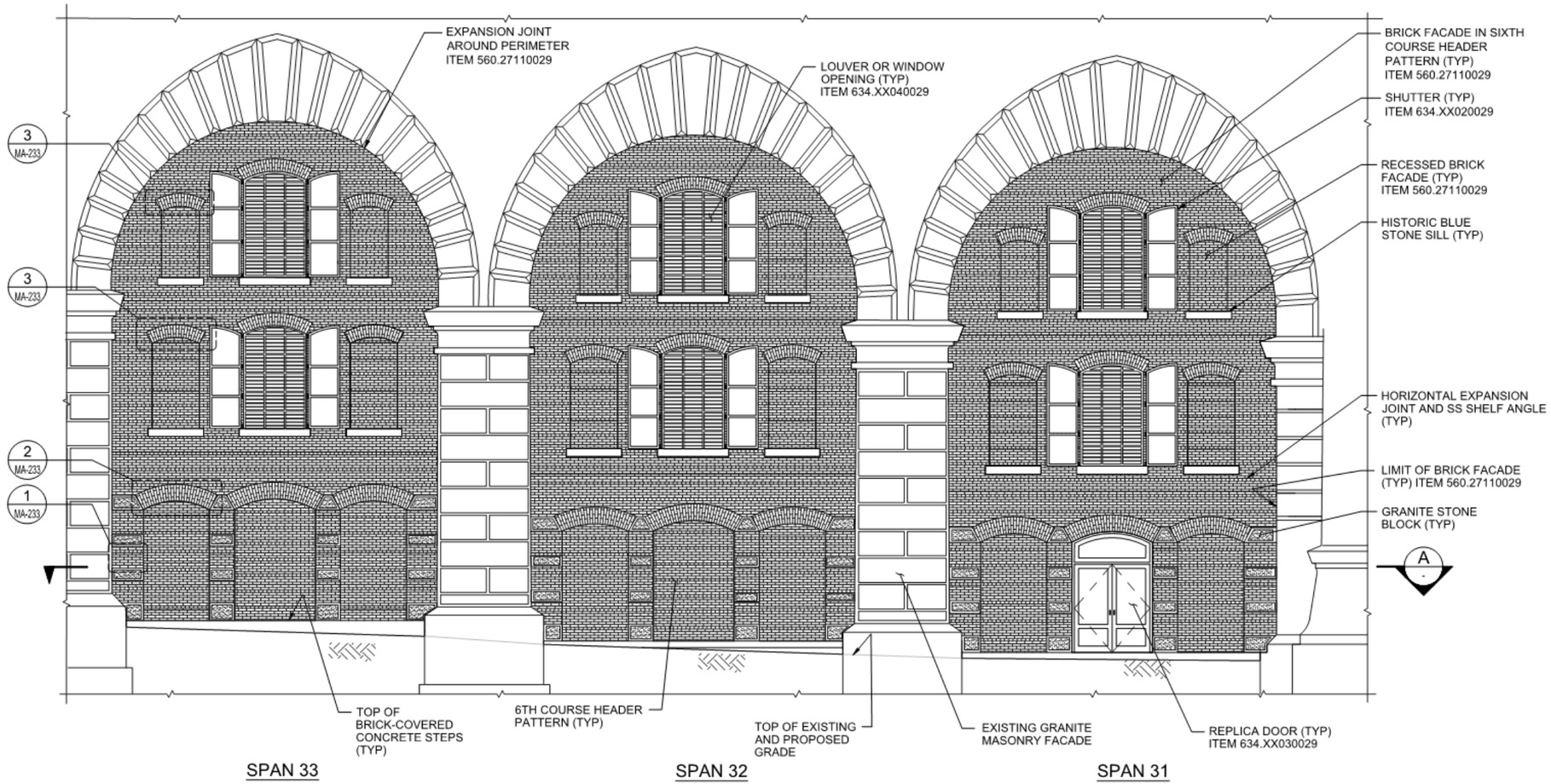
Drawing Key



SPAN 34 SPAN 33 SPAN 32 SPAN 31



Drawing Key



NORTH ELEVATION
SCALE: 3/32" = 1'-0"

Vehicle Ramp not shown for clarity

Arch Block C

General Information:

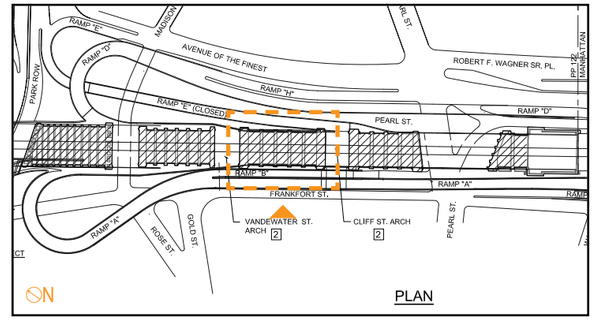
-Spans 25-29
-North Side: 5 Arch Bay
-South Side: 5 Arch Bays

Overall Architectural Layout:

-Elevation: 3 Levels
-Upper Level: 3 Window Openings
-Middle Level: 3 Window Openings
-Street Level: 2 Door Openings

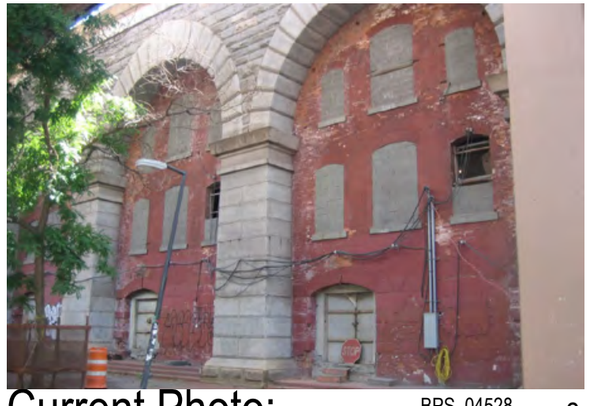
Typical Architectural Features:

- Stone Belt Course
- Stone Stringers

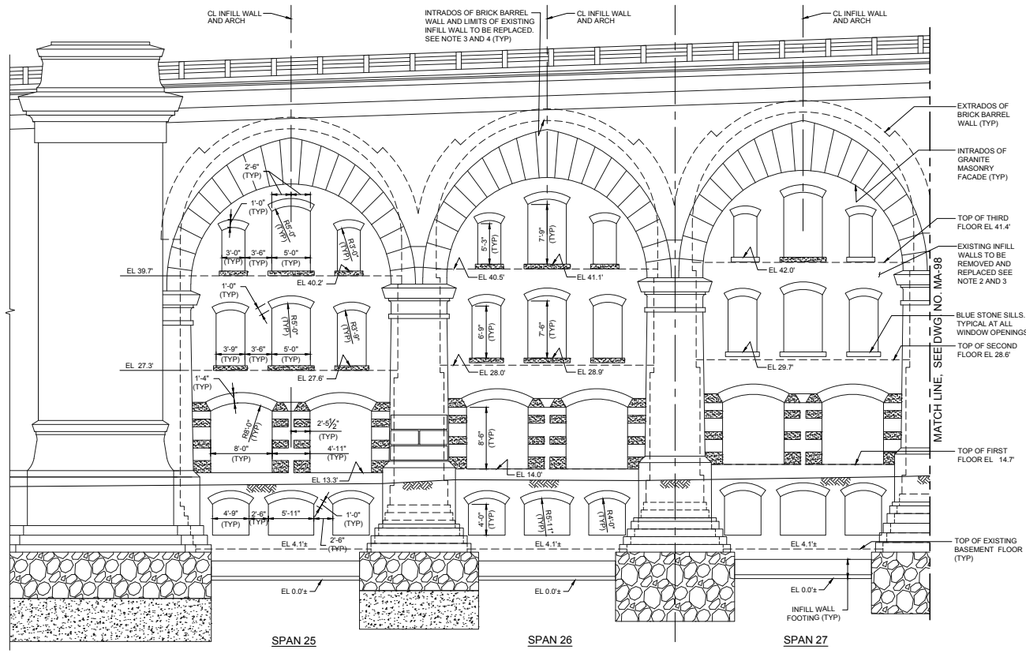


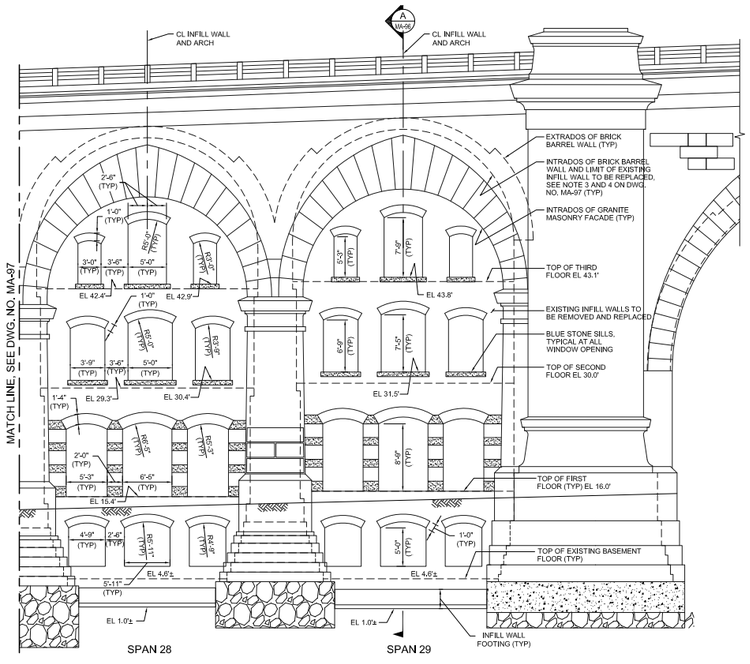
Drawing Key

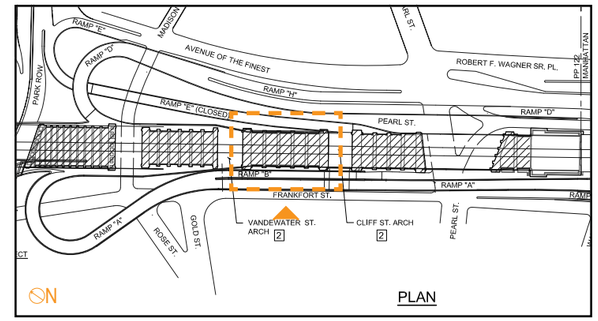
Historical Photo: BPS_05116 1



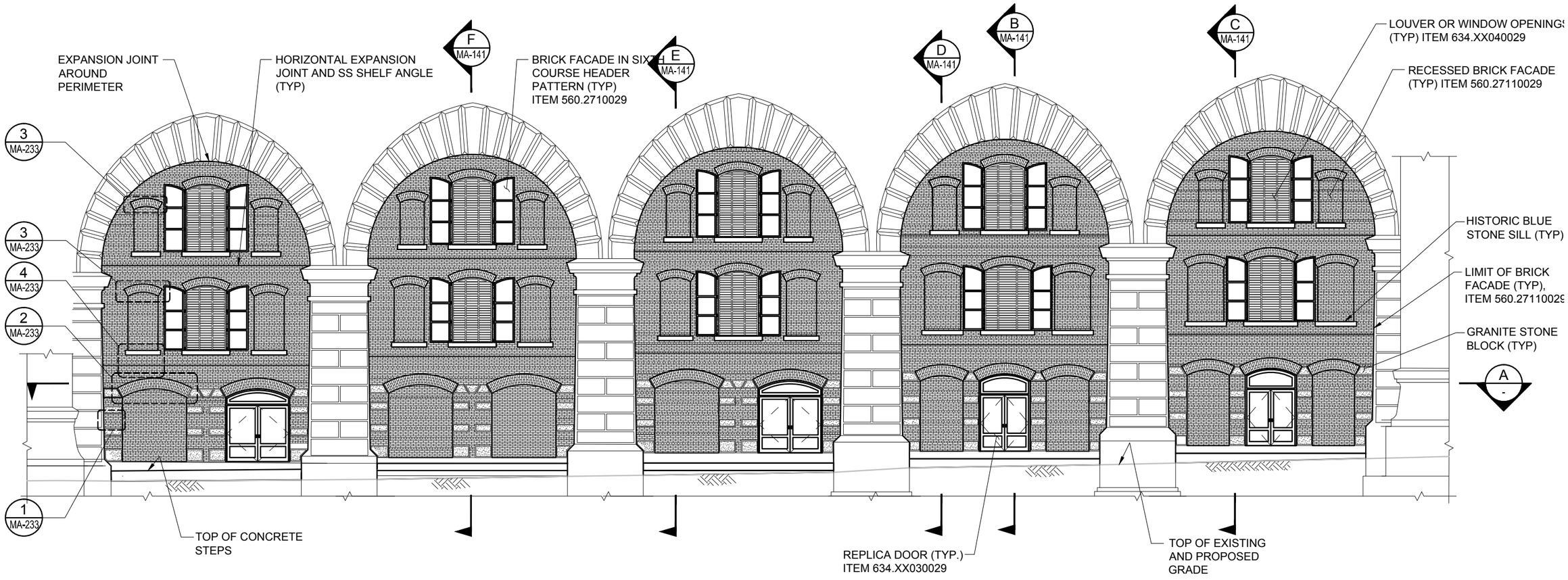
Current Photo: BPS_04528 2





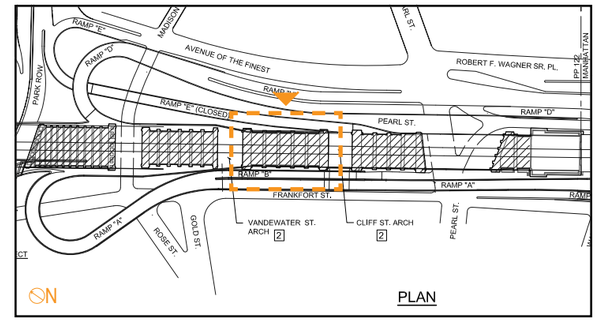


Drawing Key

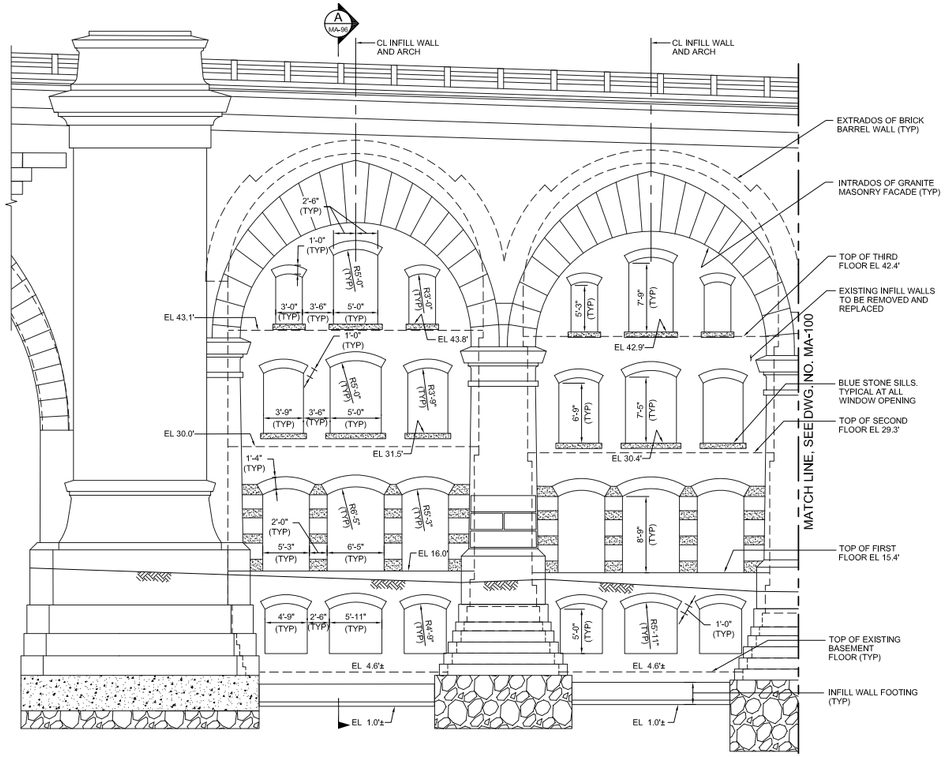


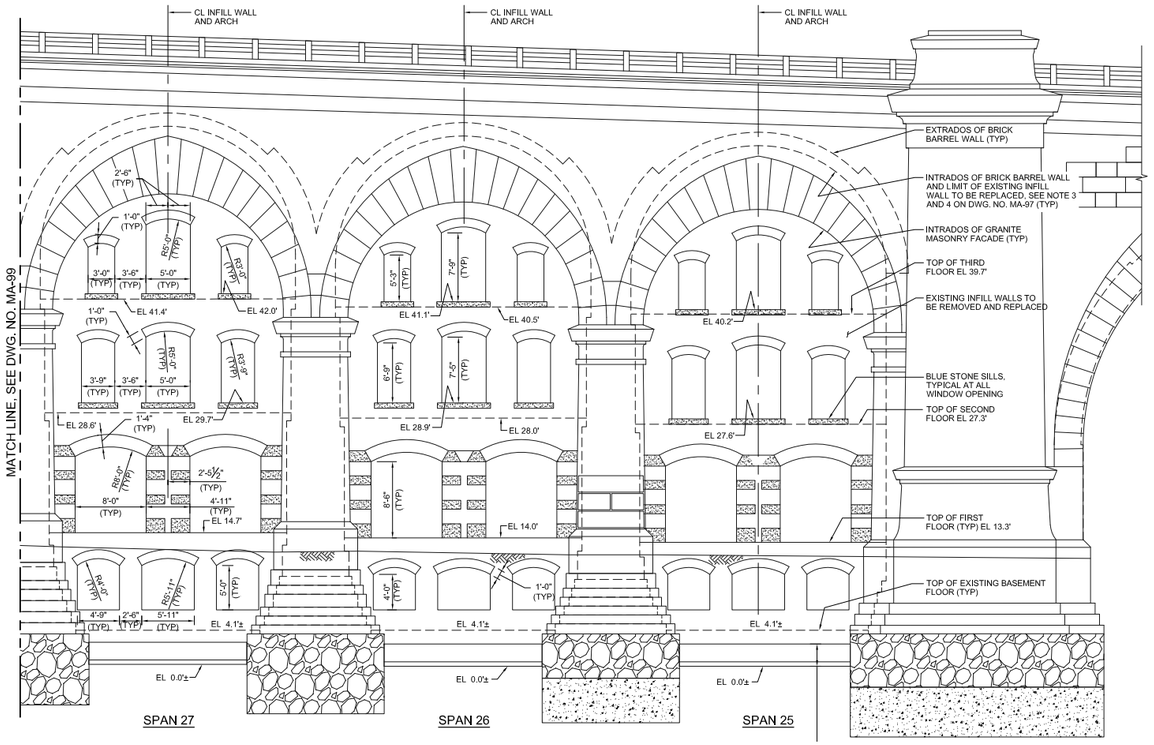
SOUTH ELEVATION

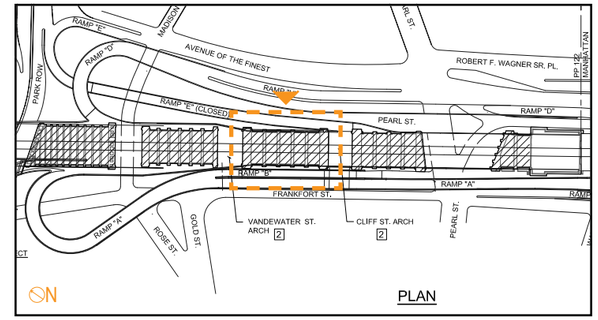
SCALE: 1/16" = 1'-0"


RAMP "E"
MADISON ST.
AVENUE OF THE FINEST
RAMP "D"
ROBERT F. WAGNER SR. PL.
PARK ROW
RAMP "C"
RAMP "E" (CLOSED)
PEARL ST.
RAMP "D"
RAMP "B"
RAMP "A"
FRANKFORT ST.
VANDEWATER ST.
ARCH 2
CLIFF ST. ARCH 2
PEARL ST.
GOLD ST.
ROSE ST.
RAMP "F"
N
PLAN

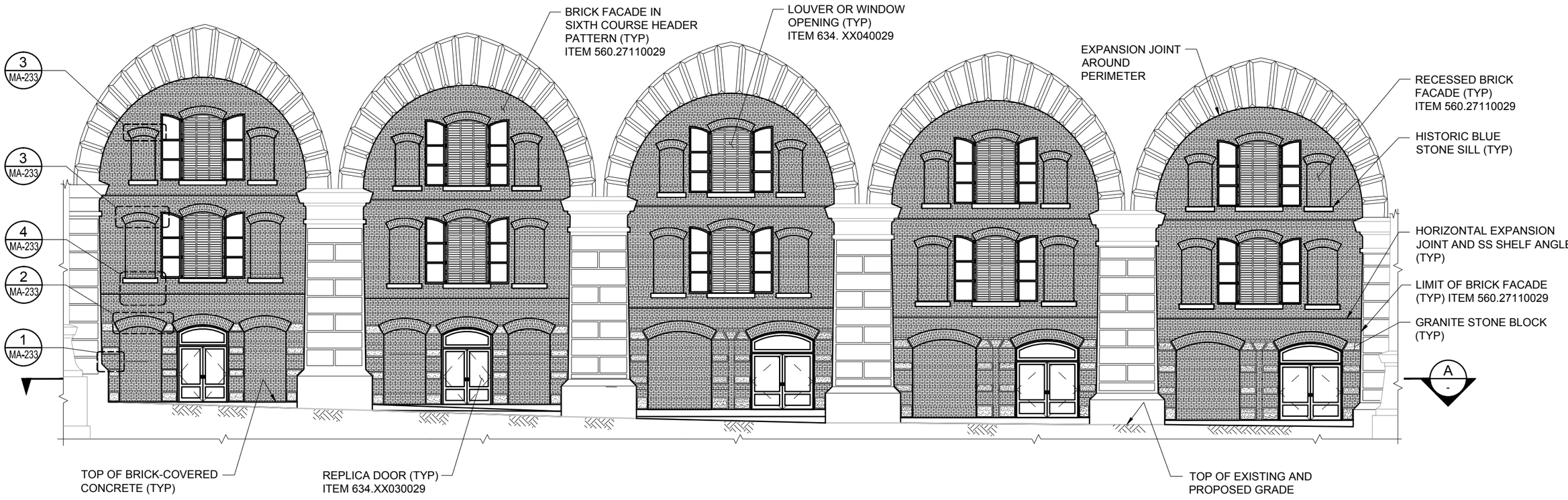
Drawing Key


A
MA-99
CL INFILL WALL AND ARCH
CL INFILL WALL AND ARCH
EXTRADOS OF BRICK BARREL WALL (TYP)
INTRADOS OF GRANITE MASONRY FACADE (TYP)
TOP OF THIRD FLOOR EL 42.4'
EXISTING INFILL WALLS TO BE REMOVED AND REPLACED
BLUE STONE SILLS. TYPICAL AT ALL WINDOW OPENING
TOP OF SECOND FLOOR EL 29.3'
TOP OF FIRST FLOOR EL 15.4'
TOP OF EXISTING BASEMENT FLOOR (TYP)
INFILL WALL FOOTING (TYP)
MATCH LINE, SEE DWG. NO. MA-100
EL 43.1'
EL 43.8'
EL 42.9'
EL 30.0'
EL 31.5'
EL 30.4'
EL 16.0'
EL 4.6'±
EL 4.6'±
EL 1.0'±
EL 1.0'±


CL INFILL WALL AND ARCH
CL INFILL WALL AND ARCH
CL INFILL WALL AND ARCH
EXTRADOS OF BRICK BARREL WALL (TYP)
INTRADOS OF BRICK BARREL WALL AND LIMIT OF EXISTING INFILL WALL TO BE REPLACED, SEE NOTE 3 AND 4 ON DWG. NO. MA-97 (TYP)
INTRADOS OF GRANITE MASONRY FACADE (TYP)
TOP OF THIRD FLOOR EL 39.7'
EXISTING INFILL WALLS TO BE REMOVED AND REPLACED
BLUE STONE SILLS. TYPICAL AT ALL WINDOW OPENING
TOP OF SECOND FLOOR EL 27.3'
TOP OF FIRST FLOOR (TYP) EL 13.3'
TOP OF EXISTING BASEMENT FLOOR (TYP)
MATCH LINE, SEE DWG. NO. MA-99
EL 41.4'
EL 42.0'
EL 41.1'
EL 40.5'
EL 40.2'
EL 28.6'
EL 29.7'
EL 28.9'
EL 28.0'
EL 27.6'
EL 14.7'
EL 14.0'
EL 4.1'±
EL 4.1'±
EL 4.1'±
EL 0.0'±
EL 0.0'±
EL 0.0'±
SPAN 27
SPAN 26
SPAN 25



Drawing Key



NORTH ELEVATION

SCALE: 1/16" = 1'-0"

Vehicle Ramp not shown for clarity

Arch Block D

General Information:

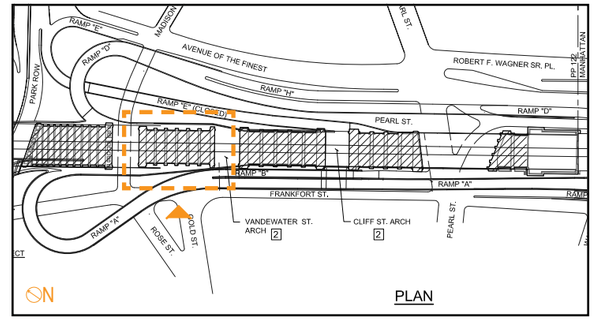
-Spans 18-23
-North Side: 6 Arch Bay
-South Side: 6 Arch Bays

Overall Architectural Layout:

-Elevation: 2 Levels
-Upper Level: 3 Window Openings
-Street Level: 2 Door Openings

Typical Architectural Features:

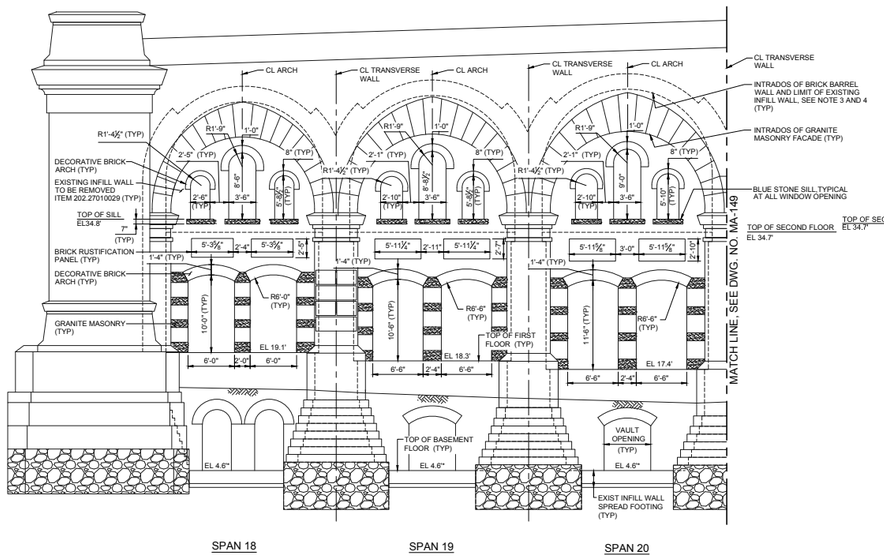
- Stone Belt Course
- Stone Stringers
- Recessed Brick Frieze

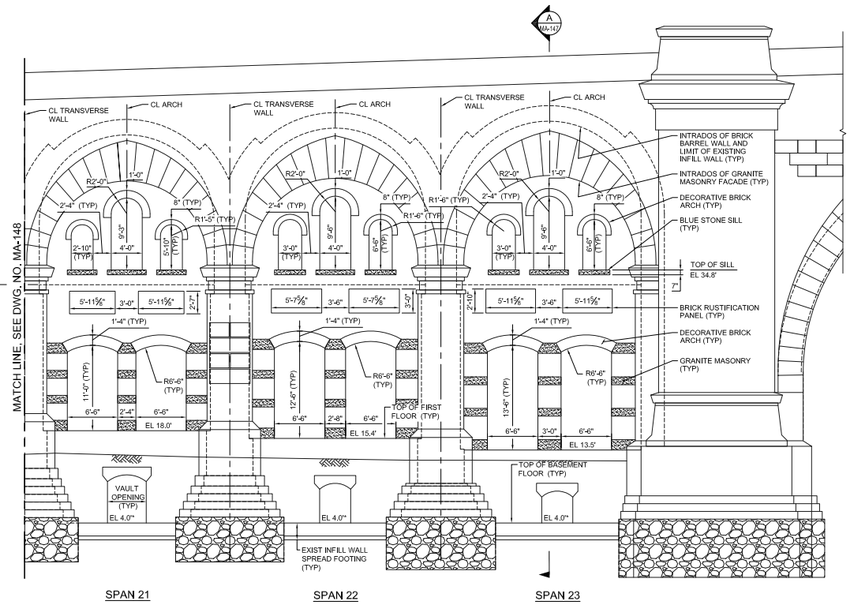


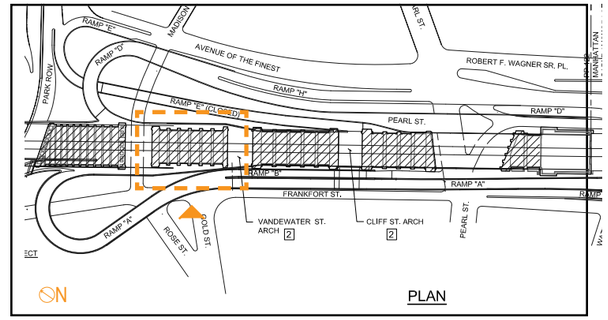
Drawing Key

Historical Photo: 1

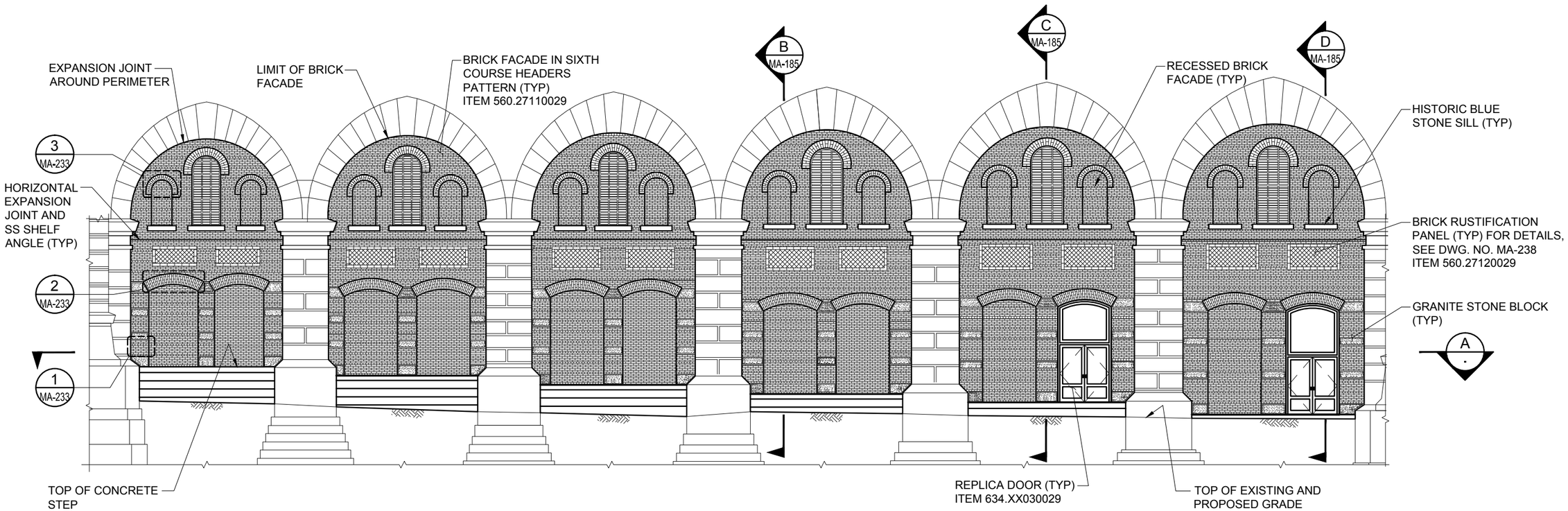
Current Photo: IMG_5881 2





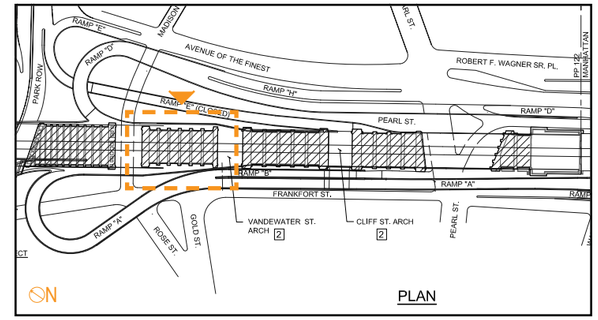


Drawing Key

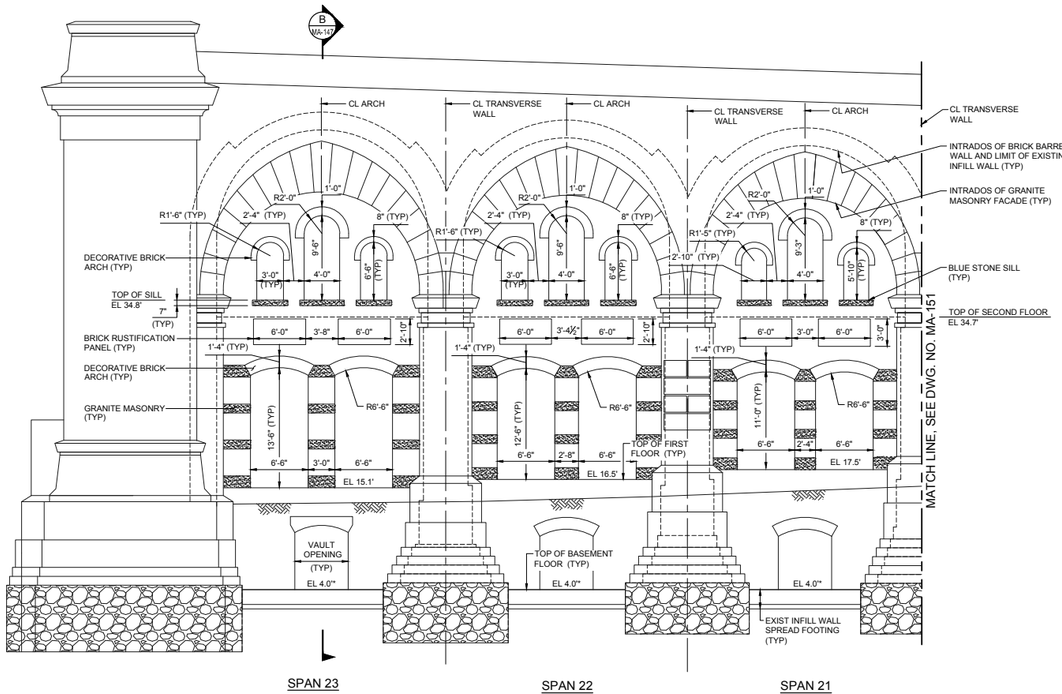


SOUTH ELEVATION

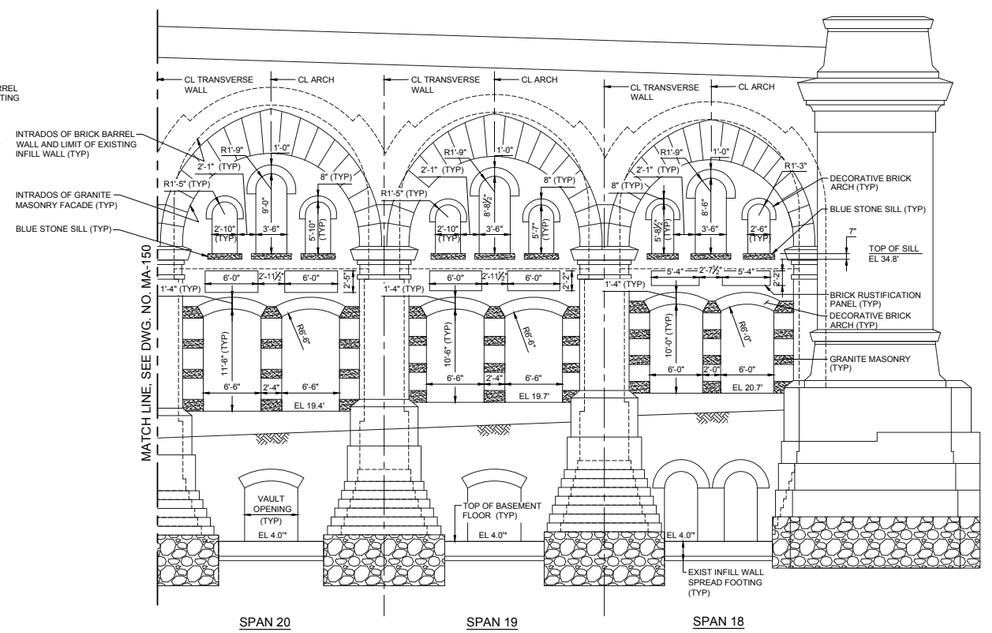
SCALE: 1/16" = 1'-0"



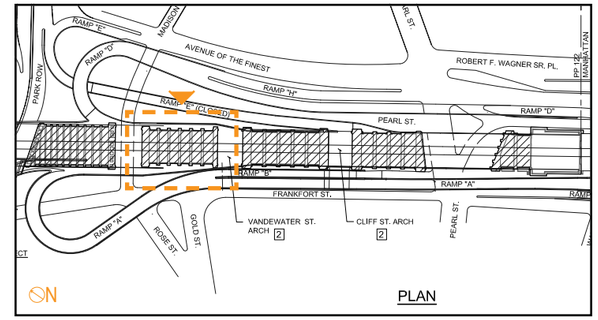
Drawing Key



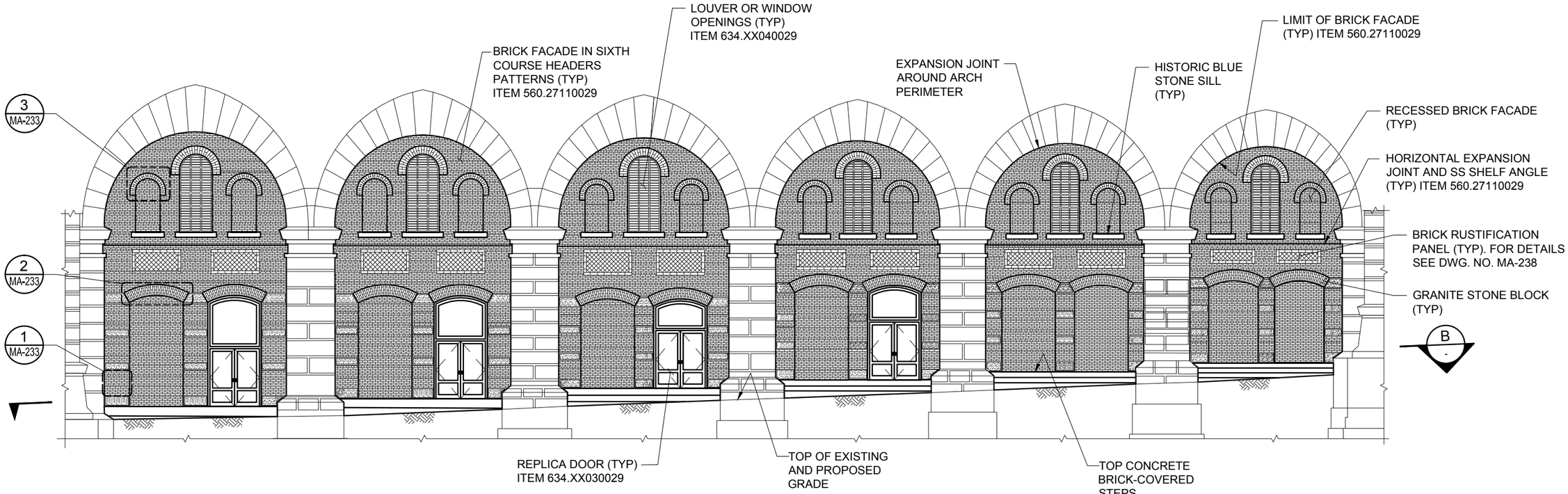
NORTH ELEVATION
SCALE: 3/32" = 1'-0"



NORTH ELEVATION
SCALE: 3/32" = 1'-0"



Drawing Key



NORTH ELEVATION

SCALE: 1/16" = 1'-0"

Vehicle Ramp not shown for clarity

Arch Block E

General Information:

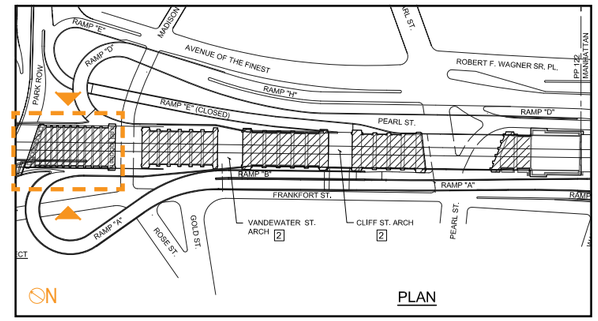
-Spans 5-16
-North Side: 9 Arch Bay
-South Side: 11 Arch Bays

Overall Architectural Layout:

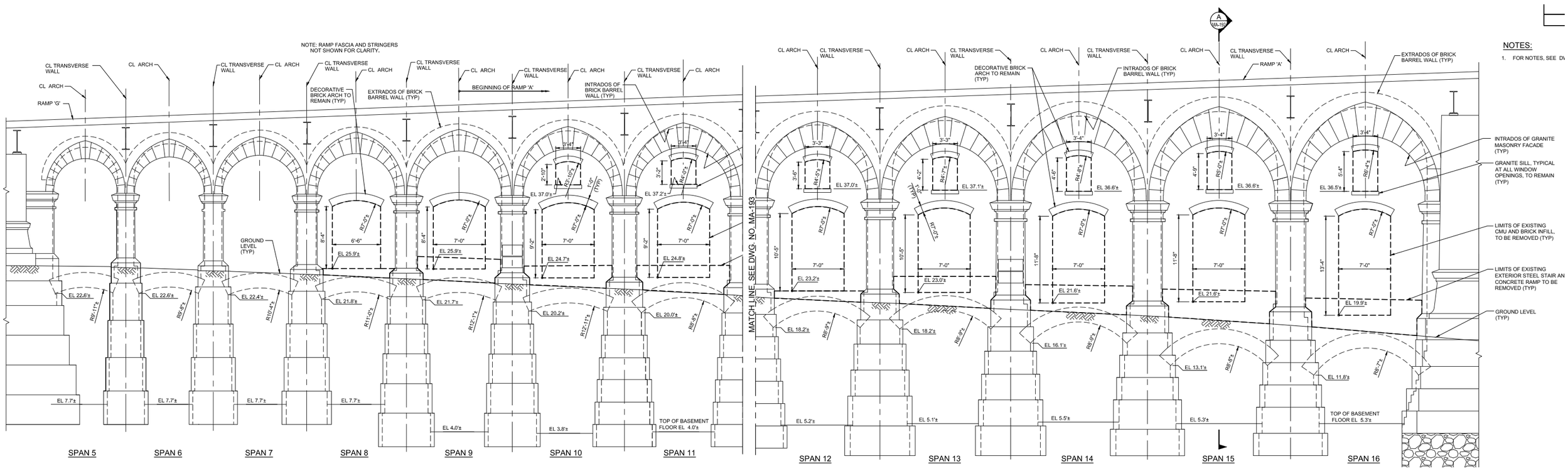
-Elevation: 2 Levels
-Upper Level: 1 Window Opening
-Street Level: 1 Door Opening

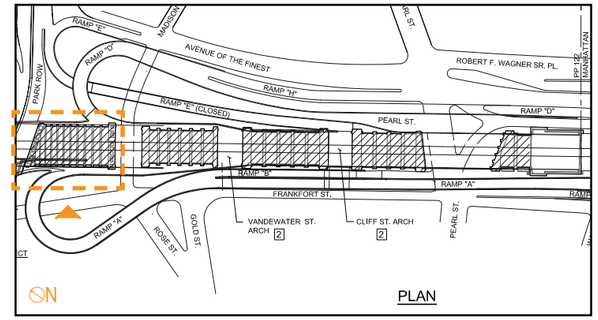
Typical Architectural Features:

- Brick Arches
- Stone Sills
- CMU Infill

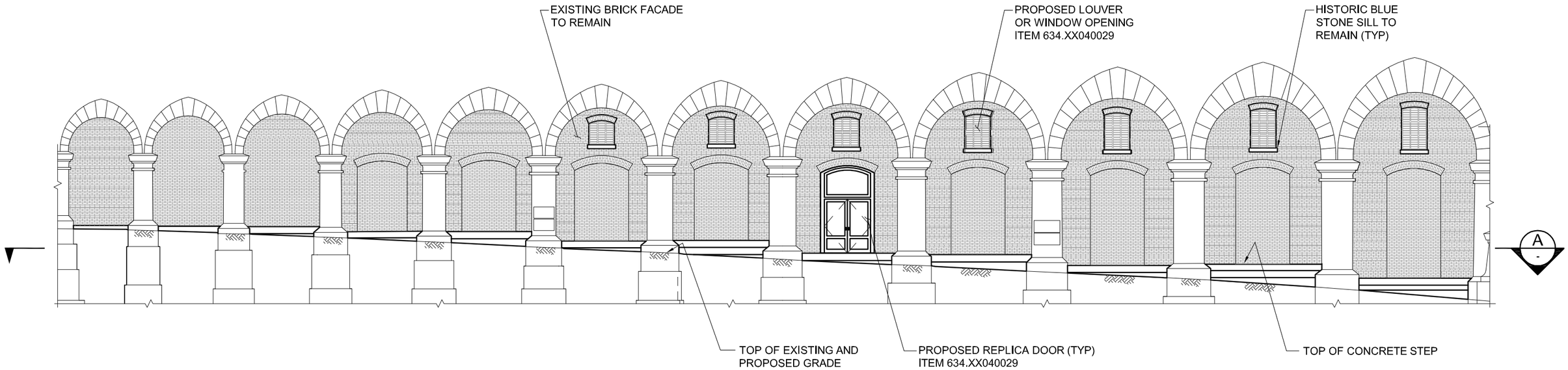


Drawing Key



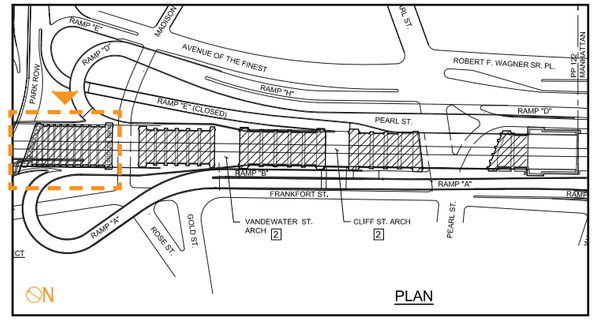


Drawing Key

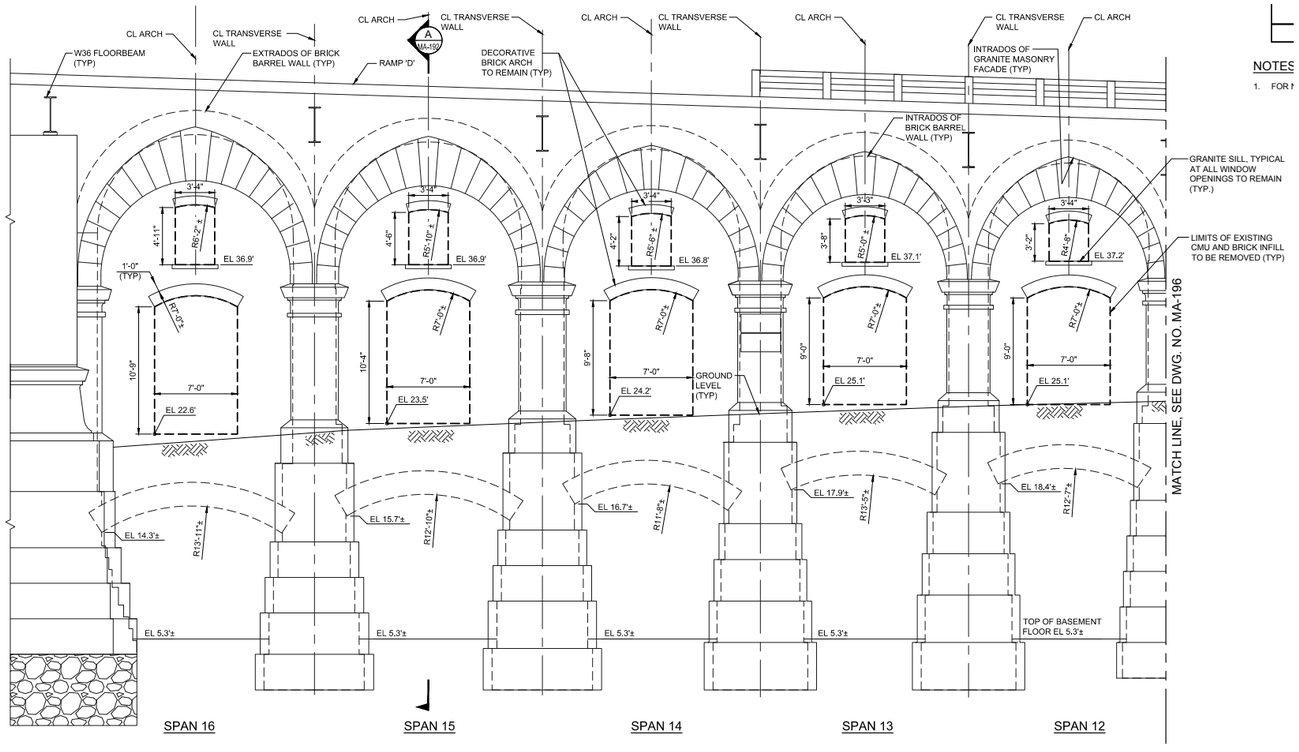


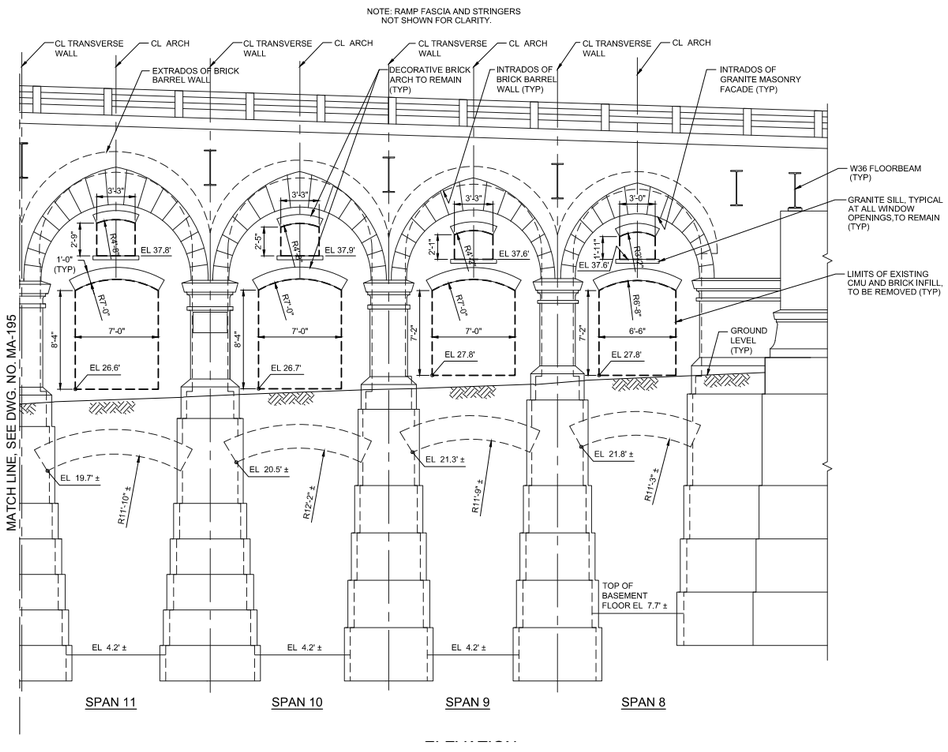
SOUTH ELEVATION

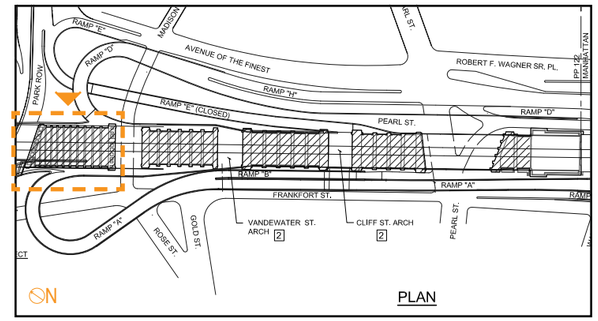
SCALE: 1/16" = 1'-0"


RAMP "E"
MADISON ST.
AVENUE OF THE FINEST
RAMP "D"
ROBERT F. WAGNER SR. PL.
PARK ROW
RAMP "H"
RAMP "E" (CLOSED)
PEARL ST.
RAMP "D"
RAMP "B"
RAMP "A"
FRANKFORT ST.
VANDEWATER ST.
ARCH 2
CLIFF ST. ARCH 2
PEARL ST.
GOLD ST.
ROSE ST.
RAMP "F"
N
PLAN

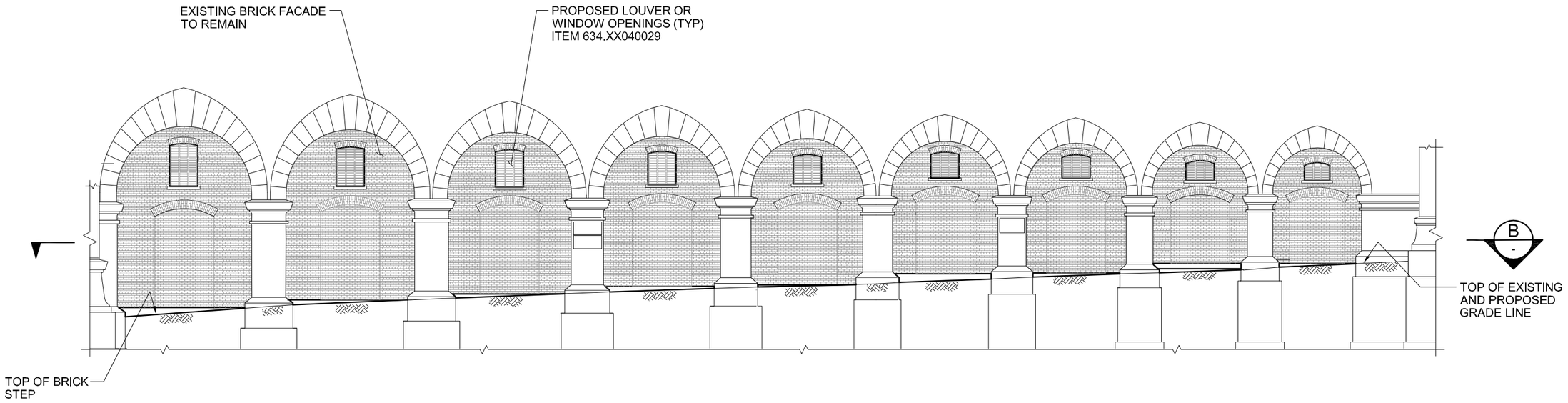
Drawing Key


CL ARCH
CL TRANSVERSE WALL
W36 FLOORBEAM (TYP)
EXTRADOS OF BRICK BARREL WALL (TYP)
RAMP 'D'
DECORATIVE BRICK ARCH TO REMAIN (TYP)
INTRADOS OF GRANITE MASONRY FACADE (TYP)
INTRADOS OF BRICK BARREL WALL (TYP)
GRANITE SILL, TYPICAL AT ALL WINDOW OPENINGS TO REMAIN (TYP.)
LIMITS OF EXISTING CMU AND BRICK INFILL TO BE REMOVED (TYP)
GROUND LEVEL (TYP)
TOP OF BASEMENT FLOOR EL 5.3'±
MATCH LINE, SEE DWG. NO. MA-196
SPAN 16
SPAN 15
SPAN 14
SPAN 13
SPAN 12


NOTE: RAMP FASCIA AND STRINGERS NOT SHOWN FOR CLARITY.
CL TRANSVERSE WALL
CL ARCH
EXTRADOS OF BRICK BARREL WALL
DECORATIVE BRICK ARCH TO REMAIN (TYP)
INTRADOS OF BRICK BARREL WALL (TYP)
INTRADOS OF GRANITE MASONRY FACADE (TYP)
W36 FLOORBEAM (TYP)
GRANITE SILL, TYPICAL AT ALL WINDOW OPENINGS,TO REMAIN (TYP)
LIMITS OF EXISTING CMU AND BRICK INFILL, TO BE REMOVED (TYP)
GROUND LEVEL (TYP)
TOP OF BASEMENT FLOOR EL 7.7' ±
MATCH LINE, SEE DWG. NO. MA-195
SPAN 11
SPAN 10
SPAN 9
SPAN 8



Drawing Key



NORTH ELEVATION

SCALE: 1/16" = 1'-0"

Vehicle Ramp not shown for clarity

The Rehabilitation of Brooklyn Bridge - Approach Arches, Towers, Ramp Substructures, and Miscellaneous Repairs

New York City Department of Transportation - Division of Bridges

New York City Landmarks Preservation Commission Review

Contract No. BRC270D

June 29, 2018

Contains:

Brooklyn Approach

Tower Approach

Additional Photographs

General Scope of Work - Brooklyn Approach

1 - Arch Block I,II, and III

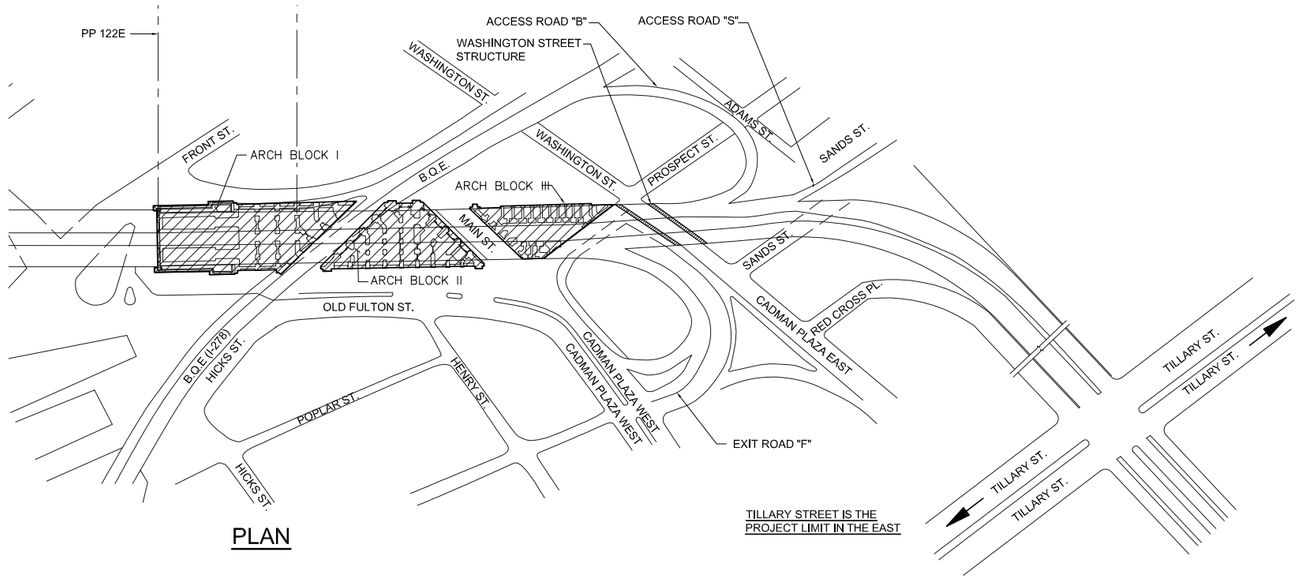
2 - Arch Block I and II

3 - Drainage Improvements

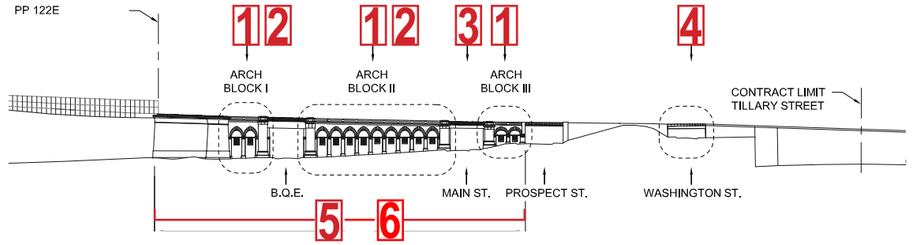
4 - Washington Street Structure
A - Reinforce existing abutment foundation

5 - Masonry cleaning and Repointing
A - Clean and repoint all masonry exteriors from the Brooklyn anchorage to Arch Block III

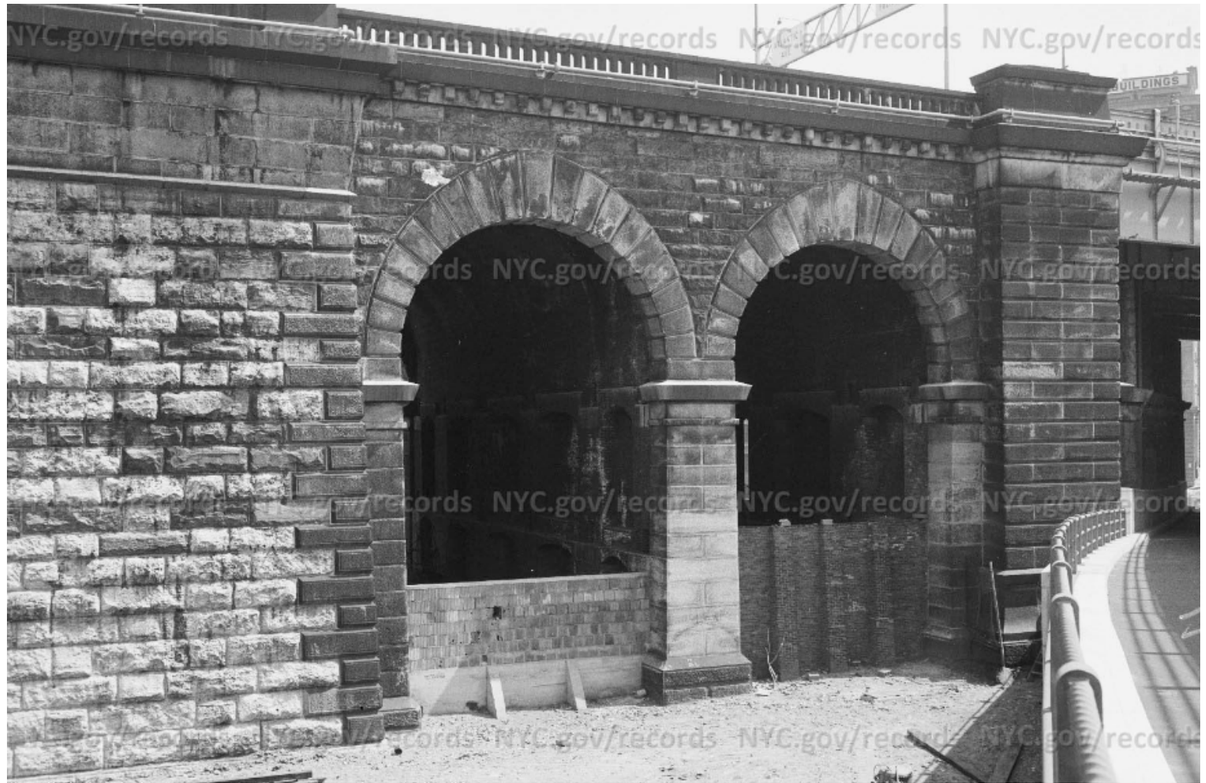
6 - HAER Photographic Documentation
A- Documenation Level II - Complete exterior of Brooklyn and Manhattan Towers



PLAN



1 - Non-Original Wall Replacement



2 - Original Stone Arch Construction (1950's)

3 - Brooklyn Side Masonry Approaches

4 - Open Arches

5 - Original Infill Design

General Scope of Work - Bridge Spans and Towers

1 - Main Bridge Towers

A - Drill, install, and grout reinforcing bars to secure granite blocks in gothic arches

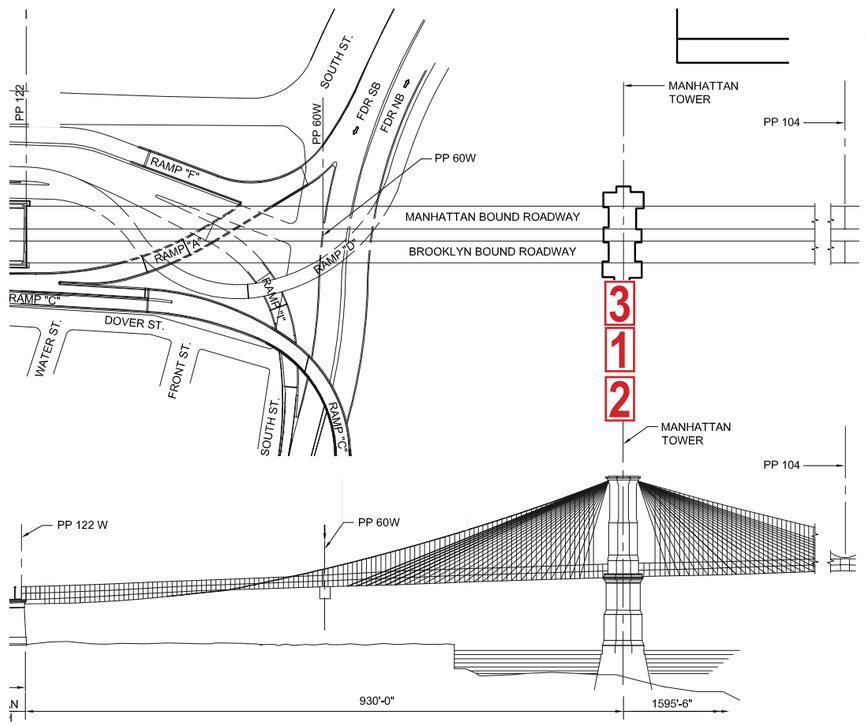
B - Tower Top Repairs

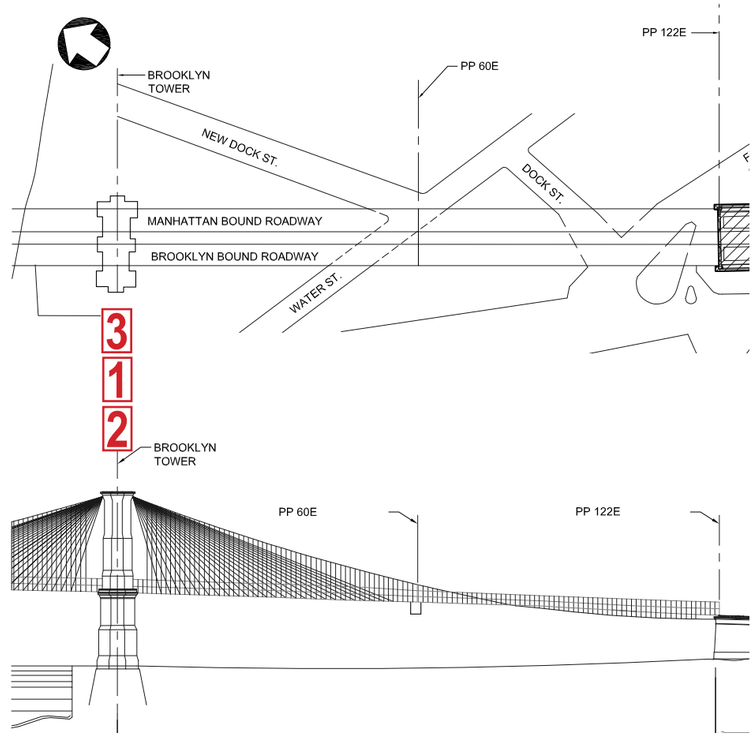
2 - Masonry cleaning and Repointing

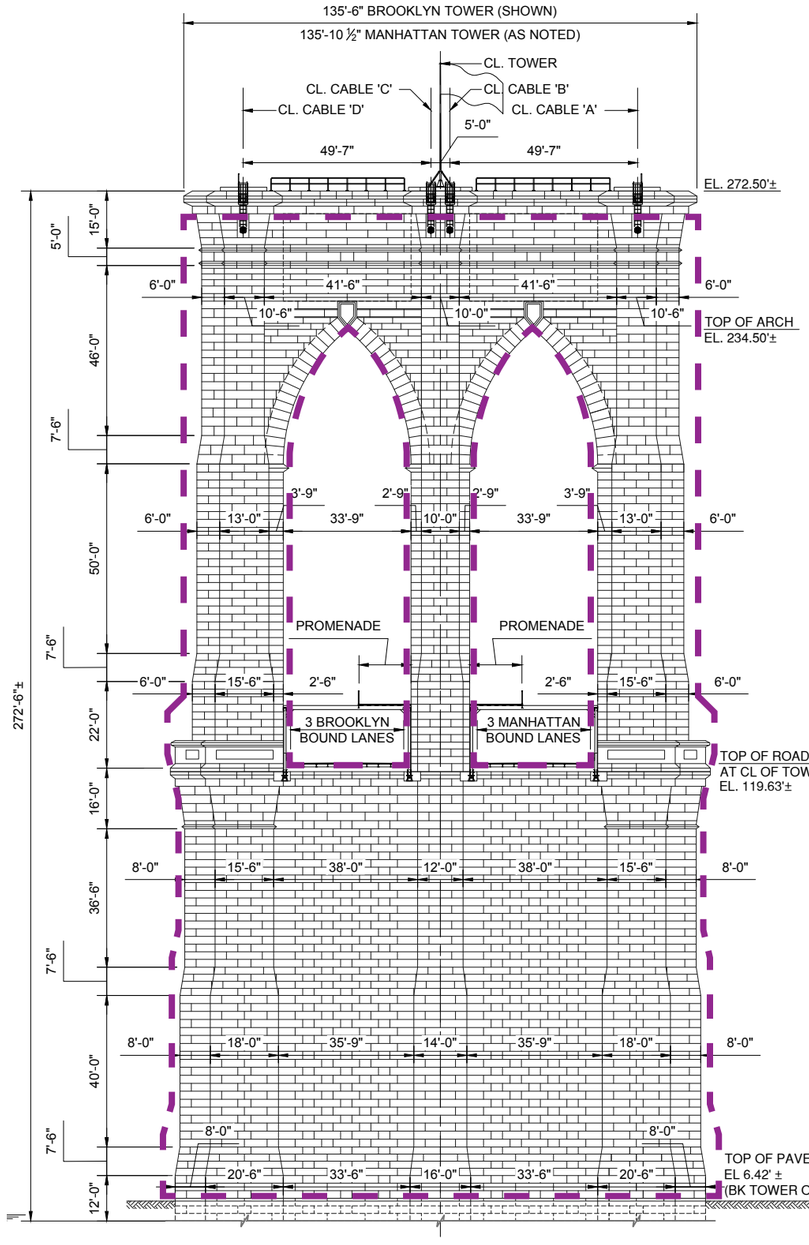
A - Clean and repoint all masonry exteriors inclusive on the Main Span Towers

3 - HAER Photographic Documentation

A- Documenation Level II - Complete exterior of Brooklyn and Manhattan Towers

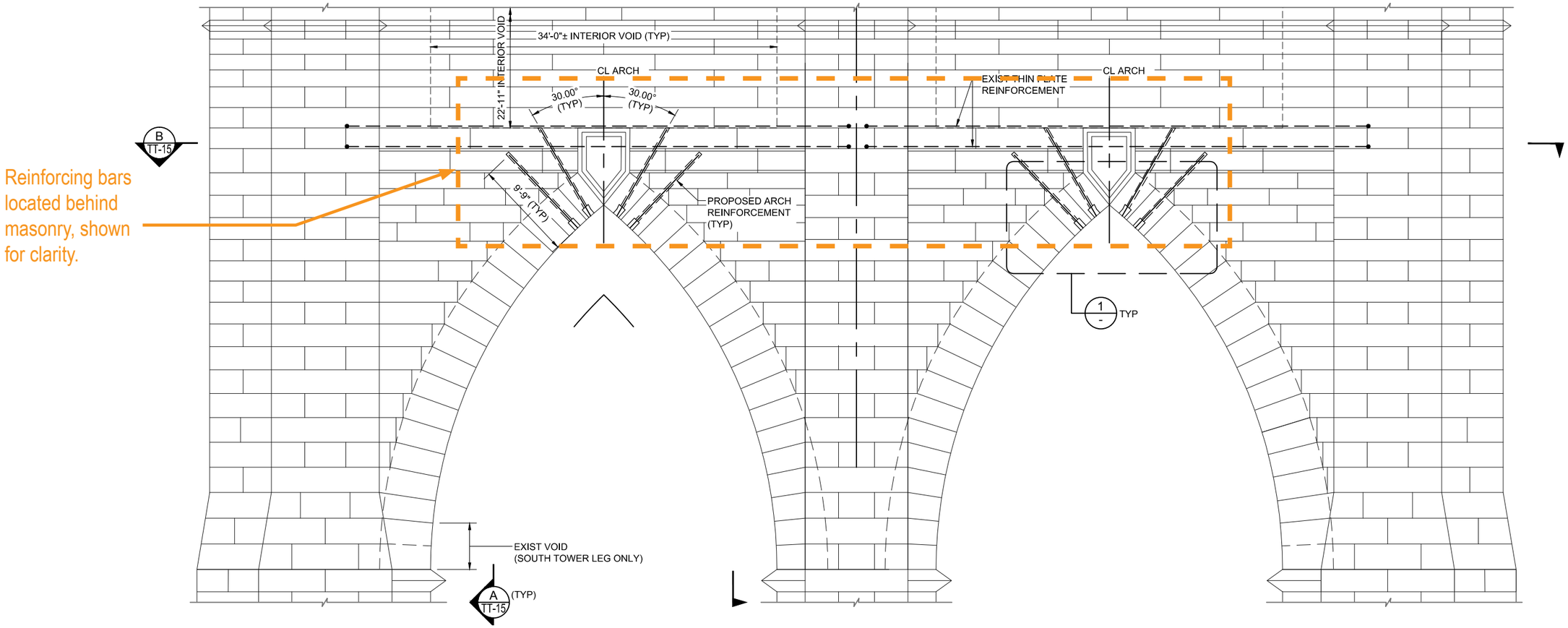






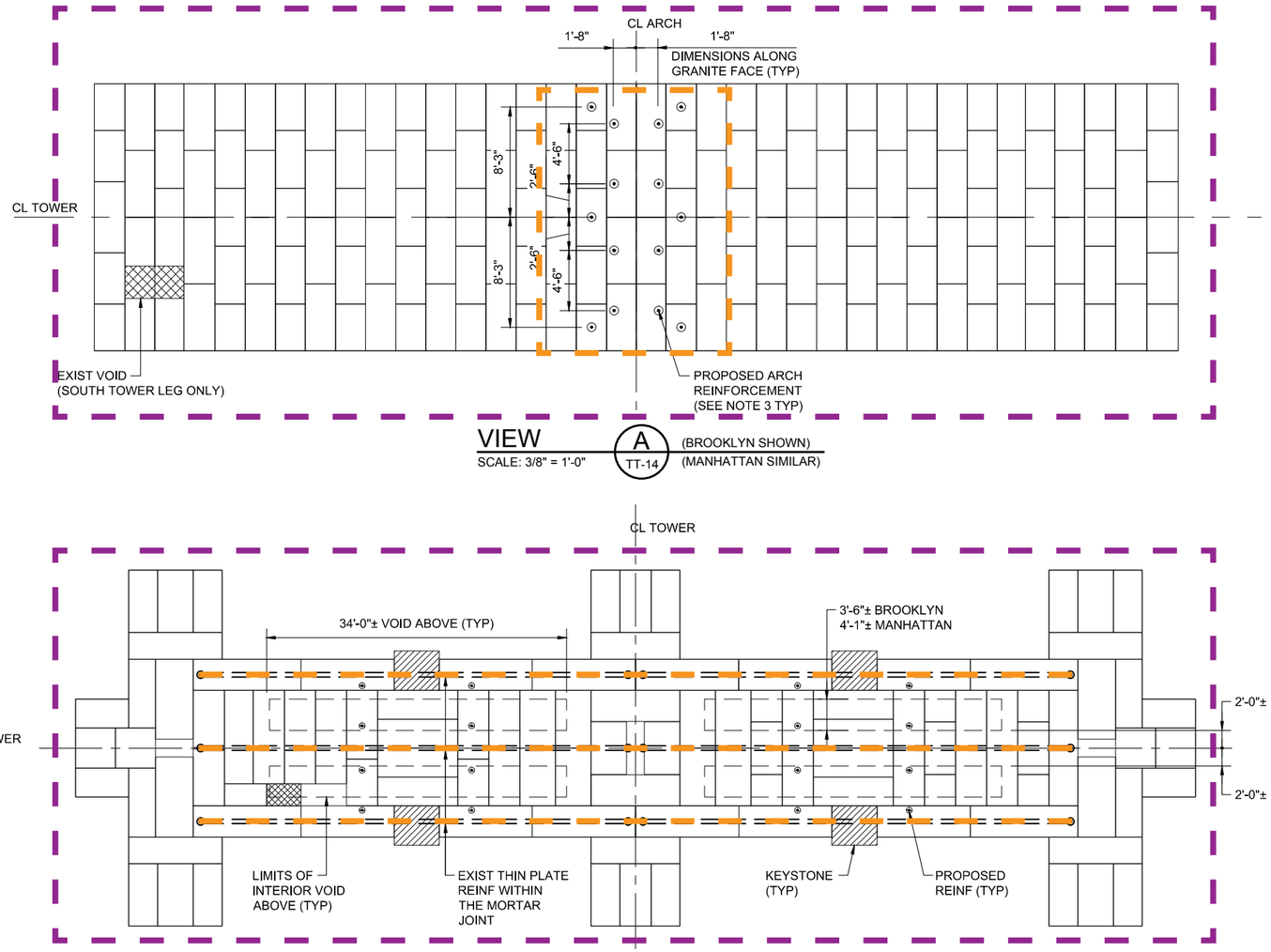
Legend

- Clean and Repoint Masonry
- Reinforcing Bars



Legend

- Clean and Repoint Masonry
- Reinforcing Bars



VIEW A (BROOKLYN SHOWN)
SCALE: 3/8" = 1'-0" TT-14 (MANHATTAN SIMILAR)

SECTION B (BROOKLYN SHOWN)
SCALE: 3/8" = 1'-0" TT-14 (MANHATTAN SIMILAR)

Legend

- Clean and Repoint Masonry
- Reinforcing Bars

Appendix : Additional Photos

Historical

1 - North Side

BPS_005116-1918

3 - South Side

BPS_003382-1904

5 - South Side

BPS_00383-1904

2 - North Side

IMG_5919

4 - North Side

IMG_5924

6 - South Side

Current

Arch Block C

Arch Block B

Arch Block A

Historical

1 - South Side

BPS_04530-1915

3 - South Side

BPS_05115-1918

5 - South Side

BPS_04528-1915

2 - South Side

IMG_5882

4 - South Side

IMG_5878

6 - South Side

IMG_5881

Current

Arch Block D - Stair

Arch Block D - Bay

Arch Block D

1 BPS_01113-1907

2 BPS_01261-1907

3 BPS_01110-1907

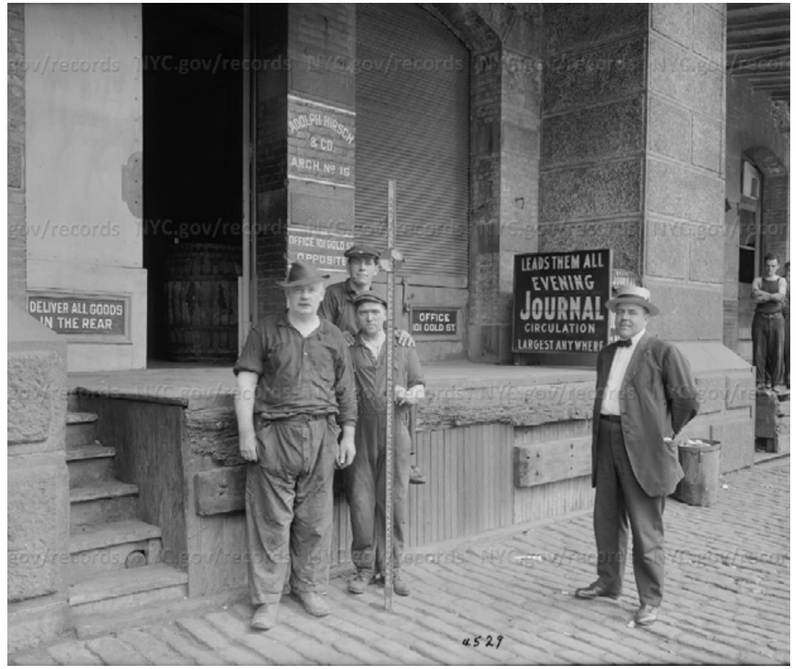
1 BPS_16005-1933

2 BPS_05114-1918

3 BPS_05088-1918

4 BPS_04529-1915

5 BPS_04531-1915



6 BPS_04529-1915

1 - Deteriorated Facade, Peeling Paint, Efflorescence IMG_5897

2 IMG_5870

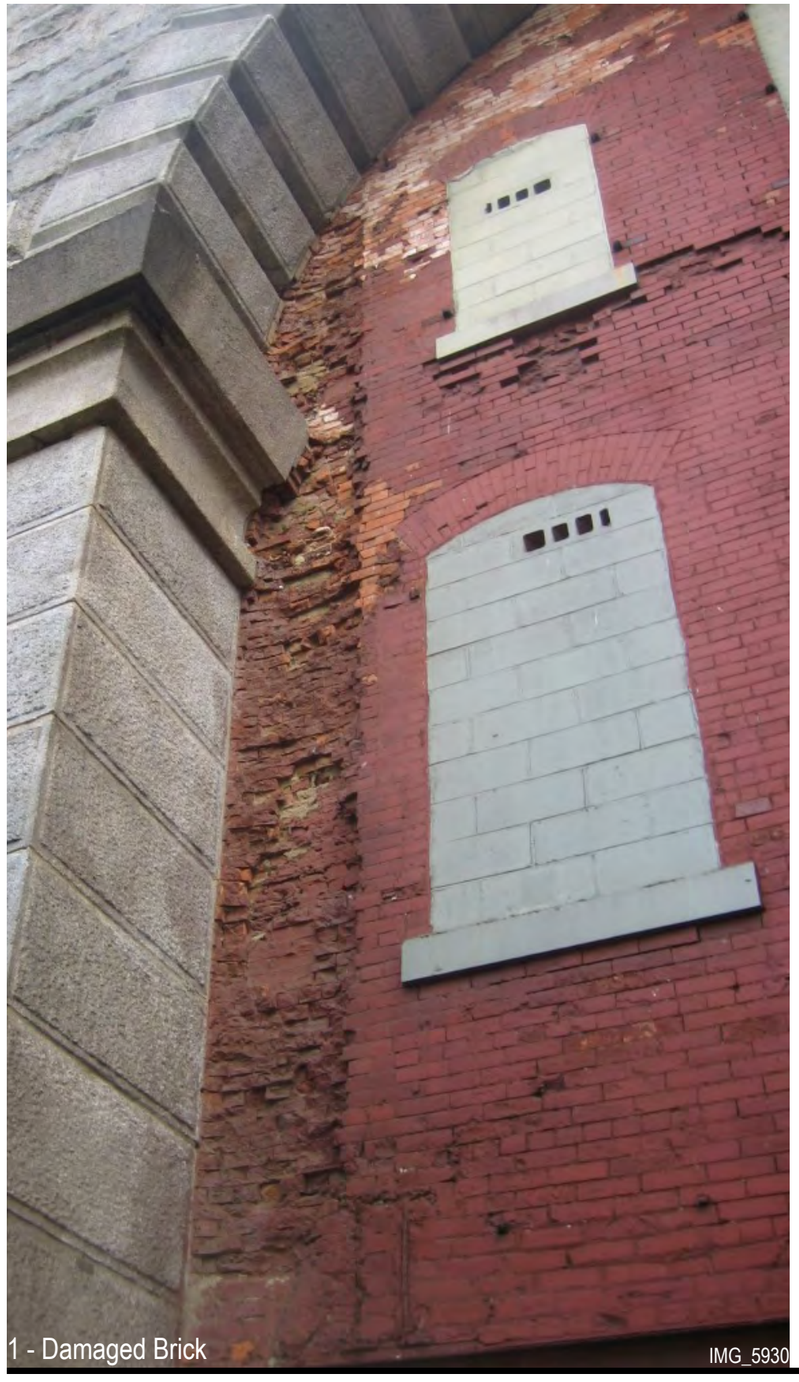
3 - Overgrown Vines on Brick Facade IMG_5869

4 - Efflorescence on Bricks IMG_5856

5 IMG_5861

6 - Non-original Metal Door IMG_5859

7 - Crumbling Brick Sill IMG_5876



1 - Damaged Brick IMG_5930

2 - Rusted Metal Assembly IMG_5853

3 - Crumbling Brick, Deteriorated Mortar IMG_5937

4 - Peeling Paint` IMG_5857

5 - Non-Original Features IMG_5923

6 - Damaged Wood Stair IMG_5902

7 - Brick Efflorescence IMG_5899

8 - Crumbling Brick Arch IMG_5927

9 - Damaged Brick Wall IMG_5929

10 - Mismatched CMU Infill IMG_5883

Landmark Preservation Commission Review
Contract No. BRC270D
June 29, 2018