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CITY OF SAINT PAUL PUBLIC WORKS

Walnut Street Stairway

June 13, 2023



Walnut Street Stairway System



Part 1: Background

History
Construction Details

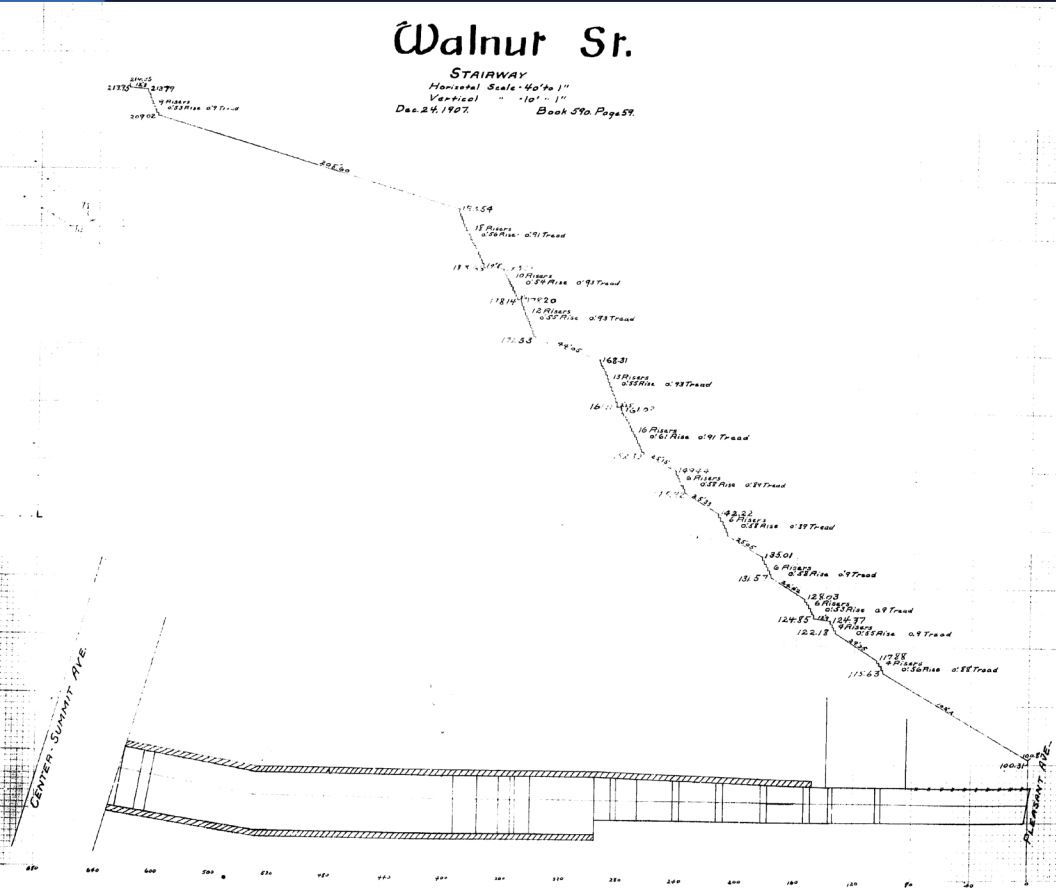


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Walnut Street Stairway System



- This plan dated December 24, 1907 is the only original construction plan known to exist. No construction details are included.
- The construction details known to the City are based on field observations and information gathered during maintenance operations over the last century.



132 Years of History

1891: Construction is completed on James J. Hill House at 240 Summit Avenue.



This photograph taken ca. 1895 shows the unimproved Walnut Street right of way, with the J. J. Hill House on the right and 260 Summit property on the left



132 Years of History

1891: Construction is completed on James J. Hill House at 240 Summit Avenue.

1908: James J. Hill acquires Walnut Street right-of-way for his properties and constructs a stairway for public use on the remaining 15' of Walnut Street right-of-way.

- James J. Hill owns properties at both 240 and 260 Summit Ave, separated by Walnut Street unimproved right-of-way.
- Hill constructs a 680' long stairway and wall structure at no cost to the City for the use of the public. The stair system follows the northern 15' of Walnut Street right-of-way from Summit Avenue to what was then Pleasant Avenue (present day I-35E).
- In return for providing the stairway system, the City vacates the Walnut Street right-of-way to Hill's property at 260 Summit Avenue and receives a 15' easement under the stairway.



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Few records exist over many decades of public use.



Cracking and mortar failure are among the typical effects of age and weather.



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- The area in cyan was reconstructed by MnDOT and bears no resemblance to the original structure.
- The area in red retained the general design elements of the original stairway, with exception of other modifications or repairs. Typical lifespan of a structure is 50-75 years.

1986: MnDOT removes the lower portion of stairs during the construction of I-35E. The rebuilt concrete stairway bears no resemblance to the original structure.



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- In 2012, DSI issued an order to 260 Summit Ave to repair the south brick wall.
- City Attorney Office negotiated an agreement with the property owner in which the City accepted ownership of the stairway/wall structure.
- Public Works was then directed to repair major wall defects in 2013.

1986: MnDOT removes the lower portion of stairs during the construction of I-35E.

2013: City performs wall rehabilitation to repair brick voids and missing mortar.



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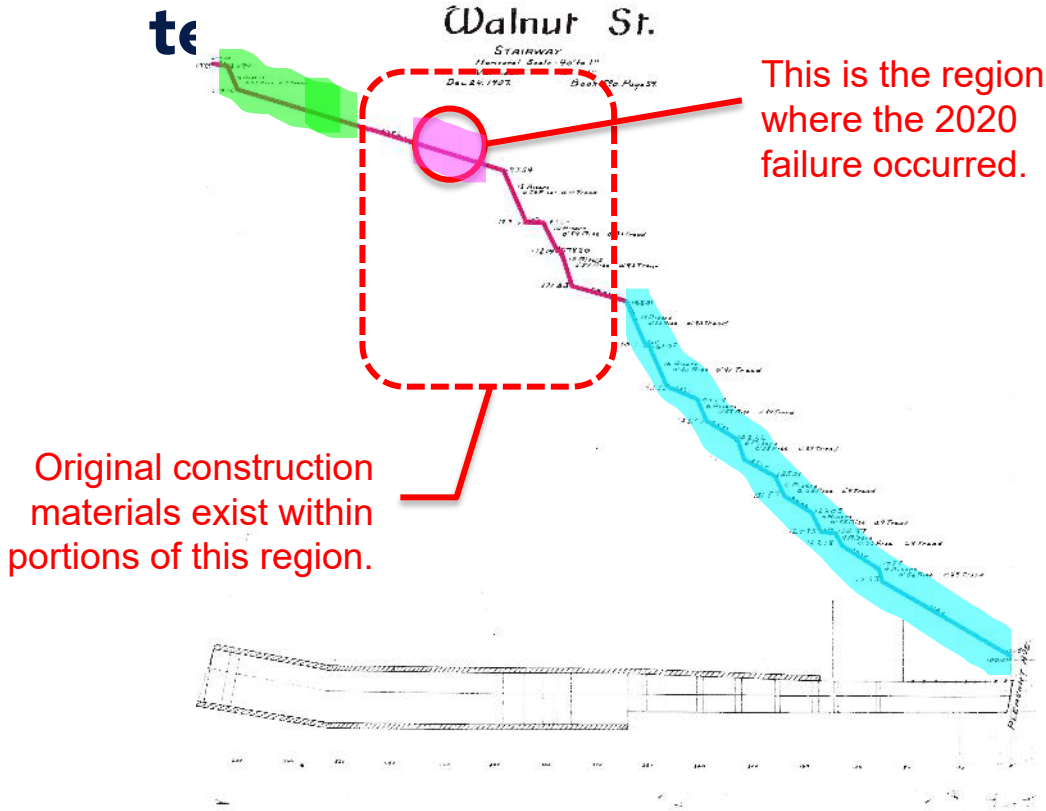
1986: MnDOT removes the lower portion of stairs during the construction of I-35E.

2013: City performs wall rehabilitation to repair brick voids and missing mortar.

2020: A portion of the south brick wall collapses and the stairway is closed.



What remains of the Original Stairway?

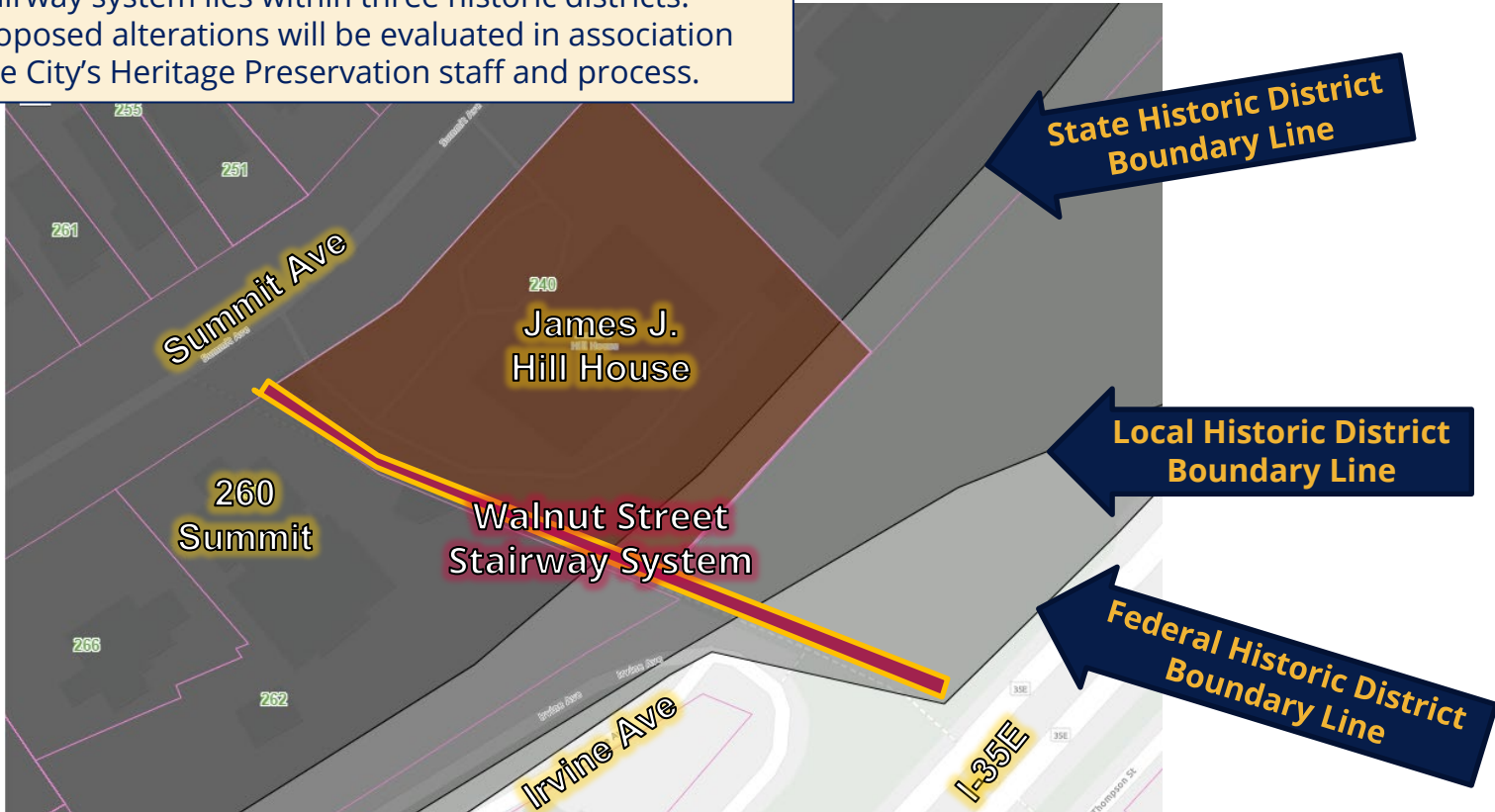


- Approximately 50% of the original stairway was removed and replaced by MnDOT in 1986.
- An additional 20% of the original system has been modified through major repairs or reconstruction.
- About 10% of upper wall structure (60' length) collapsed in 2020.
- As a result, around 20% of the original structure remains in an original state, or with a historic appearance (the 2013 repairs were also performed within this region).



Historic Hill District

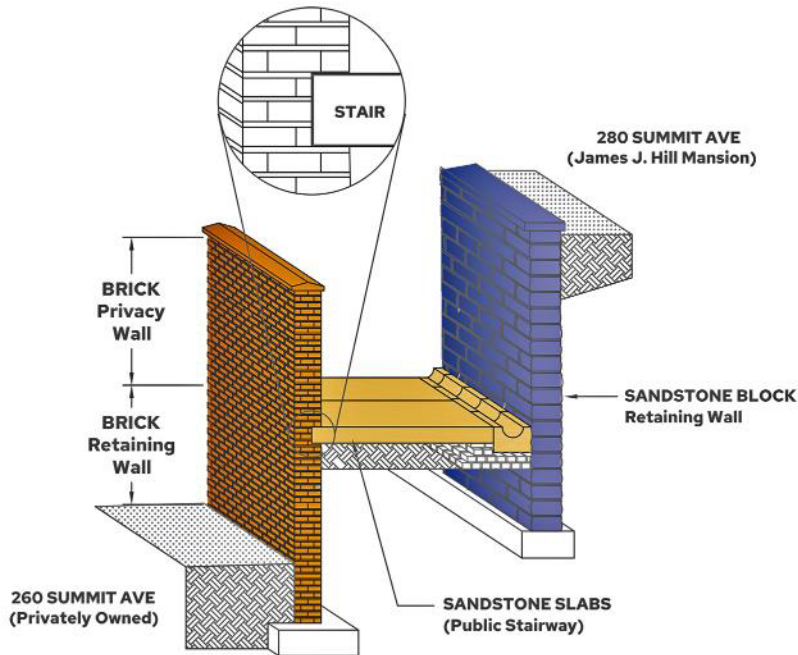
- The stairway system lies within three historic districts.
- Any proposed alterations will be evaluated in association with the City's Heritage Preservation staff and process.





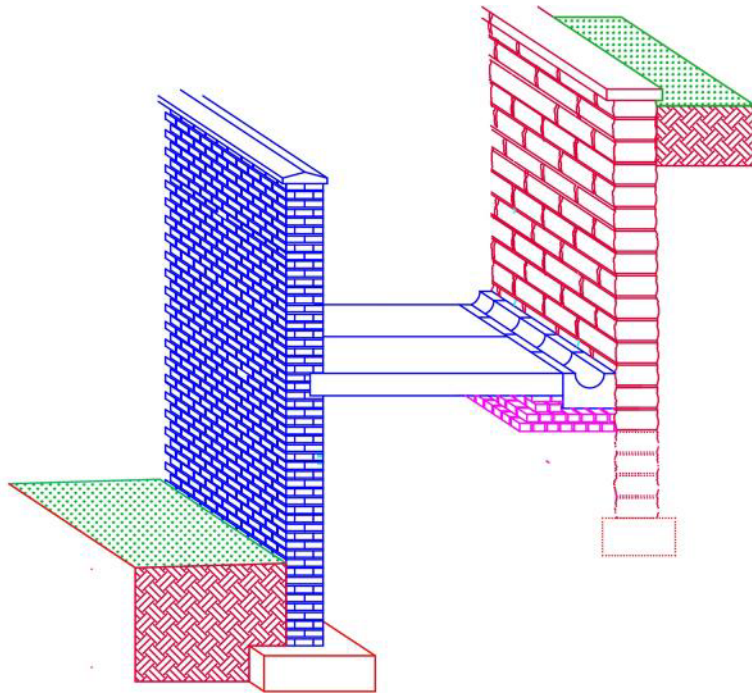
Construction Details

Components of the original Wall & Stairway system





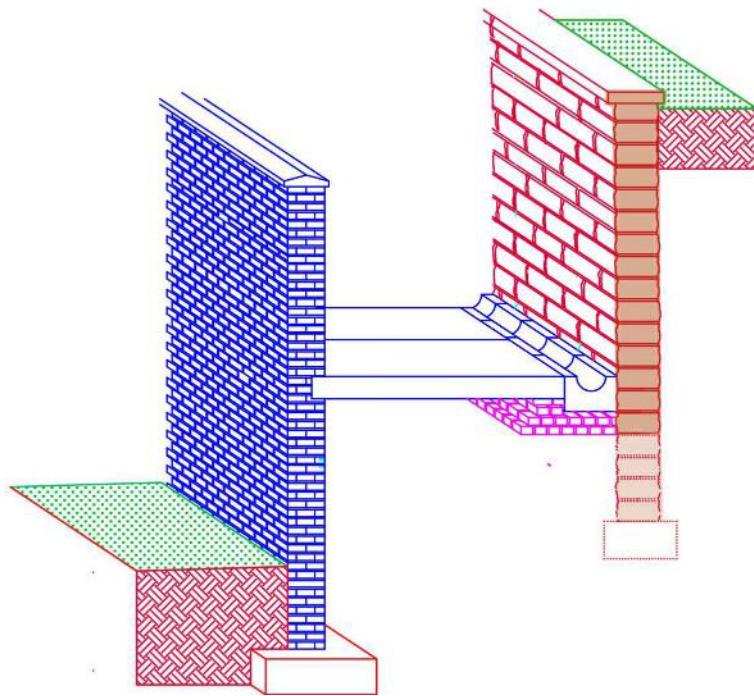
Major components of the Wall & Stairway system



- The wall/stairway system includes:



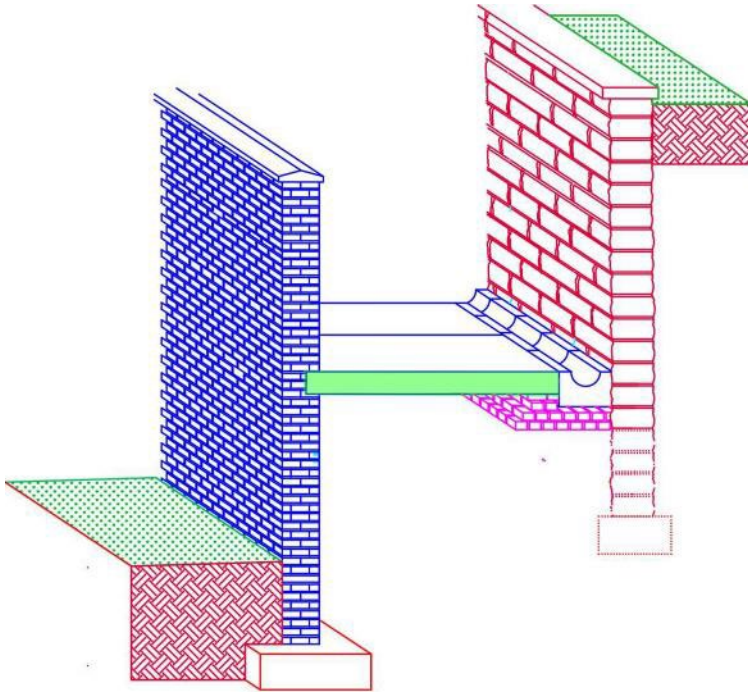
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- J.J. Hill House Sandstone Wall aka "Hill Wall"



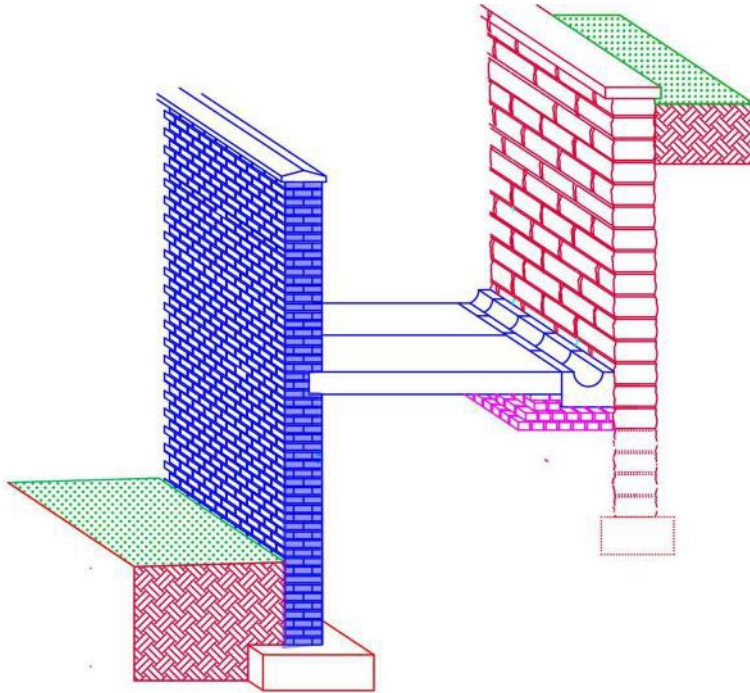
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- The wall/stairway system includes:
- J.J. Hill House Sandstone Wall aka "Hill Wall"
- Sandstone stairway slabs and treads. The slabs are approximately 8" thick, 30"-36" wide and around 10' long.
- The treads are of same thickness and length but are approximately 15" wide.



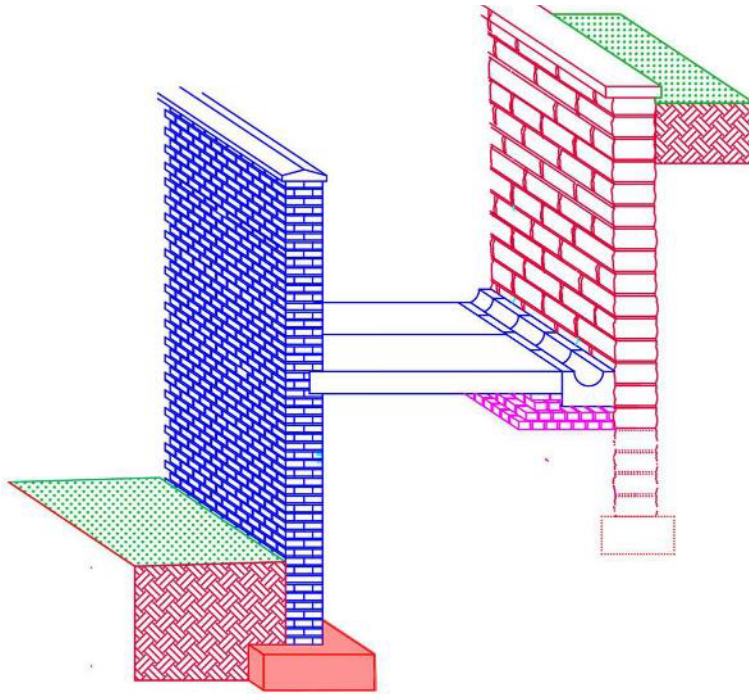
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- 'South Wall' - is the entire brick wall of the stairway system. The south wall has four components.



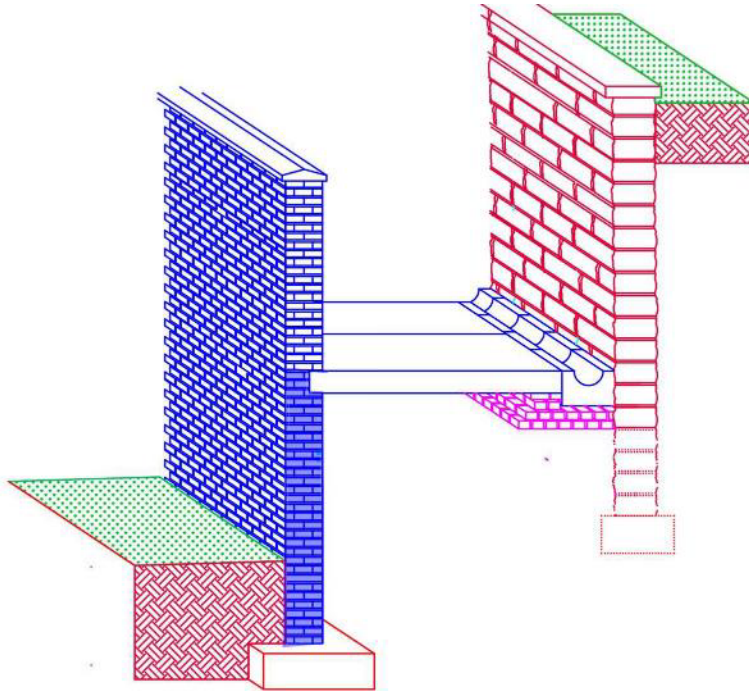
Major components of the Wall & Stairway system



1. The south Wall Footing;
The footing has been exposed during various times over the life of the structure. The footing was found to be stacked stone rubble or deteriorated low strength concrete.



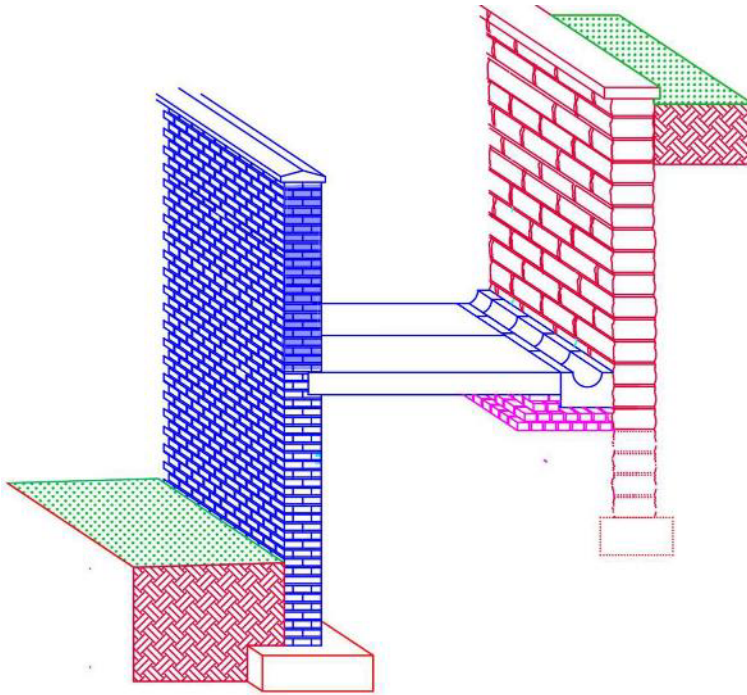
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2. 'South Retaining Wall' – which is the structural portion of the South Wall that retains soil and supports the stairway slabs and treads.



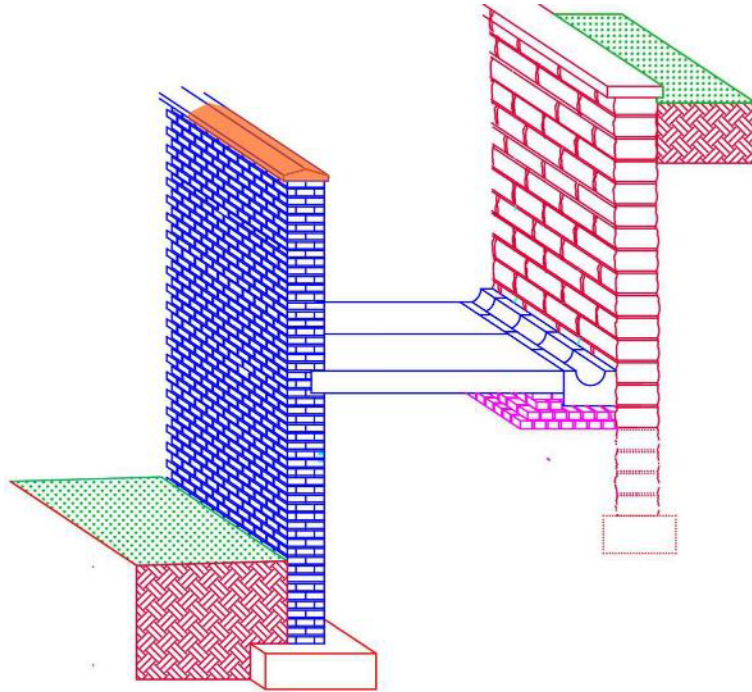
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3. South Partition Wall – which is the portion of the south wall that does not retain soil.



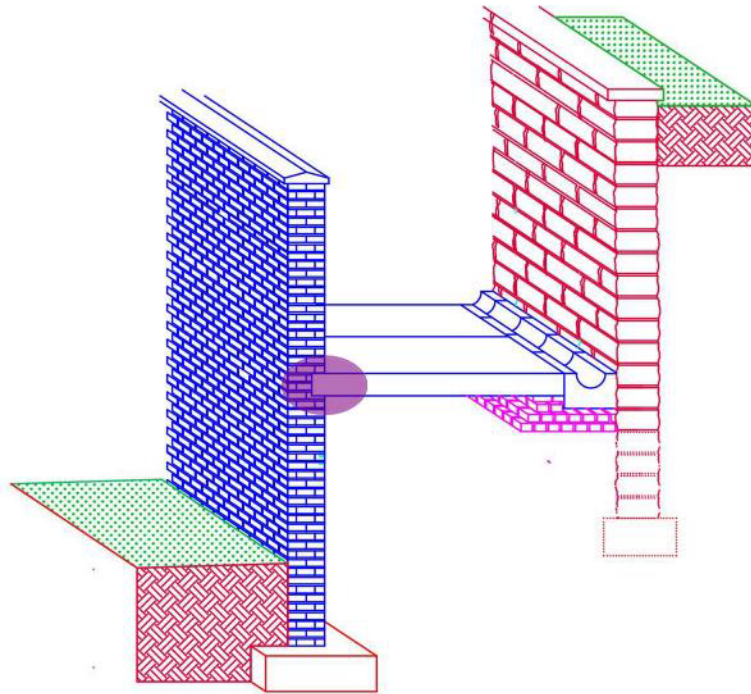
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3. South Partition Wall - which is the portion of the south wall that does not retain soil.
4. The terra-cotta Cap -which prevents water from migrating down between the three layers of the brick wall. The original cap is largely still in place.



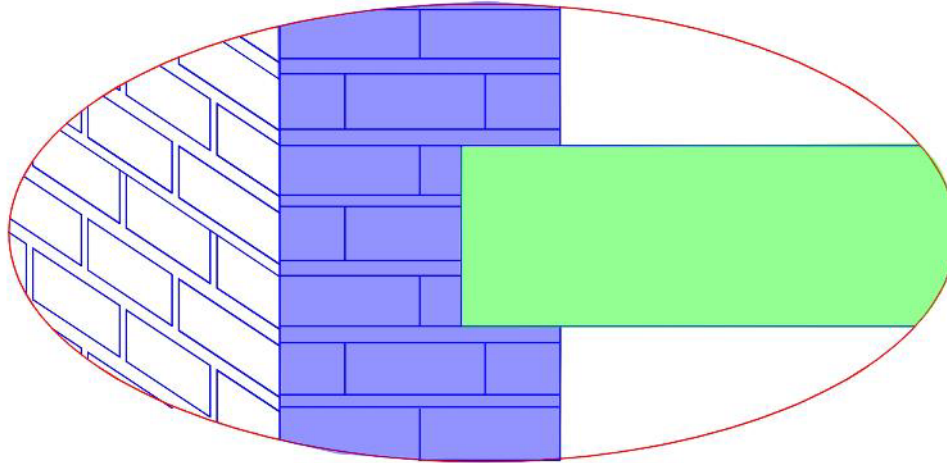
Major components of the Wall & Stairway system



- A “notch” keys in and supports the stairway slabs and treads.



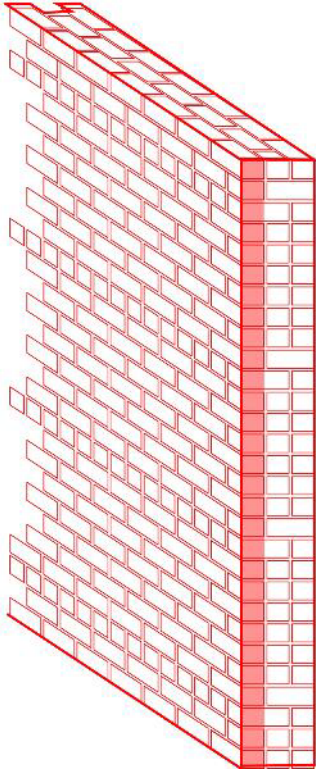
Major components of the Wall & Stairway system



- The “notch” keys in and supports the stairway slabs and treads.
- It is important to note that the stairway slabs and treads bear directly on the notch in the South Retaining Wall and both retaining wall and stairway are supported by a common footing.
- As such, no reconstruction of the south wall can be made without a simultaneous reconstruction of the stairway, and visa versa.



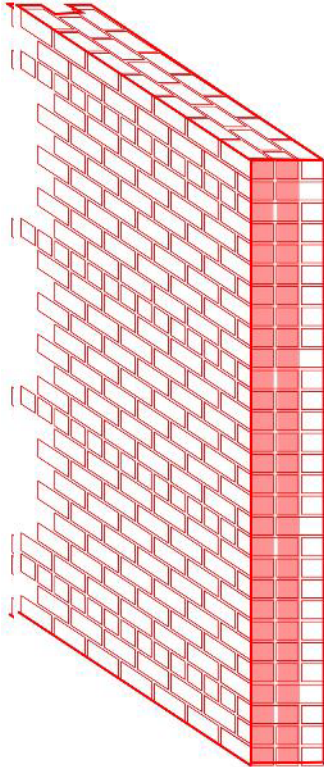
South Brick Wall Details



- In masonry, a “wythe” basically means the vertical thickness of one brick.



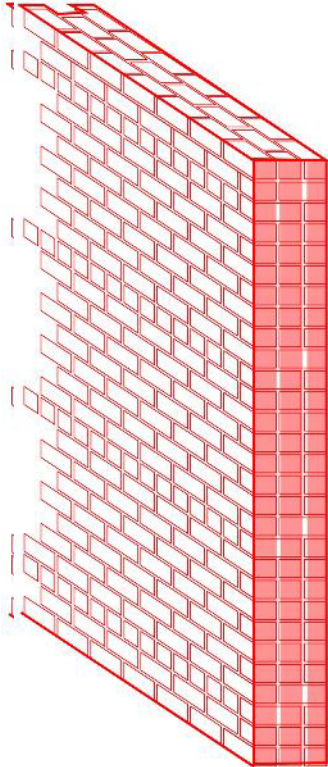
South Brick Wall Details



- In masonry, a “wythe” basically means the vertical thickness of one brick.
- In cross section, the South Wall was constructed with a “3-wythe stacked bond”.
 - In short, the wall is three layers thick.
 - Bricks are laid in a pattern to avoid lining up the vertical joints.
 - Every 7th course (row) is a “bonding” course.
 - The bonding course bricks are turned 90 degrees and tie the 3 wythes together forming a 12” thick solid wall.



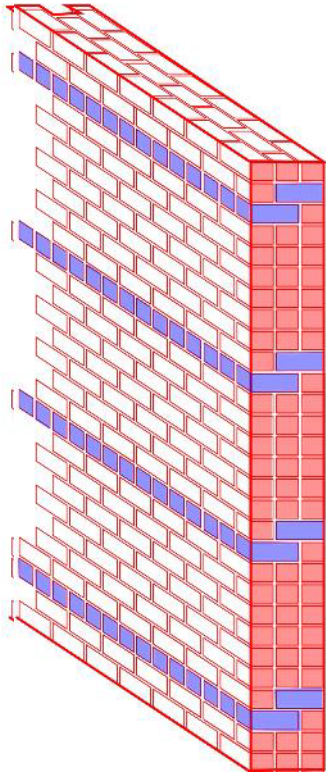
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Part 2: Condition

Recent Events in 2013 & 2020
Current Condition



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Public Works acquired the wall with immediate repair needs



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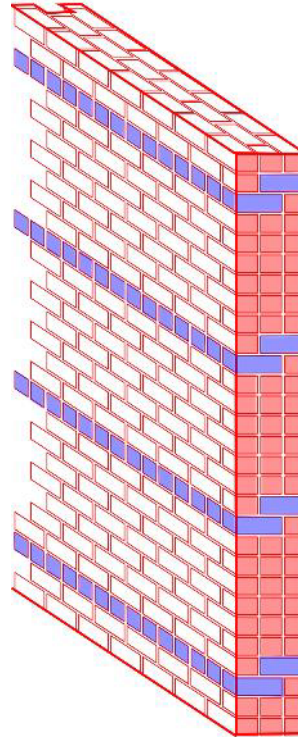


Localized failures present:

- Bulging
- Displacement
- Significant mortar loss
- Missing bricks



How do localized failures occur?

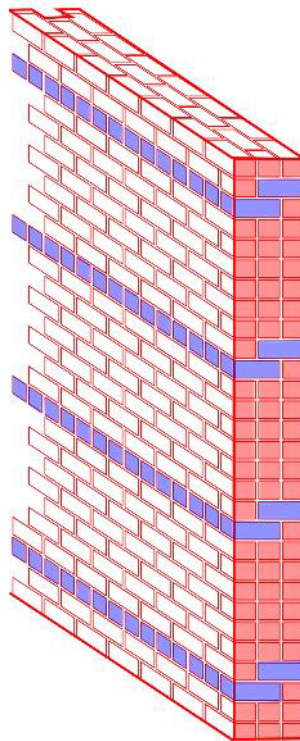


- Bulging or displacement failure can occur when the bonding courses fail



2013 Wall Condition & Repairs

How do localized failures occur?



- Bulging or displacement failure can occur when the bonding courses fail

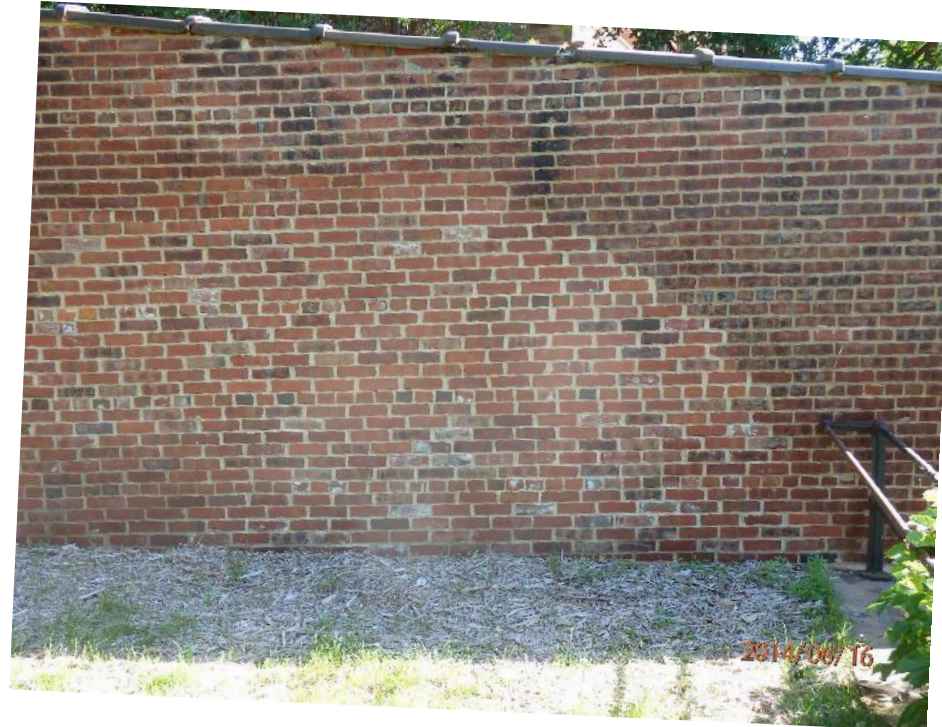


2013 Wall Condition & Repairs

Before

&

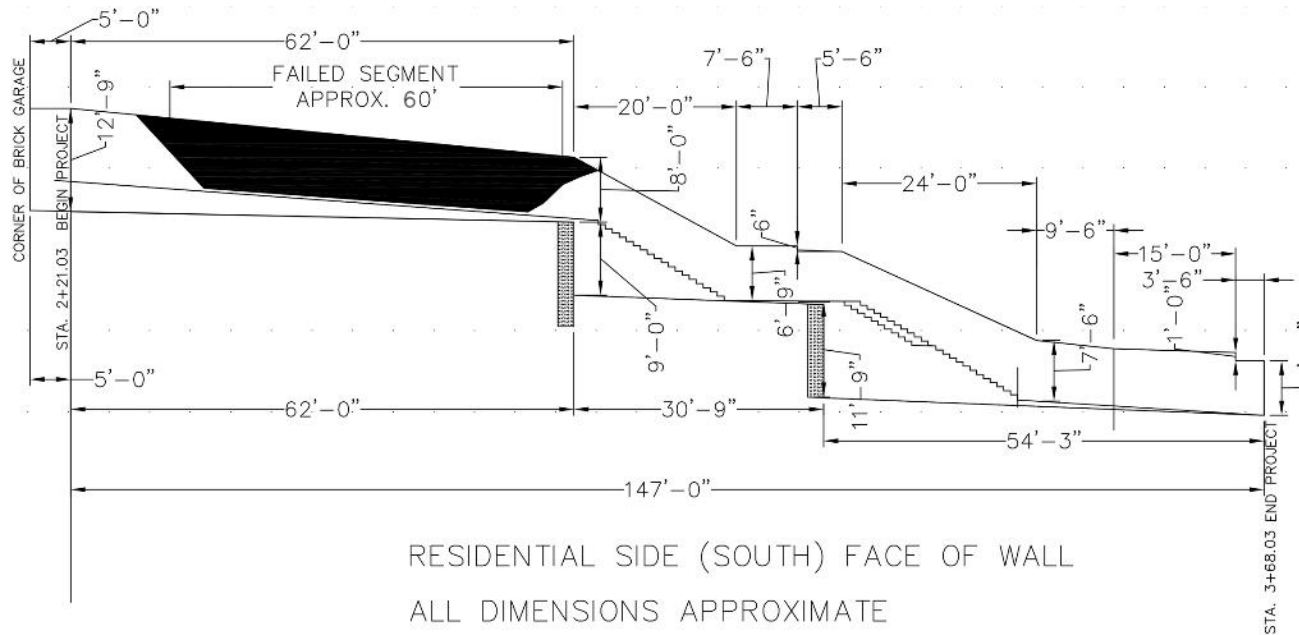
After





2020 Collapse

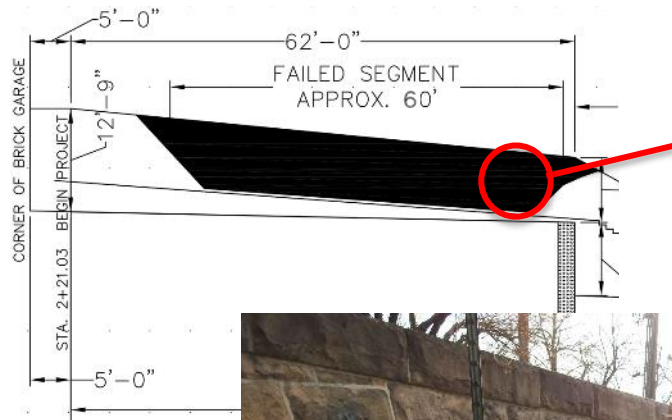
Approximately 60 feet of South Partition Wall fell on July 7, 2020





2020 Collapse

2012



A void and bulge was repaired here in 2013

2013



2020



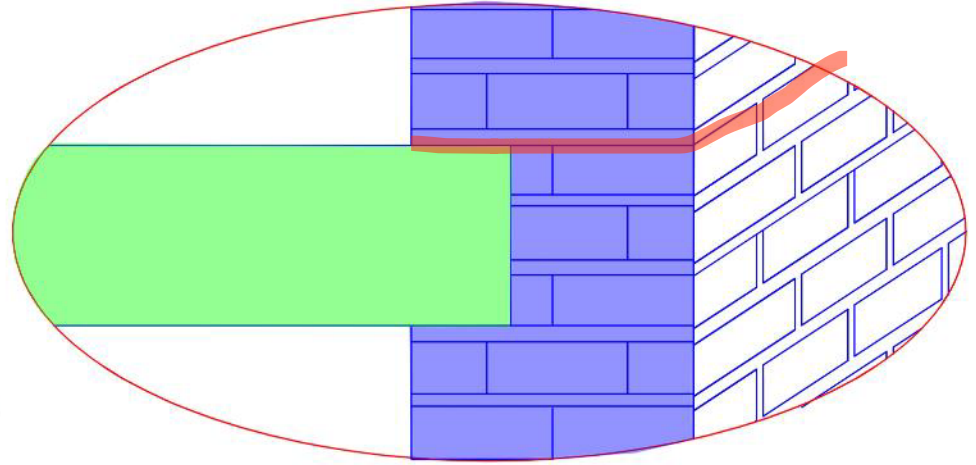
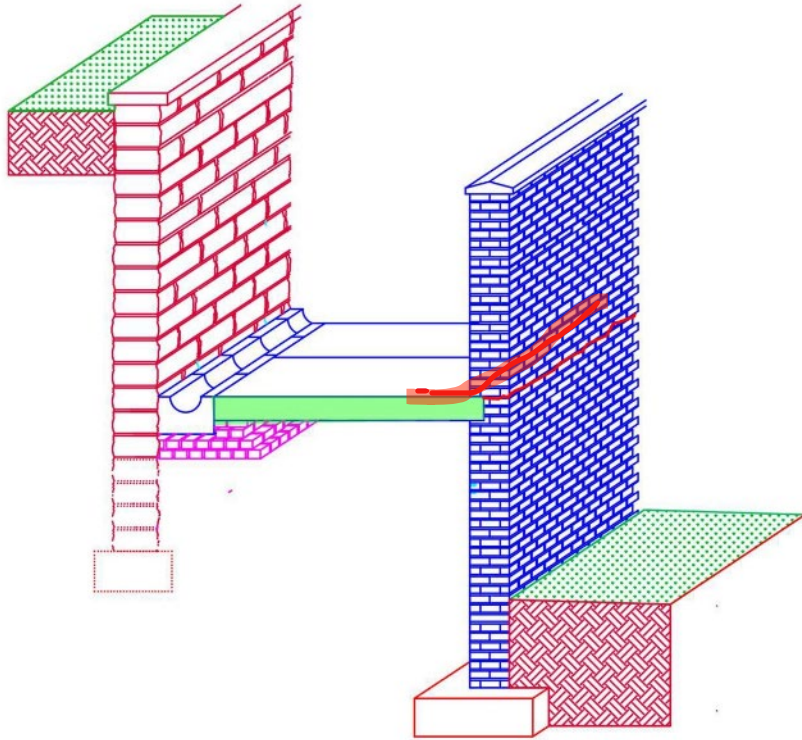


2020 Collapse





2020 Collapse



The wall failed at the notch.
Primary failure mode was mortar failure.



2020 Collapse



The wall failed at the notch.
Primary failure mode was mortar failure.



2020 Collapse

This photograph was taken the morning after the upper brick wall collapse.

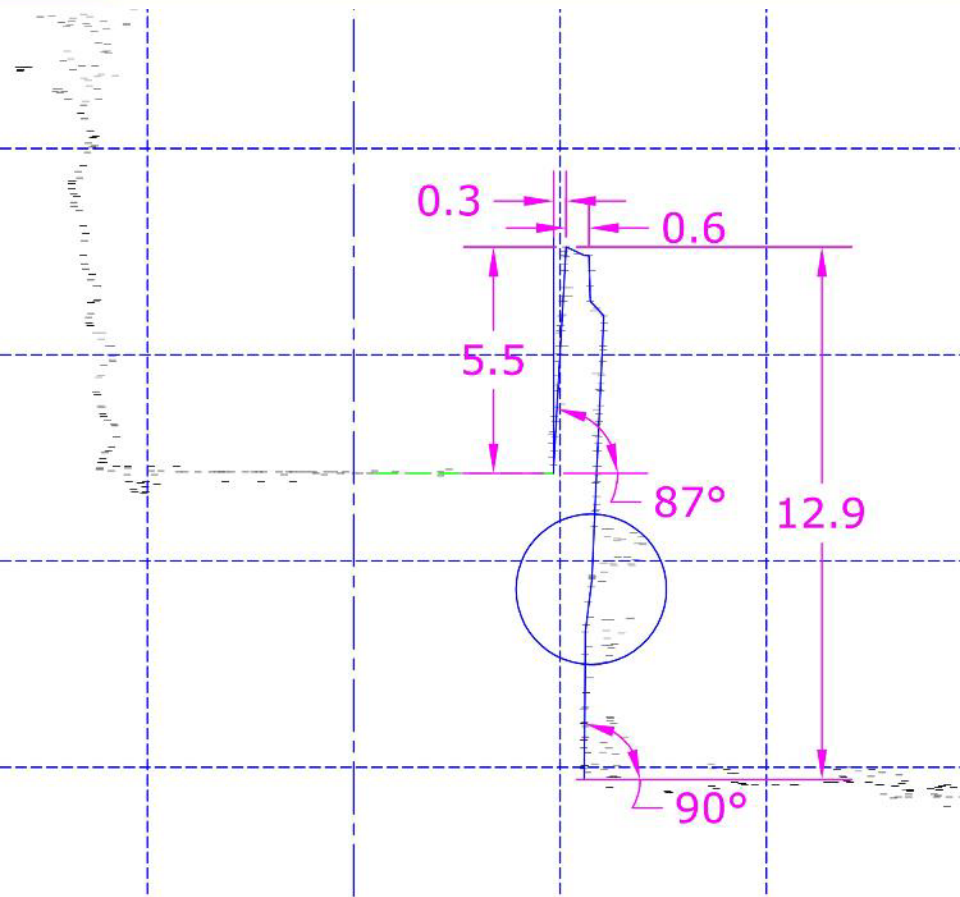
The areas that were rehabilitated in 2013 fell in large sheets.

Areas that were not rehabilitated in 2013 fell as individual bricks due to a total failure of the mortar.





Current Condition: Brick Wall



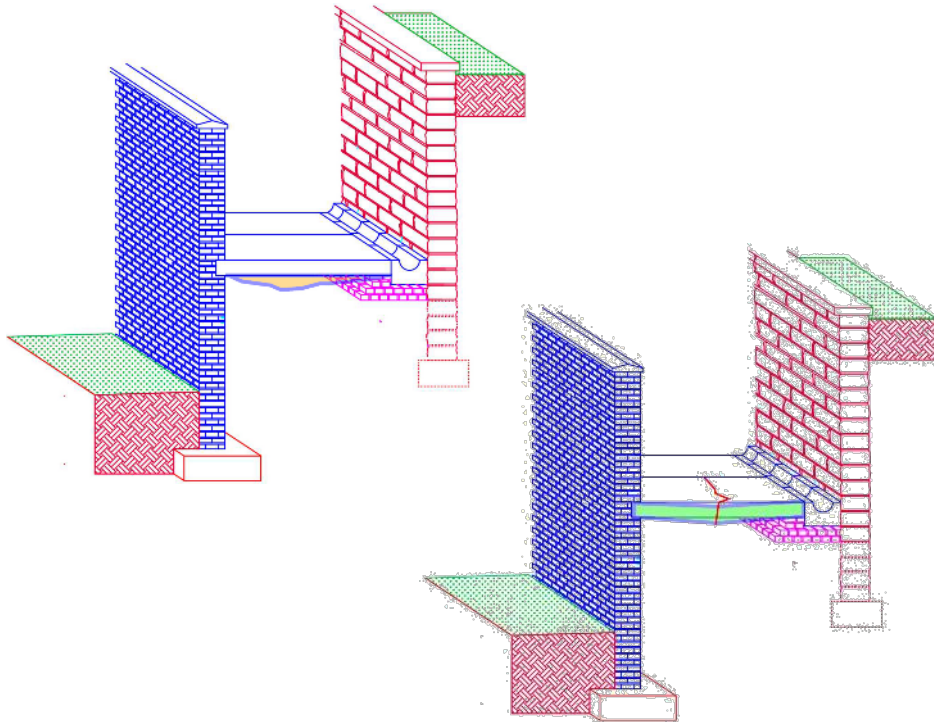
As part of the failure investigation, a Lidar laser survey was conducted.

At this survey location the wall was out of plumb 4" in 5'-6" and indicated a bulge in the back face of the wall.

In summary, the brick wall structure is in a present state of failure and repair is not feasible.



Current Condition: Stone Stair Slabs & Treads



Erosion and settlement under the stairway slabs and treads has caused numerous stones to break.

Treads have shifted out of position, resulting in non-uniform riser heights and depths.

In summary, stone slabs and treads are damaged, displaced, and no longer suitable for public use.



Current Condition: Stone Stair Slabs & Treads



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Treads have shifted out of position, resulting in non-uniform riser heights and depths.



Part 3: Next Steps

Options
Funding



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Options

Current State →

These result in no public access

This restores public access

Options	Description	Est. Project Cost
1: Keep Closed & Pursue Funding	Maintain stairway closure. Plan for & budget future wall failure(s). Seek funds to reconstruct the stair system.	Variable (2020 failure cost \$60K)
2: Vacate	Negotiate terms and cost of agreements resulting in vacation (release) of public right-of-way.	Variable
3: Remove & Stabilize	Protect & stabilize adjacent sites and structures. Remove existing wall & stair system. Leave the site stabilized but without public access.	\$1.5M - \$3M
4: Remove & Reconstruct Stair System	Protect & stabilize adjacent sites and structures. Remove existing wall & stairway system. Reconstruct <u>historic-type</u> wall & stair system.	\$7M - \$9M
	Protect & stabilize adjacent sites and structures. Remove existing wall & stairway system. Reconstruct a <u>prefabricated metal</u> stair system.	\$5M - \$6M

The above table is intended to illustrate a range of potential stairway considerations. Options presented are not an exhaustive list nor are they ordered by City or Public Works preference.



Site Challenges Increase Costs

Numerous factors increase cost of *any* option



- The narrow worksite, adjacent private structures, and steep erosive bluff restricts access for conventional equipment.
- Portions of the wall and stair system are built integral with private structures that must be protected and stabilized.
- The bluff must be stabilized (likely with reinforced concrete walls) regardless of which option is chosen.
- Temporary construction easements will be required and may involve extensive site restoration.



Walnut Street Stairway is not eligible for:

- Known federal grant fund opportunities
- Known state grant fund opportunities
- City's Municipal State Aid funds (state gas tax)
- City's new Sales Tax Revenue Funding

Identifiable funding sources include:

- Local funding (Capital Improvement Budget)
- Private funding
- Direct appropriation from State Legislature

Q & A



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