Use of Micropiles for Support of Settlement Sensitive Historic Landmark
1785 Massachusetts Avenue NW Washington DC
Design and Construction Challenges

• Column loads 300,000 to 1,000,000 pounds had to be temporarily supported and transferred to new lower foundations.

• To preserve historically significant limestone exterior and interior features, project specifications contained very stringent settlement criteria. No existing building components could move more than $\frac{1}{4}$” total, which included foundation settlements.

• Support of excavation would need to be installed under existing foundation walls.

• Low headroom work environment.

• Extremely limited site access and staging areas.
Door

Initial Project Access
Small Alley That Would Become Primary Project Access
Primary Jobsite Access
Initial Low Headroom Work Condition
Offsite Staging Area
Generalized Soil Profile

Depth (ft) | Elev. (ft)
---|---
0.8 | 81.2

FILL (Stratum A)
SPT N-values = 3 - 9 b/ft (blow/0.3 m)
Sandy silt and poorly graded sand with gravel; moist; black; contains concrete fragments and brick fragments

23.5 | 58.5

CLAYEY SAND (SC, Stratum B) LL=33, PL=19, Passing 200=16.6%
Moist, well-graded gravel, est. 5 - 10% mica

28.5 | 53.5

SANDY SILT (ML, Stratum C)
SPT N-values = 36 - 54 b/ft
Moist, est. 5 - 10% mica

33.5 | 48.5

DISINTEGRATED ROCK (DR, Stratum D)
SPT N-values = 32 = 60/4 - 100/1 b/ft
Sandy silt, moist, est. <5% mica, transitioned deeper to est. 5 - 10% rock fragments

61.3 | 20.7

71± B.O. EX. FDN.
62± T.O. NEW SLAB
Foundation Plan Showing Existing and New Foundations

Interior Columns to be Supported on Micropiles

Exterior Walls to be Underpinned
Underpinning Pits At Exterior Wall
Piles and Underpinning Approach Pit at Existing Column
Tieback Installation at Underpinning Pits
Exposed Exterior Column Footing on Underpinning
Support of Interior Columns

Transfer Beams

Footing

Micropiles
Jacking Operation
## Jacking Setup and Procedure Details

<table>
<thead>
<tr>
<th>Location</th>
<th>Total Load</th>
<th>Sequence</th>
<th>Jacking Load Per Jack</th>
<th>Load Applied at Column</th>
<th>Load Applied at Column Flange</th>
<th>Pressure (Ps)</th>
<th>Pressure (Kips)</th>
<th>Total Lift Load (Kips)</th>
<th>Column Flange Monitoring</th>
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<tbody>
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<td>F-2</td>
<td>20</td>
<td>1</td>
<td>56.5</td>
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### Column Jacking Procedures:
- **Remove Nuts on All Column Base Anchor Bolts. Nuts can be torch cut.**
- **Allow a 2.5 minute hold between jacking intervals.**
- **Monitor Column Flange Movement During Jacking with Dial Indicators on Each Column Flange Capable of Reading 0.001".**
- **Apply Jacking Loads Per Schedule Above and in Conjunction With Berkeli’s Approved Shop Drawings.**
- **Record Column Movements at Beginning and End of Each Loading Sequence.**
- **Continue jacking sequences until an average upward movement of 0.020" is observed or total jack load equals 105% of reported existing column load.**
- **If jack load of 105% does not produce an upward movement of 0.02", install shims and contact Silman Engineers for direction.**
- **Columns shall be monitored for movement daily when excavation is occurring, and weekly otherwise.**
- **When upward movement criteria is satisfied, tightly install shim and bolted plates per details. Slowly release load completely and complete welds per detail.**
- **Record final dial readings.**
Close-up View of Jacking Pocket
Bracket After Load Transfer

Steel Shims
Exposed Footings - Ready For Demolition
Excavation Begins!
Excavation Progress
Excavation Nearly Complete
New Basement Fully Excavated
Underside of Column Base
Exposed Column Base (Where Footing Used to Be)
Ready for New Pile Caps
Studs for New Pile Cap
Pile Caps Being Poured
Rebar For New Columns Installed
Column Formwork Installed Within Shoring Tower
New Columns and Floor Poured – Micropiles to be Cut-off Above New Pile Caps
Shoring Tower After Slab Pour, Ready For Load Transfer
Piles Cut For Removal
Project Summary

• Columns and walls were monitored for the duration of construction. No columns or walls moved more than the specified limit of ¼”. Most columns had a net movement less than 1/8”.

• No damage was observed in the limestone façade or plaster interiors.

• Project was completed on schedule.

• Micropiles performed extremely well, with no measurable time dependent settlements. With proper design and construction techniques, near-zero net settlements are possible.
Acknowledgments

• Owner – American Enterprise Institute
• General Contractor – Grunley Construction Company
• Architect – Hartman Cox Architects
• Structural Engineer – Robert Silman Associates
• Project Manager – Robert Bergwall
• General Superintendent – Ray Rhodes
• Site Superintendent – Stephen Harris
• Underpinning Superintendent - Pablo Echeverria
• All the men and women who’s labor made this job a success