High Capacity Minicaissons in NewYork City

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High-capacity Mini-caissons in an Urban Environment

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High-capacity Mini-caissons

- "Macropiles"
- Characteristics
  - Like a micropile – permanent steel casing, grout, all-thread bars
  - Capacity – 250 to 1700 tons
  - 12" to 24" diameter
  - "Rebar" cage
  - Ready-mix grout (6,000+ psi)
  - Rock-socketed

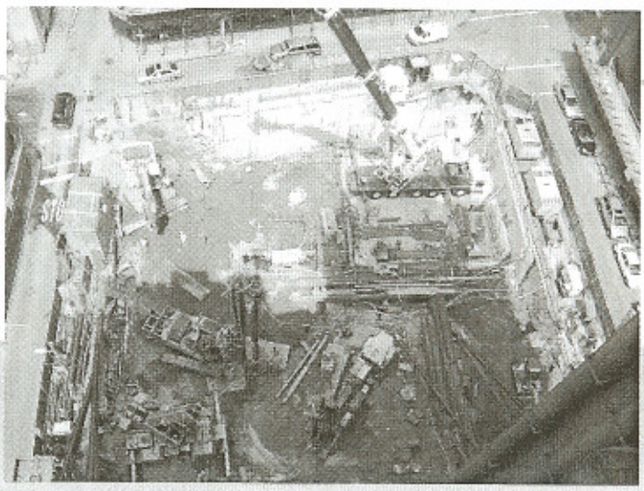
Applications

- Urban Environments
- Difficult Drilling Conditions
- High(er) Lateral Loads
- Bedrock

NYC - Urban Environment

- 23rd Street – Manhattan
- Future 53-story building
- Lot Size – 45' wide x 100' deep
- Working Grade - 15' below sidewalk
- 24" mini-caissons

NYC – Urban Environment



Washington Street - 24" caissons

Design

	Current NYCBC	Pending NYCBC	FHWA
Grout	0.25 f'c	0.33 f'c	0.4 f'c
Casing	0.35 fy ≤ 12.6 ksi	0.35 fy	0.47 fy ≤ 40.9 ksi
Rebar	0.4 fy ≤ 30 ksi	0.5 fy	0.47 fy ≤ 40.9 ksi
Other Considerations	Casing transfer	Casing transfer	Plunge length

Allowable Stress Values

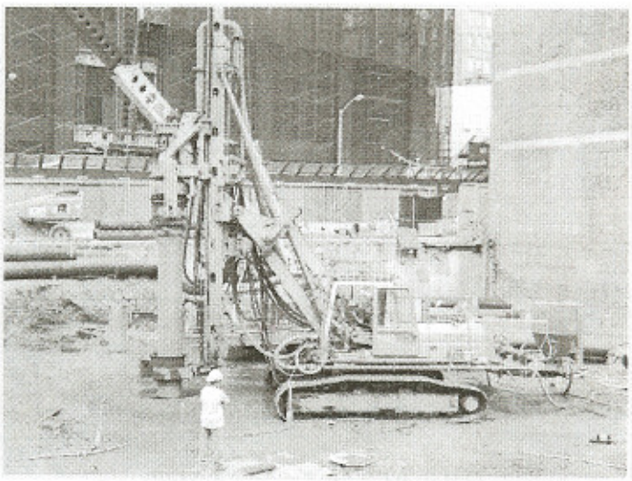
PROPORTION LOADS RELATIVE TO ALLOWABLE LOADS OF EACH

TYP. 45 KSI CASING

Equipment

- Barber Rig
  - Truck rig

Equipment



Bauer Rig – Track Mounted

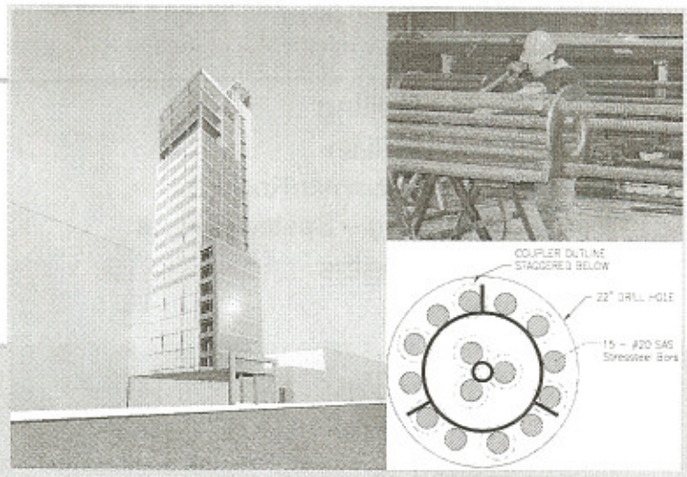
Installation Methods

- Rotary Duplex Drilling
  - Air Flush/Water Flush
  - Down-the-hole Hammer/Roller Bit
  - Permanent Casing – Seated in Rock
- Fixed Casing Lengths
  - 18"/24" casing
  - Welded joints
- Prefabricated Cages
  - Crane
- Tremie Grouted

Rotary Duplex Drilling

TYPICAL SINGLE PIECE CASING OR WELD JOINTS

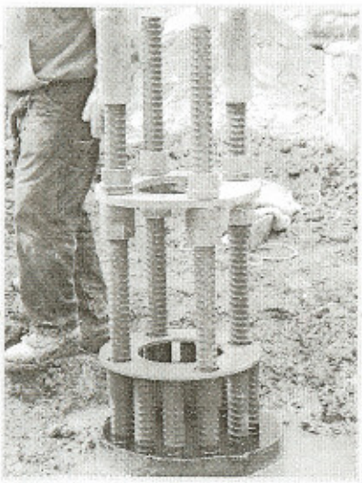
Chelsea Arts Tower



Typical Cage Configuration

SOMETIMES H-PILE IS USED FOR REINFORCING

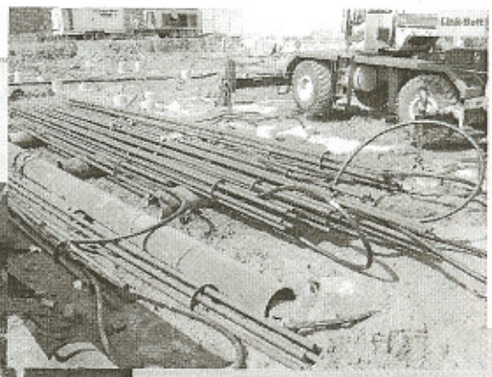
East 23rd Street



- 24" diameter mini-caissons
- 1400 tons
- Compression bearing plate
- Tension bars

Borden Avenue

- Tremie Tube Attached



- Centralizers/ Spacers – 10' c.t.c.

QA/QC

- As-built Surveys
- Load Testing
- Video Inspection
- Grout Testing – Onsite and Plant

Load Testing

- Lateral Load Test (Free Head)
- 25-ton Design Load

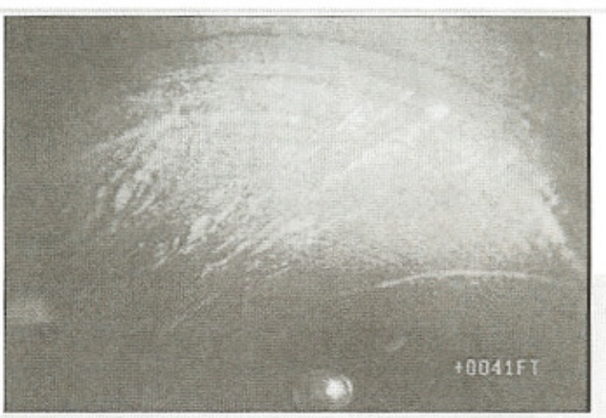
Video Inspection

- Micropiles vs. Caissons
  - Mini-caissons – benefit from caisson designation
- Inspection of rock sockets, but based on design criteria / assumptions
  - Casing connection – threaded
  - Casing embedment
  - Rock quality

Images – Video Inspection

Casing joint not completely shouldered

Images – Video Inspection



Casing on Bedrock – Above Water

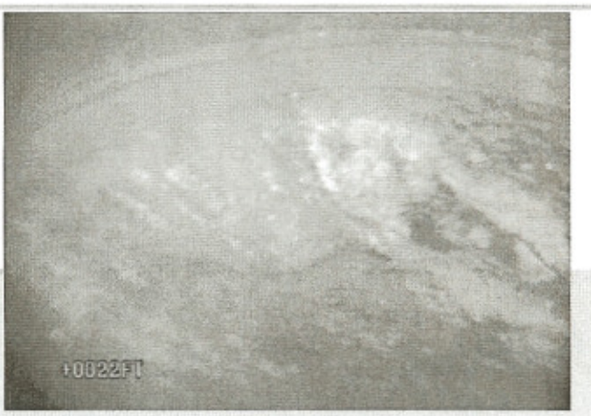
Images – Video Inspection

Bedrock – Below Water

Images – Video Inspection

Concrete Rubble – Above Water

Images – Video Inspection



Casing on Bedrock – Below Water

Images – Video Inspection

Weathered Bedrock and Large Void

Images – Video Inspection

Weathered bedrock below casing bottom

Grout Inspection

- Onsite Inspection
  - Independent (usually retained by Owner)
  - Slump
  - Cast cylinders – compressive strength breaks
- Plant Inspection
  - Independent (usually retained by Owner)
  - Required for design grouts of 6,000+ psi

Benefits

- Cost Savings
  - Fewer piles
  - Higher capacity per pile
- Schedule
- Drilled, not driven

Limitations / Considerations

- Design
  - Must be finished
  - Value engineered – flexible architect/engineer
  - Redesigns – pile caps, grade beams, mats
- Equipment
  - Size – mobility, height/clearance/access
  - Trucking costs
- Materials
  - Storage
  - Handling/Unloading
  - Assembly – coupling (if needed)

PILES IDEALLY SUITED TO 50' TO 60' LENGTH TO AVOID SPLICING CASING/ BARS

Limitations / Considerations (continued)

- Installation
  - Large volume of spoils
  - Rock profile – fixed casing lengths

Acknowledgements

- Engineer
  - Larry Johnsen, P.E. – Heller & Johnsen
- Bar/Cage Vendor
  - Felix Ferrer, P.E. – SAS Stressteel