Anchor Bank Expansion (now Old National Bank) Temporary Earth Retention System Madison, Wisconsin

Chad Underwood, P.E., P.G., D.GE Engineering Partners International LLC

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September 15, 2017 Madison, Wisconsin
ANCHOR BANK EXPANSION

- Up to 60’ deep excavation for 5 levels of below grade parking
- Soil nail walls used for temporary earth retention
- Excavation adjacent to four different buildings (2 historic)
SOIL NAIL WALLS

- Steel bars (soil nails) installed on a grid pattern
- Reinforced shotcrete facing anchored to soil nail heads
- Constructed top-down
SOIL NAIL WALLS

- Grouted Soil Nails
  - Geotechnical capacity from grout-to-soil bond
  - Similar to tieback anchors

- Shotcrete Facing
  - Spray-applied concrete (reinforced)
  - Drainage mat

Source: Ischebeck Titan / Con-Tech Systems, Ltd.
Soil Nails as Soil Reinforcing Elements


Figure 5.1: Potential Failure Surfaces and Soil Nail Tensile Forces.
SOIL NAIL WALL CONSTRUCTION

1. After grout & shotcrete reach 50% of the specified 28-day strength, nail testing is complete, and connection hardware is installed in previous lift. Excavate to neat line and place backfill. Push material back into lap trench as shown and tamp with excavator bucket.

2. Excavate take care not to hit or damage nails when excavating to neat line or when shaping lap trench.

3. Drill bench as required to accommodate drilling base of subsequent lap.

4. Backfill pushed back into trench and tamped with excavator bucket.

5. Use head and shear shotcrete (red).

6. Where applicable, perform proof tests when grout and shotcrete reach 50% of the specified 28-day strengths.

Note: At distances from the wall face greater than the current wall height, all excavation may occur at any time, but with slopes no steeper than 1H:1V unless approved by engineer.
PROJECT CHALLENGES

• Proximity to adjacent buildings
  o Relatively high footing surcharge loads (up to 10,000 psf)
  o Not enough space for underpinning

• Potential for groundwater / soil sloughing

• Underground utilities

• Stringent installation tolerances for use as backside form

• Relatively high construction surcharge loads (210 ton mobile crane, long-reach excavator, etc.)

• Winter construction

Temporary Soil Nail Wall
# Subsurface Conditions

## Log of Test Boring

**Boring No.** 1  
**Surface Elevation (ft)** 918.8  
**Job No.** C13627  
**Location** 28 N. Main Street Madison, Wisconsin

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>VISUAL CLASSIFICATION and Remarks</th>
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</table>
| 1      | 5" Asphalt Pavement/6" Base Course  
PILL: Very Loose to Medium Dense, Brown/Dark Brown Silty Fine Sand, Little to Some Gravel |
| 2      | Trace Shells Near 7.5 ft  
Concrete Pieces Near 10 ft |
| 3      | Very Dense, Brown Fine SAND, Some Silt, Little to Some Gravel, Scattered Cobbles/Boulders (SM) (SM: Possible Fill in Upper Few Feet of Layer) |
| 4      | Very Dense, Brown Fine SAND, Some Silt, Little to Some Gravel, Scattered Cobbles/Boulders (SM) |
| 5      | Very Dense, Brown Fine SAND, Some Silt, Little to Some Gravel, Scattered Cobbles/Boulders (SM) |
| 6      | Very Dense, Brown Fine SAND, Some Silt, Little to Some Gravel, Scattered Cobbles/Boulders (SM) |
| 7      | Very Dense, Brown Fine SAND, Some Silt, Little to Some Gravel, Scattered Cobbles/Boulders (SM) |
| 8      | Very Dense, Brown Fine SAND, Some Silt, Little to Some Gravel, Scattered Cobbles/Boulders (SM) |

## Water Level Observations

<table>
<thead>
<tr>
<th>WATER LEVEL OBSERVATIONS</th>
<th>GENERAL NOTES</th>
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<tbody>
<tr>
<td>While Drilling</td>
<td></td>
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<tr>
<td>Depth to Water</td>
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<td>Depth to Cave in</td>
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## Soil Properties

- **Sample No.**  
- **Sample Des. (in.)**  
- **W**  
- **LL**  
- **PL**  
- **LS**

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**Groundwater (varies)**

**Bottom of Excavation (varies)**
Stringent installation tolerance because shotcrete used as backside form
- Internal drainage for shotcrete facing tied into building drainage system
ANCHOR BANK EXPANSION

- Heavily reinforced shotcrete and prestressed soil nails adjacent to existing footings.
ANCHOR BANK EXPANSION
MONITORING DATA

Target #7

Change in X, Y, Z (inches)

Date

01/21/16 02/20/16 03/21/16 04/21/16 05/21/16 06/21/16 07/21/16 08/21/16

¼” Allowable Movement Specified for Adjacent Buildings
CONCLUSIONS

- Soil nail wall construction successfully completed in March 2016
  - 3 month duration
  - Completed 3 weeks ahead of schedule
- Monitoring of movement of existing structures was generally within the specified allowable 1/4-inch (6.4 mm) movement criteria
  - A few exceptions to movement exceeding specified limits
  - No distress or cracking of existing buildings was observed
- Site geology conducive to design and construction of tall soil nail walls adjacent to existing buildings without use of foundation underpinning
- The dense silty sand till did not produce significant volumes of water seepage below the groundwater table
ACKNOWLEDGEMENTS

• Owner: Urban Land Interest, Madison, WI

• General Contractor: J.H. Findorff, Madison, WI

• Earthwork Contractor: Edgerton Contractors, Oak Creek, WI

• Earth Retention System Contractor: Malcolm Drilling, Salt Lake City, UT
Questions?

Chad Underwood, P.E., P.G., D.GE
Engineering Partners International LLC
(612) 886-3730
chad@epillc.net

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