The Ballpark Village Development Deep Foundation System Design Build at Its Best



Eric Risberg / Kyle Carmody

Richard Goettle, Inc.

GOETTLE

Introduction

Block 400 Project Team

- Owner – St. Louis Cardinals / Cordish Group
- Structural Engineer – Optimal Engineering Solutions, Inc.
- Geotechnical Engineer – SCI Engineering Inc.
- Construction Manager – PARIC Corporation
- Deep Foundation Contractor – Richard Goettle, Inc.
- Deep Foundation EOR – GEI Consultants

Introduction

Block 100 Project Team

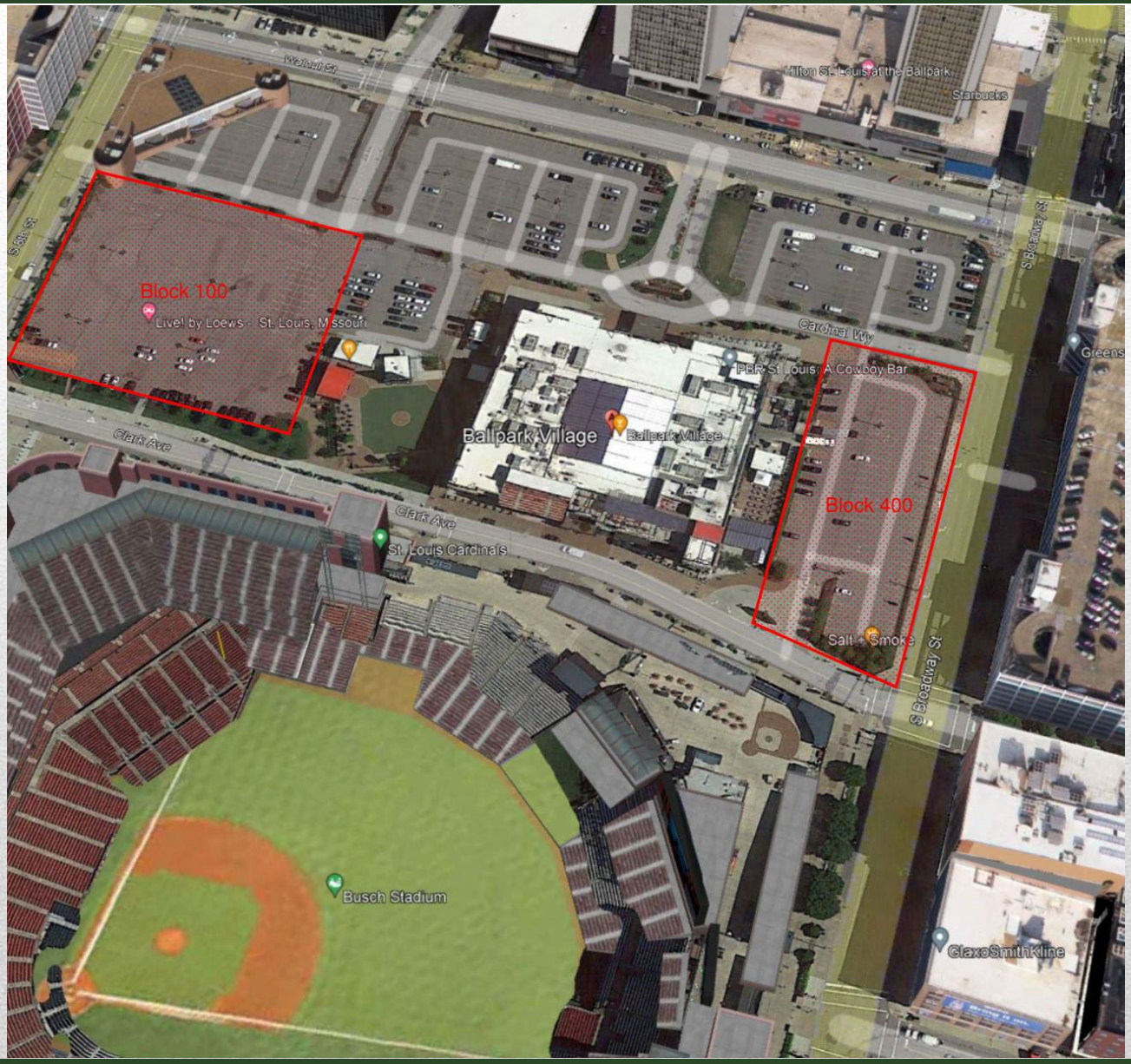
- Owner – St. Louis Cardinals/Cordish Group/Lowes
- Garage Structural Engineer – Brockette/Davis/Drake, Inc.
- Hotel Structural Engineer – OPS
- Geotechnical Engineer – SCI Engineering Inc.
- Construction Manager – PARIC Corporation
- Deep Foundation Contractor – Richard Goettle, Inc.
- Deep Foundation EOR – GEI Consultants

Introduction

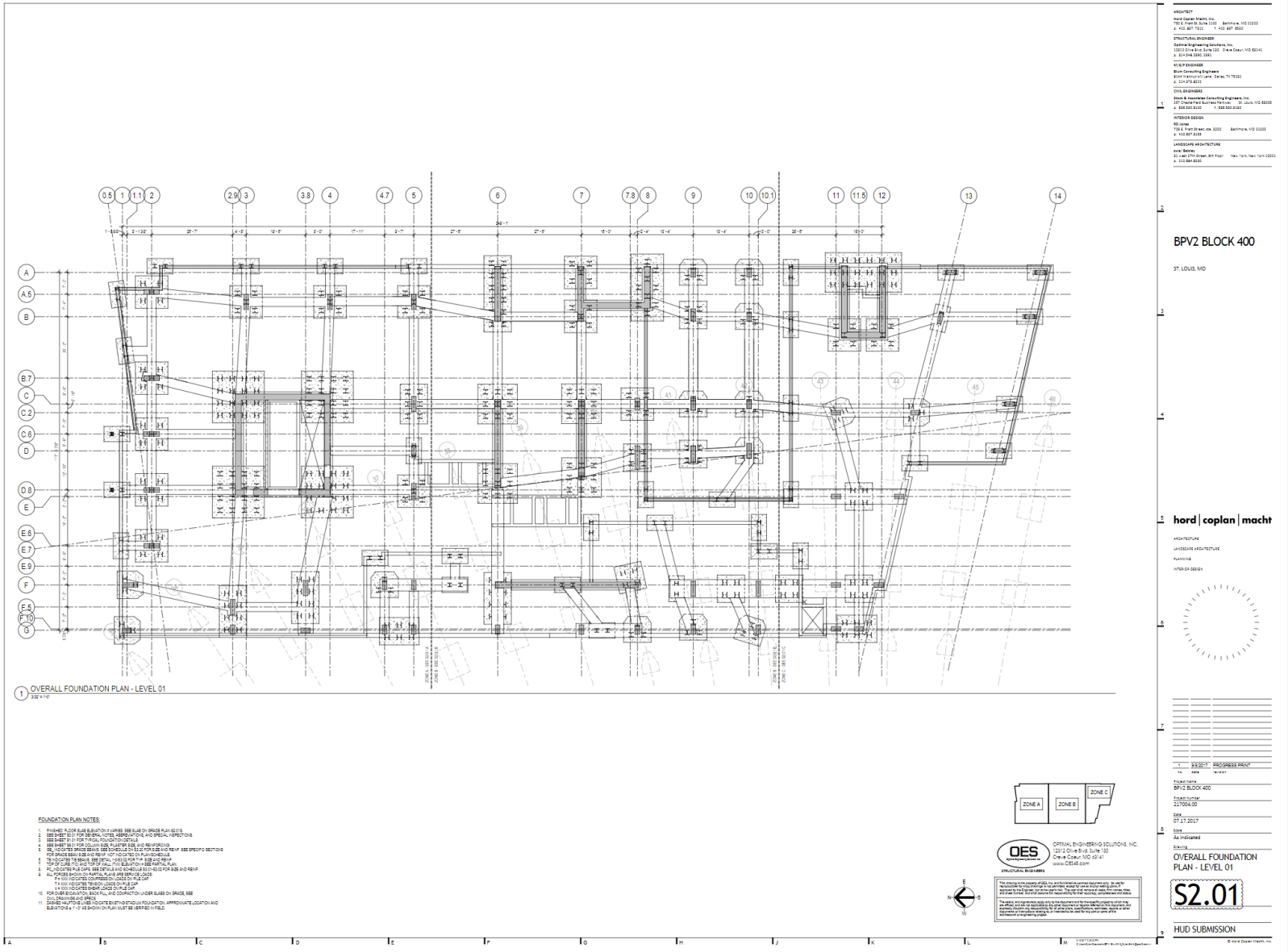
The Block 400 and Block 100 sites were the 2nd and 3rd projects in the Ballpark Village Development.

Pre-existing structures (stadium) prior to parking lot were founded on driven pipe piles and spread footings.

Driven piles were the original intended deep foundation elements for the new buildings.


Block 100
Live! by Loews - St. Louis, Missouri
Walnut St
Hilton St. Louis at the Ballpark
Starbucks
S 6th St
S Broadway St
Cardinal Wy
PBR St. Louis: A Cowboy Bar
Greens
Ballpark Village
Ballpark Village
Clark Ave
Clark Ave
St. Louis Cardinals
Block 400
Salt + Smoke
S Broadway St
Busch Stadium
GlaxoSmithKline

Introduction



Introduction

Driven Pile, Drilled Shafts and Augercast Piles were all budgeted and considered as viable solutions for the project.

Ultimately augercast piles were selected as the deep foundation system and a design build contract was awarded to Goettle first for the Block 400 Project then the Block 100 Project.

Economy

24” diameter ACIP Pile option was selected for the Block 200 site.

30" diameter ACIP Pile option was selected for the Block 400 site.

One Osterberg Load Cell Test was conducted at each site to not only verify but also economize design assumptions.

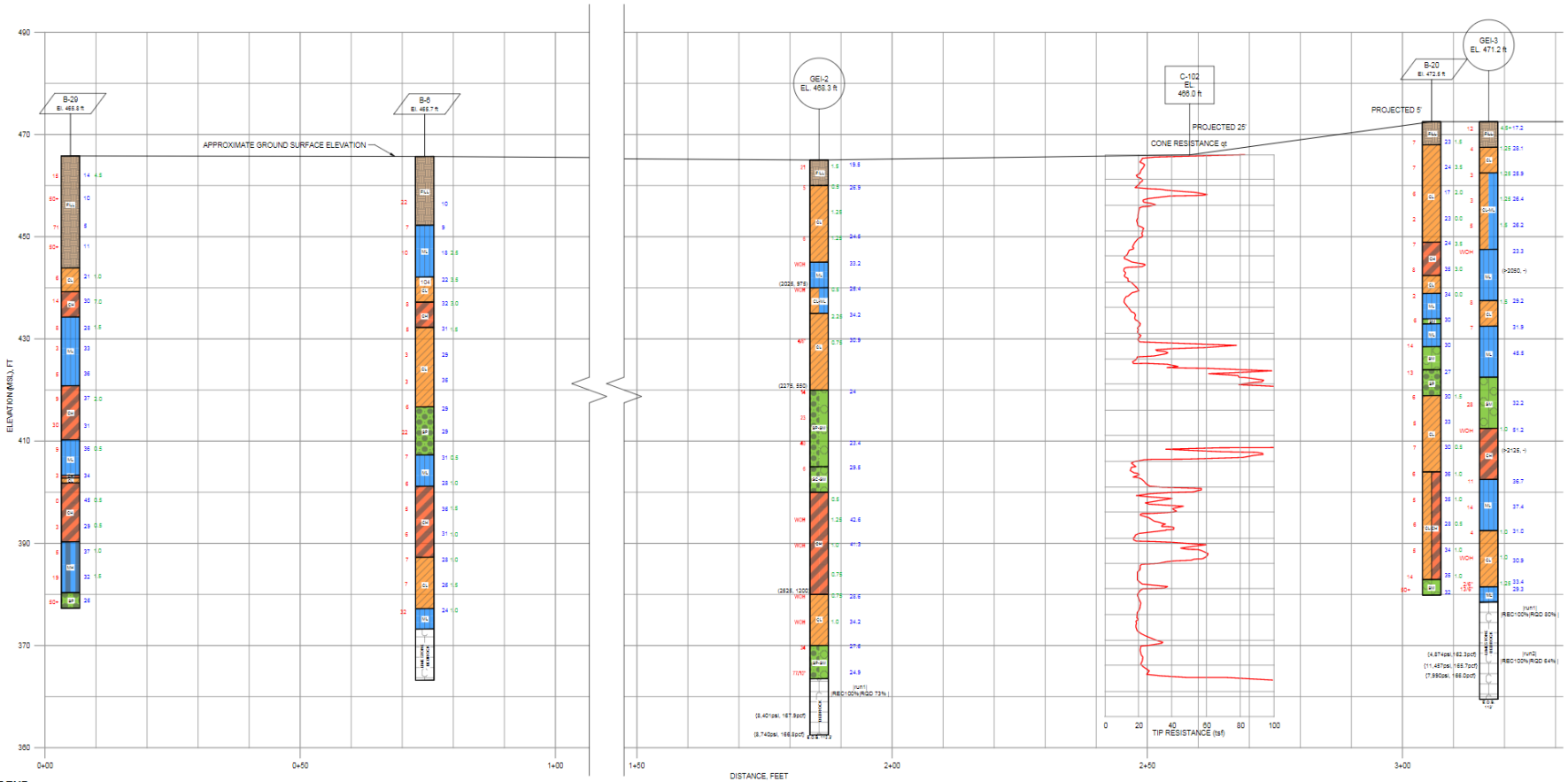
Final Deep Foundation Package Value: $7.4 Million

Design – Block 400

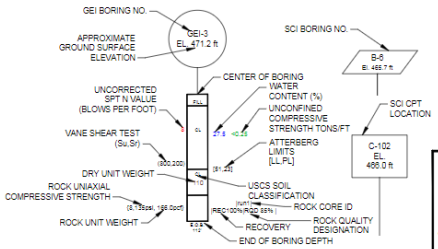
Number of Piles – 383 Each
Diameter of Piles – 24" Diameter
Pile Lengths – 94' below working grade
Design Capacity – 924 Kips Compression - 210 kips Tension – 30 kips Lateral
Design Criteria – Allowable Skin Friction - .60 ksf for Clayey Soils
Allowable Skin Friction – 0.60 ksf to 0.80 ksf for Sandy Soils
Allowable End Bearing – 180 ksf

Comments: All pile drilled to refusal on rock
Osterberg Load Test tested to over 3 times design load
7,000 psi grout was used.

Subsurface Conditions – Block 400



LEGEND



USCS MATERIAL CLASSIFICATION

FILL	MH
CL	SP
CH	SM
ML	BEDROCK

A-A' / 1 SECTION
GEOLOGIC PROFILE

SCALE: 1" = 10'

PRELIMINARY - FOR DISCUSSION PURPOSES ONLY

Attention: If this scale bar does not measure 1" then drawing is not original scale.

NO.	DATE	ISSUE/REVISION	
0	10/12/2017	PRELIMINARY - FOR DISCUSSION PURPOSES ONLY	CKT

GEI Consultants
GEI CONSULTANTS, INC.
3160 VOYAGER DRIVE
GREEN BAY, WI 54311
(920) 468-0200

Designed:	CKT
Checked:	CKT
Drawn:	CEF
Approved By:	CKT

Goettle Geotechnical Engineering & Construction

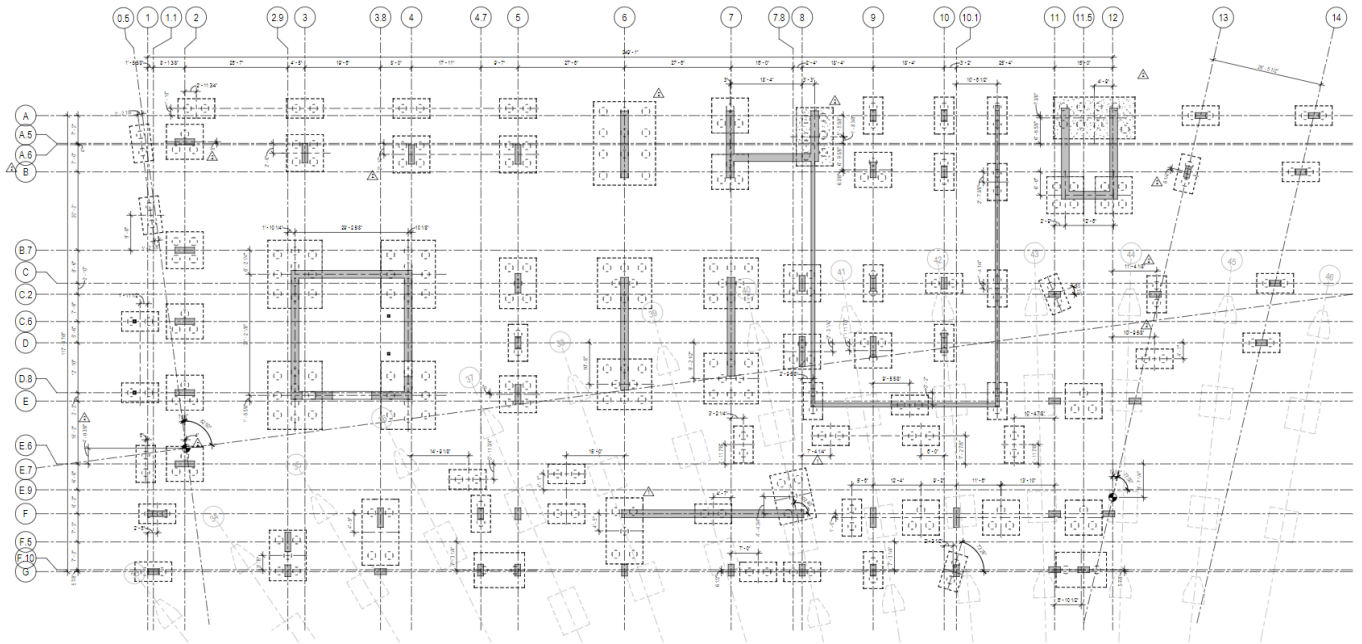
GEI Project 1704252

Ballpark Village - Block 400
St. Louis, Missouri

GEOLOGIC CROSS SECTION A-A'

FIGURE NO. 2

Design – Block 400



1 PILE PLAN - LEVEL 00
3/32" = 1'-0"

PILE CAP PLAN NOTES:

1. SEE SHEET S2.01 AND PARTIAL PLANS FOR PILE CAP DESIGN LOADS.
2. SEE SHEET S3.01 FOR PILE CAP DETAILS.
3. PILE CAPS ARE CENTERED ON GRID LINES UNLESS NOTED OTHERWISE. SEE PLAN.
4. SEE SHEET S0.01 FOR GENERAL NOTES AND ABBREVIATIONS.
5. SEE SHEET S4.01 FOR COLUMN SIZES AND REINFORCING DETAILS.
6. FOR OVER EXCAVATION, BACK FILL, AND COMPACTION UNDER SLABS ON GRADE SEE CIVIL DRAWINGS AND SPECS.

OES
OPTIMAL ENGINEERING SOLUTIONS, INC.
12312 Olive Blvd. Suite 130
Creve Coeur, MO 63141
www.OES46.com
STRUCTURAL ENGINEERS

ARCHITECT
Hord Coplan Macht, Inc.
750 E. Pratt St. Suite 1100 Baltimore, MD 21202
p. 410.347.7511 f. 410.837.8500

STRUCTURAL ENGINEER
Optimal Engineering Solutions, Inc.
12312 Olive Blvd. St. Louis, MO 63141
p. 314.548.2990

MEP/FP ENGINEER
Burn Consulting Engineers, Inc.
8144 Walnut Hill Lane, Suite 200 Dallas, TX 75231
p. 214.373.4633

CIVIL ENGINEERS
Stock & Associates
257 Chesterfield Business Parkway St. Louis, MO
p. 636.530.9100 f. 636.530.9130

ONE CARDINAL Way

ST. LOUIS, MO
HUD PROJECT NUMBER:

hord | coplan | macht
ARCHITECTURE
LANDSCAPE ARCHITECTURE
PLANNING
INTERIOR DESIGN

No.	Date	Description
2	4/18/23	ASI-P05
1	12/7/22	BUILDING PERMIT SET

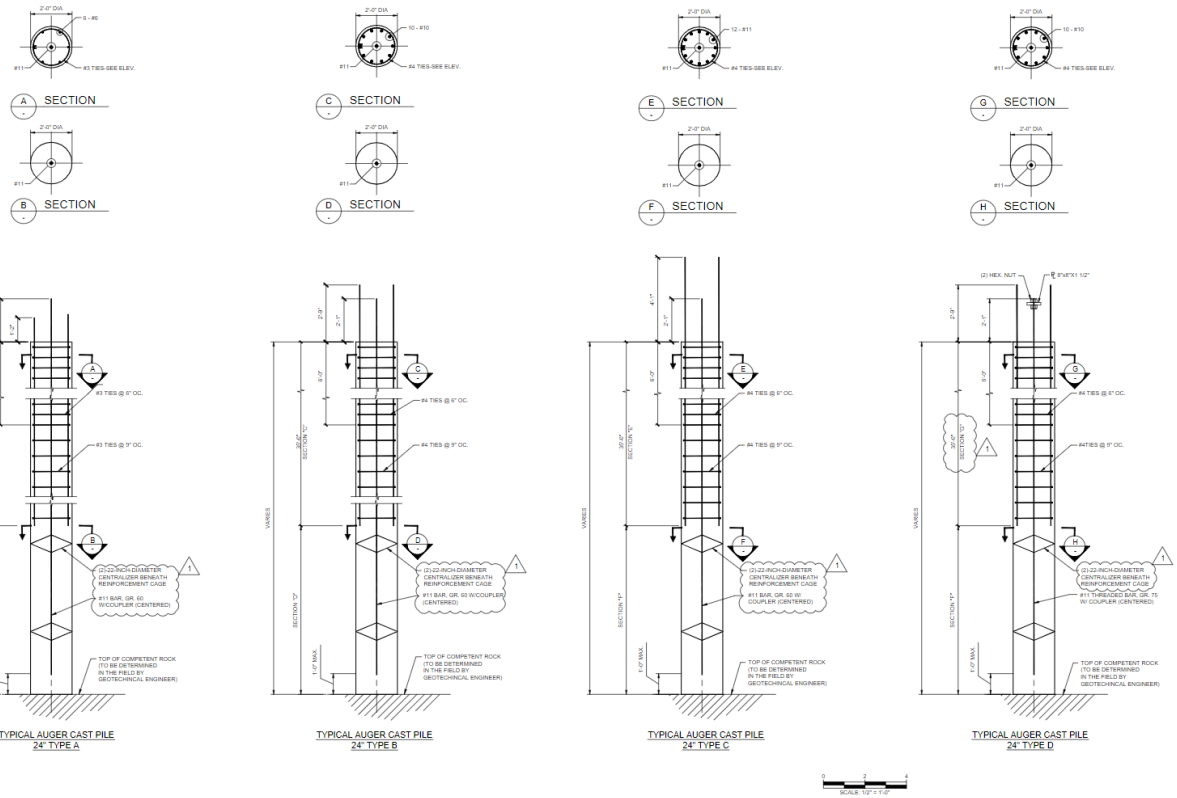
Project name
ONE CARDINAL WAY
Project number
217004.00
Date
12.22.2017
Scale
As indicated
Drawing
PILE PLAN

S2.00

CONSTRUCTION ISSUE SET

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Design – Block 400



ONE CARDINAL Way

ST. LOUIS, MO

HUD PROJECT NUMBER:

hord | coplan | macht

ARCHITECTURE
LANDSCAPE ARCHITECTURE
PLANNING
INTERIOR DESIGN

Project Name
ONE CARDINAL WAY

Project Number
217004.00

Date
11.22.2017

Scale
As indicated

Drawing
FOUNDATION PLAN PILE DETAILS

S2.00-G3

CONSTRUCTION ISSUE SET

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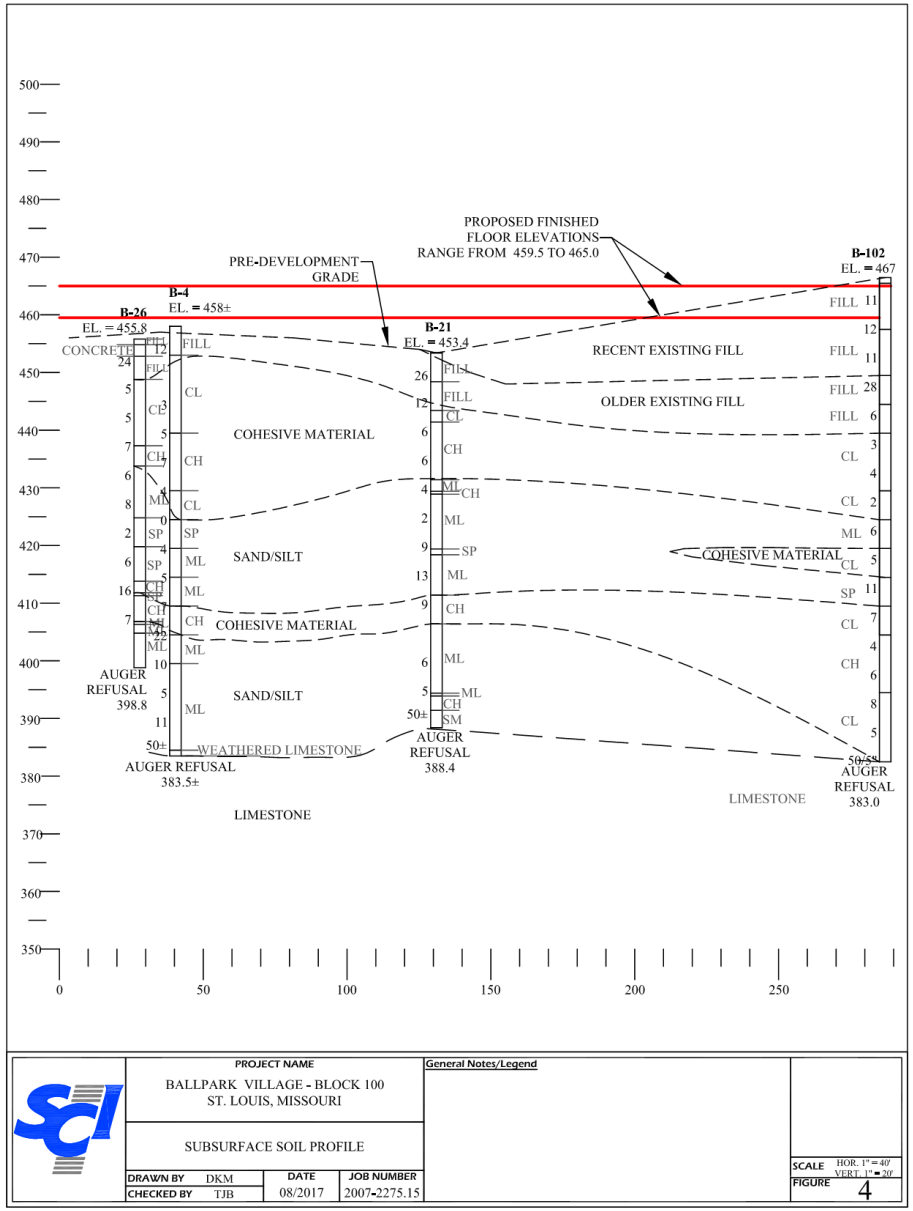
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Design – Block 100

Number of Piles – Each
Diameter of Piles – 30" Diameter
Pile Lengths – 50' to 88' below working grade
Design Capacity – 1,178 Kips
Design Criteria - Allowable Skin Friction - 0.65 ksf for Clayey Soils
Allowable Skin Friction – 0.40 ksf for Sandy Soils
Allowable End Bearing – 180 ksf

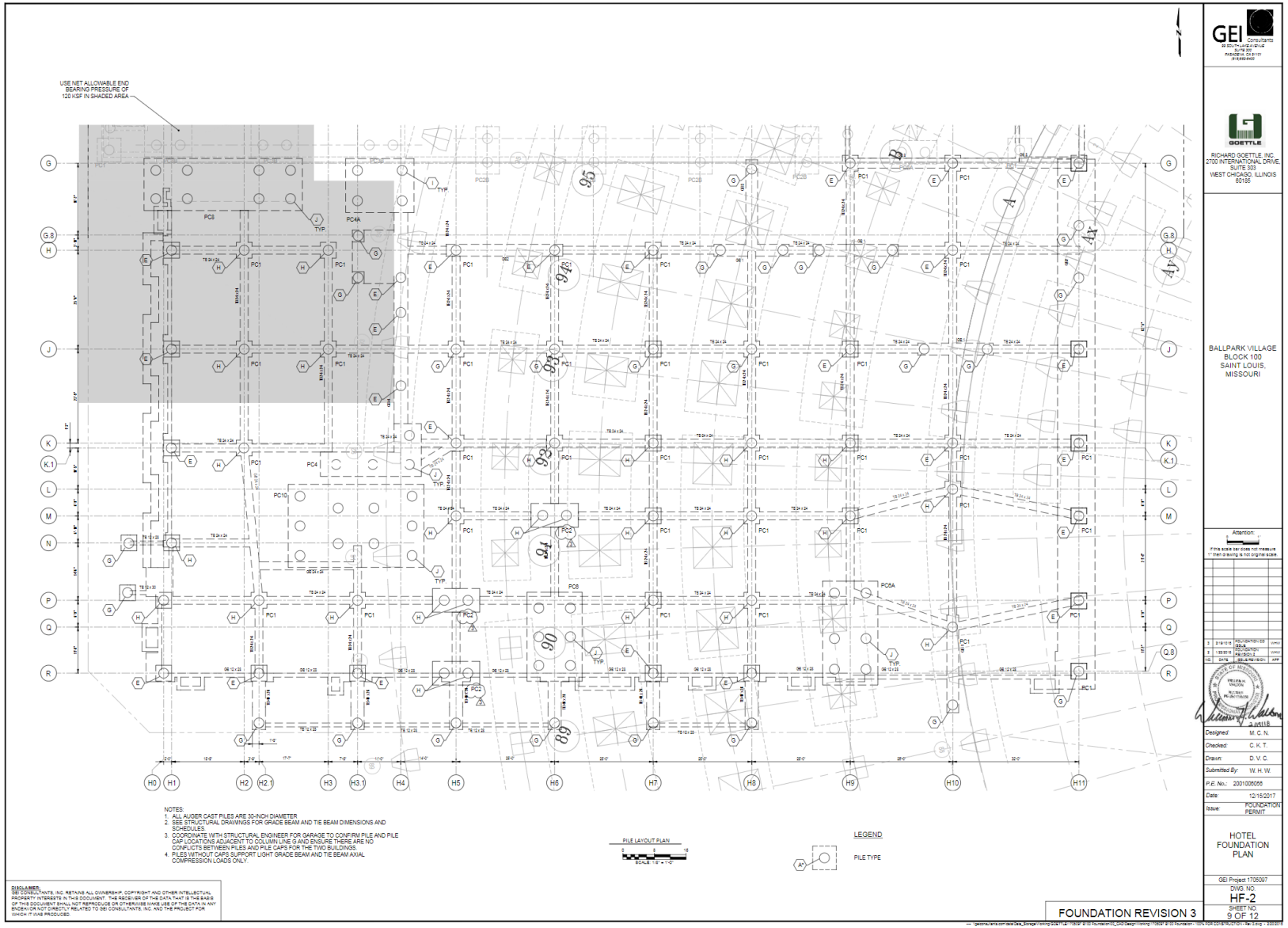
Comments: All pile drilled to refusal on rock
Some piles had cut-offs 17' below grade

Subsurface Conditions – Block 100

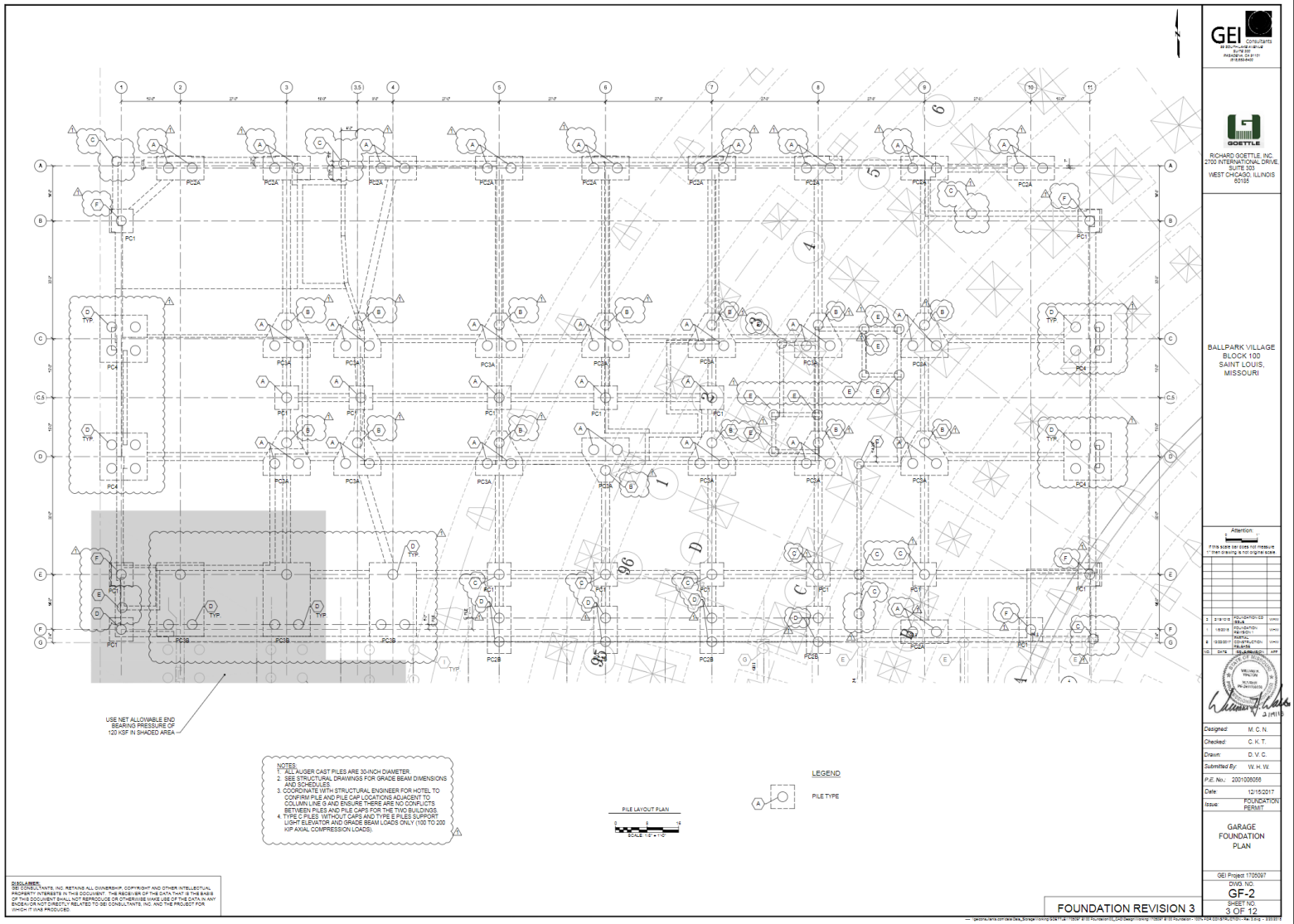


	PROJECT NAME: BALLPARK VILLAGE - BLOCK 100, ST. LOUIS, MISSOURI			General Notes/Legend	
	SUBSURFACE SOIL PROFILE				
	DRAWN BY: DKM	DATE: 08/2017	JOB NUMBER: 2007-2275.15		SCALE: HOR. 1" = 40' VERT. 1" = 20'
	CHECKED BY: TJB				FIGURE: 4

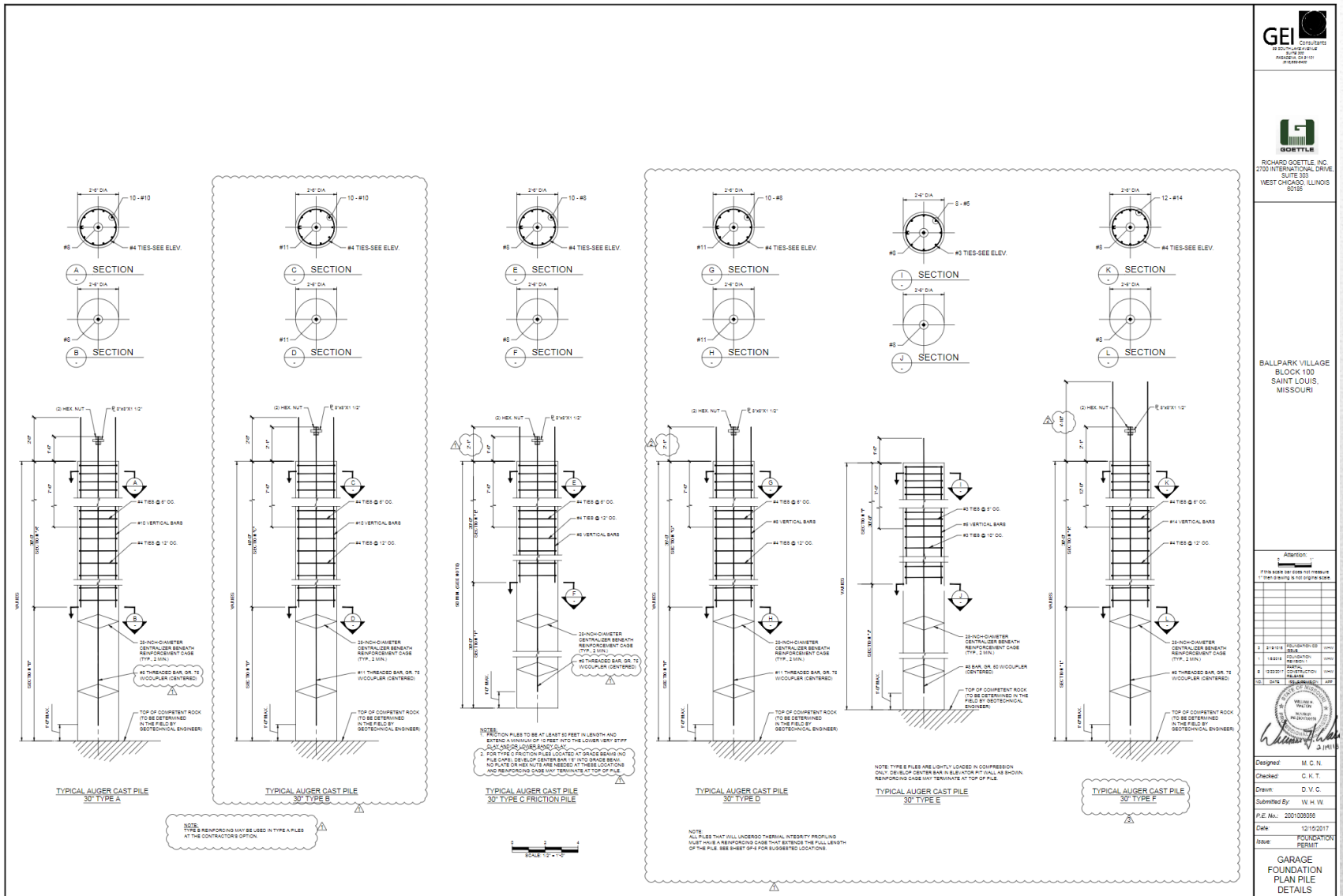
Design – Block 100 - Hotel



Design – Block 100 - Garage



Design – Block 100 - Garage



GEI consultants
65 ENTRADA DRIVE SUITE 202 PASADENA, CA 91101 (818)845-8400

RICHARD SCHEITLE, INC. 2700 INTERNATIONAL DRIVE SUITE 503 WEST CHICAGO, ILLINOIS 60185

BALLPARK VILLAGE BLOCK 100 SAINT LOUIS, MISSOURI

Attention: If this scale bar does not measure 1" then drawing is not original scale.

No.	DATE	REVISION	APP
3	3/19/2018	FOUNDATION CD ISSUE	
2	1/8/2018	FOUNDATION REVISION 1	
1	12/22/2017	PERMIT CONSTRUCTION RELEASE	

Designed:	M. C. N.
Checked:	C. K. T.
Drawn:	D. V. C.
Submitted By:	W. H. W.
P.E. No.:	2001006056
Date:	12/15/2017
Issue:	FOUNDATION PERMIT

GARAGE FOUNDATION PLAN PILE DETAILS

GEI Project 1705097
DWG NO. GF-4
SHEET NO. 5 OF 12

FOUNDATION REVISION 3

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- Additional Rock Coring was Performed to Verify Rock Conditions at both sites.

Design

Design







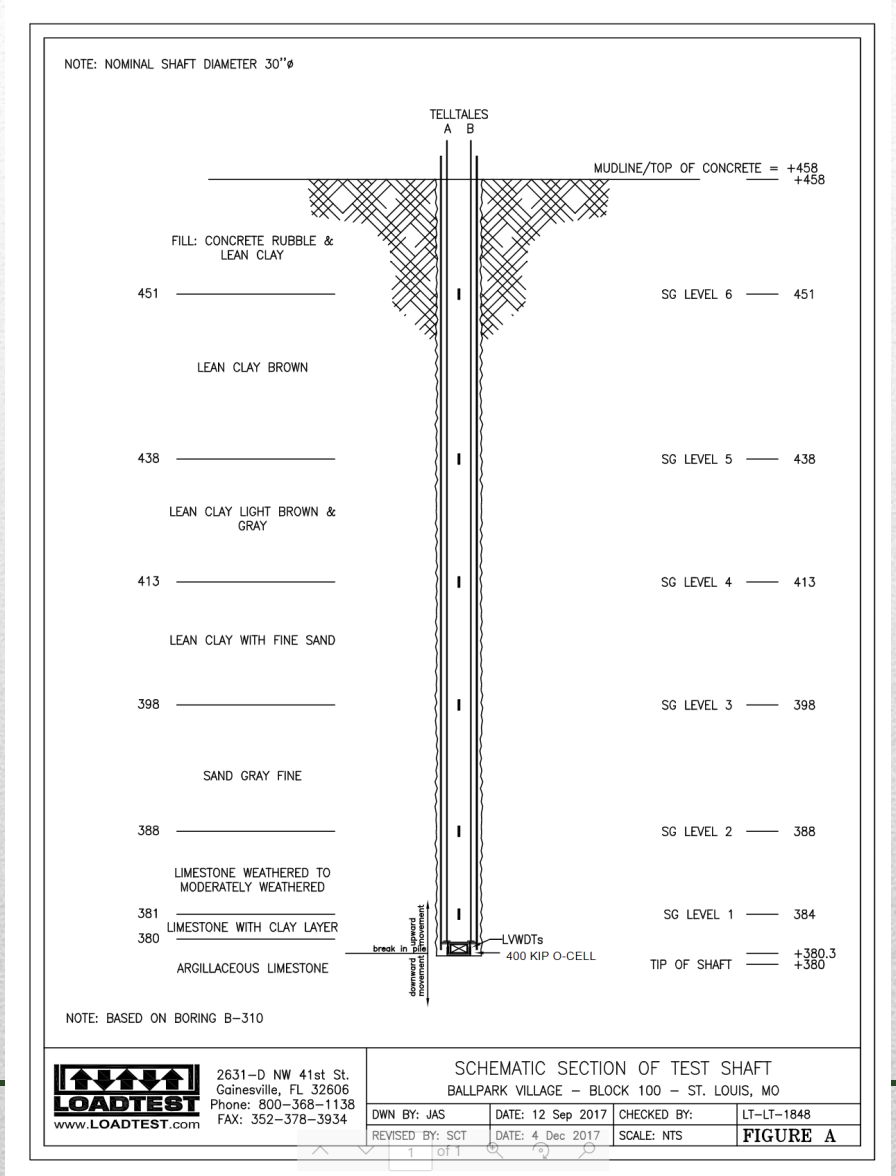
Load Testing – O-Cell Technology



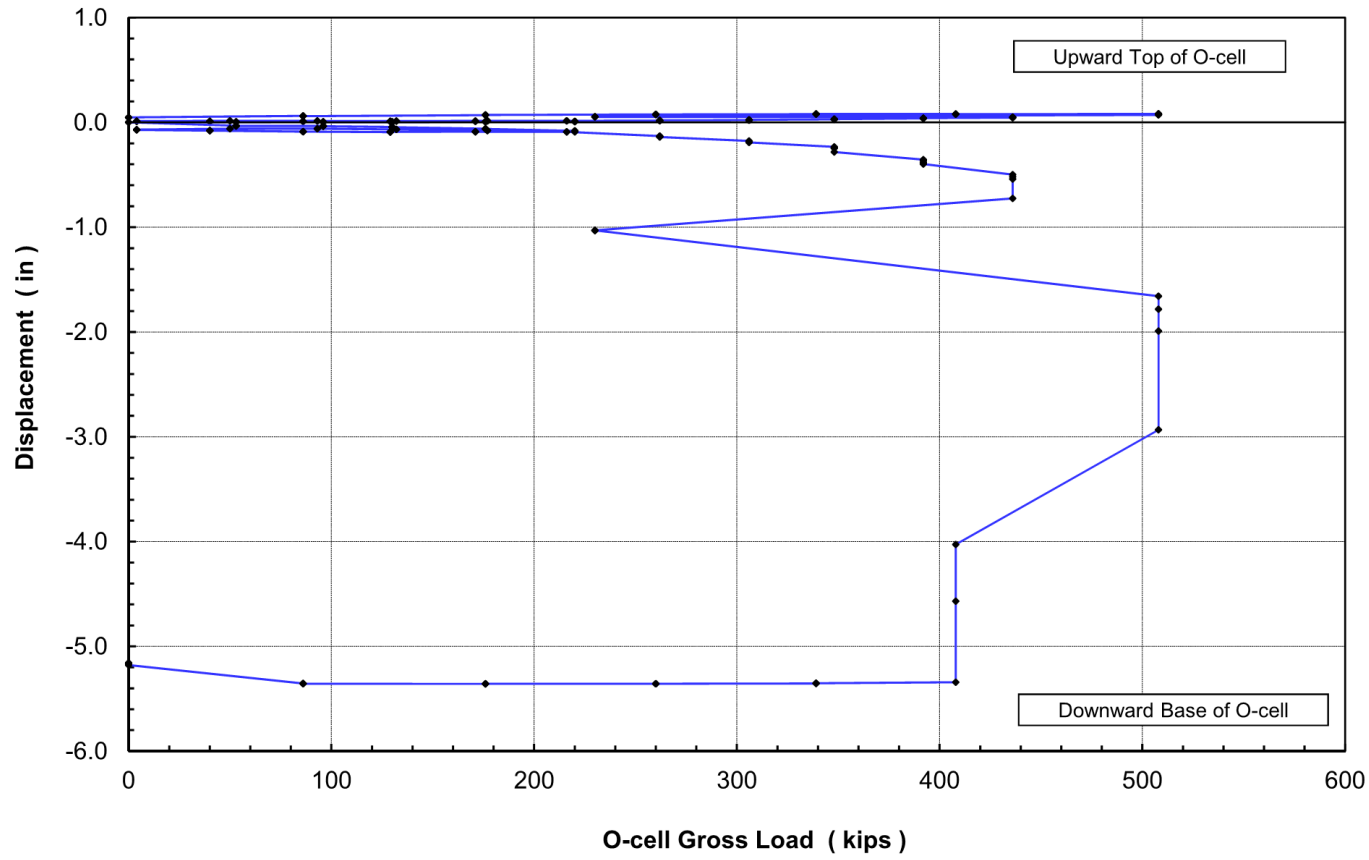


Load Testing – O-Cell Technology

Design – O-Cell Load Schematic Block 100



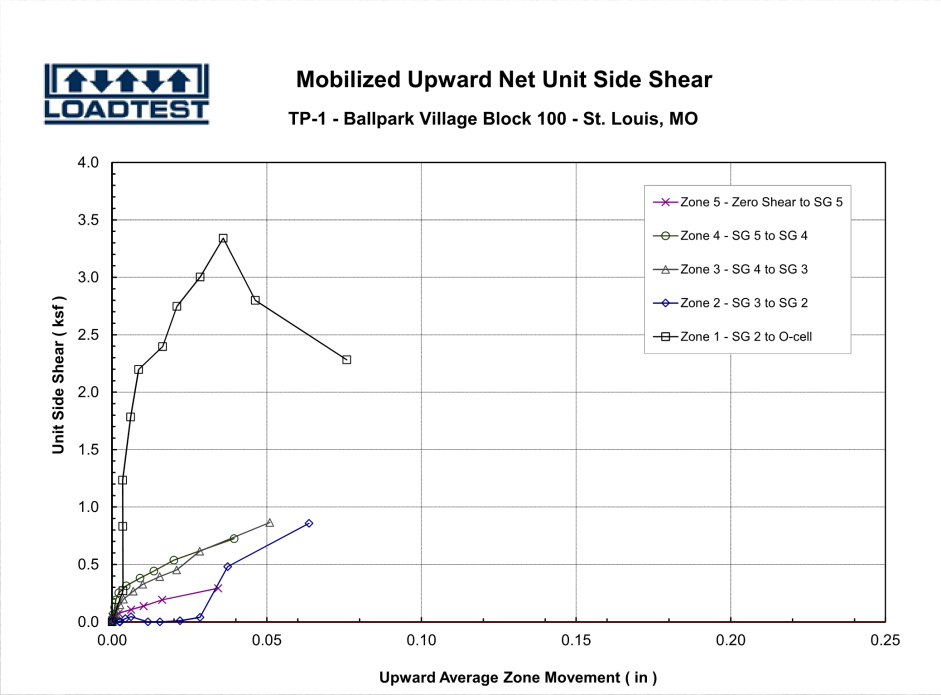
O-Cell Load Test Results – Block 100

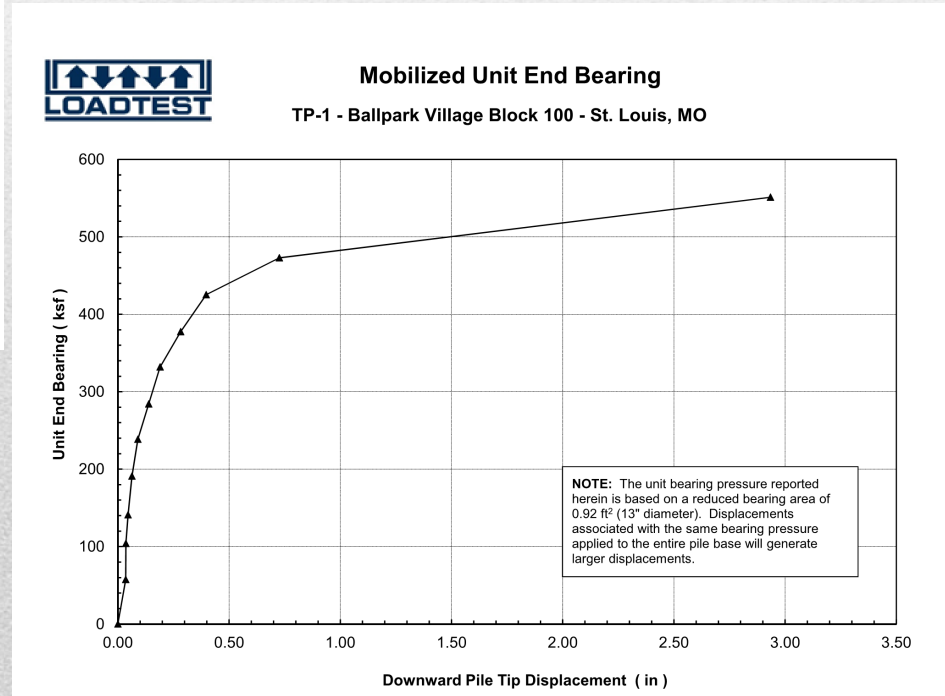


Loadtest Project No. LT-1848

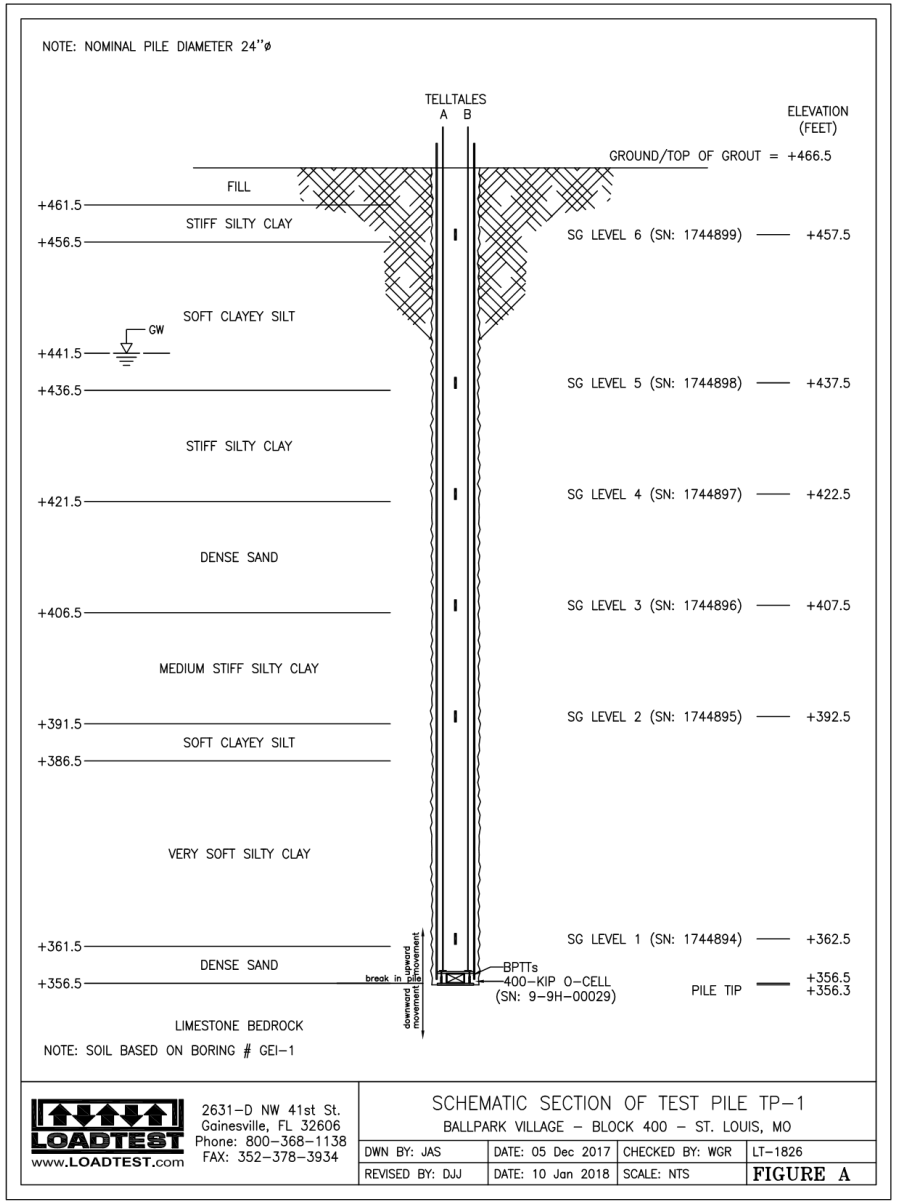
Figure 1 of 7

O-Cell Load Test Results – Block 100

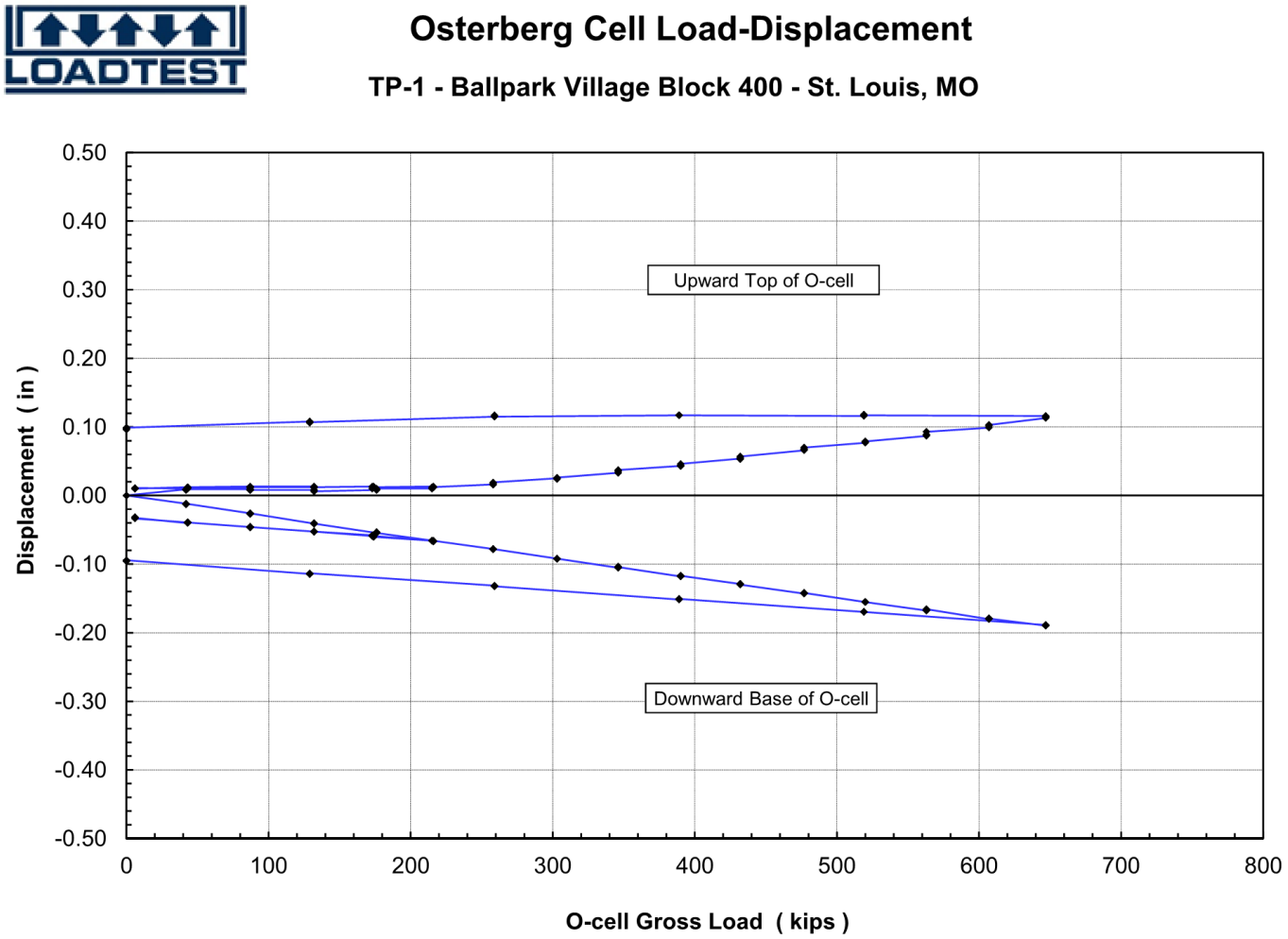




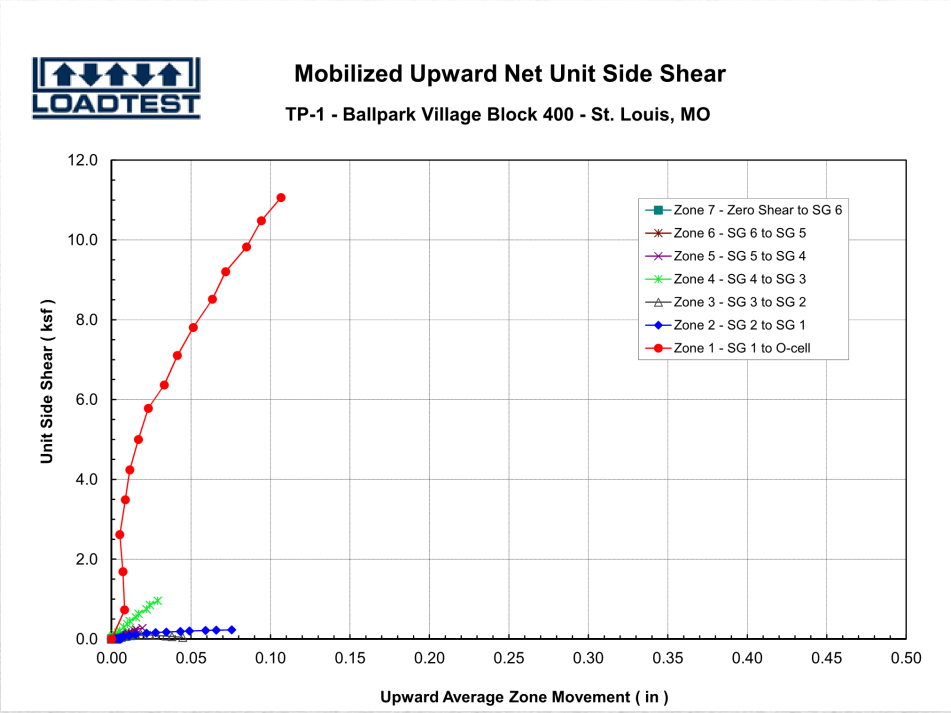
Design – O-Cell Load Schematic Block 400

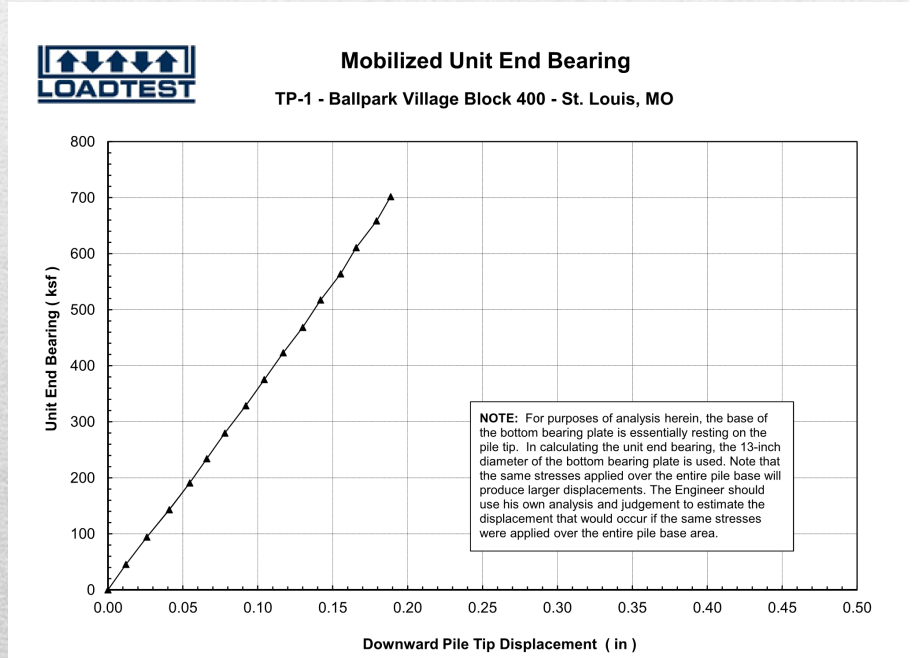


O-Cell Load Test Results – Block 400



O-Cell Load Test Results – Block 400



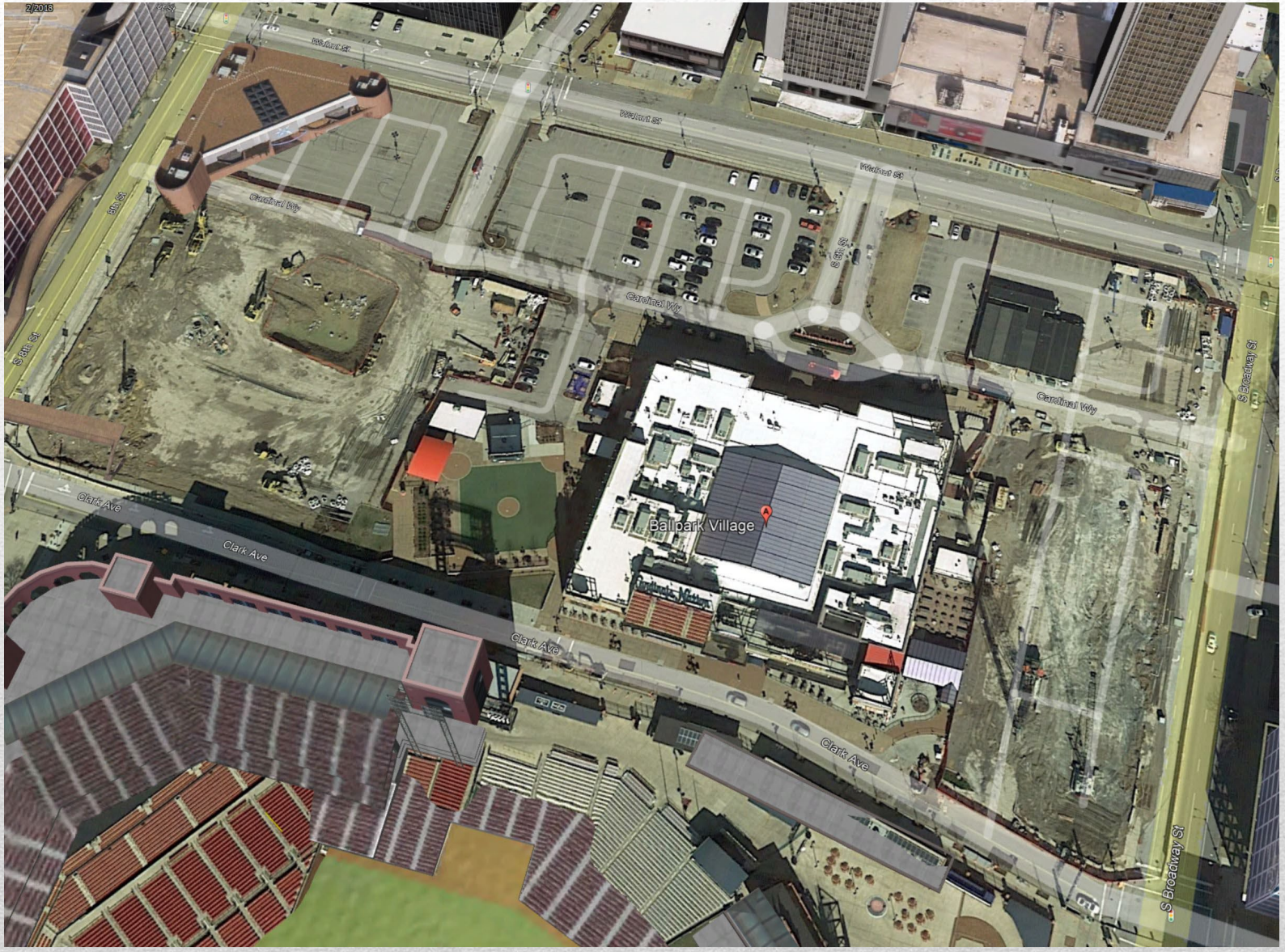


Construction/Installation

All augercast piles were installed to rock using the refusal criteria established in the load test pile. Less than 1 ft / minute.

All piles utilized a PIR system to document pile installation.

Pre-drilling required at some locations to core through existing foundations to allow for ACP installation.


2/2018
Walnut St
Cardinal Wy
9th St
S 8th St
Clark Ave
Ballpark Village
S Broadway St



Traditional Crane and Leads Set-up used for Block 400 Installation


ENTER
EXIT
EXIT
Budweiser
Mercy
MAXIM


Budweiser
Mercy
KOBELCO


Mercy
Budwe
BREW H



Fixed Mast Hydraulic Rig used for Block 100 Installation



Deep Pile Cut-Offs were a challenge – Up to 12' below grade.

- Damage to Equipment and Tooling





Challenges

- Obstructions from existing shallow foundations





Challenges

- Obstructions from abandoned utilities.



Challenges

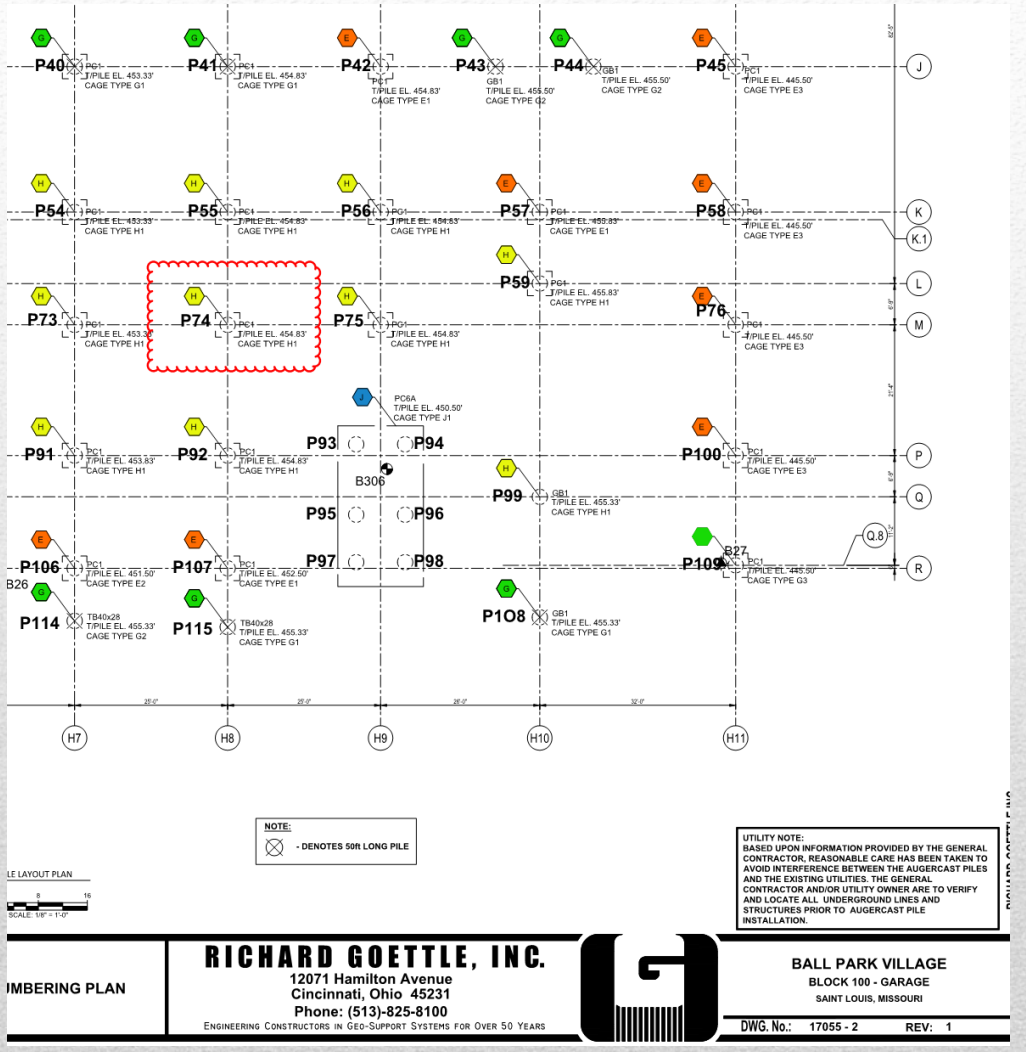
Challenges

- Obstructions from abandoned utilities

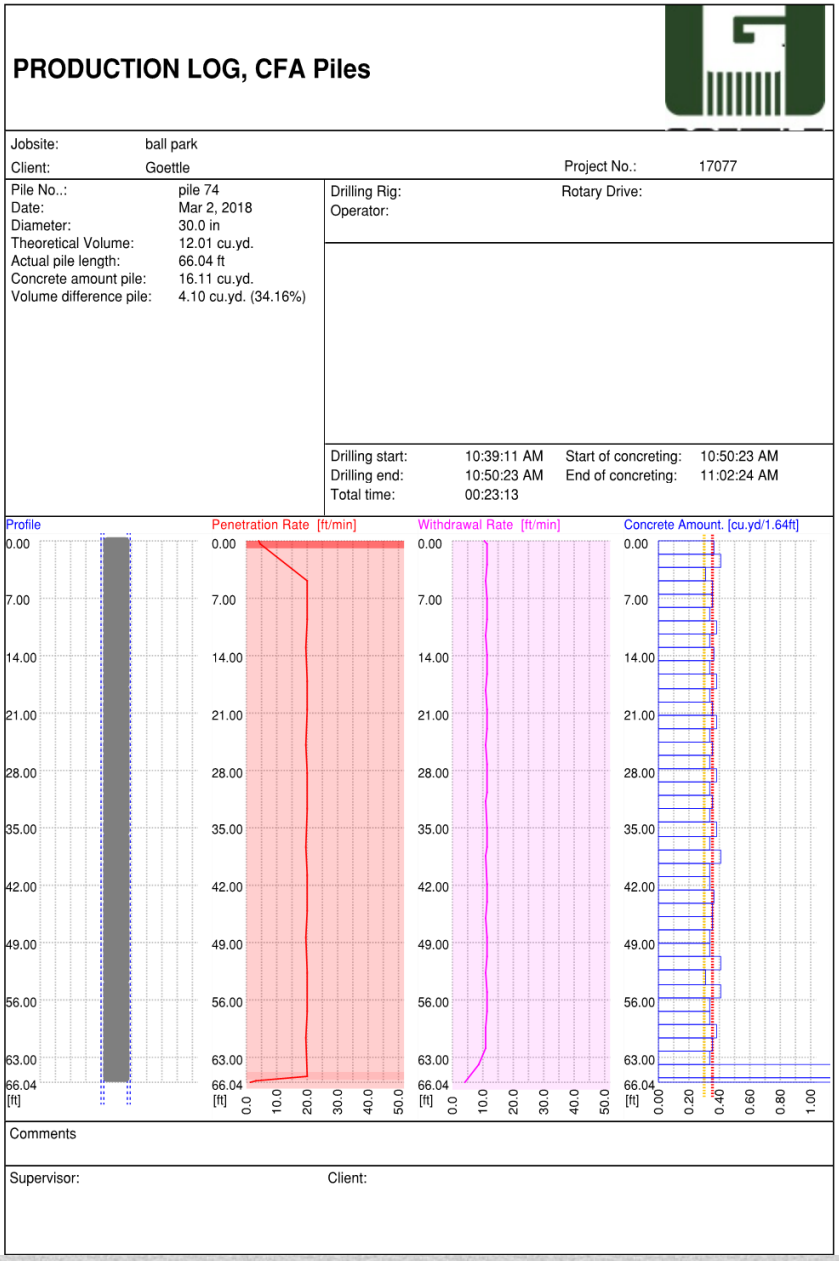


Challenges

- PIT Testing Anomaly in Pile 74
- Dynamically Testing Pile – Questionable Results
- Statically Load Testing Pile



Pile Installation Log – Pile 74



PRODUCTION LOG, CFA Piles

Jobsite:	ball park
Client:	Goettle
Project No.:	17077

Pile No..:	pile 74
Date:	Mar 2, 2018
Diameter:	30.0 in
Theoretical Volume:	12.01 cu.yd.
Actual pile length:	66.04 ft
Concrete amount pile:	16.11 cu.yd.
Volume difference pile:	4.10 cu.yd. (34.16%)

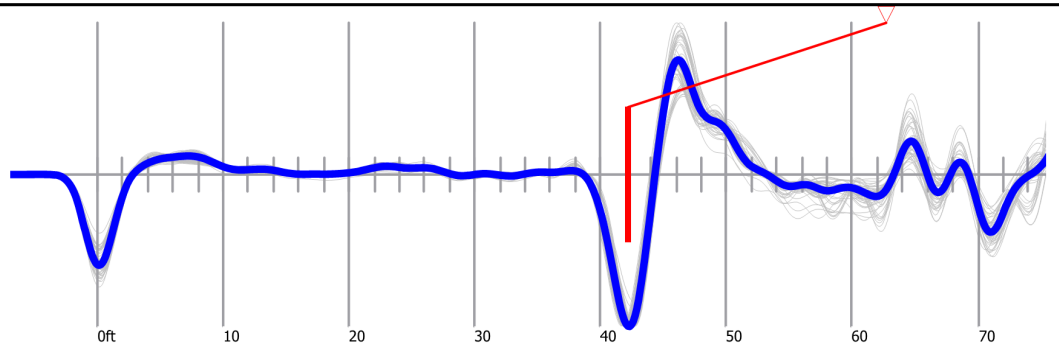
Drilling Rig: Rotary Drive:
Operator:

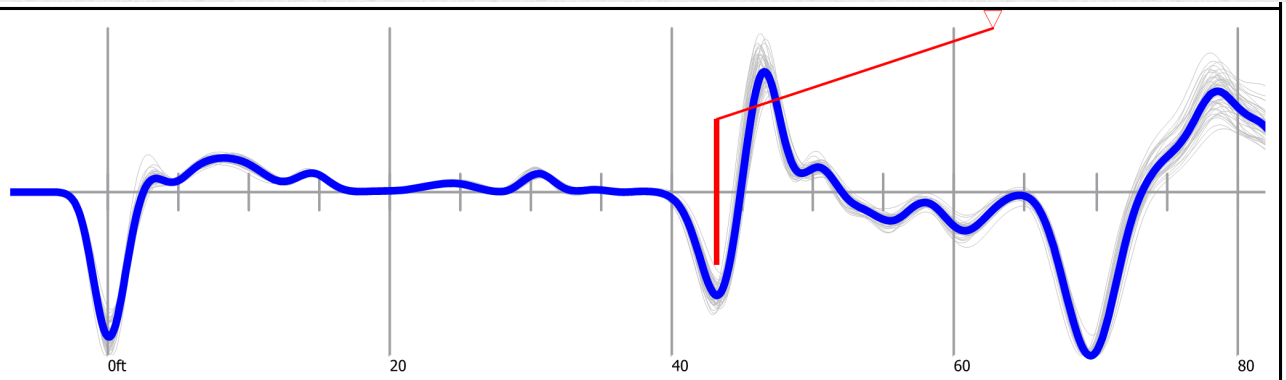
Drilling start:	10:39:11 AM	Start of concreting:	10:50:23 AM
Drilling end:	10:50:23 AM	End of concreting:	11:02:24 AM
Total time:	00:23:13		

Comments

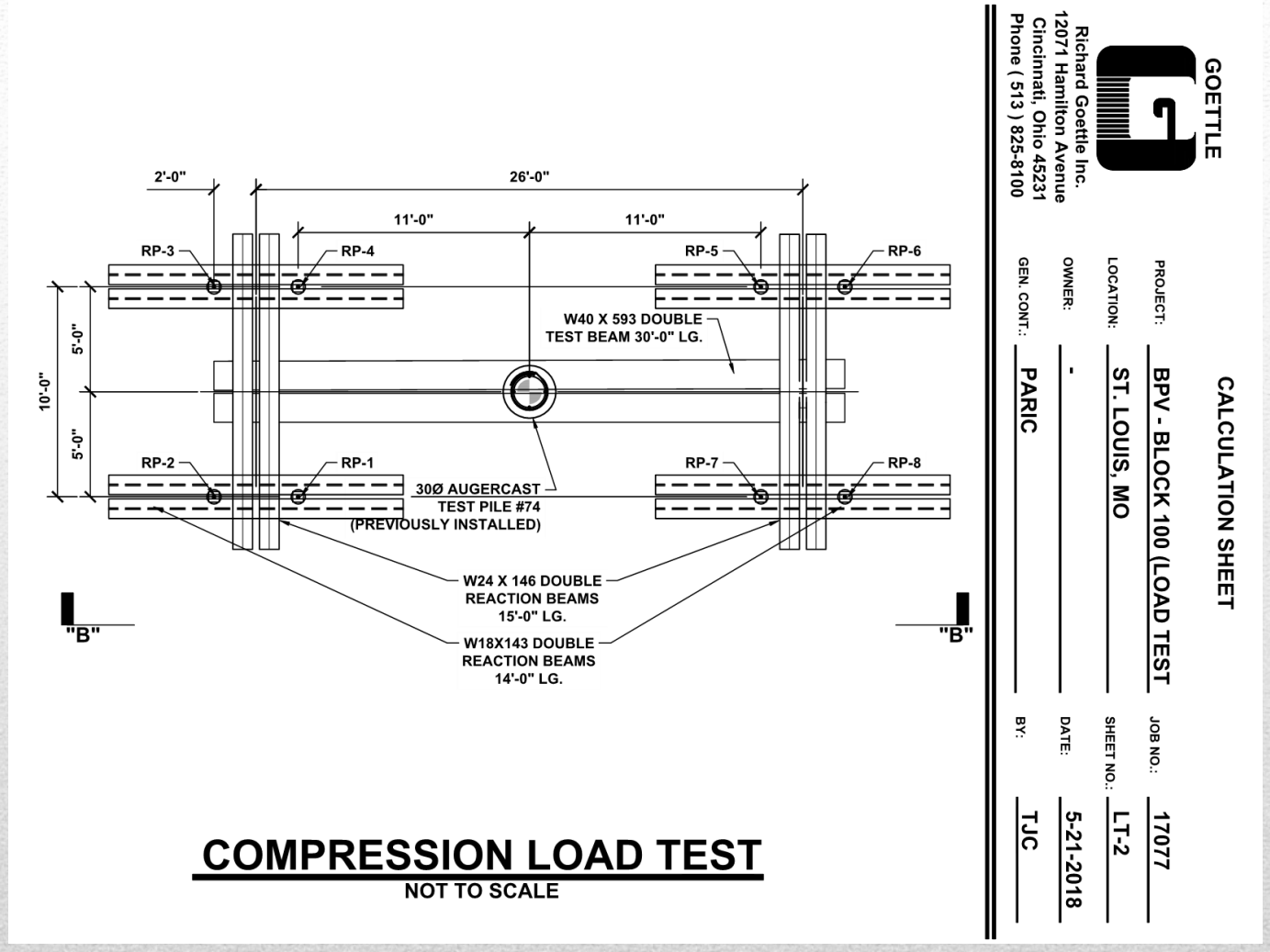
Supervisor: Client:

Challenges

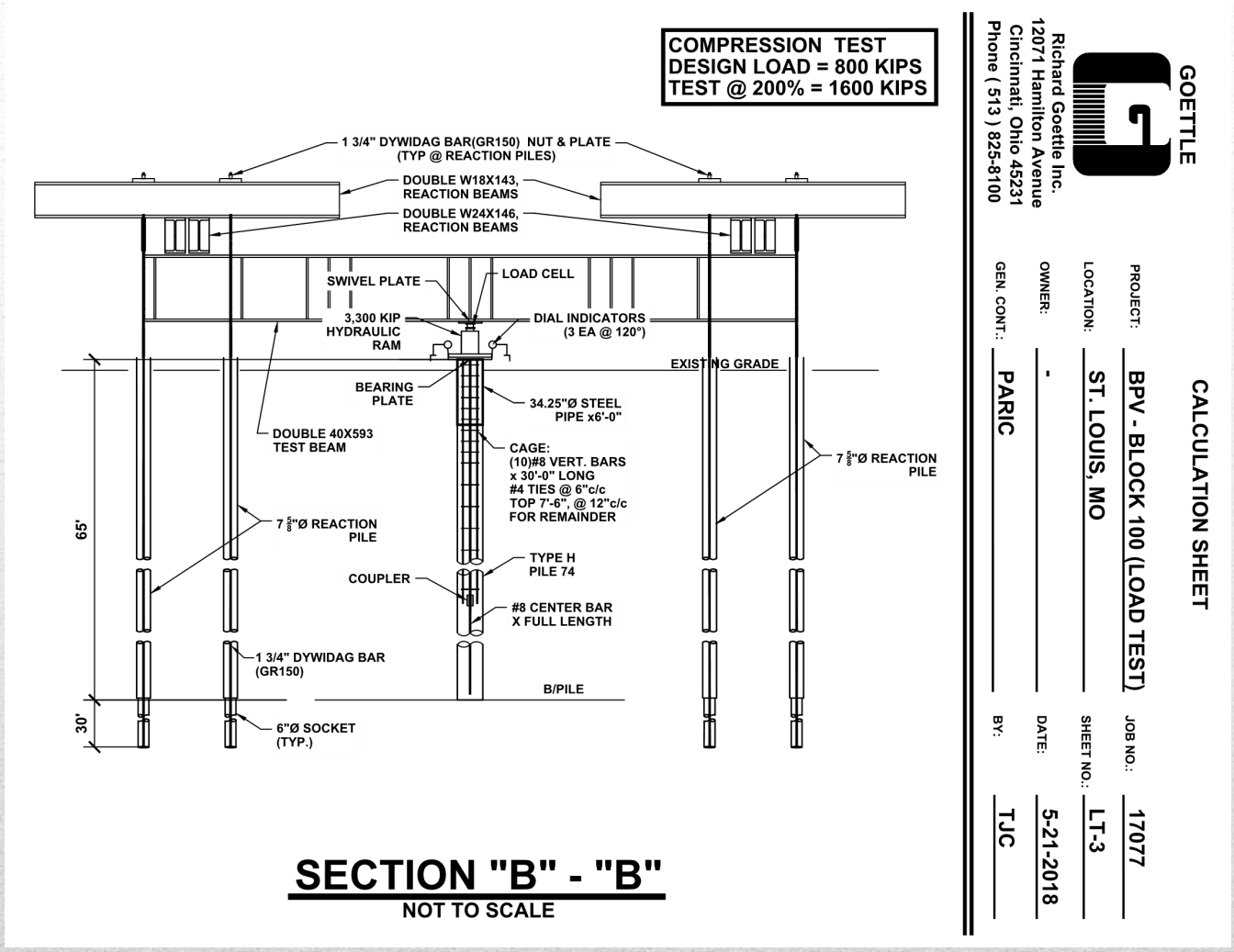
P74	4/26/2018 C:13900fps Amp:70 Planned:62.7ft	42.2ft?	

P74	5/4/2018 13900fps Amp:70 Planned:62.7ft Retest	43.2ft	

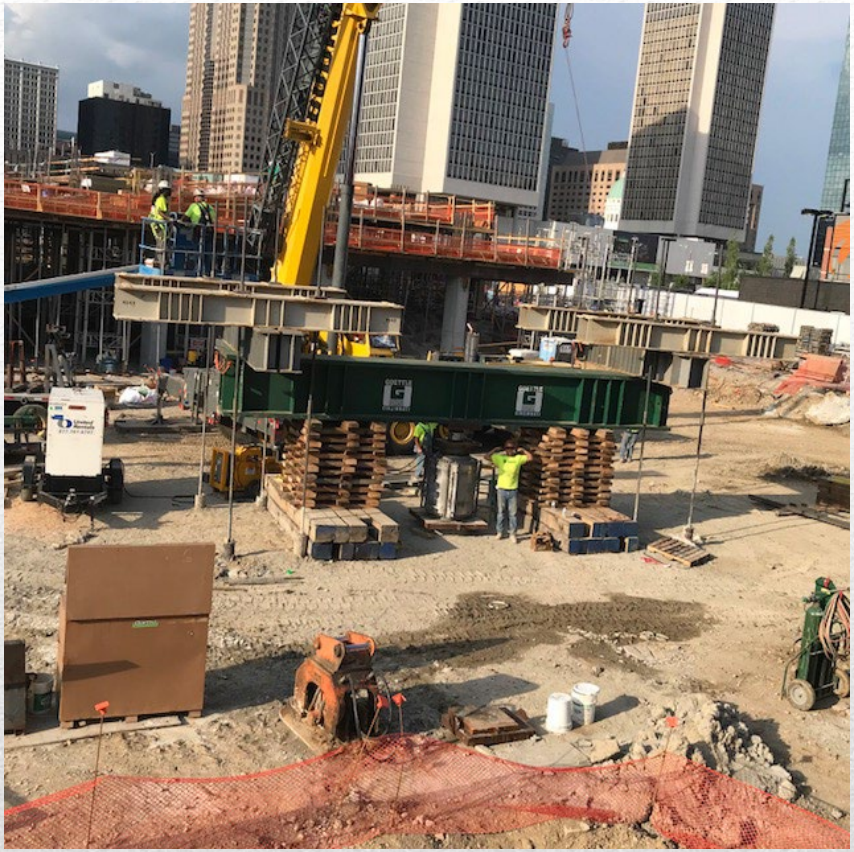
Challenges – PIT Test Pile 74???

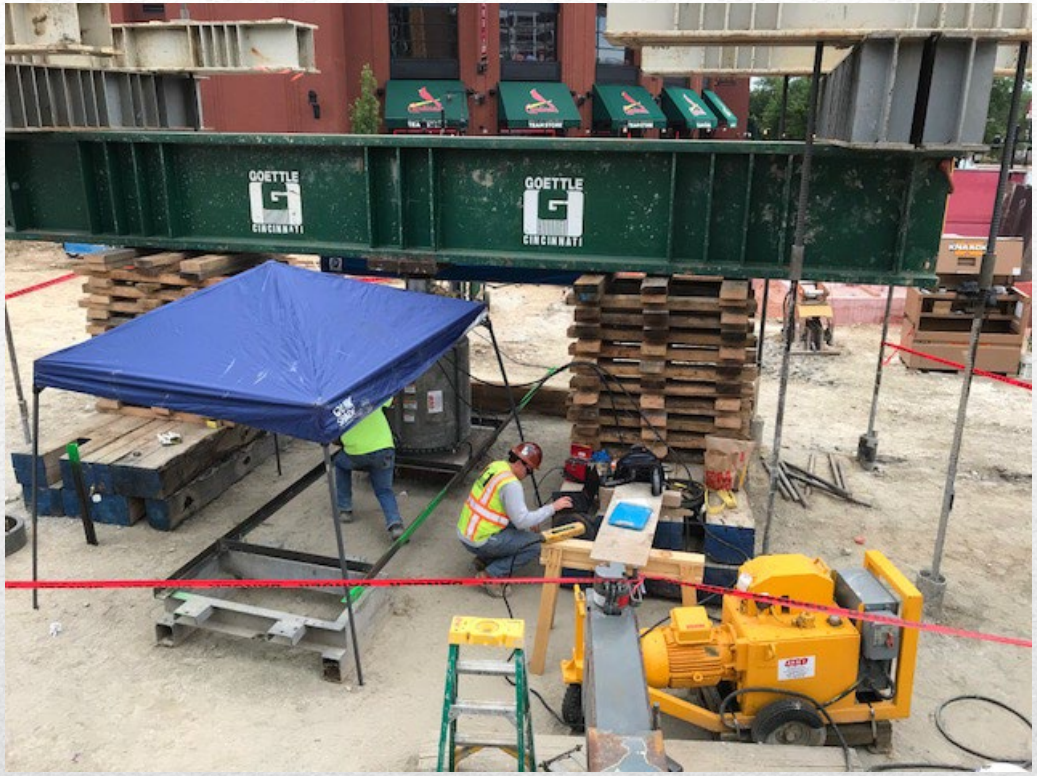


Challenges – Static Test

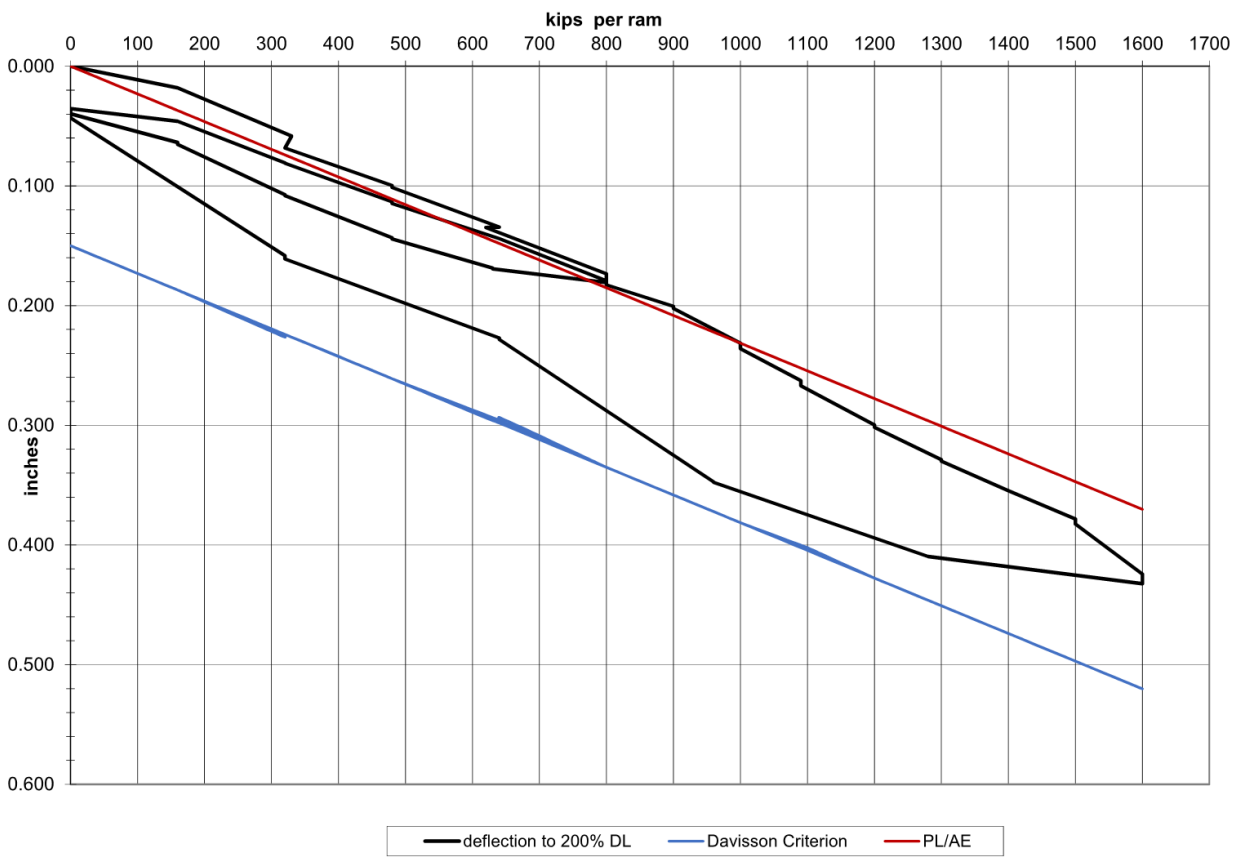


Challenges – Static Test





Challenges – Static Test Load Test Set-up for Pile 74



Challenges – Static Load Test Results on Pile 74


Ballpark Village
St. Louis Cardinals
Busch Stadium
Cardinals Special Events
Stan Musial Statue
Foro Plaza
Salt + Smoke
S Broadway St
Image Landsat / Copernicus

Thank You!
Questions?

