Stearn-Joglekar, Ltd
Consulting Structural Engineers

Howard C. Stearn, R.A.
Milind R. Joglekar, Ph.D., P.E., S.E.

January 18, 2016

Mr. Drew Friestedt
#F Properties
1101 W Monroe St., Suite 200
Chicago, IL 60607
E-mail: Drew Friestedt [drew@3fproperties.com]

Re: **851 West Grand – Foundation Load Test**

Dear Mr. Friestedt:

We have reviewed the testing protocol as outlined in the "psi" letter dated January 15, 2016. The testing procedures include both the individual stone pier tests and the full footing and foundation wall load test, as required by the "Committee on Standards and Tests.

It is our opinion that the submitted protocol will be adequate to verify the acceptability of using Helitech – Stone Vibratory Columns as an earth stabilization system for the above mentioned project.

The above constitutes our understanding of the issues discussed, if there are any questions or comments; please do not hesitate to call.

Milind R. Joglekar
Illinois License Number 081-004876

Very Truly Yours,
Stearn-Joglekar, Ltd.

Expires: Nov. 2016

Cc: psi Letter dated January 15, 2016

Information To Build On
Engineering • Consulting • Testing

January 15, 2016

Slab Masters, Inc. - Helitech
P.O. Box 24067
Belleville, Illinois 62223

Attn: Michael T. Haschemeyer

Re: QA/QC Testing Guidelines
851 W. Grand Avenue
Chicago, Illinois
PSI Project No. 00292304

Dear Mr. Haschemeyer:

Professional Service Industries, Inc. (PSI) has prepared the following Quality Assurance/Quality Control guidelines for PSI project no. 00292304, for the development at 851 W. Grand Avenue in Chicago, Illinois. The requirements/recommendations in our design report should be followed unless specifically addressed herein.

Load Testing:

As per the recommendation set forth by the Committee on Standards and Tests:

- Three (3) Individual Column Load Tests shall be performed on non-production VSC elements on a representative VSC installed to each proposed VSC length at different locations in the building footprint, and
- One (1) Foundation Load Test will be performed on a constructed non-production footing in the area of critical soil underlain by 3 VSC elements.

Individual stone columns shall be tested based on the specification set below for the Individual Column Load Test, and the footing shall be tested based on the specification set below for the Foundation Load Test. Three individual stone columns will be tested at different locations as indicated on the attached “Boring Location/Load Test Sketch.” Both the Foundation Load Test and Individual Load Tests shall be performed on a portion of the site representative of the on-site soil which will not interfere with the construction of the foundations or with utilities so the test foundation can be abandoned in place.

Foundation Load Test:

Foundation Load Test shall be performed on a footing resting on non-production columns to a minimum of 2.0 times of the design load or failure, whichever occurs first. For the purposes of this test, a WF3.5 will be tested. The test will include construction of a 3.5 feet wide, by 9 feet long, by 4 feet thick strip footing, consistent with the foundation shown on the Structural Drawing (S2-1, dated August 14, 2015) with the exception that the stem wall will be 12-inches wide to accommodate the jacks. The footing will be backfilled after construction. This footing will be supported by 3 VSC elements, spaced

3-feet on center, and installed to 16 feet below the bottom of the footing—which is consistent with the VSC design for this type of foundation. The load will be applied with 6 jacks spaced evenly along the footing. A detailed sketch showing the general layout of the foundation with respect to the VSC, jacks, dial gauges and reaction beams is attached. The actual helical reaction member layout may vary based on the actual installation torques achieved in the field. Reaction members shall be installed at a sufficient distance/depth from the stone column to limit their influence of the load test. The WF3.5 footing will be structurally designed by others.

As per the 48-hour load test criteria set forth in the Section 13-132-070 of Building Code of Chicago City, the Foundation Load Test for the stone column elements shall be loaded in accordance with the following loading schedule.

Load Increment	Stress on Element (% of Design)	Min. Duration (Minutes)
Seating	<5	1
1	17	80
2	33	100
3	50	100
4	67	100
5	83	100
6	100	960
7	117	80
8	133	100
9	150	100
10	167	100
11	183	100
12	200	960
13	150	5
14	100	5
15	5	5

To develop a load deflection curves, Helitech shall utilize a minimum of twelve (12) dial gauges reading to the nearest 0.01 inches to measure the deflection of the foundation. Ten (10) dial gauges shall be used to measure the top deflection of the foundation, and two (2) dial gauges shall be used to measure the tip deflection of an installed telltale to a minimum depth of 20 feet below grade. Refer to the sketch below for the typical section of the test set up.

Individual Column Load Test

Individual Column Load Test shall be performed on non-production individual stone columns in accordance with ASTM D1143 (Procedure B). The Individual Column Load Test can be performed using a 2-foot diameter, ½-inch steel plate over the stone column. Each of these tests shall be performed up to 2.0 times the design load using the onsite equipment or other loading system. The deflection of the plate should be measured throughout.

Individual Column Load Test for the stone column elements shall be loaded in accordance with the following loading schedule. The load should be maintained until the rate of deflection is less than 0.03 inches per hour (0.005 per 10 minutes).

Load Increment	Stress on Element (% of Design)	Min. Duration (Minutes)
Seating	<5	1
1	25	80
2	50	80
3	75	80
4	100	120
5	125	80
6	150	80
7	175	80
8	200	120
9	175	60
10	150	60
11	125	60
12	100	60
13	75	60
14	50	60
15	25	60
16	5	60

Quality Control Personnel

Helitech shall implement a full time quality control technician on site. The technician responsibilities include continuously monitoring the on-board computer system during the installation process and logging all installation data, verifying VSC depths, lift thickness, and compaction effort per lift. The quality control technician shall also report any site conditions that vary from those anticipated or obstructions that are encountered.

Documentation

Helitech shall provide the documentation of the installation of each individual stone column. The documentation shall present the stone column number, date and time of installation, depth of installation, hydraulic pressure applied during the boring process and the compacting process. Recorded data for each stone column shall be plotted for both depth and pressure versus time.

During the installation of the stone columns, an installation log will be maintained that documents the installation for comparison to the vibration/installation logs provided by the equipment. The field installation logs should include the following as a minimum:

a. Column number
b. Size and depth of vibratory stone column installed

c. Elevation of the existing ground surface at the time of installation and final elevation of compacted stone
d. Material type used for the stone column
e. Machine type, including length of passes and vibration frequency
f. Number of buckets placed by loader to estimate the yardage of material placed.

This letter has been performed in general accordance with the terms and conditions outlined in the Master Service Agreement between Helitech and PSI dated February 26, 2009. This report has been prepared for the exclusive use of Slab Masters, Inc. "Helitech" for the specific application to the stone columns for the proposed 851 W Grand Development in Chicago, Illinois. If you have questions pertaining to this report, or if we may be of further service, please contact us at your convenience.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Sean T. Hibbits, E.I.
Project Manager

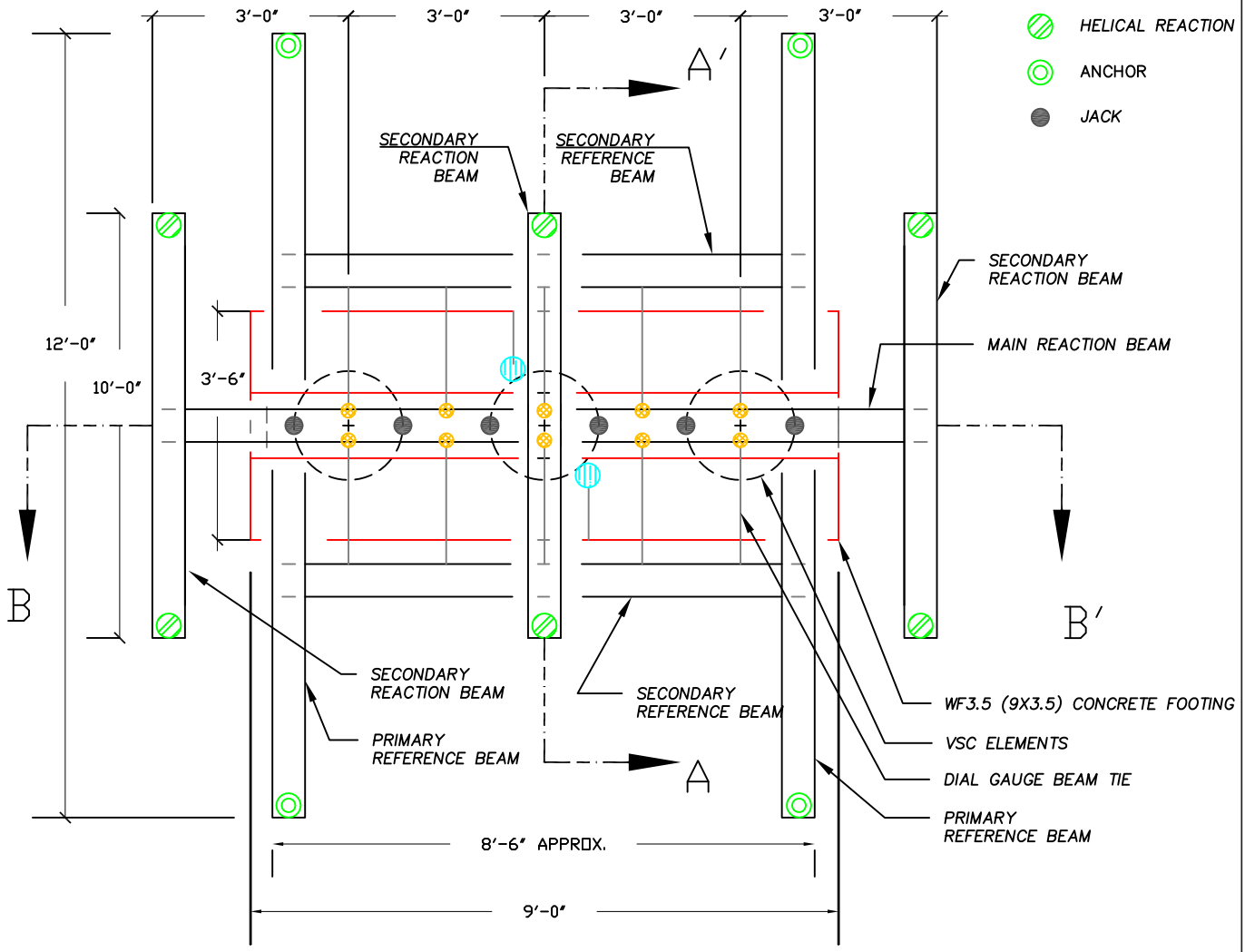
Nicholas J. Roth, P.E
Principal Consultant

Attachments: Foundation Load Test Sketches
Individual Load Test Sketch
Boring/Load Test Location Sketch

The Professional Engineering Seal is an electronic reproduction of the original seal. An original hard copy was sent to the client listed on this document. This electronic Reproduction shall not be construed as an original or certified document.

LEGEND

- DIAL GAUGES
- TELLTALE GAUGES
- HELICAL REACTION
- ANCHOR
- JACK



NOTE:
1. ACTUAL HELICAL PILE LAYOUT MAY VARY BASE ON THE TORQUES ACHIEVED IN THE FIELD.
2. ACTUAL NUMBER OF JACKS USED FOR THE LOAD TEST MAY BE MODIFIED BASED ON THE JACK DIAMETER AND MAXIMUM CAPACITY PER JACK (MINIMUM 6)

MAX. TEST LOAD: 2.0 DL x LENGTH x WIDTH = 2.0 (4,000 psf) x 9ft. x 3.5ft. = 252 kips.

MAX. LOAD PER JACK: $\frac{252 \text{ kips.}}{6 \text{ JACKS}}$ = 42 kips.

MAX. LOAD PER HELICAL = $\frac{252 \text{ kips.}}{6 \text{ HELICALS}}$ = 42 kips.

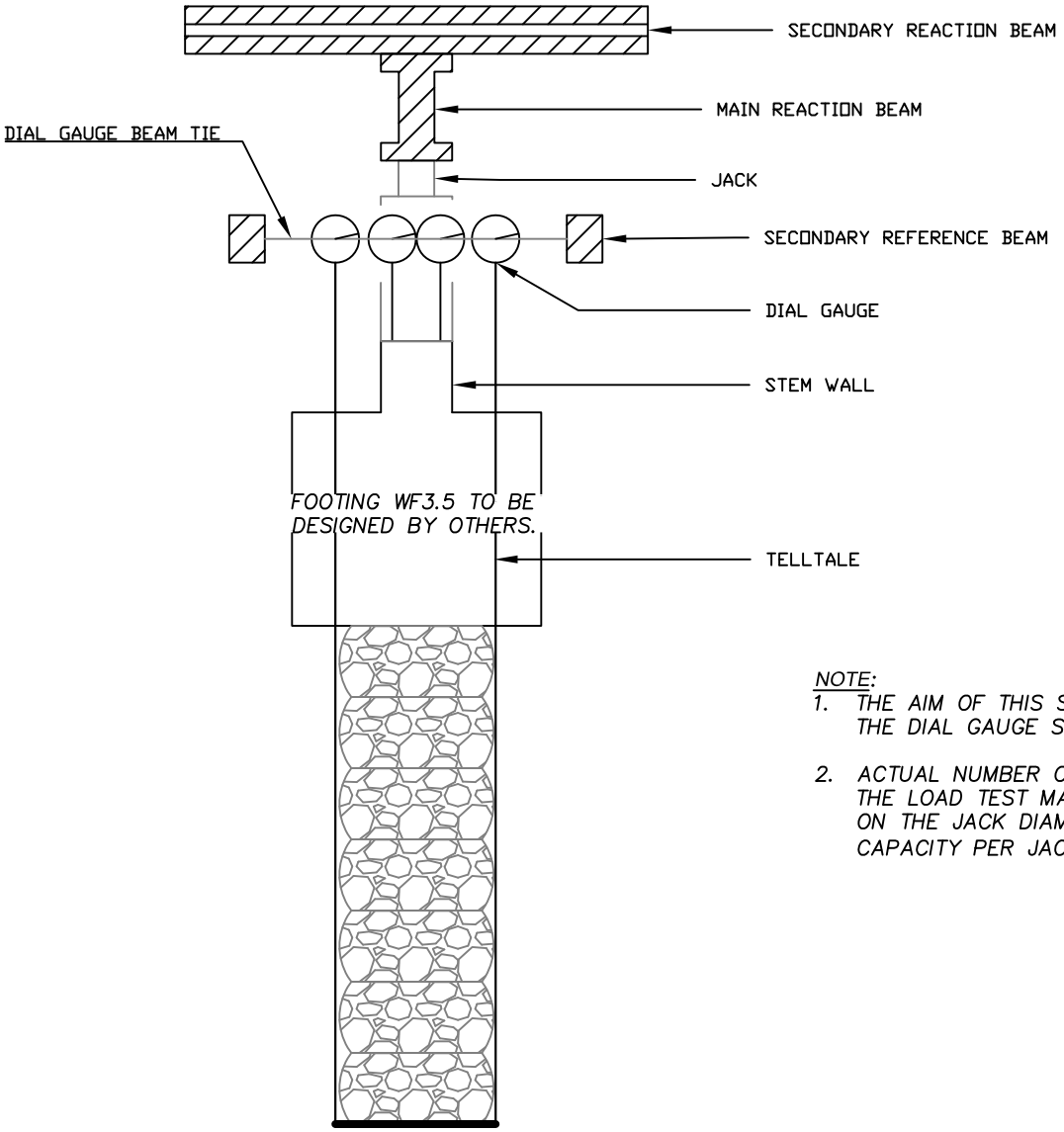
PREPARED BY PROFESSIONAL SERVICE INDUSTRIES, INC. (PSI)

HELITECH
Civil Construction Divison
www.helitechccd.com
(800) 246-9721

Foundation Load Test

851 W Grand
851 West Grand Avenue
Chicago, Illinois

Scale:	NO SCALE
Date:	01-14-2016
File Name:	sketch-1
Project Number:	00292304-1



NOTE:
1. THE AIM OF THIS SECTION IS TO SHOW THE DIAL GAUGE SUPPORT SYSTEM.
2. ACTUAL NUMBER OF JACKS USED FOR THE LOAD TEST MAY BE MODIFIED BASED ON THE JACK DIAMETER AND MAXIMUM CAPACITY PER JACK (MINIMUM 6)

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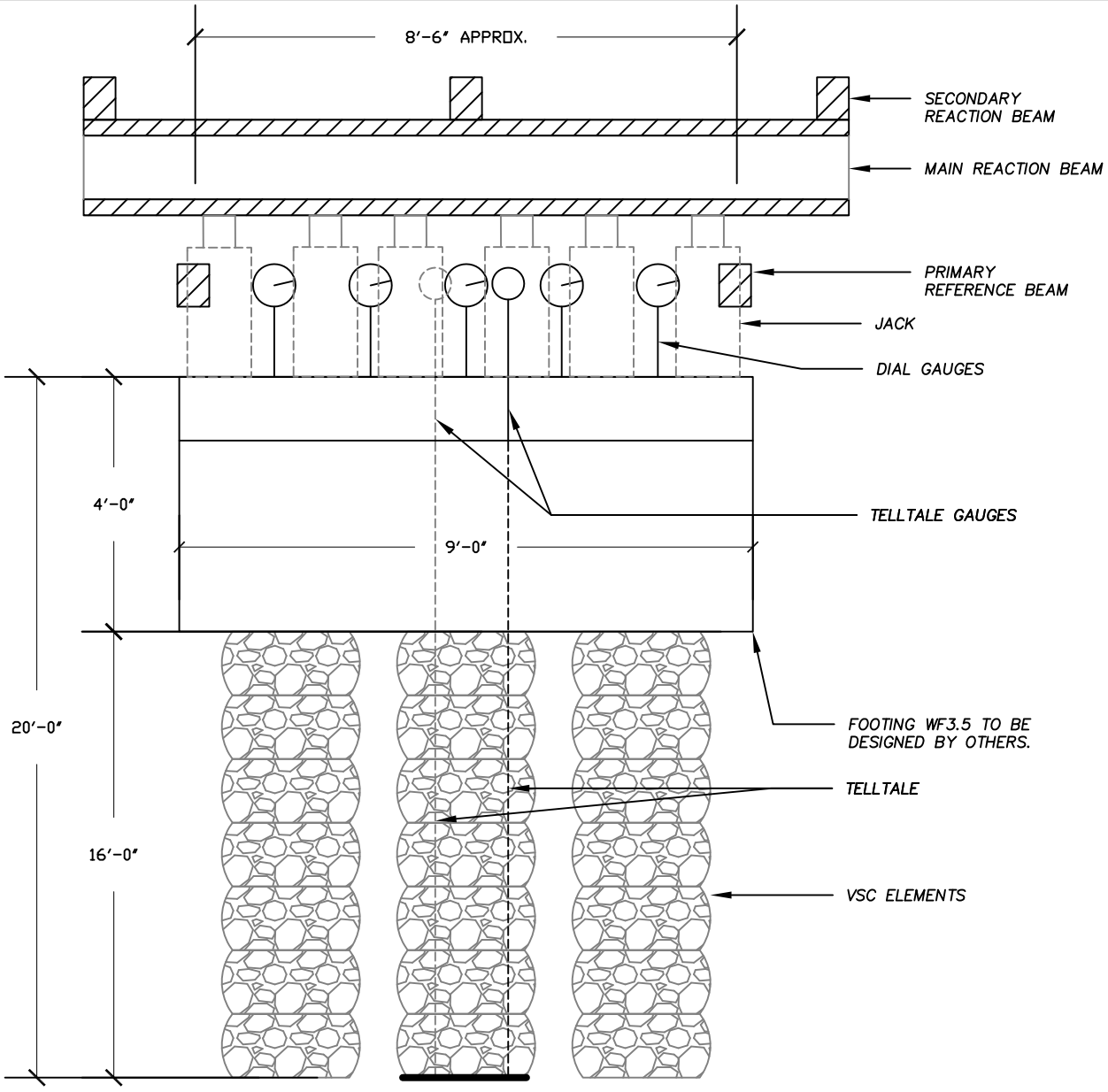
Foundation Load Test Section A-A'

851 W Grand
851 West Grand Avenue
Chicago, Illinois

Scale:	NO SCALE
Date:	01–14–2016
File Name:	sketch–2
Project Number:	00292304-1



NOTE:

1. THE AIM OF THIS SECTION IS TO SHOW THE DIAL GAUGE SUPPORT SYSTEM.
2. ACTUAL NUMBER OF JACKS USED FOR THE LOAD TEST MAY BE MODIFIED BASED ON THE JACK DIAMETER AND MAXIMUM CAPACITY PER JACK (MINIMUM 6)

MAX. TEST LOAD: 2.0 DL x LENGTH x WIDTH = 2.0 (4,000 psf) x 9ft. x 3.5ft. = 252 kips.

MAX. LOAD PER JACK: $\frac{252 \text{ kips.}}{6 \text{ JACKS}}$ = 42 kips.

MAX. LOAD PER HELICAL = $\frac{252 \text{ kips.}}{6 \text{ HELICALS}}$ = 42 kips.

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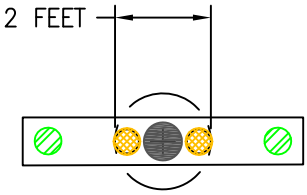
Foundation Load Test Section B-B'

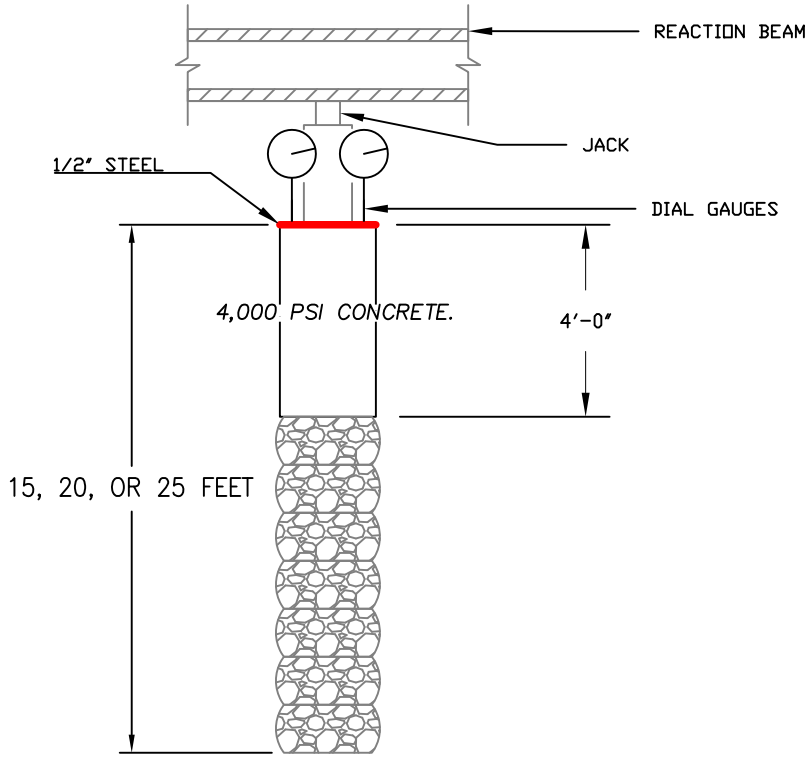
851 W Grand
851 West Grand Avenue
Chicago, Illinois

Scale:	NO SCALE
Date:	01-14-2016
File Name:	sketch-1
Project Number:	00292304-1



LEGEND

- DIAL GAUGES
- HELICAL REACTION
- JACK
- 1/2" STEEL



NOTE:

1. *ACTUAL HELICAL PILE LAYOUT MAY VARY BASE ON THE TORQUES ACHIEVED IN THE FIELD.*
2. *ACTUAL NUMBER OF JACKS USED FOR THE LOAD TEST MAY BE MODIFIED BASED ON THE JACK DIAMETER AND MAXIMUM CAPACITY PER JACK.*
3. *LOAD PER JACK TO BE DETERMINED BASED ON THE RESULT OF FOUNDATION LOAD TEST.*

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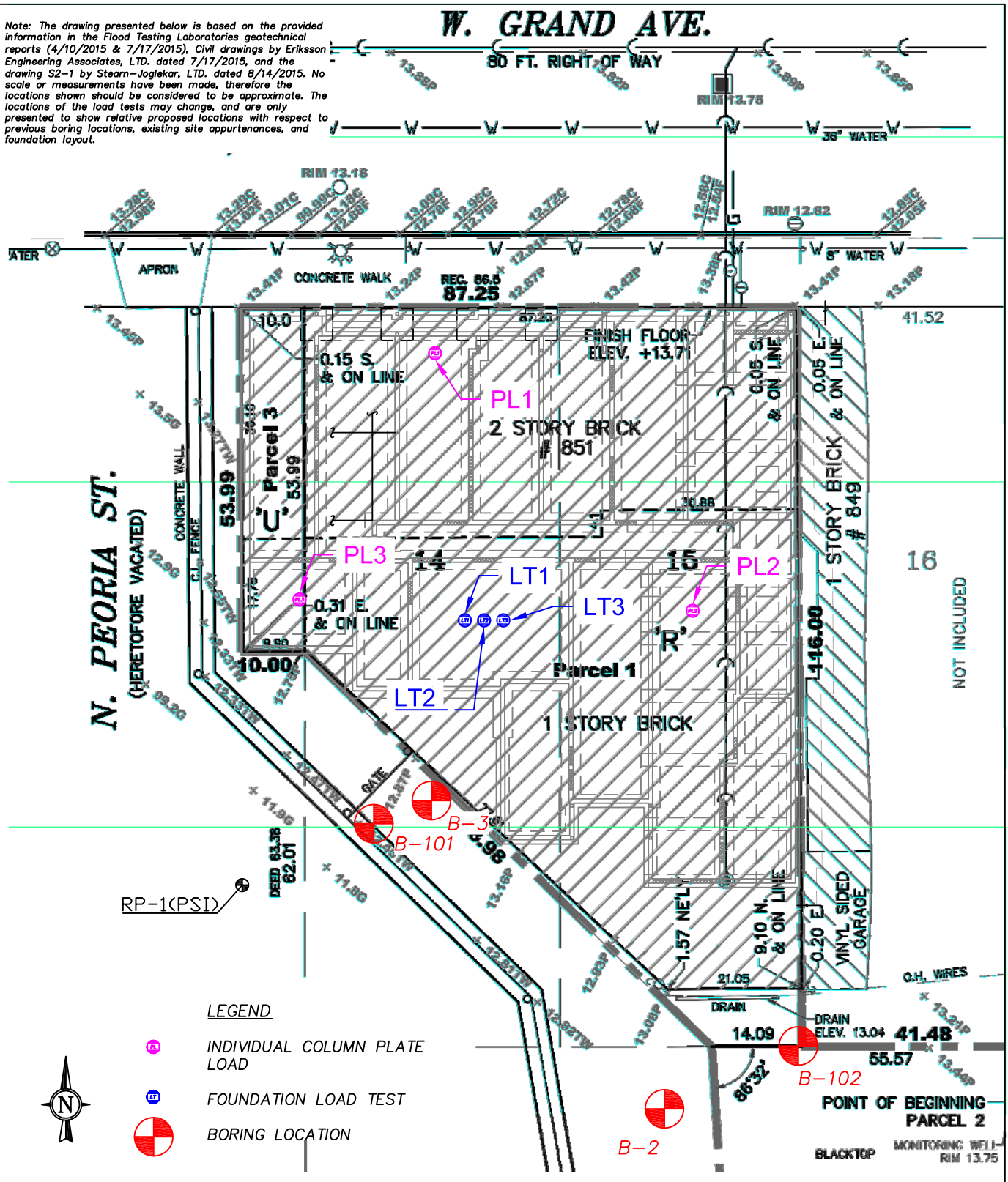
Individual Column Load Test

851 W Grand
851 West Grand Avenue
Chicago, Illinois

Scale:	NO SCALE
Date:	01-12-2016
File Name:	sketch-2
Project Number:	00292304-1

Note: The drawing presented below is based on the provided information in the Flood Testing Laboratories geotechnical reports (4/10/2015 & 7/17/2015), Civil drawings by Eriksson Engineering Associates, LTD. dated 7/17/2015, and the drawing S2-1 by Stearn-Joglekar, LTD. dated 8/14/2015. No scale or measurements have been made, therefore the locations shown should be considered to be approximate. The locations of the load tests may change, and are only presented to show relative proposed locations with respect to previous boring locations, existing site appurtenances, and foundation layout.



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Boring / Load Test Location Sketch

851 W Grand
851 West Grand Avenue
Chicago, Illinois

Scale:	NO SCALE
Date:	01-08-2016
File Name:	BoringLocationSketch.dwg
Project Number:	00292304-1

LOAD TEST RESULT DESCRIPTION:

A typical Foundation Load Test result can be shown on the load vs deflection curve as shown in Figure 1 below. X-axis represents the load increments assigned. Y-axis reflects the deflection corresponding to the average of two dial gauges readings taken for each load increment. For 851 W Grand project, there are 5 sets of dial gauges for foundation loading. Each set consists of two dial gauges. As shown in the load test sketch provided, 3 sets will placed on the stem wall along the centerline of VSC's to measure the deflection at that point and 2 sets will be placed in between the VSC's to measure the deflection at that point. Hence, 5 sets of load vs deflection curves similar to one shown in Figure 1 can be generated. Curves can be overlain in one single graph or can be presented separately depending on the engineering need and judgement

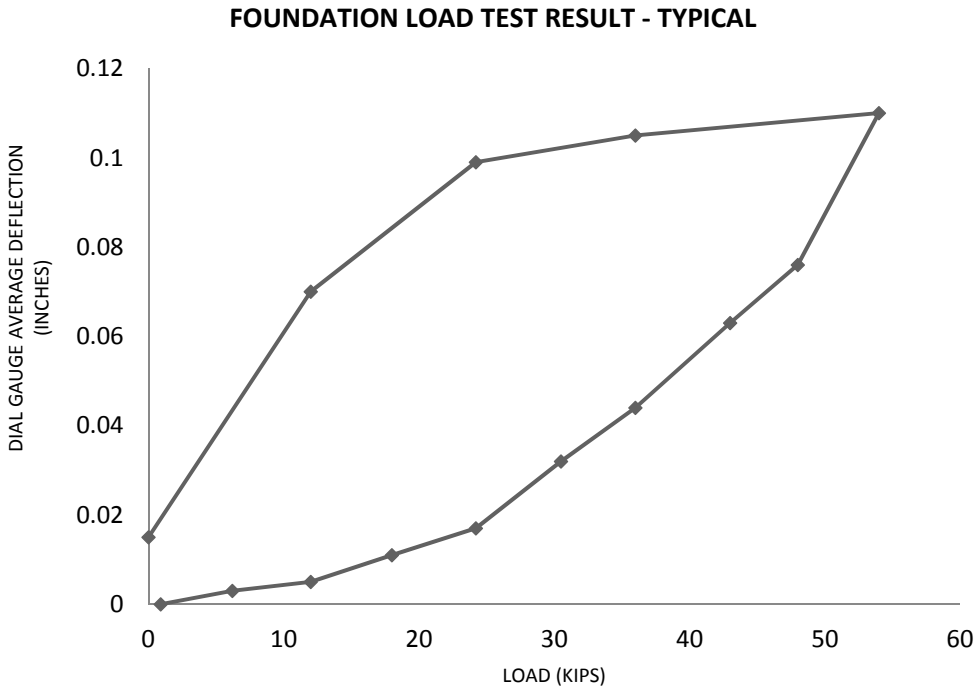

Figure 1

It should be noted that the output data can be modified to obtain pressure vs deflection curve if deemed necessary. Similarly, load-deflection curve will be generated for telltale deflection based on the data generated by the telltale gauges and the Individual Column Load Test.