January 10, 2022

Ms. Mary Ferdon
City of Columbus.
123 Washington Street
Columbus, Indiana 47201

Re: Addendum No. 1
Fair Oaks Sports Columbus
2224 25th Street
Columbus, Indiana
Patriot Project No. 21-1223-01G

Dear Mary:

Submitted herewith is the addendum letter including the field infiltration testing and Multi-Channel Analysis of Surface Waves (MASW) testing for the above referenced project. This addendum has been prepared in accordance with your request for additional seismic testing to aid in the design of the building and contains supplemental material to Patriot Project No. 21-1223-01G. This addendum can be attached to the report dated November 10, 2021.

FIELD INFILTRATION TESTING

A field infiltration test was conducted at each of the soil boring locations. The tests were completed at 3 feet below the existing pavement surface in B-1, 8 feet in B-2, and 13 feet in B-3. The soils encountered at these depths in the borings include clayey sands in Boring B-1 and sands in Borings B-2 and B-3. The results of the field infiltration tests could not be measured, as the water flowed freely through the soil. Grain size analysis tests were conducted on the soils at the test depths to get estimated values for the infiltration rate by using empirical correlations between permeability and infiltration. The results of the analysis on the sand had an estimated infiltration rate of 20 to 25 inches per hour.

SEISMIC TESTING RESULTS

At the request of the Client, Patriot hired Prism GeoImaging to perform MASW seismic testing in order to evaluate if the site had the potential to use a seismic site class of C instead of D, which was presented in the original report. The test uses 24 geophones in a linear array to collect and record Vs100 values looking at different signal frequencies and wavelengths. The lowest Vs100 value from the test is 1,086 ft/sec, and the highest test is 1,199 ft/sec. Based on this data, we understand that the seismic site class for this site is at the top of D, which has a range of 600 to

1,200 ft/sec. The full report explaining the method and results can be found in Appendix A.

We appreciate the opportunity to be of service to you on this project. If you have any questions regarding this report or if we may be of any additional assistance, please do not hesitate to contact our office.

Respectfully submitted,
Patriot Engineering and Environmental, Inc.

Ian Grafe, E.I.
Geotechnical Engineer

William D. Dubois, P.E.
Senior Principal Engineer

WILLIAM D. DUBOIS
REGISTERED
60018167
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Appendix A: Prism GeoImaging Report

Appendix B: General Qualifications
Standard Clause for Unanticipated Subsurface Conditions

APPENDIX A

PRISM GEOIMAGING REPORT

11722 Allisonville Road, Ste 103-144
Fishers, Indiana 46038-2331
www.prismgeo.com

January 5, 2022

Ian Grafe, E.I.
Patriot Engineering and Environmental, Inc.
6150 East 75th Street
Indianapolis, IN 46250
igrafe@patrioteng.com

Re: Geophysical Investigation Report
Shear Wave Velocity Testing and Seismic Site Classification via MASW
2380 25th St
Columbus, IN 47201
Prism Project No. 01-024-028

Dear Mr. Grafe,

Prism Geoimaging, Inc. (Prism) is pleased to present Patriot Engineering and Environmental, Inc. (Patriot) with this letter report documenting the geophysical shear wave velocity testing at the above-referenced project site (Site).

Introduction and Project Objectives

Patriot contracted Prism to conduct a surface wave seismic study to determine a shear wave velocity profile and generate a seismic site classification for the Site. The geophysical technique that Prism chose to utilize for this project is the multichannel analysis of surface waves (MASW) seismic method. The MASW method generates a shear wave velocity (Vs) profile (i.e., Vs versus depth) by analyzing the dispersion of Rayleigh-type surface waves on a seismic record acquired with multiple receivers (geophones). The average Vs of the upper 100 feet of the subsurface (termed the Vs100) is used to assign a seismic site class according to the International Building Code (IBC). Three MASW tests were completed for this project, see Figure 1 for test locations.

Method

Dispersion, or change in surface wave velocity with frequency, is the fundamental property utilized in MASW. The MASW method generally consists of three steps: 1) acquire a multichannel record of seismic surface waves, 2) analyze the propagation velocities of the surface waves to generate a dispersion curve, and 3) back-calculate (i.e. inverse-model) a shear-wave velocity (Vs) profile that gives a theoretical dispersion curve closest to the dispersion curve of the acquired seismic record.

The acquisition of a surface wave seismic record is the first step in the MASW method. It requires multiple geophones and a multichannel seismograph to capture the surface wave motion produced from a seismic source. There are two ways that surface waves are generated. “Active source” means that seismic energy is intentionally generated at a specific location relative to the geophone spread, and recording begins when the source energy is imparted into the ground. This is in contrast to “passive source” surveying, also called “microtremor array method (MAM)”, or “refraction microtremor” (aka ReMi) surveying, where there is no time break and motion is recorded from ambient energy generated by cultural noise (vehicle traffic, wind, wave motion, etc.) at various and usually unknown locations relative to the geophone spread. In general, passive source seismic energy is of a lower frequency than active source energy. High frequency seismic energy contains more information on the shallow subsurface while low frequency seismic energy contains more information from the deeper subsurface. Usually for MASW surveys it is preferable to obtain both active and passive source seismic records.

The second step in the MASW method is to analyze the propagation velocities of the surface waves. To accomplish this, the multichannel seismic record is first decomposed via Fast Fourier Transformation (FFT) into individual frequency components, and then the summed energy of the frequencies is calculated and displayed in a phase-velocity/frequency plot. Display of all summed energy in this plot shows patterns of energy accumulation that represent the dispersion curve.

The final step in the MASW method is inverse-modeling to arrive at a Vs profile. Inverse-modeling can be generally described as the process of seeking an unknown cause when the result of that cause is already known. In the inverse-modeling process for MASW, a theoretical dispersion curve is calculated for an initial model Vs profile, then the theoretical dispersion curve is compared to the to the dispersion curve of the acquired seismic record. The model Vs profile is then refined and the process is repeated through a number of iterations, until a model Vs profile is obtained with a theoretical dispersion curve that closely matches the dispersion curve of the acquired seismic record. At this point the model is considered a reasonable approximation of the actual subsurface materials. The effective depth of the model is dependent on the frequency spectrum of the energy contained in the seismic record. A common method of estimating the effective depth of an MASW model is to use the one-third wavelength estimation, whereby the wavelength is calculated (phase velocity divided by frequency) for each point on the dispersion curve and the effective model depth is considered to be one-third of the longest wavelength. This one-third approximation is an empirically determined estimate of the effective depth limit, outside of this effective depth limit the model is considered to be less reliable as it is essentially an extrapolation.

Data Collection and Processing

The MASW tests were completed on December 10, 2021, using 24 geophones in a linear array with an inter-geophone spacing of 8.4 feet for Test 1 and 10 feet for Tests 2 and 3 (see Figure 1 for test locations). Data were recorded with a DAQLink-III 24-channel seismograph manufactured by Seismic Source Company. A 16 lb. sledgehammer was used as the active energy source; nearby vehicle traffic provided excellent low-frequency passive energy. The dispersion analysis and inverse modeling were performed with the *SeisImager/SW* software package authored by Geometrics, Inc.

Results and Interpretations

Active source data for were very good, showing signal from approximately 50 Hz down to 5 Hz. Passive source data were excellent, showing signal from approximately 30 Hz down to 3 Hz. The active and passive dispersion curves were combined and inverse-modeled together for each test; the resulting one-third estimation of the longest wavelength results in effective model depths well beyond 100 feet for all three tests. The inverted models are presented on Figures 2-4. The lowest Vs100 is 1,086 ft/sec on Test #2, the highest is 1,199 ft/sec on Test #3. All three tests place the Site at the top of Seismic Site Class D (600-1,200 ft/sec).

Limitations

This geophysical investigation was conducted in a manner consistent with that degree of care and skill ordinarily exercised by members of the same profession currently practicing under similar circumstances and conditions. The results and interpretations of this geophysical investigation are generally reliable; however, there are other interpretations that would also match the data collected. Prism Geoimaging, Inc. makes no warranty, express or implied, as to its professional services rendered for this project. These drawings/computer files are the property of Prism Geoimaging, Inc. as an instrument of professional service. Any modification or reuse of these documents without written permission from Prism Geoimaging, Inc. is prohibited. Any person or entity using these documents for any purpose other than the project for which they were originally intended, with or without permission from Prism Geoimaging, Inc., by their use agrees to indemnify and hold harmless Prism Geoimaging, Inc. from any loss, including, but not limited to attorney's fees occurring from their use.

Closing

I appreciate the opportunity to provide geophysical services on this project. If you should have any questions regarding the enclosed information, please do not hesitate to contact me. I look forward to working with you on other projects in the future.

Sincerely,
Prism GeoImaging, Inc.

LICENSED
JOHN H. M. VANDERLAAN
No. 2146
INDIANA
PROFESSIONAL GEOLOGIST

John Vanderlaan, L.P.G., P.G.
President / Geophysicist

Attachments:	Figure 1.	MASW Vs100 Test Locations
	Figure 2.	Test #1 MASW Vs100 Results
	Figure 3.	Test #2 MASW Vs100 Results
	Figure 4.	Test #3 MASW Vs100 Results

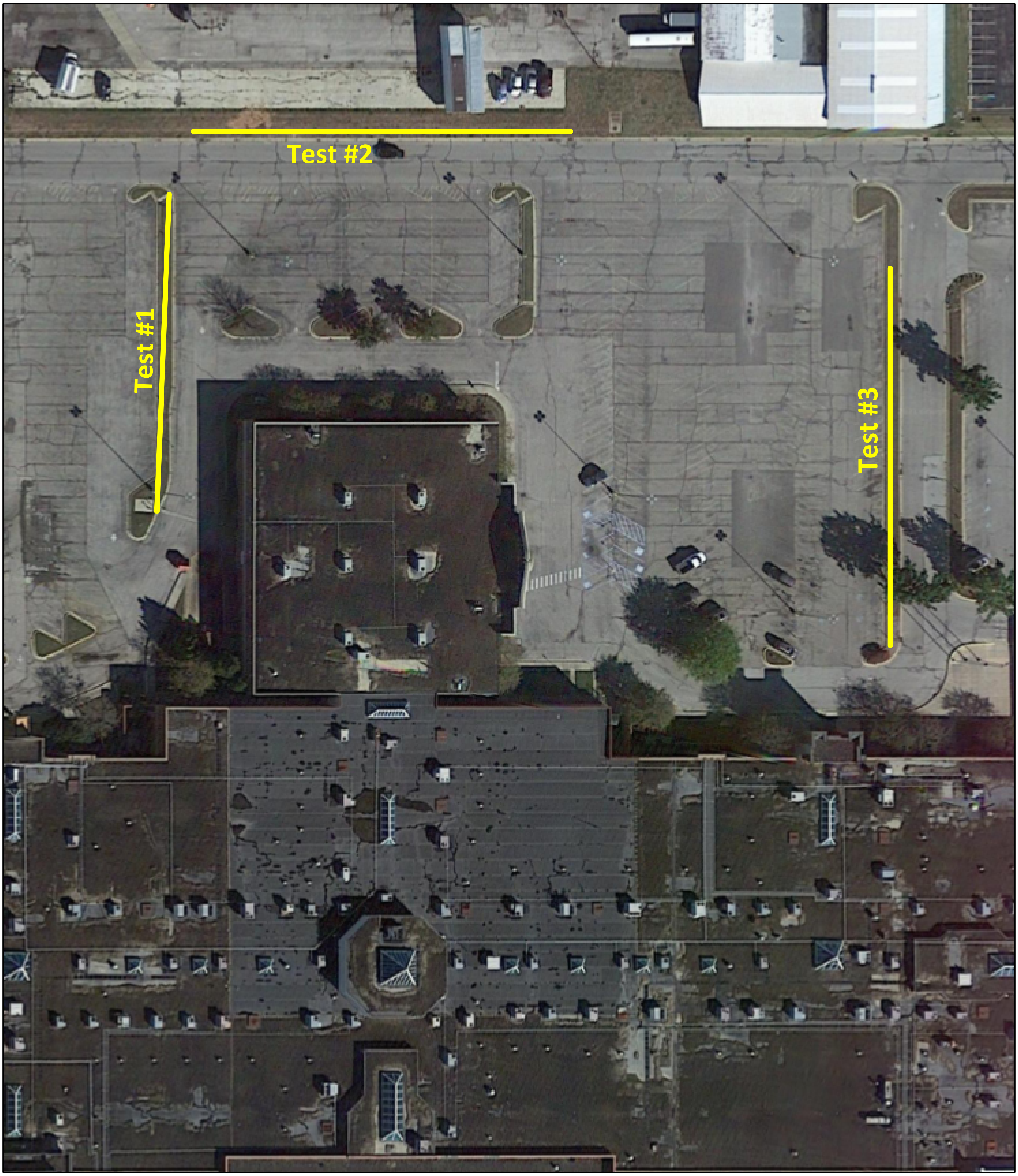
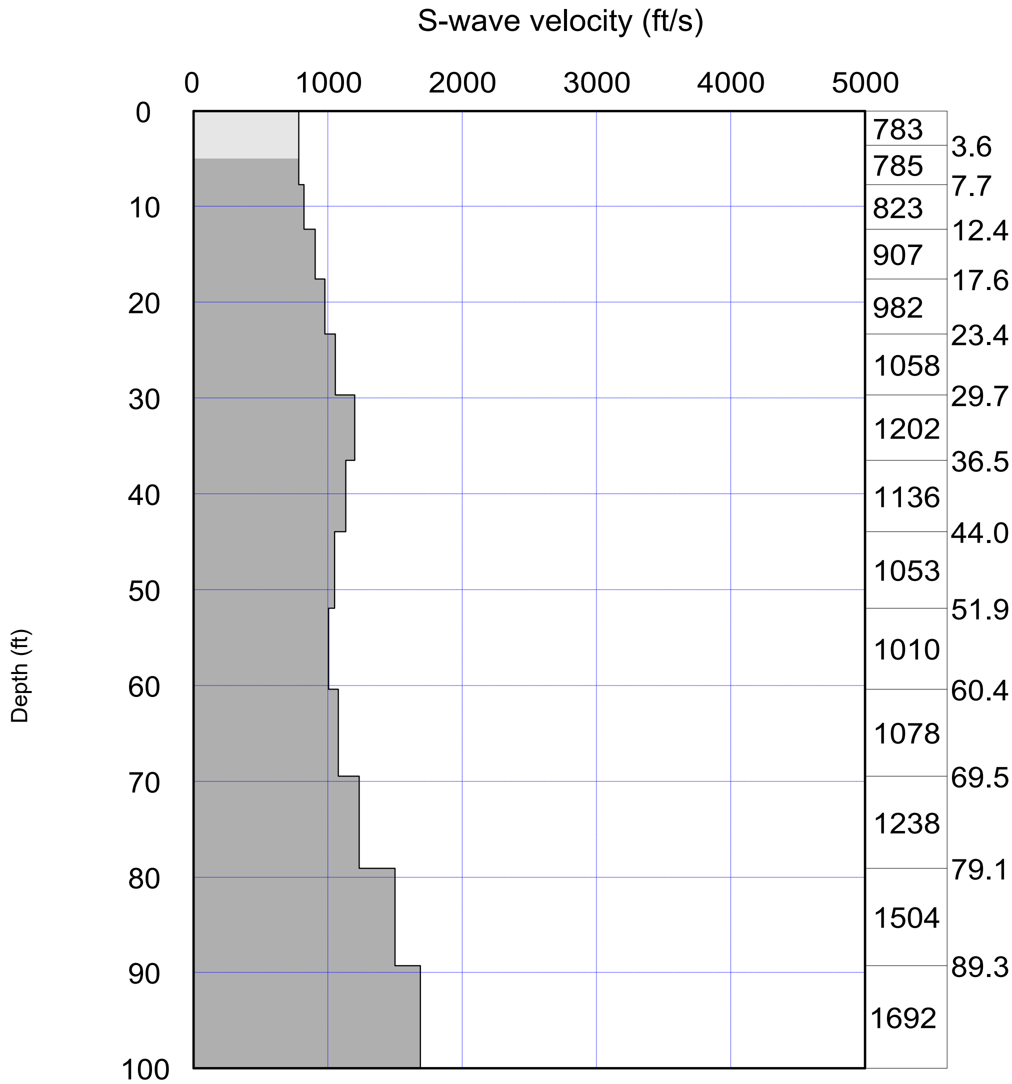


Figure 1

MASW Vs100 Test Locations

2380 25th St
Columbus, IN 47201
Prism Project No. 01-024-028

Prism GeoImaging
www.prismgeo.com



S-wave velocity model (inverted) : Line 1 Combined B.rst

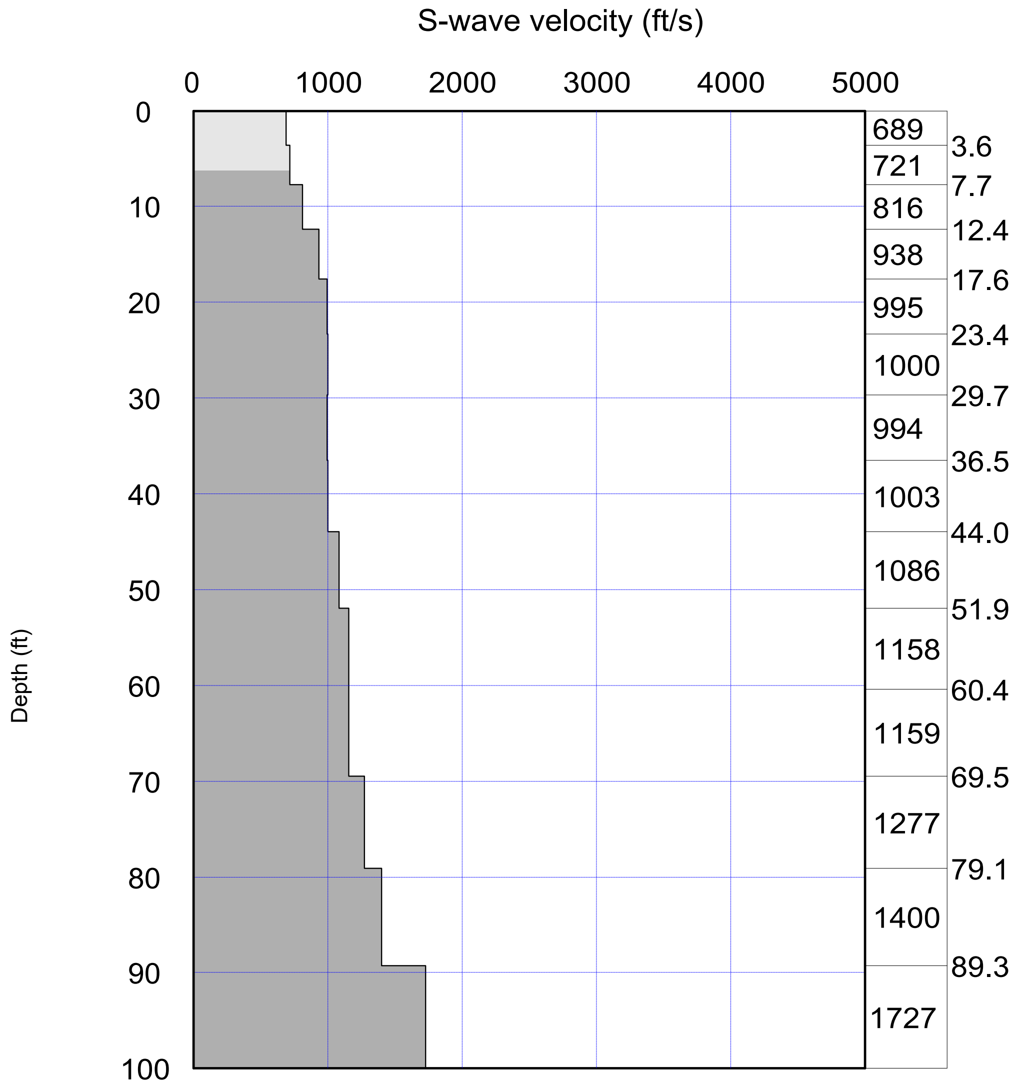
Average Vs 100ft = 1104.1 ft/sec

Figure 2

Test #1 MASW Vs100 Results

2380 25th St
Columbus, IN 47201
Prism Project No. 01-024-028

Prism GeoImaging
www.prismgeo.com



S-wave velocity model (inverted) : Line 2 Combined.rst

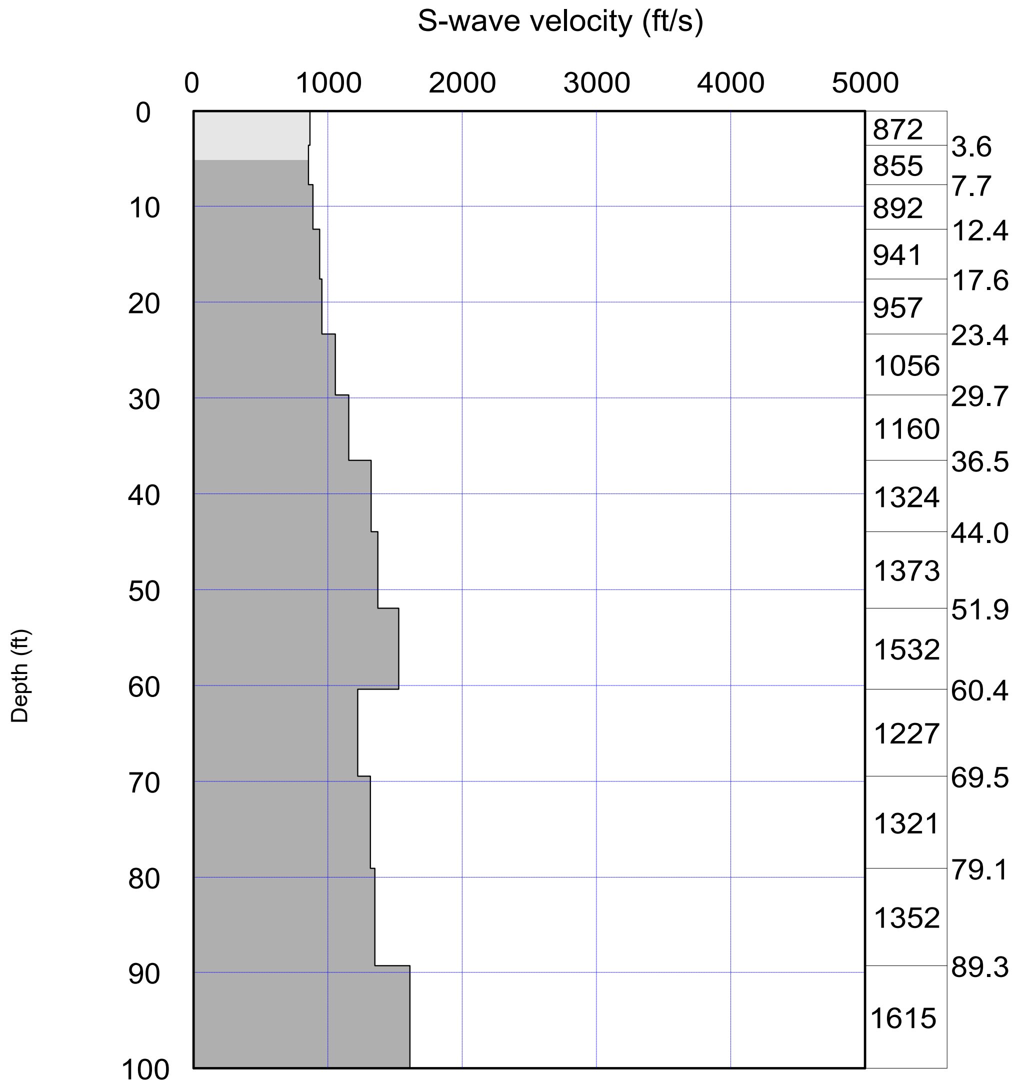
Average Vs 100ft = 1086.1 ft/sec

Figure 3

Test #2 MASW Vs100 Results

2380 25th St
Columbus, IN 47201
Prism Project No. 01-024-028

Prism GeoImaging
www.prismgeo.com



S-wave velocity model (inverted) : Line 3 Combined.rst
Average Vs 100ft = 1199.3 ft/sec

Figure 4

Test #3 MASW Vs100 Results

2380 25th St
Columbus, IN 47201
Prism Project No. 01-024-028

Prism GeoImaging
www.prismgeo.com

APPENDIX B

GENERAL QUALIFICATIONS

STANDARD CLAUSE FOR UNANTICIPATED SUBSURFACE CONDITIONS

GENERAL QUALIFICATIONS

of Patriot Engineering's Geotechnical Engineering Investigation

This report has been prepared at the request of our client for his use on this project. Our professional services have been performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report or on the test borings logs regarding vegetation types, odors or staining of soils, or other unusual conditions observed are strictly for the information of our client and the owner.

This report may not contain sufficient information for purposes of other parties or other uses. This company is not responsible for the independent conclusions, opinions or recommendations made by others based on the field and laboratory data presented in this report. Should there be any significant differences in structural arrangement, loading or location of the structure, our analysis should be reviewed.

The recommendations provided herein were developed from the information obtained in the test borings, which depict subsurface conditions only at specific locations. The analysis, conclusions, and recommendations contained in our report are based on site conditions as they existed at the time of our exploration. Subsurface conditions at other locations may differ from those occurring at the specific drill sites. The nature and extent of variations between borings may not become evident until the time of construction. If, after performing on-site observations during construction and noting the characteristics of any variation, substantially different subsurface conditions from those encountered during our explorations are observed or appear to be present beneath excavations, we must be advised promptly so that we can review these conditions and reconsider our recommendations where necessary.

If there is a substantial lapse of time between the submission of our report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, we urge that our report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

We urge that Patriot be retained to review those portions of the plans and specifications that pertain to earthwork and foundations to determine whether they are consistent with our recommendations. In addition, we are available to observe construction, particularly the compaction of structural backfill and preparation of the foundations, and such other field observations as may be necessary.

In order to fairly consider changed or unexpected conditions that might arise during construction, we recommend the following verbiage (Standard Clause for Unanticipated Subsurface Conditions) be included in the project contract.

STANDARD CLAUSE FOR UNANTICIPATED SUBSURFACE CONDITIONS

"The owner has had a subsurface exploration performed by a soils consultant, the results of which are contained in the consultant's report. The consultant's report presents his conclusions on the subsurface conditions based on his interpretation of the data obtained in the exploration. The contractor acknowledges that he has reviewed the consultant's report and any addenda thereto, and that his bid for earthwork operations is based on the subsurface conditions as described in that report. It is recognized that a subsurface exploration may not disclose all conditions as they actually exist and further, conditions may change, particularly groundwater conditions, between the time of a subsurface exploration and the time of earthwork operations. In recognition of these facts, this clause is entered in the contract to provide a means of equitable additional compensation for the contractor if adverse unanticipated conditions are encountered and to provide a means of rebate to the owner if the conditions are more favorable than anticipated.

At any time during construction operations that the contractor encounters conditions that are different than those anticipated by the soils consultant's report, he shall immediately (within 24 hours) bring this fact to the owner's attention. If the owner's representative on the construction site observes subsurface conditions which are different than those anticipated by the consultant's report, he shall immediately (within 24 hours) bring this fact to the contractor's attention. Once a fact of unanticipated conditions has been brought to the attention of either the owner or the contractor, and the consultant has concurred, immediate negotiations will be undertaken between the owner and the contractor to arrive at a change in contract price for additional work or reduction in work because of the unanticipated conditions. The contract agrees that the following unit prices would apply for additional or reduced work under the contract. For changed conditions for which unit prices are not provided, the additional work shall be paid for on a time and materials basis."

Another example of a changed conditions clause can be found in paper No. 4035 by Robert F. Borg, published in ASCE Construction Division Journal, No. CO2, September 1964, page 37.