



ARM Group Inc.

Earth Resource Engineers and Consultants

March 20, 2015

Mr. Sam Tibi, P.E.
Senior Structural Engineer and Project Manager
Miller-Remick
1010 Kings Highway South
Cherry Hill, NJ 08034

Re: Foundation Recommendations for Proposed Entrance Structure
Veterans Administration Building - Woodward Avenue, Philadelphia
ARM Project 150210

Dear Mr. Tibi:

Pursuant to our recent correspondence ARM Group Inc. (ARM) has reviewed subsurface conditions at the entrance location, in concert with consideration of the anticipated foundation loads shown on the attached copy of Drawing Number S-10B. Referring to the attached drawing, the maximum anticipated working load for at any given support point is 35 kips. As you know, ARM performed two exploratory borings at the entrance in February 2012. The conditions encountered, and recommendations for the proposed entrance structure, were presented in ARM's April 11, 2013 report. The locations of the two borings are shown on the attached figure. It is my understanding that final design of the entrance structure was temporarily halted sometime after ARM's report was submitted, and that design has recently resumed.

The entrance area is underlain by historic fill materials of variable composition and stability, and the 2013 report discussed two basic options for support of the proposed structure. One option was removal and replacement of the existing fill beneath the structure, the second was supporting the structure on drilled-in-place pipe piles (typically referred to as "micropiles") deriving their capacity from bearing within the schist bedrock that underlies the site at depths of approximately 20 to 40 feet. Discussion with Mr. Nic Mannix, P.E., who was managing the project for Miller-Remick at that time, resulted in the determination that the excavation and replacement option was not feasible, and that micropiles were the more feasible option.

Based on the discussion that you and I had a few weeks ago, it is my understanding that you would prefer to utilize a deep foundation type other than micropiles. As we discussed there are several viable alternates to micropiles, and the purpose of this supplement to the 2013 report is to provide information regarding those alternates. Recommendations regarding three alternate foundation types are presented below.

As a general comment regarding the foundations discussed below, the proposed entrance structure is not a heavy structure, and will impose only modest foundation loads. A maximum working load of only 35 kips is quite low compared to the working loads associated with most structures bearing on deep foundations, and in the case of the entrance structure the maximum working loads are controlled more by the need to maintain a reasonable spacing between adjacent foundation support points than by the weight of the structure itself. It is also noted that the recommendations below do not address tolerances regarding out-of-location or out-of-plumb shafts or piles; it is assumed that Miller-Remick will address the potential for eccentric loads associated with such installation issues.

Drilled Shafts

Concrete-filled drilled shafts bearing within the schist bedrock underlying the site could be used to support the entrance structure. A minimum shaft diameter of 18-inches is recommended to develop a working load of 35 kips, based on an allowable bearing pressure of 20 kips per square foot (ksf) for site bedrock. Drilled shafts should include a minimum rock socket length of 3 feet extending below the point of auger refusal. Auger refusal may be defined in terms of less than 2-inches of advancement per minute using an auger with carbide teeth advanced by a rig generating at least 30,000 foot pounds of torque while exerting a down force of at least 2,000 pounds. Alternately, the point of auger refusal may be determined by the judgement of a field inspector with appropriate experience; or, required tip elevations could be established on the basis of exploratory probes (e.g. small diameter holes advanced by a rotary-percussive drilling rig) performed at each pile or column location during construction.

Full depth steel reinforcement, as designed by Miller-Remick, is recommended. The installation specification should include provisions for use of temporary casing as needed to prevent sloughing of soil into the shaft. Alternately, permanent steel casing could be specified in lieu of, or in addition to, interior reinforcement. The installation specification should note the potential for encountering coarse debris within the historic fill material known to exist at the site, and the possible need for spudding or similar measures to advance shafts through the fill.

Driven H-Piles

Steel H-piles driven to end bearing in schist may be designed for an allowable bearing capacity of 6 kips per square inch (ksi) of cross sectional area. The smallest available H-section is the 8 x 36 with a cross sectional area of 10.6 inches, and therefore the 35 kip maximum working load should be readily achievable. Larger piles may be used at the option of Miller-Remick or the contractor. The installation specification should require the contractor to submit a wave equation (WEAP) analysis confirming that the proposed pile hammer can drive the pile to an ultimate capacity correlating to 12 ksi applied to the cross sectional area of the pile without overstressing the pile. The installation specification should note the potential for encountering coarse debris, and the possible need for spudding or similar measures to advance the piles. Piles should be

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equipped with prefabricated cast steel tips designed to enhance penetration through coarse debris and weathered rock.

Driven Pipe Piles

Pipe piles driven to end bearing in weathered schist should be driven closed end with prefabricated conical tips to enhance drivability through fill materials. A minimum pile diameter of 6-inches is recommended, and a minimum wall thickness of 0.375 inches is recommended to allow for long term corrosion losses. The installation specification should require the contractor to submit a wave equation analysis confirming that the proposed pile hammer can drive the pile to an ultimate capacity correlating to 12 ksi applied to the cross sectional area of the pile without overstressing the pile. The installation specification should note the potential for encountering coarse debris, and the possible need for spudding or similar measures to advance the piles. The piles should be filled with concrete after installation.

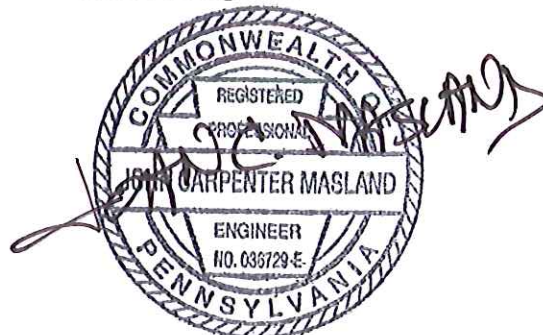
Estimated Tip Elevations

Based on the depth to rock at the two borings performed in the entrance area in 2012, it is expected that the foundation elements described above will achieve the required bearing capacities at depths ranging from 35 to 45 feet below existing grade.

Please contact the undersigned at 717-508-0529 if you have any questions or comments regarding this matter. ARM appreciates the opportunity to support Miller-Remick on this project.

Respectfully submitted,

ARM Group Inc.

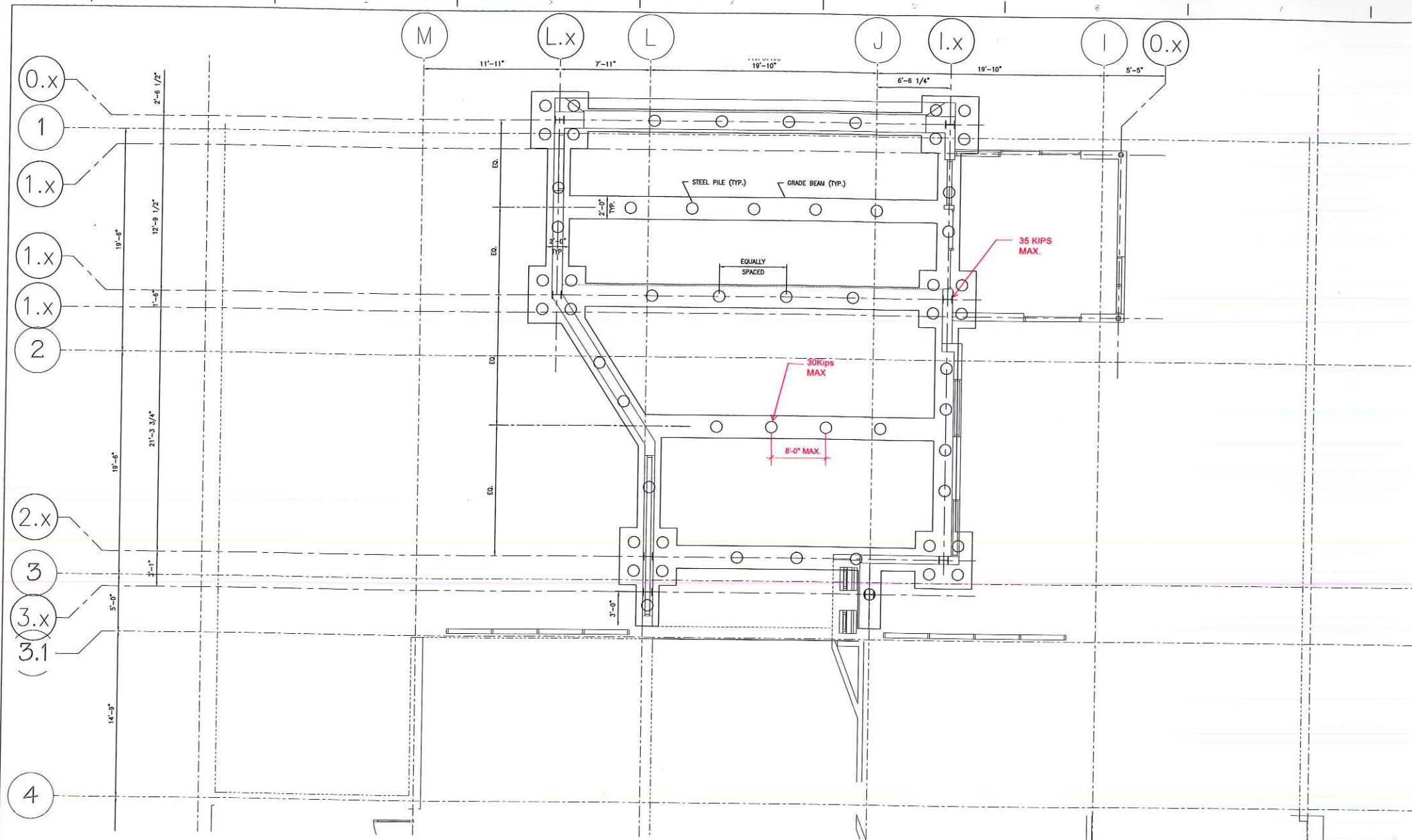


John C. Masland, P.E.
Vice President – Geotechnical Services

Attachment: Drawing S-10B
Boring Location Plan

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1 FOUNDATION/BASEMENT PLAN
SCALE: 1/4"=1'-0"

DESIGN DEVELOPMENT PROGRESS - NOT FOR CONSTRUCTION
FULLY SPRINKLERED



CONSULTANTS: 		ARCHITECT/ENGINEERS:  Miller-Remick LLC M.E.P. & Structural Engineering A Service Disabled Veteran Owned Small Business 1010 KINGS HIGHWAY SOUTH CHERRY HILL, NEW JERSEY 08034 PHONE: (856) 422-4000 FAX: (856) 422-5500 MR PROJECT NO: 0499-015A PRINTS OF THIS DRAWING SHALL NOT BE USED FOR ANY PURPOSE WHATSOEVER WITHOUT THE SEAL AND SIGNATURE OF THE PROFESSIONAL ENGINEER.		Drawing Title STRUCTURAL FOUNDATION/BASEMENT PLAN Approved: Project Director		Project Title MODIFY MAIN ENTRANCE BUILDING 1 Location V.A.M.C. PHILADELPHIA, PA Date 03-06-2015 Checked BT Drawn DS		Project Number 642-332 Building Number 1 Drawing Number S-10B Dwg. - of X		Office of Construction and Facilities Management 	
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one eighth inch = one foot
one quarter inch = one foot
one half inch = one foot
three quarters inch = one foot
one inch = one foot
one and one half inches = one foot
two inches = one foot

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