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ADDENDUM NO. 4
February 24, 2025

DLH North Business Development Area Hangar
City Project No. 25-4401
Duluth International Airprt
Duluth, Minnesota

SEH No. DULAI 180746

From: Short Elliott Hendrickson Inc.
3535 Vadnais Center Drive
St. Paul, MN 55110-3507
651.490.2000

To: Document Holders

DOCUMENT HOLDERS on the above-named project are hereby notified that this document shall be appended to, take precedence over and become part of the original bidding documents dated January 13, 2025, for this work. Bids submitted for the construction of this work shall conform to this document.

This addendum consists of 1 page(s) and attached Specification Section 31 63 31.

Approved Substitutions:

- **Vibro Stone Columns/Aggregate piers may be used in place of rammed aggregate piers. Aggregate pier design must be designed and signed by a registered professional engineer in the state of MN and be in agreement with the project geotechnical recommendations.**

Changes to Specifications:

1. Section No. 31 63 31 Aggregate Pier Soil Reinforcement – A change was made to add “or approved equal” to section 1.02 REFERENCE STANDARDS.

NOTE: Receipt of this Addendum No. 4, dated February 24, 2025 shall be acknowledged on Bid Express. Failure to do so will not allow Bidder to submit Bid.

END OF ADDENDUM

SUBSTITUTION REQUEST FORM

TO: Attn: Jessica Vinson, PE – jvinson@sehinc.com

PROJECT: DLH North Business Development Area Hangar, Duluth International Airport, Duluth, Minnesota

SECTION NO.	ARTICLE NO.	SPECIFIED PRODUCT	PROPOSED SUBSTITUTION
31 63 31	Entire Spec	Rammed Aggregate/Geopier	Vibro Stone Column/Aggregate Pier

A. Does the substitution affect dimensions shown on Drawings? Yes ☐ No ☒

B. Does the substitution affect other trades? Yes ☐ No ☒

C. Does the manufacturer's guarantee differ from that specified? Yes ☐ No ☒

D. If you indicated "Yes" to Items A, B, or C above, attach a thorough explanation on your company letterhead.

E. If there are other differences between proposed substitution and specified product, attach a thorough explanation on your company letterhead. If differences are not noted and acknowledged in writing by Engineer, product must comply with specification requirements.

F. The proposed substitution was used within the last 24 months on the following project:

Project Name Invicta Training Center

Location Edina, MN

Engineer BKBM

Telephone No. 763-843-0420

G. Has the proposed substitution been used on an SEH project within the last 12 months? Yes ☐ No ☐

If yes, which project? Unsure

All questions must be answered. Incomplete forms will not be reviewed.
Include a self-addressed, stamped envelope for reply.

Submitted By: Gary Hahn

Signature

Subsurface Constructors, Inc
Firm

120 Broadway Ave S #100 Wayzata MN 55391
Address

2/14/25
Date

612-280-8940
Phone

gary.hahn@subsurface.net
E-mail

For Use by Design Consultant

☐ Not Accepted, Not Enough Information
☐ Not Accepted, Does Not Appear to be Equal
☑ Accepted ☐ Accepted as Noted
☐ Received Too Late

By Jessica Vinson

Date 02/24/2025

Remarks

SECTION 31 63 31

AGGREGATE PIER SOIL REINFORCEMENT SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Provide aggregate pier soil reinforcement system, including:
   1. Layout of aggregate pier elements.
   2. Footing excavation.
   3. Subgrade preparation following aggregate pier installation.
   4. Removal of construction spoils.

B. Related Work
   1. Section 31 22 20 - Earthwork for Building Sites

1.02 REFERENCE STANDARDS

A. Design Reference: Geopier Foundation Company, Inc., Blacksburg, VA www.geopiers.com **OR APPROVED EQUAL**

B. ASTM:
   1. D1143 - Pile Load Test Procedures
   2. D1241 - Aggregate Quality
   3. D1557 - Compaction Characteristics of Soil
   4. STP 399 - Dynamic Cone Penetrometer Testing (available through geotechnical firms or Geopiers)

1.03 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Provide a columnar-type configuration to reinforce soils for the support of spread footings, new fill, floor slab area, column loads, and loads due to site fill.
   2. Design for a stiffness modulus of 150 pci or higher as required by the aggregate pier Designer and verified by the results of an aggregate pier modulus test.
   3. Consider the bearing capacity and settlement of footings supported by aggregate piers, and total and differential settlement.
      a. Design shall meet bearing capacity and settlement requirements as determined by the Designer.
   4. Design Life of Structure: 75 years.

1.04 SUBMITTALS

A. Refer to Section 01 33 00.

B. Shop Drawings:
   1. Submit detailed design calculations and construction drawings prepared by the aggregate pier Designer to Engineer for approval minimum 3 weeks prior to the start of construction. Include a detailed explanation of the design parameters for settlement calculations, and show aggregate pier footing layout.
   2. All Drawings and computer generated calculations shall be signed by a Professional Engineer of the state in which the Project is constructed.
   3. Submit the quality control test program for aggregate piers, meeting specified design requirements.

C. Quality Assurance/Control Submittals:
   1. Insurance: Verify the Designer has Errors and Omissions design insurance for the work, providing a minimum coverage of $2 million per occurrence.
   2. Testing Requirements:
      a. Modulus and uplift test data:
         1) Provide Engineer a description of installation equipment, installation records, complete test data, analysis of the test data and recommended design parameter values based on the modulus test results.
         2) Prepare report under supervision of a Professional Engineer licensed in the state of Project.
   3. Daily Progress Reports.
   4. Certification letter from the manufacturer approving the Designer and listing qualifications and experience.

D. Maintenance Manual: Provide to Owner, maintenance and warranty data in “Maintenance Manual” compliant with Section 01 78 23 at Maintenance Demonstration at Substantial Completion.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Designers: Approved by the manufacturer of the aggregate pier soil reinforcement system.
   2. Installers:
      a. Minimum 5 years experience in the installation of aggregate piers and completion of minimum 20 projects.
      b. Licensed to perform the work.
      c. Approved by Designer minimum 2 weeks prior to bid opening.
   3. Independent Testing Agency: A company engaged in the practice of soil and materials testing, with a minimum of 3 years experience in the testing of aggregate piers; with a minimum of 10 projects.

B. Quality Control Representative:
   1. Provide a full-time Quality Control (QC) representative to verify and report all QC installation procedures.
   2. Immediately report any unusual conditions encountered during installation to the Designer, E/A, and to the Independent Testing Laboratory.
   3. QC procedures shall include the preparation of aggregate pier progress reports completed during each day of installation and containing the following information:
      a. Footing and aggregate pier location.
      b. Aggregate pier length and drilled diameter.
      c. Planned and actual aggregate pier elevations at the top and bottom of the element.
      d. Average lift thickness for each aggregate pier.
      e. Soil types encountered at the bottom of the aggregate pier and along the length of the element.
      f. Depth to groundwater, if encountered.
      g. Documentation of any unusual conditions encountered.
      h. Type and size of densification equipment used.

C. Responsibilities of Independent Testing Agency:
   1. Monitor modulus tests. Installer shall provide and install dial indicators and other measuring devices.
   2. Monitor installation of aggregate pier elements to verify that production installation practices are similar to those used during installation of modulus test elements.
   3. Perform Dynamic Cone Penetrometer tests.
   4. Report any discrepancies to the Contractor and E/A.

D. Regulatory Requirements:
   1. Meet requirements of applicable codes.
   2. Demonstrate the aggregate pier system has been ICBO certified.

E. A geotechnical report has been prepared for this Project and is included in the appendices for information only.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aggregate Used Above the Water Table:
   1. Type I Grade B, in accordance with ASTM D1241, or other graded aggregate selected by the Installer and successfully used in the modulus test.
   2. Compact to a densification and strength which provides resistance to the dynamic penetration test (ASTM STP 399) of a minimum average of 15 blows per 1.75-inch vertical movement.

B. Aggregate Used Below the Water Table: Same as for above water table, except:
   1. Eliminate particles passing No. 40 sieve.
   2. No. 57 stone or other stone may be used.
   3. Dynamic penetration resistance testing is inappropriate for this material.

C. Use potable water to increase aggregate moisture content where required.

D. Provide adequate and suitable marshalling areas on the Site for the storage of aggregate and equipment.

PART 3 CONSTRUCTION

3.01 EXAMINATION

A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.

B. Verification of Conditions: Verify that aggregate pier may be installed in accordance with original design, pertinent codes and regulations, and pertinent portions of referenced standards.

C. Discrepancies: Immediately notify E/A. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

A. Locate and protect underground and aboveground utilities and other structures from damage during installation of the aggregate pier system.

B. Establish site subgrade within 6 inches of final design subgrade, as approved by the Designer.

C. Establish a working surface and maintain to provide wet weather protection of the subgrade and to provide access for efficient operation of the aggregate pier installation.

D. Provide layout (construction staking) of the aggregate piers.

E. Provide ground elevations in sufficient detail to estimate drilling depth elevations to within 2 inches.

F. Notify Testing Agency and Designer when excavation, placement, and compaction will occur and arrange for construction observation and testing.

3.03 CONSTRUCTION

A. Construct aggregate pier by compacting aggregate in 12-inch compacted lifts in an excavated hole. Do not exceed 12 inches.

B. Protect completed aggregate pier elements.

3.04 EXCAVATION

A. Utility Excavations:
   1. Coordinate excavations made subsequent to aggregate pier installations so that minimum 5 feet of horizontal distance remains between the edge of any installed aggregate pier and the excavation.
   2. Utility excavations required at horizontal distances of less than 5 feet from installed aggregate piers: Contact Designer to develop construction solutions to minimize impacts on the installed aggregate piers.
   3. Recommended procedures may include:
      a. Using cement-treated base to construct portions of the aggregate piers subject to future excavations.
      b. Replacing excavated soil with compacted crushed stone in the portions of excavations where the aggregate piers have been disturbed.
      c. Placement and compaction of the crushed stone shall meet the following requirements:
         1) Meet the gradation specified by the Designer.
         2) Place in a controlled manner using motorized impact compaction equipment.
         3) Compact aggregate to 95 percent of the maximum dry density as determined by the modified Proctor method (ASTM D1557).

B. Obstructions:
   1. Obstructions encountered during drilling or excavation: Remove obstruction or relocate or abandon pier as approved by Designer.
   2. Obstructions include, but are not limited to, boulders, timbers, concrete, bricks, utility lines, etc. that prevent installing the aggregate piers to the required depth, or cause the aggregate pier to drift from the required locations.
   3. Dense natural rock or weathered rock shall not be deemed obstructions, and piers may be terminated short of design lengths on such materials.

C. Pre-auger using mechanical drilling or excavation equipment. Installation of piers without pre-augering will not be allowed.

D. Use steel casing as needed to stabilize the excavation at no additional cost to the Owner.

E. If cave-ins occur on top of a lift of aggregate such that the volume of the caved soils is greater than 10 percent of the volume of the aggregate in the lift, then the aggregate shall be considered contaminated. Remove and replace with uncontaminated aggregate.

F. Protect foundation excavations to expose the tops of aggregate pier elements until concrete placement.
   1. Use procedures and equipment best suited to:
      a. Prevent softening of the matrix soil between and around the aggregate pier elements before pouring structural concrete.
      b. Achieve direct and firm contact between the aggregate pier elements and the concrete footing.
   2. Limit over-excavation below the bottom of the footing to 3 inches, including disturbance from the teeth of the excavation equipment.

3.05 COMPACTION/DENSIFICATION

A. Densify the bottom of the excavation prior to placement of the aggregate.

B. Place open-graded aggregate at the bottom of the excavation and compact to stabilize the element bottom and serve as the initial lift.

C. Use special high-energy impact densification equipment and apply direct downward pressure to each lift of aggregate.

D. Perform compaction over the entire footing bottom to compact any loose surface soil and loose surface pier aggregate.

E. Prepare compaction of surface soil and top of aggregate pier elements using a motorized impact compactor ("Wacker Packer," "Jumping Jack," or similar). Sled-type tamping devices shall not be used.

F. Densification shall be performed using a beveled tamper.

G. A minimum tamper energy level and required time shall be applied as specified by the Designer to achieve required design parameters.

H. Place footing concrete immediately after footing excavation is made and approved.
   1. Place footing concrete on the same day if the footing is bearing on expansive or sensitive soils.
   2. If same day placement of footing concrete is not possible, place a minimum 3-inch-thick lean concrete seal ("mud mat") immediately after the footing is excavated and approved.

3.06 FIELD QUALITY CONTROL

A. Independent Testing Agency to be onsite to observe placement, compaction, and provide density testing. Submit test results to Designer, Owner, and E/A.

B. Tolerances:
   1. Center of each pier: Within 6 inches of the locations indicated.
   2. The final measurement of the top of aggregate piers shall be the lowest point on the aggregate in the last compacted lift.
   3. Aggregate piers installed outside of the above tolerances and deemed not acceptable shall be rebuilt at no additional expense to the Owner, unless the Designer approves other remedial measures.

C. Testing:
   1. Modulus Test:
      a. Perform a modulus test to verify the parameter values selected for design.
      b. Install a telltale at the bottom of the test pier so that bottom-of-pier deflections may be determined.
      c. Acceptable performance is indicated when the bottom of the pier deflection is no more than 20 percent of the top of pier deflection at the design stress level.
      d. Use ASTM D1143 general test procedures as a guide to establish load increments, load increment duration, and load decrements.
      e. With the exception of the load increment representing approximately 115 percent of the design maximum top of aggregate pier stress, all load increments shall be held for a minimum of 15 minutes, a maximum of 1 hour, and until the rate of deflection reduces to 0.01 inch per hour, or less.
      f. The load increment that represents approximately 115 percent of the design maximum stress on the aggregate pier shall be held for a minimum of 15 minutes, a maximum of 4 hours and until the rate of deflection reduces to 0.01 inches per hour or less.
      g. Apply a seating load equal to 5 percent of the total load to the loaded steel plate prior to application of load increments and prior to measurement of deflections to compensate for surficial disturbance.
      h. Perform aggregate pier modulus testing in accordance with requirements outlined in the design submittal. The design submittal shall state how the modulus is calculated using the field test data.
      i. Coordinate location of aggregate pier modulus test with the E/A's office.
   2. Bottom Stabilization Verification Test:
      a. After completion of the bottom pier bulb, or at anytime during the process of constructing the pier, the energy source may be turned off, and Bottom Stabilization Verification Test

performed. Perform when a new soil formation is encountered or at the beginning of a project to provide quantitative information on pier stabilization.

b. Perform Bottom Stabilization Tests by placing a reference bar over the cavity, marking the tamper shaft, applying energy to the tamper for an additional 15 seconds, and observing the downward deflection of the tamper shaft by observing the deflection of the mark on the tamper shaft.

c. Acceptable performance is indicated if the vertical movement of the shaft is less than 150 percent of the vertical movement measured for the modulus test pier.

d. If the measured vertical movement exceeds 150 percent of the value achieved during the modulus test, added energy is applied to re-densify the bulb. The procedure for measure is then repeated. If there is still movement greater than 150 percent of that achieved during the modulus test and greater than 1/2 inch, a lift of loose aggregate may be placed on top of the compacted aggregate, and the verification test may be performed on this next lift after it is densified. If there is excessive movement on this lift, another lift may be placed and tested. Movement must be limited to below 150 percent of the values achieved for the modulus test before completion of 2/3 of the pier depth.

3. Dynamic Cone Penetrometer Test:

a. Test at locations within the upper 1/3 of the pier shaft length.

b. The minimum acceptable criteria as an indicator of acceptable densification shall be minimum 15 blows per 1-3/4 inch penetration.

c. Perform test in each aggregate pier until such time as 5 consecutive tests indicate that the minimum criterion is met. Thereafter, such tests need not be performed on every pier, provided that the aggregate used in the elements is representative of that previously tested. If average penetration resistances measured exceed 15 blows, and less than 10 percent of tests fall below 15 blows, then testing may be reduced to spot checks. A pattern of successful tests is sufficient to reduce testing to several tests per day.

d. Observation of questionable aggregate moisture content or questionable aggregate gradation appearance may determine the need for additional dynamic penetration testing to verify that the proper densification is being achieved.

e. Do not use Dynamic Cone Penetrometer on open-graded aggregate such as No. 57 stone.

D. Inspection Report:

1. Provide a written inspection report signed by the Independent Testing Agency to the Installer to confirm:

a. That water (which may soften the unconfined matrix soil between and around the aggregate pier elements, and may have detrimental effects on the supporting capability of the aggregate pier reinforced subgrade) has not been allowed to pond in the footing excavation at any time.

b. That all aggregate pier elements designed for each footing have been exposed in the footing excavation.

c. That immediately before footing construction, the tops of all the aggregate pier elements exposed in each footing excavation have been inspected and recompacted as necessary with mechanical compaction equipment, and that the tops of any aggregate pier elements which may have been disturbed by footing excavation and related activity have been recompacted to a dry density equivalent to at least 95 percent of the maximum dry density obtainable by the modified Proctor method (ASTM D1557).

d. That no excavations or drilled shafts have been made after installation of aggregate pier elements within horizontal distance of five feet from the edge of any pier, without the written approval of the Designer.

END OF SECTION

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