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MEMORANDUM

11 January 2006
File No. 31807-001

TO: SMRT, Inc.
Janusz Wszola, P.E.

C: Mercy Health System of Maine; Attn.: Timothy Prince
KLMK Group, LLC.; Attn.: Patrick Duke
DeLuca-Hoffman Associates, Inc.; Attn.: Steve Bushey
Gilbane Building Company; Attn.: Doug Butler

FROM: Haley & Aldrich, Inc.
Andrew R. Blaisdell, P.E., Wayne A. Chadbourne, P.E.

SUBJECT: Geotechnical Design Memorandum No. 1
Foundation Support and Seismic Design Recommendations
Phase I Hospital – Mercy at the Fore Development
Portland, Maine

This memorandum presents foundation support and seismic design recommendations for the proposed Phase I Hospital Building (hospital) to be constructed as part of the proposed Mercy at the Fore development in Portland, Maine. Additional geotechnical design recommendations and construction considerations will be provided under separate cover. A geotechnical data report summarizing the subsurface conditions encountered in the recently completed design-phase exploration program will be issued by 18 January 2006.

Proposed Development and Design Parameters

It is our understanding that the hospital will be a five-story structure with plan footprint area equal to 30,000 square feet (sf), resulting in a gross building plan area of approximately 150,000 sf. The level of the first floor slab is proposed to be constructed at El.32 (ft, NGVD 29), which is the approximate finished grade of the main entrance to the hospital on the west side of the building.

The hospital will be constructed with a full level of below grade space (ground floor) to house laboratory, storage and office areas as well as the loading dock/receiving area. The level of the ground floor slab is proposed to be constructed at El. 17.5, approximately 12 to 15 ft below existing site grades. Based on the proposed site grading plan provided by DeLuca-Hoffman, finished grades on the north, south and east sides of the hospital will be within several feet of the ground floor slab (i.e., between El. 13 and El. 19). As stated above, finished grade on the west side of the hospital is proposed at El. 32, approximately 15 ft above the level of the ground floor slab.

The southeast quadrant of the ground floor will be used to house mechanical equipment (electrical, chiller and boiler rooms). The level of the floor slab in this area is proposed to be constructed at El. 11.5, approximately 6 ft below the level of the rest of the round floor slab.

SMRT has provided design column loads (axial compression) and a plan showing column layout for the hospital. We understand that the hospital will have columns spaced uniformly throughout the structure at 32.5 ft on-center in both the north-south and east-west directions. Typical column loads (dead plus live and snow) will range from approximately 780 to 830 kips for interior columns, 440 to 570 kips for exterior columns, and 130 to 260 kips for corner columns. The design loading information and lower level slab elevations are the basis for the foundation recommendations presented below.

Foundation Design Recommendations

The results of our preliminary and design-phase subsurface exploration programs indicate that the soils exposed at subgrade level will vary considerably within the hospital footprint. We anticipate that dense to very dense glaciofluvial sand and gravel will be encountered at subgrade level beneath the northern half of the building, and medium stiff to stiff glaciomarine clay will be encountered at subgrade level beneath the southern portion of the building.

To determine the feasibility of using shallow foundations to support the hospital, we performed engineering analyses to evaluate the allowable bearing capacities of the soils within the building footprint, and to estimate the magnitude of total and differential settlement of spread footings. The results of our analyses were in part based on the structural design loads and column layout provided by SMRT, as well as the proposed site grading and proposed lower level slab elevations provided by DeLuca-Hoffman. Based on our engineering analyses, it is our opinion that reinforced concrete spread footings could be used to support the hospital structure. We estimate total settlement at discrete column/footing locations will range between 1 and 1.5 in. We estimate differential settlement between adjacent columns/footings will be ¾ in. or less. Based on our recent discussions with SMRT, these amounts of total and differential settlement are structurally acceptable.

The attached sketch shows four separate Foundation Design Zones, designated A through D. We recommend that footings located within these zones be sized based on the following values of allowable bearing capacity:

Foundation Design Zone A - 10,000 pounds per square foot (psf)
Foundation Design Zone B - 2,500 psf
Foundation Design Zone C - 1,200 psf
Foundation Design Zone D - 500 psf

These allowable bearing capacity values are based on current design loads and site grading information. These values may not be applicable if the magnitude of design loads, column locations, slab levels or site grading adjacent to the hospital change during the final design phase of the project.

Footings in Design Zone A should bear on glaciofluvial sand and gravel or on compacted granular fill (CGF) or lean concrete placed on top of the glaciofluvial deposit. Some minor, localized over-excavation below anticipated footing subgrade level (approximately El. 13) will be required to reach the glaciofluvial bearing soils at some column locations within Zone A. Specifically, we anticipate that over-excavation down to approximately El. 10 will be required in the vicinity of Column Lines B-5, C-5 and D-4. We do not recommend over-excavation to levels deeper than the measured static groundwater levels in the area (i.e., El. 8 and El. 10).

Where over-excavation is required, the resulting excavation can be filled with either lean concrete having a minimum 28-day compressive strength of 2,000 pounds per square inch (psi), or CGF so that the footings can be located at the desired elevations. In these areas, all of the glaciomarine clay soils must be removed from within the zone of influence (ZOI) beneath the footings. The ZOI is defined as the area below footings and below imaginary lines that extend 2 ft laterally beyond the footing outer bottom edges and down on a one horizontal to one vertical (1H:1V) slope to the top of the glaciofluvial deposit.

Footings in Design Zones B, C and D should bear on undisturbed glaciomarine clay. The design bearing capacity values in these zones are primarily limited by settlement considerations. It may be necessary for the contractor to place either a thin lift (e.g., 6 in.) of crushed stone or a 3 to 4-in. thick concrete mud mat on the bottom of the footing excavations to control groundwater, and to allow workers to place reinforcing steel without disturbing the bearing soils. Excavation in the clay within several feet of the footing subgrade level should be conducted carefully either by hand methods or using a backhoe with a smooth-edged bucket to minimize disturbance to the clay. The contractor should be required to excavate and replace disturbed clay soils exposed at footing subgrade level prior to construction of the footings.

As previously mentioned, we will provide a design memorandum summarizing applicable geotechnical constructability guidelines (e.g., gradation requirements for CGF, excavation and backfilling requirements, placement/compaction procedures for CGF) under separate cover.

A Haley & Aldrich representative should be on-site to provide full-time construction monitoring/Owner's Representative services to confirm that the bearing conditions at each footing location is consistent with the design bearing pressures, and to confirm that the soil subgrade is not disturbed prior to placement of structural concrete.

Additional foundation design parameters and considerations are presented below:

- Design footings to have a least lateral dimension of 18 in.
- Locate bottoms of footings at least 4.5 ft below the lowest adjacent ground surface exposed to freezing, and a minimum of 2 ft below the top of the adjacent ground floor slab at permanently heated interior locations.
- Design footings to bear below a reference line drawn upward and outward on a 1.5H:1V slope from the bottom of any existing or proposed adjacent utilities or other underground structures.

Ground Floor Slab

We recommend that the lowest level floor slabs (at El. 11.5 and El. 17.5) for the hospital building be designed as soil-supported concrete slabs-on-grade.

The portion of the ground floor slab at El. 17.5 should bear directly on a minimum of 12 in. of CGF in areas where the glaciomarine clay is present at subgrade, or directly on the glaciofluvial sand and gravel, where present at subgrade. All topsoil, organic soils and debris (if encountered) should be removed from within the hospital footprint.

The "depressed" portion of the floor slab at El. 11.5 should bear directly on a minimum 12-in. thick layer of crushed stone as outlined below in the foundation drainage section.

Lateral Earth Pressures on Below-Grade Foundation Walls

We recommend that any exterior below-grade foundation walls retaining soil on one side and restrained at the top be designed for static lateral earth pressures using an equivalent fluid unit weight of 60 lbs. per cubic foot (pcf). Cantilever walls (i.e., walls that are free to rotate at the top) should be designed using an equivalent fluid unit weight of 40 pcf. These fluid weights assume a free-draining granular backfill is placed within 6 ft of the wall (with moist unit weight equal to 120 pcf) and that a perimeter foundation drain system is installed as recommended herein (i.e., no unbalanced hydrostatic pressures exist; "drained condition").

Seismic Design

We anticipate that the hospital building will be designed in accordance with the seismic requirements of the latest edition of the International Building Code (IBC). The seismic design coefficient determination is controlled by the presence of medium stiff to stiff clay and medium dense sand in the glaciomarine and deeper marine deposits. Based on the shear strength and blow count values obtained from our subsurface explorations, it is recommended that the site be classified as Site Class "D". We recommend the following values be used to determine the design spectral response acceleration parameters (S_{DS} and S_{D1}) and to calculate the base shear for purposes of seismic design:

- Mapped Spectral Accelerations for Short Periods: $S_S = 0.36g$
- Mapped Spectral Accelerations for 1-Second Periods: $S_1 = 0.10g$
- Site Coefficient for Short Periods:, $F_a = 1.51$
- Site Coefficient for 1-Second Periods: $F_v = 2.40$

Please note that "g" refers to acceleration due to gravity. The foundation soils are not considered to be susceptible to liquefaction.

Foundation Drainage and Waterproofing

Because of the proximity of both the static groundwater levels (El. 8 and El. 10) and the 100-yr flood level (El. 10) to the proposed level of the "depressed" ground floor slab (El. 11.5), we recommend that a foundation drainage system be installed in this area to protect the slab and mechanical equipment from hydrostatic pressures and groundwater

infiltration. A foundation drainage system is not considered necessary for the portion of the ground floor slab constructed at El. 17.5.

The system should include underslab drains installed below the "depressed" ground floor slab. The system should consist of separation filter fabric placed on the prepared, approved soil subgrade, a minimum 12 in. thickness of ¾-in. crushed stone placed above the fabric, and a network of 4 in. diameter perforated PVC or corrugated HDPE drain pipes (laid flat) embedded mid-height in the crushed stone layer. We recommend that at least one section of pipe be installed in each column bay. We estimate that the invert of the pipes would be approximately 12 in. below the finish floor elevation (estimated El. 10.5).

The system should also include perimeter drains installed along the exterior side of below-grade building foundation walls adjacent to the "depressed" ground floor slab. We recommend that the system consist of a 4-in. diameter continuous perforated PVC or HDPE drain pipe (laid flat), surrounded by a minimum of 6 in. of crushed stone, wrapped in separation filter fabric. The invert level of the drain pipe should be positioned above the top of the wall footing and approximately 12 in. below the bottom of the ground floor slab (estimated El. 10.5). Per the requirements of the IBC Code, the perimeter drain (including the pipe, crushed stone and filter fabric) should extend a minimum of 12 in. beyond the outside edge of the footing.

Based on proposed site grading adjacent to the hospital, we also recommend that a perimeter foundation drain be installed along the outside of the western and southern exterior foundation walls. The invert level of this segment of drain pipe should be positioned above the top of the wall footing and approximately 12 in. below the bottom of the ground floor slab (estimated El. 16.5). We anticipate that this segment of pipe would likely connect into the perimeter drain installed around the "depressed" ground floor area at the southern end of the building (around column line H-3.

Perimeter and underslab drain pipes in the "depressed" slab area should be installed at roughly the same invert elevation and should be laid flat. The underslab and perimeter drain pipes should be connected by constructing "wall-through" or "box-out" penetrations at discrete locations in the foundation wall. The foundation drainage system should be designed to discharge by gravity where practicable into an appropriate receptor (e.g., new or existing storm drain system). It may be necessary to install a sump pit with pumps to discharge the effluent from the system if an appropriate receptor is not present near this area of the building. If pumping the effluent is required, sump pits should be equipped with dual pumps with alternating cycles, and a back up power system should be installed. The sump pit could be constructed either on the interior of the building, or on the outside of the building adjacent to the foundation wall.

Pipe cleanouts should be provided at system corners (for both perimeter and underslab drain piping) to allow for future maintenance. We plan on providing plan and details of the foundation drainage system for inclusion in the Contract Documents. The location and invert level of the drains and wall through penetrations should be coordinated with the Plumbing Consultant and Structural Engineer.

Waterproofing of walls and floor slabs for the below-grade portions of the hospital is not needed. However, below-grade portions of foundation walls should be damp-proofed and insulated in accordance with the IBC Code. We recommend installation of a below-slab vapor barrier. Evaluations for the need to control humidity to prevent the formation of mold or other organisms within the building were not within the scope of work of this evaluation. If vapor barriers are used, the floor slab design and construction must be coordinated with the vapor barrier installation, as the barriers may impact concrete curing and curling.

Closure

We trust this provides sufficient information to proceed with foundation design development. Please do not hesitate to contact us if you require additional information.

Attachment:
Sketch 1 – Preliminary Foundation Design Parameters

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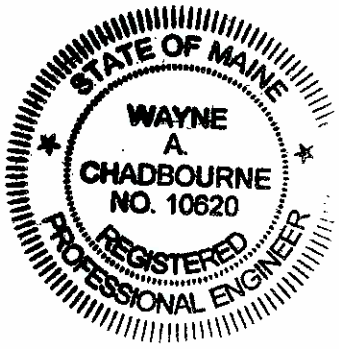

HALEY & ALDRICH NOTES:

1. Design footings in each zone using bearing capacities presented in 11 January 2006 memo.
2. Design column loads provided by SMRT are presented in kips.
3. Each footing is marked with the appropriate design zone designation.

NOTE: (by SMRT)
1. ASSUMED: SLAB-ON-GRADE
2. LIVE LOAD REDUCTION APPLIED.
3. ALL LOADS ARE IN KIPS

REV. 1 12/15/05

FOUNDATION LOADS

PRELIMINARY FOR MERCY HOSPITAL & FORE RIVER

TOTAL LOAD
DEAD LOAD
LIVE LOAD
SNOW LOAD

1.8 k/ft (FDN. WALL)

FOUNDATION DESIGN ZONE A

FOUNDATION DESIGN ZONE B

FOUNDATION DESIGN ZONE C

FOUNDATION DESIGN ZONE D

3.6 k/ft D (BASEMENT WALL)

HALEY & ALDRICH, INC.
SKETCH 1 - PRELIMINARY FOUNDATION DESIGN PARAMETERS
PHASE I HOSPITAL
31807-001 JAN '06