SEPA Environmental Checklist

Mercer Island Center for the Arts

Attachment F
Geotechnical Supplemental Memo

January 2017

MEMORANDUM

DATE: May 6, 2015

TO: Katie Oman, Mercer Island Center for the Arts

FROM: David Winter, PE, and Matt Veenstra, PE

RE: **Design Memorandum – Supplemental**
Mercer Island Center for the Arts
Mercer Island, Washington
19120-00

CC: Matt Jones, MKA

As the project evolves, additional geotechnical design criteria have been developed to supplement the recommendations in our March 31, 2015, report.

We understand that the current plans call for a fire lane to be built behind the back wall of the building. As a result, the shoring wall installed to allow excavation into the hillside and construction of the lowest level at elevation 90 feet will need to be designed as a permanent wall. This requires the following modifications to the design.

- Permanent tieback anchors must include corrosion protection.
- Pullout capacities for permanent anchors are estimated using a factor of safety of 2.5 (instead of 2.0 for temporary anchors). For Soil Units 1 and 2 the estimated allowable capacity is 0.8 kips per foot. For Soil Unit 3 the estimated allowable capacity is 2.4 kips per foot. The actual allowable capacity will need to be confirmed using field load testing.
- The first two permanent anchors should be tested using the supplementary extended creep tests described in section 8.3.4 of the Recommendations for Prestressed Rock and Soil Anchors (PTI 2004).
- Soil pressures on the permanent wall are the same as in Figures 5 and 6 of the geotechnical report (Hart Crowser 2015).

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- In order to avoid hydrostatic pressures, we recommend installing weep holes between the soldier piles at 1 and 6 feet above the base of the wall. The weep holes should be fitted with a 3-inch-diameter slotted pipe extending into the soil. Water from the weep holes should be channeled at the base of the wall with a curb and routed to a suitable discharge point. Alternatively, waffle drain material can be installed behind the permanent facing of the wall and an outlet into a drain pipe at the base of the wall. As another alternative, if the wall facing will simply be treated lagging boards, then the wall will likely be permeable enough without the addition of drainage sheets.

Additional supplemental design recommendations include the following:

- Design the lowest level floor slab as a structural slab. All other recommendations regarding underslab drainage and construction from page 15 of the report will apply.

- According to the Mercer Island Design Code, the frost penetration depth is 12 inches. We recommend that any footings for temporary or permanent structures be embedded at least 18 inches below the adjacent site grade, or well below the frost level.

- Underslab drains are typically 3- or 4- inch-diameter slotted flexible pipe or rigid perforated pipe. The pipes may be wrapped in filter fabric or placed in a trench 12 inches wide and deep and lined with non-woven filter fabric such as Mirafi 140N or better. We have not calculated the potential flows into an underslab drainage system, but we expect the flow to be less than 30 gallons per minute.

- Shallow spread footings are not recommended for occupied building structures or other settlement sensitive structures. For support of small, lightly loaded facilities, we recommend placing footings on structural fill. The structural fill should extend 2 feet below the base of the footing and laterally 2 feet beyond the outer edges of the footing. Structural fill should be surrounded by a woven geotextile such as Mirafi HP370 or better. Structural fill should be compacted to a minimum of 95 percent of the modified Proctor maximum dry density. If compaction causes excessive subgrade disturbance, the first 1.5 feet of structural should consist of quarry spalls or similar angular rock that can be tamped into placed and will provide adequate subgrade for compaction of overlying structural fill. If constructed as described, the footing may be designed for an allowable vertical bearing capacity of 2,000 psf. Calculate the lateral sliding resistance using a coefficient of friction of 0.35 for footings bearing on granular structural fill. Lateral bearing pressure for footings bearing against Soil Units 1 and 2 may be calculated using a triangular, passive earth pressure distribution of 100 psf/foot below grade. Ignore passive earth pressure in the upper 2 feet unless the ground surface is protected by pavement or concrete floor slabs.

Subgrade Recommendations for Pre-Manufactured Permeable Pavers

- Permeable pavers are a proprietary product, follow the manufacturer's recommendations for design and installation.
- We recommend the minimum subgrade sections in Table 1 for all types of permeable pavers.

Table 1 – Subgrade Sections for Permeable Pavers

Loading Type	Sub-base Geotextile	Sub-base	Base Course
Pedestrian	Mirafi 160N or better	N/A	12 inches of COS Type 1 (3/4" Minus Crushed Gravel)
Light passenger vehicles	Mirafi HP370 or better	12 inches of COS Type 1 (3/4" Minus Crushed Gravel)	6 inches of COS Type 1 (3/4" Minus Crushed Gravel)
Heavy vehicles	Mirafi RS280i or better	18 inches of COS Type 1 (3/4" Minus Crushed Gravel)	6 inches of COS Type 1 (3/4" Minus Crushed Gravel)

- Reinforcing geotextile should be placed on relatively undisturbed native soil. Construction traffic should not be allowed on native soil subgrade beyond what is necessary for excavation prior to backfilling.
- For pedestrian areas, the gravel backfill should be placed in a single lift and compacted to at least 90 percent of maximum dry density.
- For light vehicle sections the sub-base should be placed in a single lift and compacted to at least 90 percent of maximum dry density. The base course should be compacted to 95 percent of maximum dry density.
- For heavy vehicle sections, the sub-base should be placed in a single lift and the upper 12 inches compacted to at least 92 percent of maximum dry density. The base course should be compacted to 95 percent of maximum dry density.
- Vibratory compaction should not be allowed unless it is demonstrated to not degrade the native subgrade (e.g. cause subgrade pumping).
- Note that nuclear density tests may not provide reliable results in gravelly backfill. Hart Crowser may elect to evaluate adequacy of backfill compaction by visual inspection and proof rolling.
- Just prior to placing Grasspave pavers, the prepared subgrade should be proof-rolled using a loaded dump truck or similar equipment. The proof roll must be observed by a Hart Crowser representative.

- If drain pipes are placed within the sub-base, the drain pipes should be wrapped in geotextile filter fabric such as Mirafi 160N or better and placed at least 12 inches below light wheel loads and at least 18 inches below heavy wheel loads.

Note that the native subgrade soils are silt and clay and have very low infiltration capacity such that storm water infiltration into the native soils is not practical. Any water that infiltrates the pavers will be confined within the underlying gravel backfill and will need to be drained. The choice of gravel backfill will influence how much water is stored and how quickly water reaches the drain pipes. A more poorly-graded backfill than that recommended in Table 1 may be desirable if rapid infiltration to a drain pipe is desired.

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