

Introduction

The VRH Addition Project involves design of the foundation to support a two-story steel frame building expansion to the existing hospital. Both shallow and deep foundation options were considered.

Location: Kentville, N.S.

Client: Mr. Joe Moore, P.Eng.

Faculty Advisor: Dr. Craig Lake, P.Eng.

Design Process

Site Investigation

- Boreholes and Test Pits
- Soil Properties
- Topography

Bearing Capacity

- Deep Foundation
 - Pile Depth vs Capacity
- Shallow Foundation
 - Footing Size vs Bearing Capacity

Settlement

- Deep Foundation
 - Slab on Grade
 - Differential Settlement
- Shallow Foundation
 - Footing Size
 - Safe Bearing Pressure

Earthworks

- Slope Stability
 - Temporary Excavation
 - Deep: Trench for Grade Beam
 - Shallow: Uncontrolled Fill (~5m Deep)
 - Global (Southern Slope)
- Cut and Fill Quantities

Final Design

- Deep Foundation
 - Pile Layout
 - Pile Cap Design
 - Grade Beam Design
- Shallow Foundation
 - Footing Layout
 - Spread Footing Design
 - Strip Footing Design

Details of Design

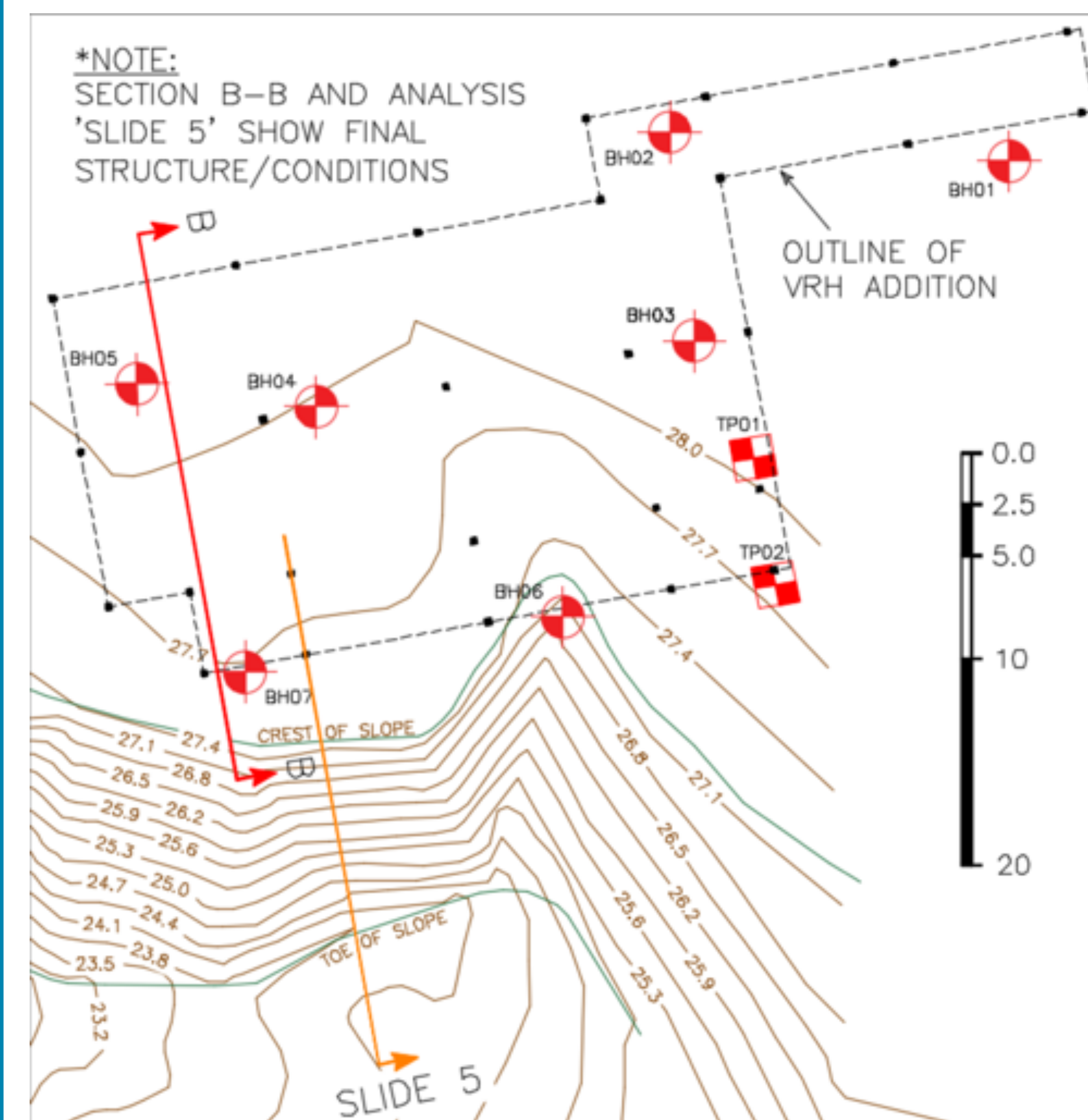


Figure 1: Existing Site Conditions

- Boreholes and test pits provide insight on subsurface conditions.
- Original grade included crest near southern face of addition.

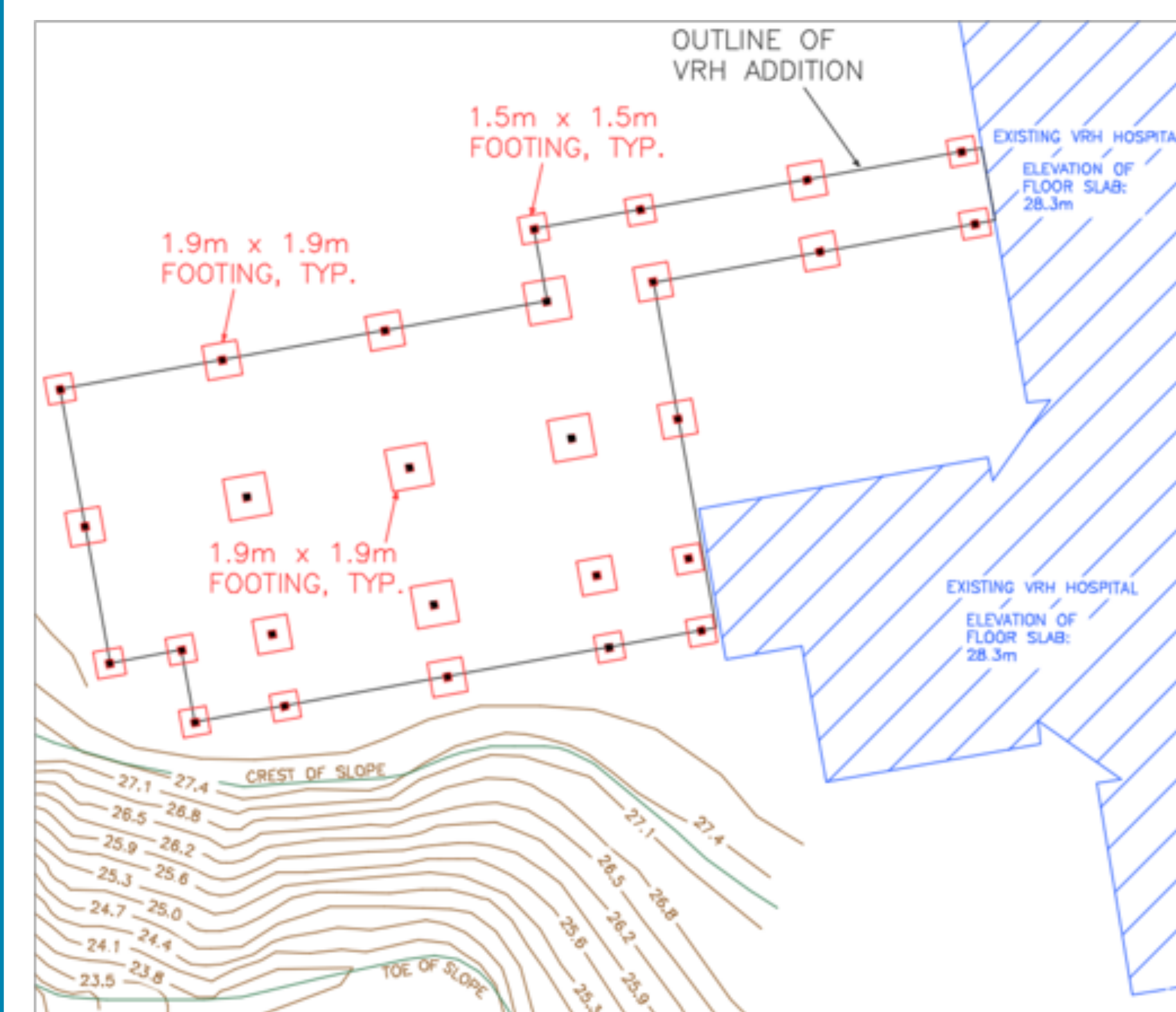


Figure 4: Spread Footing Layout

- Spread footing plan and sizes.
- Crest advanced to facilitate shallow foundation.

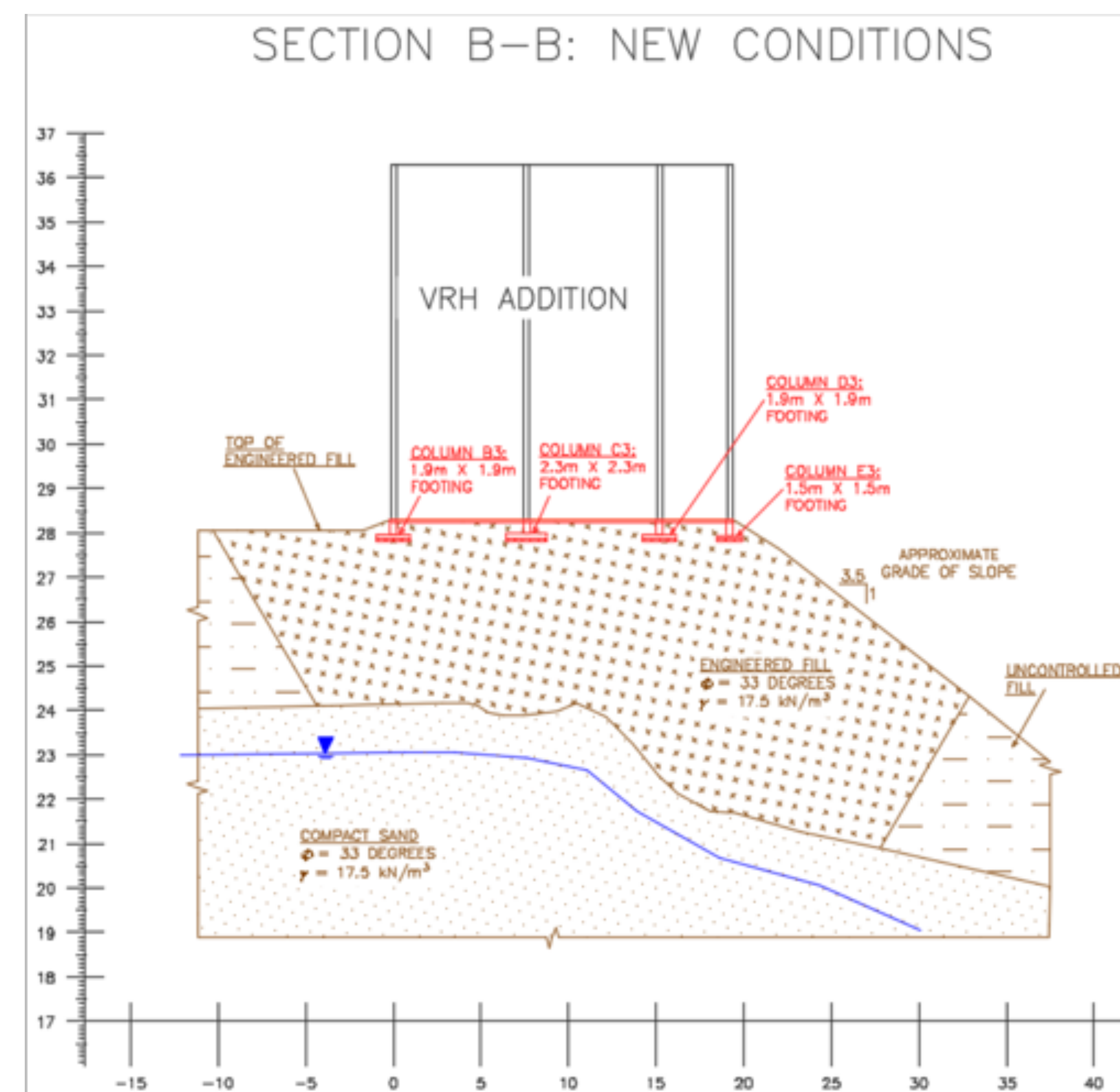


Figure 2: Cross Section B-B

- Excavation of Uncontrolled Fill extends 4 – 6 meters below surface.
- Engineered Fill to match design properties of Compact Sand.

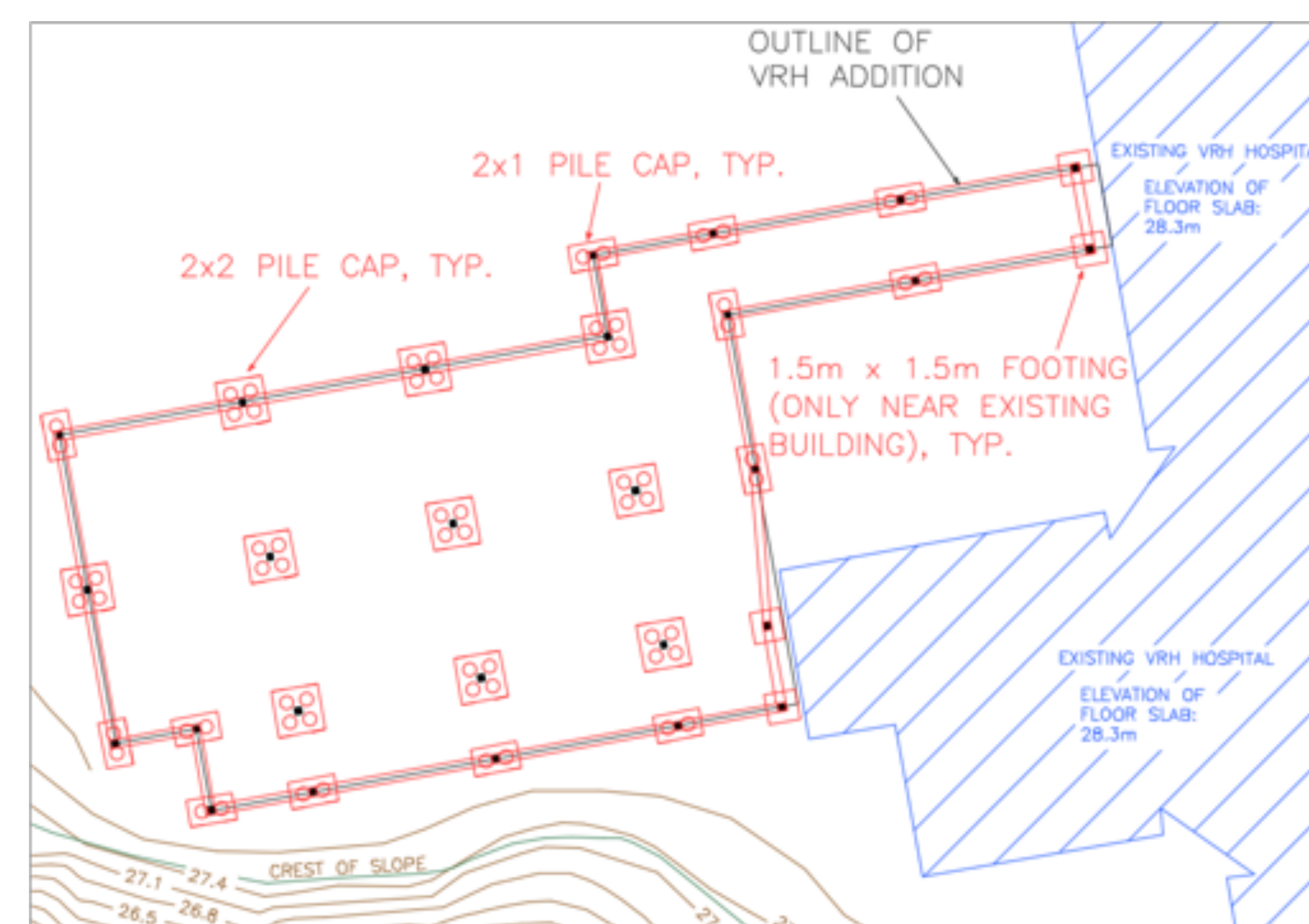


Figure 5: Deep Foundation Layout

- Pile caps shown after driving of piles.
- All piles to be HSS 324x9.5, driven to depths between 4m and 8.5m.

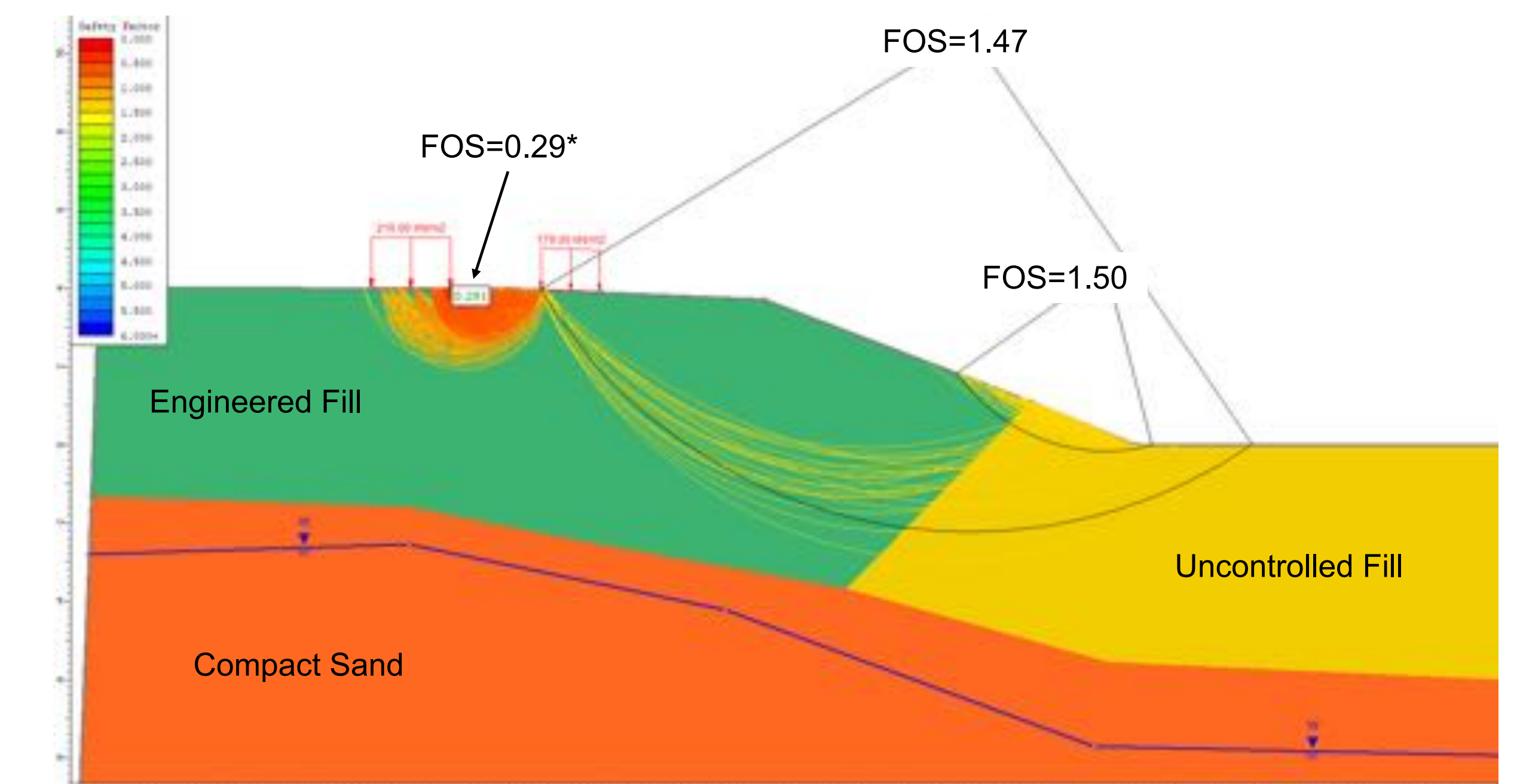


Figure 3: 'Slide 5' Analysis – Shallow Foundation

- Footing bearing on Engineered Fill, analysis performed for global slope stability. *Surficial Failure N/A
- Analysis developed with Rocscience SLIDE 8.

Conclusion and Recommendations

Shallow Foundation

- Uncontrolled Fill to replaced with Engineered Fill.
- Slopes analyzed against global and local failures.
- Strip footing to support exterior walls and serve as frost protection.
- Spread footing sizes: 1.5 x 1.5 m, 1.9 x 1.9 m, 2.3 x 2.3m; at 1.2m depth.

Deep Foundation

- Pile groups of 2 and 4 piles arranged concentrically with columns.
- Pile cap sizes: 2.27 x 2.27m and 2.27 x 1.3m.
- Grade beam to support the exterior walls and provide frost protection.
- Pile driving avoided adjacent to existing building. Spread footings employed in the S.E. corner of Addition.
- Slab-on-grade does not require additional pile support.

References

- Concrete Design Handbook, CSA A23.3
- Autodesk. AutoCAD 2016 [computer software]. Autodesk, Inc. San Rafael, CA, USA.
- National Research Council of Canada, 2015. National Building Code of Canada. NRC
- Canadian Foundation Engineering Manual 2006