# MEMORANDUM

TO: Dr. Luis Zambrano-Cruzatty
FROM: Student A
DATE: October 6, 2016
RE: **CIE-365 assignment 100**

As it was requested in the assignment sheet, I designed the retaining wall for the geometric conditions given. This memo addresses the main issues regarding the calculations and assumptions that were done to design the retaining wall. Additionally, a Drawing containing some technical details for possible construction is shown in the Attachment 4.

This memo is composed of:

- Attachment 1: Demonstrative hand calculations.
- Attachment 2: Tables and figures used.
- Attachment 3: Spreadsheet output.
- Attachment 4: Retaining wall detail.
- Attachment 5: Assignment sheet.
- Attachment 6: References.

Following, I summarize a list of the conclusions and details of the design:

- In order to select strength parameters for the sand backfill, I used the relationship between the relative density and the friction angle given by Decourt (1990). In a range of 68% to 80% of relative density, the angle of internal friction was found to be between 37° and 41°, therefore **37°** was selected for design with a unit weight of **127 pci**, however, the drawing specifies at least 80% of relative density to be on the conservative side of the design. You can find more information regarding this in the Attachment 1, page 1/3; Attachment 2, page 1/1; and Attachment 4, page 1/1.

- For the foundation soil, I used the table A.11, which can be found in the Attachment 2, page 1/1. The parameters selected were $\boldsymbol{\gamma = 120\ pcf}$ and $\boldsymbol{\phi' = 35°}$**.** More detail can be found in the Attachment 1, page 1/3.

- **The theory used** to compute the coefficient of active and passive earth pressure **was the Rankine theory**. The reasons are detailed in the attachment 1, page 1/3. The passive side was not considered in the analysis, except for the key passive resistance that needed to be added to increase the factor of safety against sliding. **The mobilized friction in the base was assumed 2/3 of the angle of internal friction of the foundation soil**. **For the wall, the friction angle was assumed to be equal to zero** due to the lack of relative displacement between the failed wedge and the soil above the footing.

- **The final dimensions of the retaining wall are detailed in the attachment 4**, page 1/1. The calculations of Factor of safety against sliding, overturning, and bearing capacity are shown in the Spreadsheet output in the attachment 3 (two pages) and were checked by hand calculations in the attachment 1, page 2 and 3 of 3. A summary of the factors follow:

$$FS_{Sl} = 1.54 > 1.5$$
$$FS_{Ov} = 2.38 > 2.0$$
$$\frac{x}{B} = 0.36 > 1/3$$
$$q = 1904\, psf$$
$$FS_{Bc} = 5.25 > 2.0$$

- The factor of safety for bearing capacity was computed as the ratio of q and the ultimate bearing capacity given in the assignment sheet (Attachment 5).

Do not hesitate to contact me if further information about this assignment is needed. You can reach me using the following contact info.

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Student

## References

Budhu, M. (2010). *Soil Mechanics and Foundations.* New York: John Wiley & Sons.

Duncan, J. M., Wright, S. G., & Brandon, T. L. (2014). *Soil Strength and Slope Stability.* New Jersey: John Wiley & Sons.

Rodriguez-Marek, A. (2016). *Foundation Engineering I handouts.* Blacksburg.

Terzaghi, K., Peck, R. B., & Mesri, G. (1996). *Soil Mechanics in Engineering Practice.* New York: John Wiley & Sons.