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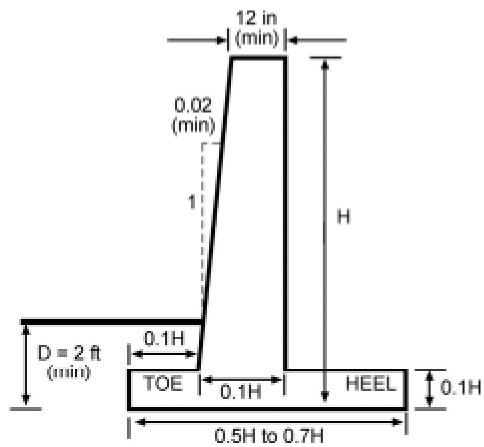
CE 462 - Geotechnical Design II
March, 2024

Rigid Retaining Walls: Project Report

Overview:



The purpose of this project was to create a program that has the capability to accept user inputs regarding rigid wall geometry and soil property parameters as they relate to the figure above. This input is then run through the program to provide stability checks and factors of safety for sliding, overturning and bearing capacity. Whereas the original problem statement had horizontal backfill, for an extra challenge the program was coded to incorporate a sloping backfill (alpha) instead. The program also produces a lateral earth pressure diagram using findings from the Rankine analysis. For extra analysis,Rankine and Coulomb earth pressure methodologies are compared as they relate to the scenario and user input. Finally, Schmertmann's method is utilized in the program to compute the immediate settlement given user inputs for 4 soil layers. This report will summarize the approach taken for this project and address any findings.

Methodology:

To run all the necessary calculations to address the features mentioned above as well as produce the lateral earth pressure graph in a singular program, Python was selected as the project method. The project can be accessed via my public repository in GitHub at the following link: https://github.com/JessikaSolleder/CE--462-Project-2 . Additional program details can be found in the README.md file. This program requires the numpy, math, tkinter and matplotlib.pyplot libraries and uses a Conda based interpreter. It is recommended that you ensure your virtual machine or coding environment is set up to run this program correctly, otherwise it may not properly compile.

Rankine vs Coulomb:

There are some key differences between Rankine and Coulomb earth pressure analysis. For starters, Rankine analysis assumes that soil is homogeneous, isotropic and cohesionless. It also assumes that the failure surface of the soil forms at an angle that is parallel to the back of the retaining wall. Because this methodology does not account for wall adhesion, soil cohesion or wall friction it tends to be less accurate than the Coulomb theory, however it is a decent method for scenarios like the one at hand where the wall is smooth, vertical and there is no surcharge.

Coulomb on the other hand *does* incorporate factors that the Rankine theory does not. This includes cohesion, wall friction and surcharge loads, effectively accounting for the soil-wall interface. It assumes that the failure surface is planar and makes an angle with the horizontal. In general it can be seen that Coulomb tends to be more accurate, however in the given problem statement the rigid retaining wall does not have a surcharge, the wall interacting with the soil is vertical and we can assume is pretty smooth. Therefore it really is more up to the preference of the user. The program includes both calculations for this reason, and just for the fun of comparison!

Summary: I hope you enjoy looking through my code and playing with inputs! Overall the program will take you through the required analysis then introduce additional features. The user will see a series of input boxes as they work through the code. A vertical stress versus depth graph will pop up in a separate screen and all essential calculations will be output in the terminal. At the end of the code, it will ask if the user would like to re-run the program. If the user elects to do so, they can retry the program with different user input values. Additionally, there is a feature included in the code where only numbers will be accepted in the input boxes.