Global Stability of Column-Supported Embankments

Danilo Botero Lopez, Civil and Environmental Engineering, University of Maine Advisor: Ph.D. Aaron Gallant

Motivation:

Column-supported embankments accelerate construction by reducing the stresses in the soft soil foundations through arching, soil-column interface, and column tip transfer. The Current design methodology (FHWA) (Fig 1.) for assessing the global stability do not account for stress compatibility between the embankment fill, column, and soil, which ignores the physics of the system.

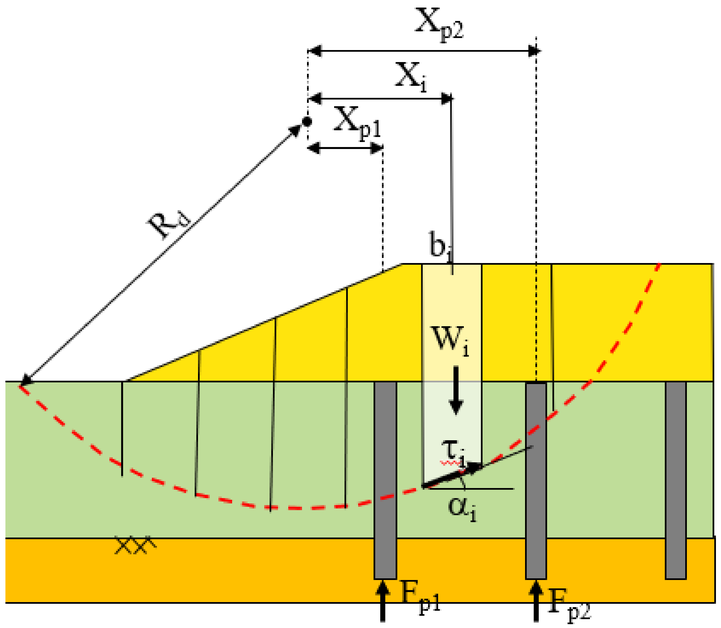
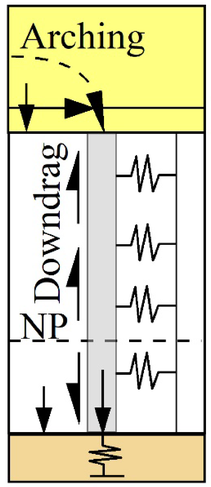


Fig 1. Design Methodology for Global Stability in the FHWA (Schaefer et al 2017).

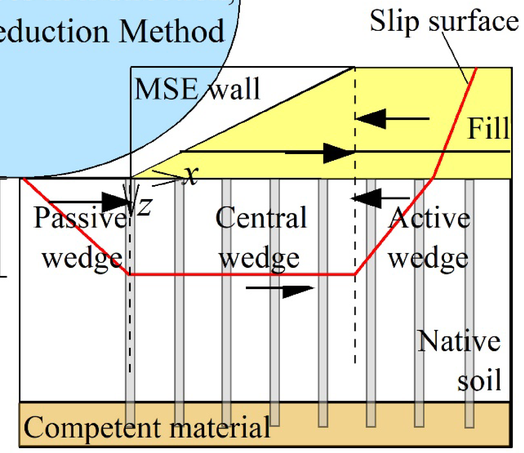
Methodology:



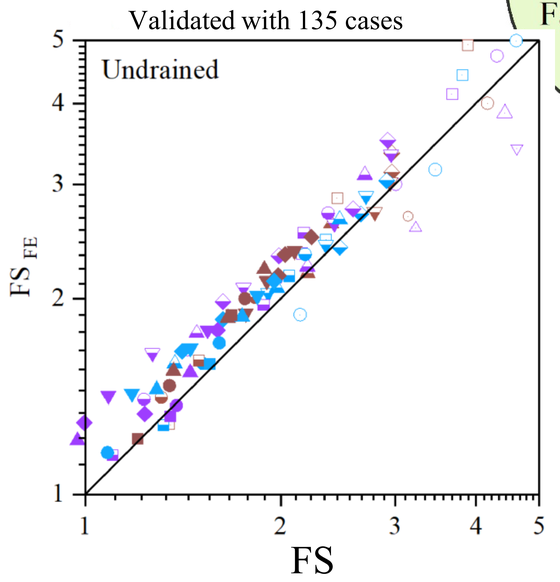
Stresses in the subsoil profile:
- Arching mechanism
- Downdrag
- Load Displacement Compatibility

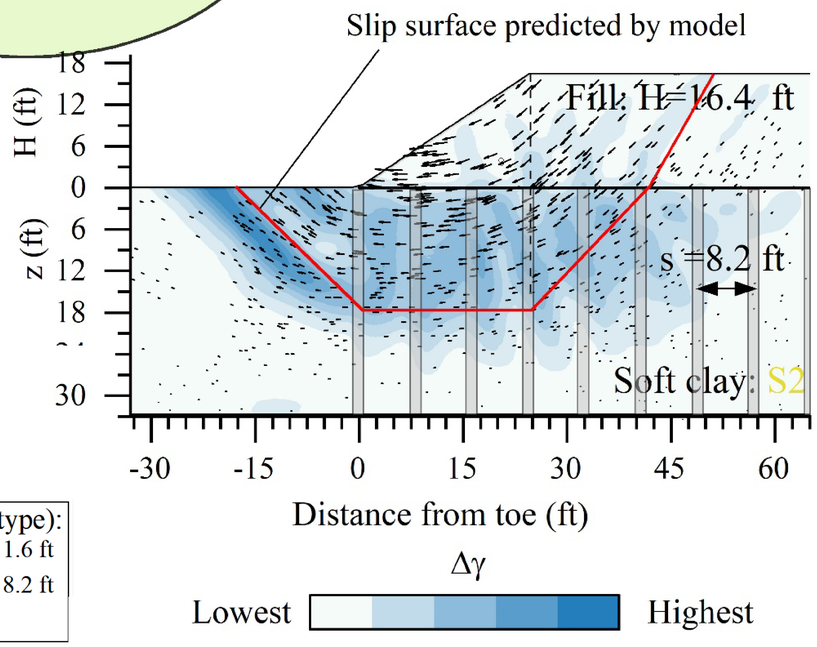
Lateral Equilibrium of Three Wedge:
-Sum of forces in x direction,
-Strenght Reduction Method

Global Stability:
- Magnitude of Factor of safety
- Slip surface location & geometry



Results:





Spacing (colors):	Fill height (fill):	Crust thickness (symbol type):
s = 4.9 ft	H = 6.6 ft	No crust; H_1 = 1.6 ft
s = 6.6 ft	H = 16.4 ft	H_1 = 4.9 ft; H_1 = 8.2 ft
s = 8.2 ft	H = 26.2 ft	H_1 = 11.5 ft

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