MSE Wall Homework

Geotechnical Design

CEG 4801

Spring 2020

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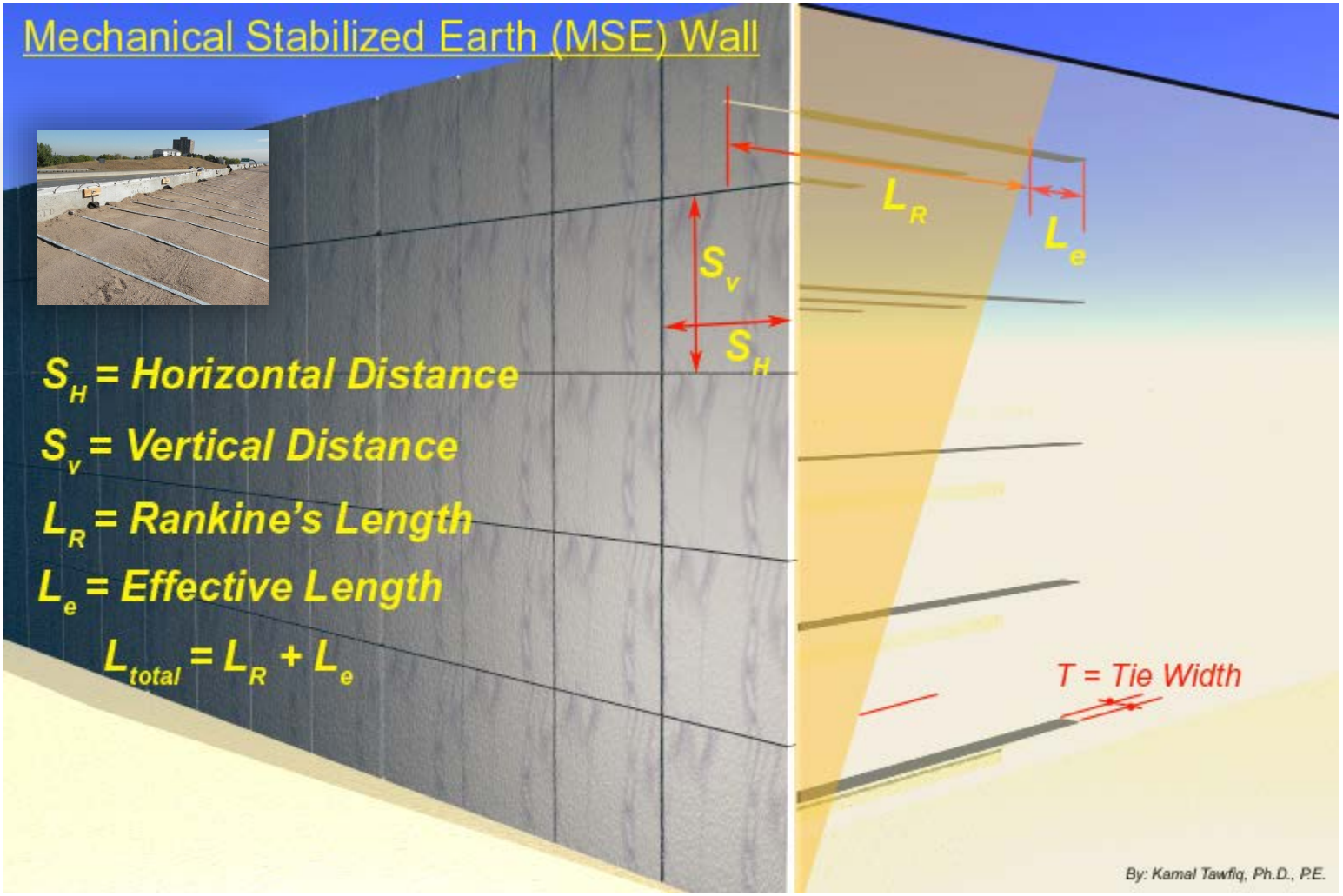
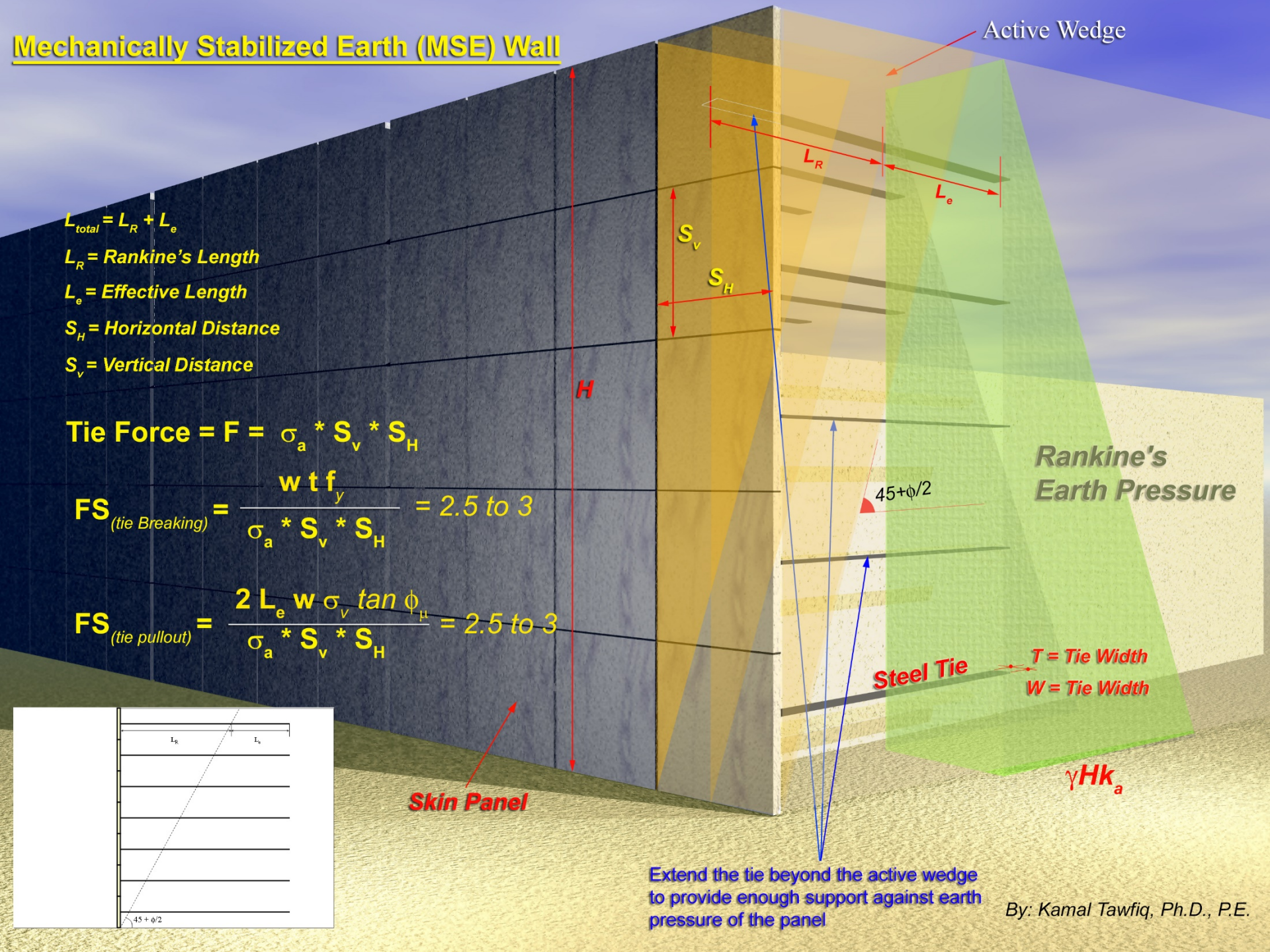


A reinforced earth retaining wall is to be **20 ft high**. The properties of the backfill material are γ = 110 lb/ft3 and $\varphi = 30^o$. Galvanized steel ties are to be used for the construction of the wall. Design the Reinforcements with $FS_{(B)}$= 1.5, $FS_{(p)}$ = 1.5, f_y= 29,000 psi and $\varphi_{tie}= 20^o$. Take $S_v = S_H$ = 4'

Mechanically Stabilized Earth (MSE) Wall



$L_{total} = L_R + L_e$

L_R = Rankine's Length

L_e = Effective Length

S_H = Horizontal Distance

S_v = Vertical Distance

$$\text{Tie Force} = F = \sigma_a * S_v * S_H$$

$$FS_{(\text{tie Breaking})} = \frac{w\ t\ f_y}{\sigma_a * S_v * S_H} = 2.5 \text{ to } 3$$

$$FS_{(\text{tie pullout})} = \frac{2\ L_e\ w\ \sigma_v \tan \phi_\mu}{\sigma_a * S_v * S_H} = 2.5 \text{ to } 3$$

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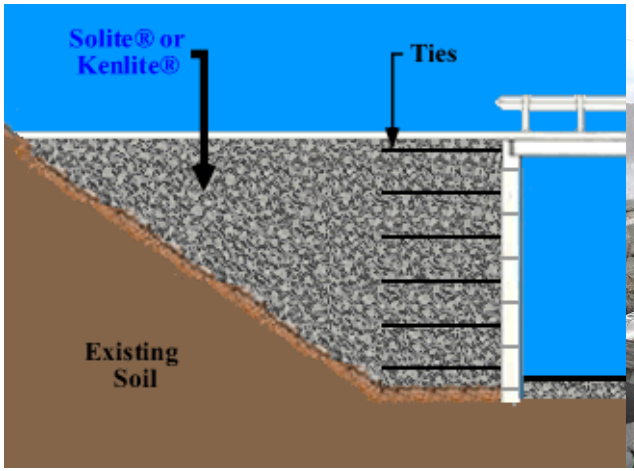
Solite® or
Kenlite®
Ties
Existing
Soil


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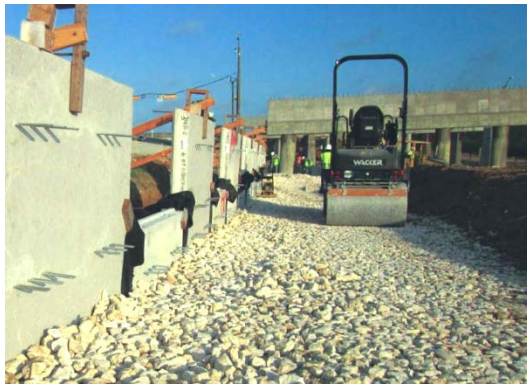
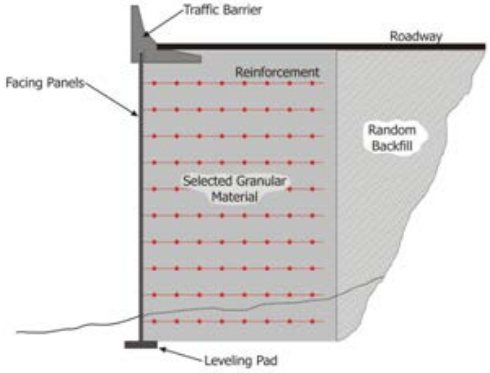
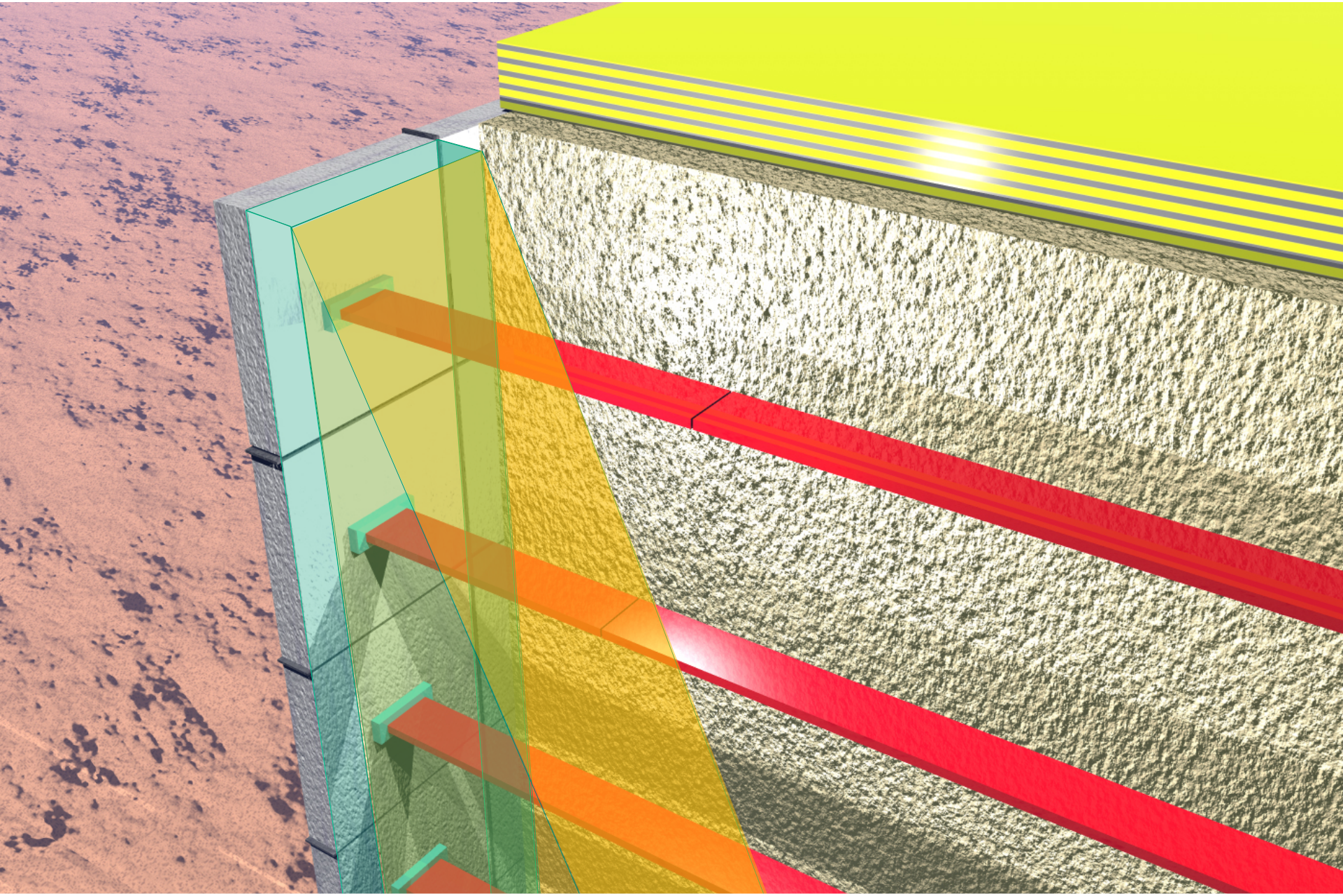


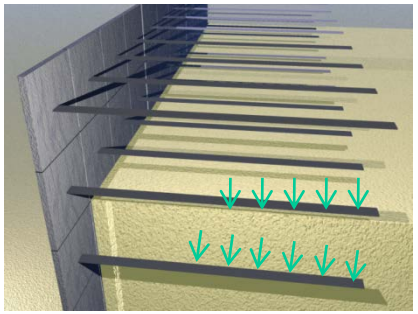

Traffic Barrier
Roadway
Facing Panels
Reinforcement
Random
Backfill
Selected Granular
Material
Leveling Pad

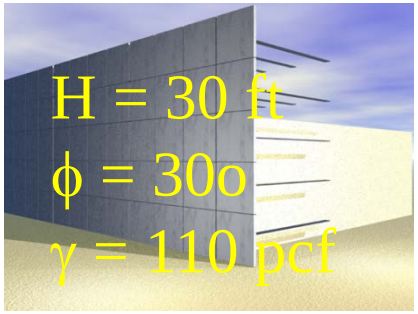


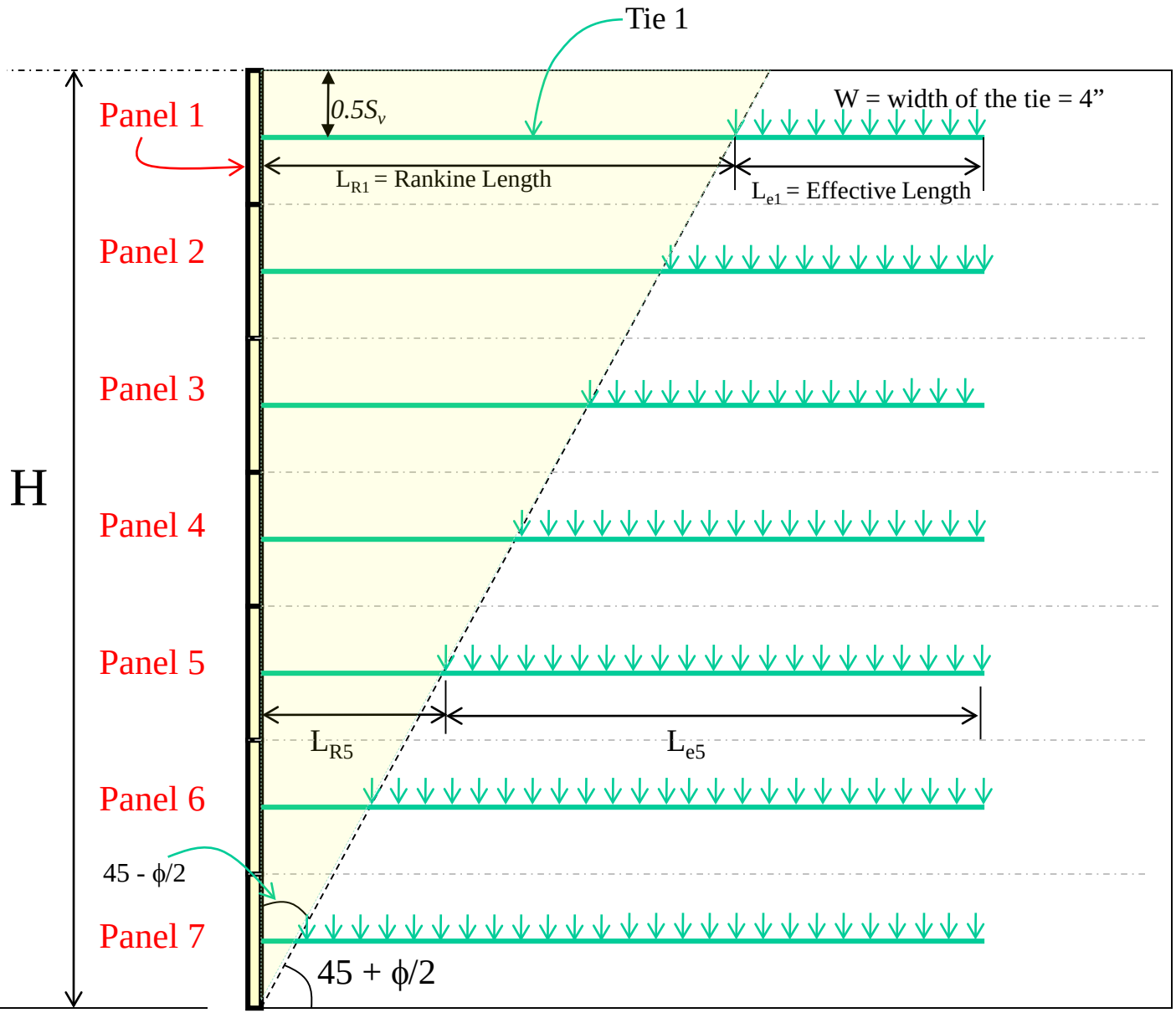
$L_{R1} = (H - 0.5\ S_v) \tan(45 - \phi/2)$

$$L_{e1} = \frac{2.5(\sigma_a . S_v . S_H)}{2\ w\ \sigma_v \tan\phi_\mu}$$

$L_1 = L_{R1} + L_{e1}$







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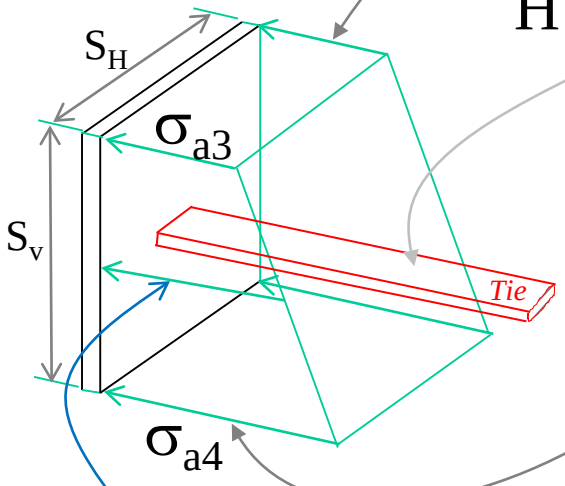
$$L_{R1} = (H - 0.5\,S_v)\tan(45 - \phi/2)$$

$$L_{e1} = \frac{2.5(\sigma_a . S_v . S_H)}{2\,w\,\sigma_v \tan\phi_\mu}$$

$(\sigma_{a1} + \sigma_{a2})/2$

Tie width

$$L_1 = L_{R1} + L_{e1}$$



$(\sigma_{a3} + \sigma_{a4})/2$

H

σ_{a1} σ_{v1} σ_{a2} σ_{v2} σ_{a3} σ_{v3} σ_{a4} σ_{a5} σ_{a6} σ_{a7} σ_{a8}

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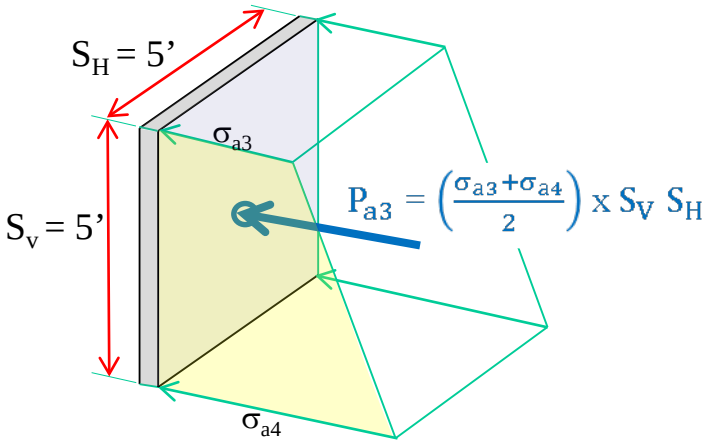
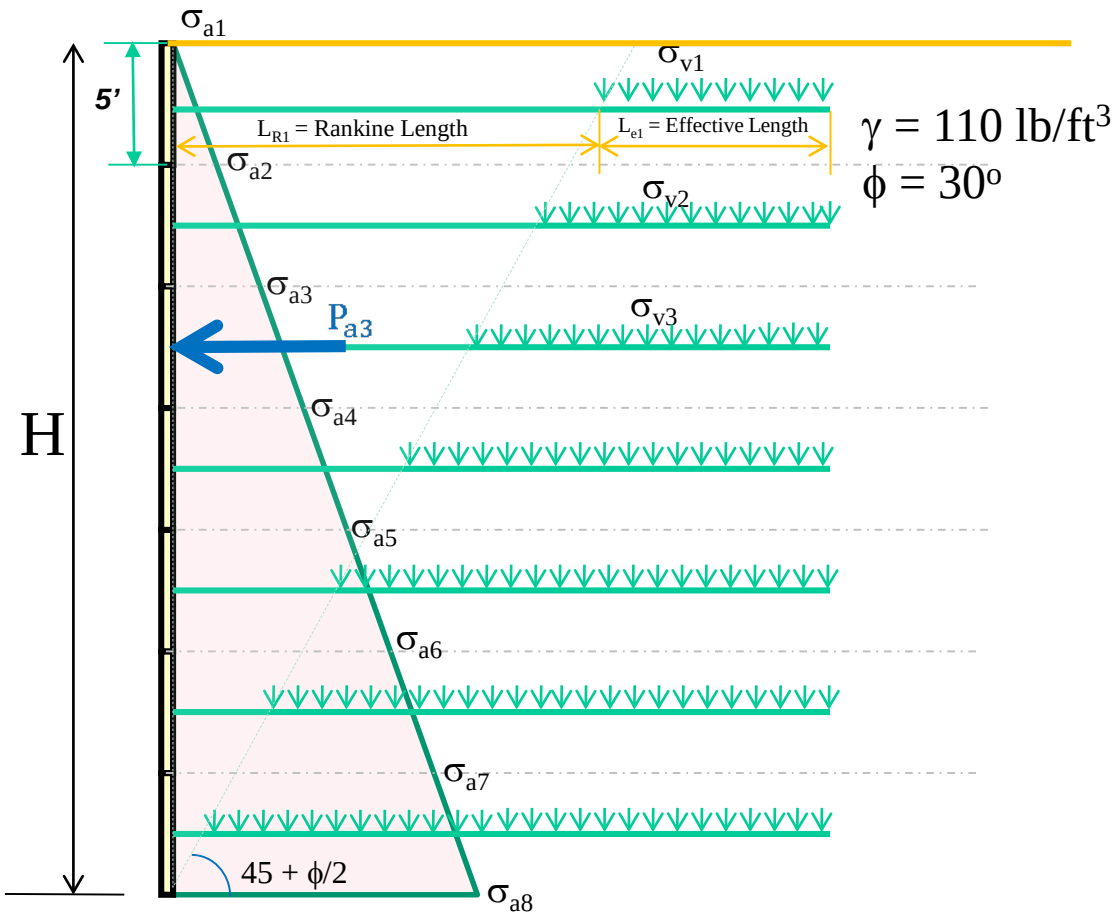
Example:

A reinforced earth retaining wall is to be **30 ft high**. The properties of the backfill material are $\gamma = 110$ lb/ft^3 and $\varphi = 30^o$. Galvanized steel ties are to be used for the construction of the wall. Design the Reinforcements with $FS_{(B)} = 3$, $FS_{(p)} = 3$, $f_y = 29{,}000$ psi and $\varphi_{tie} = 20^o$. The properties of the in-situ soil below the retaining wall are $\gamma = 120$ lb/ft^3, $\varphi = 30^o$, and c = 150 lb/ft^2. Design the panels and the ties of the wall.





Solution:

$$k_a = \frac{1-sin\emptyset}{1+sin\ \emptyset} = \frac{1-sin30}{1+sin\ 30} = 0.33$$

Point	Tie	Depth (ft)	Vertical Stress (σ_V) lb/ft^2	Horizontal Stress (σ_a) lb/ft^2	σ_a . S_v. S_H	σ_v . tanϕ_m	L_e	L_R	L_{total}	$t = s_a$. S_v. $S_{H/w.fy}$
1		0	0	0						
	Tie 1	2.5	275	90.75	2268.75	100.09	102.0	47.63	150	0.058675
2		5	550	181.5						
	Tie 2	7.5	825	272.25	6806.25	300.28	102.0	38.97	141	0.176024
3		10	1100	363						
	Tie 3	12.5	1375	453.75	11343.75	500.46	102.0	30.31	132	0.293373
4		15	1650	544.5						
	Tie 4	17.5	1925	635.25	15881.25	700.64	102.0	21.65	124	0.410722
5		20	2200	726						
	Tie 5	22.5	2475	816.75	20418.75	900.83	102.0	12.99	115	0.528071
6		25	2750	907.5						
	Tie 6	27.5	3025	998.25	24956.25	1101.01	102.0	4.33	106	0.645420
7		30	3300	1089						