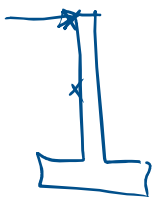
$\underline{K}$: Lateral earth pressure factor

① K_o : at rest (no movent allawed in Wall)

$$K_o = 1 - \sin\phi$$

ϕ : angle friction



② K_a : active earth pressurm

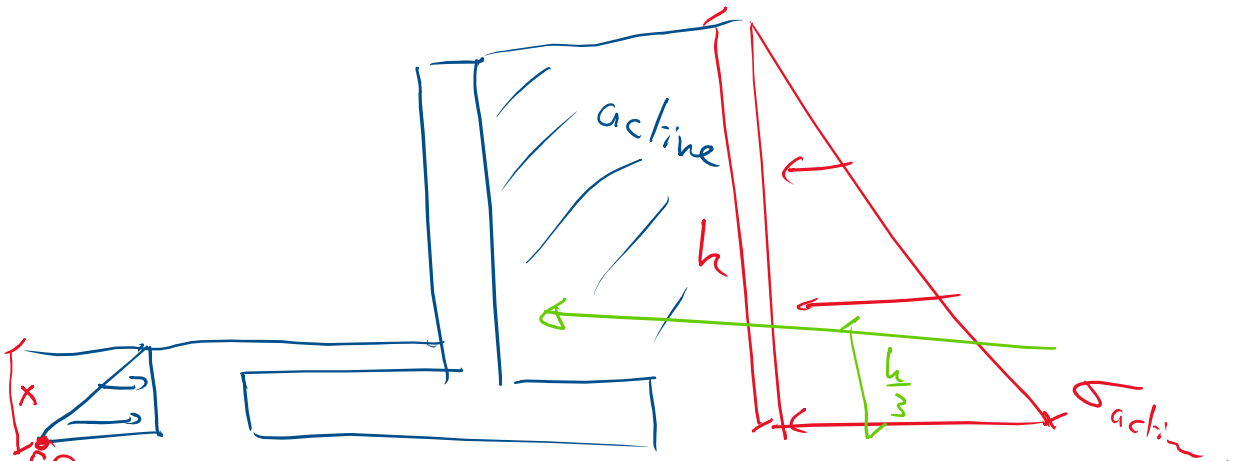
$$K_a = \frac{1 - \sin\phi}{1 + \sin\phi}$$

③ K_p : passive earth pressurm.

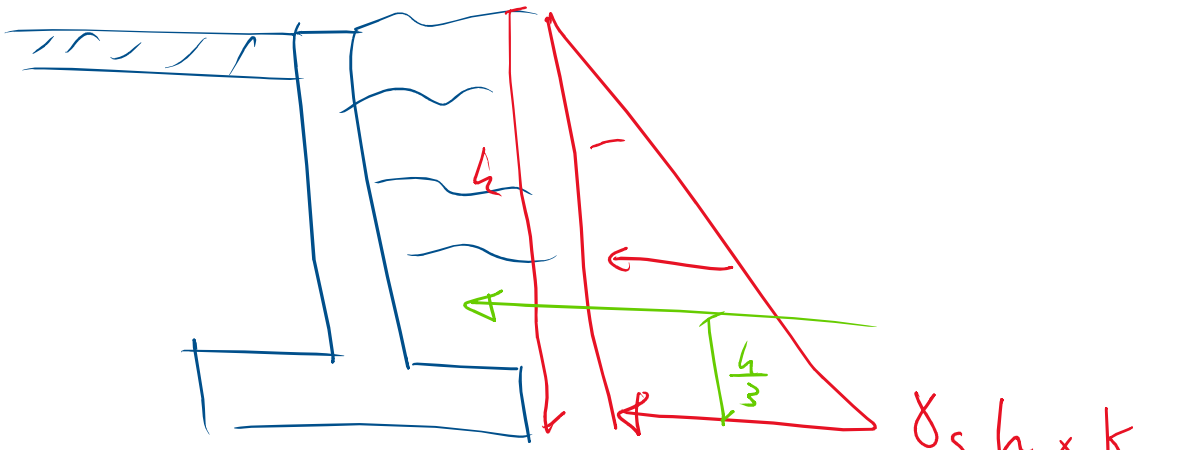
$$K_p = \frac{1}{K_a} = \frac{1 + \sin\phi}{1 - \sin\phi}$$

$$K_p > K_a$$

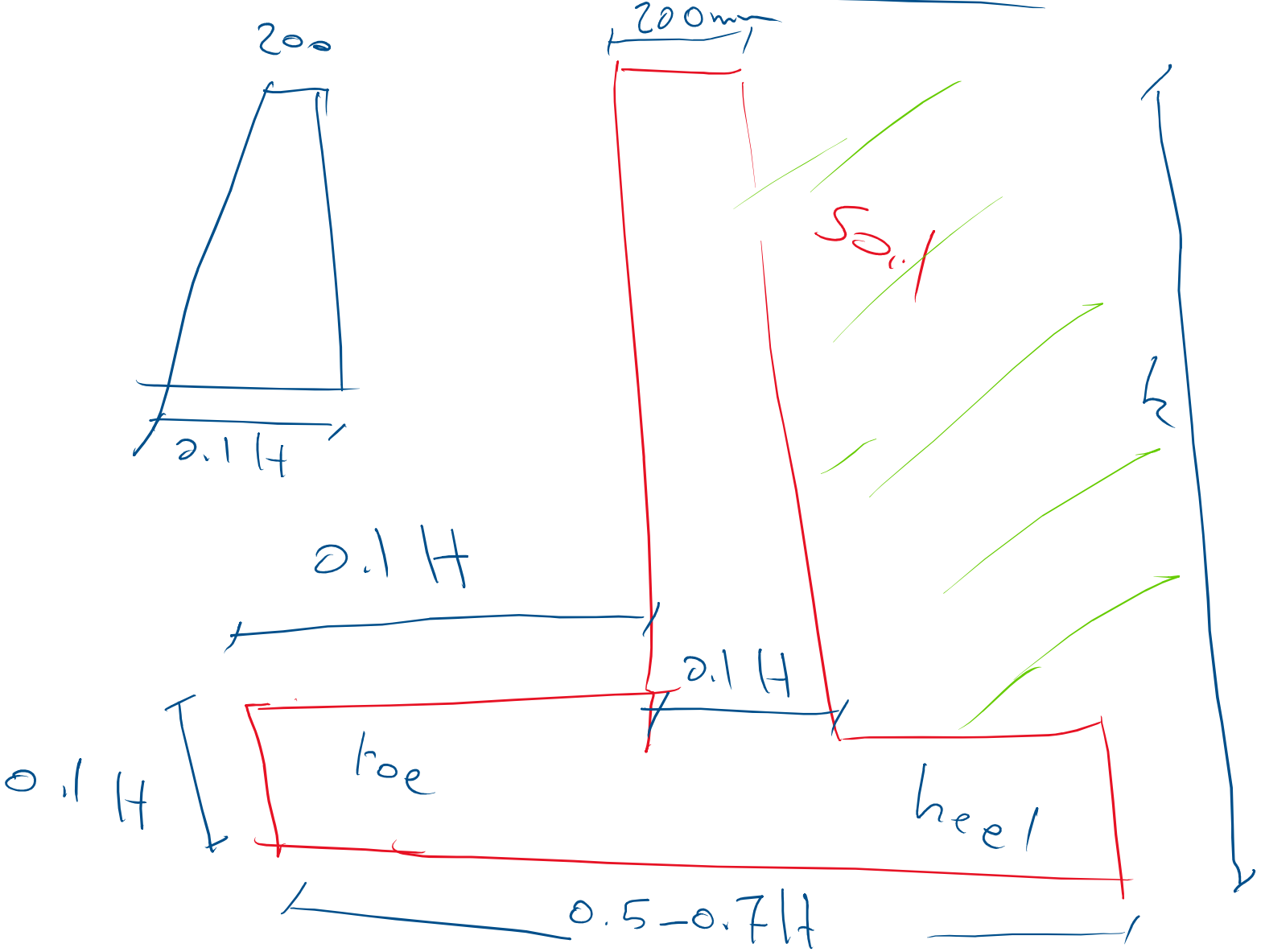
for Cantiliver RW



For basement Wall



Preliminary Dimension of Cantilever RW



Example Cantilever RW

Check and Design the Retaining Wall Shown Below assuming.

$\phi = 30^\circ$ $\quad \gamma_s = 18\ kN/m^3$

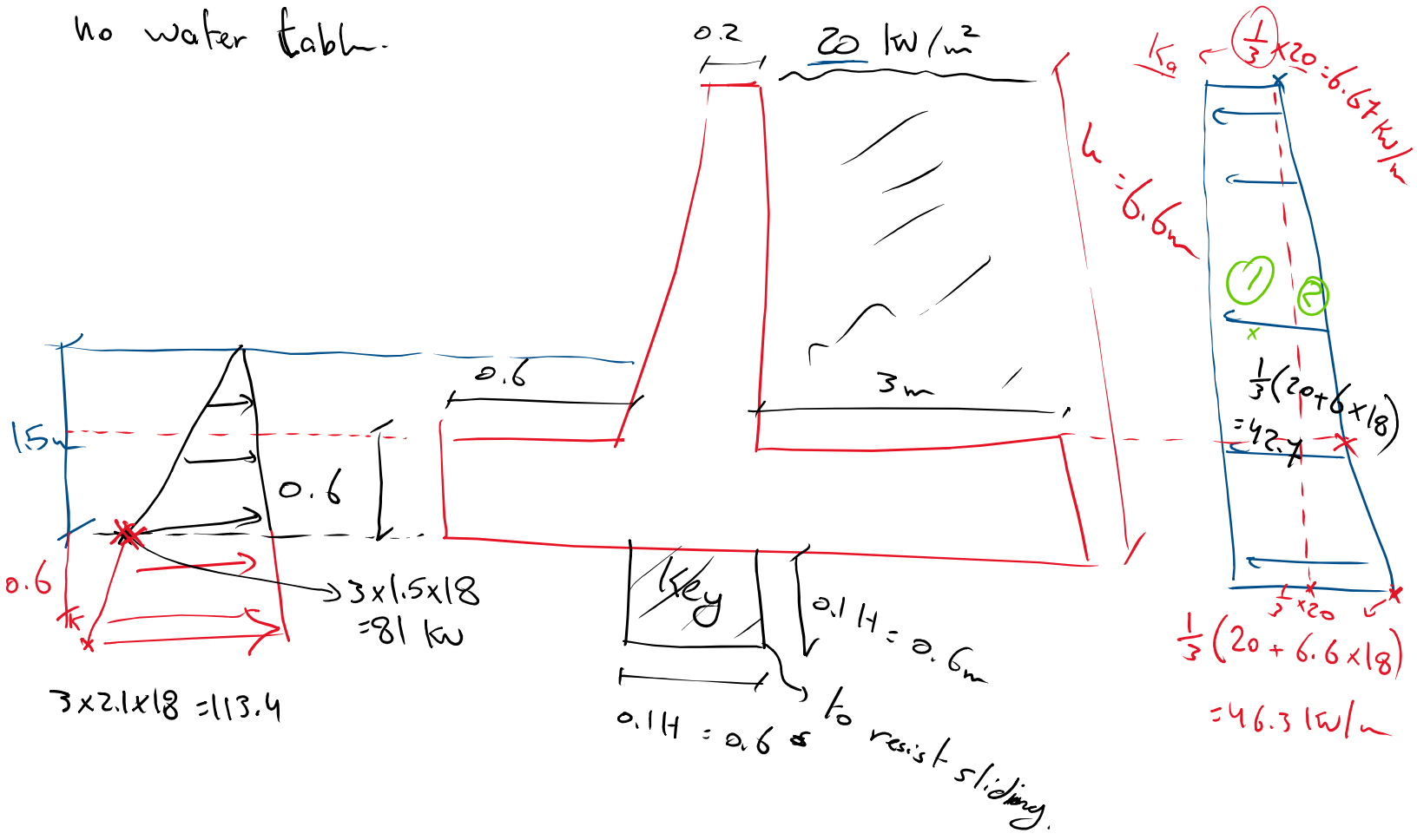
$f'_c = 25\ MPa$. $\quad$ F.S over turning : 2.5 at least

F.S sliding : 2.

$\mu = 0.5$ friction factor Between Wall and Soil (0.3–0.7) larger is Better

$q_{all} = 250\ kN/m^2$

no water table.



Solu

$$K_a = \frac{1-\sin 30}{1+\sin 30} = \frac{1}{3} \quad , \quad K_p = \frac{1}{K_a} = 3$$

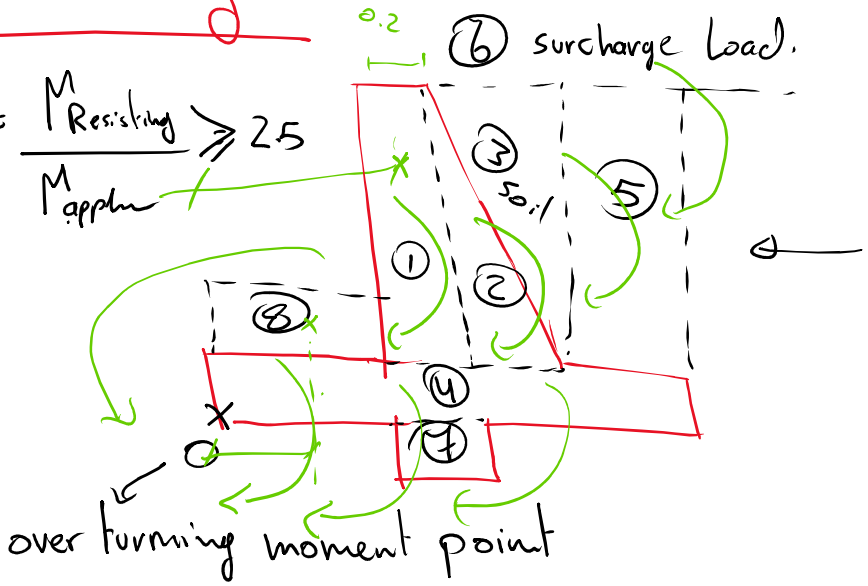
→ stability → ① over turning ✓
② sliding ✓
③ Bearing ✓

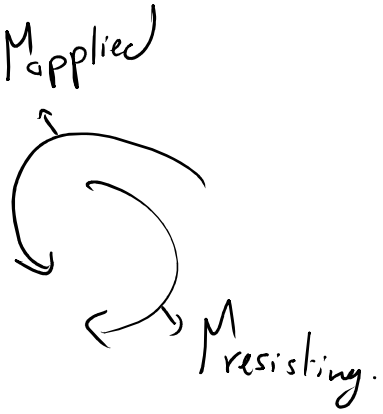
ok

→ strength → ① moment
② shear

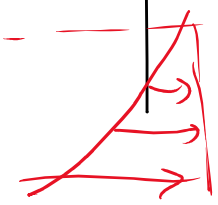
over turning

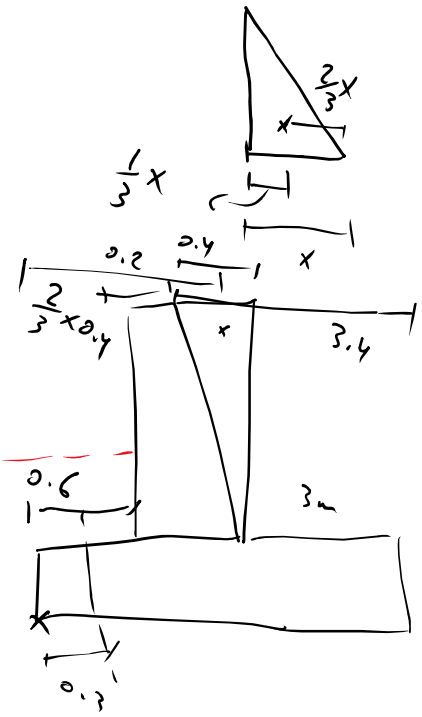
$$F.S = \frac{M_{Resisting}}{M_{applied}} \geq 2.5$$





Part	weight (KN/m) (W)	arm (m)	resist moment W x arm
①	$0.2 \times 6 \times \frac{1}{2} \times 25 = 30$	$0.6 + \frac{0.2}{2} = 0.7$	21 kN.m/m
②	$\frac{1}{2} \times 0.4 \times 6 \times 25 = 30$	$0.8 + \frac{0.4}{3} = 0.93$	28
③	$\frac{1}{2} \times 0.4 \times 6 \times 18 = 21.6$	$0.8 + \frac{2}{3}(0.4) = 1.07$	23
④	$0.6 \times 4.2 \times 25 = 63$	$\frac{4.2}{2} = 2.1$	132.2
⑤	$3 \times 6 \times 18 = 324$	$1.2 + \frac{3}{2} = 2.7$	874.8
⑥	$3.4 \times 20 = 68$	$0.8 + \frac{3.4}{2} = 2.5$	170
⑦	$0.6 \times 0.6 \times 25 = 9$	$0.6 + \frac{0.6}{2} = 0.9$	8.1
⑧	$0.9 \times 0.6 \times 18 = 10$	0.3	3
	total = 556 kN/m		$M_R = 1260$ kN.m/m





Resisting moment $= 1260 + \frac{81 \times 1.5}{2} \times \left(\frac{1.5}{3}\right) = 1290$ kN.m/m

Over turning moment : $M_{ov} = (6.67) \times 6.6 \times \frac{6.6}{2} + (46.3 - 6.67)\left(\frac{6.6}{2}\right)\left(\frac{6.6}{3}\right)$

$= 433$ kN.

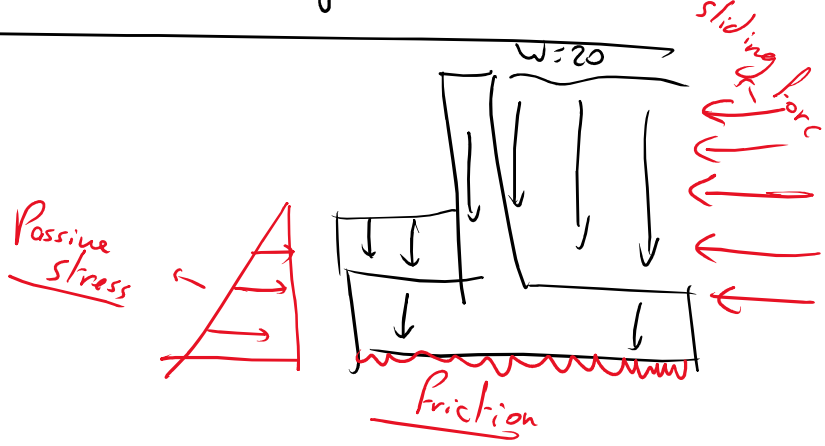
$$F.S = \frac{M_R}{M_{OV}} = \frac{1290}{433} = 2.9 > 2.5 \text{ ok}$$

→ can use 1.5 F.S instead.

if F.S Fails in O.T → increase heel length.

Sliding

F.S $\geq$ 2.0 ok ?



$P_{sliding} = \underline{6.67 \times 6.6} + (46.3 - 6.67) \times \frac{6.6}{2} = 174.4 \text{ kN/m}$

$P_{resistant} = \underbrace{\frac{1}{2}(113.4) \times 2.1}_{\text{Passive. force}} + \underbrace{556(0.5)}_{\text{Friction}} = 397 \text{ kN/m}$

$F.S_{sliding} = \frac{P_{resistant}}{P_{sliding}} = \frac{397}{174.4} = 2.2 > 2$ ok

if $F.S_{sliding}$ fails
- ① increase key Depth → increase passive force.
- ② increase footing width → increase friction.