N, V Strip Load: Normal and Tangential Stresses in a Nearby Vertical Plane

$q_v(x) := 2.5 \cdot \frac{kgf}{cm^2}$ vertical pressure, defined along transversal x

In this case the service level load is constant per unit surface

$q_h(x) := 0.5 \cdot \frac{kgf}{cm^2}$ horizontal stress action at interface

$m_a(x) := 0 \cdot \frac{m \cdot ton}{cm^2}$ we don't consider infinitesimal moments being applied. Don't enter any value or will cause the calculation below to be wrong..

$b_s := 2 \cdot m$ width of the loaded strip

We take origin of coordinates amidst the length of the transversal cut to loaded strip

Below the formulation of the stresses at any point, a mere port of the formulation above by substituting the line load by surface load multiplied by dx along transverse section, then integration. In the integral the fact of being zero is already accounted for.

$$A(x,y) := \begin{bmatrix} \cos\left(\operatorname{atan}\left(\frac{x}{y}\right)\right)^2 & \sin\left(\operatorname{atan}\left(\frac{x}{y}\right)\right)^2 & 2\cdot\sin\left(\operatorname{atan}\left(\frac{x}{y}\right)\right)\cdot\cos\left(\operatorname{atan}\left(\frac{x}{y}\right)\right) \\ \sin\left(\operatorname{atan}\left(\frac{x}{y}\right)\right)^2 & \cos\left(\operatorname{atan}\left(\frac{x}{y}\right)\right)^2 & -2\cdot\sin\left(\operatorname{atan}\left(\frac{x}{y}\right)\right)\cdot\cos\left(\operatorname{atan}\left(\frac{x}{y}\right)\right) \\ -\left(\sin\left(\operatorname{atan}\left(\frac{x}{y}\right)\right)\cdot\cos\left(\operatorname{atan}\left(\frac{x}{y}\right)\right)\right) & \sin\left(\operatorname{atan}\left(\frac{x}{y}\right)\right)\cdot\cos\left(\operatorname{atan}\left(\frac{x}{y}\right)\right) & \cos\left(\operatorname{atan}\left(\frac{x}{y}\right)\right)^2 - \sin\left(\operatorname{atan}\left(\frac{x}{y}\right)\right)^2 \end{bmatrix}$$

$$\sigma_x(X,Y) := \int_{-\frac{b_s}{2}}^{\frac{b_s}{2}} -\frac{\sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)^2\cdot\left(\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)^2 - \sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)^2\right) - 2\cdot\sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)\cdot\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)\cdot\left(\sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)\cdot\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)\right)}{\left|A(X+x,Y)\right|}\cdot\left[\frac{2\cdot q_v(x)\cdot\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)}{\pi\cdot\sqrt{(X+x)^2+Y^2}} + \frac{2\cdot q_h(x)\cdot\sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)}{\pi\cdot\sqrt{(X+x)^2+Y^2}}\right] dx$$

$$\sigma_y(X,Y) := \int_{-\frac{b_s}{2}}^{\frac{b_s}{2}} \frac{\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)^2\cdot\left(\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)^2 - \sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)^2\right) - 2\cdot\sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)\cdot\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)\cdot\left[-\left(\sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)\cdot\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)\right)\right]}{\left|A(X+x,Y)\right|}\cdot\left[\frac{2\cdot q_v(x)\cdot\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)}{\pi\cdot\sqrt{(X+x)^2+Y^2}} + \frac{2\cdot q_h(x)\cdot\sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)}{\pi\cdot\sqrt{(X+x)^2+Y^2}}\right] dx$$

$$\tau_{xy}(X,Y) := \int_{-\frac{b_s}{2}}^{\frac{b_s}{2}} -\frac{\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)^2\cdot\left(\sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)\cdot\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)\right) - \sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)^2\cdot\left[-\left(\sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)\cdot\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)\right)\right]}{\left|A(X+x,Y)\right|}\cdot\left[\frac{2\cdot q_v(x)\cdot\cos\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)}{\pi\cdot\sqrt{(X+x)^2+Y^2}} + \frac{2\cdot q_h(x)\cdot\sin\left(\operatorname{atan}\left(\frac{X+x}{Y}\right)\right)}{\pi\cdot\sqrt{(X+x)^2+Y^2}}\right] dx$$

$N_{partsx} := 20$ $H_0 := 9 \cdot m$

$i := 1 .. N_{partsx} + 1$

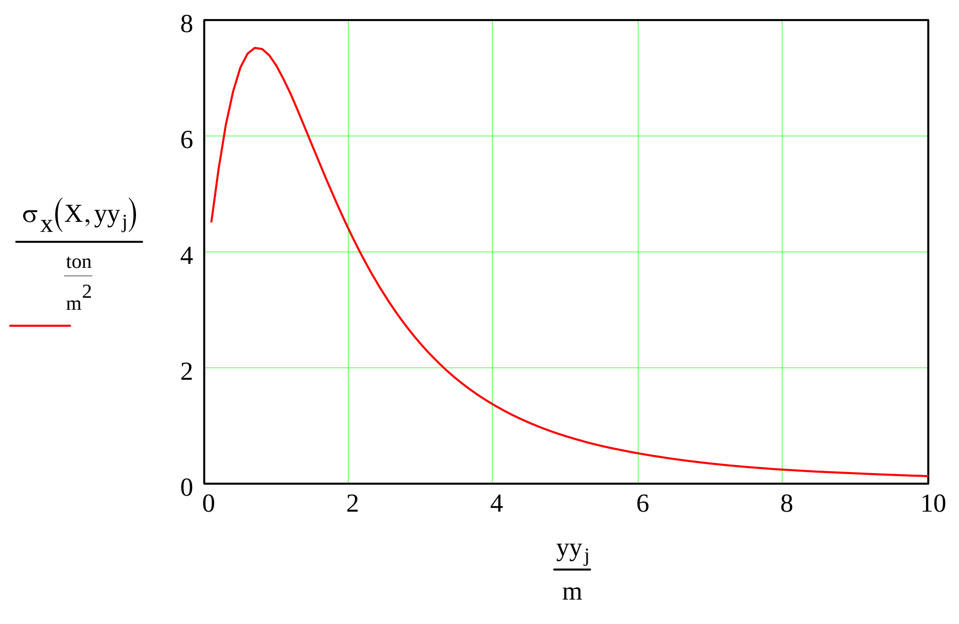
Another application is to find what effect the strip load causes in the backplane of a close earth-wall.
I say earth-wall because without the ties unto the anchorage zone it is unclear how the horizontal (unaltered state) natural shear contention can be mimicked near the backplane (cut) interface.
For the earth-walls, then, and no other walls, the laws of horizontal pressure and shear along the interface can be useful for calculation.

$X := 2m$ the abscissa of the earth-wall backplane, then at 1 meter of our example strip footing edge

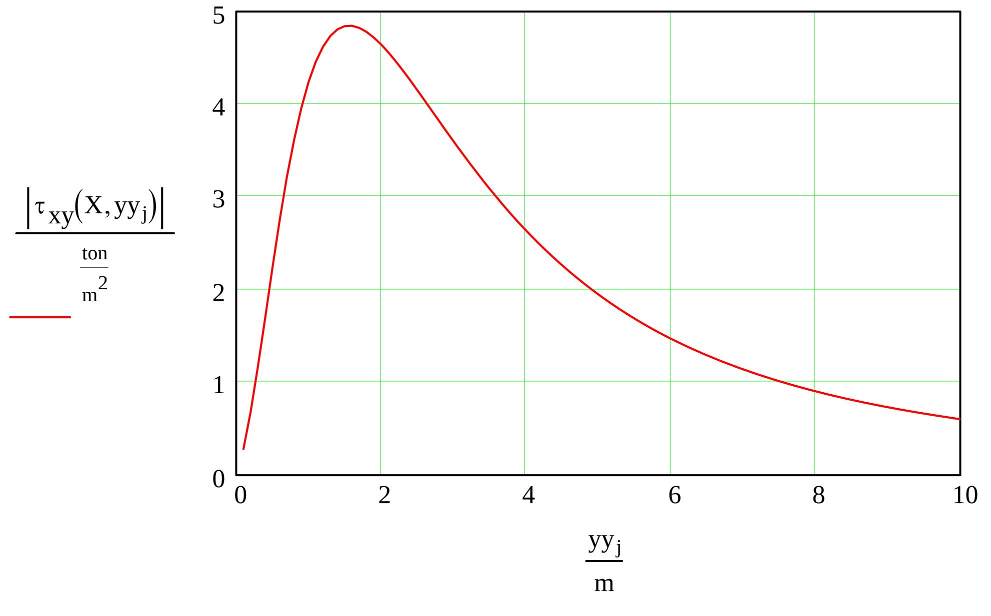
$N_{partsy} := 100$ $j := 1 .. N_{partsy} + 1$

$$yy_j := 0 \cdot m + \frac{1 \cdot m + H_0}{N_{partsy}} \cdot (j - 1)$$

Pressure in the backplane



Vertical shearing force in the earth-wall backplane interface



So to dimension an earth-wall supporting a paralell strip footing, the following approach between others could be used
1. Compute active pressure due to critical wedge effects, including distributed load effects

2. Compute pressures due to strip footing as above
3. Determine stability and reinforcement scheme to meet the sum of points 1 and 2.

You see easily that in similar manner to shear friction anchorage concept, the shearing stresses paralell to the backwall plane must be met by the ties' system in more than the resultant horizontal push at each level.
Note from the importance of the stresses coming fom common bearing stresses the convenience of distancing somewhat footings from backplanes of earth-walls (and may be see the convenience of integral abutments)