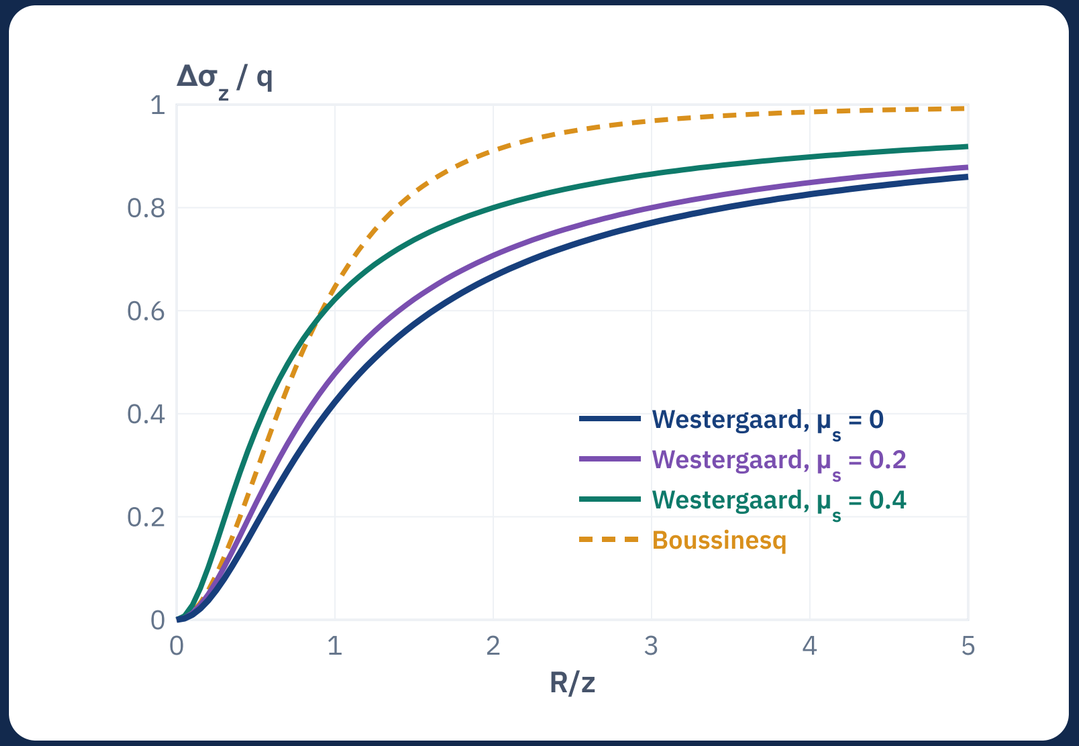
GeoTerva

Geotechnical lecture presentation · Stresses in the soil mass

Westergaard: stress under an area load

Lecture: stress under a uniformly loaded circle and rectangle in a Westergaard medium; the circle center and the rectangle corner are solved by hand.

Westergaard medium | Center of the circle | Corner of the rectangle | Corner rectangles | Superposition



Introduction

What will we learn in this lecture?

Integration of the Westergaard point-load solution over a loaded area: two closed-form results

Below the **center of the circle**: $\Delta\sigma_z = q\,\{1 - \eta/[\eta^2 + (R/z)^2]^{1/2}\}$

Under **the corner of the rectangle**: $\Delta\sigma_z = q\,I_w$; for other points, the signed **four-corner rectangle**

Comparison of Westergaard and **Boussinesq** stresses; effect of Poisson's ratio μ_s

Superposition of several areas; variation with depth

LECTURE FLOW

Each topic is covered in **three steps**:

1 · **Theory**: formula and rationale

2 · **Problem statement**: given and required

3 · **Solution**: step by step, with numbers

Example: flexible circular area, R = 4 m, q = 300 kN/m²; at z = 4 m below the centre; in the soil between the plates $\mu_s = 0$.

Loaded areas in a Westergaard medium

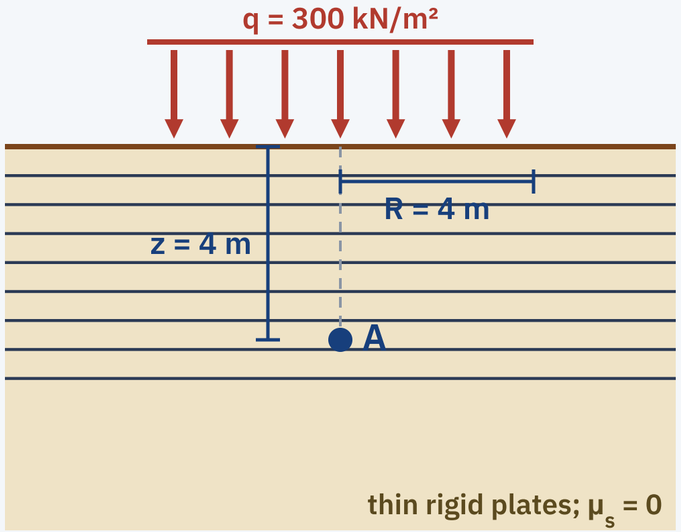
THEORY

The Westergaard point-load solution can be **integrated over a loaded area**, just as the Boussinesq solution was done for the circle and the rectangle

For a flexible and uniformly loaded area, **two closed-form results** are obtained: the stress below the **center of the circle** and below the **corner of the rectangle**

μ_s is the Poisson's ratio of the soil between rigid layers; for $\mu_s = 0$, $\eta = 1/\sqrt{2}$

$$\eta = \sqrt{\frac{1 - 2\mu_s}{2 - 2\mu_s}}$$



Under the center

THEORY

Under the center of a flexible circular area of radius **R** with uniformly distributed load:

$$\Delta\sigma_z = q\left\{1 - \frac{\eta}{[\eta^2 + (R/z)^2]^{1/2}}\right\}$$

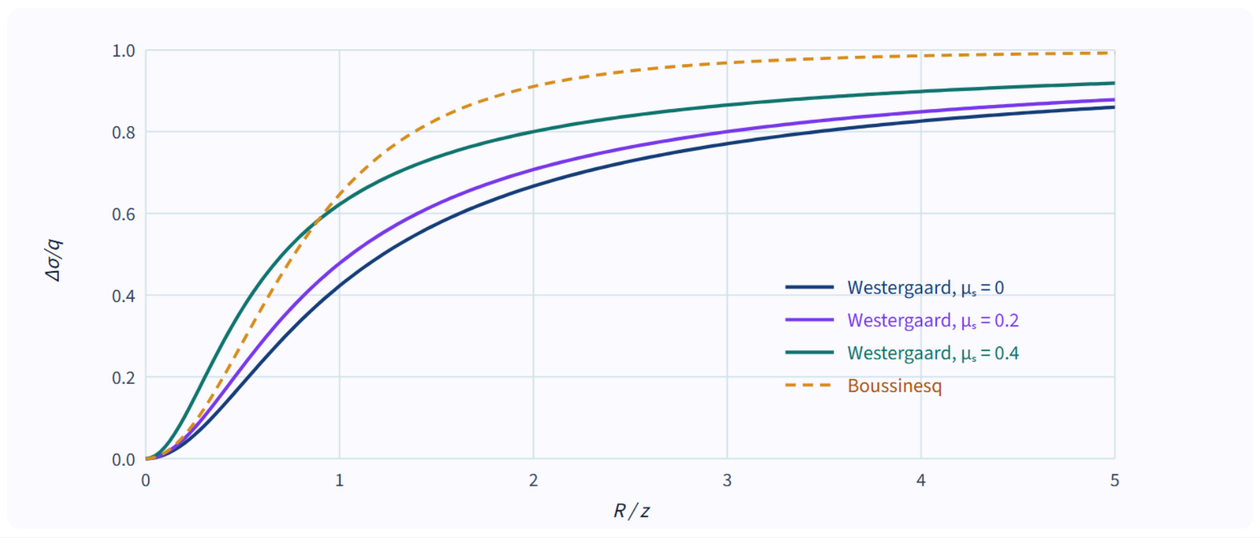
The relation is obtained from the point load solution: the element **r dr dα** carries the load **q r dr dα**; the integral over r with the influence value $\mathbf{I_5}$ of the point load is taken in terms of elementary functions

$$\Delta\sigma_z = q\int_0^R \frac{r\,dr}{\eta^2 z^2}\left[\left(\frac{r}{\eta z}\right)^2 + 1\right]^{-3/2} = q\left\{1 - \left[\left(\frac{R}{\eta z}\right)^2 + 1\right]^{-1/2}\right\}$$

Variation of $\Delta\sigma_z/q$ with R/z

THEORY

R/z	0.25	0.5	0.75	1	1.25	1.5	2	2.5	3	4	5	10
Westergaard ($\mu_s = 0$)	0.0572	0.1835	0.3140	0.4226	0.5076	0.5736	0.6667	0.7278	0.7706	0.8259	0.8600	0.9295
Boussinesq	0.0869	0.2845	0.4880	0.6464	0.7562	0.8293	0.9106	0.9488	0.9684	0.9857	0.9925	0.9990



Under the corner: I_w

THEORY

Beneath the corner of a flexible rectangle of dimensions **B × L** with a uniformly distributed load, where **m = B/z** and **n = L/z**:

$$\Delta\sigma_z = \frac{q}{2\pi}\left[\cot^{-1}\sqrt{\eta^2\left(\frac{1}{m^2}+\frac{1}{n^2}\right)+\eta^4\left(\frac{1}{m^2 n^2}\right)}\right] = q\,I_w$$

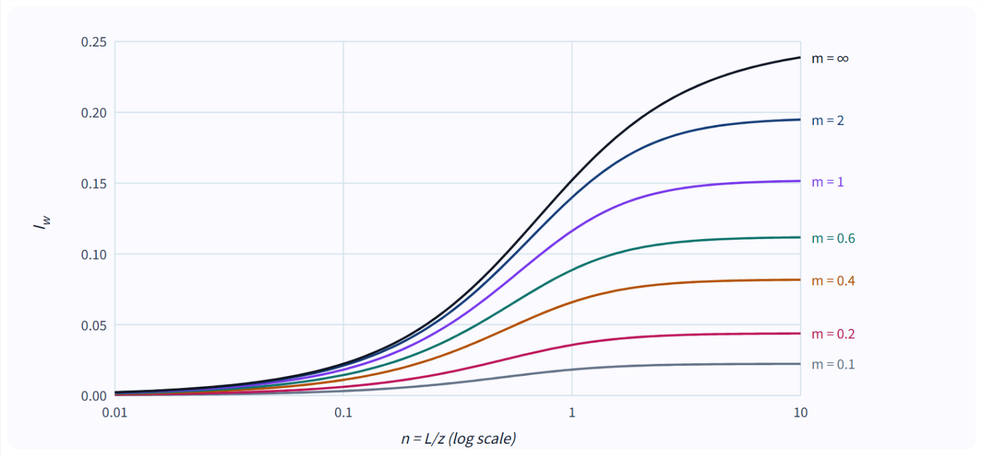
For all other points, as in the Boussinesq rectangle, a **signed four-corner rectangle** is used; the module performs this operation

$$\Delta\sigma_z = q\,\left[\pm I_w(m_1,n_1) \pm I_w(m_2,n_2) \pm I_w(m_3,n_3) \pm I_w(m_4,n_4)\right]$$

I_w values ($\mu_s = 0$)

THEORY

m	n = 0.1	n = 0.4	n = 1	n = 2	n = 5	n = 10
0.1	0.0031	0.0110	0.0182	0.0211	0.0221	0.0223
0.2	0.0061	0.0214	0.0357	0.0413	0.0434	0.0438
0.5	0.0129	0.0459	0.0781	0.0916	0.0969	0.0977
1	0.0182	0.0658	0.1161	0.1398	0.1498	0.1515
2	0.0211	0.0768	0.1398	0.1743	0.1916	0.1948
10	0.0223	0.0817	0.1515	0.1948	0.2250	0.2341



Polar integral for the circle

THEORY

There is no closed-form relation for points outside the center of the circle: the module integrates the Westergaard point-load solution over the circle **in polar coordinates** relative to the point beneath point A

Along each ray the radial integral is closed-form; only the angular integral is numerical. At the centre (r = 0) this result reduces to the closed-form expression above

$$\frac{\Delta\sigma_z}{q} = \frac{1}{2\pi}\oint \left[G(\rho_1) - G(\rho_2)\right] d\varphi \qquad G(\rho) = \left[\left(\frac{\rho}{\eta z}\right)^2 + 1\right]^{-1/2}$$

Superposition

THEORY

Circles and rectangles can be entered, each defined by its own **q** value, size and center on the ground (at most eight); the two areas may touch but must not overlap

Since the Westergaard medium is **elastic**, the stress of each area is found from its own distance to point A and the stresses are **summed**; the Boussinesq comparison value is summed in the same way

$$\Delta\sigma_z = \sum_k \Delta\sigma_{z(k)} \qquad \Delta\sigma_{z(k)} = q_k \left\{ 1 - \frac{\eta}{\sqrt{\eta^2 + (R_k/z)^2}} \right\} \text{ or } \; q_k \sum \pm I_w$$

Problem statement

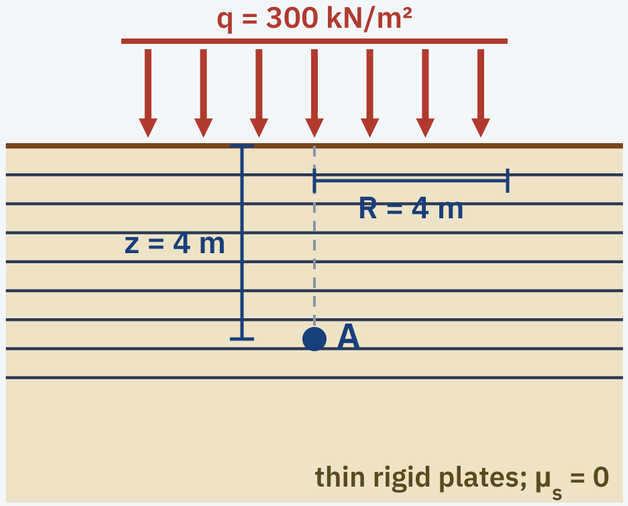
EXAMPLE

Given

Load	**flexible, uniformly distributed circular area: $q = 300$ kN/m², $R = 4$ m**
Point A	**below the center of the circle, $z = 4$ m**
Soil	**between plates $\mu_s = 0$**

REQUIRED

η, R/z, $\Delta\sigma_z/q$, $\Delta\sigma_z$ and comparison with the Boussinesq stress.



Solution (1/2)

SOLUTION

1 Westergaard constant η

$$\eta = \sqrt{\frac{1-2\mu_s}{2-2\mu_s}} = \sqrt{\frac{1}{2}} = \mathbf{0.7071} \qquad \eta^2 = 0.5000$$

2 Ratio and stress

$$\frac{R}{z} = \frac{4}{4} = 1 \qquad \sqrt{\eta^2 + (R/z)^2} = \sqrt{0.5000 + 1} = 1.2247$$

$$\frac{\Delta\sigma_z}{q} = 1 - \frac{\eta}{\sqrt{\eta^2 + (R/z)^2}} = 1 - \frac{0.7071}{1.2247} = \mathbf{0.4226}$$

$$\Delta\sigma_z = q\,\frac{\Delta\sigma_z}{q} = 300\,(0.4226) = \mathbf{126.79}\ \mathrm{kN/m^2}$$

Westergaard stress is found as **126.79 kN/m²** (42.3% of q).

Solution (2/2)

SOLUTION

4 Boussinesq (comparison)

$$\frac{\Delta\sigma_z}{q} = 1 - \frac{1}{\left[(R/z)^2 + 1\right]^{3/2}} = 1 - \frac{1}{2^{3/2}} = \mathbf{0.6464}$$

$$\Delta\sigma_{z,B} = 300\,(0.6464) = \mathbf{193.93}\ \mathrm{kN/m^2} \qquad \frac{\Delta\sigma_z}{\Delta\sigma_{z,B}} = \frac{126.79}{193.93} = 0.654$$

Westergaard **126.79 kN/m²**, Boussinesq **193.93 kN/m²**: because rigid plates spread the load sideways, the Westergaard stress under the centre is only **65.4%** of the Boussinesq stress.

Check the solution in GeoTerva ↗

Problem statement

EXAMPLE

Given

Load	**circle** $R = 4$ **m,** $q = 300$ **kN/m²,** $\mu_s = 0$
Depths	$z = 0.4;\ 2;\ 4;\ 6;\ 8;\ 10;\ 12$ **m (**$z/R = 0.1 \ldots 3$**)**

REQUIRED

At every depth **$\Delta\sigma_z/q$**, Westergaard and Boussinesq stresses; hand check for z = 2 m and 12 m.

Solution (1/2)

SOLUTION

z (m)	z/R	R/z	$\Delta\sigma_z/q$	$\Delta\sigma_z$ Westergaard	$\Delta\sigma_z$ Boussinesq	Ratio W/B
0.4	0.1	10.00	0.9295	**278.84**	299.70	0.930
2	0.5	2.00	0.6667	**200.00**	273.17	0.732
4	1.0	1.00	0.4226	**126.79**	193.93	0.654
6	1.5	0.67	0.2724	**81.72**	127.19	0.642
8	2.0	0.50	0.1835	**55.05**	85.34	0.645
10	2.5	0.40	0.1296	**38.88**	59.88	0.649
12	3.0	0.33	0.0955	**28.64**	43.86	0.653

The Westergaard stress is smaller than the Boussinesq stress at every depth (z = 4 m: 126.79 and 193.93 kN/m²; z = 12 m: 28.64 and 43.86 kN/m²). The ratio starts at 0.930 near the surface, becomes 0.654 at z = 4 m, and remains around 0.65 at depth.

Solution (2/2)

SOLUTION

1 z = 2 m (R/z = 2)

$$\frac{\Delta\sigma_z}{q} = 1 - \frac{0.7071}{\sqrt{0.5000 + 4}} = 1 - \frac{0.7071}{2.1213} = \mathbf{0.6667}$$

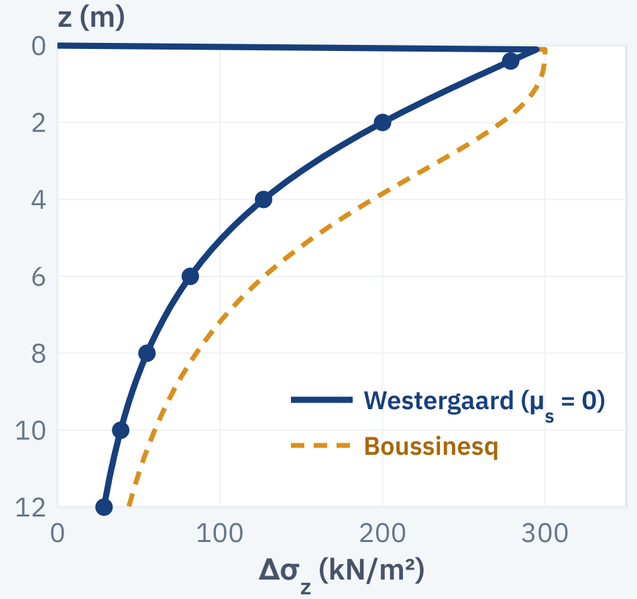
$$\Delta\sigma_z = 300\,(0.6667) = \mathbf{200.00}\ \mathrm{kN/m^2}$$

2 z = 12 m (R/z = 1/3)

$$\frac{\Delta\sigma_z}{q} = 1 - \frac{0.7071}{\sqrt{0.5000 + 0.1111}} = 1 - \frac{0.7071}{0.7817} = \mathbf{0.0955}$$

$$\Delta\sigma_z = 300\,(0.0955) = \mathbf{28.64}\ \mathrm{kN/m^2}$$

At z = 2 m the stress is exactly **2q/3 = 200.00 kN/m²** (Boussinesq: 273.17); at z = 12 m it is **28.64 kN/m²** (Boussinesq: 43.86).



Check the solution in GeoTerva ↗

Problem statement

EXAMPLE

Given

Load and point	**circle $R = 4$ m, $q = 300$ kN/m², below the center $z = 4$ m**
Varying	$\mu_s = 0;\ 0.1;\ 0.2;\ 0.3;\ 0.4;\ 0.49$

REQUIRED

For each μ_s, **η**, **$\Delta\sigma_z/q$**, **$\Delta\sigma_z$** and the ratio to Boussinesq; by hand for μ_s = 0.2 and 0.4.

Solution (1/2)

SOLUTION

μ_s	η	$\Delta\sigma_z/q$	$\Delta\sigma_z$ Westergaard	$\Delta\sigma_z$ / Boussinesq
0.00	0.7071	0.4226	**126.79**	0.654
0.10	0.6667	0.4453	**133.59**	0.689
0.20	0.6124	0.4778	**143.33**	0.739
0.30	0.5345	0.5286	**158.58**	0.818
0.40	0.4082	0.6220	**186.61**	0.962
0.49	0.1400	0.8613	**258.40**	1.332

As μ_s increases, the Westergaard stress below the center **increases**: 126.79 at $\mu_s = 0$, 186.61 kN/m² at $\mu_s = 0.4$ (Boussinesq: 193.93). At $\mu_s = 0.49$ it **exceeds** the Boussinesq value with 258.40 kN/m².

Solution (2/2)

SOLUTION

1 μ_s = 0.2

$$\eta^2 = \frac{1 - 0.4}{2 - 0.4} = 0.3750\,, \quad \eta = 0.6124\,, \quad \sqrt{\eta^2 + 1} = 1.1726$$

$$\frac{\Delta\sigma_z}{q} = 1 - \frac{0.6124}{1.1726} = 0.4778 \;\Rightarrow\; \Delta\sigma_z = 300\,(0.4778) = \mathbf{143.33}\ \mathrm{kN/m^2}$$

2 μ_s = 0.4

$$\eta^2 = \frac{1 - 0.8}{2 - 0.8} = 0.1667\,, \quad \eta = 0.4082\,, \quad \sqrt{\eta^2 + 1} = 1.0801$$

$$\frac{\Delta\sigma_z}{q} = 1 - \frac{0.4082}{1.0801} = 0.6220 \;\Rightarrow\; \Delta\sigma_z = 300\,(0.6220) = \mathbf{186.61}\ \mathrm{kN/m^2}$$

As η decreases, the stress increases: **143.33 → 186.61 kN/m²** (μ_s = 0.2 → 0.4).

Check the solution in GeoTerva ↗

Problem statement

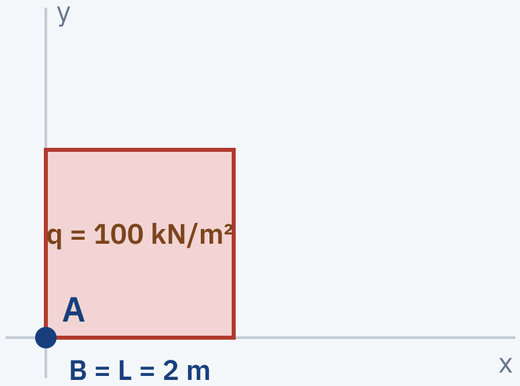
EXAMPLE

Given

Load	**flexible, uniformly distributed square: $B = L = 2$ m, $q = 100$ kN/m²**
Point A	**below one corner of the square, $z = 2$ m**
Soil	**between plates $\mu_s = 0$**

REQUIRED

m, **n**, **I_W**, **$\Delta\sigma_z$**; comparison with the Boussinesq value; the effect of μ_s.



Solution (1/2)

SOLUTION

1 m, n and η

$$m = \frac{B}{z} = \frac{2}{2} = 1\,, \quad n = \frac{L}{z} = 1\,, \quad \eta^2 = \frac{1}{2} = 0.5000$$

2 Influence value I_w

$$\sqrt{\eta^2\left(\frac{1}{m^2}+\frac{1}{n^2}\right)+\frac{\eta^4}{m^2n^2}} = \sqrt{0.5\,(2)+0.25} = \sqrt{1.25} = 1.1180$$

$$I_w = \frac{1}{2\pi}\cot^{-1}(1.1180) = \frac{0.7297}{2\pi} = \mathbf{0.1161}$$

At the corner of the square, at z = 2 m, **I_w = 0.1161** is found (table value on the page: $I_w(1; 1)$ = 0.1161).

Solution (2/2)

SOLUTION

3 Stress and Boussinesq

$$\Delta\sigma_z = q\, I_w = 100\,(0.1161) = \mathbf{11.61}\ \mathrm{kN/m^2}$$

$$\text{Boussinesq: } I_3(1;1) = 0.1752 \ \Rightarrow\ \Delta\sigma_{z,B} = \mathbf{17.52}\ \mathrm{kN/m^2}$$

μ_s	η	I_W (m = n = 1)	$\Delta\sigma_z = q\, I_W$ (kN/m²)	Boussinesq I_3	$\Delta\sigma_{z,B}$ (kN/m²)
0.0	0.7071	0.1161	**11.61**	0.1752	17.52
0.2	0.6124	0.1296	**12.96**	0.1752	17.52
0.3	0.5345	0.1418	**14.18**	0.1752	17.52
0.4	0.4082	0.1639	**16.39**	0.1752	17.52

Under the corner of the square, the Westergaard stress is **11.61 kN/m²** and the Boussinesq stress is 17.52 kN/m² (ratio 0.663). As μ_s increases, I_W grows: 0.1161 → 0.1639 (μ_s = 0 → 0.4); the Boussinesq value is I_3 = 0.1752.

Check the solution in GeoTerva ↗

Problem statement

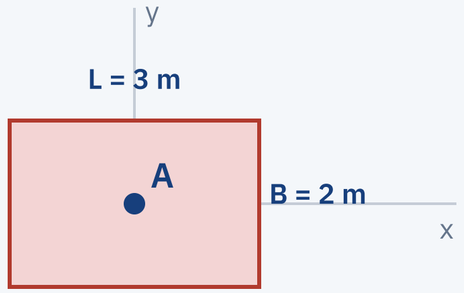
EXAMPLE

Given

Load	**flexible rectangle: $L = 3$ m (x direction), $B = 2$ m, $q = 300$ kN/m²**
Point A	**below the center, $z = 4$ m; $\mu_s = 0$**
Hint	**the centre is the common corner of four equal-corner rectangles**

REQUIRED

$\Delta\sigma_z$ by the four-corner rectangle method and the Boussinesq value; table of variation with depth.



Solution (1/2)

SOLUTION

1 Four equal corner rectangles (1.5 m × 1.0 m)

$$m = \frac{1.0}{4} = 0.2500\,, \quad n = \frac{1.5}{4} = 0.3750\,, \quad \eta^2 = 0.5000$$

2 I_W (for each corner rectangle)

$$\sqrt{\eta^2\left(\frac{1}{m^2}+\frac{1}{n^2}\right)+\frac{\eta^4}{m^2n^2}} = \sqrt{0.5\,(23.1111)+28.4444} = \sqrt{40} = 6.3246$$

$$I_w = \frac{1}{2\pi}\cot^{-1}(6.3246) = \frac{0.15682}{2\pi} = \mathbf{0.02496}$$

For each corner rectangle, **I_W = 0.02496** is obtained; the center is the common corner of the four equal corner rectangles.

Solution (2/2)

SOLUTION

3 Stress (4 corner rectangles) and Boussinesq

$$\Delta\sigma_z = 4\,q\,I_w = 4\,(300)\,(0.02496) = \mathbf{29.95}\ \mathrm{kN/m^2}$$

$$\Delta\sigma_{z,B} = 4\,q\,I_3(0.25;0.375) = 4\,(300)\,(0.03830) = 45.96\ \mathrm{kN/m^2}$$

4 Same method at every depth (m = 1.0/z, n = 1.5/z)

z (m)	1	2	4	6	8	12
$\Delta\sigma_z$ Westergaard (kN/m²)	**158.69**	**82.80**	**29.95**	**14.62**	**8.52**	**3.89**
$\Delta\sigma_z$ Boussinesq (kN/m²)	232.37	128.49	45.96	22.21	12.88	5.86
Ratio W/B	0.683	0.644	0.652	0.658	0.662	0.664

The Westergaard stress is smaller than the Boussinesq stress at every depth: 158.69 and 232.37 kN/m² at z = 1 m, 3.89 and 5.86 kN/m² at z = 12 m. The ratio remains between 0.644 and 0.683 over the range z = 1–12 m.

Check the solution in GeoTerva ↗

Problem statement

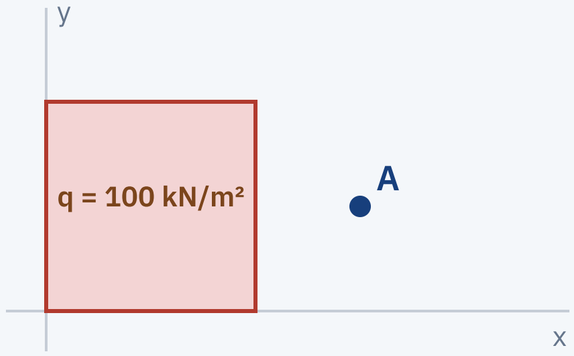
EXAMPLE

Given

Load	**flexible square $[0;\ 2] \times [0;\ 2]$ m, $q = 100$ kN/m²**
Point A	**$x = 3$ m, $y = 1$ m (1 m outside from the edge), $z = 2$ m**
Soil	**between plates $\mu_s = 0$**

REQUIRED

Using the marked **four-corner rectangle**, **$\Delta\sigma_z$**; comparison with the Boussinesq value.



Solution

SOLUTION

1 Distances from A to the corners a = $x_{corner} - x_A$, b = $y_{corner} - y_A$; four-corner rectangle

Corner rectangle	(a ; b) (m)	m = |a|/z	n = |b|/z	I_w	Sign
1	(−1 ; 1)	0.50	0.50	0.05409	−
2	(−3 ; 1)	1.50	0.50	0.08745	+
3	(−1 ; −1)	0.50	0.50	0.05409	−
4	(−3 ; −1)	1.50	0.50	0.08745	+

2 Total

$$\Delta\sigma_z = q\,[-I_w(0.5;0.5) + I_w(1.5;0.5) - I_w(0.5;0.5) + I_w(1.5;0.5)]$$

$$= 2q\,[0.08745 - 0.05409] = 200\,(0.03336) = \mathbf{6.673}\ \mathrm{kN/m^2}$$

$$\Delta\sigma_{z,B} = 9.466\ \mathrm{kN/m^2}$$

Although point A lies outside the load, it receives a stress of **6.67 kN/m²**; the Boussinesq value is 9.47 kN/m². A single operation suffices: subtract the two 1 m × 1 m rectangles from the two 3 m × 1 m rectangles.

Check the solution in GeoTerva ↗

Problem statement

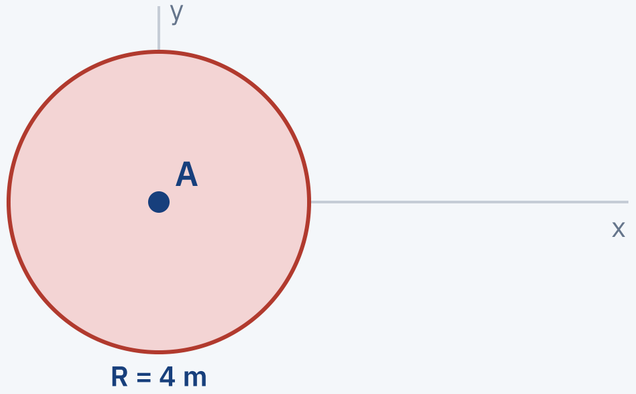
EXAMPLE

Given

Load	**circle** $R = 4$ **m,** $q = 300$ **kN/m²;** $\mu_s = 0$**,** $z = 4$ **m**
Point A	**horizontal distance from the center** $r = 0;\ 0.5R;\ R;\ 1.5R;\ 2R;\ 3R$

REQUIRED

Westergaard and Boussinesq stresses at each distance (the module's polar integral).



Solution

SOLUTION

r (m)	r/R	$\Delta\sigma_z$ Westergaard	$\Delta\sigma_z$ Boussinesq	Ratio W/B
0	0.0	**126.79**	193.93	0.654
2	0.5	**111.97**	168.67	0.664
4	1.0	**69.51**	99.67	0.697
6	1.5	**30.71**	37.99	0.808
8	2.0	**13.75**	12.54	1.096
12	3.0	**4.05**	1.87	2.163

At the center (r = 0), the value of the closed-form expression is found to be 126.79 kN/m². At the edge of the circle (r = R), 69.51 kN/m² (Boussinesq: 99.67); moving outward from the circle, the Westergaard stress decreases more slowly and **between r = 1.5R and 2R** rises above that of Boussinesq (r = 12 m: 4.05 and 1.87 kN/m²).

Check the solution in GeoTerva ↗

Problem statement

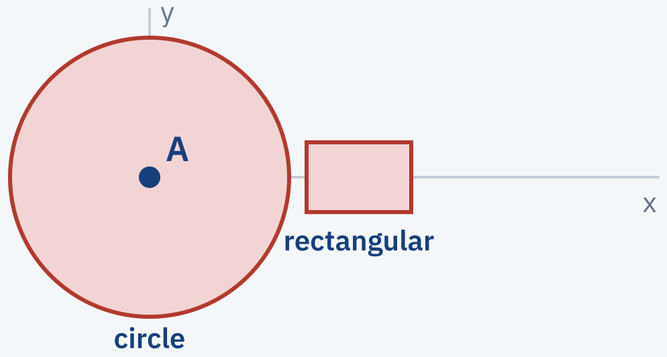
EXAMPLE

Given

Area 1	**circle** $R = 4$ **m,** $q = 300$ **kN/m², center** $(0;\ 0)$
Area 2	**rectangular** 3×2 **m (3 m in the** x **direction),** $q = 300$ **kN/m², center** $(6;\ 0)$
Point A	$x = 0$**,** $y = 0$**,** $z = 4$ **m;** $\mu_s = 0$ **(the areas do not overlap)**

REQUIRED

Contribution of each area, total stress and Boussinesq sum; depth table.



Solution (1/2)

SOLUTION

1 Area 1 (circle, below the center)

$$\Delta\sigma_{z(1)} = 300\left\{1 - \frac{\eta}{\sqrt{\eta^2 + (R/z)^2}}\right\} = 300\,(0.4226) = \mathbf{126.79}\ \mathrm{kN/m^2} \quad \text{(Example 1)}$$

2 Area 2 (rectangle; x = 4.5 and 7.5 m from A, y = ±1 m)

$$\Delta\sigma_{z(2)} = q\left[I_w\left(\tfrac{7.5}{4};\tfrac{1}{4}\right) - I_w\left(\tfrac{4.5}{4};\tfrac{1}{4}\right)\right] \times 2 = 600\,[0.05048 - 0.04553]$$

$$\Delta\sigma_{z(2)} = 600\,(0.00495) = \mathbf{2.97}\ \mathrm{kN/m^2} \qquad \Delta\sigma_{z(2),B} = 3.18$$

Because rectangle A is far from the point, its contribution is small: **2.97 kN/m²** (Boussinesq: 3.18). The contribution of the circle is 126.79 kN/m².

Solution (2/2)

SOLUTION

1 Stresses are summed (z = 4 m)

$$\Delta\sigma_z = \Delta\sigma_{z(1)} + \Delta\sigma_{z(2)} = 126.79 + 2.97 = \mathbf{129.76}\ \mathrm{kN/m^2}$$

$$\Delta\sigma_{z,B} = 193.93 + 3.18 = 197.11\ \mathrm{kN/m^2}$$

2 Depth profile below the same point

z (m)	2	4	6	8	12
Area 1 (circle)	200.00	126.79	81.72	55.05	28.64
Area 2 (rectangular)	1.91	2.97	3.18	2.95	2.17
Total Westergaard	**201.91**	**129.76**	**84.90**	**58.00**	**30.81**
Total Boussinesq	274.02	197.11	131.63	89.82	47.27

At point A the two areas together produce **129.76 kN/m²** (Boussinesq total: 197.11 kN/m²). The share of the side area increases with depth: at z = 12 m it is about 7.0% of the total.

Check the solution in GeoTerva ↗

Summary

Key points

Circle, center: $\Delta\sigma_z = q\,\{1 - \eta/[\eta^2 + (R/z)^2]^{1/2}\}$, $\eta = \sqrt{[(1 - 2\mu_s)/(2 - 2\mu_s)]}$; **rectangle, corner**: $\Delta\sigma_z = q\,I_w$, $I_w = (1/2\pi)\,\cot^{-1}\sqrt{[\eta^2(1/m^2 + 1/n^2) + \eta^4/(m^2n^2)]}$

Example (R = 4 m, q = 300, z = 4 m, $\mu_s = 0$): $\eta = 0.7071$; $\Delta\sigma_z/q = 0.4226 \rightarrow$ **$\Delta\sigma_z$ = 126.79 kN/m²**; Boussinesq 193.93 kN/m²

Rectangular: at the corner (2 m × 2 m, z = 2 m) $I_w = 0.1161$; at the center, four equal corner rectangles (3 × 2 m, z = 4 m: 29.95 kN/m²); at the point outside, **signed** four corner rectangles (6.67 kN/m²)

As **μ_s** increases, the stress beneath the center increases (0 → 0.4: 126.79 → 186.61 kN/m²); at $\mu_s = 0$ the Westergaard stress under the load is about 65% of the Boussinesq stress, and away from the load this order reverses

Superposition: each area is treated with its own distance, the stresses are summed (circle + rectangle: 129.76 kN/m²)

References

Das, B.M. (2018). Principles of Geotechnical Engineering, 9th ed. Cengage Learning.

Westergaard, H.M. (1938). A problem of elasticity suggested by a problem in soil mechanics: soft material reinforced by numerous strong horizontal sheets. In Contributions to the Mechanics of Solids, Stephen Timoshenko 60th Anniversary Volume. Macmillan, New York, 268–277.

NOTE

All numerical examples have been generated with the module's own calculation engine; the module yields the same values. The module's opening example: circle R = 4 m, q = 300 kN/m², μ_s = 0, at z = 4 m below the centre.

GeoTerva

Online geotechnical analysis

From theory to practice

Enter your own circles and rectangles, point A and the μ_s value in GeoTerva; the module provides η, the I_w values, the corner rectangles, the comparison with Boussinesq, the depth profile, the step-by-step solution and the report together.

Open the module → **Theory page →**

Open on your phone
The example modules need no registration.

If you would like to use them in your lectures: info@geoterva.com