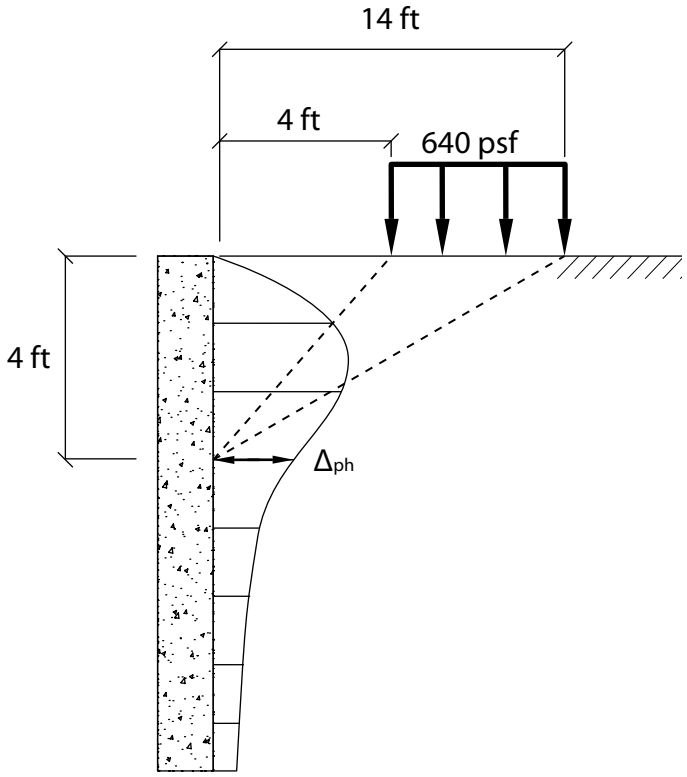
A uniformly distributed surcharge load is applied to a strip of ground parallel to a wall, as shown below.



Design Code

- AASHTO

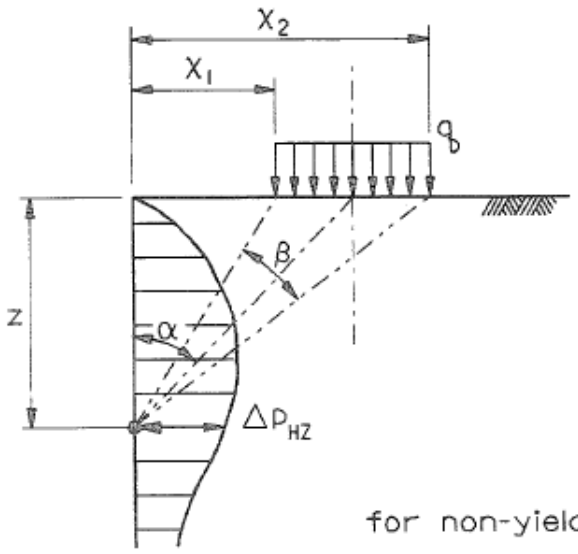
Design Criteria

- do not consider any load factors
- assume the wall is restrained from movement

At a point 4 feet below the top-of-soil elevation, the horizontal pressure due to the surcharge, Δ_{ph}, is most nearly

(A) 0.14 kip/ft^2
(B) 0.30 kip/ft^2
(C) 0.52 kip/ft^2
(D) 0.90 kip/ft^2

Uniform Surcharge
From EM1110-2-2502 or any soil textbook.



$$q_b = \frac{V}{(X_2 - X_1)}$$

for non-yielding walls:

$$\Delta P_{HZ} = \frac{2 q_b}{\pi} \left(\beta - \sin\beta \cos 2\alpha\right)$$

for yielding walls,
(walls at failure):

$$\Delta P_{HZ} = \frac{q_b}{\pi} \left(\beta - \sin\beta \cos 2\alpha\right)$$

β in radians

$$\beta = \tan^{-1}\left(\frac{X_2}{z}\right) - \tan^{-1}\left(\frac{X_1}{z}\right)$$

$$\alpha = \tan^{-1}\left(\frac{X_2 + X_1}{2z}\right)$$

X_1 = 4 ft
X_2 = 14 ft
q = 640 psf
z = 4 ft

$\alpha = \tan^{-1}$ [(14+4)/(2(4))] = 1.153 rad

$\beta = \tan^{-1}$ (14/4) - $\tan^{-1}$ (4/4) = 0.507 rad

ΔP_{HZ} = 2(640)/π [0.507 - sin(0.507) cos 2(1.153)] = 339 psf

AASHTO Surcharge Loads

3.11.6 Surcharge Loads: ES and LS
3.11.6.1 Uniform Surcharge Loads (ES)
Where a uniform surcharge is present, a constant horizontal earth pressure shall be added to the basic earth pressure. This constant earth pressure may be taken as:

$\Delta_p = k_s q_s$ (3.11.6.1-1)

where:

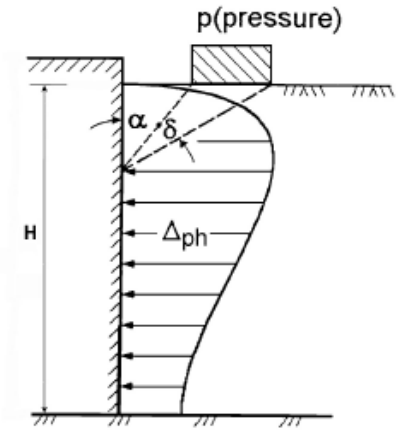
Δ_p = constant horizontal earth pressure due to uniform surcharge (ksf)
k_s = coefficient of earth pressure due to surcharge
q_s = uniform surcharge applied to the upper surface of the active earth wedge (ksf)

3.11.6.2 Point, Line and Strip Loads (ES) — Walls Restrained from Movement
The horizontal pressure, Δph in ksf, on a wall resulting from a uniformly loaded strip parallel to the wall may be taken as:

$$\Delta_{ph} = \frac{2p}{\pi} [\delta - \sin \delta \cos(\delta + 2\alpha)] \quad (3.11.6.2\text{-}1)$$

where:

p = uniform load intensity on strip parallel to wall (ksf)
α = angle specified in Figure 1 (rad.)
δ = angle specified in Figure 1 (rad.)



α = angle between foundation wall and a line connecting the point on the wall under consideration and a point on the bottom corner of the footing nearest to the wall (rad.)

δ = angle between foundation wall and a line connecting the point on the wall under consideration and a point on the bottom corner of the footing furthest from the wall (rad.)

X_1 = 4 ft
X_2 = 14 ft
q = 640 psf
z = 4 ft

$\delta = \tan^{-1} (14/4) = 1.29$ rad

$\alpha = \tan^{-1} (4/4) = 0.785$ rad

$\Delta_{ph} = 2(640)/\pi [1.29 - \sin(1.29) \cos(1.29 + 2(0.785)] = 901.7$ psf