*Earth Pressure for Common Conditions of Loading:*

Assumptions:

- Backfill material is considered “silty sands, poorly graded sand-silt mixes”
- As stated in the Subsurface Exploration and Geotechnical Engineering Analysis, the active soil pressure is 45 lbs/sf of depth and the at-rest soil pressure is 60 lbs/sf of depth
- Backfill height will be for the worst case scenario of 9 ft
- Soil surcharge (s) from the backhoe and roller drum will be 115 lb/ft²
- Unit weight (w) of the soil is 110 pcf
- PAmax for Ulma posts = 8,500 lbs

Finding the soil force per horizontal foot –

\[
C_{ah}wh = 60 \times \text{height}
\]

\[
y = h/3 = 9 \text{ ft} / 3 = 3 \text{ ft}
\]

\[
P = \frac{1}{2} \times 60 \times (9\text{ft})^2 = 2,430 \text{ lb/horizontal foot}
\]

\[
h' = 1.05 \text{ ft}
\]

\[
y = \left[
\frac{(9\text{ft})^2 + 3 \times 9\text{ ft} \times 1.05\text{ ft}}{3 \times (9\text{ ft} \times 2 \times 1.05\text{ ft})}
\right] = 3.28 \text{ ft}
\]

\[
P = \frac{1}{2} \times 60 \times 9\text{ ft} \times 2 \times 1.05 \text{ ft} = 2,997 \text{ lbs/horizontal foot}
\]
Finding the axial load in the shoring –

\[ h = 9' \]
\[ y = 3.28' \]
\[ P = 2,997 \text{ lbs} \]

Sum of Moments about pt. A =
\[ 2,997 \text{ lbs} (3.28') - F_{bx} (9') = 0 \]
\[ F_{bx} = 1093 \text{ lbs} \]

To find the axial load in the Ulma post –
\[ (1093^2 + 1093^2)^{\frac{1}{2}} = 1546 \text{ lbs} \]

Assuming each post has a max PA of 8,500 lbs, shores have to be spaced between 5 and 6 feet on-center along the face of the walls.

*Nilson 2004