Presentation Content

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Conclusions and Recommendations

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Full Analysis of Single Story RFERS

- The soil-structure interaction problem involving thermal movements of the RFERS is examined.
- Two-dimensional plain strain finite element analysis of single-story RFERS of varying number of bays, bay lengths, and member stiffness, and backfill properties.
- Plain-Strain models with Staged Construction.
- After backfill, Temperature was increased 60°F, followed by decreased and increase of 100°F for subsequent cycles.
Wall Movements \((\phi = 30^\circ)\)
Single Bay, Wall $U_h$

1 bay, $L_b = 10$ ft
$\phi = 30^\circ$
$S_c/S_b = 1$

1 bay, $L_b = 10$ ft
$\phi = 30^\circ$
$S_c/S_b = 4$

1 bay, $L_b = 20$ ft
$\phi = 30^\circ$
$S_c/S_b = 1$

1 bay, $L_b = 20$ ft
$\phi = 30^\circ$
$S_c/S_b = 4$
Single Bay, Wall $U_h$

1 bay, $L_b = 10$ ft
$\phi = 30^\circ$
$S_c / S_b = 1$

$1/4$ in

1 bay, $L_b = 10$ ft
$\phi = 30^\circ$
$S_c / S_b = 4$

< 1/16 in

1 bay, $L_b = 20$ ft
$\phi = 30^\circ$
$S_c / S_b = 1$

1/2 in

1 bay, $L_b = 20$ ft
$\phi = 30^\circ$
$S_c / S_b = 4$

3/32 in

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Single Bay, End Column $U_h$

- For $1$ bay, $L_b = 10$ ft and $S_c/S_b = 1$:
  - $1/4$ in movement

- For $1$ bay, $L_b = 10$ ft and $S_c/S_b = 4$:
  - $< 3/32$ in movement

- For $1$ bay, $L_b = 20$ ft and $S_c/S_b = 1$:
  - $1/2$ in movement

- For $1$ bay, $L_b = 20$ ft and $S_c/S_b = 4$:
  - $1/8$ in movement
Single Bay, Ret. Wall Moments

1 bay, $L_b = 10\ ft$
$\phi = 30^\circ$
$S_c/S_b = 1$

1 bay, $L_b = 20\ ft$
$\phi = 30^\circ$
$S_c/S_b = 1$

1 bay, $L_b = 10\ ft$
$\phi = 30^\circ$
$S_c/S_b = 4$

1 bay, $L_b = 20\ ft$
$\phi = 30^\circ$
$S_c/S_b = 4$
Wall Movements ($\phi = 30^\circ$)

- 1 Bay, $L_b = 10$ ft
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$

- 3 Bays, $L_b = 10$ ft
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$

- 6 Bays, $L_b = 10$ ft
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$

- 10 Bays
  - $L_b = 10$ ft
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$

- 15 Bays
  - $L_b = 10$ ft
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$

- 20 Bays
  - $L_b = 10$ ft
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$
Wall Moments ($\phi = 30^\circ$)

- **1 Bay, $L_b = 20$ ft**
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$

- **3 Bays, $L_b = 10$ ft**
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$

- **6 Bays, $L_b = 10$ ft**
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$

- **10 Bays**
  - $L_b = 10$ ft
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$

- **15 Bays**
  - $L_b = 10$ ft
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$

- **20 Bays**
  - $L_b = 10$ ft
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$
Wall Moments ($\phi = 30^\circ$)
Wall Moments ($\phi = 30^\circ$)
Wall Moments \((\phi = 30^\circ)\)

- **20 Bays**
  - \(L_b = 10\) ft
  - \(\phi = 30^\circ\)
  - \(S_c/S_b = 1\)

- **10 Bays**
  - \(L_b = 20\) ft
  - \(\phi = 30^\circ\)
  - \(S_c/S_b = 4\)

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Wall Movements ($\phi = 30^\circ$)

- 1 bay, $L_b = 10$ ft
- $\phi = 30^\circ$
- $S_c/S_b = 1$

1 Bay

- 3 bays, $L_b = 10$ ft
- $\phi = 30^\circ$
- $S_c/S_b = 1$

3 Bays

- 6 bays, $L_b = 10$ ft
- $\phi = 30^\circ$
- $S_c/S_b = 1$

6 Bays

- 10 bays
- $L_b = 10$ ft
- $\phi = 30^\circ$
- $S_c/S_b = 1$

10 Bays

- 15 bays
- $L_b = 10$ ft
- $\phi = 30^\circ$
- $S_c/S_b = 1$

15 Bays

- 20 bays
- $L_b = 10$ ft
- $\phi = 30^\circ$
- $S_c/S_b = 1$

20 Bays
Lateral Earth Pressure ($\phi = 30^\circ$)

1 bay, $L_b = 10$ ft
$\phi = 30^\circ$
$S_c/S_b = 1$

10 bays
$L_b = 10$ ft
$\phi = 30^\circ$
$S_c/S_b = 4$

3 bays
$L_b = 10$ ft
$\phi = 30^\circ$
$S_c/S_b = 1$

6 bays
$L_b = 10$ ft
$\phi = 30^\circ$
$S_c/S_b = 1$

15 bays
$L_b = 10$ ft
$\phi = 30^\circ$
$S_c/S_b = 1$

20 bays
$L_b = 10$ ft
$\phi = 30^\circ$
$S_c/S_b = 1$
Lateral Earth Pressure ($\phi = 30^\circ$)
Lateral Earth Pressure ($\phi = 30^\circ$)

- 20 bays, $L_b = 10 \text{ ft}$
- $\phi = 30^\circ$
- $S_c/S_b = 1$
- $S_c/S_b = 4$

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Lateral Earth Pressure ($\phi = 30^\circ$)

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Lateral Earth Pressure ($\phi = 30^\circ$)

- 20 bays, $L_b = 10$ ft
  - $\phi = 30^\circ$
  - $S_c/S_b = 1$

- 10 bays, $L_b = 20$ ft
  - $\phi = 30^\circ$
  - $S_c/S_b = 4$

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Ret. Wall Behavior ($\phi = 40^\circ$)

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End Column Behavior ($\phi = 40^\circ$)

- **At Backfill**
  - $L_b = 10$ ft
  - $\phi = 40^\circ$
  - $S_c/S_b = 1$

- **At Expansion**
  - $L_b = 10$ ft
  - $\phi = 40^\circ$
  - $S_c/S_b = 1$

- **Horizontal End Column Movement, $U_h$, ft**
  - $U_{hn1}$, $U_{hn3}$, $U_{hn6}$, $U_{hn10}$, $U_{hn15}$, $U_{hn20}$

- **End Column Moment, $M$, kips-ft**
  - $M_{bn1}$, $M_{bn3}$, $M_{bn6}$, $M_{bn10}$, $M_{bn15}$, $M_{bn20}$

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Lateral Earth Pressure ($\phi = 40^\circ$)

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Lateral Earth Pressure ($\phi = 40^\circ$)