Monitoring Results - Tiltmeters

- Notations
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Basement Level Tiltmeters (Level A)
Western Tiltmeters
Western Tiltmeters

Building is undergoing a PERPETUAL Movement away from the soil mass!
Interjection
Interjection
Expansion Model for Displacement Sensors

LOCATION OF JOINT METER

SOIL RESTRAINT

ROD MODEL

ΔL1

ΔL2

ΔL3

ΔL4

PG-2

PG-1

L1 = 28.5 m

L2 = 23.3 m

L3 = 7.3 m

L4 = 59.1 m

EXPANSION JOINT

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Displacement

- VW Displacement sensor
- Level B
- North Side
The structure undergoes perpetual movements away from the soil mass

- **Summer:** The structure undergoes limited expansion movements into the soil mass at the restrained end
- **Winter:** The structure undergoes asymmetrical contraction movements at its ends

- Movement of the soil into the gap formed between the soil and the contracted structure
  - Soil movement prevents the structure from reverting to its position before contraction

- Structure undergoes a cumulative lateral movement away from the soil over several temperature cycles
Initial Conditions
Summer
Winter
Conclusions

- RFERS undergo lasting and continuous displacements away from the retained soil mass when subjected to large temperature changes
  - Some laboratory experiments related to integral bridge abutments studies found that after a certain number of cycles the backfill may reach strain equilibrium
  - Integral Bridges do not undergo lasting displacements, due to the presence of a bracing abutment at each end
- Large temperature changes result in a complex Nonlinear soil structure interaction
  - Analysis by superposition is inadequate
- The development of analytical solutions describing the soil structure interaction remains a demanding task
Thank You!