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Topic of Research: Sequential Effect of nearby New Construction on Diaphragm Wall under Static and Dynamic Loading

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Findings

Here are ten key findings from my Ph.D. thesis, *"Sequential Effect of nearby New Construction on Diaphragm Wall under Static and Dynamic Loading"*:

1. Sequential Effects on Structural Response

- Sequential loading from nearby construction activities causes considerable variations in horizontal deflection, bending moment, and shear force in diaphragm walls.
- These responses increase progressively with advancing stages of construction, such as excavation and superstructure erection.
- A greater distance between the diaphragm wall and the nearby structure improves wall stability and reduces structural interaction.

2. Static vs Dynamic Loading Behaviour

- Diaphragm walls experience larger deflections, bending moments, and shear forces under dynamic loading compared to static loading.
- Seismic effects introduce additional stresses such as vibrations and redistribution of forces, making the wall more vulnerable in dynamic conditions.

3. Bending Moment Variations and Safety Limits

- At smaller distances between the wall and nearby structures, the bending moment becomes highly sensitive to changes in overburden pressure.
- Stability improves when this distance is increased, as the wall becomes less affected by variations in external loads.
- For safe performance, the design must maintain sufficient separation and apply suitable factors of safety to keep bending moments within permissible limits.

4. Anchor Force Behaviour

- Anchor forces gradually increase as construction progresses due to the cumulative effect of additional loading.
- Shallow anchors experience higher load demands compared to deeper anchors, as they resist greater lateral pressures near the top of the wall.
- Under seismic conditions, anchor forces rise significantly, highlighting the importance of designing stronger anchorage systems for upper levels.

5. Horizontal Deflection Sensitivity

- At smaller wall-to-structure distances, horizontal deflections are highly sensitive to changes in overburden pressure.
- As the separation increases, the diaphragm wall exhibits much more stable behaviour with reduced variations in deflection.
- This confirms that increasing the distance between the wall and nearby construction is an effective way to minimize horizontal movement.

6. Bending Moment Sensitivity

- At smaller wall-to-structure distances, bending moments fluctuate considerably with changes in overburden pressure.
- When the separation is greater, these variations are minimized, resulting in more stable performance.
- This demonstrates that adequate spacing reduces bending moment sensitivity and enhances structural safety.

7. Shear Force Sensitivity

- Shear forces are strongly influenced by overburden pressure when the wall is close to nearby structures.
- With greater spacing, shear force variations are reduced and become more controlled.
- This indicates that larger separation distances significantly improve the wall's shear stability under both static and dynamic loading.

8. Tolerance and Safety Assessment

- Tolerance charts were developed to evaluate changes in deflection, bending moment, and shear force under different loading conditions.
- These charts provide practical guidance for determining safe distances, acceptable load limits, and construction restrictions for adjacent buildings.
- They ensure that the diaphragm wall operates within safe performance limits during nearby construction activities.

9. Practical Engineering Insights

- Diaphragm walls located too close to new construction are more sensitive to both construction and seismic effects.
- Increasing the distance between the wall and adjacent structures improves overall stability and reduces interaction effects.
- Stronger anchor systems, particularly at shallow depths, are essential for maintaining wall safety under seismic loading.
- The findings offer practical guidelines that can be applied in urban environments to design diaphragm walls that remain stable and reliable despite nearby construction activities.

10. Research Gaps Addressed:

Most existing studies examine diaphragm walls in isolation, overlooking sequential effects of nearby construction, combined loading, and soil–structure–structure interaction. Realistic 3D modelling was also underexplored. These gaps are addressed in the present study, which investigates the sequential influence of adjacent structures on diaphragm walls under static and dynamic loading.