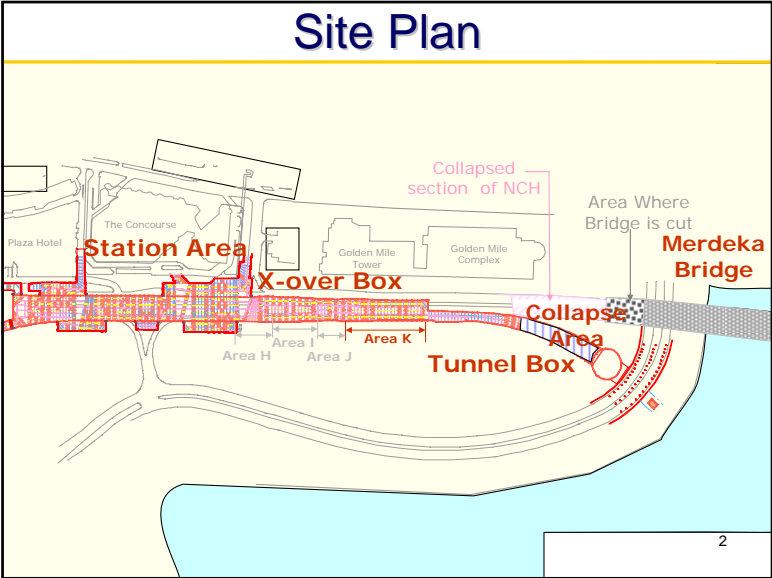


Nicoll Highway Incident in singapore

20th April 2004

1



Picture of the affected site

Before Collapse on 20 April 2004

An aerial photograph showing the construction site before the collapse. The highway is under construction, with a large section of the roadbed and embankment visible. The surrounding area includes greenery and a body of water in the background.

3

Picture of the affected site


After Collapse on 20 April 2004

An aerial photograph showing the site after the collapse. A large section of the highway has collapsed, leaving a massive pile of debris and twisted metal. The surrounding area is now a construction site with heavy machinery and materials visible.

4

Picture of the collapse

Around 3:30 p.m. on 20 April 2004



5

Picture of the collapse

Around 3:30 p.m. on 20 April 2004

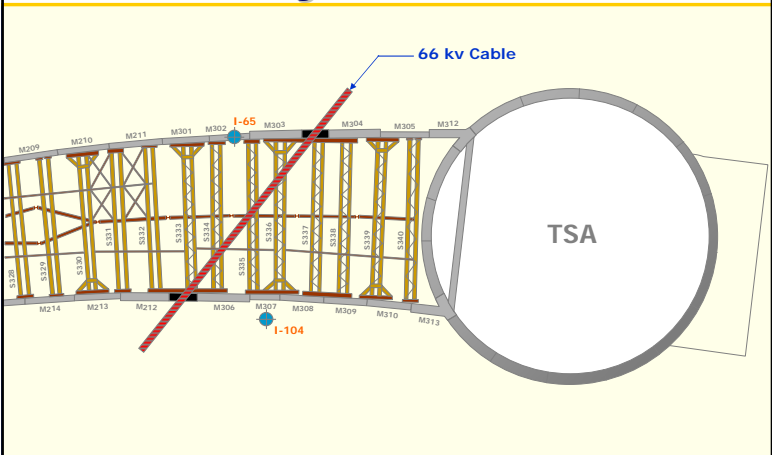


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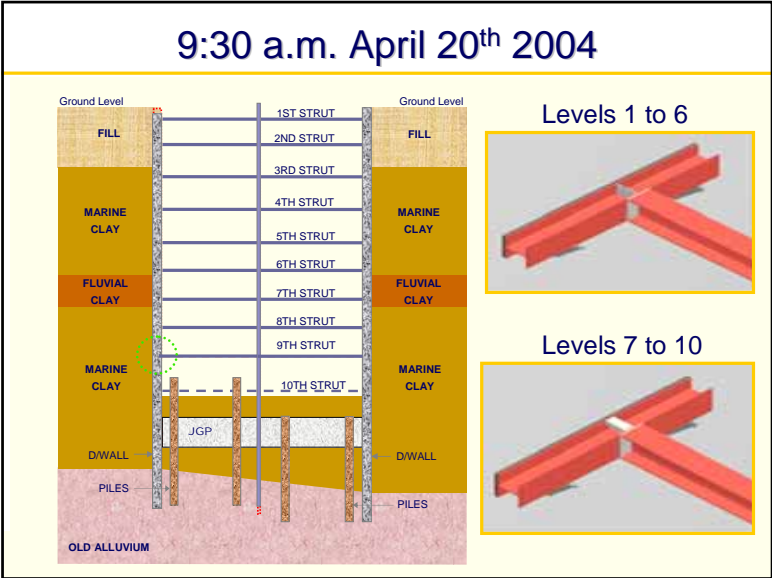
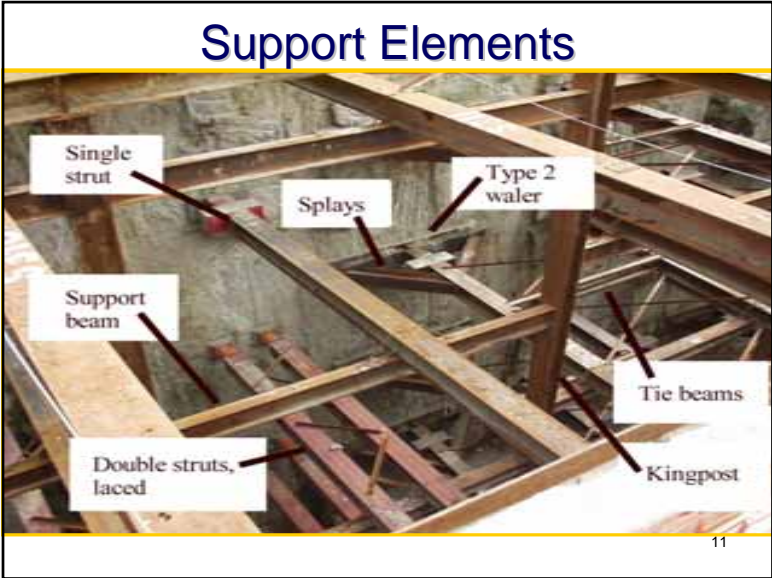
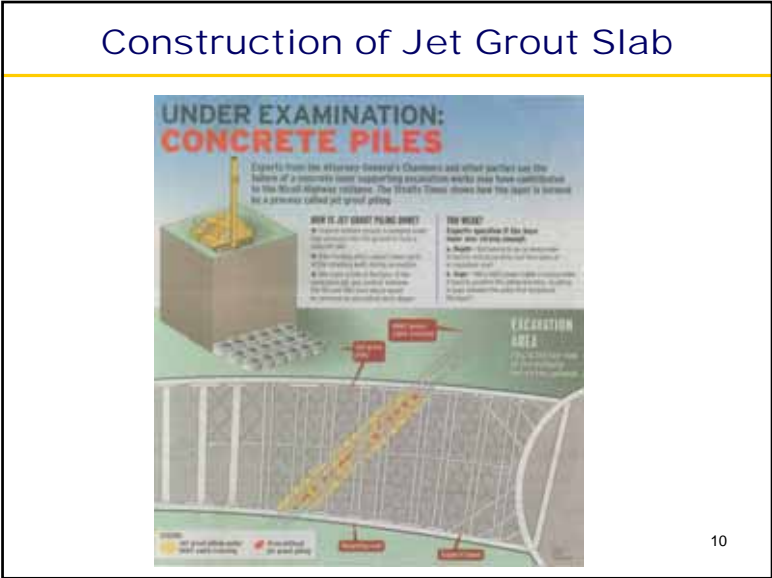
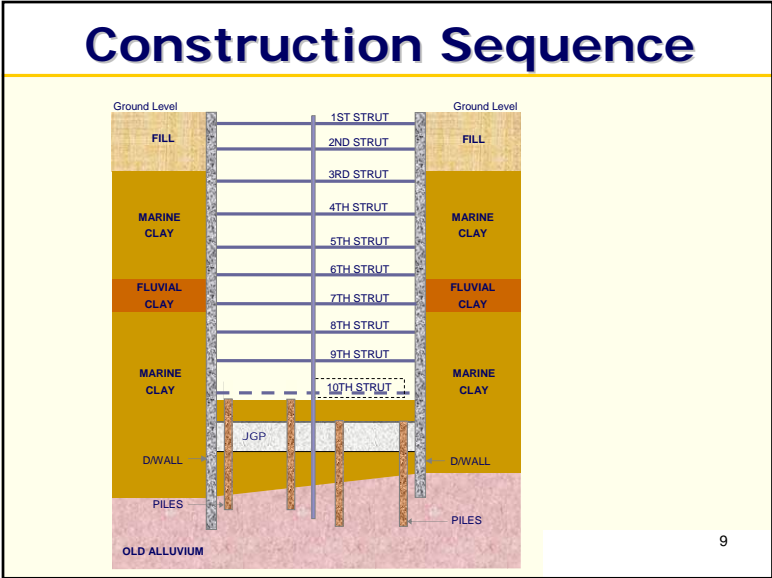


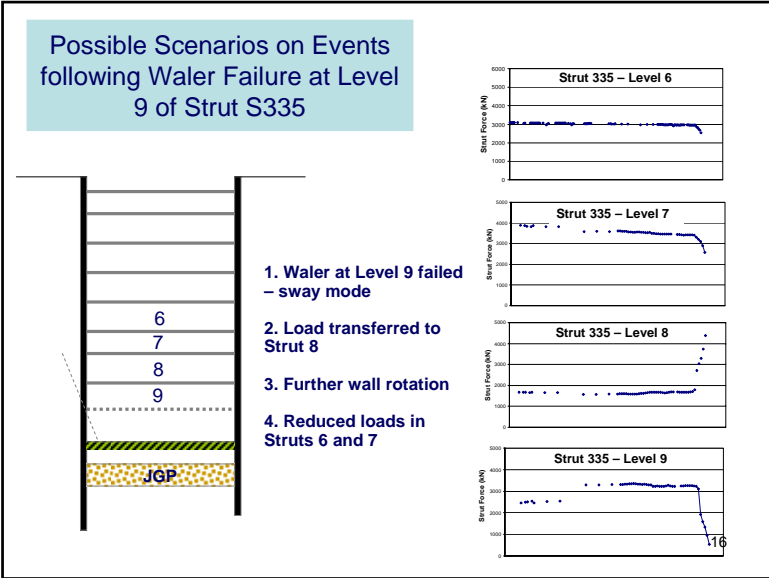
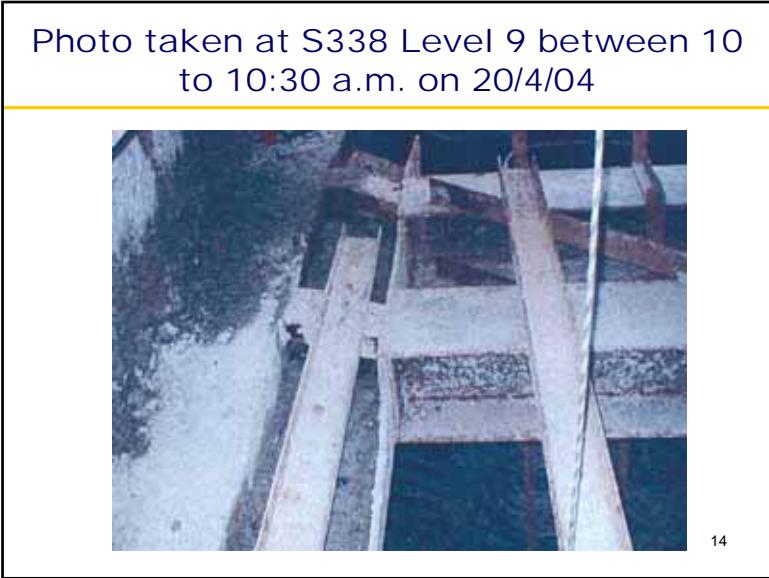
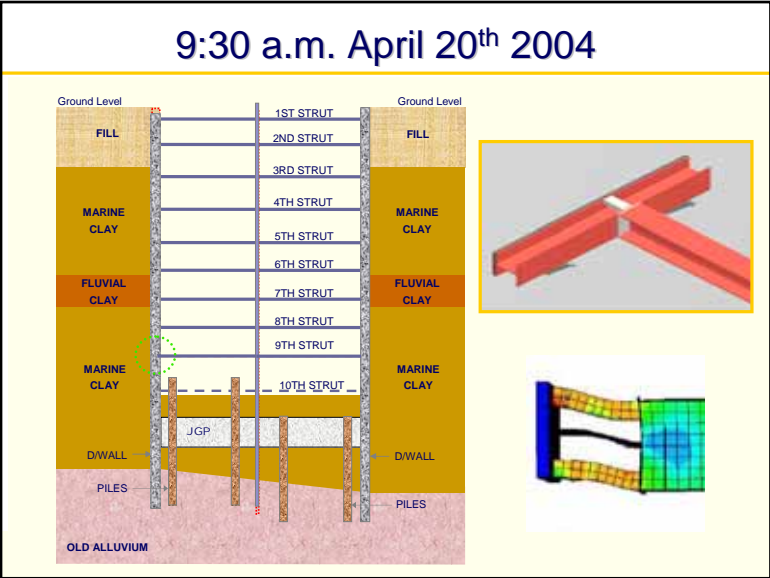
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Layout Plan

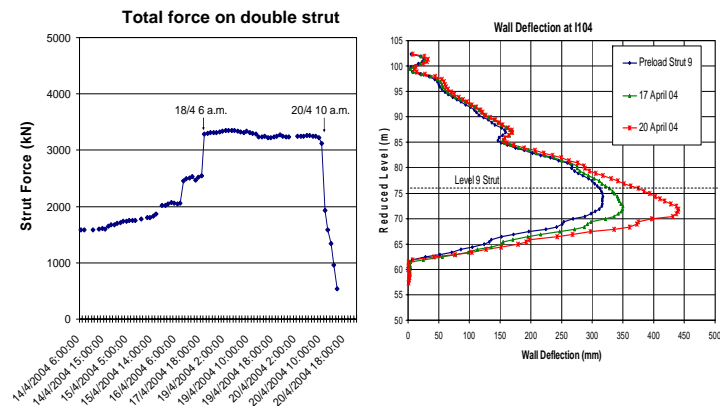


8





Strut Forces & Wall Rotation at S335 Level 9



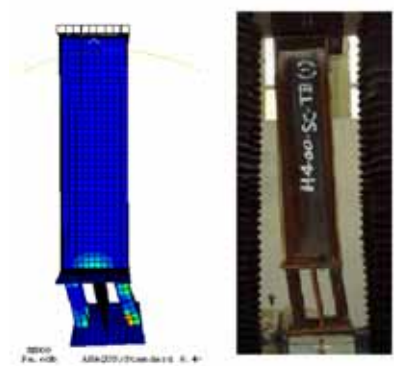
17

What are the causes of failure?

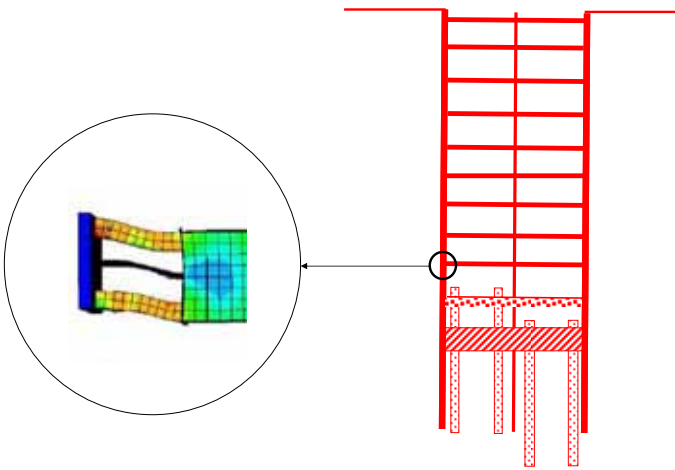
- 1. Basal heave instability
- 2. Uplift instability
- 3. Removal of JGP slab
- 4. Inadequacy of JGP
- 5. Shifting of JGP slabs
- 6. Wall kick-in – insufficient wall penetration
- 7. Wall failure – formation of plastic hinges
- 8. Curvature of tunnel alignment
- 9. Presence of the utility gaps
- 10. Short Waler & Eccentric Strut Loading
- 11. Settlement of diaphragm wall
- 12. Strut failure
- 13. Waler/stiffener failure

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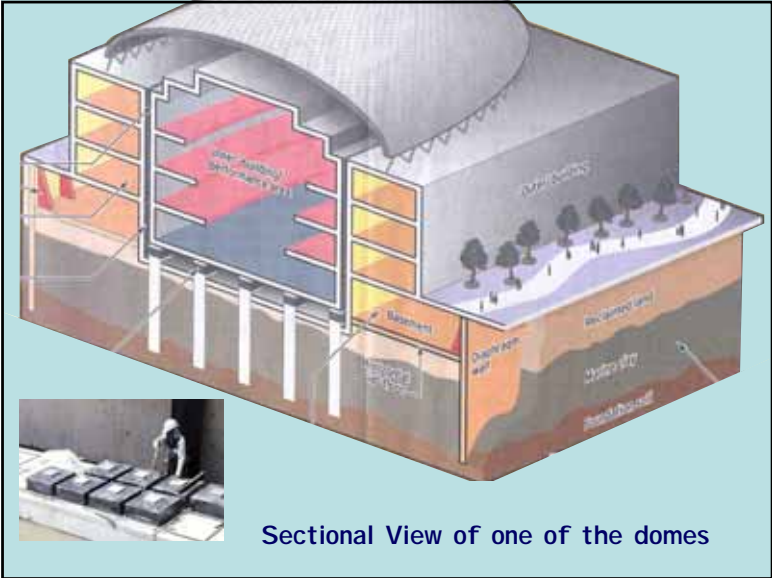
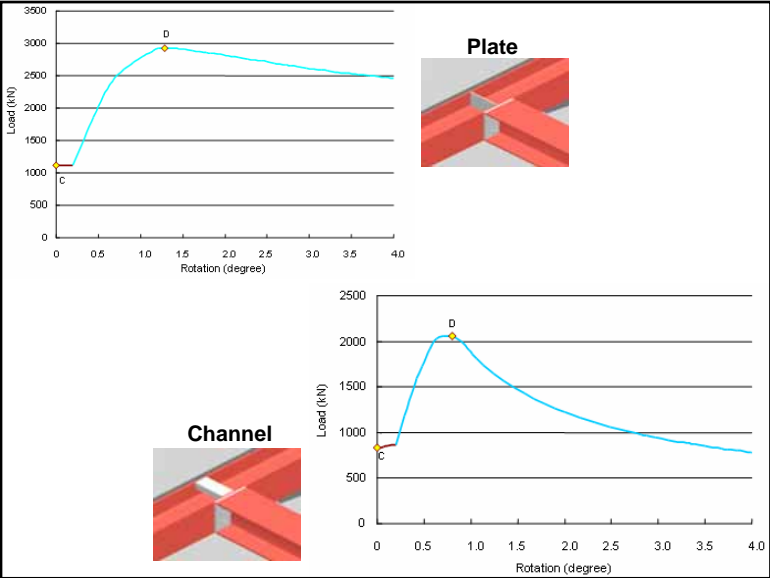
3-D Numerical Modeling

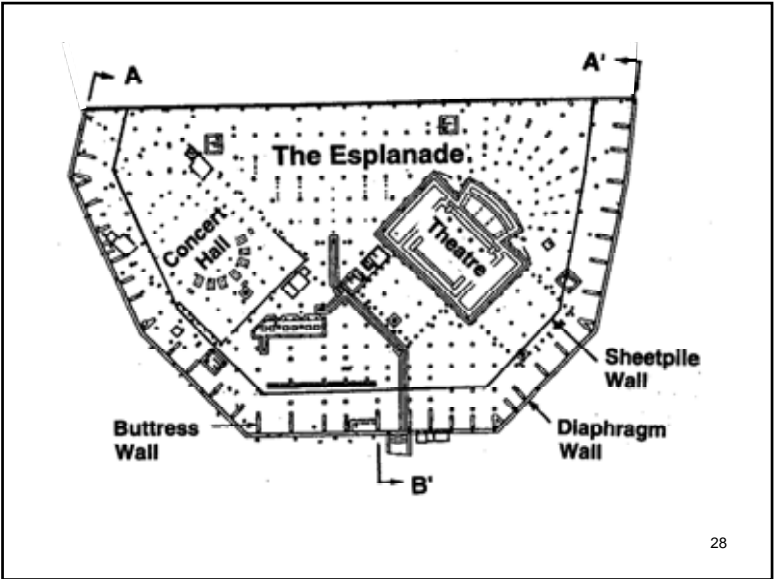
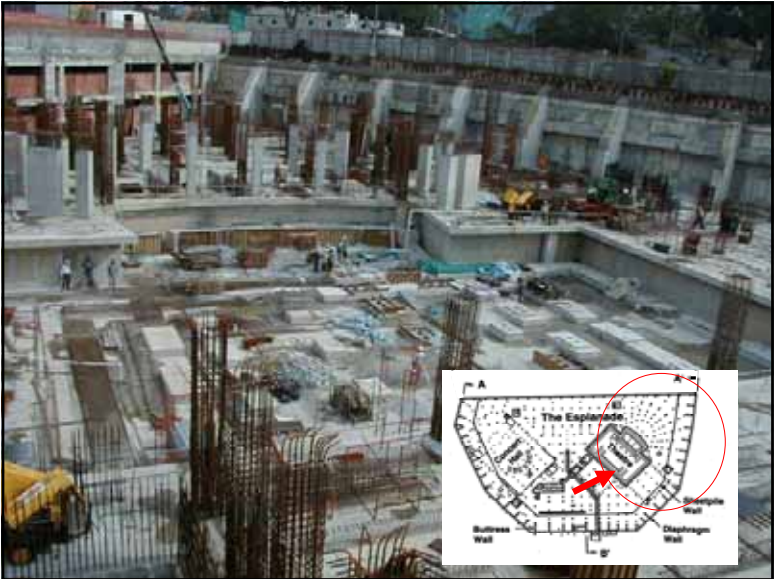
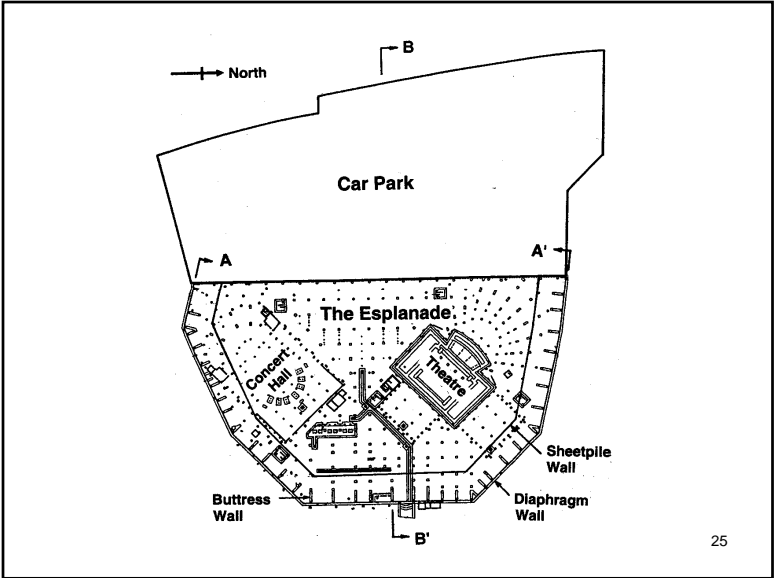


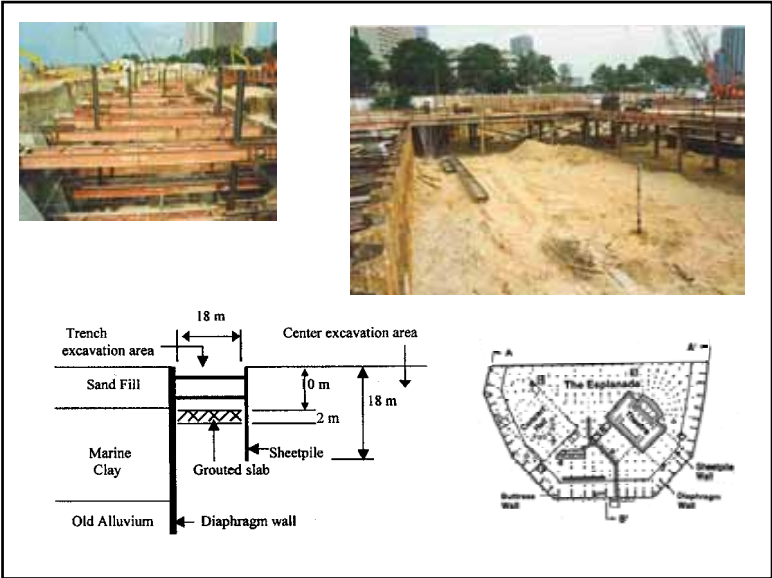
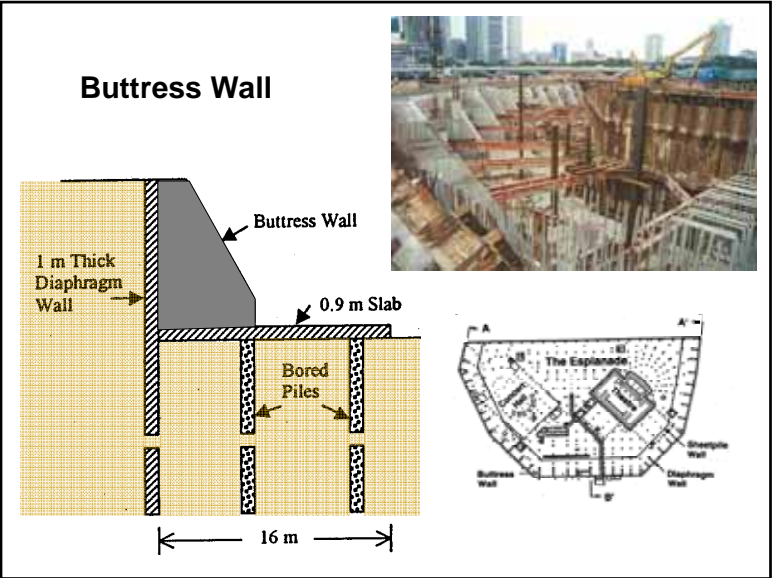
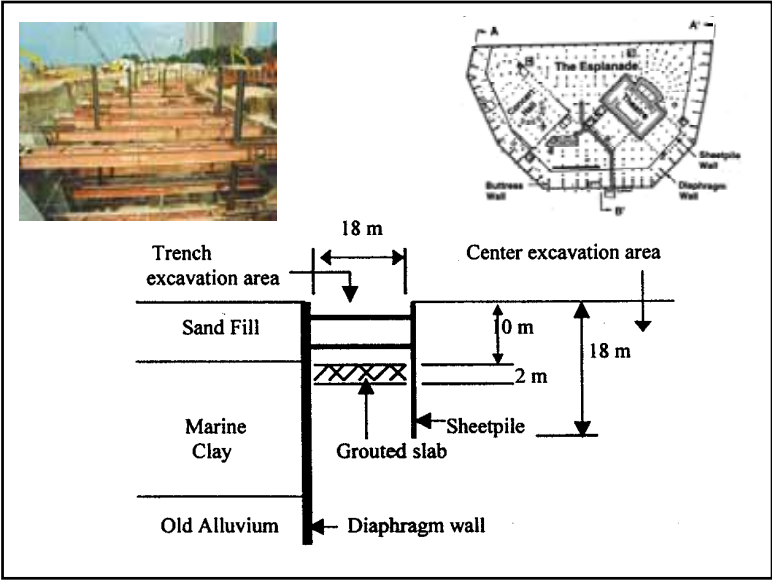
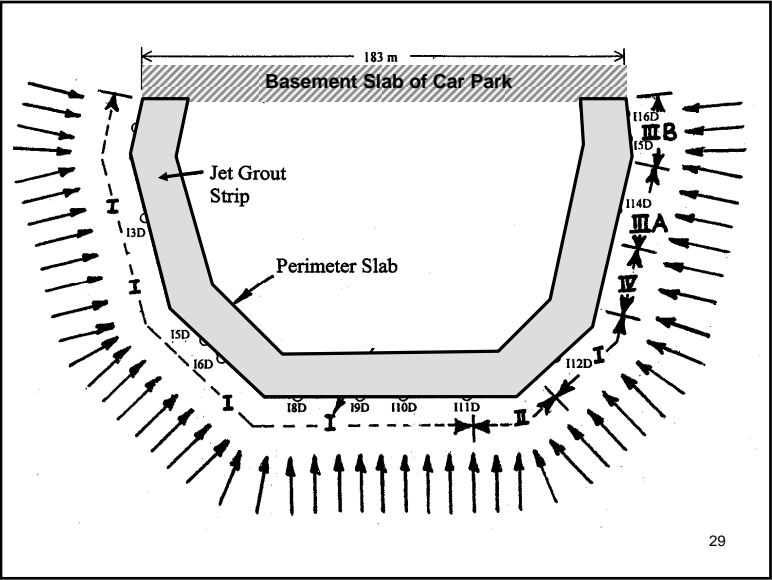
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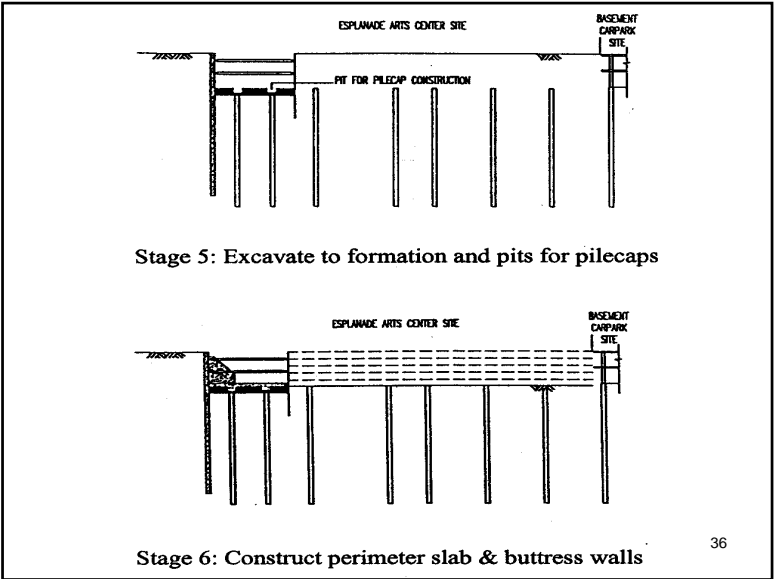
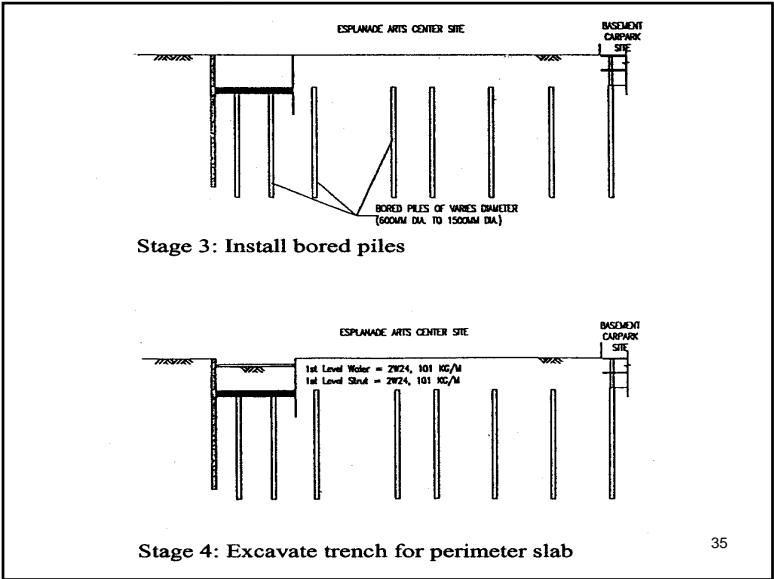
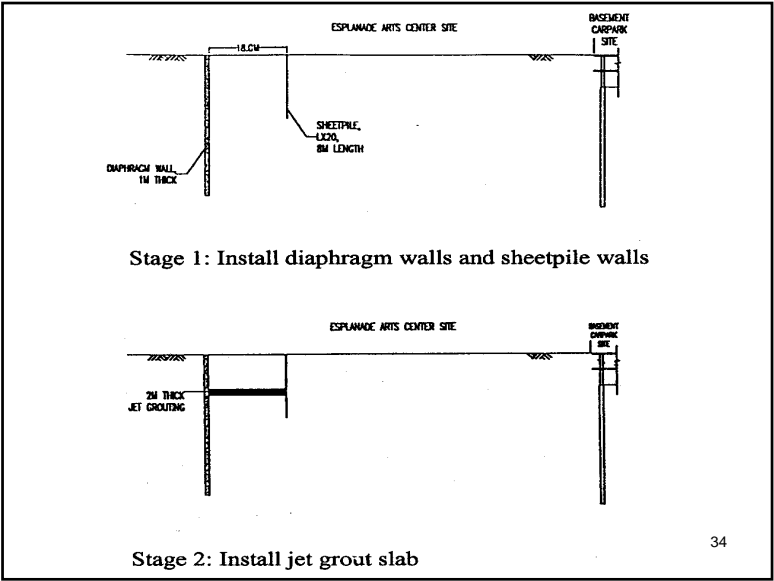
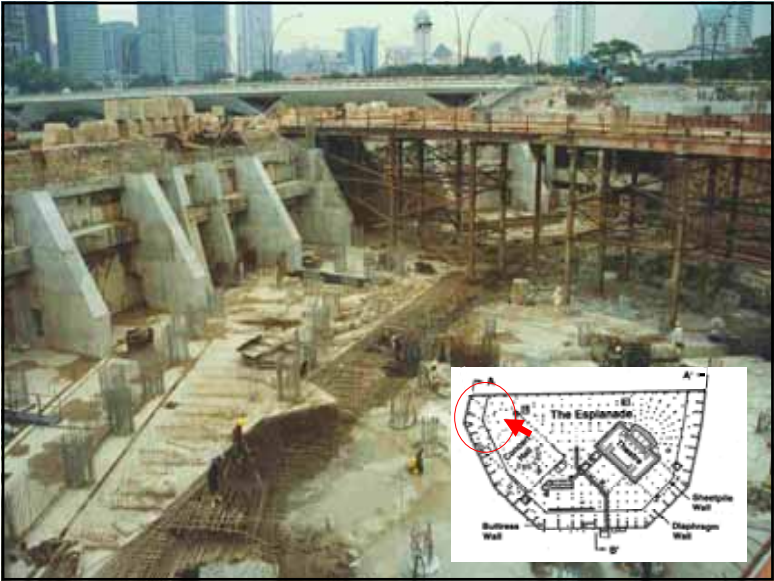


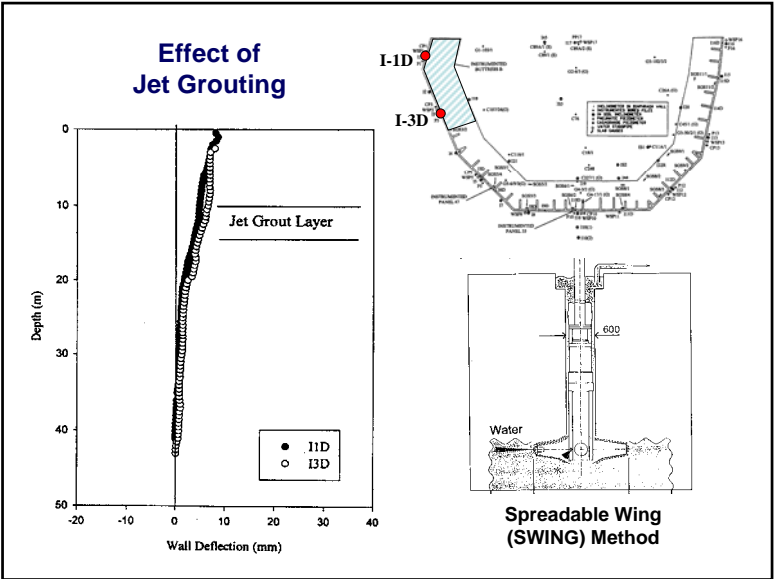
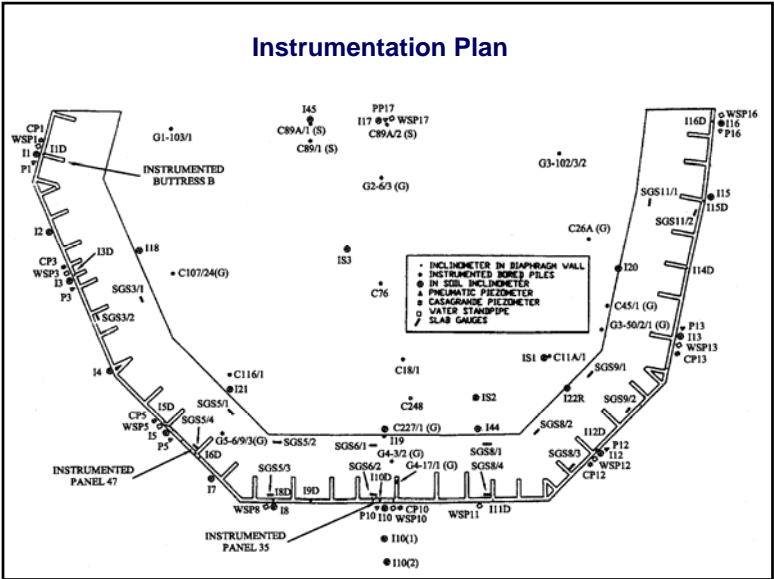
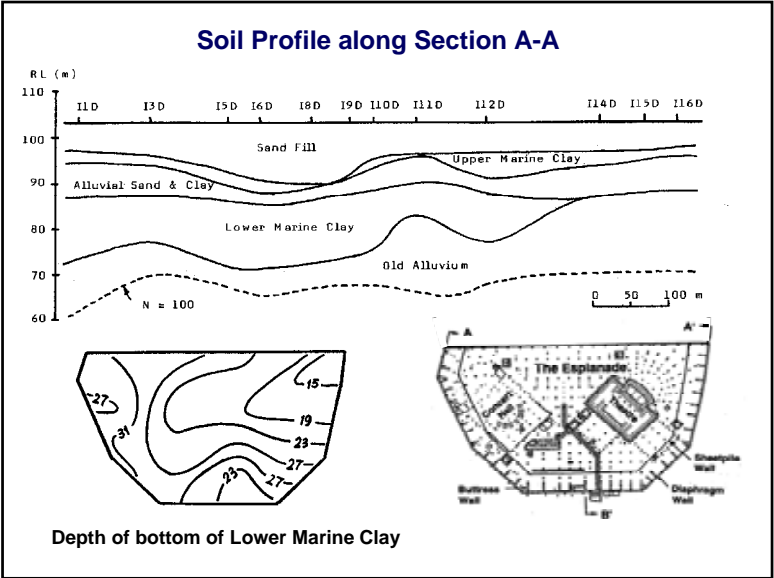
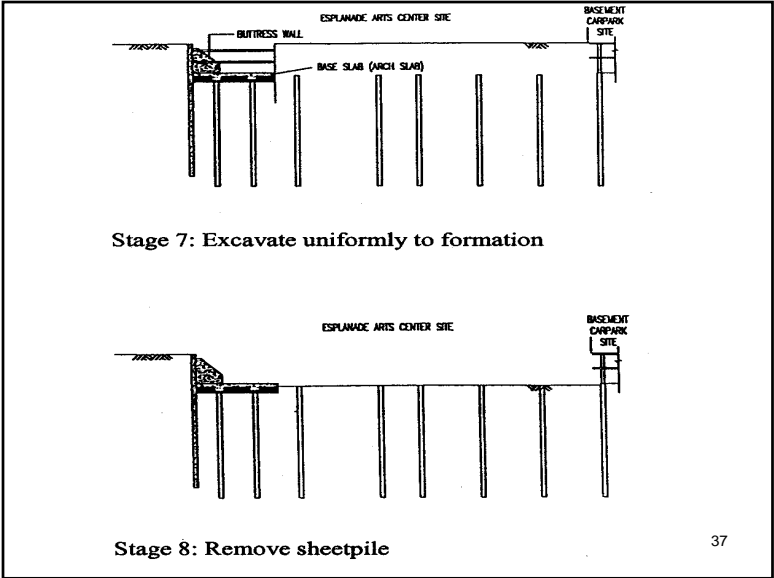
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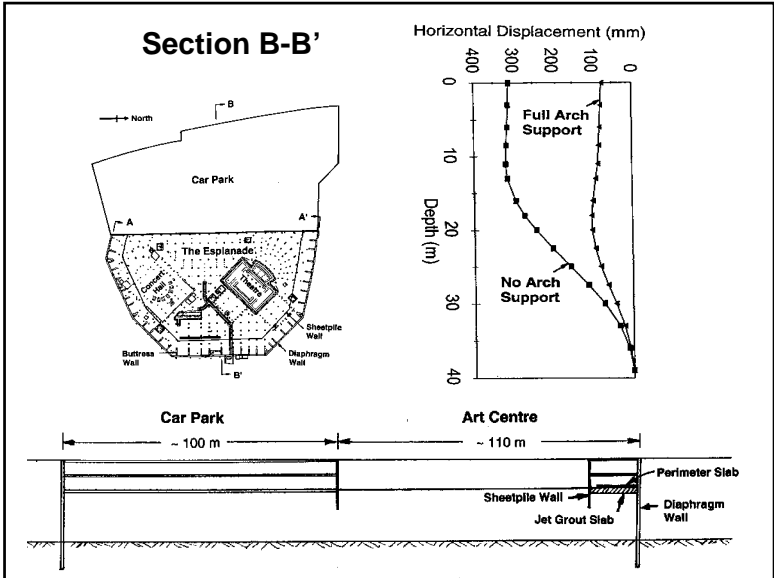
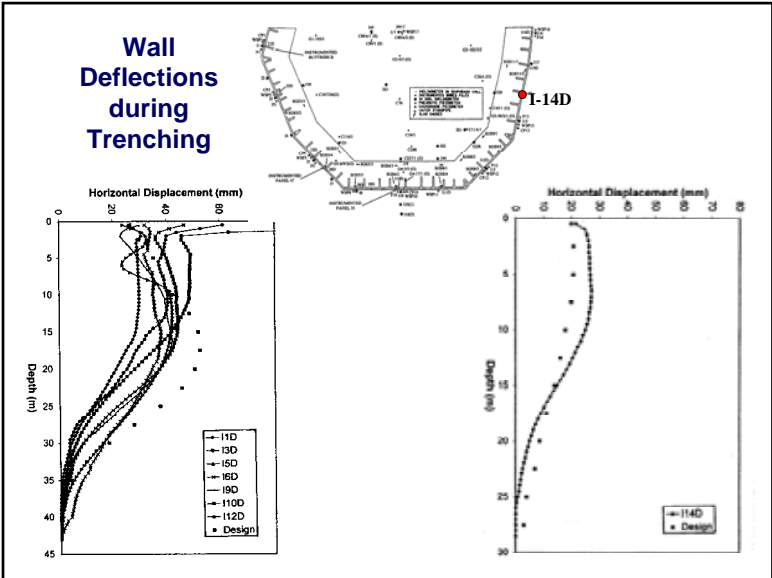
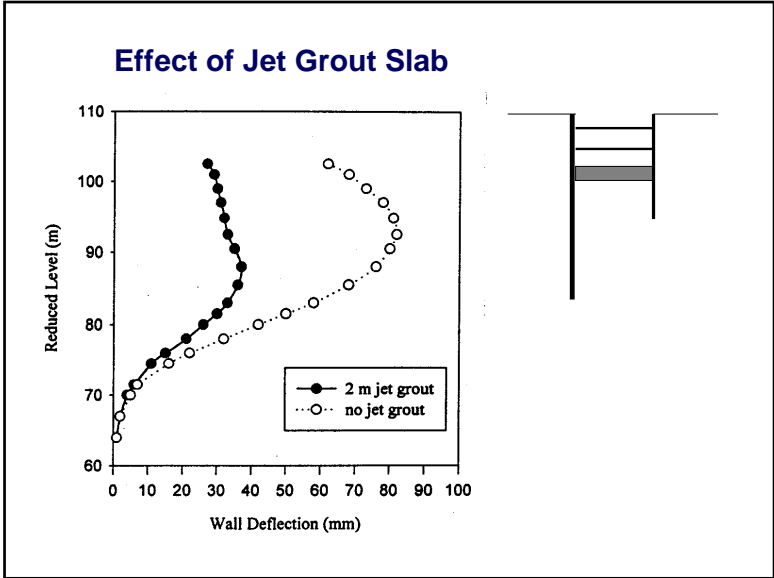
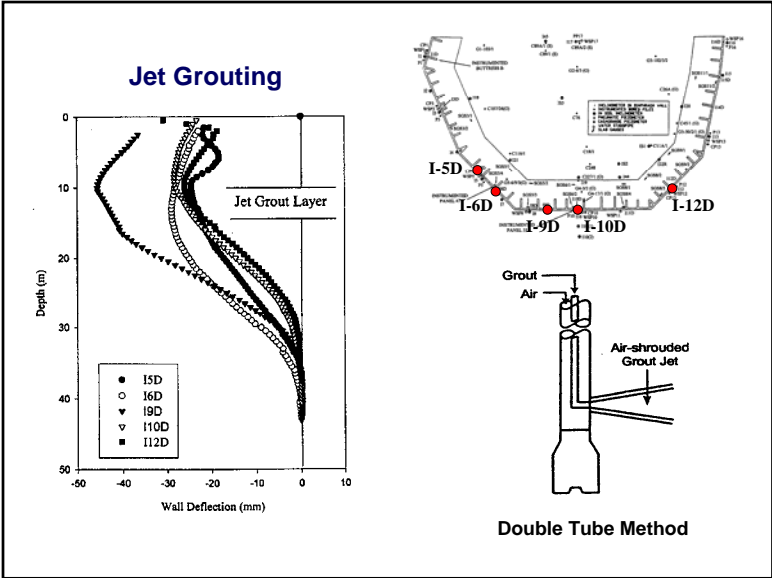


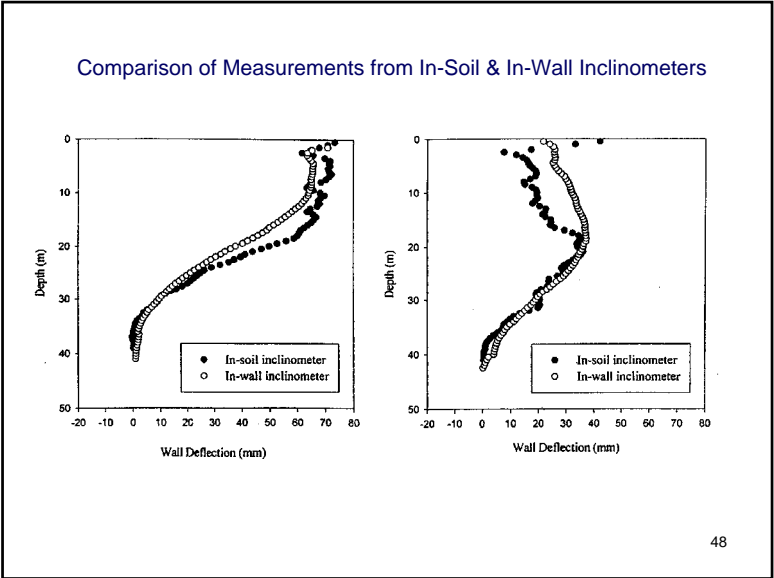
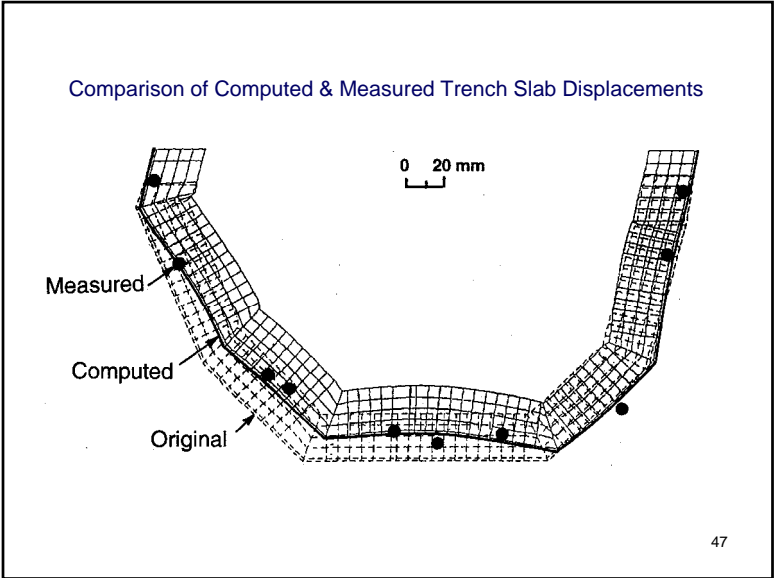
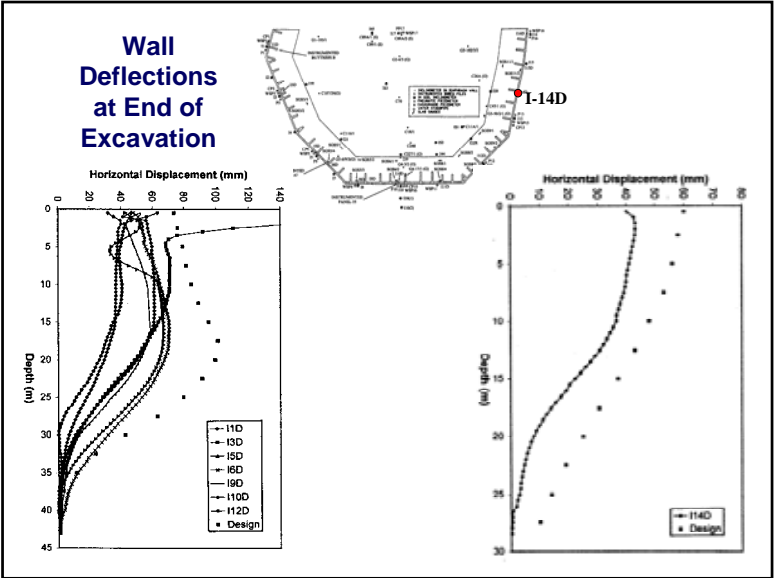
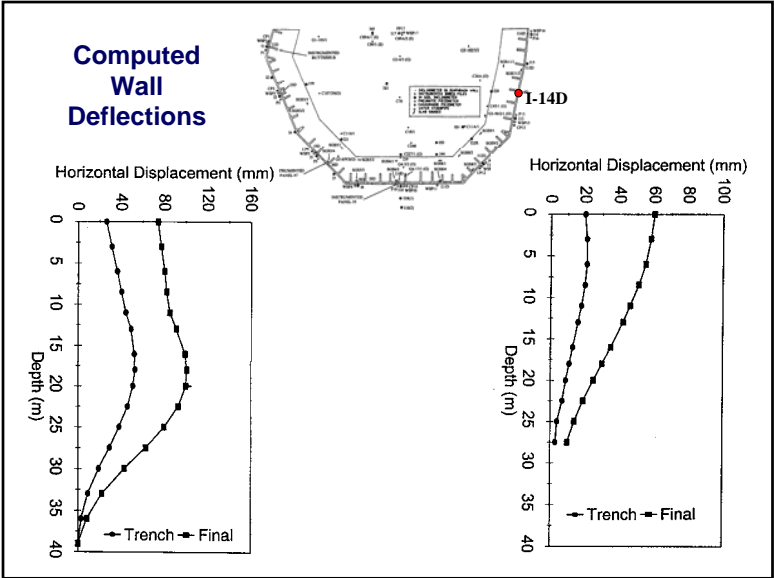


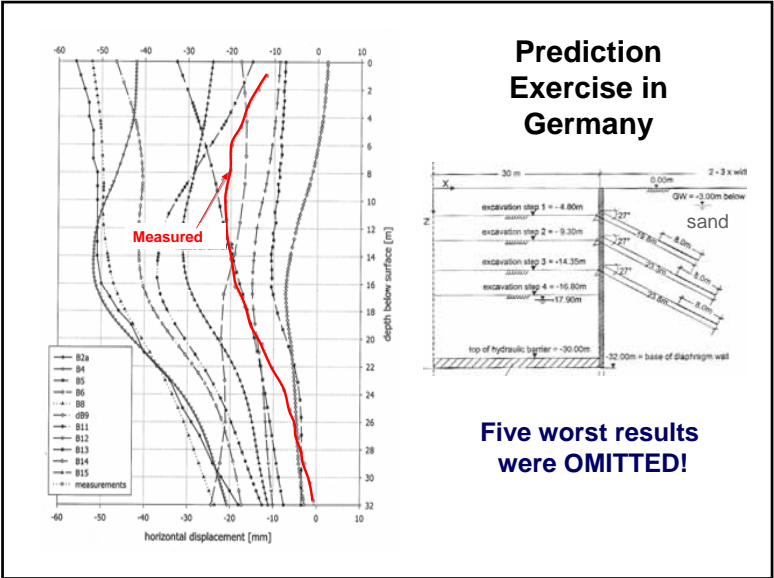
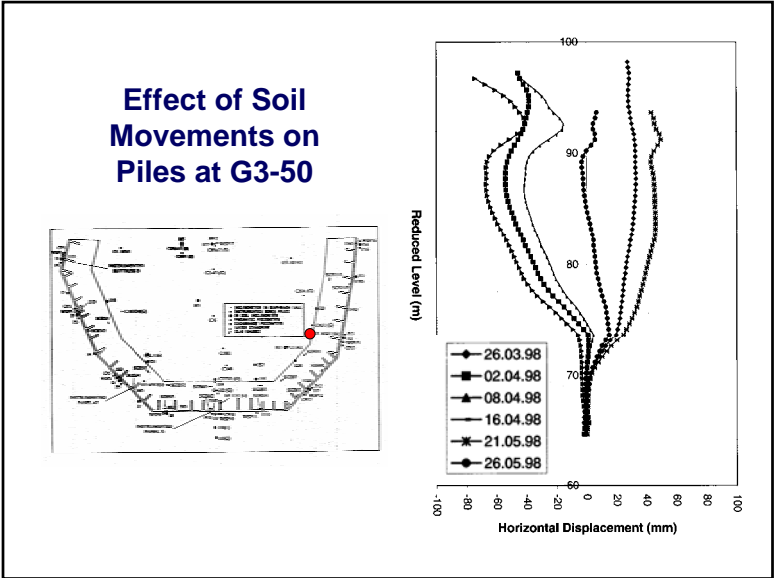
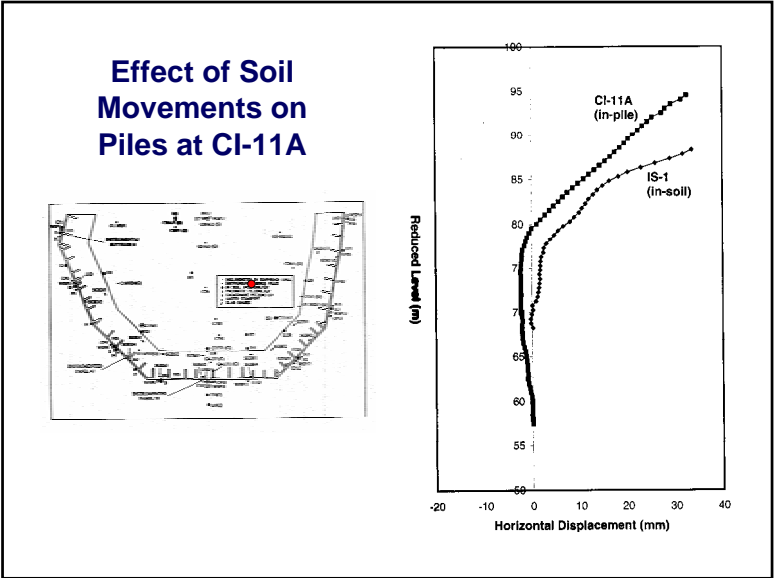
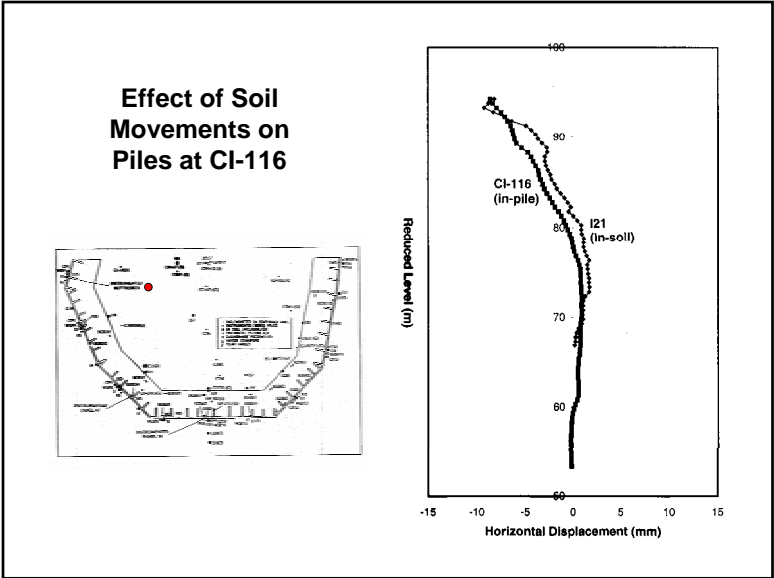


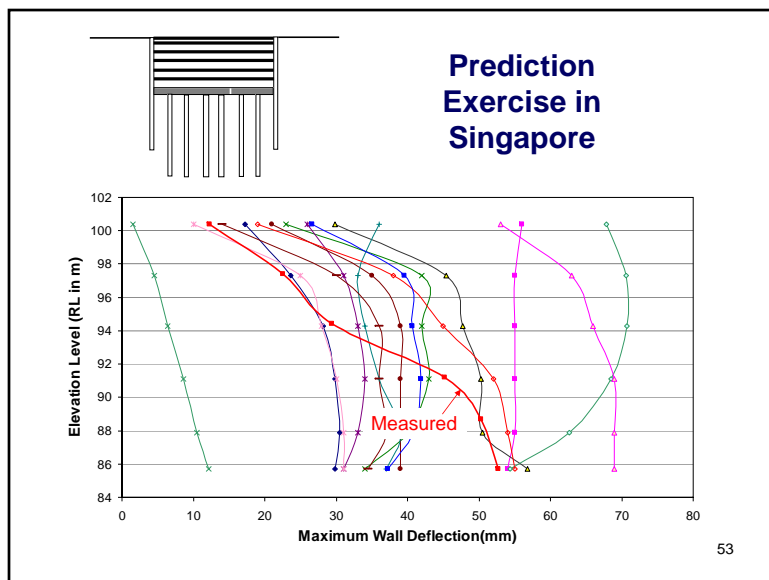












Conclusions & Recommendations

1. Don't be **over-confident** about your analysis!
2. Use **appropriate soil parameters** & apply **correct method of analysis**.
3. Seek a **second opinion**.
4. Be prepared to face **surprises**.
5. Implement **Observational Method** diligently.

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6. When in doubt, engage a **qualified geotechnical consultant to get a second opinion!**

Last but not the least

7. A **Healthy Contract \$um and a Reasonable Construction Period** will help to improve the safety of any deep excavations.

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Thank You

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