



International
Conference on **GIS**
and Geoinformation
Zoning for Disaster
Mitigation (**GIZ**)



Underpinning and deep foundations load transfer of a ten-storey building in Lisbon

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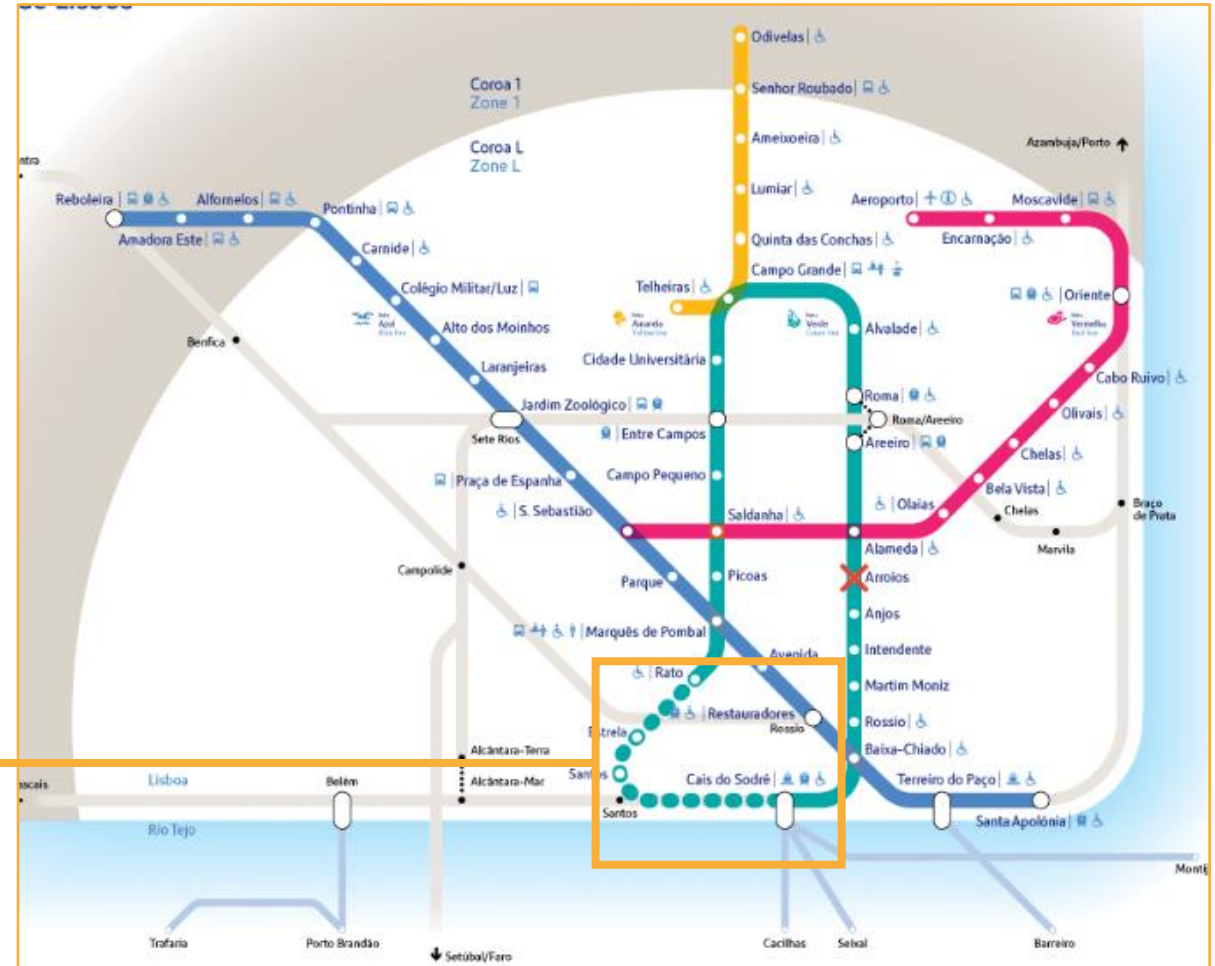
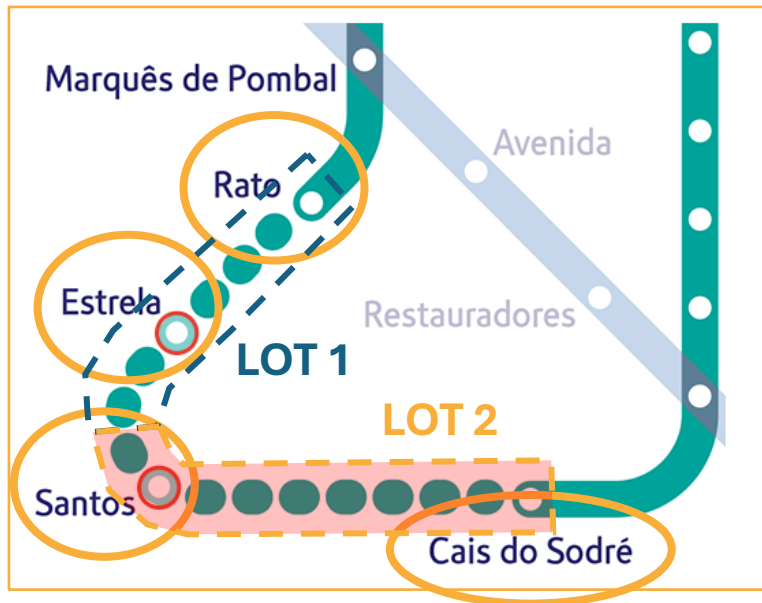
- **INTRODUCTION**
- MAIN RESTRAINTS
- ADOPTED SOLUTIONS
- LOAD TRANSFER AND MONITORING
- FINAL REMARKS

Introduction



LISBON NEW CIRCULAR METRO LINE:

- ❖ Rato station interconnection
- ❖ Estrela station
- ❖ Santos station
- ❖ Cais do Sodré station interconnection





Introduction



- ❖ Buildings n° 42 and n° 44 at Avenida D. Carlos I (XX century):
 - Reinforced concrete structure
 - Reinforced concrete bored piles foundations
 - 9 elevated floors and 1 basement
- ❖ Building n°42 was recently subject to rehabilitation works for conversion into residential use.
- ❖ Building n°44 is in its original conditions, used for offices, and showing a good state of conservation.
- ❖ Need to underpin several columns over intervention area: solution compatible with equipment operating under 3m head room

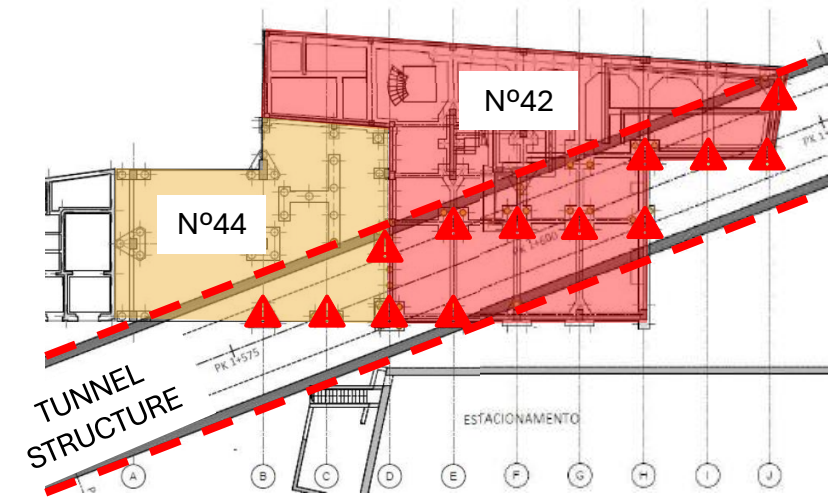


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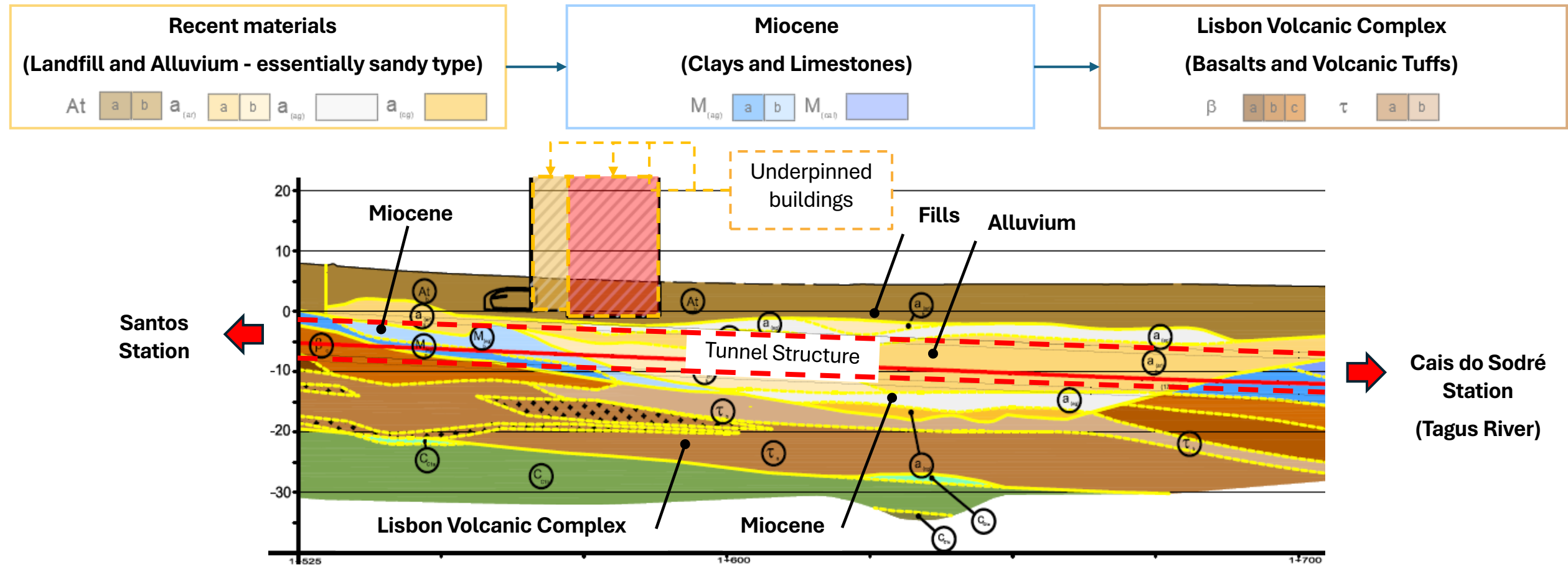
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- INTRODUCTION
- **MAIN RESTRAINTS**
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Geotechnical Restraints



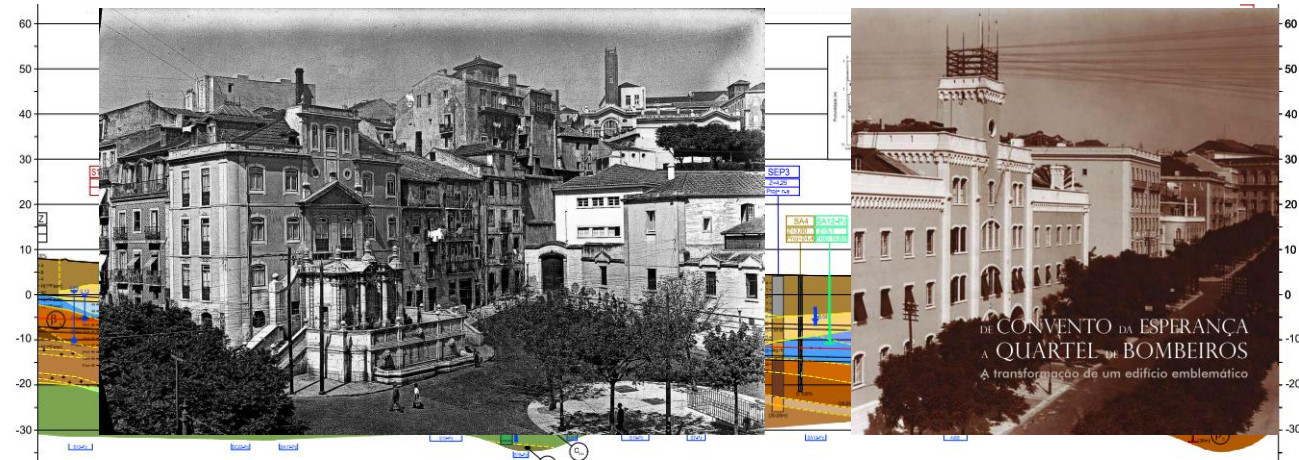
Construction Restraints



- ❖ Densely urbanized area:
 - Density of old structures and services
- ❖ Complex geological, geotechnical and hydrogeological scenario:
 - Maritime landfill area (aprox. 125 years)
 - Ground water table close to surface with tide effect
- ❖ Historic part of the city:
 - Centenary buildings
 - Former Convent of Esperança



1780 - PLANTA TOPOGRAPHICA



Construction Restraints



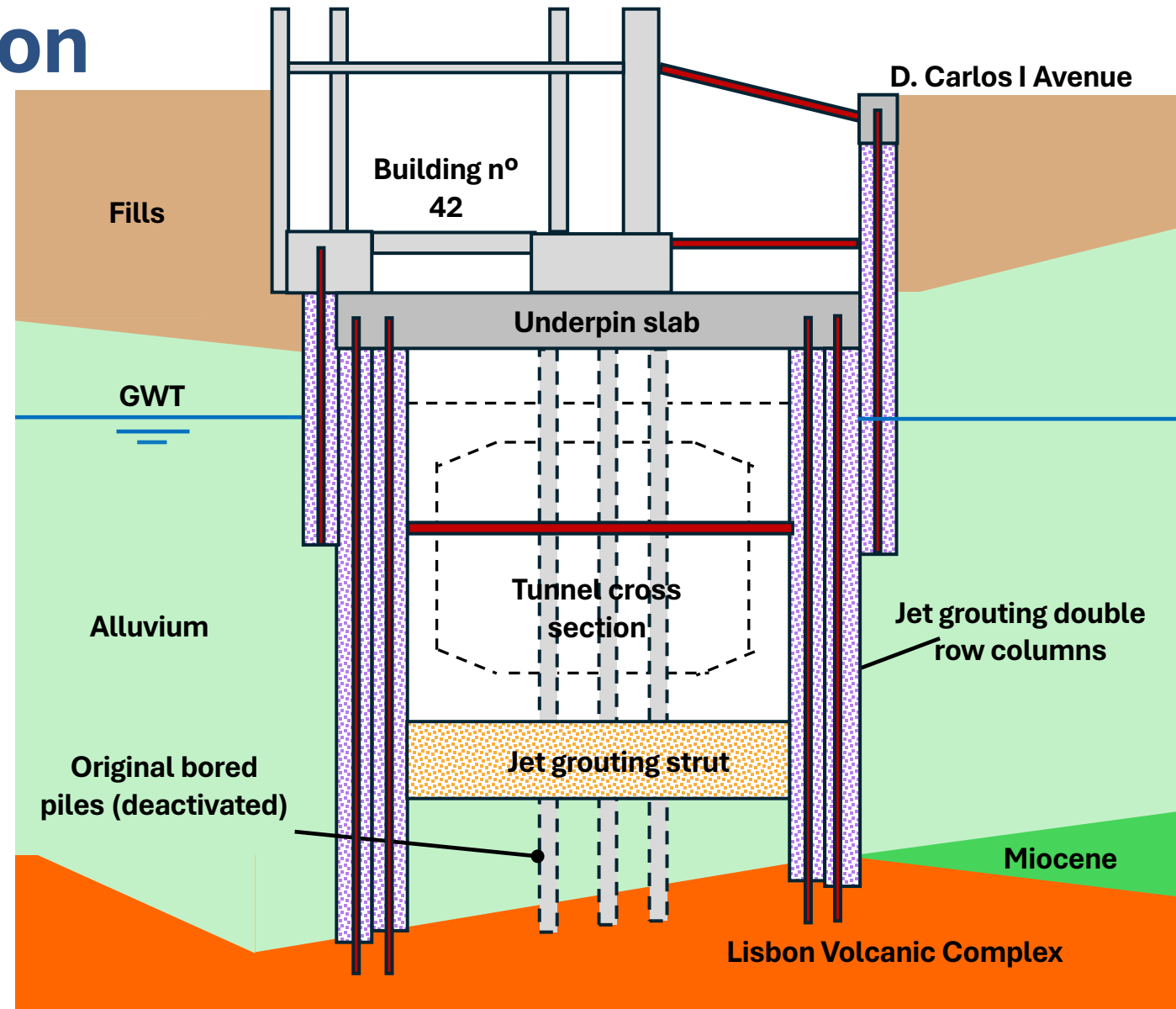
Construction Restraints



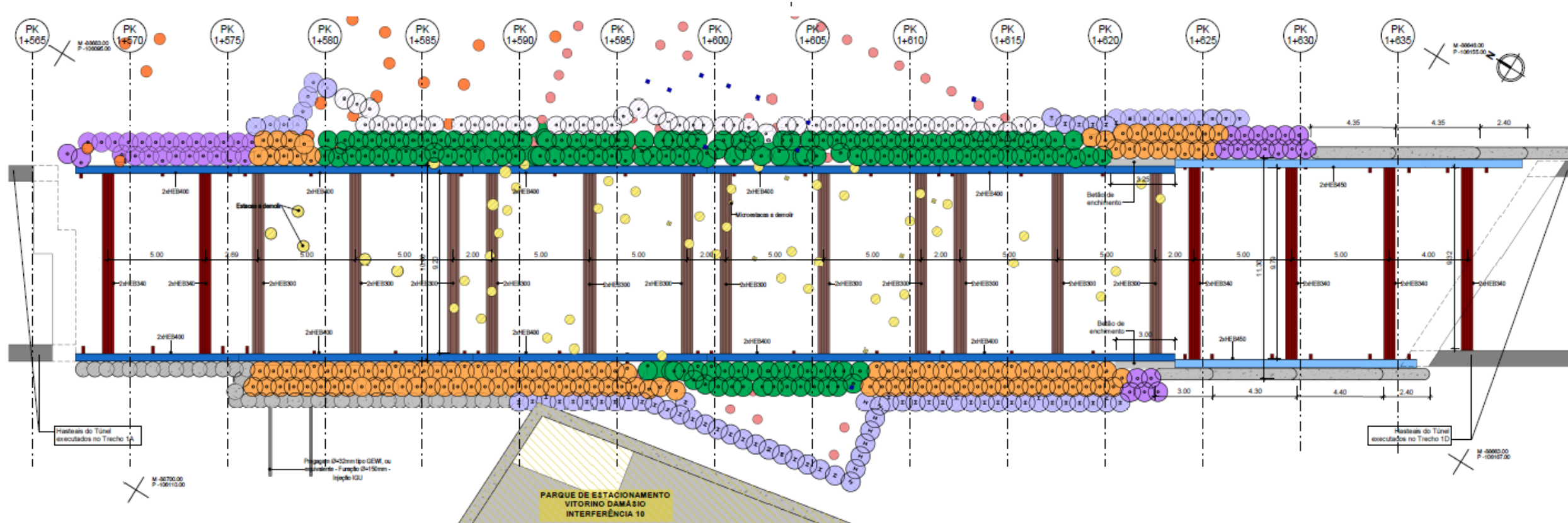


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Excavation Solution



Excavation Solution



Excavation Solution



Execution of jet-grouting columns



Installation of steel struts first level



Excavation work at the existing foundation piles area



Underpinning Solution



Existing bored piles casing at underpin slab level



Existing bored piles demolition

Excavation Solution

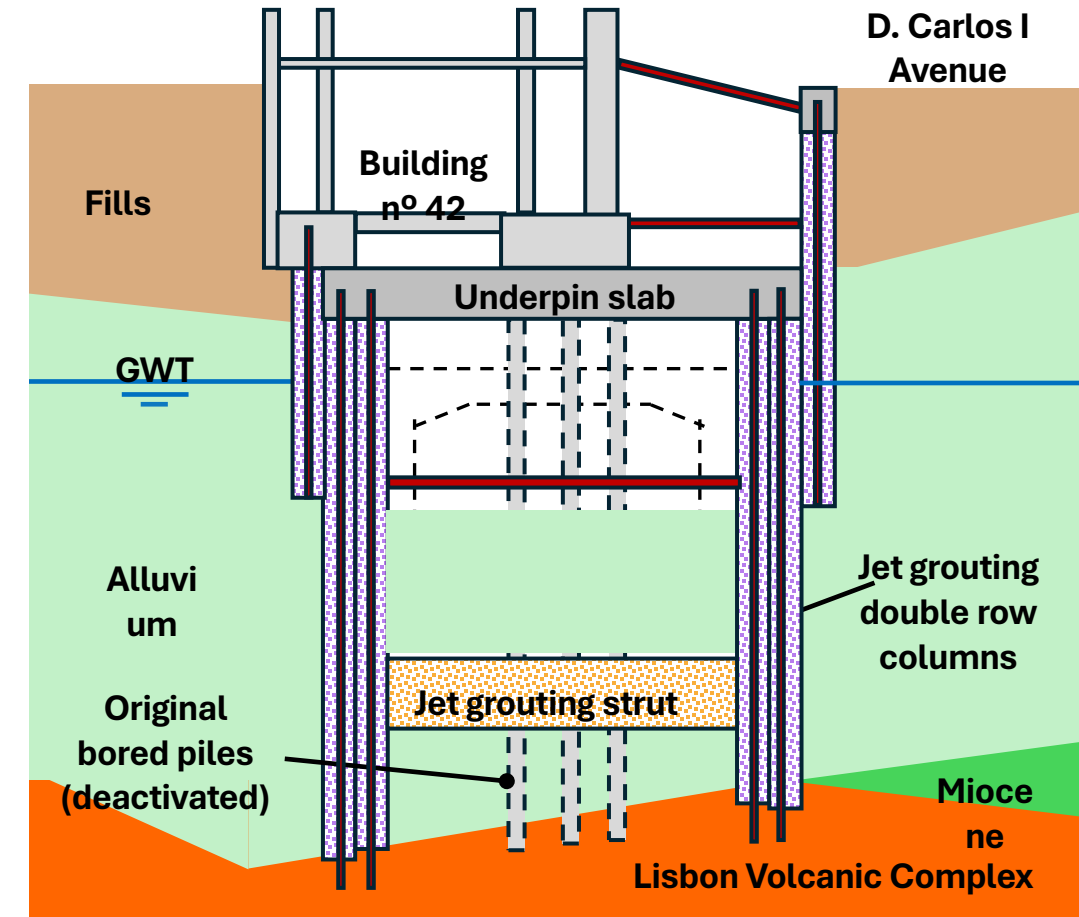


Jet grouting columns

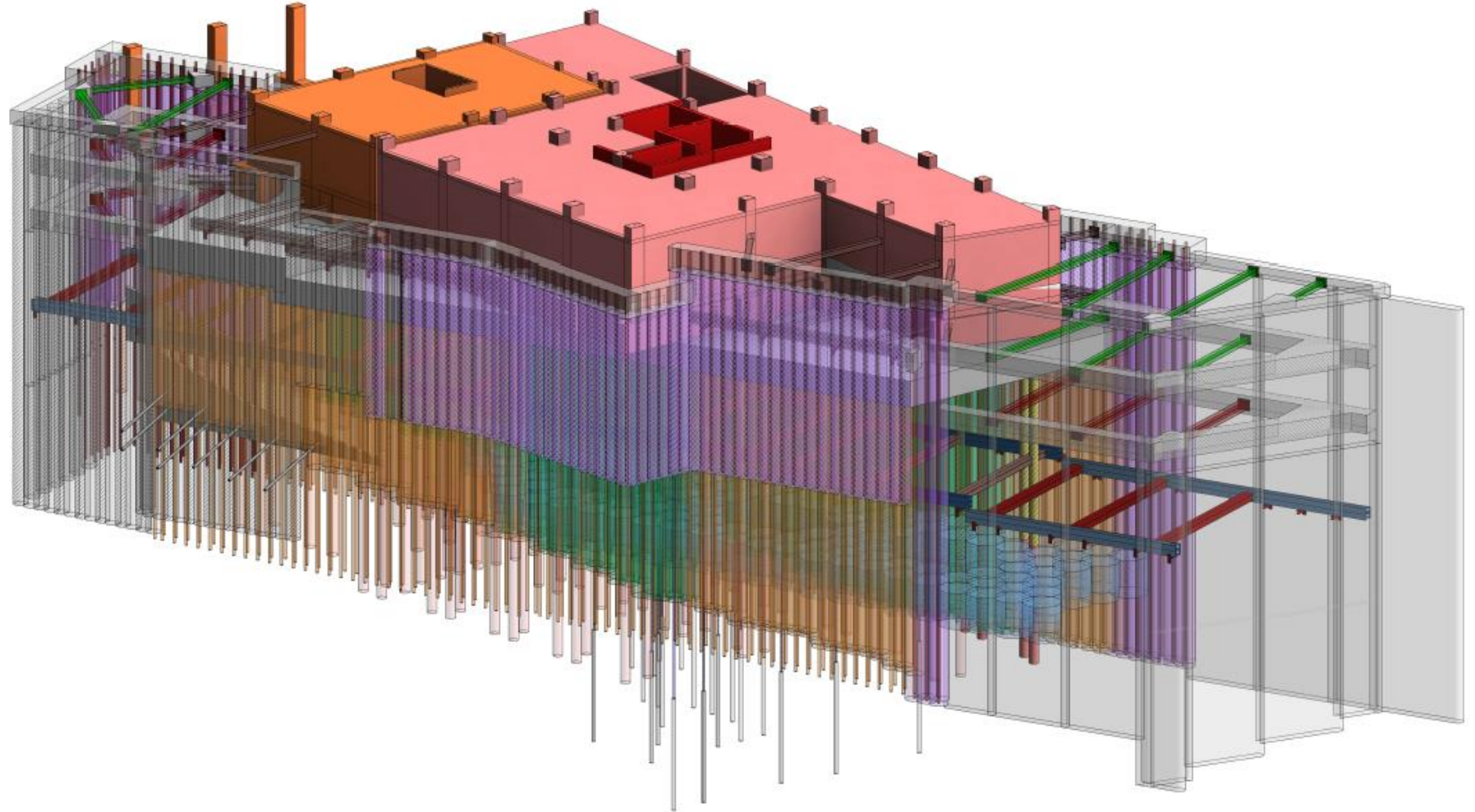
Excavation under the
underpin slab level



Underpinning Solution



Excavation + Underpinning Solution: Revit / BIM Model



Excavation + Underpinning Solution: Revit / BIM Model

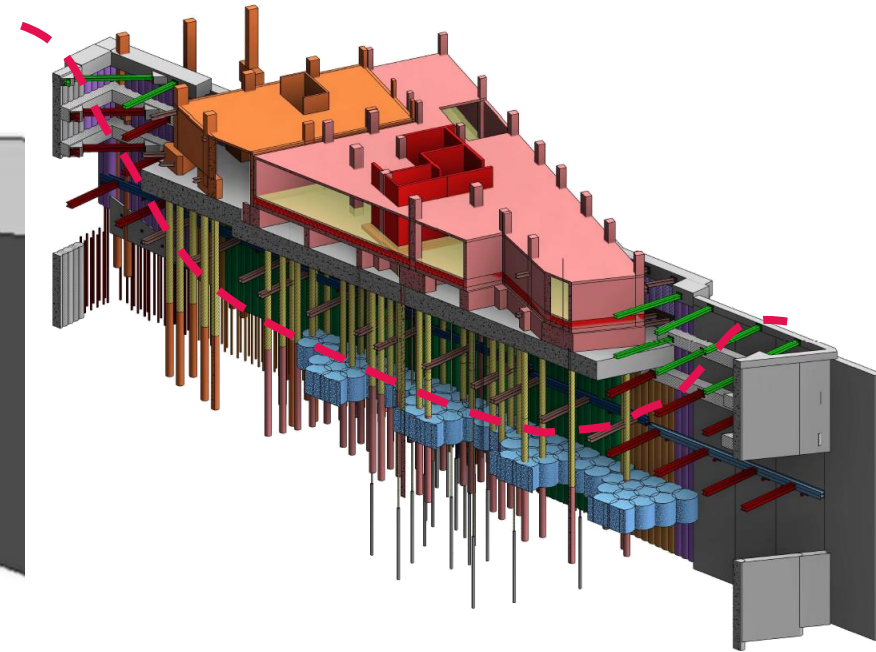
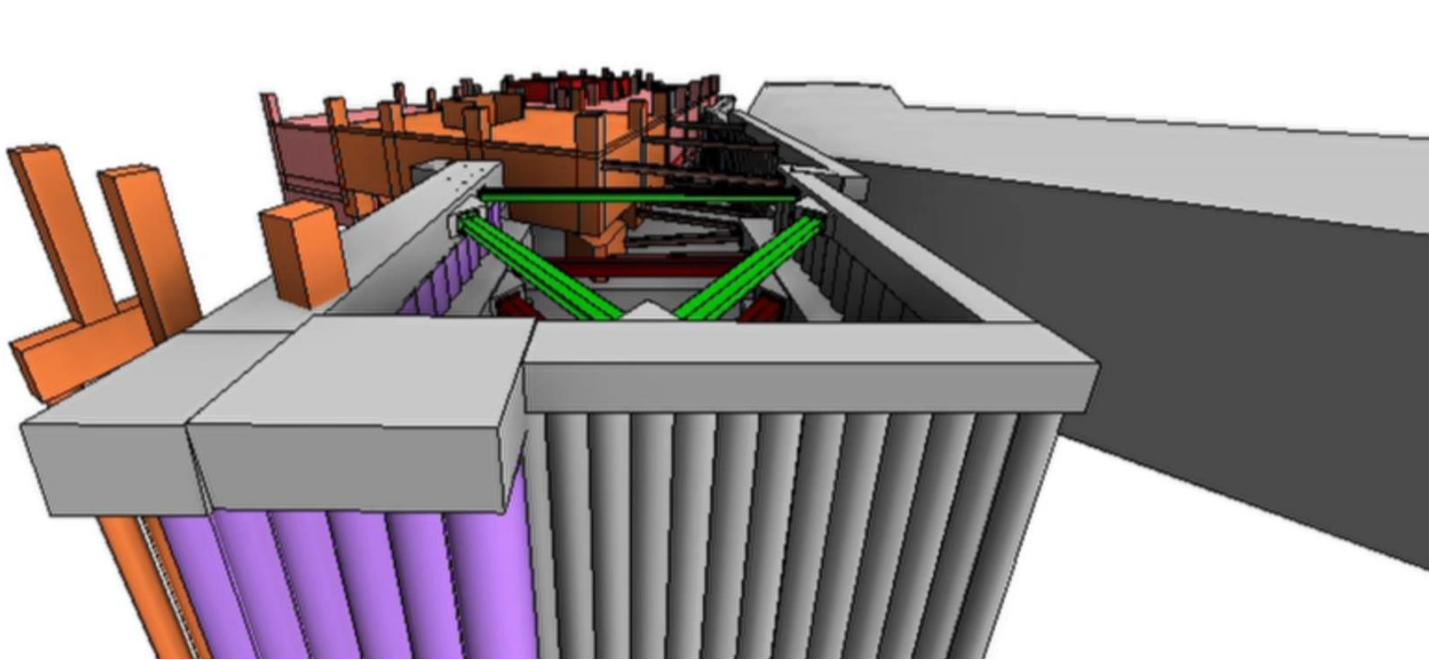


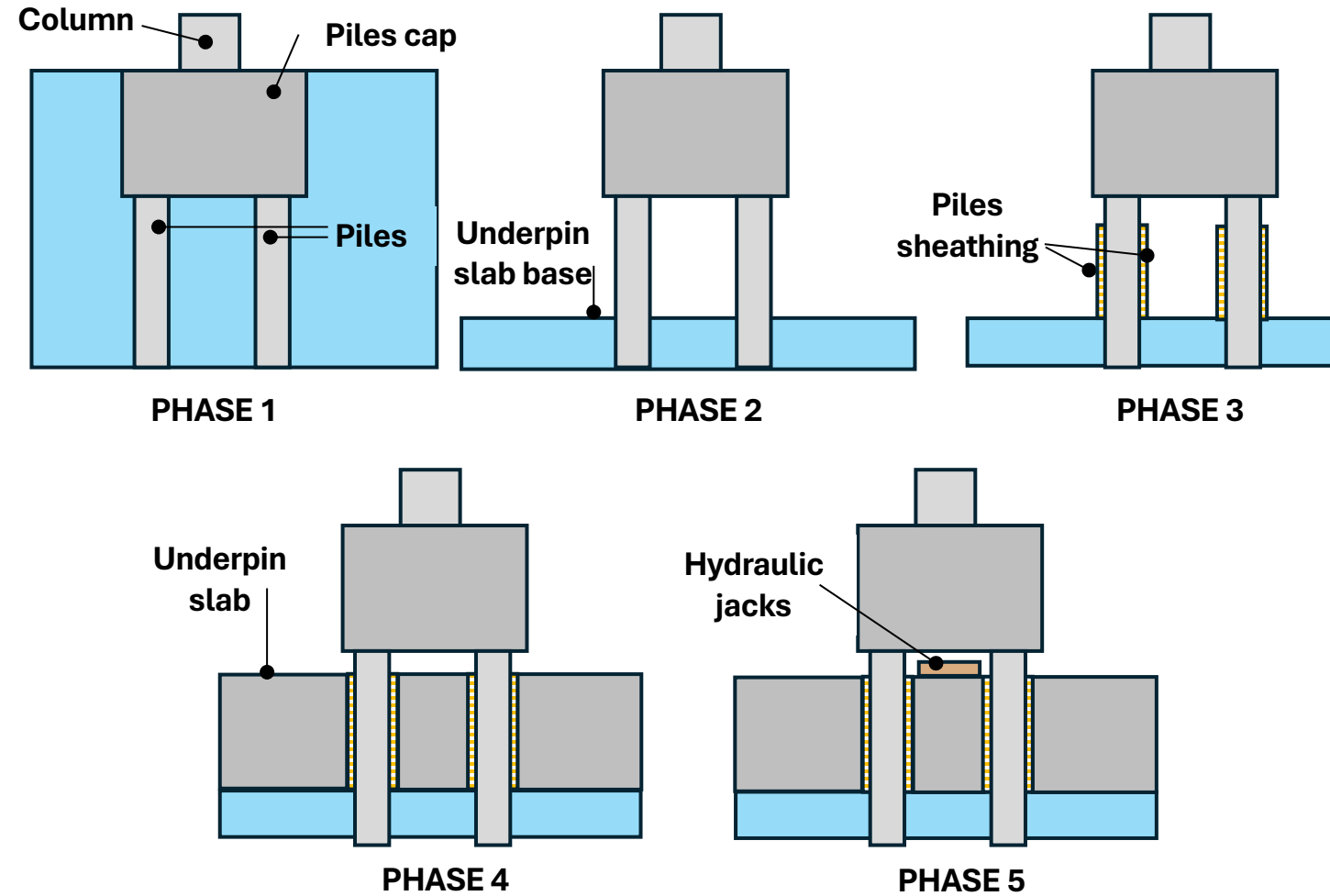
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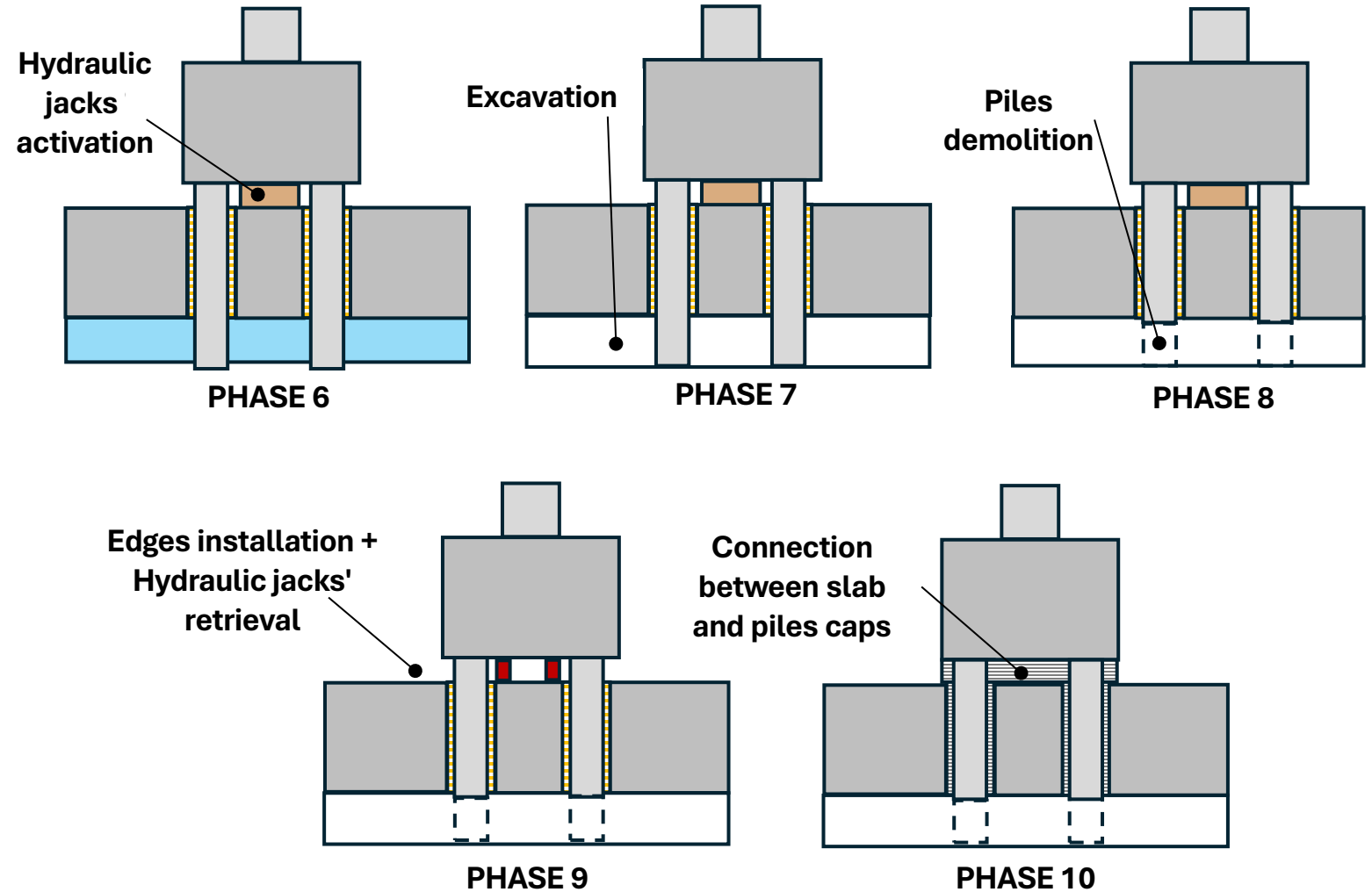


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- **LOAD TRANSFER AND MONITORING**
- FINAL REMARKS

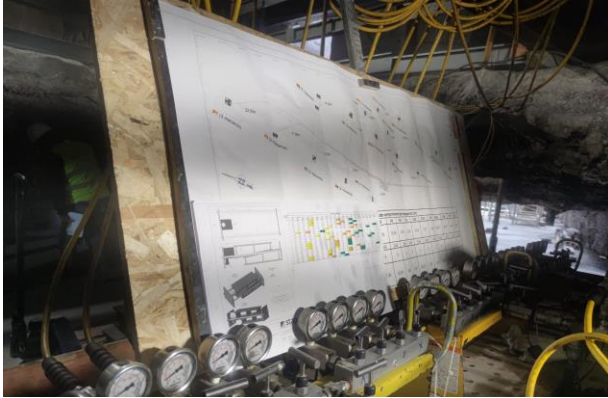
Load Transfer



Load Transfer



Load Transfer



Pressure control on the jacks



Hydraulic jacks



Fitting temporary wedges



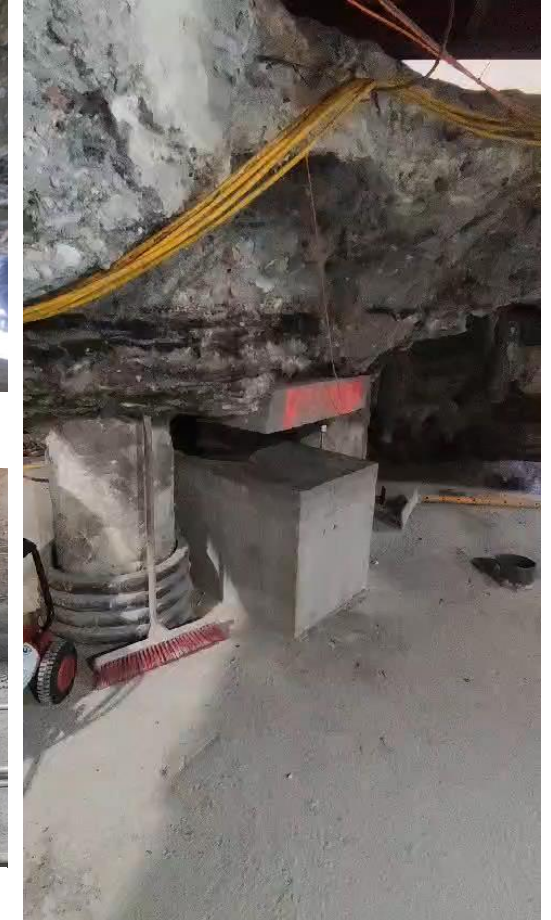
Hydraulic jacks' activation



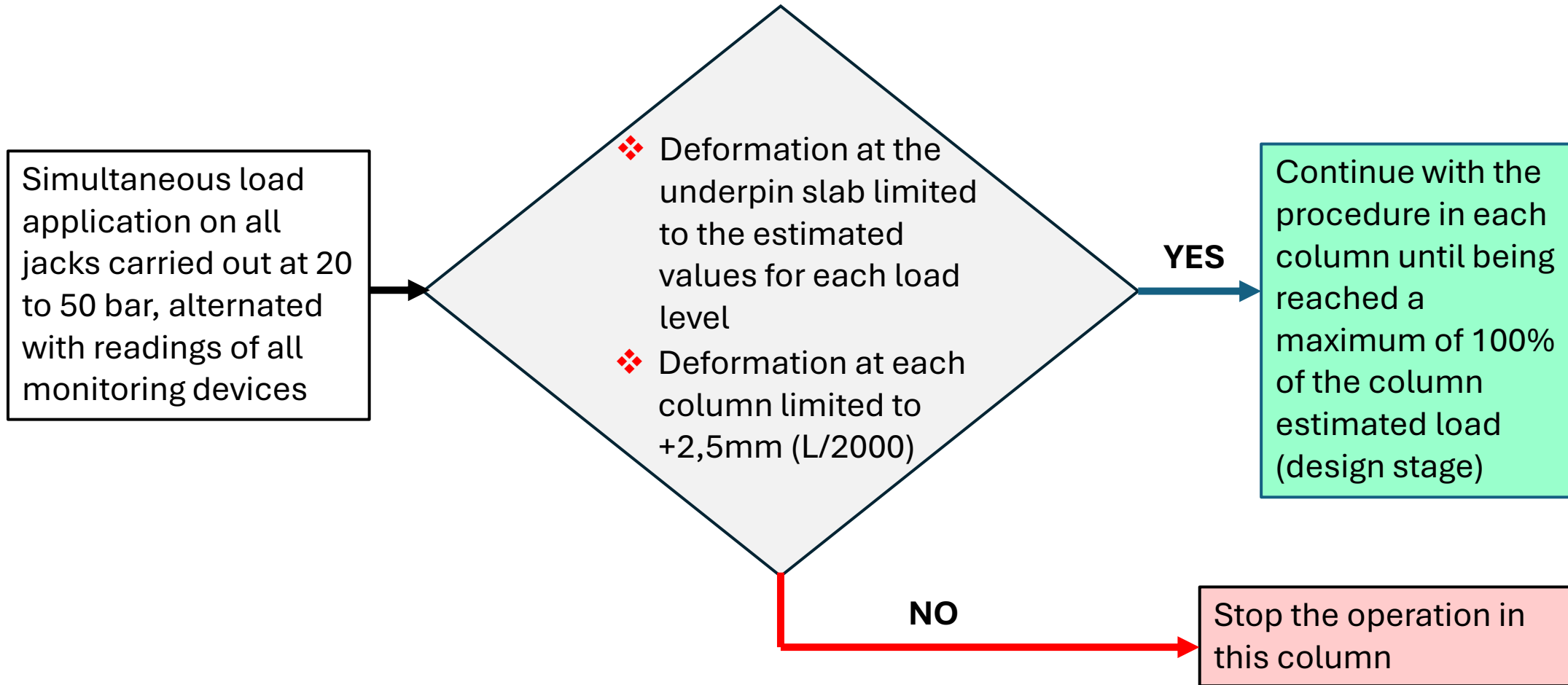
Sheathing of the piles



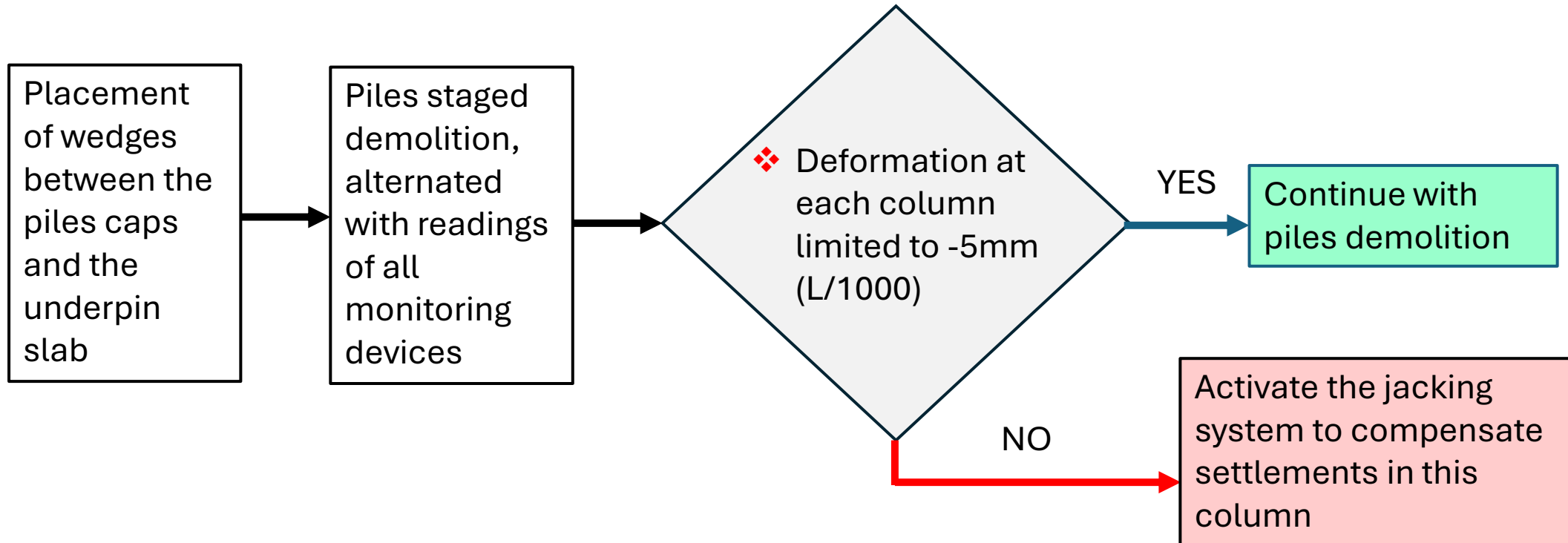
Piles demolition



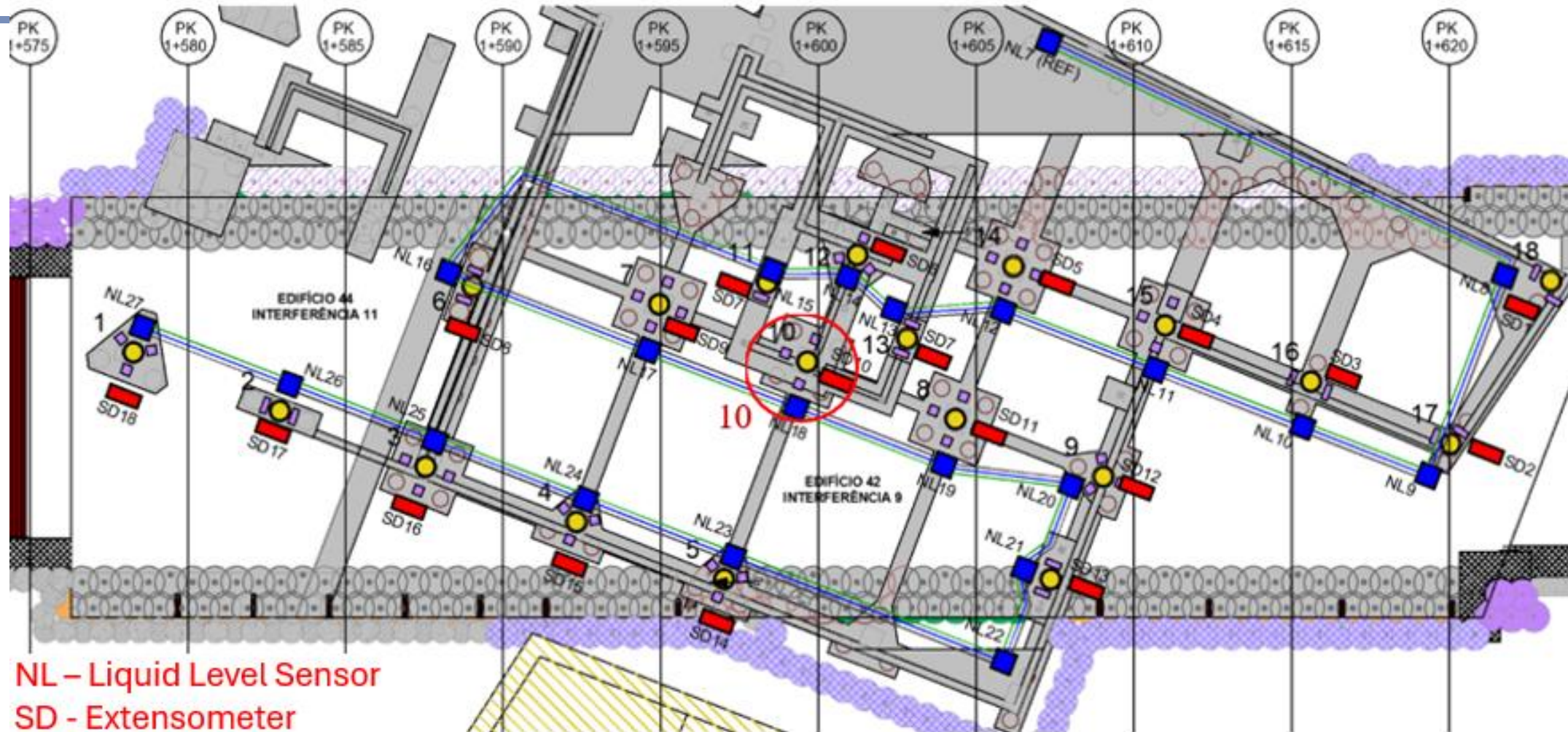
Load Transfer



Load Transfer

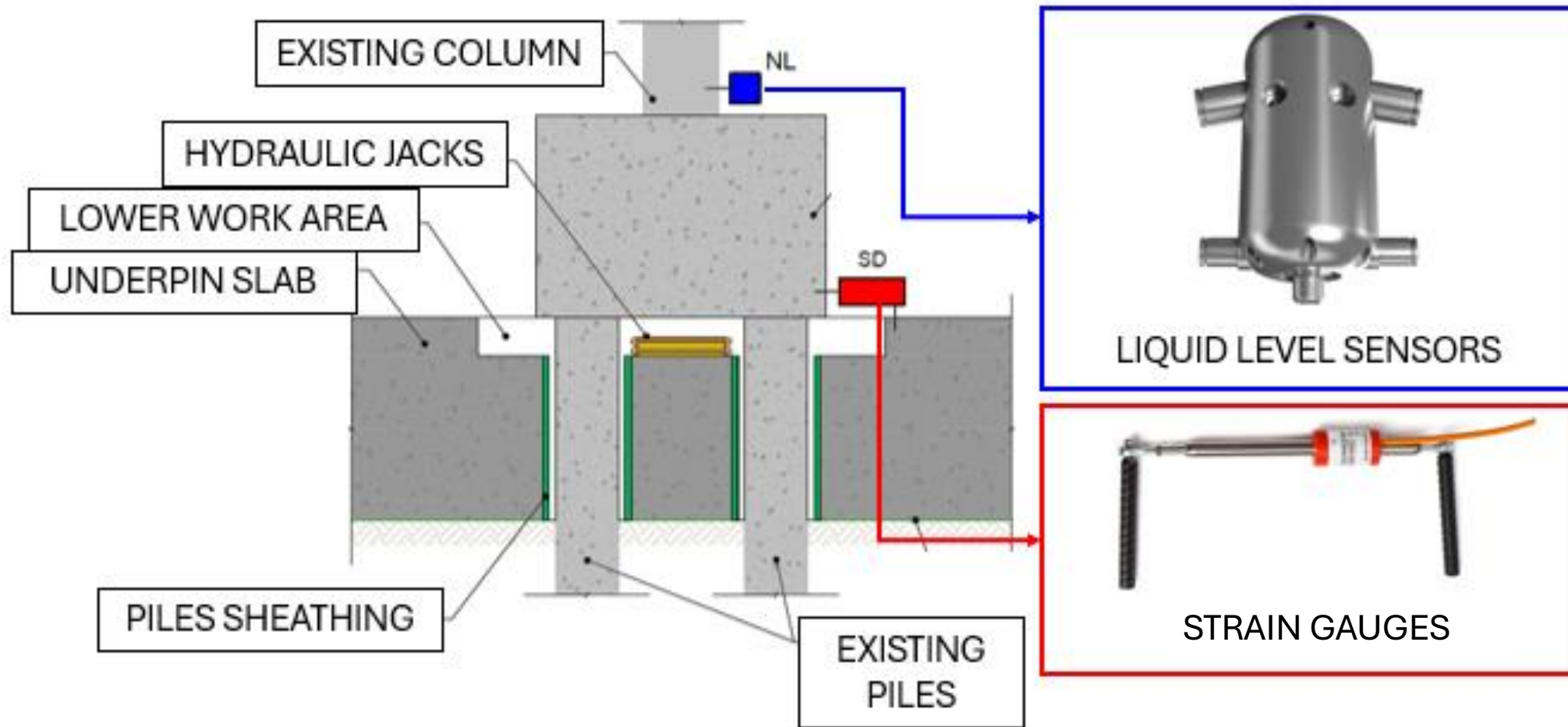


Monitoring



NL – Liquid Level Sensor
SD – Extensometer

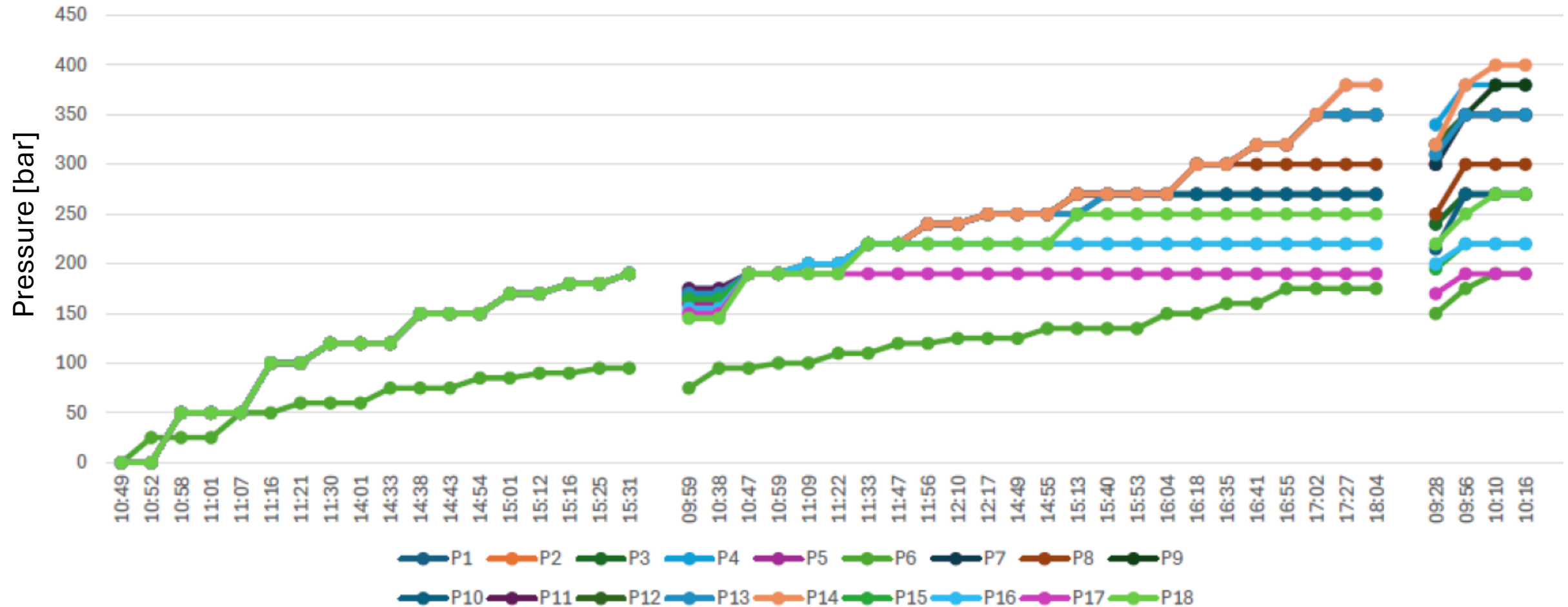
Monitoring



Monitoring



Monitoring



Monitoring

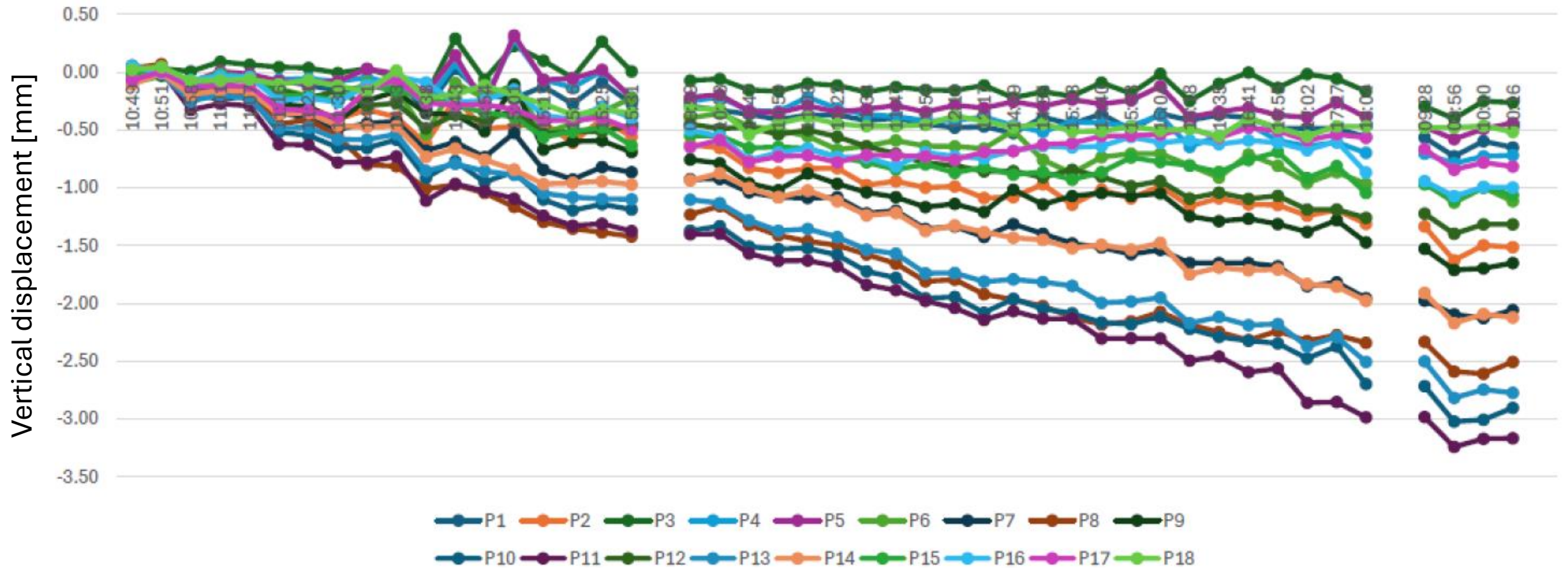


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Final Remarks



- ❖ Importance of good design solutions, considering all the complex restraints
- ❖ Importance of the monitoring and survey plan, comprising automatic measurements and IoT
- ❖ Importance of engineering judgment



**Thank you
for your kind attention!**

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