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UTILISATION OF GEODETIC MONITORING FOR
VERIFICATION OF THE NUMERICAL MODEL OF
IMPACT OF A BUILDING UNDER CONSTRUCTION ON SURROUNDING STRUCTURES

Specificity of Warsaw’s subsoil and object location

„Wolfd Marszałkowska Building”
located in the dense centre of Warsaw,
Specificity of Warsaw’s subsoil and object location

„Wolf Marszałkowska Building”
- located in the dense centre of Warsaw,
- its location within the neighbourhood of existing buildings,
- foundation in complex geotechnical conditions,
“Wolf Marszałkowska Building”
located in the dense centre of Warsaw,
its location within the neighbourhood of existing buildings,
foundation in complex geotechnical conditions,
not fully recognized the ground - the rubble of the destroyed post-second world war Polish capital,

the excavation made for 5-storey underground part of the building, which implementation forced the lowering of buoyancy of the water bearing layer.
FIG Working Week 2012
Knowing to manage the territory, protect the environment, evaluate the cultural heritage
Rome, Italy, 6-10 May 2012

“Wolf Marszałkowska Building”
“Wolf Marszałkowska Building”

Characteristic stages of implementation of the Wolf Marszałkowska Building

| Stage of construction of the plant | Dates | Performed building works | Stages of dismantling works | Control measure
|-----------------------------------|-------|--------------------------|-----------------------------|----------------
| 1                                | 22.12.2007 - 21.03.2008 | Building demolition, works on the ground | 1 | I (phase I)
| 2                                | 09.04.2008 - 01.05.2008 | Making the excavation, construction of the floor for the storey 1 | 4 | II (phase II)
| 3, 4, 5                          | 20.05.2008 - 04.08.2008 | Making the excavation, construction of the floor for the storey 2, 3, 4 | 1 | II (phase II)
| 6, 7                             | 10.08.2008 - 04.10.2008 | Making the excavation, building the foundation plate | 11 | II (phase II)
| 8, 9                             | 21.11.2008 - 18.02.2009 | Building the floor of the storey 6, transfer of loads on the foundation plate | 12 | II (phase II)
| 10-12                            | 19.02.2009 - 10.02.2009 | Building the floor of the storey 1 | | |
| 13-15                            | 04.04.2009 - 02.04.2009 | Building the floor of the storey 2 | | |
| 16-18                            | 10.05.2009 - 22.05.2009 | Building the floor of the storey 3 | | |
| 19-21                            | 08.05.2009 - 22.05.2009 | Building the floor of the storey 4 | | |
| 22-24                            | 11.05.2009 - 12.06.2009 | Building the floor of the storey 5 | | |
| 25-27                            | 30.06.2009 - 02.10.2009 | Completion of building works | 1 | |
| 28-30                            | 08.10.2009 - 10.10.2009 | Completion | | |
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Numerical model of deep foundation

<table>
<thead>
<tr>
<th>Material no.</th>
<th>Symbol</th>
<th>Description of material</th>
<th>Parameters of layer assumed in accordance to geotechnical documentation (following the standard PN-EN 1997-1)</th>
<th>Parameters considering the range of small deformations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Silty soil</td>
<td>$\gamma$, $\gamma'<em>{sat}$, $\gamma</em>{sat}$, $\gamma_s$, $\sigma_0$, $\phi'$, $\phi$</td>
<td>$D_0$, $D_1$, $D_2$, $D_3$, $E_0$, $E_1$, $E_2$</td>
</tr>
<tr>
<td>2</td>
<td>P</td>
<td>Medium sand</td>
<td>$0.25$, $0.25$, $0.10$, $0.20$, $0.25$, $0.20$</td>
<td>$500$, $1000$, $1500$, $2000$, $2500$, $3000$</td>
</tr>
<tr>
<td>3</td>
<td>Gs</td>
<td>Dense clay</td>
<td>$0.25$, $0.25$, $0.10$, $0.20$, $0.25$, $0.20$</td>
<td>$500$, $1000$, $1500$, $2000$, $2500$, $3000$</td>
</tr>
<tr>
<td>4</td>
<td>K</td>
<td>Medium sand w/ additives</td>
<td>$0.25$, $0.25$, $0.10$, $0.20$, $0.25$, $0.20$</td>
<td>$500$, $1000$, $1500$, $2000$, $2500$, $3000$</td>
</tr>
<tr>
<td>5</td>
<td>S</td>
<td>Sand</td>
<td>$0.25$, $0.25$, $0.10$, $0.20$, $0.25$, $0.20$</td>
<td>$500$, $1000$, $1500$, $2000$, $2500$, $3000$</td>
</tr>
<tr>
<td>6</td>
<td>Gs_a</td>
<td>Dry sandy clay</td>
<td>$0.25$, $0.25$, $0.10$, $0.20$, $0.25$, $0.20$</td>
<td>$500$, $1000$, $1500$, $2000$, $2500$, $3000$</td>
</tr>
</tbody>
</table>

Geodetic control network – benchmarks location
CONCLUSIONS

- Reliability of results of numerical calculations depends on the accuracy of geological recognition and the correctness of determination of parameters of materials.

- Designing and implementation of building objects in difficult conditions (complicated composition of background, neighbourhood of existing buildings, deep excavations etc.) cannot be based on typical estimation of parameters and standard methods of static calculations.

- Performed surveying observations allow for verification of the correctness of the FEM model with respect to the reality.

- Application of relative analysis of displacements between chosen points of measurement network and similar nodes on the MES model allows for assessment of the correctness of the conducted numerical simulation, regardless of possible displacements of the reference benchmarks.