

# Building response to tunnelling

## Analysis of masonry structures



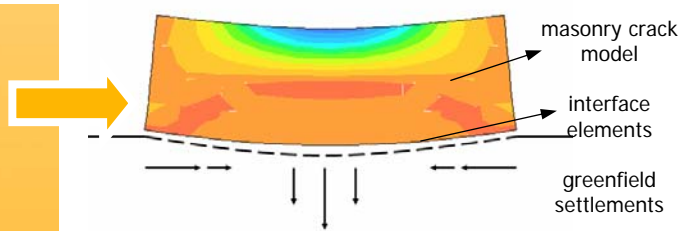
### Subject

Underground construction implies that existing buildings and architectural city heritage face the risk of being damaged due to settlements.

The issue is particularly relevant to cities in Dutch Delta areas, because of the combination of soft soil, fragile pile foundations and brittle, un-reinforced masonry facades.

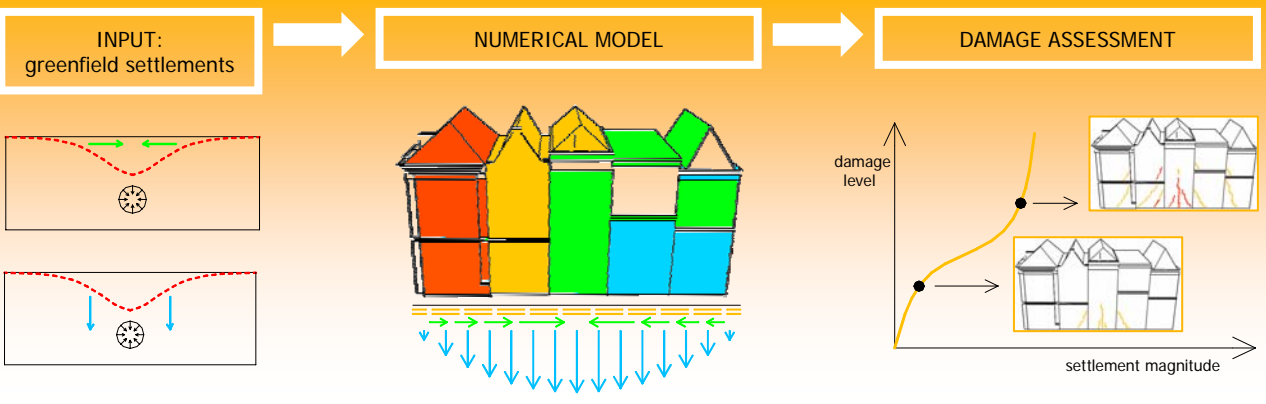
### Goal

The aim of the research project is to get a better understanding of the complex combined soil structure interaction process and to fundamentally analyze the detailed processes in both subsystems, which finally determine the actual damage effects on the structures.



### Expected Results

- Development and validation of damage classification systems for different building typologies
- Updated engineering design rules for building response to settlement.



## Building response to tunnelling Analysis of masonry structures

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### Subject

Underground construction implies that existing buildings and architectural city heritage face the risk of being damaged due to settlements. The issue is particularly relevant to cities in Dutch Delta areas, because of the combination of soft soil, fragile pile foundations and brittle, un-reinforced masonry facades. Modelling of soil-structure interaction is fundamental to assess the risk of building damage due to tunnelling.

### Goals

The aim of the research project is to get a better understanding of the complex combined soil structure interaction process and to fundamentally analyze the detailed processes in both subsystems, which finally determine the actual damage effects on the structures.

### Research Question

What are the effects of soil-structure interaction and masonry crack model on the building damage due to tunnelling?

### Strategy

- Application of different crack models for masonry and interface models for foundation to 2D and 3D building structures; numerical support is also provided by the companion project 'Robust cracking predictions for settlement damage'.
- Comparing the qualitative and quantitative differences between coupled and semi-coupled analysis of soil-building interaction.
- Better understanding of the various factors which can significantly influence the deformation and damage sensitivity of the structures (e.g. confinement and horizontal interaction at the soil-building interface, present condition and type of the building and its foundation, creep effects).
- Interpretation of the FEM output results in terms of cracking pattern, crack-width etc., to contribute to the development of a damage classification system.

### Expected Results

- Development and validation of damage classification systems for different building typologies
- Updated engineering design rules for building response to settlement.

### Preferred Partners Applications / Sponsors

This project is attached to COB-project F530 'Monitoring North-South Line', in order to inter-address the engineering and scientific challenges: applied and fundamental research. Funding is provided by Delft Cluster.

### Prime Publication / Prototyping

Giardina, G. (2008), "Numerical analyses of tunnel-induced settlement damage to a masonry wall", 7<sup>th</sup> fib PhD Symposium, 10-13 September 2008, Universität Stuttgart, Stuttgart, Germany.

### Research Period

2008 - 2011.