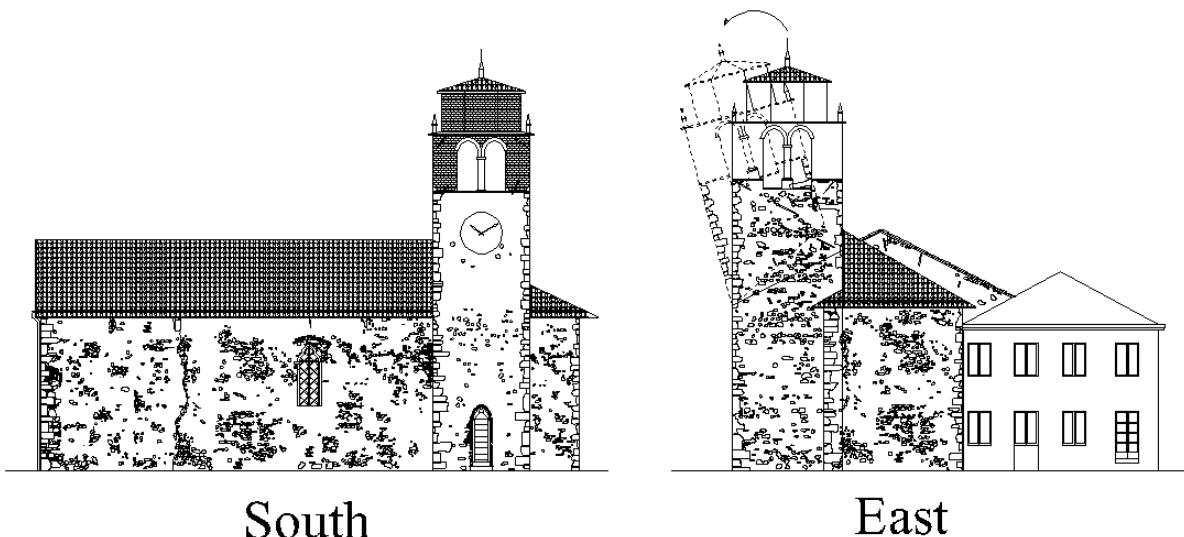


Assignment 6

To be submitted: 03.06.2025

The aim of this assignment is to evaluate the seismic behaviour of a stone masonry tower using a displacement-based approach based on a non-linear kinematic analysis and the N2 method.

A single scenario of a collapse mechanism of the tower will be studied. This is a rigid body rotation in the direction South-North, which corresponds to a common collapse mechanism observed in towers with kinematic boundary conditions imposed at a certain height due to the presence of an adjacent structure (the church in this case).

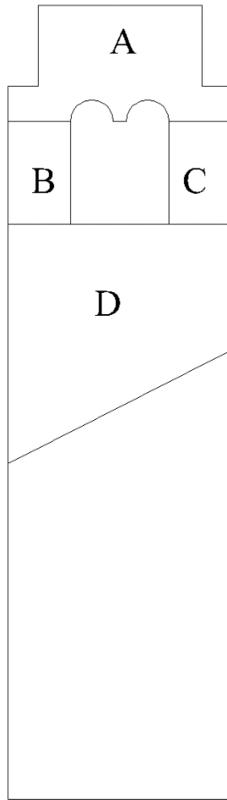


The capacity of the tower for this collapse mechanism will be studied using the nonlinear kinematic analysis. The following information is provided:

- Geometry of the tower and of the rigid body forming the kinematic chain are given in the accompanying CAD file.
- The compressive strength of masonry can be considered as infinite and the tensile strength as zero. No sliding can occur.

Task 1: Compute the weight of each rigid block – 2 pts

Consider the following simplified model for the calculations of the different blocks (see CAD file)



Task 2: Compute maximum acceleration a_0 - 7 pts

Compute the maximum acceleration necessary to start the rigid body movement

Task 3: Compute maximum displacement Δ_0 - 7 pts

Compute the maximum displacement corresponding to a zero base shear force

Task 4: Plot a bilinear pushover curve of equivalent SDOF a^* – Δ^* – 7 pts

Consider the following:

- Ultimate displacement $\Delta_u = \Delta_0 / \gamma_M$
- Yield displacement $\Delta_y = 0.4 \Delta_u$
- Safety factor $\gamma_M = 2$

Task 5: Compute performance point by applying the N2 method – 7 pts

Using the N2 method, check if the displacement demand is smaller than the ultimate displacement capacity.

Define the demand using SIA261 and considering the following:

- Valais, Zone 3b, Soil Class B.
- Construction work class COI

References

Course slides of Week 23 and Week 24