ETH zürich

Structural Dynamics and Earthquake Engineering

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Mr. Constantinos Kanellopoulos

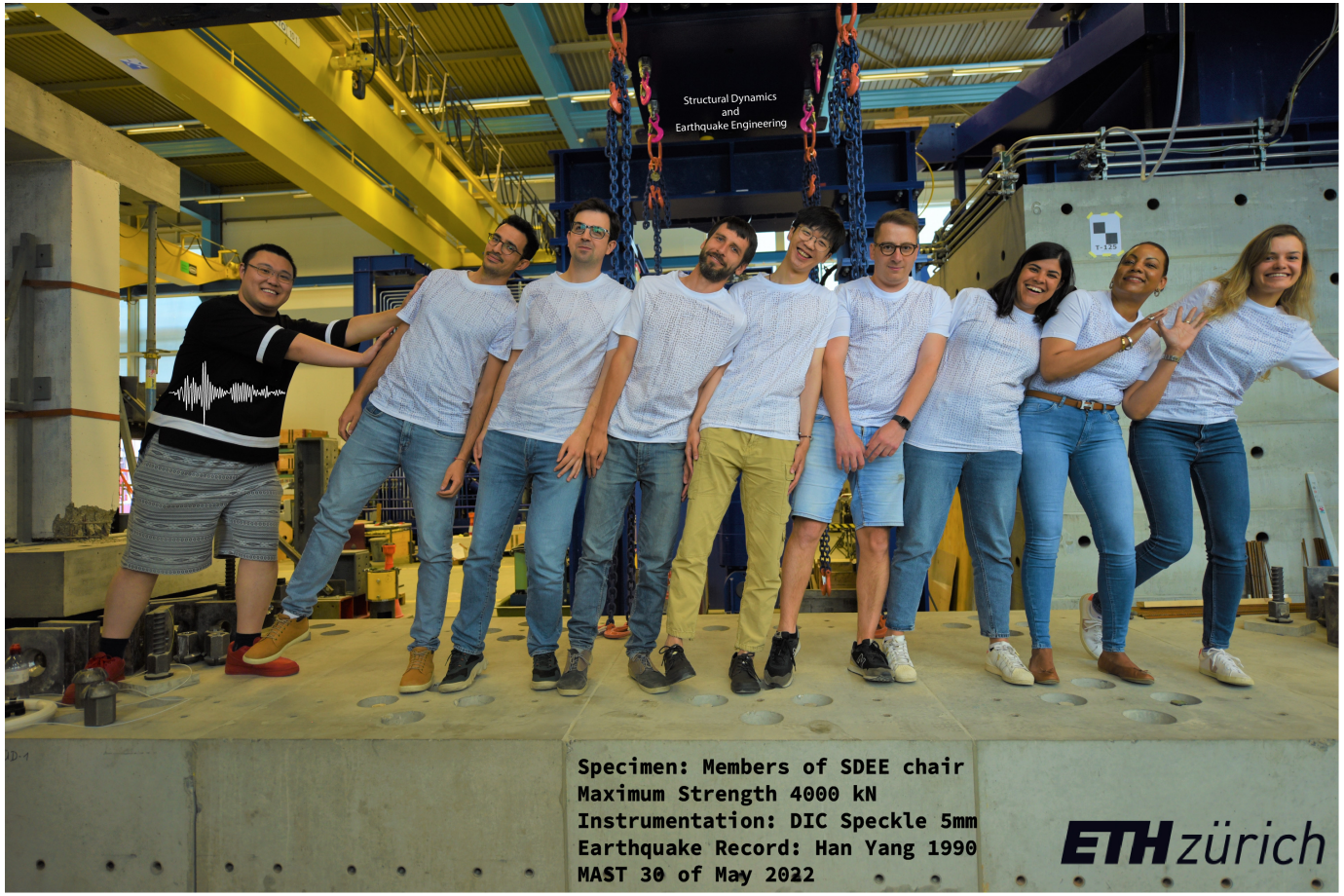
Dr. Nikola Blagojević

Dr. Lukas Bodemann

Dr. Şafak Arlslantürkoğlu

Dr. Anastasios Tsiavos

ETH Structural Dynamics and Earthquake Engineering



Recent Research

Individual Structures

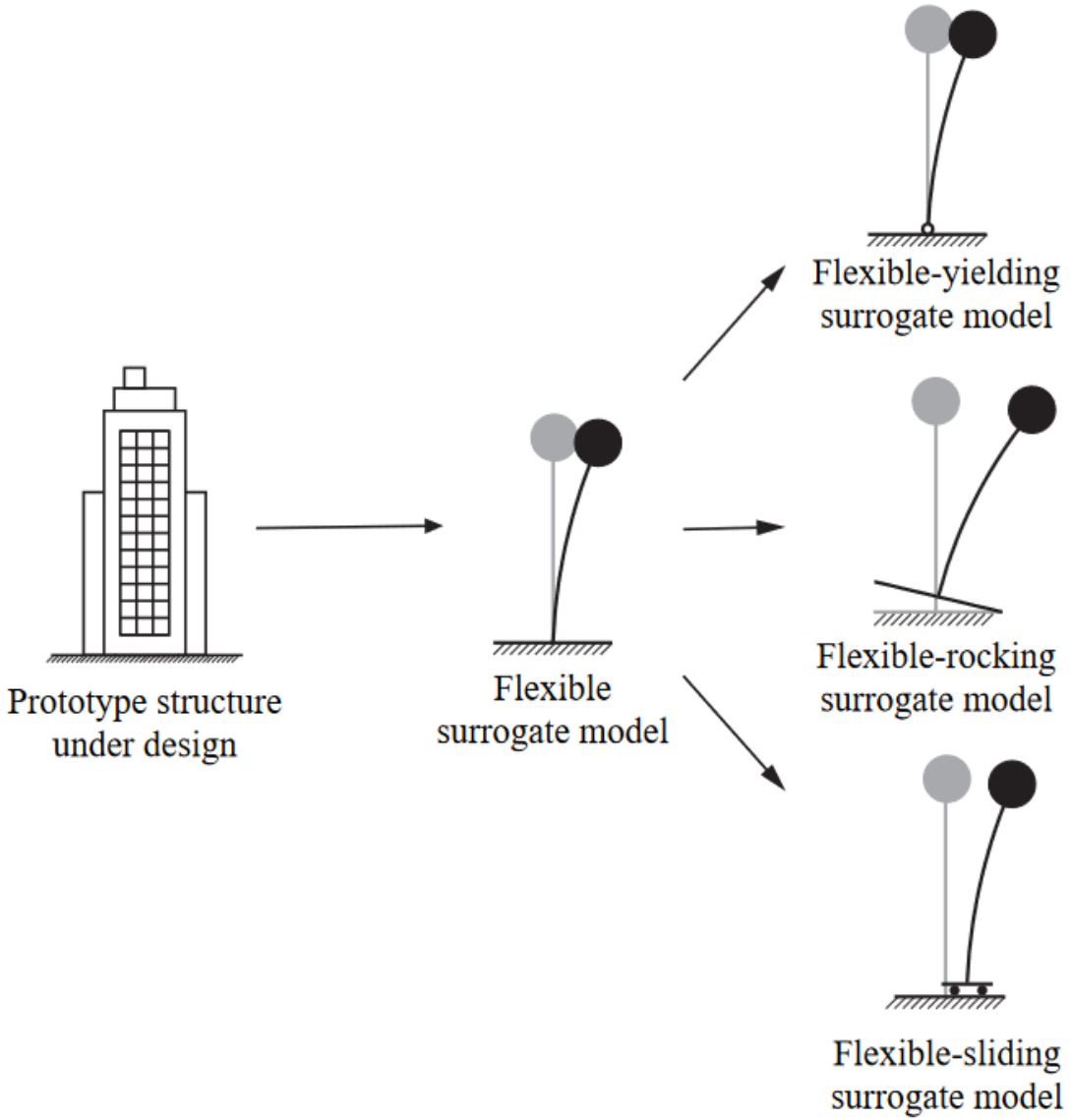


Communities

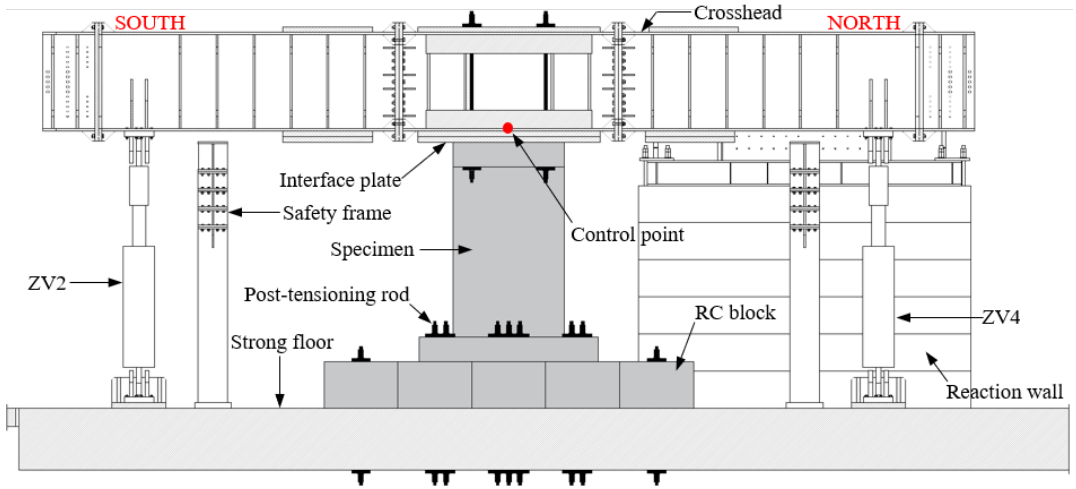


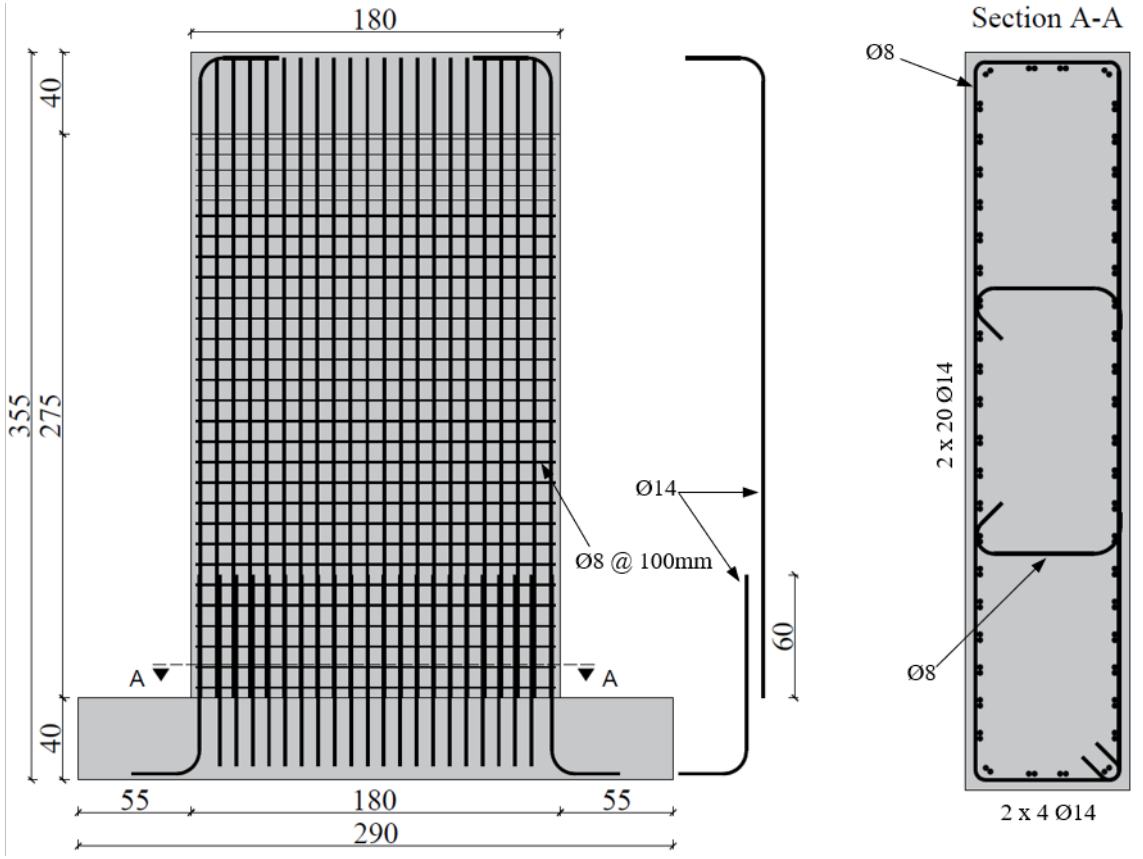
Seismic Design

- Explicitly consider strongly nonlinear seismic response modes using 2-DOF surrogate models for design:
  - Bending to rocking
  - Shear to sliding
  - Flexure-yielding



Bending to Rocking

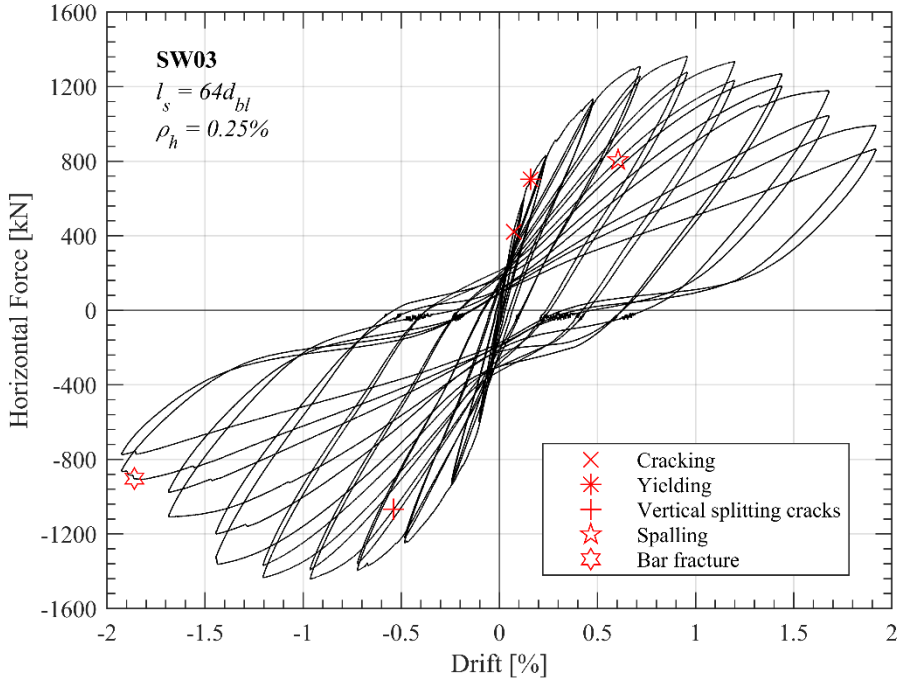


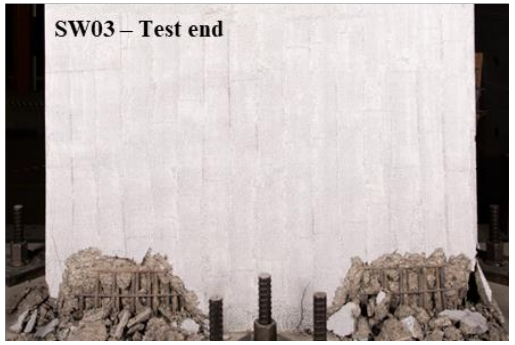


Lap splice length variation

Mr. Milan Kovarbašić

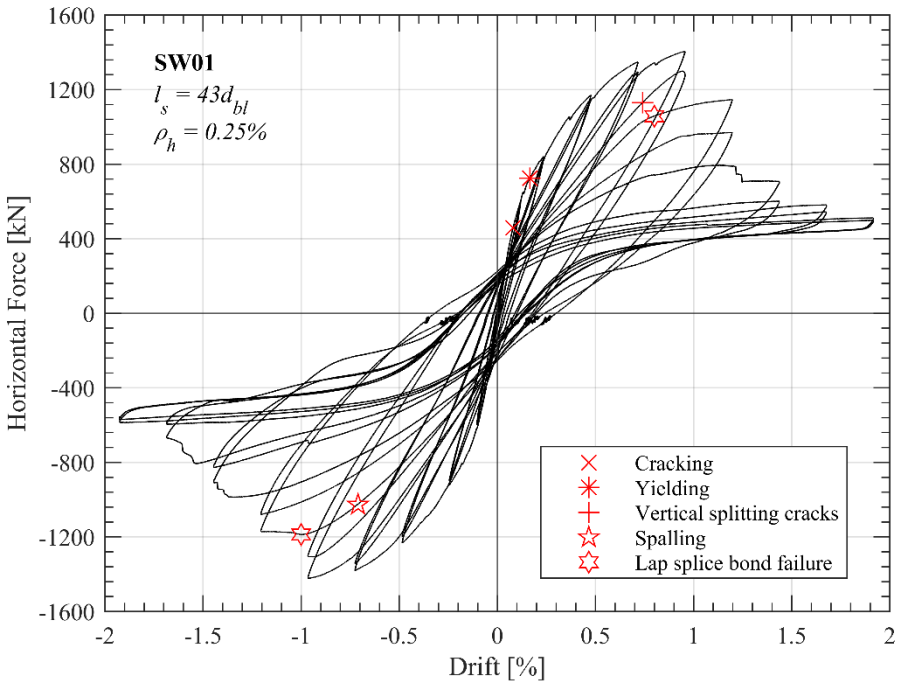
Bending to Rocking

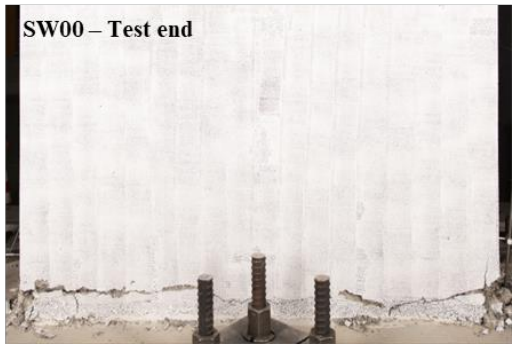




60db

Bending

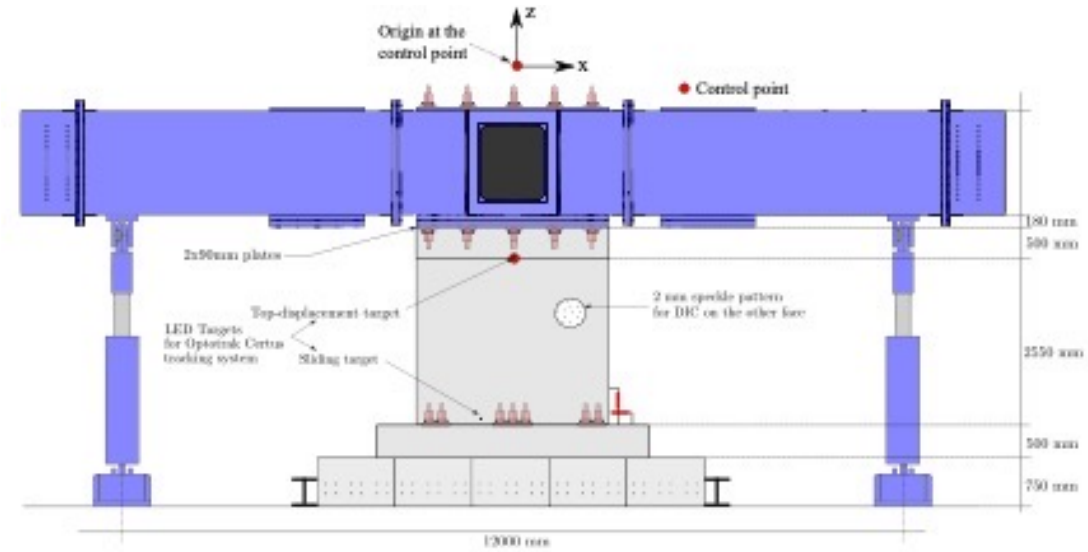


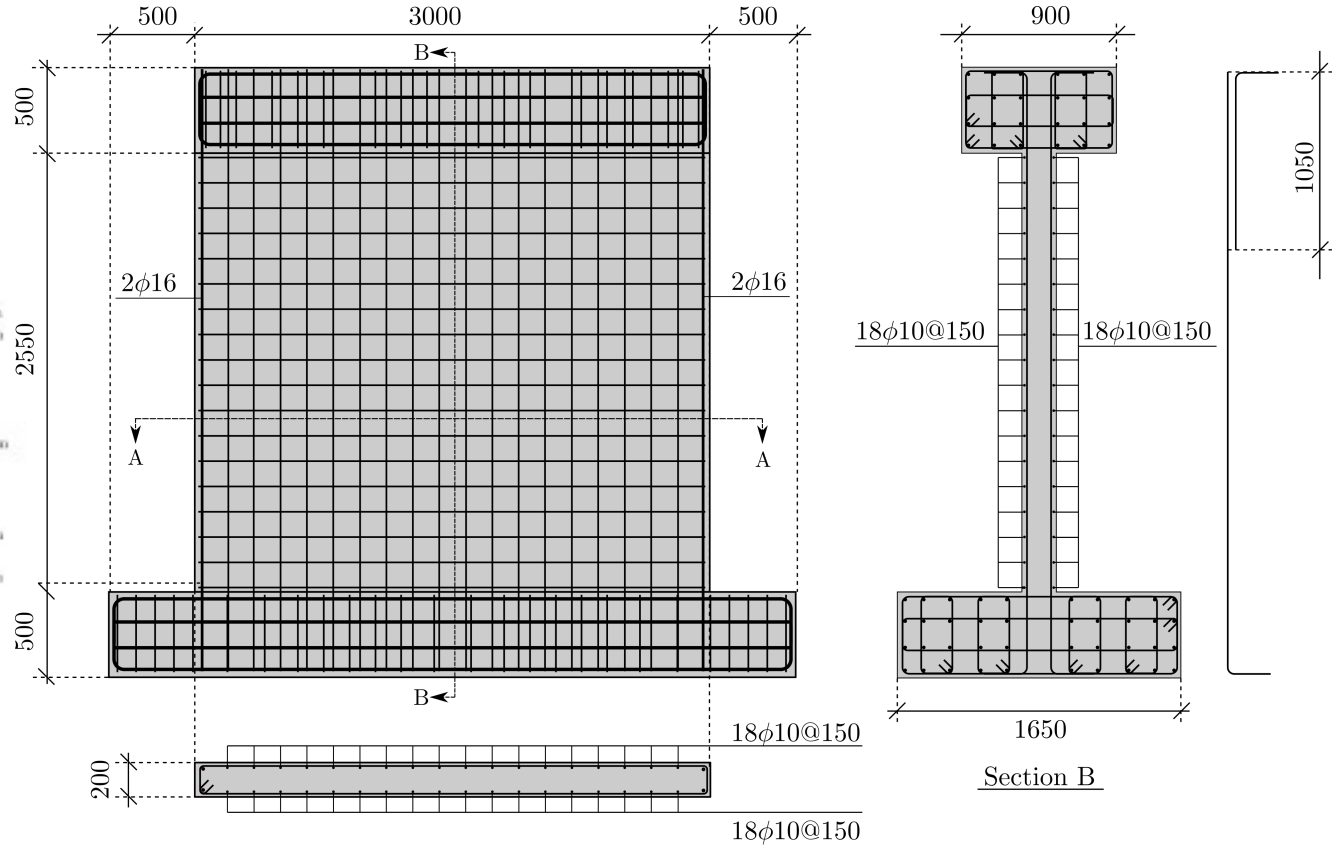


40db

Rocking

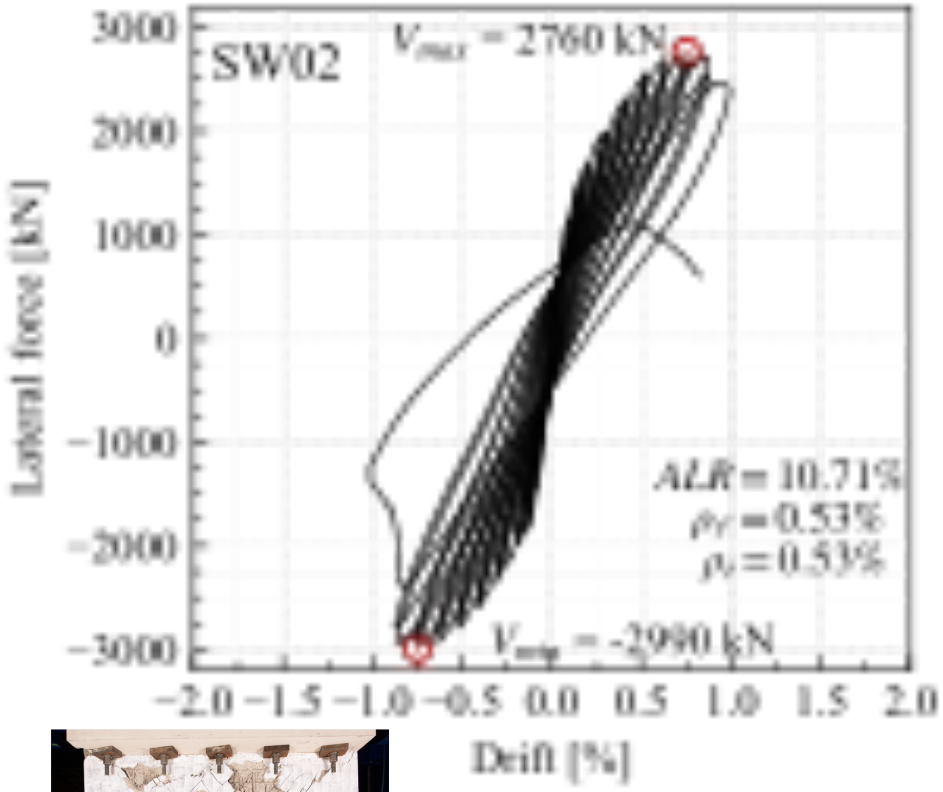
Shear to Sliding





Axial load variation

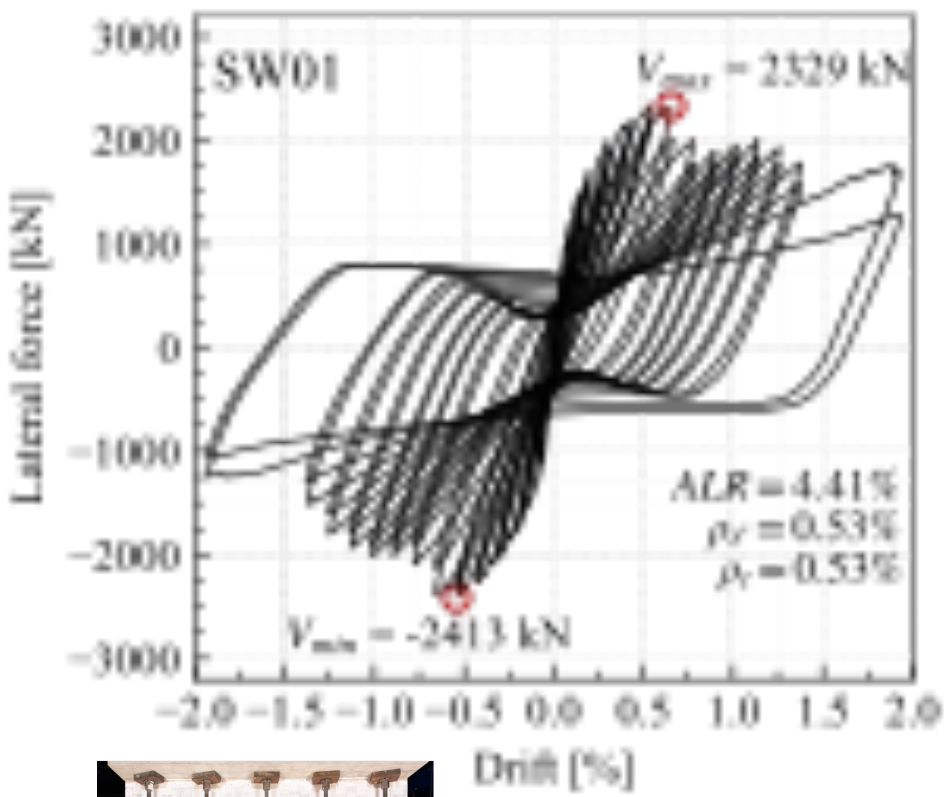
Shear to Sliding





ALR = 10.5%

Shear



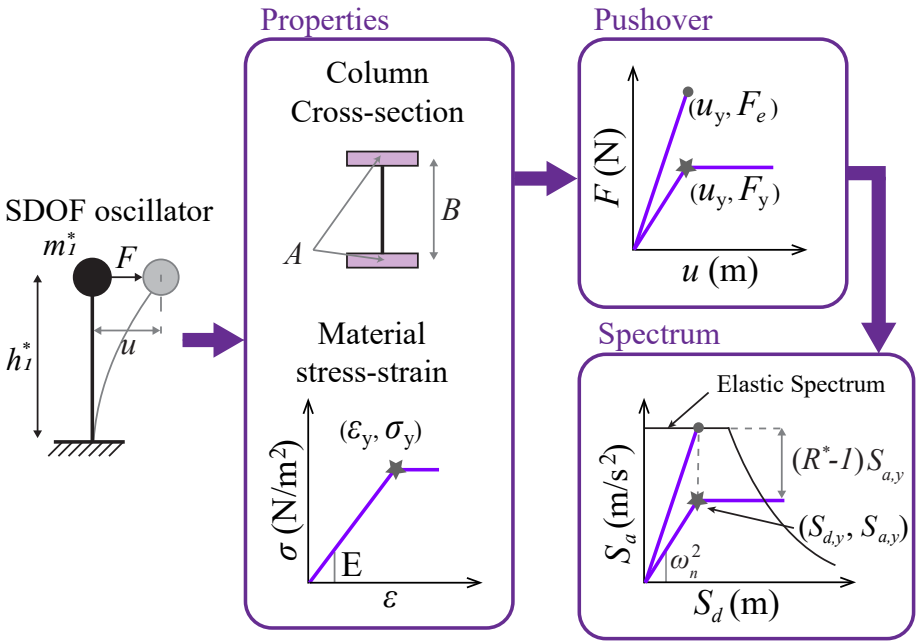


ALR = 4.3%

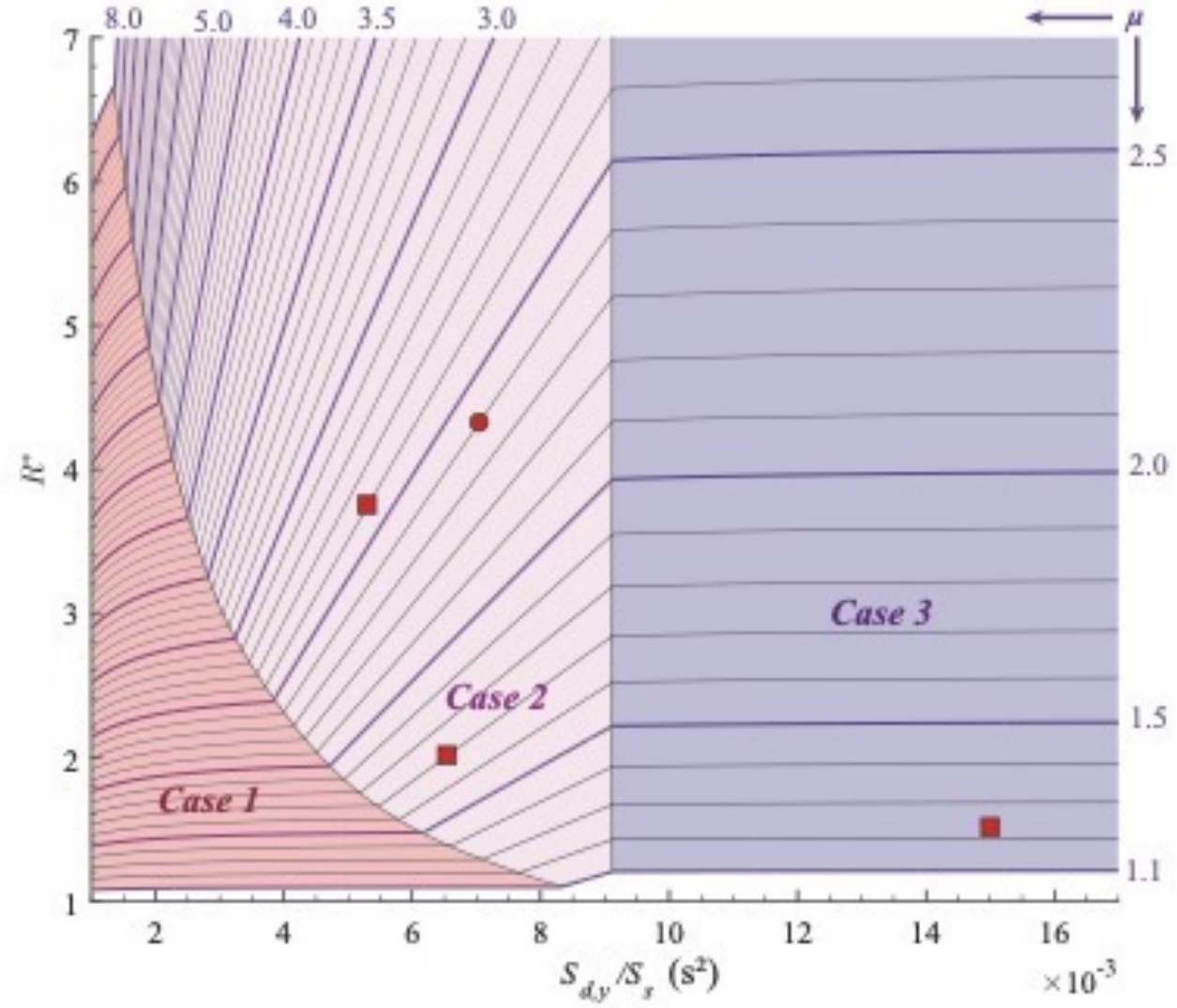
Sliding

Mr. Diego Pizarro

Constant Yield Displacement Design

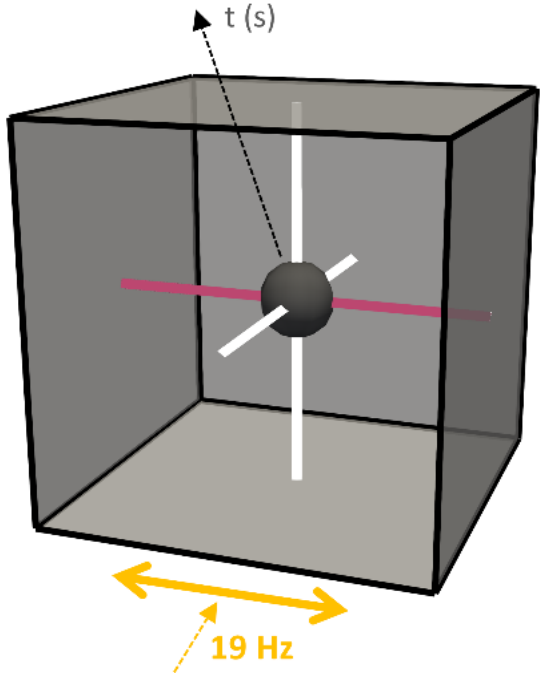


$$R^* = \frac{S_a(T^*)}{S_{a,y}} = \frac{F_e}{F_y}$$

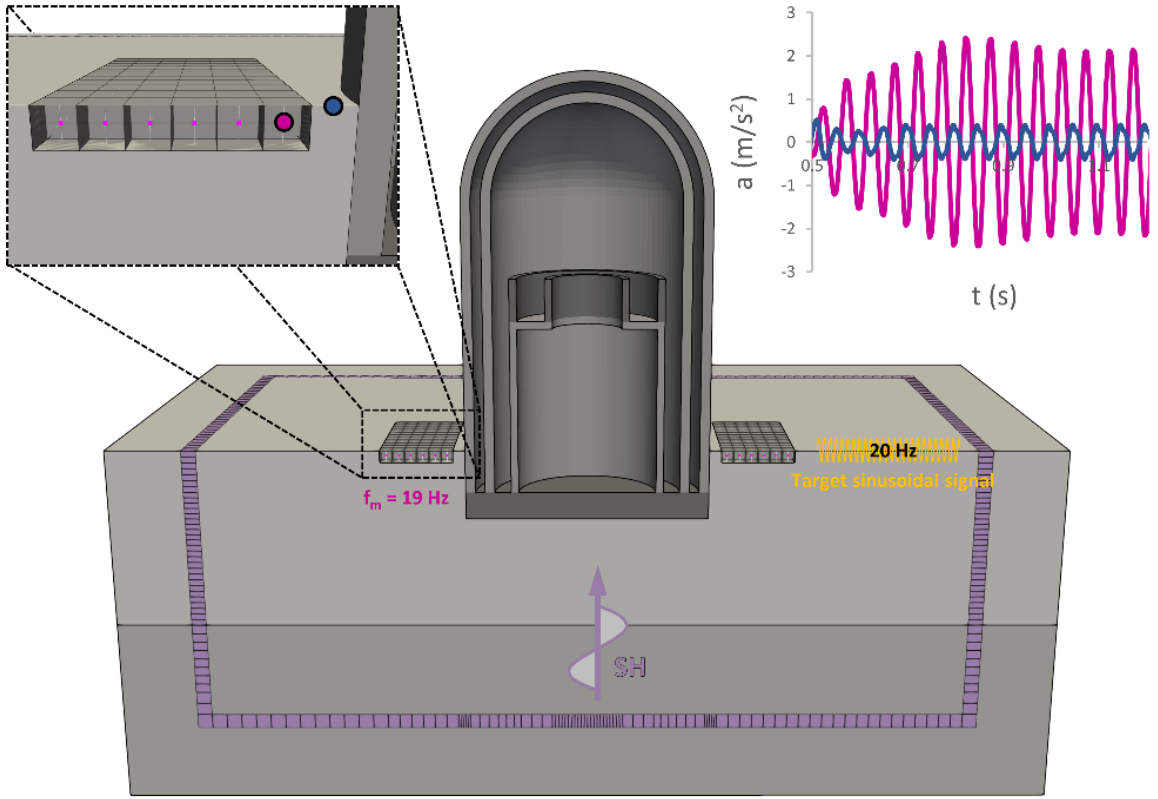


Ms. Andréia Silva

Metamaterials for Building Protection



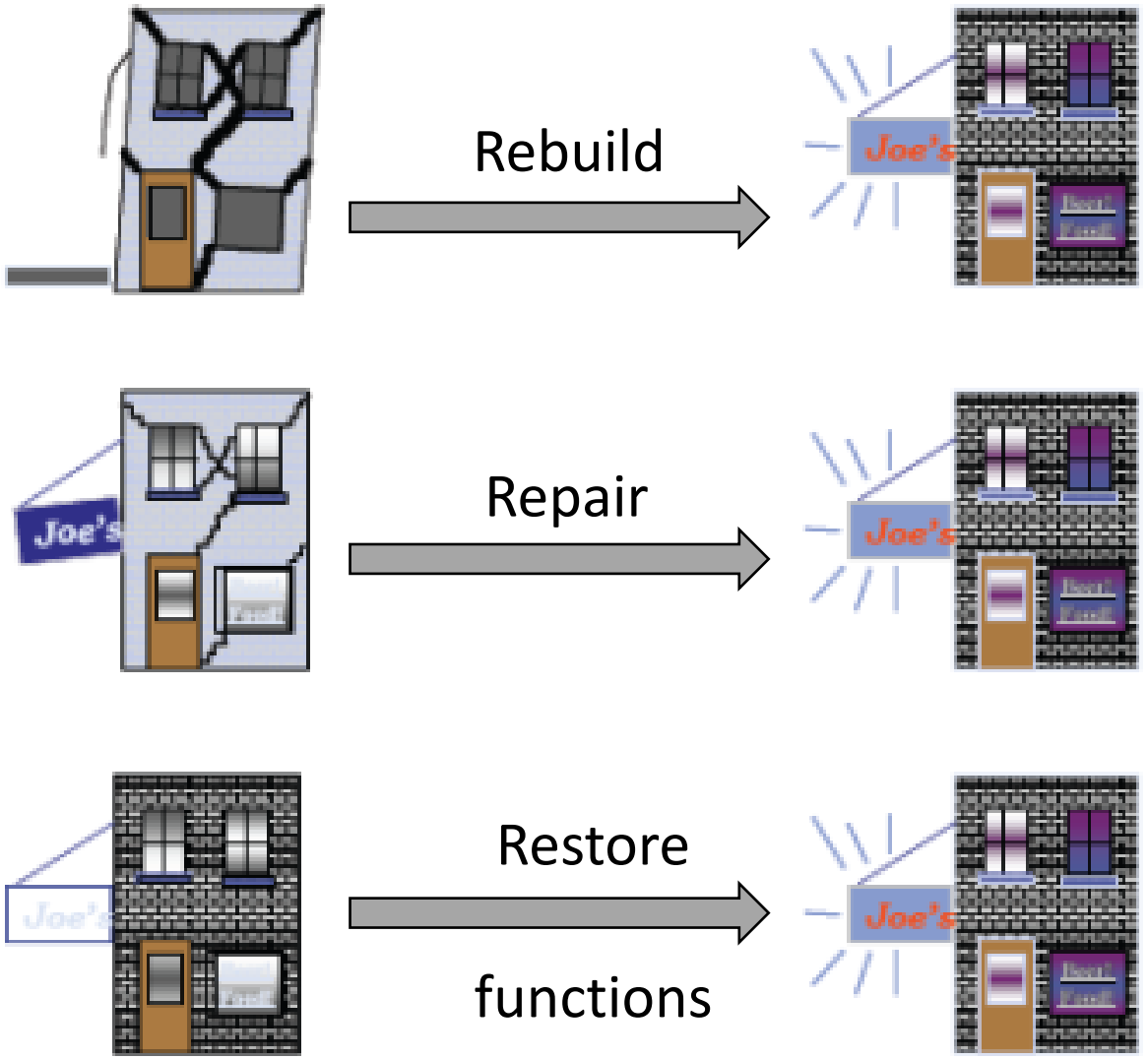
Unit metamaterial resonator cell



Mr. Constantinos Kanellopoulos

Post-Earthquake Recovery of a Structure

- Recover from collapse:
  - Re-build
- Recover from life-safety state:
  - Repair the structural elements and systems
  - Repair the non-structural elements
- Recover from immediate occupancy state:
  - Repair the equipment
  - Restore infrastructure services
  - Recover functions

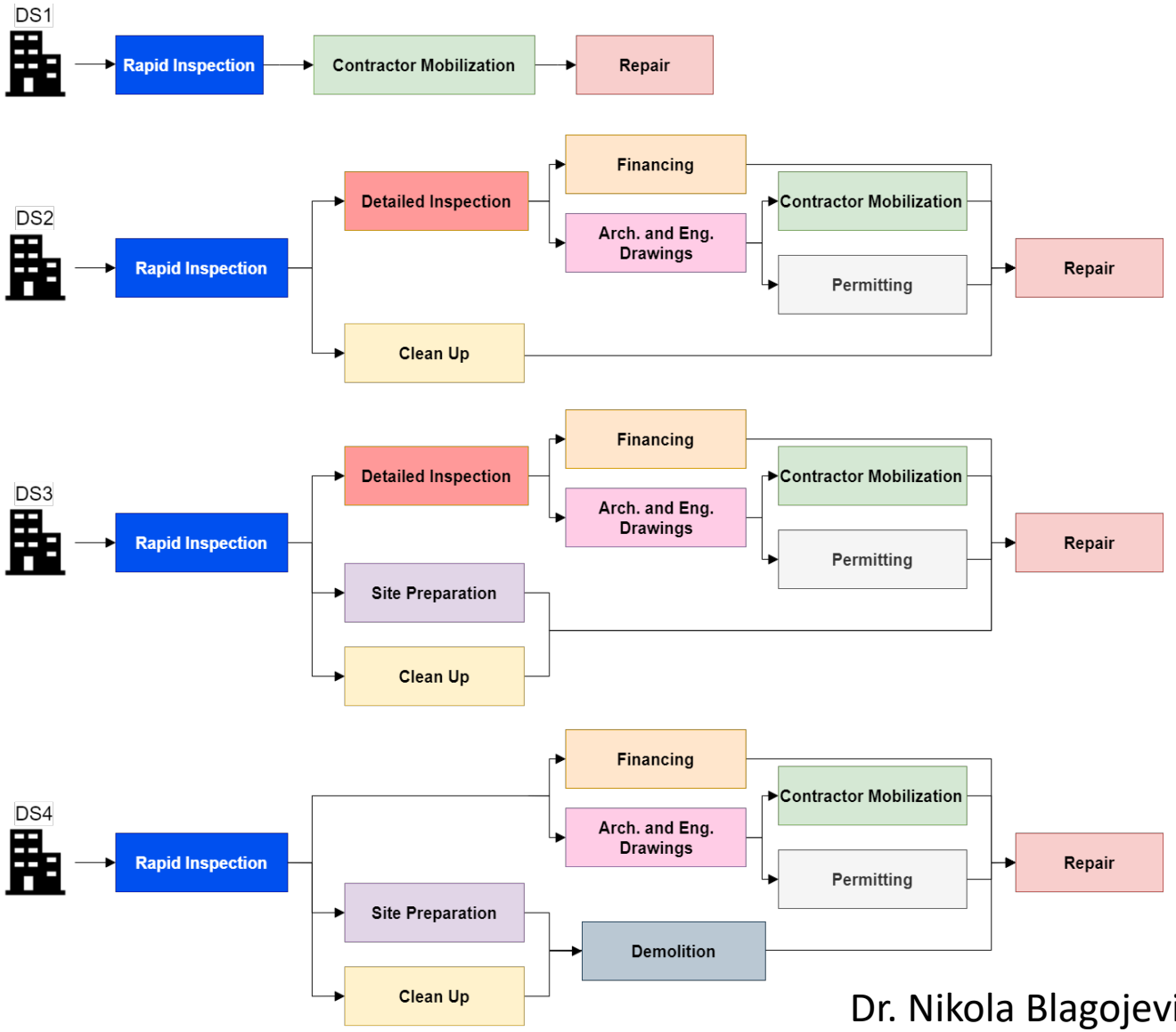


Post-Earthquake Recovery of a Structure

Preparatory tasks:

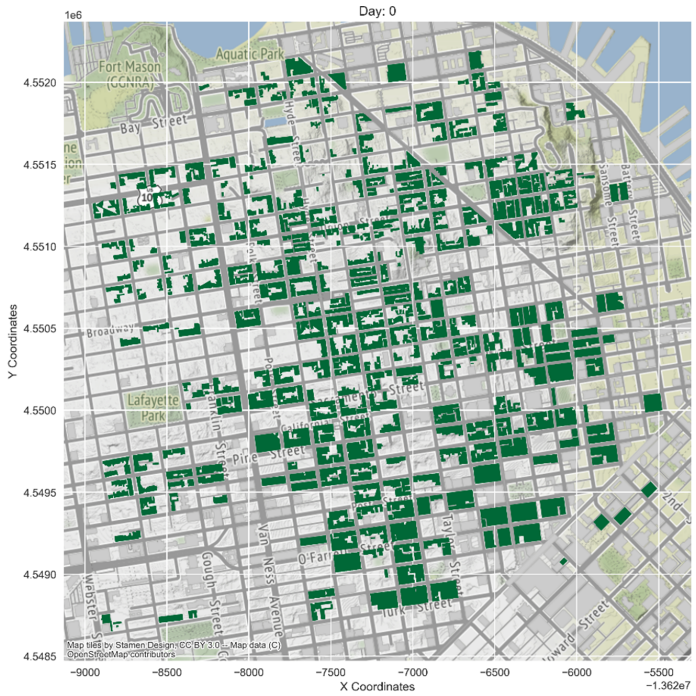
- Rapid inspection
- Detailed inspection
- Cleanup
- Repair design
- Financing and contracting
- Permitting
- Contractor mobilization

→ Actual repair

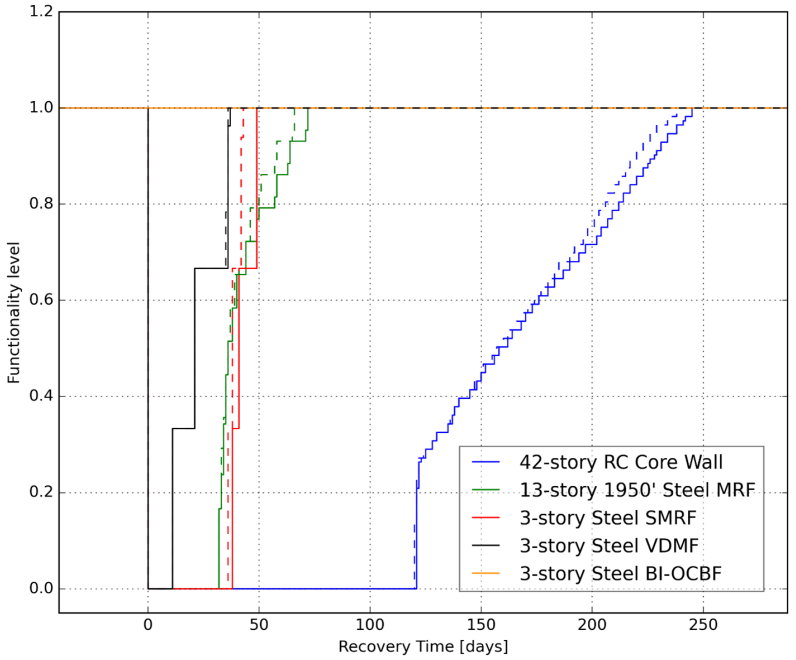


Dr. Nikola Blagojević

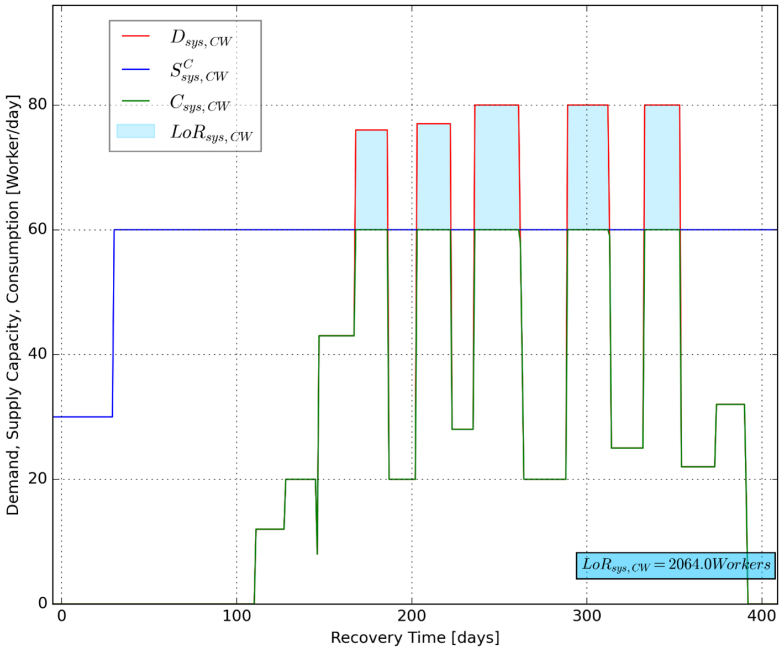
Community Recovery and Resilience



Recovery of building functions

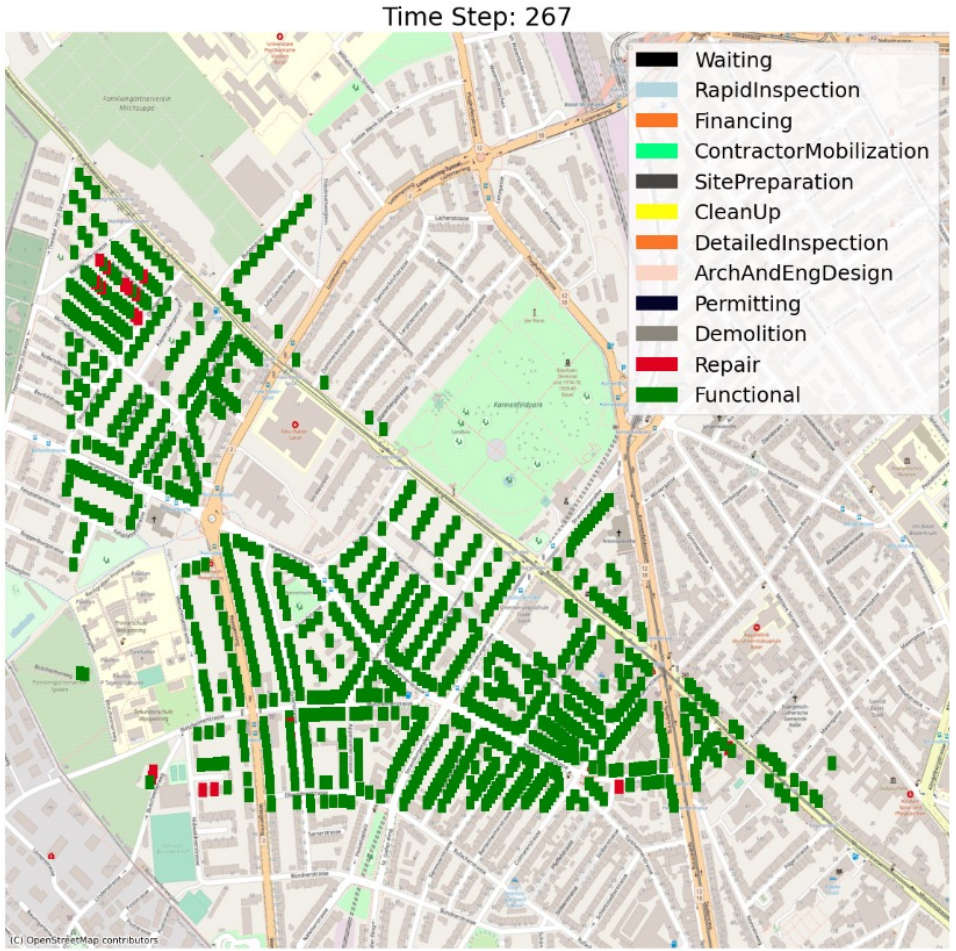


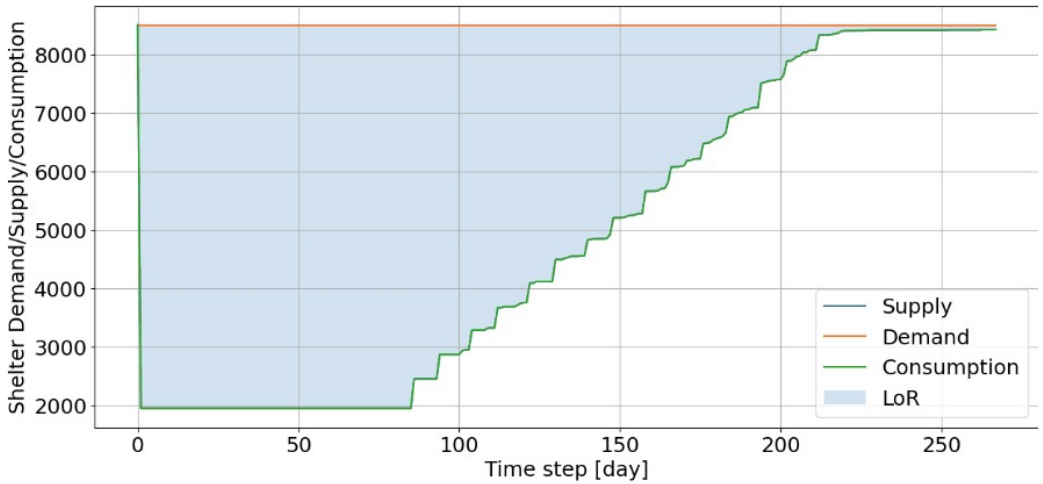
Demand for workers



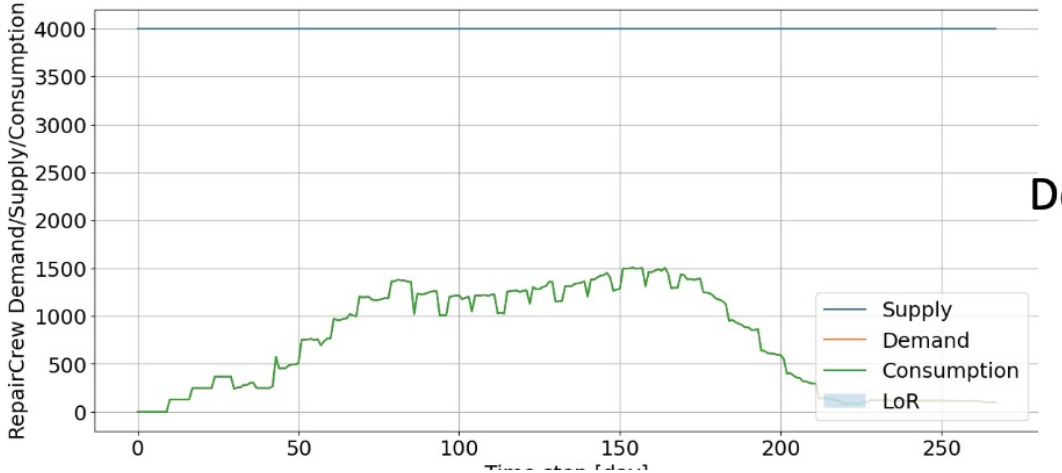
Dr. Nikola Blagojević

Recovery of Basel 4055 ZIP-Code Neighborhood Following a M6.6 Hypothetical Earthquake





Home reoccupation

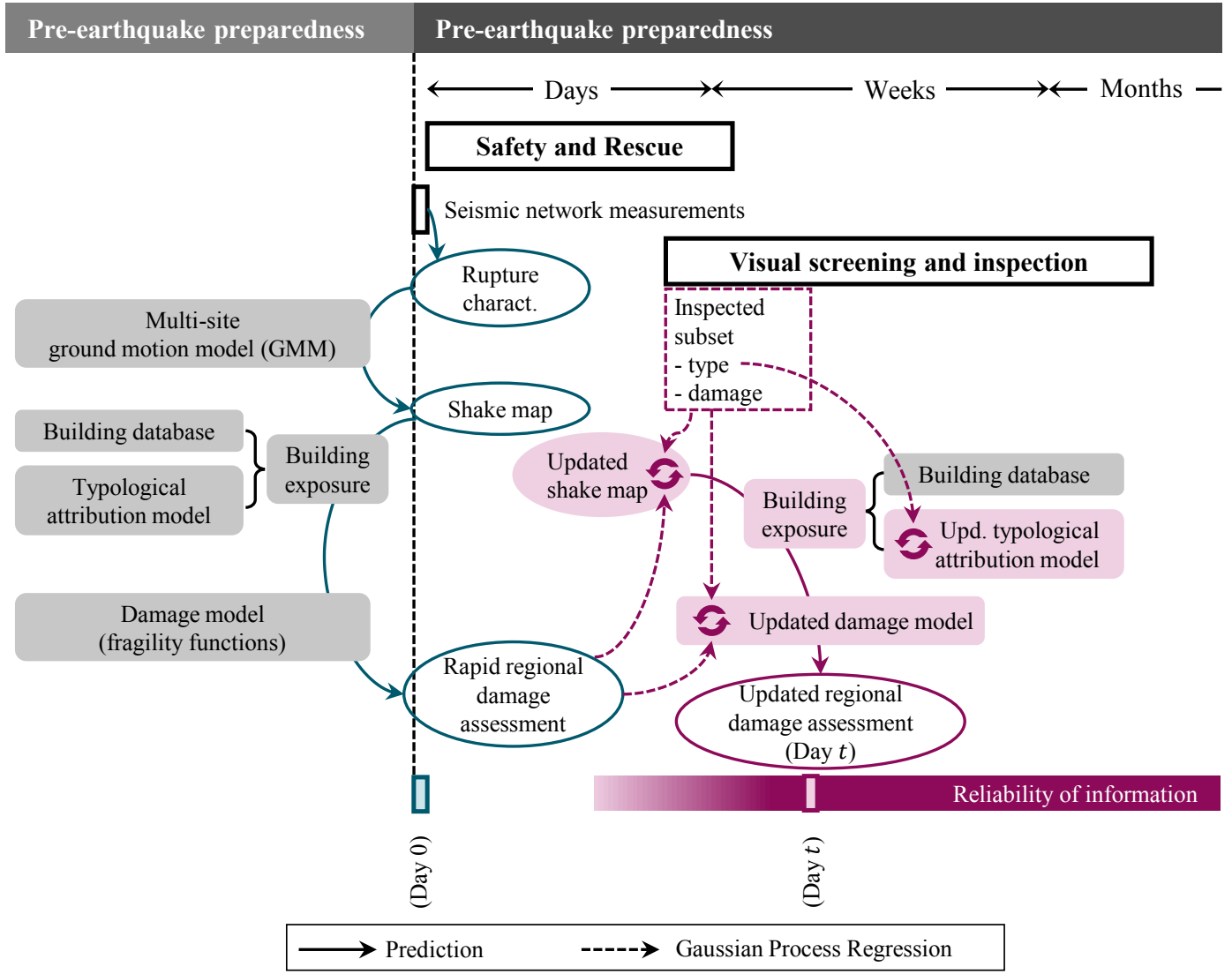


Demand for workers

Blagojević, Papadopoulos, Danciu, Stojadinović, ongoing work

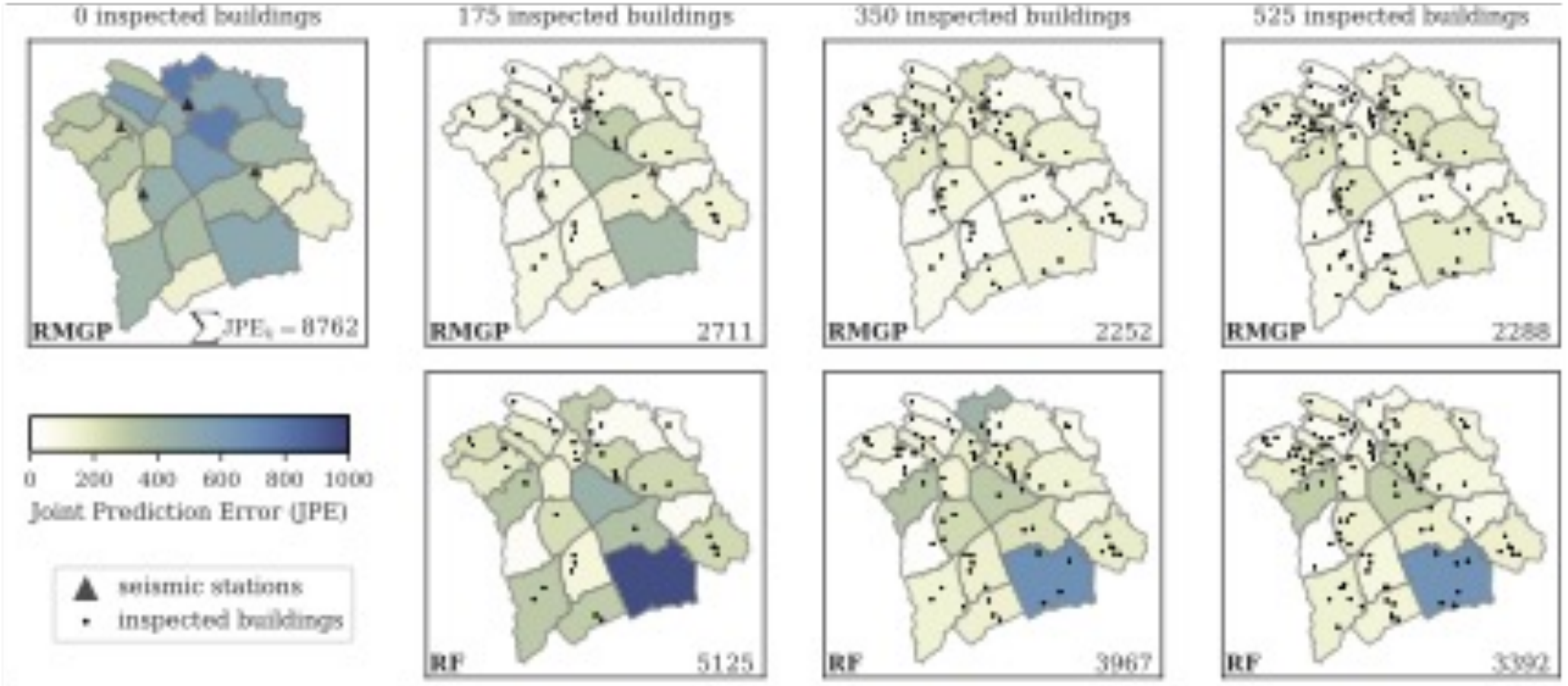
Post-Earthquake Building Inspection

- Use the first completed building inspection data to update the hazard, damage and risk predictions using machine learning

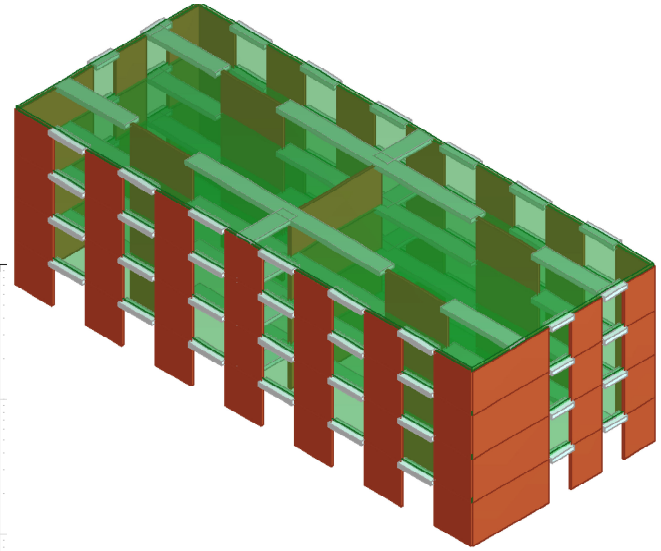


Dr. Lukas Bodenmann

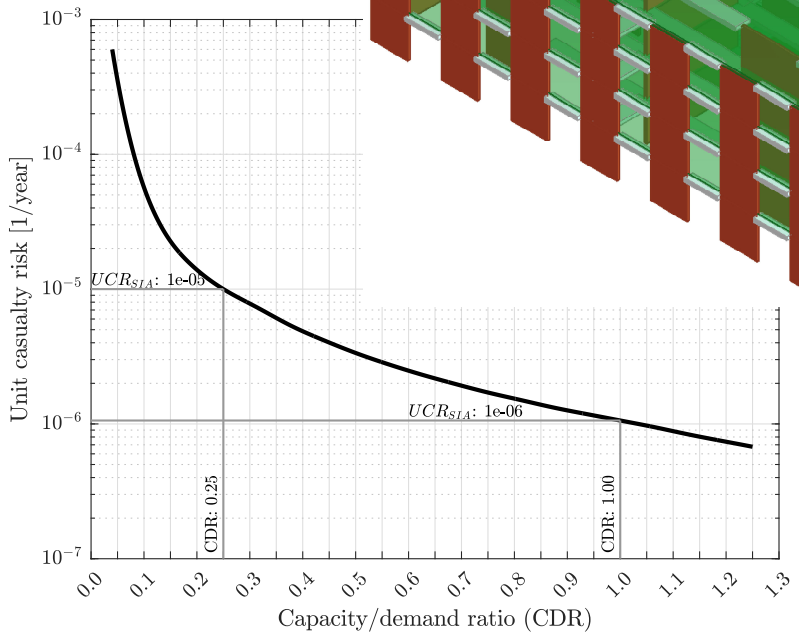
Post-Earthquake Building Inspection

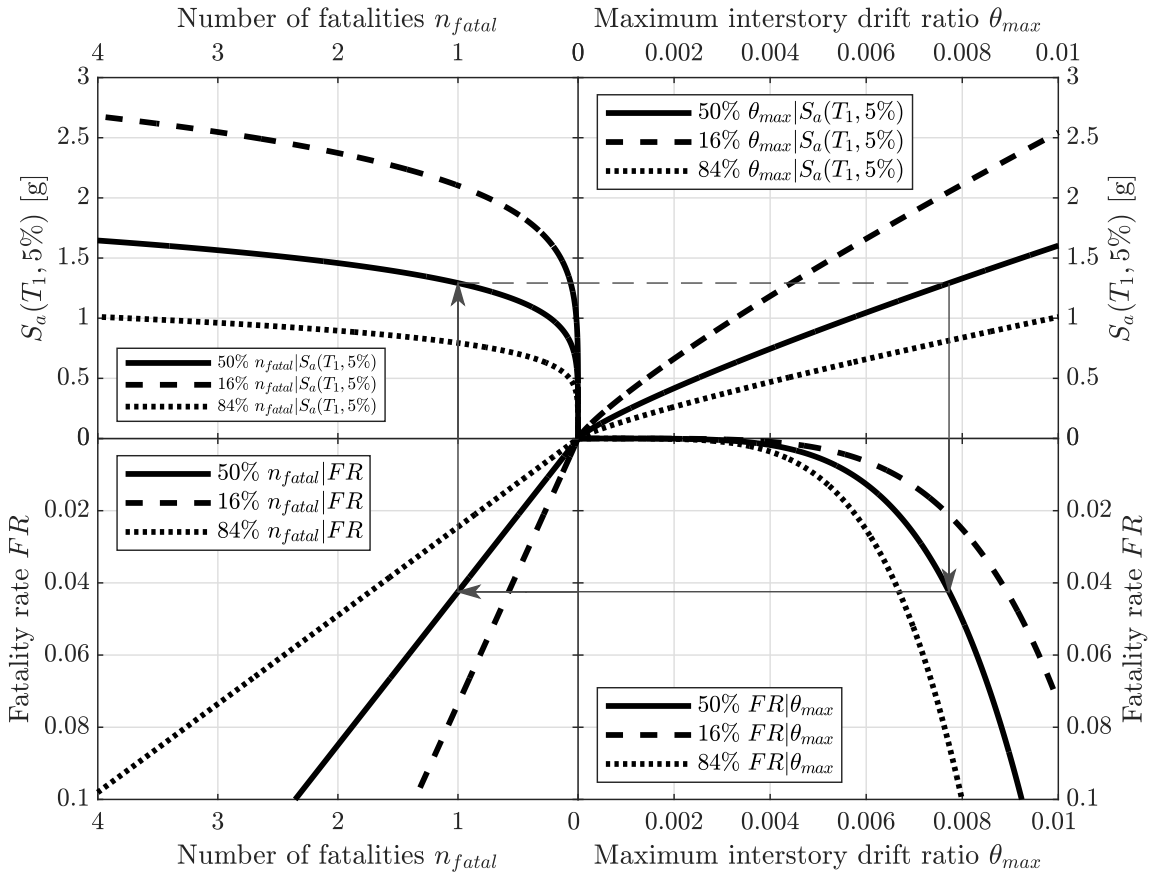


Risk-Based Building Evaluation



SIA 269/8





Thank you!

Prof. Dr. Božidar Stojadinović

Chair of Structural Dynamics and Earthquake Engineering

IBK, D-BAUG, ETH Zurich