

Seismic Risk Assessment and Mitigation in the Antakya - Maras Region on the Basis of Microzonation, Vulnerability and Preparedness Studies (SERAMAR)



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MKU – Mustafa Kemal University, Civil Engineering Dept., Antakya Hatay

Bauhaus-Universität
Weimar
Earthquake Damage Analysis Center

Project Partners:

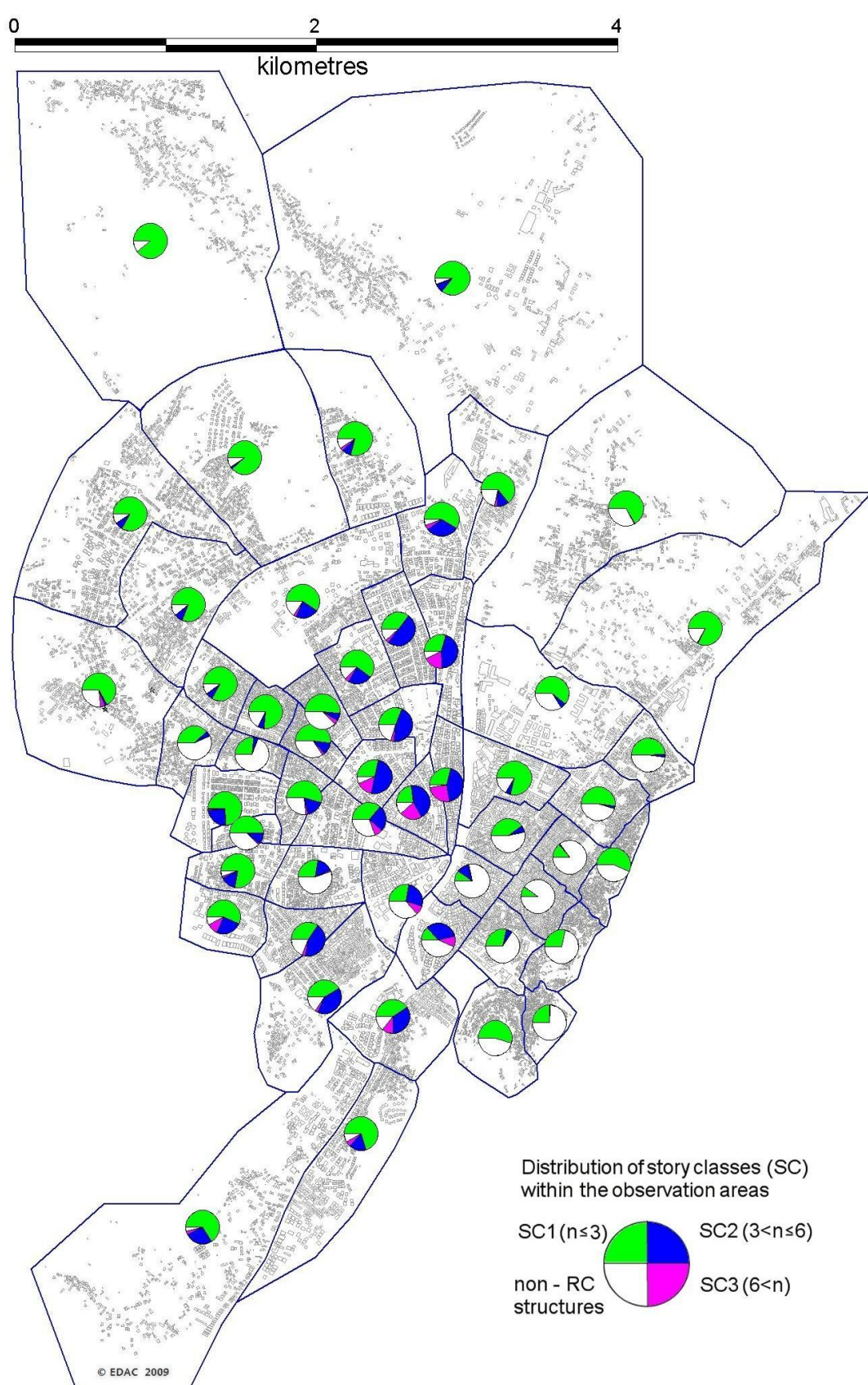


IMO – Chamber of Civil Engineers Hatay Branch
AFET – General Directorate of Disaster Affairs, Ankara

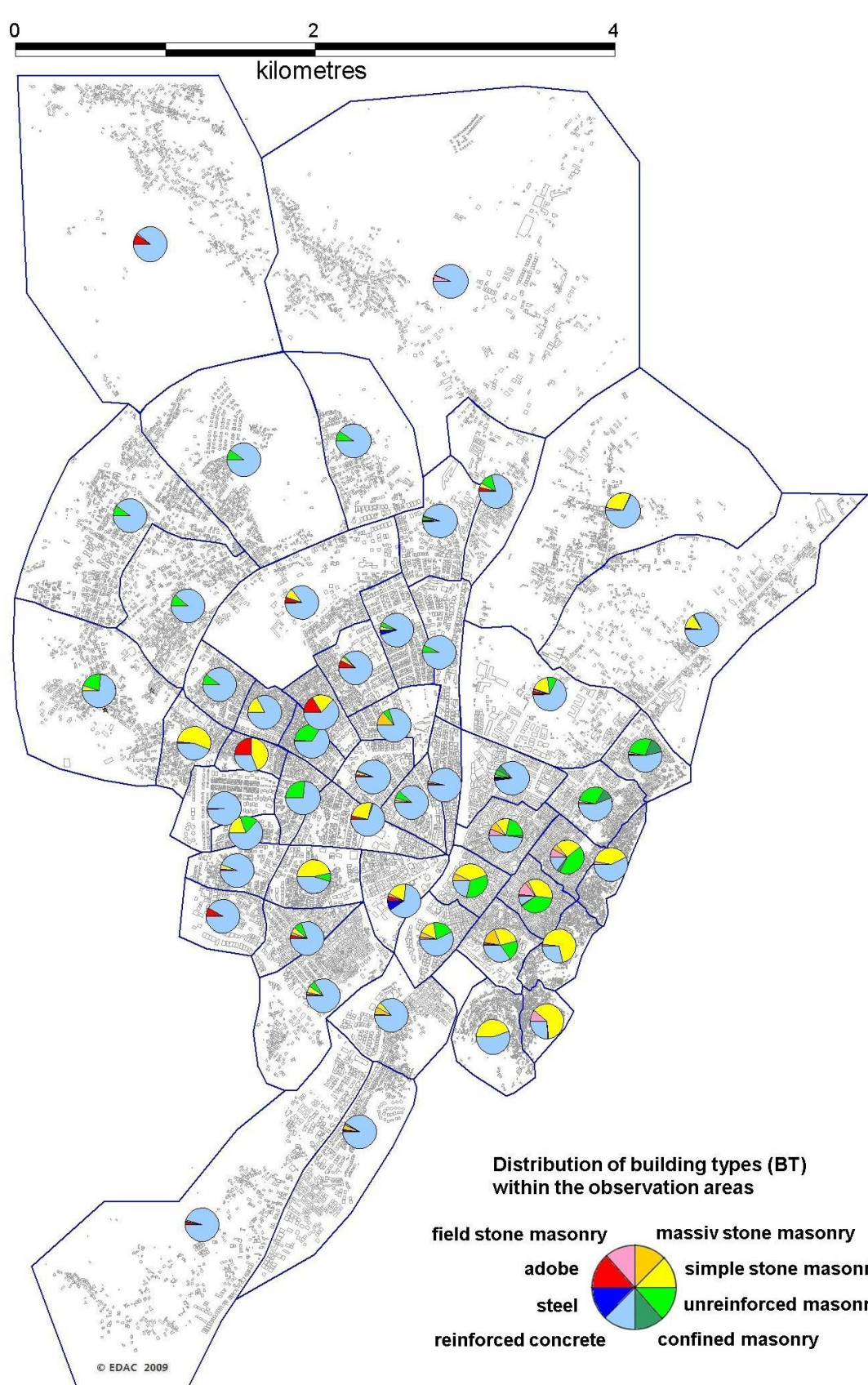


5 Elaboration, Documentation and Evaluation of Building Stock

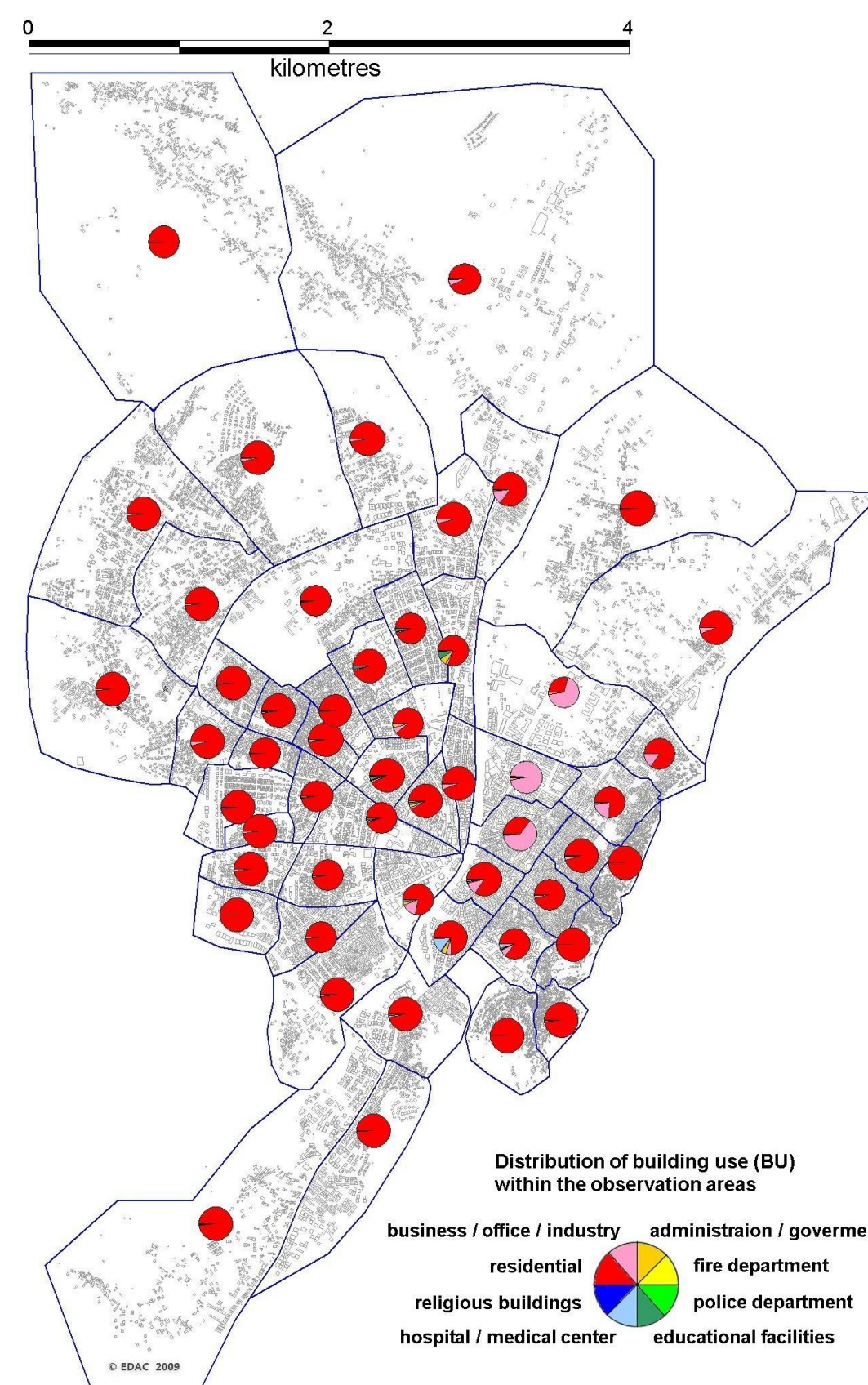
5.1 Story Classes



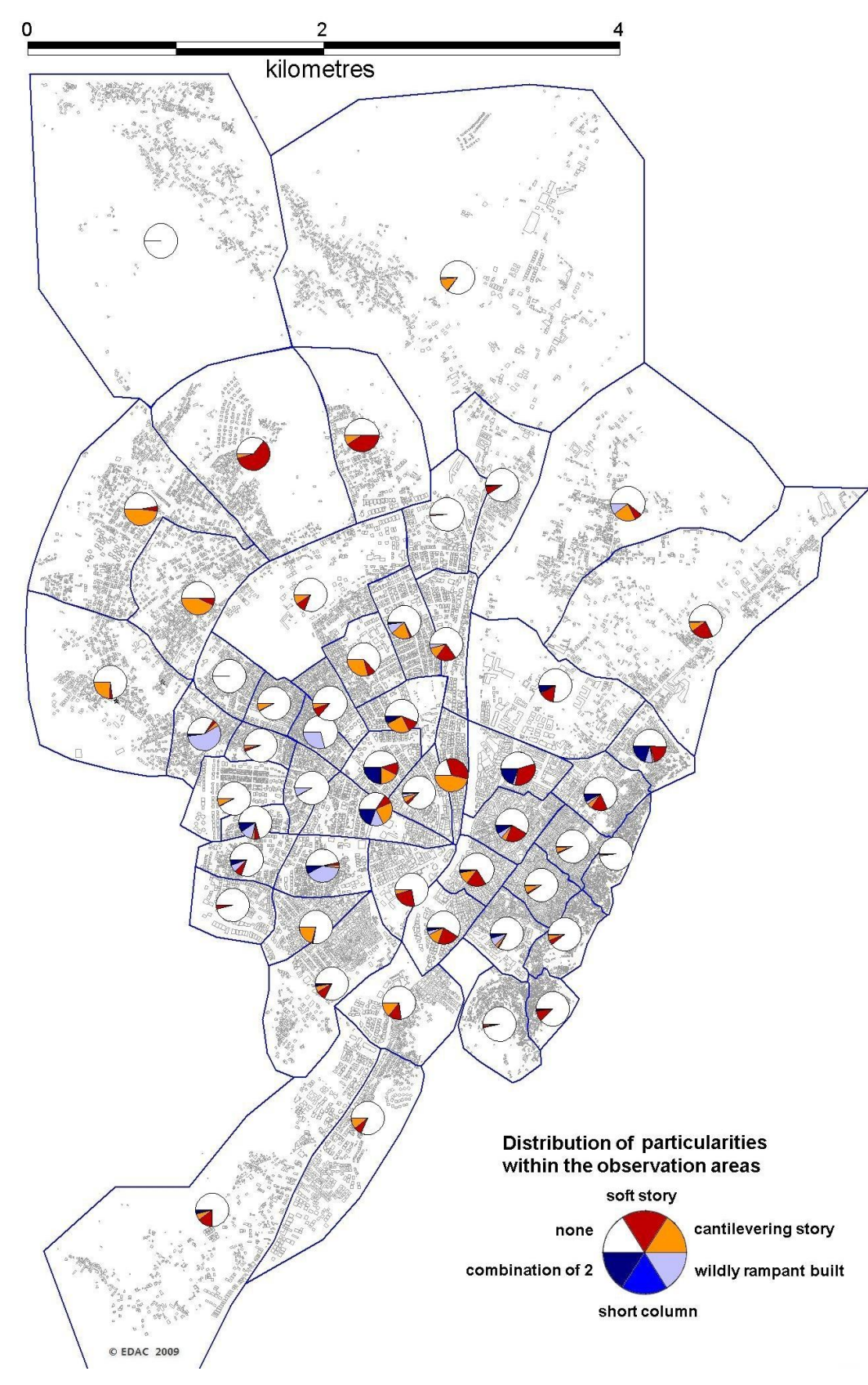
5.2 Building Types



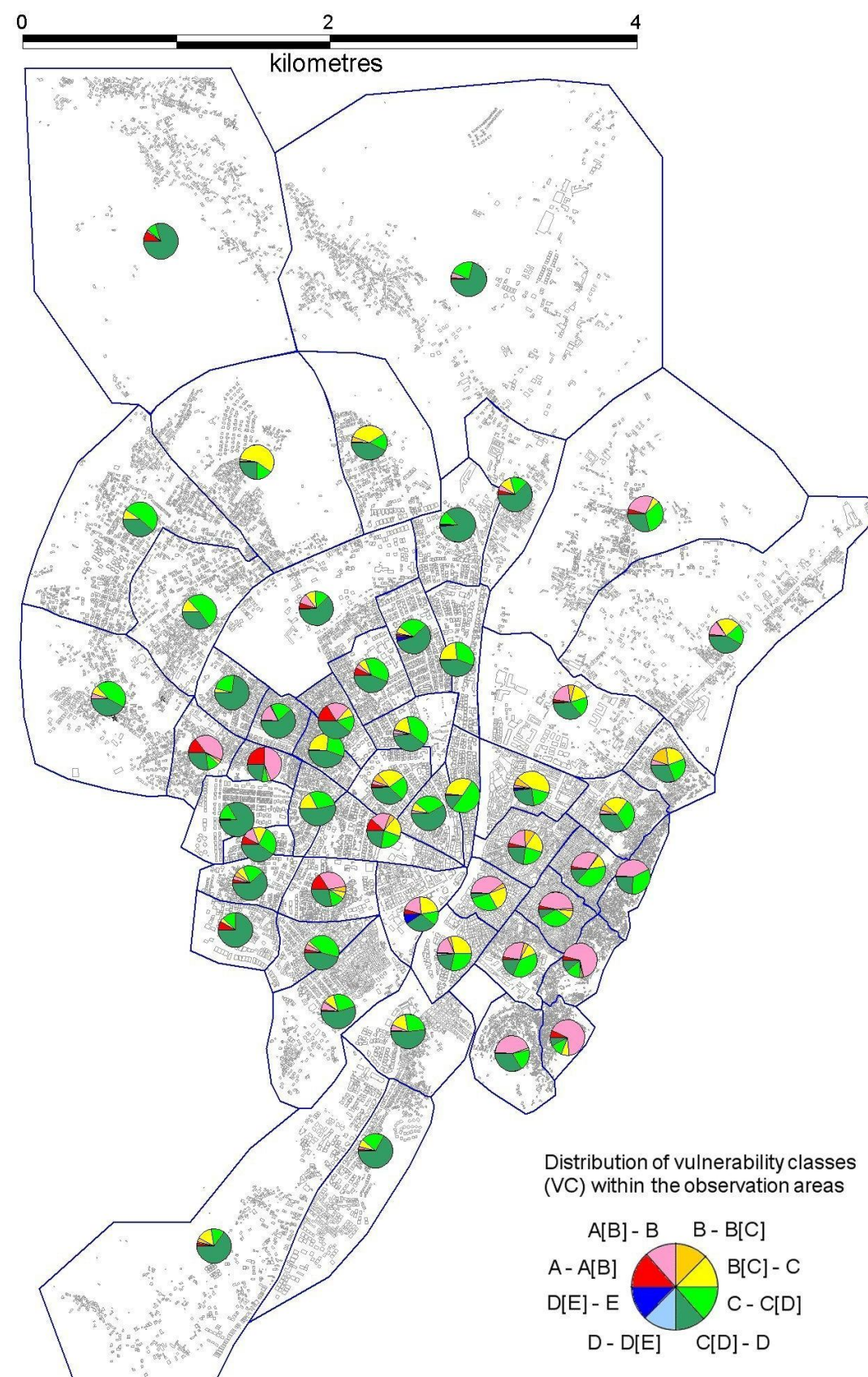
5.3 Building Use



5.4 Particularities



5.5 Vulnerability Classes



6 Methods of Seismo-Engineering Investigation and Vulnerability Assessment

(1) Field survey and visual inspection

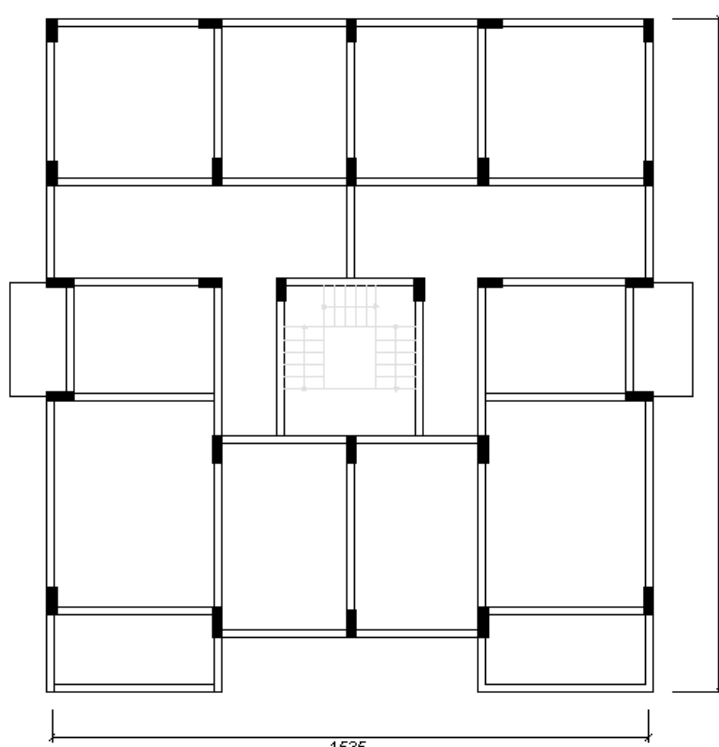
During the field survey main parameters, like number of storeys, building types, use and particularities were collected, which are used for the empirical vulnerability assessment (see 5) and elaboration of damage scenarios.

The visual inspections of single buildings evaluate the current state of the building, e.g. state of the concrete cover, corrosion of reinforcement, real number of stories, identification of superstructures.

(2) Evaluation of the building documentation

Principle Criteria of Earthquake resistant desing will be checked and evaluate like:

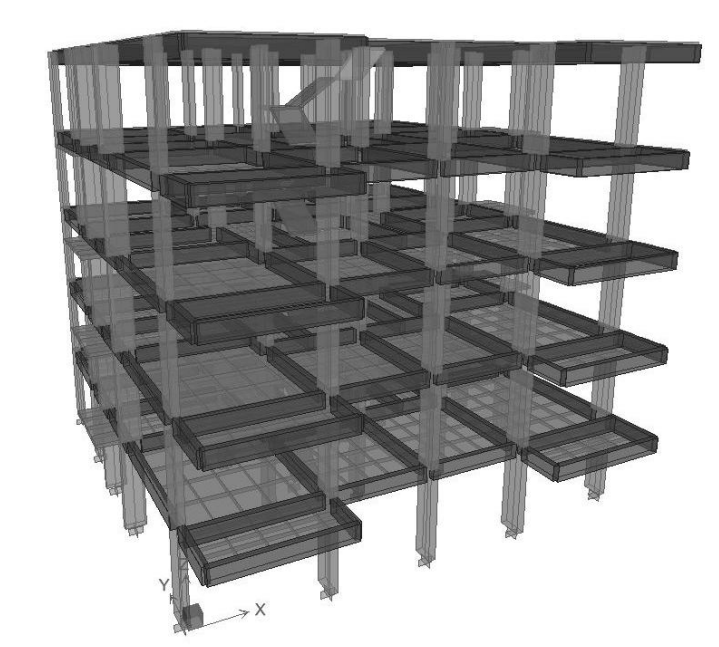
- Regularity in plan and elevation
- Particularities
- Condition of cross section



(3) Experienced based evaluation

Additionally to (2) will be checked:

- Design of cross section
- Used material properties
- Differences between center of stiffness and mass
- Considered Earthquake Code



(4) Analytical Investigation

On the basis of (2) & (3) a structural model will be created on which can be checked:

- the satisfaction of the current code requirements
- the design by considering current use

(5) Considering the results from (6) & (7) an reliable structural model can be created by calibration of the dynamic behavior.

(6) Instrumental Testing / Dynamic Building Characteristic

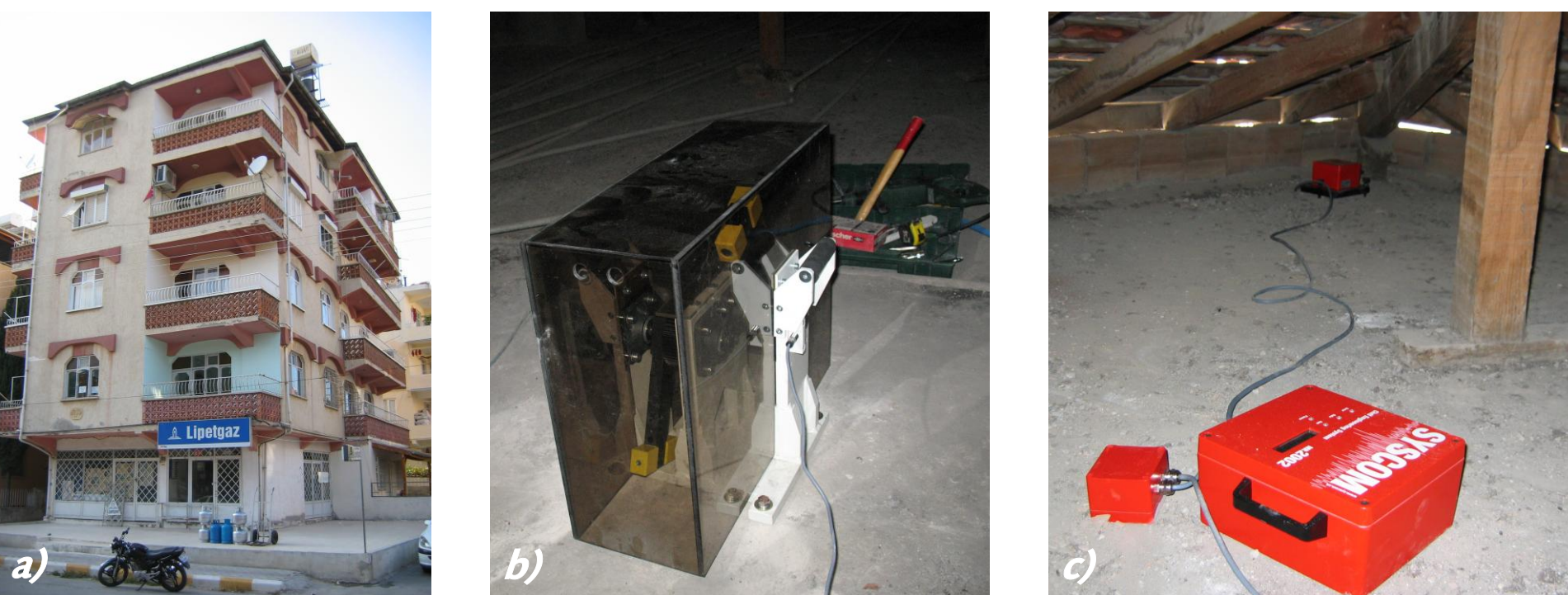


Figure 6.1. Example of instrumental testing: a) test building; b) dynamic Exciter © EDAC and c) measurement of the response by weak-motion sensors © SYSCOM

The real dynamic building characteristic are determined by a sinusoidal excitation of the structure and the measurement of the response at different points on it.

After analyzing the recorded data, results can provide for the calibration of the analytical models. This leads to more trustable results for the prognosis of damage.

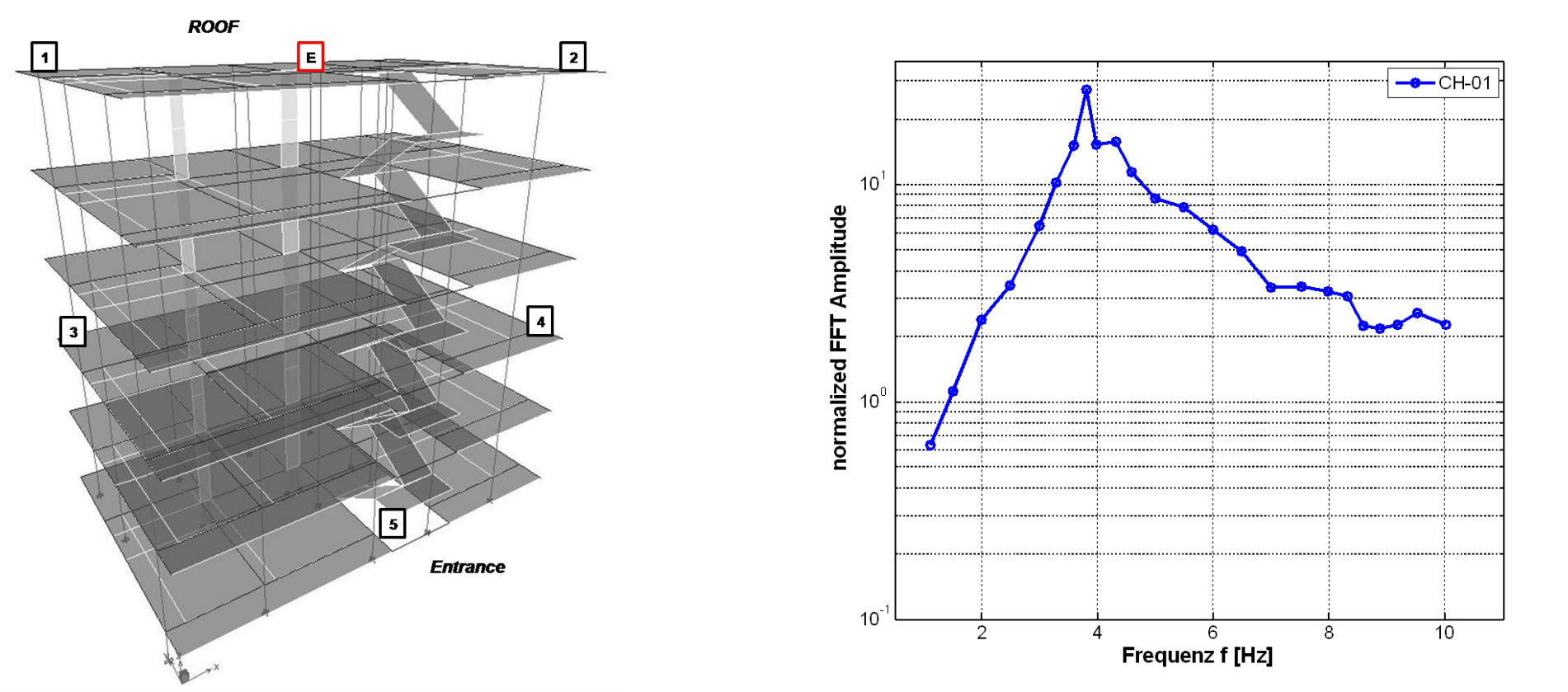


Figure 6.2. Instrumentation scheme of the temporary investigation

Figure 6.3. Exemplary result (peak indicate one Eigen frequency of the building)

(7) Long-Term Building Monitoring System

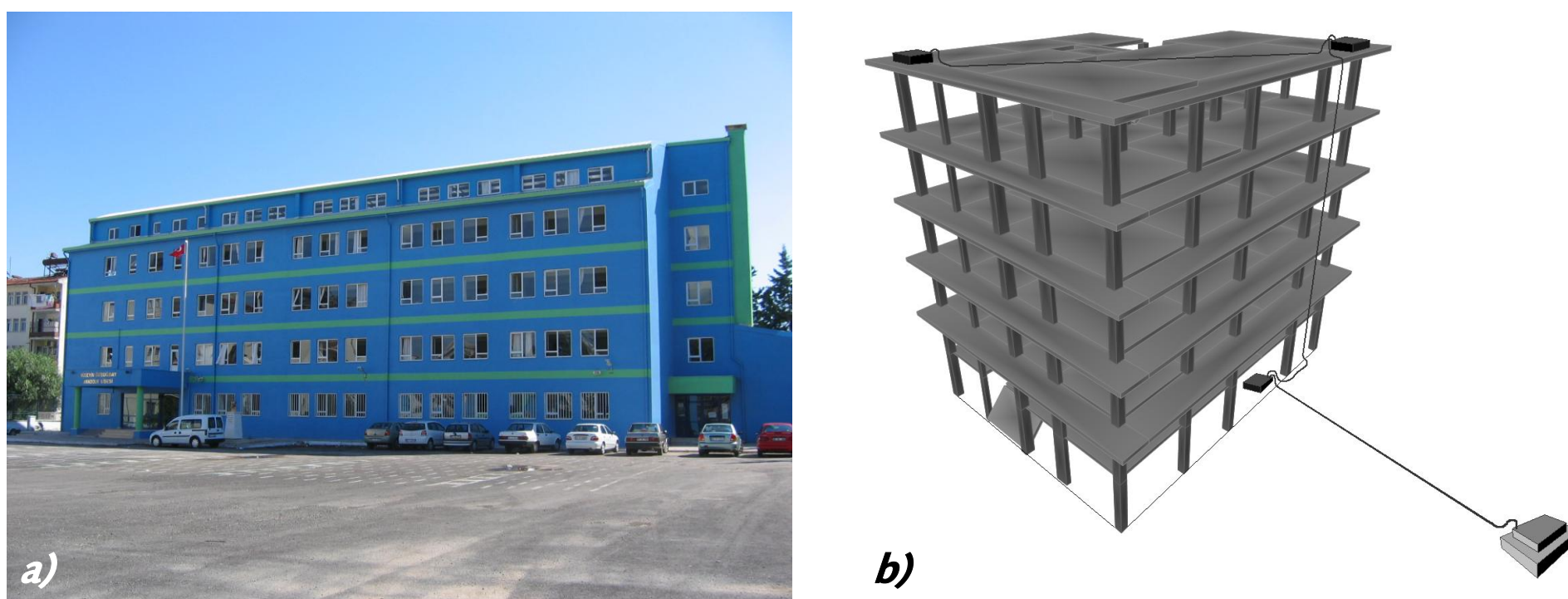


Figure 6.4. View of the a) instrumented school building and b) instrumentation scheme (2 triaxial sensors at the top, 1 at the ground floor and 1 free-field station)

Up to now, 4 buildings could be equipped by a strong-motion building monitoring system. Since start of the building instrumentation several low magnitude earthquakes occurred, a lot of them could be measured. So a rapidly increase database provides insight the current seismicity of the area, information about the wave propagation in Antakya and the real response and behavior of the structures.

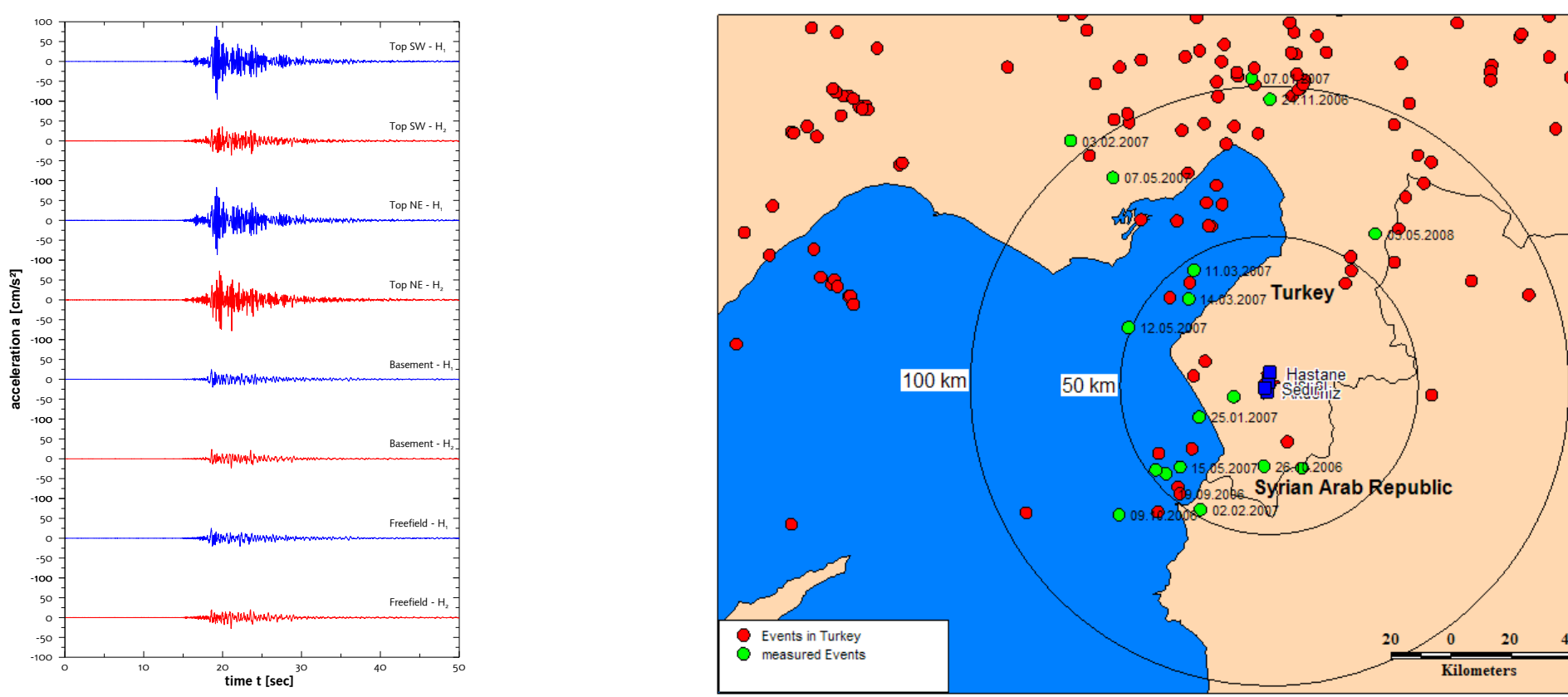


Figure 6.5. Time History of the recorded EQ from June 17, 2009

Figure 6.6. Map of the occurred earthquakes since starting of the Building Monitoring System

7 Damage Prognosis

The concept *Pre-Earthquake Damage Quantification of Instrumented Buildings* will be used to determine the prospective damage

- under different seismic impact (e.g. considered seismic zone - influenced by geology and topography),
- for differently designed structures (e.g. different code generation)

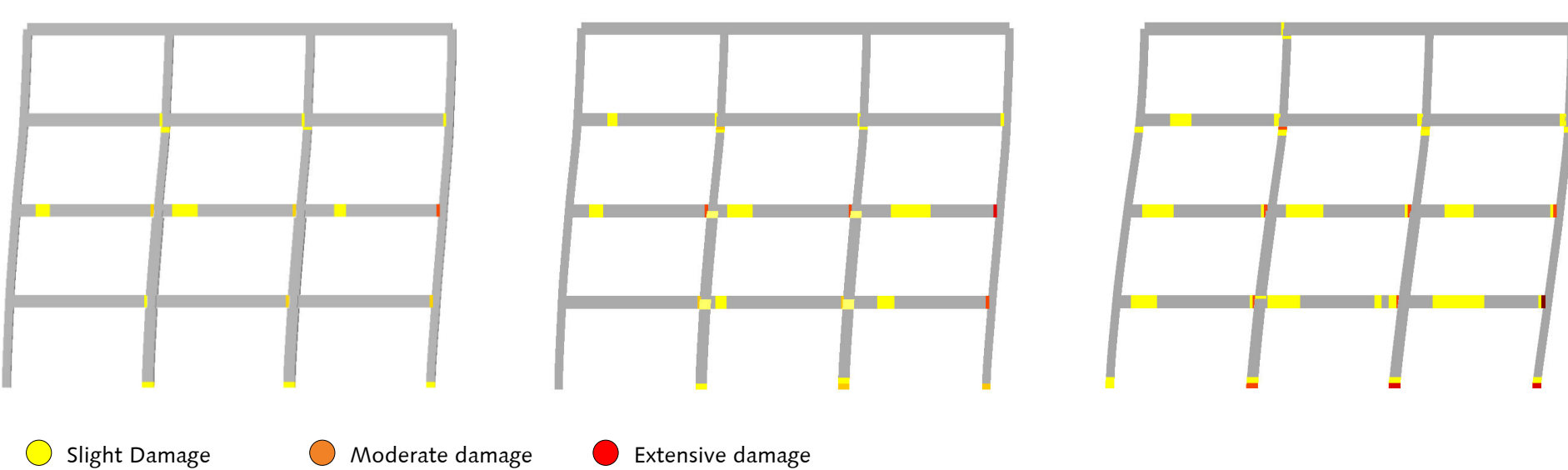


Figure 7.1. Prediction of damage state of typical RC frame structures for different earthquake scenarios or design levels of the RC frames (e.g. different code generation)

8 Certification *

Steps	Certificate		
	1 Gold	2 Silver	3 Bronze
Vulnerability Assessment			
(1) Field survey and visual inspection of the building	✓	✓	✓
(2) Evaluation of the Building documentation I – cause			✓
(3) Evaluation of the Building documentation II – detailed	✓	✓	
(4) Analytical Investigation I – based on (2)			✓
(5) Analytical Investigation II – based on (3) and (4)	✓	✓	
(6) Instrumental Testing and determination of the dynamic building characteristic	✓	✓	
(7) Long-Term Building Monitoring System	✓		
Damage Prognosis			
	✓	✓	

* Proposal has to be discussed/ decided with project partners!

Imprint

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Maps are created with the program Mapinfo© Professional 9.0