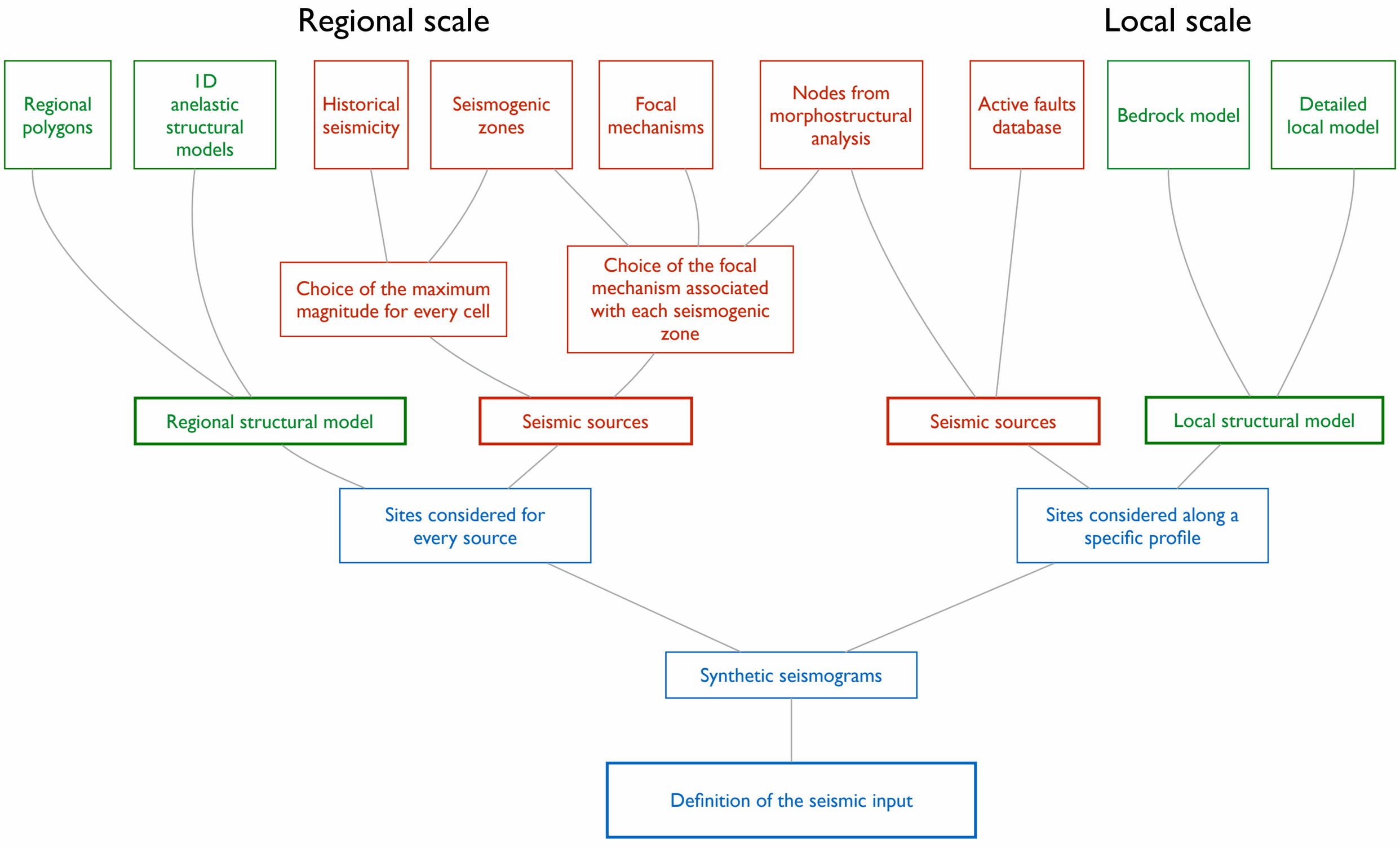
Seismic verification of existing buildings

Operational flow

http://www.provincia.trieste.it/opencms/opencms/it/attivita-servizi/cantieri-della-provincia/immobili/Programma_verifiche_sismiche/index.html

Seismological elaboration

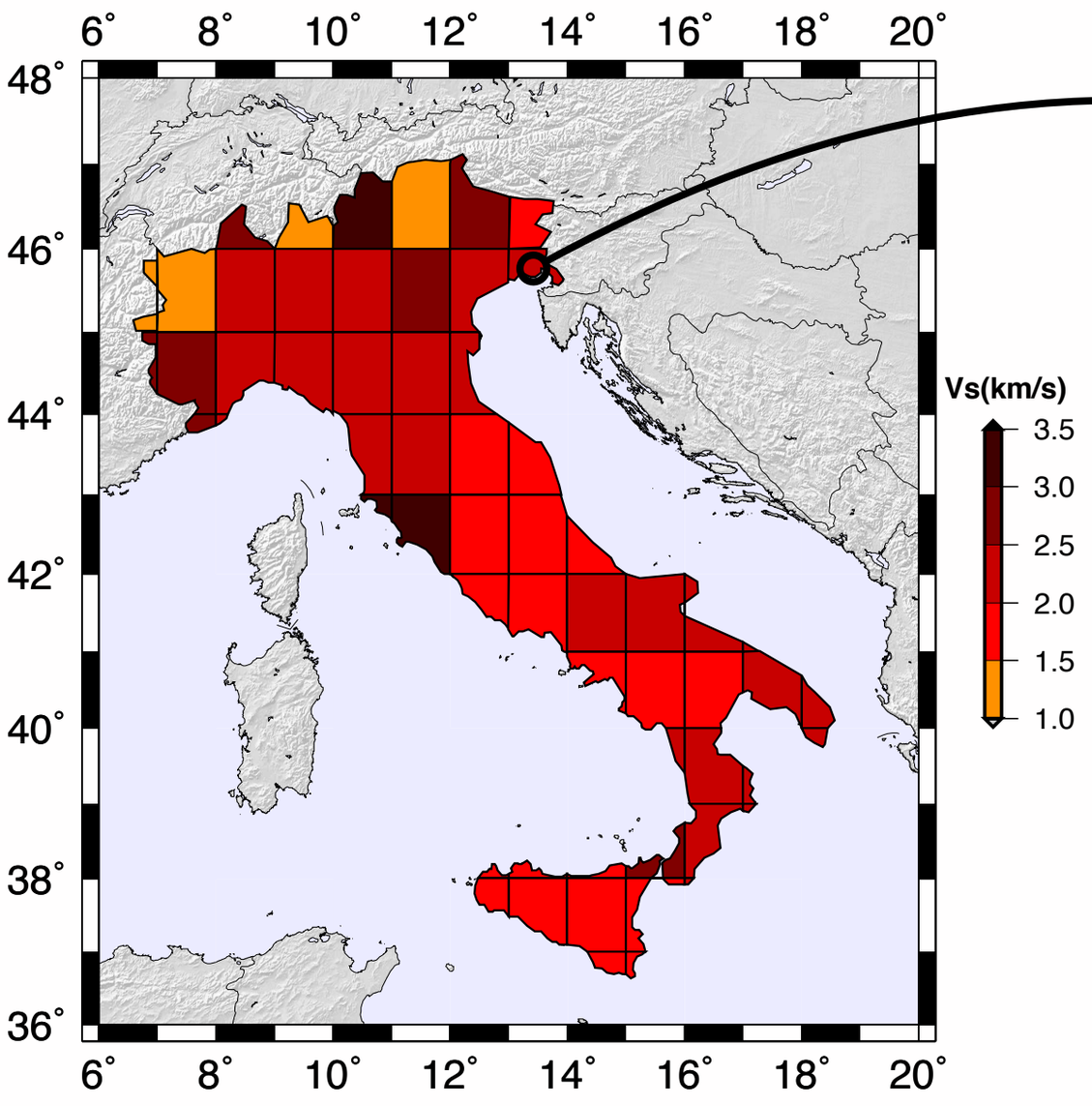
General scheme

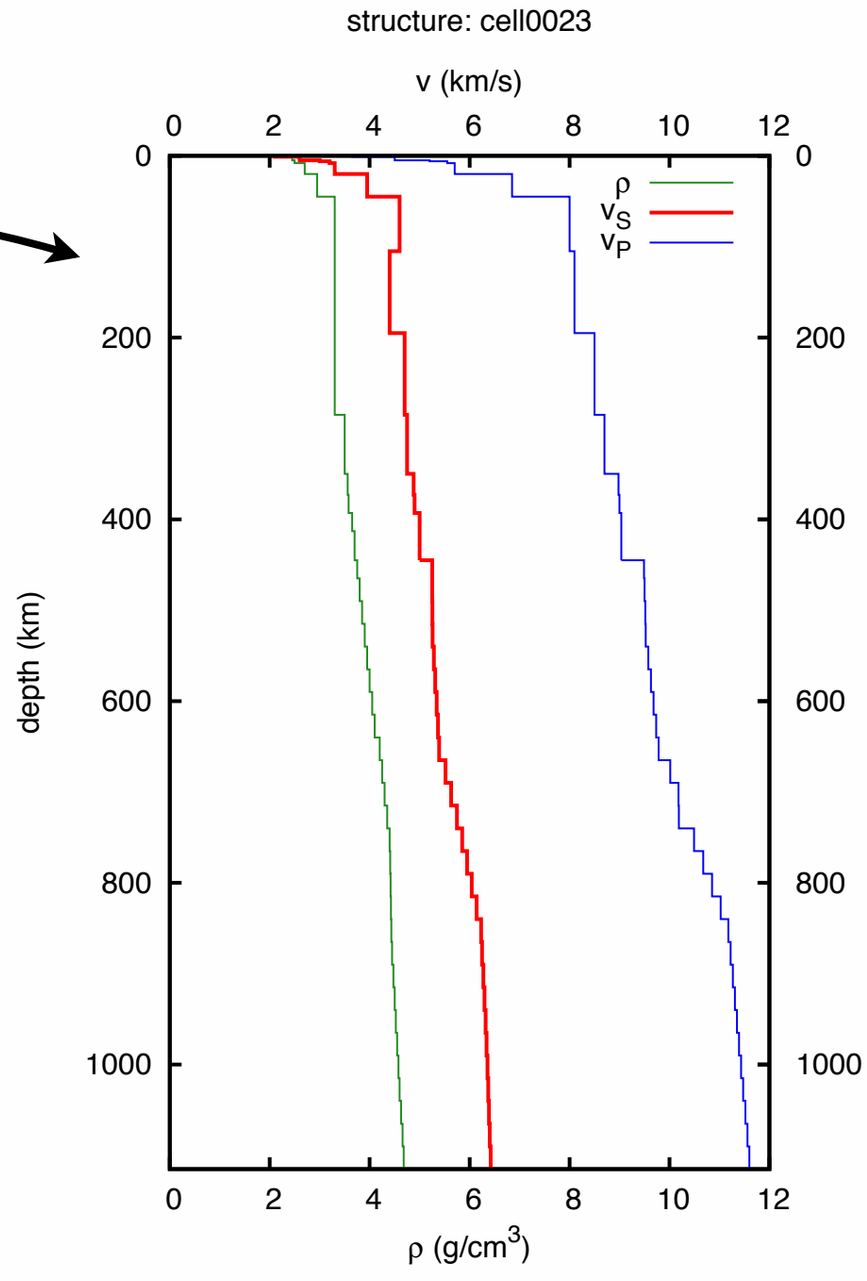


Seismological elaboration

Regional scale

Regional structural model



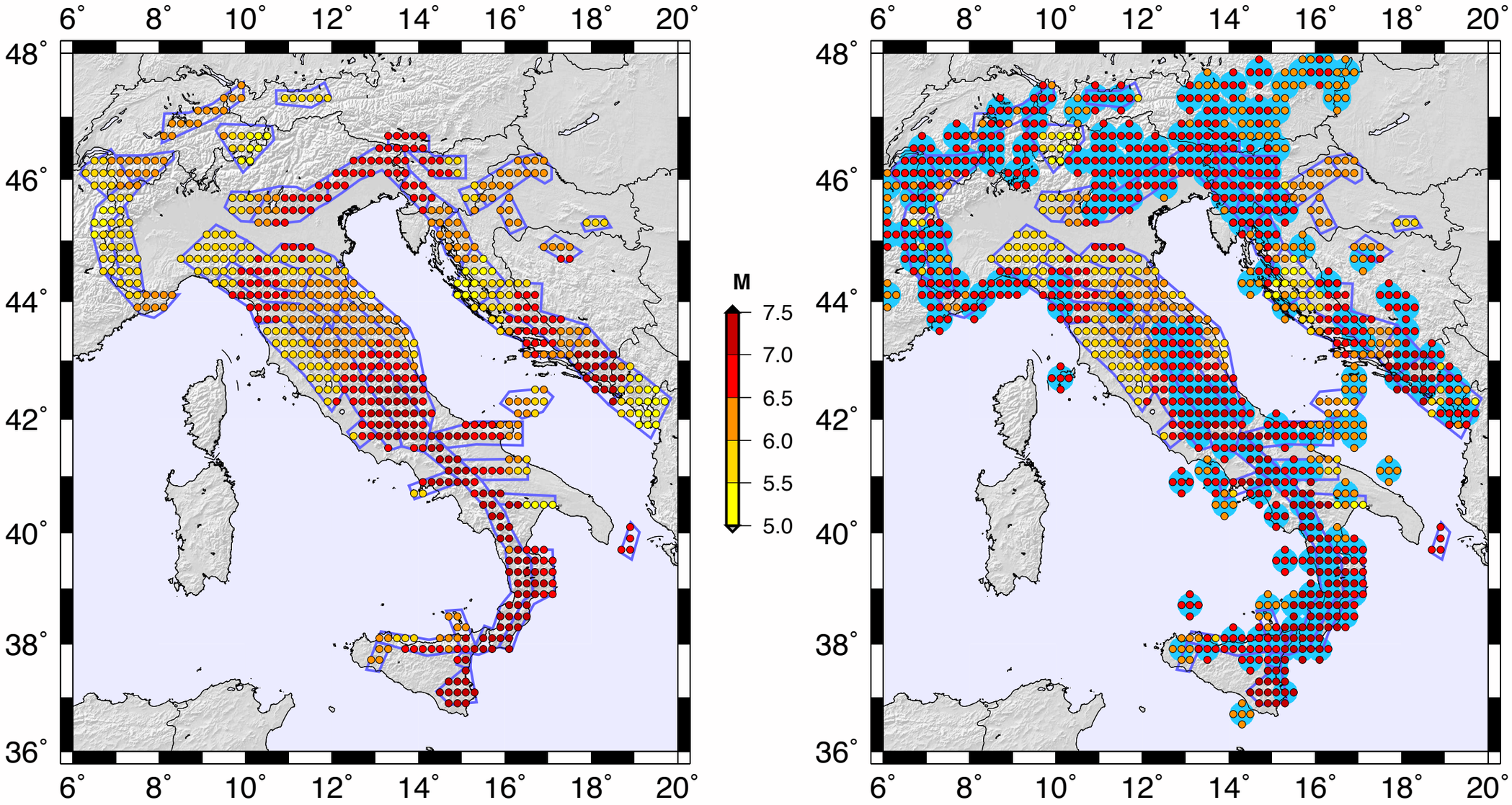


Characterisation of the bedrock model for each cell

Seismological elaboration

Regional scale

Seismic sources

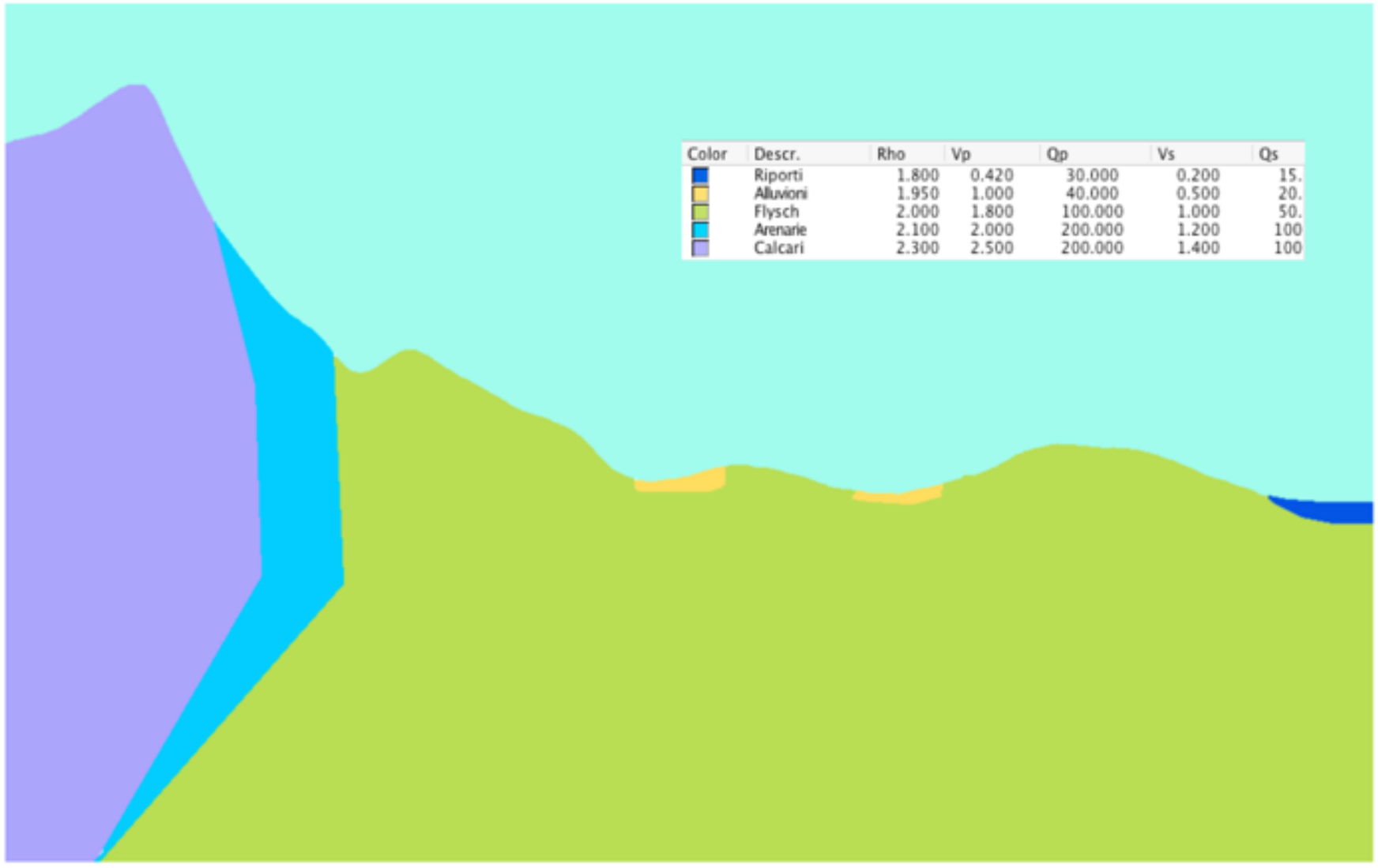


Definition of the seismic sources with the eventual inclusion of seismogenic nodes

Seismological elaboration

Local scale

Local structural model

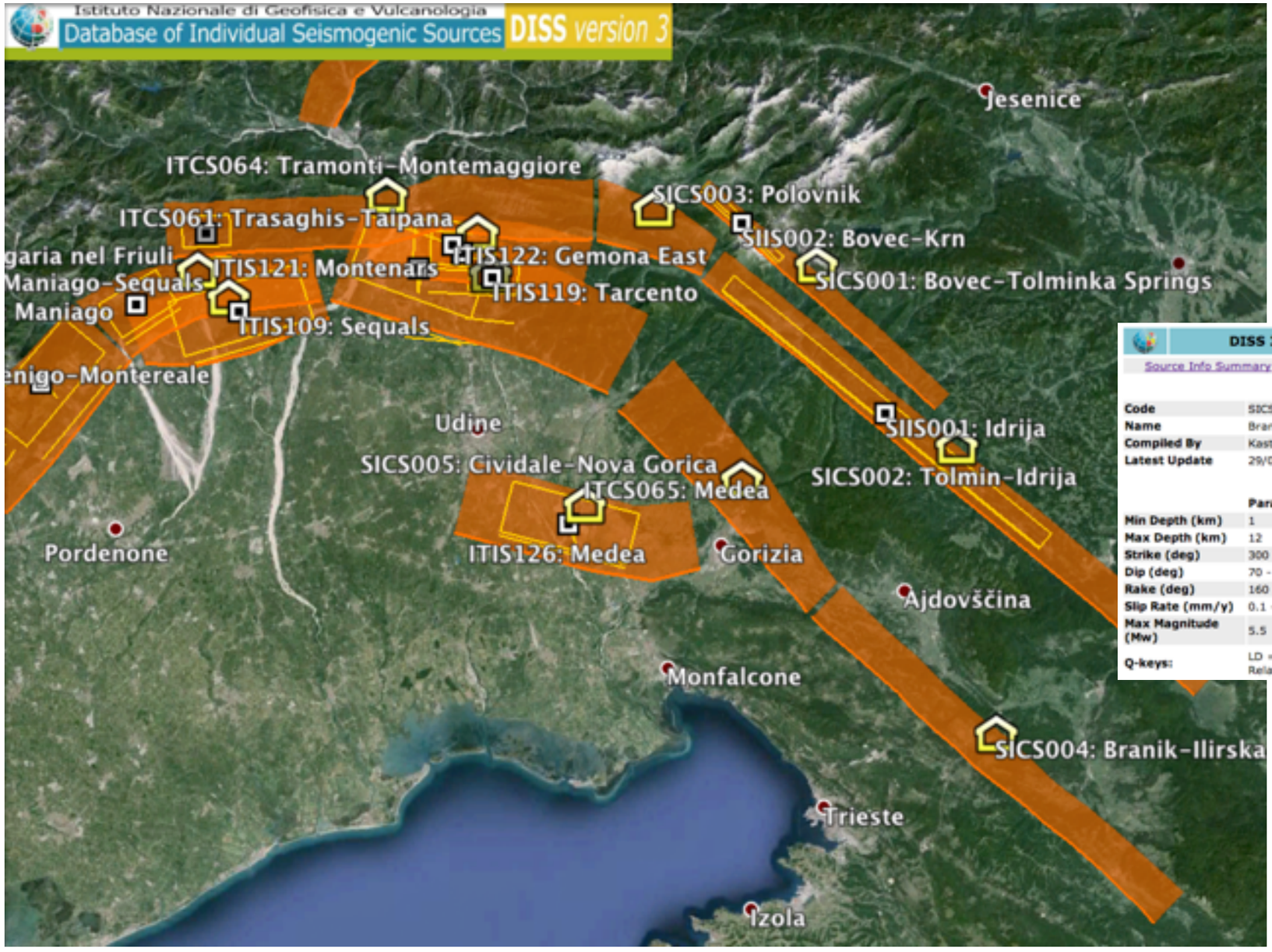


Definition of the geologic section and of the geotechnical parametrisation

Seismological elaboration

Local scale

Seismic sources



DISS 3.1.1: Seismogenic Source SICS004 - Branik-Ilirska Bistrica

Source Info Summary | Commentary | References | Pictures

General information

Code	SICS004
Name	Branik-Ilirska Bistrica
Compiled By	Kastelic, V., and P. Burrato
Latest Update	29/04/2009

Parametric information

	Parameter	Qual.	Evidence
Min Depth (km)	1	EJ	Inferred from geologic and regional structural setting.
Max Depth (km)	12	EJ	Inferred from geologic and regional structural setting.
Strike (deg)	300 - 325	LD	Based on geologic and geomorphological maps and data.
Dip (deg)	70 - 85	LD	Based on geologic, structural and seismological data.
Rake (deg)	160 - 180	EJ	Inferred from geological and seismological data.
Slip Rate (mm/y)	0.1 - 0.5	EJ	Calculated from geodetic and geodynamic data.
Max Magnitude (Mw)	5.5	EJ	Assumed from regional seismological data.

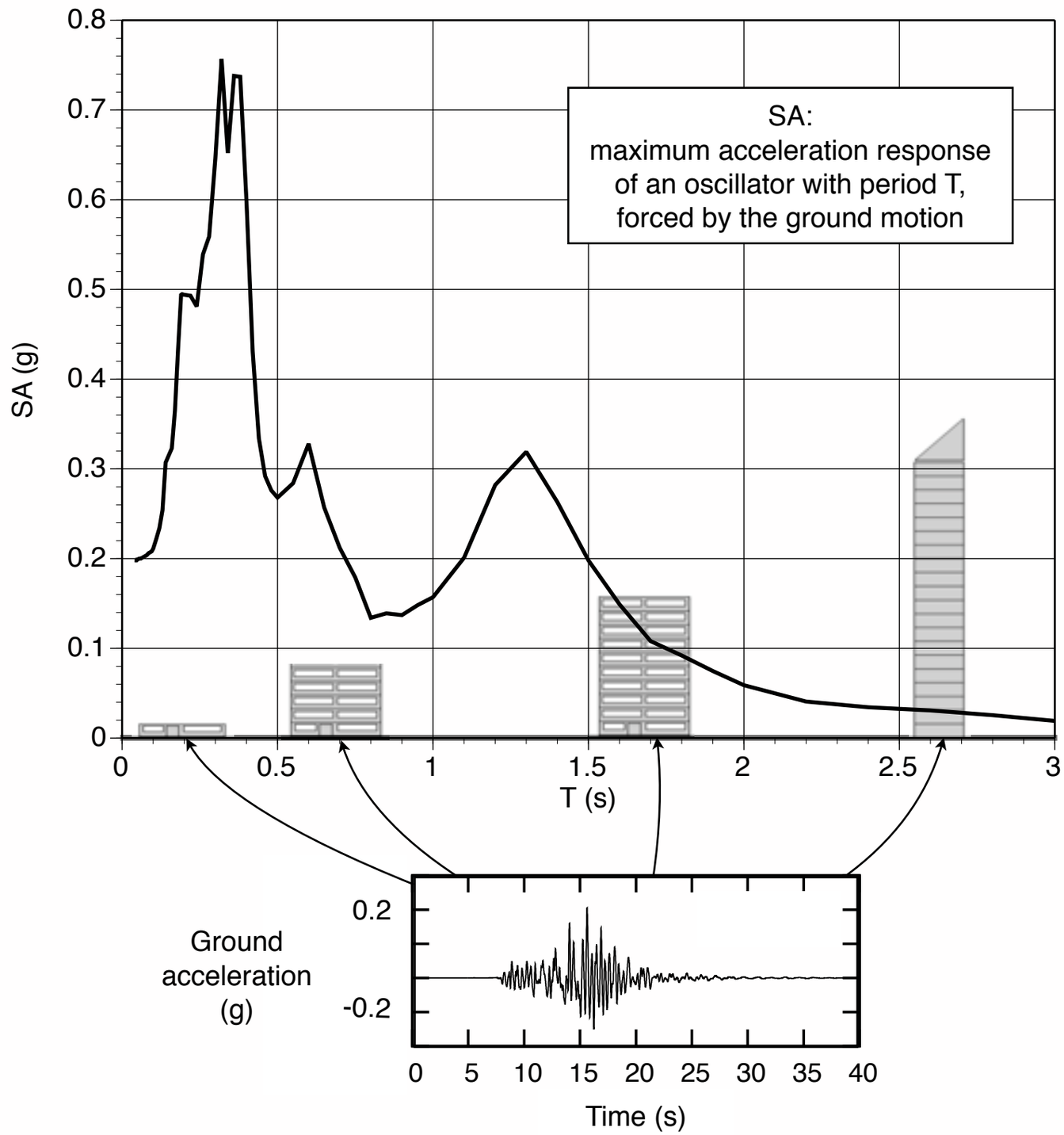
Q-keys: LD = Literature Data; OD = Original Data; ER = Empirical Relationship; AR = Analytical Relationship; EJ = Expert Judgement

Definition of the sources from the DISS database (INGV)

Seismological elaboration

Seismic input from the local scale modelling

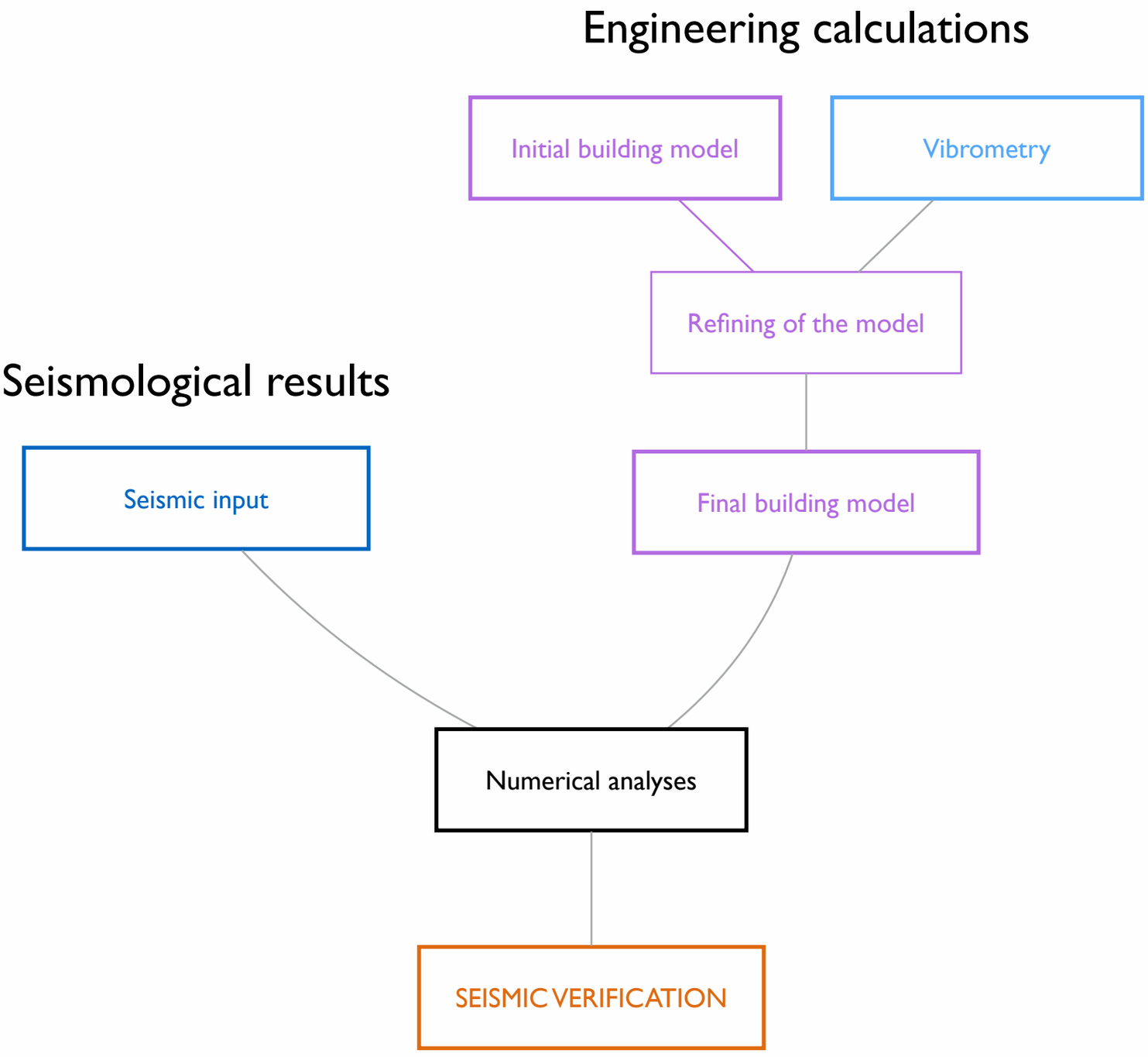
Input sismico



Response spectrum from synthetic accelerogram

Engineering elaboration

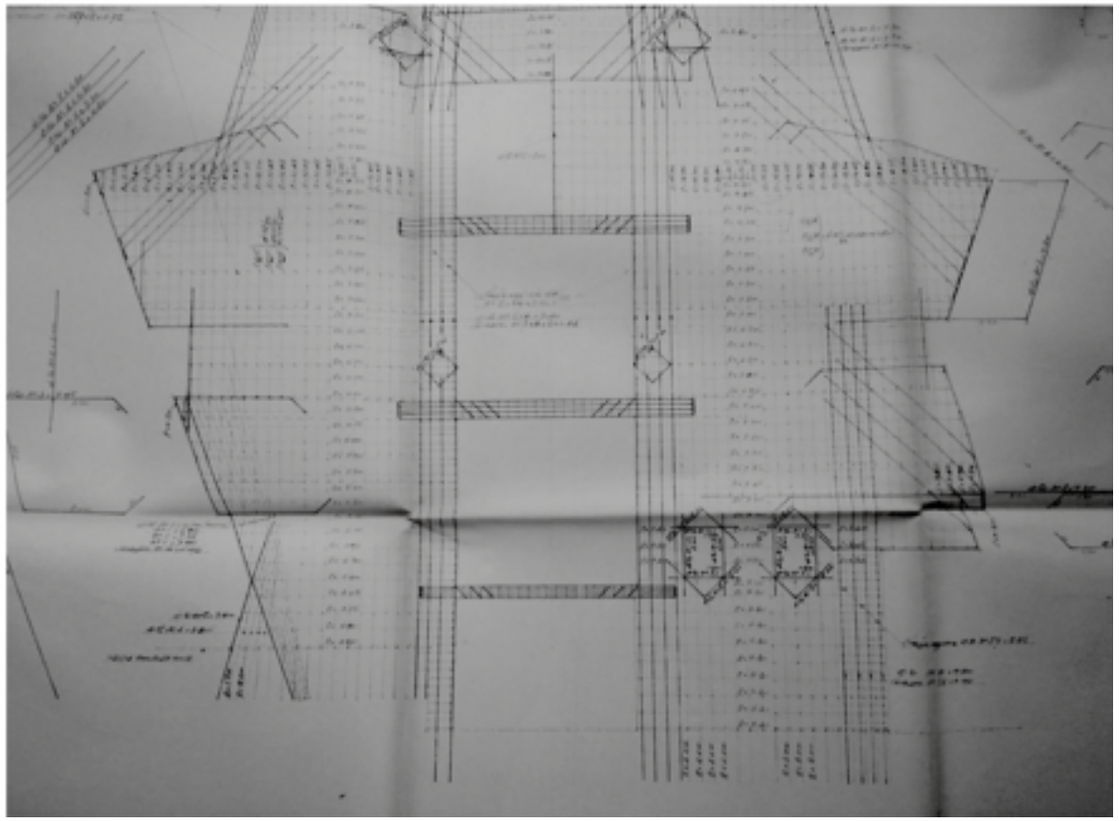
General scheme



Engineering elaboration

Information acquisition

Initial model
of the building



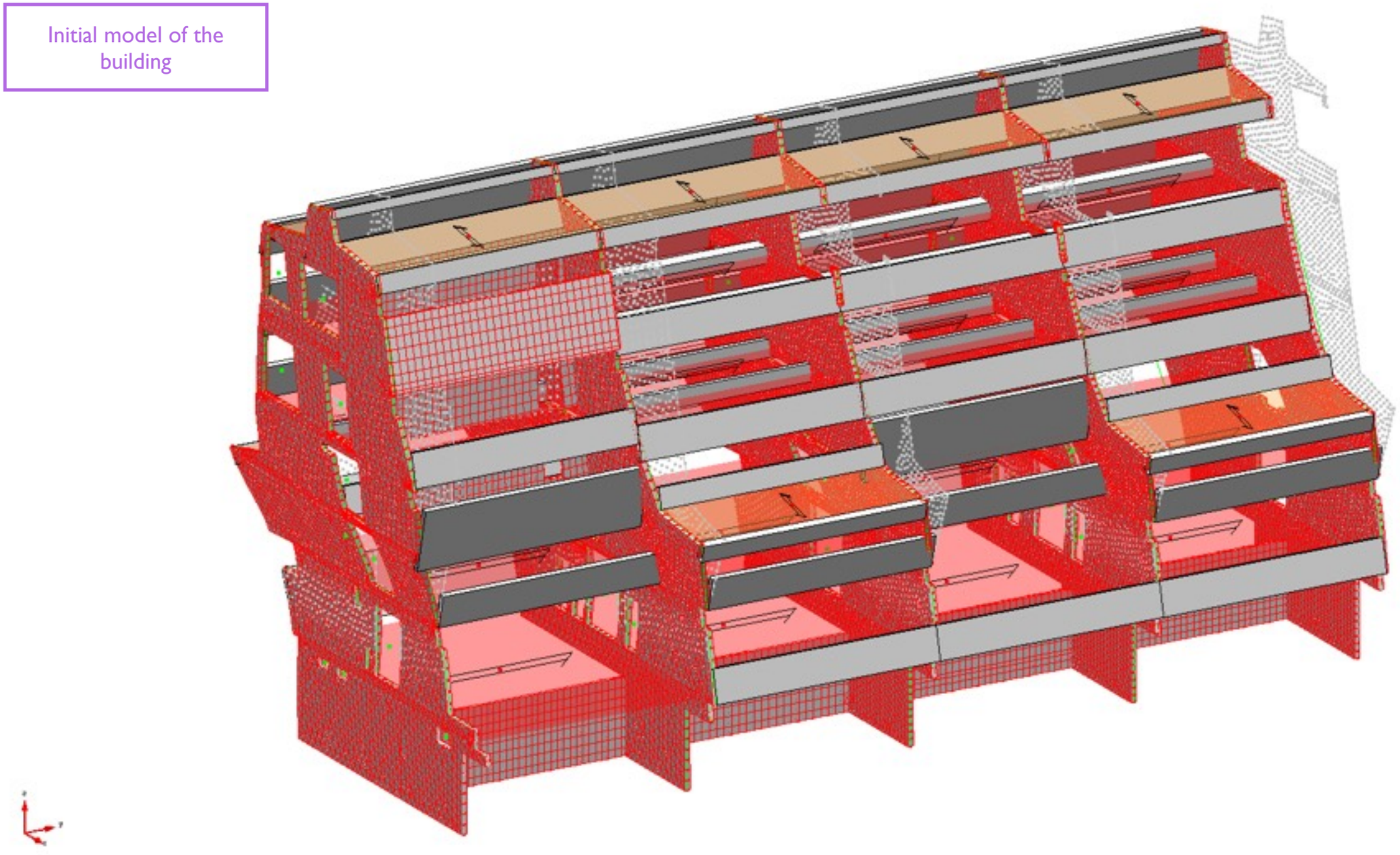
Acquisition of the design documents

Sampling and analysis of the masonry specimens for the materials characterisation

Engineering elaboration

Initial modelling of the building

Initial model of the building

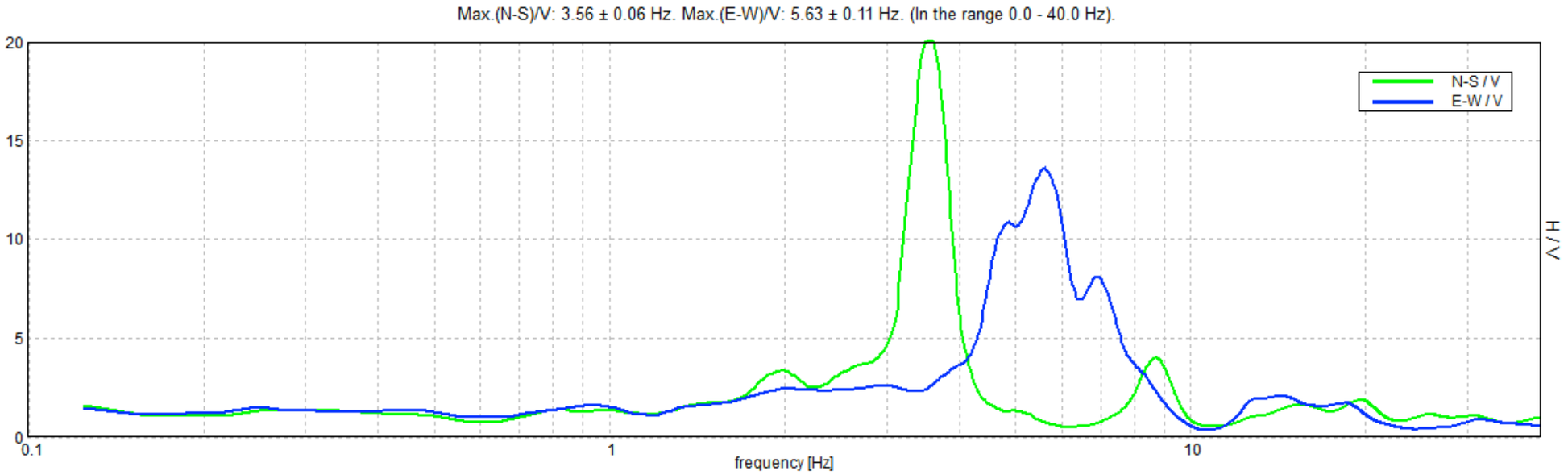


First hypothesis of the model

Engineering elaboration

Acquisition of the vibrometric measurements

Vibrometry

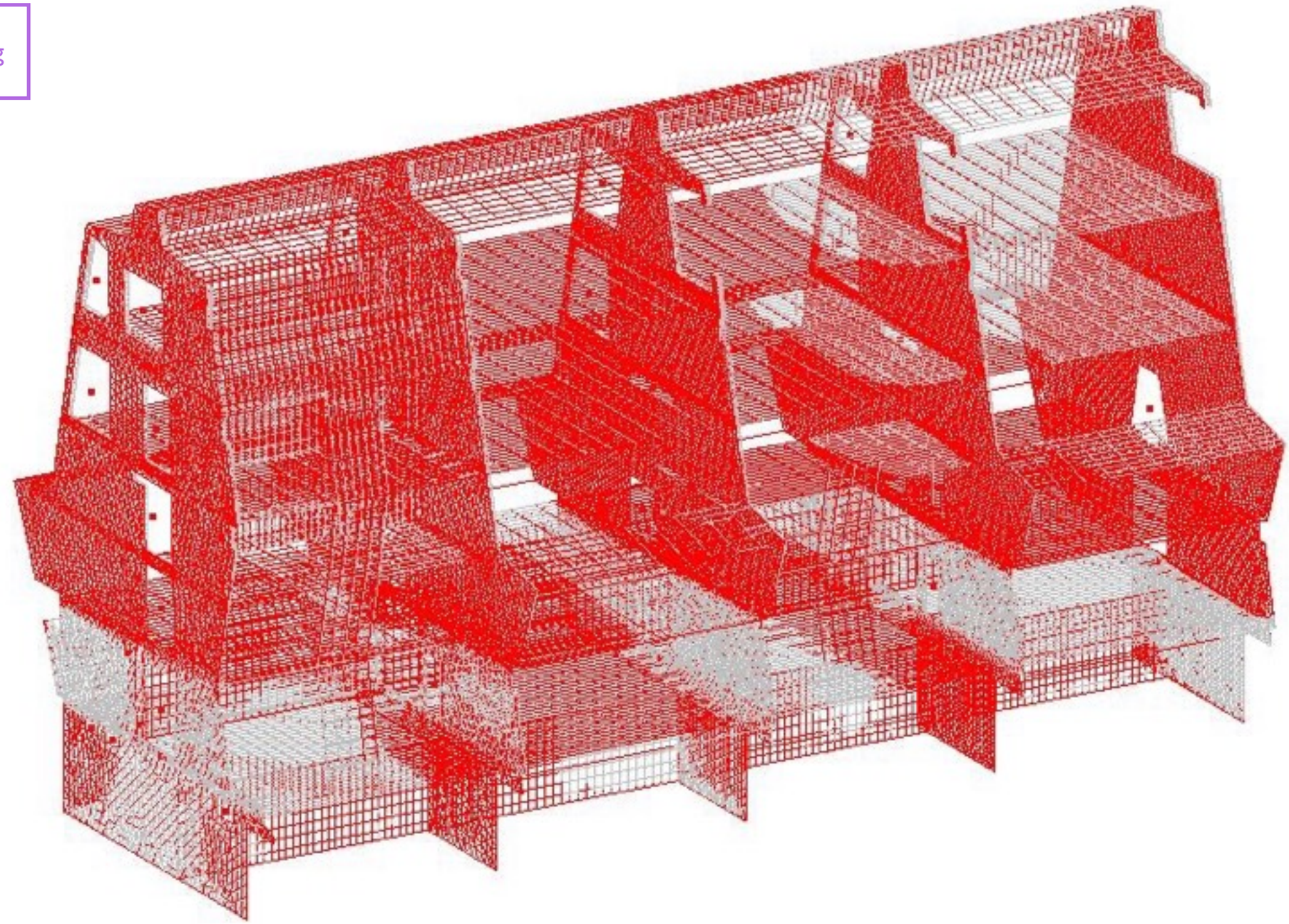


Experimental measure of the resonant frequencies
along the principal axes of the building
to be compared with the theoretical ones

Engineering elaboration

Adjustment of the model

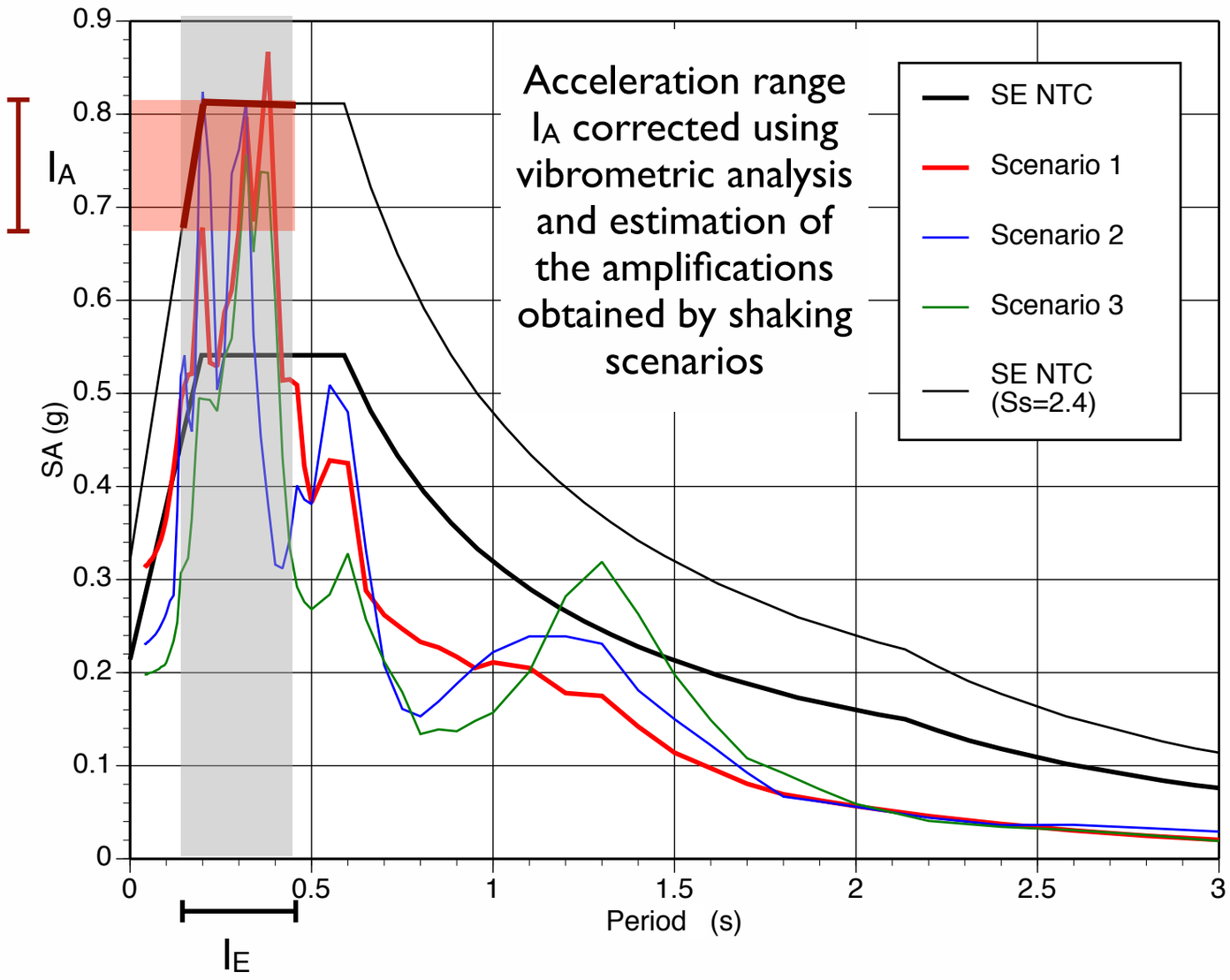
Final model of the building



Re-modelling of the building calibrated on the results of the experimental vibrometry

Seismo-Engineering elaboration

Summary

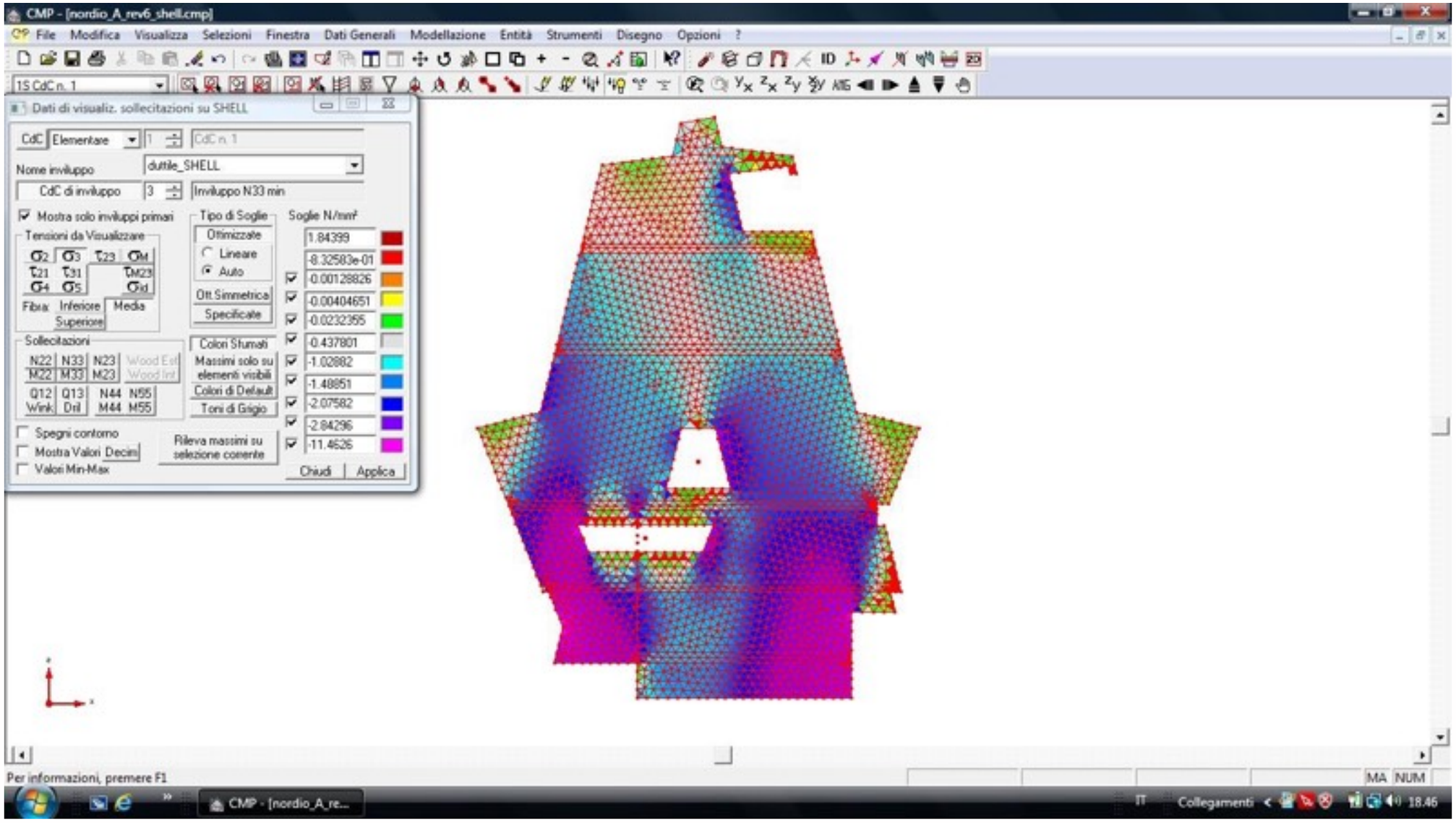


The picture can be read as a summary of the process: the engineer can “enter” in the spectrum by adopting the correct range of periods, I_E, and then "get out", through appropriate amplification that takes into account the scenario input, realistic values of acceleration to be applied to the calibrated model

Engineering elaboration

Calculus of the tensions at the ultimate limit state (SLU)

Numerical analyses



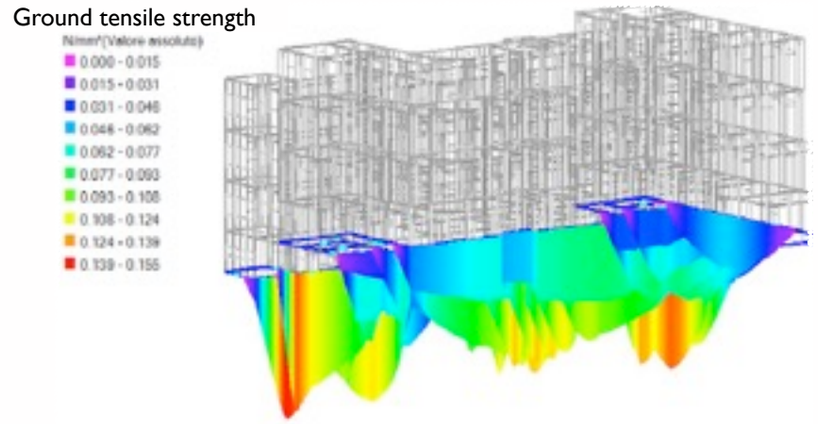
Vertical tensions

Engineering elaboration

Seismic verification

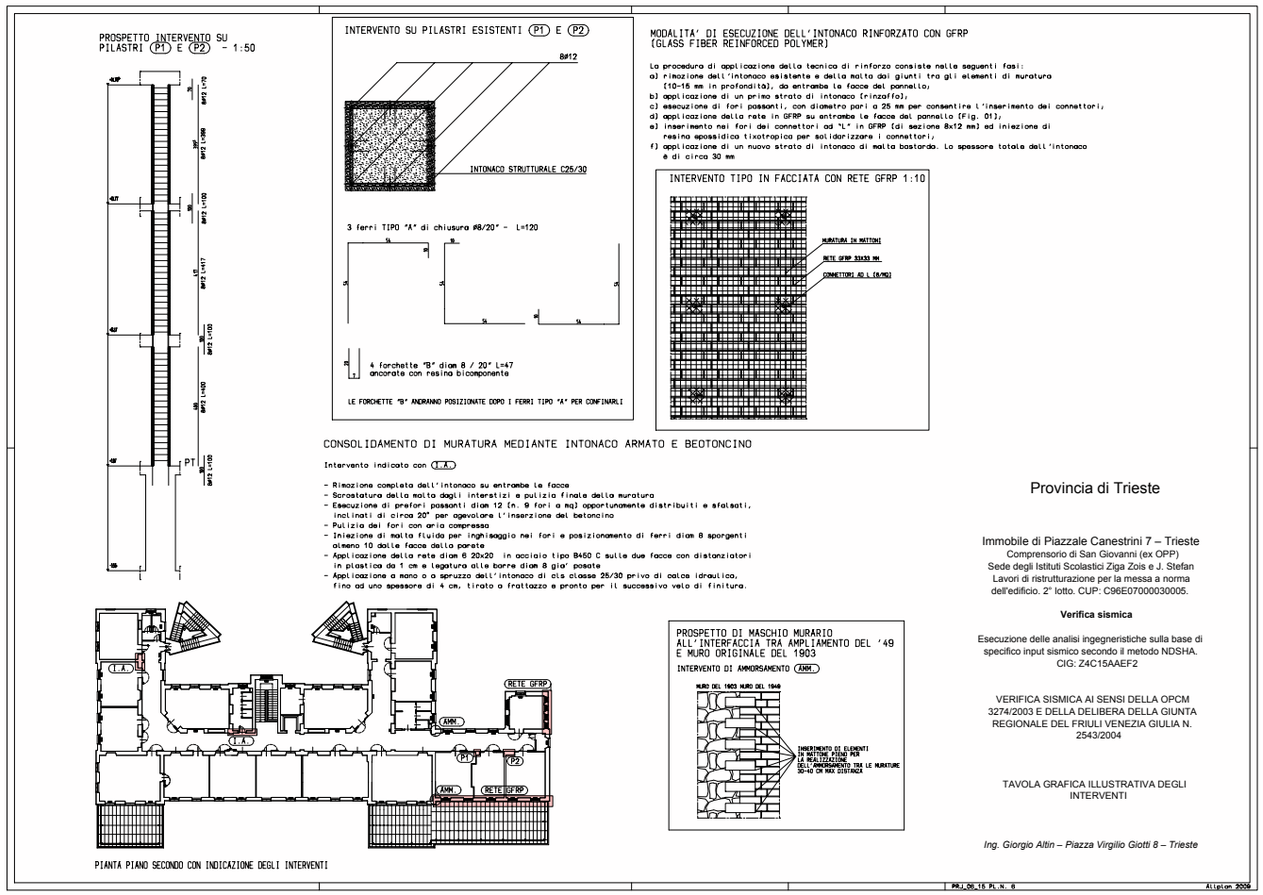
Final building model

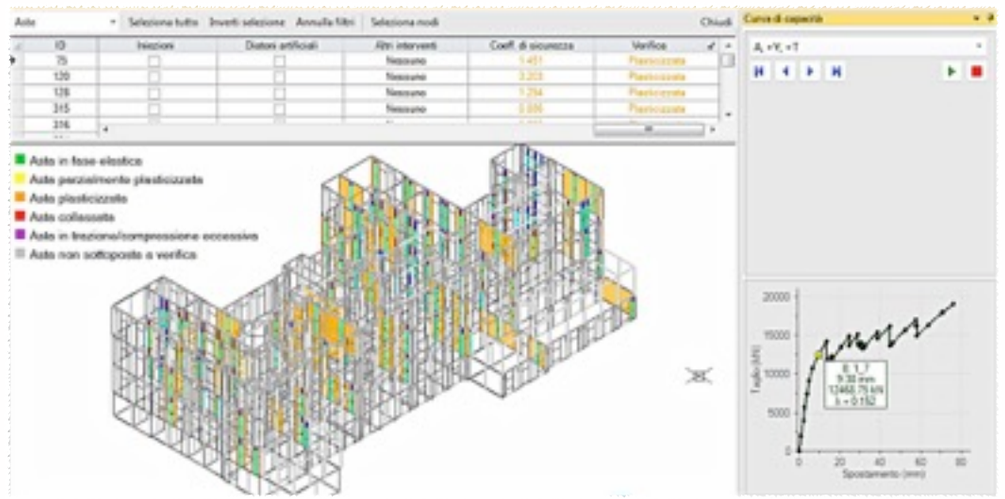
Numerical analyses



Planned structural design

SEISMIC VERIFICATION

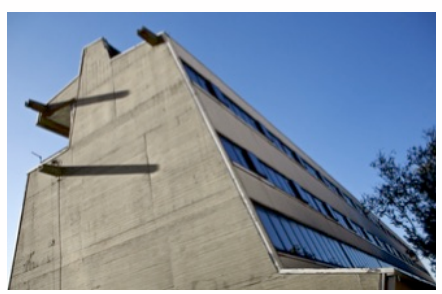




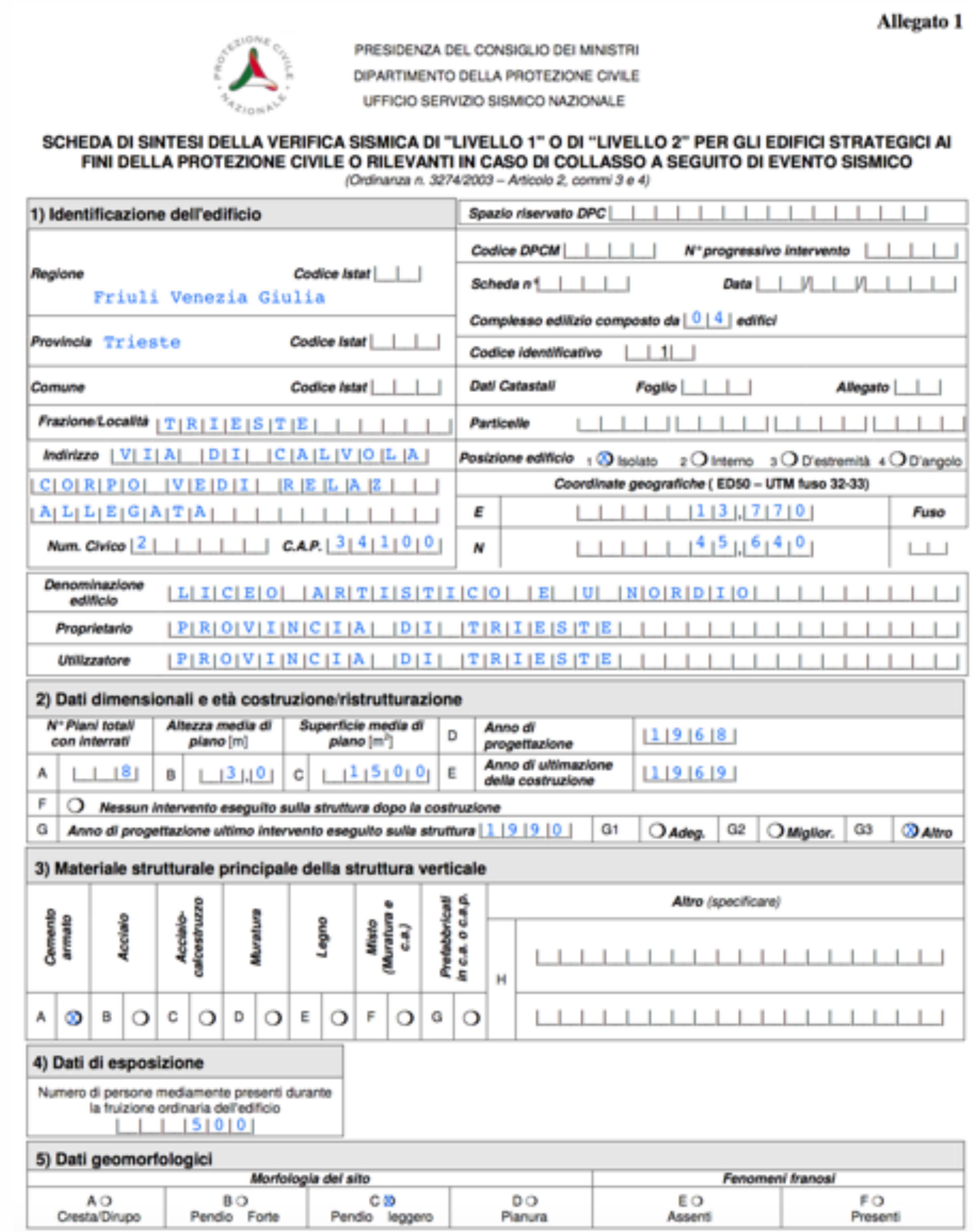
Engineering elaboration

Filling of the seismic verification form

SEISMIC VERIFICATION



The relevant buildings of the Trieste Province to which the proposed procedure has been applied



Allegato 1

PRESIDENZA DEL CONSIGLIO DEI MINISTRI
DIPARTIMENTO DELLA PROTEZIONE CIVILE
UFFICIO SERVIZIO SISMICO NAZIONALE

SCHEDA DI SINTESI DELLA VERIFICA SISMICA DI "LIVELLO 1" O DI "LIVELLO 2" PER GLI EDIFICI STRATEGICI AI FINI DELLA PROTEZIONE CIVILE O RILEVANTI IN CASO DI COLLASSO A SEGUITO DI EVENTO SISMICO

(Ordinanza n. 3274/2003 – Articolo 2, commi 3 e 4)

1) Identificazione dell'edificio

Regione: Friuli Venezia Giulia — Codice Istat
Provincia: Trieste — Codice Istat
Comune — Codice Istat
Frazione/Località: TRIESTE
Indirizzo: VIA DI CALVOLA CORPO VEDI RELAZ ALLEGATA
Num. Civico: 2 — C.A.P.: 34100

Spazio riservato DPC
Codice DPCM — N° progressivo intervento
Scheda n° — Data
Complesso edilizio composto da 04 edifici
Codice identificativo: 1
Dati Catastali — Foglio — Allegato
Particelle
Posizione edificio: 1 ☒ Isolato 2 ○ Interno 3 ○ D'estremità 4 ○ D'angolo
Coordinate geografiche (ED50 – UTM fuso 32-33)
E: 13,770 — Fuso
N: 45,640

Denominazione edificio: LICEO ARTISTICO E U NORDIO
Proprietario: PROVINCIA DI TRIESTE
Utilizzatore: PROVINCIA DI TRIESTE

2) Dati dimensionali e età costruzione/ristrutturazione

N° Piani totali con interrati	Altezza media di piano [m]	Superficie media di piano [m²]		
A: 8	B: 3,0	C: 1500	D: Anno di progettazione	1968
			E: Anno di ultimazione della costruzione	1969

F ○ Nessun intervento eseguito sulla struttura dopo la costruzione
G Anno di progettazione ultimo intervento eseguito sulla struttura: 1990 — G1 ○ Adeg. — G2 ○ Miglior. — G3 ☒ Altro

3) Materiale strutturale principale della struttura verticale

Cemento armato	Acciaio	Acciaio-calcestruzzo	Muratura	Legno	Misto (Muratura e c.a.)	Prefabbricati in c.a. o c.a.p.	Altro (specificare)
A ☒	B ○	C ○	D ○	E ○	F ○	G ○	H

4) Dati di esposizione

Numero di persone mediamente presenti durante la fruizione ordinaria dell'edificio: 500

5) Dati geomorfologici

Morfologia del sito				Fenomeni franosi	
A ○ Cresta/Dirupo	B ○ Pendio Forte	C ☒ Pendio leggero	D ○ Pianura	E ○ Assenti	F ○ Presenti