Consiglio Nazionale
Geometri e Geometri Laureati

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May 2-6, 2016 in Christchurch, New Zealand

CLE
Condizioni Limiti d'Emergenza

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FIG Working Week 2016

CHRISTCHURCH, NEW ZEALAND 2–6 MAY 2016

Recovery
from disaster

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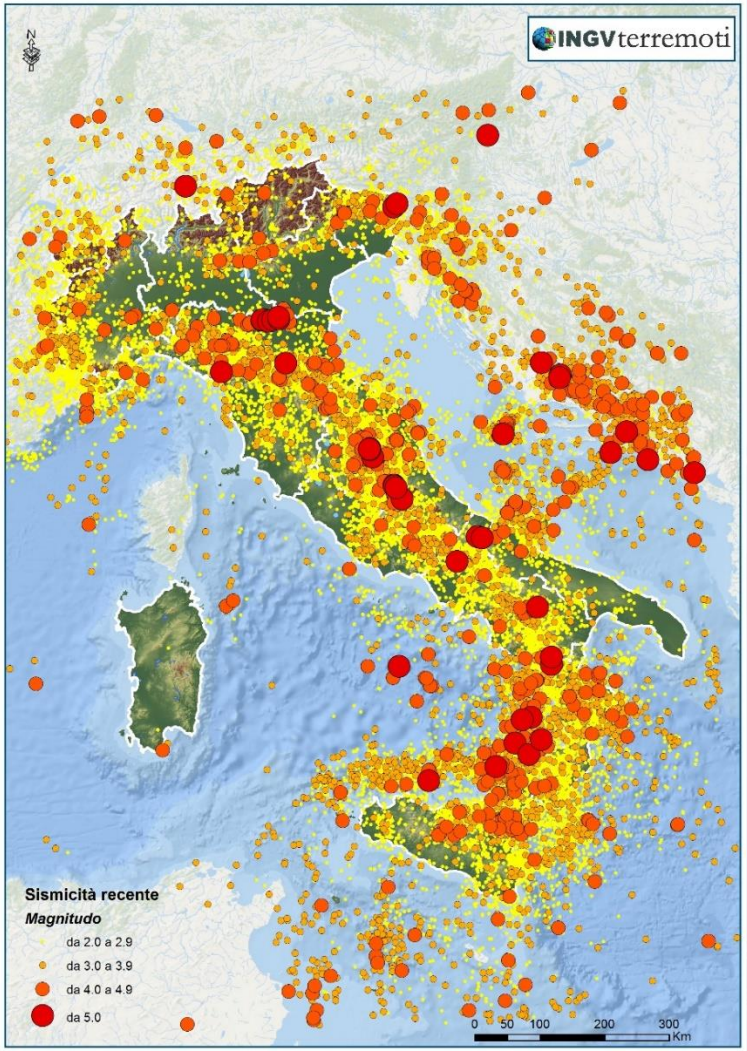
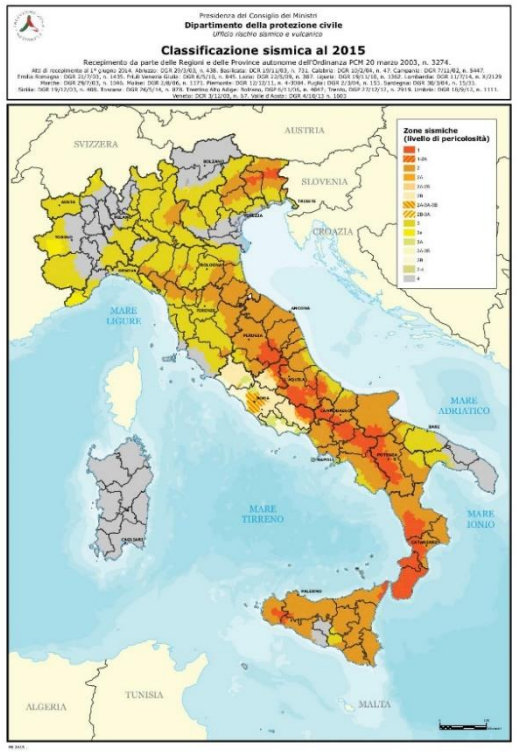
Toitū te whenua



Due to its geodynamic situation, Italy is frequently subject to seismic activities.

In the II Millennium, out of **1300** earthquakes in the Mediterrean, **500** occured within Italy



Notable Earthquakes in Italy

11/01/1693 Val di Noto, Sicily, 7,4 Richter, XI Mercalli

02/02/1703 L'Aquila, 6,7 Richter, XI Mercalli

23/07/1930 Irpinia, 6,7 Richter, XI Mercalli

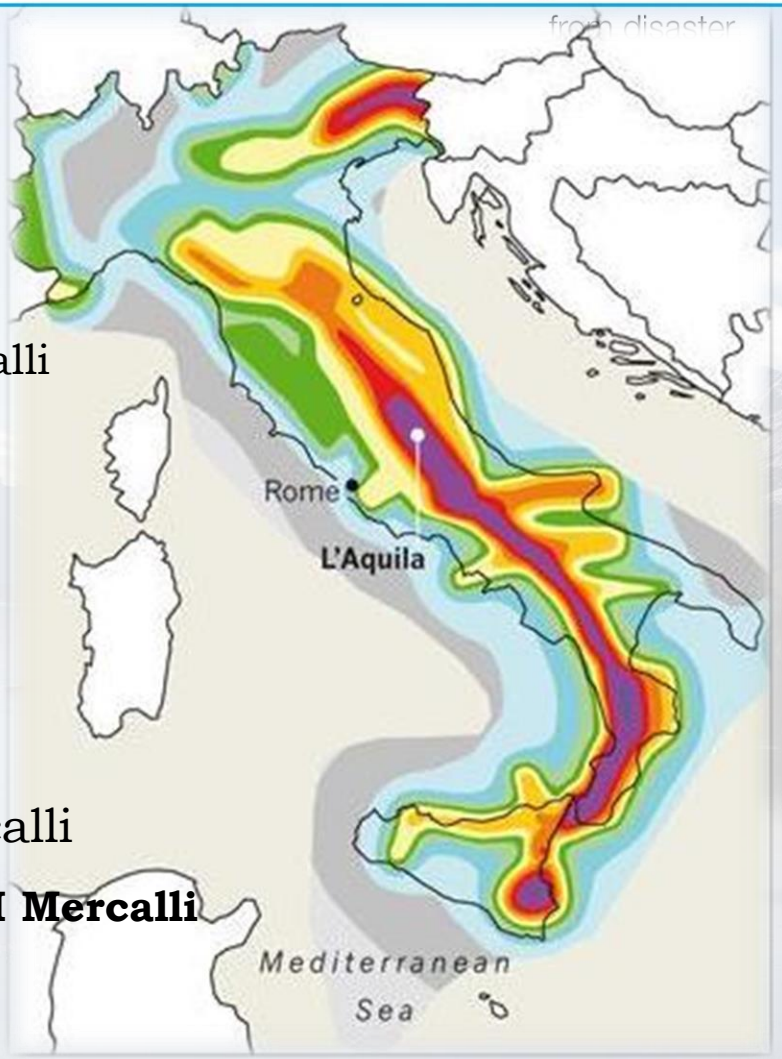
15/01/1968 Belice, Sicily, 6,1 Richter, X Mercalli

23/11/1980 Irpinia, 6,9 Richter, X - XI Mercalli

13/12/1990 Sicily, 5,7 Richter, IX Mercalli

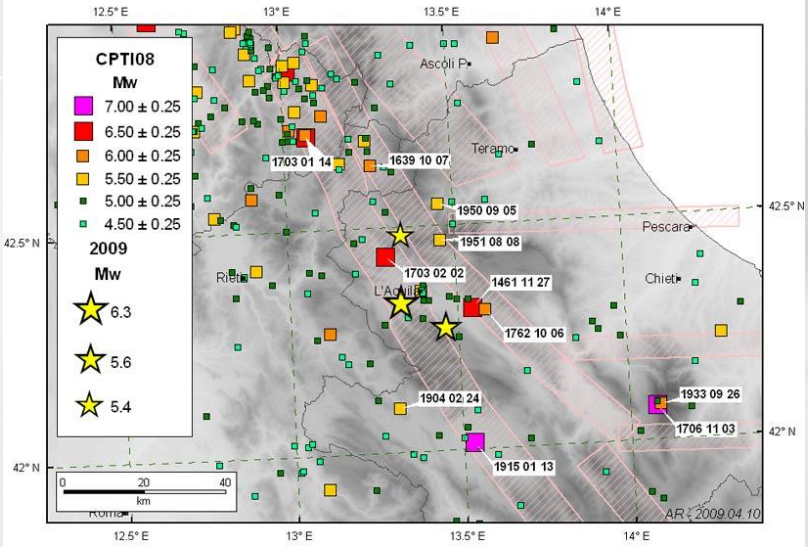
06/04/2009 L'Aquila, 5,9 Richter, IX – X Mercalli

20/05/2012 Emilia Romagna, 5,9 Richter, VI-VIII Mercalli



On the morning of April 6, 2009, a 5.9 Richter, 6.30 on Magnitude-scale earthquake hit L'Aquila in the region of Abruzzo. This disaster cost the loss of 308 victims and caused damage on numerous buildings, both of recent constructions and of historical importance.

However, it also paved way for the Italian government to new enact measures related or relating to public safety, mitigation, risk assessment, rescue and recovery, on the occurrence of an earthquake.



Particularly, article 11 of Law n. 77 of 24 June 2009 (the converted Decreto Abruzzo), provides possible financial aids or funding for actions directed towards prevention and mitigation of seismic risks throughout the national territory

The implementation of Art. 11 was assigned to the Dipartimento della Protezione Civile / Department of Civil Protection) and is regulated by the Ordinanze dal Presidente del Consiglio dei Ministri (OPCM - Ordinances from the President of the Council of Ministers) and by the Ordinanze del Capo Dipartimento della Protezione Civile (OCDPC – Ordinances from the Head of the Dept. of Civil Protection). The same law identifies “Seismic Microzoning” (Microzonazione Sismica) as a key-tool for initiating a strategic seismic risk mitigation.

PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

For the first time, a multi-year program is adapted and is in effect in the whole country. It resulted to various deeper studies about seismic events and specific measures to ensure public and private safety.

The first ordinance issued under this implementation was the OPCM n. 3907 of 13 December 2010, which specifies how the funds should be used for the year 2010. The main directives were:

A) to conduct surveys pertaining to Seismic Microzoning (MS) and to be able to define the areas susceptible to seismic amplifications or permanent ground deformation during an earthquake;

B) to create measures to favor localized building strengthening or seismic improvement or, even demolition and reconstruction of buildings and strategic public works;

C) to favor localized structural strengthening or seismic improvement or demolition and reconstruction of privately owned structures;

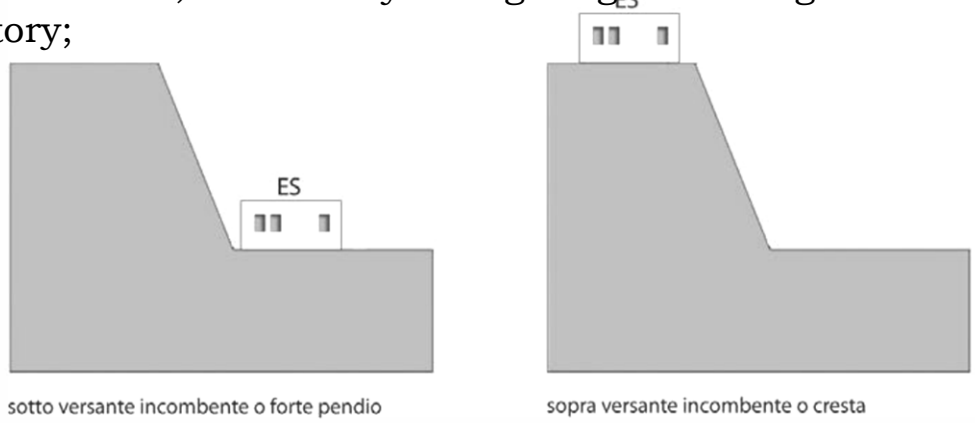
D) to call to (urgent) actions for seismic risk mitigation regarding main infrastructures such as bridges and viaducts, that are of particular interest in case of a seismic event.

Following a seismic event, primary damage assessment on buildings and infrastructures allows the identification of different types of situations depending on a location's distance from the epicenter, along with the amplification of seismic motion or soil instability. This kind of observation is the main objective of Microzonazione Sismica (Seismic Microzoning), which serves the purpose of recognizing in municipal or sub-municipal scale the geological and geotechnical conditions that can change significantly the characteristics of a seismic motion or may produce permanent soil deformations.
A complete technical report of MS permits the identification of different areas of study, which includes:

- **Stable areas**, in which the seismic motion doesn't change compared to the expected ideal conditions of plane and rigid rock;

- **Stable areas with amplifications**, or the areas in which seismic motion is changed with regards to the expected ideal conditions of rigid and plane rock, caused by the geological and geotechnical characteristics and the morphology of the territory;

- **Unstable areas**, where any earthquake-induced phenomenon may cause permanent soil deformation such as landslides, soil liquefaction, ground level fault lines and ground graduations may create morphological terracing.



CLE

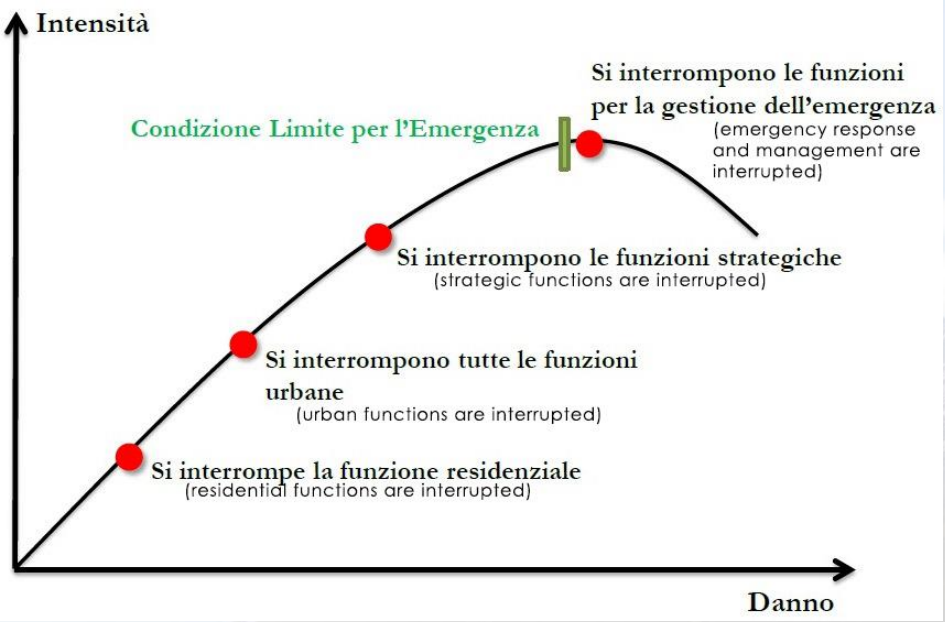
Condizione **L**imite per l'**E**mergenza

OPCM n. 4007/2012

after an occurrence of the earthquake, can still retain the operations of most of the strategic capabilities during emergency, its accessibility and connection inside and outside the local urban framework.

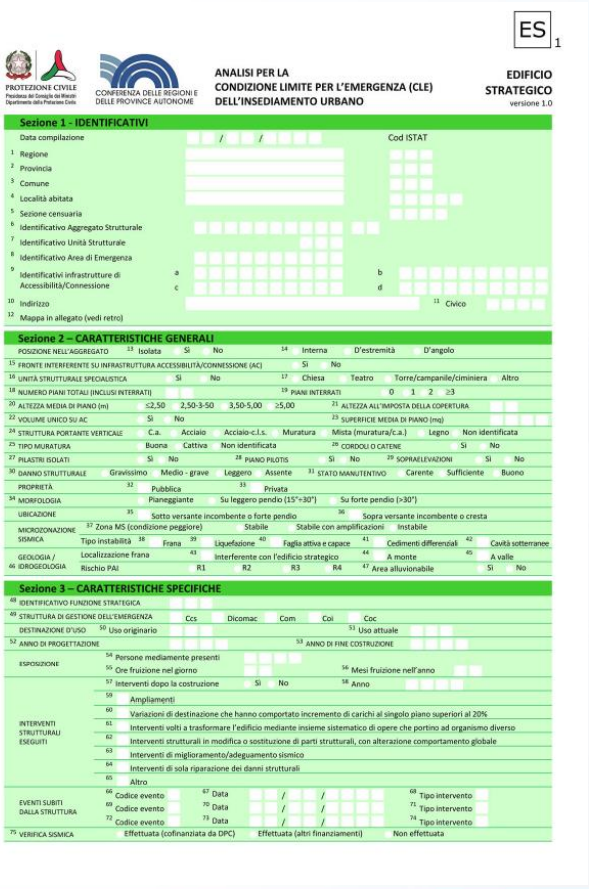
The concept of CLE plays an important role in introducing a sense of "structure" in emergency planning and somehow, it renders any emergency plan vital in urban planning.

CLE represents a different method of urban planning focusing primarily on identifications and valuations of possible interventions to prevent structural risks.



In other words, CLE analysis connects emergency planning and urban planning, with the latter that assumes guidelines aimed at reducing the vulnerability of an urban subsystem, which in turn, is aimed to support strategic functionality of emergency planning. CLE may revolutionized the current emergency planning process.

The analysis of CLE of the urban settlement is carried out using special forms prepared by a specialized Technical Committee



ES 1

PROTEZIONE CIVILE — CONFERENZA DELLE REGIONI E DELLE PROVINCE AUTONOME

ANALISI PER LA CONDIZIONE LIMITE PER L'EMERGENZA (CLE) DELL'INSEDIAMENTO URBANO

EDIFICIO STRATEGICO versione 1.0

Sezione 1 - IDENTIFICATIVI

Data compilazione / / Cod ISTAT

1 Regione
2 Provincia
3 Comune
4 Località abitata
5 Sezione censuaria
6 Identificativo Aggregato Strutturale
7 Identificativo Unità Strutturale
8 Identificativo Area di Emergenza
9 Identificativi infrastrutture di Accessibilità/Connessione a b c d
10 Indirizzo 11 Civico
12 Mappa in allegato (vedi retro)

Sezione 2 – CARATTERISTICHE GENERALI

POSIZIONE NELL'AGGREGATO 13 Isolata Si No 14 Interna D'estremità D'angolo
15 FRONTE INTERFERENTE SU INFRASTRUTTURA ACCESSIBILITÀ/CONNESSIONE (AC) Si No
16 UNITÀ STRUTTURALE SPECIALISTICA Si No 17 Chiesa Teatro Torre/campanile/ciminiera Altro
18 NUMERO PIANI TOTALI (INCLUSI INTERRATI) 19 PIANI INTERRATI 0 1 2 ≥3
20 ALTEZZA MEDIA DI PIANO (m) ≤2,50 2,50-3-50 3,50-5,00 ≥5,00 21 ALTEZZA ALL'IMPOSTA DELLA COPERTURA
22 VOLUME UNICO SU AC Si No 23 SUPERFICIE MEDIA DI PIANO (mq)
24 STRUTTURA PORTANTE VERTICALE C.a. Acciaio Acciaio-c.l.s. Muratura Mista (muratura/c.a.) Legno Non identificata
25 TIPO MURATURA Buona Cattiva Non identificata 26 CORDOLI O CATENE Si No
27 PILASTRI ISOLATI Si No 28 PIANO PILOTIS Si No 29 SOPRAELEVAZIONI Si No
30 DANNO STRUTTURALE Gravissimo Medio - grave Leggero Assente 31 STATO MANUTENTIVO Carente Sufficiente Buono
PROPRIETÀ 32 Pubblica 33 Privata
34 MORFOLOGIA Pianeggiante Su leggero pendio (15°÷30°) Su forte pendio (>30°)
UBICAZIONE 35 Sotto versante incombente o forte pendio 36 Sopra versante incombente o cresta
MICROZONAZIONE SISMICA 37 Zona MS (condizione peggiore) Stabile Stabile con amplificazioni Instabile
Tipo instabilità 38 Frana 39 Liquefazione 40 Faglia attiva e capace 41 Cedimenti differenziali 42 Cavità sotterranee
GEOLOGIA / IDROGEOLOGIA Localizzazione frana 43 Interferente con l'edificio strategico 44 A monte 45 A valle
Rischio PAI R1 R2 R3 R4 47 Area alluvionabile Si No

Sezione 3 – CARATTERISTICHE SPECIFICHE

48 IDENTIFICATIVO FUNZIONE STRATEGICA
49 STRUTTURA DI GESTIONE DELL'EMERGENZA Ccs Dicomac Com Coi Coc
DESTINAZIONE D'USO 50 Uso originario 51 Uso attuale
52 ANNO DI PROGETTAZIONE 53 ANNO DI FINE COSTRUZIONE
ESPOSIZIONE 54 Persone mediamente presenti 55 Ore fruizione nel giorno 56 Mesi fruizione nell'anno
INTERVENTI STRUTTURALI ESEGUITI 57 Interventi dopo la costruzione Si No 58 Anno
59 Ampliamenti
60 Variazioni di destinazione che hanno comportato incremento di carichi al singolo piano superiori al 20%
61 Interventi volti a trasformare l'edificio mediante insieme sistematico di opere che portino ad organismo diverso
62 Interventi strutturali in modifica o sostituzione di parti strutturali, con alterazione comportamento globale
63 Interventi di miglioramento/adeguamento sismico
64 Interventi di sola riparazione dei danni strutturali
65 Altro
EVENTI SUBITI DALLA STRUTTURA 66 Codice evento 67 Data / / 68 Tipo intervento
69 Codice evento 70 Data / / 71 Tipo intervento
72 Codice evento 73 Data / / 74 Tipo intervento
75 VERIFICA SISMICA Effettuata (cofinanziata da DPC) Effettuata (altri finanziamenti) Non effettuata

a) Identification of the buildings and areas that will provide strategic functions for emergency (ES);

b) Identification of infrastructure apt for accessibility and connection (AC) with the local urban framework, the buildings and areas as stated above in a) and any other critical elements;

c) The identification of structural aggregates (AS) and individual structural units (US) that can interfere with the infrastructure of accessibility and connection with the local urban framework (Article 18 OPCM 4007/2012).

For this purpose, a standardized process of data collection and storage was designed through special folder comprising each types of structure-specific module. Collected data are then represented in digital cartography in shapefile format.

It is composed of five technical modules corresponding to the different structural types to be surveyed and studied.

They are:

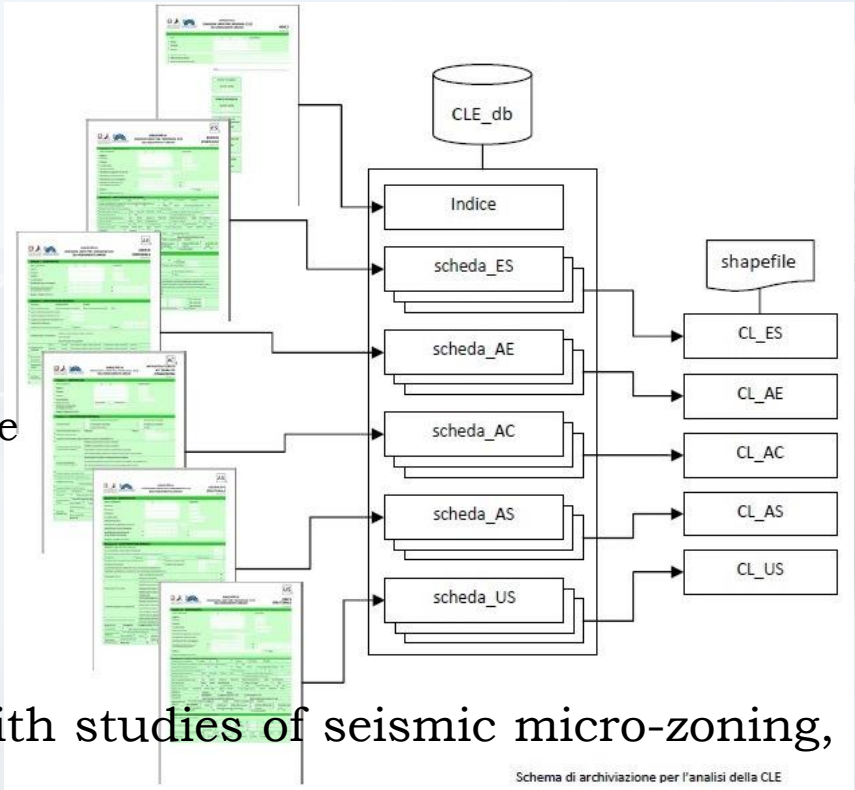
ES - Edificio Strategico / Strategic Building

AE - Area di Emergenza / Emergency Area

AC - Infrastruttura Accesibilità-Connessione / Road Accessibility-Connection

AS - Aggregato Strutturale / Structural Aggregate

US - Unità Strutturale / Structural Unit



Schema di archiviazione per l'analisi della CLE

The analysis is conducted in conjunction with studies of seismic micro-zoning, and therefore starts from the municipal level

CLE Analysis can only begin once the following documents have been sourced out:

1. **Regional Technical Map** (Carta Tecnica Regionale - CTR) in at least 1: 10,000 scale and in digital vector file;

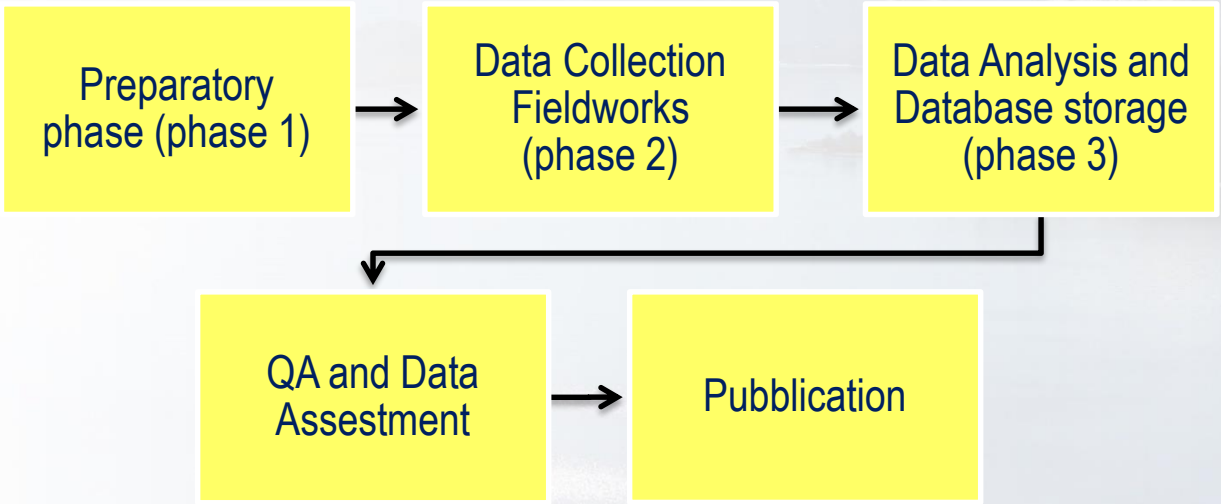
2. **Existing Municipal Emergency Plan, or Civil Protection Emergency Plan**, or other existing plans for the identification of strategic buildings (i.e. LV0 index prescribed in the Circular of the Dipartimento della Protezione Civile - 21 April 2010) and emergency areas.

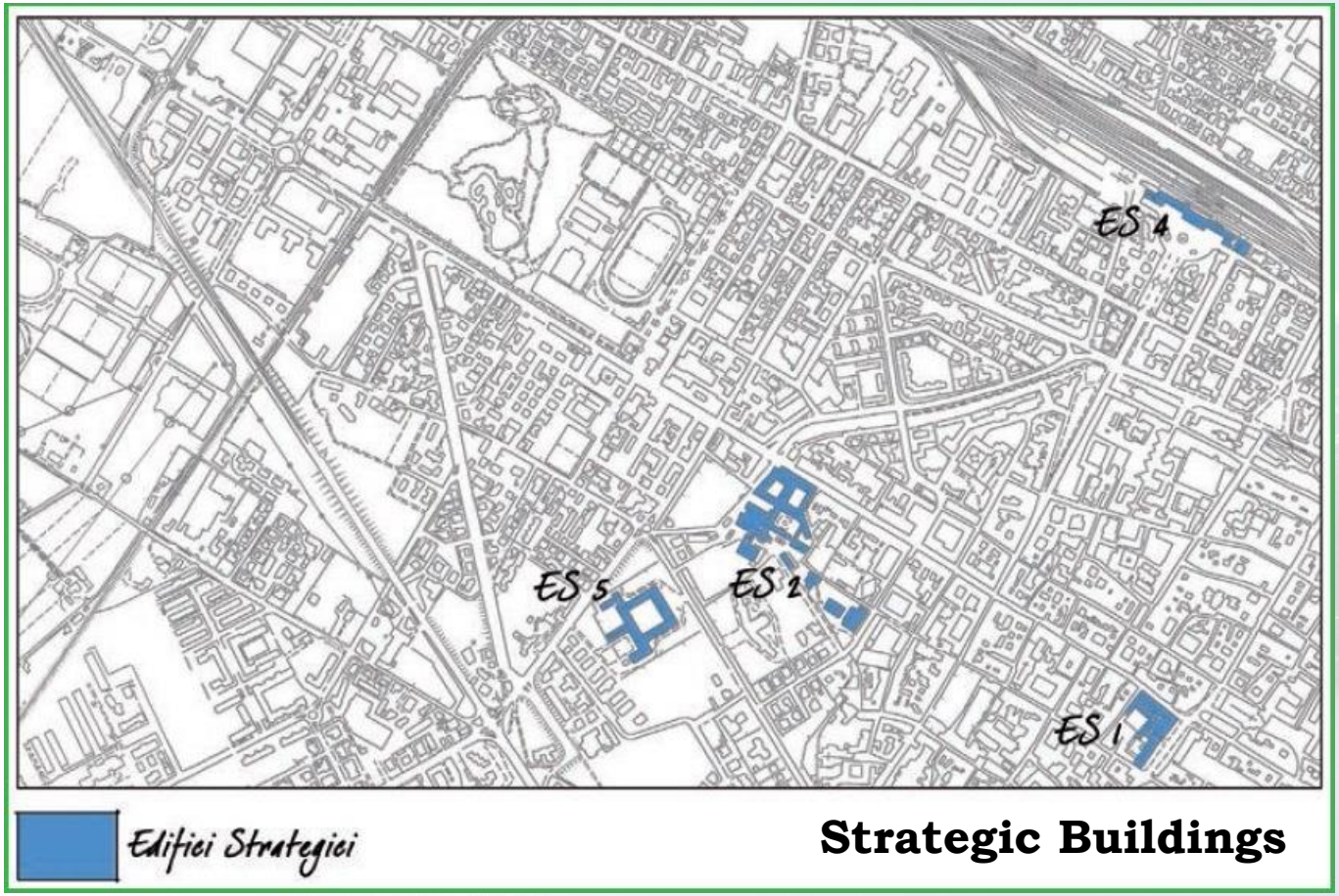
3. **Precompiled descriptive module on strategic buildings and areas of emergen**cy (specific to a certain element that is of interest for the analysis of CLE).

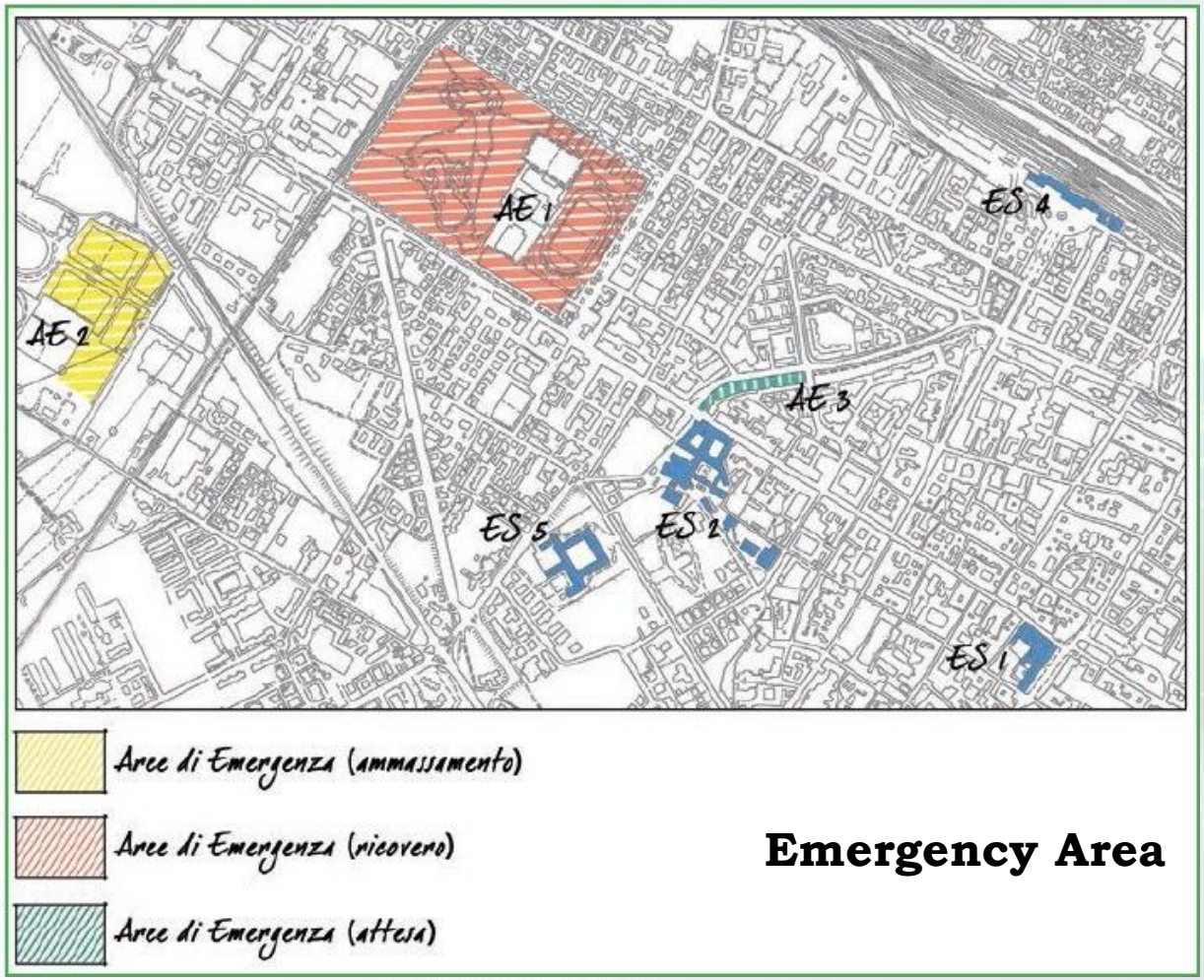
4. **Any modules already compiled regarding building vulnerability** (i.e. LV1 and LV2 indexes as in implemented by OPCM 3274/2005).

The standardized methodology applied for the analysis of CLE is divided in three (3) phases:

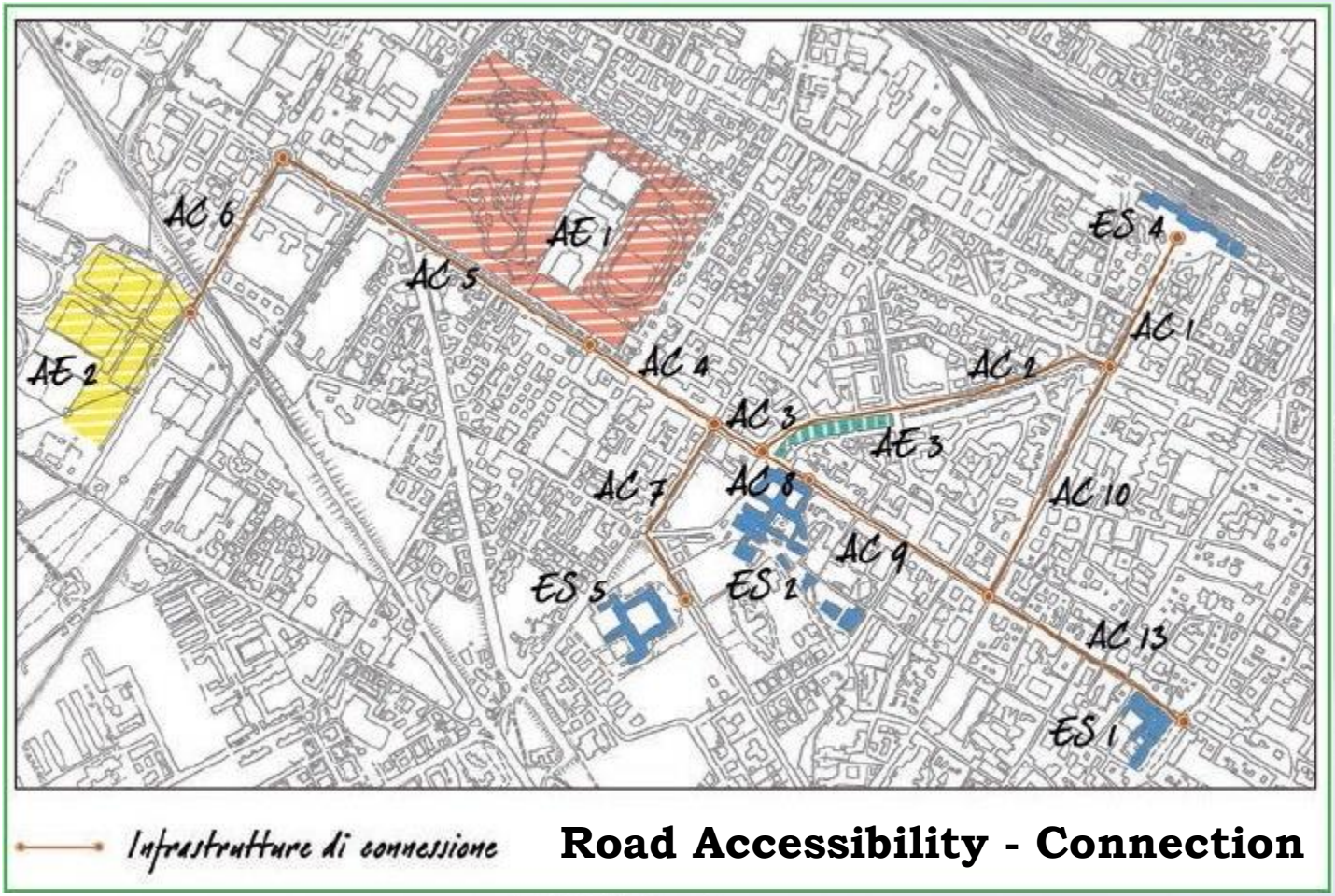
- Preparatory phase (phase 1);
- Data Collection (phase 2);
- Data Analysis and Database storage (phase 3);



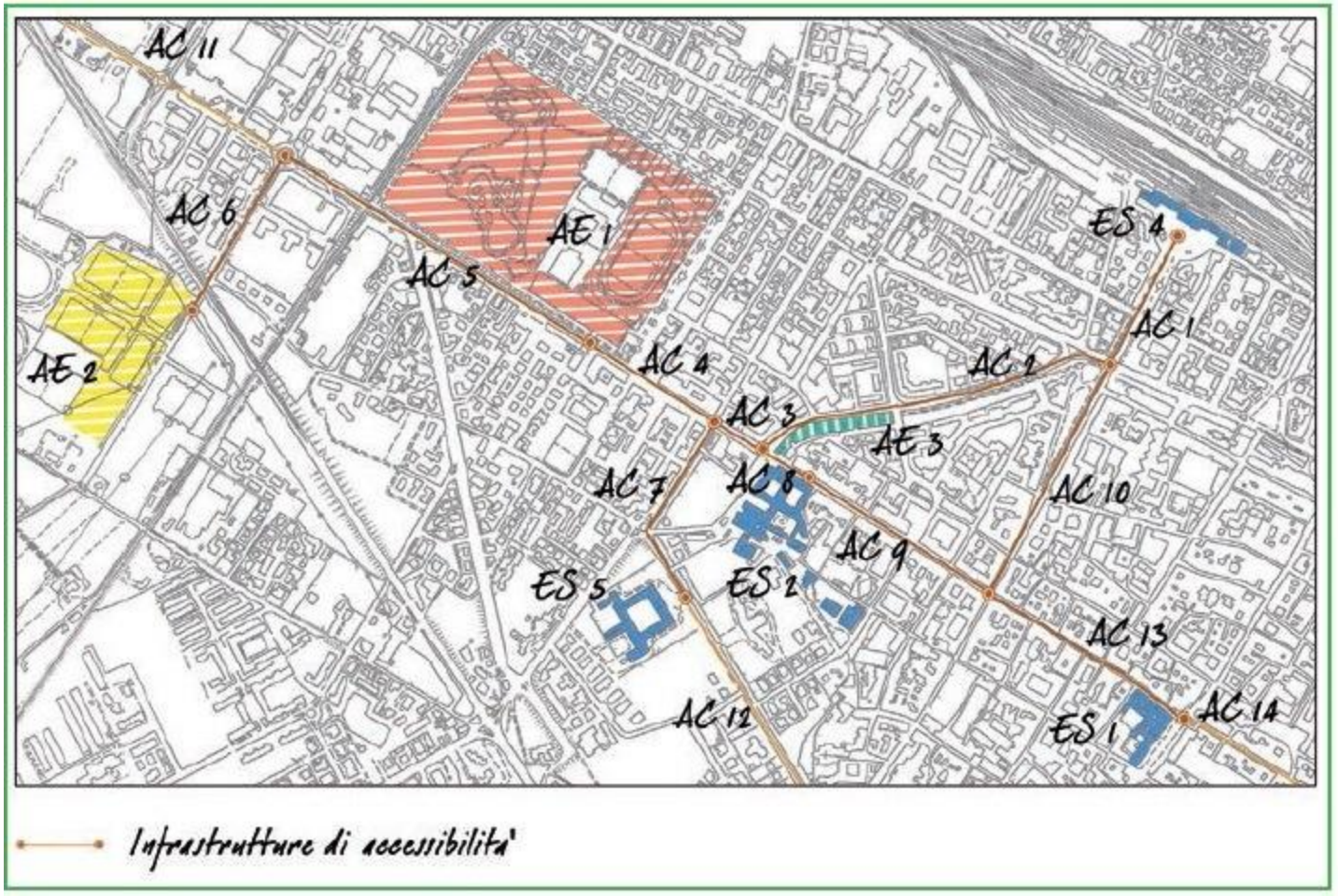

ES 4
ES 5
ES 2
ES 1
Edifici Strategici
Strategic Buildings

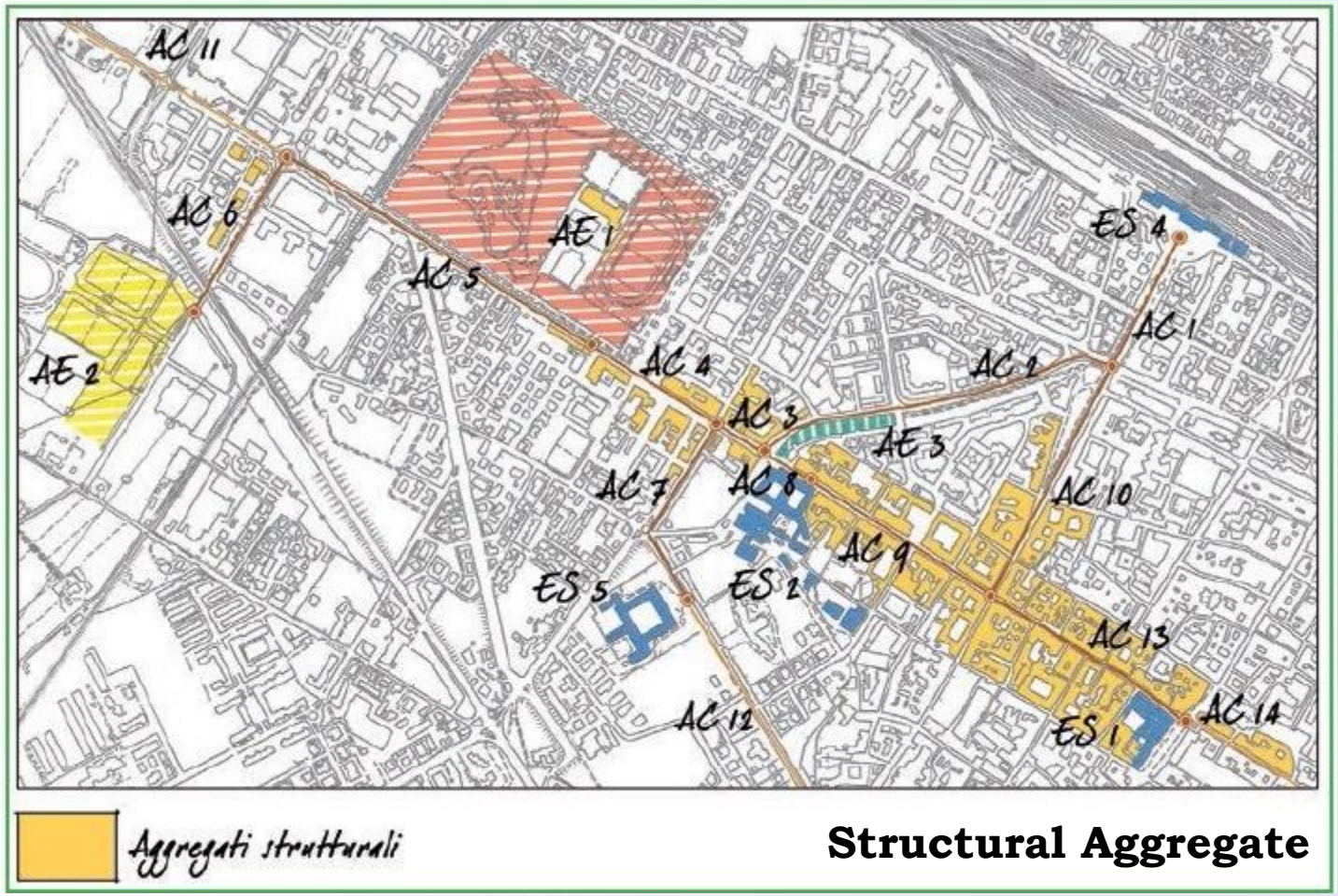


Emergency Area

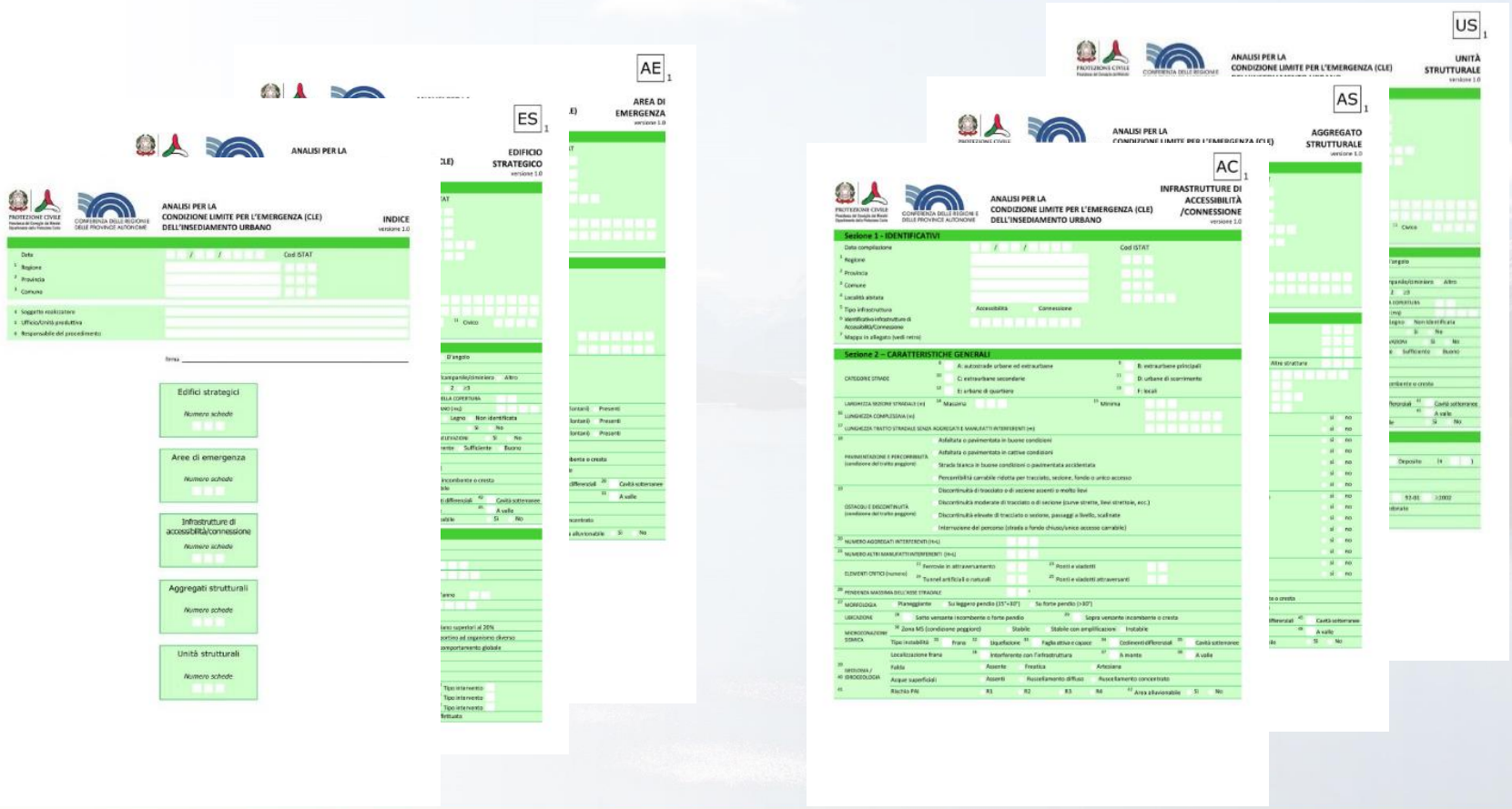


Road Accessibility - Connection

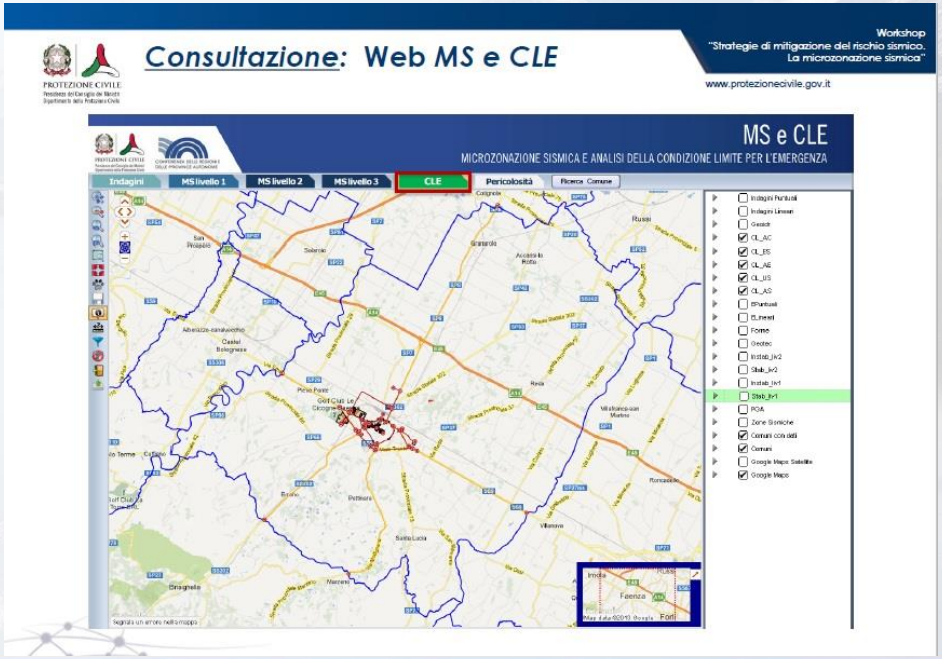

AC 11
AC 6
AE 1
AC 5
ES 4
AC 1
AE 2
AC 4
AC 2
AC 3
AE 3
AC 7
AC 8
AC 10
AC 9
ES 5
ES 2
AC 13
AC 12
ES 1
AC 14
Infrastrutture di accessibilita'


AC 11
AC 6
AE 1
AC 5
ES 4
AC 1
AE 2
AC 4
AC 2
AC 3
AE 3
AC 7
AC 8
AC 10
AC 9
ES 5
ES 2
AC 13
AC 12
ES 1
AC 14
Aggregati strutturali
Structural Aggregate

Data Collection through fieldworks to verify current state of the identified elements, their composition and characteristics, interference and relevance, and conservation



All data are uploaded to DPCN's database via a specific software freeware (SoftCLE). Corresponding shapefiles are produced.



Catania, situated on the southern island of Italy, is one of the biggest and populated cities of Sicily. Located on the eastern side of the island, Catania has a long history of strong earthquakes, volcanic eruptions caused by the neighboring Mt. Etna, and seismic events originating from the Siculo-Calabrian rift zone, some of which could be dated since 1169.


14.0
21.2
17.7
19.0
15.5
CORSO SICILIA
17.7

BO - TO - RG - AP - LI