

Analysis, Digitalisation, and Intervention on urban Aggregates to revamp historical CENTres and villages (ADIACENT)

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Background. Historical centres in Italy and in many cities around the world are made up of aggregated buildings, resulting from subsequent construction phases during ages. Despite their significance, these building types have been mainly studied in the damaged configuration, in the aftermath of recent seismic events. Indeed, building aggregates demonstrated a great seismic vulnerability, related to poor quality of material and construction details, as well as to their irregular shape.

In the undamaged condition, the knowledge process and the subsequent seismic analysis are affected by strong uncertainties, due to the strong variability and low repetitiveness of building aggregates, as well as because of the partial inspectability related to split property. It is therefore necessary to investigate these building types with a holistic approach, deepening the methodologies for the knowledge process as well as for the management of the data collected, for the purpose of a better understanding of the "aggregate system". Another relevant aspect is represented by the choice of effective retrofit interventions on building aggregates. In particular, some types of interventions are more suitable for building aggregates, whereas some other are inefficient or even harmful, also considering a localised application on portions of the built system.

Aim. This PhD project has the aim of investigating building aggregates typical of Italian historical centres, by providing a comprehensive framework for knowledge process, modelling and analysis, as well as integrated evaluations of mitigation strategies. This research will focus on urban aggregates and terraced houses. Building Information Modelling (BIM) approaches will be developed and exploited for data management. Integrated evaluations of intervention strategies will then be investigated for the retrofit of seismic and energy performances, also considering functional and conservation aspects. Devised mitigation strategies and guidelines will represent a useful result for enhancing historical centres and villages, threatened by earthquakes, and for protecting them from depopulation following seismic events. Results of the research will be of strong interest for administrations in charge with management of real estates, including building aggregates, and technicians.

Research phases and expected results.

- Development of guidelines for the knowledge process of urban aggregates, through the critical observation of typical building features.
- Development of BIM protocols for data management aimed at understanding the aggregate system and the interactions among structural units.
- Parametric modelling and sensitivity analyses on real case studies, including the application of seismic retrofit interventions.
- Integrated evaluations of intervention strategies considering also energetic, functional and conservation of historical structures.
- Guidelines and tools for administrations and technicians in charge with management of real estates, including building aggregates and terraced houses.

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