

# The INGV macroseismic photographic database (DFM): a structured photographic collection of earthquake effects in Italy

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Answers to the Reviewer #1 Giacomo Buffarini

**Comment 1:** The purpose of the paper is very important supporting the research activity but also the training activity for new surveyor. The DFM here described is a powerful mean that collects a large amount of image from numerous seismic events very that can be used in future to better understand the macroseismic effect of an earthquake.

**Answer:** We would like to thank the reviewer for appreciating our work and for emphasizing the importance of DFM for research and training.

**Comment 2:** The rules at the basis of the DFM are sharable; it is important to state how to establish the vulnerability of the structure. This is important to guide the novel researcher, especially in case of reinforced concrete structures, because they can be more vulnerable if the evaluation doesn't take into account the rules and the legislation in force at the time they were realized.

**Answer:** We thank the reviewer for highlighting this. The vulnerability assessment in DFM strictly adheres to the European Macroseismic Scale (EMS-98) guidelines. For reinforced concrete structures, the scale implicitly considers the level of earthquake resistance in the design. During field surveys and subsequent photo cataloguing, expert surveyors assess vulnerability classes, considering building typologies and inferring likely earthquake-resistant design levels. This level is estimated based on the construction period, primarily using field experience and preliminary reconnaissance of the building stock and the municipality's seismic classification history. This procedure enables the evaluators to take into account the building codes and legislative framework applicable when the structure was built, ensuring the classification is as reliable as possible, particularly for older reinforced concrete buildings that may not have been designed according to modern seismic standards. We will add a clarifying sentence to Section 3.2 to explicitly state how vulnerability is assessed according to EMS-98 principles, bearing in mind the building codes in force at the time of construction.

**Comment 3:** It could be useful to add, when possible, the image of the structure before the event. In many cases, using Google Street View, should be possible obtain the situation before the structure has been subjected to the earthquake. Sometimes, especially for heavy damaged building, it is important visualize the original defects that subsequently cause the damage.

**Answer:** This is a very interesting and useful suggestion. The primary scope of DFM is to archive photographic documentation of the post-earthquake landscape, which is collected directly by QUEST. We agree that pre-event images are invaluable for accurately assessing seismic damage versus pre-existing defects. However, field operators performing rapid post-earthquake surveys in emergency conditions (e.g. in "red zones") often encounter infrastructural issues, such as a lack of internet connectivity, as well as severe time constraints, which prevent them from using online tools such as Google Street View on site. Furthermore, as we will clarify in the revised manuscript, DFM currently does not record the precise geolocation of individual buildings. Identifying the specific building, or even the exact location, of many historical photographs in our archive (dating back to the 1976 Friuli earthquake, for example) can be extremely challenging due to subsequent urban modifications and the lack of original GPS metadata. This makes the use of modern tools like Street View extremely difficult, if not impossible. For this reason,

operators are trained to assess the state of conservation and age of damage visually. DFM does not systematically store pre-event images from external platforms due to copyright restrictions, storage constraints and the time-consuming nature of adding such a feature. Nevertheless, during the subsequent internal assessment phase at the office, our experts routinely use such tools when applicable and available to evaluate the pre-existing conditions of buildings and resolve any uncertainties. We will add a note in Section 2 to mention this practice during the quality control phase and clarify the limitations regarding historical archives.

**Comment 4:** Fig.1 It is better to add in “Classification” also the term “Vulnerability”, otherwise “Typology” may appear as a synonymous of “Vulnerability” and we know that’s not true

**Answer:** We completely agree. We will update the flow chart in Figure 1 to include “Vulnerability” alongside “Typology & Damage Grading” to avoid any confusion.

**Comment 5:** Fig. 2 It has said that the data start from 1976 Friuli earthquake, but this event is not represented in this figure, why?

**Answer:** We apologise for the error. The database begins with the earthquake that occurred in 1980. We will amend the text accordingly.

**Comment 6:** Table 1 is missing; in the text they make reference to table 1 but there isn’t at all.

**Answer:** Mentioning Table 1 is due to a previous draft not being removed. We will correct this in the final revision.

**Comment 7:** LINE 48 the link is uncorrected because contain also “in Italian” that must be removed

**Answer:** Thank you for spotting this typo. We will amend the sentence to ensure that the URL is formatted correctly.