



Data Article

Dataset of bridge collapses in Italy spanning more than 25 years (2000–2025)



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ABSTRACT

This dataset was developed as part of the research study “Bridge collapses in Italy across the 21st century: survey and statistical analysis.” The dataset has been updated and now documents 250 bridge collapse events that occurred in Italy between 2000 and 2025. Each entry includes some general information and a proposed event classification. The former includes, the date and location of the collapse, geographical coordinates (WGS84), administrative division, bridge use classification, number of fatalities and injuries. The classification of each collapse is characterized by four major fields: severity (Total Collapse or Partial Collapse), general cause (Natural or Human-induced), mechanism (Triggered or Not-Triggered), and specific cause (e.g. hydraulic phenomena, overloads, impacts, or material degradation).

The dataset was developed through systematic searches of institutional archives, news media, and satellite imagery, complemented in some cases by in-situ visual inspections. It is structured in Excel format and supports spatiotemporal analysis, risk assessment, and resilience planning. It is intended for reuse in civil engineering, infrastructure asset management, disaster risk reduction, and policy development

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contexts where empirical evidence of bridge collapse is required.

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Specifications Table

Subject	Civil and Structural Engineering
Specific subject area	Structural safety, failure mechanisms, and transport asset risk analysis
Type of data	Table (.xlsx)
Data collection	Data were collected through systematic searches of web archives, news, and official databases. Inclusion criteria: collapse events in Italy (2000–2025) with confirmed location, date, and cause. Data were cross-checked using Google Maps, satellite imagery, and on-site inspections where possible. Dates were formatted as dd/mm/yyyy; geographic coordinates follow WGS84. Event types, causes, and severity were assigned using standardized categories. Data processing and spatial analysis used Microsoft Excel and QGIS.
Data source location	Italy
Data accessibility	Repository name: Dataset of Bridge Collapses in Italy Spanning >25 years (2000–2025) Data identification number: doi: 10.17632/pmkzng9kmv.1 Direct URL to data: https://data.mendeley.com/datasets/pmkzng9kmv/2
Related research article	[1] D'Angelo, M., Civera, M., Giordano, P. F., Borlenghi, P., Ballio, F., Limongelli, M. P., & Chiaia, B. (2025). Bridge collapses in Italy across the 21st century: survey and statistical analysis. <i>Structure and Infrastructure Engineering</i> , 1–23. https://doi.org/10.1080/15732479.2025.2483500

1. Value of the Data

The dataset provides a comprehensive overview of bridge collapse events, detailing their spatial and temporal distribution, causes, and associated consequences. This information serves multiple purposes across complementary domains:

- **Research:** It enables systematic analysis of spatial and temporal collapse patterns, supports quantitative assessments of infrastructure vulnerability, and provides a foundation for developing evidence-based risk mitigation strategies (e.g., the dataset can be enriched with geometric and typological information to enable refined comparative analyses).
- **Emergency management:** The dataset offers an empirical basis to enhance preparedness and response planning, improve the allocation of critical resources, and design data-driven contingency protocols (e.g., hydraulic-related collapses can be spatially correlated with flood hazard maps to identify recurrent hotspots).
- **Asset management:** It facilitates the evaluation of safety and reliability across bridge inventories, guiding targeted maintenance strategies aimed at extending service life and reducing long-term operational costs (e.g., the observed failure rate can be used as an input for probabilistic risk models to optimize inspection priorities at the network level).
- **Engineering practice:** The identification of failure mechanisms and triggering factors yields key insights for the design, construction, and maintenance of resilient infrastructure, promoting enhanced performance under both environmental and operational stresses (e.g., recurrent trigger-cause combinations can support the definition of monitoring criteria).

A	B	C	D	E	F	G	H	I
ID	Date	Exact Coordinates	Coord Lat Y	Coord Lon X	Municipality	Province	Region	Bridge crossing
B00.01.01	25/01/2000	Yes	41.7397	14.7402	Campobasso	Campobasso	Molise	road
B00.10.01	13-16/10/2000	Yes	44.6973	7.1619	Crissolo	Cuneo	Piemonte	waterway
B00.10.02	13-16/10/2000	Yes	44.6984	7.1584	Crissolo	Cuneo	Piemonte	waterway
B00.10.03	13-16/10/2000	Yes	45.3131	7.2887	Ala di Stura	Torino	Piemonte	waterway
B00.10.04	13-16/10/2000	Yes	45.3136	7.2969	Ala di Stura	Torino	Piemonte	waterway
B00.10.05	13-16/10/2000	Yes	45.3121	7.2999	Ala di Stura	Torino	Piemonte	waterway
B00.10.06	13-16/10/2000	Yes	45.3092	7.7552	Falieto	Torino	Piemonte	waterway
B00.10.07	13-16/10/2000	Yes	45.3021	7.2080	Balme	Torino	Piemonte	waterway
B00.10.08	13-16/10/2000	Yes	45.3024	7.1772	Balme	Torino	Piemonte	waterway

J	K	L	M	N	O	P	Q
Bridge crossing name	Destination of use	Total TC vs Partial Collapse PC	Victims	Injuries	Triggered vs Not-Triggered	Natural vs Human	Specific causes
SS647	National	TC	0	0	Triggered	Natural	Hydraulic
Stura di Demonte river	National	PC	0	0	Triggered	Natural	Hydraulic
Stura di Demonte river	National	PC	0	0	Triggered	Natural	Hydraulic
Stura di Ala stream	Cycle-pedestrian	TC	0	0	Triggered	Natural	Hydraulic
Stura di Lanzo stream	Provincial/Regional	PC	0	0	Triggered	Natural	Hydraulic
Stura di Lanzo stream	Municipal	TC	0	0	Triggered	Natural	Hydraulic
Orco stream	Provincial/Regional	TC	0	0	Triggered	Natural	Hydraulic
Stura di Lanzo stream	Municipal	TC	0	0	Triggered	Natural	Hydraulic
Stura di Ala stream	Municipal	TC	0	0	Triggered	Natural	Hydraulic

Fig. 1. First ten rows of all columns included in the .xlsx file (above: columns A to I; below: J to Q).

2. Background

The compilation of the dataset on bridge collapses in Italy throughout the beginning of the 21st century is motivated by the need to deepen the understanding of structural vulnerabilities and identify the most common failure mechanisms affecting transport infrastructure.

The scarcity of publicly available information, particularly for events in the early 2000s, required a systematic effort to reconstruct the historical record. This involved extensive searches across diverse sources, including web archives and newspaper repositories, to ensure comprehensive coverage of incidents from 2000 to 2025.

The theoretical and methodological framework underpinning the dataset draws from established approaches in risk assessment, disaster risk reduction, and infrastructure resilience. Each recorded event is documented with detailed attributes, including date, location, cause of collapse, and associated impacts, to support empirical research and evidence-based strategies in civil engineering, urban and territorial planning, emergency management, and public policy.

Although the dataset does not provide interpretive analyses or conclusions, it constitutes a critical resource for subsequent investigations. Potential applications include identifying temporal and spatial patterns in bridge collapses, detecting clusters of structural vulnerability, evaluating risk mitigation measures, and studying interactions between natural hazards and anthropogenic stressors in determining infrastructure performance.

3. Data Description

The dataset is provided in a single Excel file titled “Database_Italian_bridge_collapses.xlsx” (refers to Fig. 1), consisting of 250 records of bridge collapse events that occurred across Italy between January 2000 and July 2025. Each row corresponds to one recorded event, and the dataset includes 16 fields describing key attributes such as location, administrative divisions, type of collapse, human impact, triggering factors, and underlying causes. In detail, the following fields are adopted.

- **ID.** It is the unique event code in the format *Byy.mm.nn*, where *yy* indicates the year, *mm* the month, and *nn* a progressive index to distinguish multiple events in the same month. *B* stands for bridges.



Fig. 2. Geographic distribution of collapses. Adapted from [1].

- **Date.** The date field typically follows the format *dd/mm/yyyy*. However, some entries may include a range in the case of prolonged flood events, where it was not possible to identify the day on which the bridge collapsed.
- **Latitude / Longitude** (*Coord Lat Y, Coord Lon X*). Geographic coordinates are reported in decimal degrees using the WGS84 reference system. In a few cases, the exact coordinates were not available; consequently, the coordinates refer to the municipality. Collapse locations are displayed in Fig. 2.
- **Administrative Division.** *Municipality, Province, and Region* are provided, allowing for spatial filtering and regional-level assessments.
- **Bridge Crossing Type.** It is a categorical field describing the entity that the bridge crossed, including: *Waterway, Road, Railway, Valley, and Urban area*.
- **Bridge Crossing Name.** It is the specific name of the crossed entity (e.g., river name, road code, or valley name).
- **Destination of Use.** It represents a functional classification, including: *Motorway, National, Provincial/Regional, Municipal, Railway, and Cycle-pedestrian*.
- **Collapse Severity.** The field is labelled as *Total Collapse (TC)* or *Partial Collapse (PC)*. Detailed definitions of TC and PC are given in subsection 3.1.
- **Victims:** Number of fatalities related to the collapse event.
- **Injuries:** Number of injuries reported for each event.
- **Collapse Type** (*Triggered vs Not-Triggered*). The field describes whether the collapse followed a specific triggering event. Further details are given in subsection 3.2.
- **Cause Category** (*Natural vs Human*). It is the general collapse origin, distinguishing whether the primary cause of the collapse was of *Natural* origin (e.g., floods, landslides, earthquakes,

Table 1

Classification of specific causes according to collapse type (triggered or not triggered) and cause category (Natural or Human-induced). Letters refer to the examples illustrated in Fig. 3.

	Triggered	Non-Triggered
Natural	- Earthquake (b) - Hydraulic (d) - Landslide (f)	
Human	- Fire and Explosion (c) - Overload (h) - Impact (e)	- Design and Construction (a) - Material (g)

or other environmental phenomena) or *Human-induced* (e.g., design or construction errors, lack of maintenance or impacts).

- **Specific Causes.** It gives the detailed reasons for collapse (e.g., Hydraulic, Material, Overload, etc.). The full definition of each collapse mode is described in subsection 3.3.

3.1. Total vs partial collapse

To assess the severity of damage, each event is categorized as a Total Collapse (TC) or Partial Collapse (PC). The definitions follow the standards of the New York State Department of Transportation [2]. A TC refers to cases where all primary members of one or more spans undergone such severe deformation that no travel lanes remain passable. In contrast, a PC involves cases in which some or all primary structural members have failed, compromising safety, but portions of the structure may remain functional.

3.2. Triggered vs not-triggered collapse

The dataset includes a field to distinguish between collapses based on whether they were initiated by a specific and observable event. A Triggered Collapse is defined as a sudden structural collapse caused by an identifiable external factor such as flooding, seismic activity, vehicular impact, or fire. These events usually occur without prior warning. On the other hand, Not-Triggered Collapses occur without a clear external trigger and are generally the result of long-term deterioration processes, such as material fatigue, corrosion, or design flaws. These collapses may present warning signs prior to the actual event.

Table 1 clarifies the relationships among the collapse categories (Triggered vs. Not-Triggered; Natural vs. Human-induced) and the corresponding specific causes, presented in the next paragraph.

3.3. Specific causes of collapse

Each event in the dataset is assigned to a specific cause of collapse chosen from a predefined list of categories. In detail, each specific cause is herein defined.

- *Design and Construction.* The cause includes structural deficiencies, calculation errors, inadequate detailing, or poor construction practices. Collapses in this category often result from non-compliance with design standards or execution flaws, such as insufficient reinforcement or low-quality materials.
- *Earthquake.* Bridges collapsed during a seismic event. Bridges not designed for seismic resistance or located in active seismic zones are particularly vulnerable.

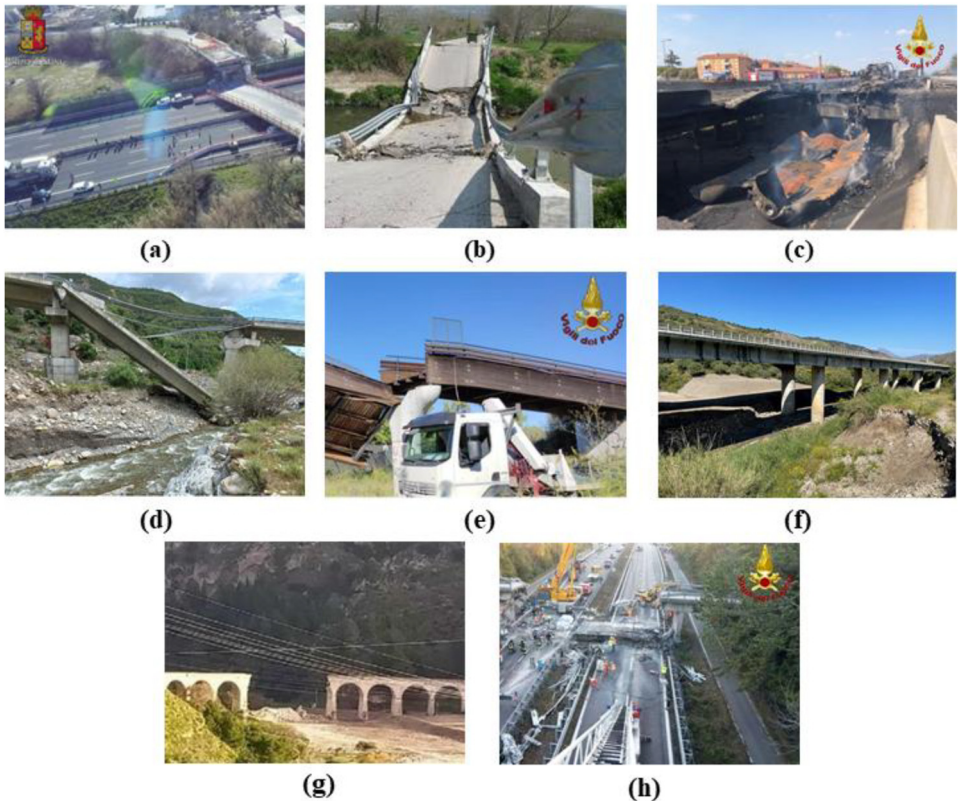


Fig. 3. (a) Overpass 167, Camerano, 2017 (cause: Design and Construction; dataset ID: B17.03.01), courtesy of Polizia di Stato. (b) Fossa, L'Aquila, 2009 (Earthquake; B09.04.01), adapted from [10]. (c) A1-A14, Bologna, 2018 (Fire and Explosion; B18.08.02), courtesy of Vigili del Fuoco and retrieved from [1]. (d) Ortiano II, Longobucco, 2023 (Hydraulic; B23.05.01), courtesy of *Anas spa* and retrieved from [1]. (e) Via Lauretina Cycle-pedestrian bridge, Rome, 2020 (Impact; B20.10.12), courtesy of Vigili del Fuoco. (f) Himera Viaduct, Scillato, 2015 (Landslide; B15.04.01), courtesy of Dipartimento della Protezione Civile, Regione Sicilia. (g) "Tredici Luci" bridge over the Sosio river, Chiusa Scaflani, 2022 (Material; B22.12.03), courtesy of Regione Sicilia. (h) Overpass SS36, Annone, 2016 (Overload; B16.10.01), courtesy of Vigili del Fuoco.

- *Fire and Explosion.* Collapse caused by high temperatures from fire or the effects of an explosion. Such events can drastically reduce the mechanical performance of structural materials, leading to rapid collapse.
- *Hydraulic.* Collapse due to river-related phenomena such as foundation scour, riverbank erosion, flooding, or riverbed changes. These actions may gradually weaken the substructure, eventually resulting in collapse
- *Impact.* Collapse triggered by external collisions, such as vehicle crashes, ship impacts, or falling objects. These events often produce localized damage.
- *Landslide.* Collapses generated by geotechnical processes like slope instability, landslides, or soil subsidence that compromise the support conditions of the bridge.
- *Material:* Collapse due to degradation or failure of materials over time, including corrosion, fatigue, or spalling. These causes are typically linked to aging infrastructure and insufficient maintenance.
- *Overload:* Structural collapse resulting from loads exceeding the design capacity, such as overweight vehicles, excessive traffic, or environmental accumulation (e.g., snow, debris).

Examples taken from the studied cases are depicted in Fig. 3.

4. Experimental Design, Materials and Methods

The dataset was compiled through a multi-stage data collection process carried out jointly by researchers at Politecnico di Torino and Politecnico di Milano. The goal was to create a comprehensive repository of bridge collapses in Italy, starting from 2000, and to update the dataset on a progressive basis. The first version of the dataset was published in [1], including events up to December 2023. The current version of the dataset has been updated to July 2025, with a total of 250 entries, each representing an individual collapse event.

4.1. Data collection and verification

An archive of bridge collapses in Italy after 2000 did not exist before. Consequently, the data for this study were obtained through a systematic open-source search. Sources comprise (i) general-purpose web search engines (standard, such as Google.com, and news verticals), and (ii) the digital archives of national and local newspapers.

Searches were performed in Italian, using Boolean queries combining failure terms with bridge terms and place/time qualifiers (e.g., “ponti” AND (“collasso” OR “crollo”) AND [Italia/Piemonte] AND [2000]; equivalents were used in English for completeness).

Official press communications and/or technical reports from local authorities were preferred as main sources wherever available. If not available, Agenzia Nazionale Stampa Associata (ANSA) and academic papers were used as the second-best choice for details. Whenever even ANSA news or peer-reviewed documents were unavailable (especially for very small, local events), other newspapers were used as references.

For newspaper archives, we queried both headline and full-text fields, where available, and repeated searches across multiple outlets to minimise outlet bias. We iterated queries by adding common synonyms (e.g., “viadotto,” instead of “ponte”, “cedimento” instead of “collasso”, etc.) and toponyms.

Records were screened in two stages. Title/lead screening removed off-topic items (e.g., traffic incidents without structural failure, planned demolitions, maintenance-related closures). Full-text screening applied several inclusion criteria, most importantly: (1) clear structural failure of at least one load-bearing component (deck, girder, arch, pier, abutment), (2) an identifiable date (± 1 week maximum, especially for older events; ideally and most often ± 1 day) and location (exact coordinates when available, otherwise municipality-level coordinates, clearly indicated in the dataset), and (3) sufficient detail to avoid duplicates beyond any reasonable doubt. Additional verifications were conducted using satellite images and street-level views from platforms such as Google Maps and Google Earth.

Exclusions covered non-bridge structures, minor defects without total or partial collapse, and rumour-only items lacking evidence for corroboration.

To ensure reliability, two reviewer groups (Politecnico di Torino and Politecnico di Milano) independently assessed each other's list and details. Duplicates between the two lists were removed by matching date, location, and description triplets through a manual review, and discrepancies were resolved by consensus.

Moreover, field inspections were conducted for selected cases of hydraulic collapse following flood events to confirm their hydraulic origin and collect photographic documentation.

Finally, QGIS software was used to map the geographical distribution of collapses, illustrating regional variations and clusters.

4.2. Method for event classification

The classification of each collapse followed a multi-step decision process to assign four major fields: severity (Total Collapse or Partial Collapse), cause category (Natural or Human-induced),

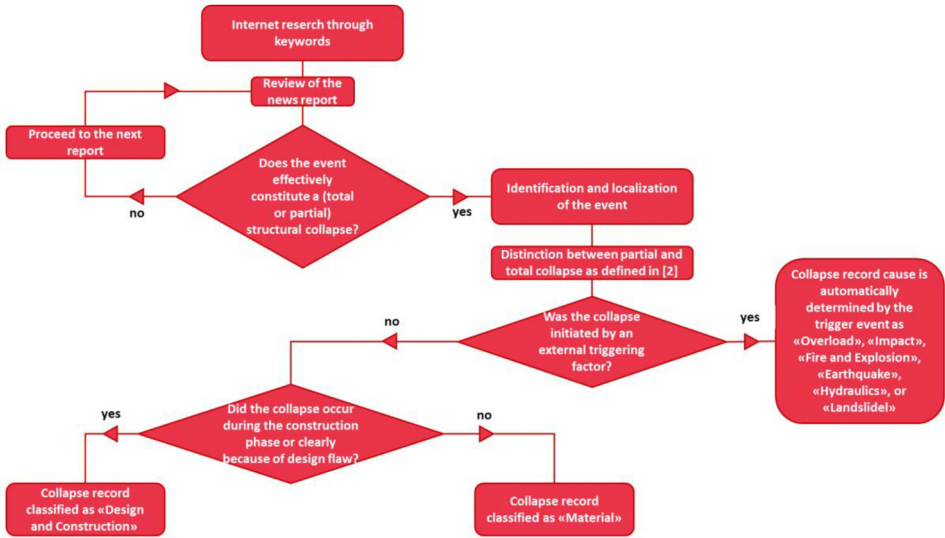


Fig. 4. Workflow used to build the collapse database, from event identification to the classification of severity and specific cause.

mechanism (Triggered or Not-Triggered), and specific cause. Fig. 4 shows the workflow used to construct the entire database, from the initial keyword-based search and screening of news reports to the identification and localization of the event, the distinction between partial and total collapse, and the final assignment of the collapse category based on triggering factors, construction-phase issues, or maintenance-related causes. In addition, the assignment of the general cause (Natural or Human-induced) does not require an explicit decision step, as each specific cause is intrinsically associated with one of the two categories, according to the classification reported in Table 1.

To enhance reproducibility, keyword-based searches were conducted using combinations tailored either to a specific event (e.g., “*ponte crollato terremoto L’Aquila*”, “*ponte crollato alluvione Piemonte*”) or to broader spatio-temporal queries (e.g., “*ponte crollato Sicilia 2020*”), ensuring consistent retrieval of all relevant news reports.

As discussed in Section 3, the definitions of Total and Partial Collapse are based on standards from the New York State Department of Transportation [2]. Triggered events are those initiated by an external event (e.g., flood, landslide), while Not-Triggered events are those resulting from long-term deterioration, often without a specific identifiable onset. Specific collapse causes were classified into one of the following categories: Design and Construction, Earthquake, Fire and Explosion, Hydraulic, Impact, Landslide, Material, and Overload. The definition of specific causes was tailored to the Italian context, considering, for instance, the absence of large navigable rivers and the traffic of large ships. Consequently, some potential causes (e.g., sabotage, wartime conflicts, storms, and barge collisions) were excluded due to inapplicability in the national context.

The adopted classification scheme is derived from a comparative review of international studies [3–9], as detailed in the related research paper by the authors. These works show that bridge collapse causes are categorized differently across contexts; the present framework harmonizes the most recurrent categories - such as design/construction deficiencies, material degradation, overload, hydraulic events, impact, and natural triggers like earthquakes and landslides - into a coherent system adapted to the Italian dataset.

The proposed classification method ensures consistency and clarity in the database structure, facilitating reliable reuse and comparative analyses. However, it is worth noting that collapses

can occur due to a variety of causes, often resulting from a combination of external triggers and internal factors. For example, a collapse caused by material degradation can occur in the presence of a trigger (e.g., overload) or without any specific external cause. Similarly, collapse due to design errors (i.e., human error) can occur during a truck load test (triggered) or during the construction phase (non-triggered). Therefore, to avoid any arbitrariness in database construction, the presence of a trigger at the time of collapse automatically results in an event record being triggered, even if other internal causes are present.

Although collapses are broadly categorized as either “natural” or “human-induced,” in many cases, the distinction is not straightforward. Most collapses, to some extent, can be attributed to human factors—such as design flaws or inadequate maintenance—that failed to prevent external hazards from becoming critical. For instance, while hydraulic erosion is classified as a natural cause, it often reveals design vulnerabilities in foundations. Similarly, collapses due to material degradation can be attributed to both natural chemical changes in the material as well as negligent construction or maintenance. In this dataset, events initiated by natural events (e.g., floods, landslides, earthquakes) are classified as natural, while collapses due to overloads, collisions, and fire, as well as, unforeseen collapses, such as material degradation, errors during the bridge construction phase, poor design standards, and maintenance practices, are categorized as human-induced.

In triggered events, the specific cause is assigned according to the triggering mechanism. For non-triggered collapses, the attribution depends on the bridge’s construction age and maintenance history—the collapse of new bridges is typically linked to human error, whereas older structures are generally classified under material-related collapses.

Limitations

The construction of this dataset involved intensive validation efforts for each event; however, several limitations persist due to the inherent limitations of the data.

- First, the availability of online information for the decade 2000–2010 is limited. As a result, the number of collapses recorded for this period is likely to be underestimated. Similarly, collapses involving small local roads in rural areas—typically less documented than those on major or urban routes—may also be underreported. The likelihood of missing records increases further when collapses occur without casualties, thus drawing less media attention.
- In the case of extreme events, such as floods or earthquakes, multiple structures may be affected simultaneously. In such circumstances, the collapse of minor bridges may go unreported, especially when attention is focused on more prominent or catastrophic events.
- In a few cases, the exact geolocation of the bridge was not determined, and the assigned coordinates refer to the municipality rather than the exact bridge location. Accordingly, these bridges are flagged in the dataset.
- Finally, technical attributes such as structural typology and year of construction are frequently unavailable, limiting their inclusion in the dataset and the possibility of conducting structural-type-specific analyses.

Ethics Statement

The authors have read and follow the ethical requirements for publication in Data in Brief and confirm that the current work does not involve human subjects, or animal experiments.

Data collection and processing were performed following the relevant institutional and national regulations and legislation and the ethical guidelines of Data in Brief; in particular, this dataset does not contain any data collected from social media platforms.

Credit Author Statement

Christian Paolini: Validation, Formal analysis, Investigation, Data Curation, Writing - Original Draft; **Marco Civera:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing - Original Draft; **Manuel D'Angelo:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data Curation, Writing - Review & Editing; **Pier Francesco Giordano:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing - Review & Editing; **Paolo Borlenghi:** Methodology, Validation, Formal analysis, Investigation, Writing - Review & Editing; **Francesco Ballio:** Methodology, Resources, Writing - Review & Editing, Supervision, Project administration; **Bernardino Chiaia:** Resources, Writing - Review & Editing, Supervision, Project administration, Funding acquisition; **Maria Pina Limongelli:** Writing - Review & Editing, Supervision, Project administration, Funding acquisition.

Data Availability

[Dataset of Bridge Collapses in Italy Spanning >25 Years \(2000–2025\) \(Original data\)](#) (Mendeley Data)

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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