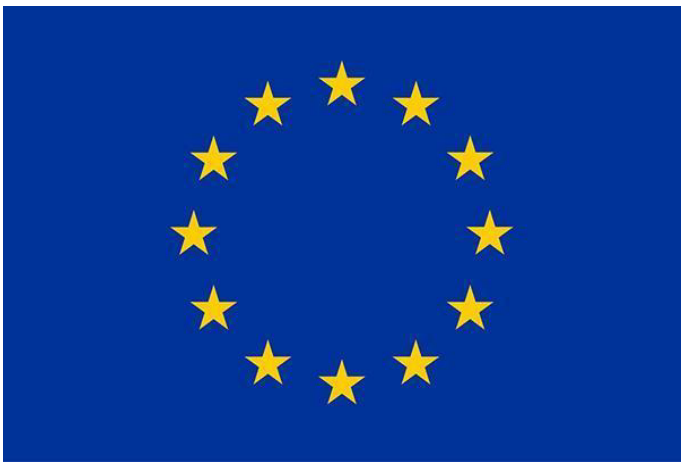


Union Civil Protection Mechanism (UCPM)

Progress Report M17

Version 1.0
14 May 2024

IMPORTANT NOTICE

What is a progress report?

Progress reports are deliverables which are sometimes requested at mid-term (or other crucial points in the project) if there is a long time-span without reporting.

The report (+ annexes) must be prepared (by all beneficiaries together) and uploaded on the Funding & Tenders Portal Grant Management System Continuous Reporting Deliverables screen.

Progress reports should NOT be confused with periodic reports. Periodic reports are linked to payments, progress reports are not.

COVER PAGE

PROJECT	
Project number:	101101236
Project acronym:	MEDEA
Project name:	MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE
Project starting date:	01/12/2022
Project duration:	24

PERIOD COVERED	
⚠ *Please note that this is only a progress report. The information in this report must also be included in the next periodic report/final report.*	
Period covered *(from last periodic report):*	From 01/09/2023 to 30/04/2024

TABLE OF CONTENTS

COVER PAGE 3
1. MILESTONES, DELIVERABLES AND CRITICAL RISKS 4
2. OVERVIEW OF THE PROGRESS AND ACTIVITIES 5
3. BUDGET IMPLEMENTATION 14
ANNEXES 15

1. MILESTONES, DELIVERABLES AND CRITICAL RISKS

Deliverables and milestones (outputs/outcomes)	YES/NO
We confirm that we updated the following Continuous Reporting screens: ● Deliverables ● Milestones	YES

Critical risks	YES/NO
We confirm that we have reviewed and updated, as relevant, the following Continuous Reporting screen: ● Critical risks	YES

2. OVERVIEW OF THE PROGRESS AND ACTIVITIES

Overview of the progress and activities

Please summarise progress in the implementation of the activities explaining how these will contribute to achieving the project objectives.

Elaborate on any emerging issue that may affect the implementation of the project and/or the achievement of its objectives.

SUMMARY OF ACTIVITIES CARRIED OUT IN THE FIRST REPORTING PERIOD (M1-M9)

WP1

The Kick-off Meeting (KoM) took place in Rome on Jan. 19, 2023 (minutes in deliverable D.1.1). During the KoM, the project work plan was prepared (deliverable D1.2). After the KoM, in order to facilitate the communication among partners, a WhatsApp group was created in order to give and have fast feedback when needed. All the partners had the official mailing list of the whole consortium including experts and technical staff not present during the KoM in Rome. A project account has been created: medea.ucpm@uniecampus.it that all the staff of the Lead Partner have access to in order to give fast feedback to any requests. A google drive has been created, all the partners have access. All official documents of the MEDEA project, technical documents divided per WP, templates that can be used for reporting issues and for public evidence procedures were stored in the folder.

On 21 April 2023 a Steering Committee has been organised.

Personnel was recruited (eCampus: Evelina Volpe, Salvatore Verre, Angelica Cristal Sirotich, Riccardo Panico, Milena Rosa; UNIPI: Michele Baldassini).

WP2

The project communication strategy has been assessed. It is reported in the Communication plan (deliverable D2.1).

WP3

Classes of masonry and reinforced concrete (RC) buildings with similar characteristics and their engineering demanding parameters (EDPs) were defined. Digital tools for collecting the technical parameters and the results of the structural analysis of benchmark structures was prepared. An initial set of EDP values of benchmark structures was evaluated by means of nonlinear structural analysis.

Procedures and criteria for: a) classification of the representative families with different levels of risk (high/low/No Risk) for the insurgence of PTSD; b) defining the research protocol for the empirical study that will be performed in the pilot areas (see WP6) were defined (deliverable D3.3). The inventory “Peri-traumatic and post-traumatic factors Inventory” was prepared.

WP4

Classification techniques to evaluate the similarity between a real building and the benchmark buildings in the knowledge base were applied. Explainable artificial intelligence (XAI) techniques were used to determine the most similar buildings to a given building (real building). Preliminary results have shown promising accuracy (approaching 89%) when determining the most similar benchmark structures to an existing structure.

WP5

The KN platform was used for increasing the impact of the project. The page is active since M3 and is continuously updated for quickly disseminating the results achieved by the project and advertising on the planned events. Deliverables with public dissemination level were uploaded in the project web page.

WP6

Tools for collecting data of structures and families in the pilot areas were prepared. In particular:

- Worksheet and manuals for collecting technical parameters of real structures was prepared and shared among partners.
- A Research Protocol for the empirical study on the psychological aspects was submitted to and approved by Ethical Commission of e-Campus University (nr. 05/2023).
- Questionnaires to obtain the psychological data were selected and transmitted to the partners for translation.

The area of the pilot study at the Croatia-Slovenia border was selected. The Slovenian area of the pilot study at the Italy-Slovenia border was selected, whereas the Italian area was not selected yet.

Lists of milestones attained in the first reporting period

Milestone 2: Stakeholders and dissemination strategy
Due date: M5
Lead participant: eCampus
Progress: Milestone 2 was achieved on time.

Milestone 5: Families identified and psychological protocol finalised
Due date: M8
Lead participant: eCampus
Progress: Milestone 5 was achieved on time.

Milestone 8: Website
Due date: M2
Lead participant: eCampus
Progress: Milestone 8 was achieved on time.

Lists of deliverables submitted in the first reporting period

Deliverable D1.1: Kick-off meeting minutes
Due date: M2
Lead participant: eCampus
Progress: Deliverable D1.1 was submitted on time.

Deliverable D1.2: Project work plan
Due date: M2
Lead participant: eCampus
Progress: Deliverable D1.2 was submitted on time.

Deliverable D2.1: Communication Plan (CP)
Due date: M6
Lead participant: eCampus
Progress: Deliverable D2.1 was submitted on time.

Deliverable D3.3: Guideline on types of families
Due date: M6
Lead participant: eCampus

Progress: Deliverable D3.3 was submitted on time.

ACTIVITIES PERFORMED IN THE CURRENT REPORTING PERIOD (M10-M17)

The activities performed during the reporting period of this report (from 01/09/2023 to 30/04/2023) and their contribution to achieve the objectives of each are WP described herein.

WP1 - Task 1.2: Coordination and internal monitoring

A technical and steering committee (SC) meeting was organized in Bovec (Slovenia) on Jan. 18, 2024 (minutes in Annex 1). The main objectives of the meeting were: i) presentation of a state of the art of the activities performed by the partners; ii) presentation and discussion of datasheets for collecting structural data in the pilot areas; iii) discussion on difficulties encountered or foreseen; iv) planning of future activities. A total of 12 people (5 of eCampus, 3 of MED, and 4 of GZS) attended the meeting.

During the meeting, the tools prepared by eCampus for the collection of the structural data in pilot areas were presented to all the partners. A discussion followed on critical aspects and possible difficulties in collecting data. Based on the discussion, decisions were taken regarding

the data collection. Details of critical aspects identified and decisions taken are reported in the minutes of the meeting (Annex 1).

As a consequence of difficulties in recruitment of personnel (Unforeseen Risk U1) met in the previous reporting period (D1.3), during the current reporting period recruitment activities were carried out:

- a comparative selection procedure has been launched by the administrative department in order to select an external expert to support the whole consortium and the lead partner in technical activities regarding the structural aspects and non-linear analysis. The expert selected was Alberto Dusi. The contract entered in force on 01 January, 2024 and will end on 01 December, 2024.

During the reporting period, equipment was purchased (software for structural and data analysis).

WP1 - Task 1.3: Financial management

Milena Rosa effectively continued supporting the coordinator in the financial management activities.

The activities performed within WP1 are on time and contribute to the achievement of the objectives. In particular, they assure the fulfilment of all the requirements by EC regarding reporting and systematic monitoring of the planned activities.

WP2 - Task 2.1: Project communication strategy

During the reporting period, the scientific paper

Camisasca E, Sirotich AC. *PTSD Risk Factors in Earthquake Survivors and Their Families: A Systematic Review*

was submitted for publication in European Journal of Psychotraumatology. The paper is currently accepted with revision.

A draft of a further scientific paper

Pistolesi F, Baldassini M, Volpe E, Focacci F, Cattoni E. *Fast and Interpretable Prediction of Seismic Kinematics for Flexible Retaining Walls in Sand through Explainable Artificial Intelligence*

was prepared. It will to be submitted to the Journal Computers and Geotechnics.

During the meeting in Bovec, it was agreed that the MEDEA project will be presented at the Prevention Fair in Međimurje (Sept. 2024). This will include press conference and round robin table with relevant stakeholders.

In addition, the project web page within the UCPKN network for disseminating the project objectives, activities and results is continuously updated reporting the main activities and achievements. Furthermore, the presence of the MEDEA project on the social media of the is duly considered.

The activities performed within WP2 are on time and contribute to the achievement of the objectives. In particular, they assure dissemination of awareness of the project outputs to interested authorities and stakeholders.

WP3 - Task 3.1: Benchmark structures and classes

Classes of masonry and reinforced concrete (RC) buildings were defined in the previous reporting period. The structures of each class have similar characteristics in terms of shape, arrangement of structural elements, and number of stories. For each class of structures, the final version of a digital tool for collecting the technical parameters and the results of the structural analysis of benchmark structure was prepared. A total of 1176 masonry benchmark structures and a total of 1200 reinforced concrete benchmark structures were defined.

The activities of this task were successfully completed, although with a slight delay with respect to the timetable of the proposal, due to the time needed for the recruitment processes and the absence of applicants to some calls.

As mentioned in the progress report M9, in order to avoid excessive delay in the beginning of subsequent activities of WP4, for which the results of Task 3.3 are needed, the recruited personnel started on time the activities of Task 3.2 (selection of the EDPs) and ahead of schedule the activities of Task 3.3 (calculation of EDP values for benchmark structures).

WP3 - Task 3.2: Selecting EDPs

For the defined classes of structures (Task 3.1) suitable EDPs were defined. In particular, for each benchmark structure a control point was identified. The displacement of the control point was used as EDP.

WP3 - Task 3.3: EDP values of benchmark structures

For benchmark structures, the EDP values associated with four levels of structural damage (D1-D4) were evaluated by means of nonlinear structural analysis. These displacements were then associated with the intensity of the seismic action producing the levels of structural damages considered.

The calculation of the EDP values for the classes of masonry structures defined in Task 3.1 started earlier than foreseen (M9). Conversely the calculation of the EDP values of RC structures started slightly in delay due to the above-mentioned difficulties in the personnel recruiting procedures.

The EDP values of the 1176 masonry benchmark structures and 126 reinforced concrete benchmark structures were collected, together with the technical parameters identifying the structures, in databases. These databases include the intensities of the seismic action producing the attainment of predefined level of damage.

WP3 - Task 3.4: Definition of representative families

The activities of this task were completed in time before the beginning of the reporting period. These activities were described in detail in Deliverable D3.3 (July, 2023).

Overall, still running activities within WP3 are on line with respect to the timetable.

WP4 - Task 4.1: Associating real with benchmark structures

This task has been completed according to the timeline included in the previous progress report (Deliverable 1.3). The detailed results are presented in Deliverable 4.1. At this stage of the project, the term *real structure* refers to structures characterized by technical parameters that closely resemble those in the areas where the pilot studies of Work Package 6 will be conducted.

WP4 - Task 4.2: Estimating EDP values of real structures

This task has been completed according to the timeline included in the previous progress report (Deliverable 1.3). The detailed results for all implemented models are documented in Deliverable 4.1, which was submitted on March 04, 2024.

WP4 - Task 4.3: XAI to estimate damages and losses

Activities of this task started on M13 according to the updated timetable included in the previous progress report (D1.3). The procedure for the estimation of damages and losses was assessed. This procedure involves the determination of the intensities of the seismic action producing the attainment of predefined levels of structural damage by means of the XAI algorithm. XAI results in terms of peak ground accelerations are then used to evaluate damages associated with predefined levels of seismic actions. Losses will be correlated to the damages according to the most reliable procedures available in the scientific literature. At present, the procedure is under assessment for the benchmark structures. Its application to real structures will be performed when a relevant number of structural data of constructions in pilot areas will be available. This task is ongoing and progressing as per the timetable in D1.3. The working group is currently developing models to estimate structural and psychological damages and losses based on the impact assessments provided by Explainable Artificial Intelligence (XAI) models regarding the effects of seismic events on buildings.

WP4 - Task 4.4: Multidimensional seismic risk assessment

Preliminary activities of this task started at M16 as foreseen according to the updated timetable included in the previous progress report (D1.3). The working group is investigating data fusion models to achieve a multidimensional seismic risk assessment that considers both structural damages and psychological impacts on affected populations. This assessment also accounts for the various vulnerabilities of individuals residing in earthquake-affected areas.

Overall, still running activities within WP4 are on line with respect to the timetable.

WP5 - Task 5.1: Website

The development of a website was planned in the proposal for increasing the impact of the project. According to MEDEA letter gap guidance, the website was replaced with the dedicated project page on the KN platform. The page is active since M3 and is continuously updated for quickly disseminating the results achieved by the project and advertising on the planned events. Deliverables with public dissemination level are regularly uploaded in the project web page.

Activities of WP5 are currently on time and contribute to the WP5 objectives.

WP5 - Task 5.2: Web application module 1

This task has been completed as per the timeline set forth in the previous reporting period (D1.3). The web application module has been implemented, covering both the front-end and back-end components. Additionally, a MySQL database has been designed and implemented for data storage.

WP5 - Task 5.3: Web application module 2

This task is ongoing and progressing according to the timeline specified in the previous reporting period (D1.3). The working group is currently implementing the part of the web application that will estimate structural damages, psychological impacts, and losses.

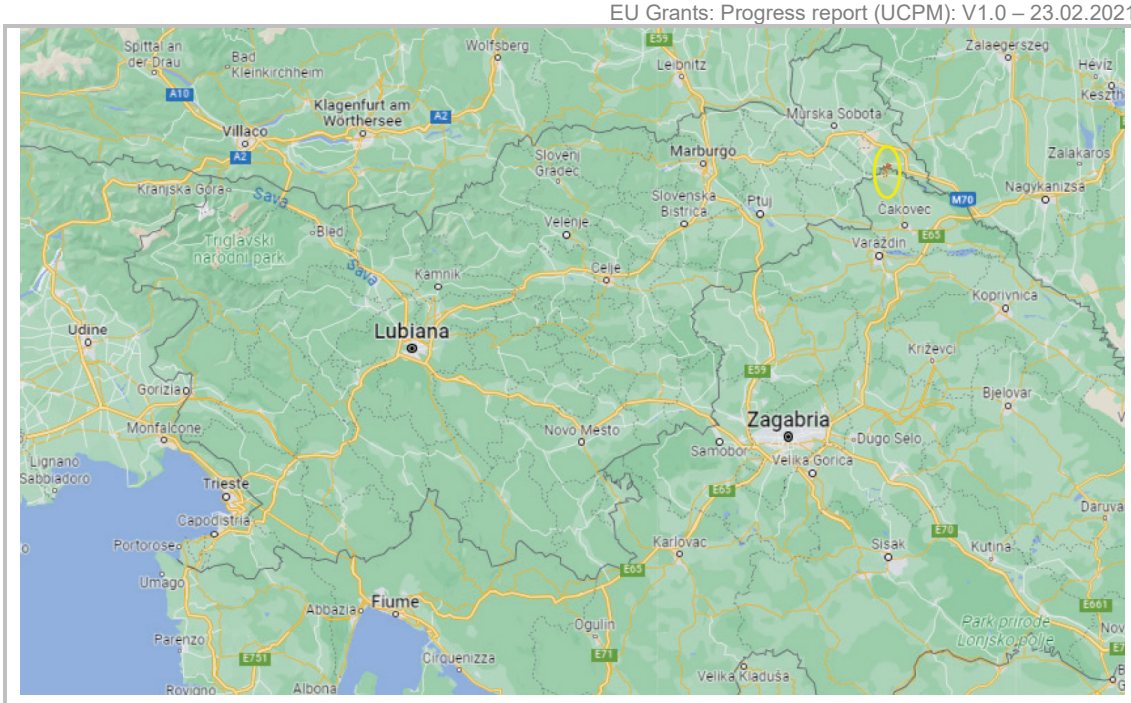
WP5 - Task 5.4: Web application module 3

Activities of this task are planned to begin after the period of this report.

WP6 - Task 6.1: Pilot studies: data collection

During the previous reporting period, electronic datasheets and manuals for collecting structural and psychological data were prepared and shared with partners. Details of datasheets and manuals were presented during the technical meeting held in Bovec (Jan, 18, 2024). Thanks to the discussion among partner during this meeting, datasheets and manuals were improved during the current reporting period (Annexes 2a and 2b, and 3a and 3b). During the reporting period, datasheets and manuals were translated in Croatian and Slovenian languages.

The site of the pilot study at the Croatia-Slovenia border was selected. It includes the municipalities of Sveti Marin na Muri in the Croatian side and Hotiza and Velika Polana in the Slovenian side.



The site of the pilot study at the Italy-Sloveina border was identified in the Slovenian side. It includes the municipalities of Kobarid and Bovec.

As far as the Italian side is concerned, contacts established via ANCI (Italian Association of Municipalities) with the municipality of Gemona del Friuli (already mentioned in the previous periodic report) did not lead to any practical result. Despite the interest declared by the mayor, technical service of the municipality was unable to collaborate in the collection of the data, due to overload caused by the implementation of the projects related to the National Recovery and Resilience Plan. Following an indication of ANCI, a further attempt was made by contacting Compa FVG (a body providing support to municipalities of Friuli Venezia Giulia, https://compa.fvg.it/). An hoc meetings with personnel of the technical office of other municipalities, including Udine was organized. Unfortunately, as it happened for Gemona del Friuli, much to their regret, technical services were not able to allocate resources for collaboration in the activities. Currently, a further effort is being made by the eCampus team by contacting professional engineers with strong relations in the territory in order to establish further contacts with municipalities or private building owners.

WP6 - Task 6.2: Pilot studies: estimating EDP values

Activities of this task are planned to begin after the period of this report.

WP6 - Task 6.3: Pilot studies: multidimensional risk assessment

Activities of this task are planned to begin after the period of this report.

Overall, activity of WP6 is slightly in delay with respect to the timetable. This is due to difficulties encountered in finding the Italian area for the pilot study at the Italy-Slovenia border (see identified risks 3 and 4 of the proposal). Contingency plans, including re-allocation of resources to accelerate the collection of data, were set-up in order to allow the successful completion of the activities on time.

Lists of milestones attained in the reporting period

Milestone 6: XAI models
Due date: M15
Lead participant: UNIPI
Progress: Milestone 6 was achieved on time.

Lists of deliverables submitted in the reporting period

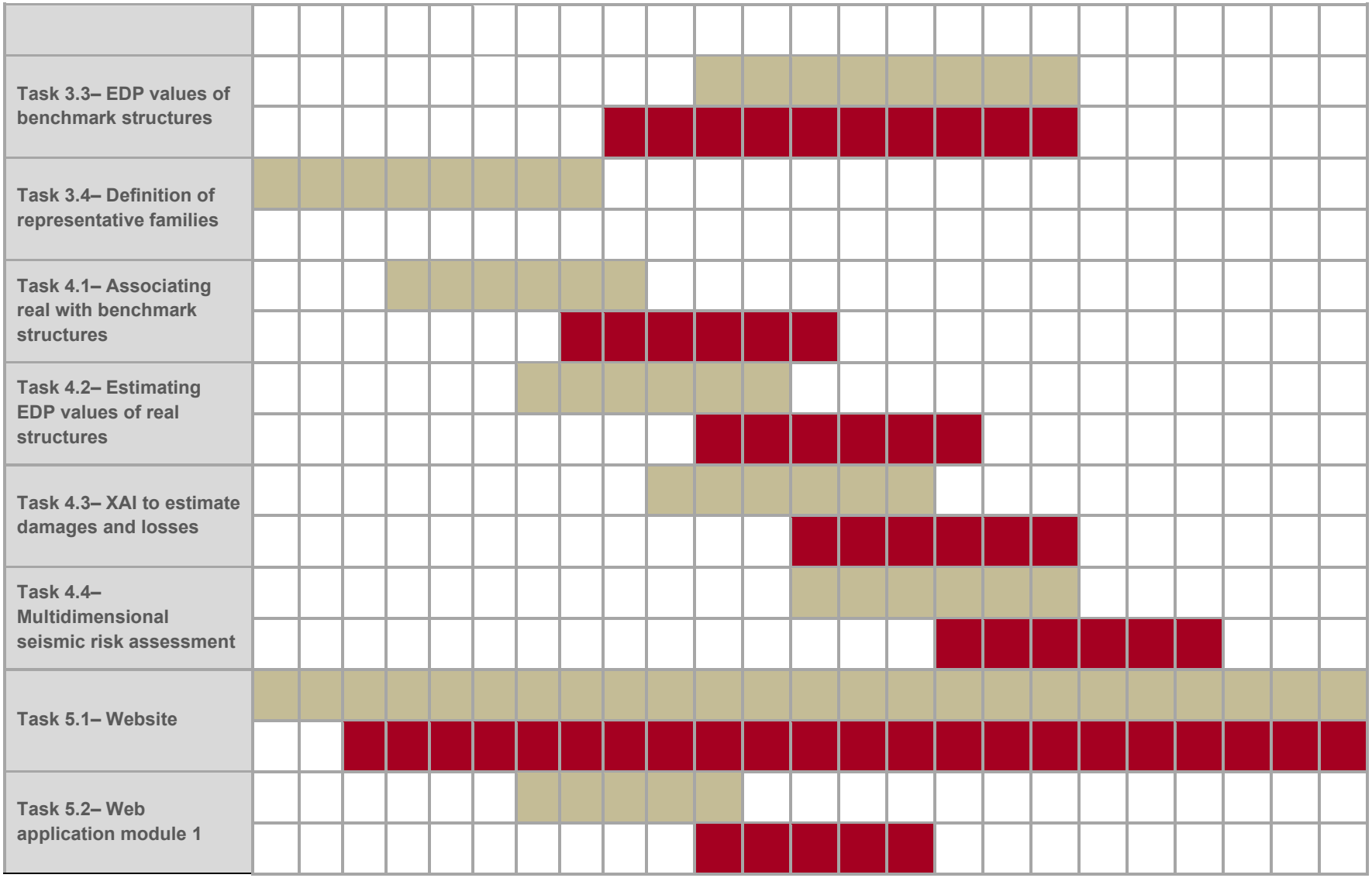
Deliverable D1.3: Progress report M9
Due date: M9
Lead participant: eCampus
Progress: Deliverable D1.3 was submitted on time.

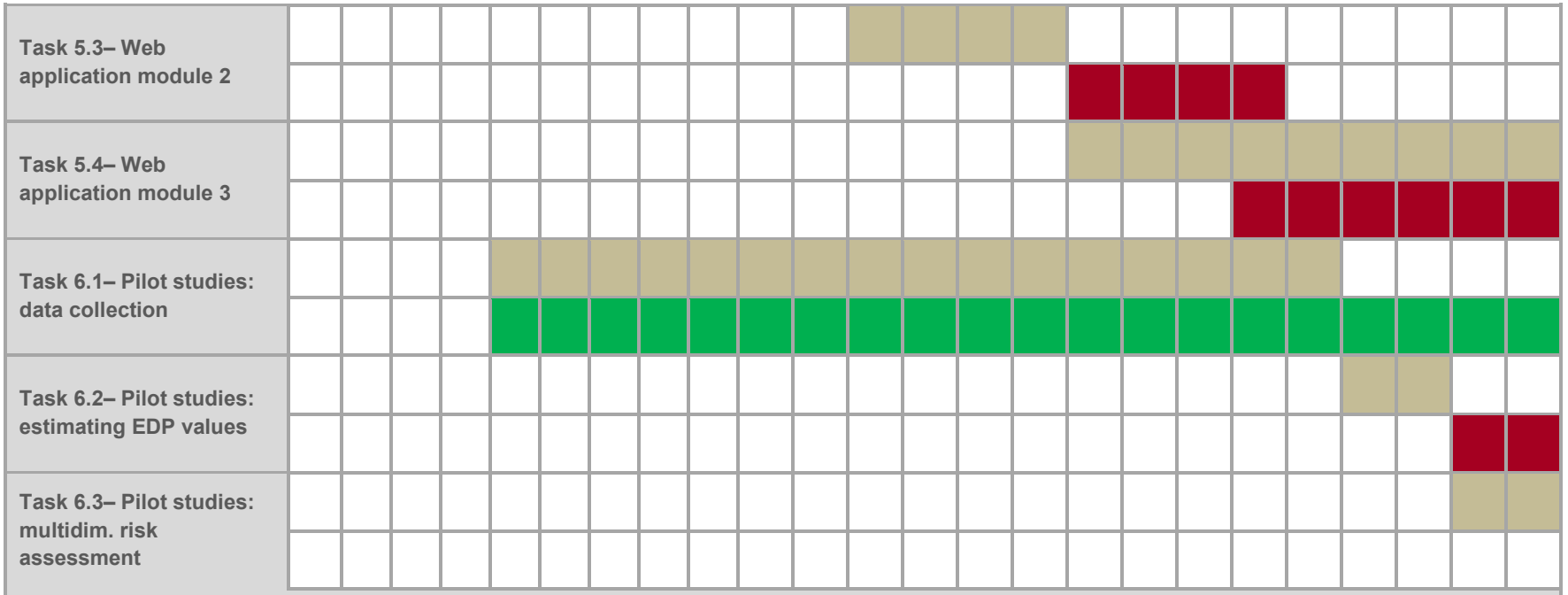
Deliverable D4.1: XAI models
Due date: M15
Lead participant: UNIPI
Progress: Deliverable D4.2 with a delay of 4 days.

Timetable

Timetable (projects up to 2 years)
Fill in the planned implementation in beige and the deviations in red. Repeat lines/columns as necessary.

ACTIVITY	MONTHS																							
	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 9	M 10	M 11	M 12	M 13	M 14	M 15	M 16	M 17	M 18	M 19	M 20	M 21	M 22	M 23	M 24
Task 1.1–Start-up activities																								
Task 1.2–Coordination and internal monitoring																								
Task 1.3–Financial management																								
Task 2.1–Project communication strategy																								
Task 3.1– Benchmark structures and classes																								
Task 3.2– Selecting EDPs																								


Task 3.3– EDP values of benchmark structures
Task 3.4– Definition of representative families
Task 4.1– Associating real with benchmark structures
Task 4.2– Estimating EDP values of real structures
Task 4.3– XAI to estimate damages and losses
Task 4.4– Multidimensional seismic risk assessment
Task 5.1– Website
Task 5.2– Web application module 1



Delays

If there are delays, identify them, explain the reasons why and how you plan to manage those delays (catch-up with / avoid further delays, impact on timetable, etc.).

Note: brown cells refer to the original timetable; red cells refer to the timetable modified in deliverable D1.3; green cells refer to the current timetable.

3. BUDGET IMPLEMENTATION

Budget implementation — Use of resources
Provide information on whether the budget consumption is in line with the advancement of the activities. Identify and justify any divergences.

The Lead partner eCAMPUS had a total expense of € 239.915 (without general costs of 7%) divided as follows:
€ 198.861,08 for staff
€ 4.345,28 for travel and accommodation
€ 28.042,40 for technical equipment
€ 8.666,60 for other goods and services

The partner MEDJIMURJE COUNTY (MED) had a total expense of € 68.338 (without general costs of 7%) divided as follows:
€ 62.589,28 for staff
€ 2.335.51 for travel and accommodation
€ 2.998,00 for equipment
€ 415,53 for other costs

The partner UNIPI had a total expense of € 93.856 (without general costs of 7%) divided as follows:
€ 93.600,00 for staff
€ 256,00 for travel and accommodation

The partner GASILSKA ZVEZA SLOVENIJE (GZS) had a total expense of € 93.867 (without general costs of 7%) divided in
€ 79.166,92 for staff
€ 12.200,00 for SMEs
€ 2.500,00 for other costs

The total project budget expended to the date of 30 April is equal to € 495.976 (without general costs of 7%). It is worthwhile recalling that a linear use of resources is not foreseen in the project duration because highest efforts will concentrate mainly in the last quarter of the project. Therefore, overall the resources mobilization is in line with the project plan and some adjustments are foreseen in the last reporting period. These are mainly due to cope with unexpected challenges met by the consortium in the reporting period (i.e., above mentioned difficulties in definition of pilot areas as well as unexpected difficulties in the recruitment processes). The coordinator is evaluating the best way to contract highly qualified personnel that could boost technical activities.

ANNEXES

LIST OF ANNEXES

Annex 1: Minutes of the technical and SC meeting (Bovec, Slovneia, Jan. 18, 2022)

Annex 2a: Datasheet for the collection of data of masonry structures in pilot areas

Annex 2b: Datasheet for the collection of data of reinforced concrete structures in pilot areas

Annex 3a: Manual for the survey of masonry buildings

Annex 3b: Manual for the survey of buildings with reinforced concrete structure

HISTORY OF CHANGES		
VERSION	PUBLICATION DATE	CHANGE
1.0	17.05.2023	Initial version.

Deliverable 1.4: Progress Report M17

Annex 1: Minutes of the partners and Steering Committee 3nd meeting (Jan. 18, 2024)

MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

Co-funded by the European Union

MINUTES OF PARTNERS AND STEERING COMMITTEE MEETING – January 18, 2024

MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

Co-funded by the European Union

Document Summary

Deliverable number: --

Deliverable Title: Partners and SC Meeting Minutes

Type: Minutes

Version: 1.0

Deliverable Lead: --

Related Work package: WP1

Author(s): Francesco Focacci (eCampus) and Elena Camisasca (eCampus)

Communication level: Public

Date: January 18,2023

Grant Agreement Number: 101101236

Project name: MEDEA

Start date of Project: 01-12-2022

Duration: 24 months

Project coordinator: Francesco Focacci (eCampus)

Table of Contents

1. GENERAL INFORMATION OF THE MEETING 2

1.1 Attendants 2

2. STATE OF THE ART OF THE ACTIVITIES PERFORMED BY THE PARTNERS 2

3. DIFFICULTIES ENCOUNTRED OR FORESEEN 3

4. DECISIONS MADE 4

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1. GENERAL INFORMATION OF THE MEETING

The MEDEA partners and Steering Committee meeting took place on January 18 st, 2024 at 10:30 a.m. in Bovec. The date was proposed via email by the coordinator of the Gasilska Zveva Slovenije unit and agreed by all the units.

The main objective of the meeting was discussed by the project partners and covered the following issues:

- state of the art of the activities performed by the partners;
- presentation and discussion of datasheet for collecting structural data in the pilot areas;
- difficulties encountered or foreseen;
- planning of future activities.

1.1 Attendants

The people who attended the meeting in representation of each institution were:

Name	Organization	email
Francesco Focacci	E- Campus	francesco.focacci@uniecampus.it
Elena Camisasca	E-Campus	elena.camisasca@uniecampus.it
Fabrizio Comodini	E-Campus	fabrizio.comodini@uniecampus.it
Salvatore Verre	E-Campus	salvatore.verre@uniecampus.it
Riccardo Panico	E-Campus	riccardo.panico@uniecampus.it
Alan Resman	Međimurje County (MED)	alan.resman@medjimurska-zupanija.hr
Marija Stanković	Međimurje County (MED)	marija.stankovic@medjimurska-zupanija.hr
Marija Marciuš	Međimurje County (MED)	marija.marcius@medjimurska-zupanija.hr
Neža Strmole	Gasilska Zveva Slovenije (GZS)	neza.strmole@gasilec.net
Tomaz Konrad	Gasilska Zveva Slovenije (GZS)	tomaz.konrad@euro-go.eu
Boštjan Žagar	Gasilska Zveva Slovenije (GZS)	zagar.nep@gmail.com
Primoz Straus	Gasilska Zveva Slovenije (GZS)	primozstraus@gmail.com

2. STATE OF THE ART OF THE ACTIVITIES PERFORMED BY THE PARTNERS

<u>Presentations for updating on the activities.</u>

- Francesco Focacci updated the participants on the activities related to the structural aspects and on communication activities. He also recalled next milestones to be achieved and deliverable to be submitted. Pilot areas were also discussed. Referring to the structural aspects, the eCampus unit is preparing sets of benchmark structures and arranged datasheets and manuals for collecting data of real structures. Details of datasheets and manuals were presented by Salvatore Verre and Riccardo Panico during the meeting.
- Elena Camisasca updated the participants on the activities related to the collection of the psychological and socio-demographic data. These data will be obtained by means of questionnaires submitted to the people living in the pilot areas. When possible, QR codes will be provided to access to the questionnaires. A discussion followed on the association of real families and real structures in the pilot areas.
- Fabrizio Comodini described the structural analysis performed on benchmark structures to obtain the peak ground acceleration (PGA) associated with predefined levels of damage and the

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criterion used to define the masonry benchmark structures.

- Boštjan Žagar provided an update on the activities performed by the GZS unit. These activities included translation of documents for collecting psychological data in the pilot areas, understanding documents for collecting masonry and reinforced concrete data, and identification of the Slovenian pilot areas: Velika Polana and Hotiza (Slovenia-Croatia border) and Kobarid and Bovec (Slovenia-Italy border). Based on the analysis of the documents, he also pointed out possible difficulty in obtaining structural and psychological data in the pilot areas, which were discussed later. These difficulties are: possible problems in acquiring data in the pilot areas, and need of language revision.
- Marija Stanković provided an update on the activities performed by the MED unit. She summarized the available budget for activities of WP2 and WP3 and the corresponding planned activities. WP2: two press conferences; conference and round robin table on Civil Protection at the Security and Prevention Fair in Međimurje (Sept. 2024); preparation of PR materials with MEDEA and EU logos. WP3: collaboration in collecting structural and psychological data by means of contracts for collaboration in the collection of data on buildings and representative families.
- Salvatore Verre described the datasheet for collecting structural data of masonry buildings. He specified that an Excel file must be prepared for each building in the pilot areas. The output data of the Excel file consists in a table summarizing the structural data of the building. This table will constitute the input for the XAI system when performing the risk assessment.
- Riccardo Panico described the datasheet for collecting structural data of buildings with reinforced concrete structures. He specified that the current Excel file will be organized in a simpler format, similar to that used for masonry structures.

3. DIFFICULTIES ENCOUNTRED OR FORESEEN

The presentations of the participants allowed to highlight some critical aspects.

1. In order to perform a seismic risk assessment including psychological consequences in the pilot areas, it would be necessary to associate the psychological data of each family with the structural data of the building where the family lives. This would require the inclusion of the precise address of the family in the questionnaire for collecting the psychological data. Since questionnaires have to be anonymous, it has been observed that the address can't be included. Two possible approaches were discussed to overcome this difficulty:
   - Reduce the number and complexity of structural data required so that they could be included in questionnaire filled in by the one member of each family (a similar approach was used in https://potrog2.vokas.si/). This approach seems to be excessively simplified and could provide less accurate results compared to those provided by the approach originally proposed.
   - Divide the pilot areas in zones (20-50 buildings each) so that each family, when compiling the questionnaire for psychological data, will be required to provide only the zone where the family lives. This will guarantee complete anonymity. This approach is currently preferred, since it will allow to perform a more reliable seismic risk assessment than the previous one.
2. Some parameters of benchmark and real structures can be derived from the building code in force at the assumed (benchmark structures) or actual (real structures) time of construction. Currently, only European and Italian building codes were introduced in the system. It would be very useful to include Croatian and Slovenian building codes at least from 1950.
3. Members of the GZS and MED units observed that it could be difficult to obtain some of the structural data required in datasheets by means of direct in situ inspections. Francesco Focacci mentioned that parameters included in the datasheets were thought to be obtained mainly from paper or electronic

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documentation available in municipalities and public offices. Members of GZS and MED units were not sure that this type of data are available in Slovenian and Croatian public offices.

4. The Italian part the pilot area at the Italy-Slovenia border is still not defined. The Italian team is working to define it as soon as possible. It will remain that the Slovenian part is constituted by the municipalities of Kobarid. Bovec will be also considered, if needed.
5. A final check of translation of questionnaires for psychological data is needed.

4. DECISIONS MADE

- The association between families and structures in the pilot areas will be obtained by dividing the pilot areas in zones. Each family will be associated with a zone. Each zone could have a specific QR code.
- GZS and MED will provide (email or shared folder) Slovenian and Croatian building codes since 1950 by Feb. 5. 2024.
- eCampus will organize the datasheet for collecting structural data of reinforced concrete structures in a simpler format, similar to that used for masonry structures by Feb. 12, 2024.
- GZS and MED will check the availability of paper and/or electronic documentation in public offices and the type and amount of data available by Feb. 12. 2024. If needed, they could send typical documents available to the eCampus team.
- eCampus will provide the final version of the questionnaires to MED and GZS by Feb. 5, 2024. MED and GZS will perform a final language check by Feb. 15, 2024.

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Annex 2a: Datasheet for the collection of structural data of masonry structures in pilot areas

MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

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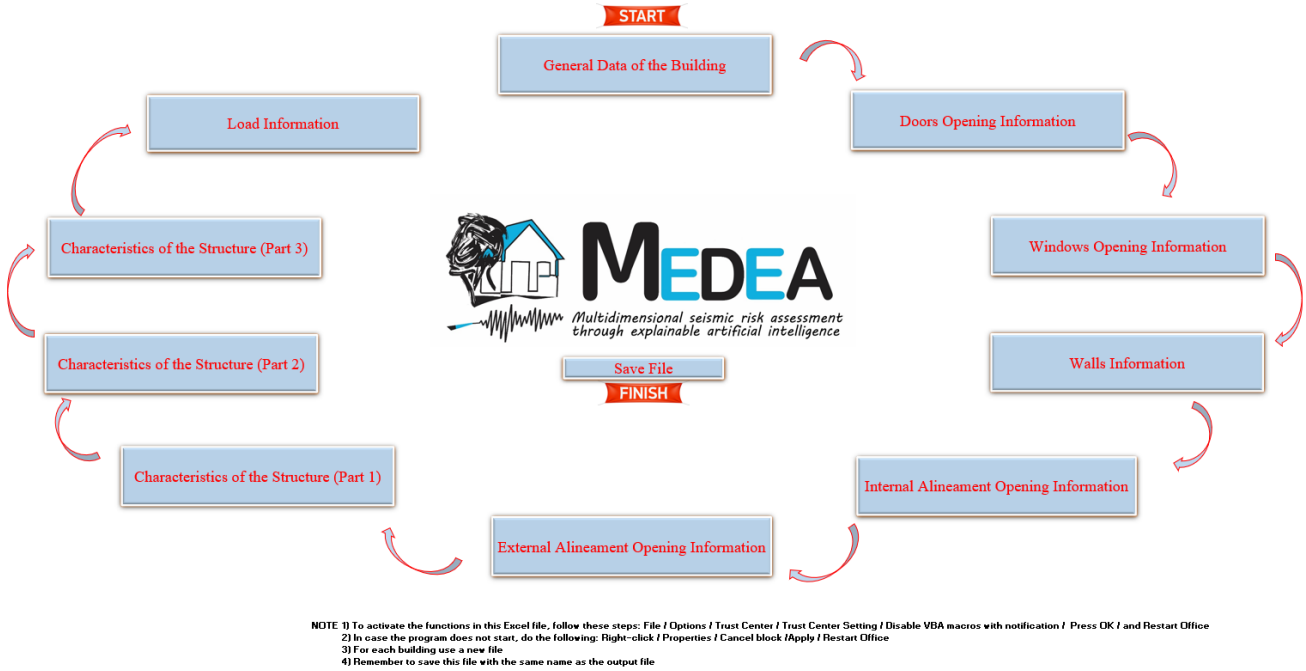
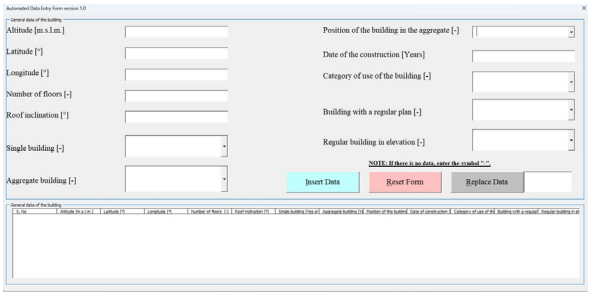
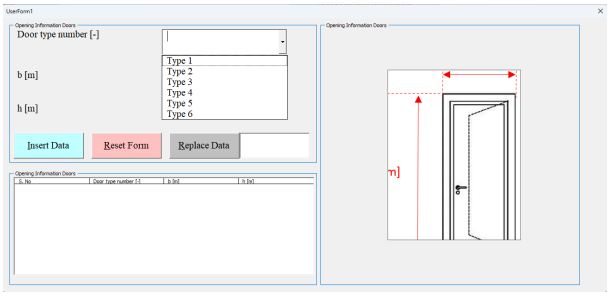
A datasheet in xlsx macro format was prepared to collect technical parameters of real masonry structures. The datasheet is organized based on the type of parameter to be introduced, as shown in the initial page. For each type or parameter, whose meaning is explained in the manual (Annex 3a), the detector has to introduce the relevant data in the corresponding form. When all data are introduced, the xlsx file generates a table with all the data. This table will be used by the AI algorithm to determine the seismic actions associated with predefined levels of damage.



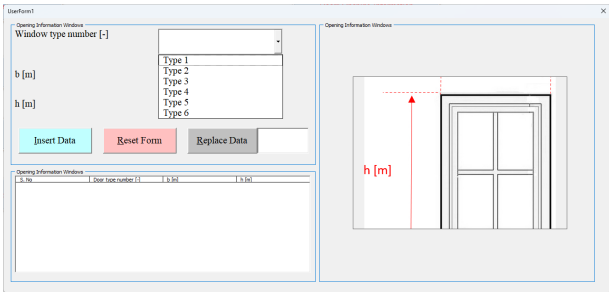
General data of the building form



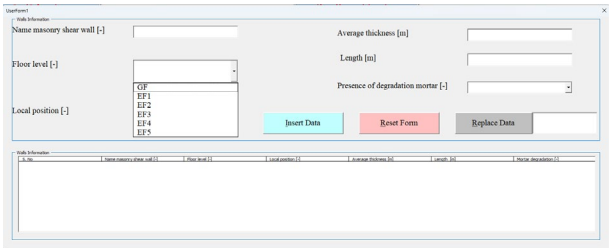
Doors opening information form



Windows opening information form



Walls information form



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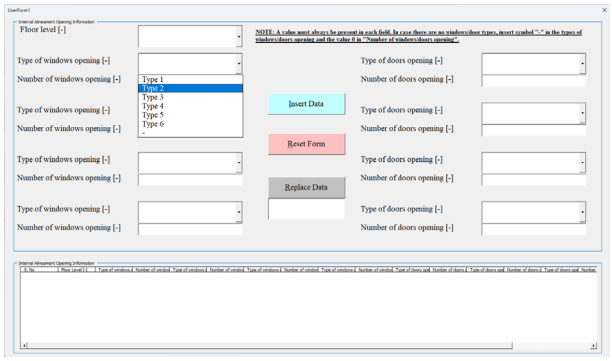
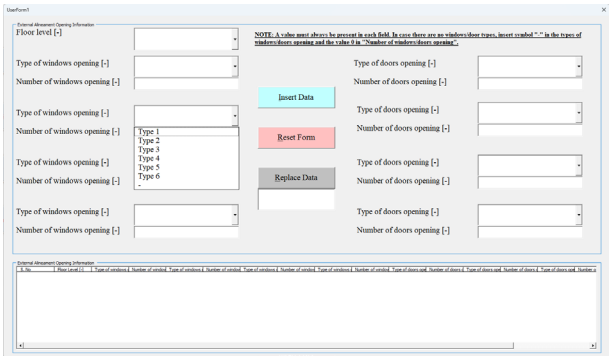
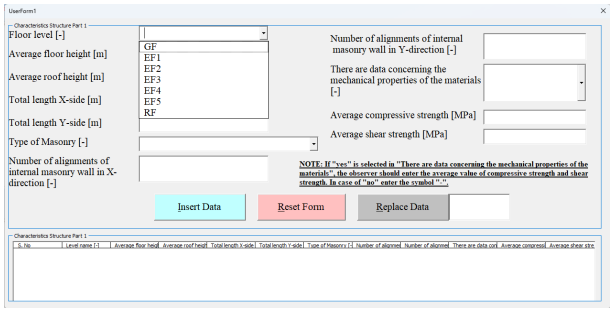
Internal alignments opening information form



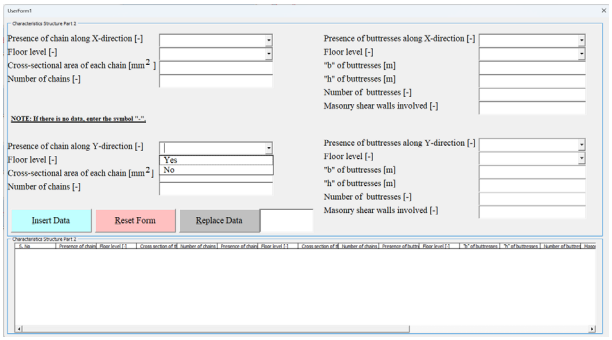
External alignments opening information form



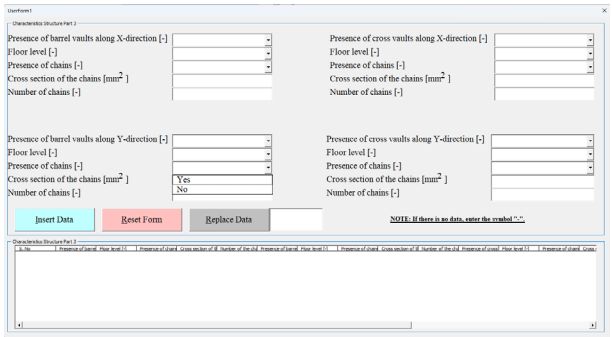
Characteristics of the structure (Part 1) form



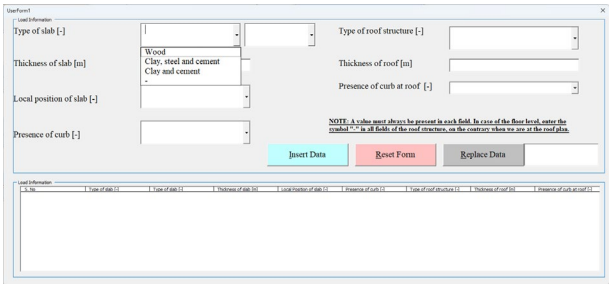
Characteristics of the structure (Part 2) form



Characteristics of the structure (Part 3) form



Load information form



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Multidimensional seismic risk assessment through explainable artificial intelligence

Deliverable 1.4: Progress Report M17

Annex 2b: Datasheet for the collection of structural data of reinforced concrete structures in pilot areas

MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

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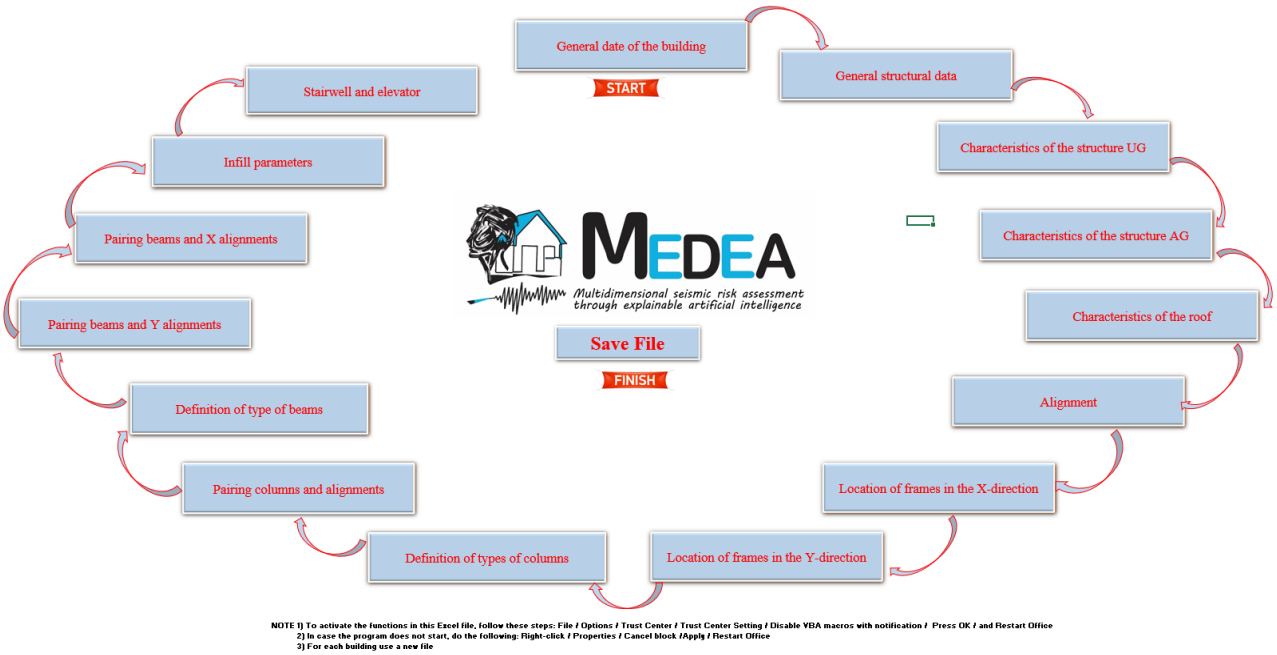
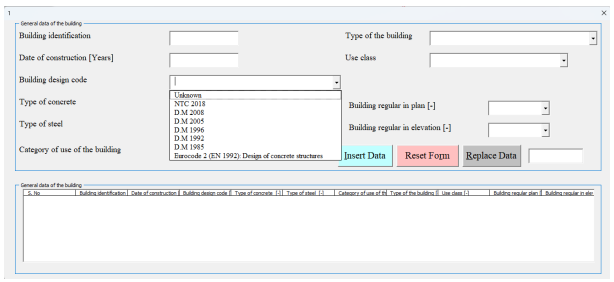
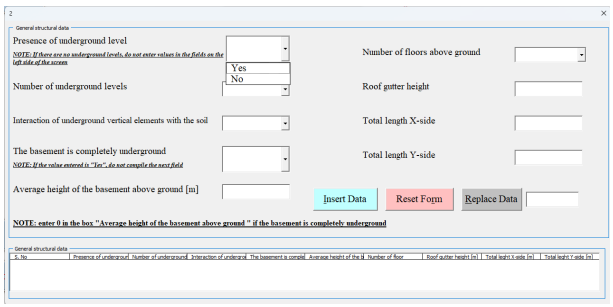
A datasheet in xlsx macro format was prepared to collect technical parameters of real reinforced concrete structures. The datasheet is organized based on the type of parameter to be introduced, as shown in the initial page. For each type or parameter, whose meaning is explained in the manual (Annex 3b), the detector has to introduce the relevant data in the corresponding form. When all data are introduced, the xlsx file generates a table with all the data. This table will be used by the AI algorithm to determine the seismic actions associated with predefined levels of damage.



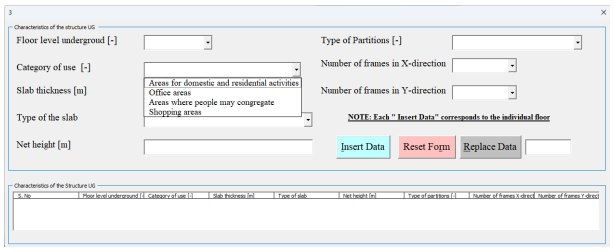
General data of the building form



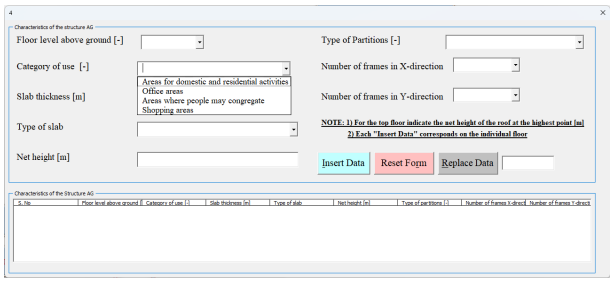
General structural data form



Characteristics of the structure underground form



Characteristics of the structure above ground form



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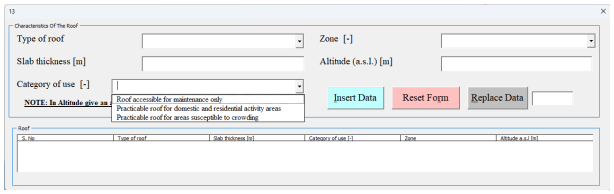
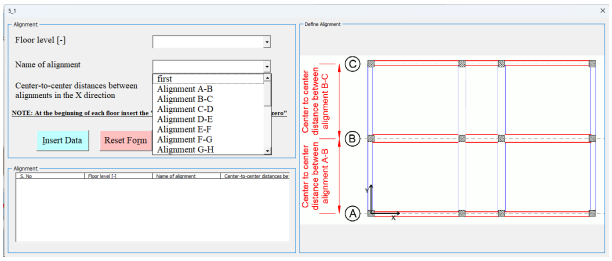
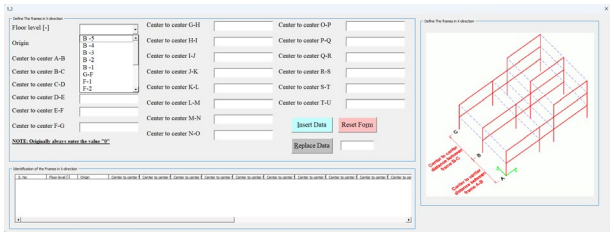
Characteristics of the roof form



Alignment form

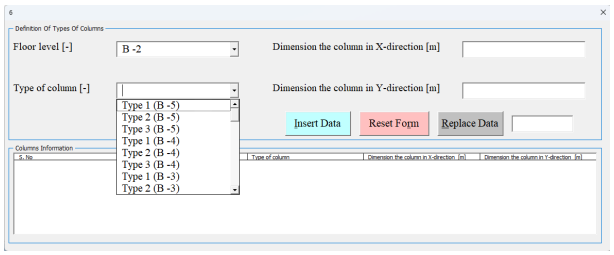


Location of frames in the X-direction form

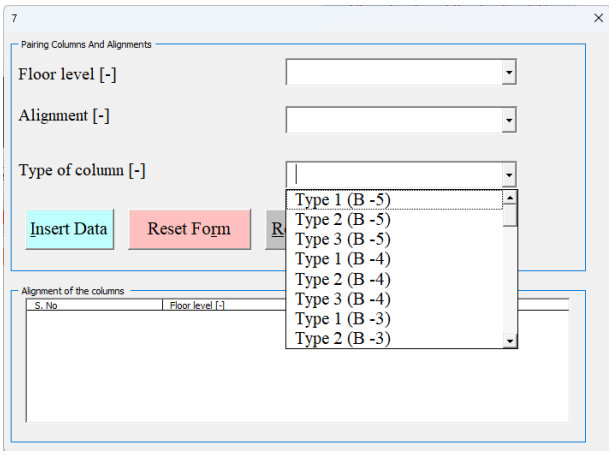


Location of frames in the Y-direction form

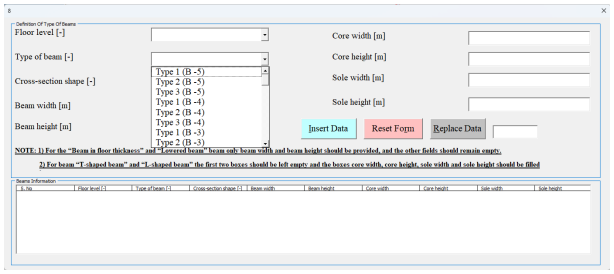
Form for definition of types of columns



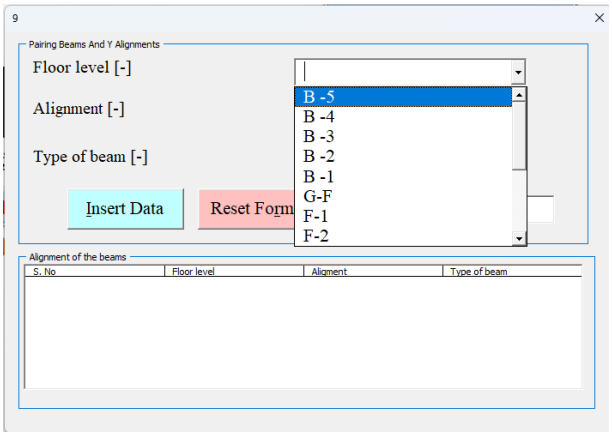
Form for pairing columns and alignments



Form for definition of types of beams



Form for pairing beams and Y- alignments



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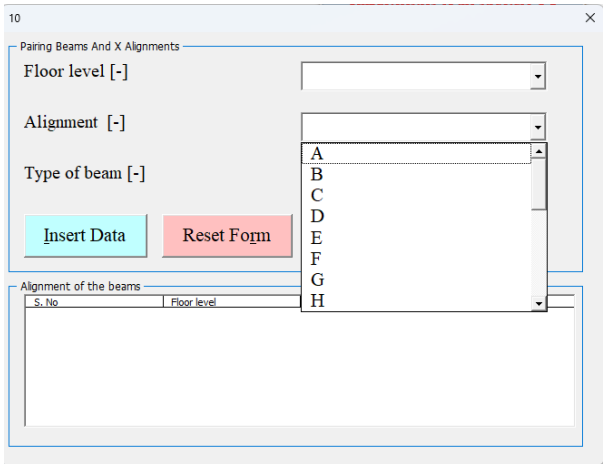
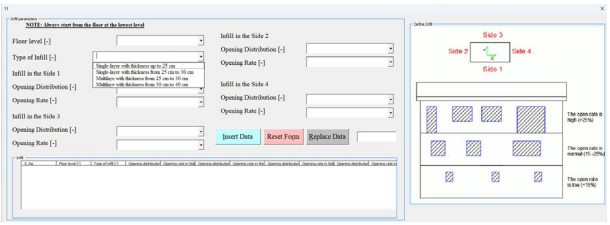
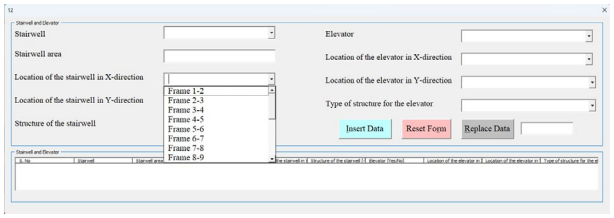
Form for pairing beams and X- alignments



Infill parameters form



Stairwell and elevator form



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Multidimensional seismic risk assessment through explainable artificial intelligence

Deliverable 1.4: Progress Report M17

Annex 3a: Manual for the survey of masonry buildings in pilot areas

MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

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MANUAL FOR THE SURVEY OF MASONRY BUILDINGS

Version 7.2 (2024-04-04)

MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

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Index

Getting started 4
Foreword 4
Characteristics of the Building 4
1. Altitude. 4
2. Latitude and Longitude. 4
3. Number of floors. 5
4. Single or aggregate building and position of the building in the aggregate. 5
5. Date of Construction. 6
6. Category of use of the building. 6
7. Building with a regular plan (yes / no). 6
8. Regular building in elevation (yes / no). 6
Doors Opening Information 7
1. Door type number and the dimensions *b* and *h*. 7
Windows Opening Information 8
1. Windows type number and the dimensions *b* and *h*. 8
Walls Information 8
1. Name shear wall, floor level and local position. 9
2. Average thickness and length. 9
3. Presence of mortar degradation (yes /no). 9
Internal Alignment Opening Information 10
1. Floor level, type of windows (or doors) opening and Number of windows (or doors) opening. 10
External Alignment Opening Information 11
1. Floor level, type of windows (or doors) opening and Number of windows (or (doors) opening. 11
Characteristics of the Structure (Part 1) 11
1. Floor level, Average floor height and Average roof height. 12
2. Total length X-side and Total length Y-side. 12
3. Type of Masonry. 13
4. Number of internal alignments of masonry wall in X-direction and Number of internal alignments of masonry wall in Y-direction. 13
5. There are data concerning the mechanical properties of the materials. 14
Characteristics of the Structure (Part 2) 14
1. Presence of chain along the X (or Y)-direction, Floor level, Cross section and Number of the chains. 15

2. Presence of buttresses along the X (or Y)-direction, Floor level, b and h, Number of the buttresses and Masonry shear wall involved. 15

Characteristics of the Structure (Part 3)....16

1. Presence of barrel vaults along the X (or Y)-direction, Floor level, Presence of the chains, Cross section and Number of the chains. 16
2. Presence of cross vaults along the X (or Y)-direction, Floor level, Presence of the chains, Cross section and Number of the chains. 17

Load Information....18

1. Type of slab, thickness and local position. 19
2. Presence of curbs (for slab and roof) and local position. 20
3. Type of roof structure and thickness. 20

Getting started

Notes for the user:

1. ***The user, before starting the data input, have to make a copy of the original excel file "MEDEA Masonry" and save it with the name of the building on which he is going to work on.***
2. ***Once the input data is completed, the user must press the button "Save file" and save the file with the same name as the file of the building just surveyed.***
3. ***For each building analyzed, it is recommended to collect pictures and structural/architectural drawings.***
4. ***To activate the functions in this Excel file, follow these steps: File / Options / Trust Center / Trust Center Setting / Disable VBA macros with notification / Press OK / and Restart Office.***
5. ***In case the program will not start, do the following: Right-click on the mouse/ Properties / Cancel block / Apply / Restart Office.***

Foreword

In the following, all the data are supposed to be obtained from technical documentation or direct survey. If documentation is not available and survey is impossible, data should be estimated.

Characteristics of the Building

Characteristic of the building shall be provided in the form shown in *Figure 1*. When all parameters are introduced, press *Insert Data* to save the data. While the *Reset Form* command clears the data in all the text boxes, the *Replace Data command*, replaces the data present in a given row (the row number must be entered by the user in the text box beside the *Replace Data* button).

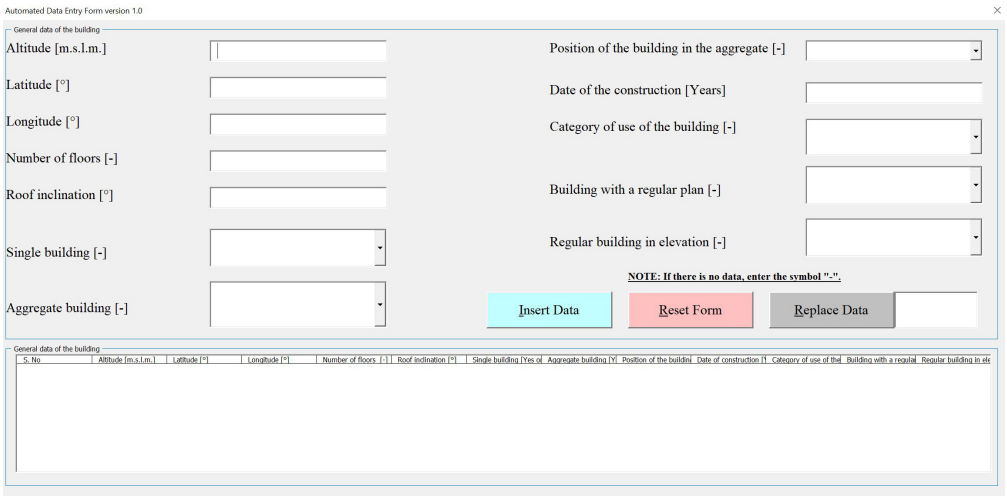


Figure 1. Form for characteristic of the building.

1. Altitude.

The user should insert the altitude.

2. Latitude and Longitude.

The user should insert the latitude and longitude (in degrees, WGS84).

3. Number of floors.

The user should evaluate the number of floors of which the building is composed. The criterion is shown in *Figure 2a* for buildings with no underground level and in *Figure 2b* in case of building with underground level. Note that an underground level is to be considered only if all masonry walls are in contact with the ground, otherwise it has to be ignored.

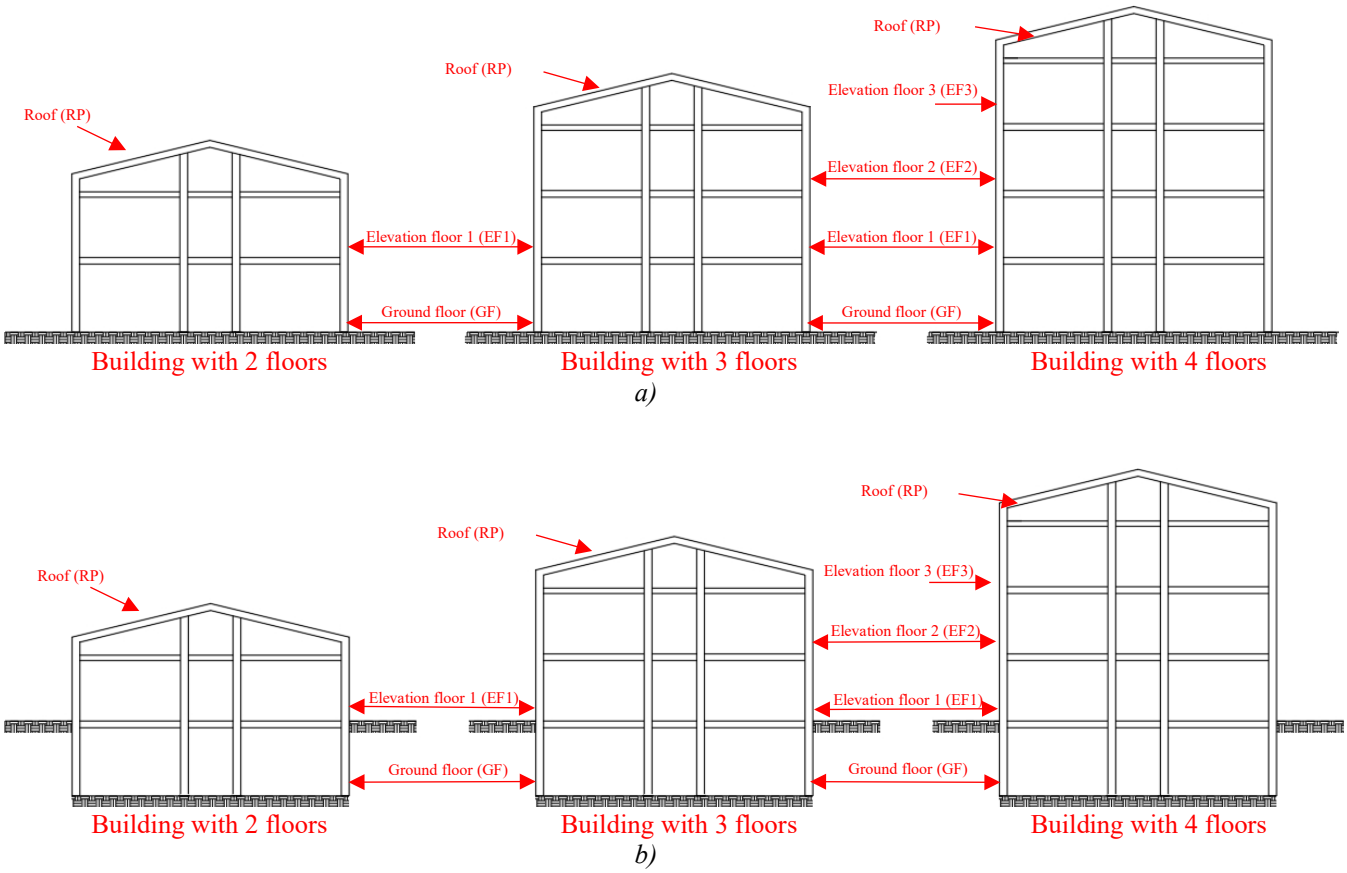


Figure 2. Number of floors without *a)* and with *b)* the underground level.

4. Single or aggregate building and position of the building in the aggregate.

The user should evaluate if the building is single or aggregate. In case of single building select *"yes"* in the corresponding box. If the building is in contact(s) with other building(s) (i.e. aggregate) select *"yes"* in the corresponding box and define the position of the building (*Start/End or Middle*), as shown in *Figure 3*, otherwise select *"no"* where the building is isolated.

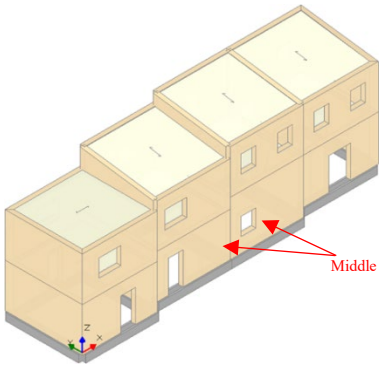


Figure 3. Aggregate building and middle position.

5. Date of Construction.

Indicate the year of construction of the building; if unknown, indicate an approximate year of construction.

6. Category of use of the building.

Choose among the following options, as defined in Eurocode 2:

- *Class 1*: Agricultural buildings;
- *Class 2*: Civil buildings;
- *Class 3*: Industrial buildings;
- *Class 4*: Strategic buildings or buildings with public functions (schools, libraries, gymnasiums municipal offices, etc....).

7. Building with a regular plan (yes / no).

The user should evaluate the regular building with regular plan. The building with regular plan must observe some requirements, listed below:

- The ratio of the sides of a rectangle in which the construction is inscribed is less than 4;
- No dimension of any indentations or projections exceeds 25% of the total dimension of the construction in the corresponding direction.

In case of building with a regular plan select *"yes"*, otherwise select *"no"*. In *Figure 4* some examples are shown.

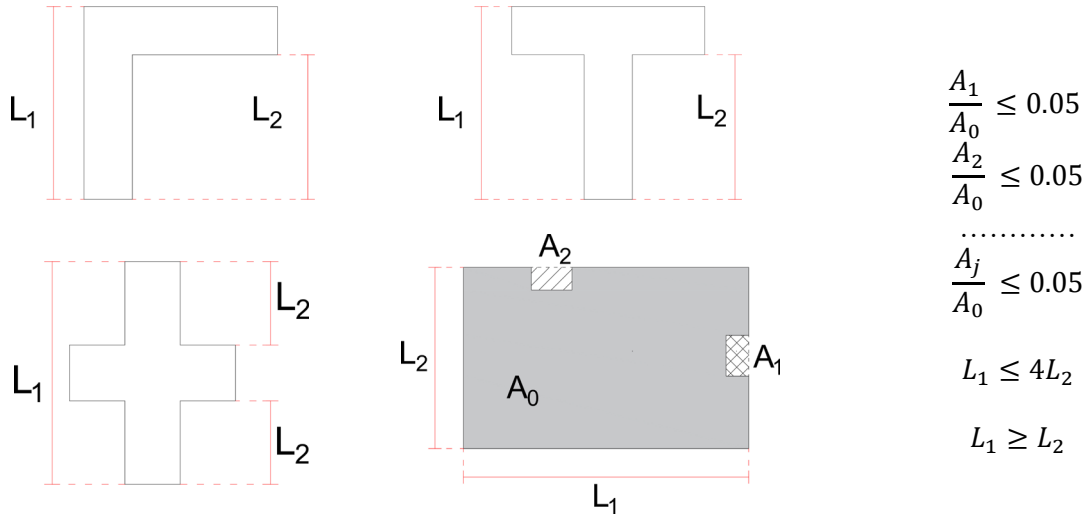


Figure 4. Building with a regular plan.

Where L_1 is the longest side of the building.

8. Regular building in elevation (yes / no).

The user should evaluate the regular building in elevation. In case of a regular building in elevation select *"yes"*, otherwise select *"no"*. In *Figure 5* criterion in order to define the regular plan are shown.

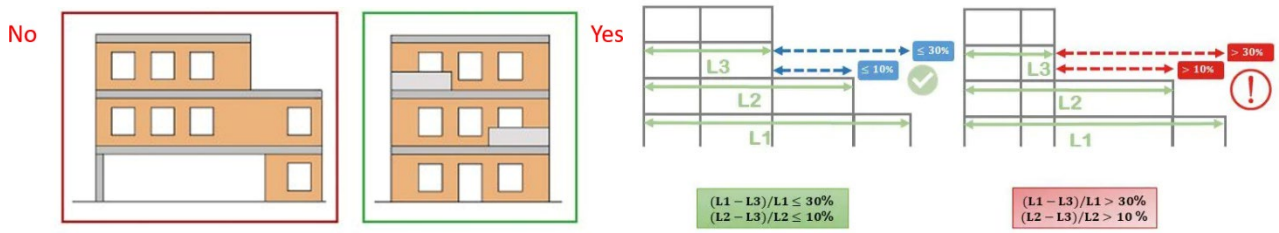


Figure 5. Regular building in elevation.

Doors Opening Information

Doors opening information shall be provided in the form shown in *Figure 6*. When all parameters are introduced, press Insert Data to save the data. While the Reset Form command clears the data in all the text boxes, the Replace Data command, replaces the data present in a given row (the row number must be entered by the user in the text box beside the Replace Data button).

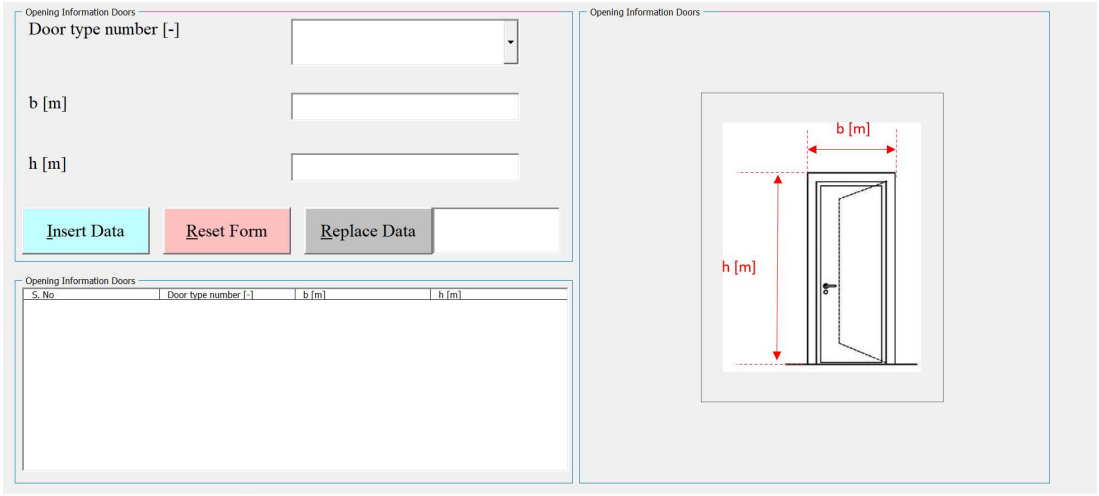


Figure 6. Form for doors opening information.

1. Door type number and the dimensions *b* and *h*.

The user should define the type for each door (*Type 1, Type 2, etc*….) in the building; it is necessary to define the width (*b*) and height (*h*). An example is shown in *Figure 7*, it is necessary to note that doors with the same dimensions belong to only one type of door.

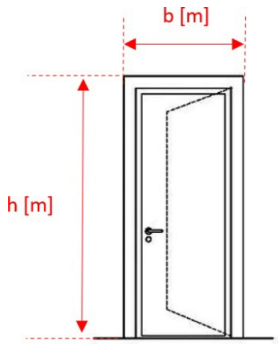


Figure 7. Door type.

Windows Opening Information

Windows opening information shall be provided in the form shown in *Figure 8*. When all parameters are introduced, press *Insert Data* to save the data. While the *Reset Form* clears the data in the various text boxes. Finally, the *Replace Data*, replaces the data present in a given row (the row number must be entered in the text box beside the button).

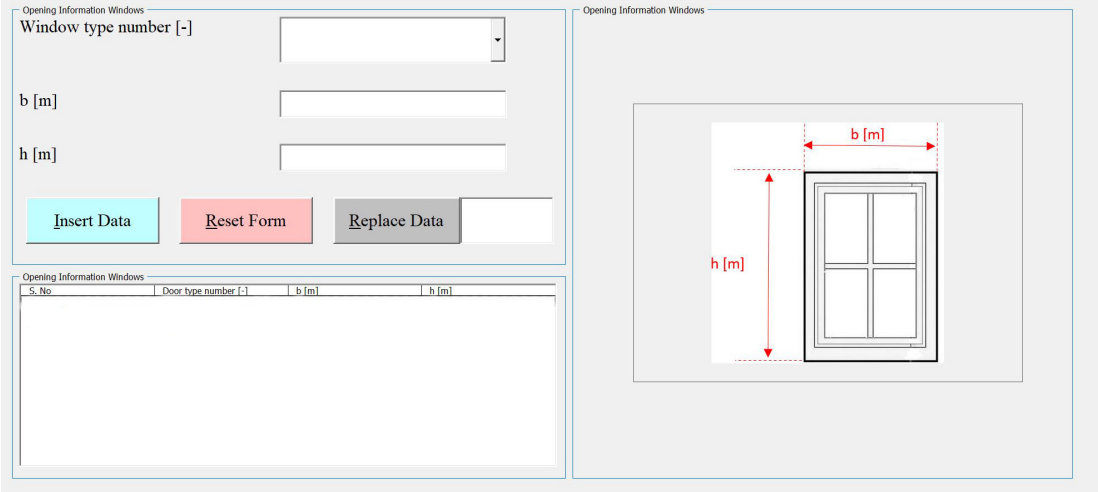


Figure 8. Form for windows opening information.

1. Windows type number and the dimensions *b* and *h*.

The user should measure the width (*b*) and height (*h*) (see *Figure 9*) of each window and define the different *Type* (*1, 2, 3 etc.…*), please note that windows with same dimensions are to be assigned to only one type of window.

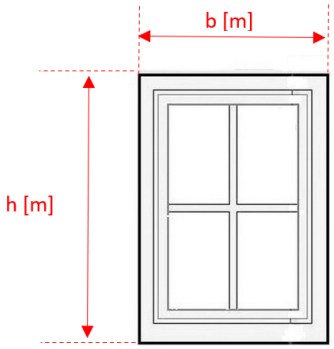


Figure 9. Window type.

Walls Information

Walls information shall be provided in the form shown in *Figure 10*. When all parameters are introduced, press *Insert Data* to save the data. While the *Reset Form* clears the data in the various text boxes. Finally, the *Replace Data*, replaces the data present in a given row (the row number must be entered in the text box beside the button).

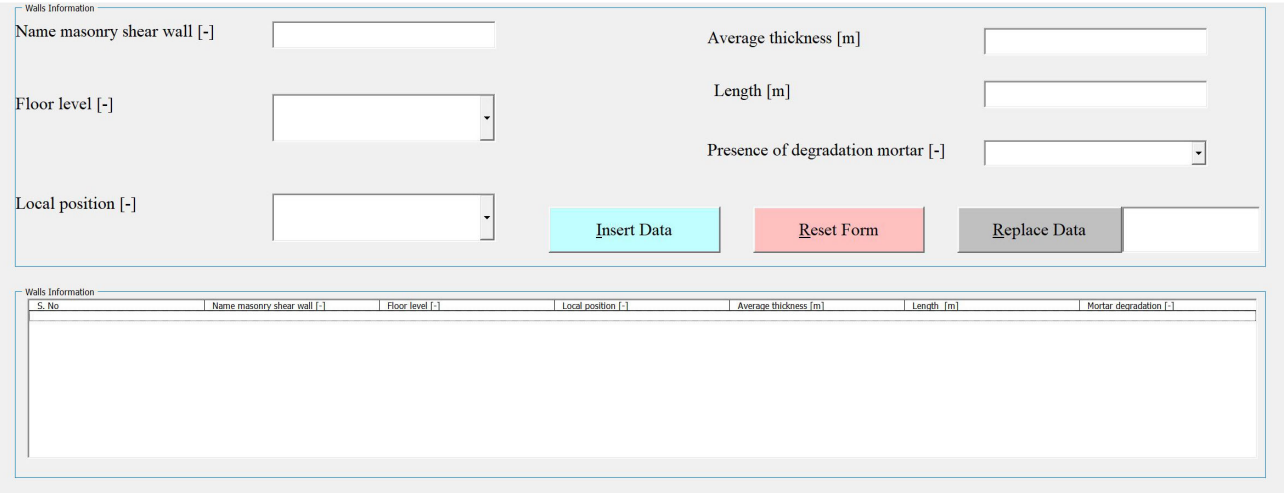


Figure 10. Form for walls information.

1. Name shear wall, floor level and local position.

The user should insert for each masonry shear wall a reference name, to which floor it belongs and if it is an external or internal. For example (see *Figure 11*), the masonry shear wall is named SW1, it is located at ground floor (GF), and it is an External masonry shear wall.

2. Average thickness and length.

The user should insert for each masonry shear wall the average thickness and the length, as shown in *Figure 11*.

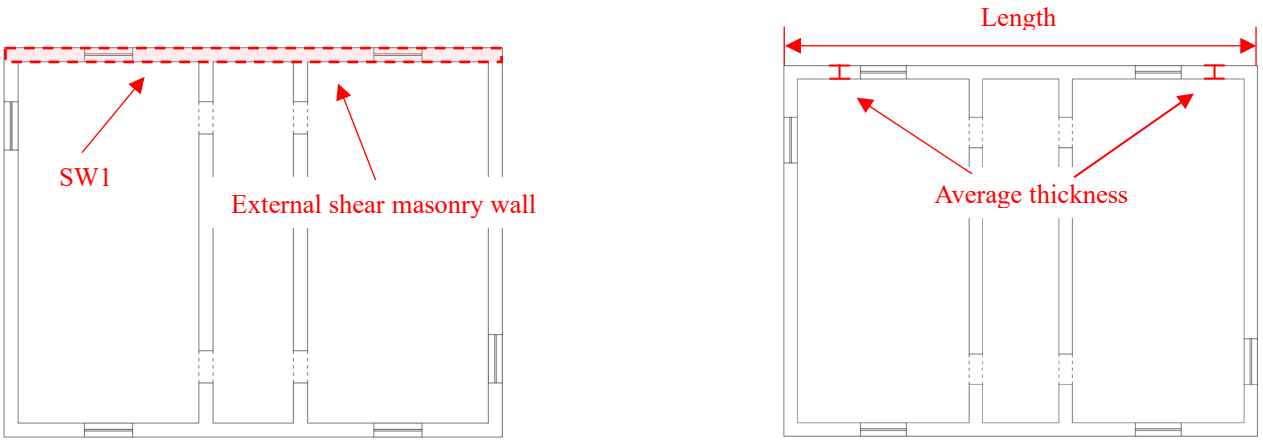


Figure 11. Wall information.

3. Presence of mortar degradation (yes /no).

The user should observe the presence of mortar degradation. Degradation of the mortar due to the effect of rising damp, weathering erosion or biological attack (see *Figure 12*).

a) *b)* *c)*

Figure 12. Type of degradation: *a)* rising damp, *b)* weathering erosion and *c)* biological attack.

Note: Data entered in section "*Walls Opening Information*" must correspond to only one masonry shear wall.

Internal Alignment Opening Information

Internal alignment opening information shall be provided in the form shown in *Figure 13*. When all parameters are introduced, press *Insert Data* to save the data. While the *Reset Form* clears the data in the various text boxes. Finally, the *Replace Data*, replaces the data present in a given row (the row number must be entered in the text box beside the button).

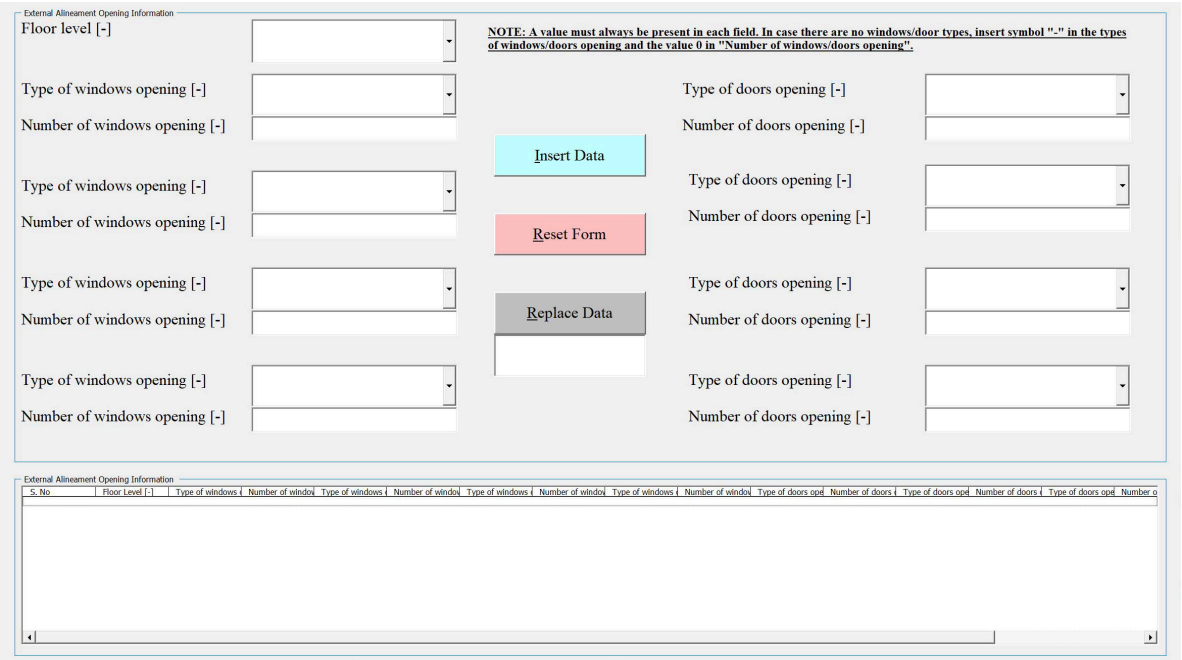


Figure 13. Form for internal alignment opening information.

1. Floor level, type of windows (or doors) opening and Number of windows (or doors) opening.

The user for each floor level (*GF, EF1, EF2, etc…*) should insert the type (*Type 1, Type 2, etc…*) of window (or door) as defined in the section *"Windows Opening Information"* (or *"Doors Opening Information"*) with the corresponding number of openings.

Note: Each data entry should be referred to only one floor of the masonry building.

External Alignment Opening Information

External alignment opening information shall be provided in the form shown in *Figure 14*. When all parameters are introduced, press *Insert Data* to save the data. While the *Reset Form* clears the data in the various text boxes. Finally, the *Replace Data*, replaces the data present in a given row (the row number must be entered in the text box beside the button).

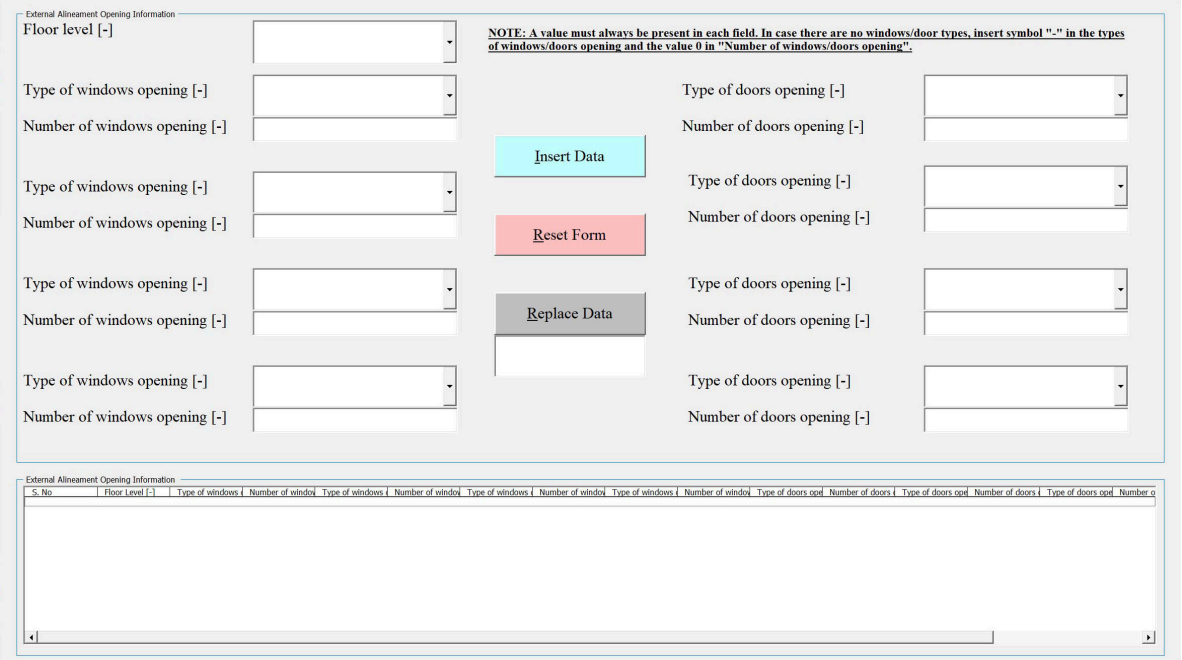


Figure 14. Form for external alignment opening information.

1. Floor level, type of windows (or doors) opening and Number of windows (or (doors) opening.

The user for each floor level (*GF, EF1, EF2, etc…*) should insert the type (*Type 1, Type 2, etc…*) of window (or door) as defined in the section *"Windows Opening Information"* (or *"Doors Opening Information"*) with the corresponding number of openings.

Note: Each data entry should be referred to only one floor of the masonry building.

Characteristics of the Structure (Part 1)

Characteristics of the structure shall be provided in the form shown in *Figure 15*. When all parameters are introduced, press *Insert Data* to save the data. While the *Reset Form* clears the data in the various text boxes. Finally, the *Replace Data*, replaces the data present in a given row (the row number must be entered in the text box beside the button).

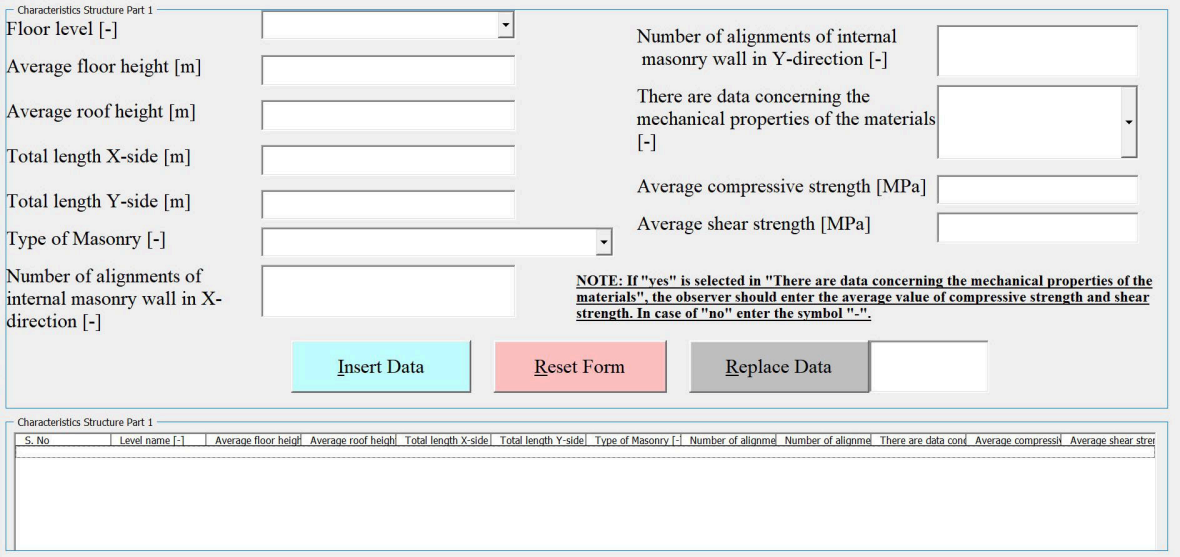


Figure 15. Form for characteristic of the structures Part 1.

1. Floor level, Average floor height and Average roof height.

The user for each floor level (*GF, EF1, EF2,..., RP*) should enter the average floor height (including the slab) and in the case of the roof plane (*RP*), should insert the average height or the average value of the measured height (including the roof plane slab) at the highest and lowest points (see *Figure 16*).

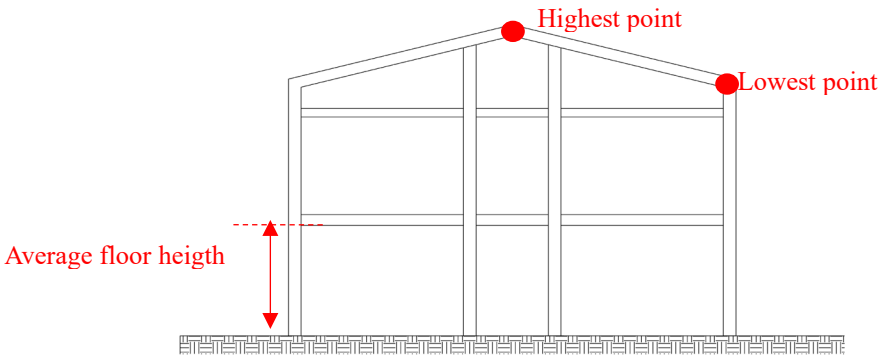


Figure 16. Average floor/roof height.

2. Total length X-side and Total length Y-side.

The user should insert the total length of the plan along the X and Y-direction, respectively, as shown in *Figure 17*.

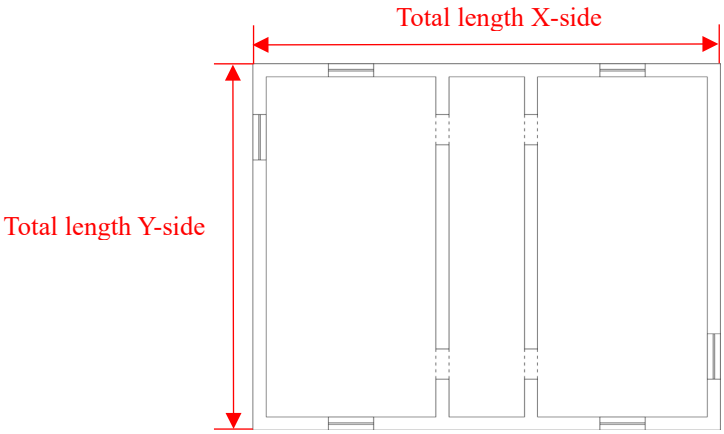
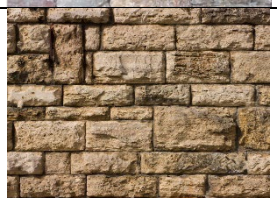
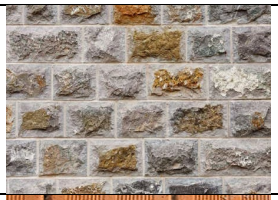
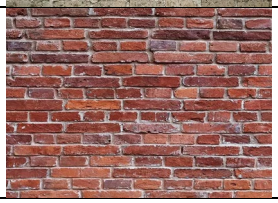


Figure 17. Total length X-side and Total length Y-side.

3. Type of Masonry.

The user should choose the type of masonry observed with respect to the type of masonry shown in Table 1.

Table 1: Type of masonry

	*Disordered stone masonry*		*Hewed ashlar masonry*
	*Cracked stone masonry with good texture*		*Irregular soft stone masonry*
	*Regular ashlar masonry of soft stone*		*Squared stone blocks masonry*
	*Clay brick and lime mortar masonry*		*Semi-full brickwork with cement mortar*

4. Number of internal alignments of masonry wall in X-direction and Number of internal alignments of masonry wall in Y-direction.

The user should determine the number of internal alignments along the X and Y-directions (see *Figure 18*). In the last *Figure* the building has two internal alignments masonry along the Y-direction while in X-direction has one internal masonry alignments.

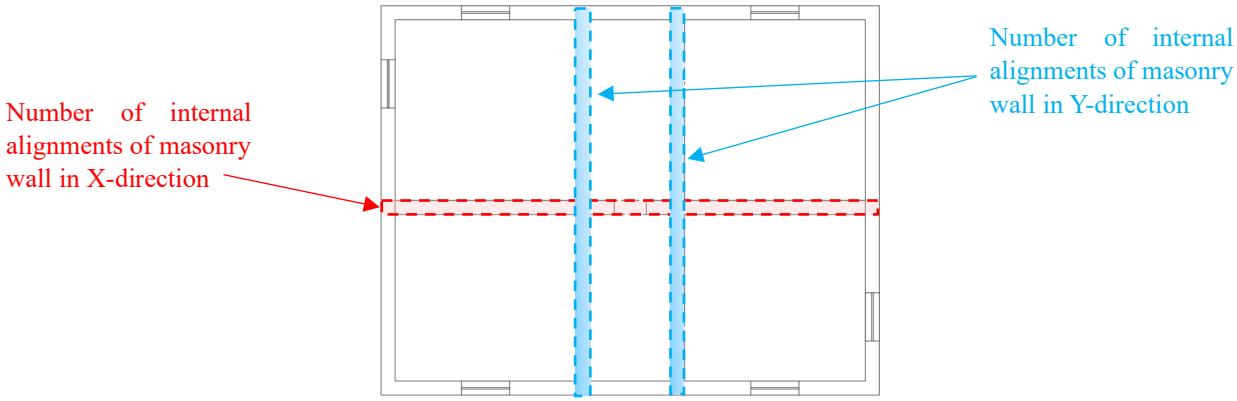


Figure 18. Number of internal alignments of masonry wall in X and Y directions.

5. There are data concerning the mechanical properties of the materials.

The user must enter "*yes*" in case of knowledge of the mechanical values of material(s) and insert the average compressive (and shear) strength. Otherwise "*no*" and in the cells relative at mechanical properties insert the symbol "-".

Note: Each data entry must refer to only one floor of the masonry building.

Characteristics of the Structure (Part 2)

Characteristics of the structure shall be provided in the form shown in *Figure 19*. When all parameters are introduced, press *Insert Data* to save the data. While the *Reset Form* clears the data in the various text boxes. Finally, the *Replace Data*, replaces the data present in a given row (the row number must be entered in the text box beside the button).

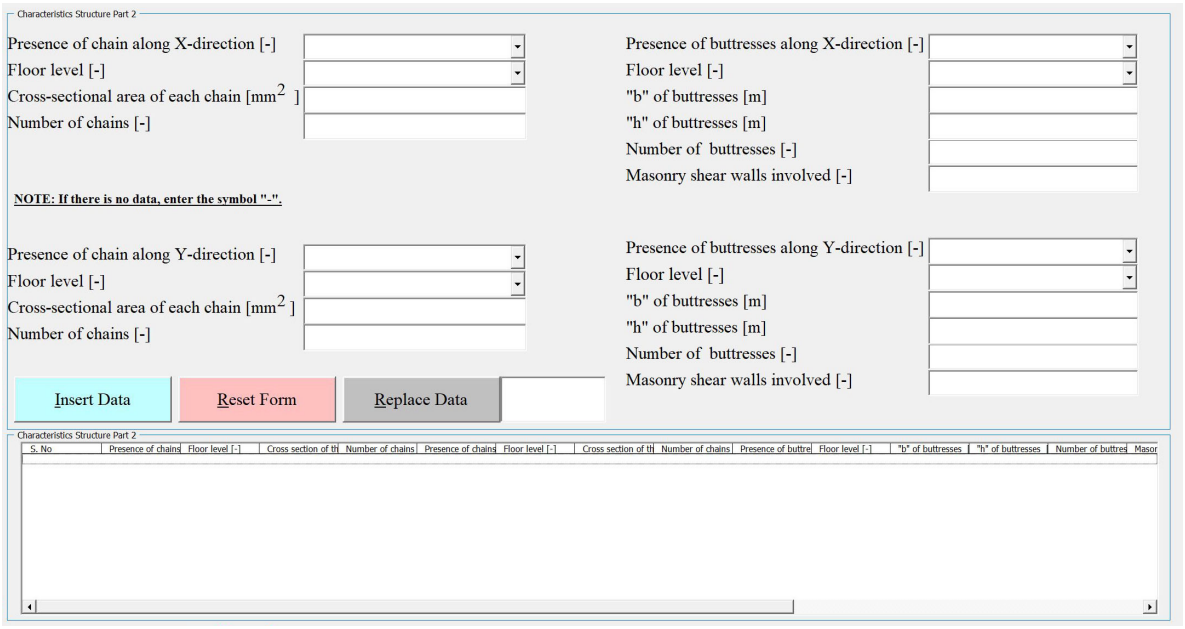


Figure 19. Form for characteristic of the structures Part 2.

1. Presence of chain along the X (or Y)-direction, Floor level, Cross section and Number of the chains.

The user must identify the presence of chains on the building under consideration. In particular, it is necessary to identify the direction (*X* or *Y*), which floor (*GF, EF1, EF2, etc…*) is involved, its cross section and number. In *Figure 20* a few examples of chains are shown, while in *Figure 21* an example is shown. In the last figure it is possible to see the presence of a chain only on the ground floor (*GF*) along the X-direction.

Figure 20. Type of chains.

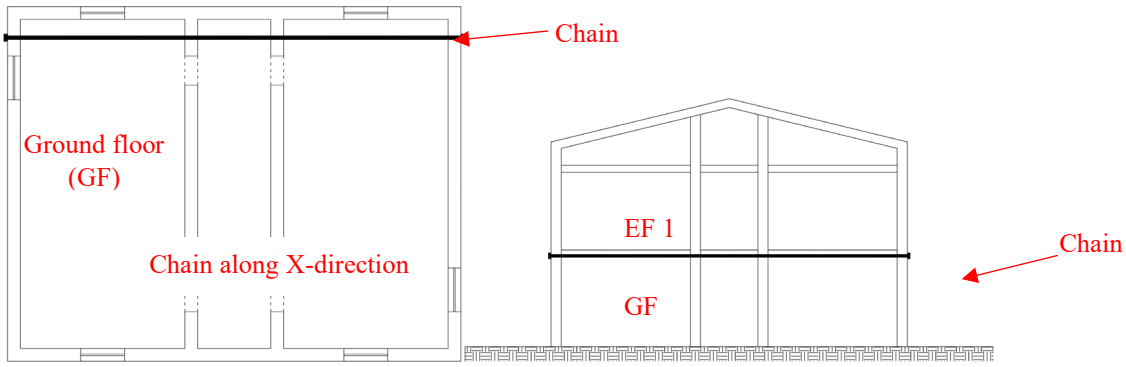


Figure 21: Presence of chain.

2. Presence of buttresses along the X (or Y)-direction, Floor level, b and h, Number of the buttresses and Masonry shear wall involved.

The user should identify the presence of counterforts/buttresses on the building under consideration. In particular, it is necessary to identify the direction (*X* or *Y*), which floor (*GF, EF1, EF2, etc…*) is involved, its geometry (*b* and *h*) number of buttresses and which masonry shear wall involved. In *Figure 22* an example of buttresses, while an example is shown in *Figure 23*. In the last figure it is possible to see the presence of buttresses only on the ground floor *(GF)* along the X-direction and masonry shear wall involved were *SW1* and *SW3*.

Figure 22. Types of counterforts/buttresses.

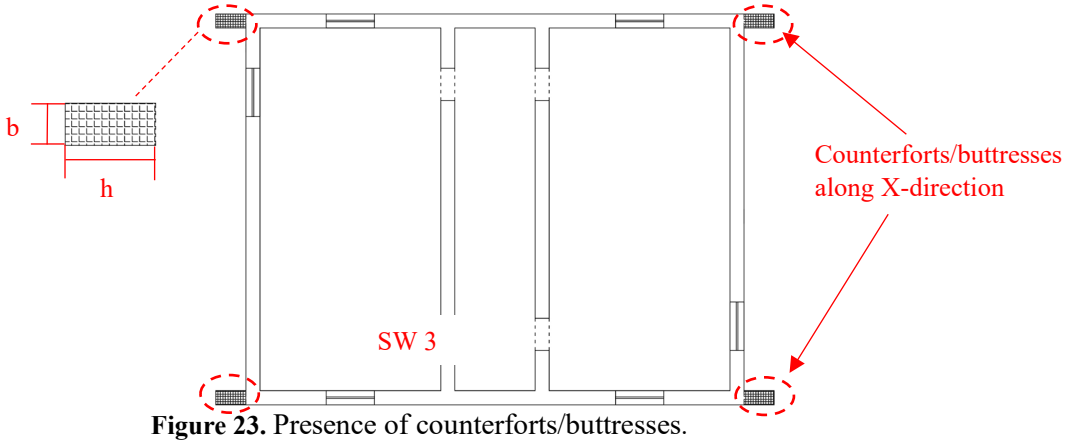


Figure 23. Presence of counterforts/buttresses.

Note: Each data entry must refer to only one floor of the masonry building.

Characteristics of the Structure (Part 3)

Characteristics of the structure shall be provided in the form shown in *Figure 24*. When all parameters are introduced, press *Insert Data* to save the data. While the *Reset Form* clears the data in the various text boxes. Finally, the *Replace Data*, replaces the data present in a given row (the row number must be entered in the text box beside the button).

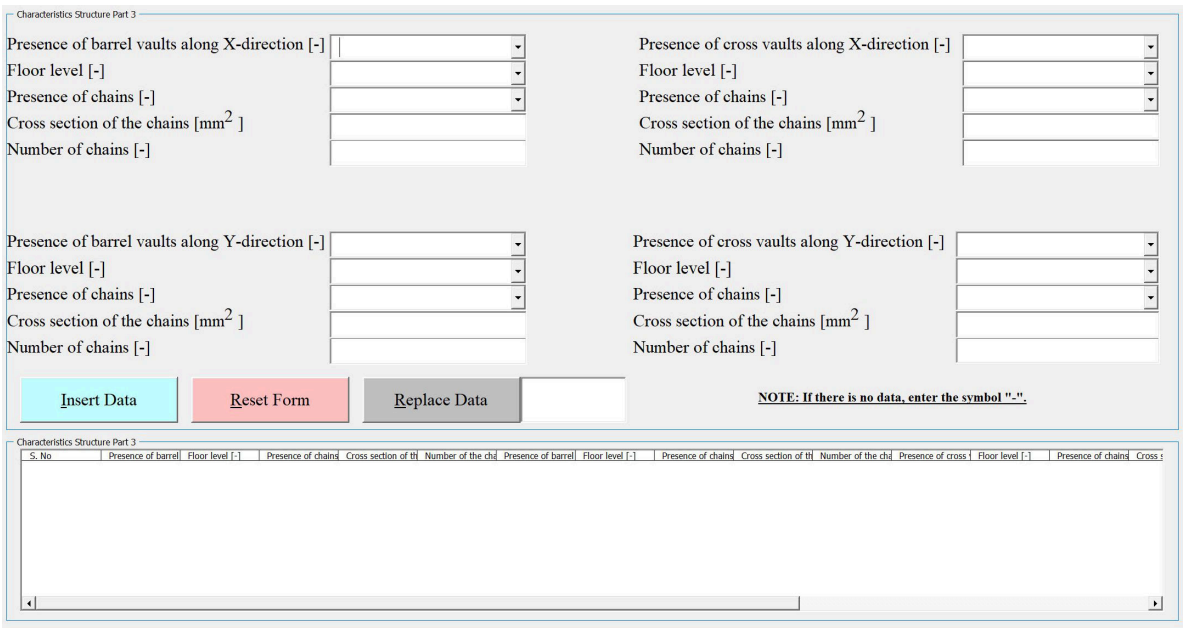


Figure 24. Form for characteristic of the structures Part 3.

1. Presence of barrel vaults along the X (or Y)-direction, Floor level, Presence of the chains, Cross section and Number of the chains.

The user should identify the presence of barrel vaults on the building under consideration. In particular, it is necessary to identify the direction (*X* or *Y*), which floor (*GF, EF1, EF2, etc…*) is involved, the presence of the chain and its cross section and number. In *Figure 25* a few examples of barrel vaults are shown, while an

example is shown in *Figure 26*. In the last figure it is possible to see the presence of chains only on the ground floor (*GF*) along the Y-direction.

a) *b)*

Figure 25. Type of barrel vaults *a)* with or *b)* without chains.

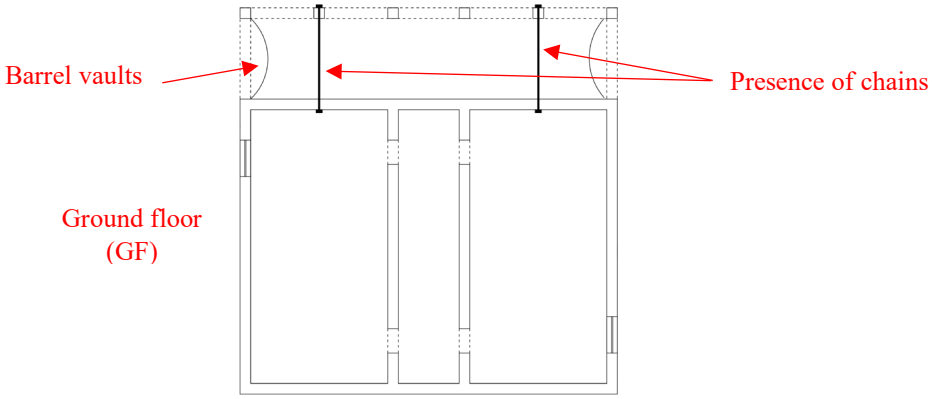
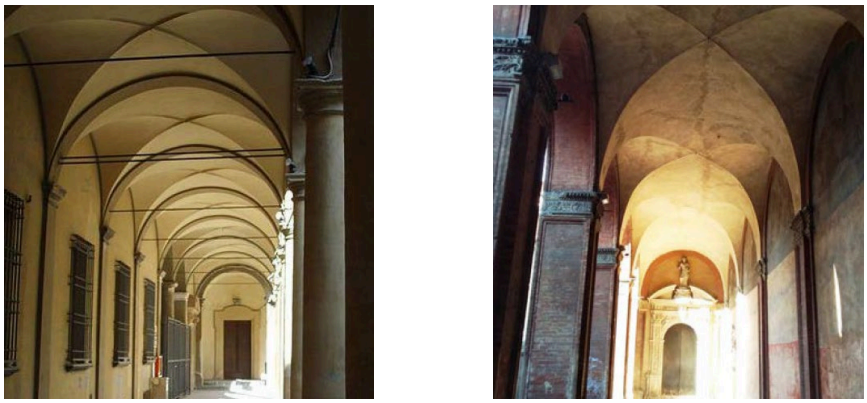


Figure 26. Barrel vaults with chain.

2. Presence of cross vaults along the X (or Y)-direction, Floor level, Presence of the chains, Cross section and Number of the chains.

The user must identify the presence of cross vaults on the building under consideration. In particular, it is necessary to identify the direction (*X* or *Y*), which floor (*GF, EF1, EF2, etc…*) is involved, the presence of the chain and its cross section and number. In *Figure 27* a few examples of chains are shown, while an example is shown in *Figure 28*. In the last figure it is possible to see the absence of chains only at the ground floor (*GF*) along the X (and Y)-direction.



a) *b)*

Figure 27. Type of cross vaults *a)* with or *b)* without chains.

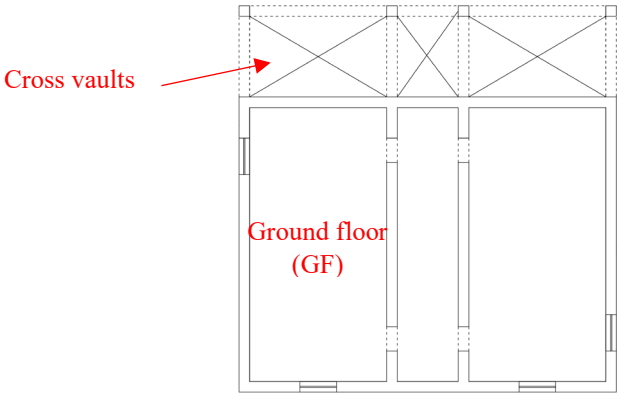


Figure 28. Cross vaults without chain.

Note: Each data entry must refer to only one floor of the masonry building.

Load Information

Load information shall be provided in the form shown in *Figure 29*. When all parameters are introduced, press *Insert Data* to save the data. While the *Reset Form* clears the data in the various text boxes. Finally, the *Replace Data*, replaces the data present in a given row (the row number must be entered in the text box beside the button).

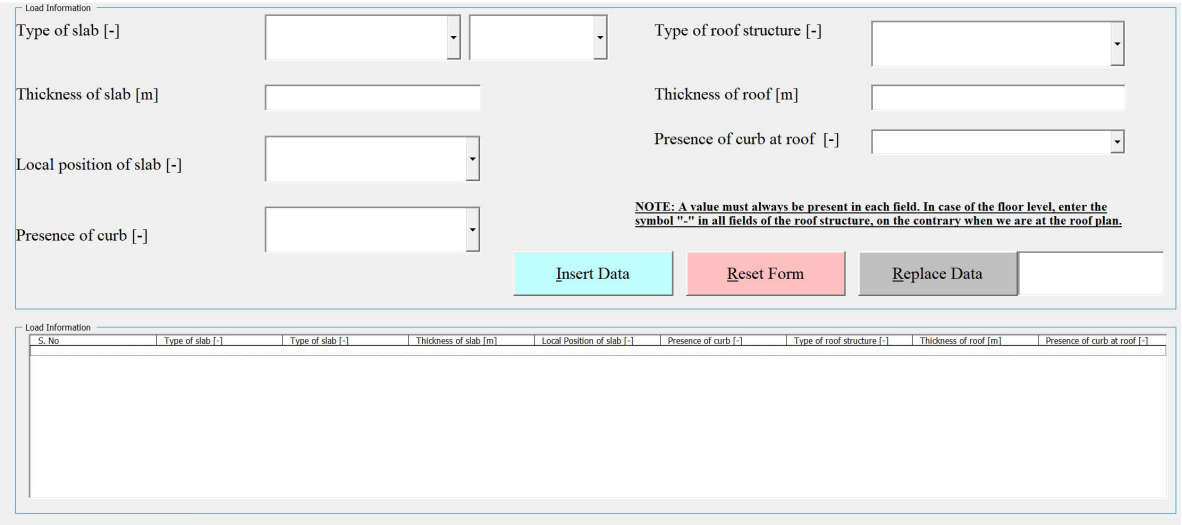


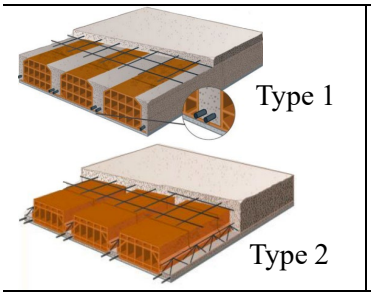
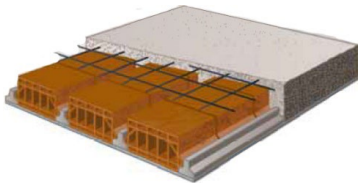
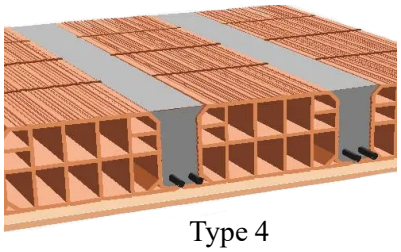
Figure 29. Form for load information.

1. Type of slab, thickness and local position.

The user must choose the type of slab on the building under consideration. In particular, it is necessary to evaluate the thickness and its local position (which floor).

Table 2: Type of slab

Type 1 Type 2	Type 3	Type 4
Wood		
Type 1 Type 2	Type 3	Type 4
Clay, steel and cement		

 Type 1 Type 2	 Type 3	 Type 4
Clay and cement		

2. Presence of curbs (for slab and roof) and local position.

The user must identify the presence or absence of the curb which should be indicated. In *Figure 30* a few examples of curbs are shown.

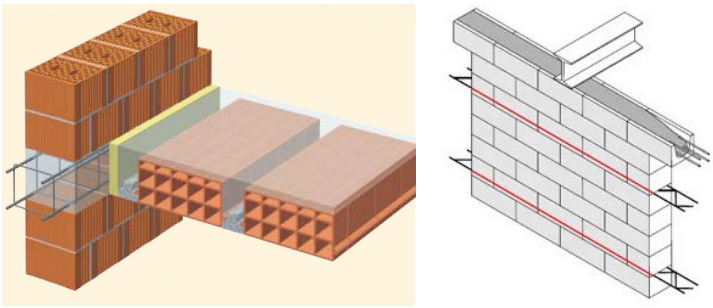
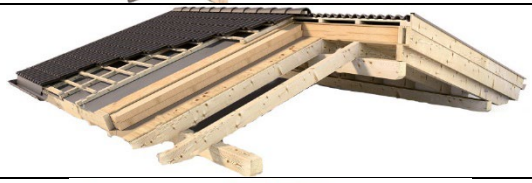


Figure 30. Type of curbs.

3. Type of roof structure and thickness.

The user should choose the type of roof structure on the building under consideration and its thickness. In *Table 3* a few examples of roof structures are shown.

Table 3: Type of roof

	Wooden roof with trusses
	Wooden roof with wooden beams
	Clay and cement

	Sandwich panels

Note: Each data entry must refer to only one slab/roof of the masonry building.

Deliverable 1.4: Progress Report M17

Annex 3b: Manual for the survey of reinforced concrete buildings in pilot areas

MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

Co-funded by the European Union

MANUAL FOR THE SURVEY OF REINFORCECD CONCRETE BUILDINGS

Version 7.2 (2024-03-15)

MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE

Co-funded by the European Union

Index

Getting start 6
Foreword 6
General data of the building 6
1. Building identification 6
2. Date of construction 6
3. Building design code 7
4. Type of concrete 7
5. Type of steel 7
6. Category of use of the building 7
7. Type of the building 7
8. Use class 7
9. Building regular in plan (yes / no) 7
10. Building regular in elevation (yes / no) 8
General structural data 8
1. Presence of underground levels (Yes/No) 8
2. Number of underground levels 9
3. Interaction of underground vertical elements with the soil (Yes / No) 9
4. The basement is completely underground (Yes / No) 10
5. Average height of the basement above ground level. 10
6. Number of floors 10
7. Roof gutter height 11
8. Total length X-side and total length Y-side 11
Characteristics of the structure underground (UG) 11
1. Floor level underground 11
2. Category of use 12
3. Slab thickness 12
4. Type of slab 12
5. Net height 13
6. Type of partitions 13
7. Number of frames in X-direction and number of frames in Y-direction 13
Characteristics of the structure above ground (AG) 14
1. Floor level above ground 14

2. Category of use 14
3. Slab thickness 14
4. Type of slab 15
5. Net height 15
6. Type of partitions 15
7. Number of frames in X-direction and number of frames in Y-direction 15
Characteristics of the roof 15
1. Type of roof 16
2. Slab thickness 16
3. Category of use 16
4. Zone 16
5. Altitude 16
Alignments 16
1. Floor level 17
2. Name of alignment 17
3. Center-to-center distances of alignments in the X direction 17
Location of frames 17
Location of frames in the X-direction 18
1. Floor level 18
2. Origin 18
3. Center-to-center distances of frames in the X-direction 18
Location of frames in the Y-direction 19
1. Floor level 19
2. Origin 20
3. Center-to-center distances of frames in the Y-direction 20
Definition of types of columns 20
1. Floor level 21
2. Type of column 21
3. Dimension the column in X-direction 21
4. Dimension the column in Y-direction 21
Pairing columns and alignments 21
1. Floor level 22
2. Alignment 22
3. Type of columns 22

Definition of types of beams 23
1. Floor level 23
2. Type of beam 23
3. Cross-section shape 23
4. Beam width 24
5. Beam height 24
6. Core width 24
7. Core height 24
8. Sole width 24
9. Sole height 24
Pairing beams and alignments 25
1. Floor level 25
2. Alignment 25
3. Type of beam 25
Infill parameters 26
1. Type of the infill 26
2. Openings distribution 26
3. Opening rate 27
Stairwell and elevator 27
1. Stairwell 28
2. Stairwell area 28
3. Location of the stairwell in the X- and Y-directions 28
4. Structure of the stairwell 28
5. Elevator (Yes/No) 29
6. Location of the elevator in the X- and Y-directions 29
7. Type of structure for the elevator 29

Getting start

Notes for the observer:

1. ***The observer before starting to perform the survey must necessarily take the original file "MEDEA C.A." save it with the name of the structure he is surveying.***
2. ***For each building use a new original file "Medea C.A."***
3. ***Performed the survey of must press the button in the center named "Save file", save it with the same name as the file of the building just surveyed.***
4. ***For each building, it is recommended to collect and provide pictures and structural/architectural drawings.***
5. ***To activate the functions in this Excel file, follow these steps: File / Options / Trust Center / Trust Center Setting / Disable VBA macros with notification / Press OK / and Restart Office.***
6. ***In case the program does not start, do the following: Right-click / Properties / Cancel block /Apply / Restart Office.***

Foreword

In the following, all the data are supposed to be obtained from technical documentation or direct survey. If documentation is not available and survey is impossible, data should be estimated.

General data of the building

General data of the building shall be provided in the form shown in 1. When all parameters are introduced, press "Insert Data" to save the data.

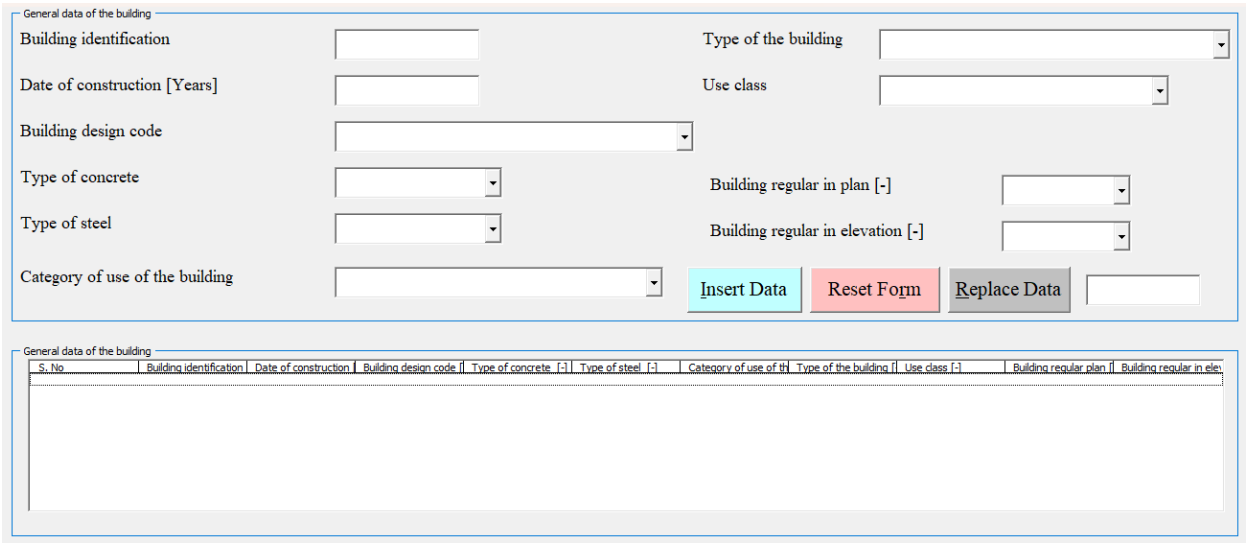


Figure 1. Form for general data of the building.

1. Building identification

Identify the building by providing an identification code.

2. Date of construction

Indicate the year of construction of the building; if unknown, indicate an approximate year of construction.

3. Building design code

Provide information about the code used for the design or in force at the construction time. In addition to those listed, it is possible to introduce a further design code. If unknown, please refer to the code in force at the design (or construction) time.

4. Type of concrete

Choose from the options the type of concrete used for the structural elements.

5. Type of steel

Choose from the options the type of steel bars used for the structural elements.

6. Category of use of the building

Choose among the following options, as defined in Eurocode 2:

- Areas for domestic and residential activities;
- Office areas;
- Areas where people may congregate;
- Shopping areas.

If there are different categories of use, please provide the most representative.

7. Type of the building

Choose the type of building among the following options, as defined in Eurocode 2:

- Temporary construction;
- Building structure and other common structure;
- Monumental building structure, bridge and other civil engineering structure.

8. Use class

Choose the use class among the following options, as defined in Eurocode 8:

- I (buildings with the occasional presence of people);
- II (buildings with normal crowding);
- III (buildings with significant crowding);
- IV (strategic construction).

9. Building regular in plan (yes / no)

Referring to Figure 1, a building is regular in plan if both the following conditions are satisfied:

1) $\frac{A_i}{A_0} \leq 0{,}05$ for any *i*;
2) $L_1 \leq 4L_2$, where L_1 and L_2 are the lengths of the sides and $L_2 < L_1$.

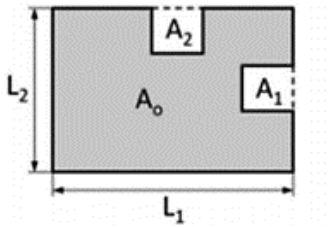


Figure 2. Scheme for building regularity in plan.

10. Building regular in elevation (yes / no)

The criteria to establish whether a building is regular or not in elevation are shown in Figure 2.

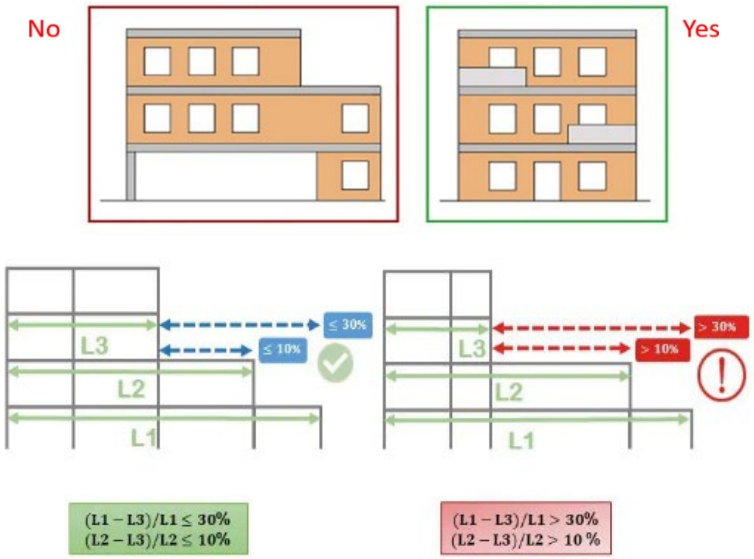


Figure 3. Criteria for regularity in elevation.

General structural data

General structural data shall be provided in the form shown in Figure 4. When all parameters are introduced, press “Insert Data” to save the data.

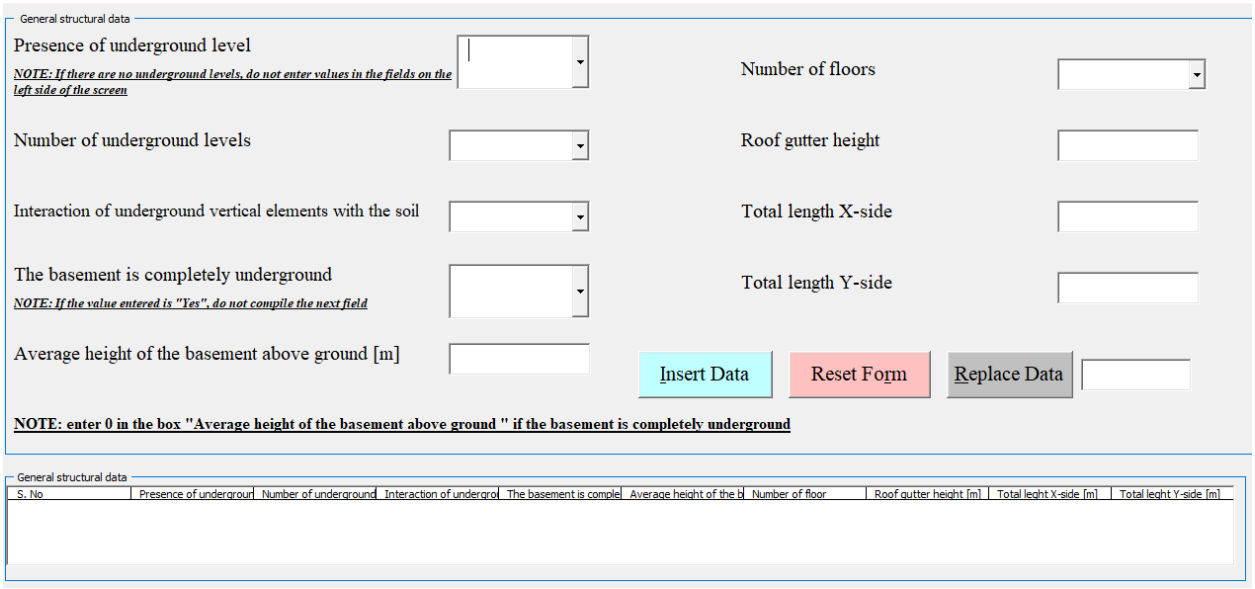


Figure 4. Form for general structural data.

1. Presence of underground levels (Yes/No)

Specify if underground levels are present.

2. Number of underground levels

Indicate the number of underground levels. For example, B -3 means that there are three floors underground Figure 5

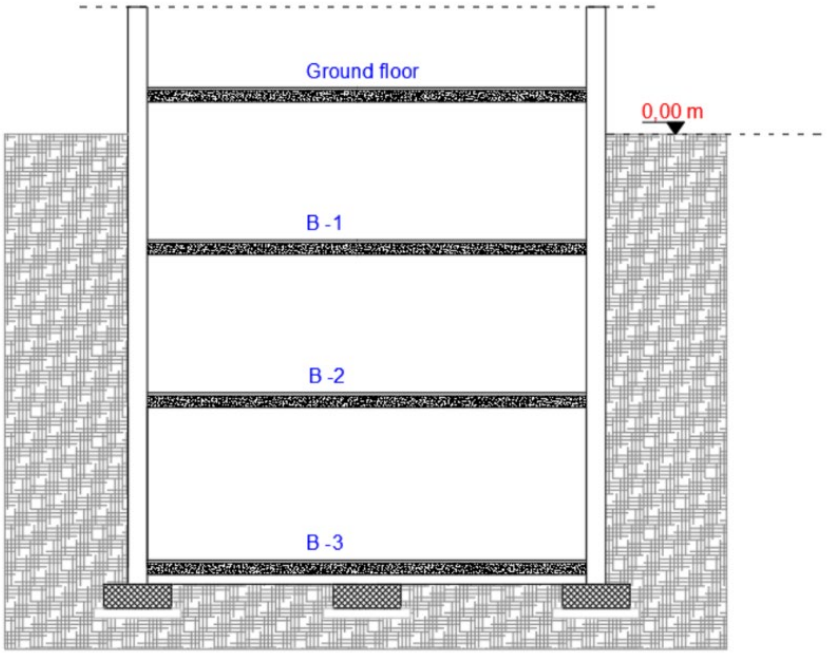


Figure 5. Underground levels.

3. Interaction of underground vertical elements with the soil (Yes / No)

Yes: the soil interacts with the structure of the building (Figure 6).
No: soil does not interact with the structure of the building (Figure 7).

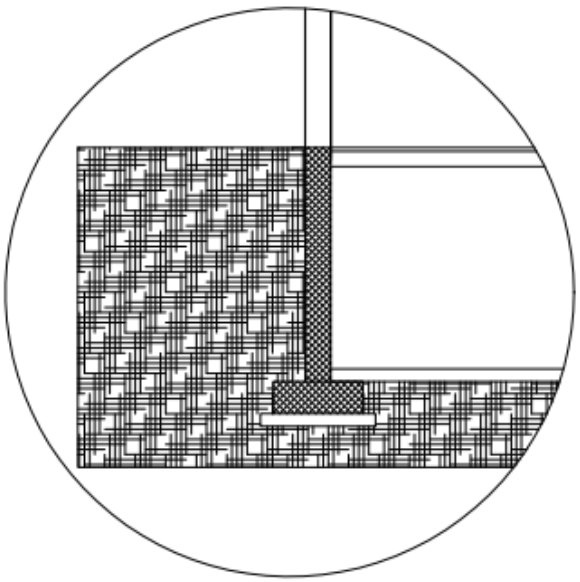


Figure 6. Soil interacts with the structure.

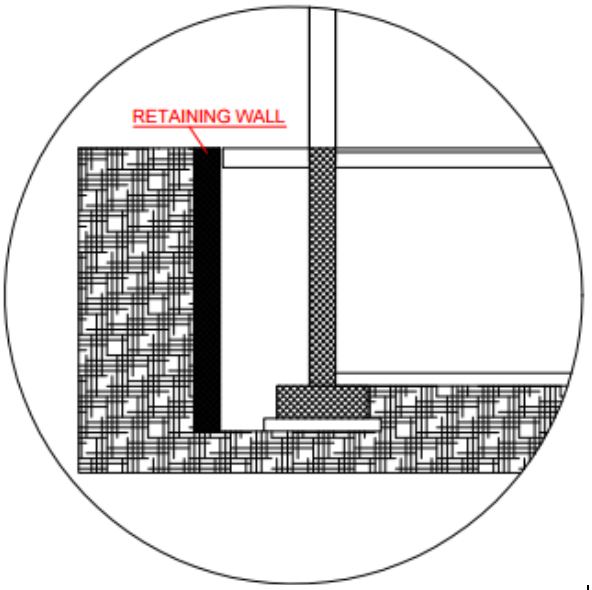
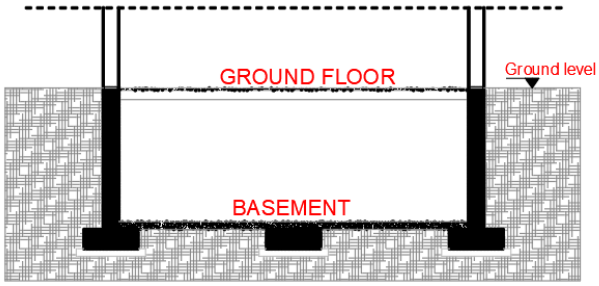


Figure 7. Soil does not interact with the structure.

4. The basement is completely underground (Yes / No)

Referring to Figure 8, specify if the basement is completely underground or not.

Yes



No

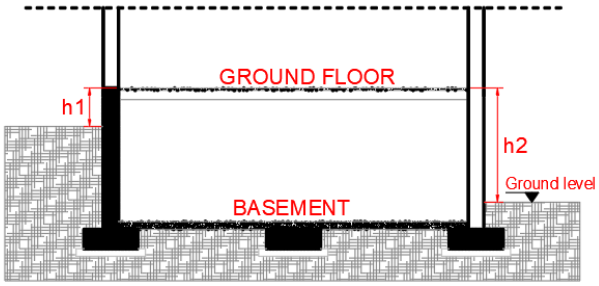


Figure 8. Position of the basement with respect to the ground.

5. Average height of the basement above ground level.

If the basement is not completely underground (previous option is “No”), the average height of the floor above the ground level must be provided, determined as: $h_m = \frac{(h1+h2)}{2}$. Enter 0 in the box "Average height of the basement above ground " if the basement is completely underground (previous option is “Yes”).

6. Number of floors above ground

Number of floors, including ground floor. The example shown in Figure 9 has 3 floors: ground floor, 1st floor, and 2nd floor. Floors below ground should not be considered.

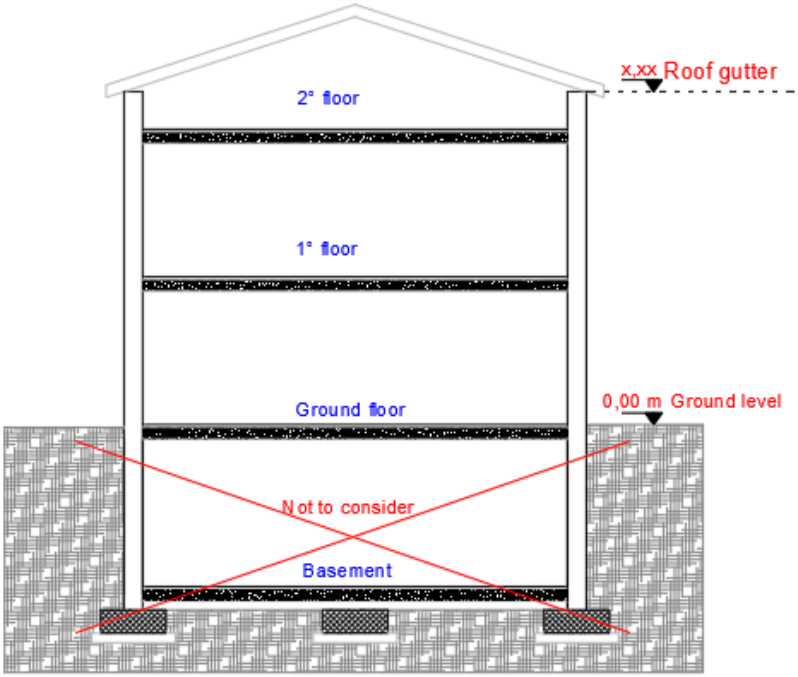


Figure 9. Identification of the number of floors and roof gutter heights.

7. Roof gutter height

Gutter height from the ground level Figure 9 shall be provided.

8. Total length X-side and total length Y-side

Indicate the total lengths of the plan along the X and Y directions, respectively, as shown in Figure 8. If the structure is not rectangular in plan, the dimensions of the rectangle circumscribing the plan (bonding box) shall be reported.

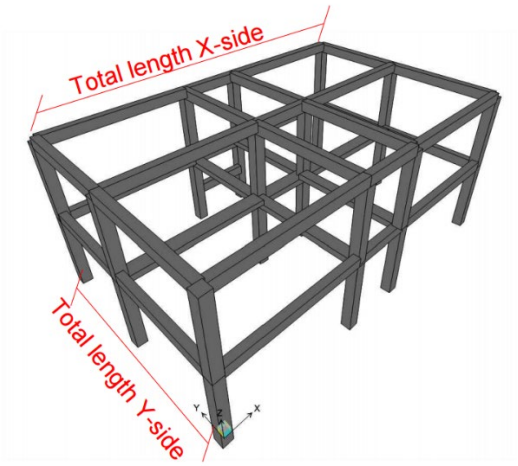


Figure 10. Total length X-side and total length Y-side.

Characteristics of the structure underground (UG)

The form shown in Figure 11 has to be filled for each underground level. When data of an underground level are complete, press “insert data” to save data and proceed with the following underground level. A line with the data of each underground level will be created at the bottom of the form.

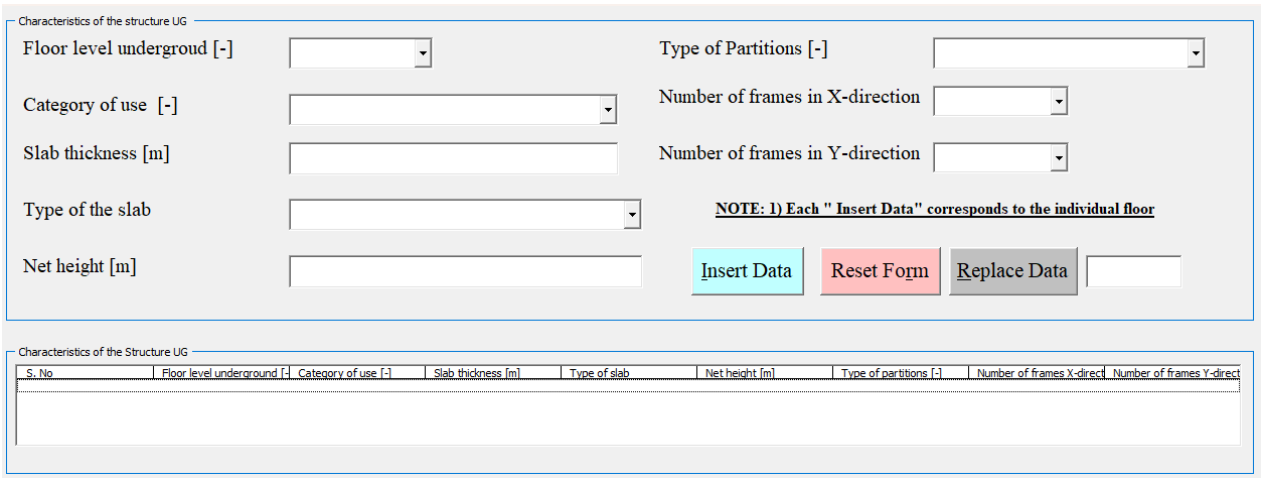


Figure 11. Characteristics of the structure underground form.

1. Floor level underground

Indicate the underground floor for which data are provided. For example, "B - 4" indicates that refers to the fourth underground floor.

2. Category of use

Choose among the following options:

- Areas for domestic and residential activities;
- Office areas;
- Areas where people may congregate;
- Shopping areas.

3. Slab thickness

Input the thickness of the slab Figure 12 including screed and floor.

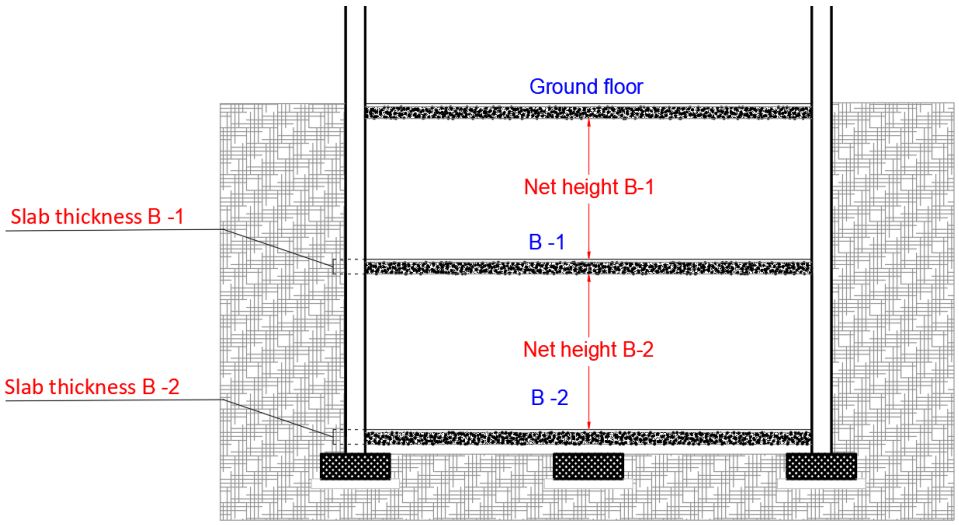


Figure 12. Slab thickness and floor net height.

4. Type of slab

Choose among the following options:

1. Slab in clay, steel and concrete (examples are provided in Figure 13);
2. Slab in clay and concrete (examples are provided in Figure 14);
3. Slab in corrugated steel sheet (Hi-bond) or wood beams (examples are provided in Figure 15).

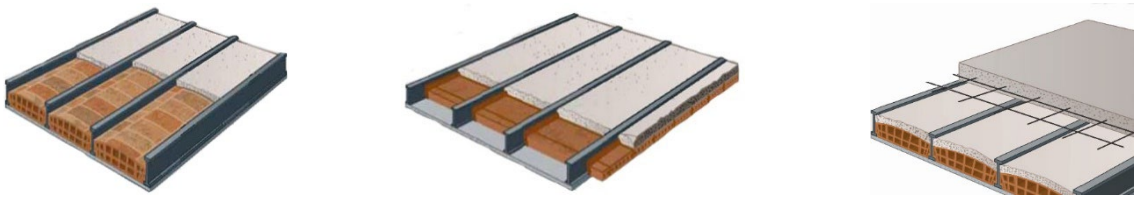


Figure 13. Examples of slab in clay, steel and concrete.

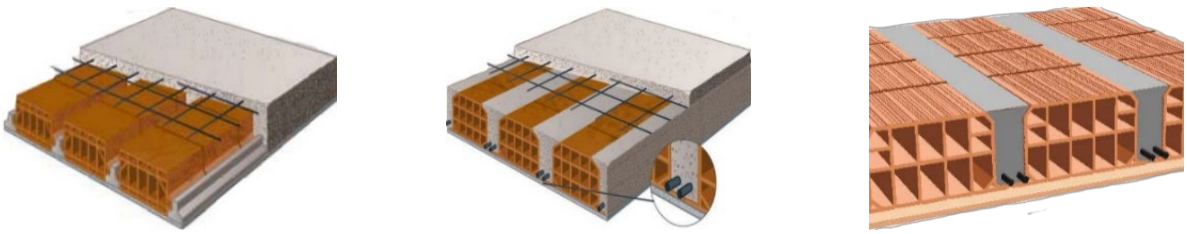


Figure 14. Examples of slab in clay and concrete.

Figure 15. Slab in corrugated steel sheet (Hi-bond) or wood beams.

5. Net height

Provide the net height between the pavement and the ceiling Figure 12.

6. Type of partitions

Choose the type of partitions among:

Light (plasterboard) Medium (perforated brick) Heavy (solid brick)

Figure 16. Type of partitions.

7. Number of frames in X-direction and number of frames in Y-direction

Indicate the number of frames in the X- and Y-directions for the current level.

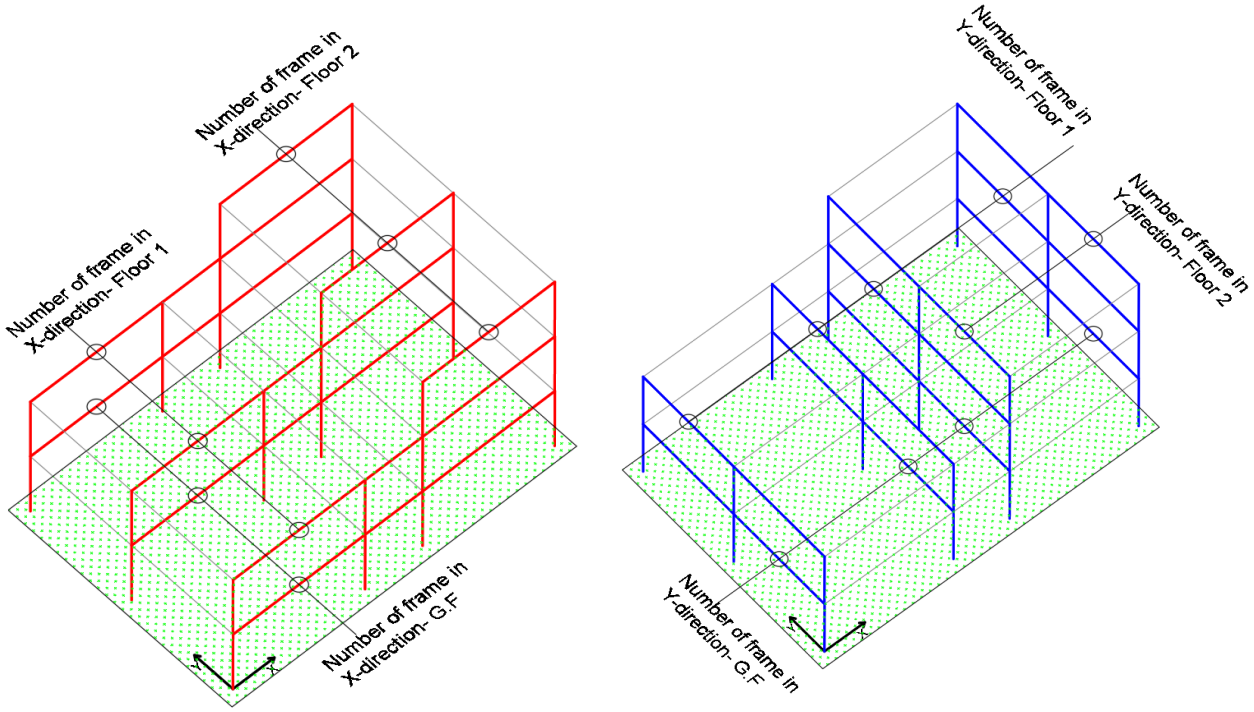


Figure 17. Number of frames in X and Y directions.

Characteristics of the structure above ground (AG)

The form shown in Figure 18 has to be filled for each level above ground. When data of a level are complete, press “insert data” to save data and proceed with the following level. A line with the data of each level will be created at the bottom of the form.

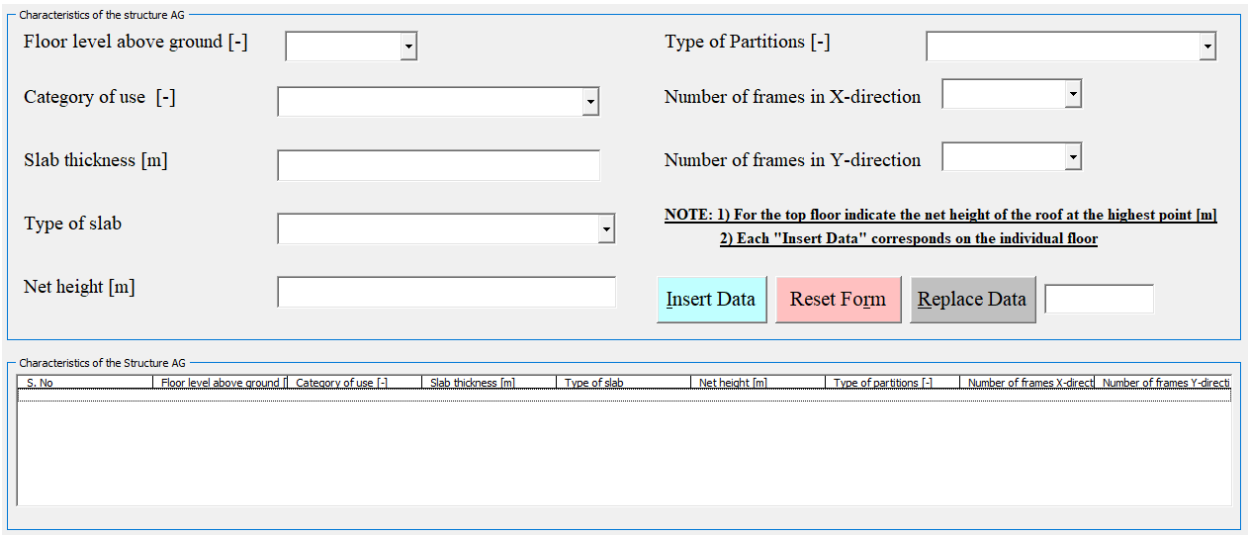


Figure 18. Characteristics of the structure above ground form.

The following information should be defined for each above-ground floor.

1. Floor level above ground

Indicate the above ground floor for which data are provided. For example, "F - 3" indicates that refers to the third above ground floor.

2. Category of use

Choose among the following options:

- Areas for domestic and residential activities;
- Office areas;
- Areas where people may congregate;
- Shopping areas.

3. Slab thickness

Input the thickness of the slab Figure 19 including screed and floor.

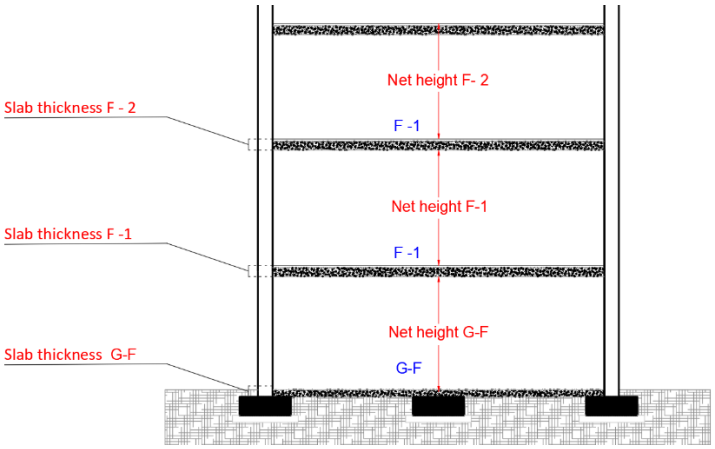


Figure 19. Slab thickness and floor net height.

4. Type of slab

If data on the structural design are available (if not), provide the following parameters of the slabs, for each floor.

Choose among the following options:

1. Slab in clay, steel and concrete (examples are provided in Figure 13);
2. Slab in clay and concrete (examples are provided in Figure 14);
3. Slab in corrugated steel sheet (Hi-bond) or wood beams (examples are provided in Figure 15).

5. Net height

Provide the net height between the pavement and the ceiling Figure 19.

6. Type of partitions

Choose the type of partitions among Figure 16.

7. Number of frames in X-direction and number of frames in Y-direction

Indicate the number of frames in the X- and Y-directions for the current level, Figure 17.

Characteristics of the roof

Data of the roof shall be provided in the form shown in Figure 20. When all parameters are introduced, press “Insert Data” to save the data.

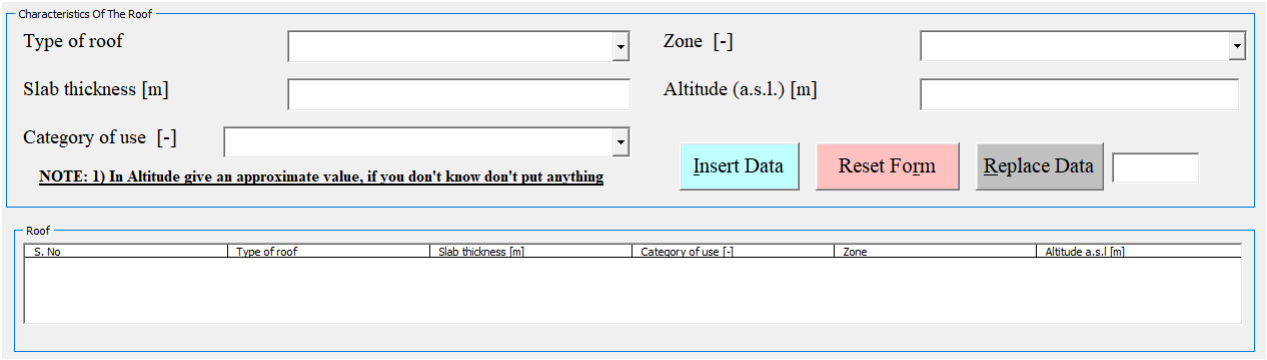


Figure 20. Characteristics of the roof.

1. Type of roof

Choose among the following options (Figure 21):

1. Clay and concrete roof;
2. Wooden roof;
3. Sandwich panels roof.

Clay and concrete roof | Wooden roof | Sandwich panels roof

Figure 21. Type of the roofs.

2. Slab thickness

Input the thickness of the roof.

3. Category of use

Choose among the following options:

- Roof accessible for maintenance only;
- Practicable roof for domestic and residential activity areas;
- Practicable roof for areas susceptible to crowding.

4. Zone

Choose among the following options:

- Zone I: alpine/mountains;
- Zone II: hill;
- Zone III: plains (<200 a.s.l.).

5. Altitude

Provide the altitude a.s.l.

Alignments

The form shown in Figure 22 has to be filled for each level and for each alignment. When data of an alignment are complete, press “insert data” to save data and proceed with the next alignment. A line with the data of each alignment will be created at the bottom of the form.

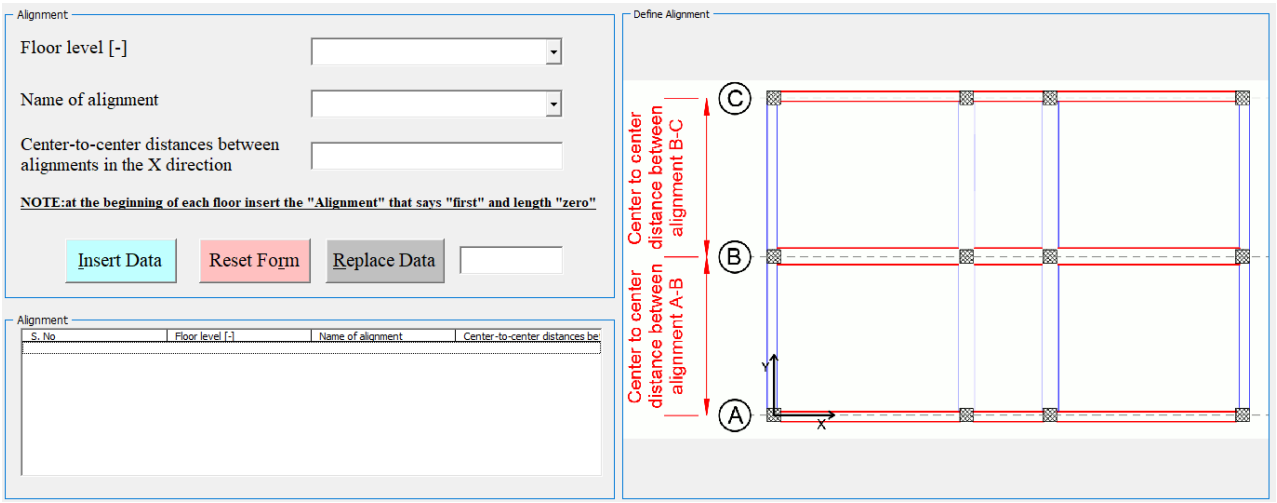


Figure 22. Form for position of frames in the X-direction.

The following characteristics should be included for all floors in the building.

1. Floor level

Indicate the floor being analyzed.

2. Name of alignment

Indicate the alignment number (which belongs to the floor shown in Step 1) that you give the information.

3. Center-to-center distances of alignments in the X direction

Report the distance of the alignment (identified in step 2) in the Y direction of the alignments arranged in the X direction.

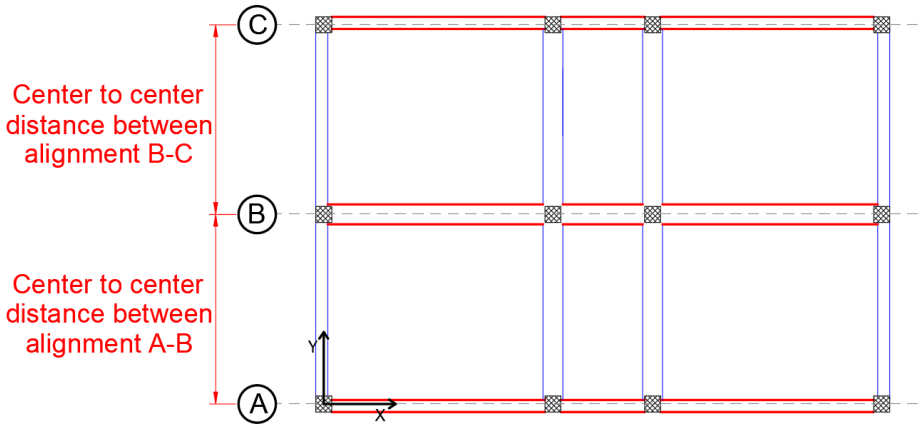


Figure 23. Identification of pupils and lengths of each alignment.

Location of frames

Referring to Figure 24, frames in the X-directions are identified by capital letters (A, B, C,…), whereas frames in the Y-direction are identified by numbers (1, 2, 3,…). Hence, distance of frames in the X-direction are measured in the Y-direction (e.g., distance between frame A and B, B and C,….) and distance of frames in the Y-direction are measured in the X-direction (e.g., distance between frame 1 and 2, 2 and 3,….).

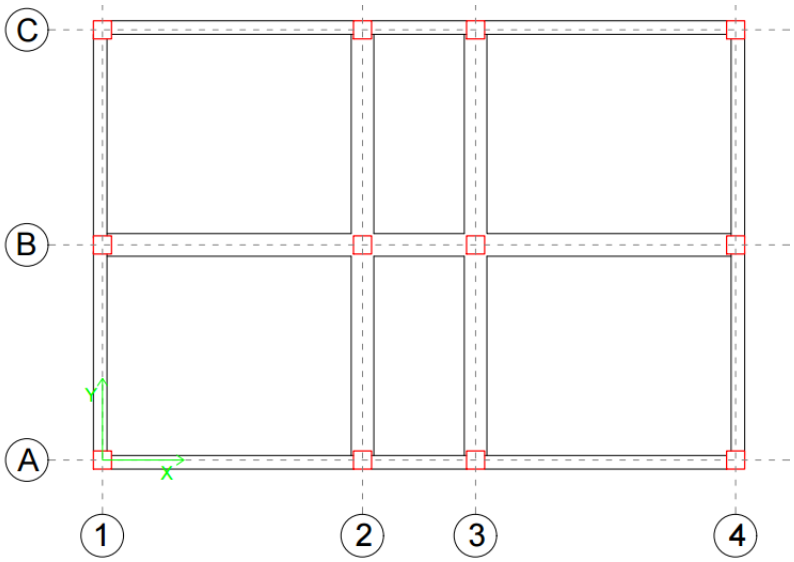


Figure 24. Identification of frames.

Location of frames in the X-direction

The form shown in Figure 25 has to be filled for each level. When data of a level are complete, press “insert data” to save data and proceed with the next level. A line with the data of frames at each level will be created at the bottom of the form.

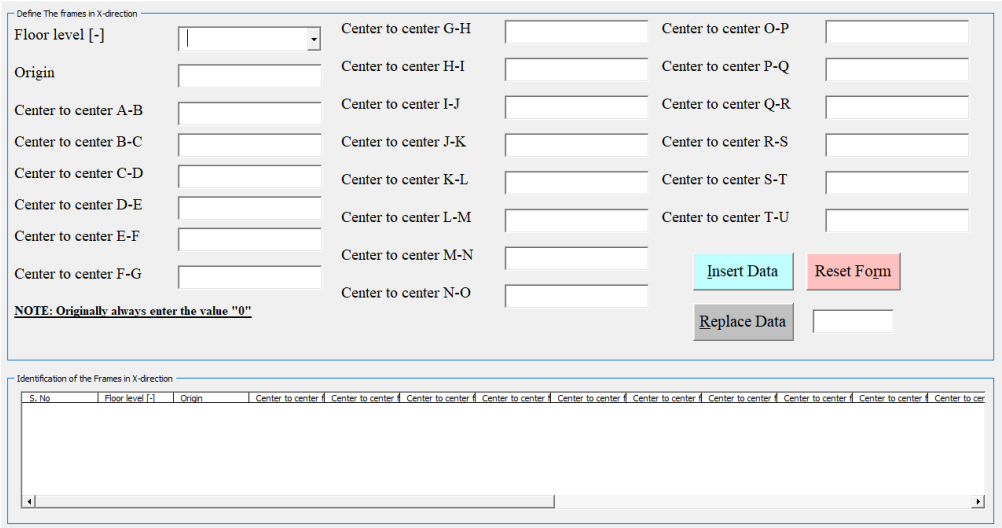


Figure 25. Form for position of frames in the X-direction.

1. Floor level

Select the floor level for current data.

2. Origin

Always introduce 0 (zero).

3. Center-to-center distances of frames in the X-direction

Introduce the center-to-center distance (measured in the Y-direction) of frames in X-direction. As an example, referring to Figure 26, frames in the X-direction are identified by a capital letter (A, B, C,..). Hence, distances

measured in the Y-direction between frames, A and B, B and C,… shall be provided. These data are reaquired for each floor.

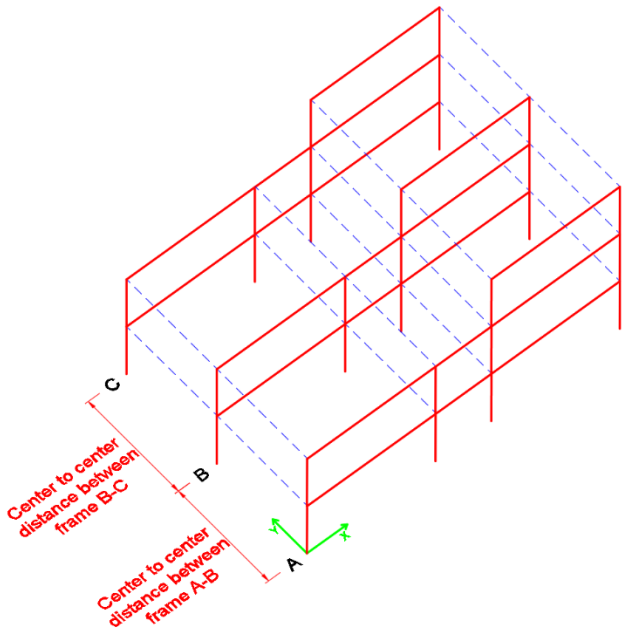


Figure 26. Distances of frames in the X-direction.

Location of frames in the Y-direction

The form shown in Figure 27 has to be filled for each level. When data of a level are complete, press “insert data” to save data and proceed with the next level. A line with the data of frames at each level will be created at the bottom of the form.

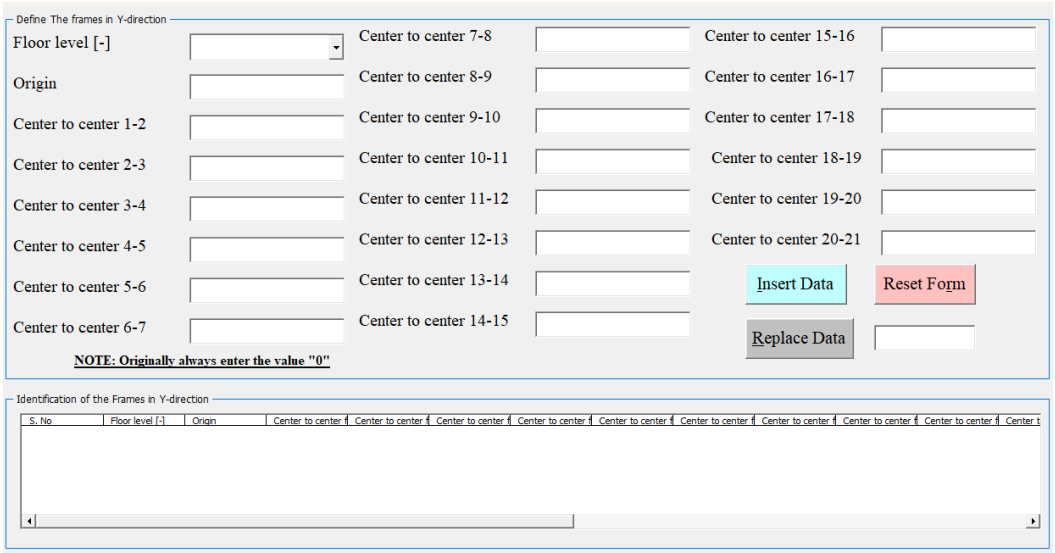


Figure 27. Form for position of frames in the Y-direction.

1. Floor level

Select the floor level for current data.

2. Origin

Always introduce 0 (zero).

3. Center-to-center distances of frames in the Y-direction

Introduce the center-to-center distance (measured in the X-direction) of frames in Y-direction. As an example, referring to Figure 28, frames in the Y-direction are identified by a capital letter (A, B, C,..). Hence, distances measured in the X-direction between frames, A and B, B and C,… shall be provided. These data are reaquired for each floor.

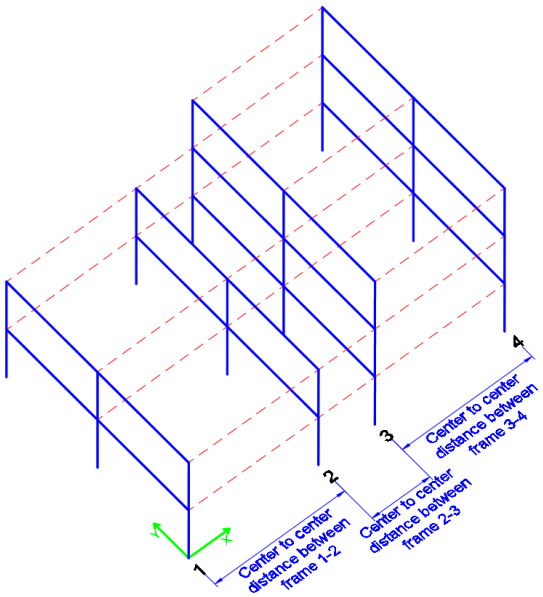


Figure 28. Distances of frames in the Y-direction.

Definition of types of columns

The form shown in Figure 29 has to be filled for each type of column at each floor level. When data of a type of column are complete, press “insert data” to save data and proceed with the next column. A line with the data of each type of column will be created at the bottom of the form.

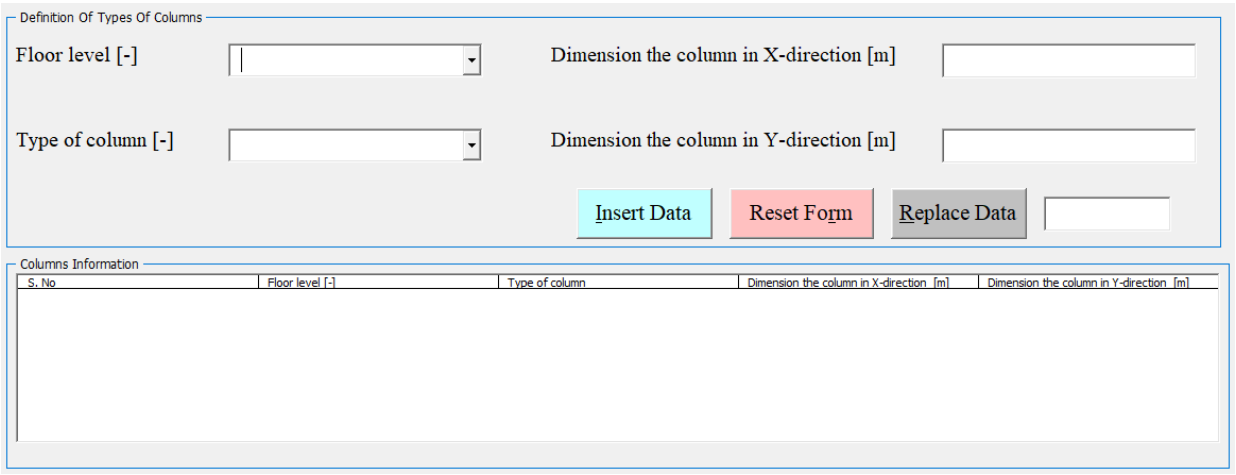


Figure 29. Form for the definition of the types of columns.

For each floor level, three types of columns can be defined based on the geometrical parameters. Each type of column is identified by a number and the floor level above which the column is located (Figure 29). Please note that columns associated with a certain floor are columns on that floor. E.g., column Type 1 (B-1) indicates column type 1 on basement level 1; column Type 2 (G-F) indicates column type 2 on the ground floor; column Type 3 (F-1) indicates column type 3 on the first floor.

1. Floor level

Select the floor level for the current column type.

2. Type of column

Select the type of column by choosing one of the options in the pull-down menu.

3. Dimension the column in X-direction

Provide the dimension of the cross-section of the column in the X-direction (Figure 26).

4. Dimension the column in Y-direction

Provide the dimension of the cross-section of the column in the Y-direction (Figure 26).

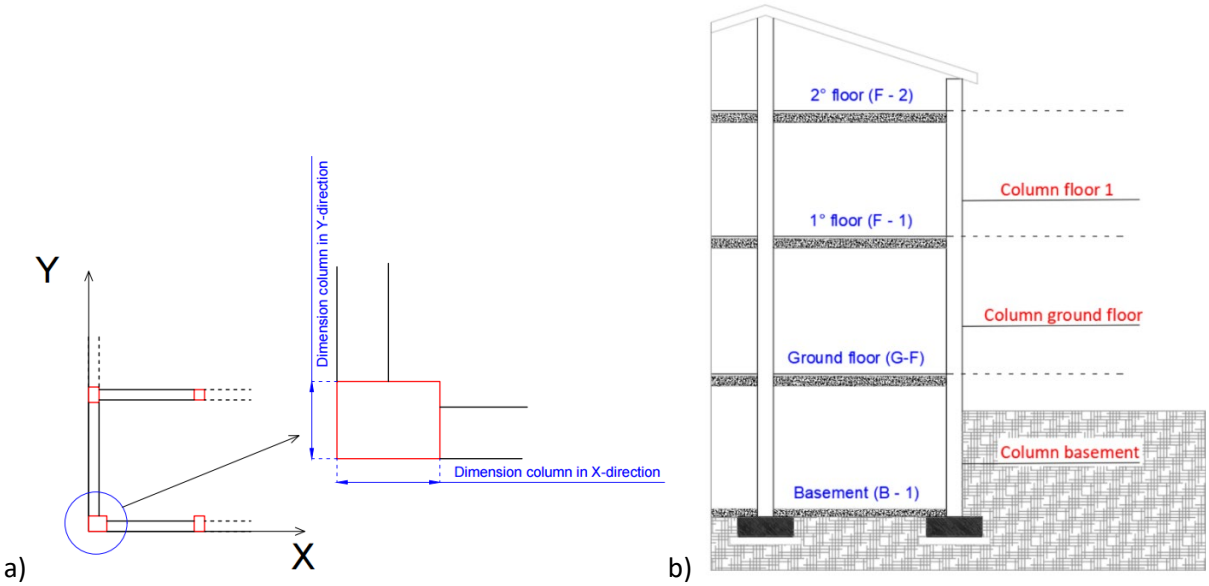


Figure 30. a) Dimensions of the column cross-section; b) Identification of the columns based on their position.

Pairing columns and alignments

For each floor level, data in the form “pairing of the columns” (Figure 31) associate each alignment with the majority of the columns in the alignment itself. It has to be filled for each level and alignment. When data of a floor level/alignment and are complete, press “insert data” to save data and proceed with the next level/alignment. A line with the data of each level/alignment will be created at the bottom of the form.

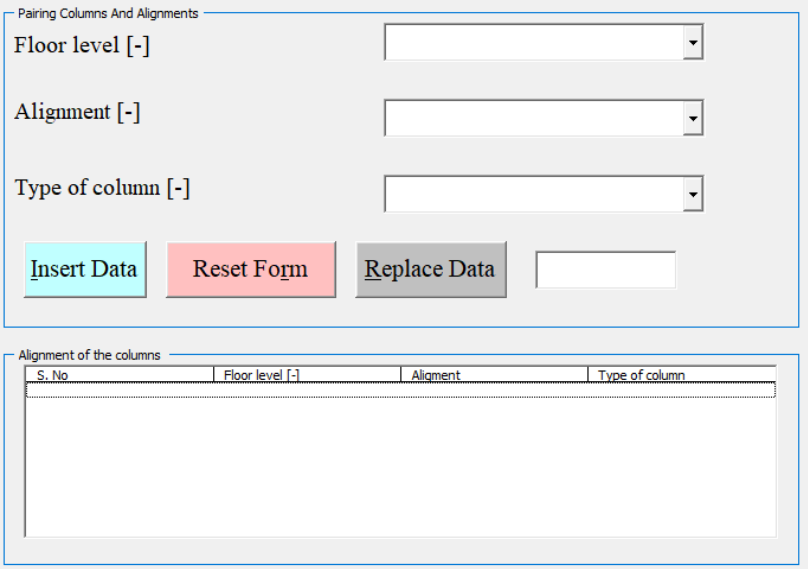


Figure 31. Form for paring columns and alignments.

1. Floor level

Provide the floor level for the current alignment and type of column.

2. Alignment

Provide the alignment for the current type of column.

3. Type of columns

Provide the type of the majority of the columns in the selected alignment on the selected floor level (Figure 32).

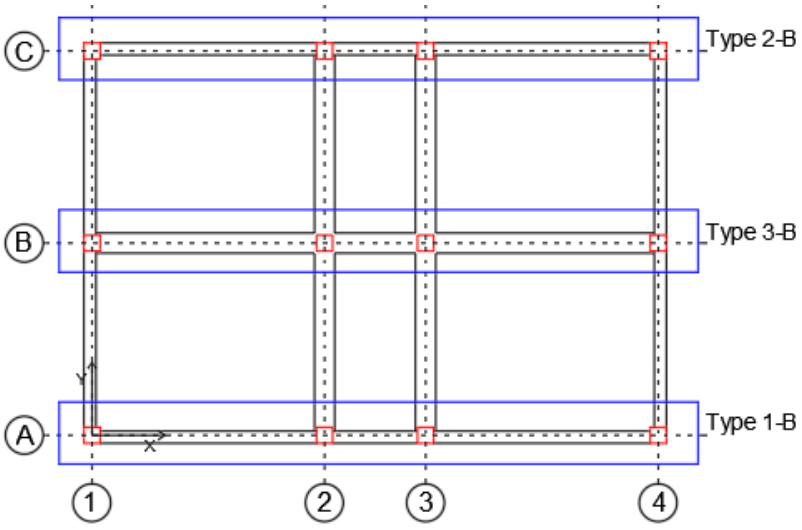


Figure 32. Association of a type of column with any alignment.

Definition of types of beams

The form shown in Figure 33 has to be filled for each type of beam at each floor level. When data of a type of beam are complete, press “insert data” to save data and proceed with the next column. A line with the data of each type of column will be created at the bottom of the form.

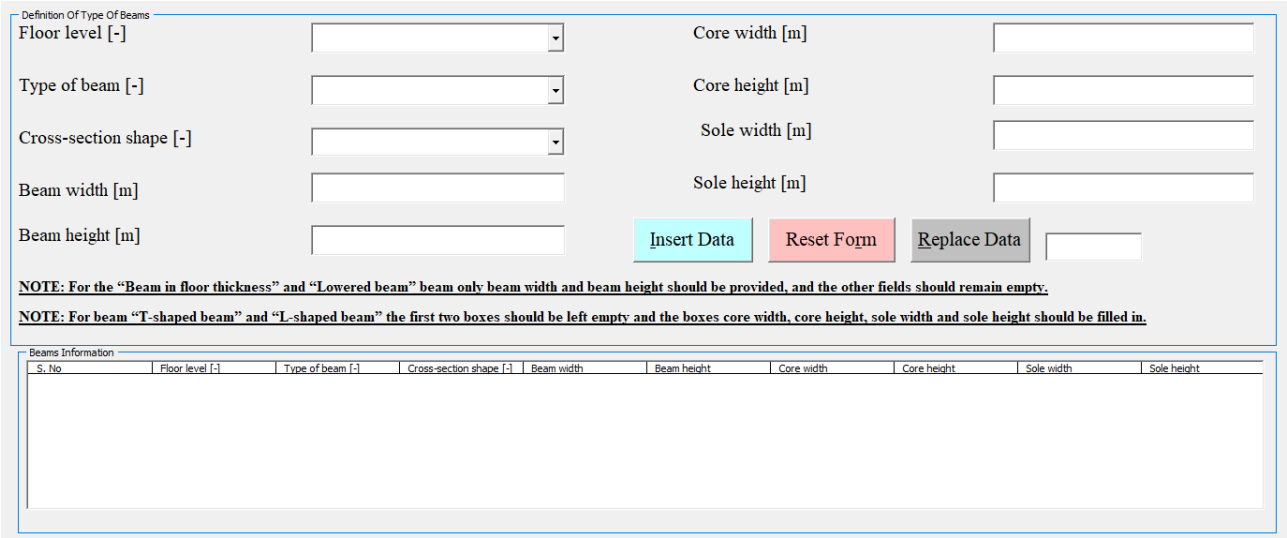


Figure 33. Form for the definition of the types of beams.

For each floor level, three types of beams can be defined based on the geometrical parameters. Each type of beam is identified by a number and the floor level where the beam is located.

1. Floor level

Select the floor level for the current column type.

2. Type of beam

Select the type of beam by choosing one of the options in the pull-down menu.

3. Cross-section shape

Referring to Figure 34, select one of following options:

- Beam in floor thickness

- Lowered beam

- T-shaped beam

- L-shaped beam

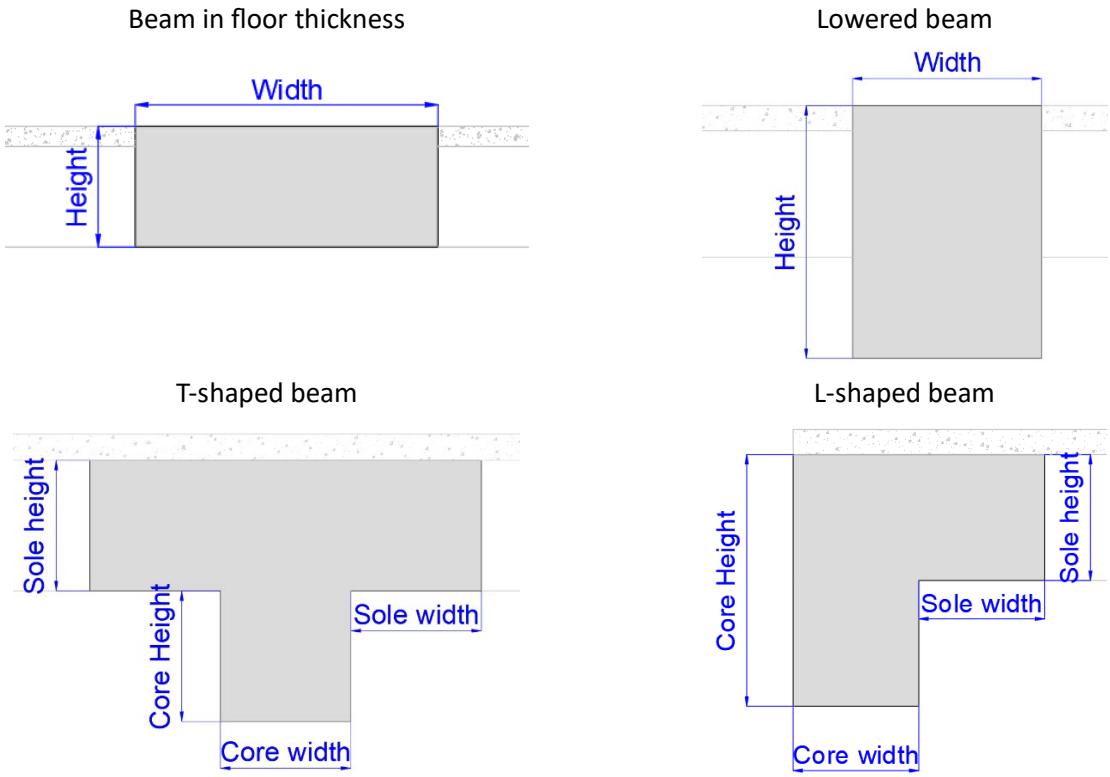


Figure 34. Cross-section shape.

For the “Beam in floor thickness” and “Lowered beam” beam only beam width and beam height should be provided, and the other fields should remain empty.

For beam “T-shaped beam” and “L-shaped beam” the first two boxes should be left empty and the boxes core width, core height, sole width and sole height should be filled in.

4. Beam width

For beam in floor thickness and lowered beam, provide the width of the beam cross-section (Figure 34).

5. Beam height

For beam in floor thickness and lowered beam, provide the height of the beam cross-section (Figure 34).

6. Core width

For T- and L-shaped beams, provide the core width of the beam cross-section (Figure 34).

7. Core height

For T- and L-shaped beams, provide the core height of the beam cross-section (Figure 34).

8. Sole width

For T- and L-shaped beams, provide the sole width of the beam cross-section (Figure 34).

9. Sole height

For T- and L-shaped beams, provide the sole height of the beam cross-section (Figure 34).

Pairing beams and alignments

For each floor level, data in the forms “pairing beams and alignments” (Figure 35) associate each alignment with the beam in the alignment itself. It has to be filled for each level and alignment. When data of a floor level/alignment and are complete, press “insert data” to save data and proceed with the next level/alignment. A line with the data of each level/alignment will be created at the bottom of the form.

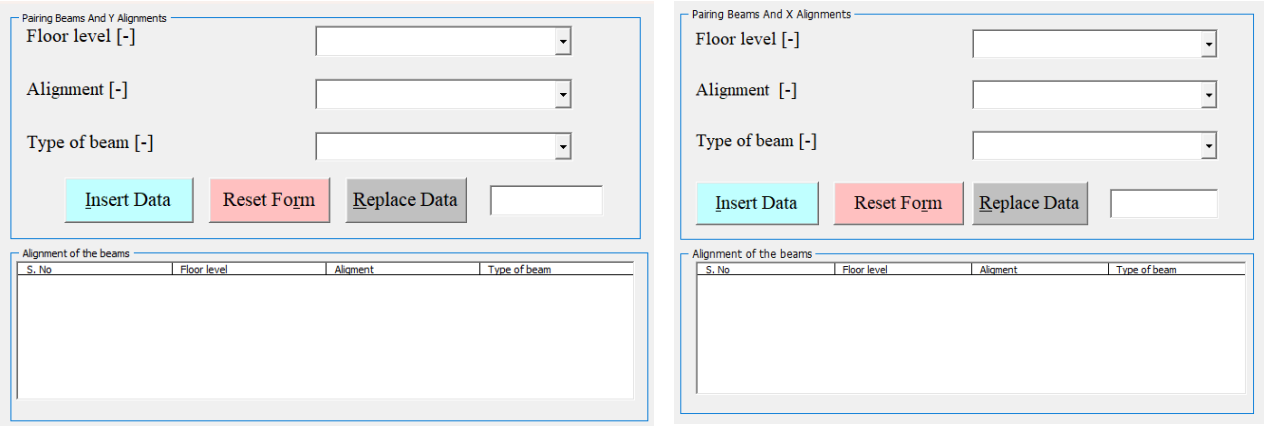


Figure 35. Forms for pairing beams and alignments (left: Y-direction; right: X-direction).

Referring to Figure 36, for each floor level and for each alignment in the X-direction as well as in the Y-direction, the type of beam must be specified.

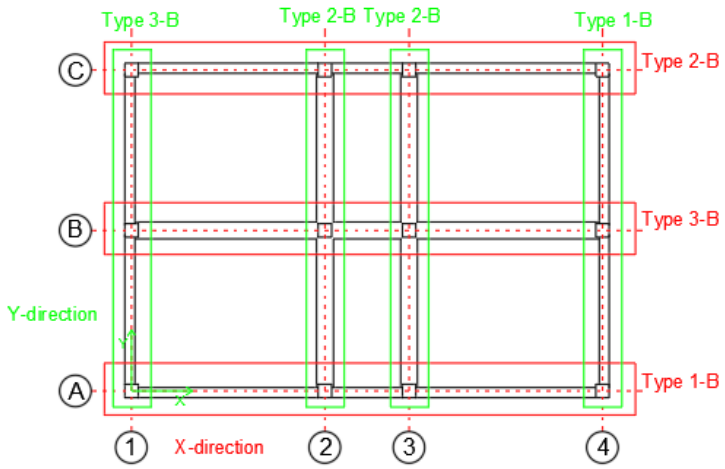


Figure 36. Definition of the beam for each alignment and floor.

1. Floor level

Provide the floor level for the current alignment and type of beam.

2. Alignment

Provide the alignment for the current type of beam.

3. Type of beam

Provide the type of the beam in the selected alignment on the selected floor level (Figure 36).

Infill parameters

The form shown in Figure 37 has to be filled for each floor level by providing the type of infill at that level and its properties (i.e.), opening distribution and rate) in the four façades. When data of a floor level are complete, press "insert data" to save data and proceed with the following floor level. A line with the data of each floor level will be created at the bottom of the form.

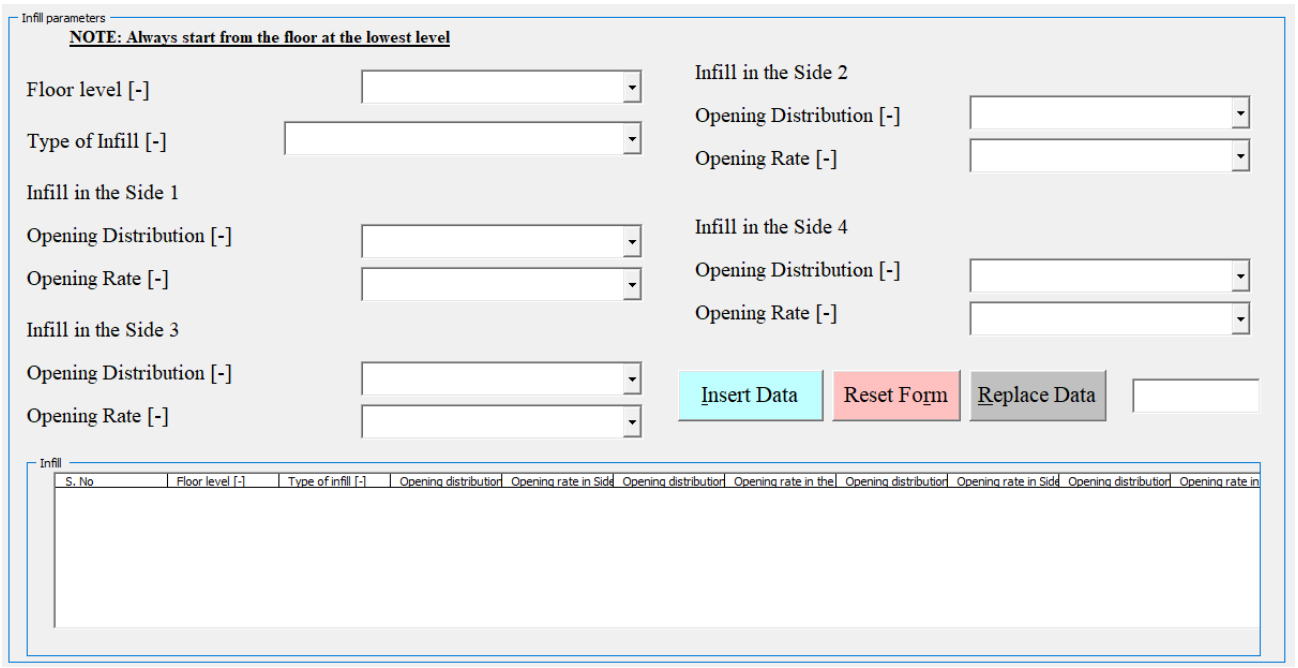


Figure 37. Form for infill parameters.

1. Type of the infill

The most representative type of infill above the current floor level shall be selected among the following options:

- Single-layer with thickness up to 25 cm;
- Single-layer with thickness from 25 cm to 30 cm;
- Multilayer with total thickness from 25 cm to 30 cm;
- Multilayer with total thickness from 30 cm to 40 cm.

2. Openings distribution

This datum shall be provided for each façade. From visual assessment, indicate whether the openings are uniformly or non-uniformly distributed, according to the example shown in Figure 38.

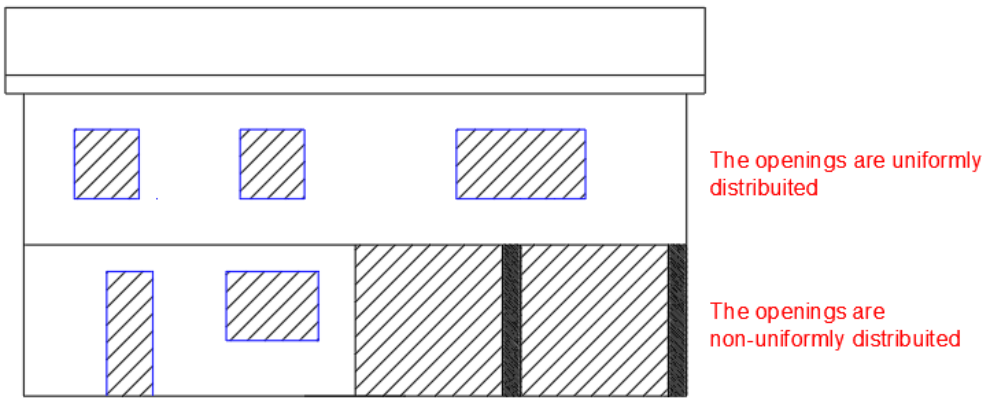


Figure 38. Opening distribution.

3. Opening rate

This datum shall be provided for each façade. From visual assessment (without calculations), indicate an approximate opening rate (rate of the area of openings to the area of the façade), referring to Figure 39.

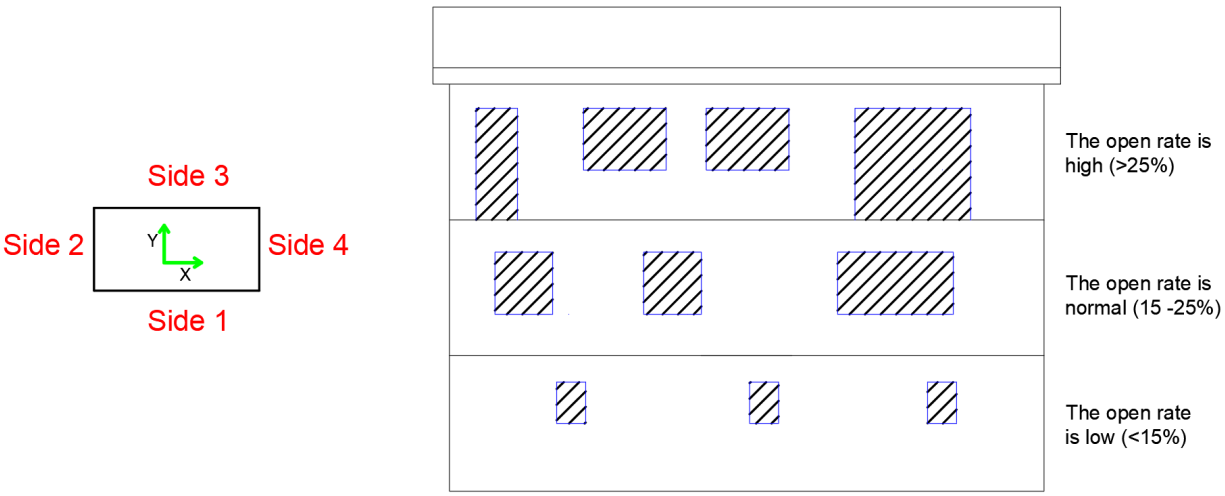


Figure 39. Opening rates.

Sides 1 and 3 are in x-direction, sides 2 and 4 are in y-direction.

Stairwell and elevator

The form shown in Figure 40 collects the data (presence, location and structure) of stairwell and elevator.

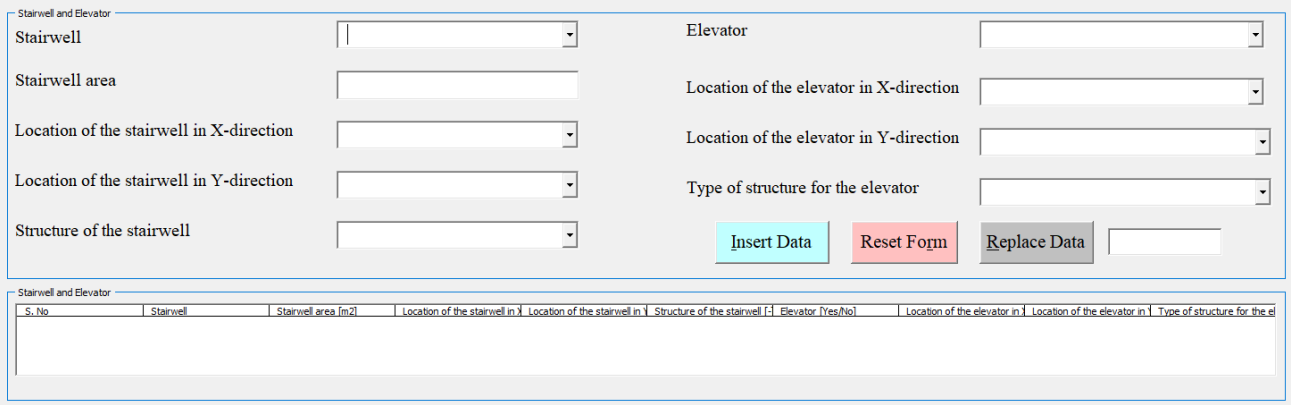


Figure 40. Form for stairwell and elevator.

1. Stairwell

Internal or external stairwell is defined according to Figure 41.

2. Stairwell area

The stairwell area is evaluated according to Figure 41.

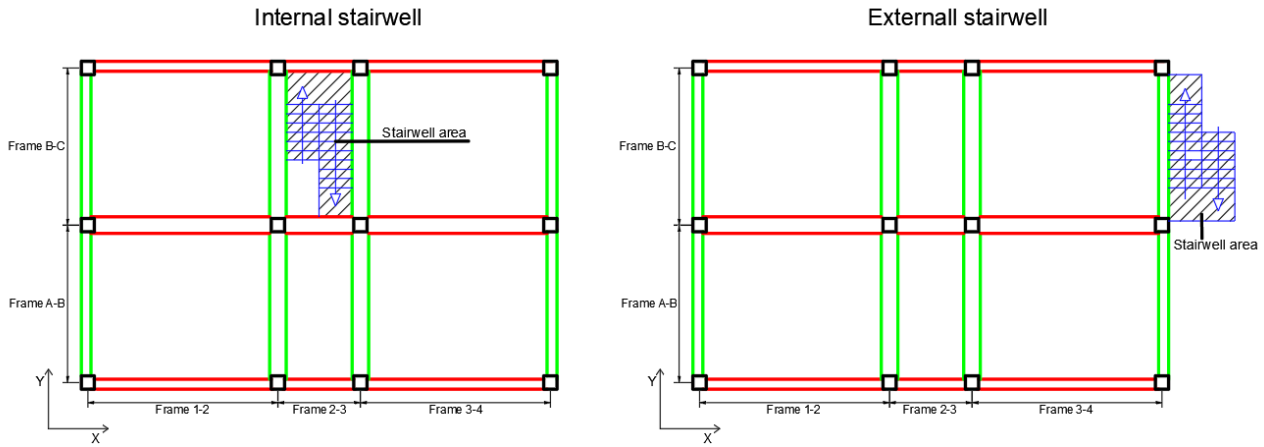


Figure 41. Internal or external stairwell and location.

3. Location of the stairwell in the X- and Y-directions

The position of the internal stairwell is identified by the names of the frames surrounding it in the X- and Y-directions; referring to Figure 41 for example, frames 2-3 and frame B-C. Data on the position of external stairwell are not required.

4. Structure of the stairwell

Select one of the following options:

- Climbing slab (Figure 42a);

- Reinforced concrete walls (Figure 42b).

a) b)

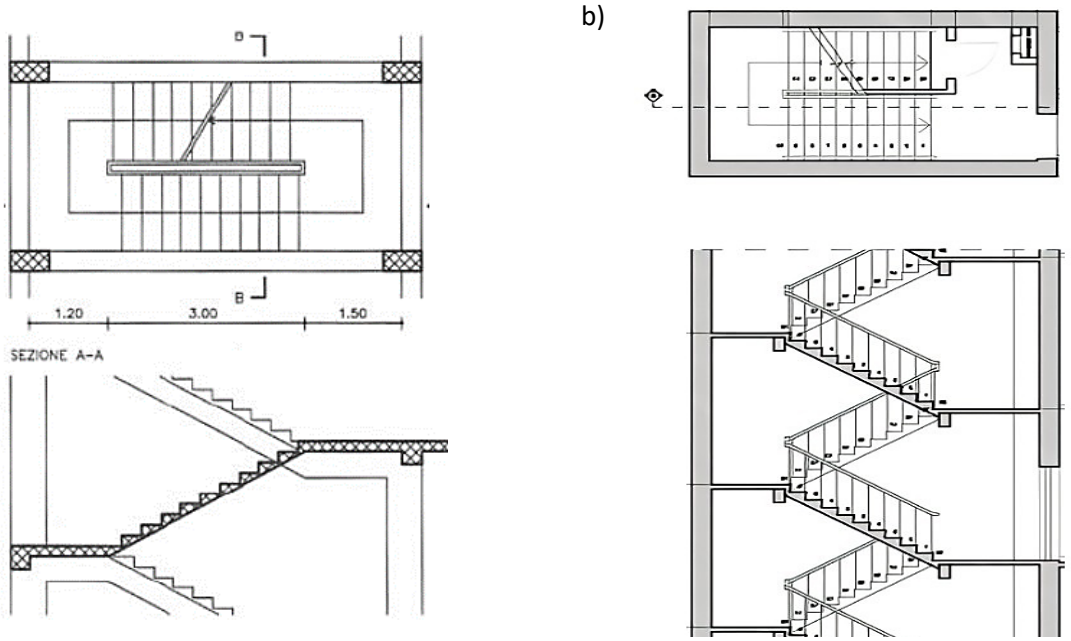


Figure 42. a) Climbing slab supported by reinforced concrete frames; b) Stairwell supported by reinforced concrete walls.

5. Elevator (Yes/No)

Indicate whether the elevator is present or not.

6. Location of the elevator in the X- and Y-directions

The position of the internal stairwell is identified by the names of the frames surrounding it in the X- and Y-directions.

7. Type of structure for the elevator

Select one of the following options:

- Independent structure (Figure 43a);

- Reinforced concrete wall (Figure 43b).

Independent structure

Reinforced concrete wall interacting with the structure.

a)

b)

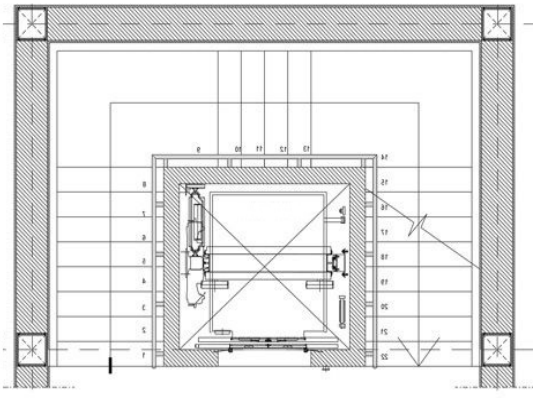


Figure 43. a) Elevator with independent structure; b) Elevator with reinforced concrete structure.