



United Nations
Educational, Scientific and
Cultural Organization



Sustainable
Development
Goals

UNESCO Guidelines for Assessing Learning Facilities in the Context of Disaster Risk Reduction and Climate Change Adaptation

VOLUME 3 - *VISUS Implementation*



UNIVERSITY
OF UDINE



SAFETY AND PROTECTION
INTERSECTORAL
LABORATORY



UNESCO Guidelines for Assessing Learning Facilities
in the Context of Disaster Risk Reduction
and Climate Change Adaptation

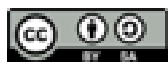
VOLUME 3

VISUS Implementation

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VISUS methodology has been conceived and developed by the SPRINT-Lab of University of Udine, Italy

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INTRODUCTION

The **UNESCO Guidelines for Assessing Learning Facilities in the Context of Disaster Risk Reduction and Climate Change Adaptation** provides comprehensive information on the Visual Inspection for defining Safety Upgrading Strategies (VISUS) methodology. The VISUS methodology aims at identifying the necessary actions for upgrading the safety of existing schools in a multi-hazard perspective, while reducing as much as possible the time and costs of the safety assessment. VISUS has adopted a triage approach for quantifying and prioritizing the safety upgrading needs of a large number of schools.

The guidelines are structured in three volumes, as follows.

Volume 1 (**Introduction to learning facilities assessment and to the VISUS methodology**) contextualized the concept of school safety and showcases its relevance in the various frameworks contributing to the Global 2030 Agenda. It provides decision-makers with clear understanding of the outcomes of the implementation of the VISUS methodology.

Volume 2 (**VISUS Methodology**) explains the theoretical aspects of the VISUS methodology, and presents in its annexes the rules and criteria that are the basis for assessment and evaluation.

Volume 3 (**VISUS Implementation**) explains the phases of VISUS implementation and presents in its annexes the tools developed for it.

In particular, this Volume illustrates the following phases:

- Preparation and organization: the organizational and logistical aspects of implementation
- Survey organization and execution: preparation for and conduct of a survey
- Automated elaboration: elaboration of survey data using the algorithms, based on the VISUS logical trees
- Automated reporting: creation of the VISUS outputs (e.g. reports, maps, databases, inventories)

Before reading Volume 3, it is recommended to understand the basics of the VISUS methodology presented in Volume 2.

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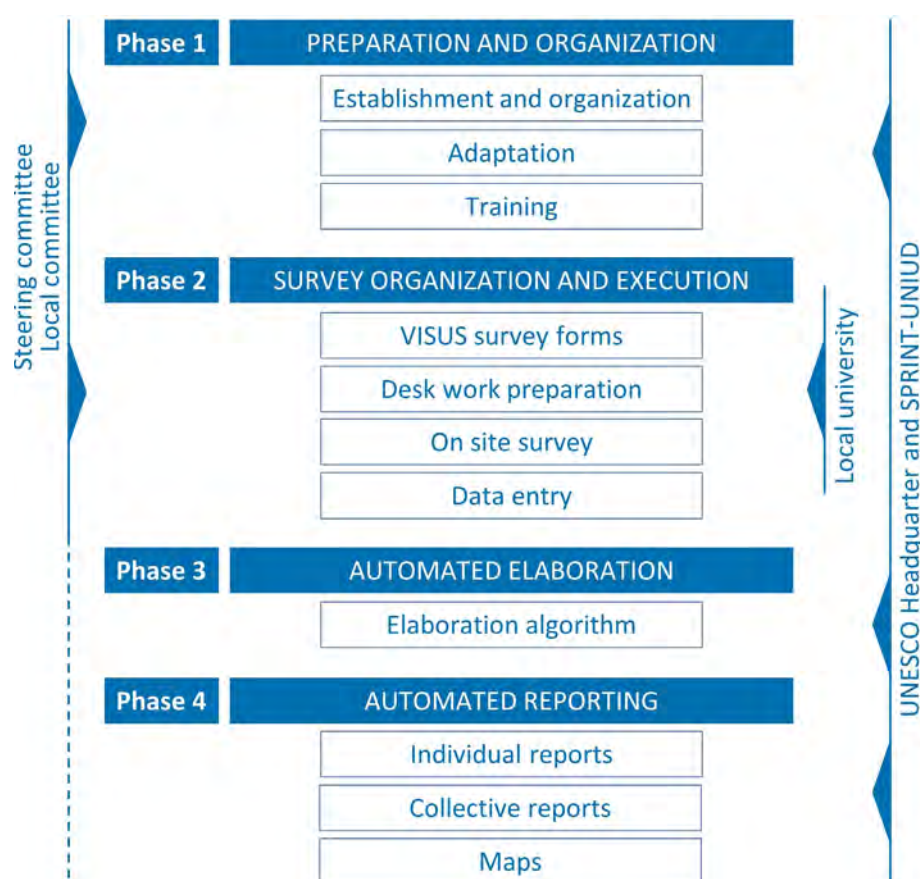
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1. PHASES OF THE VISUS IMPLEMENTATION

Volume 3 of the ‘UNESCO Guidelines for Assessing Learning Facilities in the Context of Disaster Risk Reduction and Climate Change Adaptation’ follows the structure outlined in Figure 1.1. The figure provides

an overview of the VISUS implementation process, showing the main phases and processes involved.

Fig. 1.1 *Phases of the VISUS implementation process*



The first phase of VISUS implementation is the **preparation and organization**. The core of this phase is capacity-building and knowledge transfer among the people involved in each project. Steering and local committees play key roles in this phase as they prepare all the information required for the implementation and share it with UNESCO Headquarters and the UNESCO Chair on Intersectoral Safety for Disaster Risk Reduction and Resilience at the Safety and Protection Intersectoral Laboratory of the University of Udine, Italy (SPRINT-UNIUD).

The second phase entails **survey organization and execution**. This phase aims at efficiently deploying

the surveys in schools. Steering and local committees work with local universities for this purpose.

The third and fourth phases of implementation involve **automated elaboration** of the survey data with consequent **automated reporting**, that is, the creation of the assessment reports and the definition of the indicators for decision-maker support. SPRINT-UNIUD performs these two phases using a purpose-built algorithm. The outcomes are shared with UNESCO and with the steering and local committees involved in the project.

2. VISUS IMPLEMENTATION PHASE 1: PREPARATION AND ORGANIZATION

The application of VISUS in several pilot projects (El Salvador, Haiti, Indonesia, Italy, Lao PDR, Mozambique and Peru) highlighted the importance and strategic value of effective preparation and organization to the entire process of assessment. The implementation of VISUS at the country level should start with direct involvement of the local authorities and decision-makers, that is, the recipients of the VISUS outcomes. In order to prepare and manage the implementation of VISUS locally, a local committee and a steering committee should be established.

The goals of the preparation and organization phase are:

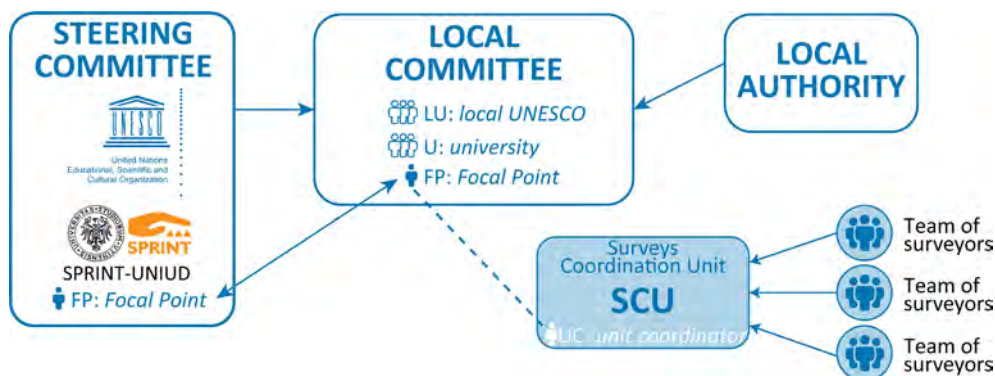
- To acquire all the information required to adapt the VISUS characterization and evaluation processes to the local (or country) circumstances
- To bring together a local team that will be responsible for overseeing capacity-building and survey-or training
- To establish a survey coordination unit to arrange the survey logistics

2.1 Establishment and organization

Various stakeholders play different roles in implementing VISUS. Figure 2.1 shows the actors involved,

their roles and how they are connected to one another.

Fig. 2.1 VISUS implementation: connections among stakeholders



The organizational structure for VISUS implementation comprises:

- A steering committee (see section 2.1.1)
- A local committee (see section 2.1.2)
- A focal point (see section 2.1.3)
- Local authorities
- Survey coordination units (SCUs) (see section 2.1.4)

2.1.1 Steering committee

The VISUS steering committee comprises staff from UNESCO Headquarters and SPRINT-UNIUD, as well as a focal point designated by the local committee.

The role of the steering committee involves:

- Adapting the VISUS methodology to the circumstances of the country in accordance with the indications provided by the local committee
- Training VISUS surveyors (i.e. local experts and students) in the particularities of VISUS and its implementation in the field

- Preparing and sharing the individual and collective reports and the maps containing the outcomes

2.1.2 Local committee

The local committee is composed of staff from the following institutions in each country of the project:

- Ministry of Education
- Universities
- UNESCO field office

Ideally, members of local technical institutions (e.g. engineers, architects) also take part in the local committee, contributing with their knowledge of local building practices.

The tasks of the local committee are:

- Preparing the groundwork for the implementation of VISUS
- Providing information for and facilitating the adaptation of the VISUS methodology to the local circumstances
- Providing technical and financial information for VISUS evaluations
- Establishing and assisting the SCUs
- Organizing the VISUS training sessions
- Finalizing the collective report with local information useful for decision-makers
- Communicating the outcomes of the project to decision-makers and providing support for the interpretation of the results, and eventually, for the establishment of prioritization strategies

2.1.3 Focal point

The focal point is a key figure in the VISUS implementation process. The role should preferably be assigned to a local expert with a technical background (i.e. an engineer or an architect) and experience in project management. The focal point is a member of both the local committee and the steering committee, and maintains contact with UNESCO and SPRINT-UNIUD during the implementation of the project.

The focal point is the point of reference for and manages the links among the steering committee, local authorities and the local committee.

The focal point's responsibilities are:

- Liaising with the local committee and steering committee and improving the exchange of information for the adaptation of the VISUS methodology to the local circumstances
- Supporting SPRINT-UNIUD researchers in the adaptation of VISUS, managing the acquisition of the preliminary information, and coordinating the translation of the VISUS training material and the survey forms into the local language
- Liaising with and sometimes coordinating SCUs

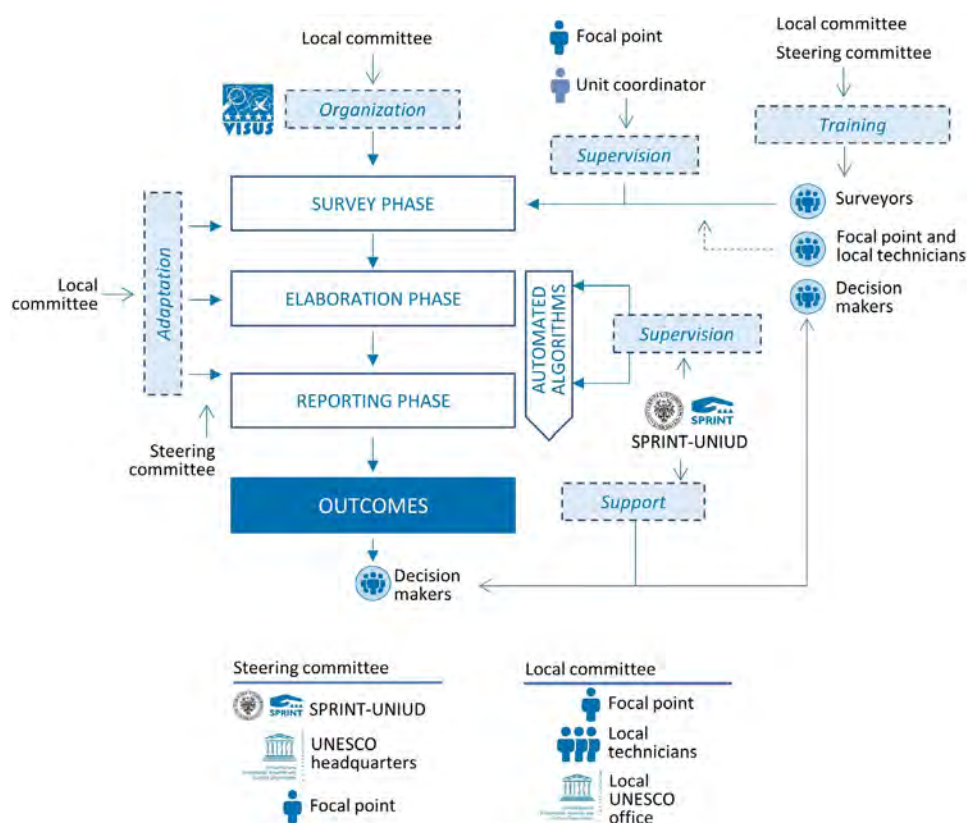
2.1.4 Survey coordination units

The SCUs manage the phase of survey organization and execution and data input for the elaboration and reporting phases. Each SCU manages one or more teams of surveyors. The SCU is headed by a coordinator, who in the case of small projects can be the focal point. The number of SCUs depends on the number and size of the schools and their location in the country.

2.1.5 VISUS implementation workflow

Figure 2.2 depicts the people involved in the VISUS implementation workflow and summarizes their main responsibilities (shaded blue boxes). The figure highlights that:

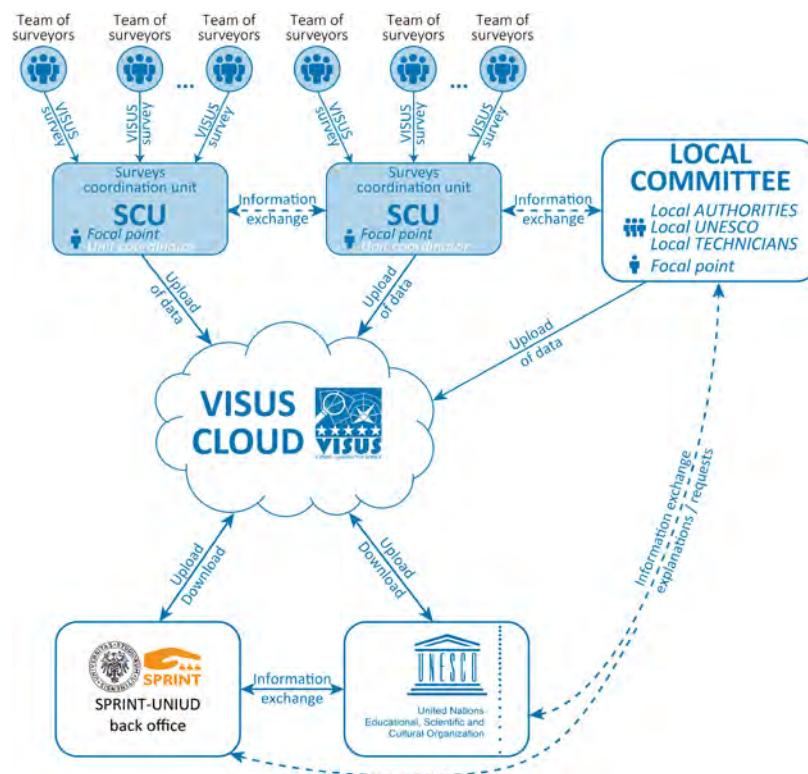
- The role of the focal point is of particular importance, as he or she is involved across all aspects of the project
- The local committee is involved in the organization of the whole project but especially in the preparatory processes of adaptation and of training of surveyors
- The steering committee, of which UNESCO is a member, is deeply involved in the preparatory processes of adaptation and training, as well as in the final delivery of outcomes to decision-makers
- SPRINT-UNIUD, as a member of the steering committee, is involved in preparatory processes, in elaboration and reporting, for which it develops algorithms, and in supporting decision-makers in the interpretation of outcomes

Fig. 2.2 People involved in the VISUS implementation workflow and their responsibilities

The local committee first makes a list of the schools to be assessed by VISUS in accordance with the requests of the local authorities. The local committee then proceeds with setting up an adequate number and appropriate distribution of SCUs, giving consideration to the number and size of the schools on the list together with their location in the country. Each SCU manages the assessment of its assigned set of schools. The coordinator of each SCU organizes the VISUS surveyors into teams of at least three persons, giving consideration to the number of schools to be assessed and the schedule arranged for the surveys. Figure 2.3 shows the recommended organizational structure for efficiently implementing VISUS in a country. If this proposal is adopted, VISUS implemen-

tation proceeds as follows. Survey teams are trained, at the country level, on how to inspect schools using the VISUS methodology. The surveyors carry out a survey of each school using the VISUS tools. Each team reports to the coordinator of the applicable SCU – at the country level. After a preliminary validation of the survey data, each SCU uploads the survey data to the VISUS cloud, while liaising with the focal point on information exchange or with specific requests. The focal point maintains contact with the SPRINT-UNIUD back-office. The SPRINT-UNIUD back office and UNESCO Headquarters use the data in the VISUS cloud for elaboration and reporting.

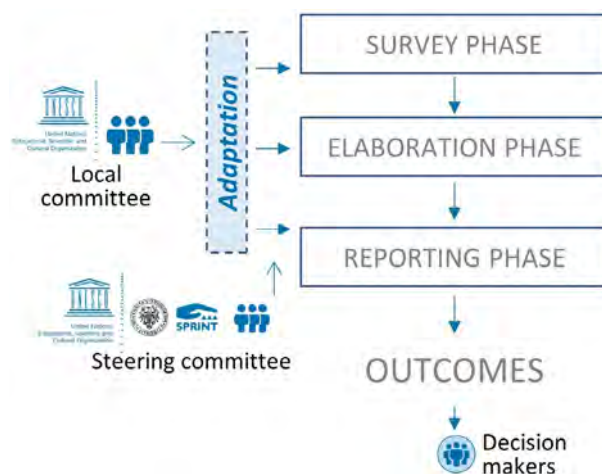
Fig. 2.3 Organizational structure proposed for implementing VISUS



2.2 Adaptation

The implementation of VISUS in a country, region, district or city requires the adaptation of some parameters of the VISUS methodology to take into account the specific circumstances that apply. Figure 2.4 is an overview of adaptation in the VISUS implementation process. While adaptation is a core task of preparation and organization (phase 1), it influences all phases of VISUS implementation.

Fig. 2.4 Adaptation in the VISUS implementation process



The focal point, with the support of the local and steering committees, is responsible for providing the information relevant to adaptation of the VISUS methodology to the local circumstances. The required information is summarized as follows:

- **General information for the characterization of the schools**, such as location, school types (e.g. levels of education), number of students and similar data available in an existing school inventory, and main local building types (with representative photos).
- **Hazard information**, listing and characterizing the hazards that potentially affect the country (with hazard maps, if possible). Reports or photos concerning the effects of hazardous events on buildings are desirable as they strongly support the adaptation of the triggering tables.
- **Building codes** relevant to each type of hazard, both current and archived versions. If there are no building codes, other references such as guidelines for typical building construction are desirable.
- **Technical information for the assessment of structural capacity**, which includes: comments on building codes, with comparisons of current and past structural demands; research papers describing the assessment of structural capacity in

accordance with the country's requirements (e.g. fragility curves for all types of hazards, empirical evaluations of structural behaviour from damage assessments); and calibration of the triggering tables of the evaluation procedure for the local building types.

- **Technical information on safety upgrading measures**, listing and describing briefly local safety upgrading measures ('interventions') typically adopted in learning facilities for renovating, repairing and retrofitting buildings.
- **Technical and financial information on safety upgrading measures and actions**, including: the

typical cost (range) for constructing new learning facilities, with a description of the main features of the buildings (e.g. building type, dimensions, number of floors); an estimation of the cost (range) for typical interventions in schools; and potential cost modification parameters, such as the location, construction site and unforeseen interventions.

Further details on this information are provided in Annex A11, in which Chapter 1 lists the documents and other information to be uploaded to the VISUS cloud, and Chapter 2 includes the VISUS adaptation forms – which summarize the adaptation information – to be compiled for each project.

2.3 Training

Training is an essential component of the implementation of VISUS, and is especially integral to building the capacity of trainees.

Customized training is provided for:

- Decision-makers
- Trainers
- Surveyors

The training of decision-makers focuses on their needs (see Volume 2, section 1.1) and how VISUS could be used as a support tool for defining prioritization strategies for safety upgrading actions.

The training of trainers (and of focal points) focuses on technical issues. The topics covered concern:

- The technical approach to the VISUS methodology, with a focus on the expert reasoning process and its phases of characterization, evaluation and judgement
- The evaluation phase, with a focus on the expert reasoning approach (in particular on the logical trees) and on adaptation
- Safety indicators and their meaning
- The reasoning process for evaluating safety upgrading needs
- Technical definitions concerning hazards and buildings

- Examples of application of the VISUS methodology in pilot projects
- The organization of SCUs

The training of surveyors includes all the methods and criteria surveyors need to understand to efficiently inspect schools. This training is divided into several modules, which together cover:

- The purpose of the VISUS methodology, and in particular, of the characterization phase
- The VISUS observables and reference events, with examples such as photos and videos
- The organization of the inspections, the roles of the surveyors, and the tools to use during the survey, with particular attention paid to mobile devices in this regard
- The process for uploading the survey data to the VISUS cloud

Usually, a training session requires four days: half a day with decision-makers, half a day with trainers and three days with surveyors. During the surveyor training, a half day is assigned for a field test, during which the supervised survey of several school buildings identified by the focal point is carried out.

3. VISUS IMPLEMENTATION PHASE 2: SURVEY ORGANIZATION AND EXECUTION

The VISUS survey aims at collecting all the substantial elements defined in the characterization phase of the expert reasoning process (see Volume 2, section 3.1). The survey, which is based on a pre-codified survey form, is the main activity of the characterization phase and comprises an on-site inspection of the school carried out by trained VISUS surveyors (see section 3.1 in Volume 2).

The survey requires organization, a method and a logistical approach. Survey strategies and forms are therefore used to facilitate the inspections and make them more effective.

The VISUS survey forms support the surveyors during

their inspections of the schools. The forms have fields for collecting general information on the school, and observables (OBS) for acquiring the substantial elements. The OBS are organized in groups reflected in sections of the form that distinguish:

- The components to be inspected: location/site, schoolyard and buildings
- The hazards to be considered: air, earthquake, water and fire as well as the threats that might arise during ordinary use

The VISUS survey forms and survey strategies are described and shown in sections 3.1 and 3.2, respectively.

3.1 Survey forms

The VISUS survey forms enable surveyors to collect and organize the OBS and reference events (rE) identified as substantial elements during the characterization phase of the VISUS expert reasoning process (see Volume 2, section 3.1).

The forms are shown in Figures 3.1, 3.2 and 3.3, and are described in detail in Annex A12. They are organized in sections that correspond to the survey phases. Each section groups the OBS and the other substantial elements to be identified during the survey with reference to the hazard considered. The master version of the forms is in English; in the adaptation phase they are usually translated into the local language and these versions are used by the surveyors.

During the implementation of the VISUS pilot projects, several versions of the survey forms were created and used. This handbook shows version 3.0, which was validated after the First Meeting of VISUS Experts, held in Udine, Italy, in 2018.

3.1.1 Paper versus digital survey forms

The VISUS survey forms are designed with the requirement to keep on record a printed copy as well as a digital one in mind. Surveyors can fill in either paper or digital survey forms during a survey.

Paper survey forms must be printed before the survey is commenced. This means that surveyors need to know the expected number of buildings in the school.

- Advantages:
 - Enable a simpler and faster survey for surveyors with basic IT skills (experience has shown)
 - Provide the surveyor with a better visual overview of the collected data and photos
 - Provide an easy means for the surveyor to take notes
 - Provide an opportunity for verification and reconsideration of the data, as well as an exchange of views with other surveyors and the SCU coordinator, when the surveyor fills in the digital version of the survey forms from the paper copy
- Disadvantages:
 - Require desk time after the survey to fill in the digital version of the survey forms from the paper copy

Digital survey forms are prepared using PDF modules so that surveyors can use a mobile device (i.e. tablet, smartphone or laptop), if one is available, to prepare the digital copy of the forms directly.

- Advantages:
 - Enable a faster survey for surveyors with good IT skills, because if the school has very similar buildings, it is possible to copy the first completed form and adapt the data, with a few adjustments, for each building, and because the 'search' function can be used to find the OBS for specific issues
 - Require no desk time after the survey
 - Require no paper (i.e. environmentally friendly)

- Disadvantages:
 - Require the surveyor to have good IT skills
 - Surveyors have a poor visual overview of the collected data
 - Require security measures to prevent theft of equipment

3.1.2 Structure of the survey forms

The VISUS survey forms comprise six pages divided into eight sections, which correspond to the survey phases (see Figures 3.1, 3.2 and 3.2).

Pages 1 to 4 of the forms use blue shading, while pages 5 and 6 use orange – this colour difference has been applied because the pages should be filled in by different surveyors (see section 3.2.1.1 for an explanation regarding the various surveyors).

Table 3.1 outlines the structure of the forms.





































Fig. 3.1 *VISUS survey forms: SP0, SP1 and SP2*

[illegible][illegible]

Fig. 3.2 *VISUS survey forms: SP3 and SP4*

[illegible]

Fig. 3.3 VISUS survey forms: SPS and SPN



VISUS MULTI-HAZARD SURVEY

SCHOOL SKETCH and NOTES

SPS

Building plan
Sketch or structural
expansion joint
60° Name of the building

→ Access to school complex
→ Access to school buildings
→ Point of view of photos
1/2 and shot number

→ Fences
→ School complex property
→ North direction
(symbol rotation as needed)





































School ID CODE

Time CODE

Survey DATE

SPN

SPN

VISUS logo" data-bbox="118 868 148 888"/>






VISUS MULTI-HAZARD SURVEY

NOTES

SPN

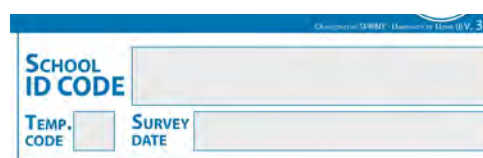
SPN

Table 3.1 Structure of the VISUS survey forms

Filename	Page	Colour	Survey phase	Icon	Content
XX_VISUS_survey_vv_SC.pdf	1	Blue	SP0		General information concerning the school (identification, contacts, use), the surveyors (identification) and the hazards
	2	Blue	SP1		Inspection of the school location
	2	Blue	SP2		Inspection of the schoolyard
XX_VISUS_survey_vv_Bn.pdf	3	Blue	SP3		External inspection of a school building
	4	Blue	SP4		Internal inspection of a school building
XX_VISUS_survey_vv_SC.pdf	5	Orange	SPS	–	Space for sketching the school
	5	Orange	SPN	–	Space for taking notes
	6	Orange	SPN	–	Space for taking notes







The header of each page of the form highlights the survey phase in which it should be compiled and provides some hints on what to do in that phase (see section 3.2 for more details). Furthermore, in the header, there is space for the school ID code and for the survey date (Fig. 3.4). The header also has space for assigning a temporary code surveyors can use while taking notes. However, in the final version, the temporary code will not be used.

Note The school ID code must be univocal. It is generally assigned by the Ministry of Education to each school.

Fig. 3.4 VISUS survey form header information


The sections SP1, SP2, SP3 and SP4 of the survey forms are divided into six subsections in order to separate the OBS in accordance with their relevance for each hazard (Table 3.2).

Table 3.2 Subsections of the SP1, SP2, SP3 and SP4 VISUS survey forms

Aspect	Abbreviation	Icon	Content	Form
General	G		Observables (OBS) required for the evaluation of all hazards	SP1, SP3, SP4
Ordinary use	U		OBS required for the evaluation of ordinary use	SP1, SP2, SP3, SP4
Fire	F		OBS required for the evaluation of fire hazard	SP1, SP2, SP3, SP4
Water	W		OBS required for the evaluation of water hazard (flood, tsunami)	SP1, SP2, SP3, SP4
Earthquake	E		OBS required for the evaluation of earthquake hazard	SP1, SP2, SP3, SP4
Air	A		OBS required for the evaluation of air hazard (strong wind)	SP1, SP2, SP3, SP4
Status	S	–	OBS required for the evaluation of the status of the school	SP2, SP4

The digital version of the VISUS survey forms consists of two PDF files named:

- *XX_VISUS_survey_v.v_SC.pdf*: contains the SP0, SP1, SP2, SPS and SPN sections (i.e. pages 1, 2, 5 and 6)
- *XX_VISUS_survey_v.v_Bn.pdf*: contains the SP3 and SP4 sections (i.e. pages 3 and 4)

The name of the files is altered considering that:

- The letters 'XX' refer to the language of the forms (e.g. 'EN' for English, 'BH' for Bahasa Indonesia, 'SP' for Spanish, 'FR' for French, 'PR' for Portuguese)
- The letters 'v.v' refer to the version of the forms (e.g. '3.0')

3.1.3 Observables

During VISUS surveys, OBS and rE are identified (recognized and acquired) (see section 3.1.1 of Volume 2 for more information).

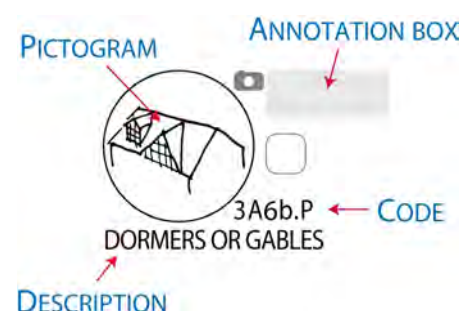
A VISUS OBS is defined by the following elements (Fig. 3.5):

- **Pictogram**. A graphical representation of what

the surveyor should identify, that is, the scenario or the feature.

- **Description**. A brief textual description of the scenario or feature to be identified.
- **Code**. A univocal code assigned to each OBS.
- **Annotation box**. A place for annotating the photos representing the OBS, where the surveyor can write the name of the photo that captures evidence of the presence of the OBS.

Fig. 3.5 Example of a VISUS observable showing the elements that define all observables



There are three types of OBS, and they can be distinguished by looking at the frame containing the pictogram (Table 3.3).

Table 3.3 VISUS observable types have different frames for the pictogram

OBS pictogram frame	OBS type	Meaning
	Typological	The surveyor has to recognize the presence of the scenario or feature illustrated in the pictogram.
	Behavioural	The surveyor has to evaluate the predisposition of the actual situation to show, in the case of an adverse event, the behavioural scenario illustrated in the pictogram. The adverse event to consider is illustrated at the bottom-left of the circle.
	Status	The surveyor has to recognize the presence of the scenario or feature illustrated in the pictogram, which characterizes the status.

3.1.3.1 Observables codes

In order to be able to simply refer to the OBS, a code has been assigned. The code is defined by a sequence of five characters, as follows (Fig. 3.6):

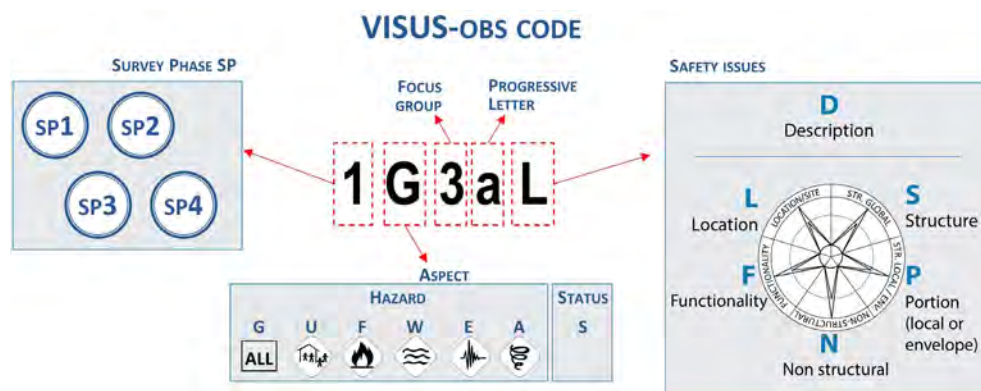
- 1st character. *Number*. Survey phase
- 2nd character. *Letter*. Aspect (using the letter reported in the column 'Abbreviation' in Table 3.2)

3rd character. *Number*. Focus group

4th character. *Letter*. Progressive letter assigned to each OBS in the focus group

5th character. *Letter*. Safety issues (defined in accordance with Fig. 3.6, and section 1.1.3.1 of Volume 2)

Fig. 3.6 Definition of the VISUS observables code



3.2 Survey strategy and procedures

The VISUS survey is divided into three phases: desk work preparation, on-site survey and data entry. Details of these phases are provided in the following sections.

3.2.1 Desk work preparation

The desk work preparation phase comprises the organization of the VISUS survey teams, the preliminary acquisition of data and the preparation of the tools for the survey.

3.2.1.1 Organization of the survey teams

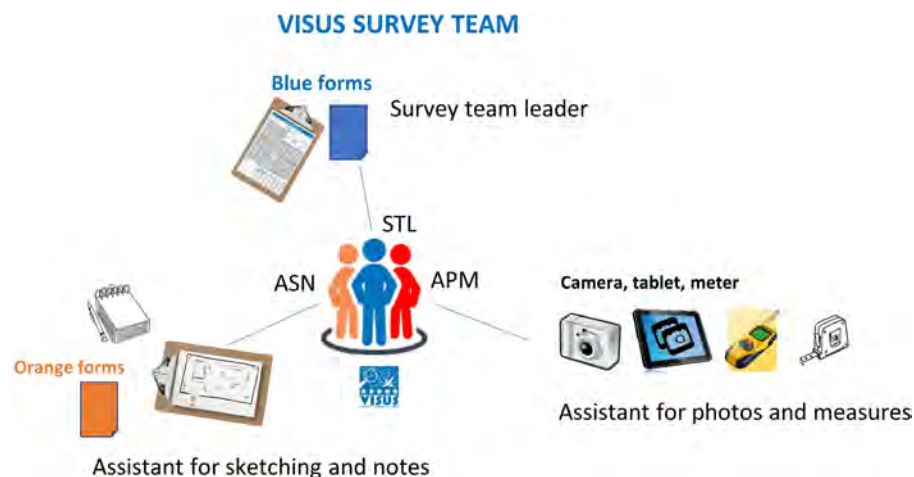
The coordinator of the SCU organizes the trained VISUS surveyors into teams. Taking into account the number of schools to be assessed and the schedule

arranged for the surveys, the survey team is formed with at least three trained surveyors, each with a specific role (Fig. 3.7):

- The **Survey Team Leader** (STL) leads the survey team, establishes how to proceed with the survey, and fills in the blue pages of the survey forms
- The **Assistant for Sketching and Notes** (ASN) sketches the school complex, annotates on the sketch the position, view and the number of the photos, and takes notes of the observations of the survey team
- The **Assistant for Photos and Measures** (APM) takes photos according to the STL's indications and shares with the ASN the photos to annotate

All the survey team members should agree on the observations and on the notes made in the forms.

Fig. 3.7 VISUS survey team: definition of roles



3.2.1.2 Preliminary acquisition of data

During the desk work preparation for the survey, the surveyors will:

- Receive the list of the schools to survey. The school ID codes will be their reference IDs.
- Acquire preliminary information on each school using available documents and online data, and:
 - Identify the position of the school on online maps
 - Identify (or assess) the potential number of school buildings
 - Save a screenshot of the map showing the location of the school (named *IDCode_Location.jpg*) (Fig. 3.8 shows an example of a location image)
 - Save a screenshot of the map of the school, zooming in on the schoolyard (named *ID-Code_Context.jpg*) (Fig 3.9 shows an example of a context image)
 - Find contact information and call the school to agree on the survey date
- Prepare the survey forms both in paper and digital versions (see section 3.1.1 for the advantages and disadvantages of the two versions). Figures 3.10 and 3.11 show a schema of the folder to be prepared during the desk work preparation for each school and an example of a school folder prepared before the survey, respectively. Concerning the files:
 - Create in the survey device a copy of the *XX_VISUS_survey_v.v_SC.pdf* file and rename it, including, at the beginning of the filename, the school ID code; the new name will have the format *IDcode_XX_VISUS_survey_v.v_SC.pdf*
 - Create in the survey device a copy of the *XX_VISUS_survey_v.v_Bn.pdf* file and rename it, including, at the beginning of the filename, the school ID code – one file should be created for each school building, with the number 'n' at the end of the filename changed:

the new name will have the format *IDcode_XX_VISUS_survey_v.v_Bn.pdf*

- Pre-compile, with the support of the SCU, the survey forms, using the available data. Almost all the SPO section (except 'Use of the school' and 'Hazardous events – experienced') and almost all the SP1 section should be able to be pre-compiled.

Fig. 3.8 Example of a location image

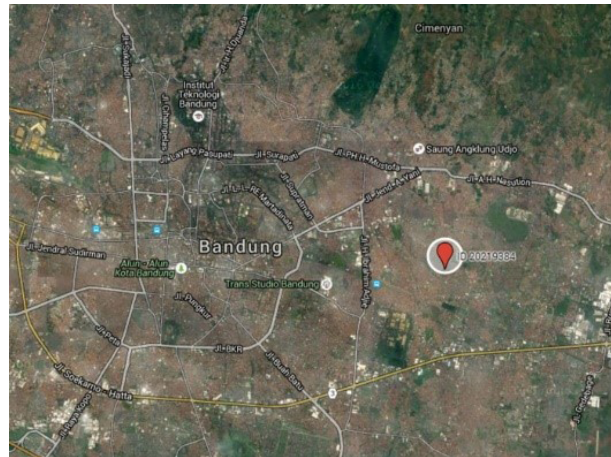


Fig. 3.9 Example of a context image

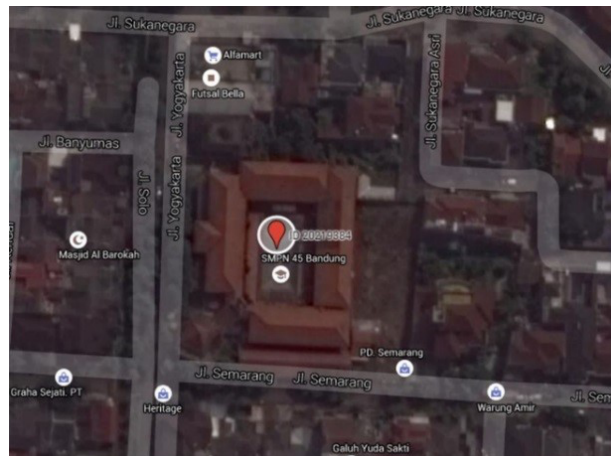
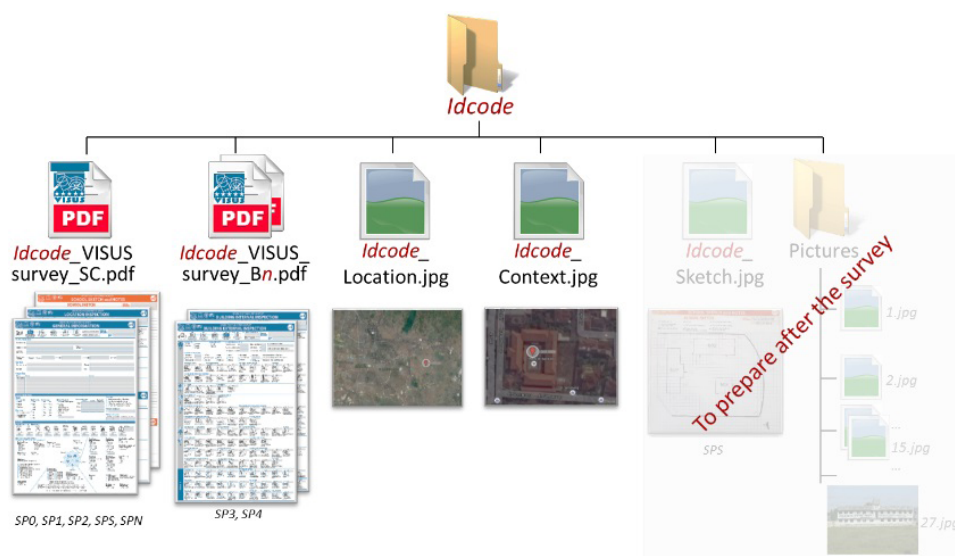
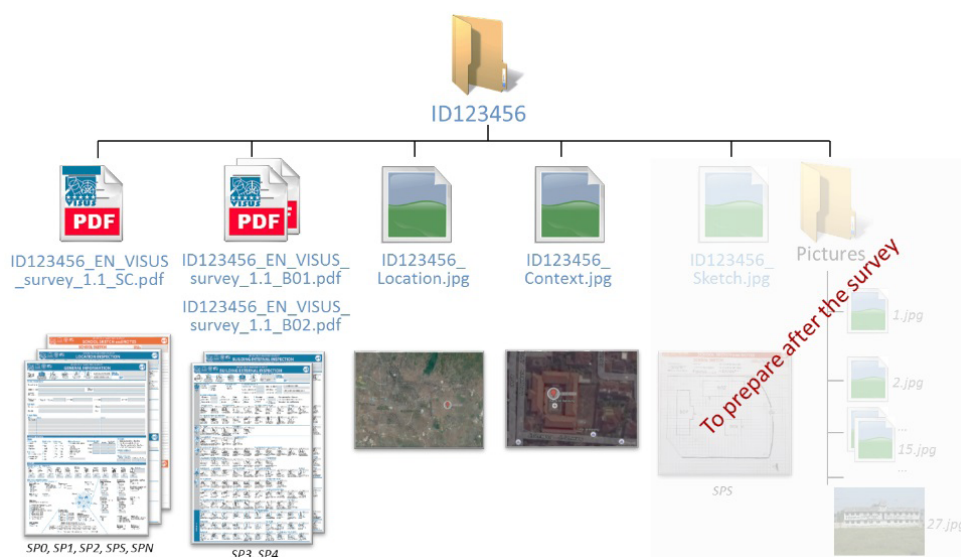


Fig. 3.10 Schema of the school folder to be prepared before the VISUS survey**Fig. 3.11** Example of a school folder prepared before the VISUS survey for a school with the school ID code ID123456

3.2.1.3 Preparation of the tools for the survey: VISUS kit

The following tools are essential for conducting the VISUS survey:

- Clipboard with paper copies of the survey forms (these should always be available, even if the surveyors later decide to use the digital version of the forms)
- Tablet or smartphone with camera (or camera with GPS)
- Office supplies (pens of different colours, pencil, eraser, notepaper)
- Measuring tape
- Small hammer

- Stick of wood or metal
- Technical equipment (e.g. laser distance meter, digital wall scanner and detector)

Surveyors should bring with them to the survey their identification badge (a general ID), a backpack and a printed copy of the slides shown during the training to refer to.

3.2.2 On-site survey

The main purpose of the VISUS survey is to characterize the school for the subsequent elaboration of the data in phase 3 of the VISUS implementation process. The survey also improves the skills of VISUS surveyors through learning-by-doing. During the inspection,

surveyors use the VISUS survey forms, which help them recognize the presence, in the school they are inspecting, of situations that can be characterized by the OBS. Surveyors note the presence of OBS on the forms and take photos of these features or scenarios.

Experience suggests that organizing the survey in a specific sequence of phases saves time and maximiz-

es the effectiveness and thoroughness of the inspection (Fig. 3.12). The sequence of pages in the survey forms is the same as that of the inspection phases, that is, location, schoolyard, building-external and building-internal. Furthermore, the top of each page of the survey forms highlights the current phase, thus guiding the surveyors during the inspection.

Fig. 3.12 Phases of the VISUS survey, as illustrated on the VISUS survey forms



If, during the inspection, surveyors recognize the presence of unsafe situations, they note them in the notes space of the survey forms and take photos showing the problem. One of the outcomes of the survey is therefore a photographic report of the school that highlights the critical safety issues. The survey forms have fields for recording the photo numbers in order to associate the characterized OBS to the photo.

Figure 3.13 shows an example of a filled in digital survey form (SP2). In the digital version of the form, the inputs are coloured red so as to be more evident. The 'X' indicates that an OBS has been recognized, and the number above the 'X' is the photo number.

Surveyors also sketch the school, producing a representation of the school buildings and of the school complex.

Fig. 3.13 Example of a filled in VISUS survey form (SP2 of digital version)

The form is titled "VISUS MULTI-HAZARD SURVEY SCHOOLYARD INSPECTION" and is for phase SP2. It includes a progress bar at the top showing the sequence of phases. The form is divided into several sections, each with a category icon and a list of hazards with checkboxes and photo numbers (e.g., 2511N, 2512N, etc.).

U1. DANGERS (U icon):

- 2511N POTENTIAL FALLS FROM TERRACES, STEEP SLOPES, ... (X)
- 2512N HOLES OR POTHOLES (X)
- 2513N UNSAFELY COVERED HOLES (X)
- 2514N POTENTIAL COLLISION WITH OBJECTS OR SHARP OBJECTS (X)
- 2515N POTENTIAL COLLISION WITH FLOOR OR ROOFING (X)
- 2516N POTENTIAL COLLISION WITH UNSEEN HAZARDS (X)
- 2517N POTENTIAL COLLISION WITH DANGEROUS ANIMALS (X)
- 2518N MUD (X)
- 2519N INVESTIGATION OF WASTE COLLECTION OR NOXIOUS AREA (X)

F1. IGNITION SOURCES (F icon):

- 2511N FREE FLAME NEAR COMBUSTIBLE ELEMENTS (X)
- 2512N ELEMENTS WITH POTENTIAL AUTO-IGNITION (X)
- 2513N ACCUMULATION OF COMBUSTIBLE ELEMENTS (X)
- 2514N DRY WIDE-LEAF BRUSHES (X)
- 2515N EXTINGUISHERS (X)

W1. PROTECTION FROM WATER (W icon):

- 2511N SCHOOL COMPLEX ON AN ELEVATED SITE (X)
- 2512N POTENTIAL SCHOOL COULD BE DAMAGED BY FLOODING (X)
- 2513N LEVEL ON IMPERMEABLE GROUND OR WITH PUMPS (X)
- 2514N IMPERMEABLE GROUND (X)
- 2515N RELEASE OF CONTAMINANT CONTENT IN THE FLOOD-WATER (X)
- 2516N SAFE AND DRY AREA (X)

E1. FALLS OF ELEMENTS (E icon):

- 2511N POTENTIAL FALLS OF ELEMENTS (X)
- 2512N POTENTIAL FALLS OF ELEMENTS (X)
- 2513N POTENTIAL FALLS OF ELEMENTS (X)
- 2514N POTENTIAL FALLS OF ELEMENTS (X)
- 2515N POTENTIAL FALLS OF ELEMENTS (X)
- 2516N POTENTIAL FALLS OF ELEMENTS (X)
- 2517N POTENTIAL FALLS OF ELEMENTS (X)
- 2518N POTENTIAL FALLS OF ELEMENTS (X)
- 2519N POTENTIAL FALLS OF ELEMENTS (X)

A1. PROTECTION (A icon):

- 2511N STABLE WIND BARRIERS (X)
- 2512N POTENTIAL FALLS OF ELEMENTS (X)
- 2513N POTENTIAL FALLS OF ELEMENTS (X)
- 2514N POTENTIAL FALLS OF ELEMENTS (X)
- 2515N POTENTIAL FALLS OF ELEMENTS (X)
- 2516N POTENTIAL FALLS OF ELEMENTS (X)
- 2517N POTENTIAL FALLS OF ELEMENTS (X)
- 2518N POTENTIAL FALLS OF ELEMENTS (X)
- 2519N POTENTIAL FALLS OF ELEMENTS (X)

S1. ACCESSIBILITY (S icon):

- 2511N ACCESSIBILITY BARRIERS TO SCHOOL COMPLEX (X)
- 2512N MOBILITY BARRIERS IN THE SCHOOLYARD (X)
- 2513N WATER (X)
- 2514N SEWER (X)
- 2515N CESSPOOL (X)
- 2516N LIGHTING (X)
- 2517N PLAYGROUND EQUIPMENT AND/OR SPORT FIELDS (X)
- 2518N CAR PARKING AND DRIVEWAYS (X)
- 2519N WASTE COLLECTIONS AND COLLECTION AREA (X)

S4. SECURITY (FENCES AND ACCESS GATES) (S icon):

- 2541N NO FENCE (X)
- 2542N PARTIALLY FENCED (X)
- 2543N FULLY FENCED (X)
- 2544N LOW FENCE (X)
- 2545N HIGH FENCE (X)
- 2546N OPEN ACCESS (X)
- 2547N CONTROLLED ACCESS GATES (X)
- 2548N DISADVANTAGED LOCATION (X)
- 2549N CONTRAINDICATIONS IN THE SITE CHARACTERIZATION (X)

3.2.2.1 Survey strategies

The following procedures for VISUS surveyors are suggested to optimize the efficiency of the surveys:

- Ask questions to school personnel to complete the general information on school (SP0) and verify the fields pre-compiled during desk work preparation (SP0 and SP1)
- Analyse the environmental context (SP1), and verify the fields pre-compiled during desk work preparation
- Determine the school's features: walk around the schoolyard and identify the schoolyard area, the school buildings (main and ancillary), and accessories (Fig. 3.14)
- Sketch the school (SPS) (the sketch can also be used as a map during the survey)
- Assign codes to the main buildings and then the ancillary buildings (name them as B01, B02, etc.)
- Proceed with a survey of the schoolyard (SP2): check for the presence of OBS, take photos of the OBS, and write the photo number next to the OBS on the form
- Proceed with a survey of each building:
 - External survey (SP3): check for the presence of OBS, take photos of the OBS, and write the photo number next to the OBS on the form
 - Internal survey (SP4): check for the presence of OBS, take photos of the OBS, and write the photo number next to the OBS on the form
- Take notes on any aspects that are not pre-codified in the survey forms, writing a short description of the identified problem

- Each building: representative photo
- Each building: overview photos
- OBS identified
- Sections and details of buildings: close-up photos
- Specific connections (e.g. walls, roofs): close-up photos
- Damage, dangers or hazards that can be seen (including those related to access or entrance to the school)
- Situations of inadequacy related to water, sanitation and waste
- Sketch of the school complex (SPS)

Some tips for surveyors for taking effective photos are:

- Use automatic settings of the camera (unless you are an expert)
- Give preference to landscape (horizontal) format photos
- Try to not focus on faces, because it will be necessary to hide the faces using photo editing software before uploading the photos
- Make sure that the camera saves the coordinates of the photo (if this function is available in the camera settings on the mobile device or on the camera)
- Avoid using the zoom function if using a smartphone or a tablet to take the photos
- Take a single shot (avoid the panorama option or any automatic combination of multiple photos [rare exceptions are allowed, for complex conditions])
- Avoid taking backlit photos
- Check the quality of your photo: if it is not good, delete it and take another one

3.2.2.2 Photographic description

Photographic description is an important part of the VISUS survey, contributing greatly to identifying and characterizing the school and each of its buildings. The purpose of photographic description is to produce a set of photos that shows the main features recognized during the inspection. The task is assigned to the APM surveyor.

At a minimum, photographic description should include photos of:

- School sign (if one exists)
- School site
- School complex: representative photo
- School complex: overview photos
- Access or entrance to the school
- Schoolyard: representative photo
- Schoolyard: overview photos

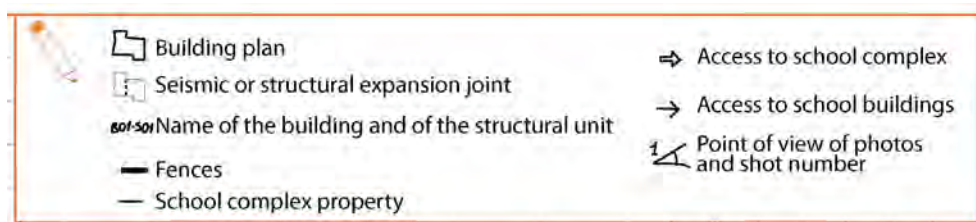
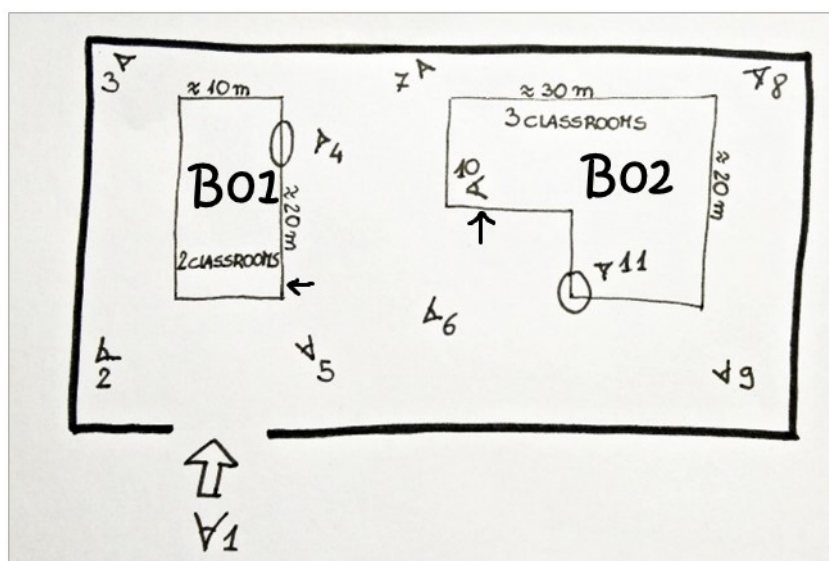
3.2.2.3 Sketching

Surveyors should sketch the school complex on the SPS survey form.

The building plan should be clearly recognizable from the sketch, and the building codes (e.g. B01, B02) should be included.

Figure 3.14, which is the legend for the sketch from the survey form, shows the elements to be included on the sketch. Figure 3.15 shows an example of a sketch.

Note *It is possible to draw, in pencil, the sketch during the desk work preparation for the survey, using online maps as the basis (e.g. those used for the context image). The task of sketching during the survey is thereby simplified, as the draft sketch will only need to be confirmed or adapted.*

Fig. 3.14 Legend for the sketch of the school complex (from VISUS survey form SPS)**Fig. 3.15** Example of the sketch of a school complex (for VISUS survey form SPS)

3.2.3 Data entry

Data entry is the last step of the survey organization and execution phase of VISUS implementation. During the post-survey data entry, under the supervision of the unit coordinator, surveyors follow these steps:

1. Check the data with the unit coordinator (or other VISUS experts, such as VISUS trainers)
2. Fill in the digital version of the survey forms, copying the data from the paper version if one was used during the survey
3. Check the association between the photos and OBS
4. Organize files in the school folder prepared before the survey, which should include:
 - VISUS survey forms (PDF)

- Location and context photos (verify if these are already present in the folder)
 - Photo of the sketch of the school complex
 - A subfolder named 'Pictures' containing all the photos taken during the survey; the file-names of the photos are the numbers in the VISUS survey forms (e.g. '1.jpg', '2.jpg')
5. Upload the school folder containing all the data to the VISUS cloud in accordance with the instructions provided by SPRINT-UNIUD.

Figure 3.16 shows a schema of the structure of the school folder, while Figure 3.17 is an example of a school folder finalized during data entry for a school complex with two buildings.

Note

It is fundamental to create one or more backups of the survey data and photos.

Fig. 3.16 Schema of the school folder to be finalized during post-survey data entry

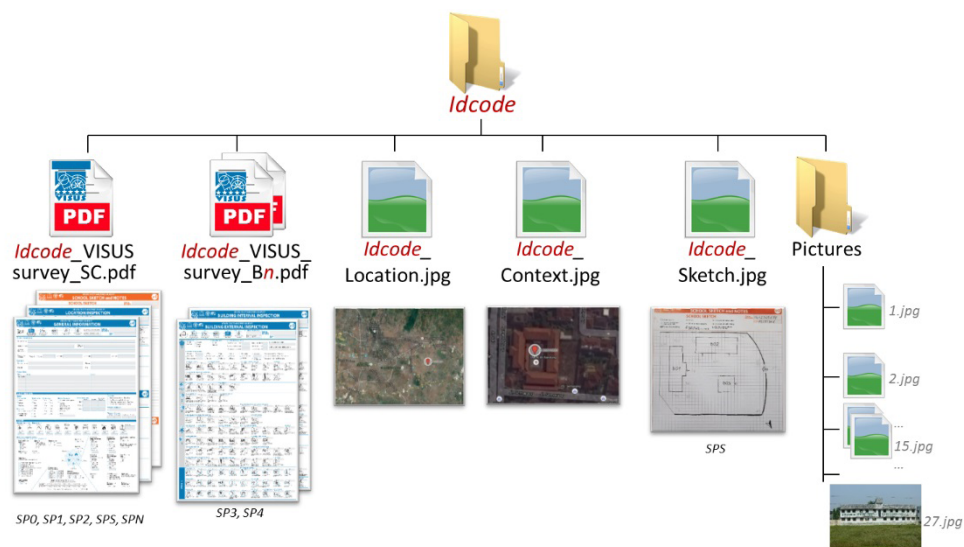
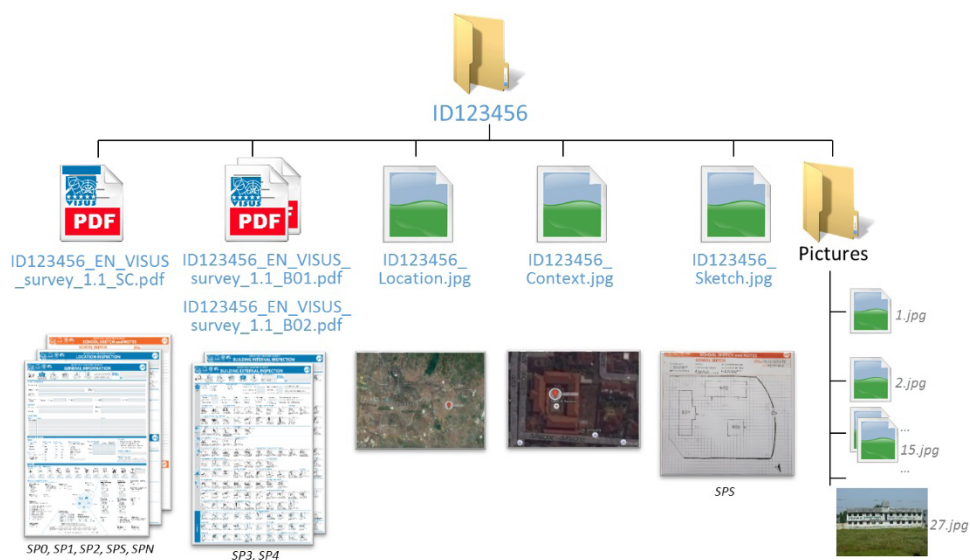


Fig. 3.17 Example of a school folder after post-survey data entry for a school with the school ID code ID123456



4. VISUS IMPLEMENTATION PHASE 3: ELABORATION

The elaboration phase of VISUS implementation comprises the automated application of algorithms based on the VISUS evaluation criteria to the VISUS survey data (see the evaluation criteria in Annexes AM1 to AM7 of Volume 2). This phase is performed by SPRINT-UNIUD.

The outcomes of the surveys are shared with the SPRINT-UNIUD back office via the VISUS cloud. SPRINT-UNIUD provides specific instructions for sharing the data.

The elaboration of the data uses an automated tool (software) – the VISUS elaboration tool – that imports

the survey outcomes (i.e. PDF files of completed survey forms and .jpg files from photographic description) and creates the individual and collective reports (Fig. 4.1). The software is called VISUS ‘blue-box’. Its functions are hidden to users, who simply provide the inputs and receive the outputs.

Figure 4.2 shows the ‘engine’ of the VISUS blue-box, that is, Matlab® (a commercially available software for numerical computation and visualization), the pdftk toolkit (a freeware PDF toolkit) and LaTeX (a freeware programming language commonly used for typesetting technical data).

Fig. 4.1 The VISUS survey data are elaborated through the VISUS elaboration tool, which is based on the VISUS evaluation criteria

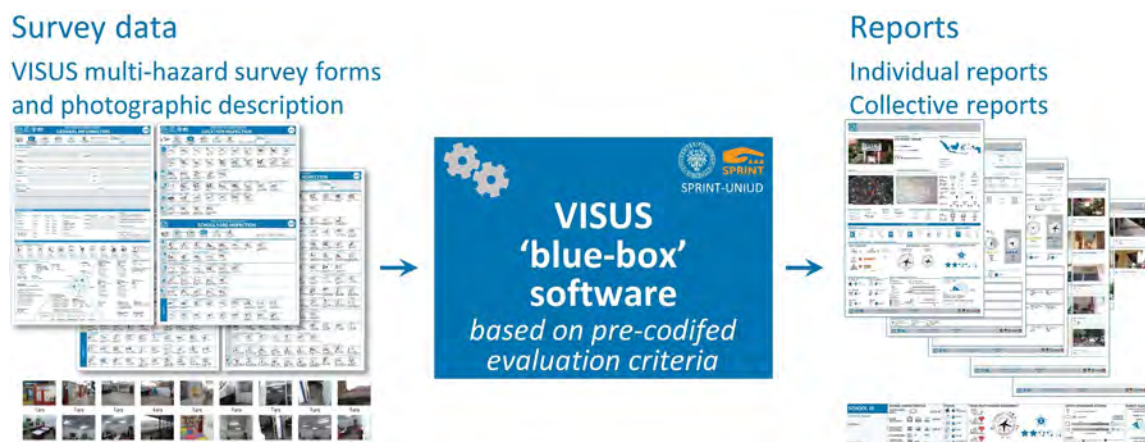


Fig. 4.2 The algorithms of the VISUS ‘blue-box’ software are defined through combined use of Matlab, pdftk and LaTeX



4.1 Elaboration algorithm

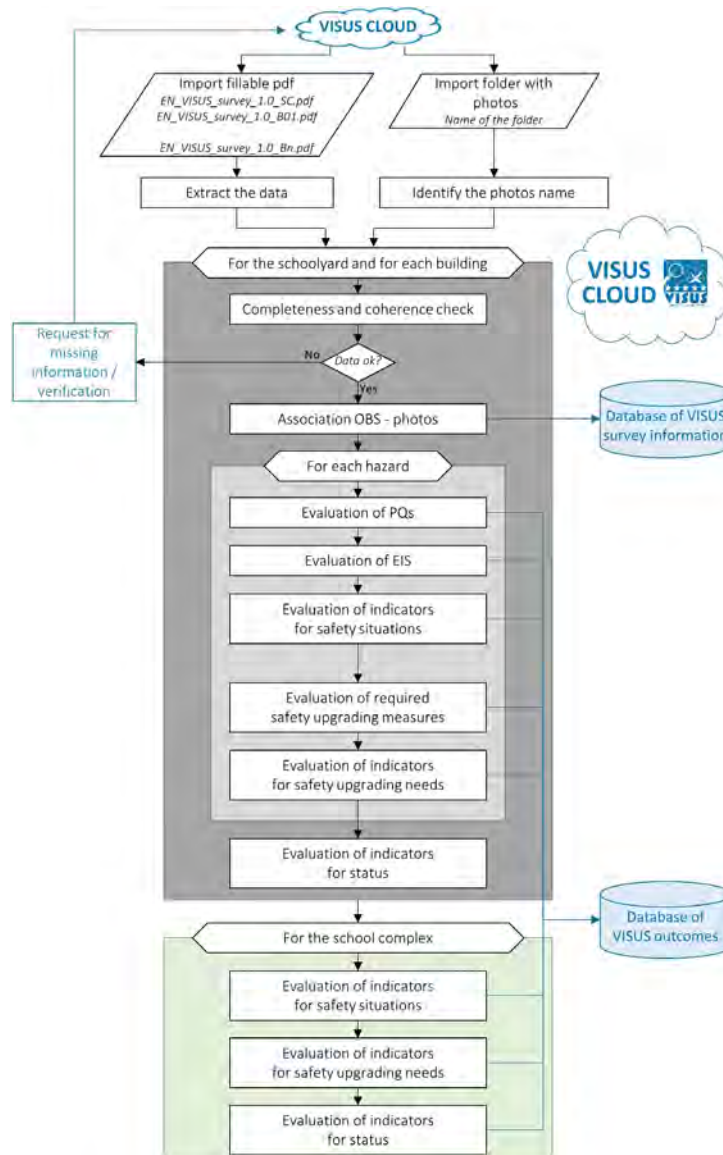
Figure 4.3 shows a flow chart of the VISUS elaboration algorithm. The steps are as follows. The VISUS survey forms are automatically interpreted and the data are extracted. At the same time, the software analyses the photos and their filenames. For each school building and for the schoolyard, the completeness and coherence of the data are then checked. In case of problems with the uploaded data (e.g. missing information or unclear associations), SPRINT-UNIUD researchers contact the focal point and request an explanation and potential missing information. Once there are no problems with data, the algorithm associates the OBS to the photos using the indications provided in the survey forms. The data extracted from the survey forms are organized in a database of VISUS survey information. Then, an internal loop for each

hazard (and ordinary use) calculates the profile qualifiers (PQs), expected impact scenarios (EIS), indicators for safety situations, required safety upgrading measures, and indicators for safety upgrading needs. The algorithm also calculates the status indicators for each building and for the schoolyard.

After elaborating the information for each building and the schoolyard, the algorithm summarizes the evaluation for the school complex, providing global indicators concerning the safety situation, safety upgrading needs and status.

All the outcomes of elaboration (e.g. PQs, EIS, VISUS indicators) are stored in the database of VISUS outcomes.

Fig. 4.3 Flow chart showing the main steps of the VISUS elaboration algorithm



| 5. VISUS IMPLEMENTATION PHASE 4: REPORTING

VISUS generates final reports for supporting decision-makers. The reporting phase results in the creation of:

- An **individual report** for each school, with technical information
- A **collective report**, with a summary of the outcomes for all the assessed schools
- The **VISUS maps**, with the geolocation of each school and a summary of the outcomes in VISUS safety stars

Decision-makers can largely define the safety upgrading strategies by analysing the information in the map and the collective report, using the individual reports for refining their decisions.

The current contents and layout of the reports were established after joint work between SPRINT-UNIUD and UNESCO Headquarters.

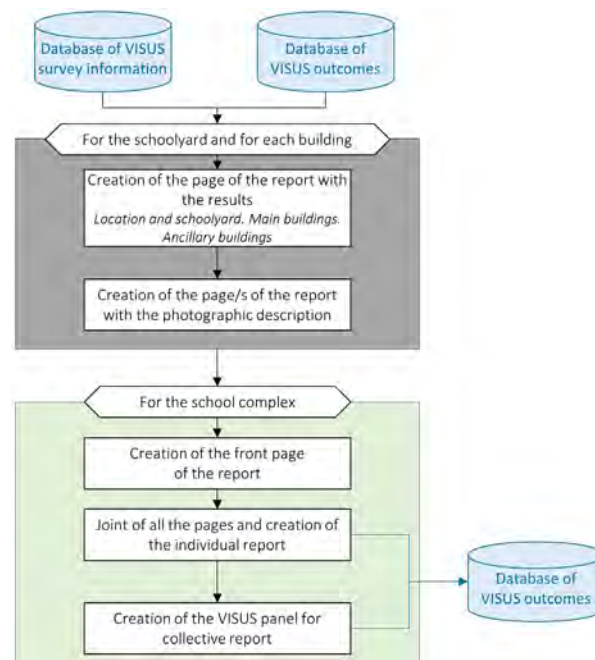
The following subsections present an overview of the VISUS reporting algorithm, of the layout of individual and collective reports, and of the maps.

5.1 Reporting algorithm

The reporting phase is automatically applied to the outcomes of the elaboration phase, that is, the database of VISUS outcomes, to create the reports. The passage from elaboration to reporting is hidden from the users of the VISUS blue-box software on which the algorithm runs (Fig. 4.1). Figure 5.1 shows a flow chart of the VISUS reporting algorithm. The steps are as follows. Single pages of the report for each school building and for the schoolyard are created together with the pages concerning the photographic description. The algorithm then creates the front page of the

report for the school complex and joins all pages to create the individual report of the school.

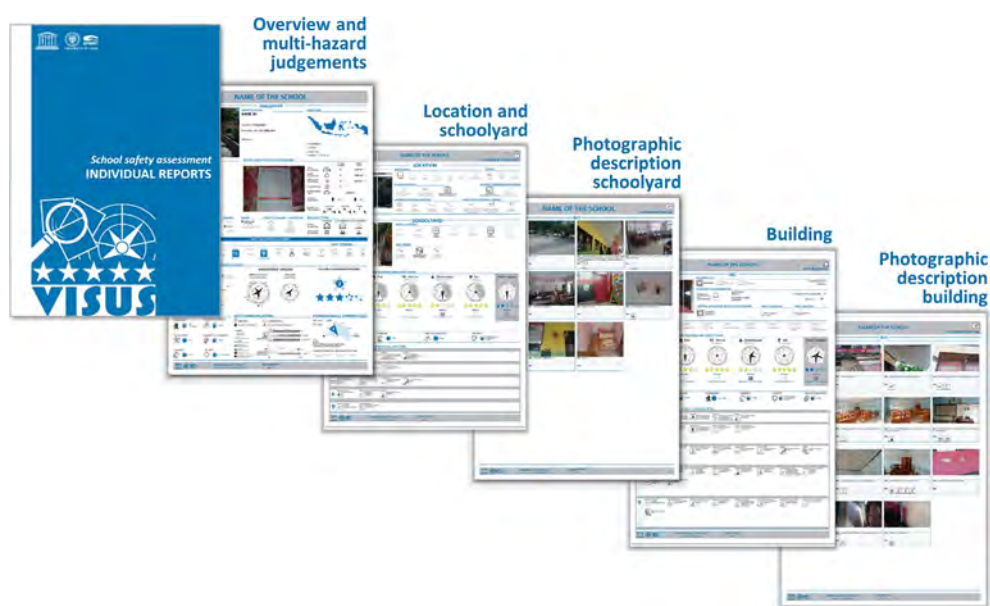
Finally, the algorithm creates the VISUS panel of the school (see section 5.3.1) to use in the collective report and in the web map.

Fig. 5.1 Flow chart showing the main steps of the VISUS reporting algorithm

5.2 Individual reports

The design of the individual report aims at highlighting the main information for and evaluation of each school, and providing details concerning the location of the school, the schoolyard, and the main and ancillary buildings. Standardization of the layout simplifies the interpretation of the data. A distinction between main and ancillary buildings is maintained through-

out the report because of the different importance of the two types of buildings. Figure 5.2 shows the layout of the individual report, and the contents of the pages of the report are detailed in subsections 5.2.1 to 5.2.3.

Fig. 5.2 VISUS individual report layout, showing organization of the contents

5.2.1 Overview and multi-hazard judgements

The first page summarizes the main information for and the evaluation of the school complex (Fig. 5.3). The evaluation considers the worst cases in the entire school. The page is divided into two sections: an upper, showing the main characteristics of the school, including location, identification of the buildings and the schoolyard, and the number of students and staff at the school; and a lower, showing a synthesis of the multi-hazard assessment, using the VISUS safety indicators (see Volume 2, section 3.3).

5.2.2 Location and schoolyard

The second and third pages of the individual report contain information, evaluations and photographic description concerning the location of the school and the schoolyard.

The characterization of the location and the schoolyard is included in page two of the report (Fig. 5.4). For the schoolyard, it also shows the safety evaluation outcomes using VISUS safety indicators, the complementary evaluations for the status, and the characterization profile (i.e. the set of assigned PQs).

The third page of the report shows the photographic description of the location and schoolyard, that is, the photos taken during the survey and a description of the OBS for each photo (Fig. 5.5). The main PQs related to the OBS are listed under the photos.

5.2.3 Main and ancillary buildings

The remaining pages of the individual report show the outcomes of the evaluations and the photographic description of the main (Fig. 5.6 and 5.7) and ancillary (Fig. 5.8 and 5.9) buildings. The layout of the pages is such that half the page contains the outcomes of the evaluation, and half contains the characterization profile (i.e. the set of assigned PQs).

Fig. 5.3 Individual report: page for overview and judgements (identifying and sensitive information has been removed)



NAME OF THE SCHOOL

SCHOOL



IDENTIFICATION

SCHOOL NAME

Country: **Indonesia**

Province, district: **MALUKU**

Address:
ADDRESS HERE

LOCATION



COORDINATES
LATITUDE: 123456
LONGITUDE: 123456
ALTITUDE: m

CONTEXT



SCHOOLYARD AND SCHOOL BUILDINGS



	TOTAL NUMBER	TOTAL AREA
TOTAL BUILDINGS	7	526 m ²
MAIN BUILDINGS	2	300 m ²
ANCILLARY BUILDINGS	5	226 m ²
CLASSROOMS	7	
SCHOOLYARD AREA		3225 m ²
TOILETS (NUMBER)	1	1
PEOPLE IN THE SCHOOL	STUDENTS 151 TEACHERS 13 OTHER 1	

EDUCATIONAL TYPOLOGY

☐ PRESCHOOL (TYPICAL AGE: 3-6)

☒ PRIMARY (TYPICAL AGE: 6-12)

☐ MIDDLE SCHOOL (TYPICAL AGE: 12-15)

☐ UPPER SECONDARY (TYPICAL AGE: 15-18)

☐ VOCATIONAL (AGES VARY)

☐ OTHER

OWNER

☒ PUBLIC

☐ PRIVATE

☐ RELIGIOUS

USAGE

☒ CURRICULAR ACTIVITIES

☐ EXTRACURRICULAR ACTIVITIES

SPECIFIC VALUES / FUNCTIONS

☐ CULTURAL HERITAGE

☐ USED FOR EMERGENCY PURPOSES

BUILDING TYPES

	PERMANENT	SEMI-PERMANENT	NON PERMANENT
MAIN BUILDINGS	2	-	-
ANCILLARY BUILDINGS	3	2	-

MULTI-HAZARD EVALUATIONS

REFERENCE HAZARDS

HAZARD	REFERENCE
EARTHQUAKE	PGA 0.40-0.49 g
TSUNAMI	
VOLCANO	
LANDSLIDE	
FLOOD	Not defined
LANDSLIDE	
WIND	V ₁ < 62 km/h
LIGHTNING	
FIRE	
WILDFIRE	
OTHER	

EARLY WARNING

HAZARD	REFERENCE
TSUNAMI	
FLOOD	
WIND	

VISUS SAFETY INDICATORS - FOR REFERENCE HAZARDS

SAFETY EVALUATIONS

LOCATION: ☒ LOCALIZED ☐ WIDESPREAD

MAIN BUILDINGS: ☒ LOCALIZED ☐ WIDESPREAD

ANCILLARY BUILDINGS: ☒ LOCALIZED ☐ WIDESPREAD

WARNING ROSES - ENVELOPE




VISUS MULTI-HAZARD SAFETY STARS

2



COMPLEMENTARY EVALUATIONS

ACCESSIBILITY: ☒ NOT ACCESSIBLE

MAINTENANCE: ☒ POOR

COMFORT: ☒ POOR

WATER AND SANITATION: ☒ POOR

CONTENT AND EQUIPMENT: ☒ POOR

SECURITY: ☒ UNCONTROLLED OR UNLIMITED ACCESS

SAFETY UPGRADING ACTIONS

LOCATION: ☒ NO ACTION REQUIRED

SCHOOLYARD: ☒ LIGHT MEASURES, LOCALIZED

MAIN BUILDINGS: ☒ NO ACTION REQUIRED

ANCILLARY BUILDINGS: ☒ NO ACTION REQUIRED

SAFETY UPGRADING REQUIREMENTS

Intensity of Upgrading Actions for School complex: **0.26**

Upgrading Requirements Class: **B**

NEW CONSTRUCTION OF THE SCHOOL WITH THE SAME NUMBER OF CLASSROOMS, ACCORDING TO THE REFERENCE CONSTRUCTION STANDARD

CONSTRUCTION-SITE INCREASE FACTORS

☒ DISADVANTAGED LOCATION ☐ DIFFICULT INSTALLATION ON SITE




INDONESIA PILOT PROJECT

Survey: 08/08/2016


SCHOOL ID

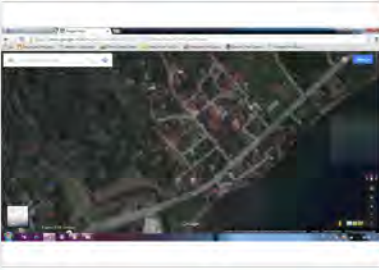
p. 1

Fig. 5.4 Individual report: page for evaluation of the school location and the schoolyard



NAME OF THE SCHOOL





LOCATION

TOPOGRAPHY

FLAT
 ROUGH
 SLOPE
 SCARP CLIFF
 CREST TOP
 VALLEY
 ALLUVIAL FAN

ACCESS TO SCHOOL

ACCESSIBLE ONLY BY FOOT/PATH
 SCHOOL ACCESS VIA HIGH-TRAFFIC STREET
 UNSAFE TRANSIT TO AND FROM SCHOOL

IMPENDING NATURAL HAZARDS

WITHIN A FOREST
 ON A LANDSLIDE
 IMPACT BY A LANDSLIDE
 IMPACT BY A ROCKFALL

CONTEXT


URBAN
 RURAL
 MOUNTAIN

DISTANCE FROM EMERGENCY SERVICES

FAR FROM EMERGENCY SERVICES
 CLOSE TO EMERGENCY SERVICE

MAN-MADE POTENTIAL HAZARDS

NEARBY ACTIVITY MAY CAUSE TECHNOLOGICAL ACCIDENT
 UNDER ELECTRICAL POWER-TRANSMISSION LINE
 DAM UPSTREAM



SCHOOLYARD

FENCES / ACCESS

NO FENCE
 PARTIALLY FENCED
 FULLY FENCED
 LOW FENCE
 HIGH FENCE
 OPEN ACCESS
 CONTROLLED ACCESS

SAFE AREAS

SAFE AREAS FOR FLOOD
 SAFE AREAS FOR EARTHQUAKE
 SAFE AREAS FOR WIND

VISUS SAFETY INDICATORS: WARNING ROSES AND SAFETY STARS

ORDINARY USE

NORMAL CONDITIONS



★★★★★

Action

LIGHT INTERVENTIONS

FIRE



★★★★★

Action

NO ACTION REQUIRED

WATER

NOT DEFINED



★★★★★

Action

NO ACTION REQUIRED

EARTHQUAKE

PGA 0.40-0.49 g



★★★★☆

Action

LIGHT ACTION

AIR

V: < 62 km/h



★★★★★

Action

NO ACTION REQUIRED

MULTI-HAZARD



★★★★★

Action

LIGHT ACTION

COMPLEMENTARY EVALUATIONS

ACCESSIBILITY

COMFORT

WATER & SANITATION

SECURITY

VISUS CHARACTERIZATION PROFILE: PROFILE QUALIFIERS (PQs)

REACHABILITY

SCHOOL COMPLEX EASY TO REACH

SALUBRITY

SALUBRITY GOOD, NO PROBLEMS

DANGERS

PEOPLE COULD SLIP (WITH CONSEQUENT IMPROPER SITUATIONS)

DANGERS

DANGEROUS ANIMALS COULD ENTER IN THE SCHOOL

TRIGGER / SOURCE

NO TRIGGERING SOURCES

EXPECTED FIRE SCENARIO

PHENOMENON TO EXTENDED FIRE, NO TRIGGER

PROTECTION SYSTEM

NO PROTECTION SYSTEM

HAZARD INTENSITY

WATER DEPTH UNKNOWN

HAZARD INTENSITY

WATER VELOCITY UNKNOWN

PROTECTION FROM HAZARD

DISTANCE FROM HAZARD

HAZARD INTENSITY

HEAVY RAIN

UNDERMINING

UNDERMINING NOT CREDIBLE

EGRESS

ALREADY IN A SAFE ZONE

HAZARD INTENSITY

HIGH HAZARD

POTENTIAL FALL OF ELEMENTS

EXTERNAL, LOCALIZED, HEAVY

EGRESS

SAFE PATH TO SAFE ZONES

HAZARD INTENSITY

HAZARD NEGLIGIBLE/TRIVIAL

HAZARD MODIFIERS

POTENTIAL HAZARD REDUCTION













INDONESIA PILOT PROJECT


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SCHOOL ID

p. 2

Fig. 5.5 Individual report: page for photographic description of the school location and the schoolyard


 NAME OF THE SCHOOL 	
LOCATION & SCHOOLYARD	
 <p>Obs: view of the school; fully fenced. PQs:</p>	 <p>Obs: representative picture of the school; pot, dangerous animals; sufficient safe area; open access; flat; wetland. PQs:</p>
 <p>Obs: hazards from nearby buildings; surrounded by tall buildings - protected. PQs:</p>	 <p>Obs: pot, falls due to uneven floor or tripping hazards. PQs:</p>
 <p>Obs: sewer. PQs:</p>	 <p>Obs: waste receptacles and collection area. PQs:</p>
 <p>Obs: playground equipment and/or sport fields. PQs:</p>	 <p>Obs: cesspool; accumulation of combustible elements. PQs:</p>
 <p>Obs: water. PQs:</p>	 <p>Obs: impermeable ground. PQs:</p>




INDONESIA PILOT PROJECT
Survey: 08/08/2016

SCHOOL ID
p. 3


Fig. 5.6 Individual report: page for evaluation of a main building



NAME OF THE SCHOOL



MAIN BUILDINGS




B01

BUILDING TYPE

☒ PERMANENT
☐ SEMI PERMANENT
☐ NON PERMANENT

GEOMETRY AND DIMENSIONS

NUMBER OF FLOORS ABOVE AND UNDERGROUND



PLAN SHAPE: SIMPLE

ELEVATION SHAPE: COMPLEX

NUMBER OF STRUCTURAL UNITS: 1

AREA (m²): 144

VERTICAL STRUCTURAL MATERIAL AND SYSTEM

☒ CONFINED MASONRY

ROOF STRUCTURE

☒ OTHER

ROOF COVERING

☒ SHEETS

CONSTRUCTION DATE: -
STANDARD: -

UTILIZATION

☒ CLASSROOMS: 03

☐ MALE TOILETS

☐ FEMALE TOILETS

☐ OFFICES

☐ LABORATORY

☐ KITCHEN

☐ CANTEEN

☐ GYM

☐ AUDITORIUM

☐ ARCHIVE

☐ STORAGE

☐ BEDROOMS

☐ OTHER USES

☐ TECHNICAL ROOM


☐ UNUSED

☐ UNDER CONSTRUCTION

VISUS SAFETY INDICATORS: WARNING ROSES AND SAFETY STARS

ORDINARY USE

Normal conditions




★★★★☆

Action

LIGHT ACTION

FIRE




★★★★☆

Action

NO ACTION REQUIRED

WATER

Not defined




★★★★☆

Action

NO ACTION REQUIRED

EARTHQUAKE

PGA 0.40-0.49 g




★★★☆☆

Action

MODERATE ACTION

AIR

V₂ < 62 km/h




★★★★★

Action

NO ACTION REQUIRED

MULTI-HAZARD




★★★★★

Action


HIGH (RAT) ACTION

COMPLEMENTARY EVALUATIONS


WATER & SANITATION

 POOR


MAINTENANCE

 POOR


ACCESSIBILITY

 ACCESSIBLE


COMFORT

 POOR













































































SECURITY


 UNCONTROLLED OR UNLIMITED ACCESS

CONTENT/EQUIPMENT

 POOR

VISUS CHARACTERIZATION PROFILE: PROFILE QUALIFIERS (PQs)

 SALUBRITY	 PRESENCE OF DISCOMFORTS WITH POT. CONSEQUENCES ON HEALTH	 DANGERS	 OBJECTS/ELEMENTS COULD FALL CAUSING POTENTIAL DIFFICULT SITUATIONS	 DANGERS	 PEOPLE COULD BUMP OR PROTRUDING ELEMENTS, WITH POT. DIFFICULT SITUATIONS	 EGRESS	 SAFE EGRESS FROM BUILDING
 TRIGGER / SOURCE	 NO TRIGGERING SOURCES	 EXPECTED FIRE SCENARIO	 PREDISPOSED TO SMALL FIRE, NO TRIGGER	 PROPAGATION	 FAST PROPAGATION OF SMOKE AND FIRE IN THE BUILDING	 PROTECTION SYSTEM	 NO PROTECTION SYSTEM
 STRUCTURAL BEHAVIOUR	 NO FIRE EFFECTS ON STRUCTURE						
 HAZARD INTENSITY	 WATER DEPTH - UNKNOWN	 HAZARD INTENSITY	 WATER VELOCITY - UNKNOWN	 PROTECTION FROM HAZARD	 DISTANCE FROM HAZARD	 PROTECTION FROM HAZARD	 RISED
 HAZARD INTENSITY	 HEAVY RAIN	 STRUCTURAL ROBUSTNESS CLASS	 HIGH CLASS FOR FLOOD	 CONNECTION TO GROUND	 LOCAL ANCHORAGE, FIXED	 UNDERMINING	 UNDERMINING NOT CREDIBLE
 LOCAL STRESS	 DISTRIBUTION OF STRESSES	 EGRESS	 ALREADY IN A SAFE ZONE				
 HAZARD INTENSITY	 HIGH HAZARD	 STRUCTURAL ROBUSTNESS CLASS	 VERY HIGH CLASS FOR EARTHQUAKE	 ROBUSTNESS MODIFIERS	 REGULAR HORIZONTAL BEHAVIOUR	 ROBUSTNESS MODIFIERS	 REGULAR VERTICAL BEHAVIOUR
 ROBUSTNESS MODIFIERS	 MASS MODIFIER, BOTTOM	 ROBUSTNESS MODIFIERS	 NO WEAK DIRECTIONS	 LOCAL CRITICAL ISSUES	 LOCALIZED STRESS CONCENTRATED	 CAUSING POTENTIAL DIFFICULT SITUATIONS	 POTENTIAL FALL OF ELEMENTS
 POTENTIAL FALL OF ELEMENTS	 EXTERNAL WIDESPREAD, HEAVY	 EGRESS	 SAFE PATH TO SAFE ZONES				
 HAZARD INTENSITY	 NEGLIGIBLE/TRIVIAL	 HAZARD MODIFIERS	 POTENTIAL HAZARD REDUCTION	 STRUCTURAL ROBUSTNESS CLASS	 HIGH CLASS FOR WIND	 CONNECTION TO GROUND	 ANCHORED TO GROUND
 INCREASE OF STRESS	 FLOW INSIDE THE BUILDING	 CAUSING POTENTIAL DIFFICULTIES	 LOCAL CRITICAL ISSUES	 NO LOCAL CRITICAL ISSUES	 INCREASE OF LOCAL STRESS	 NO INCREASE OF LOCAL STRESSES	 POTENTIAL FALL OF ELEMENTS
 EGRESS	 SAFE ZONE EASY TO REACH						



INDONESIA PILOT PROJECT

Survey: 08/08/2016

SCHOOL ID

p.4

Fig. 5.7 Individual report: page for photographic description of a main building


VISUS		NAME OF THE SCHOOL		PICTURES REPORTAGE	
B01					
				Obs: moderate slope; hazards from nearby buildings; pitched roof; sheets; multiple exits from the building; main building.	Obs: shallow foundation.
PQs: 	PQs: 	PQs: 	PQs: 		
				Obs: Representative picture of the building; pot. hits with protruding objects or sharp objects; medium openings (windows, doors) fragile closure (glass); permanent building; building on an elevated site (> rftl).	Obs: moderate amount of wood-based furniture.
PQs: 	PQs: 	PQs: 	PQs: 		
				Obs: mold.	Obs: pot. fall of portions of non structural elements.
PQs: 	PQs: 	PQs: 	PQs: 		
				Obs: horizontal propagation paths.	Obs: moderate slope; pitched roof; pounding; poor maintenance.
PQs: 	PQs: 	PQs: 			



INDONESIA PILOT PROJECT
Survey: 08/08/2016


SCHOOL ID
p.5

Fig. 5.8 Individual report: page for evaluation of an ancillary building



NAME OF THE SCHOOL

☐ ANCILLARY BUILDINGS




B04

BUILDING TYPE

☒ PERMANENT
 ☐ SEMI PERMANENT
 ☐ NON PERMANENT

GEOMETRY AND DIMENSIONS

NUMBER OF FLOORS ABOVE AND UNDERGROUND



PLAN SHAPE: SIMPLE

ELEVATION SHAPE: SIMPLE

NUMBER OF STRUCTURAL UNITS: 1

AREA (m²): 24

VERTICAL STRUCTURAL MATERIAL AND SYSTEM

☒ CONFINED MASONRY

ROOF STRUCTURE

☐ OTHER

ROOF COVERING

☐ OTHER

UTILIZATION

☒ CLASSROOMS: 01

☐ MALE TOILETS

☐ FEMALE TOILETS

☐ OFFICES

☐ LABORATORY

☐ KITCHEN

☐ CANTEEN

☐ GYM

☐ AUDITORIUM

☐ ARCHIVE

☐ STORAGE

☐ BEDROOMS

☐ OTHER USES


☐ TECHNICAL ROOM

☐ UNUSED

☐ UNDER CONSTRUCTION

VISUS SAFETY INDICATORS: WARNING ROSES AND SAFETY STARS

ORDINARY USE
Normal conditions




★★★★☆

Action

LIGHT ACTION

FIRE




★★★★★

Action

NO ACTION REQUIRED

WATER
Not defined




★★★★★

Action

NO ACTION REQUIRED

EARTHQUAKE
PGA 0.40-0.49 g




★★★☆☆

Action

MODERATE ACTION

AIR
V₂ < 62 km/h




★★★★★

Action

NO ACTION REQUIRED

MULTI-HAZARD




★★★★★

Action

MODERATE ACTION


COMPLEMENTARY EVALUATIONS

WATER & SANITATION




POOR

MAINTENANCE




POOR

ACCESSIBILITY




NOT ACCESSIBLE

COMFORT




POOR

SECURITY








































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CONTENT/EQUIPMENT



BASIC

VISUS CHARACTERIZATION PROFILE: PROFILE QUALIFIERS (PQs)


 SALUBRITY PRESENCE OF DISCOMFORTS WITH POT. CONSEQUENCES ON HEALTH	 STRUCTURAL CRITICAL ISSUES STRUCTURAL WEAKNESSES WITH SIGNIFICANT EFFECTS	 EGRESS SAFE EGRESS FROM BUILDING					
 TRIGGER / SOURCE NO TRIGGERING SOURCES	 EXPECTED FIRE SCENARIO NO EXPECTED FIRE SCENARIO	 PROPAGATION SLOW PROPAGATION OF SMOKE AND/OR FIRE IN THE BUILDING	 PROTECTION SYSTEM NO PROTECTION SYSTEM	 STRUCTURAL BEHAVIOUR NO FIRE EFFECTS ON STRUCTURE			
 HAZARD INTENSITY WATER DEPTH - UNKNOWN	 HAZARD INTENSITY WATER VELOCITY UNKNOWN	 PROTECTION FROM HAZARD DISTANCE FROM HAZARD	 HAZARD INTENSITY HEAVY RAIN	 STRUCTURAL ROBUSTNESS CLASS HIGH CLASS FOR FLOOD	 CONNECTION TO GROUND LOCAL ANCHORAGE, FIXED	 UNDERMINING UNDERMINING NOT CREDIBLE	 LOCAL STRESS DISTRIBUTION OF STRESSES
 EGRESS SAFE PATH TO SAFE ZONE							
 HAZARD INTENSITY HIGH HAZARD	 STRUCTURAL ROBUSTNESS CLASS VERY HIGH CLASS FOR EARTHQUAKE	 ROBUSTNESS MODIFIERS REGULAR HORIZONTAL BEHAVIOUR	 ROBUSTNESS MODIFIERS REGULAR VERTICAL BEHAVIOUR	 ROBUSTNESS MODIFIERS MASS MODIFIER, UNIFORM	 ROBUSTNESS MODIFIERS NO WEAK DIRECTIONS	 ROBUSTNESS MODIFIERS POOR CONSTRUCTION OR MATERIAL QUALITY	 LOCAL CRITICAL ISSUES LOCALIZED FAILURES CAUSING POTENTIAL DIFFICULT SITUATIONS
 LOCAL CRITICAL ISSUES LOCALIZED FAILURES CAUSING HEAVY SITUATIONS	 POTENTIAL FALL OF ELEMENTS NO CRITICAL ISSUES	 EGRESS SAFE PATH TO SAFE ZONES					
 HAZARD INTENSITY NEGLECTABLE/TRIVIAL	 HAZARD MODIFIERS POTENTIAL HAZARD REDUCTION	 STRUCTURAL ROBUSTNESS CLASS HIGH CLASS FOR WIND	 CONNECTION TO GROUND ANCHORED TO GROUND	 INCREASE OF STRESS FLOW INSIDE THE BUILDING CAUSING POTENTIAL DIFFICULTIES	 LOCAL CRITICAL ISSUES NO LOCAL CRITICAL ISSUES	 INCREASE OF LOCAL STRESS BY UPLIFT FORCE	 POTENTIAL FALL OF ELEMENTS NO CRITICAL ISSUES
 EGRESS SAFE ZONE EASY TO REACH							




INDONESIA PILOT PROJECT
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SCHOOL ID
p.10

Fig. 5.9 Individual report: page for photographic description of an ancillary building




NAME OF THE SCHOOL








PICTURES REPORTAGE

B04





Obs: critical weakness; evidences of existing severe damage; poor maintenance.

PQs:    





Obs: small openings always open.

PQs: 





Obs: View of the building; low slope; pitched roof; permanent building; limited access to building.

PQs: 








Obs: Representative picture of the building; low light; false ceilings; ancillary building; resistance distributed mainly to the perimeter.

PQs: 



Obs: confined masonry.

PQs:   

INDONESIA PILOT PROJECT

Survey: 08/08/2016

SCHOOL ID

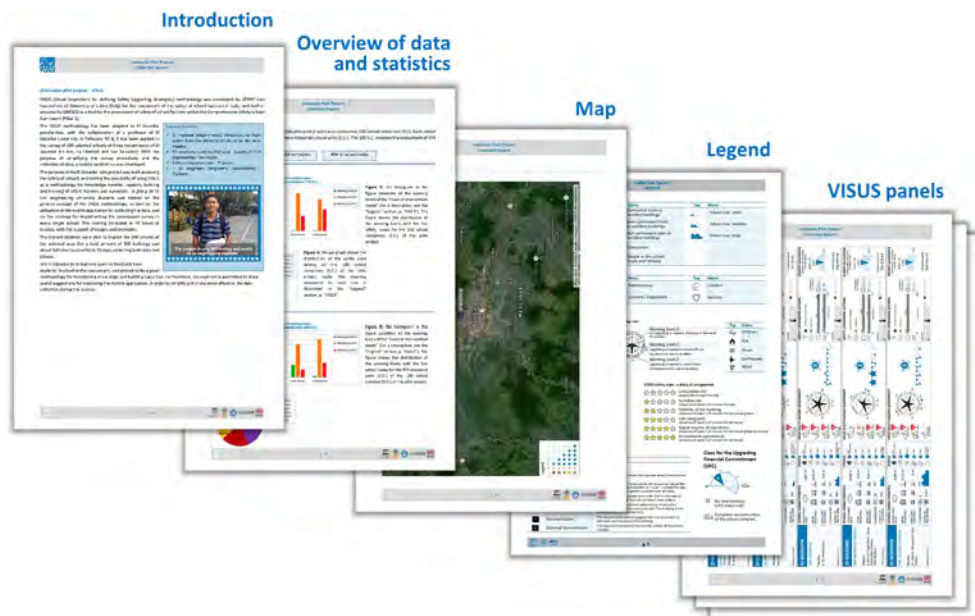
p.11

5.3 Collective report

The collective report summarizes all the information on the assessed schools and therefore constitutes a decision-support tool for decision-makers. Figure 5.10 shows the layout and the organization of contents of the collective report, which are:

- An introduction to the project and to the results in order to explain the purpose of the school safety assessments
- An overview of the assessed schools (e.g. information on their location, type, number, the number of main and ancillary buildings, the number of
- classrooms, the number of students and staff in the schools) and statistics on the results (e.g. the distribution of schools, taking into account the VISUS multi-hazard safety stars, the distribution of stars for each hazard)
- A map with the geolocation of the schools (with links to the web maps of each school with the outcomes of the VISUS assessments [see section 5.4])
- The legend to use for interpreting the VISUS panels
- The VISUS panel for each school

Fig. 5.10 VISUS collective report layout, showing organization of the contents



5.3.1 VISUS panel

The VISUS panel (Fig. 5.11) groups all the VISUS safety indicators and is a tool for supporting the decision-making process. The panel provides the basic

information required to support definition of the strategies for prioritizing interventions on the basis of criteria defined by public administrators. All the indicators are explained on the legend page (Fig. 5.12).

Fig. 5.11 Collective report: VISUS panel



Fig. 5.12 Collective report: legend for interpreting the VISUS panel

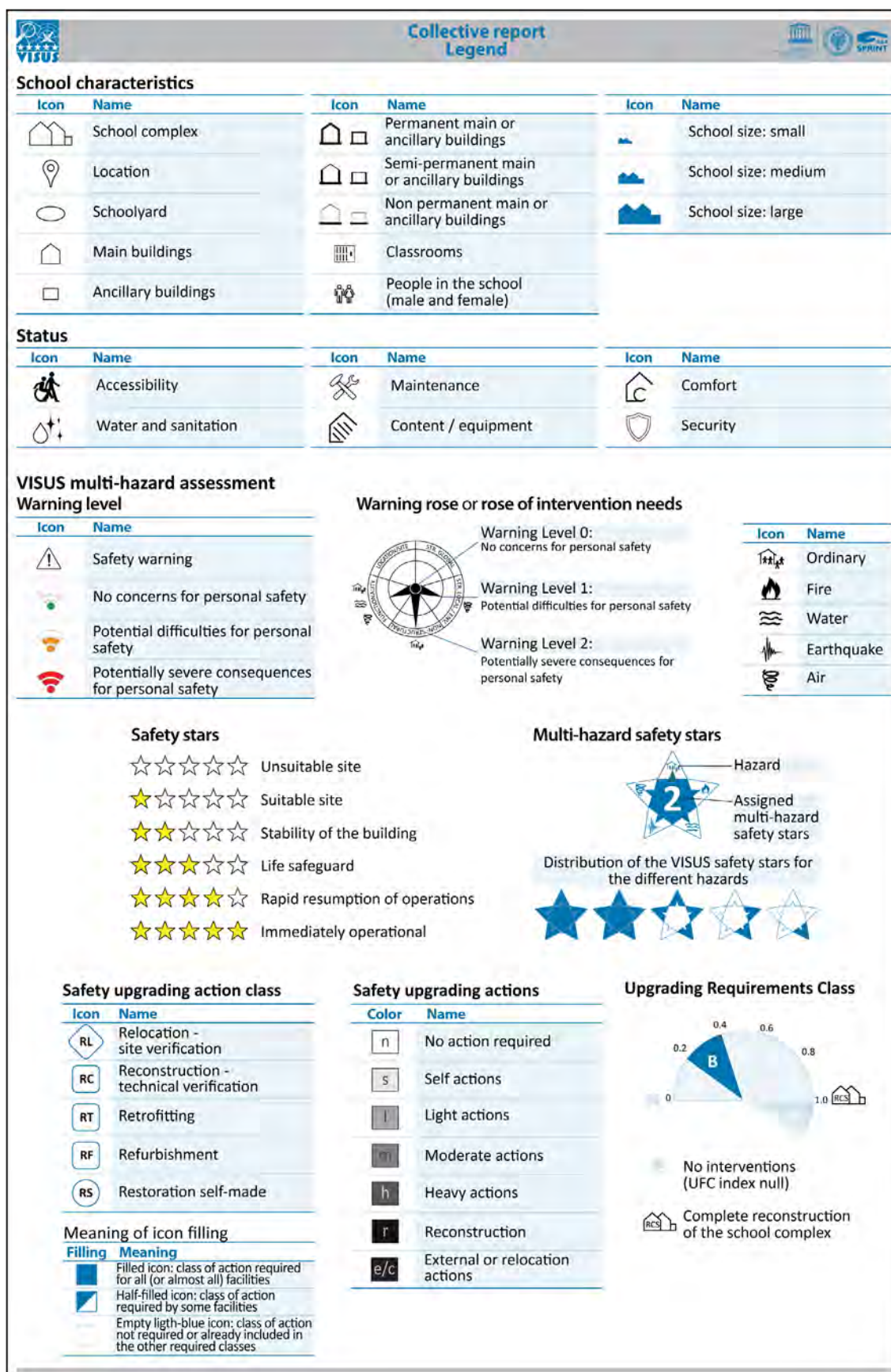


Fig. 5.13 VISUS panel: light blue section (main characteristics of the school)

SCHOOL ID	SCHOOL CHARACTERISTICS		STATUS
SCHOOL NAME	SCHOOLYARD AREA	3000 m ²	PARTIALLY ACCESSIBLE
Address	MAIN BUILDINGS	637 m ²	POOR
	ANCILLARY BUILDINGS	8 m ²	GOOD
	CLASSROOMS	11	BASIC
MIDDLE SCHOOL	PEOPLE IN THE SCHOOL	653	POOR
			CONTROLLED ACCESS

The first section of the VISUS panel (light blue background) (Fig. 5.13) shows the main information for identifying the school (i.e. the school ID code, name, address, school type [pre-school, primary, lower, upper, vocational]). The school's characteristics are then listed (using the symbols explained in section 3.3 of Volume 2 and defined in the legend of the collective report). This school's characteristics are:

- The area of the schoolyard
- The number and the area of the main buildings, distinguishing among permanent, semi-permanent and temporary buildings
- The number and the area of ancillary buildings, distinguishing among permanent, semi-permanent and temporary buildings

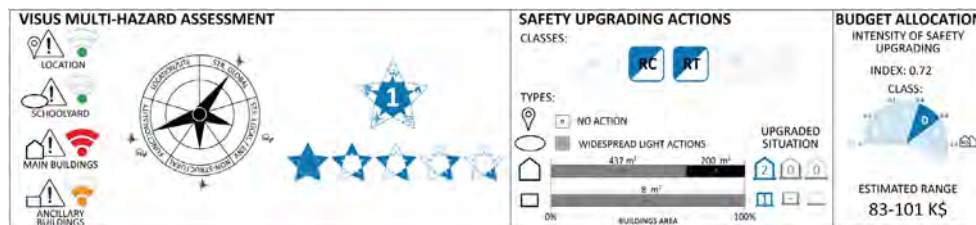
- The number of classrooms
- The total number of persons at the school
- The size of the school, classified as:
 - Small: less than 200 persons
 - Medium: from 200 to 1,000 persons
 - Large: more than 1,000 persons

The evaluation of status of the school complex is also shown (see Volume 2, section 3.3.3 and Annex AM7).

The second section of the VISUS panel (white background, Fig. 5.14) shows the safety evaluations using the VISUS safety indicators. The first subsection (VISUS multi-hazard assessment) shows:

- The safety warnings for the location, schoolyard, main buildings and ancillary buildings, using the warning level indicators (the warning level summarizes the worst case in the school complex)
- The warning rose of intervention needs, which shows the worst cases of the warning roses assessed for the schoolyard and the main and ancillary buildings
- The multi-hazard safety stars assigned to the school complex

Fig. 5.14 VISUS panel: white section (safety upgrading actions)



The second subsection (Fig. 5.14) shows the suggested safety upgrading actions for the location, schoolyard, and main and ancillary buildings. Next to the suggested actions for the school building, the upgraded situation is shown, assuming that the upgrading actions are executed. The purpose of this subsection is to highlight the cases in which, with reconstruction intervention, the class of the building (i.e. permanent, semi-permanent or temporary) changes. Indeed, when reconstructing, the new building should be built as a permanent building. This subsection is important for schools in very poor countries, where the constructions are often self-made and very poor. Anyway, the choice of final intervention is made by decision-makers.

The final subsection concerns the budget allocation, and it is where the index of the Intensity of Upgrading Action for School complex and the upgrading requirement class are reported. The value of the estimated range for the budget allocation is also shown, in thousands of United States dollars. This value is reported only in the collective report.

5.4 Maps

At the end of the reporting phase, when all the schools have been analysed, an interactive map is created that summarizes all the information (Fig. 5.15). The VISUS map is the graphical representation of a geo-database built with the information gleaned from the VISUS assessments.

The map has a specific marker corresponding to each school. The marker is a symbol that summarizes the VISUS safety stars assigned to the school. The map has several layers illustrating the safety evaluations for:

- Multiple hazards
- Ordinary use
- Fire hazard
- Water hazard
- Earthquake hazard
- Air hazard

When a school's marker is clicked on, a pop-up box opens that contains the main characteristics of the school and a link to its individual report (Fig. 5.16).

Fig. 5.15 VISUS map: example showing the summary of outcomes of the VISUS multi-hazard assessments

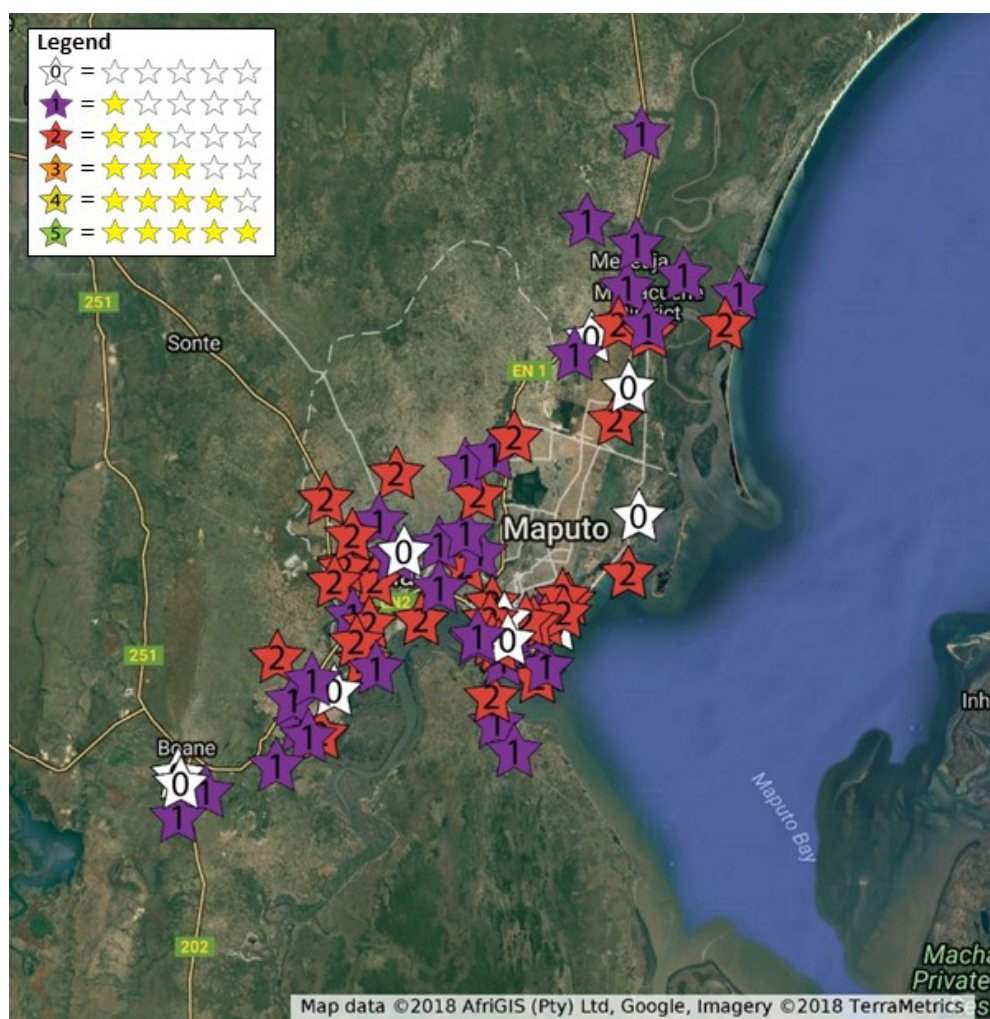
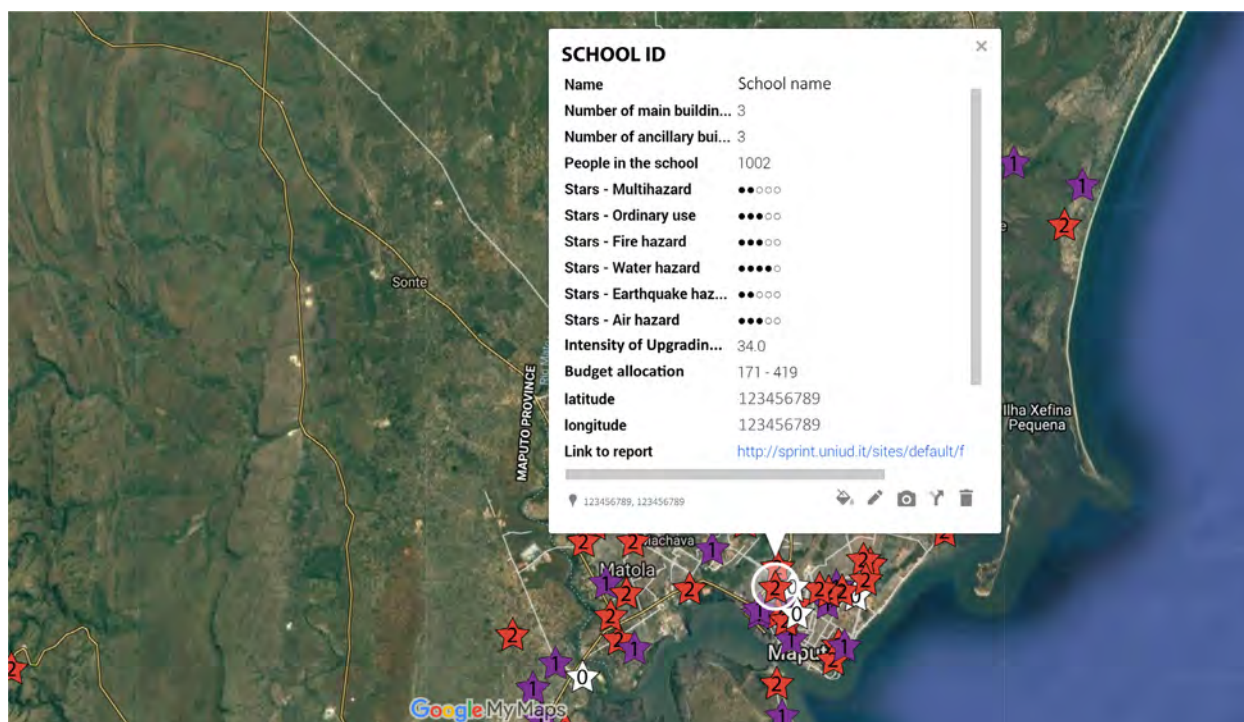


Fig. 5.16 VISUS map: example of a pop-up box (identifying and sensitive information has been replaced by ad hoc numbers or names)



5.5 Databases

The final VISUS outcome comprises two databases for recording information obtained from VISUS implementation. The databases are:

- **Database of VISUS survey information** holding information on the characteristics of the school acquired through the VISUS survey forms and the photos taken in each school
- **Database of VISUS outcomes** recording the outcomes of the VISUS elaboration and reporting phases

SPRINT-UNIUD researchers will create databases for the information provided by local committees for the implementation of VISUS in different countries and regions in order to facilitate the comparison of VISUS implementation results at the global level. The following information will be summarized:

- School types, by country
- Local circumstances and the reference values for each country (e.g. costs for new constructions, design standards), defined in the adaptation process
- Reference hazards
- Safety evaluations of schools

Annex to VISUS Implementation

| AI1

Preliminary Required Information

Please kindly note that the content of the annex is subject to updates. The latest version of the annex can be accessed here:

- <http://www.unesco.org/new/en/natural-sciences/special-themes/disaster-risk-reduction/school-safety/safety-assessment-method-visus/>
- <http://sprint.uniud.it/en/research/methodologies/visus>

1. INFORMATION REQUIRED FOR VISUS IMPLEMENTATION

The following tables list the information required for the implementation of Visual Inspection for defining Safety Upgrading Strategies (VISUS). The local committee and the focal point share the information with the steering committee in the VISUS cloud.

Each item of information is assigned one of two levels of priority:

- High priority: information essential for the implementation
- Very useful: information for refining the implementation process, which results in a more detailed assessment

The information is divided into two categories:

- Preparatory information: general information and information on the reference events
- Technical and financial information: technical information for the assessment of structural capacity and on typical interventions, and technical and financial information on safety upgrading measures

In the 'Phases' column of the tables, the phases of the implementation process in which the information is used are identified.

1.1 Preparatory information

Local committee has to provide the information in Tables 1.1 and 1.2 for VISUS implementation.

Table 1.1 *Preparatory information: general information*

General information	High priority	Very useful	Phases
Pre-identification of schools: school ID codes, location, coordinates	X		Survey organization
All available information on schools: level of education, number of students, etc.		X	Survey organization
List and short description of school building types (prevalent structural materials and construction types) and representative photographic documentation	X		Adaptation of training

Table 1.2 *Preparatory information: information on reference events*

Information on reference events	High priority	Very useful	Phases
List of the main hazards that affect the area	X		Desk work preparation
Regional or country maps or tables identifying the reference hazard values (e.g. peak ground acceleration values for earthquake hazards, wind velocity for air hazards, floodwater depth and velocity for water hazards) for life safety performance level	X		Desk work preparation
Flooding areas (both areas that have flooded in the past and those prone to flooding) and maximum level of water (which indicate the reference return period)	X		Desk work preparation
Landslide maps	X		Desk work preparation
Wildfire maps	X		Desk work preparation

Information on reference events	High priority	Very useful	Phases
National definition of soil classes and maps of their distribution in a territory		X	Desk work preparation
Hazard maps or documents on hazard and risk assessment (e.g. areas at risk of tsunamis)		X	Desk work preparation
Photos of schools damaged by various hazards in the past, with characterization of the hazard (e.g. indication of magnitude, location and date)		X	Adaptation of the triggering tables of the evaluation process

1.2 Technical and financial information

Technical and financial information is defined in close coordination with the focal point. Local technicians (see chapter 2 of Volume 3), under the leadership of the focal point, should check the evaluation criteria in Annexes AM1 to AM7, and, wherever necessary, adapt them to local circumstances. For example, local fragility curves describing the expected behaviour of structures can be used to confirm or modify the data

in the triggering tables and/or to describe the specific behaviour of the pre-characterized VISUS typologies (defined in the VISUS multi-hazard adaptation form: pre-characterized VISUS typology [see section 2.3]).

Tables 1.3, 1.4 and 1.5 list the information concerning the technical and financial information for the VISUS implementation.

Table 1.3 *Technical information: structural capacity*

Structural capacity	High priority	Very useful	Phases
Comparison of historical and current building codes, considering the design related to each hazard, and if possible, an evaluation of the ratio (current/historical) of the design strength (structural global evaluation). The strength ratios could change by typology (e.g. in the case of earthquakes they could depend on the adopted value of ductility). The values should be assessed for all the relevant performance levels (e.g. life safety, fully operational)	X		Adaptation of the triggering tables of the evaluation process
Scientific papers that compare building codes adopted over the years in the country, or any other relevant research		X	
Evaluation of simplified algorithms related to structural behaviour for the various hazards and building types (further information concerning simplified algorithms and structural behaviour will be provided by local experts at a later stage)	X		
Definition of the trigger values for the activation of non-structural problems (e.g. wind velocity that provokes uplift of different types of roof)		X	

Table 1.4 *Technical information: typical safety upgrading measures.*

Typical safety upgrading measures	High priority	Very useful	Phases
List and short description of safety upgrading measures typically adopted for renovating, repairing or retrofitting school buildings (structural/non-structural measures typical of the region)		X	Adaptation of the safety upgrading needs algorithm
List and short description of typical safety upgrading measures for defence/protection against various hazards		X	

Table 1.5 *Financial information: costs for different building types*

Costs for different building types	High priority	Very useful	Phases
Typical range (minimum to maximum) of costs (in United States dollars) for: Demolition and reconstruction (\$/m ²) Global structural renovation and retrofit (\$/m ²) Local structural consolidation or reinforcement (\$/m ²) Non-structural remake (\$/m ²) Non-structural stabilization (\$/m ²) Reorganization of functional system (\$/m ²) Verification of structural global resistance with in-depth analysis (\$) Site verification (\$)		X	Adaptation and improvement of the safety upgrading needs algorithm

2. INFORMATION REQUIRED FOR VISUS ADAPTATION

To facilitate the adaptation of the VISUS methodology to the specific country circumstances, a set of adaptation forms has been prepared. The focal point should complete the VISUS multi-hazard adaptation forms and share them with the steering committee in the VISUS cloud. The forms concern the definition or description of:

- Reference events
- Building codes
- Pre-characterized VISUS typology (local typical structural typology)
- Safety upgrading needs (local costs for constructing a new school and modifiers for safety upgrading needs, for budget allocation)

2.1 VISUS multi-hazard adaptation form for reference events

The VISUS multi-hazard adaptation form *AF-E*: reference events (Fig. 2.1) facilitates the acquisition of information on water, earthquake and air hazards. On this form, the focal point (with the assistance of the local committee) describes essential information that characterizes the reference events and their maps. The mean return period is the main parameter that defines the expected action intensity in a hazard map and it is generally defined in the building codes.

As an example, Table 2.1 shows an example of the definitions of the mean return periods for various

hazards derived from American standards (FEMA, 2010). Other country's standards might adopt different definitions for the reference events.

The local committee defines the performance objectives (the predictable results in the event of a hazard with a specific magnitude) expected for the schools in the country. Usually, the performance objectives are already established in the local building codes, and hazard maps define the predicted values for the hazard.

Table 2.1 Mean return periods for earthquake, flood and wind hazards of various magnitudes (FEMA, 2010)

Seismic		Mean return period of the hazard		
		Seismic	Flood	Wind
Magnitude of the hazard	Very large (very rare event)	2,475 years	Determined on a site-specific basis	125 years
	Large (rare event)	475 years	Determined on a site-specific basis	100 years
	Medium (less frequent event)	72 years	500 years	75 years
	Small (frequent event)	25 years	100 years	50 years

The *AF-E* form requires the filename of the hazard map and the URL of the web page from where the map can be downloaded or consulted.

For each hazard, the form requires: characterization of past events, including the date/period of the event and its magnitude; a photographic description of the damage caused by the events (especially to schools); and a short description of the events.

Ordinary use and fire hazards are not included in this form: ordinary use considers the normal use of the school, therefore there is no reference event, while the fire hazard is determined mainly by the characteristics of the school (with the exception of wildfire and lightning events).

Fig. 2.1 VISUS multi-hazard adaptation form AF-E: reference events

VISUS MULTI-HAZARD ADAPTATION FORMS
REFERENCE EVENTS

PROJECT NAME

FOCAL POINT IDENTIFICATION

(NAME, SURNAME, AFFILIATION, EMAIL)

WATER (FLOOD)

☐ **ACTION CHARACTERIZATION**
 Mean return period for the reference action T_r years Map with hazard values

filename
 url

☐ **EXPERIENCED EVENTS**

Date/ period	Magnitude <small>(water depth, velocity, ...)</small>	Photos of the event and of damage <small>(filenames)</small>	Short description
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>

EARTHQUAKE

☐ **ACTION CHARACTERIZATION**
 Mean return period for the reference action T_r years Map with hazard values

filename
 url

☐ **EXPERIENCED EVENTS**

Date/ period	Magnitude <small>(intensity, PGA, ...)</small>	Photos of the event and of damage <small>(filenames)</small>	Short description
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>

AIR (WIND)

☐ **ACTION CHARACTERIZATION**
 Mean return period for the reference action T_r years Map with hazard values

filename
 url

☐ **EXPERIENCED EVENTS**

Date/ period	Magnitude <small>(wind velocity ...)</small>	Photos of the event and of damage <small>(filenames)</small>	Short description
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>

2.2 VISUS multi-hazard adaptation form for building codes

The VISUS multi-hazard adaptation form ^{AF-B}: building codes (Fig. 2.2) facilitates the collection of information concerning the current and former building codes (related to schools). This information includes the name, the filename of the building code (or the link to the online file), the year of enforcement, the hazards considered in the code, a short description of the code and of the design methodology, the safety

coefficients and how the site soil response is considered.

For former building codes, the form also requires an assessment of the esteemed percentage of safety with respect to the current building code (the value generally depends on the structural type of the school).

Fig. 2.2 VISUS multi-hazard adaptation form AF-B: building codes

VISUS MULTI-HAZARD ADAPTATION FORMS		AF-B	
BUILDING CODES			
PROJECT NAME			
FOCAL POINT IDENTIFICATION			
(NAME, SURNAME, AFFILIATION, E-MAIL)			
BUILDING CODES (FOR SCHOOLS)			
<input type="checkbox"/> CURRENT BUILDING CODE			
Name		filename (or link)	
Year	Hazards considered	<input type="checkbox"/> Earthquake	<input type="checkbox"/> Wind <input type="checkbox"/> Flood <input type="checkbox"/> Fire <input type="checkbox"/> Other:
Short description (design methodology, safety coefficients, soil site response,...)			
<input type="checkbox"/> FORMER BUILDING CODE			
Name		filename (or link)	
Year	Period of enforcement		
Hazards considered		<input type="checkbox"/> Earthquake	<input type="checkbox"/> Wind <input type="checkbox"/> Flood <input type="checkbox"/> Fire <input type="checkbox"/> Other:
Esteemed % of safety with respect to the current building code (for school buildings, considering the different structural typologies)			
Short description (design methodology, safety coefficients, soil site response,...)			
<input type="checkbox"/> FORMER BUILDING CODE			
Name		filename (or link)	
Year	Period of enforcement		
Hazards considered		<input type="checkbox"/> Earthquake	<input type="checkbox"/> Wind <input type="checkbox"/> Flood <input type="checkbox"/> Fire <input type="checkbox"/> Other:
Esteemed % of safety with respect to the current building code (for school buildings, considering the different structural typologies)			
Short description (design methodology, safety coefficients, soil site response,...)			

2.3 VISUS multi-hazard adaptation form for pre-characterized VISUS typology

The VISUS multi-hazard adaptation form AF-T: pre-characterized VISUS typology (Fig. 2.3) requires the pre-identification of the VISUS typologies. A VISUS typology (VT) is the set of buildings characterized by the same structural profile qualifiers (PQs) and connotative architectonic/constructive features.

The form requires that the local committee identifies the main VTs and describes each one of them using the VISUS observables (OBS) in the form. The OBS are an extract of the OBS in the VISUS survey forms (see Annex A12). For each building type, the form requires characterization of the robustness, considering all the reference events (water, earthquake and air hazards).

Two values of action are associated with different levels of likelihood of activation of specific damage: A1, low probability of slight damage; and A2, near certainty of moderate damage.

The robustness characterization can be done following various approaches, each of which is based on in-depth studies and expert knowledge. Specifically, the characterization can be done through:

- Fragility curves. Each VT is characterized by a set of fragility curves (for different hazard and damage states). The values of A1 and A2 are derived from the curves, as shown in the form.
- Equivalent structural fragility. The values of A1 and A2 are defined using existing methodologies that allow a value to be assigned that distinguishes between the beginning of slight and of moderate structural damage. The values must be defined for

all the assessed hazards. An example of a methodology that can be used for the definition of the A1 and A2 values using this approach is the HAZUS® methodology (FEMA, 2003).

- Local expert evaluations. Experts can assign the values of A1 and A2 on the basis of their knowledge and experience. To do this, the study of building damage after hazardous events is essential. The VISUS methodology requires the available photos of schools damaged by various hazards in the past; this photographic reportage is essential for the definition and verification of the values.
- Building codes. If a building is constructed following the requirements of a building code, its robustness can be calculated assuming the values assigned by the code. This approach works very well for recently built schools.
- VISUS robustness classes. It is possible to assign a VISUS robustness class directly to the building using the values given in the form as a reference.

The form requires some representative photos of the VT to be shared – these photos will be used to support surveyors in identifying the VTs. The form also requires photos showing examples of damaged buildings (together with a brief description of the hazard that has caused the damage). Finally, the last field of the form requires a short textual description of the VT.

The characteristics of the pre-characterized VT will be shared with the VISUS surveyors to support them in recognizing the VTs during the VISUS surveys.

Fig. 2.3 VISUS multi-hazard adaptation form AF-T: pre-characterized VISUS typology

VISUS MULTI-HAZARD ADAPTATION FORMS
PRE-CHARACTERIZED VISUS TYPOLOGY

AF-T

PROJECT NAME

VISUS TYPOLOGY CLASS **VT**

FOCAL POINT IDENTIFICATION

(NAME, SURNAME, AFFILIATION, E-MAIL)

VISUS TYPOLOGY CHARACTERIZATION THROUGH VISUS OBS

STRUCTURAL SYSTEM
Reinforced concrete
☐ RC-WALLS 3G4a.S
☐ RC-DUAL FRAME-WALL SYSTEM 3G4b.S
☐ RC-FRAME 3G4c.S
☐ PRECAST 3G4d.S
Steel
☐ UNBRACED STEEL FRAME 3G4k.S
☐ BRACED STEEL FRAME 3G4l.S
☐ STEEL VERTICAL PIERS ONLY 3G4m.S
Wood
☐ WOOD-FRAME UNBRACED 3G4n.S
☐ WOOD-RAMBLE S OR WOOD-FRAME BRACED 3G4o.S
☐ WOOD VERTICAL PIERS ONLY 3G4p.S
Bamboo
☐ BAMBOO STRUCTURE 3G4q.S
Other
☐ OTHER (DESCRIPTION) 3G4r.S

Masonry
☐ RC VERTICAL PIERS ONLY 3G4e.S
☐ REINFORCED MASONRY 3G4f.S
☐ CONFINED MASONRY 3G4g.S
☐ UNREINFORCED MASONRY 3G4h.S
☐ MASONRY VERTICAL PIERS ONLY 3G4i.S
Earth / adobe
☐ EARTH OR ADOBE STRUCTURE 3G4j.S

NUMBER OF FLOORS
 Above ground:
 Under ground:

PLANE SHAPE
☐ Simple
☐ Complex
☐ Compact
☐ Elongated
☐ Winged

ELEVATION SHAPE
☐ Simple
☐ Complex

CONSTRUCTION INFORMATION
 Construction date / period:
 Building code/s (standard/regulations):

HORIZONTAL DISTRIBUTION AND ORGANIZATION OF LATERAL RESISTANT ELEMENTS
☐ REGULAR CELL DISTRIBUTION OF RESISTANCE 3G5a.S
☐ RESISTANCE DISTRIBUTED MAINLY TO AN EXTREMITY 3G5b.S
☐ RESISTANCE DISTRIBUTED MAINLY TO THE CENTER 3G5c.S
☐ RESISTANCE DISTRIBUTED MAINLY TO THE PERIMETER 3G5d.S
☐ "C" SHAPE DISTRIBUTION OF RESISTANCE (ONE WEAK AXIS) 3G5e.S
☐ LARGE DISTANCE AMONG LATERAL RESISTING SYSTEMS (10/20) 3G5f.S
☐ INADEQUATE RESISTANCE IN ONE DIRECTION 3G5g.S
☐ INADEQUATE RESISTANCE IN BOTH DIRECTIONS 3G5h.S

CONSTRUCTION QUALITY
☐ COUNTERMEASURES FOR OUT-OF-PLANE BEHAVIOUR 3G7a.S
☐ IN-PLANE REINFORCEMENT OF LATERAL LOAD RESISTANCE 3G7b.S

FLOOR BEHAVIOUR AND CONNECTION
☐ FLOOR NON-RIGID 4G4a.S
☐ FLOOR POORLY OR NOT CONNECTED TO VERTICAL STRUCTURE 4G4b.S
☐ FLOOR HEAVY 4G4c.S

ROOF BEHAVIOUR AND CONNECTION
☐ ROOF NON-RIGID 4G5a.S
☐ ROOF POORLY OR NOT CONNECTED TO VERTICAL STRUCTURE 4G5b.S
☐ ROOF HEAVY 4G5c.S

NOT UNITARY STRUCTURAL BEHAVIOUR
☐ CRUMBLING 4E1a.S
☐ DETACHABLE ELEMENTS 4E1b.S

SOFT FLOOR
☐ SOFT INTERMEDIATE FLOOR 4E2a.S
☐ SOFT GROUND FLOOR 4E2b.S

IRREGULAR VERTICAL MASS DISTRIBUTION
☐ LARGE MASS ON THE BOTTOM 4E3a.S
☐ LARGE MASS ON THE TOP 4E3b.S

INCREASED STRESSES AND/OR DISPLACEMENTS
☐ SHORT COLUMN 4E5a.P
☐ UNSUPPORTED LOAD 4E5b.P
☐ OUT-OF-PLANE 4E5c.P
☐ UNCONSTRAINED THRUST 4E5d.P
☐ AMPLIFIED LATERAL DISPLACEMENT 4E5e.P
☐ PRECARIOUS BALANCE 4E6a.P
☐ OVERTURNING/DOWING EFFECT 4E6b.P

ROBUSTNESS CHARACTERIZATION

FRAGILITY CURVES
 Probability of exceeding the damage state

EQUIVALENT STRUCTURAL FRAGILITY (E.G. HAZUS)

Damage State	Measure unit	Value
Slight structural damage A1	g	<input type="text"/>
Moderate structural damage A2	m/s ²	<input type="text"/>
Slight structural damage A1	m	<input type="text"/>
Moderate structural damage A2	ft	<input type="text"/>
Slight structural damage A1	km/h	<input type="text"/>
Moderate structural damage A2	mph	<input type="text"/>

BUILDING CODES
 Building code:
 Slight structural damage A1:
 Moderate structural damage A2:
 Measure unit: g m/s² m ft km/h mph

VISUS ROBUSTNESS CLASS

Class	A1	A2
CLASS 1	0.05g	0.20m
CLASS 2	0.25g	0.50m
CLASS 3	0.10g	0.25m
CLASS 4	0.01g	0.10m
CLASS 5	0.01g	0.10m

THROUGH EXPERT LOCAL EVALUATIONS

Damage State	Measure unit	Value
Slight structural damage A1	g	<input type="text"/>
Moderate structural damage A2	m/s ²	<input type="text"/>
Slight structural damage A1	m	<input type="text"/>
Moderate structural damage A2	ft	<input type="text"/>
Slight structural damage A1	km/h	<input type="text"/>
Moderate structural damage A2	mph	<input type="text"/>

REPRESENTATIVE PHOTOS

REPRESENTATIVE PHOTOS OF THE VISUS TYPOLOGY
 Filenames:

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
----------------------	----------------------	----------------------	----------------------

EXAMPLES OF DAMAGED BUILDINGS
 Filenames:
 Brief description of the hazard that caused the damage:

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
----------------------	----------------------	----------------------	----------------------

SHORT DESCRIPTION AND NOTES

* for water hazard, the water velocity assumed as default is 0.3 m/s < Vw ≤ 1.0 m/s

2.3.1 Response adaptation

The adaptation of the response to a hazard requires the availability of technical documents providing information on the expected behaviour of a structural type, or of a specific element or component (for non-structural or parts of the buildings). These data should be provided by the focal point for the natural hazards assessed through the VISUS methodology.

This information could be supplied using different methodologies, such as (see also Fig. 2.4):

- The capacity spectrum method (e.g. Hazus® [FEMA, 2003]), Figure 2.4a

- Fragility curves (e.g. global earthquake model [Jaiswal et al., 2013]), Figure 2.4b
- Vulnerability classes (with expected damage) (e.g. European macroseismic scale 1998 [Grunthal, 1998]), Figure 2.4c
- An empirical expert estimation that defines three points indicating typical, lower and upper capacity values, taking into account local knowledge or the cases documented after past events (Grimaz, Malisan and Zorzini, 2016), Figure 2.4d

The adaptation process of VISUS acquires information on the response of buildings or elements and implements it in the evaluation algorithm.

Fig. 2.4 Examples of methodologies for the adaptation of the VISUS methodology to local data

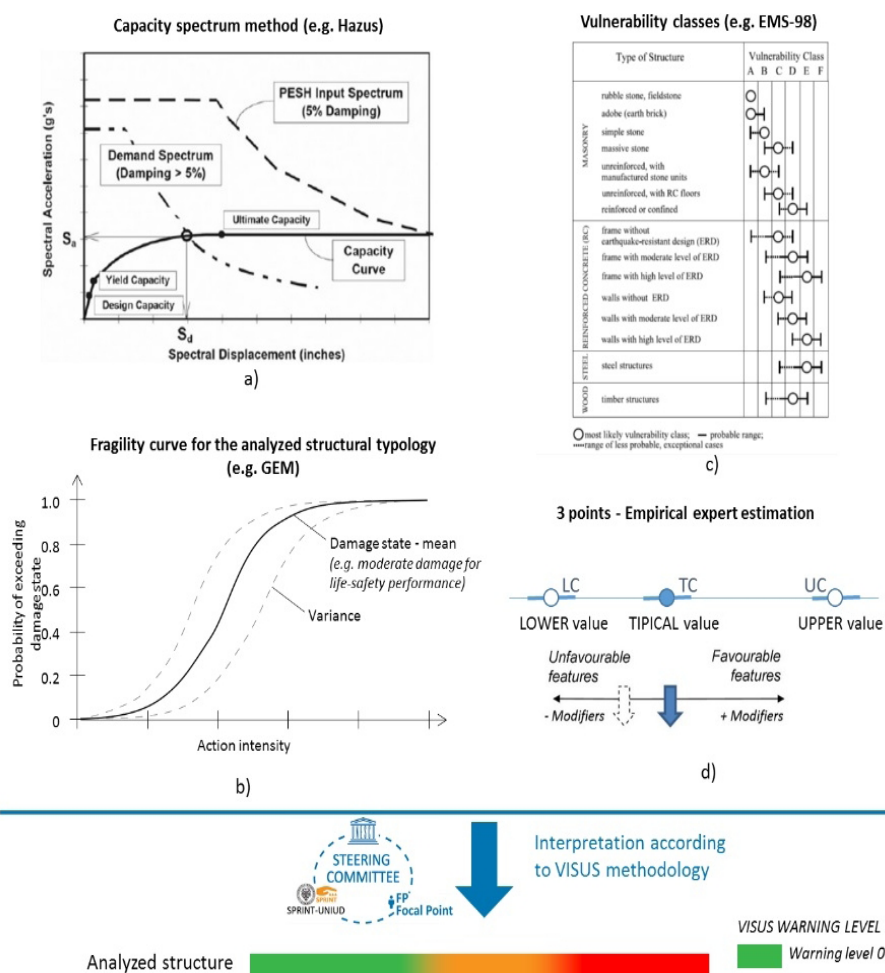


Figure 2.5 shows an example of how to use a fragility curve to adapt the VISUS methodology to local data. A fragility curve associates a probability with a structure, an element or a component, that is, a probability of it reaching a specific damage state when exposed to the acting hazard. Fragility curves are specific for pre-identified types of structure (or element, component, etc.) and specific hazards. They can be defined using different approaches, such as empirical, expert

elicitation based, analytical or hybrid (Maio and Tsionis, 2015).

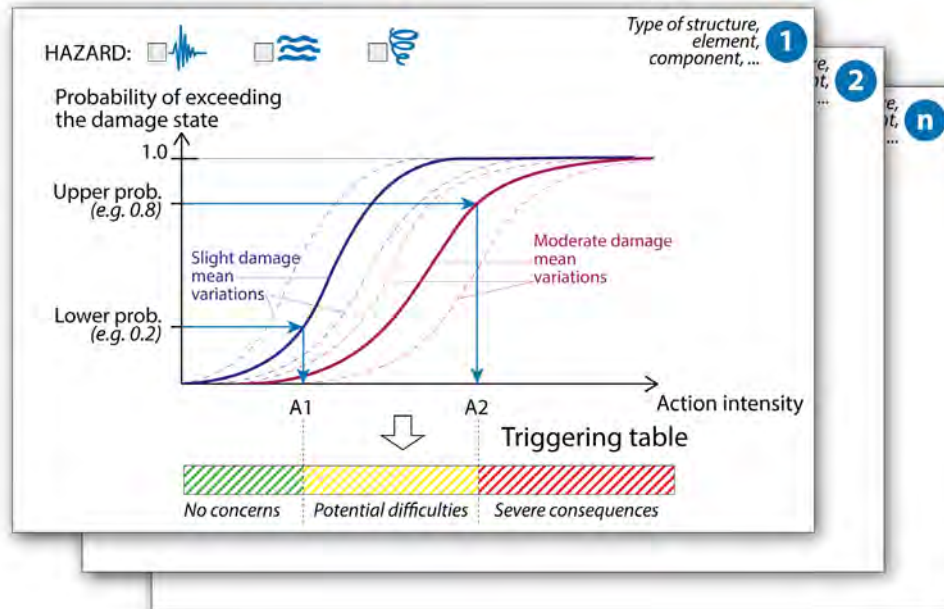
Fragility curves represent the mean value of several data points, therefore, they are affected by a (sometimes large) level of uncertainty.

The adaptation of the VISUS methodology using fragility curves requires the identification of the two val-

ues A1 and A2, which are the discriminating factors between the warning levels. A1 identifies the upper limit of the green class (no safety concerns). The value is obtained from the fragility curve corresponding to slight damage, and in turn corresponds to a low

probability of occurrence of the damage (as a guide, a value of 20 per cent probability can be adopted). A2 is derived from the fragility curve describing moderate damage. For this value, a higher probability (e.g. 80 per cent) is adopted.

Fig. 2.5 *Adaptation of the VISUS methodology to local data using a fragility curve*



2.4 VISUS multi-hazard adaptation form for safety upgrading needs

The VISUS multi-hazard adaptation form AF-S: safety upgrading needs (Fig. 2.6) is essential for the adaptation to local circumstances of the algorithms concerning the safety upgrading needs (see Volume 2, Annex AM6). The information acquired through the form concerns the range of the cost of a new school (United States dollars per square metre), and the definition of coefficients and modifiers adopted and explained in the safety upgrading needs evaluation

criteria (Volume 2, Annex AM6). The form shows the values proposed by VISUS, which are eventually adopted if no data are provided.

Fig. 2.6 VISUS multi-hazard adaptation form AF-S: safety upgrading needs

VISUS MULTI-HAZARD ADAPTATION FORMS				
SAFETY UPGRADING NEEDS				
<div> <div> </div> <div> </div> </div>				
<div> <div>PROJECT NAME</div> <div></div> </div>				
<div> <div>FOCAL POINT IDENTIFICATION</div> <div></div> </div>				
<div> <div>(NAME, SURNAME, AFFILIATION, E-MAIL)</div> </div>				
VISUS SAFETY UPGRADING NEEDS - DEFINITION OF REFERENCE VALUES				
<input type="checkbox"/> REFERENCE VALUE				
<div> <div>Cost of a new school</div> <div>Costs for new construction (reference construction standard for a new school)</div> <div>\$/m²</div> <div> <div>min</div> <div></div> <div>max</div> <div></div> </div> </div>				
<div> <div>Description of the reference construction</div> <div>Number of floors, area, structural typology, ...</div> <div></div> </div>				
<div> <div>Cost of a new school based on structural typology</div> </div>				
<div> <div>Structural typology (main)</div> <div>Reinforced concrete</div> <div>Masonry</div> <div>Steel</div> <div>Wood</div> </div>				
<div> <div>Costs for new construction (\$/m²)</div> <div> <div>min (\$/m²)</div> <div></div> <div>max (\$/m²)</div> <div></div> </div> </div>				
<div> <div>Cost for global structural retrofit (\$/m²)</div> <div> <div></div> <div></div> </div> </div>				
<div> <div>Short description of the reference construction</div> <div>Number of floors, area, ...</div> <div></div> </div>				
<input type="checkbox"/> MODIFIERS				
<div> <div>Coefficient for regional (or province or district) variation</div> <div>Name of the region (or province or district)</div> <div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> </div> </div>				
<div> <div>Coefficient for disadvantaged location</div> <div>K_r</div> <div>Proposed: 1.1</div> </div>				
<div> <div>Coefficient for difficulties in construction site</div> <div>K_v</div> <div>Proposed: 1.2</div> </div>				
<div> <div>Weight for interventions in schoolyard</div> <div>w_{sy}</div> <div>Proposed: 0.05</div> </div>				
<div> <div>Weight for interventions in buildings in permanent, semi-permanent and temporary buildings</div> <div> <div>$w_{type=permanent}$</div> <div>Proposed: 1.0</div> <div>$w_{type=semi-permanent}$</div> <div>Proposed: 0.8</div> <div>$w_{type=temporary}$</div> <div>Proposed: 0.5</div> </div> </div>				
<div> <div>Weight for interventions in ancillary buildings</div> <div>w_{ancil}</div> <div>Proposed: 0.5</div> </div>				
<div> <div>Weight for interventions in heritage buildings</div> <div>w_h</div> <div>Proposed: 1.5</div> </div>				
<div> <div>Maximum level of effort for each group of measures</div> <div>It expresses the maximum allowable effort for each group of measures, as a percentage of the amount necessary for the reconstruction of a new school</div> </div>				
<div> <div>L_{G1}</div> <div>Proposed: 3%</div> <div>measures concerning non-structural elements, performed directly by school personnel or by workers with no specific technical skills</div> </div>				
<div> <div>L_{G2}</div> <div>Proposed: 50%</div> <div>measures concerning non-structural elements, usually performed by skilled workers</div> </div>				
<div> <div>L_{G3}</div> <div>Proposed: 50%</div> <div>re-entrant or localized work on structural elements, usually entailing the installation of a small construction site by groups of skilled workers or a small construction company</div> </div>				
<div> <div>L_{G4}</div> <div>Proposed: 70%</div> <div>significant work on the structural elements, usually entailing the installation of a construction site by a large construction company</div> </div>				
<div> <div>Coefficient for the reduction of the level of effort from a group to the higher group</div> <div>α</div> <div>Proposed: 0.7</div> </div>				

3. TRANSLATION OF VISUS MATERIALS

The adaptation process requires the translation of the VISUS survey forms and of the VISUS training material into the local language in order to simplify the transfer of knowledge from experts to surveyors. The list of terms to translate and editable training slides are shared with the local committee in the VISUS cloud to facilitate translation.

VISUS has been translated, from the master English version, into Bahasa Indonesia, French, Portuguese, and Spanish.

4. REFERENCES

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Annex to VISUS Implementation

| AI2 VISUS Survey Forms

Please kindly note that the content of the annex is subject to updates. The latest version of the annex can be accessed here:

- <http://www.unesco.org/new/en/natural-sciences/special-themes/disaster-risk-reduction/school-safety/safety-assessment-method-visus/>
- <http://sprint.uniud.it/en/research/methodologies/visus>

1. STRUCTURE OF THE VISUS SURVEY FORMS

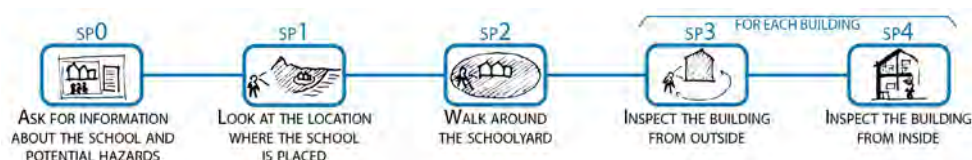
The Visual Inspection for defining Safety Upgrading Strategies (VISUS) survey forms are divided into six parts that correspond to the survey phase (SP) during which they are completed:

- SP0: General information on the school and on reference events
- SP1: Inspection of the location

- SP2: Inspection of the schoolyard
- SP3: External inspection of each building
- SP4: Internal inspection of each building
- SPS: Sketch of the school complex
- SPN: Notes on the survey

The forms are shown in section 2. Figure 1.1 illustrates the first five phases of the VISUS survey.

Fig. 1.1 First five phases of the VISUS survey, as illustrated on VISUS survey forms SP0 to SP4



1.1 SP0: general information

The VISUS survey form SP0 is shown in section 2.

In the header of this form, there are two fields, for:

- Representative picture of the school: the filename of a photo (only one) that will be used as the reference photo for the individual report of the school. The photo should be taken from the front of the school.
- Overview of the school (pictures): filenames of photo that provide an overview of the school.

1.1.1 School and survey information

The **school information section** of the form (Fig. 1.2) is for the following information:

- School name: the name used for identifying the school. The school name is usually provided by the focal point, or can be found on the sign of the school.
- State/country, province, district and address: together, these fields describe the location of the school. The focal point should guide the surveyor in completing this information.
- Coordinate system (latitude, longitude and altitude): the coordinates facilitate the school being located on a map. They can be pre-determined and filled in the form during the desk work preparation phase of the survey, or by using a global positioning system (GPS) device during the survey.

Fig. 1.2 VISUS survey form SPO: school information

SCHOOL INFORMATION				
School name:				
State/Country:		Province, District:		
Address: (Village, city, ...)				
Coordinate system:	<input type="checkbox"/> WGS 84 <input type="checkbox"/> Other:	Latitude:	Longitude:	Altitude:

The **contacts section** of the form (Fig. 1.3) is for the following information:

- Contact name: full name of the person at the school who is the contact point for VISUS, and his or her role at the school.
- Phone: if available, the phone number of the school or of the contact person is noted here.
- Email: if available, the email address of the school or of the contact person is noted here.
- Fax: if available, the fax number of the school is noted here.

Fig. 1.3 VISUS survey form SPO: contacts

CONTACTS	
Contact name:	Phone:
E-mail:	Fax:

In the **survey team section** of the form (Fig. 1.4), the members of the survey team (see section 3.1.1 of Vol-

ume 3) are listed with their email address or phone number.

Fig. 1.4 VISUS survey form SPO: survey team

SURVEY TEAM		
ROLE	NAME	CONTACT
Team leader		

1.1.2 Use of the school

The information required on the use of the school could be asked for from school staff or be determined from other investigations previously conducted on the school (e.g. a census).

In the **use of the school** section (Fig. 1.5) data that allow, among other things, assessment of persons in the school are recorded. These data are:

- Type of school: public, private or religious. More than one type can be selected.
- Daily usage: to indicate whether the school is used only during the day, or there are dormitories in the school and it is used both day and night.
- Weekly usage: to indicate the days of the week on which the school is used.
- Yearly usage: to indicate the months in which the school is used.
- Grade levels taught: the grade levels are grouped according to the definitions in Table 1.1.
- People in the school: to record the number of students, teachers and non-teaching personnel at the school, with each of these categories being divided into male and female. The values given here can be approximate, as it is understood they will change from year to year.
- Other information:
 - Whether there are people with disabilities attending the school
 - Whether the school is used (or is set up to be used) for extracurricular activities
 - Whether the school has one or more cultural heritage buildings (if so, different (higher)

values for safety upgrading actions will be associated with the buildings and precautions will be necessary during potential safety upgrading actions)

- Whether the school is used for emergency purposes, for example as a safe zone (shelter)

during a hazardous event or as a gathering place for the community after a disaster.

- Number of buildings: the number of main and ancillary buildings in the school should be recorded, and the values should be the same as those on the SP3 and SP4 forms.

Fig. 1.5 VISUS survey form SP0: use of the school

Table 1.1 Association of the level of study, school grade and typical ages used in the VISUS survey forms

Level of study	Grade	Ages
Pre-primary/ kindergarten	Nursery	3+
	Preschool	4+
	Kindergarten	5+
Primary	Grade 1	6+
	Grade 2	7+
	Grade 3	8+
	Grade 4	9+
	Grade 5	10+
Lower secondary	Grade 6	11+
	Grade 7	12+
	Grade 8	13+
	Grade 9	14+
Upper secondary	Grade 10	15+
	Grade 11	16+
	Grade 12	17+
Vocational	–	14+

1.1.3 Reference events

The questions on the hazard are divided into two sections, the first one concerns the experienced hazardous events and the second the characterization of the reference events.

1.1.3.1 Hazardous events experienced

In this section (Fig. 1.6), information is gathered on hazardous events experienced by the school. This information should be acquired by asking school personnel or by a research on historical events.

For each hazard, a check mark is made if it has been experienced by the school and, if it has been, the year in which it occurred is recorded, if known. This infor-

mation will enable a deeper research on the events and, eventually, the understanding of their magnitude.

Fig. 1.6 VISUS survey form SP0: hazardous events – experienced

1.1.3.2 Reference events characterization

This section (Fig. 1.7) is divided into five subsections. The VISUS methodology enables a safety assessment for ordinary use and for the following hazards:

- Fire
- Water (flood and tsunami)

- Earthquake
- Air (strong wind, hurricane, etc.)

Note: This section should be filled in during desk work preparation with the support of the survey co-ordination unit and using the national hazard maps.

Fig. 1.7 VISUS survey form SP0: reference events characterization

For ordinary-use characterization, the following aspects should be determined:

- The **predicted snow height** (usually defined in the building code)
- The **humidity** (an estimate)
- The **temperature** in the periods during which the school is used (see section 1.1.2) – the minimum and maximum values are recorded, in degrees Celsius or Fahrenheit
- The presence of **insects** ('Yes' is checked when their presence could cause disease)
- The presence of **termites** ('Yes' is checked when they could affect the school buildings)

For fire reference events characterization, the following aspects should be determined:

- Occurrence of **lightning**, which could ignite fires
- The potential for **wildfire**, which could affect the school if it is surrounded by trees, especially if the building structures are of combustible material

For water reference events characterization, the following aspects should be determined:

- **Flood level, from hazard map (FLM):**
 - No flood
 - ≤ 0.3 m
 - 0.3–1.0 m
 - 1.0–2.0 m
 - ≥ 2.0 m
 - Other (m): the value of the depth of flood level in metres (only the number, not the unit of

measure [metres] is needed)

- **Flood level, experienced (FLE):** the maximum water depth of experienced flood, using the ranges defined above.
- **Predicted tsunami area (PTA):** this information could be determined from hazard maps and from past events.
- **Predicted or experienced tsunami level (TL):** the tsunami level (the maximum between the level reported in the hazard map and the level experienced during past events). This should be a single value; if the hazard maps provide a range, the focal point should advise whether to record the maximum or the mean value.
- **Reference flood level (RFL):** this value summarizes all the previous values, and is defined as the maximum of them, as follows:

$$\text{RFL} = \max(\text{FLM}, \text{FLE}, \text{TL})$$
 The RFL should be indicated using the ranges defined above.
- **Reference water velocity (RWV):** if available on the hazard maps, a reference value for floodwater velocity should be recorded, using the ranges given on the VISUS form.
- **Flash flooding area (FFA):** to indicate whether the school is in a location subject to flash flooding, which means that the floodwater level rises very quickly, usually because the site is in a low lying area. Flash flooding can also be characterized by high water velocity and a large amount of debris in the water.
- **Heavy rain:** to indicate the potential occurrence of heavy rain (which is often associated with severe wind).
- **Rainfall (upstream):** to indicate the presence of conditions that could cause flooding of the school site; for this purpose, conditions upstream to the school must be determined. If heavy rainfall, prolonged rainfall or potential snowmelt that could cause flooding at the school are identified, these conditions should be recorded.
- **Wind force:** if the school is in a coastal area, floods could be associated with storm surges, so

this should be indicated in the air hazard section.

- **Early warning for flood:** to indicate whether systems or devices are in place that provide an early warning for flood hazards.
- **Early warning for tsunami:** to indicate whether systems or devices are in place that provide an early warning for tsunamis.

For earthquake reference events characterization, the following aspects should be determined:

- **Predicted peak ground acceleration (PGA)** values (defined in units of acceleration gravity [g]) in the horizontal direction, obtained from hazard maps.
- **Macroseismic intensity** (predicted or experienced), using the following scales: Mercalli-Cancani-Sieberg (MCS), Medvedev-Sponheuer-Karnik (MSK), European Macroseismic Scale (EMS), Modified Mercalli (MM), Japanese Meteorological Agency (JMA) and China Seismic Intensity Scale (CSIS).
- **Early warning for earthquake:** to indicate whether systems or devices are in place that provide an early warning for earthquakes.

For air reference events characterization, the following aspects should be determined:

- **Wind force,** as a maximum of the predicted and experienced wind speed in the location of the school. The predicted wind speed velocity could be defined using hazard maps or building codes. The definition of the classes takes into consideration both the Beaufort and the Saffir-Simpson scales. Table 1.2 lists the classes for relevant wind actions and their wind speed, both in kilometres per hour and miles per hour.
- **Early warning for wind** indicates whether systems or devices are in place that provide an early warning in case of strong winds.

Table 1.2 *Wind force classes definition*

Class name	Wind velocity	
	km/h	mph
Breeze or moderate gale	< 62	< 39
Gale	62–74	39–46
Strong gale	75–88	47–54
Storm or violent storm	89–118	55–73
Class 1	119–153	74–95
Class 2	154–177	96–110
Class 3	178–208	111–130
Class 4	209–251	131–155
Class 5	≥ 252	≥ 156

1.2 SP1: inspection of the location








The VISUS survey form SP1 is shown in section 2.




















photos that illustrate the location are recorded.




















In the header of the form, the surveyor indicates the school ID code and the survey date. In the ‘Overview of the location (pictures)’ field, the filenames of the

Then, the surveyor records the presence of observables (OBS). Table 1.3 lists the OBS of the SP1 form, divided by focus group.

Table 1.3 *VISUS observables (OBS) for location inspection (VISUS survey form SP1)*

Focus group	Code	OBS	Name
G1 - Topography	1G1a.L		Plain
	1G1b.L		Rough
	1G1c.L		Slope
	1G1d.L		Scarp/cliff
	1G1e.L		Crest/top
	1G1f.L		Valley
	1G1g.L		Alluvial fan

Focus group	Code	OBS	Name
G2 - Context	1G2a.L		Urban
	1G2b.L		Rural
	1G2c.L		Mountainous
G3 - Natural hazards	1G3a.L		Volcano
	1G3b.L		On a landslide
	1G3c.L		Impact by a landslide
	1G3d.L		Impact by a rockfall
	1G3e.L		Within a forest
G4 - Human-induced hazards	1G4a.L		Nearby activity may cause a technological accident
	1G4b.L		Dam upstream
	1G4c.L		Under electrical power transmission lines
G5 - Unsuitable location	1G5a.L		Unsuitable location for a school
G6 - Emergency services	1G6a.L		Emergency services far from school
U1 - Access to school	1U1a.L		Access via high-traffic street
	1U1b.L		Access via high-traffic street with traffic signals or lights
	1U1c.L		Unsafe transit to and from school
	1U1d.L		Accessible only by footpath
U2 - Healthiness	1U2a.F		Wetland
W1 - Wave action	1W1a.L		Coast – wave action

Focus group	Code	OBS	Name
W2 - Upstream slope (water velocity)	1W2a.L		Gentle or no slope upstream (mean slope < 4°)
	1W2b.L		Moderate slope upstream (mean slope 4-15°)
	1W2c.L		Steep slope upstream (mean slope > 15°)
W3 - Land roughness (water velocity)	1W3a.L		Open land upstream
	1W3b.L		Upstream conditions reduce the water velocity
W4 - Debris generation	1W4a.L		Highly erodible soil upstream
	1W4b.L		Potential for debris generation upstream
W5 - Local characteristics	1W5a.L		School located on a previous mudflow
E1 - Soil stiffness (hazard modifier)	1E1a.L		Very stiff soil or hard rock (NEHRP: A or B class)
	1E1b.L		Intermediate soil stiffness (NEHRP: C, D or unknown class)
	1E1c.L		Very soft soil (NEHRP: E class)
E2 - Geomorphology (hazard modifier)	1E2a.L		Foothill zone
	1E2b.L		Landfill
E3 - Local characteristics	1E3a.L		Liquefaction
	1E3b.L		On or near a fault
A1 - Land roughness (wind speed)	1A1a.L		Scattered buildings – minor protection
	1A1b.L		Surrounded by small buildings or forest
	1A1c.L		Surrounded by tall buildings – protection
A2 - Debris generation	1A2a.L		Context could cause large items of debris

1.3 SP2: inspection of the schoolyard

The VISUS survey form SP2 is shown section 2.















In the header of the form, the surveyor indicates the filenames of the 'Representative picture' of the schoolyard and the photos that represent the 'Overview of the schoolyard'.




















In the box 'Estimated schoolyard area (m²)', the sur-


















veyor records the area of the school. This value could be provided by the school personnel or could be determined during desk work preparation using web tools on web maps.

Then, the surveyor records the presence of observables (OBS). Table 1.4 lists the OBS of the SP2 form, divided by focus group.

Table 1.4 VISUS observables (OBS) for schoolyard inspection (VISUS survey form SP2)

Focus group	Code	OBS	Name
U1 - Dangers	2U1a.L		Potential falls (from, e.g., terraces, steep slopes)
	2U1b.L		Holes or potholes
	2U1c.N		Unsafely covered holes
	2U1d.N		Potential hits with protruding or sharp objects
	2U1e.N		Potential falls due to tripping hazards
	2U1f.N		Potential falls due to slippery or uneven floor
	2U1g.N		Potentially dangerous contact with live lines or high voltage elements
U2 - Healthiness	2U2a.N		Potentially dangerous animals
	2U2b.F		Mud
	2U2c.F		Unrestricted waste collection or noxious area
F1 - Ignition sources	2F1a.N		Free flames near combustible material
	2F1b.N		Material with potential for autocombustion
F2 - Combustible material	2F2a.N		Accumulation of combustible material
	2F2b.L		Dry, widespread bushes

Focus group	Code	OBS	Name
F3 - Protection	2F3a.F		Extinguishers
W1 - Protection	2W1a.L		School complex on an elevated site (> RFL)
	2W1b.L		Potential scour could impact the school complex
	2W1c.L		Levee (on impermeable ground or with pumps)
W2 - Impermeability	2W2a.L		Impermeable ground
W3 - Releases	2W3a.N		Contaminants released into the floodwater
W4 - Safe areas	2W4a.F		Safe and dry area
E1 - Falls of elements	2E1a.N		Potential overturning of fences
	2E1b.N		Falls of elements in the schoolyard
	2E1c.N		Hazards from nearby buildings
	2E1d.N		Potential falls of suspended live lines (e.g. electrical)
E2 - Safe areas	2E2a.F		Sufficient safe area
A1 - Protection	2A1a.N		Stable wind barriers
A2 - Falls of elements	2A2a.N		Potential falls of trees or poles
	2A2b.N		Potential overturning of fences
	2A2c.N		Potential falls of suspended live lines (e.g. electrical)
A3 - Shelter	2A3a.F		Wind shelters in the schoolyard
S1 - Accessibility	2S1a.D		Accessibility barriers to school complex
	2S1b.D		Mobility barriers in the schoolyard

Focus group	Code	OBS	Name
S2 - Water and sanitation	2S2a.D		Water (pipelines)
	2S2b.D		Water tank
	2S2c.D		Sewer
	2S2d.D		Cesspool
S3 - Equipment and facilities	2S3a.D		Lighting
	2S3b.D		Playground equipment and/or sport fields
	2S3c.D		Car parking and driveways
	2S3d.D		Waste receptacles and collection area
S4 - Security (fences and access gates)	2S4a.D		No fence
	2S4b.D		Partially fenced
	2S4c.D		Fully fenced
	2S4d.D		Low fence
	2S4e.D		High fence
	2S4f.D		Open access
	2S4g.D		Controlled access gates
S5 - Constraints	2S5a.D		Disadvantaged location
	2S5b.D		Constraints in the site construction spaces

1.4 SP3: external inspection of each building

The VISUS survey form SP3 is shown in section 2.









This form has to be compiled for each building of the school (jointly with the SP4 form).

















In the header of the form, the surveyor indicates the 'Building ID code' (e.g. 'B01', 'B02', etc., where B stands for building). The codes are included on the sketch of the school (see section 1.6). The surveyor indicates the filename of the 'Representative picture'




















of the building in the appropriate field. This photo will be used as the main photo of the building in the individual report. The field 'Overview of the building (pictures)' allows the surveyor to annotate the photos that provide an overview of the building.





















Then, the surveyor records the presence of observables (OBS). Table 1.5 lists the OBS of the SP3 form, divided by focus group.














Table 1.5 VISUS observables (OBS) for building external inspection (VISUS survey form SP3)









Focus group	Code	OBS	Name
G1 - Natural hazards on the building	3G1a.L		On a landslide
	3G1b.L		Impact by a landslide
	3G1c.L		Impact by a rockfall
G2 - Type of function, class of building and VISUS typology	3G2a.D		Main building
	3G2b.D		Ancillary building
	3G2c.S		Permanent building
	3G2d.S		Semi-permanent building
	3G2e.S		Temporary building
	VT	-	VISUS typology number
G3 - Building characteristics: plan shape	-	-	Simple
	-	-	Complex
	-	-	Compact
	-	-	Elongated
	-	-	Winged
G3 - Building characteristics: elevation shape	-	-	Simple
	-	-	Complex




















Focus group	Code	OBS	Name
G3 - Building characteristics	-	-	Gross floor area (m ²)
	-	-	Structural units (number of)
	Nag	-	Above-ground stories (number of)
	Nug	-	Underground stories (number of)
	-	-	External staircases (number of)
	-	-	Exits (number of)
	-	-	Construction date/period
	-	-	Building code/s (standards/regulations)
G4 - Structural system: reinforced concrete	3G4a.S		Reinforced concrete walls
	3G4b.S		Reinforced concrete dual frame wall system
	3G4c.S		Reinforced concrete frame
	3G4d.S		Precast
	3G4e.S		Reinforced concrete vertical piers only
G4 - Structural system: masonry	3G4f.S		Reinforced masonry
	3G4g.S		Confined masonry
	3G4h.S		Unreinforced masonry
	3G4i.S		Masonry vertical piers only
G4 - Structural system: earth or adobe	3G4j.S		Earth or adobe structure
G4 - Structural system: steel	3G4k.S		Unbraced steel frame
	3G4l.S		Braced steel frame
	3G4m.S		Steel vertical piers only
G4 - Structural system: wood	3G4n.S		Wood frame unbraced
	3G4o.S		Wood panels or wood frame braced
	3G4p.S		Wood vertical piers only

Focus group	Code	OBS	Name
G4 - Structural system: bamboo	3G4q.S		Bamboo structure
G4 - Structural system: other	3G4r.S		Other
G5 - Horizontal distribution and organization of lateral resistance elements	3G5a.S		Regular cell distribution of resistance
	3G5b.S		Resistance distributed mainly to an extremity
	3G5c.S		Resistance distributed mainly to the centre
	3G5d.S		Resistance distributed mainly to the perimeter
	3G5e.S		'C-shape' distribution of resistance (one weaker side)
	3G5f.S		Large distance among lateral resistance systems ($L/s > 25$)
	3G5g.S		Inadequate resistance in one direction
	3G5h.S		Inadequate resistance in both directions
G6 - Material resistance	3G6a.S		Poor material resistance (lower than ordinary)
G7 - Construction quality and building condition	3G7a.S		Countermeasures for out-of-plane behaviour
	3G7b.S		In-plane reinforcement of lateral load resistance
	3G7c.S		Poor connection of vertical load-carrying elements
	3G7d.S		Weak for gravity loads
	3G7e.S		Poor maintenance
	3G7f.S		Poor construction quality (e.g. concrete segregation)
	3G7g.S		Evidence of existing light damage
	3G7h.S		Evidence of existing severe damage

Focus group	Code	OBS	Name
G8 - Roof covering and architectural features	3G8a.S		Concrete or masonry structure
	3G8b.S		Wood structure
	3G8c.S		Steel structure
	3G8d.N		Tiles/pieces heavy
	3G8e.N		Tiles/pieces sharp
	3G8f.N		Tiles/pieces light
	3G8g.N		Sheets
G9 - Egress	3G9a.F		External obstruction to egress
U1 - Dangers	3U1a.N		Potential hits with protruding or sharp objects
	3U1b.N		Potential falls of people from unprotected and accessible raised areas
	3U1c.N		Potential fall of objects or elements (e.g. vases, equipment, tiles, cladding)
	3U1d.N		Potential falls due to slippery or uneven floor
	3U1e.N		Potentially dangerous contact with live lines or high voltage elements
U2 - Healthiness	3U2a.N		Insect screens
	3U2b.N		Asbestos
F1 - Interdependence	3F1a.L		Proximity to accumulation of combustible material < 5 m
	3F1b.L		Proximity to combustible building < 10 m
	3F1c.L		Proximity to forest area < 15 m
F2 - Combustible envelope	3F2a.P		External combustible sidings
F3 - Egress	3F3a.P		External stairs for fire escape

Focus group	Code	OBS	Name
W1 - Protection from floodwater	3W1a.L		Building on an elevated site (>RFL)
	3W1b.S		Lowest floor higher than RFL
	3W1c.S		Solid perimeter foundation wall
	3W1d.S		Piers, piles or columns with braces
	3W1e.S		Piles or columns without braces
W2 - Water permeability and flow into the building	3W2a.P		Water flow into building prevented
	3W2b.P		Water flow into building reduced
	3W2c.P		Free flow of water into building
	3W2d.N		Sewer with backflow valves
	3W2e.P		Sealed/impermeable envelope below water
W3 - Foundations (anchoring and/or scouring)	3W3a.S		No foundation
	3W3b.S		Shallow foundation
	3W3c.S		Deep foundation
	3W3d.P		Protected foundation (e.g. riprap)
	3W3e.L		Potential scour could impact the building
	3W3f.S		Building anchored to ground
W4 - Rain flooding	3W4a.S		Underground area could be inundated by rainwater
E1 - Foundations	3E1a.S		Stepped foundation

Focus group	Code	OBS	Name
E2 - Stress focus and local weaknesses	3E2a.P		Discontinuous load path
	3E2b.P		Pounding
	3E2c.P		Weak connection
	3E2d.P		Weak small portion of the building
E3 - Falls from nearby buildings	3E3a.N		Hazards from nearby buildings
E4 - Falls from building	3E4a.N		Unsecured infills or sidings
	3E4b.N		Falls of unsafe elements - severe consequences
	3E4c.N		Falls of unsafe elements - difficulties
E5 - Egress	3E5a.F		Exit exposed to potential threats
A1 - Local intensity increase	3A1a.L		Proximity to other buildings (less than 15 m)
A2 - Air permeability	3A2a.P		Small openings always open
	3A2b.P		Medium openings (windows and doors) always open
	3A2c.P		Medium openings (windows and doors) with fragile closure (glass)
	3A2d.P		Large openings (> 30%) always open
	3A2e.P		Large openings (> 30%) with fragile closure
	3A2f.P		No openings or enclosed openings (e.g. shutters)
A3 - Connection to ground	3A3a.S		Raised building
	3A3b.S		No foundations (simple support)

Focus group	Code	OBS	Name
A4 - Roof shape (suction)	3A4a.P		Flat roof
	3A4b.P		Sloping roof
	3A4c.P		Barrel roof
A5 - Roof slope (suction)	3A5a.P		Low slope
	3A5b.P		Moderate slope
	3A5c.P		Steep slope
A6 - Irregularities (local stress)	3A6a.P		Complex architectural shape
	3A6b.P		Dormers or gables
	3A6c.P		Roof of veranda is extension of main roof
	3A6d.P		Indentation (> 1 m)
A7 - Falls from nearby buildings or elements	3A7a.N		Hazards from nearby buildings
	3A7b.N		Potential falls of trees or poles
	3A7c.N		Potential falls of suspended live lines (e.g. electrical)
A8 - Falls from this building	3A8a.P		Envelope poorly anchored to structure
	3A8b.P		Roof covering poorly anchored to structure
	3A8c.P		Unsecured infills or sidings
	3A8d.N		Falls of unsafe elements – severe consequences
	3A8e.N		Falls of unsafe elements – difficulties
A9 - Egress	3A9a.F		Exit exposed to potential threats

1.5 SP4: internal inspection of each building





The VISUS survey form SP4 is shown in section 2. that used in the SP3 form.




















This form has to be compiled for each building of the school (jointly with the SP3 form).




















Then, the surveyor records the presence of observables (OBS). Table 1.6 lists the OBS of the SP4 form, divided by focus group.





















In the header of the form, the surveyor indicates the 'Building ID code', which should be the same code as

















Table 1.6 VISUS observables (OBS) for building internal inspection (VISUS survey form SP4)



















Focus Group	Code	OBS	Name
G1 - Utilization	-	-	Classrooms (number of)
	-	-	Male toilets (number of)
	-	-	Female toilets (number of)
	-	-	Offices
	-	-	Laboratory
	-	-	Library
	-	-	Gym
	-	-	Canteen
	-	-	Kitchen
	-	-	Archive
	-	-	Storage
	-	-	Auditorium
	-	-	Dormitories
	-	-	Technical room
	-	-	Unused spaces
	-	-	Other-use spaces
	-	-	Under construction spaces
G2 - Occupancy	-	-	Occupancy less than 100 persons
	-	-	Occupancy between 100 and 500 persons
	-	-	Occupancy more than 500 persons
G3 - Egress	4G3a.F		Alternative egress paths
	4G3b.F		Single exit serving more than 50 people
	4G3c.F		Narrowed egress
	4G3d.F		Obstructed egress




















Focus Group	Code	OBS	Name
G4 - Floor behaviour and connection	4G4a.S		Floor: non-rigid
	4G4b.S		Floor: poorly or not connected to vertical structure
	4G4c.S		Floor: heavy
G5 - Roof behaviour and connection	4G5a.S		Roof: non-rigid
	4G5b.S		Roof: poorly or not connected to vertical structure
	4G5c.S		Roof: heavy
G6 - Roof decking	4G6a.N		Continuous roof decking
	4G6b.N		Not continuous or fragile decking
G7 - Quality	4G7a.S		Ineffective connections
	4G7b.S		Poor maintenance
U1 - Falls of elements or objects	4U1a.P		Potential falls of unstable structural elements
	4U1b.N		Potential falls of objects
	4U1c.N		Potential falls or overturning of portions of non-structural elements
U2 - Falls of people	4U2a.P		Potential injuries due to collapse of the floor
	4U2b.N		Potential falls due to flimsy railings
	4U2c.N		Potential falls due to the absence of protective measures
	4U2d.P		Potential falls due to slippery or uneven floor
U3 - Dangers	4U3a.P		Potential hits with protruding or sharp objects
	4U3b.N		Potential bumps with fragile doors opening onto crowded areas





















Focus Group	Code	OBS	Name
U4 - Dangerous contacts	4U4a.N		Potentially dangerous contact with high temperature objects
	4U4b.N		Potentially dangerous contact with live lines or high voltage elements
U5 - Healthiness	4U5a.P		Water infiltration/s
	4U5b.P		Mould
U6 - Comfort	4U6a.F		Direct exposure to sun
	4U6b.F		Low light
	4U6c.F		Limited or no ventilation
	4U6d.F		Low temperatures in the classrooms
	4U6e.F		High temperatures in the classrooms
F1 - Combustible contents	4F1a.N		Moderate amount of books or wood-based furniture
	4F1b.N		Notable amount of books or wood-based furniture
	4F1c.N		Moderate amount of upholstered or plastic-based furniture
	4F1d.N		Notable amount of upholstered or plastic-based furniture
	4F1e.N		Limited amount of flammable liquids
	4F1f.N		Notable amount of flammable liquids
	4F1g.N		Limited amount of flammable gas
F2 - Disposal of combustible contents	4F2a.N		Combustibles isolated from one another
	4F2b.N		Combustibles in close proximity to one another
	4F2c.N		Piles of material or objects

Focus Group	Code	OBS	Name
F3 - Presence of ignition sources near combustible material	4F3a.N		Free flames near combustible material
	4F3b.N		Hot high-power lights near combustible material
	4F3c.N		Electrical or gas heaters near combustible material
	4F3d.N		Overloaded electrical outlets near combustible material
	4F3e.N		Flammable material handled with potential aero-dispersion
F4 - Structural fire behaviour	4F4a.S		Heat-sensitive structural material
	4F4b.S		Combustible structural material
	4F4c.S		Heat-sensitive elements have fire protection
F5 - Combustible interior finishes	4F5a.P		Presence of internal combustible sidings
	4F5b.S		Presence of dropping while burning material
F6 - Fire and smoke propagation paths	4F6a.P		Firewalls
	4F6b.P		Vertical propagation paths
	4F6c.P		Horizontal propagation paths
	4F6d.P		Holes and/or ductwork
F7 - Smoke accumulation	4F7a.P		Rooms with small or no openings
	4F7b.P		Large top or roof openings or smoke venting system
F8 - Protection systems	4F8a.N		Detection and alarm system
	4F8b.N		Personnel trained in the use of fire extinguishers
	4F8c.N		Automatic fire suppression system
F9 - Egress	4F9a.F		Presence of safe areas for people with disabilities

Focus Group	Code	OBS	Name
W1 - Resistance to water loads	4W1a.S		Structural material weakens when exposed to water
	4W1b.S		Envelope or infills do not collapse under water load
W2 - Losses	4W2a.N		All equipment above the RFL
W3 - Releases	4W3a.N		Contaminants released into the floodwater
W4 - Dangers	4W4a.N		Electrical system in contact with water
W5 - Shelter	4W5a.F		Building is a shelter during a flood
E1 - Structural behaviour not as a whole	4E1a.S		Crumbling
	4E1b.S		Detachable elements
E2 - Soft floor	4E2a.S		Soft intermediate floor
	4E2b.S		Soft ground floor
E3 - Irregular vertical mass distribution	4E3a.S		Large mass on the bottom of the building
	4E3b.S		Large mass on the top of the building
E4 - Weaknesses	4E4a.P		Horizontal sliding
	4E4b.P		Disjunction
	4E4c.P		Critical weakness
	4E4d.P		Buckling failure

Focus Group	Code	OBS	Name
E5 - Increased stresses and/or displacements	4E5a.P		Short column
	4E5b.P		Unsupported load
	4E5c.P		Out of plane
	4E5d.P		Unconstrained thrust
	4E5e.P		Amplified lateral displacement
E6 - Failure hazards	4E6a.P		Precarious balance
	4E6b.P		Overturning domino effect
E7 - Falls of elements or objects and releases	4E7a.N		Falls of unsafe elements - severe consequences
	4E7b.N		Falls of unsafe elements - difficulties
	4E7c.N		Overturning of unsafe elements - severe consequences
	4E7d.N		Overturning of unsafe elements - difficulties
	4E7e.N		Falls of unsafe objects - severe consequences
	4E7f.N		Falls of unsafe objects - difficulties
	4E7g.N		Release of hazardous material
E8 - Anti-seismic devices	4E8a.N		Anti-seismic devices (e.g. insulators, dissipators)
E9 - Egress	4E9a.F		Obstructed egress
	4E9b.F		Presence of safe areas for people with disabilities
A1 - Connections	4A1a.S		Roof poorly connected to vertical structure locally

Focus Group	Code	OBS	Name
A2 - Falls of elements or objects	4A2a.N		Falls of unsafe elements – severe consequences
	4A2b.N		Falls of unsafe elements – difficulties
	4A2c.N		Overturning of unsafe elements – severe consequences
	4A2d.N		Overturning of unsafe elements – difficulties
	4A2e.N		Falls or overturning of unsafe objects – severe consequences
	4A2f.N		Falls or overturning of unsafe objects – difficulties
A3 - Egress	4A3a.F		Obstructed egress
	4A3b.F		Presence of safe areas for people with disabilities
A4 - Shelter	4A4a.F		Wind shelter
S1 - Accessibility	4S1a.D		Limited access to building
	4S1b.D		Limited mobility inside the building
	4S1c.D		Lift
	4S1d.D		Accessible toilet
S2 - Water and sanitation	4S2a.D		Drinking water
	4S2b.D		Water for hand washing
	4S2c.D		Warm water
	4S2d.D		Water reservoir
	4S2e.D		Pit latrine
	4S2f.D		Conventional flush toilet

Focus Group	Code	OBS	Name
S3 - Equipment	4S3a.D		Educational equipment
	4S3b.D		Audiovisual equipment
	4S3c.D		Computer laboratory
	4S3d.D		Communication system
	4S3e.D		Solar panels
	4S3f.D		Power unit
S4 - Contents	4S4a.D		Fixtures for cooking or heating food
	4S4b.D		Minimal or poor furniture
	4S4c.D		Regular furniture
	4S4d.D		First aid kit
S5 - Comfort	4S5a.D		Electricity and light fixtures
	4S5b.D		Fans
	4S5c.D		Coolers or air-conditioning units
	4S5d.D		Heating units or system
	4S5e.D		Curtains, shutters or other shade coverings on the windows
	4S5f.D		Earth floor
S6 - Security	4S6a.D		Unsecured openings facing public areas
S7 - Maintenance	4S7a.D		Poor maintenance
S8 - Constraints	4S8a.D		Structural complexity
	4S8b.D		Cultural heritage building

1.6 SPS and SPN: sketch of the school and notes

The VISUS survey form SPS and SPN is shown in section 2.

The SPS form provides space for the sketch of the school. The sketch should illustrate the plan of the schoolyard, and identify fences and access gates to the school. It should also identify the school build-

ings, and include the building plans, the codes of the buildings and (if present) the position of the seismic joints.

The SPN forms provides space for the surveyor to write notes and observations.

2.

VISUS SURVEY FORMS

VISUS MULTI-HAZARD SURVEY GENERAL INFORMATION										SP0																					
										SCHOOL ID CODE _____ TEMP. CODE _____ SURVEY DATE _____																					
SCHOOL INFORMATION School name: _____ State/Country: _____ Province, District: _____ Address: (Village, city, ...) _____ Coordinate system: <input type="checkbox"/> WGS 84 <input type="checkbox"/> Other: _____ Latitude: _____ Longitude: _____ Altitude: _____																															
CONTACTS Contact name: _____ Phone: _____ E-mail: _____ Fax: _____																															
SURVEY TEAM <table border="1"> <thead> <tr> <th>ROLE</th> <th>NAME</th> <th>CONTACT</th> </tr> </thead> <tbody> <tr> <td>Team leader</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </tbody> </table>											ROLE	NAME	CONTACT	Team leader	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
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TYPE OF SCHOOL	WEEKLY USAGE	YEARLY USAGE	GRADE LEVELS TAUGHT	PEOPLE IN THE SCHOOL	TEACHERS	NON-TEACHING PERSONNEL	OTHER INFO																								
<input type="checkbox"/> Public <input type="checkbox"/> Private <input type="checkbox"/> Religious	<input type="checkbox"/> Mon <input type="checkbox"/> Tue <input type="checkbox"/> Wed <input type="checkbox"/> Thu <input type="checkbox"/> Fri <input type="checkbox"/> Sat <input type="checkbox"/> Sun	<input type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr <input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug <input type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input type="checkbox"/> Dec	<input type="checkbox"/> Pre-primary/Kindergarten <input type="checkbox"/> Grade 1 <input type="checkbox"/> Grade 2 <input type="checkbox"/> Grade 3 <input type="checkbox"/> Grade 4 <input type="checkbox"/> Grade 5 <input type="checkbox"/> Grade 6 <input type="checkbox"/> Grade 7 <input type="checkbox"/> Grade 8 <input type="checkbox"/> Grade 9 <input type="checkbox"/> Grade 10 <input type="checkbox"/> Grade 11 <input type="checkbox"/> Grade 12 <input type="checkbox"/> Vocational <input type="checkbox"/> Other _____	# MALE _____ # FEMALE _____ # TOTAL _____	<input type="checkbox"/> Presence of people with disabilities <input type="checkbox"/> Used for extra-curricula activities <input type="checkbox"/> Cultural heritage building/s in the school <input type="checkbox"/> School used for emergency purposes	# MAIN _____ # ANCILLARY _____ # TOTAL _____																									
REFERENCE EVENTS <table border="1"> <thead> <tr> <th>HAZARDOUS EVENTS - EXPERIENCED</th> <th>REFERENCE EVENTS CHARACTERIZATION</th> </tr> </thead> <tbody> <tr> <td> <input type="checkbox"/> EARTHQUAKE <input type="checkbox"/> TSUNAMI <input type="checkbox"/> VOLCANOE <input type="checkbox"/> LANDSLIDE <input type="checkbox"/> FLOOD <input type="checkbox"/> MUDFLOW <input type="checkbox"/> WIND <input type="checkbox"/> SANDSTORM <input type="checkbox"/> LIGHTNING <input type="checkbox"/> FIRE <input type="checkbox"/> WILDFIRE <input type="checkbox"/> OTHER </td> <td> Predicted Snow Height: <input type="checkbox"/> No snow, <input type="checkbox"/> < 0.5 m, <input type="checkbox"/> 0.5 - 1.0 m, <input type="checkbox"/> > 1.0 m Humidity: <input type="checkbox"/> High humidity, <input type="checkbox"/> Dry air, <input type="checkbox"/> Other Temperature: <input type="checkbox"/> °C, <input type="checkbox"/> °F Insects: <input type="checkbox"/> Yes, <input type="checkbox"/> No Termites: <input type="checkbox"/> Yes, <input type="checkbox"/> No Wind Force: <input type="checkbox"/> Breeze or moderate gale, <input type="checkbox"/> Gale, <input type="checkbox"/> Strong gale, <input type="checkbox"/> Storm or violent storm, <input type="checkbox"/> Class 1, <input type="checkbox"/> Class 2, <input type="checkbox"/> Class 3, <input type="checkbox"/> Class 4, <input type="checkbox"/> Class 5 Early warning for wind: <input type="checkbox"/> Yes, <input type="checkbox"/> No Predicted PGA [g]: <input type="checkbox"/> < 0.05, <input type="checkbox"/> 0.05-0.09, <input type="checkbox"/> 0.10-0.14, <input type="checkbox"/> 0.15-0.19, <input type="checkbox"/> 0.20-0.24, <input type="checkbox"/> 0.25-0.29, <input type="checkbox"/> 0.30-0.39, <input type="checkbox"/> 0.40-0.49, <input type="checkbox"/> 0.50-0.59, <input type="checkbox"/> ≥ 0.60 Early warning for earthquake: <input type="checkbox"/> Yes, <input type="checkbox"/> No Lightning: <input type="checkbox"/> Yes, <input type="checkbox"/> No Wildfire: <input type="checkbox"/> Yes, <input type="checkbox"/> No Flood Level from hazard Map: <input type="checkbox"/> No flood, <input type="checkbox"/> ≤ 0.3 m, <input type="checkbox"/> 0.3 - 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VISUS MULTI-HAZARD SURVEY LOCATION INSPECTION

SP1

SP-0 Ask for information about the school and potential hazards

SP-1 Look at the location where the school is placed

SP-2 Walk around the schoolyard

SP-3 Inspect the building from outside

SP-4 Inspect the building from inside

SP-5 Overview of the location (picture)

SCHOOL ID CODE _____

TEMP. CODE _____ **SURVEY DATE** _____

GENERAL	G1. TOPOGRAPHY G1a.L G1b.L G1c.L G1d.L G1e.L G1f.L G1g.L	G2. CONTEXT G2a.L G2b.L G2c.L	G3. NATURAL HAZARDS G3a.L G3b.L G3c.L G3d.L G3e.L G3f.L G3g.L G3h.L	G4. HUMAN INDUCED HAZARDS G4a.L G4b.L G4c.L	G5. UNSUITABLE LOCATION G5a.L G5b.L
UNDESIRABLE	U1. ACCESS TO SCHOOL U1a.L U1b.L U1c.L U1d.L	U2. HEALTHINESS U2a.F			
WATER	W1. WAVE ACTION W1a.L	W2. UPSTREAM SLOPE (WATER VELOCITY) W2a.L W2b.L W2c.L	W3. LAND ROUGHNESS (WATER VELOCITY) W3a.L W3b.L	W4. DEBRIS GENERATION W4a.L W4b.L W4c.L W4d.L	
EARTHQUAKE	E1. SOIL STIFFNESS (HAZARD MODIFIER) E1a.L E1b.L E1c.L	E2. GEO-MORPHOLOGY (HAZARD MODIFIER) E2a.L E2b.L	E3. LOCAL CHARACTERISTICS E3a.L E3b.L		
AIR	A1. LAND ROUGHNESS (WIND SPEED) A1a.L A1b.L A1c.L	A2. DEBRIS GENERATION A2a.L			

VISUS MULTI-HAZARD SURVEY SCHOOLYARD INSPECTION

SP2

SP-0 Ask for information about the school and potential hazards

SP-1 Look at the location where the school is placed

SP-2 Walk around the schoolyard

SP-3 Inspect the building from outside

SP-4 Inspect the building from inside

SP-5 Overview of the schoolyard (more pictures)

ESTIMATED SCHOOLYARD AREA (m²) _____

REPRESENTATIVE PICTURE (1 picture) _____

OVERVIEW OF THE SCHOOLYARD (more pictures) _____

UNDESIRABLE	U1. DANGERS U1a.L U1b.L U1c.L U1d.L U1e.L U1f.L U1g.L U1h.L U1i.L	U2. HEALTHINESS U2a.F U2b.F U2c.F				
FIRE	F1. IGNITION SOURCES F1a.L F1b.L	F2. COMBUSTIBLE MATERIAL F2a.L F2b.L	F3. PROTECTION F3a.F			
WATER	W1. PROTECTION W1a.L W1b.L W1c.L W1d.L	W2. IMPERMEABILITY W2a.L W2b.L	W3. RELEASES W3a.L W3b.L	W4. SAFE AREAS W4a.F		
EARTHQUAKE	E1. FALLS OF ELEMENTS E1a.L E1b.L E1c.L E1d.L	E2. SAFE AREAS E2a.F				
AIR	A1. PROTECTION A1a.L A1b.L	A2. FALLS OF ELEMENTS A2a.F A2b.F	A3. SHELTER A3a.F			
STATUS - S	S1. ACCESSIBILITY S1a.L S1b.L	S2. WATER AND SANITATION S2a.L S2b.L S2c.L S2d.L	S3. EQUIPMENT AND FACILITIES S3a.L S3b.L S3c.L S3d.L			
	S4. SECURITY (FENCES AND ACCESS GATES) S4a.L S4b.L S4c.L	S5. CONSTRAINTS S5a.L S5b.L				

VISUS MULTI-HAZARD SURVEY BUILDING EXTERNAL INSPECTION

SP3

sp0 ASK FOR INFORMATION ABOUT THE SCHOOL AND POTENTIAL HAZARDS

sp1 LOOK AT THE LOCATION WHERE THE SCHOOL IS PLACED

sp2 WALK AROUND THE SCHOOLYARD

sp3 INSPECT THE BUILDING FROM OUTSIDE

sp4 INSPECT THE BUILDING FROM INSIDE

BUILDING ID CODE

SCHOOL ID CODE

TEMP. CODE

SURVEY DATE

GENERAL G

G1. NATURAL HAZARD ON THE BUILDING

G2. TYPE OF FUNCTION, CLASS OF BUILDING AND VISUS TYPOLOGY

G3. BUILDING CHARACTERISTICS

G4. STRUCTURAL SYSTEM

G5. HORIZONTAL DISTRIBUTION AND ORGANIZATION OF LATERAL RESISTANCE ELEMENTS

G6. MATERIAL RESISTANCE

G7. CONSTRUCTION QUALITY AND BUILDING CONDITION

G8. ROOF COVERING AND ARCHITECTURAL FEATURES

ENVIRONMENTAL U

U1. DANGERS

U2. HEALTHINESS

ENVIRONMENTAL F

F1. INTERDEPENDENCE

F2. COMBUSTIBLE ENVELOPE

F3. EGRESS

ENVIRONMENTAL W

W1. PROTECTION FROM FLOOD WATER

W2. WATER PERMEABILITY AND FLOW INTO THE BUILDING

W3. FOUNDATIONS (ANCHORING AND/OR SCOURING)

W4. RAIN FLOODING

ENVIRONMENTAL E

E1. FOUNDATIONS

E2. STRESS FOCUS AND LOCAL WEAKNESSES

E3. FALLS FROM NEARBY BUILDINGS

E4. FALLS FROM BUILDING

E5. EGRESS

ENVIRONMENTAL A

A1. LOCAL INTENSITY INCREASE

A2. AIR PERMEABILITY

A3. CONNECTION TO GROUND

A4. ROOF SHAPE (SUCTION)

A5. ROOF SLOPE (SUCTION)

A6. IRREGULARITIES (LOCAL STRESS)

A7. FALLS FROM NEARBY BUILDINGS OR ELEMENTS

A8. FALLS FROM BUILDING

A9. EGRESS

VISUS MULTI-HAZARD SURVEY									
BUILDING INTERNAL INSPECTION									
SP4									
<div style="display: flex; justify-content: space-between;"> <div> <p>SP0 ASK FOR INFORMATION ABOUT THE SCHOOL AND POTENTIAL HAZARDS</p> <p>SP1 LOOK AT THE LOCATION WHERE THE SCHOOL IS PLACED</p> <p>SP2 WALK AROUND THE SCHOOL/COMPOUND</p> <p>SP3 INSPECT THE BUILDING FROM OUTSIDE</p> <p>SP4 INSPECT THE BUILDING FROM INSIDE</p> </div> <div> <p>BUILDING ID CODE</p> <p>SCHOOL ID CODE</p> <p>TEMP. CODE</p> <p>SURVEY DATE</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>G1. UTILIZATION</p> <p>Classrooms #</p> <p>Male toilets #</p> <p>Female toilets #</p> <p>G2. OCCUPANCY</p> <p>< 100</p> <p>100 - 500</p> <p>> 500</p> </div> <div> <p>Offices</p> <p>Laboratory</p> <p>Library</p> <p>Gym</p> <p>Canteen</p> <p>Kitchen</p> <p>Archive</p> <p>Storage</p> <p>Auditorium</p> <p>Dormitories</p> <p>Technical room</p> <p>Unused spaces</p> <p>Other-use spaces</p> <p>Under construction spaces</p> </div> <div> <p>G3. EGRESS</p> <p>4G3a.F ALTERNATIVE EGRESS PATHS</p> <p>4G3b.F SINGLE EXIT SERVING MORE THAN 50 PEOPLE</p> <p>4G3c.F NAVIGATED EGRESS</p> <p>4G3d.F OBSTRUCTED EGRESS</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>G4. FLOOR BEHAVIOUR AND CONNECTION</p> <p>4G4a.S FLOOR NON-RIGID</p> <p>4G4b.S FLOOR POORLY OR NOT CONNECTED TO VERTICAL STRUCTURE</p> <p>4G4c.S FLOOR HEAVY</p> <p>4G4d.S ROOF NON-RIGID</p> <p>4G4e.S ROOF POORLY OR NOT CONNECTED TO VERTICAL STRUCTURE</p> <p>4G4f.S ROOF HEAVY</p> </div> <div> <p>G5. ROOF BEHAVIOUR AND CONNECTION</p> <p>4G5a.N CONTINUOUS ROOF DECKING</p> <p>4G5b.N NOT CONTINUOUS OR INADEQUATE LIFTING</p> <p>4G5c.N INADEQUATE STRUCTURAL CONNECTIONS</p> <p>4G5d.N POOR MAINTENANCE</p> </div> <div> <p>G6. ROOF DECKING</p> <p>4G6a.N CONTINUOUS ROOF DECKING</p> <p>4G6b.N NOT CONTINUOUS OR INADEQUATE LIFTING</p> <p>4G6c.N INADEQUATE STRUCTURAL CONNECTIONS</p> <p>4G6d.N POOR MAINTENANCE</p> </div> <div> <p>G7. QUALITY</p> <p>4G7a.S INADEQUATE STRUCTURAL CONNECTIONS</p> <p>4G7b.S POOR MAINTENANCE</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>U1. FALLS OF ELEMENTS OR OBJECTS</p> <p>4U1a.P POTENTIAL FALLS OF UNSAFE ELEMENTS</p> <p>4U1b.P POTENTIAL FALLS OF OBJECTS</p> <p>4U1c.P POTENTIAL FALLS OF UNSAFE ELEMENTS - SEVERE CONSEQUENCES</p> <p>4U1d.P POTENTIAL FALLS OF UNSAFE ELEMENTS - DIFFICULTIES</p> </div> <div> <p>U2. FALLS OF PEOPLE</p> <p>4U2a.P POTENTIAL INJURIES DUE TO FLOOR FALLING</p> <p>4U2b.P POTENTIAL INJURIES DUE TO FLOOR FALLING</p> <p>4U2c.P POTENTIAL INJURIES DUE TO FLOOR FALLING</p> <p>4U2d.P POTENTIAL INJURIES DUE TO FLOOR FALLING</p> </div> <div> <p>U3. DANGERS</p> <p>4U3a.P POTENTIAL LITS WITH PROTRUDING OR SHARP OBJECTS</p> <p>4U3b.P POTENTIAL BURN WITH FLAMMABLE OR HOT OBJECTS</p> <p>4U3c.P POTENTIAL BURN WITH FLAMMABLE OR HOT OBJECTS</p> <p>4U3d.P POTENTIAL BURN WITH FLAMMABLE OR HOT OBJECTS</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>U4. DANGEROUS CONTACTS</p> <p>4U4a.N POTENTIALLY DANGEROUS CONTACT WITH HIGH OR HIGH-VOLTAGE ELECTRICITY</p> <p>4U4b.N POTENTIALLY DANGEROUS CONTACT WITH HIGH OR HIGH-VOLTAGE ELECTRICITY</p> <p>4U4c.N POTENTIALLY DANGEROUS CONTACT WITH HIGH OR HIGH-VOLTAGE ELECTRICITY</p> <p>4U4d.N POTENTIALLY DANGEROUS CONTACT WITH HIGH OR HIGH-VOLTAGE ELECTRICITY</p> </div> <div> <p>U5. HEALTHINESS</p> <p>4U5a.P WATER INFILTRATION</p> <p>4U5b.P MOULD</p> <p>4U5c.P DIRECT EXPOSURE TO SUN</p> <p>4U5d.P LOW LIGHT</p> </div> <div> <p>U6. COMFORT</p> <p>4U6a.F LIMITED OR NO VENTILATION</p> <p>4U6b.F LOW TEMPERATURES IN THE CLASSROOMS</p> <p>4U6c.F HIGH TEMPERATURES IN THE CLASSROOMS</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>F1. COMBUSTIBLE CONTENTS</p> <p>4F1a.N MODERATE AMOUNT OF BOOKS OR PAPER</p> <p>4F1b.N MODERATE AMOUNT OF WOODEN FURNITURE</p> <p>4F1c.N MODERATE AMOUNT OF PLASTIC-BASED FURNITURE</p> <p>4F1d.N MODERATE AMOUNT OF PLASTIC-BASED FURNITURE</p> </div> <div> <p>F2. PRESENCE OF FLAMMABLE MATERIAL</p> <p>4F2a.N FLAMMABLE MATERIAL</p> <p>4F2b.N FLAMMABLE MATERIAL</p> <p>4F2c.N FLAMMABLE MATERIAL</p> <p>4F2d.N FLAMMABLE MATERIAL</p> </div> <div> <p>F3. STRUCTURAL FIRE BEHAVIOUR</p> <p>4F3a.N FLAMMABLE MATERIAL</p> <p>4F3b.N FLAMMABLE MATERIAL</p> <p>4F3c.N FLAMMABLE MATERIAL</p> <p>4F3d.N FLAMMABLE MATERIAL</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>F4. DISPOSAL OF COMBUSTIBLE CONTENTS</p> <p>4F4a.N COMBUSTIBLES ISOLATED FROM ONE ANOTHER</p> <p>4F4b.N COMBUSTIBLES ISOLATED FROM ONE ANOTHER</p> <p>4F4c.N COMBUSTIBLES ISOLATED FROM ONE ANOTHER</p> <p>4F4d.N COMBUSTIBLES ISOLATED FROM ONE ANOTHER</p> </div> <div> <p>F5. COMBUSTIBLE INTERIOR FINISHES</p> <p>4F5a.N PRESENCE OF CHIPPING WOODEN BURNING MATERIAL</p> <p>4F5b.N PRESENCE OF CHIPPING WOODEN BURNING MATERIAL</p> <p>4F5c.N PRESENCE OF CHIPPING WOODEN BURNING MATERIAL</p> <p>4F5d.N PRESENCE OF CHIPPING WOODEN BURNING MATERIAL</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>F6. FIRE AND SMOKE PROPAGATION PATHS</p> <p>4F6a.P FIREWALLS</p> <p>4F6b.P VERTICAL PROPAGATION PATHS</p> <p>4F6c.P HORIZONTAL PROPAGATION PATHS</p> <p>4F6d.P HORIZONTAL PROPAGATION PATHS</p> </div> <div> <p>F7. SMOKE ACCUMULATION</p> <p>4F7a.P ROOMS WITH SMALL OR NO OPENINGS</p> <p>4F7b.P LARGE TOP OR ROOF OPENINGS DETECTION AND ALARM SYSTEM</p> <p>4F7c.P LARGE TOP OR ROOF OPENINGS DETECTION AND ALARM SYSTEM</p> <p>4F7d.P LARGE TOP OR ROOF OPENINGS DETECTION AND ALARM SYSTEM</p> </div> <div> <p>F8. PROTECTION SYSTEMS</p> <p>4F8a.N PERSONNEL TRAINED IN THE USE OF FIRE EXTINGUISHERS</p> <p>4F8b.N AUTOMATIC FIRE SUPPRESSION SYSTEM</p> <p>4F8c.N AUTOMATIC FIRE SUPPRESSION SYSTEM</p> <p>4F8d.N AUTOMATIC FIRE SUPPRESSION SYSTEM</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>W1. RESISTANCE TO WATER LOADS</p> <p>4W1a.S STRUCTURAL WEAKNESS WHEN EXPOSED</p> <p>4W1b.S STRUCTURAL WEAKNESS WHEN EXPOSED</p> <p>4W1c.S STRUCTURAL WEAKNESS WHEN EXPOSED</p> <p>4W1d.S STRUCTURAL WEAKNESS WHEN EXPOSED</p> </div> <div> <p>W2. LOSSES</p> <p>4W2a.N ALL EQUIPMENT ABOVE THE FLOODWATER</p> <p>4W2b.N ALL EQUIPMENT ABOVE THE FLOODWATER</p> <p>4W2c.N ALL EQUIPMENT ABOVE THE FLOODWATER</p> <p>4W2d.N ALL EQUIPMENT ABOVE THE FLOODWATER</p> </div> <div> <p>W3. RELEASES</p> <p>4W3a.N CONTAMINANTS RELEASED INTO THE FLOODWATER</p> <p>4W3b.N CONTAMINANTS RELEASED INTO THE FLOODWATER</p> <p>4W3c.N CONTAMINANTS RELEASED INTO THE FLOODWATER</p> <p>4W3d.N CONTAMINANTS RELEASED INTO THE FLOODWATER</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>E1. STRUCTURAL BEHAVIOUR NOT AS A WHOLE</p> <p>4E1a.S CRUMBLING</p> <p>4E1b.S DETACHABLE ELEMENTS</p> <p>4E1c.S DETACHABLE ELEMENTS</p> <p>4E1d.S DETACHABLE ELEMENTS</p> </div> <div> <p>E2. SOFT FLOOR</p> <p>4E2a.S SOFT INTERMEDIATE FLOOR</p> <p>4E2b.S SOFT GROUND FLOOR</p> <p>4E2c.S SOFT GROUND FLOOR</p> <p>4E2d.S SOFT GROUND FLOOR</p> </div> <div> <p>E3. IRREGULAR VERTICAL MASS DISTRIBUTION</p> <p>4E3a.S LARGE MASS ON THE TOP OF THE BUILDING</p> <p>4E3b.S LARGE MASS ON THE TOP OF THE BUILDING</p> <p>4E3c.S LARGE MASS ON THE TOP OF THE BUILDING</p> <p>4E3d.S LARGE MASS ON THE TOP OF THE BUILDING</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>E4. WEAKNESSES</p> <p>4E4a.P DISJUNCTION</p> <p>4E4b.P CRITICAL WEAKNESS</p> <p>4E4c.P CRITICAL WEAKNESS</p> <p>4E4d.P CRITICAL WEAKNESS</p> </div> <div> <p>E5. INCREASED STRESSES AND/OR DISPLACEMENTS</p> <p>4E5a.P SHORT COLUMN</p> <p>4E5b.P UNSUPPORTED LOAD</p> <p>4E5c.P CUT-OF-PLANE</p> <p>4E5d.P UNCONSTRAINED THRUST</p> </div> <div> <p>E6. FAILURE HAZARDS</p> <p>4E6a.P OVERTURNING MOMENT EFFECT</p> <p>4E6b.P OVERTURNING MOMENT EFFECT</p> <p>4E6c.P OVERTURNING MOMENT EFFECT</p> <p>4E6d.P OVERTURNING MOMENT EFFECT</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>E7. FALLS OF ELEMENTS OR OBJECTS AND RELEASES</p> <p>4E7a.N FALLS OF UNSAFE ELEMENTS - SEVERE CONSEQUENCES</p> <p>4E7b.N FALLS OF UNSAFE ELEMENTS - DIFFICULTIES</p> <p>4E7c.N FALLS OF UNSAFE ELEMENTS - SEVERE CONSEQUENCES</p> <p>4E7d.N FALLS OF UNSAFE ELEMENTS - SEVERE CONSEQUENCES</p> </div> <div> <p>E8. ANTI-SEISMIC DEVICES</p> <p>4E8a.N ANTI-SEISMIC DEVICES (E.G. ISOLATORS, DIAPHRAGMS)</p> <p>4E8b.N ANTI-SEISMIC DEVICES (E.G. ISOLATORS, DIAPHRAGMS)</p> <p>4E8c.N ANTI-SEISMIC DEVICES (E.G. ISOLATORS, DIAPHRAGMS)</p> <p>4E8d.N ANTI-SEISMIC DEVICES (E.G. ISOLATORS, DIAPHRAGMS)</p> </div> <div> <p>E9. EGRESS</p> <p>4E9a.F OBSTRUCTED EGRESS</p> <p>4E9b.F OBSTRUCTED EGRESS</p> <p>4E9c.F OBSTRUCTED EGRESS</p> <p>4E9d.F OBSTRUCTED EGRESS</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>A1. CONNECTIONS</p> <p>4A1a.S ROOF POORLY CONNECTED TO VERTICAL STRUCTURE FOR LIFT</p> <p>4A1b.S ROOF POORLY CONNECTED TO VERTICAL STRUCTURE FOR LIFT</p> <p>4A1c.S ROOF POORLY CONNECTED TO VERTICAL STRUCTURE FOR LIFT</p> <p>4A1d.S ROOF POORLY CONNECTED TO VERTICAL STRUCTURE FOR LIFT</p> </div> <div> <p>A2. FALLS OF ELEMENTS OR OBJECTS</p> <p>4A2a.N FALLS OF UNSAFE ELEMENTS - SEVERE CONSEQUENCES</p> <p>4A2b.N FALLS OF UNSAFE ELEMENTS - DIFFICULTIES</p> <p>4A2c.N FALLS OF UNSAFE ELEMENTS - SEVERE CONSEQUENCES</p> <p>4A2d.N FALLS OF UNSAFE ELEMENTS - SEVERE CONSEQUENCES</p> </div> <div> <p>A3. EGRESS</p> <p>4A3a.F OBSTRUCTED EGRESS</p> <p>4A3b.F OBSTRUCTED EGRESS</p> <p>4A3c.F OBSTRUCTED EGRESS</p> <p>4A3d.F OBSTRUCTED EGRESS</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>S1. ACCESSIBILITY</p> <p>4S1a.D LIMITED ACCESS TO THE BUILDING</p> <p>4S1b.D LIMITED ACCESS TO THE BUILDING</p> <p>4S1c.D LIMITED ACCESS TO THE BUILDING</p> <p>4S1d.D LIMITED ACCESS TO THE BUILDING</p> </div> <div> <p>S2. WATER AND SANITATION</p> <p>4S2a.D DRINKING WATER</p> <p>4S2b.D WATER FOR HAND WASHING</p> <p>4S2c.D WARM WATER</p> <p>4S2d.D WATER RESERVOIR</p> </div> <div> <p>S3. CONTENTS</p> <p>4S3a.D TEXTILES FOR COOKING OR HEATING PURPOSES</p> <p>4S3b.D MINIMAL OR POOR FURNITURE</p> <p>4S3c.D REGULAR FURNITURE</p> <p>4S3d.D FIRST AID KIT</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>S4. EQUIPMENT (BUILDING SERVED BY)</p> <p>4S4a.D EDUCATIONAL EQUIPMENT</p> <p>4S4b.D AUDIOVISUAL EQUIPMENT</p> <p>4S4c.D COMPUTER LABORATORY</p> <p>4S4d.D COMMUNICATION SYSTEM</p> </div> <div> <p>S5. COMFORT</p> <p>4S5a.D ELECTRICITY AND LIGHT FIXTURES</p> <p>4S5b.D FANS</p> <p>4S5c.D COOLERS OR AIR-CONDITIONING UNITS</p> <p>4S5d.D HEATING UNITS OR SYSTEM</p> </div> <div> <p>S6. SECURITY</p> <p>4S6a.D UNSECURED OPENINGS FACING PUBLIC AREAS</p> <p>4S6b.D UNSECURED OPENINGS FACING PUBLIC AREAS</p> <p>4S6c.D UNSECURED OPENINGS FACING PUBLIC AREAS</p> <p>4S6d.D UNSECURED OPENINGS FACING PUBLIC AREAS</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>S7. MAINTENANCE</p> <p>4S7a.D POOR MAINTENANCE</p> <p>4S7b.D POOR MAINTENANCE</p> <p>4S7c.D POOR MAINTENANCE</p> <p>4S7d.D POOR MAINTENANCE</p> </div> <div> <p>S8. CONSTRAINTS</p> <p>4S8a.D STRUCTURAL COMPLEXITY BUILDING</p> <p>4S8b.D CULTURAL HERITAGE BUILDING</p> <p>4S8c.D CULTURAL HERITAGE BUILDING</p> <p>4S8d.D CULTURAL HERITAGE BUILDING</p> </div> </div>									

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VISUS MULTI-HAZARD SURVEY
NOTES


UNESCO Guidelines for Assessing Learning Facilities in the Context of Disaster Risk Reduction and Climate Change Adaptation

VOLUME 1 - Introduction to learning facilities assessment and
to the VISUS methodology

VOLUME 2 - VISUS Methodology

VOLUME 3 - VISUS Implementation

