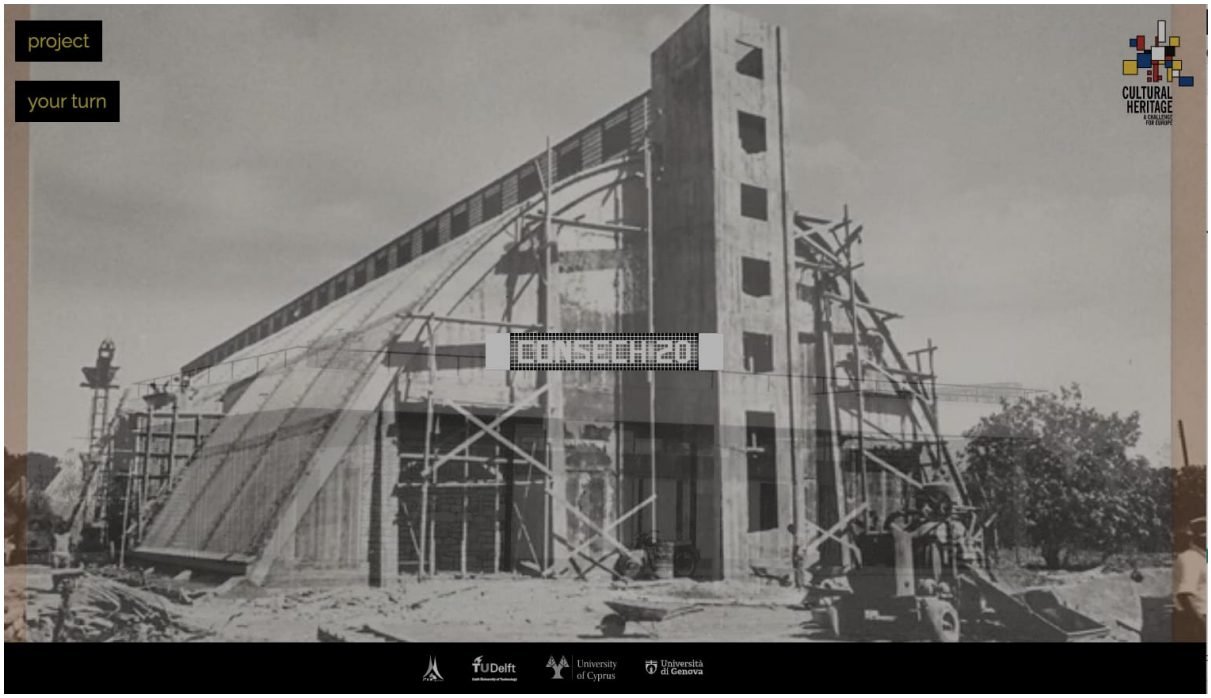

Open Access Transdisciplinary Online Platform

Multimedia database and site – Manual

Project: CONSECH20

Working Package 3 – Action (ii)

Version 1.2

Date: June 27th 2021

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WP3 - Multimedia database and site

Manual

Summary

Foreword

This manual deals with several subsystems:
- The Database, its logical and physical layout
- The interface for the user and the administrator of the database
- The backend of the Web site
- The layout of the Web site.

This comprehensive approach requires some compromise on detail and suggests to refer to specific sources for a thorough description of the technical components, for a generic step-by-step user guide; it focuses on distinctive features and possible misunderstanding. Nonetheless, we take some time to justify choices that may seem peculiar to the user to anticipate questions that may arise and that do not find replies in the suggested references.

The manual is provided with

> WP3 (ii) – Establishment of an **open-access trans-disciplinary online platform**.
>
> For each one of the screening case studies selected in WP2, a complete record of all the relevant architectural and historical information (existing and non-existing) will be created. These records will include information about the original construction of the buildings (initiative, funding, materials used, architectural plans, etc.), their use throughout the ages (whether it is currently used, if not when did it stop being used and why, purpose(s) served, in case this had/has changed what was the reason behind it, who worked there etc.), the interaction and co-existence with the neighbouring community (past and present: what were/are the perceptions of the immediate society towards the buildings, what memories still exist, what stories are told etc.), the current state of conservation of the buildings studied in WP2, and the to-be-developed conservation proposals in WP4. The platform will be open to the public who will be encouraged and invited to contribute with information, photos etc. using the strategies developed in WP1. This will ensure the involvement of the society in the project and will help in making the project an asset of the public, rather than of the research team alone. All the data collected will be presented in the form of open-access GIS and linked to the upgraded MDCS system developed in WP2 and to the databases listed in (I – List of databases dedicated to modern architecture). [CONSECH20 – CONSErvation of 20thcentury concrete Cultural Heritage in urban changing environments, «Proposal», p. 10].

The version of this manual can be found on the front page. The number 1.x means that we are now in evolutive maintenance mode and that all updates look forward future enhancements and new surveys. While the database changes, we update the text and change figures so to match the upgrades.

Technical Implementation

The database was developed ex-post, based on the E-R analysis of the outcomes of the surveys carried out during WP2 and recorded on flat templates on a spreadsheet that was used during and after the site inspections, it could also benefit from the suggestions by the partners during the long implementation phase. A simplified version of the ER diagrams is provided to explain the structure of the database.
The database was implemented on PostgreSQL (v. 12), an object-relational open source (MIT) and free DBMS (postgresql.org) with a long record of reliability. Started in 1986 as an UC Berkeley project, in 1995 (version 6) the PostQuel proprietary query language was substituted with SQL adopting the current ANSI standard with several extensions. The structure of the implemented database does not make use of these extensions.
GIS data are stored and handled with SQL-MM extensions provided by PostGIS (v. 3) , an open source (GPL2) and free extension of PostgreSQL (postgis.net) continuously developed since 2004 (v. 0.01). The ST spatial constructs developed in PostGIS became a *de facto* standards for other DBMSs.
The database facility is provided by ITAM under the coordination of Cyril Fisher in a highly protected environment. ITAM provides as well a storage facility using the Nextcloud collaborative platform (nextcloud.com) that was used during the project. Nextcloud continues to be available for the foreseeable future as the base of informal contribution by other scholars cooperating in the conservation of early 20th Century Reinforced Concrete Architecture.
The management interface, completely independent from the DBMS implementation, uses the open source and free Directus (directus.io) dashboard and headless CMS (v. 9) developed in nodeJS language.
This arrangement enables the implementation of a headless web platform where “static” HTML pages are fed by dynamic JSON streams that are independently provided by simple read-only connectors, detached from the management interface, that serve the logical views directly coded in the database, using a native subsystem of the DBMS.
The images are provided by Nextcloud to an image CDN (content delivery network) that provides countinuos availability of the files in a format adapted to the device using the site without burdening the ITAM network that remains unaccessible from outside.

This manual documents the DBMS and database schemas resident on the backend servers (on the support domain c620.cf) and the web site, www.consech.eu. The backend server also provides short permalinks for the project. To add a short link to the list, just head to c620.cf/cgi-bin/shorten and input a new URL to obtain the short code.

Web site of the project

Contents of the project site

The outcomes of the work packages are organised in several data sets and some texts (reports) that are delivered in web pages and PDF.

The site is organised as follows:

Database
> *Inventories on Modern Architecture*
> *Admission Form*
> *All Case Studies*
> *In Depth Studies*

Videos
> *Concrete heritage architecture in the Czech Republic*
> *A plea for reuse of 20th century concrete buildings: Cases from the Netherlands*
> *Reuse of historic concrete buildings: The case of the Nicosia Old Municipal Market*
> *A story of modernist architecture: The first concrete multistorey buildings in Nicosia*
> *Voices from the City: a Genoese Experience*

Reports – State of the Art Studies
> *European Legislation and Regulations*
> *Material and Techniques*
> *Restoration Support*
> *State of the Art on New Technologies*

Publications
> *Thematic Approach*
> *Technical Essays*
> *Case Studies*

An Inclusive Project Team
> *The Consech20 Project Partners and People*
> *A New Partnership*
> *Your Contribution to RC Heritage*

In the following pages you will find some specific information on the database and a terse documentation for the treatment of the reports.
The site is almost-self explanatory but some parts need further instructions to provide content that could be subsequently elaborated and correctly shared.

Implementation details

The web site is implemented following a headless design. To keep it simple, a monolithic web site produces all content processing all the pages whenever the user visits it. In the headless model, the pages are mostly static and their content is provided by autonomous

services or APIs that feed them in JSON format. This increases flexibility – it's enough to create a specialised static page to add a content type that may come from any host. And this works even the other way around, every partner institution could use the feeds in its sites.
We use this for images which are delivered via a specialised external site, an image CDN (content delivery network) that uses a network of sites near to the user to provide relatively heavy files in a short time and to shield the Nextcloud image repository. But, most important, we feed pages with the content of the database which is accessible read-only in this way (we may limit the sites who can access it, if necessary).
The documents are mostly converted to JSON and may be delivered via CDN to shield the servers and increase speed.
All browsers include this feature: they use multiple concurrent connections to feed a page. If they use only one site they usually exploit only one pipe (and the server load increases), if they use multiple sites the load is generally low on the main server and the pages are rendered inside the browser instead of being regenerated all the time before sending them to the user. This is especially true for database generated content: the web server does not know if something is changed, so it disregards the cached content and generates a new page again and again, waiting for new content.

The database

The Database is the main outcome of WP3 but also a durable outcome of the WP2, being extensible to other international RC buildings by scholars identified by EduGAIN (edugain.org), an international identification system for universities and research bodies (federated identification).

Inventory on Modern Architecture

An independent section in WP3 is the **Inventory on Modern Architecture**, an online list of the sites and databases dedicated to modern architecture and reinforced concrete that will be updated from time to time to reflect the state of the art of documentation.
The list is managed inside the database, so it will be easy to be implemented and curated.
The data model is a simple flat table displayed in the following input form.

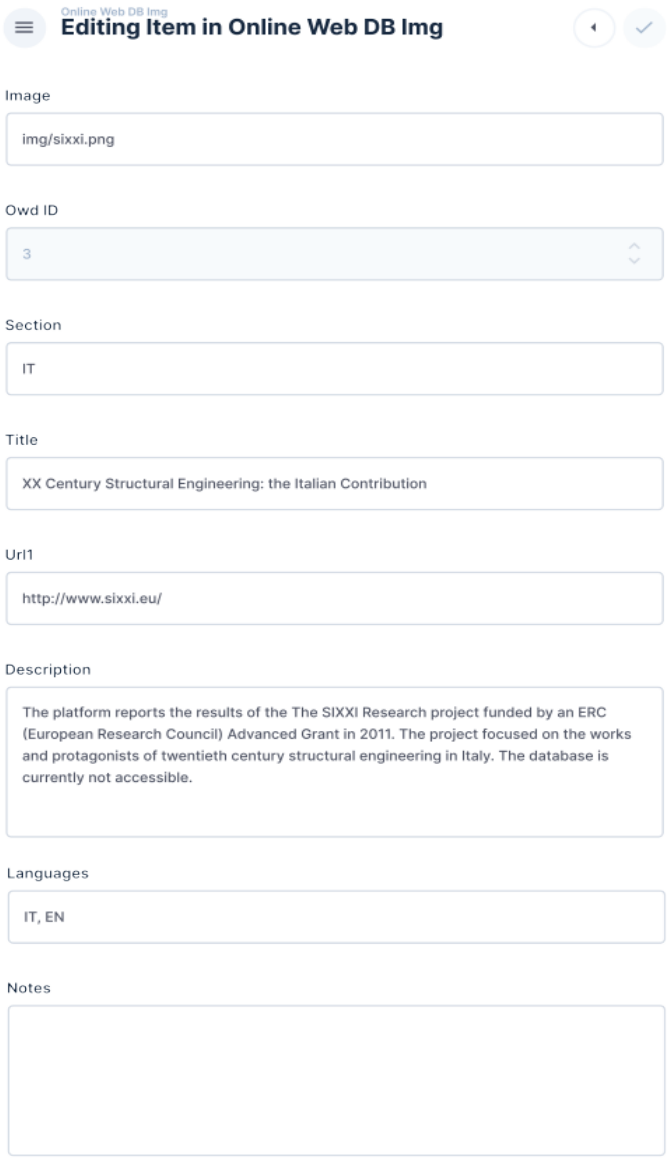


Fig. 1 – Online web databases editing form

The survey on case studies

The survey carried out on ten or more cases by every work group in WP2 is summarised in **building assessment templates** that we have used to describe various assets of any case study building.
The templates provide a sort of anticipated report from a future database. It has only one reading level (no more/no less in depth) and it flattens much information, multiplicities and internal processes (time) in a handy way focused on the survey.
The database adds more flexibility, enabling contributors to capture all the effective knowledge they gather during the survey and possibly afterwards, through in-depth studies, laboratory analyses and archival investigations.

The information on every case study is managed by the relational database management system (RDBMS) in a multi-level way. Allowing data to be entered at different levels of detail.

The figure shows a block overview of the database model for the survey of screening cases. In the manual we show the phisical data model (table set) and the editing forms of the Directus interface. A corresponding conceptual data model is provided in the appendix for every block. The “resources” block represents local files (I. e. images, drawings and reproductions) and links on web sites.

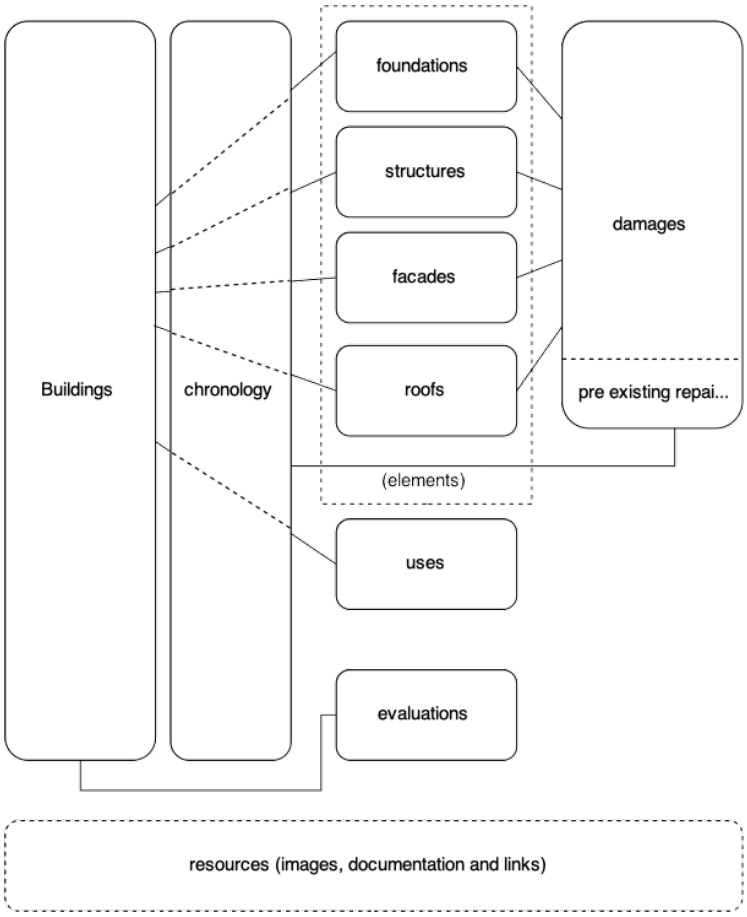


Fig. 2 – block overview of the screening case survey

The admission form

Any new user must fill in a form which is a simplified version of the database. The following picture shows it in the interface provided by Directus.
This form is conceived to be very simple, to be tackled by complete beginners and casual database users. The underneath structure is flat from the user's point of view.
The approval process is provided by a relationship with the evaluation issued by the database curators.
Admission by the curators is based on the proposal entered into this form.
The person willing to contribute is requested to provide information about the first proposed building (name, country, city, address, designer, building year and original main usage), the reasons for submission (importance, conservation state, risk of demolition) but also her/his name and the name of the institution whom she/he belongs.
A Status is also provided for the submission.
If the submitter wants to keep it private while collecting further information, the form is saved but not published or available to the curator (status "Draft"). If the status is "Published", it is immediately available to the public, but may be obliterated by the curators if it does not meet the requirements.

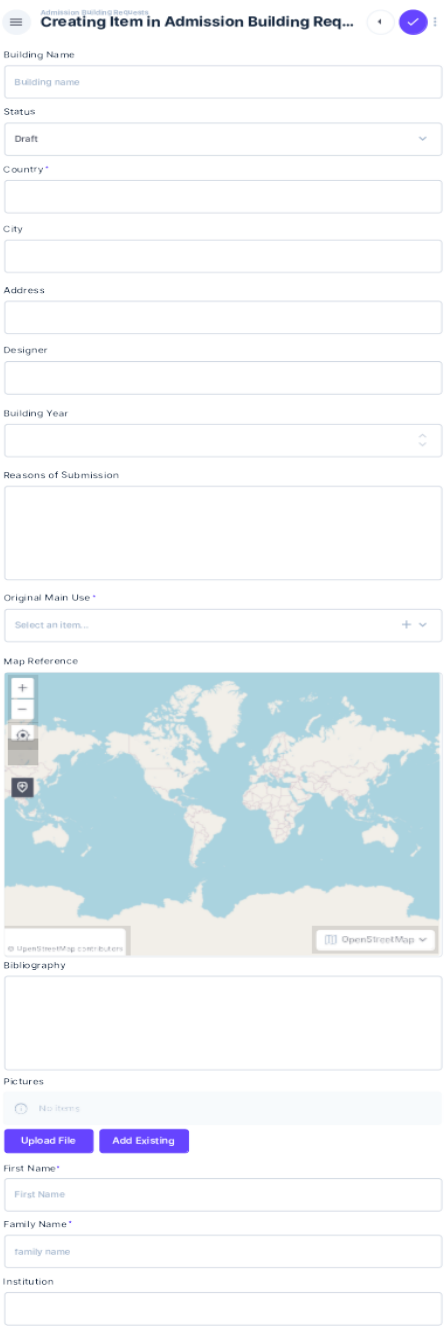


Fig. 3 – Input form for the admission building request (on the right)

When the user is admitted to the database, probably she/he will provide more information in the complete version and will put the record in a quiescent state (Status "Archived").
When possible, menus are provided to handle the most common cases.
Finding out the building in the map, the user can input the coordinates with a simplified procedure.
Via the bibliography input space, the user can provide some simple references for the building.
The pictures are the only thing handled in a relational way. The user can provide as many pictures as required. She/he will be personally responsible for the provided material.

This is the simple structure for this table

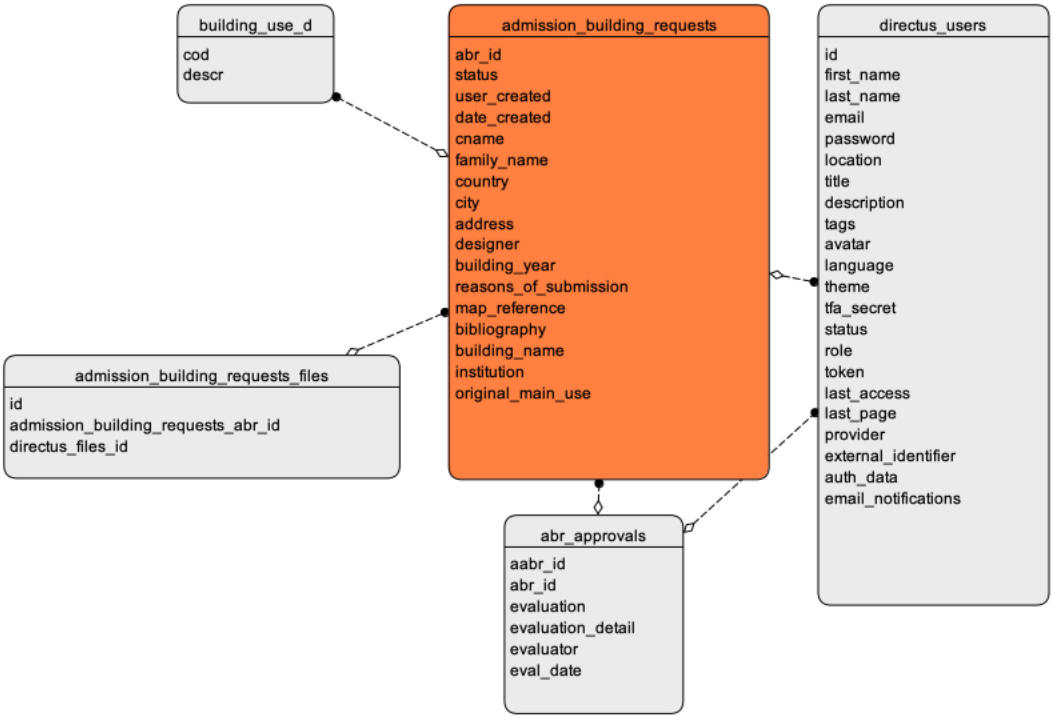


Fig. 4 – Admission building requests (phisical diagram)

From the survey forms to the data model

The survey forms and the survey itself predates the database design which is provided as a development (and a possible refinement) of the WP2 outcomes. So the reference to the template is an aid and a useful example.
We reference the survey template as a guide, showing where the form entries are seeded in the database. The following figure shows a general view of the main tables.

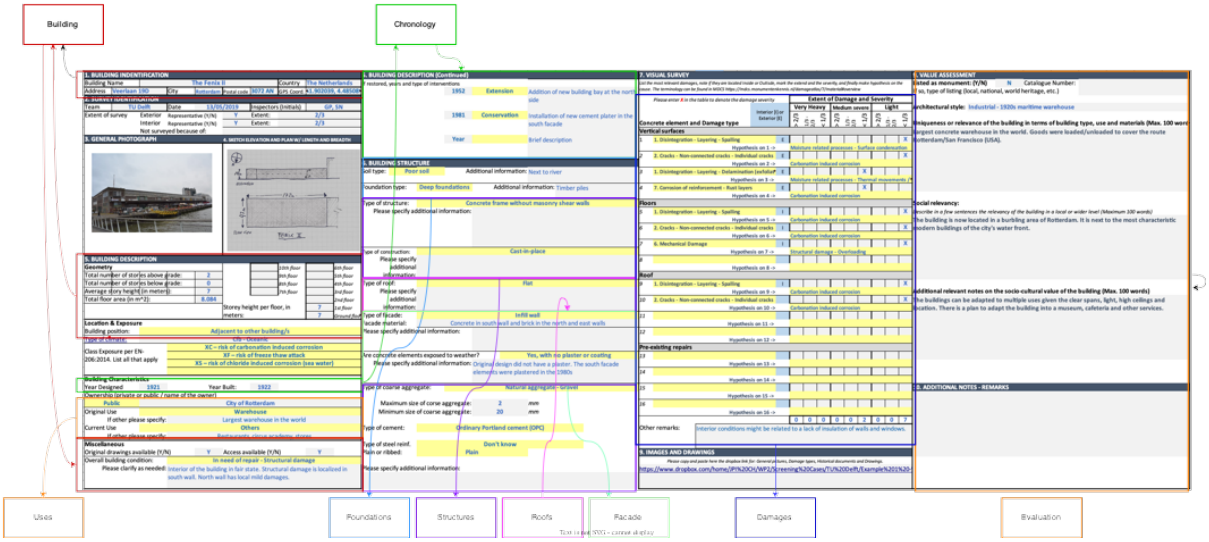


Fig. 5 – Panels of the template mapped to the database physical model

A relational database organises information in a very simple way that is usually able to represent complex scenarios; all complex information is clearly referred to entities (things)

and relations (verbs or transitive attributes). This is a horribly crude definition, but following the explanation, things become more accurate and clear.

In the following pages we will trace the transition from the implicit data model behind the suvey, the conceptual model and the physical one, a set of tables.
The conceptual diagrams are collected in the Appendix.

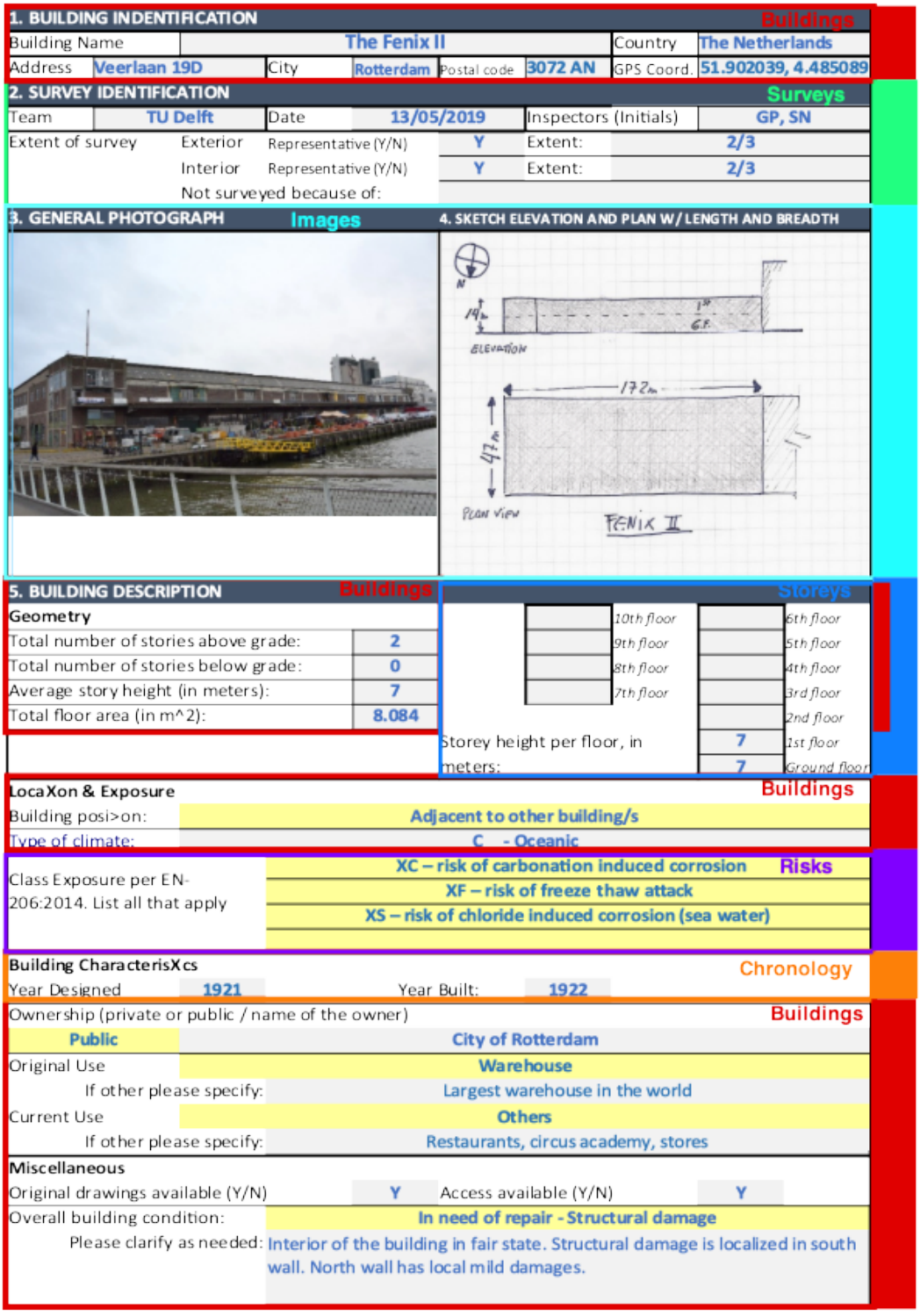


Fig. 6 – Panel 1

Buildings (red)

The "Building" table locates the object, in fact it collects the main data for its location such as the address and GPS coordinates (so country and city), as well as the name. We must then pay close attention to the unique identification code of the "Building" (key field B_Number) which is used to link all the data collected in the other tables to the reference building.

Column	Content	Reference
b_number	Identifying number	code of the surveyed building
country	country	countries_d
city	inhabited place	
address		
postal_code		
building_name	(if available)	
gps_coord	GPS coordinates in decimal degrees (WGS84 reference)	map
stories_above_grade	how many storeys above ground	
stories_below_grade	how many storeys below ground	
avg_story_height	average storey height (cm)	
tot_floor_area	total floor area (sq metres)	
position	position relative to other buildings	building_position_d
climate_type	climate type (referenced to →)	climates_d
climate_spec	textual specification or notes	
ownership	actual main ownership	ownership_d
owner	owner specification	
original_main_use		building_use_d
current_main_use		building_use_d
b_condition	building conditions	building_condition_d
b_cond_info	textual specification or notes	
weather_exp	exposed class of elements	exposed elements_d
protection_info	textual specification or notes	

Most of the fields reference a set of options (domain tables in the column “Reference”).
Sometimes it is better to have multiple occurrences for some of the columns.
The following tables help to keep the proper information for multiple occurrences:

Storey Heights (blue)

The "Storey Heights" table contains all building height information; height data are stored individually for each floor (Eight and Level fields) and linked to the building by the B_Number identification code. This multiplicity cannot be represented outside of a 1-N relationship (a building, several storeys). Instead of using a table for a single attribute, this may led to a proper representation of storeys and horizontal structures (slabs, see the same entity in damages) and to a link to building chronology.

Surveys (light green)
The "Surveys" table contains information about the survey (surveyors, team, extension, internal/external, survey date). The screening cases rely to two surveys only, one internal, the other on the external of the building, but monitoring a building suggests recurrent inspections to assess the conservation state.

Building Uses (orange)
The "Building Uses" table contains information on the use over time from the present (current use) to the construction time (original use) of the building, the different uses (Use field) have been coded in the "building_use_d" table. The “main” use is included in the building record, but often reuse means attributing new functions that may be rather diverse.

A very important table is **building_chronologies** which encompasses a part of the second panel of the report and some data in the first panel (see previous image).

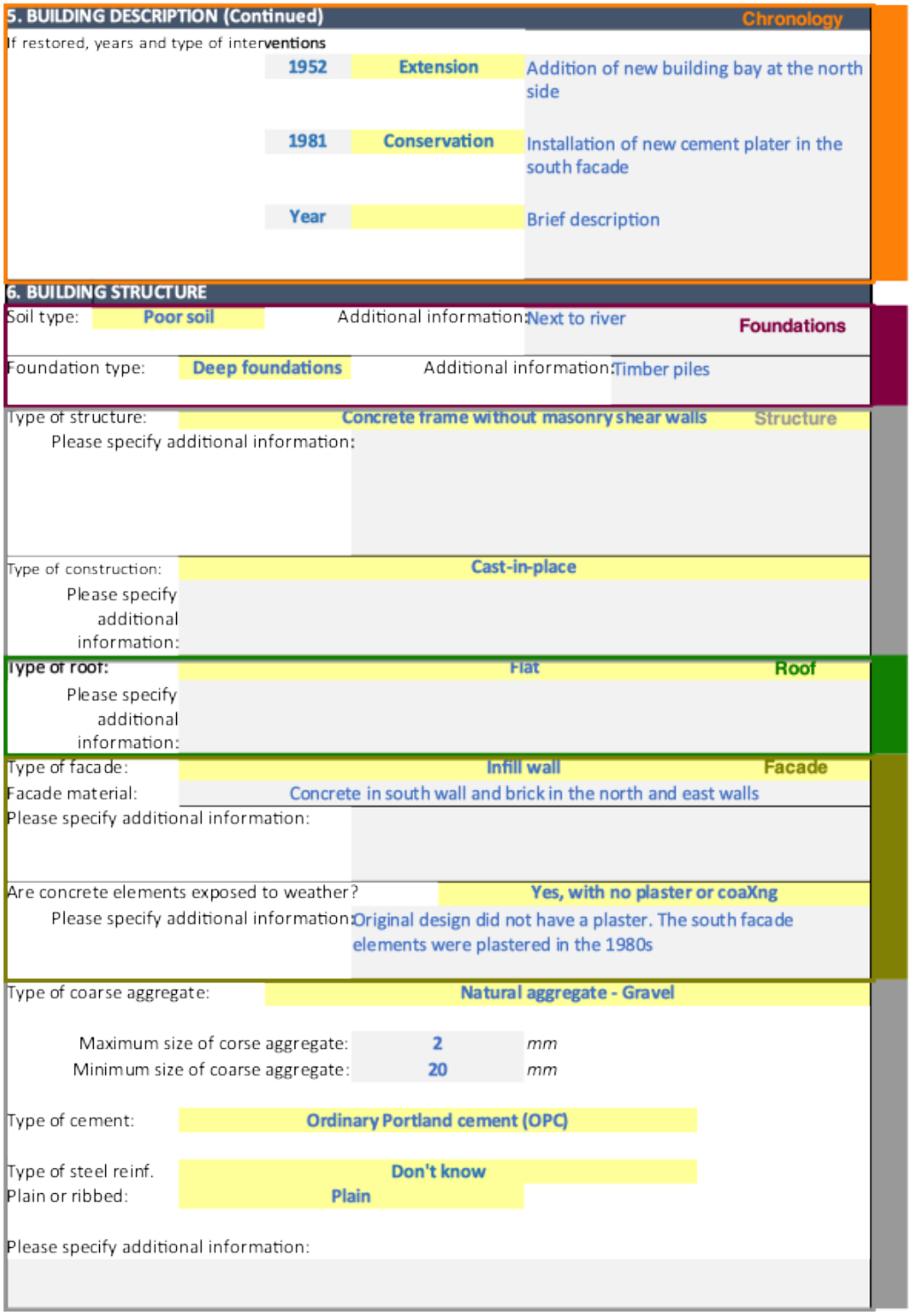


Fig. 7 – Second panel of the survey templates and information content

Buiding Chronologies (orange)

The "Buiding Chronologies" table contains information on the order in which building-related events occur over time from design to construction and all subsequent relevant interventions.

Every step in the transformation of the buildings is recorded as follows.

Column	Content	Reference
chron_id	identifying sequence	
b_number	reference to buildings	buildings
action	type of action	actions_d
a_year_begin	beginning year, when known; may be empty	
a_year_end	end of actions (usually known)	
description	narrative explaination of transformation	

To understand the **chronology**, it's mandatory to cite the relation with actors (who perform actions) in table **chronology_actions**.

Column	Content	Reference
ch_a_id	identifying sequence	
chron_id	connection with chronology	building_chronologies
id_pers	reference to personae	personae
agent_role	the role of the concerned person, firm or organisation	personal_roles_d
notes	the role in detail or comments	

The relation enables describing the multiple responsibilities for an action. Looking on the opposite site of the relation, the table **personae** keeps all the actors together, so it is possible to search for all the actions performed by an actor

Column	Content	Reference
id_pers	identifier	
cname	First Name or Firm	
surname	Family Name	
birthplace	character varying *NULL*	
birthday	date of birth or beginning date	
e_date	date of death or end for firms	
patronym	(if needed)	
main_profession	profession (main, others in bio)	main_profession_type_d
main_address		
country	actual country	countries_d
city		
postal_code		
bio	visible description	
notes	notes, not publically visible	

All references to persons and firms throughout the database are linked to the records in this table.

The Directus interface provides the following form to input and modify chronology.

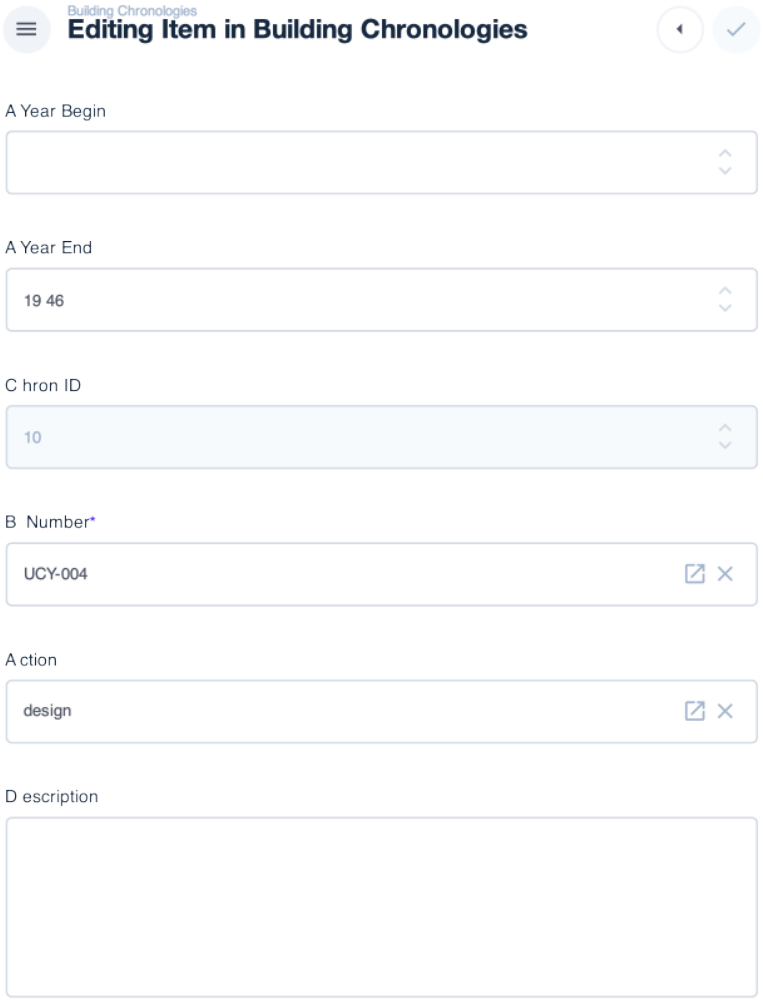


Fig. 8 – Building chronology

Parts of the building

The survey omits some information here because the chronology could provide more historical information about the parts that are only by chance or incidentally recognizable as belonging to a certain modification of the building. The database is anyway able to keep this information, linking elements to phases in chronology.
These elements are possibly identified and a structural description is available.

Building Foundations (purple)

The "Building Foundations" table contains information on the type of soil and foundation of the building. The template has space to describe one foundation only, but the database may host as many records as needed for an accurate description, accounting for differences in time, space, material and technology.

Building structures (grey)
The table "Building structures" contains information about the type of structure and construction, as well as the type of materials used including concrete. This table provides for a better description as well. Even the structures may face different approaches in space and time via the relationship with the chronology table.

Roofs (dark green)
The "Roofs" table contains information on the type of building roofing. The table may record multiple coverings in space and time like other elements.

Façades (caki)
The **facades** table contains information on the type of structure and materials used in the building facades. The templates provide space for one record only, but the database is conceived for every facade of the building and suggests keeping track of vertical structures as well, a more general case for façades (see the damage assessment that may reference them more directly).

Other elements

The damaged elements panel ("Visual survey" in the third panel of the template, see detailed description in the dedicated paragraph) references a class of elements or single elements that are the same – or strict relatieves – as these. Façades may be a special case of *vertical elements* while the structures table references a specific system instead of a single element.

General overview
A general overview of the diagram – limited to the building relationships shown in the first and second panels – follows.

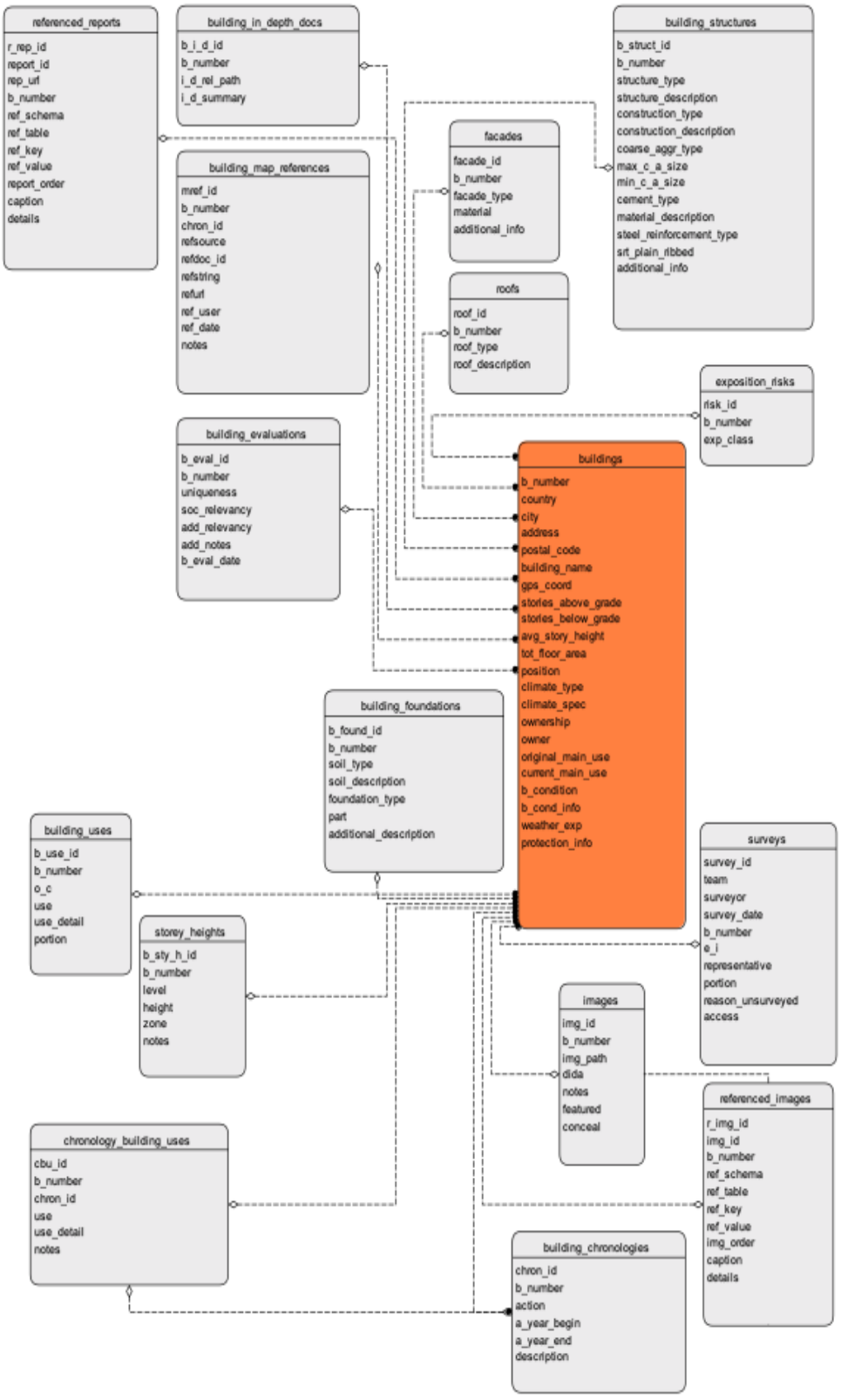


Fig. 9 – Buildings table and related tables

Adding new buildings and related information

The application provides several forms to enter data into the building table and its related tables. The following pages show the forms that collect data on buildings.

Buildings (main table)

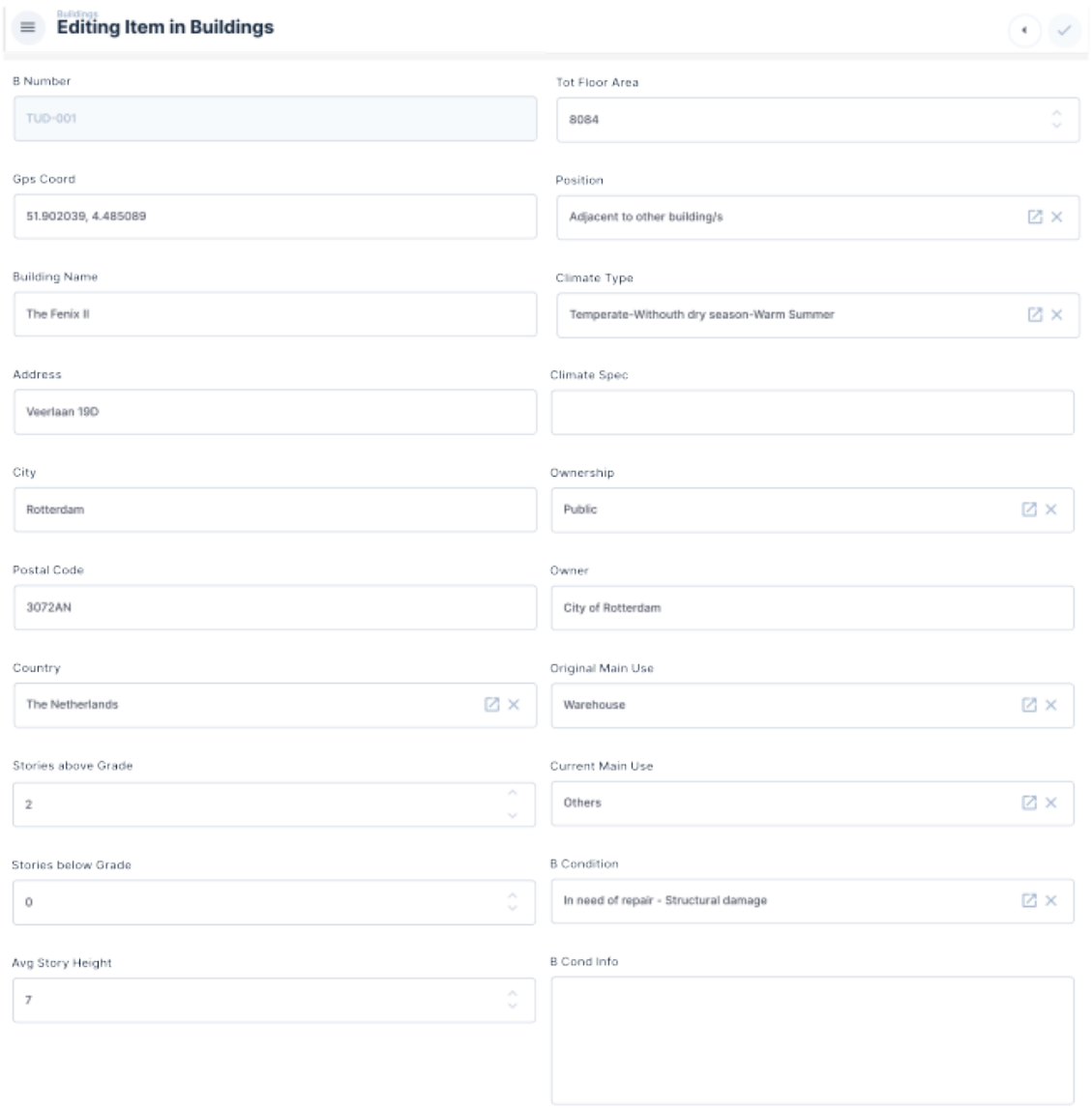


Fig. 10 – Directus main input form for buildings

The input is approved with the check sign (√) at the top of the form.
A partial input is accepted and can be built up in several sessions, but if the minimum requirements are not met, the building will not be presented online.
Any session should be approved to prevent losing the provided information. The interface advises the user to save the form to avoid this.
All the linked tables are condensed in lists at the end of the previous form. When clicked they open the specific form on the linked table.

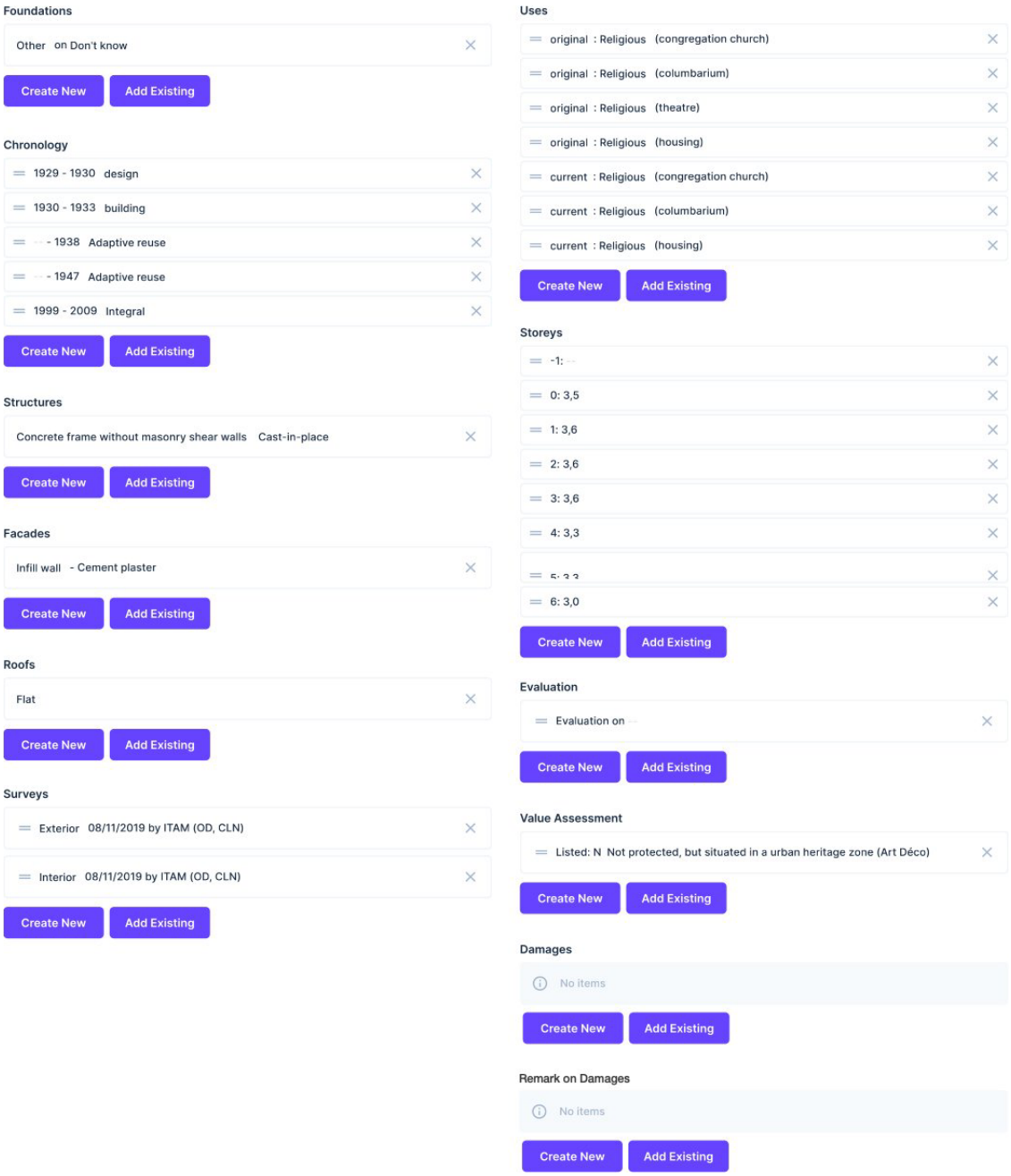


Fig. 11 – Ancillary tables of the building

Several forms are available for input. It's not mandatory to fill all them at once and even to put data in all them. If you do not have the information, there is no need to enter it. A missing information has no other consequence than the absence of the data among those displayed on the site page and can be added anytime, enriching the data presented to the website visitor.

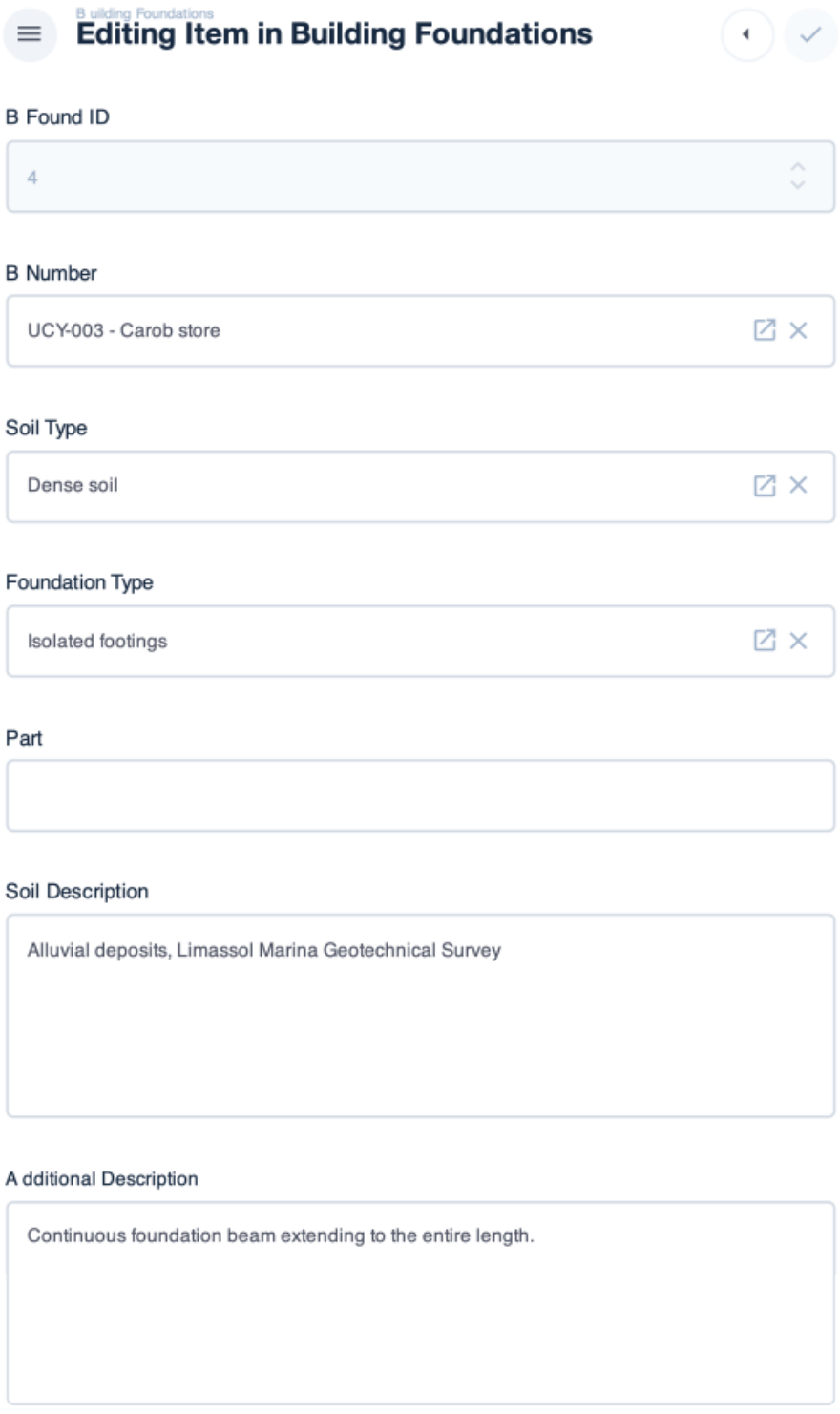


Fig. 12 – Foundation(s)

Beyond the point location, the database can handle the spatial extent of the building that was gathered from OpenStreetMap vectors using QGIS. The `building_polygons_osm` is loaded as a vector layer. The background map is only for presentation purposes. In this figure the background map is provided by OpenStreetMap, an open-source map that users can enhance and correct.

Fig. 13 – Map extent of buildings

While georeferencing the surveyed buildings we found very often the corresponding polygons in OSM (almost everything the drawing was accurate), in the rare case of missing polygons we faced two cases:

- an accurate plan of the current state of the building is available, in this case we could copy and paste the drawing (if coming from a georeferenced plan) or georeference and trace it (if coming from a paper scan/photo);
- building decay or overgrowing vegetation prevents an accurate tracing. In this case, we georeferenced the original drawing (raster reproduction).

The vector layer in the (geo)database obviously carries descriptive data: an ID deriving from import (ogc_fid), a part may come from OSM, a part which adds information about the parts of the concerned building, if more complex than a single building body.
In the following figure, the corresponding data entry form.

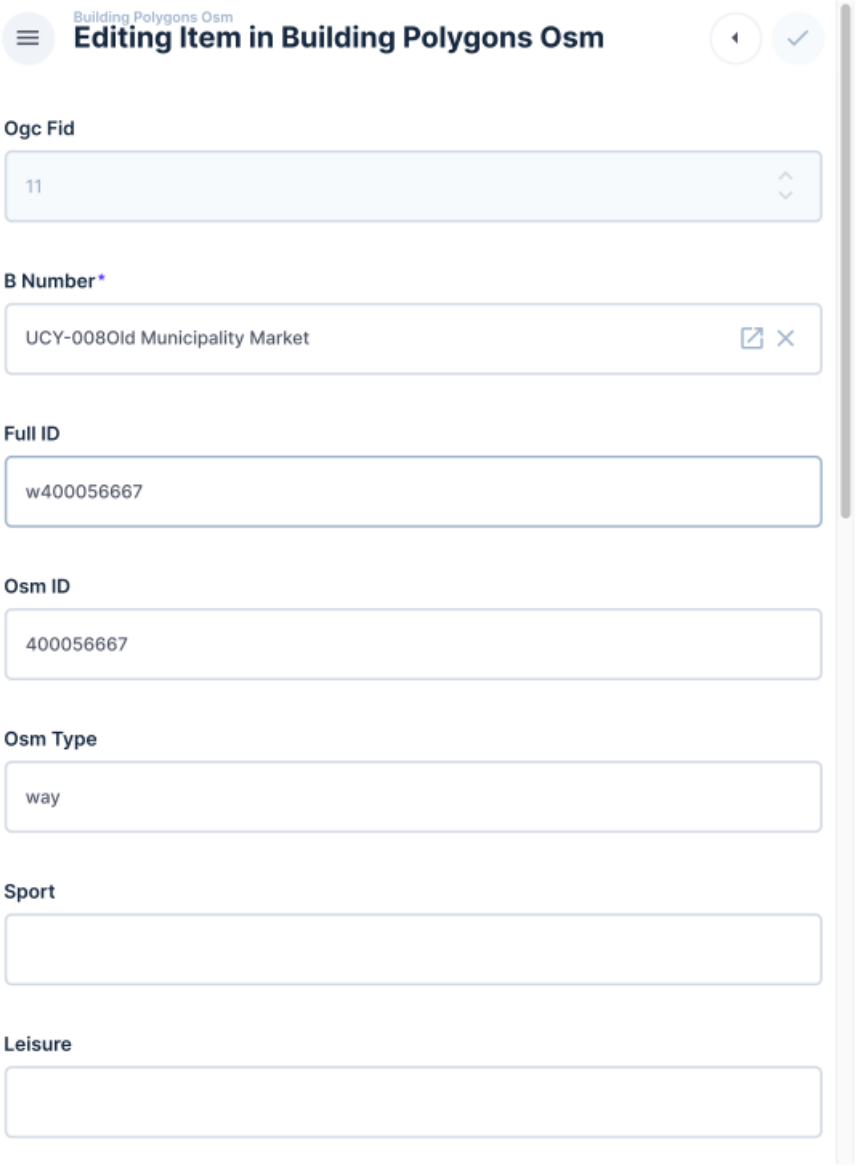


Fig. 14 – Map data entry

The **in-depth reports** are related to buildings in a more specific way than the other documents (see *resources*), so these relationships are recorded in a dedicated table.
The records should at least refer the report to the building(s) – a report may be referred to one or more buildings – cite the title and add a short summary to feed a descriptive introductory page in the web site.
For data entry the Directus Interface provides the following form.

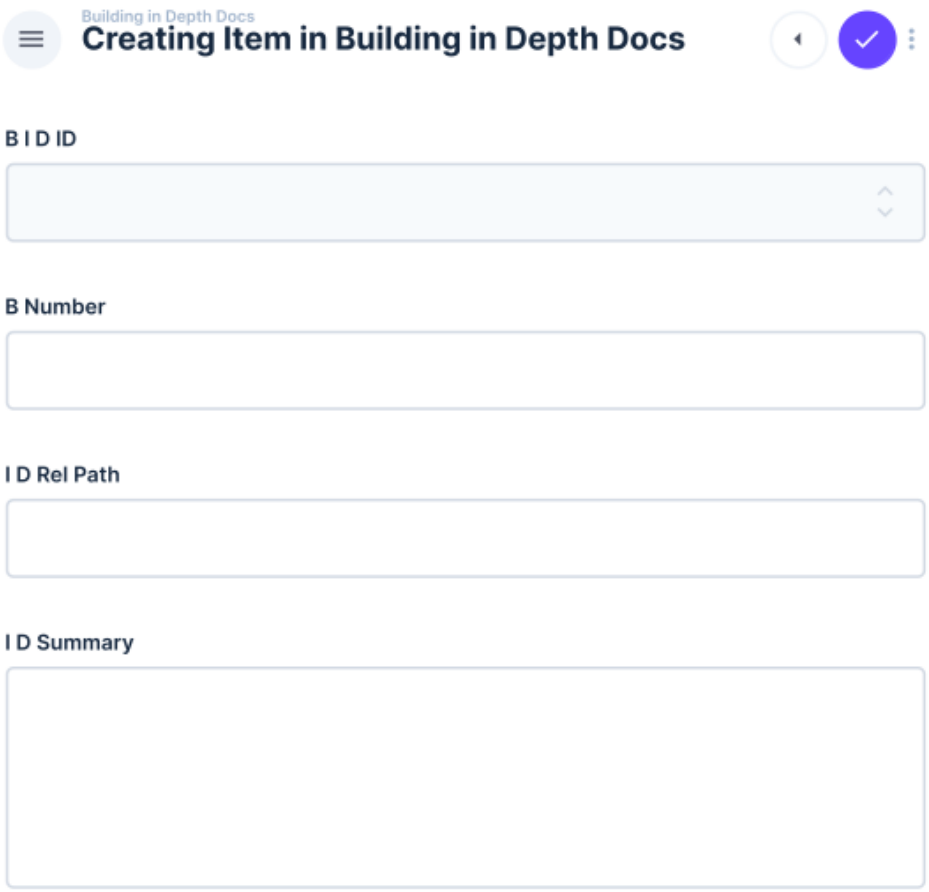


Fig. 15 – Reference in-depth reports

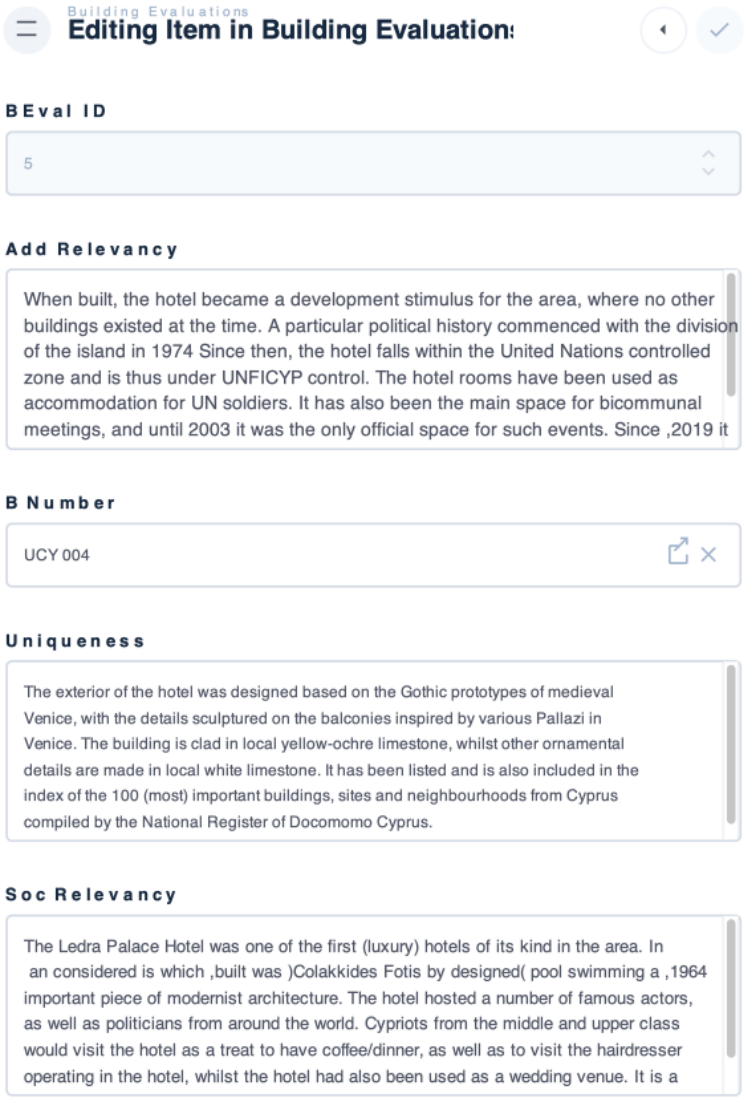
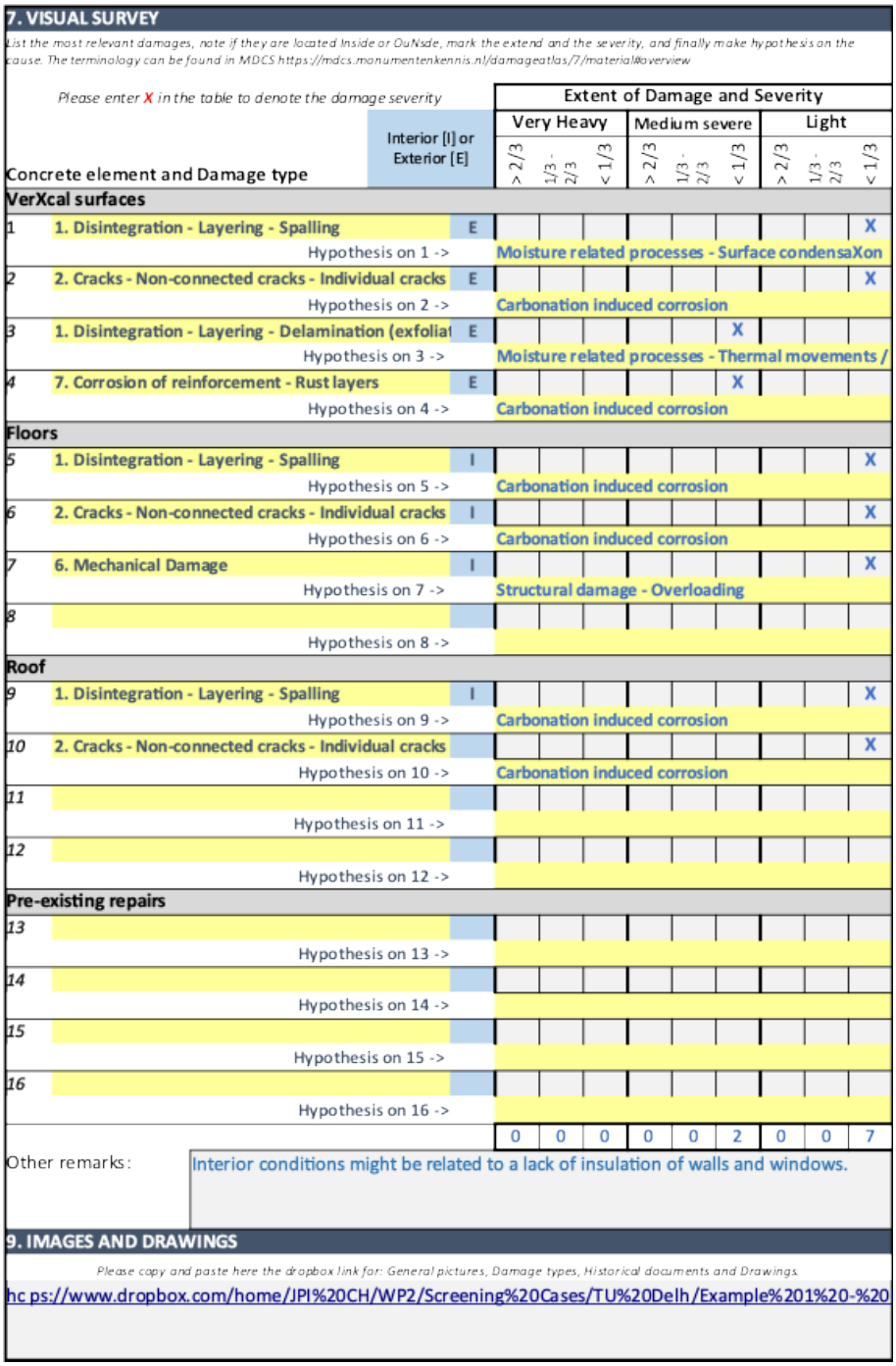


Fig. 16 – Building Evaluations

Damages

The third panel shows the outcomes of the visual survey which are recorded in the **damages** table. The table is a form to collect data with a simplified procedure as well as a score bitcode that summarises the amount of damage and its severity. In the database this can be calculated as needed, there is no use in storing it as it is dynamically generated by additional damages.



7. VISUAL SURVEY

List the most relevant damages, note if they are located Inside or OuNside, mark the extend and the severity, and finally make hypothesis on the cause. The terminology can be found in MDCS https://mdcs.monumentenkennis.nl/damageatlas/7/material#overview

Please enter X in the table to denote the damage severity

	Concrete element and Damage type	Interior [I] or Exterior [E]	Extent of Damage and Severity								
			Very Heavy			Medium severe			Light		
			> 2/3	1/3 - 2/3	< 1/3	> 2/3	1/3 - 2/3	< 1/3	> 2/3	1/3 - 2/3	< 1/3
VerXcal surfaces											
1	1. Disintegration - Layering - Spalling	E									X
	Hypothesis on 1 ->		Moisture related processes - Surface condensaXon								
2	2. Cracks - Non-connected cracks - Individual cracks	E									X
	Hypothesis on 2 ->		Carbonation induced corrosion								
3	1. Disintegration - Layering - Delamination (exfoliat	E						X			
	Hypothesis on 3 ->		Moisture related processes - Thermal movements /								
4	7. Corrosion of reinforcement - Rust layers	E						X			
	Hypothesis on 4 ->		Carbonation induced corrosion								
Floors											
5	1. Disintegration - Layering - Spalling	I									X
	Hypothesis on 5 ->		Carbonation induced corrosion								
6	2. Cracks - Non-connected cracks - Individual cracks	I									X
	Hypothesis on 6 ->		Carbonation induced corrosion								
7	6. Mechanical Damage	I									X
	Hypothesis on 7 ->		Structural damage - Overloading								
8											
	Hypothesis on 8 ->										
Roof											
9	1. Disintegration - Layering - Spalling	I									X
	Hypothesis on 9 ->		Carbonation induced corrosion								
10	2. Cracks - Non-connected cracks - Individual cracks										X
	Hypothesis on 10 ->		Carbonation induced corrosion								
11											
	Hypothesis on 11 ->										
12											
	Hypothesis on 12 ->										
Pre-existing repairs											
13											
	Hypothesis on 13 ->										
14											
	Hypothesis on 14 ->										
15											
	Hypothesis on 15 ->										
16											
	Hypothesis on 16 ->										
			0	0	0	0	0	2	0	0	7

Other remarks: Interior conditions might be related to a lack of insulation of walls and windows.

9. IMAGES AND DRAWINGS

Please copy and paste here the dropbox link for: General pictures, Damage types, Historical documents and Drawings.

hc ps://www.dropbox.com/home/JPI%20CH/WP2/Screening%20Cases/TU%20Delh/Example%201%20-%20

Fig. 17 – Damages template

The **Damages** table contains information on the type of damage and its extent/severity. The survey provides an accurate description of the damages that affect the parts of the building. Some of the elements concerned are more general and the extent of the implied class is wider than the recognition of the parts: vertical surfaces, floors, roofs. Besides it there is a specific attention to the recent repair actions; the *pre-existing repairs* take into account the more or less fast decay of recent repairs. The table shows:

Column	Content	Reference
id_ed1	damage identifier	
bulding_n	reference to buildings	buildings
element_type		element_type_d
id_degr	order of the damage	
damage		damages_d
i_e	internal/external	I/E
severity		damage_severity_d
extent		damage_extent_d
cause		damage_cause_d
notes		

The reliance to a class of elements can become a reference to a specific element of the building. This can be useful if damage is directly located in one member. This could support referencing to analytical reports, drawings, photos, etc.

How to compile damages information

The following form records the damages. Any damage is entered per-se. There is no limit to the number of damages found in the survey while the template only allowed a fixed number of occurrences.

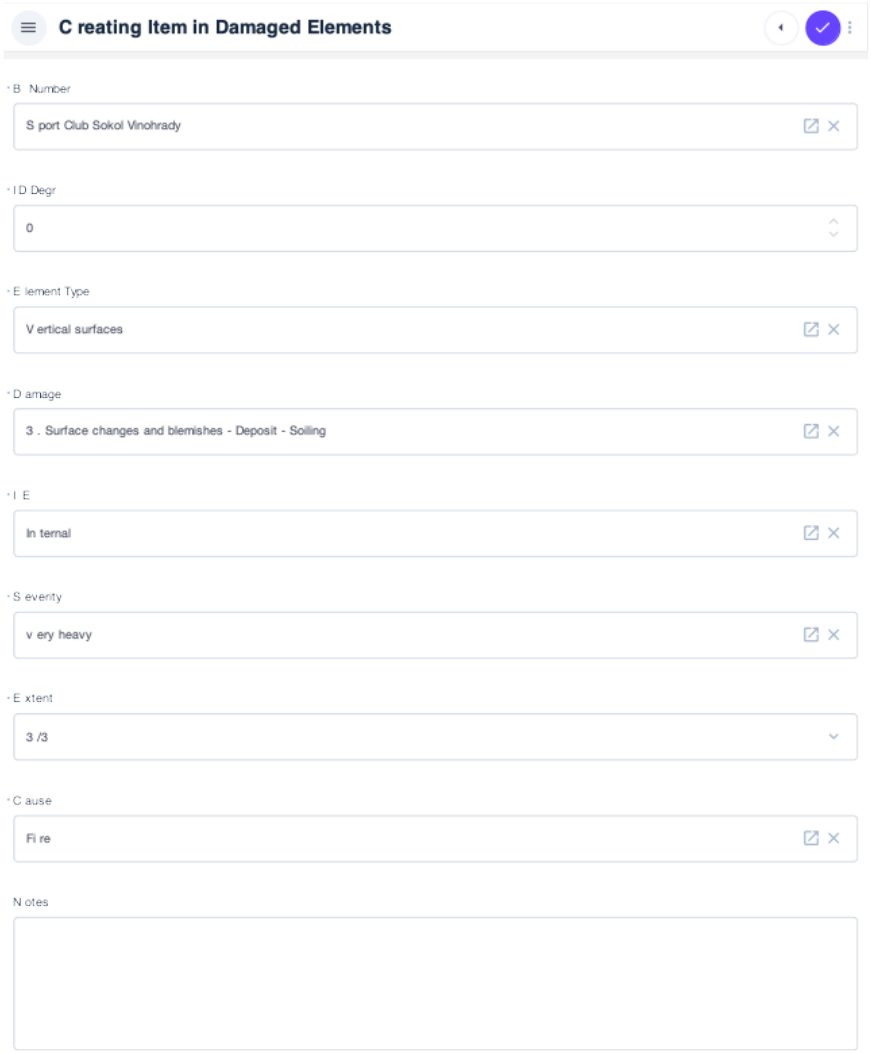


Fig. 18 – Damages form

Damage Remarks

In the same template panel there is an entry “Additional remarks” that allows the surveyor to enter more information on the damage. The additional remark may provide more detailed information on damaged elements or systems.
The evaluation has a direct relationship to the building and may be an assessment of the state of conservation of the building as a whole.
The form is very simple and contains only the parent ID (b_number) and a text input.

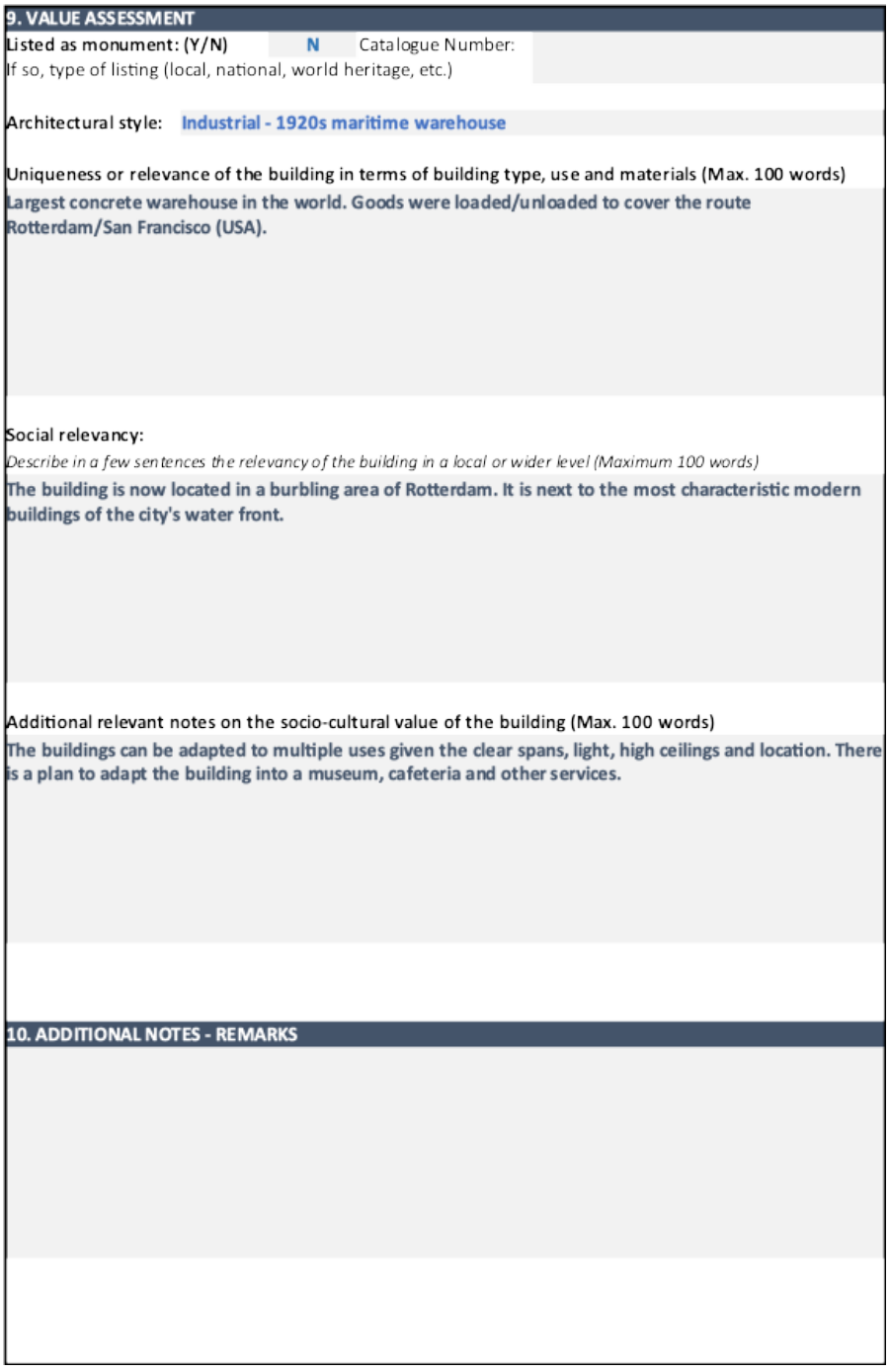
Images and drawings

The survey need to start before the database was ready. So the folder structure of the filesystem was used to store and reference graphical resources and could not handle any specific relationships with the items in the database. These informations were added by the

surveyors, using accompanying word files or long captions as filenames, or came from the title or legend of the drawings or reproductions.

General evaluations

In the template the fourth panel is dedicated to a more comprehensive evaluation of the building(s).
These remarks are given in the fourth panel in the template as in the following example.



9. VALUE ASSESSMENT

Listed as monument: (Y/N) N Catalogue Number:
If so, type of listing (local, national, world heritage, etc.)

Architectural style: Industrial - 1920s maritime warehouse

Uniqueness or relevance of the building in terms of building type, use and materials (Max. 100 words)

Largest concrete warehouse in the world. Goods were loaded/unloaded to cover the route Rotterdam/San Francisco (USA).

Social relevancy:

Describe in a few sentences the relevancy of the building in a local or wider level (Maximum 100 words)

The building is now located in a burbling area of Rotterdam. It is next to the most characteristic modern buildings of the city's water front.

Additional relevant notes on the socio-cultural value of the building (Max. 100 words)

The buildings can be adapted to multiple uses given the clear spans, light, high ceilings and location. There is a plan to adapt the building into a museum, cafeteria and other services.

10. ADDITIONAL NOTES - REMARKS

Fig. 19 – General evaluations in the template

Value Assessments

The "Value Assessments" table contains information on monumental constraint and level of recognition (local, national, world heritage, ...), as well as architectural style.

This information could be better handled as a partitioned set of tables dedicated to national listings, linked to the responsible authorities. This table acts as a proxy of an European Listing without proper links to national bodies which is currently not available.

Column	Content	Reference
b_v_ass_it	abstract identifier	
b_number		buildings
listed	Listed as monument (Y/N)	
listing_date		
cat_num	Catalogue Number	
list_type	Type of listing	
style	Architectural style	
style_details	Specifications of style	
obs_date		

Building Evaluations

The "Building Evaluations" table contains information on the cultural and social relevance of the building, as well as its uniqueness.

Column	Content	Reference
b_eval_id	identifier	
b_number	reference to building	buildings
uniqueness	uniqueness and main evaluation	
soc_relevancy	social and relational relevancy	
add_relevancy	additional relevancy	
add_notes	additional notes	
b_eval_date	evaluation date	

The structure of the table mimics the survey. A possible development could be a more flexible and single layout that recognises the benefits of multiple evaluations in time. The structure could be more strongly tied to time and reference the author of the evaluation (even in the past).

Column	Content	Reference
b_eval_id	identifier	
b_number	reference to building	buildings
topic	uniqueness, social relevancy, etc.	
evaluation	social and relational relevancy	
add_notes	additional notes	
b_eval_date		
evaluator		personae

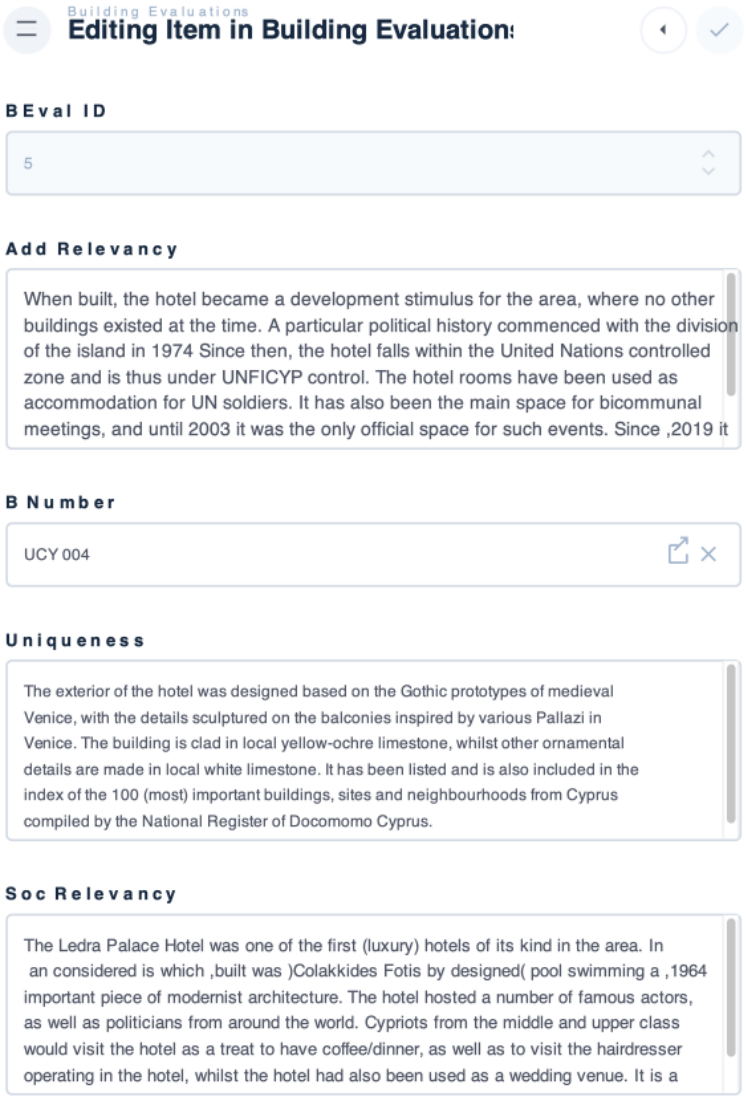


Fig. 15 – Evaluations form

Resources

Data are not the exclusive way to survey and report on a complex reality. A lot is entrusted to complex documents, images, drawings, historical sources that are collectively identified as resources and are stored on a filesystem or a remote repository. Shortly, they are files that need further "introspection" (metadata) to be characterized by function.
They are usually attached or linked to the records of a database, but they are more efficiently let outside with a simple reference in a table. The relationship with the items is possibly multiple (for instance, an image may portrait several items and the same item is usually present in several images) and it may be qualified by specific attributes – like a caption.

Link to In-depth Reports

In-depth reports are are an important part of the survey, being a free-text document with a structure specific to any surveyed building. The table contains the link to the documents, the format and path/URL and a short summary of the results. The in-deph reports are included in the resources that are attached or linked to any table of the database. They are complex documents that encompass several aspect of the building concerned.
On the other hand, there is no limit on the number of reports for the same building and a report can encompass more than one building or site.

See the information on treatment of in-depth reports in section 3.

Pictures and Reproductions

The surveyors provided several images. These pertain to these categories:

- photos:
    - general overviews
    - internal views
    - details and damages
- historical photos
    - overview
    - photos during construction (details and chronology)
- drawings
    - reproductions (raster)
    - files and file conversions (dwg/dxf, pdf, svg)
- documents
    - photomechanical replication (tiff, raster pdf)
    - photographic reproduction (tiff, jpeg, raster pdf)
    - files and file conversions (vector pdf)
    - written full text transcriptions (txt, md, doc/docx, odt, html, epub, mobi)
- technical images (infrared/true color couples, etc.)

The images are all listed in the images table.
The table comes from the file list of the Nextcloud instance. Unfortunately we couldn’t access the unique identifier (Nextcloud runs on another DBMS which is not readable by ours) and some files were moved after collecting and recording data. So, in some cases the

paths need to be fixed. This is due to security reasons that may be overcome in the future, maybe recurring to a foreign data wrapper.
Several images reference unidentified objects and places. Especially photos of details and technical images. Some problems may be sorted out by the surveyors, but others are due to the absence of the portrayed objects from the database.

The main table, **images** (or image_files) bears this structure:

Column	Content	Reference
img_id	identifier	
b_number	reference to building (general)	buildings
img_path	relative path	
dida	descriptive caption	
notes	notes on the file	
featured	identifying image for building	
conceal	hidden (unsuitable format)	

Further information on images is provided by **images_info** table:

Column	Content	Reference
img_id	image id	images
date_precision	precision of the date	date_precision_d
date_yyyy	year or approximate date	
image_role	role of the image for the represented object	image_role_d
drawing_type	for drawing reproduction	drawing_type_d
survey	internal or external survey	interior_exterior_d
element	represented element	

The additional information pertains more specifically the image (and not the file) but is related to the depicted object only implicitly (examining the image).

With an implicit reference to the diagram “C – Resources” in the appendix, we observe that images, documents, videos and all sort of attachments/links (URLs) are a special case of relationship inside the database.
A resource (e. g. an image or a drawing) can play as a *children* in a 1-N relationship – an item can be described by several pictures, usually with different explanatory roles that can be usefully recorded. Conversely, a resource cannot act as a *parent* in an N-1 relation. Internal multiplicity (multiple elements in the same image) remains implicit without a 'support structure'.
A photo can represent several elements, can be a pole of an N-1 or N-M relationship, but cannot be an *active* part in it unless it *receives* a structure accessible by the database; e. g. parts of an image are “mapped” to the database (it may be overlaid with a vector labelling that is stored as an XML or JSON or referenced in a special table in the database). Otherwise the photo cannot work as a parent for multiple relations because a file cannot be queried with standard database tools; in a relational database everything is a table (even if tables may contain complex structures).

To make it simple, most of these multimedia resources (or documents without an explicit structure) cannot play any active role in the database, so there is no use in a relational setup. Multimedia should be indexed, but not queried, so foreign key are not mandatory and a relationship like chronology phase ↔ image would always use the phase to find related images and not images to query the chronology, even if pictures could directly link chronology. We can pack all reference to multimedia items in a single table, if we prefer a more compact solution.
This can be performed by a table, image_elements with the following columns:

Column	Content	Reference
img_el_id	identifier	
img_id	link to image	images
reftab	referenced table	[table name]
refid	referenced item	[item key value]
imgrole	role of the image	img_role_d
caption	caption (relative to the table)	
notes		

As you can spot, the unique id has only one firm reference, the image id, but it's programmatically generated (in the query, selecting the name of the primary key from metadata tables), so il will be very slow to handle many-to-many relationships in a query.
To help inserting these relationships, there is a view that joins every record with its table and key identifier.

A form is provided to edit and enrich information on images for any item class. These are not detailed here for brevity.

Buildings, Sites and their Parts (in time)

There is a further path of development in the database.
The surveys found out differents settlements: entire sites containing several buildings (cut in parts, as per the survey by UCY), buildings evolving in time that were surveyed as complexes, but were recorded in the current state (ITAM), buildings that were surveyed in temporal intervals (the Silos in Genova by UNIGE) but the transformation was so granular to suggest to let these evidences in BIM, but not to transfer them to the database, transformations that were surveyed as if they were different and overlaying buildings (TUD).
This condition can be enhanced or overcome with a proper use of the chronology and with a partial extension to the database that was performed to link the chronology with parts, elements and possibly components of the buildings.

The database provides additional tables to establish the relationships with chronology:

- chronology_building_structures
- chronology_facades
- chronology_roofs
- chronology_building_uses (proxy for building types).

By now these are not used but could be used by future surveys when recording valuable chronological information, referencing building phases and damage processes.

GIS and BIM database

GIS

The database provides GIS support via two geometric entities and georeferenced images.
Sites and buildings are indifferently referenced with a couple of coordinates (i. e. a point) with a geometric view, but the buildings are also represented by polygons for built bodies.
There is a specific geographic layer that has two sources: polygon relations representing buildings in Open Street Map, when available and accurate and digitisation of geometric documents or direct survey.
Sometimes the building is too complex or too "light" to be correctly represented by OSM, so a better solution is the georeferencing of drawings (scanned documents) on the geographic map. A raster layer is provided for this action.
During the past months all buildings were georeferenced using one or more of the three ways (points, polygons, raster).
We used the data directly input by the researchers for the points and made use of QGIS to extract the polygons from an OSM query. QGIS was also the tool of choice for the georeferencing of drawings. OSM polygons were used as external references as well when the polygon was absent.

The connection between the buildings (via b_mumber) and the polygons is direct, the b_number is directly written in the polygon with the rule of 1 to N polygons on the map for one building. So there is no flexibility to describe complex relations between alphanumeric data and geometries besides the 1-N link. In the real world, the connection between buildings and polygons is richer and requires an intermediate table that is by now provided but not really used.

The layer or geometric table for polygons is called **building_polygons_osm** and it hosts both polygons coming from OSM and newly drawn polygons. The first have the OSM identifier, the latter are only identified by a sequential primary key.

There are also some base layers used to generate some little scale maps with inherited and generalised data (say density of RC heritage cases). These are **lau_lb_01m_2020** (municipalities and inhabited places at 1:100.000 scale), NUTS0 (states), NUTS1 (regions) and NUTS2 and 3 maps (nuts0_rg_10m2021, nuts1_rg_20m, nuts2_rg_03m, nuts3_rg_03m, nuts3_lb_2021). In the following images you can see the maps drawn by points, by query on base maps, by polygons and an example of georeferenced image.

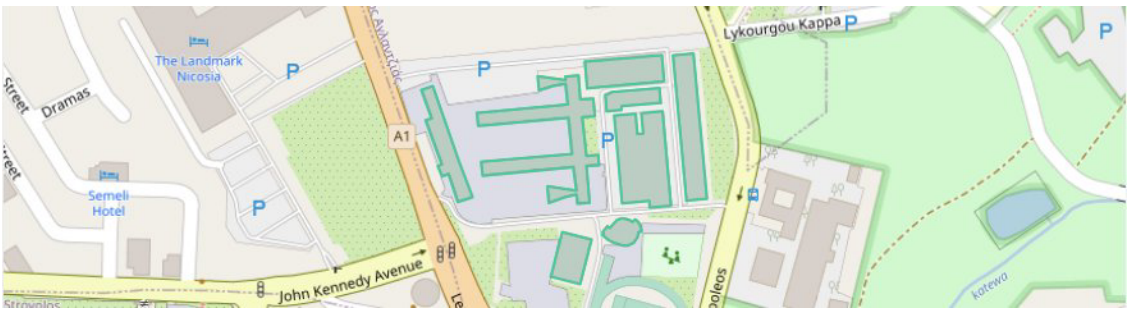


Fig. 20 – Multiple polygons for the technical school in Nicosia (background map by OSM)

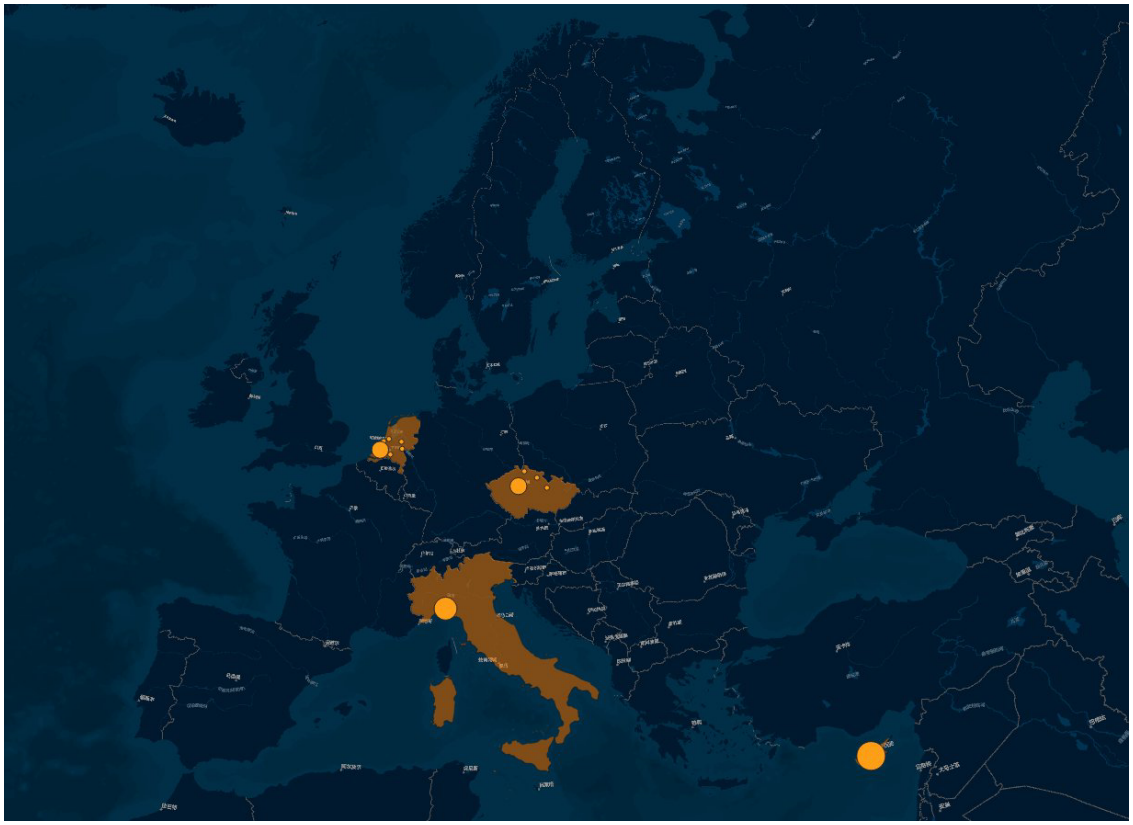


Fig. 2 - References to NUTS. The map is completely built inside the database.

BIM

Building Information modeling is not a new and fancy name for parametric CAD or a glorified version of the bill of materials. It is a parametric CAD or a database, but it has a standard structure based on the so called Industry Foundation Classes that are the base for the storage/exchange file, but also a standard body of classes to describe in an exchangeable way the elements of the building and the building itself. If GIS is a horizontal set, BIM is a vertical one. Generally a BIM encompasses one building only or a strongly related set of buildings.

To further describe the configuration, the database we are using is meant to store only the information gathered by the surveyor, you are never forced to input anything, it's not an interrogation, the BIM has strict requirements and it's mainly meant for automatic input while drawing: a wall is a wall, a pillar is a pillar and without vertical structure you have no building.

The *vertical* nature of BIM is by default devoted to a single case which is virtually built with mandatory elements (foundation classes). We may compare it with the MONDIS database which uses the database structure as a guide for a virtually mandatory input.

The single-case nature of BIM, despite the tight requirements of IFC (Industry Foundation Classes rule the storage of informations for BIM and it's materialised in a file format), lets the user draw and add the information she/he likes. So, examining the outcomes of a model designed by different users or by the same users on different buildings shows little to huge incompatibilities. At little to medium scale (site to building) it is always possible to derive a

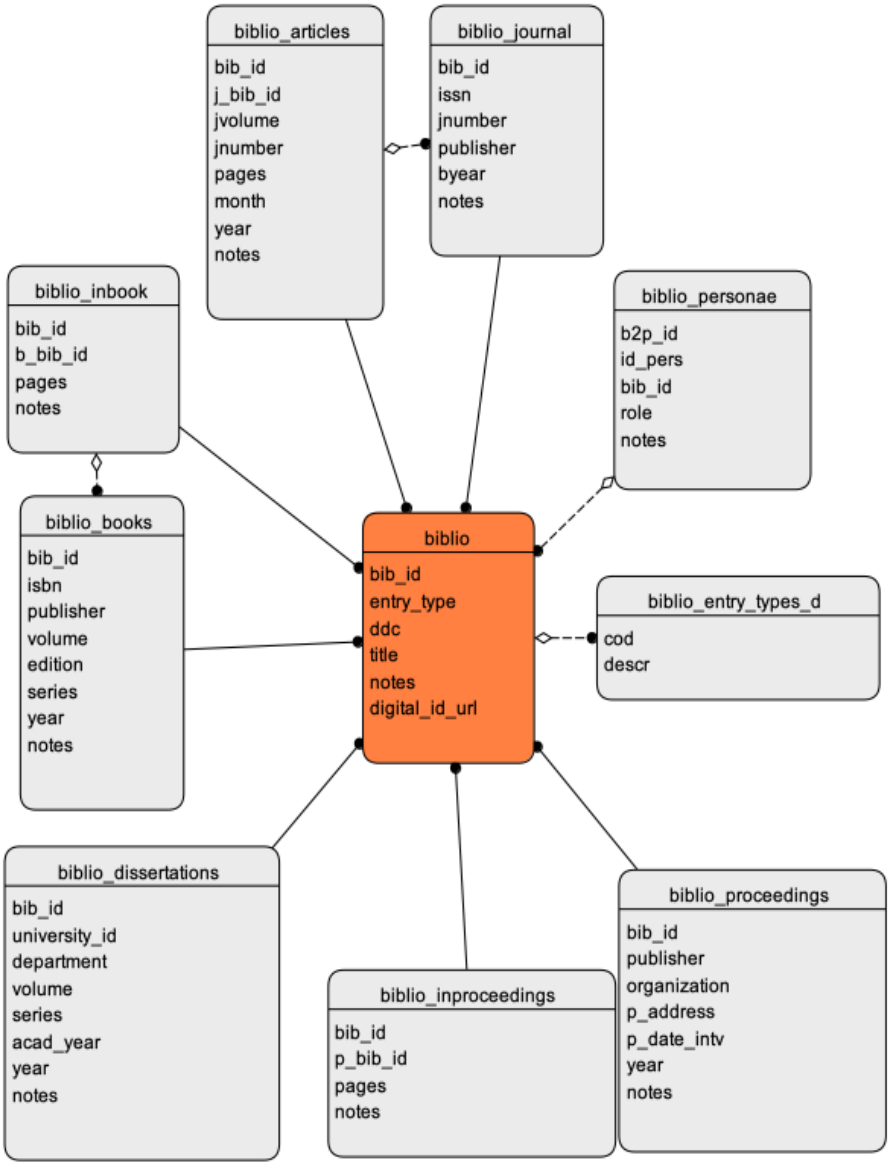
3D or 2D GIS representation and – more important – entities can be treated in a relational or object-relational DBMS, but the inheritance prevails while increasing scale and records become non-comparable.

Is anyway possible to **store** the IFC file as is inside a database – the IFC file is an XML – and it can be navigated to extract relevant and useful parts or more easily IFC can be opened, exporting then 2D or 3D files suitable to work inside GIS and become an impoverished skeleton to reference structural information.
All this is very unfortunate, because a data-oriented attention in BIM yields very good and articulated data sets that can be stored inside the database in native format (only some specific parts are stored as XML for future uses). Examining the so called HBIM (historical BIM) we found a constrained even if useful GIS-in-a-BIM at very high scales. It will take some time until a complete archaeological field management system will be able to deal with surveys. In the mean time, only the inquisitive and rigorous efforts of research labs will be able to deal with this tool in a profitable way.

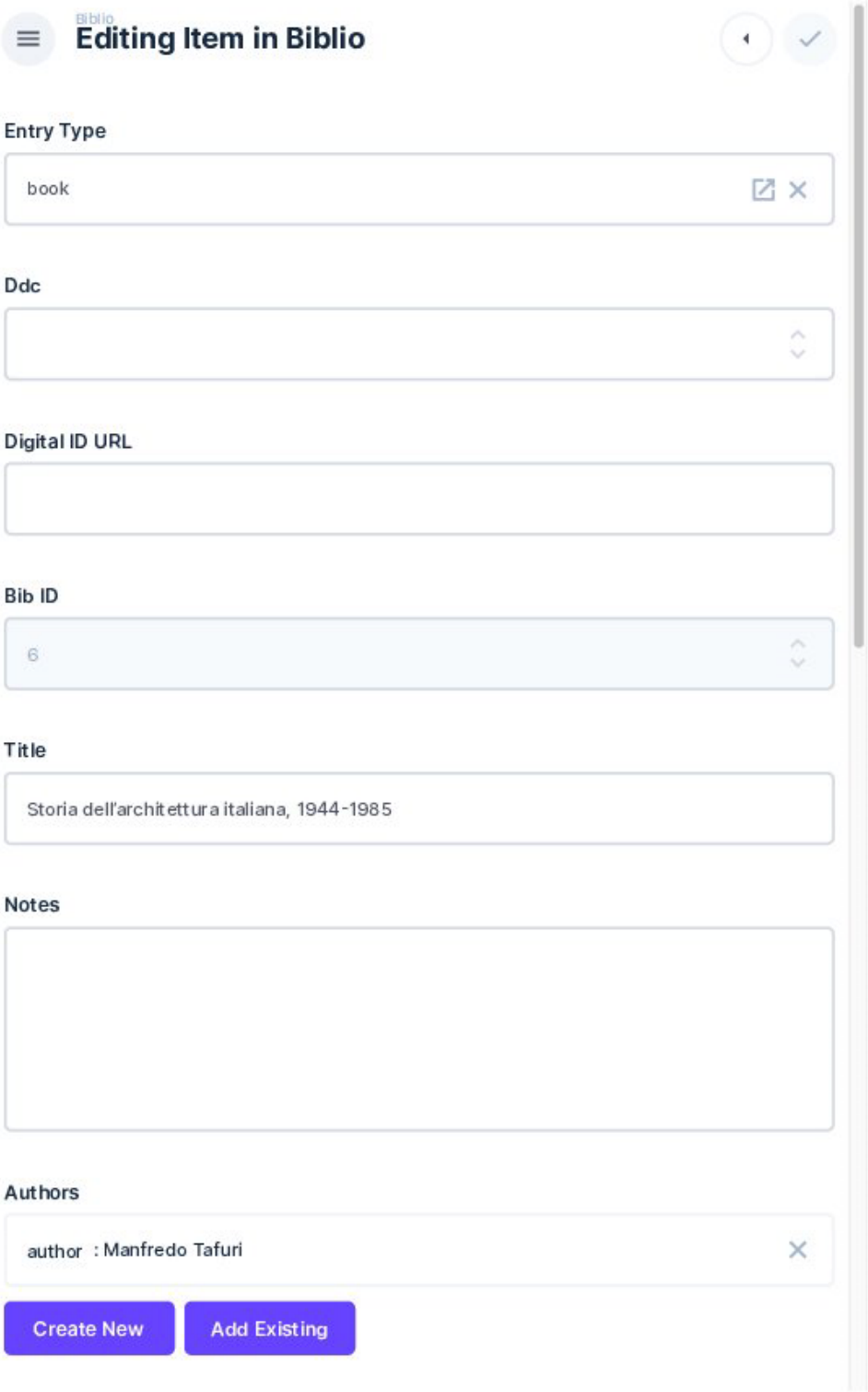
Some of the screening cases and at least two of the in-depth cases were accompanied by images taken from a BIM model, but they were not available in the file repository.

Bibliography

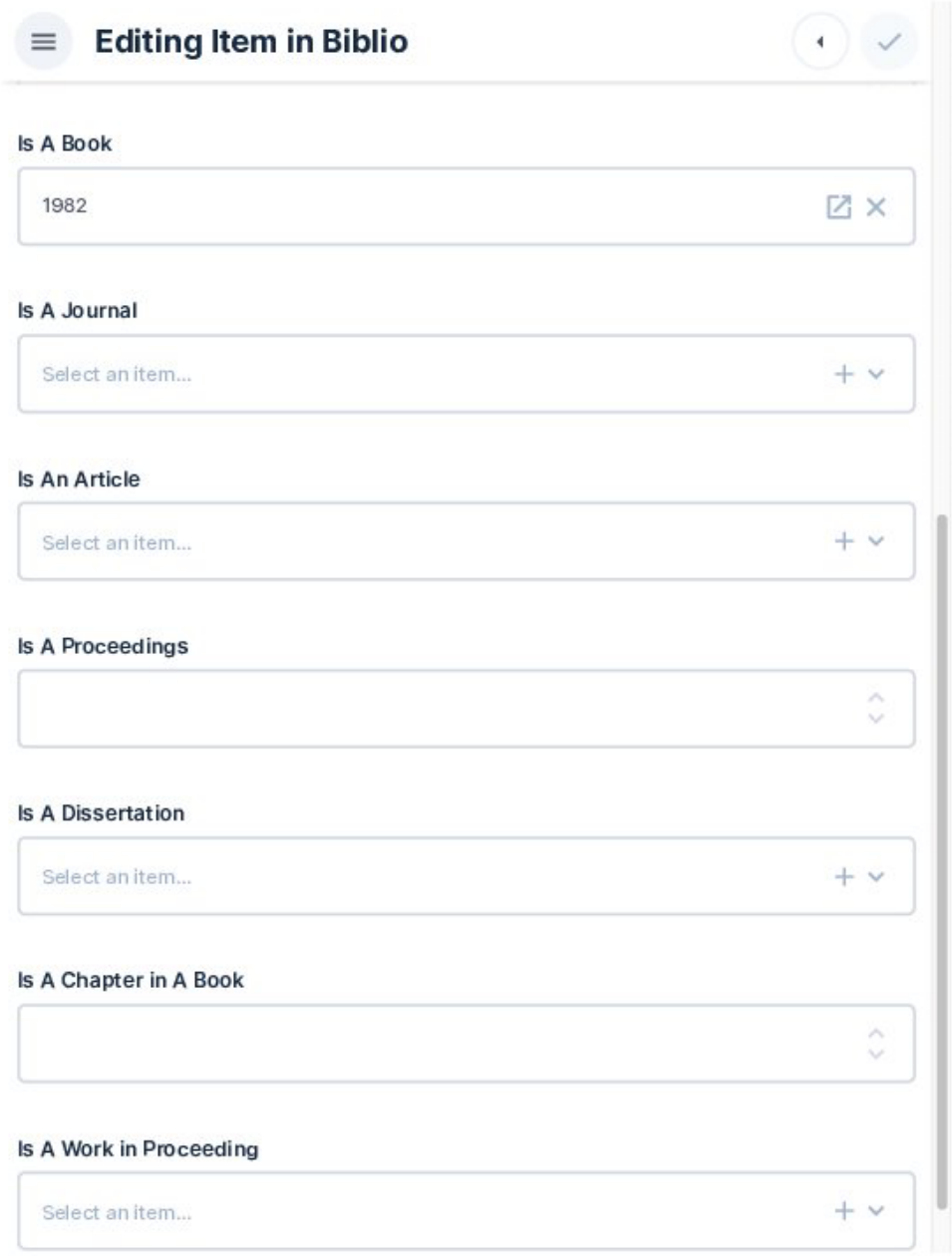
This is a lateral service to the database. The structure is somehow hierarchic and not relational but it mimics other common design for this type of data as its design follows a IS-A structure and inheritance.



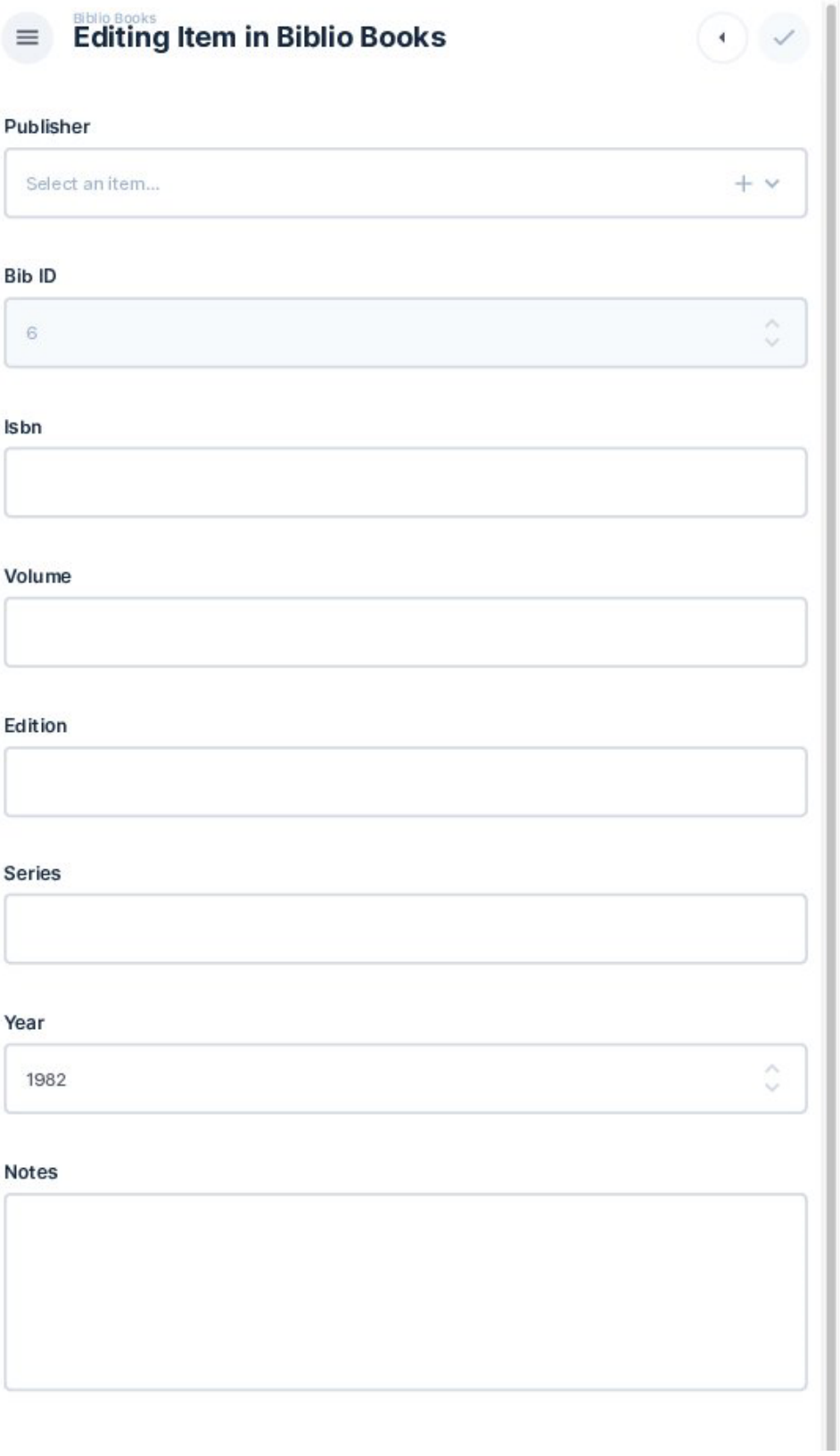
To fill in bibliography information you can head to the *biblio* form on directus.



The work, by now undefined, becomes a book, a journal, an article in a journal, etc., filling the proper record.



Choosing the book, we fill in this form



The main table, biblio, carries only the main information: the title and the digital_id while it retains the linik to the author(s) and publisher(s).
A *biblio* can be (or IS-A) several things:

- a book or
    - a chapter inside a book
- a journal
    - an article in a journal
- the proceedings of a conference
    - a transcription of a speech in the proceedings
- a dissertation.

This design is extensible because the main table captures only the essential information and the IS-A tables only carry the accompanying data.

The entry type can be considered superfluous, but it helps to verify the correctness of the input.
Input in this scheme can be tricky without a proper interface. It may be easier to prepare a delimited text in batch.

Outcome from database

JSON Feeds
All the contents of the database are provided as dynamical API that outputs JSON files. They are rendered on the web page with a static form and some javascript code.
The rendering provides:

- a list (which may be filtered on specific attributes)
- a linked map (that follows the same filter)
- an extensible form.

The form, conceived as the main outcome for a static site is feed by JSONs in both directions: a “horizontal” feed that encompasses all cases selected at start (it’s the first query by the user) and provides general data, and a “vertical” one that pertains a specific case and provides additional ad more specific information.
So we have three levels of information:

- basic information which is provided for every building, the same that comes from the admission form. An example is provided in this code (it’s not meant to be read by humans, but to feed pages);
- screening information which is provided with the survey, the first 48 cases come from the project, further cases are provided by the researchers and professionals that apply for admission and become members of the database committers (an example is provided in this code (again JSON); feel free to change the reference to the building number to see other cases);
- in-depth reports which are provided as a free text referenced by the database (an example in this sample report). They can be especially prepared reports or slightly edited existing document.

The best solution for an in-depth report is to be... a report. An autonomous work could be an academic dissertation, but a research work should bring data that need a structure that is provided by the database to become informative. When possible data should be “navigable” and visualised in a proper and readable way. So the provided mix of an

extensible DBMS that enable users to shape new schemes (without touching the others) could be very attractive for scientists.

The JSON feeds are provided by the database without any external computing contribution. It does it by itself, and the outcome is transmitted by a script deprived of any elaborative power on the database itself. It's only a very limited withdrawal that is meant to be reasonably secure.

This structure is independent from the Consech20 web site and can feed any other site by partner institutions or enabled parties (it may be even completely free for anyone, better if beyond a CDN that lowers the load on the server). Obviously the script that provides the JSON feeds should run on a web site anyway, but it may be different from the database and may be connected to the database with a local or very fast connection to provide timely feeds. Providing content from two or more different sources is the preferred setup for a web page that, counterintuitively becomes faster in this way, getting files from multiple sources at the same time.

Static pagesets

The page set follows the example of two well known web applications: the LigurArch900 mobile app for mobile and the Nonument.org site and database.
The final page set is in continuous development as it can follow the development of content types and sections hosted in the platform.

In-Depth Reports

The In-depth reports are linked to the screening cases in the database and are treated as an "extra" content of the database.
A direct descendant of the survey, the reports were treated as a partially independent content prepared for delivery as printable PDF with an accurate layout. The provided Reports are:

WP2_Case studies_In-depth_Reports (Merged).pdf

- WP2_ITAM-In-Depth_Report_Barrandov Tower (docx/pdf)
- WP2_ITAM-In-Depth_Report_Fuchs Restaurant (docx/pdf)
- WP2_TUD-In-Depth_Report_Fenix II (pdf)
- WP2_TUD-In-Depth_Report_Timmerfabriek (pdf)
- WP2_UCY-In-Depth_Report_AlexDimitriou Tower (pdf)
- WP2_UCY-In-Depth_Report_Melkonian Educational Institute_Final (pdf)
- WP2_UCY-In-Depth_Report_Old Municipality Market_Final (pdf)
- WP2_UNIGE-In-Depth_Report_Hennebique silos (pdf)
- WP2_UNIGE-In-Depth_Report_Fruit Vegetable Market (pdf)
- WP2_UNIGE-In-Depth_Report_Museum (pdf)

To "live" in the web site, the reports should be well integrated with the database and accessible, being "mobile-first" and readable on all devices. This includes mobiles, but also screen readers for blind people.

To meet a bearable level of accessibility, we made a double conversion:

- from word processing (or even PDF) to markdown. Markdown is the basic form of text in Nextcloud; it's in itself accessible and very easy to convert. This is a batch process that is performed only for reports written by the partners. Contributors are supposed to write the reports in this format or to convert the text by themselves, using the widely available tools. For instance, to convert the reports from word (docx) to markdown (Github flavour) we used *pandoc* with a simple batch command ($i is the filename):
  `pandoc -s -f docx -t gfm --wrap=preserve "$1" -o `basename "$1" .docx`.md`
  followed by the simple extraction of the images that are inside the docx with
  `unzip "$1" word/media/*`
- from markdown to html pages. This is an automatic command that converts to a formatted output like this:
  https://storage.c4a.it/c620/WP2/(iii)%20Screening%20Cases%20and%20In-Depth%20Analysis/In-Depth%20cases/In-depth%20Cases/ITAM/FUCHS-In_Depth_analysis_report_DRAFT-_ITAM_2021.6.14/#1
  which is slow because it's stored on Nextcloud with a proxy on the storage site. These pages will be provided as a linked content to database forms.

Videos

An important section in WP3 outcomes are videos. By now they are loosely linked to the survey and to the reports.
It's a rich and complex relationship that is proposed to the user as a free exercise in understanding.
An advisable approach could help the user by solving at least part of the complexity, enabling a link with the proper building and their parts.
This could be useful with a one-to one relation: one video pertains one building, but it describes some of its features and parts during the motion. This can be achieved with a simple structure

v_id	b_number	feature	start	end	intro
1167	ITAM-009	congregation church	66	124	The congregation church...
1168	ITAM-009	columbarium	125	210	In the colombarium...
1169	ITAM-009	theatre	211	322	The hall is made...
1170	ITAM-009	housing	346	355	The complex provides...

This is not an unusual treatment for a video. It mimics the format of the .SRT files used for subtitles, like this:

```
1
00:00:00,000 --> 00:00:06,000
Concrete Heritage Architecture
```

```
2
00:00:38,760 --> 00:00:45,960
The application of reinforced concrete became widespread within
the Czech Lands as early as the very beginning of the 20th
century.

3
00:00:47,080 --> 00:00:56,120
Concrete structures built about a century ago are rather
different from those constructed these days; and the difference
goes much beyond mere ageing.

4
00:00:57,040 --> 00:01:01,040
The technology that was then used was in comparison much more
primitive.

5
00:01:01,640 --> 00:01:08,960
The quality and thus the characteristics of what we now call
historical reinforced concrete would therefore often vary even
within one single structure.
```

This leads to partitioning via subtitles, but it can be done for any other purpose.
One of them is linking parts of video material to any data structure as the survey e. g.

The site could implement a simple procedure to provide video segments at will. A feature provided by several video service as Vimeo and YouTube.

State of the Art Studies

The project provides several State of the Art reports that offer a comparative scenario and suggest an European converging approach. These may be supplemented in the near future with other case studies by country or theme.
The site provides a facility (tab interface) to compare corresponding themes, when possible.

The SoA studies are usually provided in definitive version as PDF. This format does not retain the text hierarchy, so they should be provided in DOC, DOCx, HTML, Markdown or equivalent formats.

WP1 - Actors and legislation – a Comparative European Framework

- Ondřej Dušek and Cristiana Lara Nunes, Concrete Heritage Protection in the Czech Republic. Conservation and re-use: actors, tasks and approach (WP1_ITAM-Report_Actors_Legislation.docx/WP1_ITAM-Report_Actors_Legislation.pdf)
- Silvia Naldini, Gabriel Pardo Redondo, Barbara Lubelli, Historic concrete buildingsin The Netherlands Conservation and re-use: actors, tasks and legislation (WP1_TUD-Report_Actors_Legislation.pdf)
- Maria Hadjimichael, Antroula Georgiou, Ioannis Ioannou, Historic concrete buildings in the Republic of CyprusConservation and re-use: actors, tasks and approach (WP1_UCY-Report_Actors_Legistlation.pdf)

- Stefano F. Musso, Giovanna Franco, Rita Vecchiattini, Federica Pompejano, Historic concrete buildings in Italy – Conservation and re-use: actors, tasks and approach (WP1_UNIGE-Report_Actors_Legislation.pdf)

WP2 – State of the Art Studies (Task (i))

Gabriel Pardo Redondo, Barbara Lubelli, Silvia Naldini, State of the Art Report on new technologies to monitor, conserve and restore the materiality of modern buildings in a compatible, durable and sustainable way (WP2_TUD-SoA_Report_New_Technologies_Restore.pdf)

WP4 – State of the Art Studies

- EU Regulations
  - Antroula Georgiou, Ioannis Ioannou, State of the Art on European Regulations concerning fire, seismic stability, energy efficiency and environmental comfort, used as directives for preparing conservation proposals. (WP4_UCY-SoA_Report_EU_Regulations.pdf)
  - Ondřej Dušek, Cristiana Lara Nunes, Overview of European Regulations in The Czech Republic: Seismic Stability, Fire Safety, and Energy Performance (WP4_EU-regulations_ITAM.docx/WP4_ITAM-CZ_Regulations.pdf)
  - Gabriel Pardo Redondo, Silvia Naldini, Barbara Lubelli, Overview of the European Regulations in The Netherlands (WP4_TUD-NL_Regulations.pdf)
  - Stefano F. Musso, Giovanna Franco, Rita Vecchiattini, Federica Pompejano, Italian Regulations about concrete buildings. Seismic stability, Fire safety, Energy efficiency and environmental comfort (WP4_UNIGE-IT_Regulations.pdf)
- Gabriel Pardo Redondo, Barbara Lubelli, Report on Conservation Proposals – Case Study: Fenix II (Rotterdam) (WP4_TUD-Conservation_Proposal.pdf)
- Silvia Naldini, Gabriel Pardo Redondo, Barbara Lubelli, Selection of suitable materials and techniques for the conservation of buildings in need of restoration –A Review of the Cleaning Techniques (WP4_TUD-Review_Cleaning_Concrete.pdf)
- Antroula Georgiou, Ioannis Ioannou (eds.), Selection of suitable materials and techniques for the conservation of buildings in need of restoration; Input on Local Cases by: TU Delft: Silvia Naldini, Gabriel Pardo Redondo, Barbara Lubelli; ITAM: Ondřej Dušek, Cristiana Lara Nunes; UCY: Antroula Georgiou, Ioannis Ioannou; UNIGE: Giovanna Franco, Stefano Francesco Musso, Rita Vecchiattini, Andrea Fenialdi, Caterina Lavarello (WP4_UCY-Report_Materials_and_techniques_for_conservation.pdf)

Publications

Every publication is introduced by a short summary that links to

- a full-text version of the publication (suitable for mobile devices and desktops if not available elsewhere)
- a PDF version of the printed publication.

The available publications are listed and divided in three sections.

Thematic Approach

- Franco G. (2021) The fate of the 20th Century Heritage. Research and Actions.pdf
- Georgiou, A., Ioannou and I. (2019) 20th Century Concrete as integral part of our architectural heritage, ETEK (Cyprus Scientific and Technical Chamber) magazine, 238 [in Greek].pdf
- Musso S. F., Franco G. (2020) The time of the short 20th cent. Growth of values and decay of matter.pdf

Technical Reports

- Georgiou et al (2019) Contribution of slab wall connections to the seismic resistance of structures, 4th Hellenic conference on Antiseismic Design (Greek).pdf
- Redondo (2020) Decay Patterns and Damage Processes Of Historic Concrete. A Survey In The Netherlands – SAHC2020.pdf
- Redondo (2021) State of Conservation of Concrete Heritage Buildings.pdf

Case Studies

- Georgiou (2020) Conservation of 20th cent. concrete heritage Structures in Cyprus - SAHC2020.pdf
- Georgiou (2021) Reinforced Concrete Cultural Heritage Study Building Melkonian Complex (Greek).pdf
- Georgiou et al (2019) Rehabilitation of 20th century concrete heritage buildings – The case study of the municipal market in Nicosia, Cyprus, SEDEC, London, September 9-10 , 2019.pdf

Afterword

The deliverables of the project are thoroughly displayed into the digital facilities provided.
Every outcome has been mapped to an accessible platform, using an easy file-based collection of sources and documents that found their way to the page, and a data centred approach. The complex and multilevel office-type file formats which may become obsolete in the future are converted in a plain markdown text file that does not include images which are instead linked.
All the components of the platform are individually available to be arranged in a different technical organisation and are durably stored as simple files or managed into a relational database that handles any information in tables that can be exported to a different DBMS or another archival tool.
The output of the database is a standard text-based JSON and may be consumed in a relatively simple way by any recent web client.
The database is additionally accessible with client-server programs, like office automation applications or GIS programs via VPN.

Appendix

Conceptual models of the database

All along this manual the features of the database are detailed with a practical approach that starts from the survey templates to the table structure, ending with the data entry forms.
In this appendix we provide another starting point, the discussion of the conceptual models behind the physical design of the database. The ER (entity-relationship) diagrams follows the Codd formalism.
To understand the diagrams and their individual role, they should be mapped to the block diagram found at the beginning of the manual (Fig. 2 – block overview of the screening case survey).

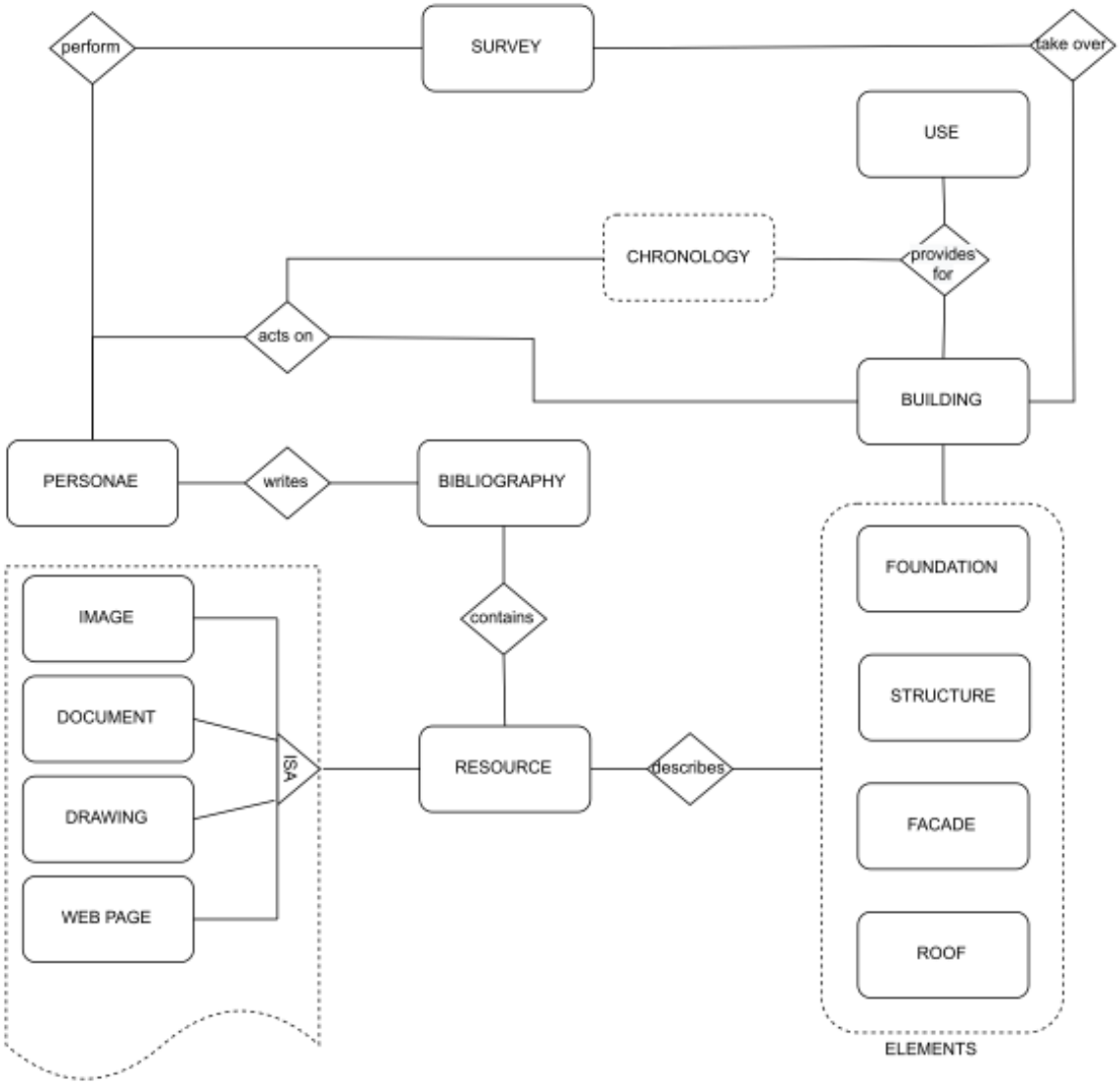


Diagram A – general

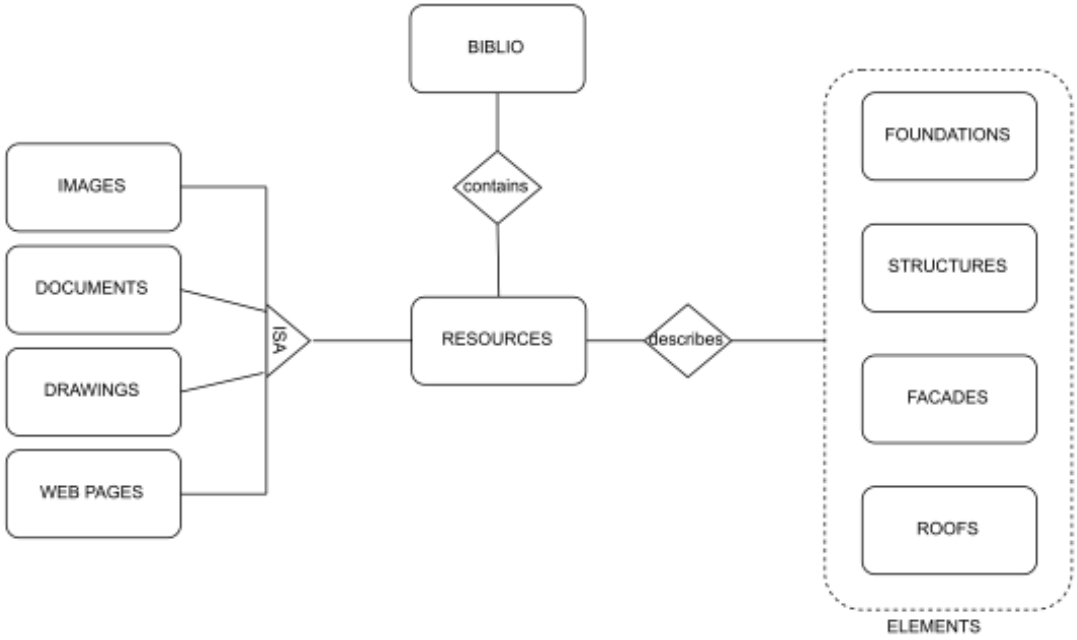


Diagram B – Resources

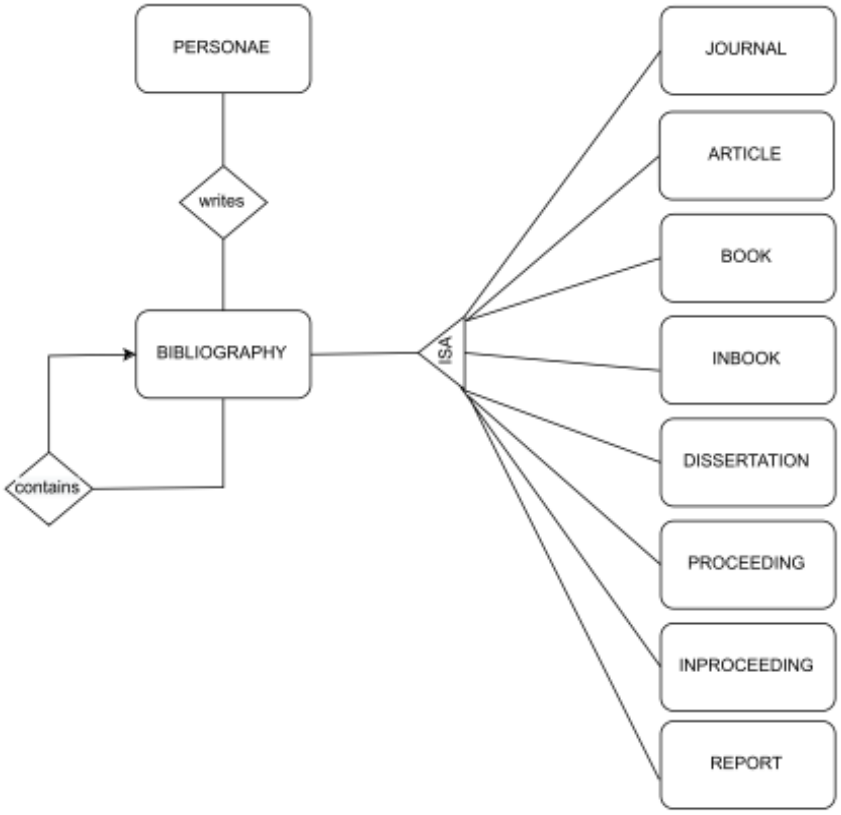


Diagram C – Bibliography (detail of biblio in the preceding diagram)