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**Abstract:**

This deliverable describes the developmental processes creating the online guidelines with information and research from WP 1-5 during the RIBuild project. The website is a product of the international collaborative research in internal insulation funded by the European Commission.

The deliverable contains decisions concerning navigation, visual display, communication, structure and user-surveys regarding the RIBuild website. The content on the website is based on deliverable D6.2 and the digital features on the prior user-survey among practitioners working with retrofitting and internal insulation.

**Keyword list:** RIBuild, online guidelines, website, developmental process, internal insulation, historic buildings

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## Abbreviations

D	Deliverable
DIY	Do-it-yourself
EEAB	External Expert Advisory Board
LCA	Life Cycle Assessment
LCC	Life Cycle Cost
WP	Work Package

# 1 Executive Summary

This deliverable describes the thoughts and decisions developing the RIBuild website ([www.ribuild.eu](http://www.ribuild.eu)) and online guidelines. Based on deliverable D6.2, the website summarizes information and research from previous deliverables and WP1-5 during the RIBuild-project.

The website and web tools contain knowledge from five years of research, communicated in order to make complex information accessible for users with different technical background. It includes small videos and tutorials, visual descriptions and guidelines for renovation with internal insulation and a user guide.

The RIBuild-website: [www.ribuild.eu](http://www.ribuild.eu) – is a user-friendly and informative website presenting the newest research on internal insulation in historic buildings, checklists to assess buildings before renovations and web tools to calculate the feasible renovation solutions and life cycle analysis of the building.

The four guidelines presented - Set you Goals, Know your Building, Insulation systems and LCA/LCC - consist of a step-by-step user interface with access to all materials produced during the RIBuild project. Knowledge on the website are directed at both professionals and non-professionals with different experiences, nationality and interests. To include user groups with different knowledge, expertise and interests, content on the website is divided into two levels. The first level represents brief texts, a broad selection of visual examples and videos, whereas the second level represents the written material corresponding to the full written report (D 6.2).

The website has been created to favour usability, consistency and simplicity to efficiently guide the user to the needed information. In accordance with the RIBuild Description of Action (ver. 13.11.2019), the website has been tested in 2-3 partner countries by 2-4 engineers and 2-4 architects in each country (European Commission, 2019). For this purpose, the voluntary RIBuild partner countries were Italy, Sweden, Switzerland and Denmark. Moreover, the survey was distributed to all RIBuild partners and EEAB-members.

The user-survey tested navigation, written content and visual display on the website in order to enhance quality and secure a user-friendly experience of the final website.

The user guide on the website and in appendix A make it easy for any user to navigate through the online content. Thus, the website represents a platform for knowledge sharing and transfer of industrial knowledge from one project to another. The exchange of knowledge has the potential to reduce errors, increase utilization of tested methods and overall improve innovation, work efficiency, decision-making processes and inspire future European collaboration.

Link to the RIBuild-website:

**[www.ribuild.eu](http://www.ribuild.eu)**

## 2 Introduction

### 2.1 A platform for knowledge-sharing

This deliverable describes the thoughts and decisions developing the RIBuild website and online guidelines. The website is based on deliverable D6.2 summarizing information and research from previous deliverables and WP1-5 during the RIBuild project. The website is a product of the international collaborative research in internal insulation funded by the European Commission. It includes data and knowledge from ten research institutions and companies from Denmark, Sweden, Latvia, Germany, Belgium, Italy and Switzerland.

Previous user tests have revealed most building professionals to avoid internal insulation, due to a lack of knowledge and fear of damaging the building and therefore internal insulation is commonly avoided as a solution (Skovgaard & Bonderup, 2016). The complexity, potential risks and uncertainties of applying internal insulation create a need for a preliminary decision tool and simple practical guidelines when internal insulation is to be considered in a specific situation (European Commission, 2019).

The RIBuild website presents new knowledge, user-friendly guidelines and web tools representing a complete step-by-step guide with insight to visual assessments, risks, solutions and necessities for a successful use of internal insulation. The guidelines are divided into two levels of knowledge to include user groups with different knowledge, expertise and interests. The first level represents brief texts, a broad selection of visual examples and videos, whereas the second represents the written material corresponding to the full written report (D6.2).

Features and information on the website are particularly useful for professionals in the construction industry, such as project designers, supervisory architects, engineers, constructors, craftsmen and contractors. Nevertheless, the levelling of details and complexity of information makes the website accessible and relevant to all interested.

Thus, the website represents a platform for knowledge sharing and transfer of industrial knowledge from one project to another. The exchange of knowledge has the potential to reduce errors, increase utilization of tested methods and overall improve innovation, work efficiency, decision-making processes and inspire future European collaboration.

### 2.2 Objectives creating a website

The main purpose of the website is to provide information for building professionals to:

1. Set a goal for application of internal insulation
2. Understand what kind of damages to look for and how to inspect a building before renovation
3. Learn about the different types of insulation systems for internal insulation
4. Get basic knowledge on CO<sub>2</sub>-emissions and life cycle analysis.

Hence, the three main objectives of the online guidelines are to:

1. Make research accessible
2. Create an online international reference point
3. Create a practical and user-friendly guide for internal insulation

The prior user-survey among practitioners with retrofitting and internal insulation (Skovgaard & Bonderup, 2016) revealed three main requests for the online guidelines:

1. To tell whether retrofitting with internal insulation is recommended or not in a specific case
2. To propose several possible solutions for internal insulation
3. To demonstrate pros, cons and risks with the possible solution

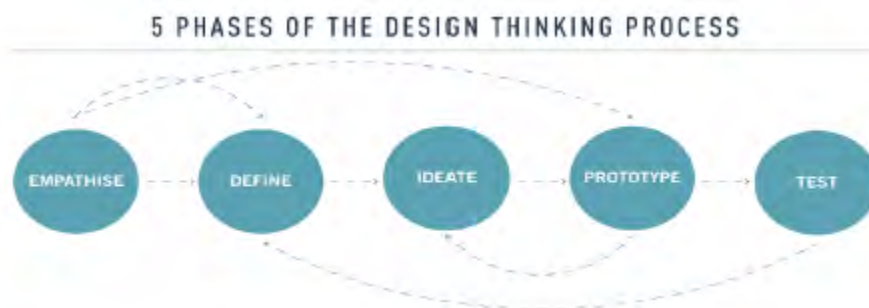
To cover these preferences the online guidelines consists of a step-by-step user interface with access to all materials produced during the RIBuild project. The website includes small videos and tutorials, visual descriptions, and guidelines about the feasibility to add internal insulation to an existing solid wall made of brick masonry or natural stone.

The first level of written material is short and concise as to give the user a quick overview and basic knowledge and covers pros, cons and risks with internal insulation. The different tools available through the website, assist the user with (1) indications on whether internal insulation is recommended or not in a given case (RIBuild web tool) and (2) life cycle assessment of environmental and economic impact of the energy renovation (WP5 tool). When retrofitting with internal insulation is recommended, the RIBuild web tool simulates input and output, and presents several feasible solutions.

Thus, anybody with an interest in building physics, internal insulation and energy efficient restoration can benefit from the guidelines and the RIBuild tools.

## 2.3 Phases and timeline

The process of creating a website is an iterative process with a constant flow between designing, testing, evaluating and redesigning. The process of design thinking is described by Tim Brown through five main phases: empathise, define, ideate, prototype and test (Brown, 2008).



*Figure 1 The five stages of the design thinking process (Brown, 2008)*

In respect to the RIBuild website, the five stages included:

1. **Empathise:** The process was initiated by identification of user needs, which were identified and described by the master thesis students Gabriele Jatulyte and Stratis Skourletis (Jatulyte & Skourletis, 2019).
2. **Define:** Based on the insight gained on user needs, the challenges on how to develop a user-friendly website that accommodate several users in the building profession were defined. The

tasks were defined by the main question: How to develop a website with useful guidelines about internal insulation in historic buildings that benefits both architects, engineers and researchers?

3. **Ideate:** in this phase, it was essential not to limit a creative mind-set or exclude inspiration that might help framing and developing the information and tools to be implemented on the website. Ideas were generated through techniques as brainstorming, association-processes, research on existing platforms with similar purpose, data collection, selection and overview of information from the written guidelines.
4. **Prototype:** Based on a selection of the ideas, a direction was chosen, and a prototype of the website was created in the website builder ‘Squarespace’. Simultaneous, all written content, images, visual display, questions for checklists etc. were constantly evaluated in relation to insights from the preliminary phases.
5. **Test:** The temporary finished prototype of the website was tested on different user groups among building professionals. The user survey presented new and unexpected insight to user needs specific to this website and thus highlighted problems, missing features or misunderstandings to be improved. This information lead back to the previous phases defining problems, ideating and implementing new solutions once more to be tested in order to optimize the website.

Despite the constant flow between processes and phases, **Table 1** the following timetable shows the overall time spent on the different phases developing the online guidelines.

**Table 1: Timetable for developmental process of the website**

	Dec	Jan	Feb	Mar	Apr	May	Jun
Content and structure	█						
Website setup		█					
Setup of checklists		█					
User groups		█					
User test			█				
Website editing					█		
Finale setup					█		
Rapport for website	█						
Meetings & presentations		█		█		█	

Website prototype	█
User test	█
Website editing	█

Finale setup	█
Rapport for website	█
Meetings & presentations	█



## 3 Website content

The website is developed with the purpose to share knowledge across professions and countries. To reach multiple professions and nationalities it is essential with an appealing design, interesting and comprehensible information, and an intuitive navigation system flexible to individual needs.

### 3.1 Written material

Knowledge on the website are directed at both professionals and non-professionals with different experiences, nationality and interests. In order to welcome more diverse user-groups than scientists and building specialists, information from the full written guidelines (D6.2) has been divided into two levels of knowledge. Hence, the project research becomes accessible and comprehensible for everybody with an interest in internal insulation, regardless of professional background.

The first level holds brief introduction texts, videos, checklists and tools based on the written guidelines (D6.2). Text on this level introduces the different topics and answers basic questions. The written material on this level is collected in a printable booklet in *Knowledge base*.

At the bottom of each page *Read more* leads to the second level of knowledge representing text on each topic from deliverable D6.2. For the user to find the exact same section in the full report, the paragraphs use the same numbering as in deliverable D6.2. The written guidelines are accessible for print or download in *Knowledge base*.

This should make it easy for the user to move between the two levels depending on interest and former knowledge.

### 3.2 Visual design

The overall design and structure of the website favours usability, consistency and simplicity with visualizations to support the written text. The visual principles are based on the overall purpose to clearly communicate about sender and scientific foundation, and to create a pleasing experience for the visitors of the website.

The website has been created in the website-building program Squarespace (<https://www.squarespace.com/>). Squarespace offers a wide range of digital templates for development of websites and thus creates the possibility for individual variation and expression.

White space, proper letter spacing and margins have been used to eliminate graphic “cramping” and represent users with a clean, professional website in order to create a trustful representation of the written guidelines. Moreover, a “clean website” will minimize frustration and discrepancy between content and visual display and overcome the challenge of uniting complicated and profound scientific content with an uncomplicated user-friendly visual look.

The different elements on the website such as images, placement of text and elements, typography etc. are conceptually matched together in order to create a harmonic, easily understandable site with a smooth information flow.

The detailed photo material, illustrations and infographics provide an extensive catalogue of differences in buildings, obstacles, risks etc. Photos are contributed either by project researchers or from free photo bases and thus all rights for the photo materials are reserved.

The colour-theme of the site is chosen to match the colours in the original RIBuild logo and animated project films to create a united visual expression of the content.

Inspired by the German architect Ludwig Mies van der Rohe, the “less is more”-approach both recur in the visual display and written content on the first level. Thus, the visual and informational level become appealing to all user-groups regarding of profession or prior knowledge.

## 3.3 Structure

### 3.3.1 General structure

The navigation on the website favours usability and individuality to efficiently guide the user to the needed information. With an intuitive and responsive design, the website could subsidize construction processes as a useful tool. A shorter version of the navigation is presented in the user guide in appendix A and on the website in the *Knowledge base*.

#### WP5:

**Development of cost/benefit analysis and environmental impact assessment methodologies**

Develops a probabilistic assessment methodology for assessing the environmental impact and cost/benefit of internal insulation solutions. The methodologies are based on Life Cycle Impact Assessment (LCA), Life Cycle Cost (LCC) and Cost-Optimal (CO) analysis.

WP Leader: UNIVPM

Participants: AAU, RTU, DTU, HES-SO Deliverables WP5

**D5.1:** [Report and tool: Probability based Life Cycle Impact Assessment](#)

#### WP6:

**Application and evaluation of guidelines**

Develops and assesses written and web-based guidelines and a web tool for renovation of historic buildings with internal insulation, based on methodologies and procedures developed in WP2 – WP5, data collected in WP1 – WP3 and other gained knowledge.

WP Leader: DTU

Participants: AAU, RTU, TUD, KUL, UNIVPM, RISE, HES-SO, INTROFLEX, ERIK arkitekter

**D6.2:** [Robust Internal Thermal Insulation of Historic Buildings](#)

**D.6.3:** Design and test of RIBuild website hosting written guidelines and the web tool

**Appendix:** Step-by-step navigation to the RIBuild website

#### WP7:

**Communication and dissemination**

Communicate results of the project that are relevant to the public authorities, building owners, consulting engineers and other professional practitioners, as well as international academics.

WP Leader: AAU

Participants: RTU, TUD, KUL, UNIVPM, DTU, RISE, HES-SO, INTROFLEX, ERIK arkitekter

**D7.1:** [Procedure for evaluating research results](#)

**D7.2:** [D7.2 Mapping of networks,](#)

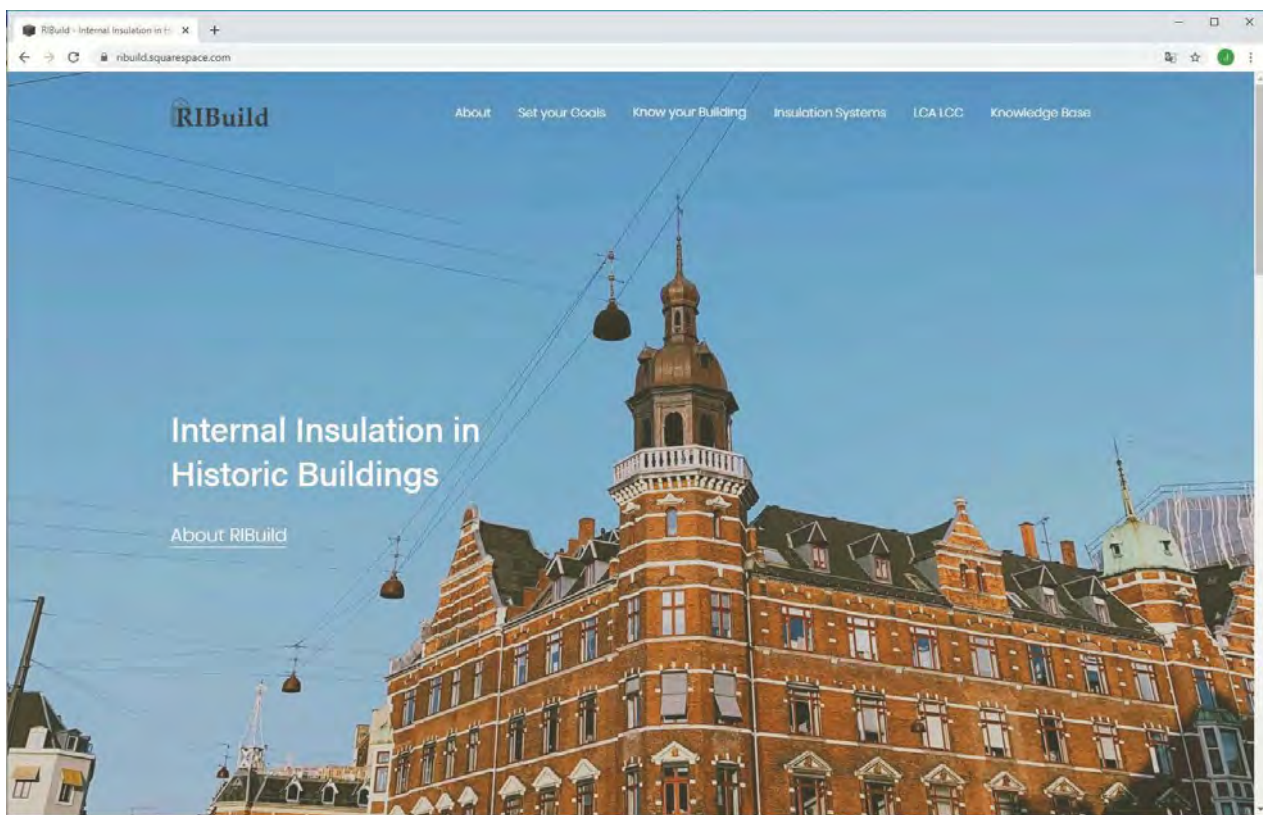
[D7.3 Formation of network partnerships, D7.9 First press release of the project](#)

**D7.5:** [Report on first workshop/seminar](#)

**D7.8:** [Project website](#)

*Top menu and footer* are fixed and recur on each page on the website and provide constant access to this information.

The *fixed top menu* hosts access to the main pages, including the four guidelines – About, Set your Goal, Know your Building, Insulation Systems, LCA/LCC and Knowledge Base. The top menu is a direct access to all topics and provides a constant access to the multiple options.

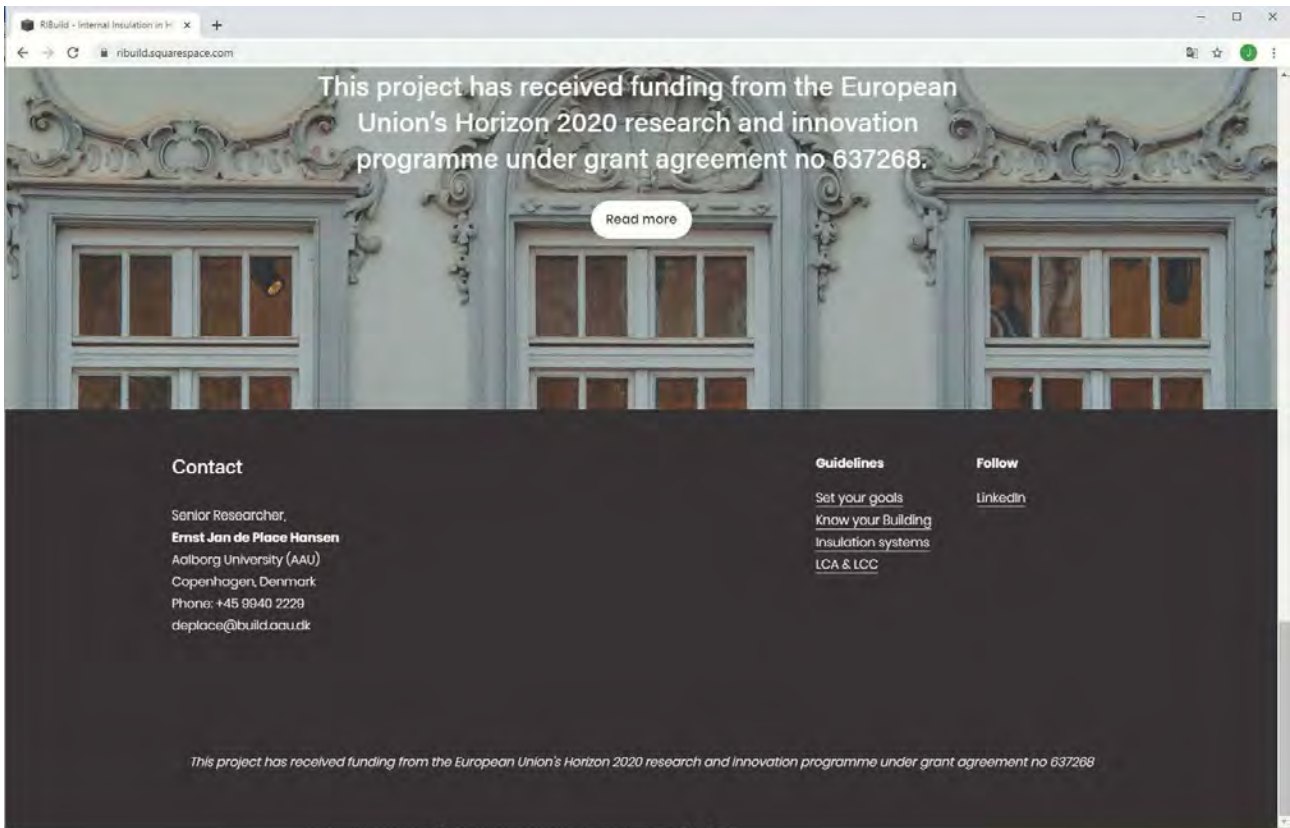


The order of the topics follows the content in the written guidelines (D6.2) and suggests progression through the four guidelines from first to last. Access to each guideline in the top menu, creates coherency in the material whether or not the suggested order is followed. This flexibility and dynamic should encourage exploration according to personal interests and needs.

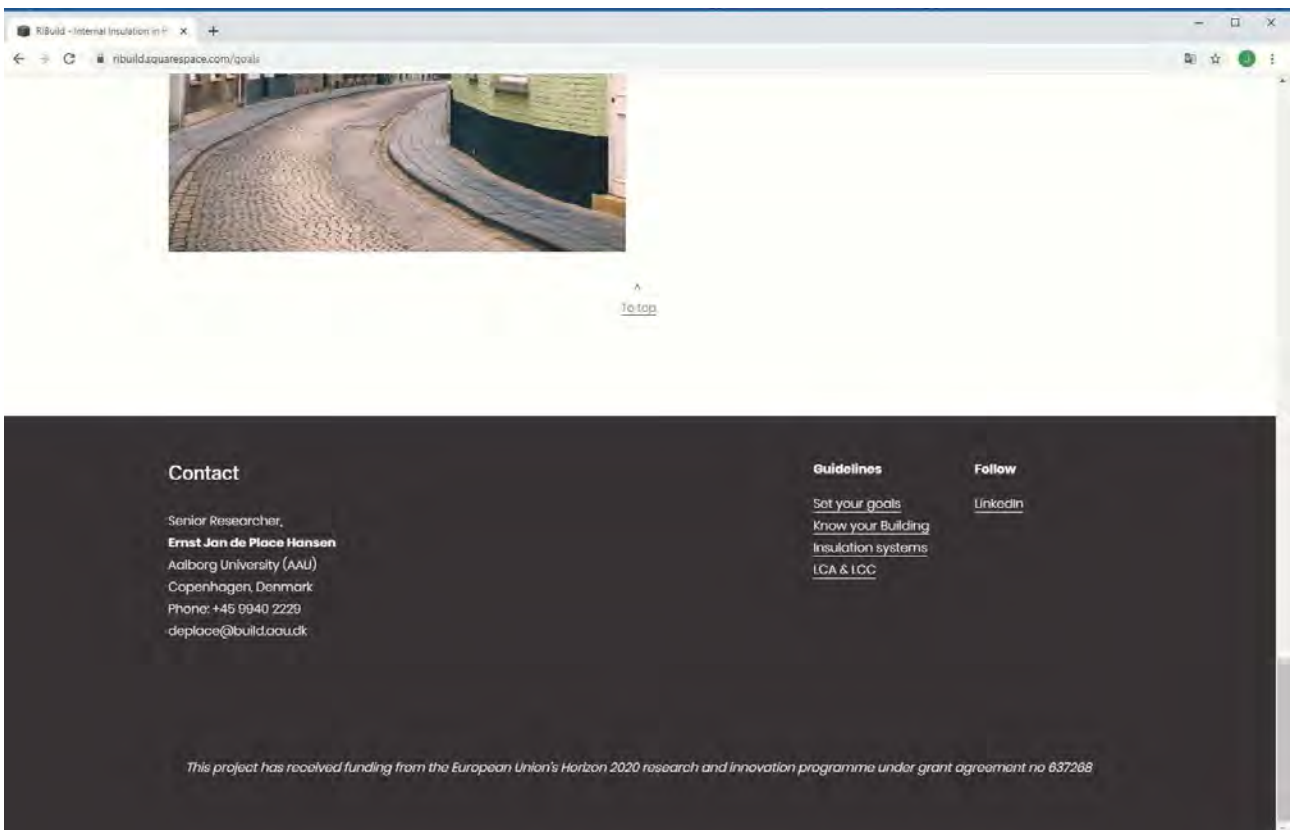
Clicking on the *RIBuild-logo* in the top left corner leads back to the landing page.

If the website is accessed in a google-browser as Google Chrome, the website can be translated into any national language by right-clicking at a random place on the website and selecting 'translate'.

The *fixed footer* contains contact information, direct access to the four guidelines and a LinkedIn-function for incoming news about project.

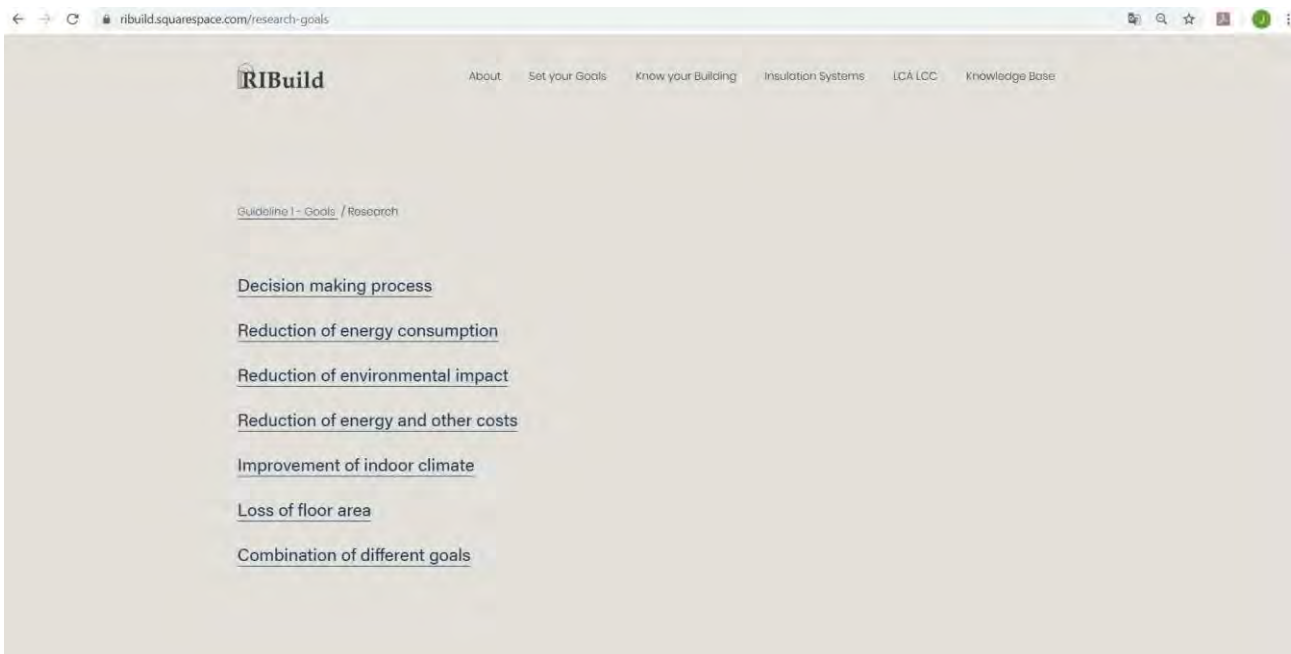


**To top**-functions are found at the bottom of all pages and minimize scrolling for quick jump back to the top menu with access to all topics on the website.



The website holds two levels of knowledge; the first level aimed at all professions can be found in the texts on the website. *Read more* leads to more profound levels of knowledge presenting text parts from deliverable D6.2.

In addition to the horizontal top menu, the longer paragraphs under *Read more* and *Knowledge base* also have vertical menus presenting the topics in the paragraph with the possibility to go directly to the needed information in the text.



The website texts include *links* to both related information on the RIBuild webpage or to external relevant sources of information. Internal crosslinking creates natural coherence between themes and information on the RIBuild website. Links to external sources of information present valid sources of information relevant to the RIBuild research project and should thus enhance the informational level on the website.

At the end of each *Read more*-paragraph, *Publication base* leads to the publication base with scientific research publications related to the RIBuild project.

**Research**

The full research reports on internal insulation in historic buildings: Robust Internal Thermal insulation of Historic Buildings

**Work Packages (WP)** This project has been divided into 4 work packages. One work package takes care of overall project management

**Deliverables (D)** Deliverables summarizes the work in each work package during the whole project period

Publication base

**WP1: Pre-renovation assessment**

Examines common structural elements of historic buildings, determines their physical properties and classifies them according to type. The objective is to observe and describe the main symptoms of a deteriorating building envelope and study their possible causes. Further, it investigates existing methods and materials for internal insulation and reviews existing guidelines and decision tools on internal insulation.

**WP2: Material characterisation**

Provides data for material properties and threshold values for historic building materials and existing insulation materials as a background for material characterisation models and guidelines for safe retrofitting measures. Further, it evaluates the impact of water repellent agents on the moisture behavior of (internally insulated) walls.

WP leader: AAU  
Participants: RTU, TUD, KUL, UNIVPM, DTU, RISE, HES-SO, INTROFLEX

**WP3: Case studies and laboratory measurements**

Supports the research with high quality measurement data from both laboratory experiments on components and on-site monitoring of test buildings

WP leader: TUD  
Participants: AAU, RTU, KUL, UNIVPM, DTU, RISE, INTROFLEX

**D3.1:** Closed Technology Loop of Laboratory Experiments and Simulation Models in the Field of

**WP4: Probabilistic assessment of internal insulation solutions**

Develops an efficient strategy for the probabilistic hygrothermal assessment of internal insulation solutions.

WP leader: KUL  
Participants: AAU, TUD, HES-SO

**D4.1:** Basic probabilistic analysis of hygrothermal performance of interior insulation

**D4.2:** Modelling approaches for hygrothermal performance of

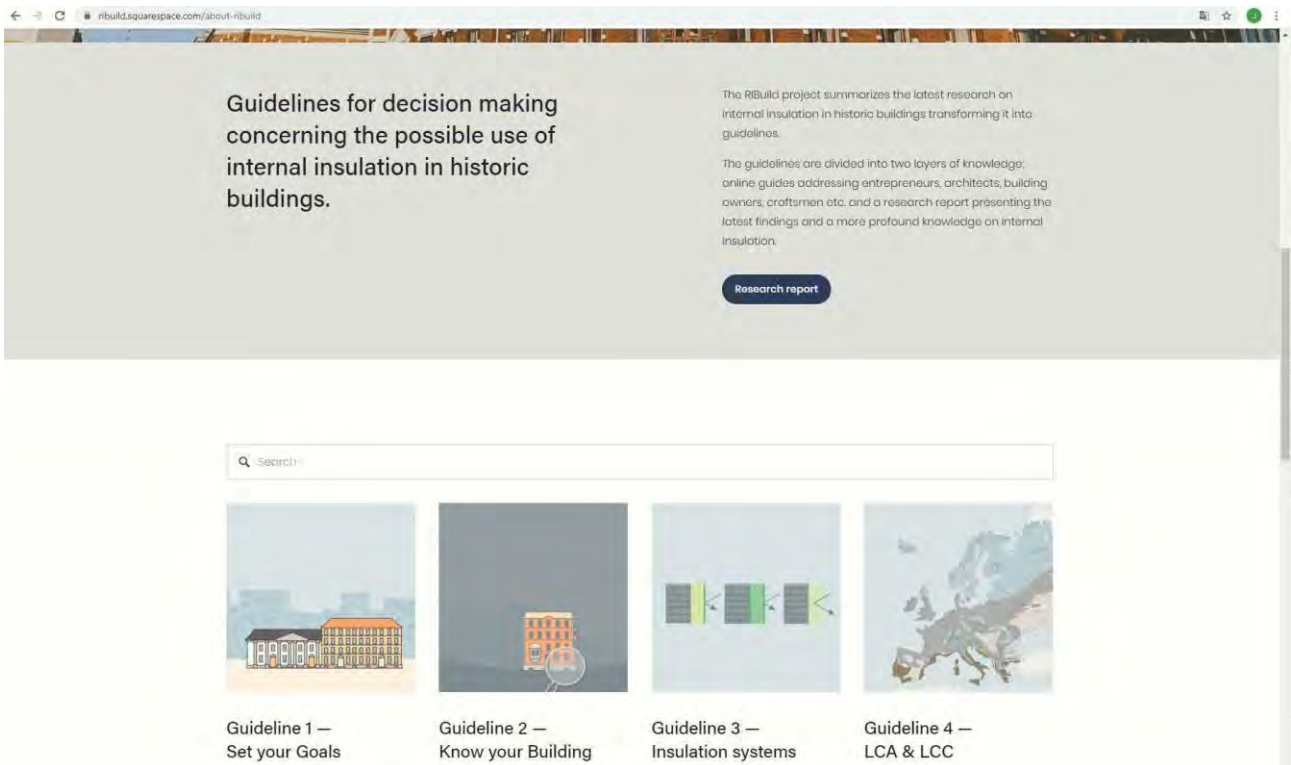
Section 3.3.2 – 3.3.8 presents a step-by-step navigation-tour through topics and knowledge presented on the website, proceeding through topics in the top menu.

### 3.3.2 Landing page

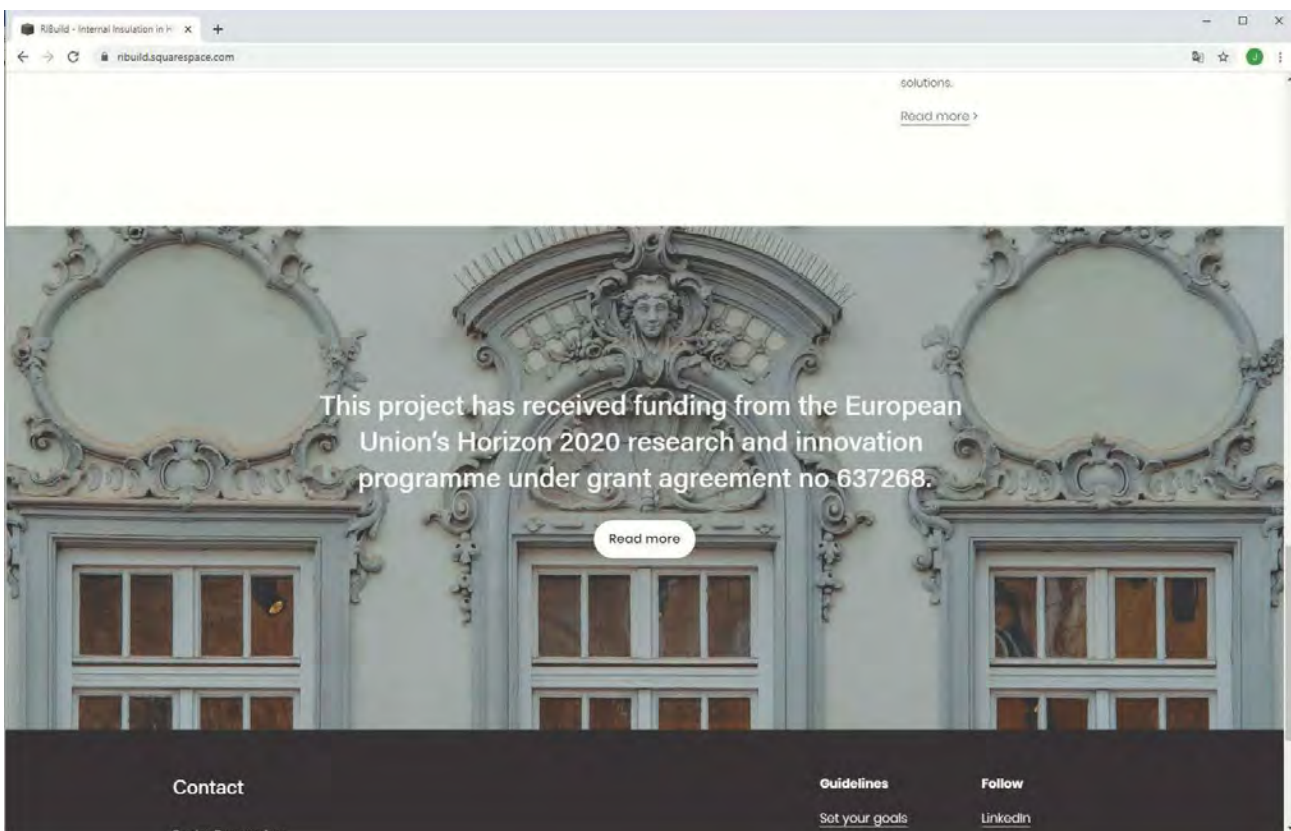
On the banner photo of the *landing page* is a link to *About RIBuild*, which is also found in the first tab of the fixed top menu. The landing page includes a brief presentation of the project through text and video and a direct link to the written guidelines (deliverable D6.2).

Entering keywords, the *search*-function creates a shortcut to specific information on the website.

The four guidelines are illustrated and accessed through interlinks. Hence, each guideline is accessible from the fixed top menu or from the landing page. Each guideline is presented with a number that suggests a certain flow/connection between the four guidelines without forcing a fixed order.



*Read more* leads to the European Commission-website with information on preservation of European cultural heritage and the European Union’s Horizon 2020 research.

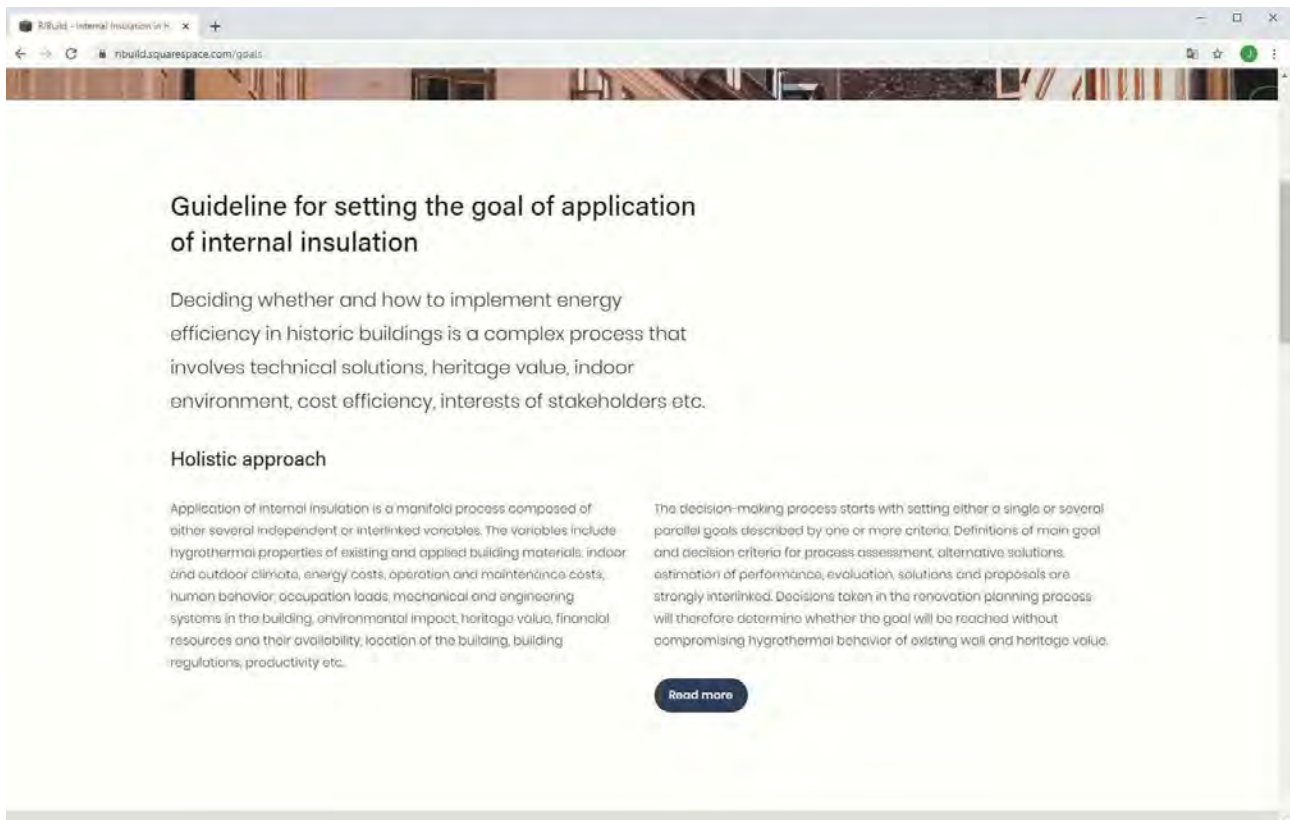


### 3.3.3 About

*About* summarizes the RIBuild project and research process in texts and videos, present the involved

### 3.3.4 Set your Goal

The first guideline *Set your Goal* present information on the procedure and goal setting decision criteria before application of internal insulation in historical buildings. This includes three areas of knowledge: the holistic approach when setting a goal, types of goals in the RIBuild project and an introduction to building regulations.



A *holistic approach* is an important part of each renovation planning process. The approach might determine whether the goal set will be reached without compromising hygrothermal behaviour of existing wall and heritage value of the building. RIBuild describes five types of independent or interlinked goals – reduction of energy consumption, reduction of environmental impact, reduction of energy and other costs, improvement of indoor climate and loss of floor area. Each goal is presented with a figure and an interlink to more profound explanations and examples.



The screenshot shows a web browser window with the URL [nbuild.squarespace.com/goals](http://nbuild.squarespace.com/goals). The page content is titled "Main goals to combine" and features a central diagram and a list of goals.

**Goals of application of internal insulation in historic buildings**

- Energy consumption reduction
- Reduction of energy and other costs
- Indoor climate improvement
- Reduction of environmental impact
- Loss of floor area

**• Reduction of energy consumption**  
aims at minimizing building energy consumption, expressed as energy spent for either heating, ventilation or cooling of the building regardless the energy source.

**• Reduction of environmental impact**  
aims to reduce possible environmental impact when applying internal insulation, it can be either reduction of CO2 emissions to lower the impact on climate change during operation phase of the building or reduction of environmental impact considering all three phases of a building lifetime - the construction phase, the operation and maintenance phase and the end of life phase.

**• Reduction of energy and other costs**  
includes all costs for application of internal insulation, particularly energy, material and installation costs as well as life cycle costs or other case-specific costs.

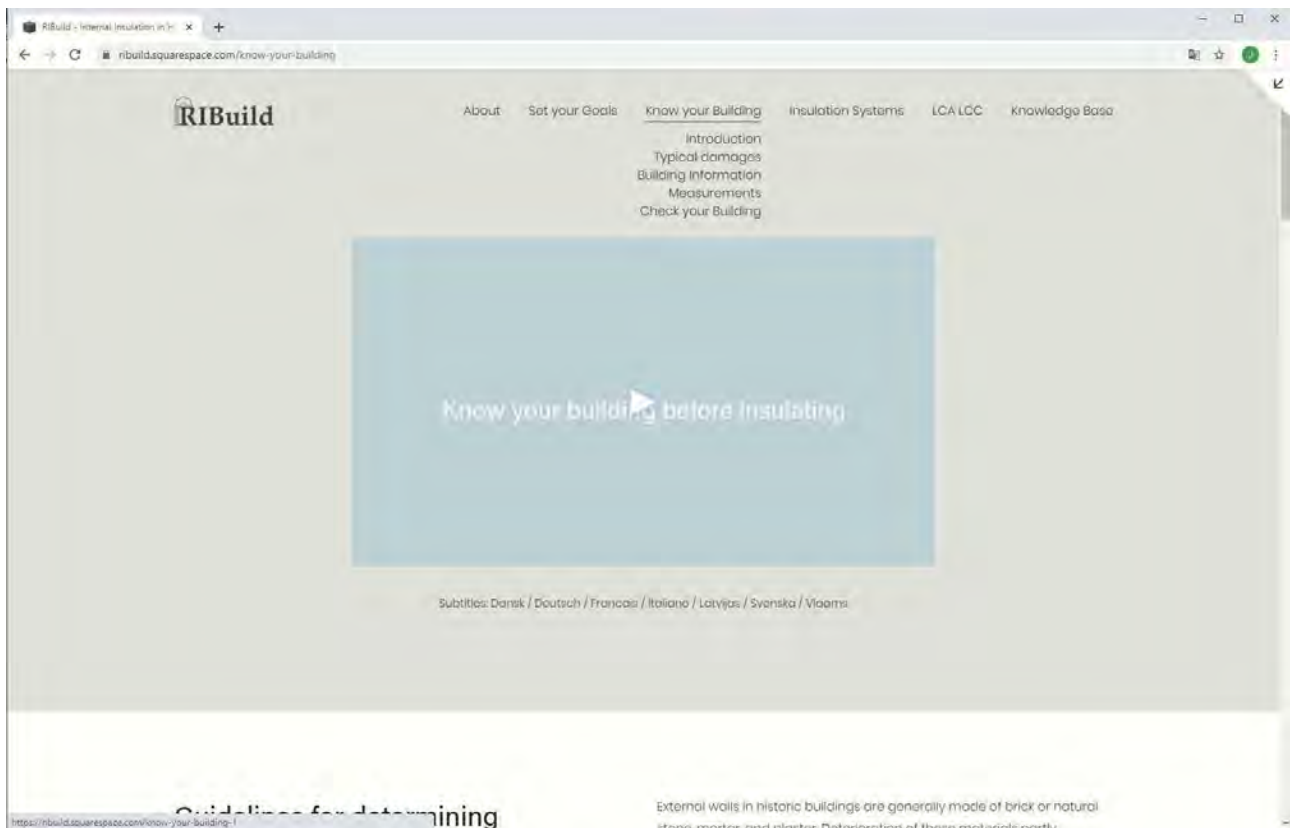
**• Improvement of indoor climate**  
aims to improve the indoor thermal comfort. Unsatisfactory thermal comfort is related to low surface temperature of the wall which causes thermal asymmetry.

**• Loss of floor area**  
focuses on minimizing the loss of the room floor area due to application of internal insulation.

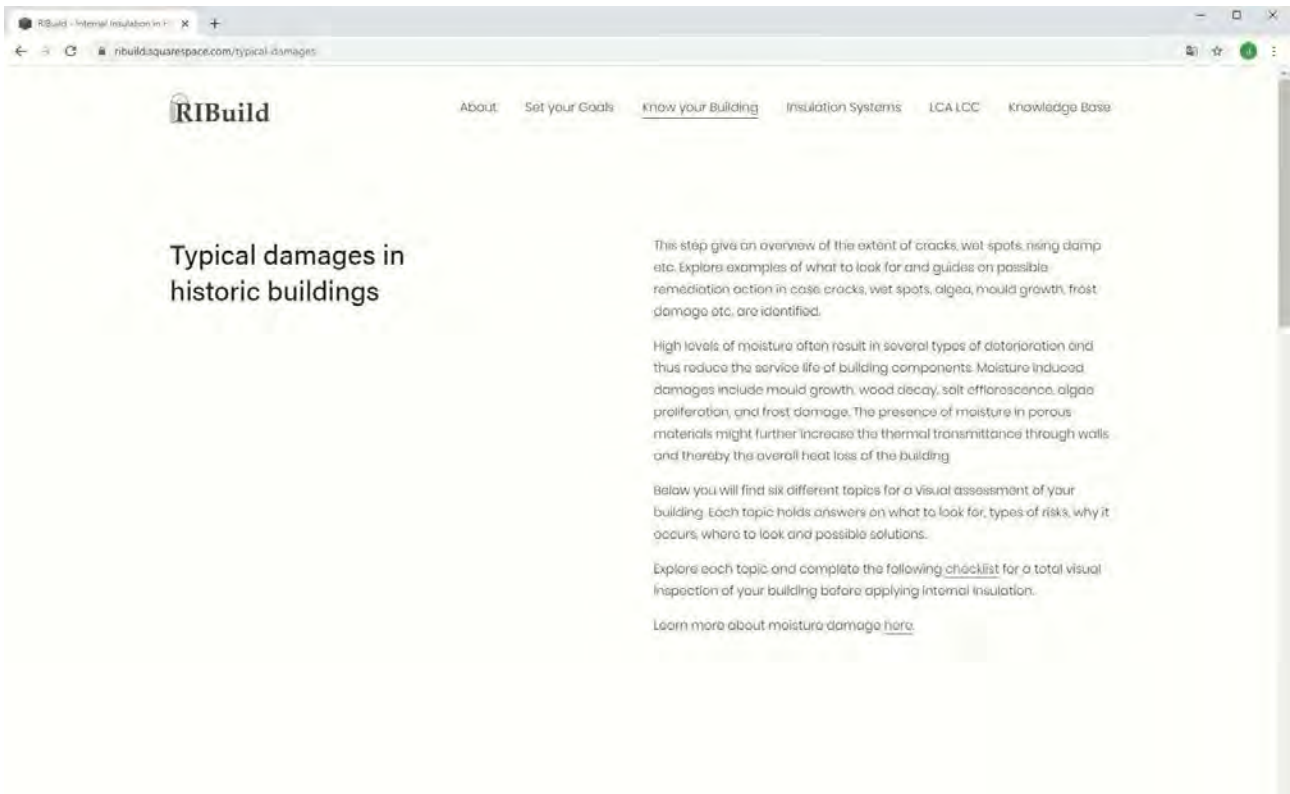
Awareness of national building regulations before starting a renovation project is supported with a link to the Directive of the European Parliament and of the Council on energy performance of buildings. *Read more* presents the part of deliverable D6.2 about national building regulations.

### 3.3.5 Know your Building

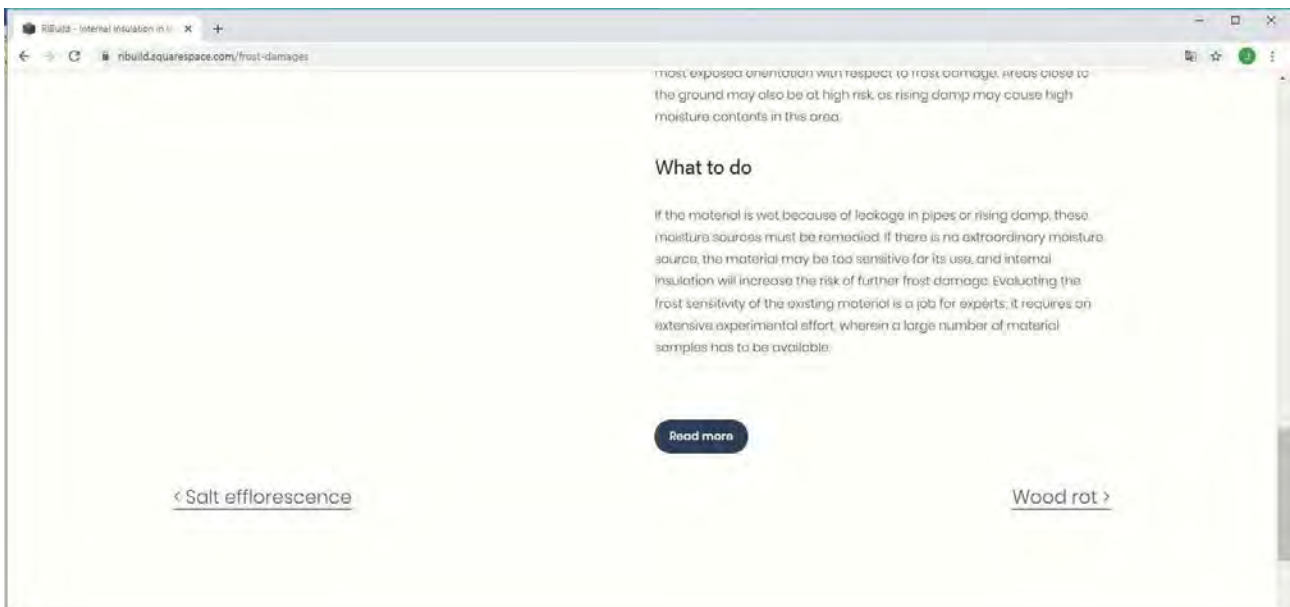
***Know your Building*** covers guidelines for determining whether a building is suitable for internal insulation and contains five topics; Introduction, Typical damages, Building Information, Measurements and Check your Building.



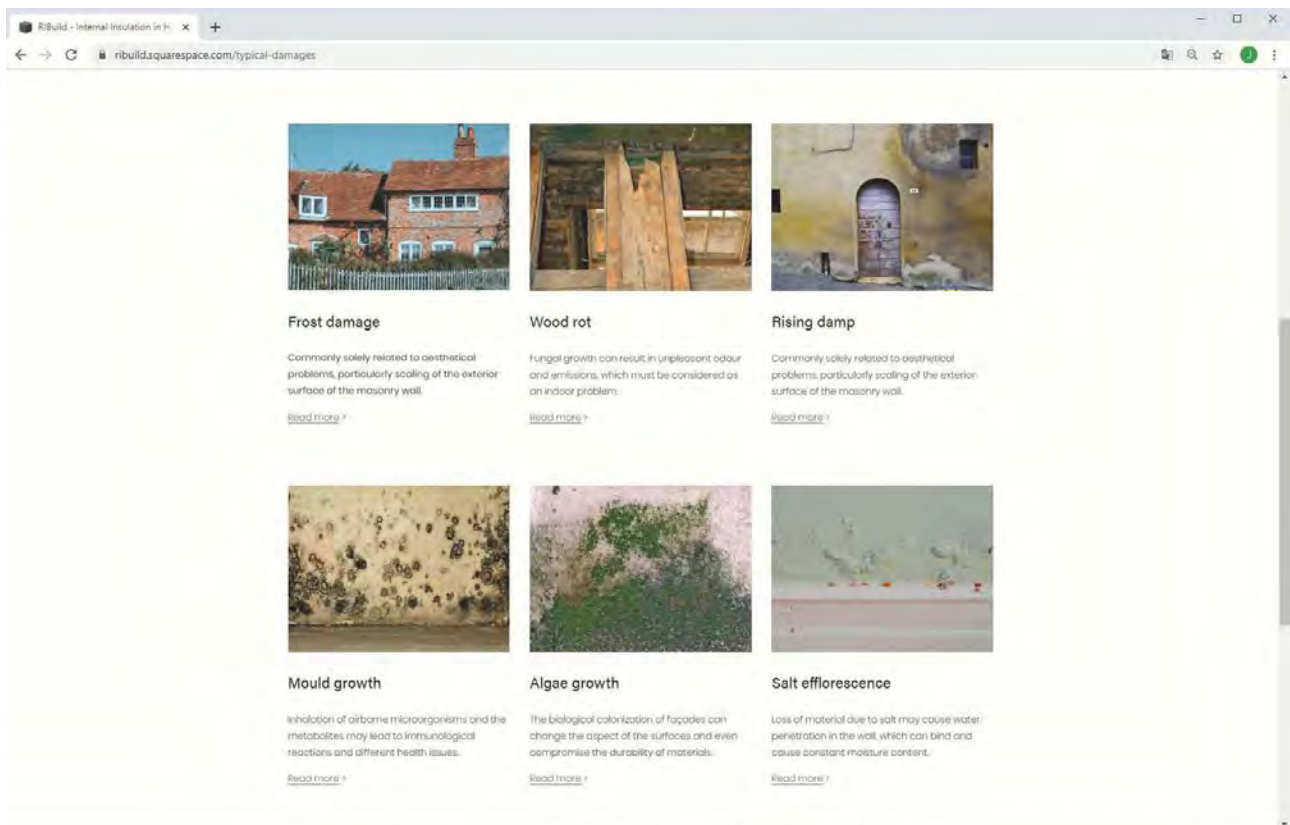
**Typical damages** covers the six most common areas of risks to assess before starting a renovation process. **Typical damages** introduces frost damage, wood rot, rising damp, mould growth, algae growth or salt efflorescence and briefly answers what, why and where to look for occurring risks and what to do. *Read more* leads to text from deliverable D6.2 covering each specific topic.



A visual gallery at the bottom of each page presents examples of damages. Suggestion-arrows point to other damages among the six that might be relevant for the building assessment.



The six types of damages can be accessed from either the solid top menu or the landing page. Under each topic, the remaining risks are presented and accessible for further exploration before a visual building assessment.



**Building Information** presents important documents and useful sources of information about buildings and their surroundings that might be relevant to include in the progressing analysis of the actual state of the building. All renovation projects should be preceded by an analysis of the actual state of the building and a comparison with existing planning documents. Five sensitive building areas to assess during this analysis are pointed out.

**RIBuild**    About    Set your Goals    Know your Building    Insulation Systems    LCA LCC    Knowledge Base

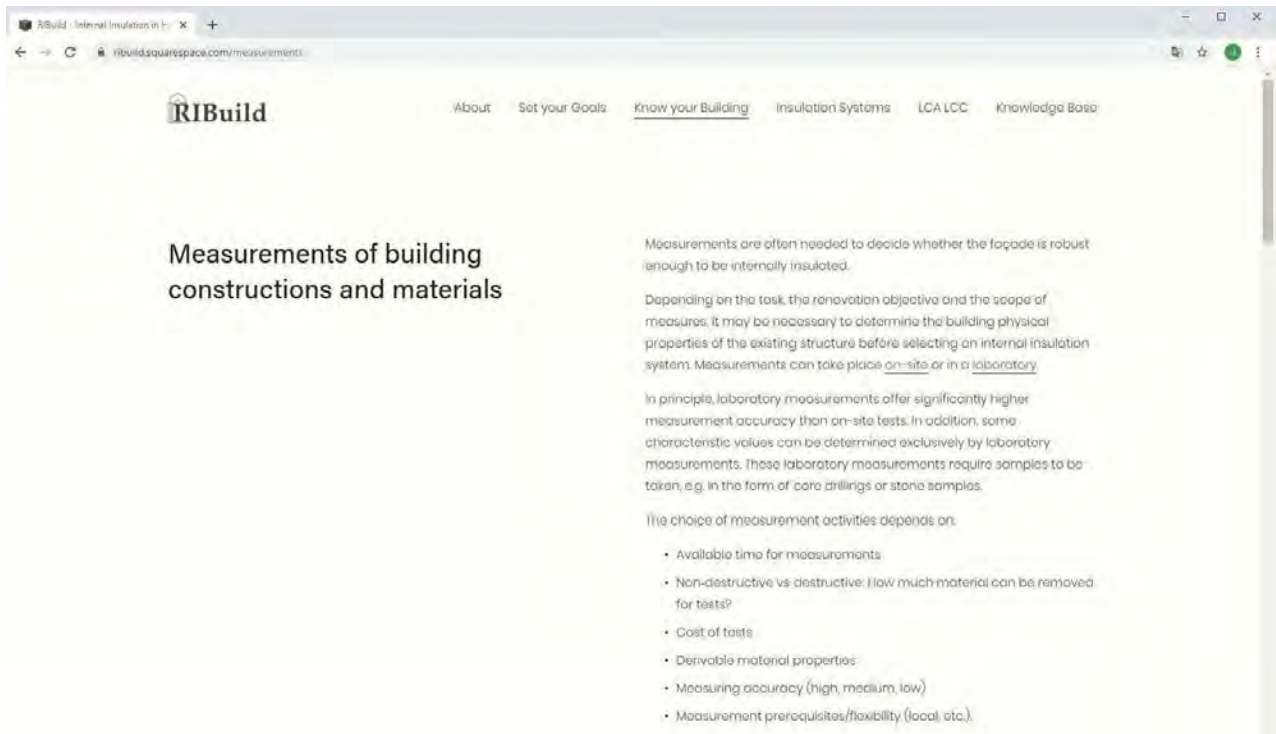
## Collection of information about exposed areas of the building and its surroundings

If no cracks etc. are identified during the visual [assessment](#), the building owner can move on to the next step, looking at details of the building and its surroundings that describe how robust the building is.

Energy efficient projects are always preceded by an analysis of the actual state of the building and a comparison with the existing planning documents. If no plans are available, it is recommended to have a building survey carried out revealing all the necessary constraint and connection points:

Data	Source	Purpose
Floor plans, cross sections, facade views	Building application documents, archives, measurements, photos, information on year of construction	Information on construction (dimensions, superstructures) and areas of use
Construction details	Documents on statics, building descriptions, detailed plans, photos	Detailed structures, information on statically relevant components governing the building envelope (supports, beams, girders)
Constructions and materials	In addition to above mentioned documents: building material remnants from previous renovation, invoices, literature sources	Determine the composition of the building envelope
Previous renovation	Planning documents for renovation, photos, invoices, construction diaries, etc.	Changes to the building envelope (superstructures, statics, materials)
Other documents	Expert opinions, e.g. subsoil reports, wood preservation reports, usage history	Observance of special boundary conditions

**Measurements** emphasizes the need for measurements as part of the decision process during a renovation. Measurement methods and choices related to on-site and laboratory methods are presented in text, flow charts, photo collections and videos. Besides the professional methods, a video interlink to the printable materials in *Knowledge base* shows how to conduct a DIY material test. *Read more* leads to deliverable D6.2 describing measurement procedures and equipment for tests in detail.



**RIBuild** About Set your Goals Know your Building Insulation Systems LCA LCC Knowledge Base

## Measurements of building constructions and materials

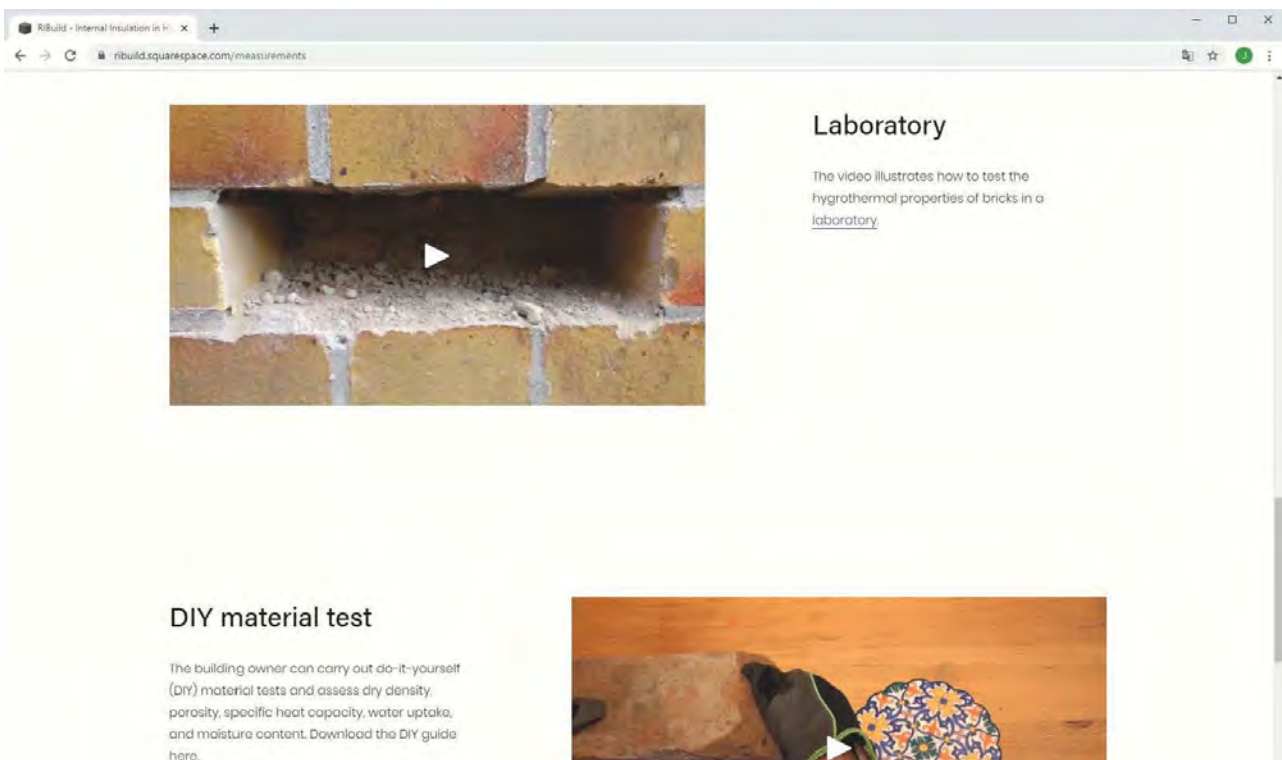
Measurements are often needed to decide whether the façade is robust enough to be internally insulated.

Depending on the task, the renovation objective and the scope of measures, it may be necessary to determine the building physical properties of the existing structure before selecting an internal insulation system. Measurements can take place on-site or in a laboratory.

In principle, laboratory measurements offer significantly higher measurement accuracy than on-site tests. In addition, some characteristic values can be determined exclusively by laboratory measurements. These laboratory measurements require samples to be taken, e.g. in the form of core drillings or stonor samples.


The choice of measurement activities depends on:

- Available time for measurements
- Non-destructive vs. destructive: How much material can be removed for tests?
- Cost of tests
- Derivable material properties
- Measuring accuracy (high, medium, low)
- Measurement prerequisites/flexibility (local, etc.).




## Laboratory

The video illustrates how to test the hygrothermal properties of bricks in a laboratory.

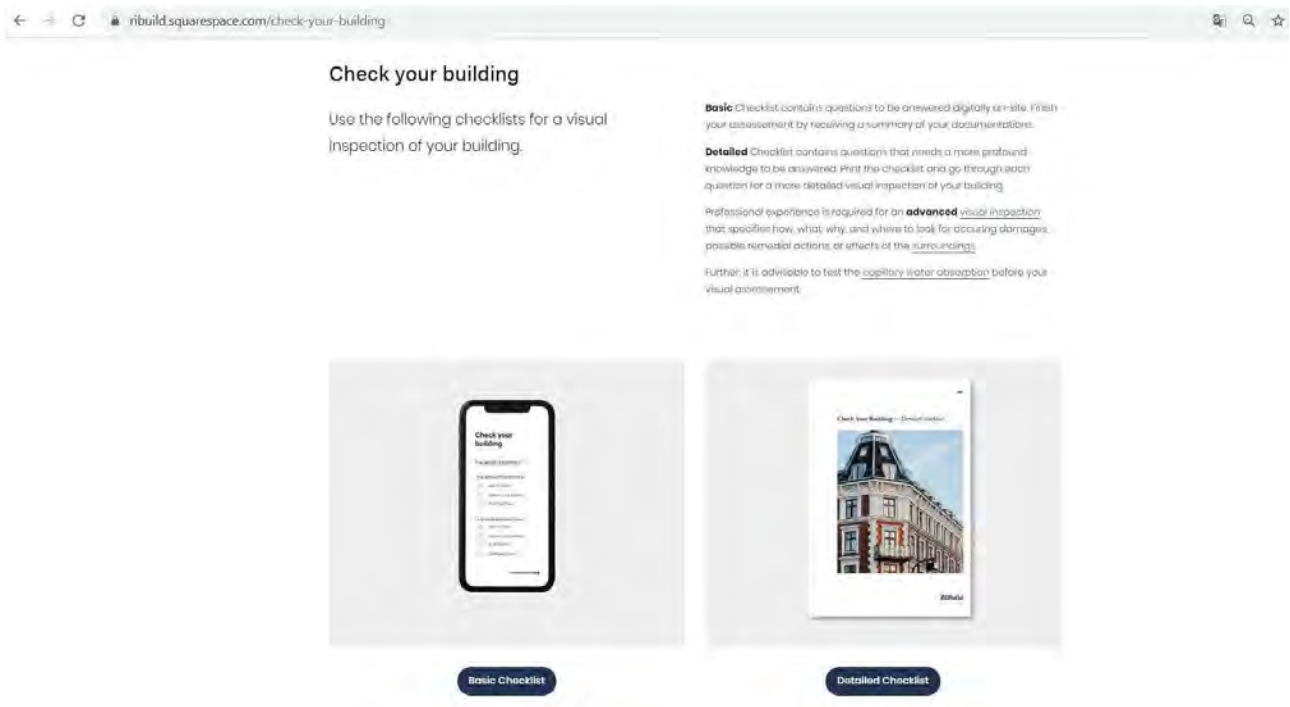
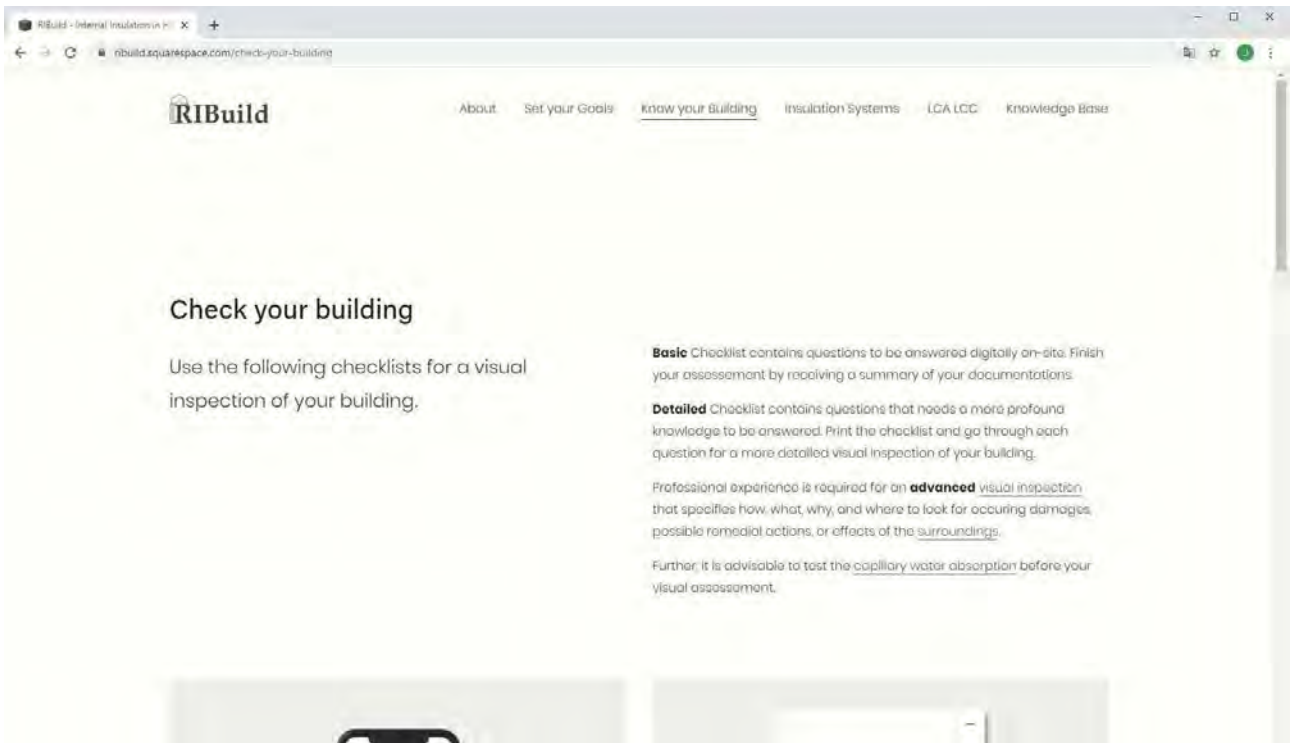


## DIY material test

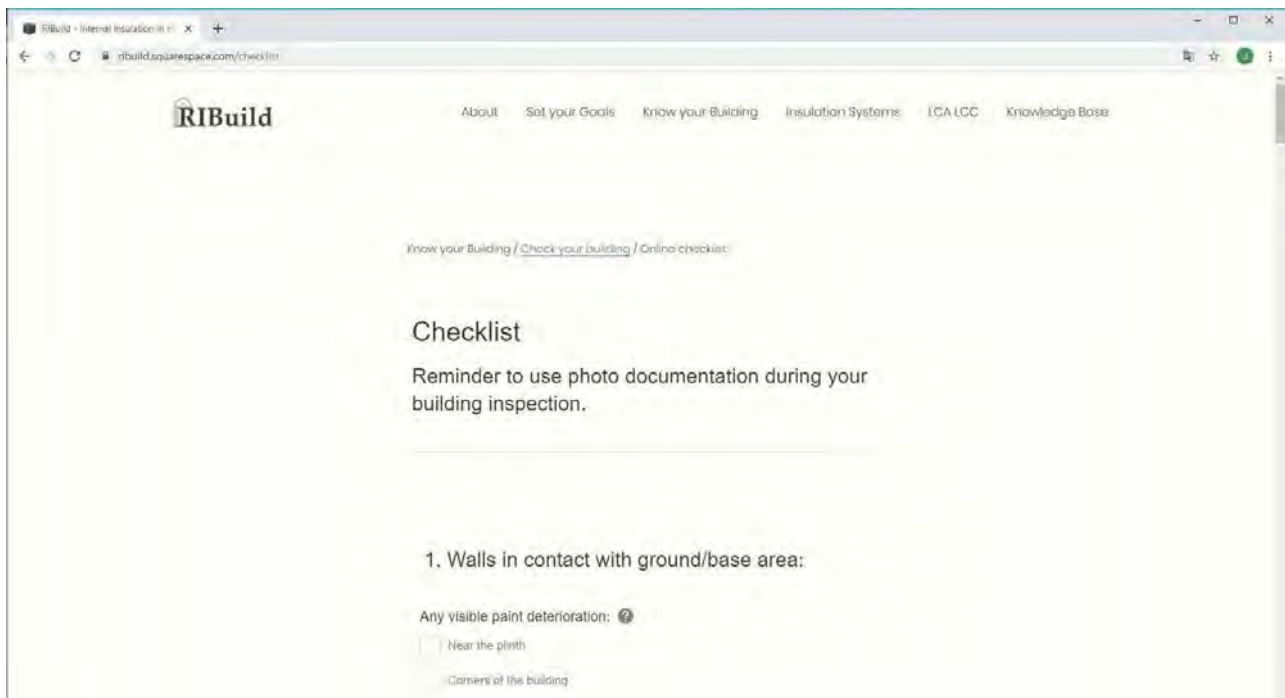
The building owner can carry out do-it-yourself (DIY) material tests and assess dry density, porosity, specific heat capacity, water uptake, and moisture content. Download the DIY guide here.



**Check your Building** presents two checklists for building assessment – a basic and a detailed version. The questions in each checklist assist to reveal moisture damages through a visual assessment of the state of the building. As the remaining website, the checklists cover two levels of knowledge; Basic Checklist corresponding to the first level of knowledge on the website and Detailed Checklist corresponding to professional expertise and knowledge from the second level (D6.2).



*Basic Checklist* contains rather simple yes-no-questions to be answered online. A mouse-over function elaborates each question with representative photos and short texts on each specific topic. By use of a phone or tablet, the digital version of the checklist can be completed on site. After completion, the list of replies and observations can be sent directly to a chosen email.



*Detailed Checklist* has more elaborated questions that needs professional knowledge to answer. Regardless of computer software, paper and pencil are still highly preferred tools among architects (Jatulyte & Skourletis, 2019). Detailed Checklist is directed at building professionals with elaborated knowledge and a need for specific drawings and notes during an assessment. To meet these needs, Detailed Checklist is found in a printable version.





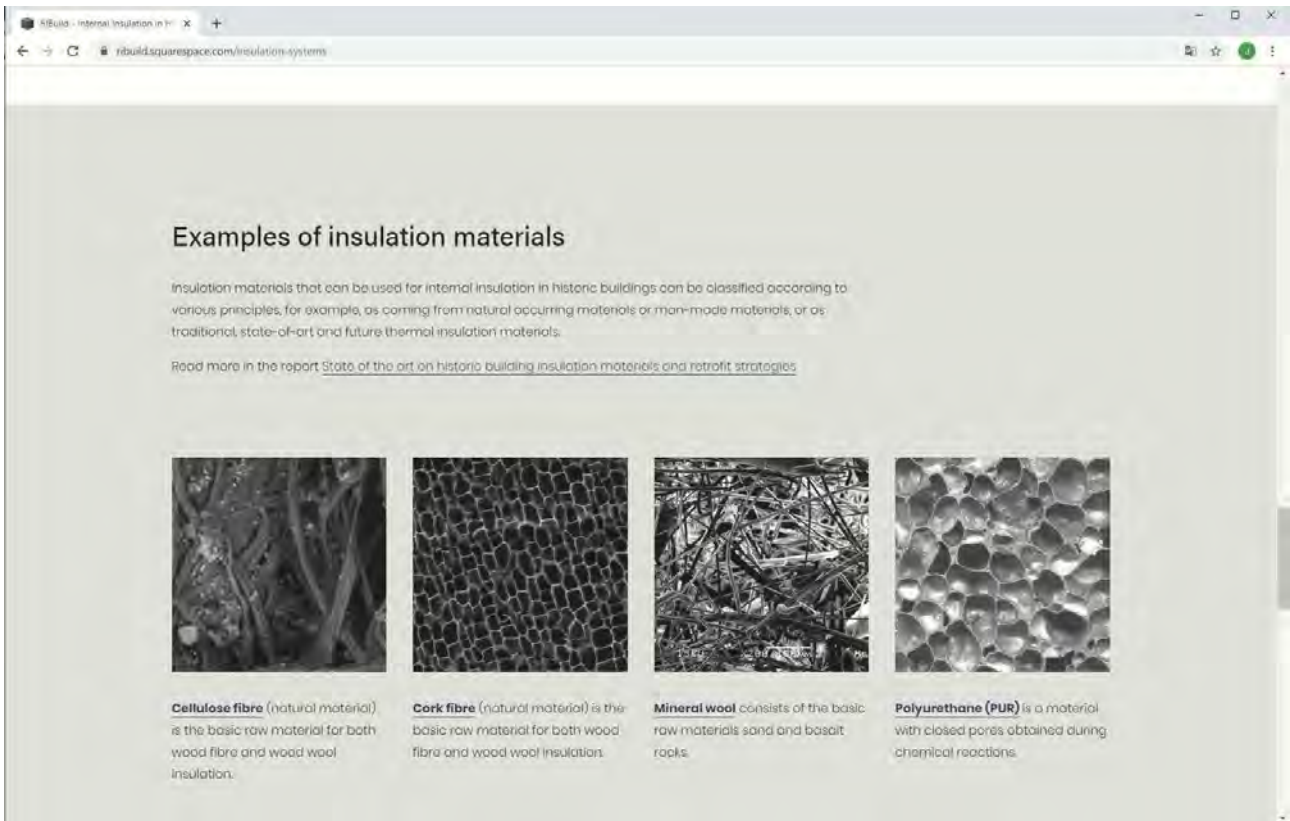
### 3.3.6 Insulation Systems

The third guideline covers *Insulation Systems* and includes theory about internal insulation solutions and a practical interactive tool.

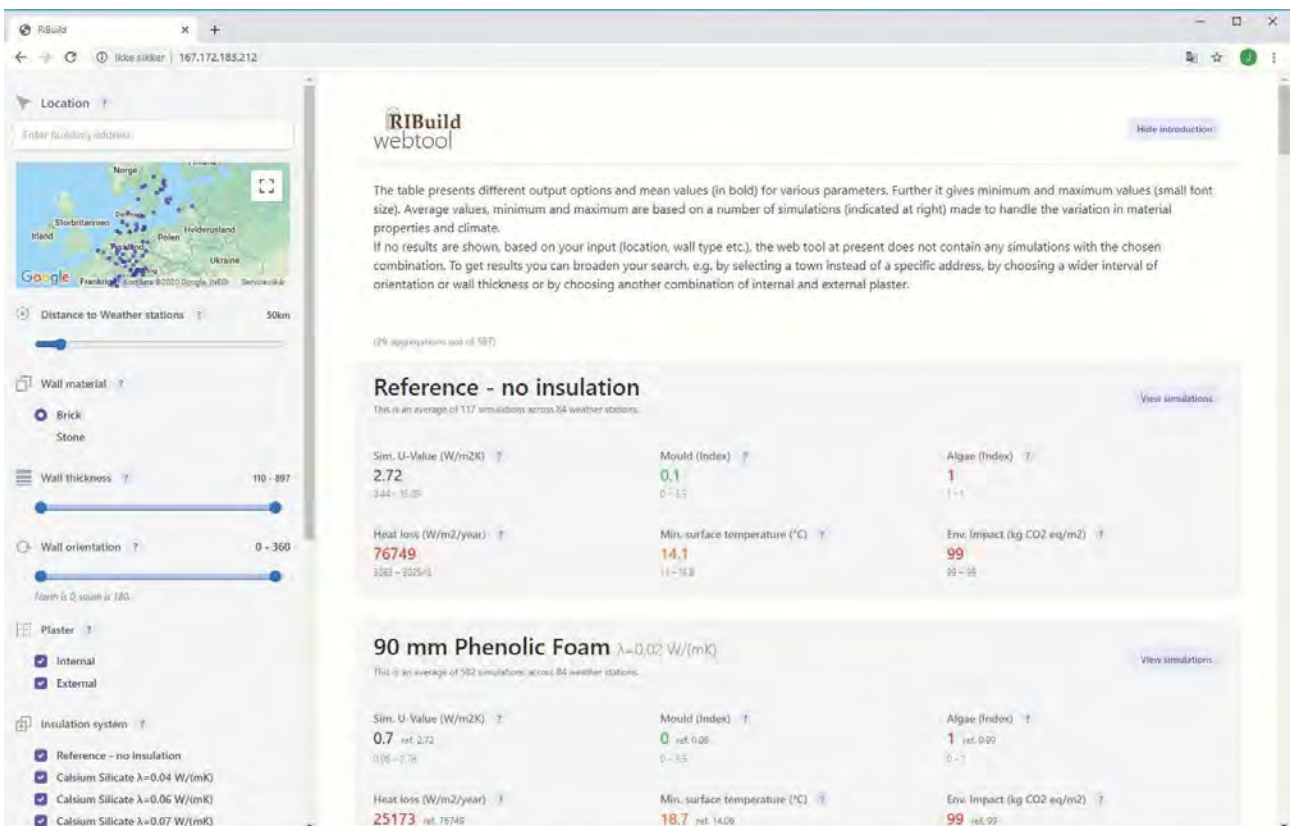


*Systems & materials* holds theoretical knowledge about vapour-tight and vapour-open insulation systems, installation procedures and a gallery of different insulation materials. Information on systems and procedures are described on two levels with text, visuals and tables. “*Read more*” leads to corresponding written paragraphs from deliverable D6.2 with extended and profound research knowledge on insulation systems.

The gallery presents microscope photos of 11 different insulation materials indicating structural qualities, and includes a direct link to the report “State of the art on historic building insulation materials and retrofit strategies” (deliverable D1.2 from RIBuild WP1). Clicking on the titles lead to extended explanations on material qualities and links to further research articles.



*Insulation Calculator tool* presents a direct link to the RIBuild WP6 web tool.



Depending on user input (location, orientation, wall design etc.), the web tool presents suitable insulation systems for a specific building case, based on seven insulation systems, including both vapour-tight and vapour-open systems. The presented solutions are picked by the web tool from a database with pre-calculated simulations, based on probabilistic approach further developed as part of RIBuild. It is possible to set priorities, ranging the solutions after e.g. their U-value or the mould risk.

The web tool in its present state (June 2020) does not cover all combinations of locations, wall types and insulation systems in RIBuild countries, and not all relevant models of failure, but is a first version (beta version) of such a type of assessment tool, to be further developed in future projects.

### 3.3.7 LCA LCC

The fourth guideline holds knowledge for evaluating energy saving potential, environmental impact and life cycle costs.

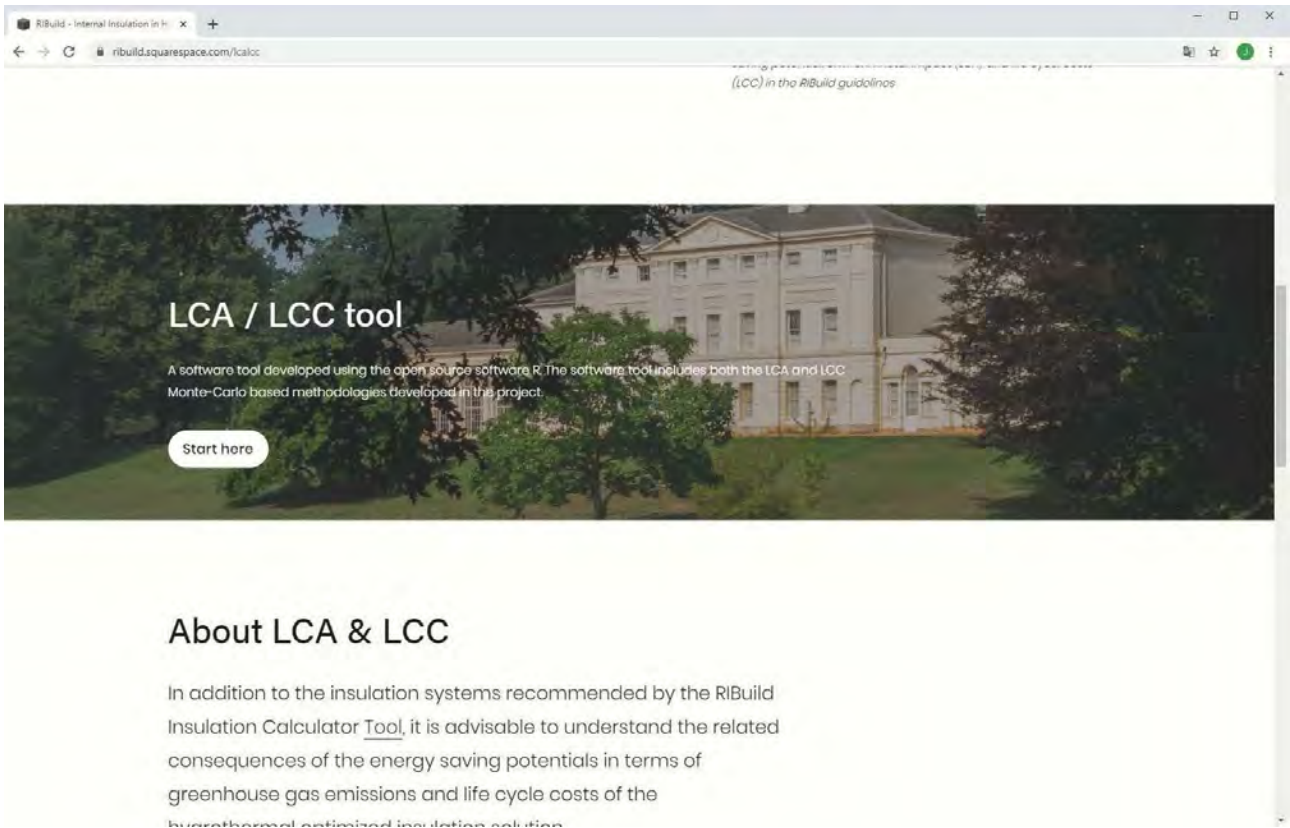
The screenshot shows the RIBuild website interface. The navigation menu includes: About, Set your Goals, Know your Building, Insulation Systems, LCA LCC, and Knowledge Base. The main heading is "Guideline for evaluating energy saving potential, environmental impact and life cycle cost". Below the heading, there is a "Read more" button. To the right, a flowchart diagram titled "Guidelines" is displayed. The flowchart starts with "Guidelines: 1 set of probabilistic internal facade" and "Facade level recommendations for hygrothermal assessment and energy saving potential (using the U-value)". This leads to a box: "Probabilistic hygrothermal assessment with DELPHI pre-calculated losses in a window". This box branches into two paths: "Output for the hygrothermal guidelines: Hygrothermal analysis allowing a probabilistic assessment of design options for the facade" and "Output for the energy saving potential of the facade: Heat losses and U-value of the wall and U-value of the window". Both paths lead to a final box: "Environmental impact (LCA) & life cycle costs (LCC) - Facade level assessment results in a report.pdf".

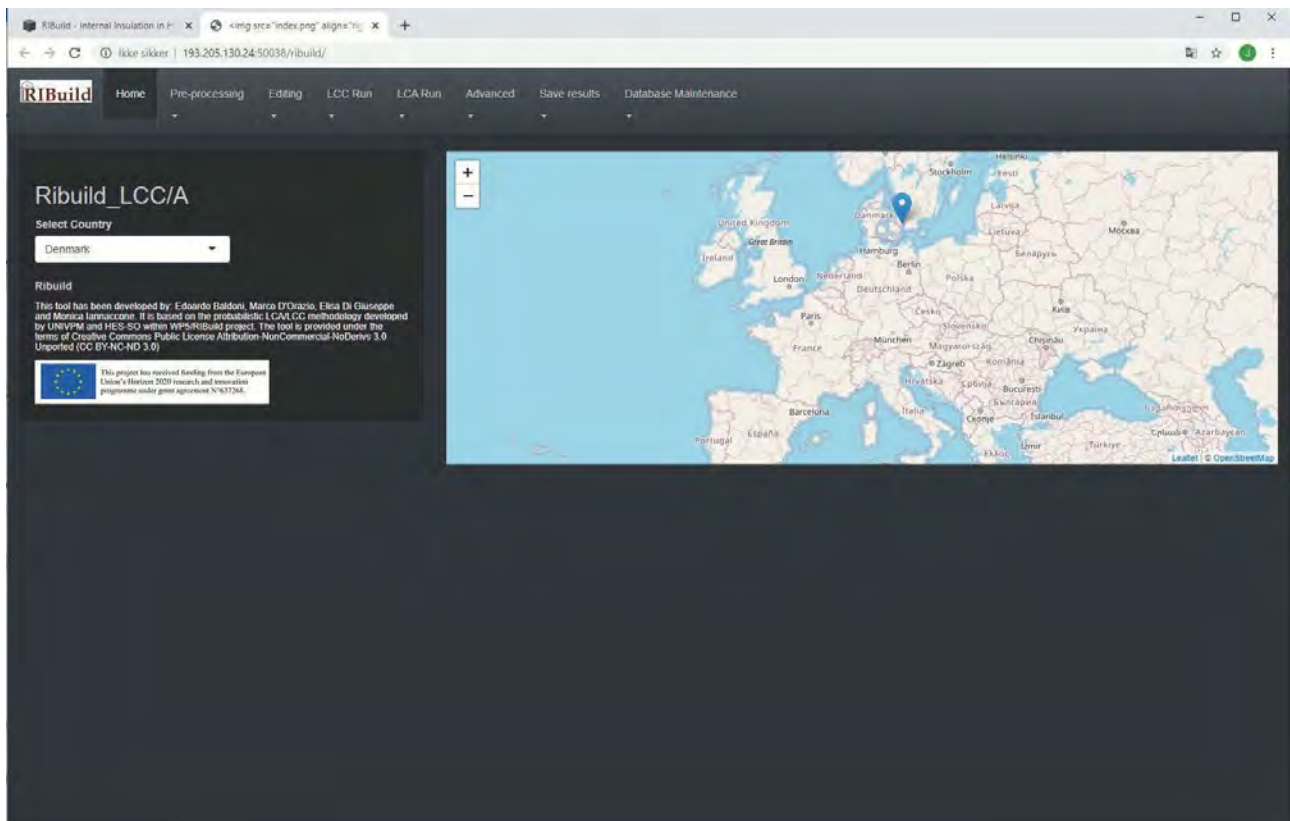
The probabilistic methods and specific explanation of the related consequences of the energy saving potential and life cycle cost of a hygrothermal optimized insulation system, e.g. suggested by the Insulation Calculator tool, are described on two levels with *Read more* linking from the first level on the website to the corresponding parts in deliverable D6.2.

The first level of knowledge includes links to deliverable D5.1 and D5.2 presenting documentation for the probabilistic methodologies for calculation of building life cycle impact and costs.

*Start here* leads to the software tool described in WP5 including both the LCA and LCC Monte-Carlo based methodologies developed within the project. The LCA/LCC-tool is a software tool coded in

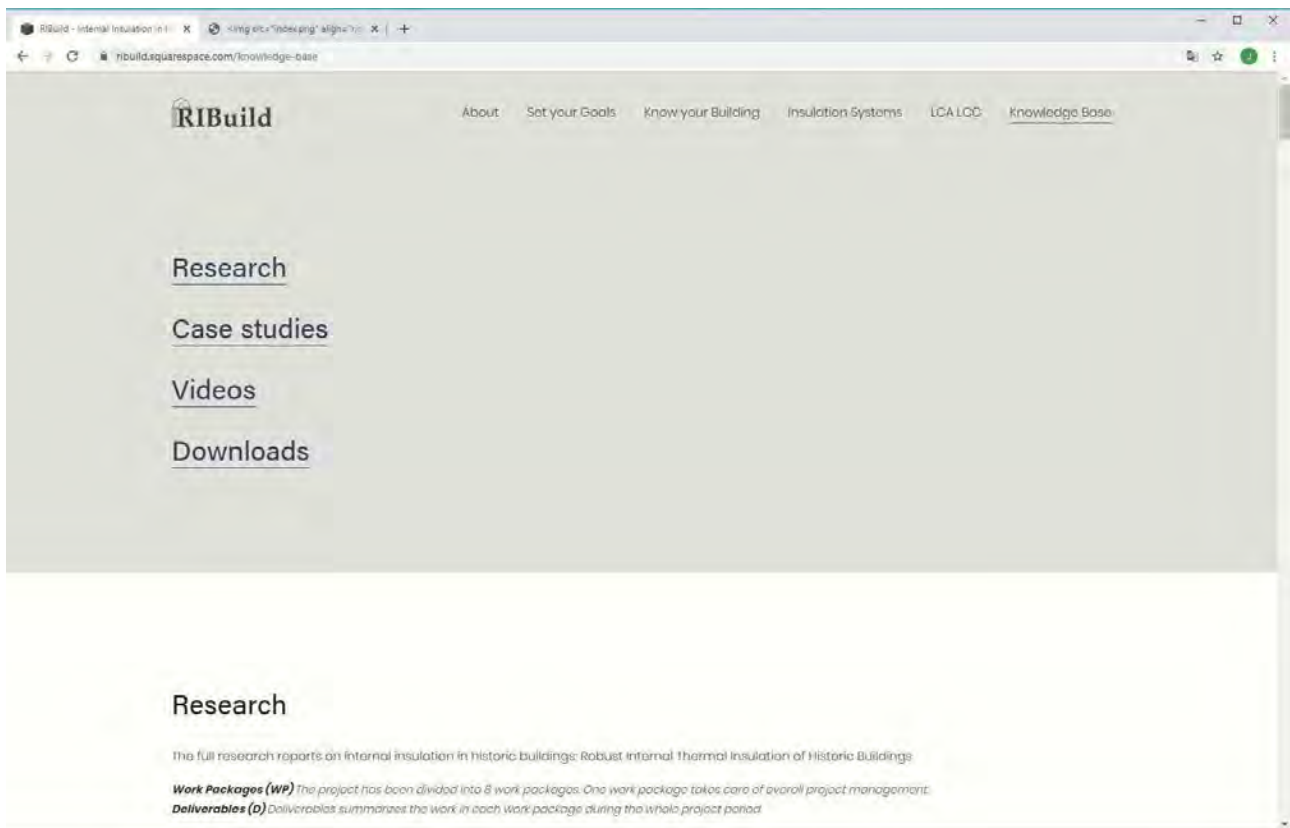
the open source software R – Project for Statistical Computing [R Cores Team 2013]. A graphical user-interface has been developed through Shiny, an R-package addressed to build interactive and user-friendly apps straight from R Studio (<https://shiny.rstudio.com/>).





### 3.3.8 Knowledge base

**Knowledge base** represents a RIBuild research library with search-functions and easy access to the project research material.



Thus, it collects:

1. A link to *publication base* holding all scientific publications from RIBuild in alphabetic order (based on first author family name) with link to each specific research article and journal.
2. Research deliverables (reports) from all project WPs.

## Research

The full research reports on internal insulation in historic buildings: [Robust Internal Thermal Insulation of Historic Buildings](#)

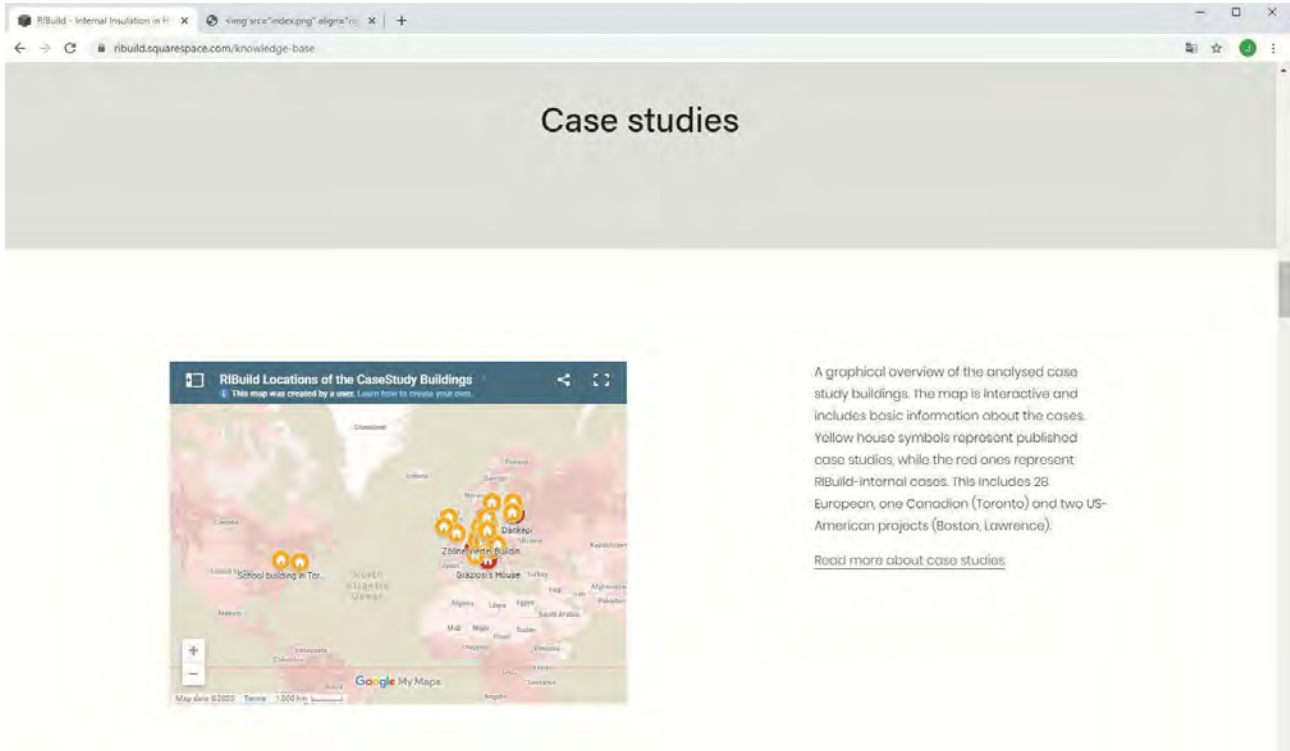
**Work Packages (WP)** The project has been divided into 8 work packages. One work package takes care of overall project management.

**Deliverables (D)** Deliverables summarizes the work in each work package during the whole project period

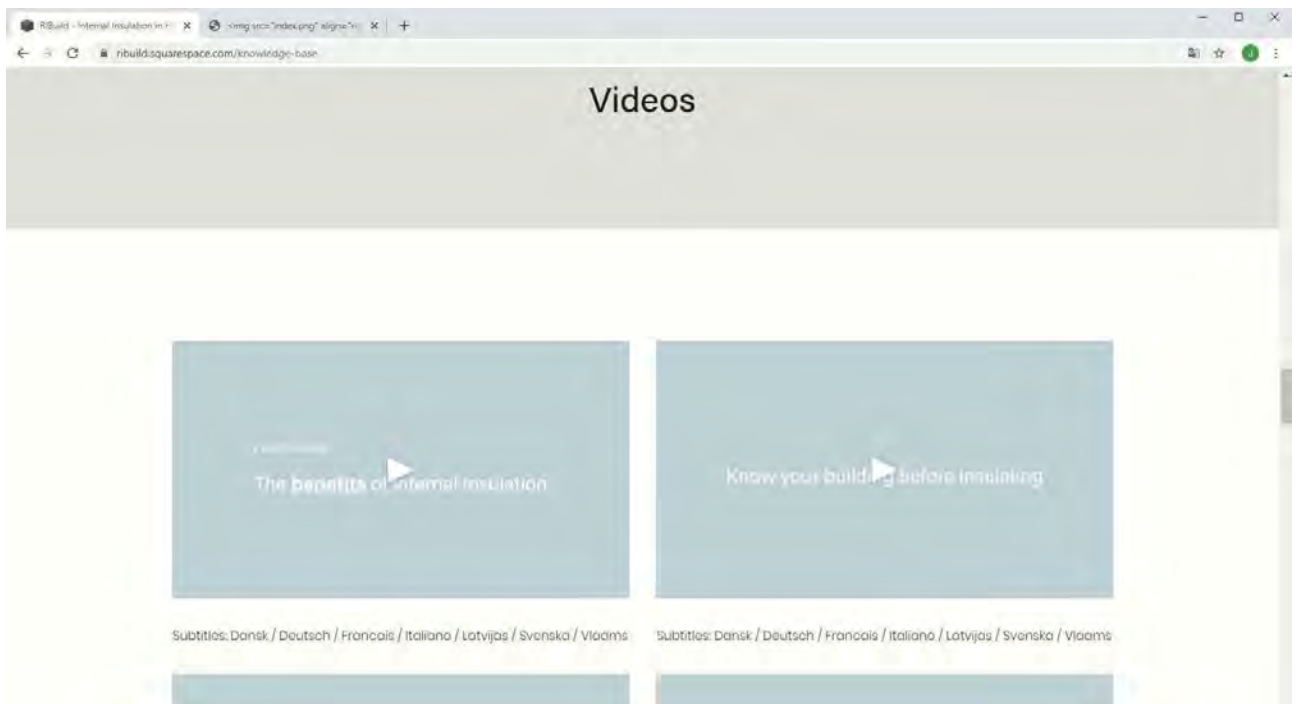
[Research data](#) [Publication base](#)

<p><b>WP1:</b> Pre-renovation assessment</p> <p>Examines common structural elements of historic buildings, determines their physical properties and classifies them according to type. The objective is</p>	<p><b>WP2:</b> Material characterisation</p> <p>Provides data for material properties and threshold values for historic building materials and existing insulation materials as a background for material</p>	<p><b>WP3:</b> Case studies and laboratory measurements</p> <p>Supports the research with high quality measurement data from both laboratory experiments on components and on-site</p>	<p><b>WP4:</b> Probabilistic assessment of internal insulation solutions</p> <p>Develops an efficient strategy for the probabilistic hygrothermal assessment of internal insulation solutions.</p>
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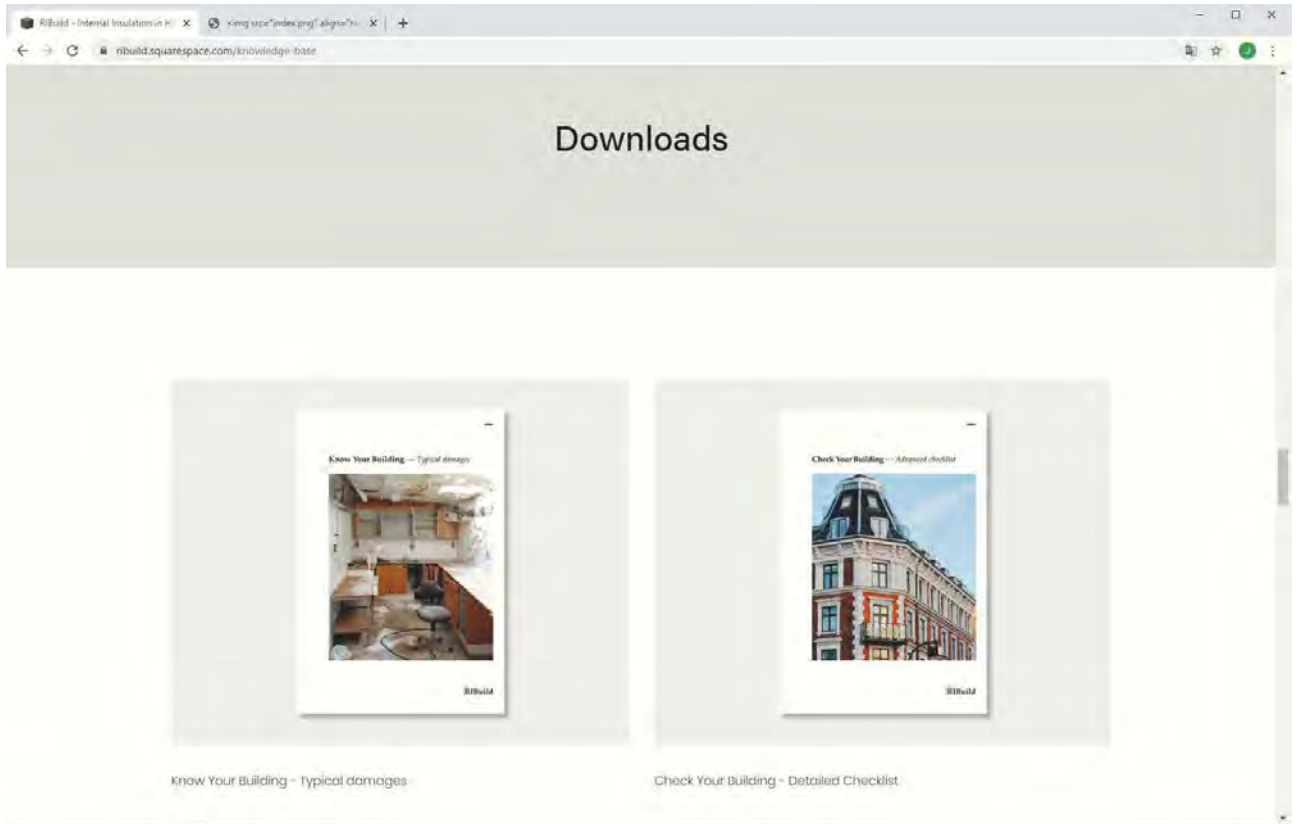
- 3. Case studies included in RIBuild. These are presented on an interactive map and by a link to deliverable D3.2 describing the research on internal insulation systems under different conditions. Furthermore, videos present specific case examples with testing internal insulation in practice, including an old Danish farmhouse and a multi-storey residential building.



- 4. A collection of the video material explaining the RIBuild project used on the website.



- Downloads covering information on Typical damages, Detailed Checklist, DIY materials test and Information folder for print or online reading.



- Research data* includes a link to a repository (data archive) where research data from RIBuild is stored. It includes measurement data files and photo documentation from case studies, laboratory test stands and out-door test units, data bases (excel sheets) with data for historic building materials, data from a survey of the historic building stock, etc.

## Research

The full research reports on internal insulation in historic buildings: [Robust Internal Thermal Insulation of Historic Buildings](#)

**Work Packages (WP)** The project has been divided into 8 work packages. One work package takes care of overall project management.

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Research data

Publication base

### WP1: Pre-renovation assessment

Examines common structural elements of historic buildings, determines their physical properties and classifies them according to type. The objective is

### WP2: Material characterisation

Provides data for material properties and threshold values for historic building materials and existing insulation materials as a background for material

### WP3: Case studies and laboratory measurements

Supports the research with high quality measurement data from both laboratory experiments on components and on-site

### WP4: Probabilistic assessment of internal insulation solutions

Develops an efficient strategy for the probabilistic hygrothermal assessment of internal insulation solutions.



Most of the website material in the *Knowledge base* is available in printable versions to accommodate users preferring to read on paper. The materials can e.g. be used as inspiration at conferences, school materials or during practical assessments.

## 4 User tests

User-surveys are essential tools to evaluate website content and avoid overlooked misunderstandings. The overall scope of the survey was to test navigation, written content and visual display on the website in order to enhance quality and secure a user-friendly experience of the final website.

The survey was conducted in February and March 2020 after a prototype of the website was finished.

In accordance with the RIBuild Description of Action (ver. 13.11.2019), the website was tested in 2-3 partner countries by 2-4 engineers and 2-4 architects in each country (European Commission, 2019). For this purpose, the voluntary RIBuild partner countries were Italy, Sweden, Switzerland and Denmark. Moreover, the survey was distributed to all RIBuild partners and EEAB-members.

The survey was conducted using the online form builder Wufoo ([www.wufoo.com](http://www.wufoo.com)). Each user had access to a prototype of the website through a given login. Before filling out the survey, they were encouraged to explore the website on their own for a personal first impression.

The survey contained 24 questions for each user to reply. Most questions could simply be answered choosing among prescribed answers, whereas others made room for personal comments.

All replies have been summarized in individual graphs included in appendix B. Some of the questions allowed the participants to write answers in free text. The full answers have been included in appendix C. Appendix B and C also includes indications of whether each question allowed for one or several answers.

Even though the survey was widely distributed, several challenges were faced in the process of receiving of replies. Corresponding with the recipients outside of Denmark only through mail created a digital and impersonal distance. This also created the discussion about horizon of time to fill out the survey. The lack of personal contact creates less commitment from each user. The lack of user-response was further challenged by the worldwide COVID19-epidemic peaking in the same period as the user survey was running. In order to receive the amount of replies in accordance with amendment, extensions of the deadline to reply and several reminders were sent to all users. Despite the effort and a rather disappointing number of replies, the replies represented varied user opinions with fulfilling and detailed observations for the further editing phases.

Based on these test replies, the website was edited to optimize usability and content according to user needs. Due to the extended period of testing, the final phase editing and implementation of new information was shortened and limited.

### Main takeaways from user-survey

1. A more thorough explanation / step-by-step guideline / explanations on the different steps in the guidelines and how they are interlinked
2. Too large amounts of space on each page

3. The website is mostly used as a source of information in the preliminary construction phases and accessed by computer
4. The purpose of the website and scientific rooted content as part of a large research project was clear to all users
5. The sender of the website is in general perceived as the RIBuild project or EU. A few users wish for this to be further underlined throughout the website
6. Most users prefer the video materials
7. The photo material is sufficient, complement the written material and supports the overall understanding/messages. It is desired to have access to images in the checklist in a larger format. Photo material for “Insulation systems” is missing
8. Overall, the content of the texts is interesting. The levelling divided by the *Read more*-tap is understandable and increases the free user experience without “frightening” users on a basic level. In the long text parts under *Read more* shorter summaries would be preferred to introduce the next paragraph  
The *Read more*-function could refer directly to the specific section in the full report.
9. The headlines in the menu are functional according to the content on each page but most users only found it “average” simple/logical to find the needed information
10. About 2/3 will use the functions in the toolbox
11. As the remaining content, it is anticipated that the LCA/LCC-tool to be part of the preliminary phases of energy conservation considerations
12. In general, the website lives up to expectations about / in relation to professionalism, level of information and visual expression
13. Even though 2/3 of the users had preliminary knowledge about internal insulation in historic buildings, almost everyone had gained a more profound knowledge and expect to use the website in the future
14. The colour-representation of knowledge levels in the text is confusing but the division of levels seem relevant
15. Together with the existing printable materials booklets or materials about insulations systems are missed

## 5 Digital services and costs

The website is hosted by Squarespace with domain transfer from the first RIBuild website to the present one through Dandomain. The online form-builder Wufoo is used for the online checklist (basic checklist).

Costs related to maintaining the website:

Domain: 320 dkr./year

Squarespace: 216 dollars/year

Wufoo form-builder: 19 dollars/month

## 6 Outcome

The RIBuild website and web tools contains knowledge from five years of research, communicated in order to make complex information accessible for users with different technical backgrounds.

The final RIBuild website – [www.ribuild.eu](http://www.ribuild.eu) – is a user-friendly and informative website presenting the newest research on internal insulation in historic buildings, checklists to assess buildings before renovations and web tools to calculate the most feasible renovation solutions and life cycle analysis of the building.

The RIBuild website is a unique platform due to the profound and comprehensive project research on internal insulation. The website presents the newest knowledge in an easily understandable language that can be understood by both building professionals and non-professionals and therefore has the potential to reach a wide range of users.

The website contains valuable knowledge about internal insulation set into an international context. Further development might include a forum for sharing of knowledge, news about the latest research presented at the website and in newsletters, more data for the web tools to base simulations on for more accurate results, or additional real-life cases providing information about experiences. Such further development will maintain future relevance of the website.

## 7 References

Brown, T. (2008). Design thinking. *Harvard Business Review*, 86(6), 84–92, (p. 141). Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/18605031>

European Commission (2019). Amendment Reference No. AMD-637268-37. Grant Agreement number: 637268 — Robust Internal Thermal Insulation of Historic Buildings (RIBuild). *European Commission, 1049 Brussels, Belgium*

Jatulyte, G. & Skourletis, S. (2019). Don't tell – show! A study of architect's requirements for a platform that include knowledge about internal thermal insulation in the classical buildings. Master Thesis – Information Studies. *Aalborg University*  
[https://projekter.aau.dk/projekter/da/studentthesis/dont-tell--show\(683801d7-e6d6-4195-96cb-dadc83339b9f\).html](https://projekter.aau.dk/projekter/da/studentthesis/dont-tell--show(683801d7-e6d6-4195-96cb-dadc83339b9f).html)

Skovgaard, M. & Bonderup, S. (2016). Survey among practitioners working with retrofitting with internal insulation. *RIBuild WP7 Survey10122016* <https://www.ribuild.eu>

### Website links

**R** Core Team (2013). **R**: A language and environment for **statistical** computing. **R** Foundation for **Statistical** Computing, Vienna, Austria. ISBN 3-900051-07-0, URL <http://www.R-project.org/>

**Shiny** – work package from R Studio: <https://shiny.rstudio.com/>

**Squarespace**: <https://www.squarespace.com/>

**Wufoo** – online form builder: <https://www.wufoo.com/>

## Appendix A: User guide to the RIBuild website [www.ribuild.eu](http://www.ribuild.eu)

The RIBuild website is created as a user-friendly and intuitive platform for knowledge sharing of valuable research about internal insulation in historic buildings.

### General structure

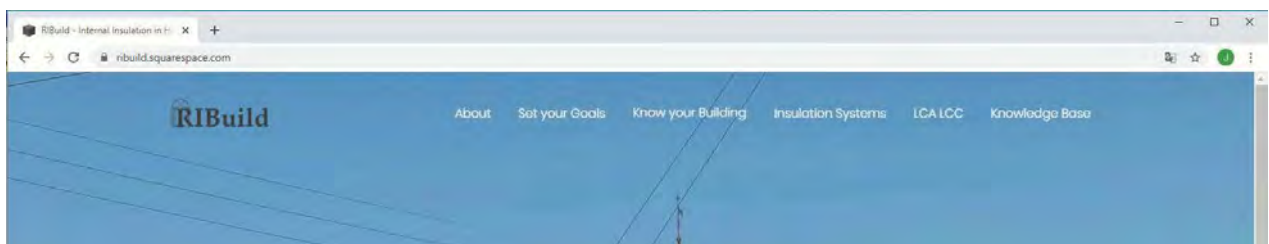
- *Two levels of knowledge*: first level on website, second entered through *Read more*-buttons presenting text parts from deliverable D6.2

source, the material may be too sensitive for its use, and internal insulation will increase the risk of further frost damage. Evaluating the frost sensitivity of the existing material is a job for experts; it requires an extensive experimental effort, wherein a large number of material samples has to be available.

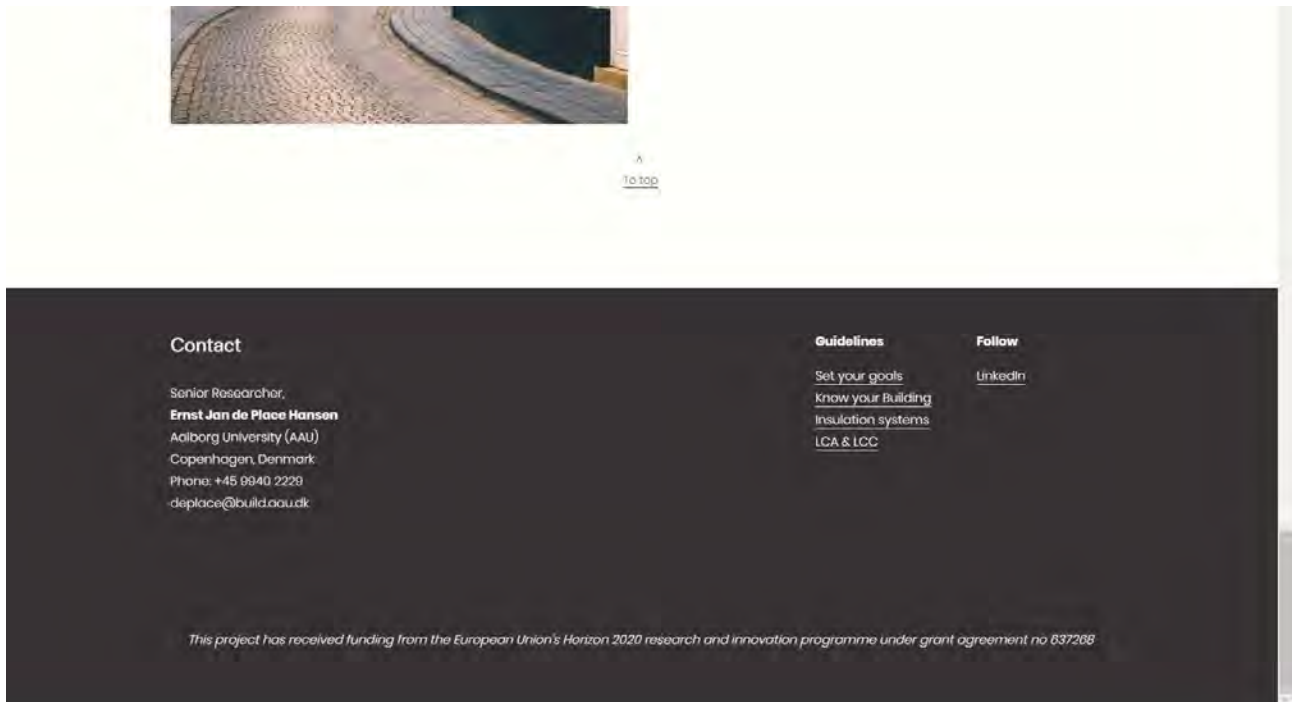
Read more

[Wood rot >](#)

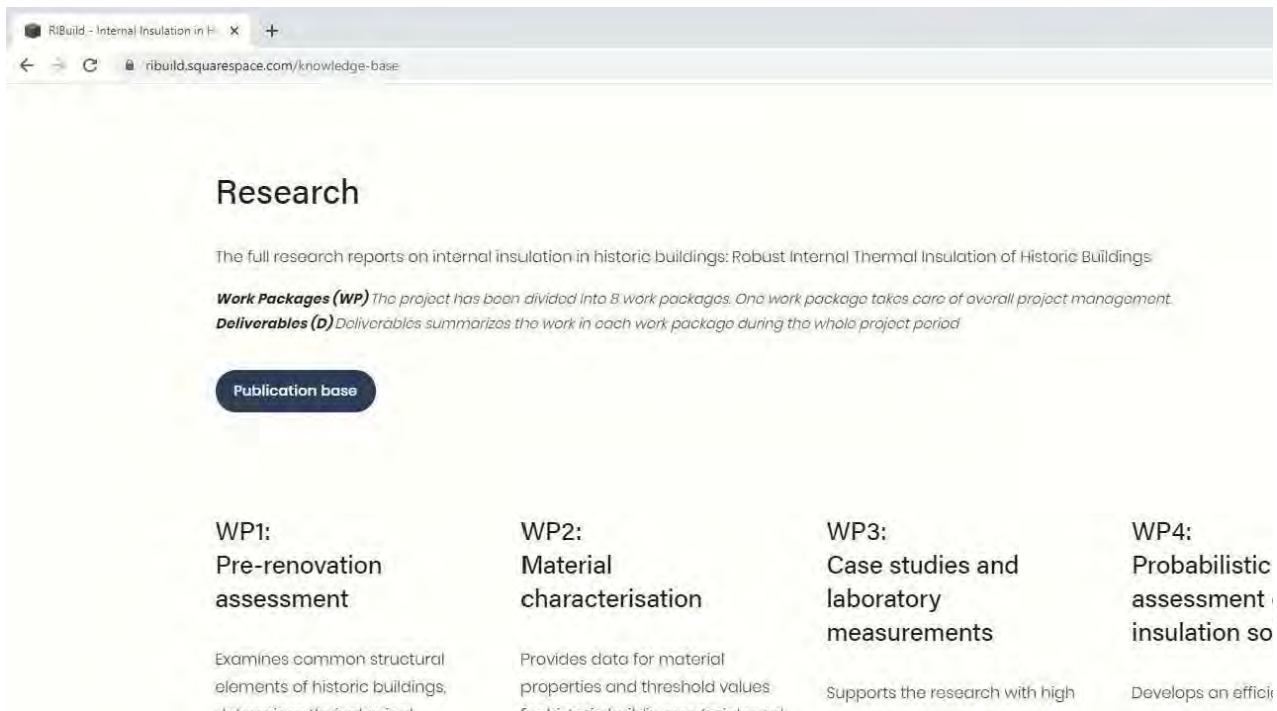
- *Fixed top menu* is a direct access to all topics and provides the user with a constant overview of the multiple options wherever they are
- The themes and topics have been ordered to naturally follow the content of the written guidelines (D6.2) without the need to explore sections or features in a specific order



- *Fixed footer* holds contact information, direct access to the four guidelines and link to LinkedIn to follow news about project
- *To top-function* on each page to minimize scrolling and quick navigation back to top menu with access to all topics



- Links to related information on the RIBuild-webpage or to external relevant sources of information for easy access to valid sources of information relevant to the project
- Links to the publication base are placed at the end of each *read more*-text

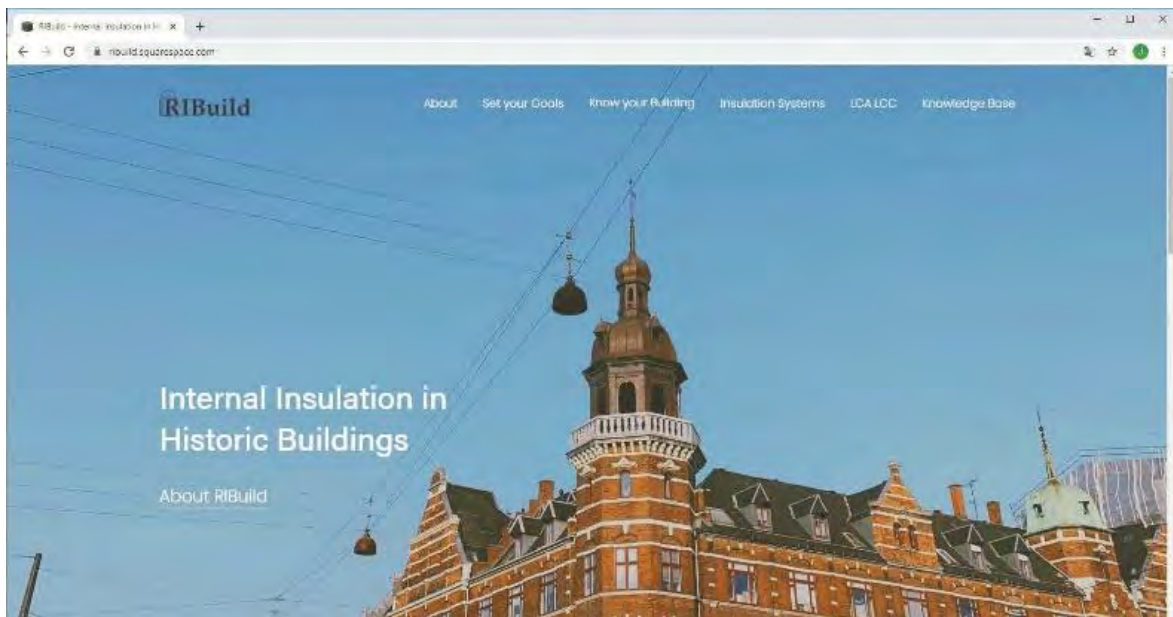


- *Clicking on the RIBuild-logo in the left corner leads back to the landing page*
- If the website is accessed in a google-browser as Google Chrome, the website can be translated into any national language by right-clicking at a random place on the website and selecting translate.

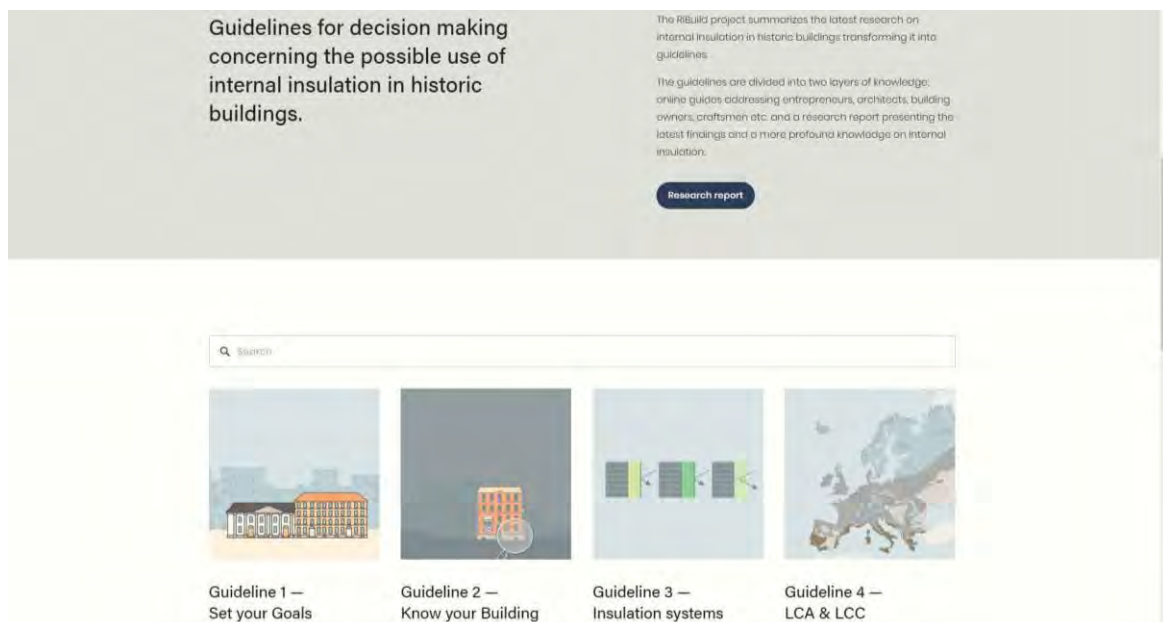
The following presents a step-by-step list of the topics, knowledge and features presented on the website, proceeding through topics in the top menu:

### Landing page includes

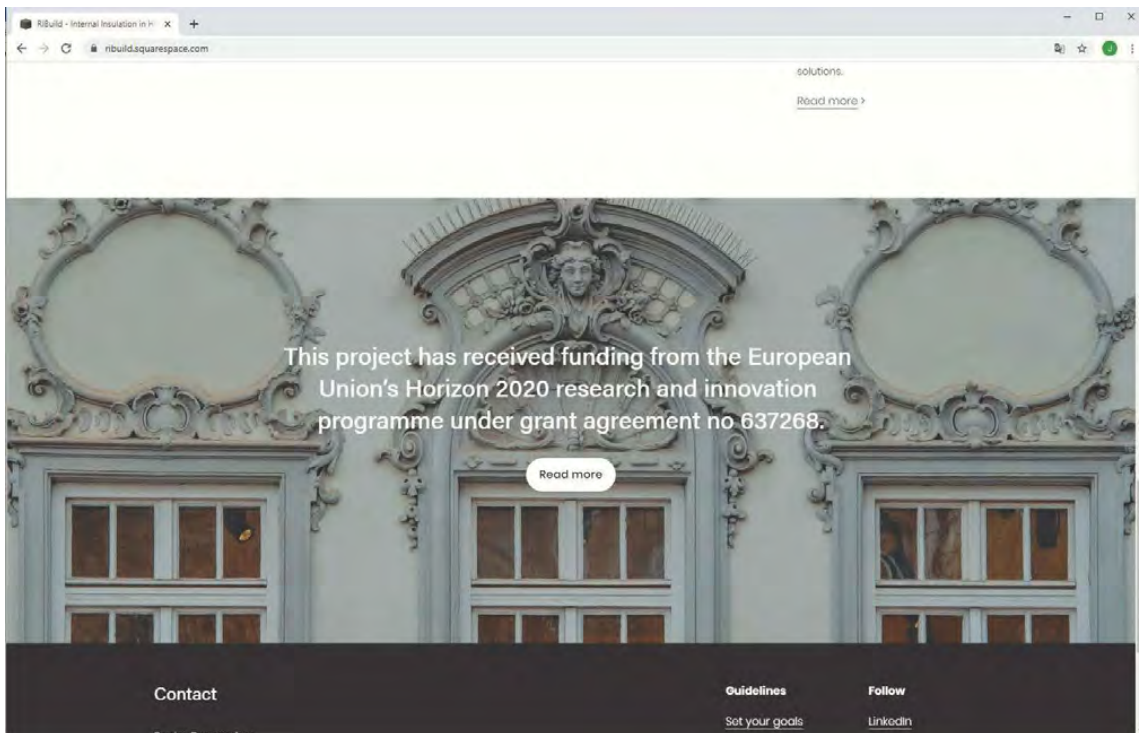
- Link to *About RIBuild*
- A brief presentation to the RIBuild-project through text and video
- Link to the full written report (deliverable D6.2)



- Search function
- Presentation and direct access to the four guidelines (1. Set your Goal, 2. Know you building, 3. Insulation Systems and 4. LCA/LCC)



- Clicking on *Read more* leads directly to the European Commission-website (for further knowledge about the European Union's Horizon 2020 research)



## About

- Summarizes the RIBuild-project and research process through text and videos
- Presents involved project partners through logos from institutions
- Direct link to deliverable D6.2

## Guideline 1: Set your Goal

- Information on how to set a goal for the building renovation and decision criteria
- Three areas of knowledge:
  - a. the holistic approach when setting a goal
  - b. the five types of goals described in the RIBuild project (reduction of energy consumption, reduction of environmental impact, reduction of energy and other costs, improvement of indoor climate and loss of floor area)
  - c. an introduction to building regulations
- Interlink leads to a more profound explanation of each goal with examples
- Link to the Directive of the European Parliament and of the Council on energy performance of buildings
- *Read more* leads to part of deliverable D6.2 about national building regulations

**Guideline for setting the goal of application of internal insulation**

Deciding whether and how to implement energy efficiency in historic buildings is a complex process that involves technical solutions, heritage value, indoor environment, cost efficiency, interests of stakeholders etc.

**Holistic approach**

Application of internal insulation is a manifold process composed of either several independent or interlinked variables. The variables include hygrothermal properties of existing and applied building materials, indoor and outdoor climate, energy costs, operation and maintenance costs, human behavior, occupation loads, mechanical and engineering systems in the building, environmental impact, heritage value, financial resources and their availability, location of the building, building regulations, productivity etc.

The decision-making process starts with setting either a single or several parallel goals described by one or more criteria. Definitions of main goal and decision criteria for process assessment, alternative solutions, estimation of performance, evaluation, solutions and proposals are strongly interlinked. Decisions taken in the renovation planning process will therefore determine whether the goal will be reached without compromising hygrothermal behavior of existing wall and heritage value.

[Read more](#)

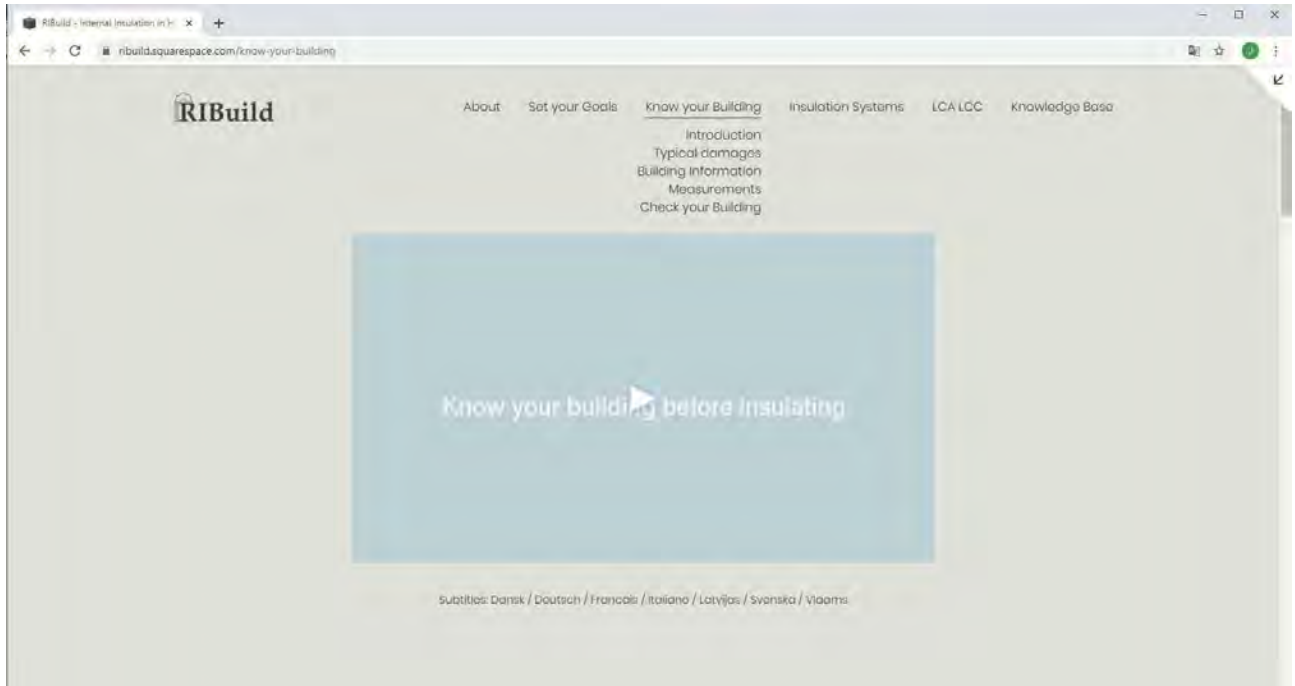
**Main goals to combine**

- Reduction of energy consumption**  
aims at minimizing building energy consumption, expressed as energy spent for either heating, ventilation or cooling of the building regardless the energy source.
- Reduction of environmental impact**  
aims to reduce possible environmental impact when applying internal insulation. It can be either reduction of CO2 emissions to lower the impact on climate change during operation phase of the building or reduction of environmental impact considering all three phases of a building lifetime - the construction phase, the operation and maintenance phase and the end of life phase.
- Reduction of energy and other costs**  
includes all costs for application of internal insulation, particularly energy, material and installation costs as well as life cycle costs or other case-specific costs.
- Improvement of indoor climate**  
aims to improve the indoor thermal comfort. Unsatisfactory thermal comfort is related to low surface temperature of the wall which causes thermal asymmetry.
- Loss of floor area**  
focuses on minimizing the loss of the room floor area.

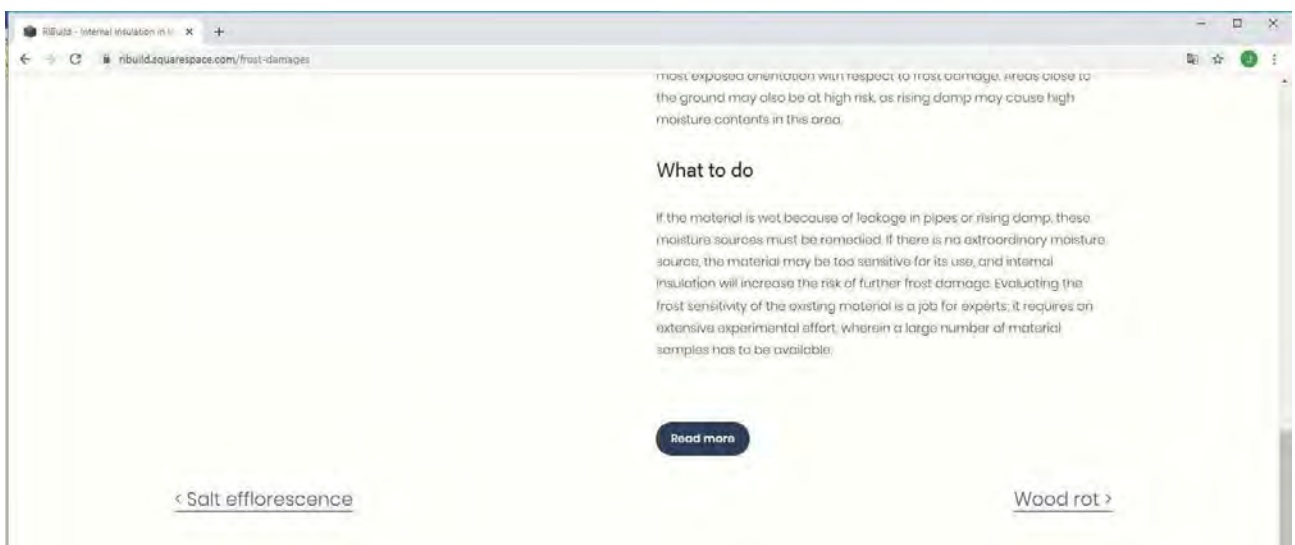


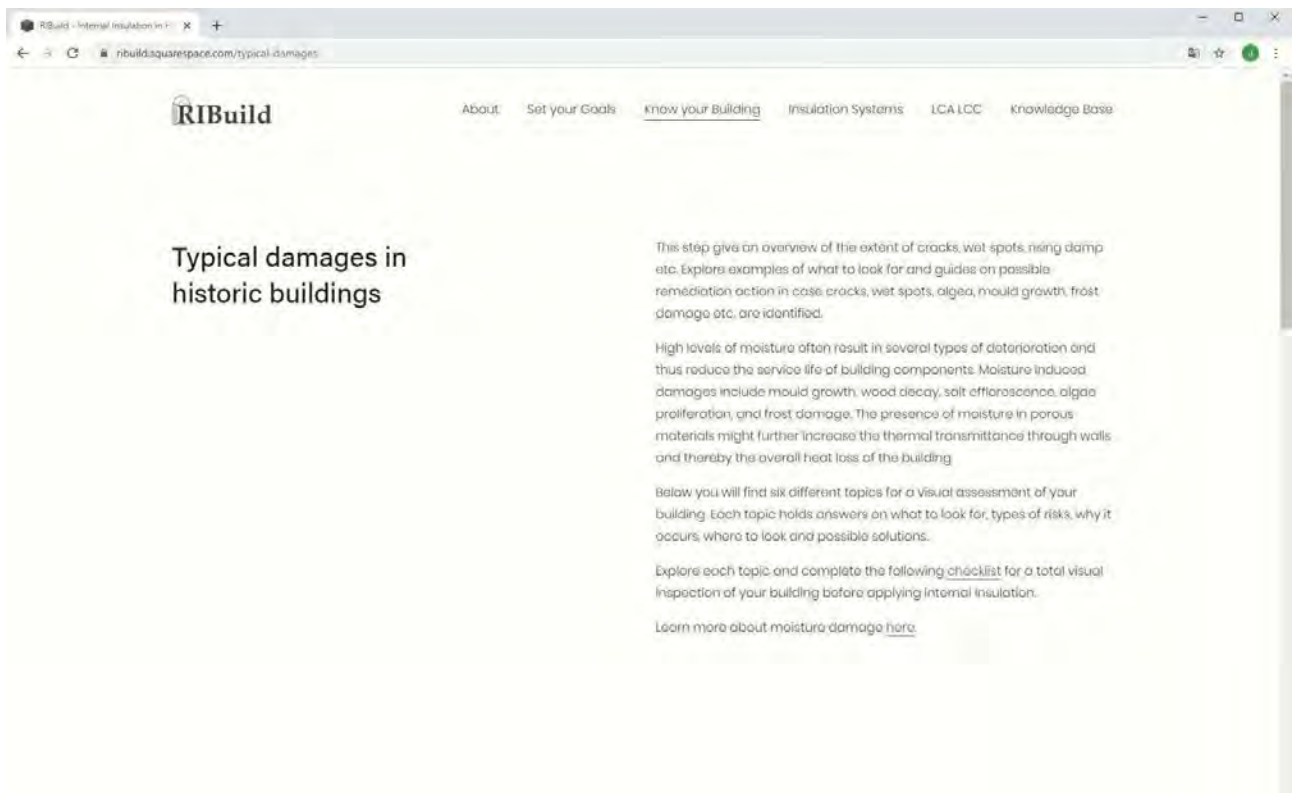
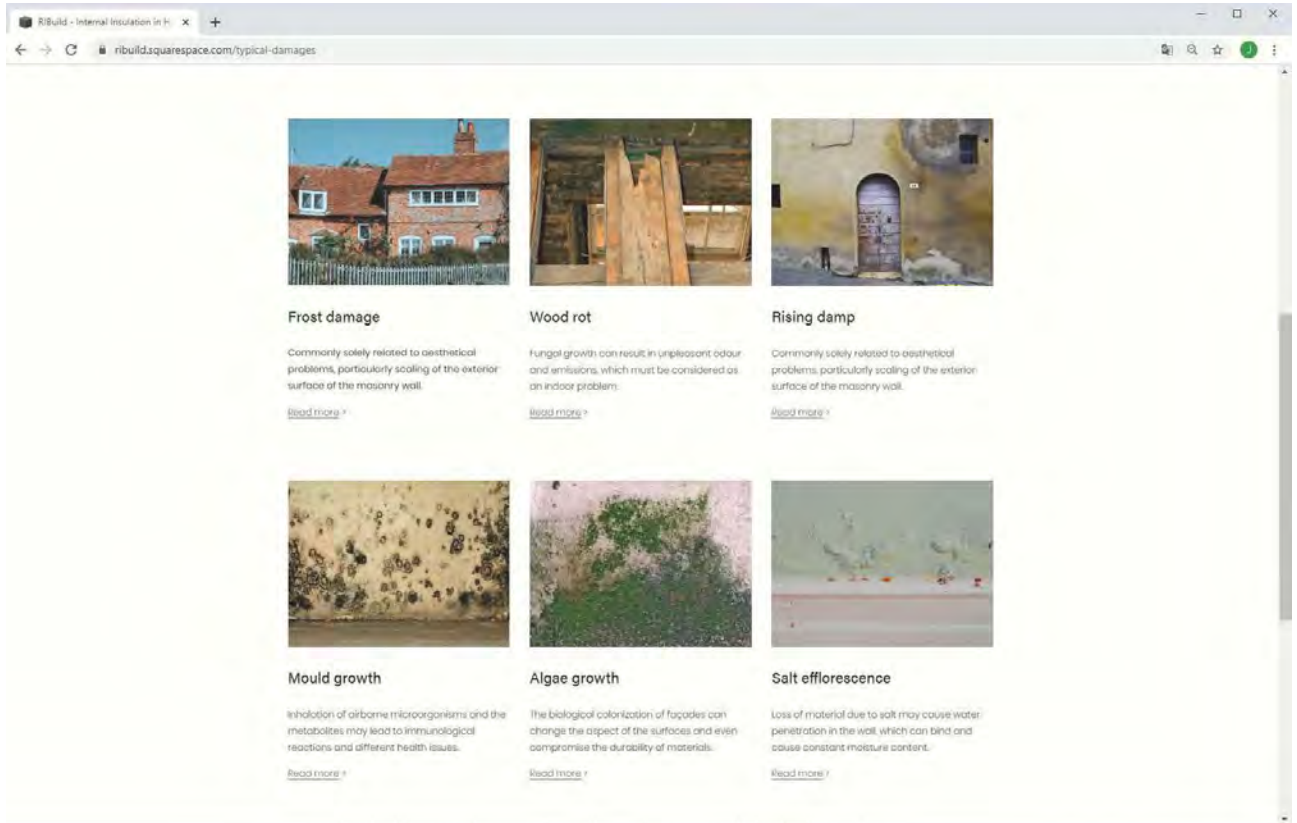
## Guideline 2: Know you Building

- Contains five topics: Introduction, Typical damages, Building information, Measurements and Check your Building
- **Introduction**

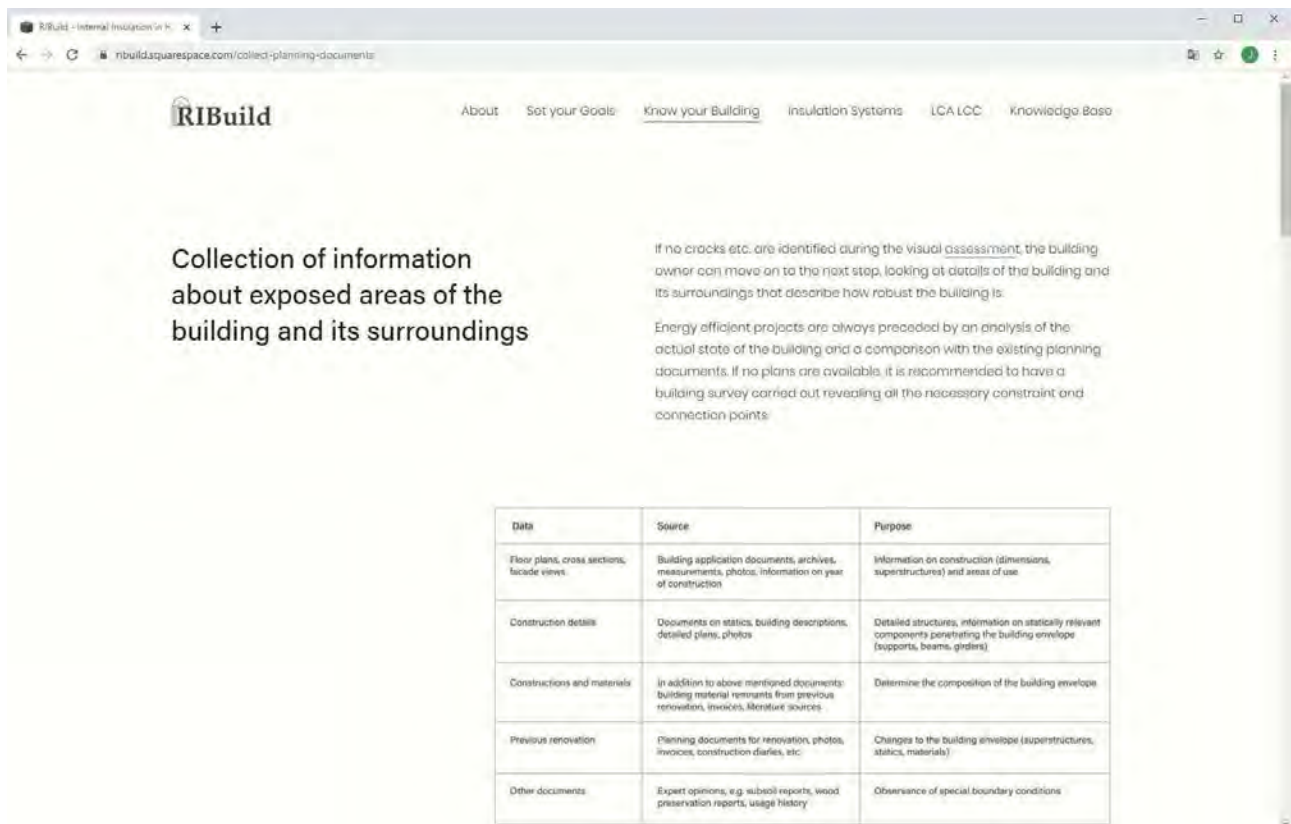


- **Typical damages** cover six most common areas of risks to assess before starting a renovation process; frost damage, wood rot, rising damp, mould growth, algae growth and salt efflorescence, with brief answers on what, why and where to look for occurring risks and what to do
- **Read more** leads to text part from deliverable D6.2 covering the topic
- A visual gallery at the bottom presents examples of damages
- Arrows guide to other typical damages among the six





- **Building information** presents types of important data documents and useful sources of information about the building and surroundings
- Five sensitive building areas to assess during the analysis are pointed out



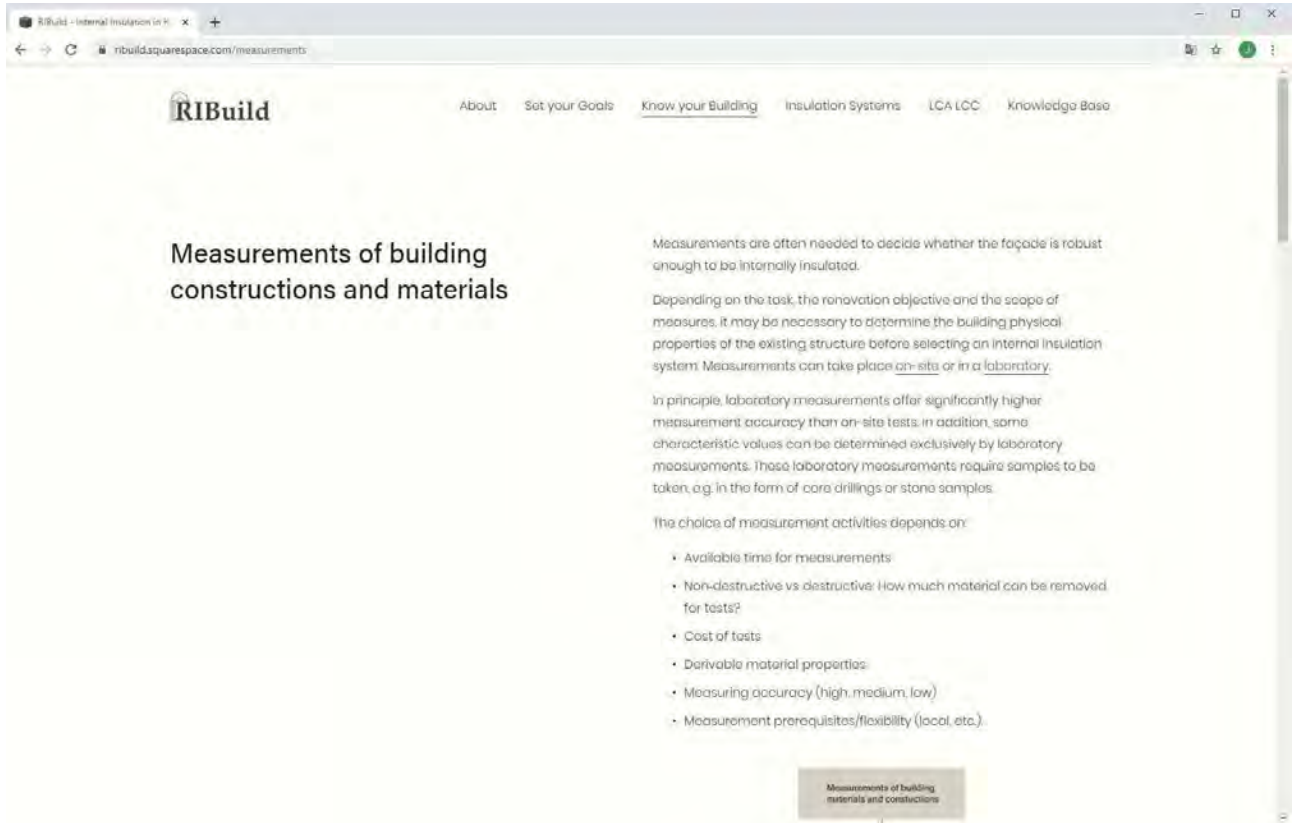
**Collection of information about exposed areas of the building and its surroundings**

If no cracks etc. are identified during the visual assessment, the building owner can move on to the next step, looking at details of the building and its surroundings that describe how robust the building is.

Energy efficient projects are always preceded by an analysis of the actual state of the building and a comparison with the existing planning documents. If no plans are available, it is recommended to have a building survey carried out revealing all the necessary constraint and connection points:

Data	Source	Purpose
Floor plans, cross sections, facade views	Building application documents, archives, measurements, photos, information on year of construction	Information on construction (dimensions, superstructures) and areas of use
Construction details	Documents on statics, building descriptions, detailed plans, photos	Detailed structures, information on statically relevant components penetrating the building envelope (supports, beams, girders)
Constructions and materials	In addition to above mentioned documents: building material remnants from previous renovation, invoices, literature sources	Determine the composition of the building envelope
Previous renovation	Planning documents for renovation, photos, invoices, construction diaries, etc.	Changes to the building envelope (superstructures, statics, materials)
Other documents	Expert opinions, e.g. subsoil reports, wood preservation reports, usage history	Observance of special boundary conditions

- **Measurements** presents on-site and laboratory methods through text, flow charts, videos and photo collections
- Emphasizes the need for measurements as part of the decision process during a renovation
- Interlink leads to printable material on the DIY-material test in Knowledge Base
- *Read more* leads to section describing measurements procedures and equipment for tests in deliverable D6.2



**RIBuild** About Set your Goals Know your Building Insulation Systems LCA LCC Knowledge Base

## Measurements of building constructions and materials

Measurements are often needed to decide whether the façade is robust enough to be internally insulated.

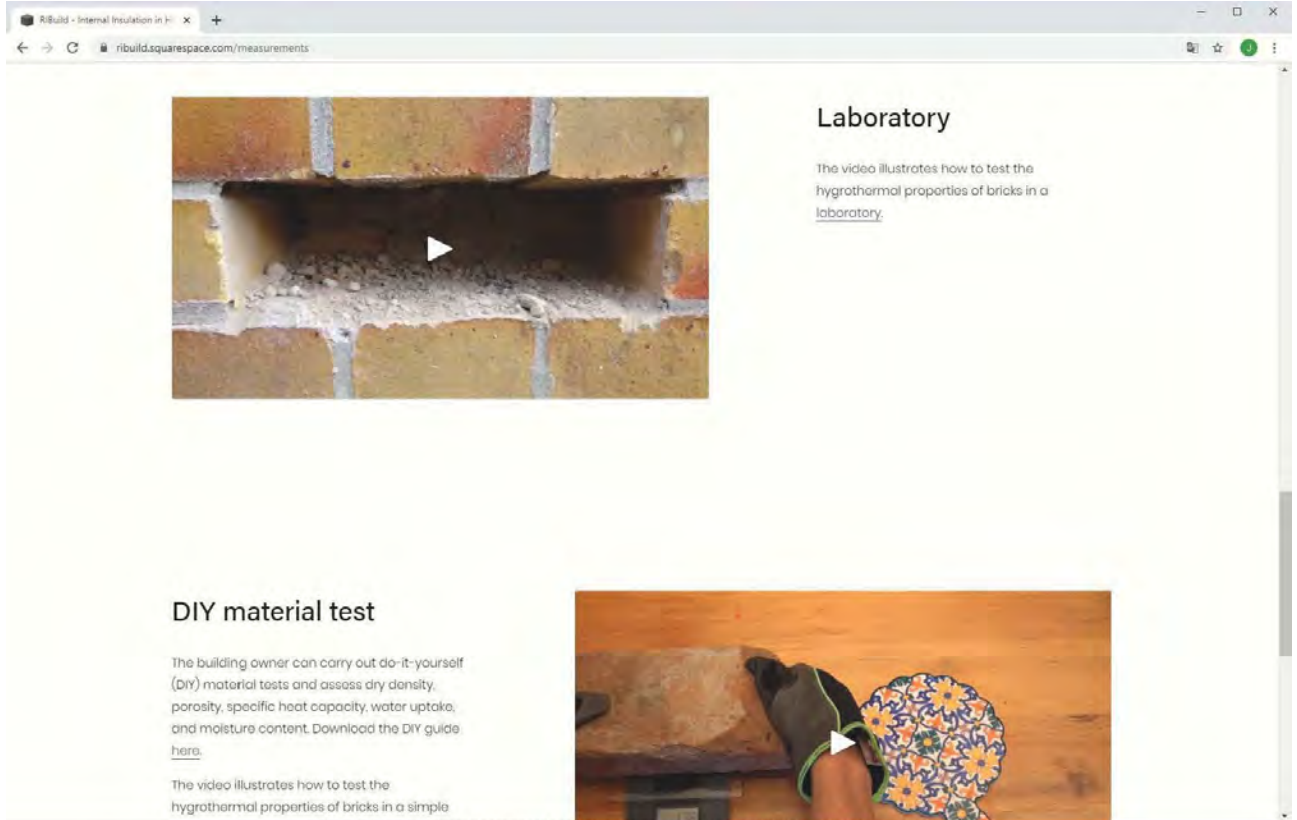
Depending on the task, the renovation objective and the scope of measures, it may be necessary to determine the building physical properties of the existing structure before selecting an internal insulation system. Measurements can take place on-site or in a laboratory.

In principle, laboratory measurements offer significantly higher measurement accuracy than on-site tests. In addition, some characteristic values can be determined exclusively by laboratory measurements. These laboratory measurements require samples to be taken, e.g. in the form of core drillings or stone samples.

The choice of measurement activities depends on:


- Available time for measurements
- Non-destructive vs destructive: How much material can be removed for tests?
- Cost of tests
- Derivable material properties
- Measuring accuracy (high, medium, low)
- Measurement prerequisites/flexibility (local, etc.)

Measurements of building materials and constructions



## Laboratory


The video illustrates how to test the hygrothermal properties of bricks in a laboratory.



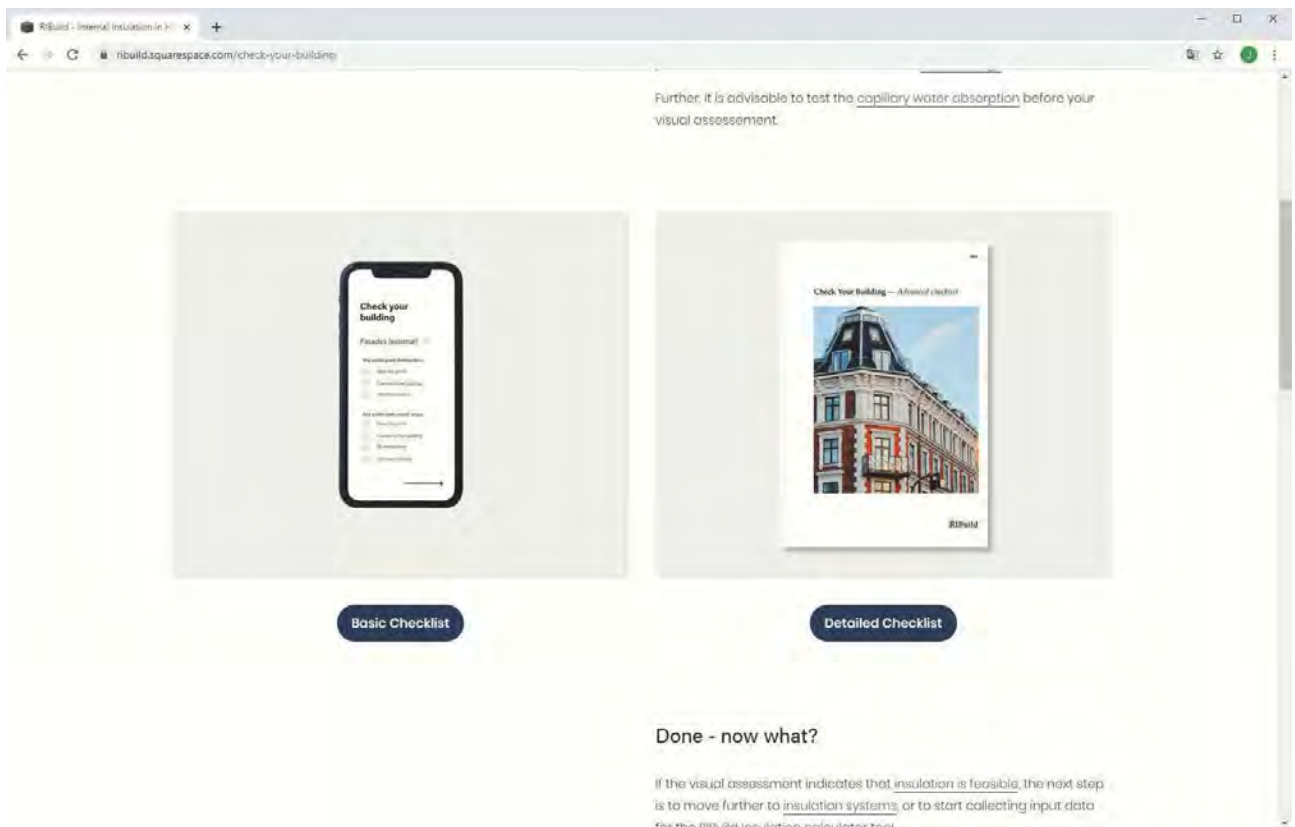
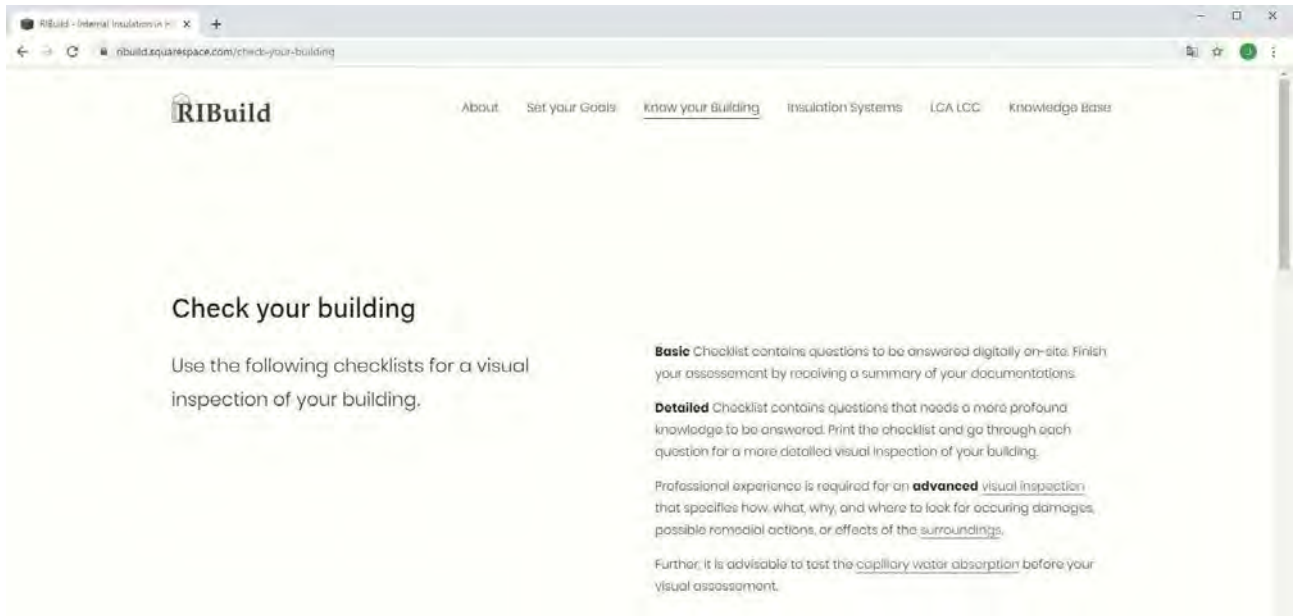
## DIY material test

The building owner can carry out do-it-yourself (DIY) material tests and assess dry density, porosity, specific heat capacity, water uptake, and moisture content. Download the DIY guide here.

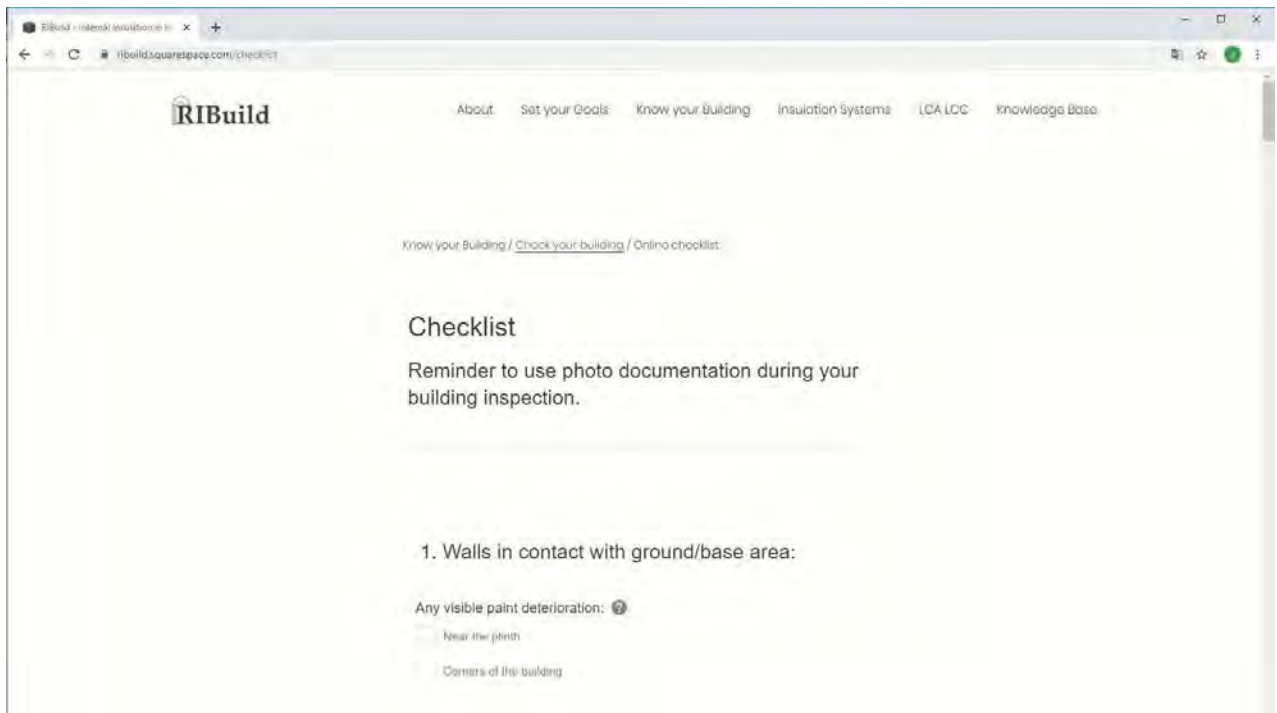
The video illustrates how to test the hygrothermal properties of bricks in a simple



- **Check your building** presents two checklists for building assessment



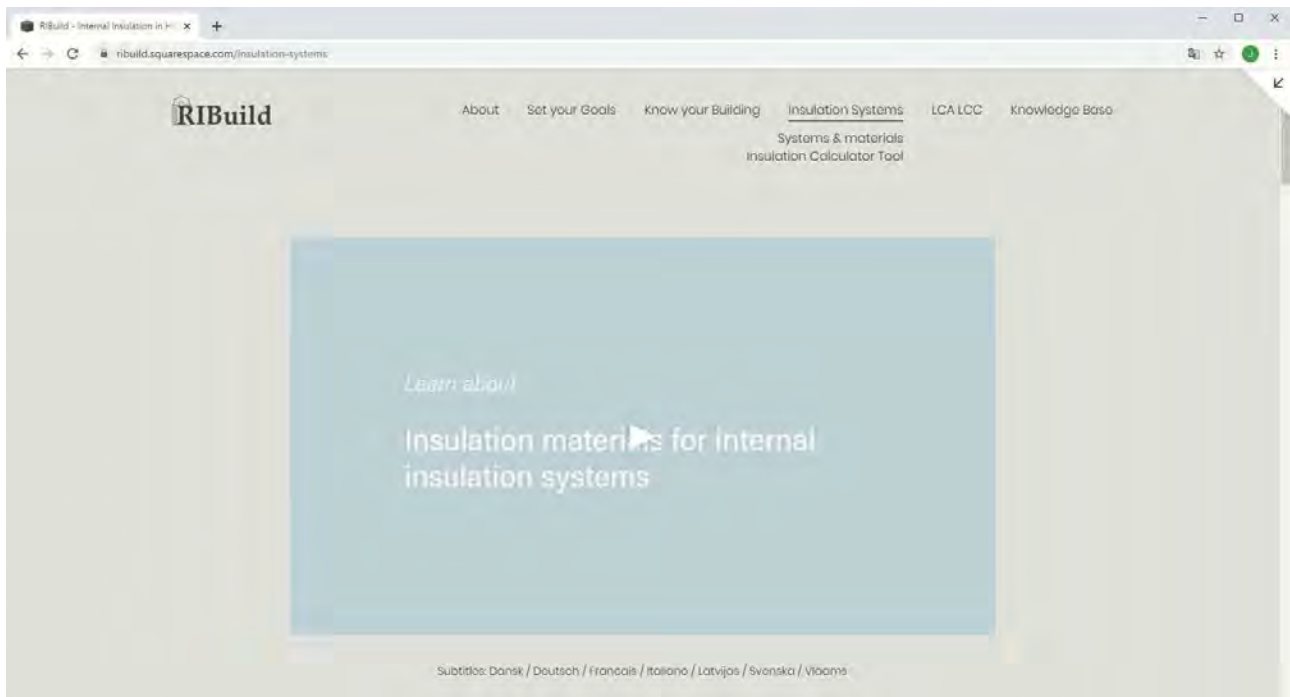
- **Basic checklist** corresponding to first level of knowledge on the website holds yes-no-questions, possible to answer online or on print. Mouse-over function elaborates each question with text and photo. Final replies can be sent directly to personal mail



- **Detailed checklist** corresponds to professional expertise and knowledge from second level (D6.2), aimed at building professionals with elaborated knowledge and need for specific drawings and notes during assessment, therefore in a printable version

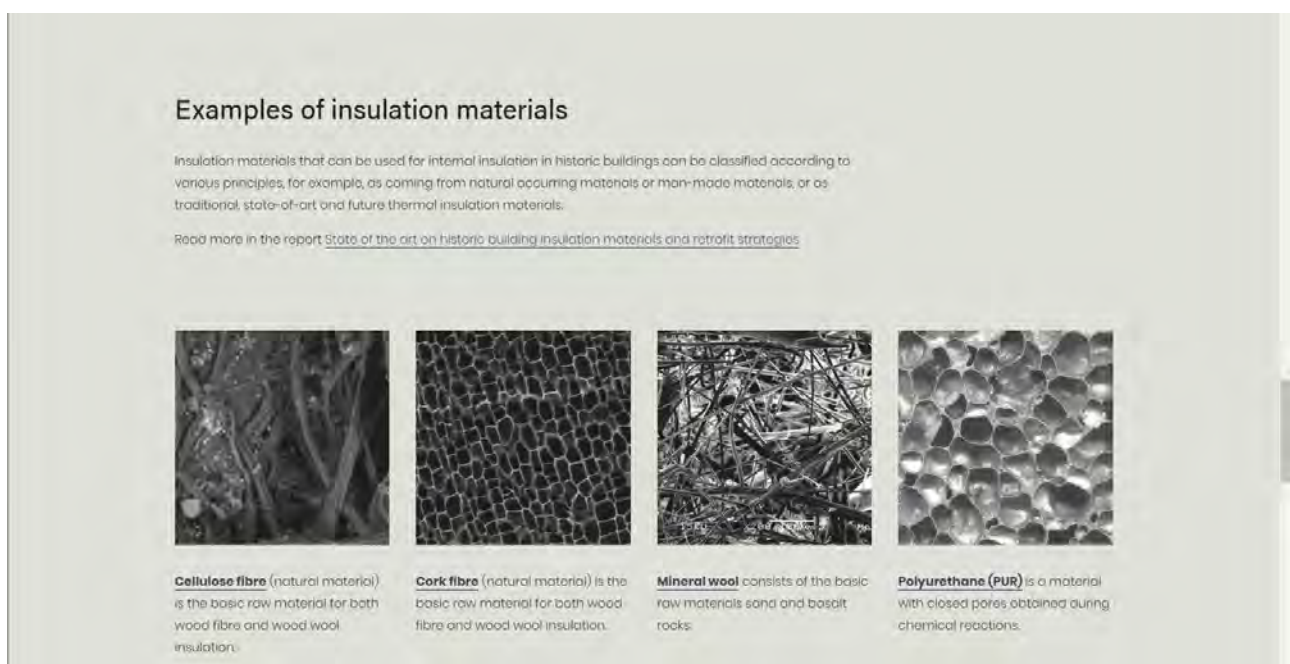


## Guideline 3: Insulation Systems

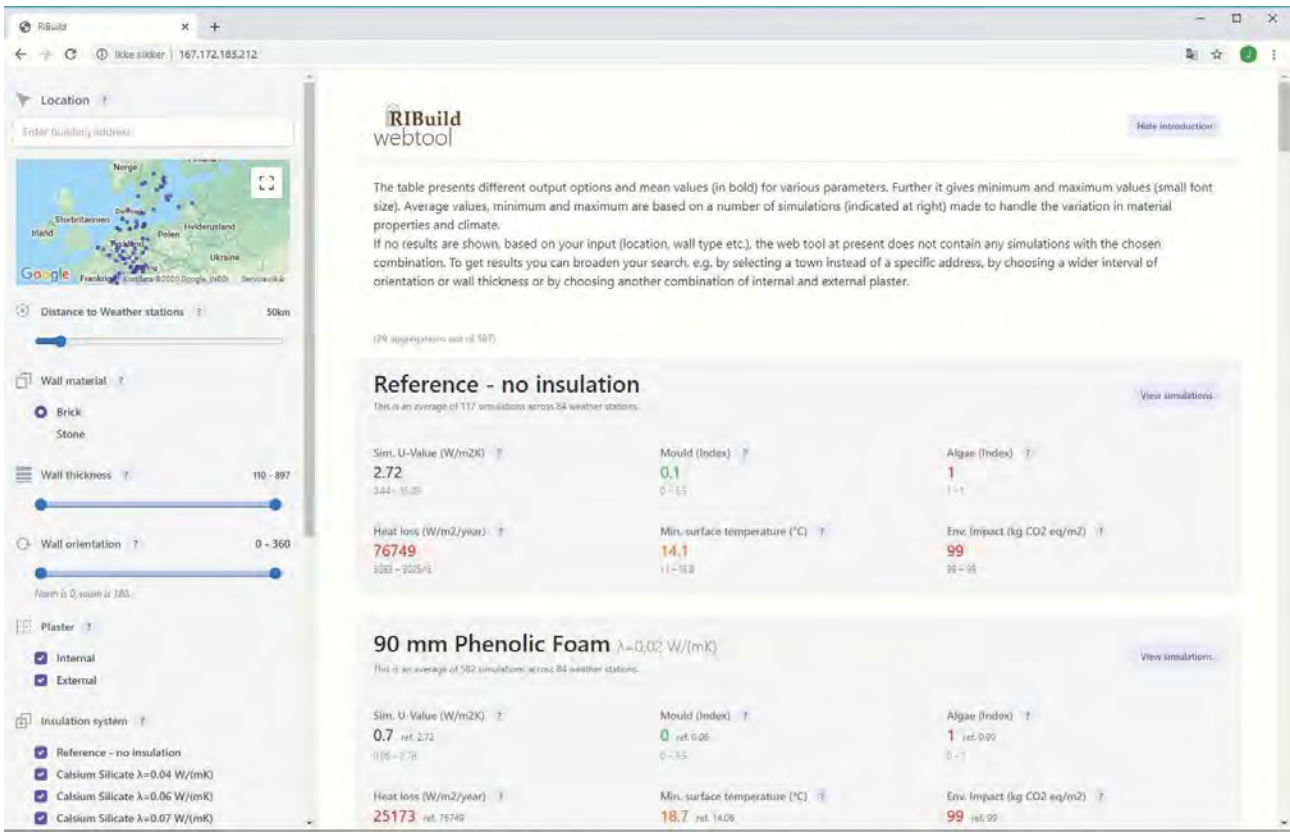


*Systems & materials* presents

- The main types of systems; vapour-tight and vapour-open internal insulation systems through text, table and illustration
  - Phases in the installation procedure
  - A photo gallery of examples of insulation materials
- Clicking on the different materials will lead to an extended description of the qualities of each material. A interlink leads to deliverable D1.2 with research on insulation materials



**Insulation Calculator tool** is a direct link to the WP6 web tool (beta-version) presenting suitable insulation systems for a specific building case.





## Guideline 4: LCA LCC

- Presentation of knowledge for evaluating energy saving potential, environmental impact and life cycle costs through text and flow chart
- Interlinks lead to deliverable D5.1 and D5.2 presenting documentation for the probabilistic methodologies for calculation of building life cycle and costs

The screenshot shows a web browser window displaying the RIBuild website. The page title is "Guideline for evaluating energy saving potential, environmental impact and life cycle cost". The navigation menu includes "About", "Set your Goals", "Know your Building", "Insulation Systems", "LCA LCC", and "Knowledge Base". The main content area features a heading "Guideline for evaluating energy saving potential, environmental impact and life cycle cost" followed by two paragraphs of text. The first paragraph describes the LCA and LCC probabilistic methodology developed and documented in the "Probability Based Life Cycle Impact Assessment" report and the "Probability based Life Cycle Cost" report, implemented into a software tool. The second paragraph states that the software tool can be used to assess other possible renovation measures than internal insulation. A "Read more" button is located below the text. To the right of the text is a flowchart diagram titled "Guidelines:" which shows a process flow from "Probabilistic hygrothermal assessment and DCLPWH (precalculated based on a dataset)" to two output boxes: "Outputs for the fundamental guidelines" and "Outputs for the energy saving potential of the building".

- *Start here* leads to the LCA LCC-tool
- Specification on the related consequences of the energy saving potentials and life cycle costs of the hygrothermal optimized insulation solution

The banner features a background image of a large, classical-style white building with a green lawn in front. The text "LCA / LCC tool" is prominently displayed in white. Below it, a smaller line of text reads: "A software tool developed using the open source software R. The software tool includes both the LCA and LCC Monte-Carlo based methodologies developed in the project." A white button with the text "Start here" is positioned at the bottom left of the banner.

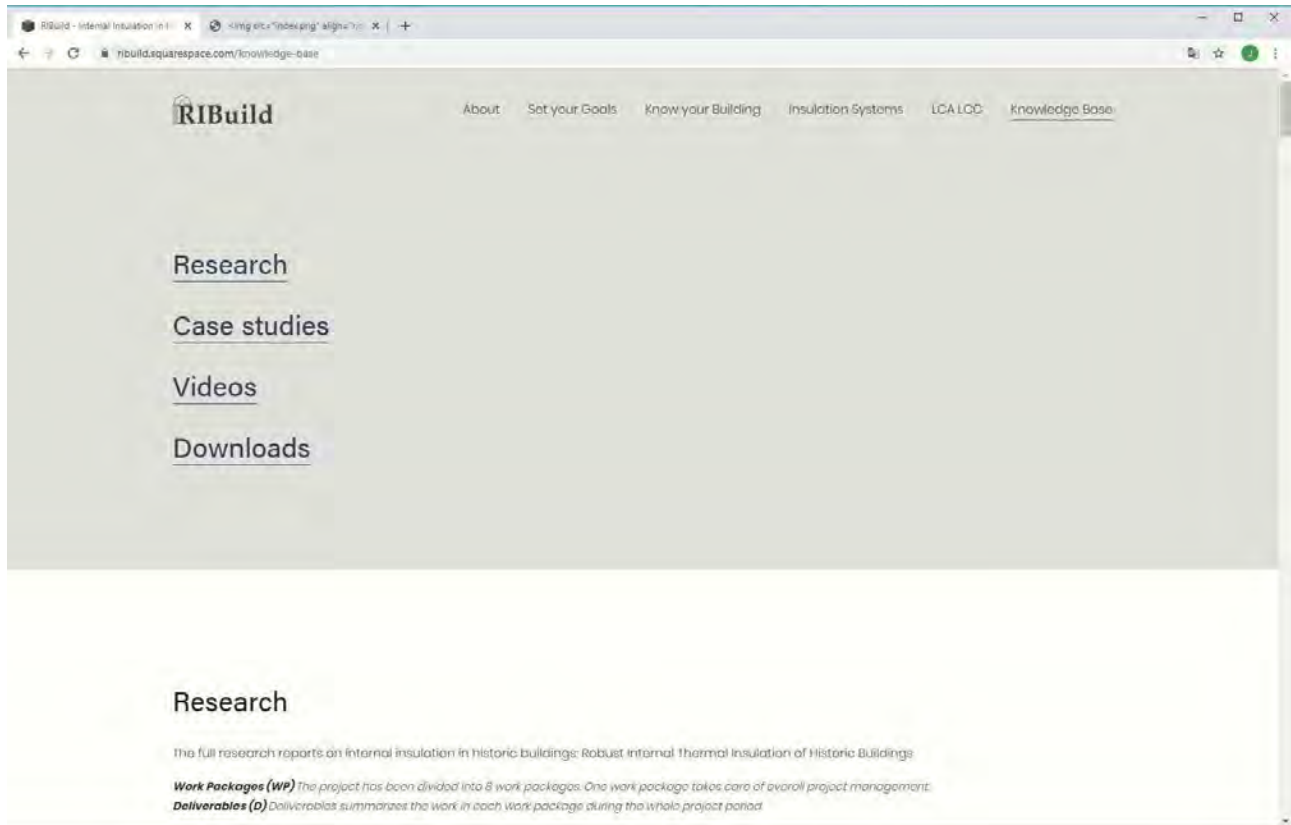
## About LCA & LCC

In addition to the insulation systems recommended by the RIBuild Insulation Calculator [Tool](#), it is advisable to understand the related consequences of the energy saving potentials in terms of greenhouse gas emissions and life cycle costs of the

## Knowledge base

Contains a RIBuild research library with easy overview and access to research materials:

1. Link to the publication base with all scientific publications prepared as part of RIBuild
2. Research deliverables (reports) from all project WPs



## Research

The full research reports on internal insulation in historic buildings: [Robust Internal Thermal Insulation of Historic Buildings](#)

**Work Packages (WP)** The project has been divided into 8 work packages. One work package takes care of overall project management.

**Deliverables (D)** Deliverables summarizes the work in each work package during the whole project period

Research data

Publication base

### WP1: Pre-renovation assessment

Examines common structural elements of historic buildings, determines their physical properties and classifies them according to type. The objective is

### WP2: Material characterisation

Provides data for material properties and threshold values for historic building materials and existing insulation materials as a background for material

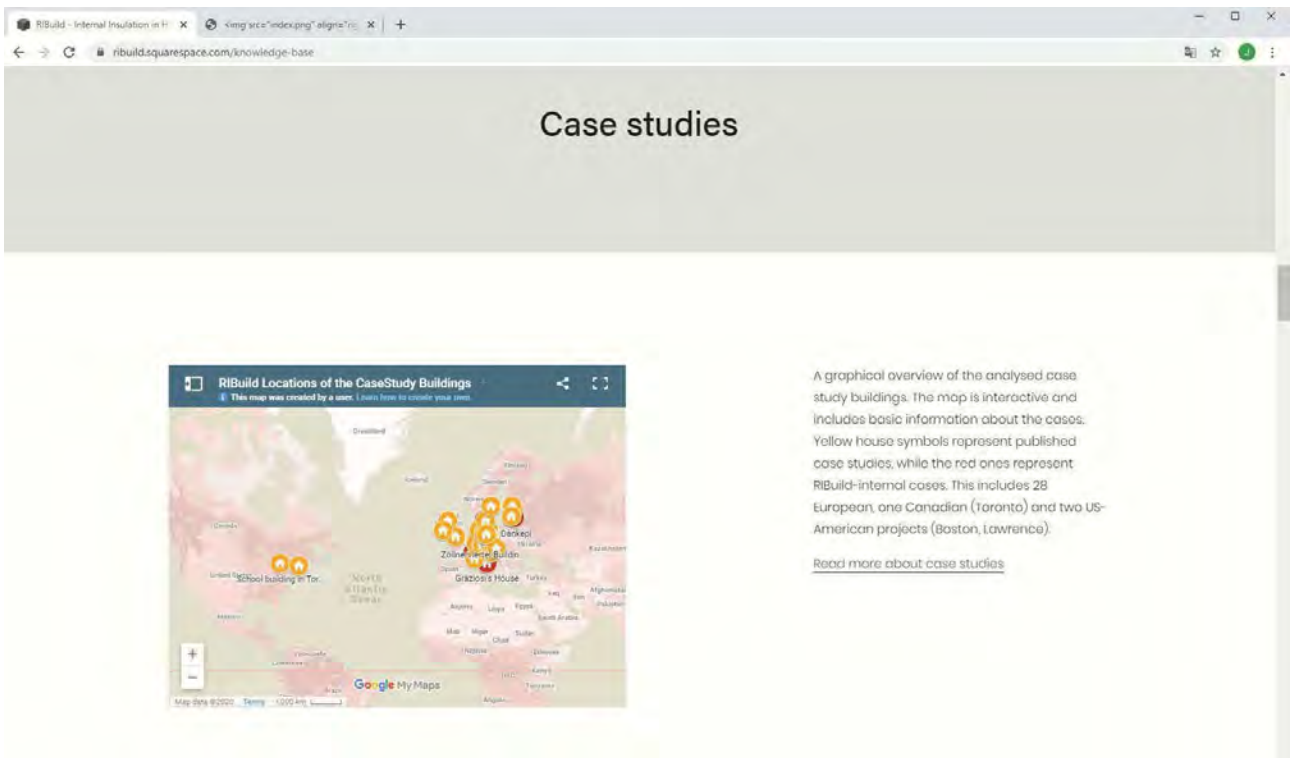
### WP3: Case studies and laboratory measurements

Supports the research with high quality measurement data from both laboratory experiments on components and on-site

### WP4: Probabilistic assessment of internal insulation solutions

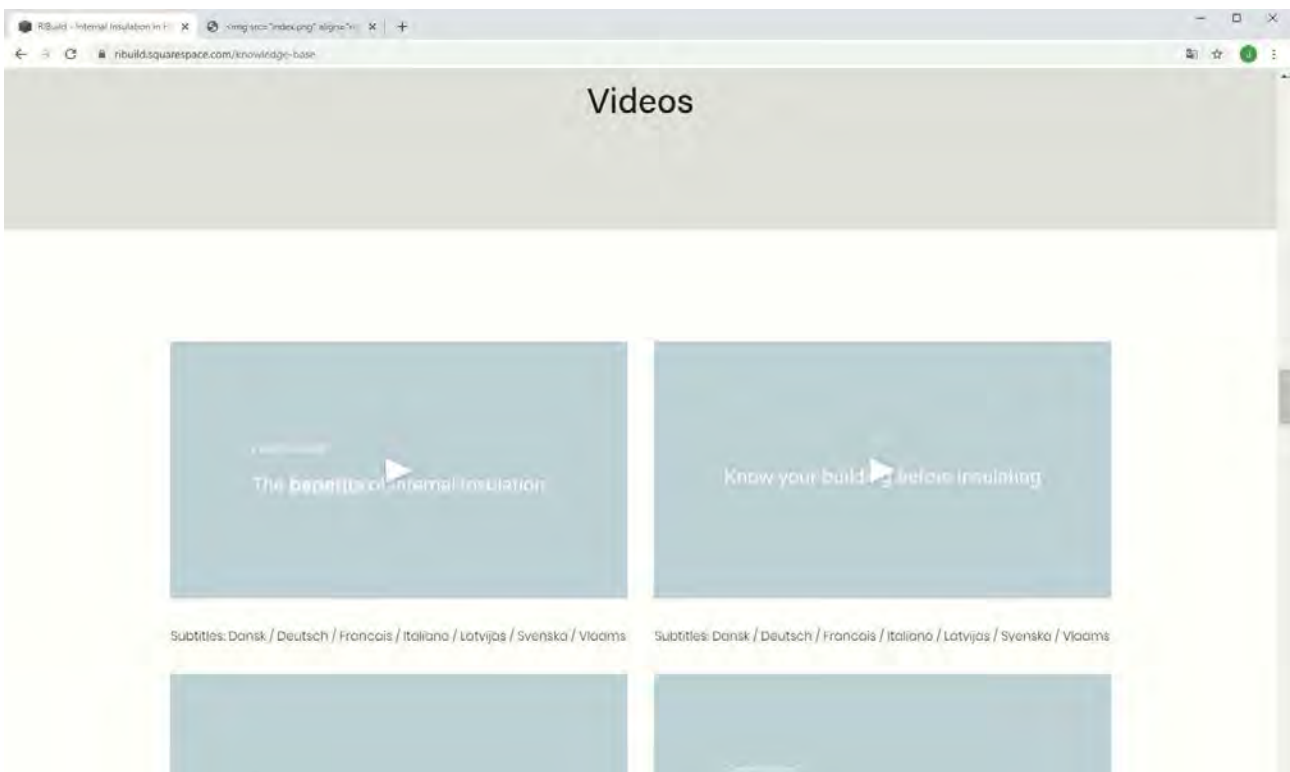
Develops an efficient strategy for the probabilistic hygrothermal assessment of internal insulation solutions.

### 3. Case-studies through an interactive map and a interlink to D3.2

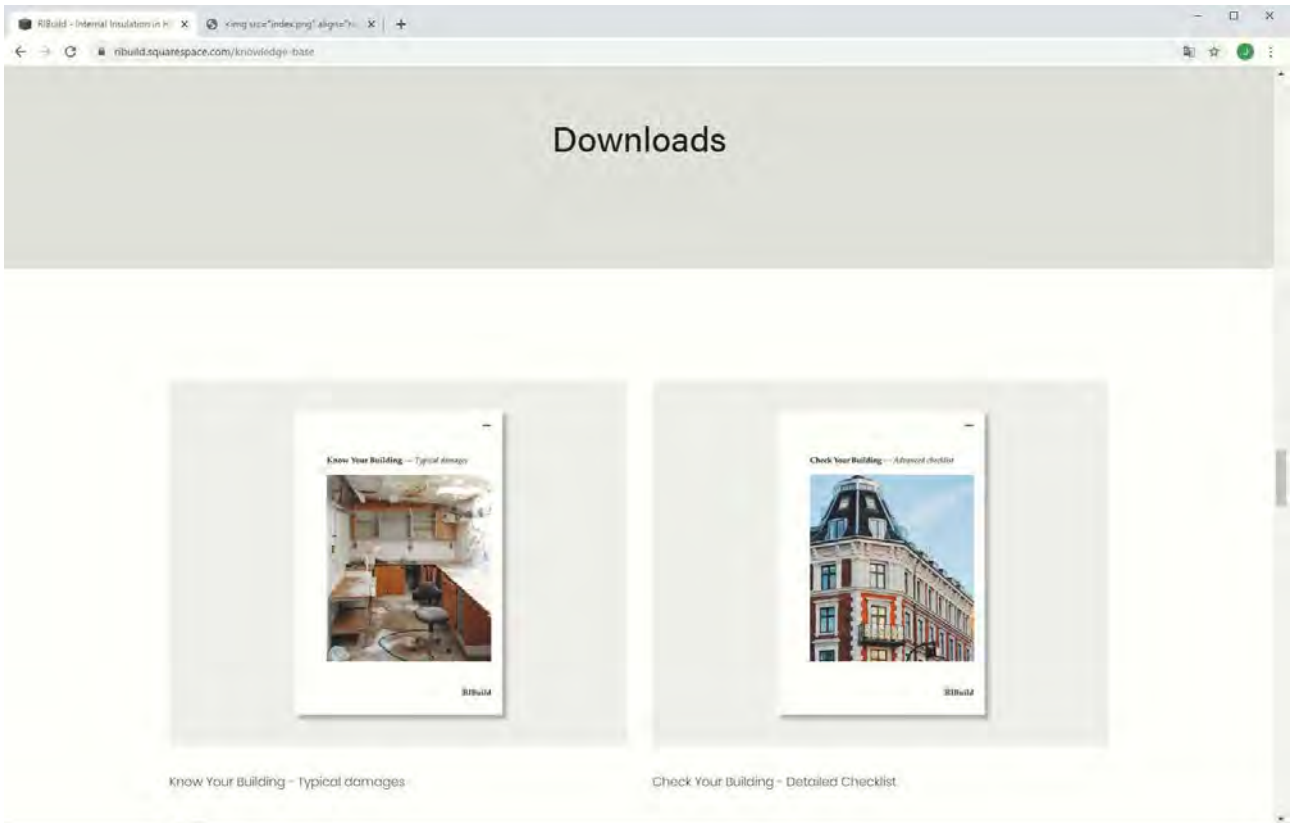


### 4. Videos with case examples

### 5. Videos explaining the RIBuild-project



- 6. Downloads covering information on Typical damages, Detailed Checklist, DIY materials test and Information folder for print or online reading



- 7. *Research data* includes a link to research data from RIBuild (e.g. measurement data from test stands etc. and data for historic building materials)

## Research

The full research reports on internal insulation in historic buildings: [Robust Internal Thermal Insulation of Historic Buildings](#)

**Work Packages (WP)** *The project has been divided into 8 work packages. One work package takes care of overall project management.*

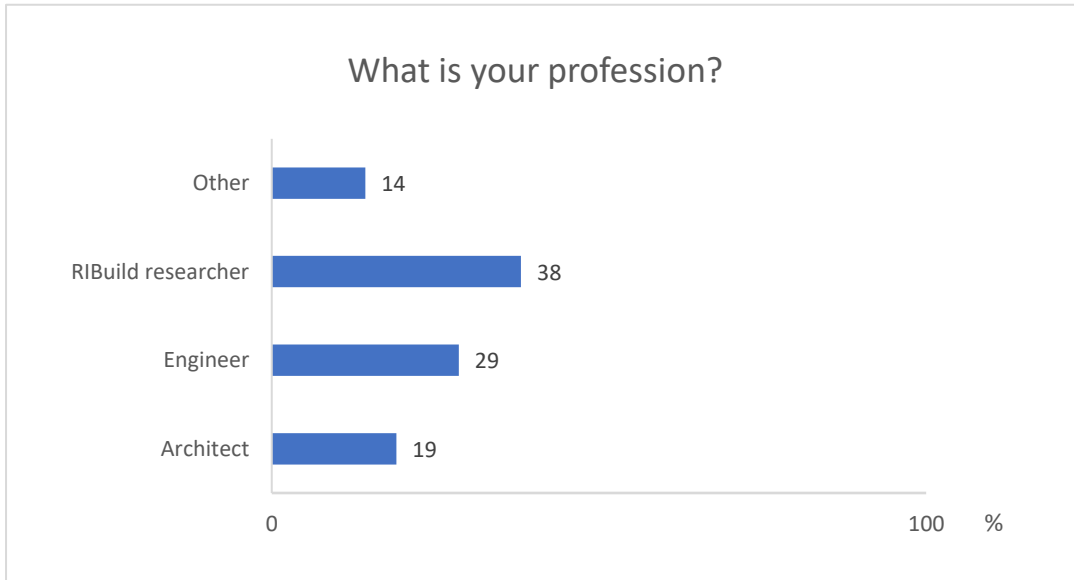
**Deliverables (D)** *Deliverables summarizes the work in each work package during the whole project period*

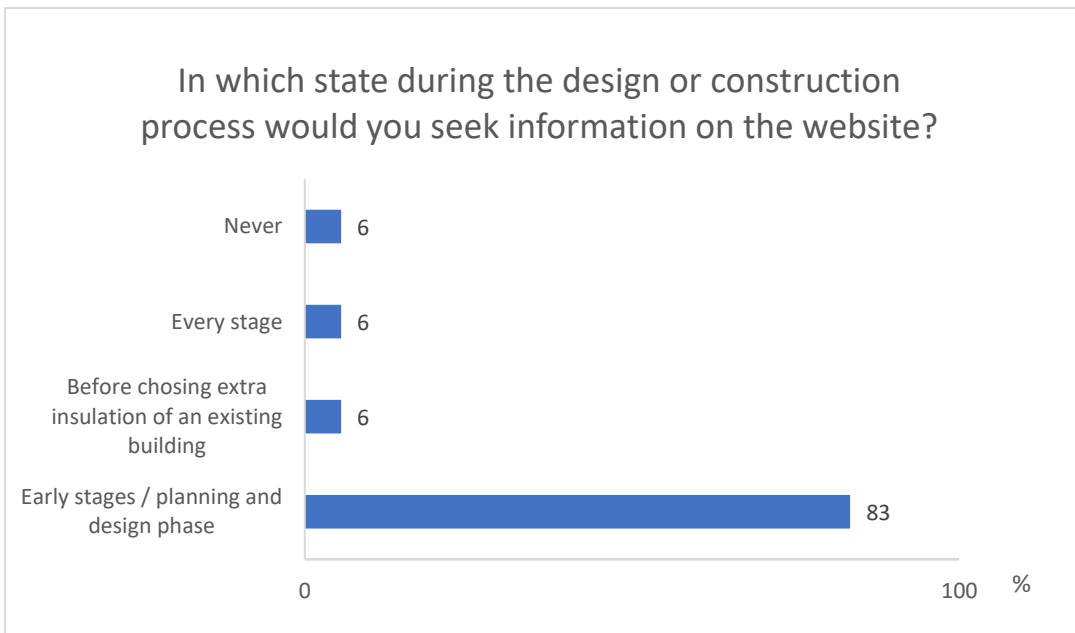
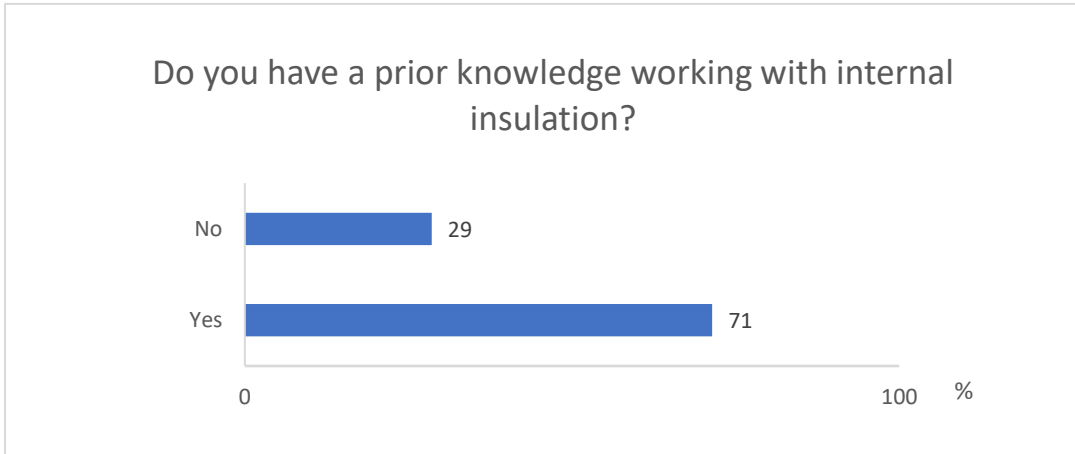
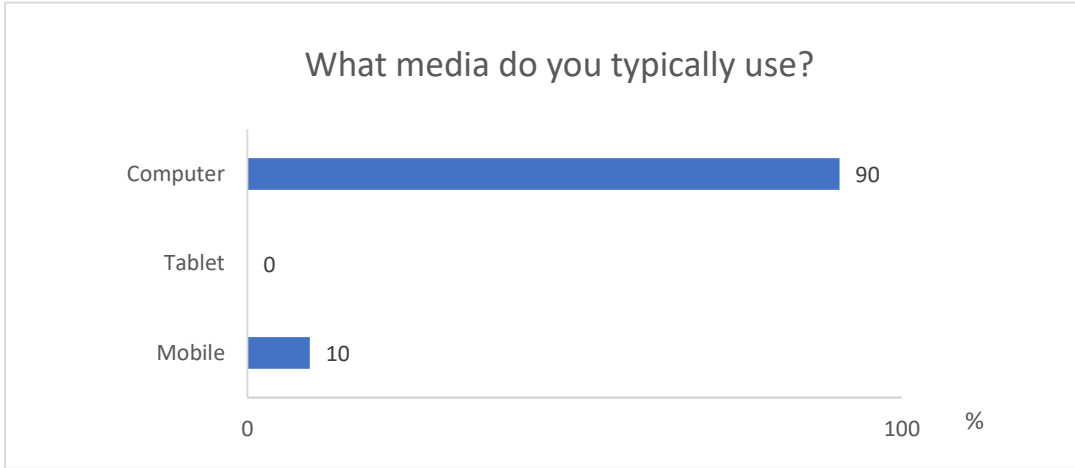
[Research data](#)
[Publication base](#)

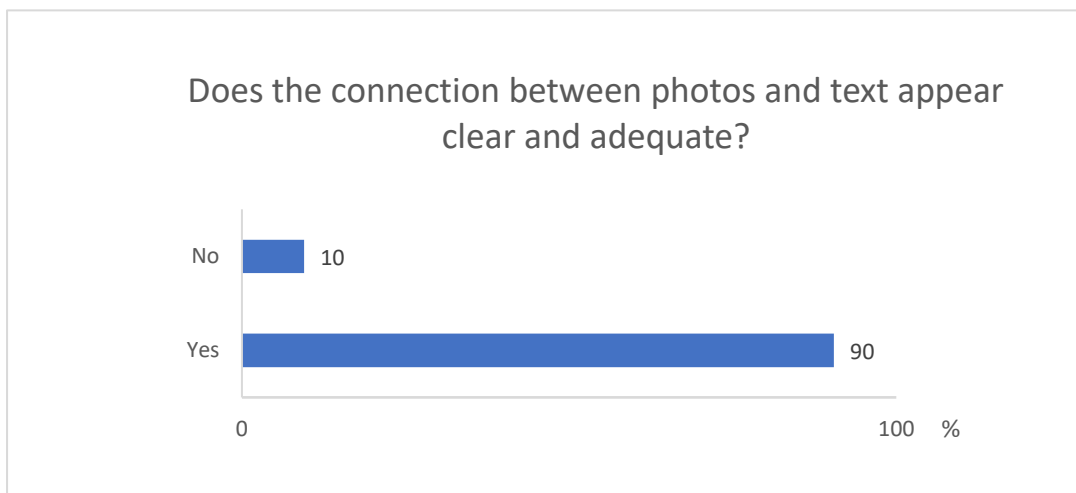
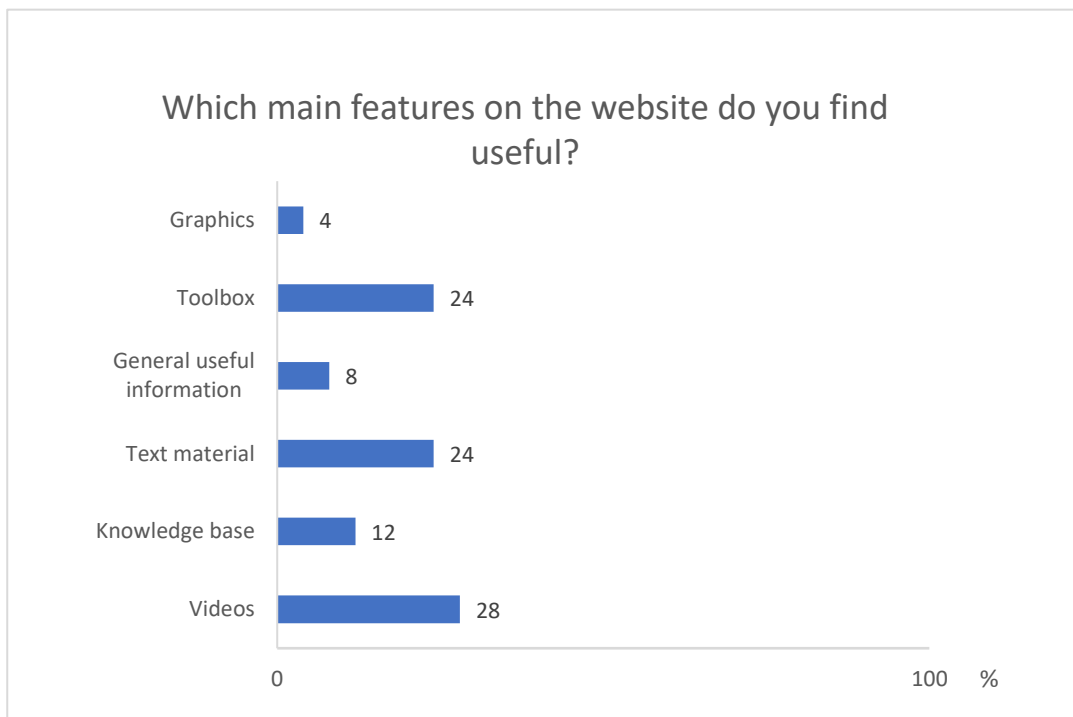
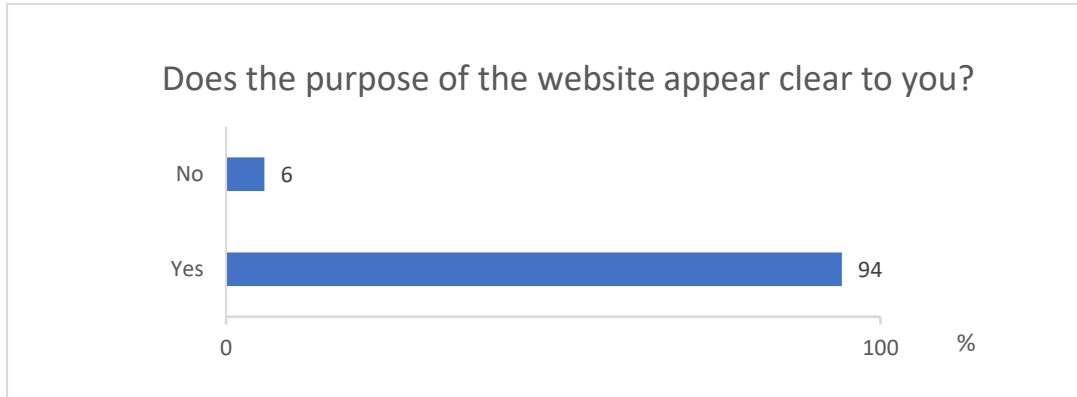
<p>WP1: Pre-renovation assessment</p>	<p>WP2: Material characterisation</p>	<p>WP3: Case studies and laboratory</p>	<p>WP4: Probabilistic assessment of internal</p>
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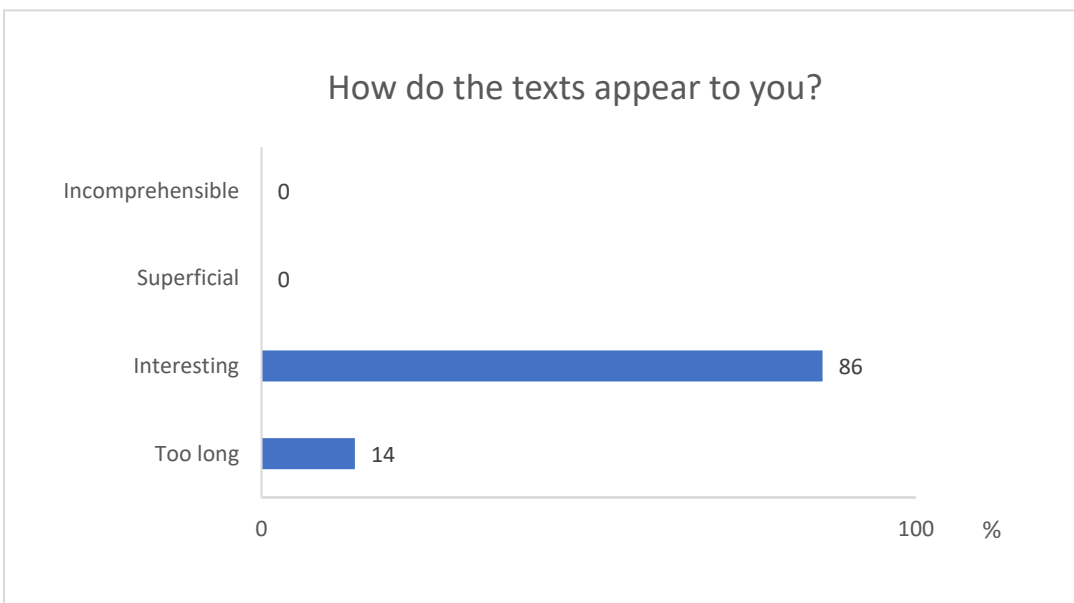
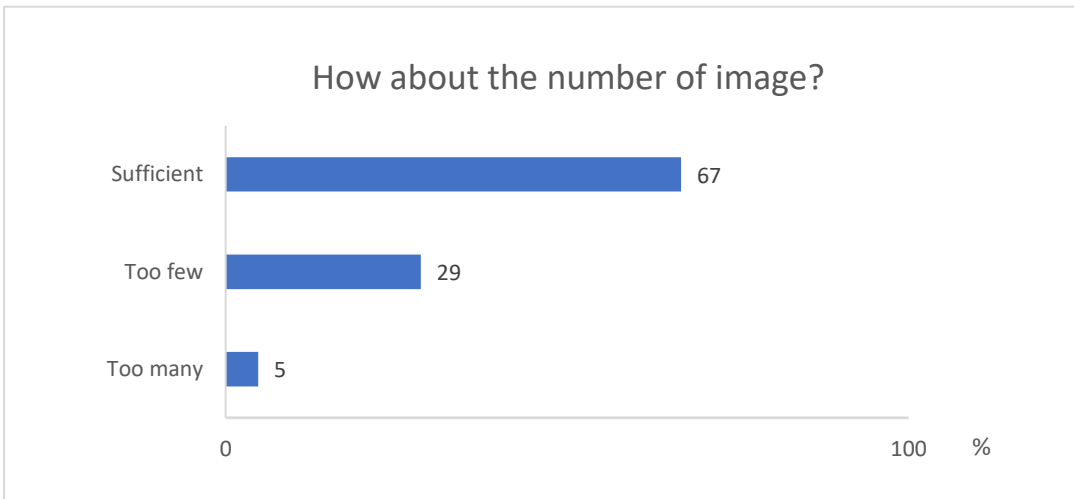
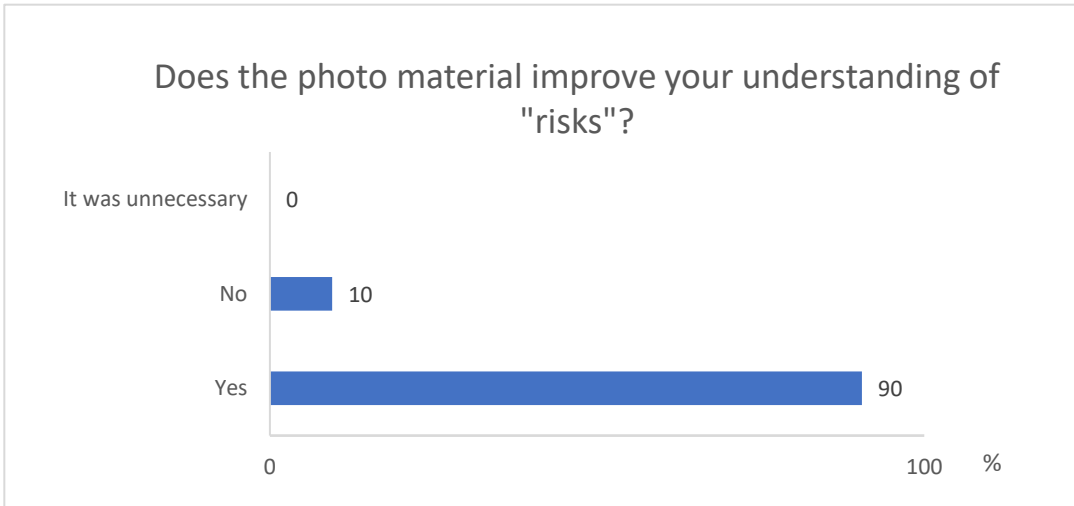
## Appendix B: Graphic summary of replies in user test

Based on the user test, some of the previous titles and features have been changed and might not be in accordance with the present material on the website.

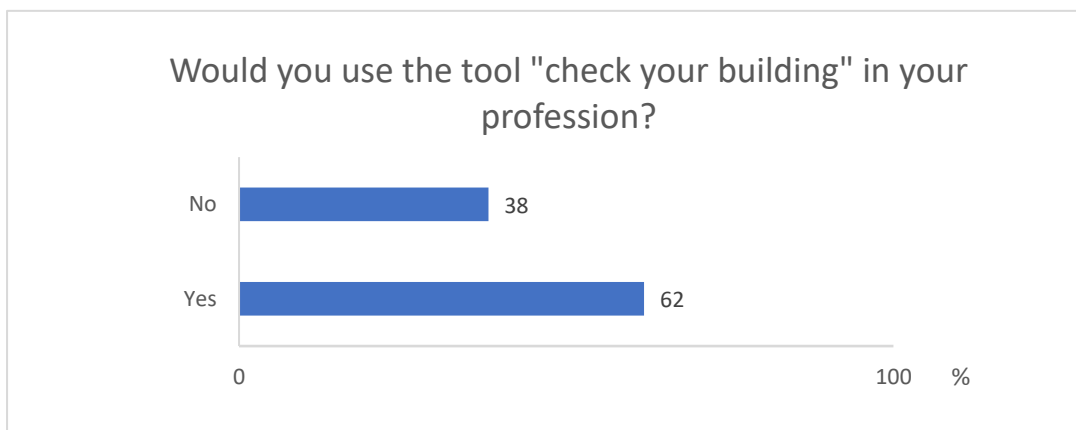
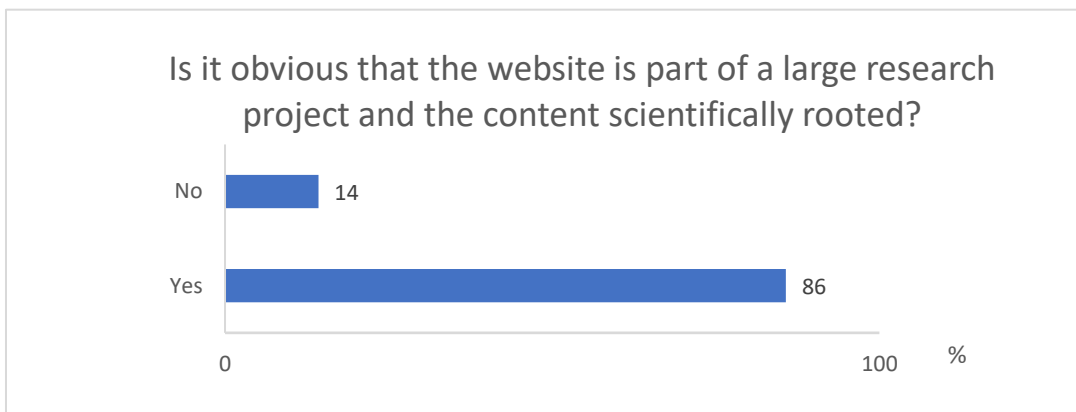
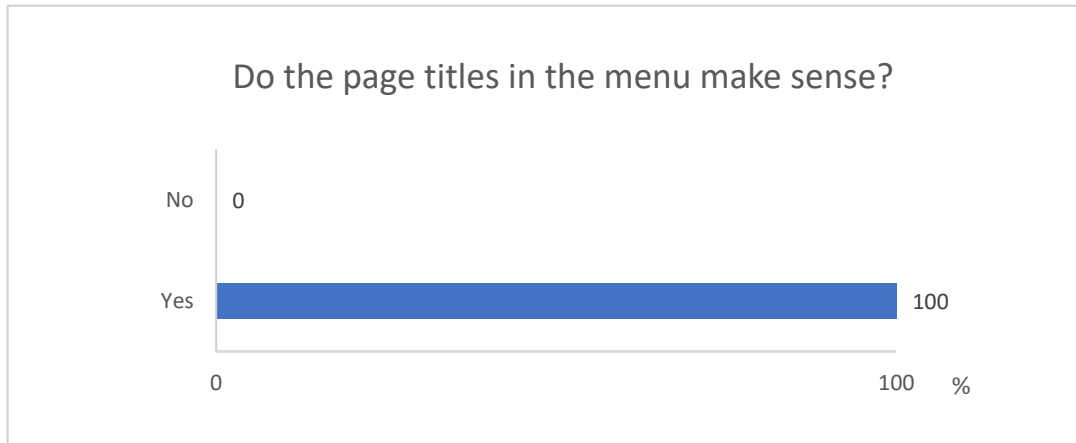


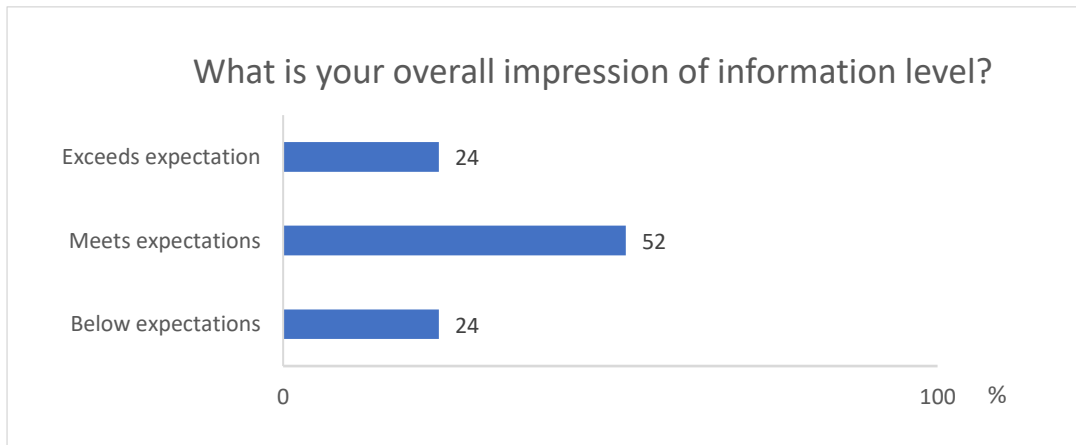
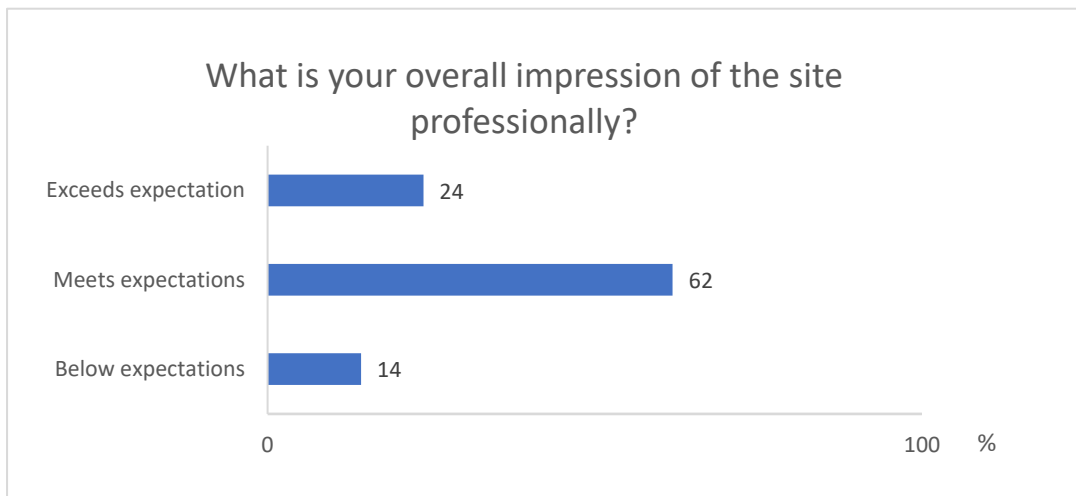
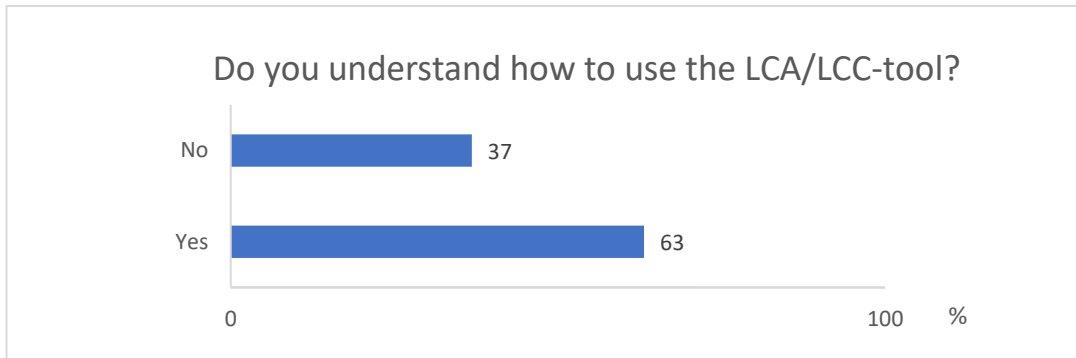


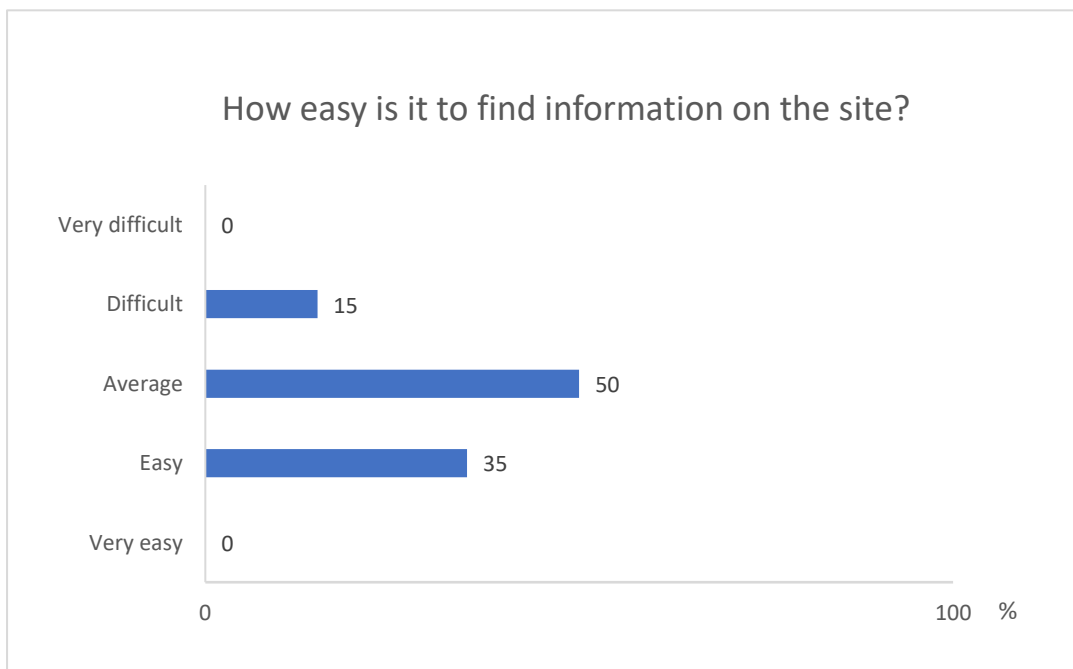
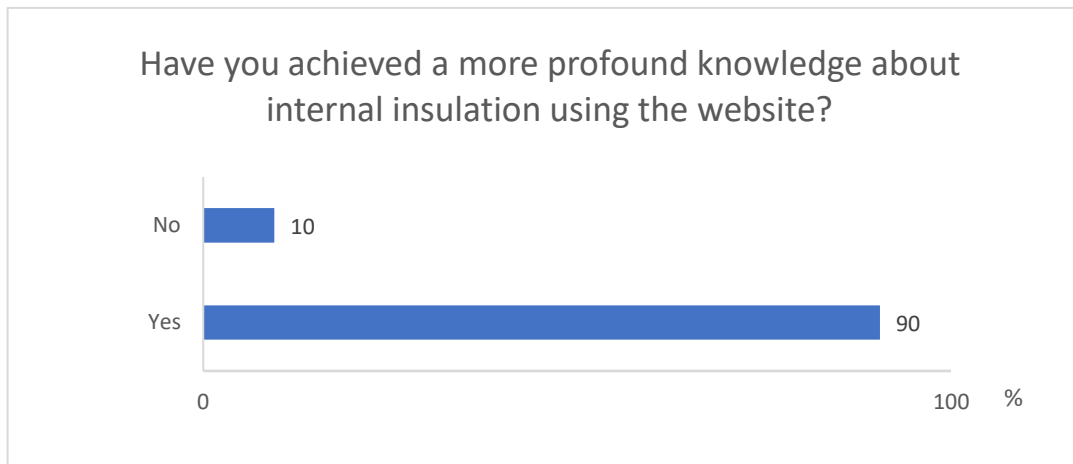
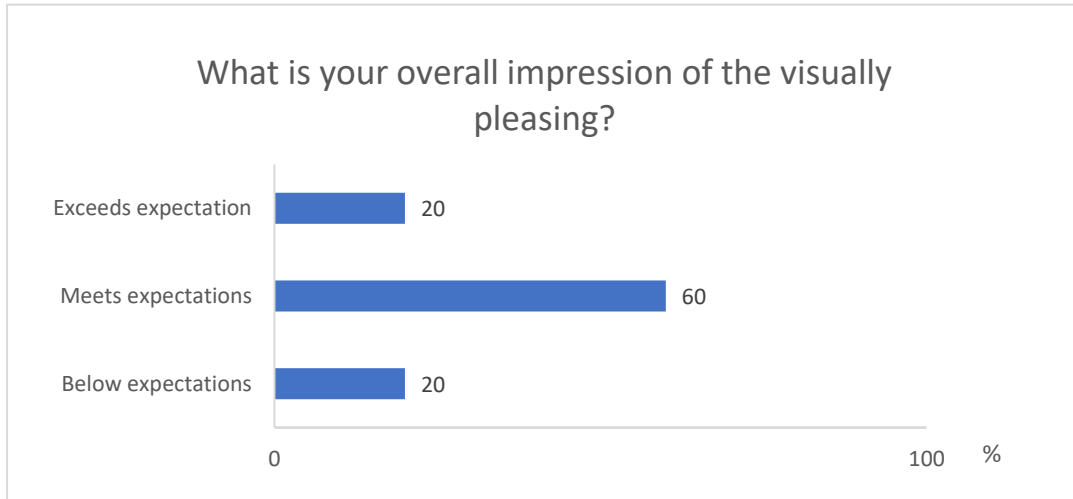














## Appendix C: Summary of individual comments from user test

Summary of replies to questions with individual comments.

### Confusion regarding the purpose of the website

- If the goal is supporting the internal insulation project planning, a step by step procedure could be more emphasized: 1. assess your building, 2. select and evaluate the insulation system. Now all seems a bit "flat"
- Lack of overview. Lot of scrolling if needed to find stuff
- The general build-up of pages is hard to get an overview of. The page does not have a specific target person it addresses. It is somewhat to advance for being a tool. Could be an option to choose line of work/competence level.
- The pages are too big for the provided content. you don't get a good overview on what each page is providing
- The videos talk about steps/RIBuild guidelines. I couldn't find these guidelines / I couldn't find the answer to which type of insulation is recommended for different types of walls/buildings

### Notes for photo material improving the understanding of "risks":

- I suggest adding pictures on the insulation systems (e.g. extracted from the videos, or real pictures of materials)
- The photos are great for comparison. Maybe a click-function would come in handy so that the photos can be seen in a larger scale. The photos and explanation text in context of "Check your building" were very helpful.

### How do the texts appear?

- They seem adequate to me. Particularly, I find the "*Read more*" function intelligent so as to give the possibility to deepen without "frightening" the user on the main screen
- Quite long, maybe abstract could be useful
- To get an overview, you need a combination of short introductory texts and longer descriptive ones.
- The page is a mix of project page knowledge base and tool. It should be more of a tool. Maybe separate pages would make it more comprehensible
- Confusing, very little text on the screen. You need to scroll a lot to find anything
- Text is well written and not too heavy on an inexperienced reader of the subject. I find it easier to read when there is diagrams and photos emphasizing the point. The diagrams on page for "Planning documents" is well informing and makes it clear.
- I think the photos are too big in relation to the text, yet the explications of the text are necessary
- I think the connection between the videos and the text was sometimes lacking. I think the text should be more connected the videos, and also explain in a deeper way what the video is saying.

### *Perspectives on colour-representation of knowledge level*

#### Page titles in the menu that does not make sense:

- Maybe too short... I suggest "Assess your building" instead of "assessment" or "select the insulation systems" instead of "insulation systems"
- How is "Assessment" related to "Check your building"?

- I think it would be more understandable if the page titles were for example "Step1 Registration, step 2 choice of insulation materials" and so on...

### **Who do you perceive as sender of the website?**

- Good question! Difficult to answer... us (RiBuild partners and supporters), professional bodies of architects and engineers, national organization on thermal insulation
- Considering the way, the site is set up, I would say it is intended to be referred to professionals or researchers
- Building Professionals
- The RiBuild project
- I perceive that the team of the project is the website sender.
- The research Project. It could be made clearer by putting at top banner on the landing page with the partners in the project.
- Architects, engineers and academics
- The companies represented by loo and mainly researcher Ernst Jan de Place Hansen
- RiBuild - could be more explicit in the "About" section, maybe a clearer view of the influencing parts / the sender of the website. "Research" section + diagram could maybe be highlighted to accommodate this, because this explains the huge amount of research you have done.
- I find it written in a suitable neutral style, signalling not to be a producer-based website. It is explaining to the reader how to assess a building etc. not focusing on specific products. It is mentioned at the landing page that the website is part of an EU-funded research project
- Institutions with an interest in restoring and keeping buildings alive.
- EU. Different universities.

### **When would you use the LCA/LCC-tool?**

- The tool cannot be installed by not-experts! It is written in a R code! The tool has been developed to be used through a web link. In the last months we agreed that it would be hosted in the same computer as the RiBuild web tool, hence in the RiBuild website when the user click on the LCA/LCC tool, it automatically starts.
- To support general evaluation concerning consequences of the energy saving potentials
- I was able to download a lot of files. After ten minutes I still don't understand what to do
- I would use the LCA/LCC-tool in design process that involve environmental certification protocols.
- To guide the project choices
- When starting up a project
- when required by the building project
- For the right project, I would use the tool for dialog with building owners (the costumer) and building workers to achieve the right focus and solution to a problem.
- LCA/LCC is not part of my professional work 'Check your building' is relevant for my teaching of master students
- For decision making
- In the designing stage
- When choosing energy saving solution
- To determine the life cycle and lifetime of the insulation material I would choose...

## In which situations would you use the print material and how could it be improved?

- It is interesting. I would add a booklet on insulation systems typologies and hygrothermal behaviour (highlighting pros and cons). It could be showed by professionals to customers.
- I think it should be clearer that within the full report you can find the guidelines. I would therefore recommend creating separate files for each of them and make the word "guideline" visible in the title so that it can be immediately clear to the user.
- I think that the documents can be used in a preliminary phase but also in the construction/retrofit process as they are.
- The full report could be developed into a useful handbook, printed or not.
- I think that the print material could be very useful to make customers aware about risks of mould, wood rot, frost damage, salt efflorescence, algae and rising damp in the very preliminary state of design process or in checking existing buildings. The material could be very useful to illustrate the solutions that can be used.
- During the design stage. Maybe adding schemes and summary pages
- in order to convince someone (owner, contractor) to use the right interior insulation
- When starting up a project - and showing the material to the building owner.
- Making a digital version for dialog between different participants of a project would be useful.
- Check list: Consider to have photos illustrating the different parts of the check list (I am mainly thinking about the check list on-line as part of Toolbox' Know your building: This will be relevant in my teaching of students (Master in Building Physics) (as well as the rest of the website would be)
- For archiving and preservation of the content of the website. maybe on site also
- Hard to say, seems adequate
- I don't think I would use those. Maybe if it was case studies that were similar to a case, I was working on...

## Comments for improvement

- I would suggest giving more visibility to the interactive case study map, because it seems to me a marketable tool. When the "*Read more*" tap corresponds to a guideline, I would specify it in the link. For example: "*Read more* Guideline 3..."
- 1) Please check the typing of words, e.g. in <https://cylinder-lettuce-6xm3.squarespace.com/lcalcc>: "and life cycle costa sot " seems to be affected by mistakes 2) Include dynamic access to each profile in <https://cylinder-lettuce-6xm3.squarespace.com/setting-the-goals>
- General Do not link *read more* on bottom of page use links to documents inside text instead the "*Read more*" links should be able to find in more places. The movie material is good in general. The build and branching of the page is somewhat hard to grasp get an overview of and the principle of layering pages on top of each other is not helping. Landing page: An option to select languages on the landing page is a must, at least ENG, DEU, FRA, SWE A web page map in form of a tree/board of content would be practical for the navigation. There might be a point in separating the guideline/screening and tool on one webpage and the research project info on another and link between them to have two distinct platforms. Assessment Ingress would be useful and look good before movie. This part of the page has a massive amount of good information but is very layered and sometimes interlinked, i.e. for the moisture risk part. Insulation systems Would also benefit from an ingress before movie clip Is there really a need to address how to prepare and mount insulation, that's dependent of what choices are made etc. Focus on basic principles and the different materials and properties? For LCA and LCC it would be good with an ingress and a text that explains more in detail what LCA and LCC is. Sum up / general view on webpage It is

full of good information, but it is somewhat hard to get an overview and to navigate the page, it could need a cleaner more consistent build up. The main menus Assessment – Insulation systems – Toolbox – Knowledge base could be clickable and have an explanatory page for the section and its build up. The page should work as a tool in general not be a knowledge base. This could be separated into one user focused info project page with the knowledge and one tool page that links to the project page. The tool page and the project page could maybe complement each other. In general use ingresses on pages. “*Read more* links” that can also be found in the menus would be nice.

- should be better structured with more colours, more taps screen is almost empty...too much scrolling to find something
- Examples of how the insulation is mounted. And type of products.
- Implement a search engine on the site to find relevant documents by keywords
- I really like the simplicity and cleanliness of the graphic design of the page - more colour on would not harm. The website is in my opinion on its way to make a very complicated material easier to digest - yay! I would love to see more infographics and diagrams to explain the texts on the website and boost the information to the next level. For me pictures and graphics pin out the points and makes it easier to navigate on different subjects.
- I answered 'No' concerning whether I achieved a more profound knowledge, since I have been part of defining the content of the web page. Concerning specific comments, I refer to my mail sent at Mar 14 (right after midnight)
- General feel is that information is almost on the heavy side, straighter to the point would have been beneficial. I'm not entirely sure about the menu layout, assessments and toolbox contains similar information but one "online" and the other in print format. Insulation systems feel misplaced? Isn't that part of the knowledgebase and part of what I already know before coming here? Would a menu more geared towards stages like analyses / design / implement make more sense maybe? and then have tools and additional knowledge under a separate menu?
- I would visit again to try to find the answer to my central question - is internal insulation suitable in my project? I think it would be better if you had a diagram saying: If you have this type of wall with these types of properties you can use these kinds of insulation (a guideline of course). And then a diagram saying if you want to be certain you have to test the wall for the parameters (for example moisture, surface temperature etc.).