



DRAFT FINAL REPORT

36 MONTH
DELIVERABLE

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APPENDICES WP2

APPENDIX 2.2: Questionnaire on pathology sources and case study data

Section 1 – about you and your organisation

Name:

Job title:

Organisation name:

Address:

Date questionnaire completed:

Would you like a summary of the results?:

What type of organisation do you represent?
apply

Please tick all that

Government organisation	<input type="checkbox"/>
Housing organisation	<input type="checkbox"/>
Architectural practice	<input type="checkbox"/>
Construction company	<input type="checkbox"/>
Manufacturer	<input type="checkbox"/>
Retailer/merchant	<input type="checkbox"/>
Installer	<input type="checkbox"/>
Building inspection service	<input type="checkbox"/>
Certification organisation	<input type="checkbox"/>
Insurance company	<input type="checkbox"/>
Trade association	<input type="checkbox"/>
Professional institution	<input type="checkbox"/>
Other (please specify:)	<input type="checkbox"/>

Section 2 – about your data

1. Does your organisation collect data on:

Specific risks of certain technologies	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Defects and damages of a building	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Defects and damages of building components	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Defects and damages of construction products	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Insurance claims relating to construction damages/defects and technical causes	Yes <input type="checkbox"/>	No <input type="checkbox"/>

2. What kind of damages/defects does the data refer to?

Please tick all that

apply

Damages/defects/risks during the construction process	<input type="checkbox"/>
Liability of people involved in construction, such as builders, architects	<input type="checkbox"/>
10 year warranty damages/claims (arisen after handover of the building)	<input type="checkbox"/>
'Traditional risks (e.g. fire, storm, water leakage, collapses)	<input type="checkbox"/>

'Non-traditional' risks (e.g. performance not as claimed)	<input type="checkbox"/>
Other (please specify:)	<input type="checkbox"/>

3. Do you collect data on these types of buildings?

Residential homes	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Other buildings	Yes <input type="checkbox"/>	No <input type="checkbox"/>

4. How do you collect the data?

Please tick all that

apply

Technical reports by your own inspectors	<input type="checkbox"/>
Technical reports submitted by external experts	<input type="checkbox"/>
Data from insurance companies	<input type="checkbox"/>
From your own claim records	<input type="checkbox"/>
Other (please specify:)	<input type="checkbox"/>

5. Why, or for whom, do you collect the data?

Please tick all that

apply

Building inspection services	<input type="checkbox"/>
Insurance companies	<input type="checkbox"/>
Housing organisations	<input type="checkbox"/>
Government organisations	<input type="checkbox"/>
Private initiative	<input type="checkbox"/>
Other (please specify:)	<input type="checkbox"/>

6. Do you have a database for storing this data?

	Yes <input type="checkbox"/>	No <input type="checkbox"/>
When did you start collecting data?	_/_/____	

7. Do you carry out any statistical analysis of the data?

	Yes <input type="checkbox"/>	No <input type="checkbox"/>
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8. Do you publish information about the data on the web, in a newsletter or in other publications?

	Yes <input type="checkbox"/>	No <input type="checkbox"/>
If yes, please specify the web address and/or name of the publication(s):		

9. Do you make the data publically available?

Only summary data	Yes <input type="checkbox"/>	No <input type="checkbox"/>
All raw data	Yes <input type="checkbox"/>	No <input type="checkbox"/>
All raw data, but made anonymous	Yes <input type="checkbox"/>	No <input type="checkbox"/>

Section 3 – specific data

10. In our study we wish to collect data on the technologies listed below. If you have information on the typical risks, damages or defects related to these technologies, please enter the number of installations in the table below.

<i>Eco-technology</i>	<i>Do you have information on risks, damages or defects?</i>	<i>Approximately how many installations do you have information on?</i>	<i>How many of these installations have had defects?</i>	<i>On how many of the installations has performance been comprised?</i>
Energy production				
1. Photovoltaic panels (PVs)	Yes <input type="checkbox"/> No <input type="checkbox"/>			
2. Ground source heat pumps	Yes <input type="checkbox"/> No <input type="checkbox"/>			
Energy conservation				
3. Double skin curtain wall / façade	Yes <input type="checkbox"/> No <input type="checkbox"/>			
4. Mechanical ventilation with heat recovery (MVHR)	Yes <input type="checkbox"/> No <input type="checkbox"/>			
5. Vacuum-insulated panels (VIPs)	Yes <input type="checkbox"/> No <input type="checkbox"/>			
6. Bio-materials, e.g. Straw, hemp, sheep's wool	Yes <input type="checkbox"/> No <input type="checkbox"/>			
7. Paper based insulation, e.g. Warmcell	Yes <input type="checkbox"/> No <input type="checkbox"/>			
Water				
8. Rainwater harvesting, incl.	Yes <input type="checkbox"/> No <input type="checkbox"/>			

Catchment basins & Grey water re-cycling				
9. Green or brown roofs	Yes <input type="checkbox"/> No <input type="checkbox"/>			
Other sustainability-related technologies				
10. Low VOC materials, e.g. paints, kits & glue	Yes <input type="checkbox"/> No <input type="checkbox"/>			

Section 4 - technology-specific issues for specific technologies. Please duplicate this page once for each technology that you have indicated in section 3 above.

TECHNOLOGY (enter here:)

<i>Possible cause of failure</i>	<i>Do you have experience of this reason for failure?</i>	<i>How many of the installations indicated above have failed for this reason?</i>	<i>How might this cause of failure be avoided, to reduce the risk in future?</i>
Requirement management			
a) Change in client's requirements	Yes <input type="checkbox"/> No <input type="checkbox"/>		
b) Misunderstanding of the effectiveness of the technology	Yes <input type="checkbox"/> No <input type="checkbox"/>		
c) Poor project management	Yes <input type="checkbox"/> No <input type="checkbox"/>		
d) Inaccurate engineering or architectural data	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Delivery issues			
e) Late delivery	Yes <input type="checkbox"/> No <input type="checkbox"/>		
f) Storage issues	Yes <input type="checkbox"/> No <input type="checkbox"/>		

g) Awkward packaging	Yes <input type="checkbox"/> No <input type="checkbox"/>		
h) Poor transport of product	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Installation problems			
i) Incorrect design for installation	Yes <input type="checkbox"/> No <input type="checkbox"/>		
j) Incorrect installation documentation	Yes <input type="checkbox"/> No <input type="checkbox"/>		
k) Failure in installation	Yes <input type="checkbox"/> No <input type="checkbox"/>		
l) Commissioning failure	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Operational failure			
m) Product failure once installed	Yes <input type="checkbox"/> No <input type="checkbox"/>		
n) Incorrect user documentation	Yes <input type="checkbox"/> No <input type="checkbox"/>		
o) Misuse of product by end- user	Yes <input type="checkbox"/> No <input type="checkbox"/>		
p) Performance not as claimed	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Other reasons for failure			
q)	Yes <input type="checkbox"/>		
r)	Yes <input type="checkbox"/>		
s)	Yes <input type="checkbox"/>		
t)	Yes <input type="checkbox"/>		
u)	Yes <input type="checkbox"/>		
v)	Yes <input type="checkbox"/>		
w)	Yes <input type="checkbox"/>		
x)	Yes <input type="checkbox"/>		
y)	Yes <input type="checkbox"/>		
z)	Yes <input type="checkbox"/>		

Section 5 – ELIOS II

11. Do you think a European-wide database on typical risks and building pathology for sustainable construction and eco-technologies would be useful?

	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Please give reasons:		

12. Other remarks or comments on this questionnaire, or on the ELIOS II project:

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Thank you for completing this questionnaire. Your time and effort is greatly appreciated.

Summary of the findings of the questionnaire survey

General introductory questions

Question 1: What building types do you collect data on?

The processed answers show that there is a good split of building types (residential/non residential), but pathology data are mostly collected for residential homes.

Question 2: What data is collected?

This question is about the type of information that is collected on specific causes of problems.

- 34 respondents answer that they collect data on specific risks of certain technologies;
- 43 respondents collect data on defects and damage to a building;
- 41 respondents collect data on defects and damage of building components or construction products;
- 25 respondents data on insurance claims relating to construction damage/defects and technical causes.

This means that we can expect that a good collection of data will be available.

Question 3: What kind of damages/defects does the data refer to?

- 37 respondents answer that the data refer to damages/defects/risks during the construction process;
- 21 respondents answer: liability of people involved in construction, such as builders/ architects;
- 25 respondents answer: 10 year warranty for damages/claims that arise after handover of the building;
- 28 respondents answer: traditional risks, e.g. fire, storm, water leakage, collapses;
- 22 respondents answer: non-traditional risks, e.g. performance not as claimed;
- 7 respondents answer: other types of risks.

So there is a big focus on damage during construction, and a smaller focus on liabilities, 10 year warranties, traditional risks and non-traditional risks.

Possible future action could be to carry out a more focussed survey of insurers to get a level of detail that they may have and quantify the various causes of faults. This may give us more information about risks of adoption of new technologies.

The answers on traditional risks might need a further clarification to establish if these incidental issues damage the uptake of certain ecotechnologies.

Question 4: How do you collect the data?

- 31 respondents say that they collect the data by means of technical reports by their own inspectors;
- 27 respondents answer: technical reports submitted by external experts;
- 5 respondents answer: data from insurance companies;
- 21 respondents answer: from their own claim records;
- 5 respondents answer: other.

It means that significant amount of data is collected by own inspectors or external experts.

Question 5: For whom do you collect that data?

- 10 respondents answer that they collect the data for building inspection services;
- 10 for insurance companies;
- 12 for housing organisations;
- 11 for government organisations;
- 31 for their own organisation / use
- 11 for other organisations.

Note: respondents may have ticked more than one reason.

It means that most organisations collect the data for their own organisation/use.

Question 6: Where do you publish the collected information, and what is published?

- 32 respondents answer that they publish the data on the web;
- 20 in newsletters;
- 28 in other publications;
- 30 publish only as summary data;
- 19 publish all raw data;
- 19 publish anonymous raw data.

Since the biggest response on the question 'where published' is: 'on the web', a further action may be to interrogate this published raw data for more detailed assessment of reasons of failure.

Question 7: Do you have a database?

- 24 respondents answered that they have a database for storing the data;

From the answers it appears that especially insurance companies have a database, but also some government organisations, housing organisations, construction companies, certification institutes, so a broad range of organisations seem to have some kind of database for storing the data.

Those who have a database, normally carry out statistical analysis.

Further research about what is in the database may be required, together with the degree of analysis that organisations carry out (and perhaps what ELIOS 2 may be able to do with the data?).

Question 8: Do you carry out a statistical analysis?

- 19 respondents answered that they carry out any statistical analysis of the data.

The answers on this question reflect the previous question: if they have a database they normally carry out statistical analysis.

Key findings from the 10 case studies

1. Photovoltaic panels (PV's)

In summary:

- Significant amounts of data exist for this technology. First database commenced ca. 1990.
- High degree of satisfaction in all areas, although performance sometimes not as expected, due to insufficient access to direct and diffuse solar irradiation. The sizing of the inverter in order to maximise efficiency is then key.
- The failures (albeit a small percentage) are generally associated with installation/ commissioning (notably inadequate documentation), user documentation and breakages from both transportation and vandalism.

Lessons learned:

- Improve documentation in general
- More training for installers

2. Ground source heat pumps

In summary:

- Most failures were reported to be in the areas of
 - initial design
 - performance in practice
 - unsuitable ground type.

Lessons:

- Comments confirm the importance of careful and correct system design.

3. Double skin curtain walls/facades

In summary:

- Unsurprisingly, given the nature of this technology, the installation phase is seen as key to avoiding failures.
- Very little opinion was offered on ways to avoid failures in future.

Lessons:

- Improve understanding and manage expectations at all stages of the product lifecycle (designer, installer, end-user)

4. Mechanical ventilation with heat recovery (MVHR)

In summary:

- The most significant issue is in commissioning, but that may also relate to a misunderstanding of the use of the technology.
- Difficulties in commissioning can also be caused by inadequate or over-complex design; installers should not have to improvise important details on site.
- Any issues of late delivery and storage also relate to poor project management. The causes of poor project management are more general than the scope of this project, unless it relates to a misunderstanding of the technology.

Lessons:

- Raise awareness of the effectiveness of the technology, both for designers and for users.
- Suggested methods: case studies and articles.
- Raise awareness of the issues of design, installation and commissioning.
- Suggested methods: better documentation and training.

5. Vacuum insulated panels

In summary:

- Small sample size
- Fear about risk of puncturing
- Claimed loss of vacuum in practice

Lessons:

- Increase awareness of suitable applications and need to avoid puncturing.

6. Bio-material insulation

In summary:

- It is hard to draw firm conclusions with such small samples, and so little data
- This is well established technology with a range of solutions available and tested.
- There seems to be a general concern about keeping the products dry both before and after installation.

Lessons:

- Appropriate storage, and more warning to installers and project managers, may help with preventing damp.

7. Paper-based insulation

In summary:

- Experience with paper-based insulation is broadly in line with more traditional products.
- There are no specific, major concerns other than anecdotally.

Lessons:

- Attention to detail is paramount.
- Damp conditions must be avoided.

8. Rain-water harvesting, incl. catchment basins and grey water re-cycling

In summary:

- There were no significant numerical counts of causes of failure beyond what one might expect for typical building projects.
- Product failure was most commonly cited as a cause of failure, for example pumps.
- There is a concern about maintenance due to poor maintenance of filters.
- No further detail was given about product failure in this survey.

Lessons:

- Further research might be carried out to identify the reasons for product failure – whether this is due to installation, filtering or other issues such as tree roots, etc.

9. Green or brown roofs

In summary:

- The most significant failures (6%) would appear about installation issues (water leakage). They imply that the design and construction is inappropriate to get the best from this technology. These may be about the lack of knowledge of making the “roof box” i.e. layer 5, watertight.

Lessons:

- Improve training for builders and installer.
- Raise awareness of existing codes of practice like the UK Green Roof Code of the GRO (Green Roof Organisation).
- Perhaps consider creating an accreditation scheme for builders/roofers based on these codes of practice.

10. Low VOC materials

In summary:

- As no counts were provided, it is difficult to provide information on specific areas for action. However, some generalised comments can be made.
- There appears to be some change in colour of some low-VOC paints over time
- There may be a need for increased knowledge of the designers/painters to make sure that the preparation is better. The chosen product is not always fit for the intended application (that means: not fit for the subsurface upon which the product will be applied). New products often demand another application/processing or are more sensitive. Often products are applied on the traditional manner. This requires more education and support of the applicators. There may also be an issue with epoxy resin, but this would need verifying.

Lessons:

- Perhaps there needs to be increased awareness of the limitations of these products, specifically amongst property owners.
- More education and support of the applicators for applying new products in the correct way.

Opinions about an EU-wide database

The last question of the questionnaire was: “Do you think a European-wide database on typical risks and building pathology for sustainable construction and eco-technologies would be useful?”

The response was:

- 4x 'no'
- 35x 'yes'
- 31x no response

The respondents gave the following comments when they answered 'no':

- "Green roofs are very climate dependent. Knowing what the issues for green roofs are in Spain or Poland will not have any benefit to Sweden. Please take a look at German, Swiss and Austrian legislation and Building Regulations, green roofs are the norm in those countries and they are considered to have very low risk, in almost all contexts."
- "I think there is enough knowledge available to undertake your own due diligence on new materials and systems. An EU database would be confusing and constrained by local changes and regulations. It will be unlikely to be used by developers and designers at the coal face when designing new projects or considering new materials and systems. A UK database may offer some benefit and be more relevant to our regulation, practise and conventions."

The respondents gave the following comments when they answered 'yes':

- "Information sharing would facilitate the reception of products by insurers."
- "A lot of the information in this sector is anecdotal. Because the technologies can be seen as additional to standard, often if there are problems they won't be reported as a home still functions, but the benefit of the technology will not be being achieved."
- "Sharing data and information should reduce future instances of failure by sharing learning outcomes."
- "Many technologies are applied where they are not appropriate and many technologies require special care to get them right, from design to construction to operation."
- "The more info the better - admittedly, not everything that works in country A in Europe will work in country B in Europe, but if we can avoid some common mistakes or bad products then that must be a good thing."
- "Absence on database at present."
- "Northern European countries have greater experience over a longer period of the materials and their use."
- "If we are to construct better buildings in the future, it is vital to learn from experience to date."
- "I think this would be vitally important to help the industry."
- "It would assist in making choices on new materials and technologies that may be established in some areas but new in others."
- "We have tried working on a pan-European data base for structural concerns for several years but have made absolutely no progress."
- "It would help the design of certain buildings when thinking about using such technologies."
- "Information is generally difficult to find in a form to be able to compare and contrast."
- "With building pathology you have to take into account the diverse climatic conditions for which manufacturers produce construction products in/for each member state."
- "The rules, the building traditions the roles of the authorities, the education of people in the construction sector, etc., differs from one country to another. So it will be difficult to transfer knowledge from one country to another."
- "It could be useful depending on how many cases it will include and the size of the risks related to the different types of damages etc. The purpose of developing such a database must be described in detail to avoid collecting information that is not going to be used. The Danish

Building damage fund for urban renewal (BvB) has since the first data were collected in 1995 reduced the number of data that are collected and focused on the most important.”

- “It is by default relevant to get experience from other countries and the way that specific technologies are used, although adaption to national conditions is necessary (building technology, climate, legislation etc.)”
- “Of special interest for the insurance industry is of course the potential impact on future risk assessment and insurance costs.”
- “Our company is not directly involved in the insurance industry, however, from the studies we have conducted, we have drawn a conclusion that such a database would help the insurance companies to assess the risks related to the sustainable technologies.”
- “Yes, it would be useful, but not only for eco-technologies, but for every new or innovative product.”
- “There is a massive need for knowledge on even relatively simple things for site managers.”
- “Collect data from different regions and if possible with enough input. Knowledge is the way to avoid mistakes”
- “To make information widely available; to share information among actors of construction industry; to avoid repetition of mistakes; to promote partnerships.”
- “EU database is useful, but who are going to provide data? We are only partially willing to provide data for that as this is extreme competitive sensitive information. Based on our data we do our product development while our competitors do not have these data. In any way it is good you start with it.”
- “EU database is useful, provided that the special constructive issues are specified. For example: sealing a canvas roof is provided in Spain by concrete tiles, in Germany a sealing without tiles.”
- “Pay attention to the sustainability requirements for the performance. These are not the same for all countries, very complicated to set up, each country must give its opinion.”
- “A pan-European database provides indeed the value that the reinsurers have a data source that supports them in assessing some very specific and recent technologies in the construction sector.”
- “Useful, but it will be important to ensure any databases are kept up to date and the reasons behind failures of technologies are accurately reported to enable evidence based decisions to be made.”
- “The Elios 2 approach is risk assessment for eco-technologies coupled with an insurance system. Claims by technology in no two countries will be the same is probably correct. However, if the database can also be used by research institutes, the transnational joint pathologies can be quickly investigated, with or without the ‘affected’ countries. We refer to the example of a not eco-technology. Since 2009 we have noticed a huge increase in loosening of top layers on concrete floors. Initially, the insurance covered such pathologies, but this did not last. More and more contractors started losing a lot of money because of the claims. It has taken the Belgian research institute quite some time to become aware of the situation in Germany, the Netherlands and France. In France, a similar pattern developed, both in terms of pathology and the intervention of the insurers. Through an international database, it might have been possible to contact AQC and others faster to initiate a pilot study and there would have been room for a qualitative and quantitative comparison (e.g. comparison of used concrete specifications, ...).”