A scheme for the evaluation of experience about the performance of timber structures

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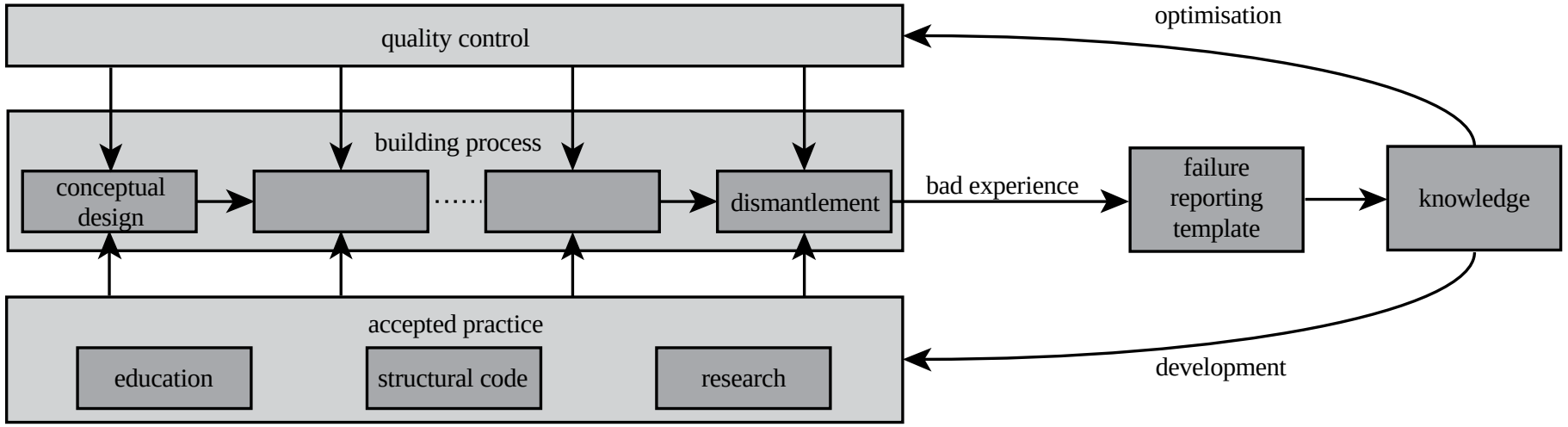
Content

- Motivation to develop a new approach of a failure reporting template
- Design of a failure reporting template
  - Failure classification (according to cause of failure)
  - Identification of essential information
  - Failure reporting template
- Characteristic of documented experience

Motivation

Principles of a failure reporting template:

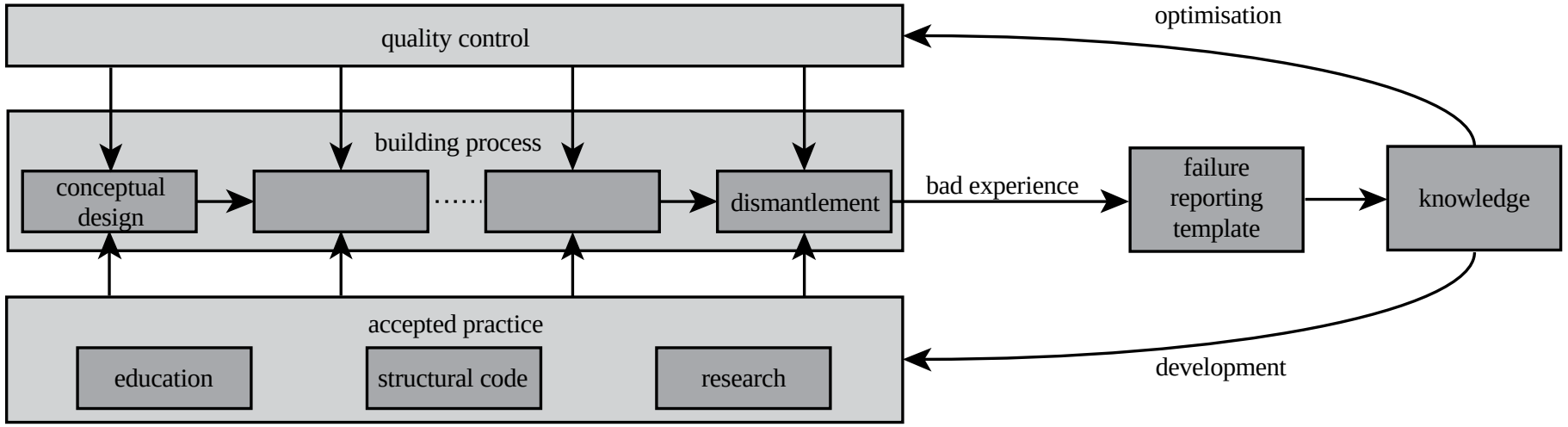


Failure reporting has to collect **all** information to:

- develop the accepted practice and to
- optimise the magnitude of quality control.

Motivation

Principles of a failure reporting template:



Essential information depends on the cause of failure!!!

Motivation – e.g. failed connection

Failure according to mistake in calculation

Failure despite accepted practice

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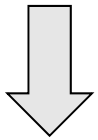
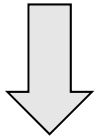
Failure according to mistake in calculation

Failure despite accepted practice



Essential questions

- Why the engineer has made the mistake?
- Why the error was not detected?



Essential information

Detailed description of

- cause of failure
- magnitude of quality control

Motivation – e.g. failed connection

Failure according to mistake in calculation

Failure despite accepted practice

Essential questions

- Why the engineer has made the mistake?
- Why the error was not detected?

- Is there a mistake in our codes?
- Is there a lack of knowledge?

Essential information

Detailed description of
- cause of failure
- magnitude of quality control

Detailed description of
- failed connection
- structural system
- load (at time of damage)

Motivation

Development of a failure reporting template:

- **Only** essential information
  (depending on the cause of failure)
- Uniform
  → optimal comparability of documented experience
- Easy to use (e.g. excel based software)
  → facilitate the broad use of the template

Design of a failure reporting template

1. Failure classification (according to cause of failure)
2. Identification of essential information
   → Improve best practice
   → optimise the magnitude of quality control
3. Development of a failure reporting template which **only** collects the essential information

Failure classification (according to cause of failure)

Failures Type A

Failures Type B

Failures Type C

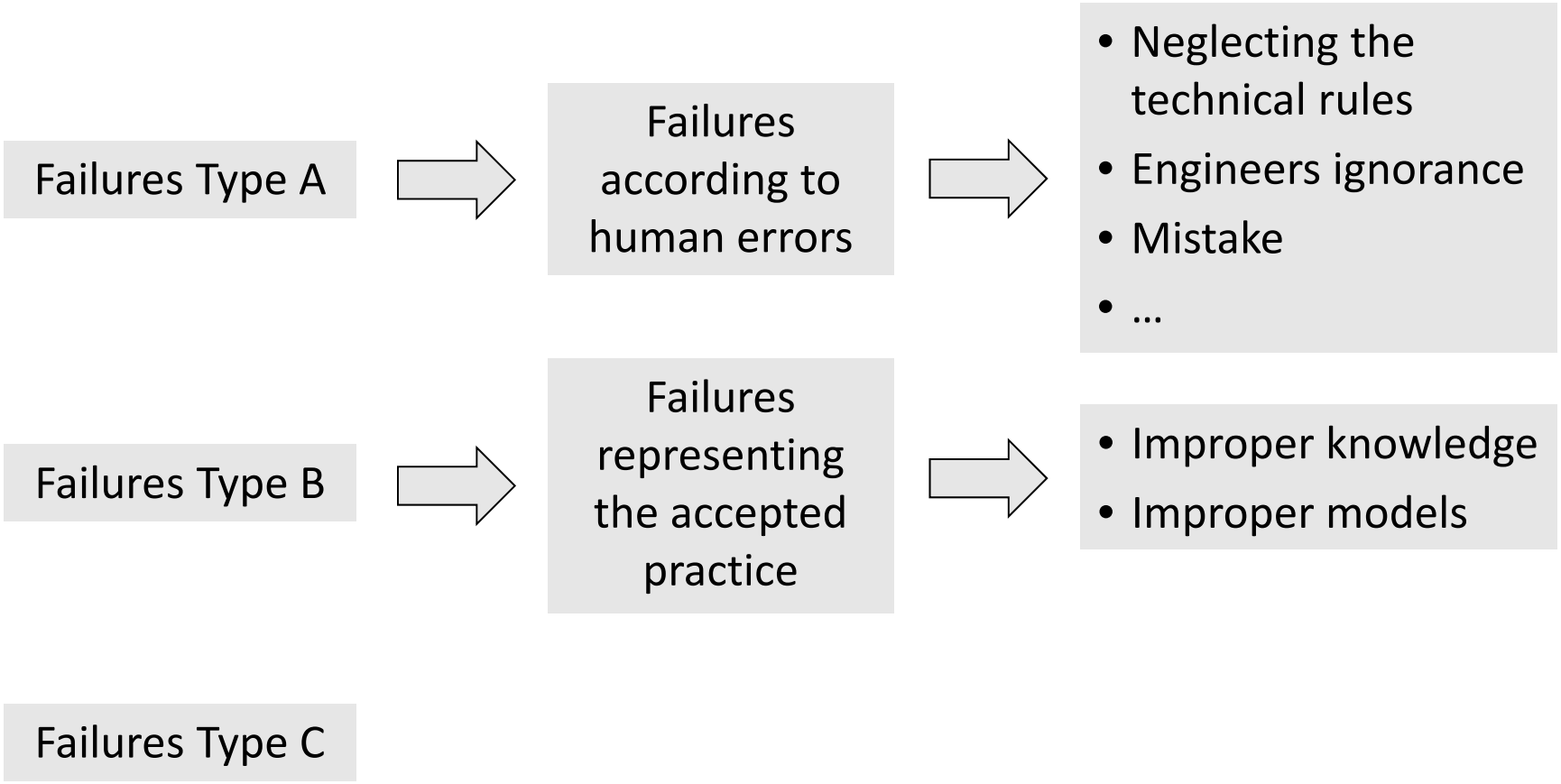
Failure classification (according to cause of failure)

Failures Type A → Failures according to human errors →
- Neglecting the technical rules
- Engineers ignorance
- Mistake
- …

Failures Type B

Failures Type C

Failure classification (according to cause of failure)



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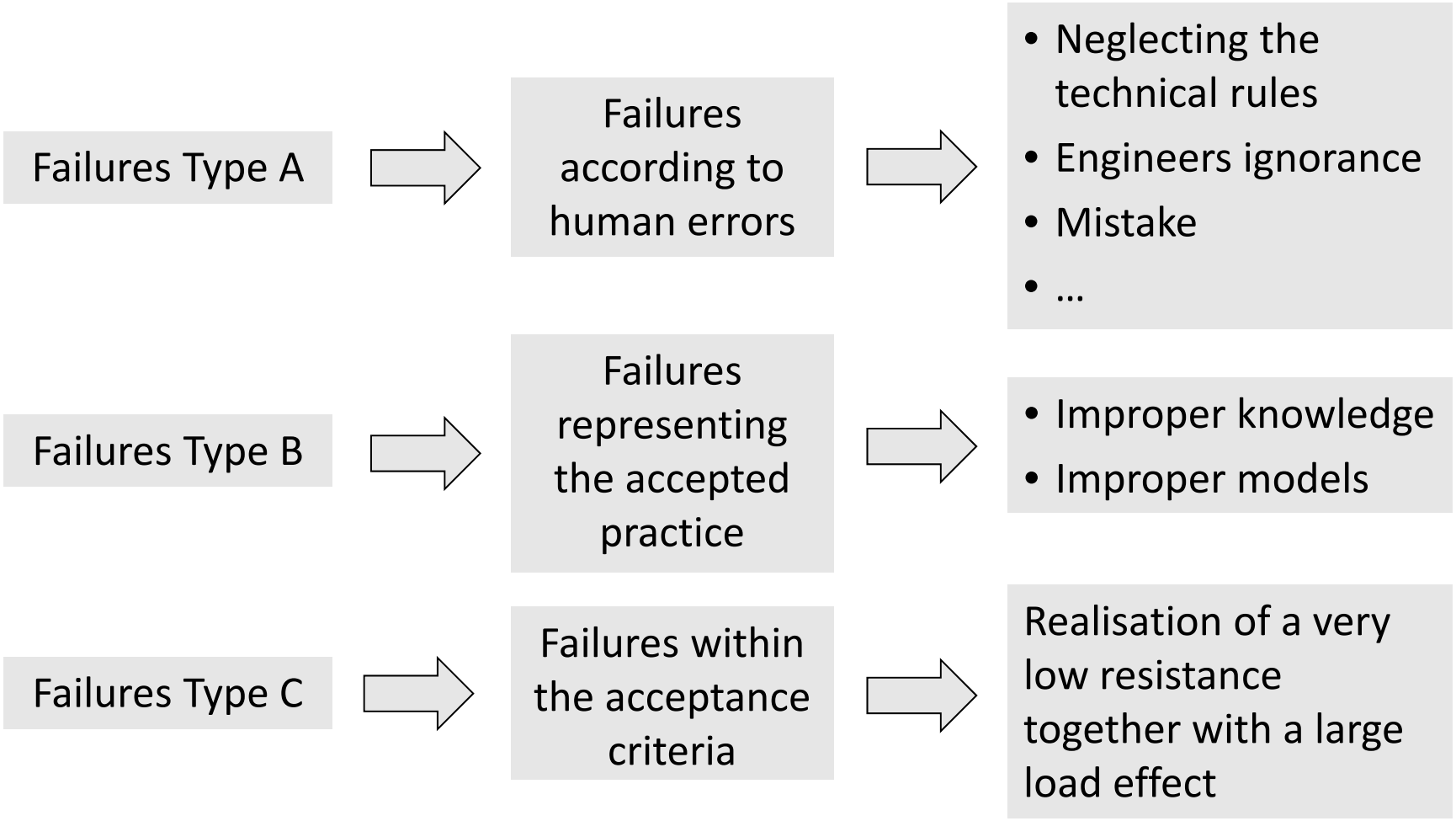
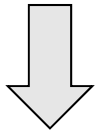


Identification of essential information

Avoid errors



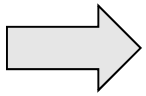
Error prevention

Error detection and correction

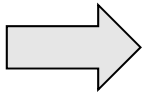
Reduction of the consequences

Error prevention

Human error
(Error Type A)

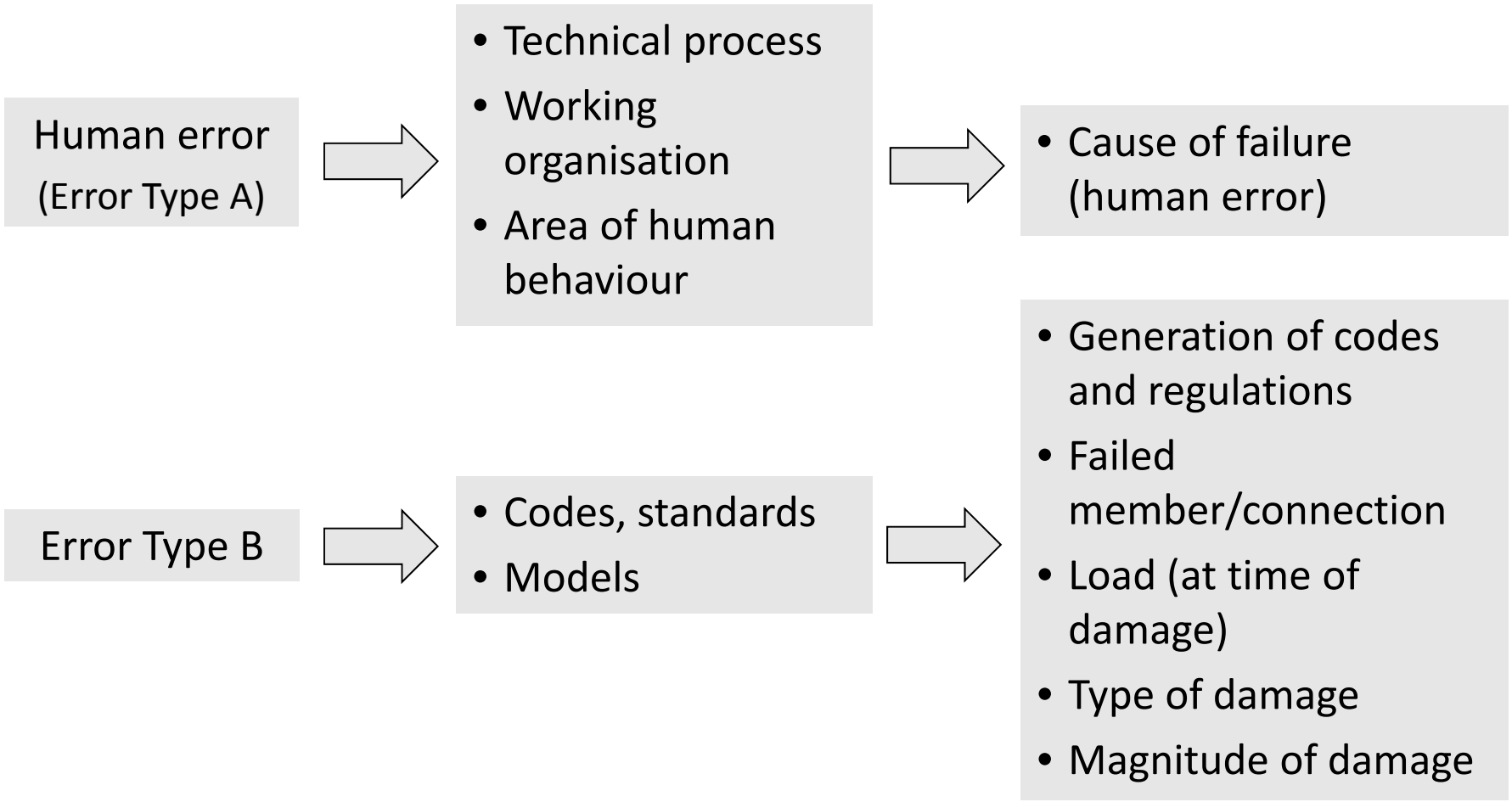


- Technical process
- Working organisation
- Area of human behaviour



- Cause of failure (human error)

Error prevention



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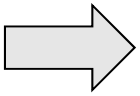
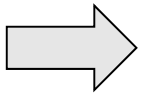
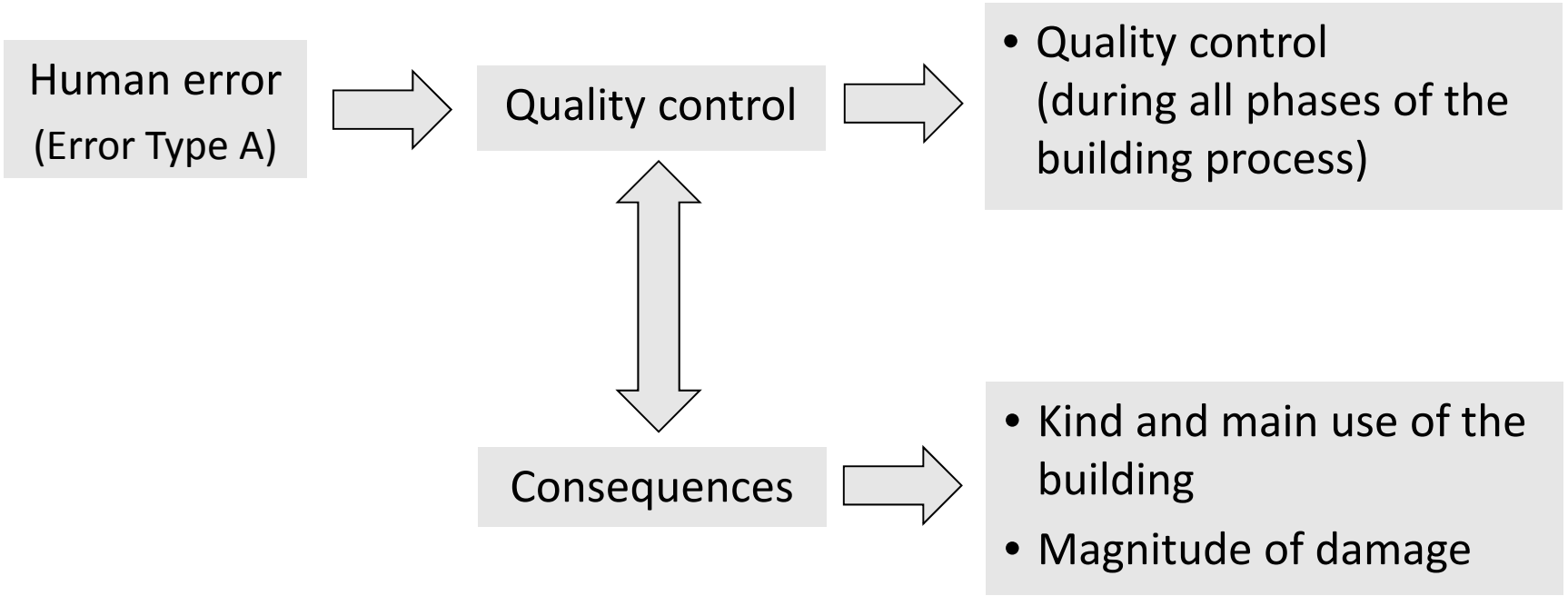


Quality control



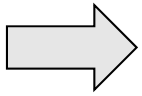
- Quality control
  (during all phases of the building process)

Error detection and correction



Reduction of the consequences

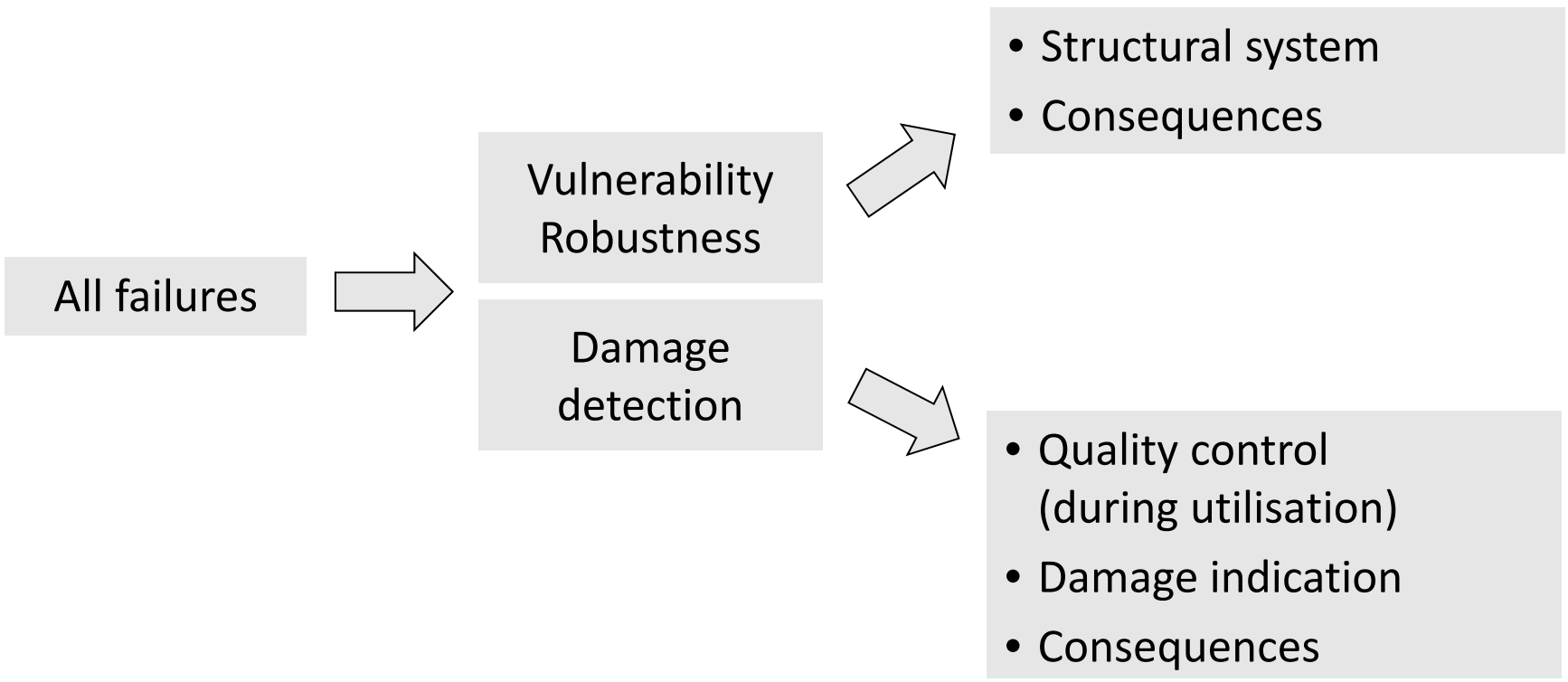
All failures



Vulnerability
Robustness

Damage
detection

Reduction of the consequences

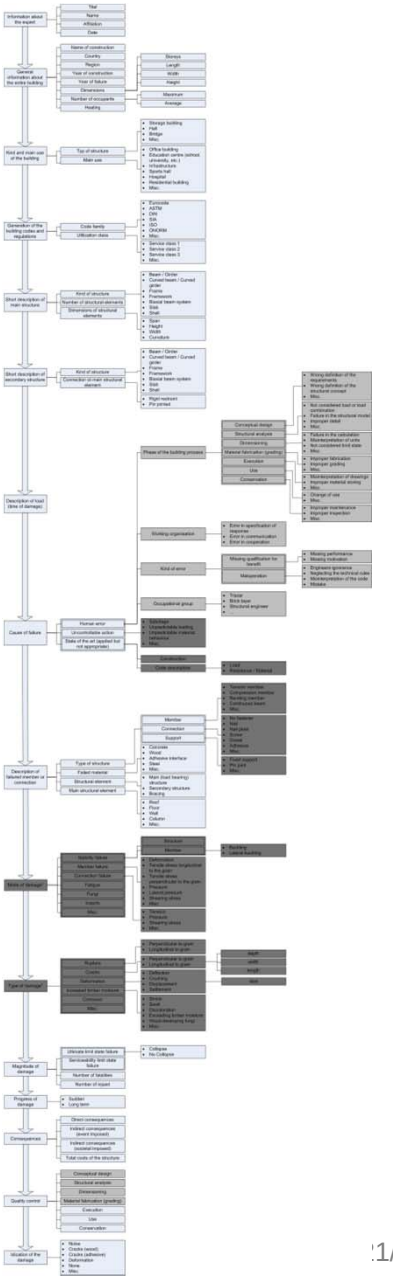


Failure reporting template

Full template & adequate software is published on the homepage of the COST Action E55 – “Modelling of the performance of timber structures”.

http://www.cost-e55.ethz.ch

Both, the proposal and the program can be downloaded. This should facilitate the broad use of this template.



Characteristic of documented experience

- Only a small part of our buildings are analysed.

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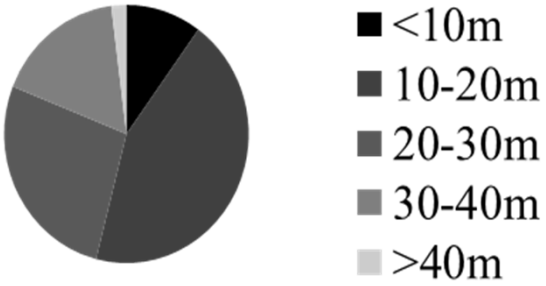
  e.g.: Span of failed timber halls:



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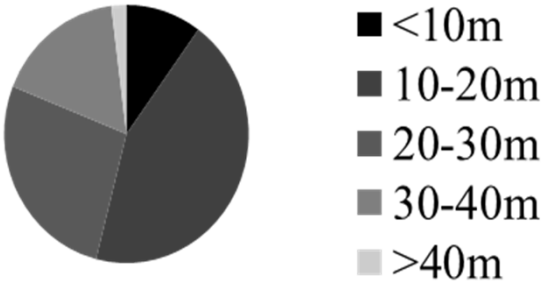
$P(I_i|F)$



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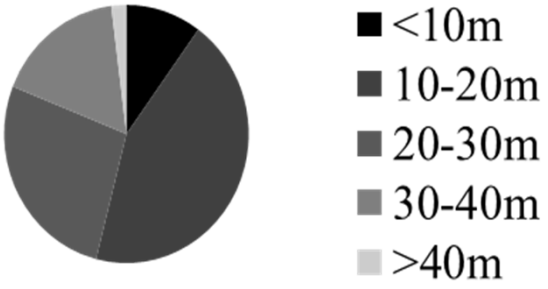

$$P(I_i|F) \rightarrow P(F|I_i) = \frac{P(I_i|F)P(F)}{P(I_i)}$$

$$P(F) = \frac{\text{total number of failed constructions}}{\text{total number of constructions}}$$

$$P(I_i) = \frac{\text{number of constructions with } I_i}{\text{total number of constructions}}$$

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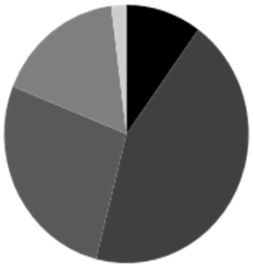

<0.10
10-20m
20-30m
30-40m
>40m

$P(I_i)$

0.10
0.40
0.30
0.15
0.05

$$P(F|I_i) = \frac{P(I_i|F)P(F)}{P(I_i)}$$

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$P(F|I_i)$

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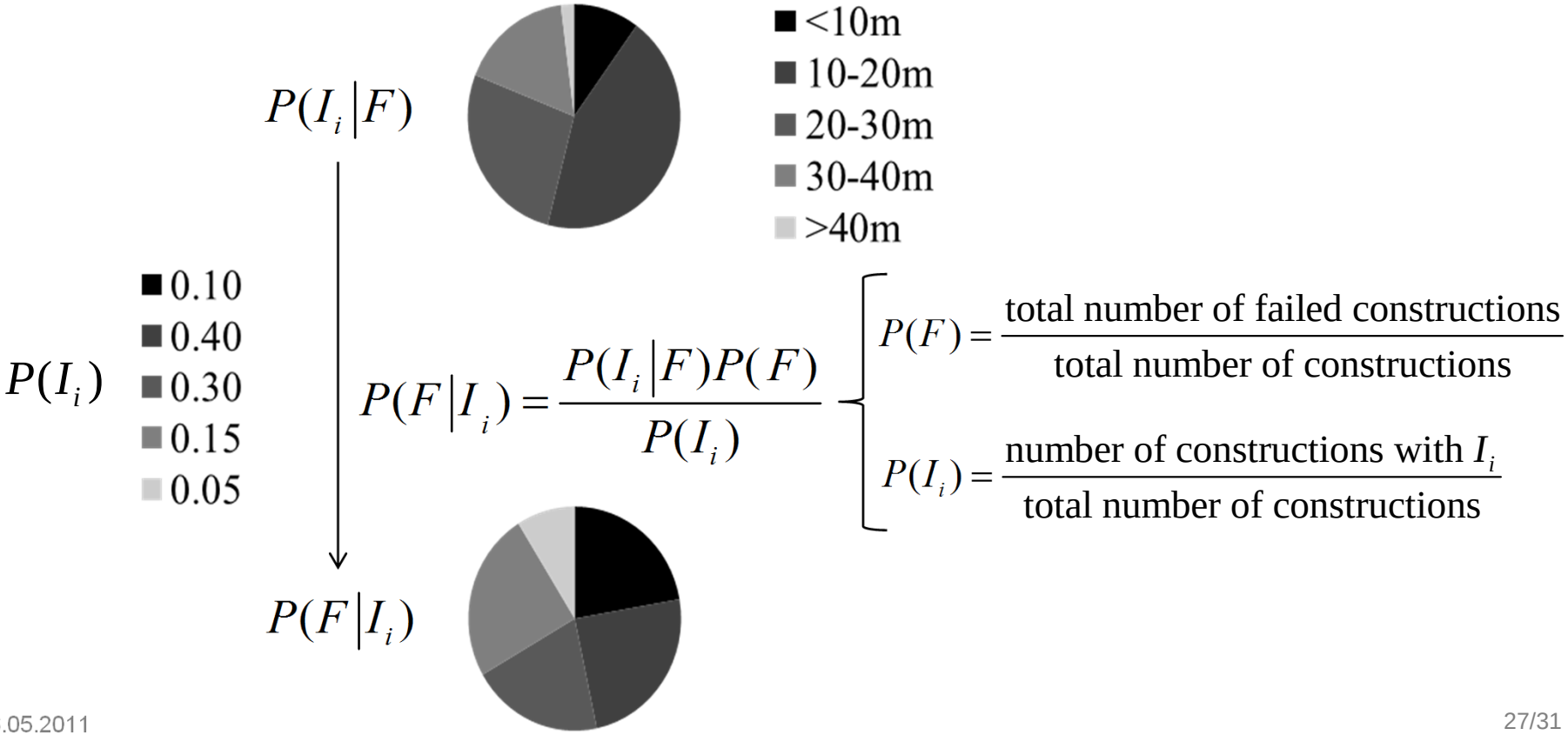

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- Only a small part of our buildings are analysed.
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  (more ULS-damages are documented than SLS-damages)

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- Only a small part of our buildings are analysed.
- In the documented data there is a bias.

  (more ULS-damages are documented than SLS-damages)
- Not every damage is according to an error.

Summary

Development of a failure reporting template

- **Only** essential information are collected
  (depending on the cause of failure)
- Detailed description of the cause of failure
  (for human errors)
- Easy to use (excel based software)
  → facilitate the broad use of the template

Thank you for your attention!