Data verification for "Empirical fragility and ROC curves for masonry buildings subjected to settlements"

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Data verification for "Empirical fragility and ROC curves for masonry buildings subjected to settlements"

Report

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Report

Title:
Data verification for "Empirical fragility and ROC curves for masonry buildings subjected to settlements"

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Table of Contents

1 Introduction

This report details the data verification process for the information utilized in the publication "Empirical fragility and ROC curves for masonry buildings subjected to settlements" [3]. The data are stored in the 4TU.ResearchData repository [4]. Data collection and analysis took place between 2020 and 2021, with the final version being published in 2023. A thorough check was conducted before and after the publication of the manuscript to ensure data quality. While the first check was conducted by the Authors of [3] during the initial data collection, this report focuses on the second check, carried out after the publication. In this document, the adopted methodology for the data verification is detailed and the results of the procedure are presented.

This report begins with Section 2, which outlines the methodology used for the data verification, whereas Section 3 summarises the results. Section 4 offers a discussion and conclusions. Finally, appendix A contains the calculations that support the verification checks.

1.1 The collected information: buildings' features and levelling measurements

The dataset collects information on 386 masonry buildings located in the Netherlands. The original hardcopy reports were produced by various Dutch engineering firms and institutes. Appendix B provides three representative examples of reports from the dataset, shown in an anonymized format to ensure that all sensitive information is excluded. For each building, the collected information includes: i) the measurements of bed-joint levelling along the buildings' walls, ii) the information about the damage documented in the field survey, iii) the foundation system (i.e. shallow or deep foundation)[3]. The data from these hard copies were digitized and saved in a MATLAB ".mat" file, available at https://doi.org/10.4121/18279155.v1 [4], including a "ReadMe.txt" file in the repository to detail the metadata.

The dataset, however, excludes the original hard copies, which may contain addresses, photographs of the surveyed buildings, and the names of surveyors, in order to protect the privacy of residents, owners, and other relevant parties. For the same reason, any references to the engineering firms and institutes that conducted the surveys are not disclosed.

Regarding the sources of uncertainties of the dataset, the data collection followed a non-standardized procedure, as there are currently no guidelines for this type of information gathering. The procedure included a desk survey and manual digitization, which introduces the potential for human error. For example, bed-joint levelling measurements along walls were extracted from technical drawings. When drawings were not to scale but included a scale reference (e.g., 1:500), distances and displacements were measured by rescaling the drawings in AutoCAD. This method is prone to scaling errors, especially since some of the hard copies were scanned documents, which can distort the measurements (see B.3 as an example).

Moreover, the original hardcopy reports were written in Dutch, whereas not all the Authors of [3] involved in the data collection and curation are Dutch native speakers.

1.2 The computed settlement parameters

The collected levelling measurements of each surveyed wall collected in the dataset were used to compute different parameters that measure the intensity of the settlements, namely differential (or relative) settlement $\delta\rho$, rotation (or slope) Δ, relative rotation (or angular distortion) β, and deflection ratio δ/L. These parameters are schematically illustrated in Figure 1, and are detailed in the following:

- The "**Differential settlement** $\delta\rho$" is calculated as the maximum difference in elevation between recorded settlement points.
- "**Rotation** θ" represents the maximum gradient among lines connecting two reference points in the settlement profiles.
- The "**Relative rotation**" or "angular distortion β" refers to the slope of the line joining two consecutive points in relation to the rigid body rotation of the structure.
- The "**deflection ratio**" Δ/L" represents the ratio between the maximum relative deflection and the corresponding length.

Additional information regarding the settlement parameters is provided in [3]. The reader is referred to [1] for the original definitions.

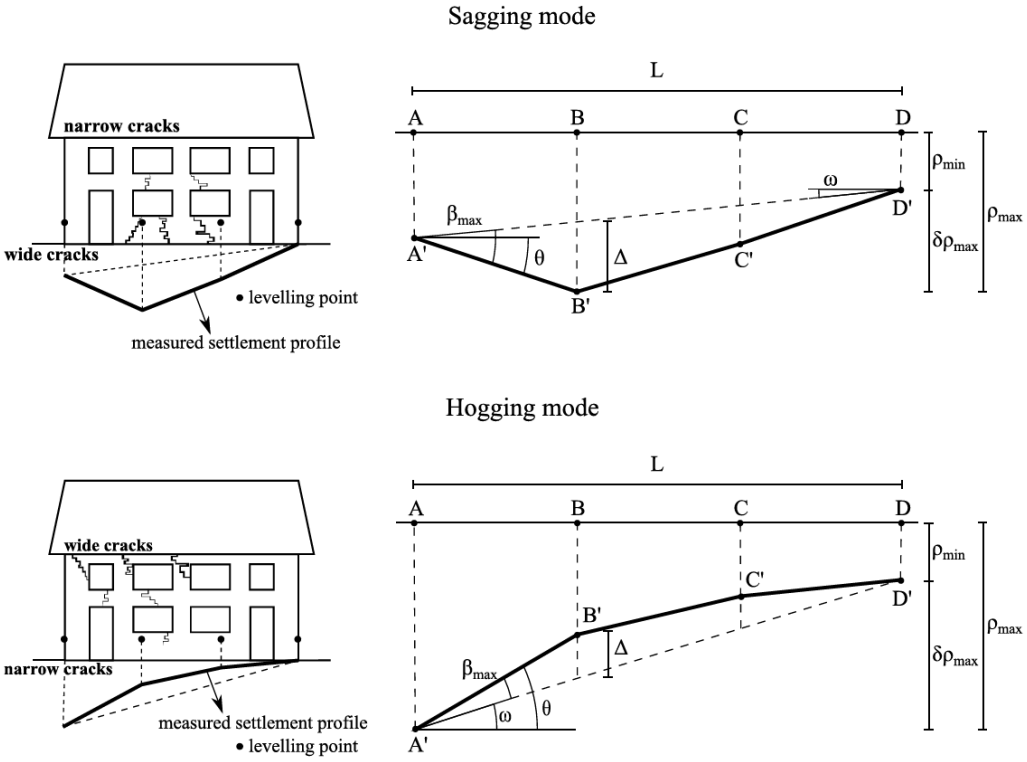

Figure 1: Schematic illustration of different settlement parameters, following the original definitions proposed by [1]. Image retrieved from [3].

In the published article [3], a MATLAB code was employed to automatically calculate the settlement parameters for all the surveyed walls. The computed values are not reported in the dataset. However, the authors provided the adopted script. Therefore, a systematic review is conducted in this document to ensure that no technical glitches are present that could impact the calculations.

2 Data verification procedure

In this document, two types of checks were conducted (as schematically illustrated in Figure 2):

Check 1. A verification was carried out to ensure that the input information was accurately collected from the various hard copies ("Check 1" in Figure 2). A native Dutch speaker conducted the verification of the quality of the collected documentary information. In total, 116 cases, representing approximately one-third of the dataset, were thoroughly checked, starting from the original hard copies. The checks primarily focused on the buildings' features, such as foundation type and year of construction. Additionally, the bed-joint leveling measurements were verified for each selected case.

Check 2. The calculations of the settlement parameters adopted in [3] have also been checked ("Check 2" in Figure 2). Toward this email, five chases have been randomly selected. The wall length, tilt, differential settlement, rotation, relative rotation and deflection ratio have been computed again and compared with the information used in the published manuscript. The settlement parameters are not published in the dataset, however, the code used to compute them for each wall was provided by the Authors upon request. The values adopted in the published article are then compared with the ones computed herein.

It is important to emphasize that both checks were conducted independently of the Authors of the published articles to ensure an unbiased and independent process. However, the Authors provided the original data and supported the initiative to verify both the data and calculations, ensuring the quality and accuracy of the dataset.

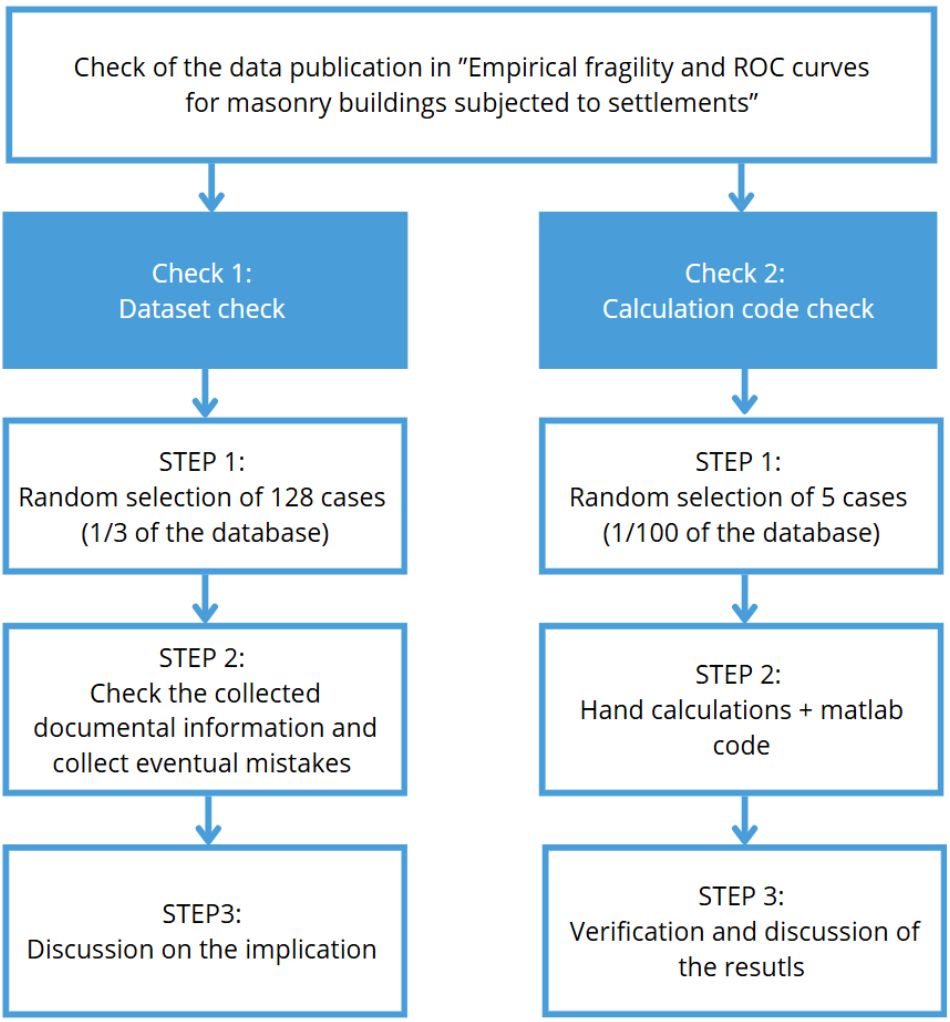

Figure 2: Flowchart of the data verification procedure.

3 Results of the data verification

The following sections summarize the findings of the data verification procedure.

3.1 Documental information

Each building in the dataset is assigned a unique "ID." The 116 randomly selected cases are identified by the following IDs:

B1 - B50, B55, B57, B61, B72, B81, B87, B94, B110, B119, B122 - B130, B142 - B151, B213 - B219, B240 - B245, B254 - B262 and B343 - B358.

Among the randomly selected 116 cases, the data verification process did not uncover any discrepancies in the collected information regarding foundation typology, structural typology, or year of construction.

Regarding the damage information, all the buildings in the dataset were classified according to the visible damage as "No Damage", "Light Damage" and "Moderate to Severe Damage" [3]. This classification is more suitable for the buildings in the dataset compared to more detailed classification systems, as the damage was assessed using the available documentary information rather than being quantified through extensive surveys. Consequently, the adopted damage classification may be influenced by subjectivity. Nevertheless, no discrepancies are found in this document.

Regarding the levelling measurements stored for each building, a few typos were found and are reported herein in Table 1.

Table 1: Overview of the typos found among the levelling measurements stored in the dataset [4].

Case	Wall	Coordinate	Mistake	Correction
B16	1	Z	[−115, −10, −135, −105]	[−115, −120, −135, −105]
B28	4	Z	[−20, 20, −28, −94]	[−20, −20, −28, −94]
B31	4	Z	[−114, −89, −84, −14]	[−114, −89, −84, −114]
B63	3	X	[0, 3.8, 8.4, 13.1, 17.2, 22.1, 16.7, 30.4]	[0, 3.8, 8.4, 13.1, 17.2, 22.1, 26.7, 30.4]
B40	3	X	[0, 2.9, 5.8, 9.1]	[0, 2.9, 6.2, 9.1]
B104	6	Z	[-1.71, -0.40, -0.97, 0, -0.31]	[-17.10, -4.00, -9.70, 0,-3.10]
B121	1	X	[0, 3.69, 8.80, 12.45, 16.10, 25.35, 285.44, ... 34.11, 38.70, 46.08, 50.87, 59.90, 66.10, 72.49]	[0, 3.69, 8.80, 12.45, 16.10, 25.35, 28.54, ... 34.11, 38.70, 46.08, 50.87, 59.90, 66.10, 72.49]
B212	1	X	[0, 5.27, 11.99, 18.29, 24.73, 31.62, 37.14, ... 3.97, 50.19, 57, 63.36, 60.61, 75.96, 82.6, 88.8]	[0, 5.27, 11.99, 18.29, 24.73, 31.62, 37.14, ... 3.97, 50.19, 57, 60.61, 63.36, 75.96, 82.6, 88.8]
B245	1	Z	[250, 237, 228, 223, 254, 271, 238]	[250, 237, 228, 223, 254, 271, 283]
B256	1	Z	[−8, −9, 0]	[−8, 9, 0]
B376	1	X	[0, 1, 20, , 7.02, 14.49, 21.20, 28.31, 35.50]	[0, 7.02, 14.49, 21.20, 28.31, 35.50]
	1	Z	[0, 1, 218.68, 38.63, 27.64, 19.48, 9.93, 0]	[21.87, 38.63, 27.64, 19.48, 9.93, 0]

3.2 Computed settlement parameters

Manual calculations were performed and compared against the data adopted in [3]. The hand calculations were integrated and compared with the results of a MATLAB script. Five cases were randomly selected for this aim, namely, B1 wall 3, B50 wall 1, B98, B211, and B317. When checking the 5 cases, no mistake has been found. One example is provided in the following, whereas the remaining are reported in Appendix A.

3.2.1 Hand calculations for the case "B1" - wall 3

Figure 3 reports the hand calculations for the case "B1" - wall 3. All the four selected settlement parameters are computed, namely differential settlement, rotation, relative rotation and angular distortion. In addition, the length of the wall was also checked.

Additional examples for other cases are reported in Appendix 3.2.

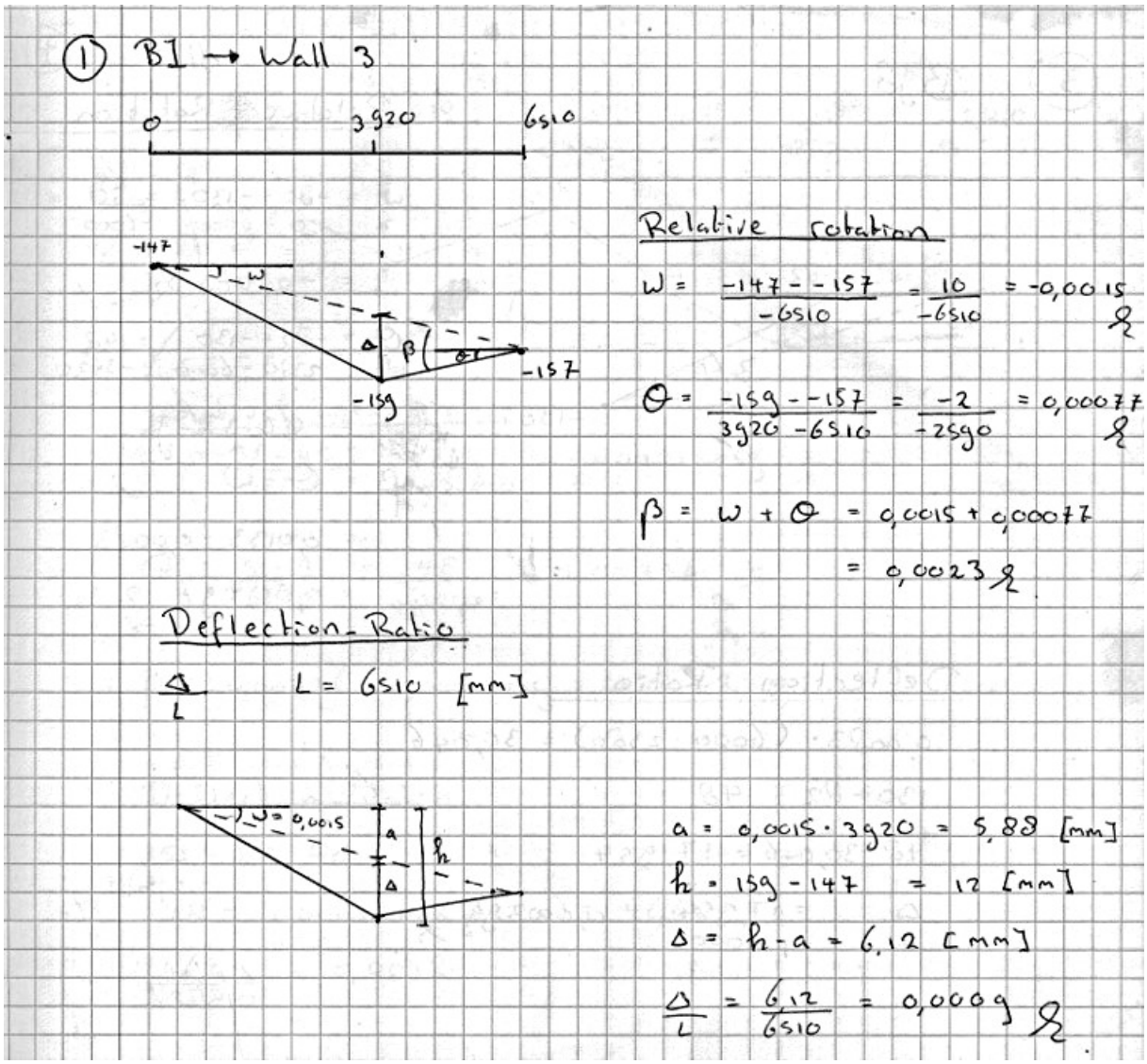

Figure 3: Hand calculations for case "B1" wall 3.

This example highlights how laborious manual calculations can be, especially given the large number of cases included in the dataset. However, they serve an indispensable role in ensuring the accuracy of the calculations.

3.2.2 Verification via a MATLAB script for the case "B1" - wall 3

In the following section, a MATLAB script is employed to further verify the calculations. The dataset is represented by the variable "Database," while the variable "Re-

sults" denotes a structure that consolidates the data and settlement parameters used in the published manuscript. The variable "Temp" contains the same version of the dataset, stored locally on a TU server, and is included to ensure redundancy within the script and facilitate multiple checks.

The first part of the code selects a case using the variable "i." The information regarding damage, foundation, and wall length is cross-checked among the three versions of the dataset. Then, the settlement parameters are computed and compared with the ones adopted in the published manuscript.

```
%%
% Data

Database; % The dataset
Results; % The data and settlement parameters used in the
   published manuscript.
Temp; % dataset, stored locally on a TU server


i = randi([1, length(Database)],1) %select a random case from
    the database
disp("for case: B" + num2str(i)) %displace the selected case
%%
% Check if the damage from results, database and temp are
   similar

if Database(i).Damage == Results(i).Damage & Database(i).
   Damage == Temp(i).Damage
    display('Damage is correct')
else
    display('Damage is wrong')
end
%%
% Check if the foundation from results, database and temp are
    similar

if Database(i).Foundation == Results(i).Foundation & Database
   (i).Foundation == Temp(i).Foundation
    display('Foundation is correct')
else
    display('Foundation is wrong')
end
%%
% Check if the wall from database and results are similar

D = Database(i).Wall;
R = Results(i).Wall;
for p = 1:length(R)
```

```
33      if R(p).x == D(p).x*1000 & R(p).z == D(p).z
34          disp(" Wall " + num2str(p) + " is correct")
35      else
36          disp(" Wall " + num2str(p) + " is wrong")
37      end
38  end
39  %%
40  % Checks if the wall lenght is calculated correct
41
42  for p = 1:length(R) %for all walls
43      wall_lenght = D(p).x(end)*1000; %finded the last value of
            the wall = wall lenght
44      wall_length_temp = Temp(i).Wall_Lenght;
45      if wall_lenght == wall_length_temp(p) %check of the
           calculated wall lenght is similar to temp
46          disp(" Wall length " + num2str(p) + " is correct")
47      else
48          disp(" Wall length " + num2str(p) + " is wrong")
49      end
50  end
51  %%
52  % Checks if the Differential_Settlement is calculated correct
53
54  lst = zeros(1,length(R)); %empty list of the nummer of walls
55  for p = 1:length(R) %for all walls
56      z0 = min(abs(D(p).z)); %find min value of Z coordinate
57      z1 = max(abs(D(p).z)); %find max value of Z coordinate
58
59      delta_z = abs(z0-z1); %difference between min and max Z
           coordinate
60      lst(p) = delta_z; %store in the empty list
61  end
62
63  diff_settlement = max(lst); %find max difference in Z
       coordinate
64
65  if diff_settlement == Results(i).Differential_settlement %
       check with the result table
66        disp(" Differnetial_settlement is correct")
67  else
68         disp(" Differnetial_settlement is wrong")
69  end
70  %%
71  % Check if the rotation is calculated correct
72
73  D = Database(i).Wall;
74  lst_rot = zeros(1, length(D)); %empty list to store data of
```

```
   rotation
lst_tilt = zeros(1, length(D)); %empty list to store data of
   tilt

for p = 1:length(R) %for all walls
    x = D(p).x*1000;    %x-coordinate
    z = D(p).z;         %z-coordinate
    lst_rot_wall= zeros(1, length(x)-1); %empty list for
       rotations of one wall
    for k = 1:length(x)-1 % for all x-coordinates
        rotation = abs(z(k) - z(k+1)) / abs(x(k)-x(k+1)); %
           calculation of rotation
        lst_rot_wall(k) = rotation; %store in empty list for
           one wall
    end
    lst_rot(p) = max(lst_rot_wall); %store the max rotation
       of one wall to the general rotation list
end

rotation = max(lst_rot); %find max rotaion value

if rotation == Results(i).Rotation %check with the result
   table
     disp(" Rotation is correct")
else
      disp(" Rotation is wrong")
end
%%
% Display x and z coordinates for hand calculations

x = D(1).x % x-coordinates
z = D(1).z % z-coordinates
```

The output of the code for case 1 is given below. Additional examples for other cases are reported in Appendix 3.2.

Data

```
for case: B1
```

Check if the damage from results, database and temp are similar

```
Damage is correct
```

Check if the foundation from results, database and temp are similar

```
Foundation is correct
```

Check if the wall from database and results are similar

```
Wall 1 is correct
Wall 2 is correct
Wall 3 is correct
Wall 4 is correct
```

Checks if the wall lenght is calculated correct

```
Wall length 1 is correct
Wall length 2 is correct
Wall length 3 is correct
Wall length 4 is correct
```

Checks if the Differential_Settlement is calculated correct

```
Differnetial_settlement is correct
```

Check if the rotation is calculated correct

```
Rotation is correct
```

Display x and z coordinates for hand calculations

```
x = 1×3
         0    5.7200    6.5100

z = 1×3
     0  -145  -145
```

4 Discussion and Conclusion

Although the data collection conducted in [3] adhered to a non-standardized procedure, due to the lack of established guidelines for gathering information on buildings affected by the settlement, it was carried out systematically. Similar datasets have been used in previous research, *e.g.*, [2, 5].

The data collection involved a digitization process for data originally obtained from hard copies of varying quality and from different sources. This digitization was done by manually entering information into a digital dataset, which may be prone to human errors.

In the checks performed herein on the information of the subsample of 116 cases (about 1/3 of the total number of cases), only minor mistakes in the collected levelling measurements are found and reported. Therefore, the database [4] can be considered accurate and suitable for further research. However, this observation does not address the limitations inherent in the dataset, which are discussed in detail in [3]. No inconsistencies were detected in the collected data regarding foundation typology, year of construction, or structural typology.

The collected levelling measurements of each building in the dataset were then used to compute settlement parameters, as herein briefly discussed in Section 1. The calculations were checked both manually and using a MATLAB script (see section 2) for five cases randomly selected. Accordingly, no mistake has been found.

Overall, the data verification has not revealed any major issues with the information stored dataset, although typos or mistakes could be present, they are not expected to have a major impact on the results and/or conclusion of the published manuscript.

While this document does not aim to provide recommendations for future research, implementing a standardized procedure for collecting and storing data on structures affected by settlements could significantly reduce subjectivity and human errors in the process.

Acknowledgments

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Data availability

The dataset discussed here is accessible at https://doi.org/10.4121/18279155.v1, accompanied by a "ReadMe.txt" file that provides detailed metadata information. Hard copies are available for collaborative purposes and can be consulted by contacting the authors of the published manuscript.

References

1. Burland, J. B. & Wroth, C. Settlement of buildings and associated damage (1975).
2. Peduto, D., Korff, M., Nicodemo, G., Marchese, A. & Ferlisi, S. Empirical fragility curves for settlement-affected buildings: Analysis of different intensity parameters for seven hundred masonry buildings in The Netherlands. *Soils and Foundations* **59,** 380–397 (2019).
3. Prosperi, A., Korswagen, P. A., Korff, M., Schipper, R. & Rots, J. G. Empirical fragility and ROC curves for masonry buildings subjected to settlements. *Journal of Building Engineering* **68,** 106094. ISSN: 2352-7102. `https://www.sciencedirect.com/science/article/pii/S2352710223002735` (2023).
4. Prosperi, A., Korswagen Eguren, P., Korff, M., Rots, J. (& Schipper, H. (*Supporting data for: Empirical fragility and ROC curves for masonry buildings subjected to settlements* 2023. `https://data.4tu.nl/articles/dataset/Supporting_data_for_Empirical_fragility_and_ROC_curves_for_masonry_buildings_subjected_to_settlements/18279155/1`.
5. Zhang, L. & Ng, A. Probabilistic limiting tolerable displacements for serviceability limit state design of foundations. *Geotechnique* **55,** 151–161 (2005).

A Result table calculations

A.1 B50 wall 1

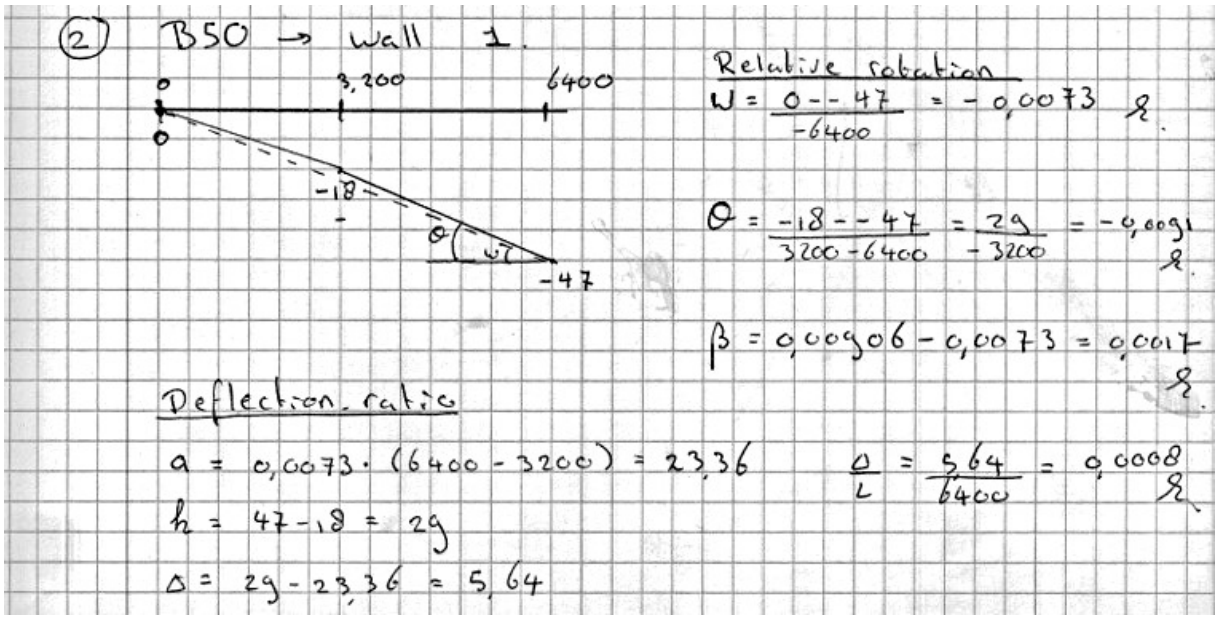


Figure 4: Hand calculations for case B50 wall 3

Data

```
for case: B50
```

Check if the damage from results, database and temp are similar

```
Damage is correct
```

Check if the foundation from results, database and temp are similar

```
Foundation is correct
```

Check if the wall from database and results are similar

```
Wall 1 is correct
Wall 2 is correct
Wall 3 is correct
```

Checks if the wall lenght is calculated correct

```
Wall length 1 is correct
Wall length 2 is correct
Wall length 3 is correct
```

Checks if the Differential_Settlement is calculated correct

```
Differnetial_settlement is correct
```

Check if the rotation is calculated correct

```
Rotation is correct
```

Display x and z coordinates for hand calculations

```
x = 1×3
         0    3.2000    6.4000

z = 1×3
     0   -18   -47
```

A.2 B98

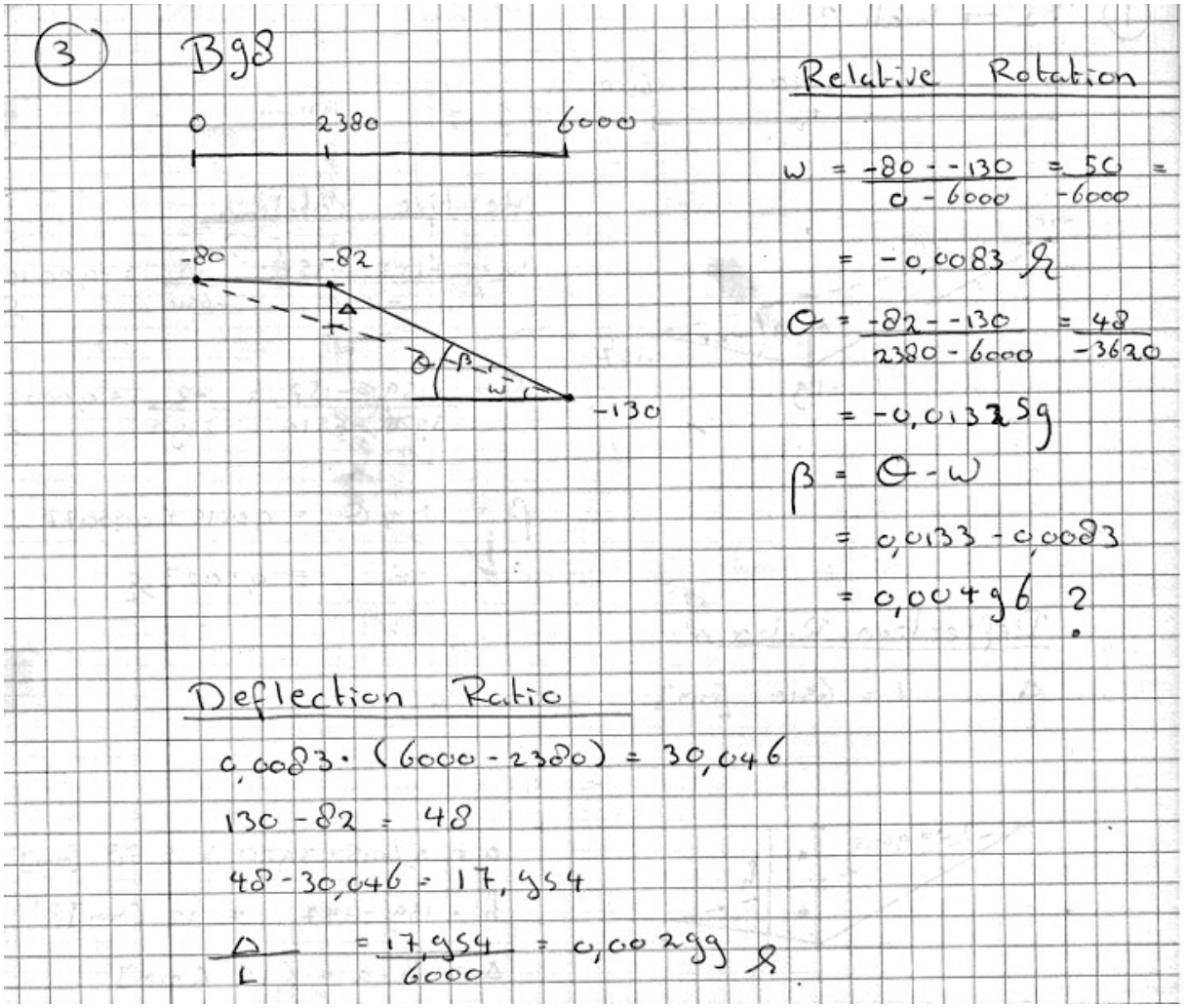


Figure 5: Hand calculations for case B98

Data

```
for case: B98
```

Check if the damage from results, database and temp are similar

```
Damage is correct
```

Check if the foundation from results, database and temp are similar

```
Foundation is correct
```

Check if the wall from database and results are similar

```
Wall 1 is correct
```

Checks if the wall lenght is calculated correct

```
Wall length 1 is correct
```

Checks if the Differential_Settlement is calculated correct

```
Differnetial_settlement is correct
```

Check if the rotation is calculated correct

```
Rotation is correct
```

Display x and z coordinates for hand calculations

```
x = 1×3
         0    2.3800    6.0000

z = 1×3
   -80   -82  -130
```

A.3 B211

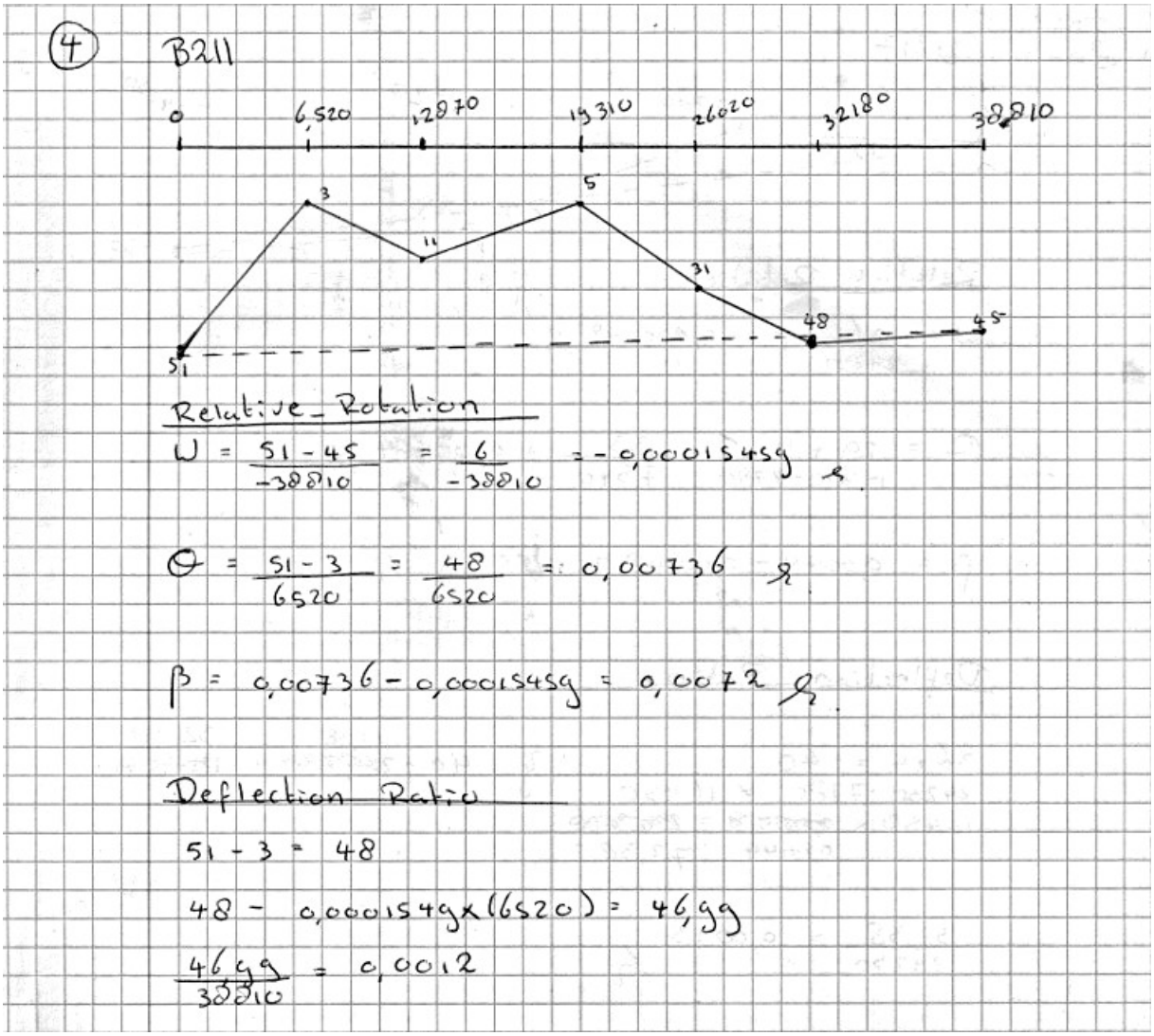


Figure 6: Hand calculations for case B211

Data

```
for case: B211
```

Check if the damage from results, database and temp are similar

```
Damage is correct
```

Check if the foundation from results, database and temp are similar

```
Foundation is correct
```

Check if the wall from database and results are similar

```
Wall 1 is correct
```

Checks if the wall lenght is calculated correct

```
Wall length 1 is correct
```

Checks if the Differential_Settlement is calculated correct

```
Differnetial_settlement is correct
```

Check if the rotation is calculated correct

```
Rotation is correct
```

Display x and z coordinates for hand calculations

```
x = 1×7
         0    6.5200   12.8700   19.3100   26.0200   32.1800   38.8100

z = 1×7
    51     3    11     5    31    48    45
```

A.4 B317

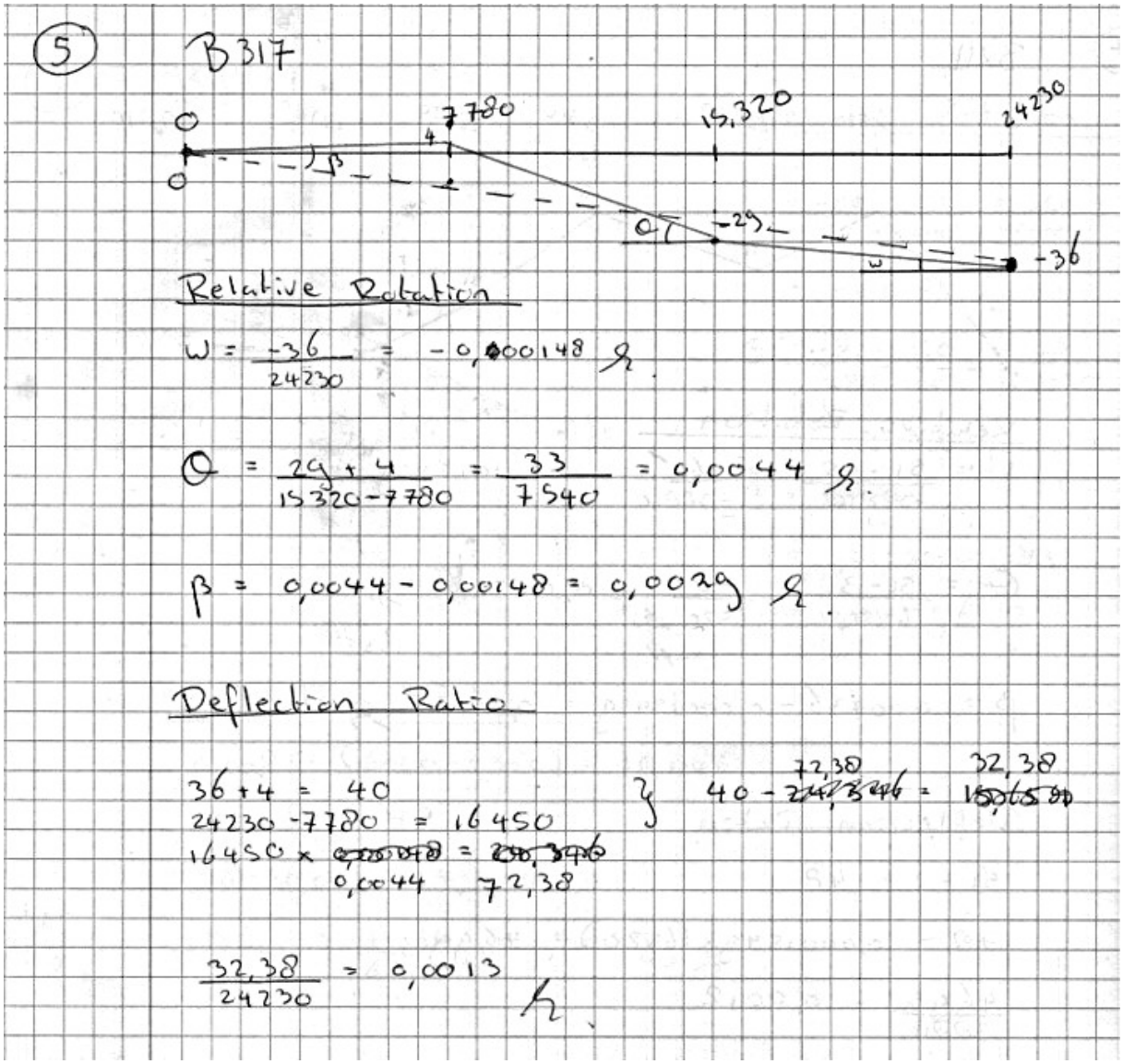


Figure 7: Hand calculations for case B317

Data

```
for case: B317
```

Check if the damage from results, database and temp are similar

```
Damage is correct
```

Check if the foundation from results, database and temp are similar

```
Foundation is correct
```

Check if the wall from database and results are similar

```
Wall 1 is correct
```

Checks if the wall lenght is calculated correct

```
Wall length 1 is correct
```

Checks if the Differential_Settlement is calculated correct

```
Differnetial_settlement is correct
```

Check if the rotation is calculated correct

```
Rotation is correct
```

Display x and z coordinates for hand calculations

```
x = 1×4
         0    7.7800   15.3200   24.2300

z = 1×4
     0     4   -29   -36
```

B Reports used for obtaining the dataset

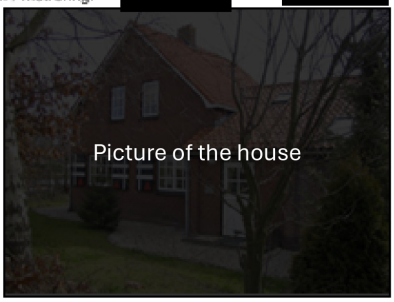
This section includes three types of reports to provide the reader with an overview of their structure and content. The reports presented correspond to B14, B45, and B161 to B172.

B.1 Report for B14

pand: [redacted]

[redacted]
Address

dwarspr. / metrering: [redacted] [redacted]



[redacted]

zetting tpv voorgevel	0,051 m	tot	0,174 m	
zettingshelling	1:114	tot	1:32	cat.
paalmoment	1,2	kNm (hout)		3
paalmoment	10,0	kNm (beton)		3
staal categorie				3

beschikbare informatie:

bouwtekeningen beschikbaar:	[x] ja, archief Waternet (voorhuis)	[ ] nee	
funderingsgegevens beschikbaar:	[x] ja, archief Waternet (voorhuis)	[ ] nee	
bouwjaar bekend:	[x] ja, nl. 1929 (schuur) 1960 (voorhuis)	[ ] nee, geschat	[ ] voor 1900 [ ] 1900 - 1950 [ ] 1950 - 1975 [ ] 1975 - 2000 [ ] na 2000
eigenaar/bewoner gesproken:	[x] ja	[ ] nee	
foto's genomen:	[x] ja, nrs 3433 t/m 3445	[ ] nee	

bouwkundige omschrijving:

voorhuis	2 bouwlagen	schuur	voormalige stal
	spouwmuren		twee bouwlagen (bg, zolder)
	pannendak		halfsteens metselwerk
	fundering op betonpalen met oplanger		pannendak
	steenachtige vloeren		vermoedelijk fund. op staal
			betonvloer
	geen schade		diverse rotatiescheuren in zijgevel langs kade
			zijgevel tuinzijde en achtergevel geheel vernieuwd

lintvoegwaterpassing:

linkerzijgevel (tuinzijde)	woonhuis	dz = 150 mm	rotatie	< 1:300	tot 1:30
voorgevel	woonhuis	dz = 150 mm	rotatie =	1:35	
rechterzijgevel (kade)	woonhuis	dz = 105 mm	rotatie =	< 1:300	tot 1:40
linkerzijgevel (tuinzijde)	schuur	dz = 62 mm	rotatie	< 1:300	tot 1:150
achtergevel	schuur	dz = 38 mm	rotatie =	< 1:300	
rechterzijgevel (kade)	schuur	dz = 400 mm	rotatie =	1:110	tot 1:4

toetsing op basis van quickscan:

- huidige scheefstand van het voorhuis zodanig dat criterium voor schadecategorie 3 (zettingsgradiënt > 1:100) nu al wordt overschreden
- vermoedelijk wordt de scheefstand van het voorhuis veroorzaakt door negatieve kleef en/of paalmoment
- op dit moment nog geen schade zichtbaar aan voorhuis doordat pand in zijn geheel is geroteerd
- schuur vertoont aan zijde kade slechts beperkte rotaties, vooral aan achterzijde; desondanks wel scheurvorming zichtbaar aan zijde kade
- scheefstand voorhuis is op dit moment kritisch; verdere toename scheefstand leidt tot onveilige situatie; geadviseerd wordt e.e.a. met eigenaar te bespreken

Logo of the company

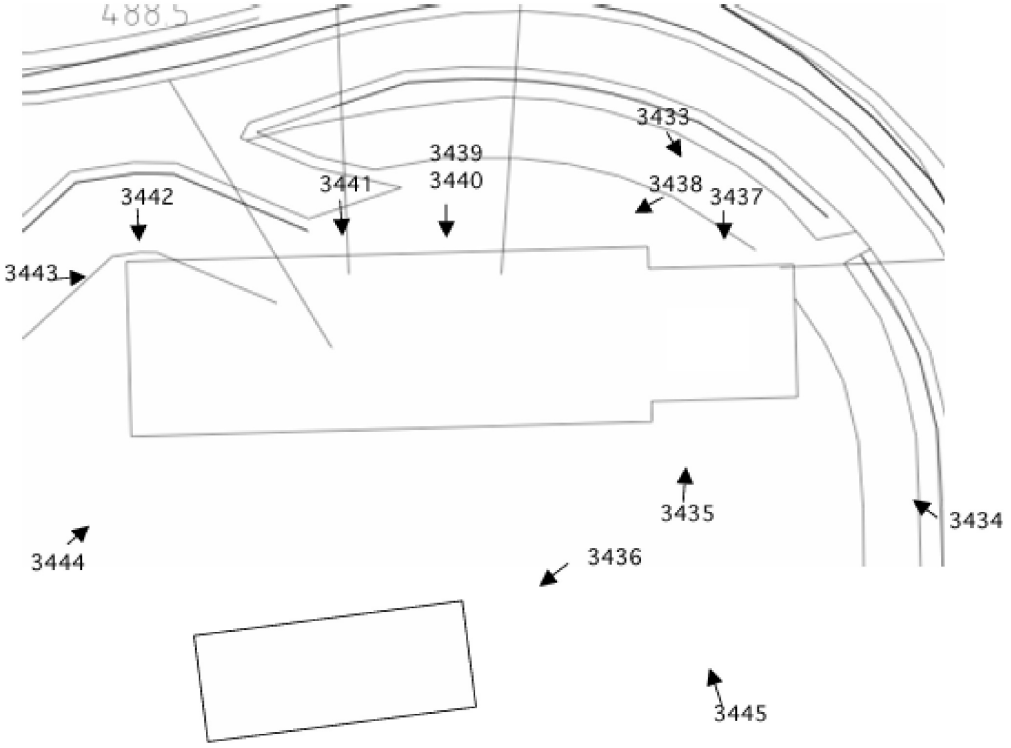
dat. **06-04-06** Name of the project

pand: [redacted]

Address

dwarspr. / metrering:

situatieschets, positie foto's



Logo of the company

dat. 06-04-06

Name of the project

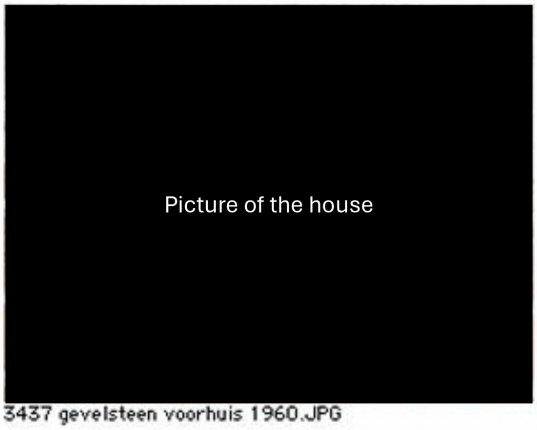
Address

3433 rechterzijgevel.JPG

3434 voorgevel - linkerzijgevel.JPG

3435 naad voorhuis - schuur.JPG

3436 schuur.JPG



3437 gevelsteen voorhuis 1960.JPG

3438 zijgevel schuur langs kade.JPG

Address

3439 scheur zijgevel schuur.JPG

3440 scheur zijgevel schuur.JPG

3441 schuur zijgevel.JPG

Picture of the house

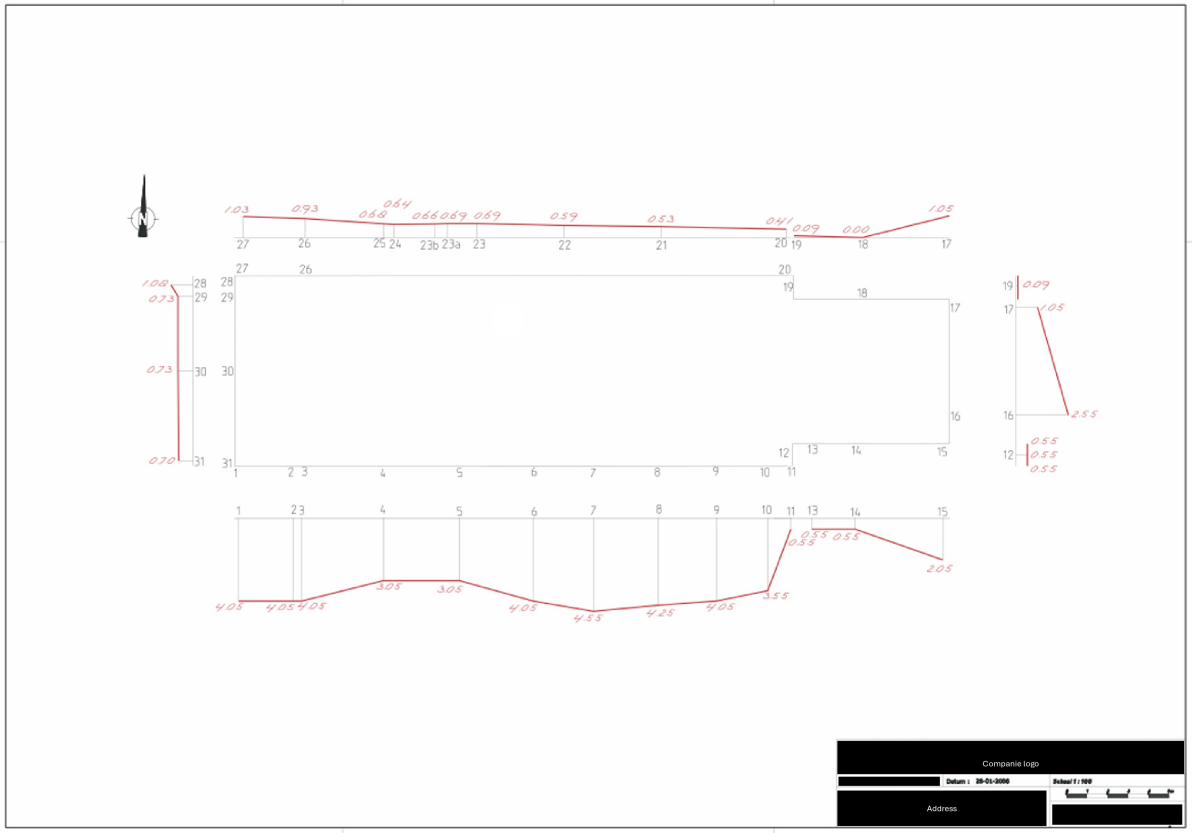
3442 gevelsteen schuur 1929.JPG

3443 naad zijgevel-achtergevel schuur.JPG

3444 overzicht linkerzijgevel.JPG

Address

3445 linkerzijgevel voorhuis.JPG


1.03
0.93
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0.68
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0.00
1.05
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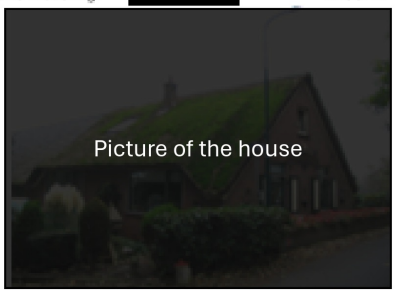
2.05
Companie logo
Datum : 28-01-2026
Schaal 1 : 100
Address

B.2 Report for B45

pand: 1e versie [redacted]

[redacted] dwarspr. / metrering: [redacted] 1188 m

Address



prognose [redacted]

zetting tpv voorgevel	0,025 m
zettingshelling	1:227
paalmoment (beton)	n.v.t.
paalmoment (hout)	n.v.t.
staal categorie	cat. 2

beschikbare informatie:

bouwtekeningen beschikbaar:	[x] ja, alleen renovatietek. 1990	[ ] nee	
gegevens fundering op tekening:	[ ]	[x] nee	
nader onderzoek fundering (graafwerk):	[ ] ja	[x] nee	
bouwjaar bekend:	[x] ja, 1962 stallen + oudere gevels, 1990 gevels deels vernieuwd	[ ] nee	fundering [x] voor 1900 / [ ] 1900 - 1950 / [ ] 1950 - 1975 / [ ] 1975 - 2000 / [ ] na 2000
eigenaar/bewoner gesproken:	[x] ja	[ ] nee	
opname niveau:	[ ] quickscan	[x] basis	[ ] expertise
opname:	[ ] interieur	[x] exterieur	
foto's genomen:	[x] ja, nrs 4969 t/m 4986		[ ] nee

beknopte bouwkundige omschrijving:

- voorhuis baksteen (spouwmuur) met rieten kap
- stal baksteen (halfsteens?) met pannendak
- pand is in vlg. eigenaar 1962 herbouwd op bestaande fundering op staal (daterend van voor 1800)
- gevels voorhuis in 1990 vernieuwd
- voorhuis begane grond en 1e verd./zolder
- voorgevel staat dichtbij kade (1,50 m van rand weg)
- diverse gevelankers aanwezig

lintvoegwaterpassing:

(huidige situatie)	verschilzett. dz	rotatie hoek	rotatie mm/meter	richting	rel. hoekverdr. δ/L
voorgevel	11 mm	1:420	2,4		
linkerzijgevel voorhuis	32 mm	1:250	4,0	kade	
linkerzijgevel stal	niet bereikbaar				
rechterzijgevel voorhuis	16 mm	1:625	1,6	kade	1:320
rechterzijgevel stal	50 mm	1:295	3,4	achtergevel	1:320
achtergevel	50 mm	1:50	20,0		

Voorhuis helt licht voorover richting kade, stal juist naar achteren.
Totale zettingsverschillen zijn relatief klein (tot 56 mm).
Waterpassing mogelijk niet representatief als gevolg van herbouw 1962/1990 en oudere leeftijd fundering.

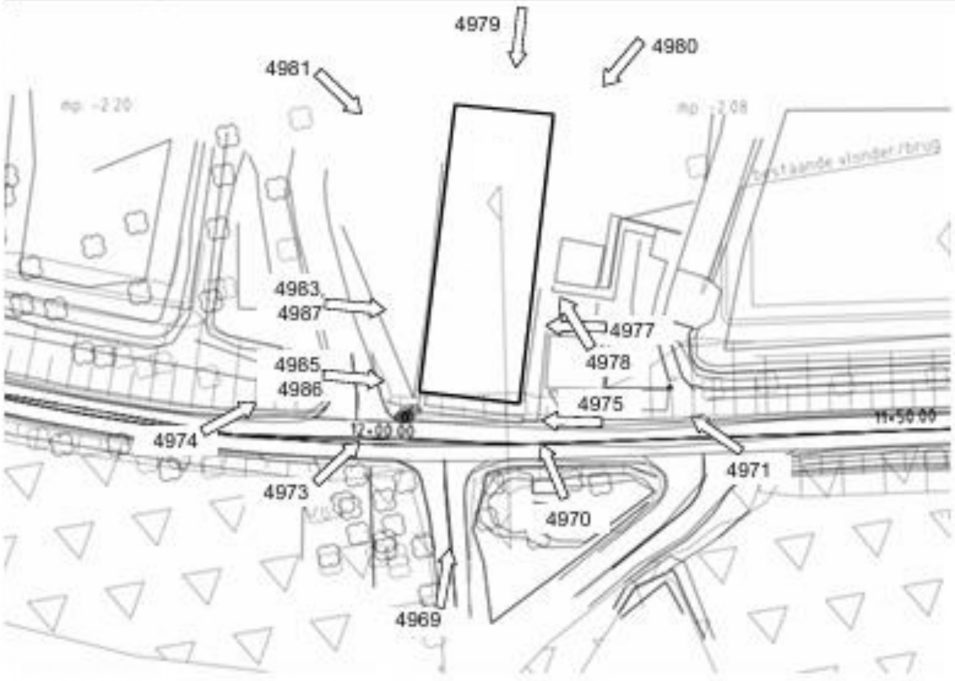
Logo of the company

dat. 01-12-06 Name of the project

pand: [redacted]

Address

situatieschets, positie foto's



eventuele schade of bijzonderheden

- pand is constructief in redelijke conditie
- ter plaatse van linkerzijgevel enige scheurvorming zichtbaar in voorhuis waarschijnlijk als gevolg van rotatieverschil tussen voorhuis en stal
- ter plaatse van aanhechting plantenbak - woonhuis enige scheurvorming zichtbaar.

Logo of the company

dat. **01-12-06**

Name of the project

pand: [redacted]

Address

indeling huidige situatie in schadeklasse volgens SBR-273 **klasse 2: lichte schade**

omschrijving schadeklasse 2:
- scheuren ter wijdte van maximaal 5 mm
- licht vervormde raam- en deurkozijnen

nader onderzoek fundering

Geen funderingsonderzoek gedaan.
Volgens eigenaar is pand in 1962 herbouwd op oude strokenfundering, gemetseld met een breedte van circa 0,5 tot 0,75 m. Er zouden geen palen onder het pand aanwezig zijn.
Herbouw 1990 gevels voorhuis mede als gevolg van tussen 1962 en 1990 opgetreden scheurvorming in het voorhuis.

analyse oorzaak aanwezige gebreken

gebrek: scheurvorming linkerzijgevel
oorzaak: rotatieverschil woonhuis - stal

Logo of the company

dat. **01-12-06** Name of the project

pand: [redacted]

Address

prognose schade als gevolg van ongelijkmatige zettingen bij fundering op staal basis

[redacted]		verschilzett. dz	rotatie hoek	mm/meter	richting	rel. hoekverdr. δ/L
zijgevel links	nu	20 mm	1:250	4,0	kade	
	extra	22 mm	1:227	4,4	kade	
		42 mm	1:119	8,4		
zijgevel rechts	nu	9 mm	1:556	1,8	kade	
	extra	22 mm	1:227	4,4	kade	
		31 mm	1:161	6,2		

Op het moment dat een rotatie van circa 1:120 tot 1:160 zal optreden ter plaatse van het voorste deel van het pand, mag zeker worden verwacht dat dit tot (verdere) scheurvorming leidt in de beide zijgevels en mogelijk ook in de voorgevel.

Om deze reden is door [redacted] een variant uitgewerkt waarbij 0,30 m van de wegfundering wordt uitgenomen en vervangen door granulite. Daarna wordt alleen geasfalteerd.

prognose schade als gevolg van ongelijkmatige zettingen bij fundering op staal variant

[redacted] zal worden berekend of met een gewichtsneutrale oplossing of met een lagere ophoging (voor t=15 jr.) een kleinere zetting kan worden bereikt. Uitgegaan is hier van 5 mm tpv voorgevel.

		verschilzett. dz	rotatie hoek	mm/meter	richting	rel. hoekverdr. δ/L
zijgevel links	nu	20 mm	1:250	4,0	kade	
	extra	5 mm	1:1000	1,0	kade	
		25 mm	1:200	5,0		
zijgevel rechts	nu	9 mm	1:556	1,8	kade	
	extra	5 mm	1:1000	1,0	kade	
		14 mm	1:357	2,8		

Verwacht wordt dat deze vervorming opneembaar is. Niet uit te sluiten valt dat enige esthetische scheurvorming ontstaat, maar niet in die mate als bij het oorspronklijke ontwerp.

Logo of the company

dat. **01-12-06** Name of the project

pand: [redacted]

Address

prognose schade **klasse 3: matige schade**

Voorgevel zal maximaal 5 mm zakken, uitgaande van gewichtsneutraal of lagere ophoging-alternatief
Toename scheefstand zal mogelijk kunnen leiden tot lichte scheurvorming in zijgevels en/of voorgevel.

Bij het oorspronkelijke ontwerp is schadeklasse 3+ (ten minste matige schade) te verwachten.

raming herstelkosten bestaande schade

type schade	hersteltechniek	hoeveelheid (m / m2 / st)	prijs/eenheid	kostenpost
lichte scheefstand	herstel niet nodig			PM
lichte scheurvorming links	inboeten, voegen	2,00 m2	€ 75	€ 150
scheurvorming plantenbak	inboeten, voegen	4,00	€ 75	€ 300
			totaal excl. btw	**€ 450**

raming herstelkosten nieuwe schade (indien deze daadwerkelijk optreedt) variant

type schade	hersteltechniek	hoeveelheid (m / m2 / st)	prijs/eenheid	kostenpost
lichte scheurvorming buiten	inboeten, voegen	4,0 m2	€ 75	€ 300
toename lichte scheefstand	herstel niet nodig			PM
			totaal excl. btw	**€ 300**

Indien de herstelkosten voor de eventueel optredende nieuwe schade worden vermenigvuldigd met de kans dat deze schade daadwerkelijk optreedt, ontstaat de volgende risicotabel:

risico (kans x kosten) variant

type schade	kans	post	risico
lichte scheurvorming buiten	50%	€ 300	€ 150
toename lichte scheefstand			PM
		totaal risico	**€ 150**

Logo of the company

dat. **01-12-06**

Name of the project

pand: [redacted]

Address

eindconclusie en advies

indeling huidige situatie in schadeklasse volgens SBR-273	klasse 2: lichte schade
schade bestaande situatie (zonder kadeversterking)	€ 450 excl. btw
prognose schade na kadeversterking	klasse 3: matige schade
schaderisico (herstelkosten x kans, naar boven afgerond)	€ 150 excl. btw

Het pand is in redelijke conditie maar is wel kwetsbaar. De zichtbare vervorming wijst op een draagkrachtprobleem. Gezien de beperkte verwachte maaiveldzetting (5 mm) bij een lichte ophoogvariant wordt hieruit slechts geringe schadekans verwacht.

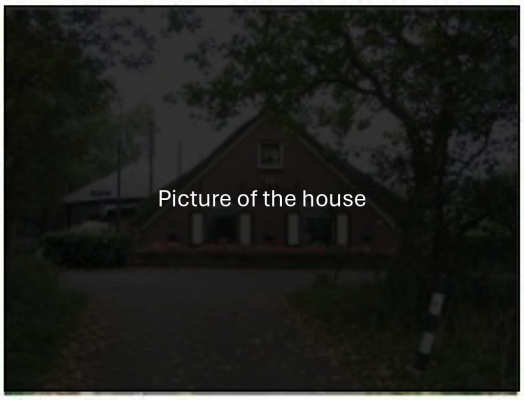
Gezien de geringe afstand tot de voorgevel dient bij de uitvoering ter plaatse rekening te worden gehouden met trillingen en eventuele horizontale gronddruk op de voorgevel als gevolg van wegbelasting.

Logo of the company

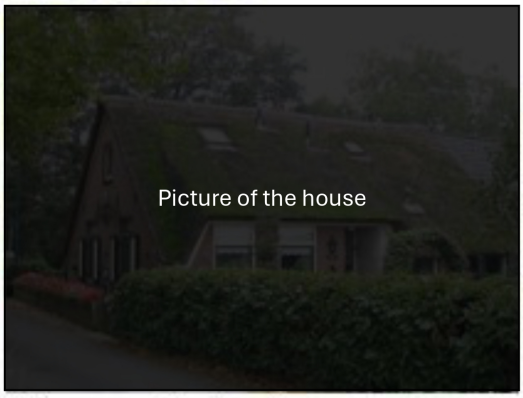
dat. **01-12-06**

Name of the project

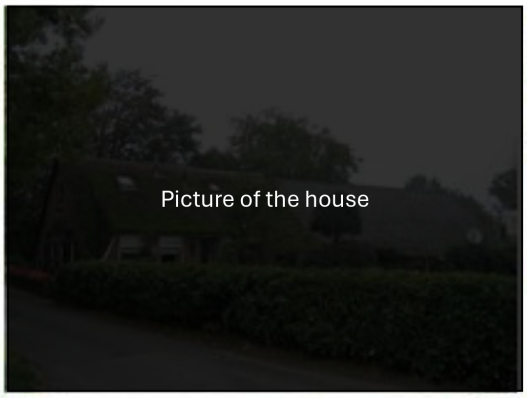
Address



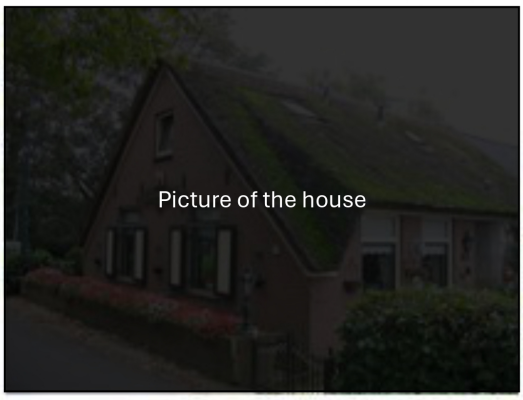
4969 voorgevel



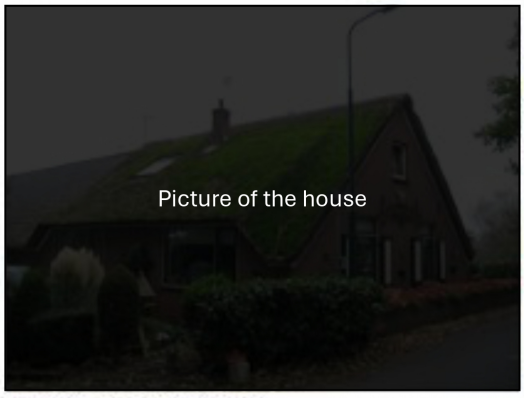
4970 voor- en rechterzijgevel



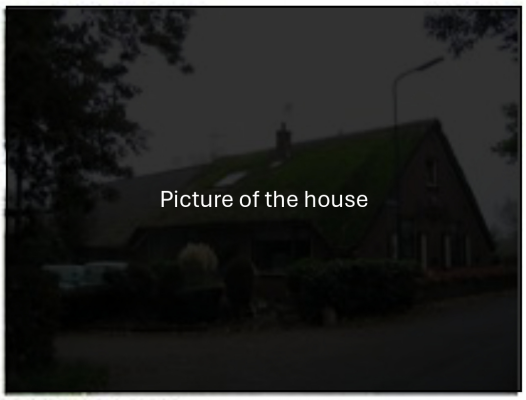
4971 overzicht rechts



4972 voorhuis

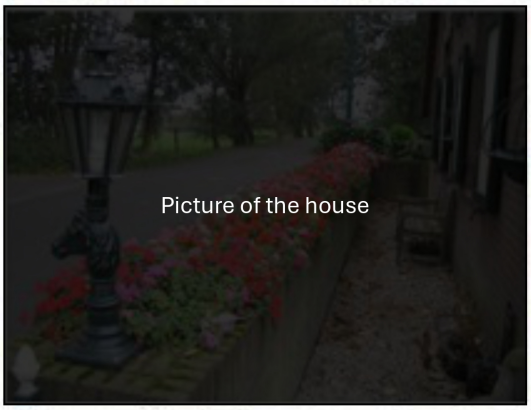


4973 voorhuis linkerzijgevel



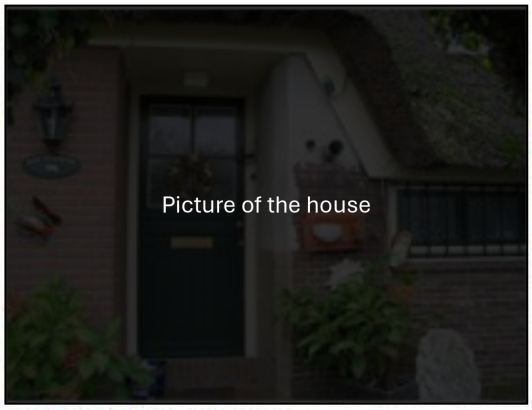
4974 overzicht links

Address

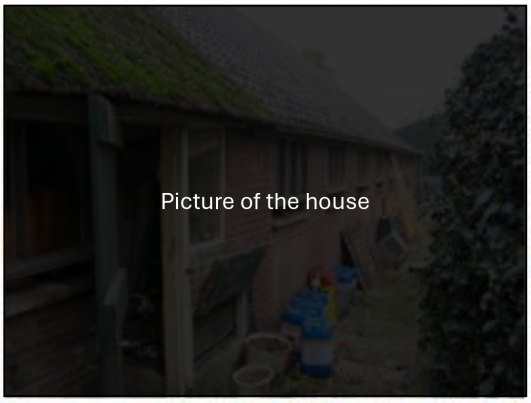


4975 voorgevel t.o.v. kade

4976 hoogteligging t.o.v. kade

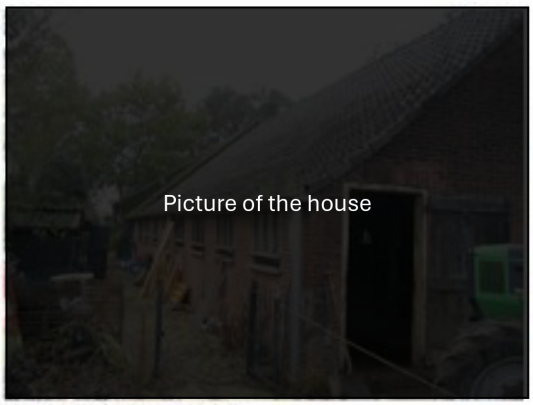


4977 overgang voorhuis - stal



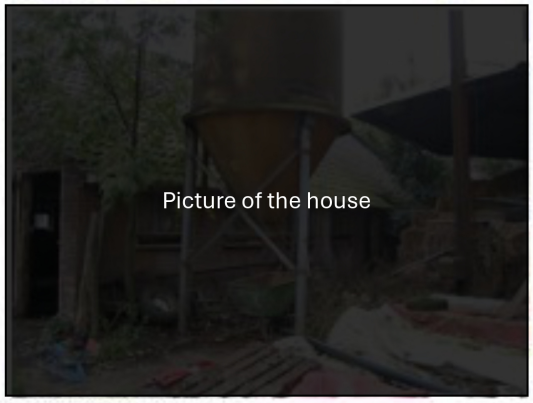
4978 stal rechterzijgevel

4979 stal achtergevel

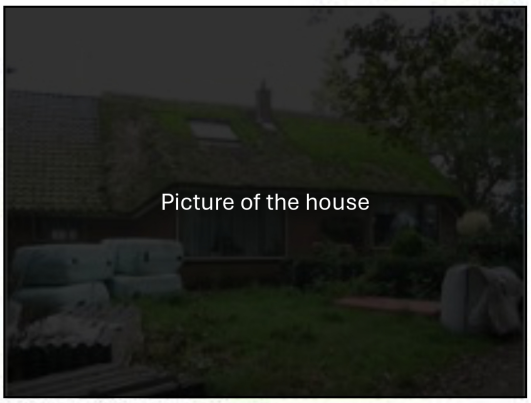


4980 stal rechterzijgevel

Address



4981 stal linkerzijgevel



4982 voorhuis linkerzijgevel

4983 scheurvorming linkerzijgevel voorhuis

4984 idem detail

4985 plantenbak

4986 voorgevel vernieuwd

BIJLAGE W1: LINTVOEG- EN VLOERWATERPASSING

Inleiding
Bij een lintvoegwaterpassing wordt de ligging van een originele horizontale voeg in het metselwerk van een gebouw ingemeten met behulp van een waterpasinstrument. Ervan uitgaande dat het metselwerk bij de bouw nagenoeg horizontaal is gemetseld, kan worden gemeten of onderdelen van het pand ten opzichte van elkaar zijn gezakt. Op deze manier kan een goede inschatting worden verkregen van de ongelijkmatige zettingen (= zakking) die de fundering na de bouw heeft ondergaan. Als de buitengevels van een pand niet bereikbaar zijn, bijvoorbeeld wanneer het een tussenwoning betreft, kan ook in het pand het vloerpeil worden ingemeten. Als de vloeren na de bouw niet zijn opgehoogd of rechtgelegd, kan bij benadering de opgetreden zetting van de fundering waarop deze vloer ligt worden gemeten.

Grafiek
De resultaten van de lintvoegwaterpassing worden weergegeven in een plattegrond van het gebouw, waarbij de zettingen rondom de buitengevels op schaal in een grafiek worden ingetekend in millimeters. Hierbij wordt het hoogste punt van de lintvoeg in het metselwerk als nul ingetekend, en de overige punten als zakkingen ten opzichte van dit hoogste punt. De resultaten van de vloerwaterpassing worden in de plattegrond weergegeven met behulp van de getallen die op de plaats van meting de mate van zetting weergeven in millimeters.

Scheurvorming
Omdat scheurvorming in het metselwerk nogal eens veroorzaakt wordt door ongelijkmatige zettingen van de fundering, blijkt uit een waterpassing vaak of de aanwezige scheuren inderdaad hierdoor verklaard kunnen worden. Dit kan wijzen op een funderingsprobleem. Bij het ontbreken van scheuren terwijl de fundering wel gezakt is zegt de waterpassing ook iets over de capaciteit van het metselwerk om (eventuele) ongelijkmatige vervormingen zonder schade op te nemen. Hierbij is met name de afstand waarover de ongelijkmatige zettingen zijn "uitgesmeerd" van belang. De ervaring leert dat bij rotaties tussen 3 mm per meter (rotatie 1:333) en 20 mm per meter (rotatie 1:50) scheurvorming begint op te treden in metselwerk. Met name bij knikken in de lintvoegwaterpassing is de kans op scheuren het grootst.

Nauwkeurigheid
Omdat de nauwkeurigheid van de meting beperkt is tot ±5 mm, kan niet worden gemeten of een pand nog altijd zakt. Hiervoor is andere meetapparatuur nodig, en moeten boutjes in de gevels worden geplaatst, die gedurende enkele jaren worden gemeten.

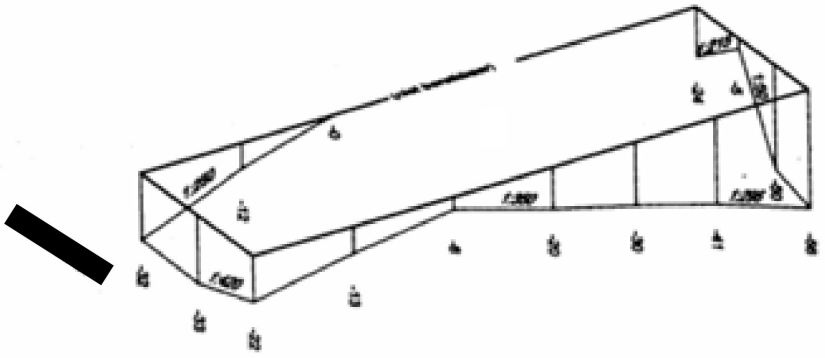
Beoordelingscriteria

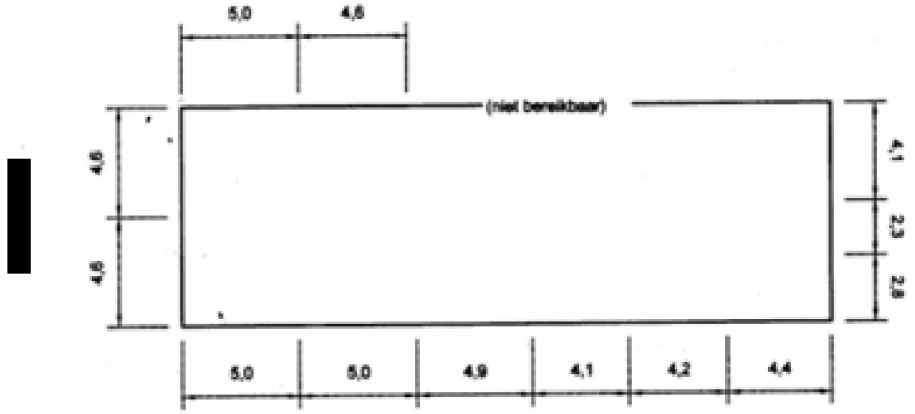
scheefstand in millimeter per meter	*rotatie*	*beoordeling*
>15	1:67 tot 1:50	slecht
10 tot 15	1:100 tot 1:67	matig
5 tot 10	1:200 tot 1:100	redelijk
0 tot 5	0 tot 1:200	goed

Logo of the company

dat. alg. Name of the project

Logo of the company





SCHAAL 1:250

Address

B.3 Report for B161-B172

Cases located in Schiedam, damage information retrieved from [2].