

Identification of maintenance practices within the Monumentenwacht model in Belgium

CHANGES, intermediate results WP3
October 2017



Objectives WP3

- Investigate maintenance practices, understand the types of interventions done in the past
- Evaluate the interventions in terms of effectiveness, durability (service life) and cost
- Understand the skills and knowledge involved in the process

Identification
of maintenance practices

Evaluation
of maintenance practices

Selection of case studies

Cases are selected based on:

1. The ownership (private vs public)
2. The number of available consecutive reports of Monumentenwacht
3. Insights on the maintenance behavior, based on interview with local heritage agency
4. Two regions: urban environment (Mechelen), rural area (South-East Limburg)



Urban environment (Mechelen)



Rural area (South-East Limburg)

Selected case studies

	Urban environment	Rural area
Private ownership	58.33 %	75.00 %
Public ownership	41.67 %	25.00 %
Private ownership with residential use	33.33 %	50.00 %
Private ownership with commercial use	25.00 %	25.00 %
Church	16.67 %	12.50 %
Public municipality	25.00 %	12.50 %

Research data for case studies

- In-depth interviews with the owners
- Inspection reports Monumentenwacht
- project documentation for interventions (Flemish Heritage Agency, local heritage agencies, owners)
- Site visits and focus group

In-depth interviews

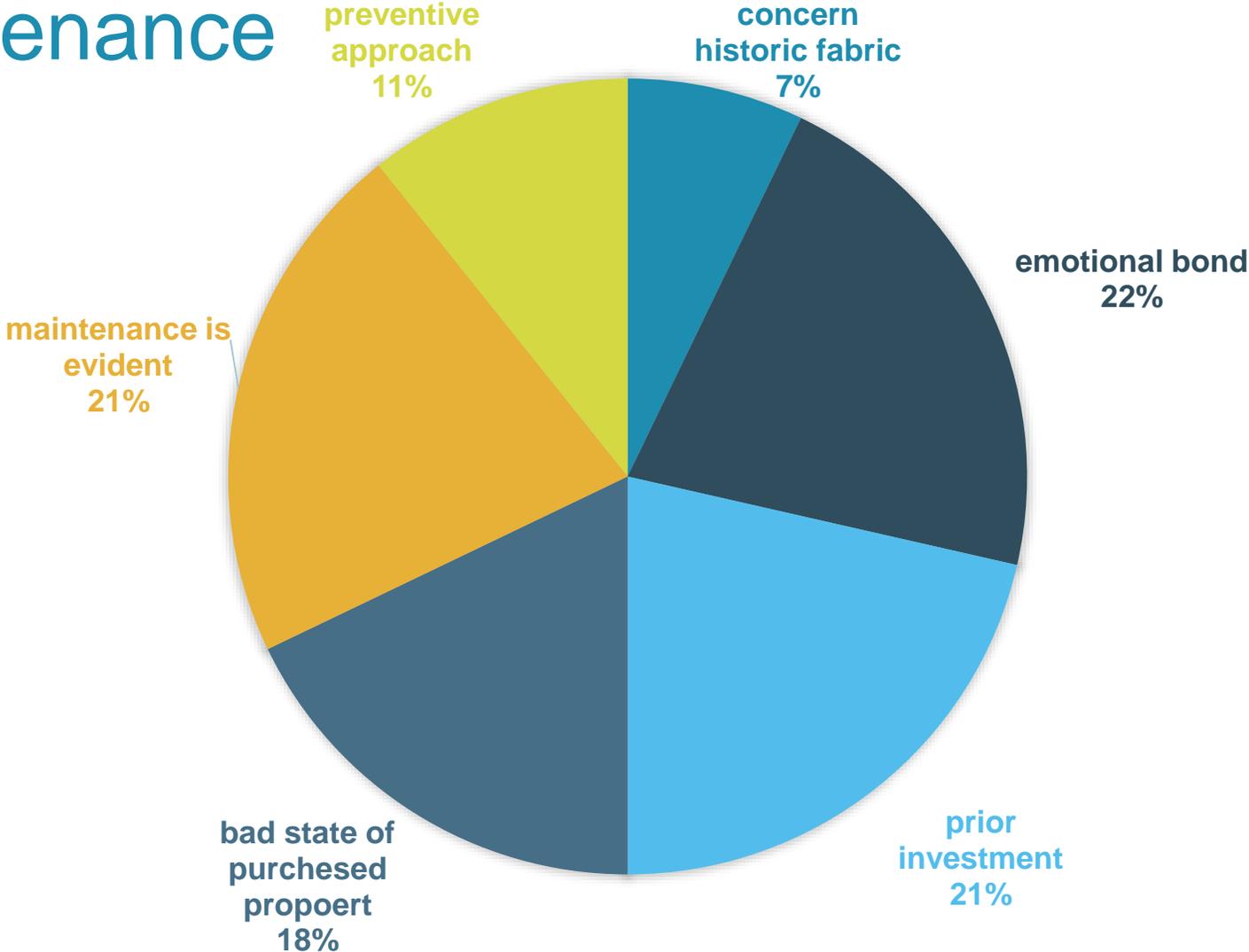
- Open questions
- Maintenance objectives: appreciation of the property, perception on maintenance
- Maintenance approach: which interventions? How often? Planned or reactive? In relation to reports Monumentenwacht? Quality evaluation? Stakeholders involved? When inspections Monumentenwacht? Why inspections? What actions based on reports?
- Analysis: Grounded Theory (open coding, axial coding, selective coding)

Identification of the maintenance objectives

Table 1: The maintenance objectives.

	C1	C2	C3	C4	C5	C6	C7
Concern for historical fabric		X	X				
Emotional bond	X	X	X	X	X		X
Prior investment	X		X	X	X	X	X
Bad state of purchased property	X		X		X	X	X
Maintenance is evident	X	X	X	X		X	X
Preventive approach	X	X	X				

Note: the financial burden of regular works was not identified as impeding the owners to regularly undertake maintenance activities.

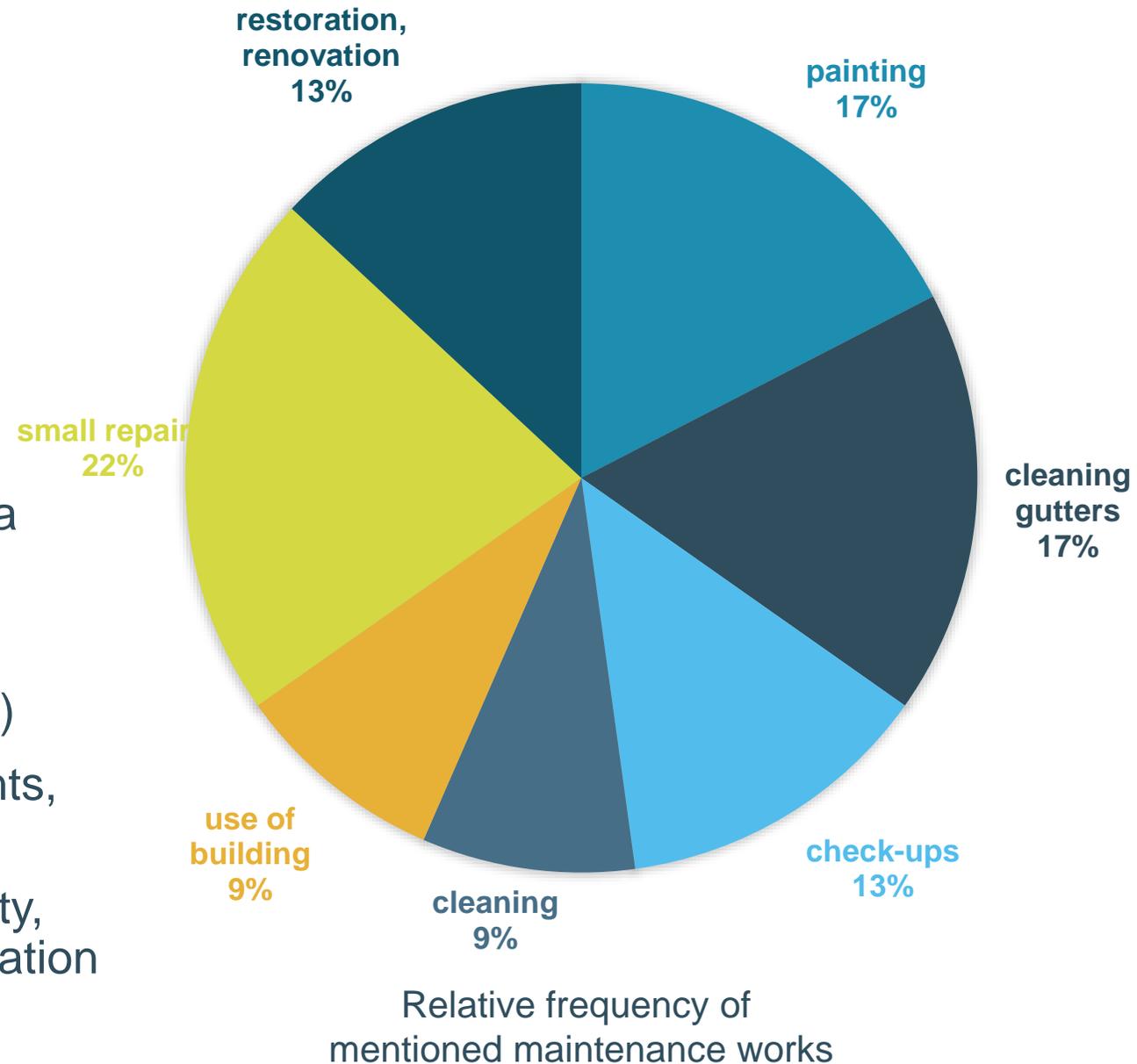


Relative frequency of maintenance objectives

Maintenance interventions

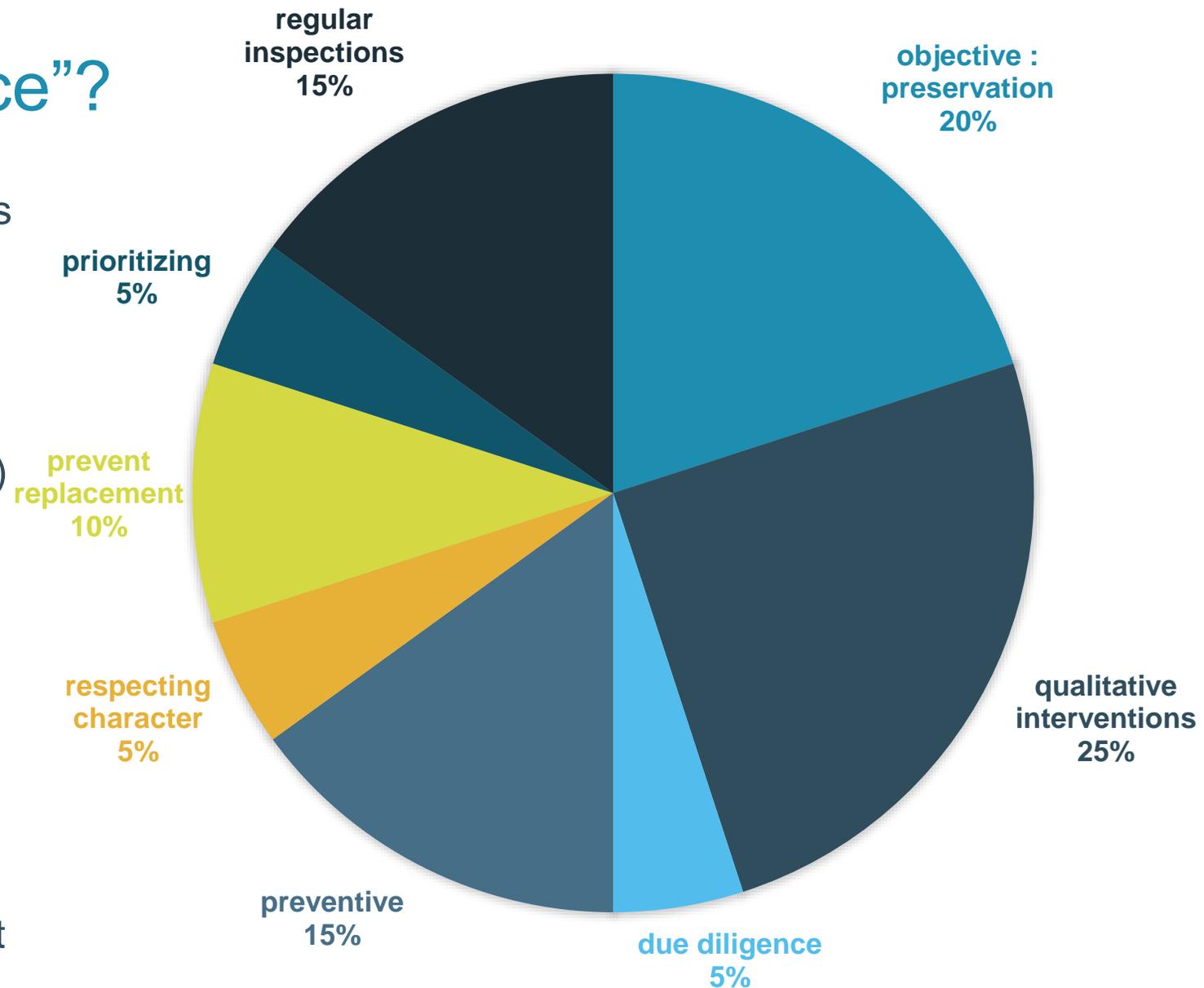
Interventions that are considered “maintenance”

1. Painting of windows (57.14 %)
2. Cleaning gutters (57.14 %)
3. Check-ups: cracks, pressure of water tubes central heating, positioning of roof tiles after a storm (42.86 %)
4. Cleaning (28.57 %)
5. Use of the building (heating, airing) (28.57 %)
6. Small repairs: repositioning loosened elements, repair of leakages (71.43 %)
7. Renovation and restoration: renewal electricity, new windows, new roofing, repointing, restoration of wooden floors (42.86 %)



What is “good maintenance”?

1. Objective = preservation of the building's state (57.14 %)
2. Qualitative interventions (71.43 %)
3. Administrated with due diligence (14.28 %)
4. Good maintenance is preventive (timely) (42.86 %)
5. Respecting the character of the historic property (14.28 %)
6. Preventing replacement (due to authenticity of historic fabric) (28.57 %)
7. The motivation to do the right thing (14.28 %)
8. Prioritizing correctly (14.28 %)
9. Regular inspections (Monumentenwacht or own inspections) (42.86 %)



Inspection reports Monumentenwacht

Case	Years of inspections	Number of inspections	Frequency
UPr – case 1	2013	1	0.25
UPr – case 2	1999, 2004, 2011, 2015	4	0.22
UPr – case 3	(1995, 1997), 2006	1	0.09
UPr – case 4	1999, 2002	2	0.11
UPr – case 5	2001, 2004, 2007, 2009, 2011, 2015	6	0.37
UPr – case 6	1995, 1998, 1999, 2002, 2005, 2014	6	0.27
UPr – case 7	1996, 1998, 2000, 2002, 2005, 2007, 2010, 2014	8	0.38
UPu – case 8	1993, 1995, 1998, 2004, 2009, 2014	6	0.25
UPu – case 9	1996, 1999, 2003, 2006, 2010, 2014	6	0.29
UPu – case 10	1997, 2000, 2007	3	0.18
UPu – case 11	1997, 2000, 2005, 2010	4	0.20

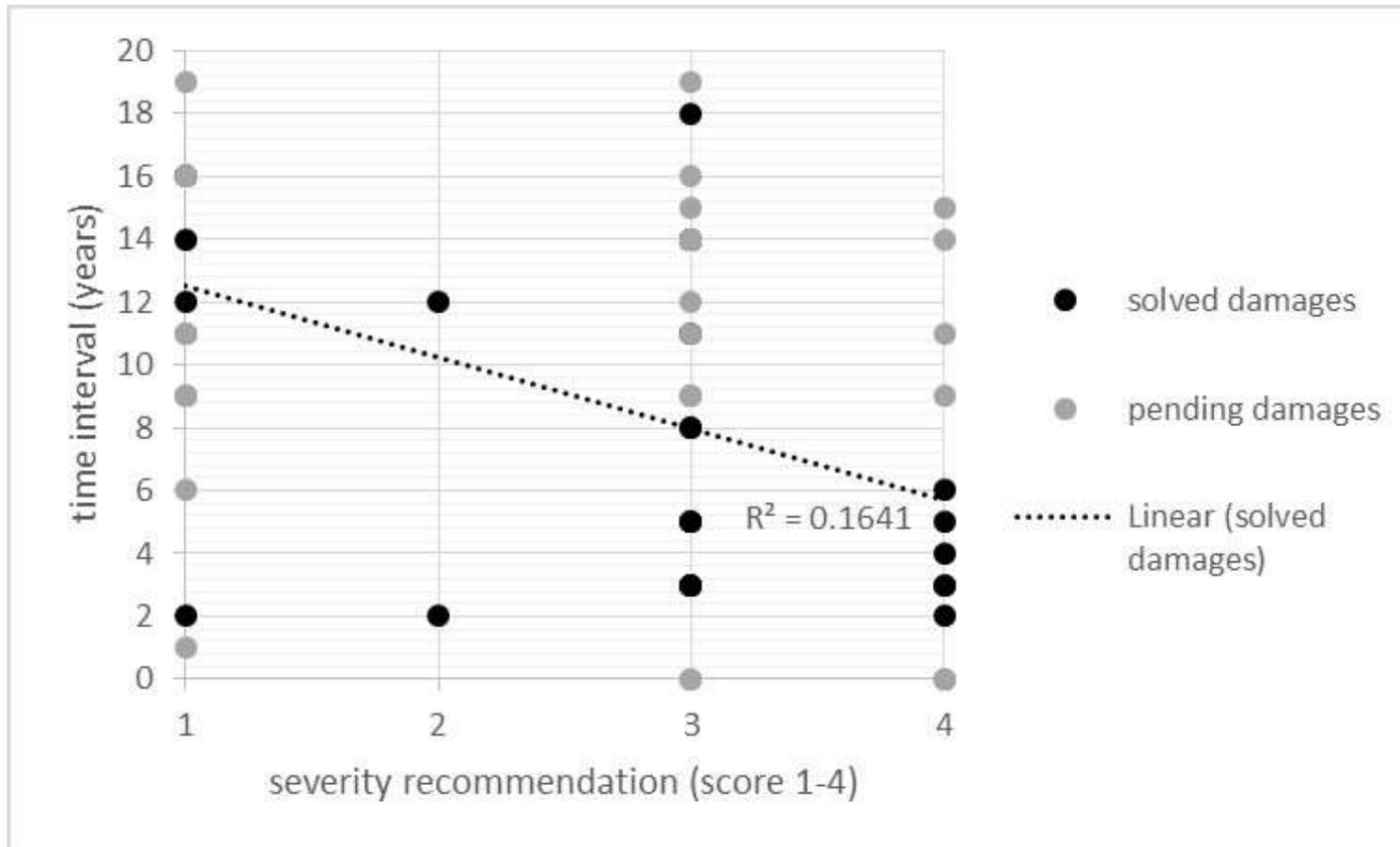
Inspection reports Monumentenwacht

Case	Years of inspections	Number of inspections	Frequency
RPr – case 1	2017	1	/
RPr – case 2	2017	1	/
RPr – case 3	/	0	/
RPr – case 4	2016	1	/
RPr – case 5	/	0	/
RPr – case 6	(2001)	(1)	/
RPu – case 7	2017	1	/
RPu – case 8	2014	1	0.33

Tendencies in owners' approaches based on data inspection reports

- Focus on rainwater disposal system (roof coverings, gutters, drainpipes, connections)
- Two aspects are investigated:
 1. owners' response time in relation to recommendations of MoWa
 2. owners' response time in relation to severity of detected damages

owners' response time in relation to recommendations of MoWa



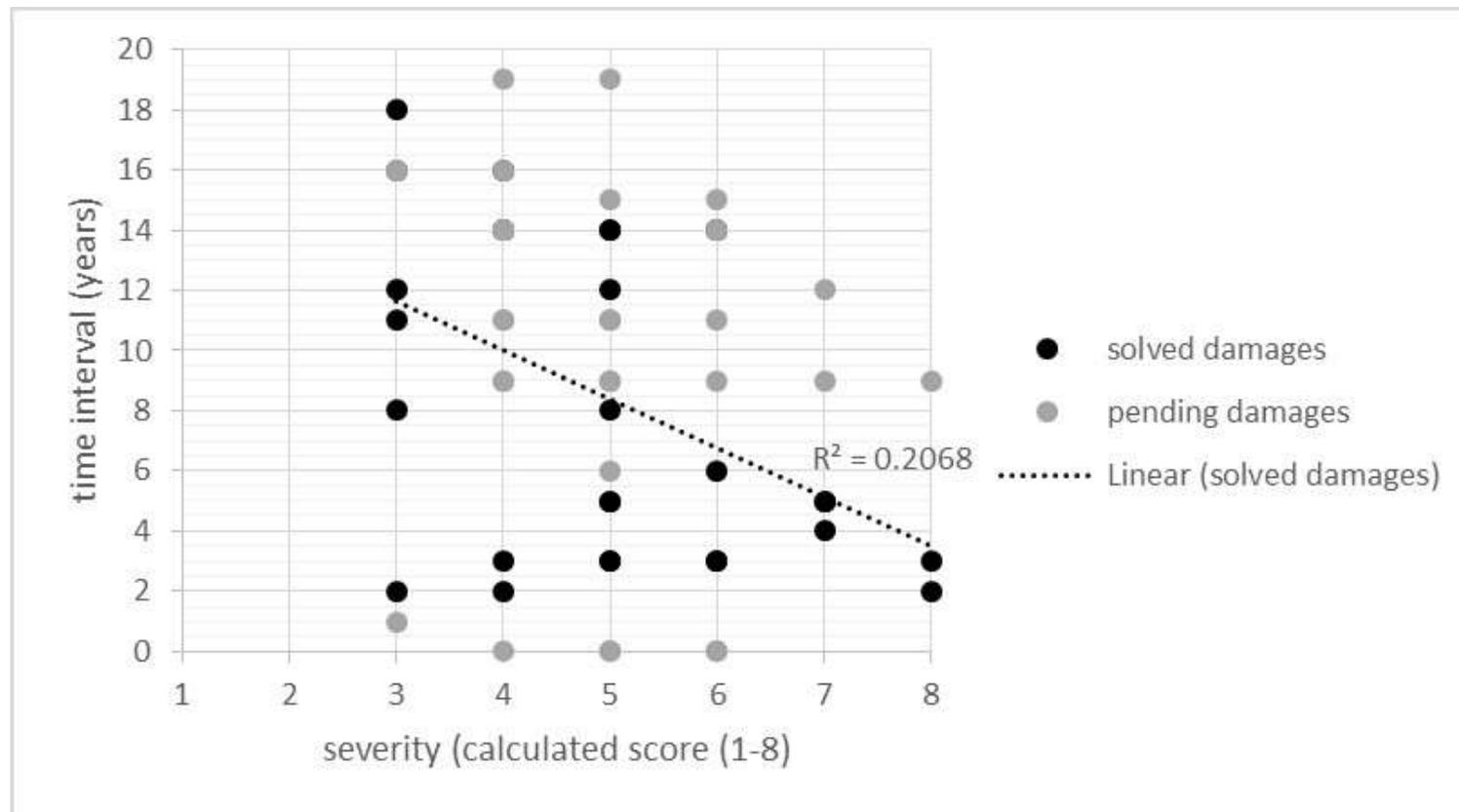
- Severity recommendations
1. No recommendations made
 2. Recommended to solve on the long run
 3. Recommended to solve shortly
 4. Recommended to solve urgently

Owners' response time in relation to severity of detected damages

- Severity of damages is defined and based on (1) type of damage, (2) condition, (3) resulting infiltrations
- Damages are classified according to four categories: (1) disintegration of materials and connections, (2) poor design or execution, (3) mechanical damage to materials or loosening of connections, (4) missing elements

Damage category	Number of infiltrations	Total occurrences	Probability P of resulting infiltrations
Disintegration	3	17	8.33%
Poor design or execution	1	12	17.65%
Mechanical damage, loosening	11	24	45.83%
Missing elements	3	5	60.00%

Owners' response time in relation to severity of detected damages



Severity = condition (1-4) + damage type (1-4)

condition:

1. good
2. tolerable
3. moderate
4. bad

damage type

1. disintegration
2. poor design/execution
3. mechanical damage/loosening
4. missing elements

Identification of factors that influence relationship between severity and response time

Table 4: Overview of damages solved within 5 years time, based on data MOWAv

Case	Damage type	Condition	Severity	Urgency	Time interval	Description	Accessibility	
2	2	3	5	Short term	5	sloppy placement roofing material flat roof	easy	
2	3	4	7	Short term	5	Repair tiles balcony	Easy	
2	2	3	5	Short term	5	Repair connections roofing material flat roof	Easy	
2	3	4	7	Urgent	4	Repair leak roofing material flat roof	Easy	Easy no ladders or scaffolding needed
5	2	3	5	Short term	3	Repair loosened welds flat roof	Easy	
5	3	3	6	Short term	3	Repair leak eaves gutters	Medium	
5	4	4	8	Urgent	2	Shifted tiles near valley gutters	Difficult	Medium ladder needed
7	4	4	8	Urgent	3	Replace missing soaker	Difficult	
7	1	4	5	Urgent	3	Repair mortar connection	Difficult	
7	1	3	4	Short term	3	Renewal gutters	Difficult	
7	3	4	7	Urgent	5	Replacement damaged and missing tiles	Difficult	Difficult scaffolding needed
7	1	2	3	Long term	2	Repointing connection raised gables	Difficult	
7	2	2	4	No recommendation	2	Repointing connection raised gables	Difficult	

Identification of factors that influence relationship between severity and response time

- 39% of solved damages in easy accessible areas
- 86% of solved damages in difficult accessible areas are solved as part of larger repair intervention: renewal of gutters (case 5), execution of works with government funding (case 7)
- Three practical considerations that moderate the relation between the response time and the severity:
 1. Accessibility of the damages
 2. Clustering of interventions as part of larger interventions
 3. Influence of funding opportunities

In-depth analysis of three case studies: time series analysis



CASE 2
good intents, but errors in execution



CASE 5
durability of initial design choices and repairs



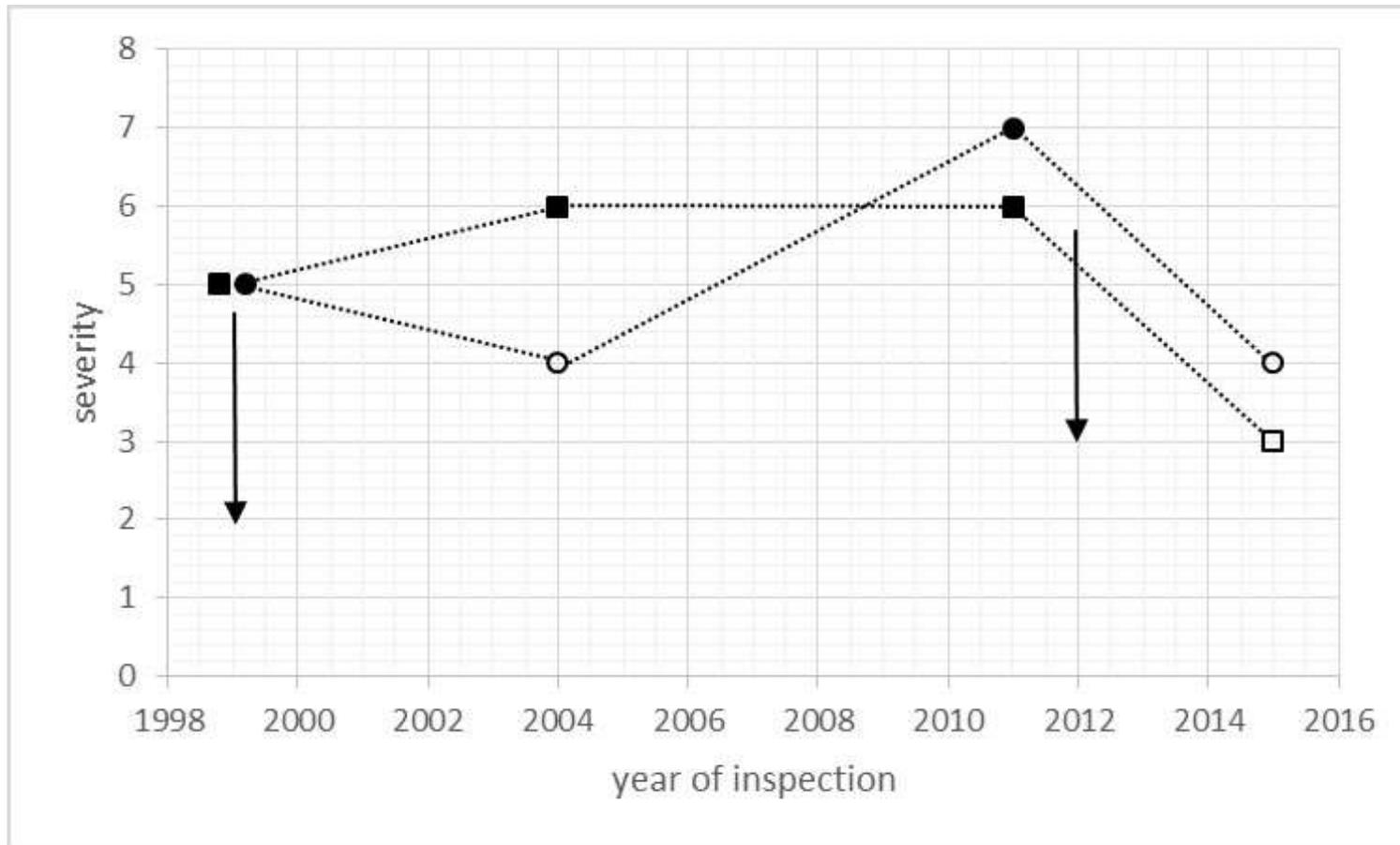
CASE 7
initial restoration and regular repairs



CASE 2: good intents, but errors in execution

- Owner indicates concern for historic fabric and tendency towards a preventive approach
- Average frequency (f) of Monumentenwacht is once every 5.33 years (f=0.188)
- Average response time is 6.1 years
- Only 30% of the detected damages have not yet been solved
- The average severity, on a score of 1 to 8, is 4.7

CASE 2: good intents, but errors in execution



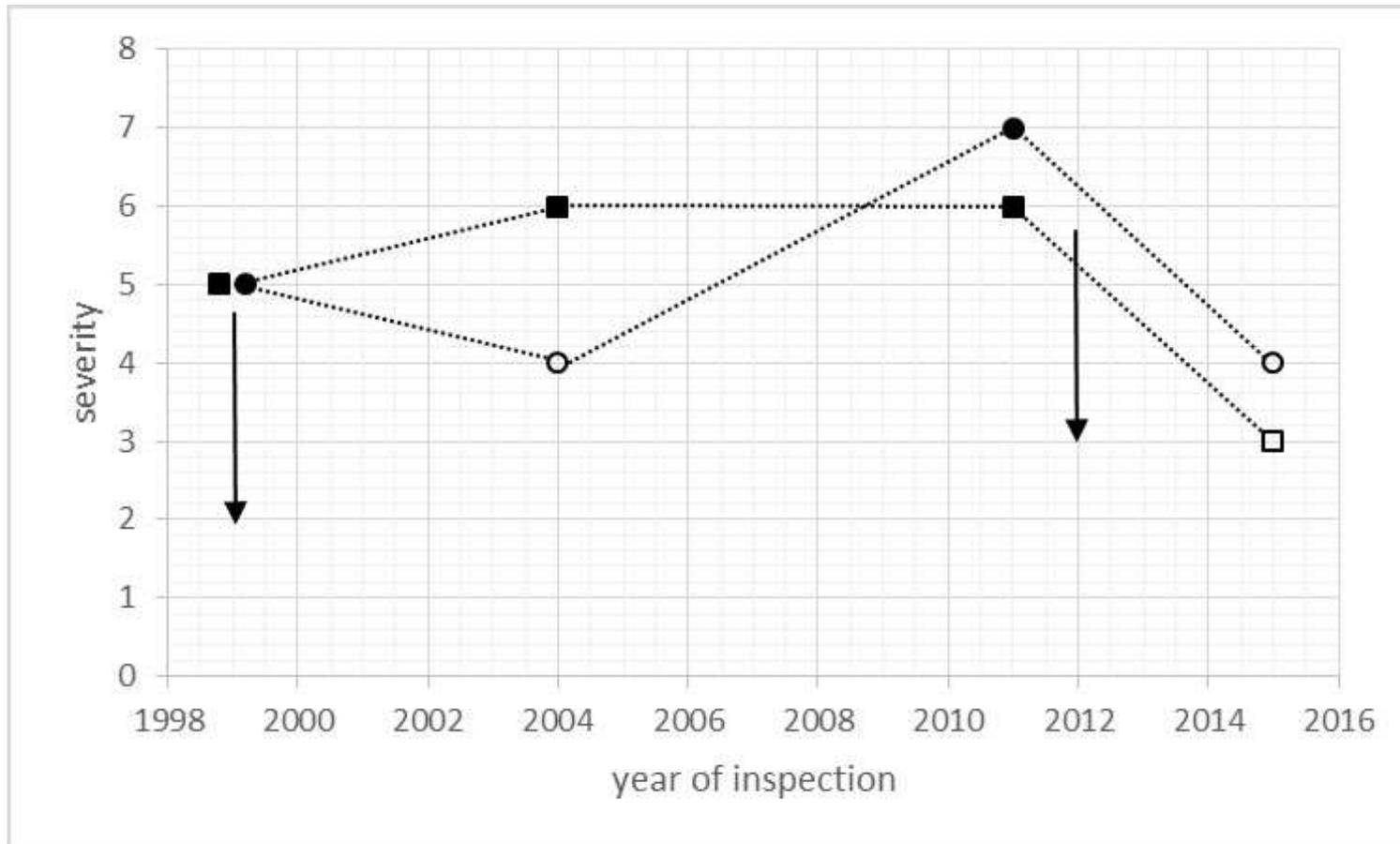
Chronological sequence of the severity of damages with respect to years of inspection

spheres: roof covering

squares: connection roof covering-masonry

coloured in = infiltrations detected
vertical arrow = intervention

CASE 2: good intents, but errors in execution



- 1994: renewal roof covering
- 1998: MoWa: sloppy placement of roof covering, poor execution of connections
- 1999: renewal roof covering
- 2004: MoWa: sloppy placement of roof covering resulted in superficial cracks, mechanical damage, folding of the borders, loosening of connections, loosening of seams
- 2008: repair small roof
- 2011: MoWa: leakages
- 2012: repair detected leakages

CASE 2: good intents, but errors in execution



CASE 2: good intents, but errors in execution

1994: renewal roof covering **1655.43 euros**

1998: MoWa: sloppy placement of roof covering, poor execution of connections

1999: renewal roof covering **320.86 euros**

2004: MoWa: sloppy placement of roof covering resulted in superficial cracks, mechanical damage, folding of the borders, loosening of connections, loosening of seams

2008: repair small roof **127.20 euros**

2011: MoWa: leakages

2012: repair detected leakages **3965.46 euros**

Site visits



Focus group



Identification of the maintenance approaches (private owners)

- Is there a well defined approach? Yes, for 6 of 7 cases, case 4 relies on durability of previous repairs and renovation works
- What is the approach?
 - Monumentenwacht model (case 2, case 5, case 6, case 7)
 - Monumentenwacht model with involvement of architect (case 1)
 - DIY monitoring and maintenance calendar (case 3)

Identification of the maintenance approaches (private owners)

- Six factors that influence the relationship between the understanding in the severity of the damages and the responses of the owners:
 1. Accessibility of the location of damage
 2. Clustering of interventions
 3. Availability of funding
 4. Lack of quality control during the execution of the works (architect?)
 5. Durability of the initial design choices
 6. Availability, knowledge and skills of the contractor

Identification of the maintenance approaches for the remaining case studies

- In-depth interviews will be analysed with the same methodology
- In-depth analysis of the maintenance practices in the rural area is difficult based on reports MoWa, but would focus on how owners deal with local natural stone (Mergelsteen)
- In-depth analysis of the two churches in the urban environment will be done based on the identification of the responses to reports Monumentenwacht, in relation to a larger set of churches
- In-depth analysis of the three public properties in the urban environment will be done based on time-series analysis

WP 3 in the framework of CHANGES

- We analyse different models (Distretti Culturali, Halland model, Monumentenwacht model) with the aim of demonstrating how they contribute to local sustainable development
- WP3: Monumentenwacht model
- Main research questions:
 - How do owners operate within the Monumentenwacht model?
 - How is the Monumentenwacht model contributing to local sustainable development? WP2 grid (quality protection, knowledge enhancement, community involvement, impact on the market, impact on decision making), therefore evaluate maintenance practice based on these four aspects?