



TE HUUR
KANTOORRUIMTE

TE KOOP



VERKOCHT

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Challenges & opportunities to reuse of tall office buildings

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Overview

- Research foundation
- Theoretical findings - literature study
- Methodology
- Empirical findings - case studies
 - Lessons learned
 - Comparison
 - Results
- Conclusion, discussion and recommendations

Research proposal

Problem statement

- Vacancy:
 - bad city image
 - waste of space
- Housing shortage:
 - high demand
 - especially in the Randstad
- Adaptive reuse:
 - challenges and possibilities

Tall buildings: challenges to conversion

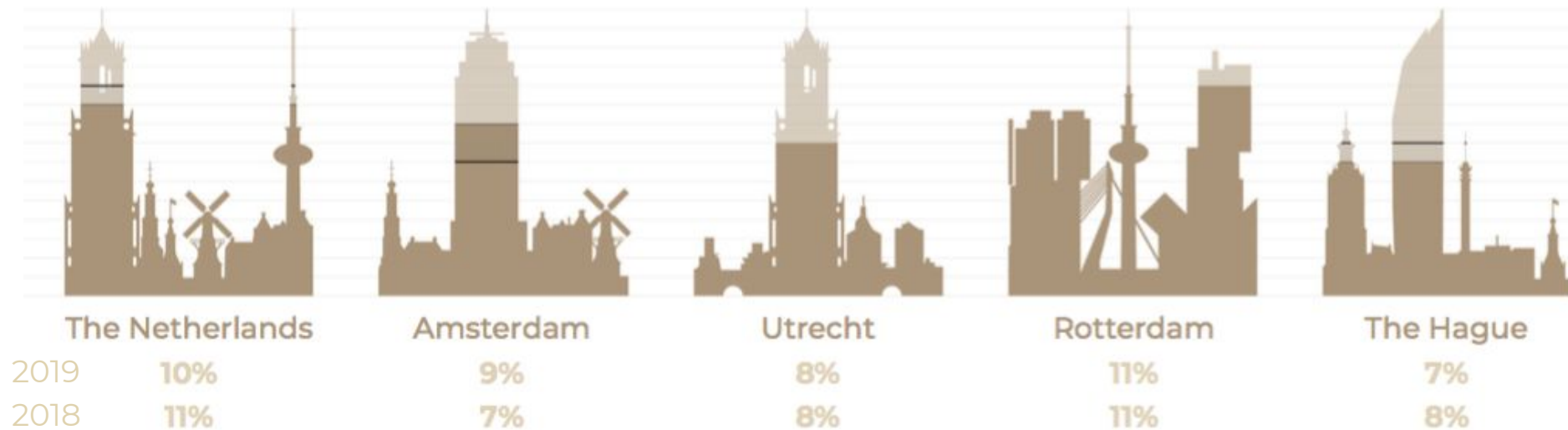


Conceptual model

Vacancy definition

- Vacant building
 - = currently no tenant
- Structurally vacant building
 - = no tenant for at least the past three years
 - = no future tenant prospective

Vacancy rates



Numbers - reflection

Amsterdam	Utrecht	Rotterdam	The Hague
Schiphol	Stichtse Vecht	Schiedam	Zoetermeer
Diemen	Houten	Capelle a/d IJssel	Rijswijk
Amstelveen	Nieuwegein	Nieuwegein	Leidschendam / Voorburg

Available dwellings

Average	- 8,0 % The Netherlands	- 19,1 % Amsterdam	- 18,2 % Utrecht	- 11,4 % Rotterdam	- 9,7 % The Netherlands
Jan 2016	130.000	2.400	1.100	3.600	2.800
Jul 2016	150.000	2.900	1.400	4.600	3.500
Jan 2015	180.000	3.700	2.300	5.900	4.300
Jul 2015	180.000	4.300	2.400	6.200	4.400
Jan 2014	200.000	5.200	2.900	7.000	5.000
Jul 2014	200.000	7.000	3.200	6.800	4.800

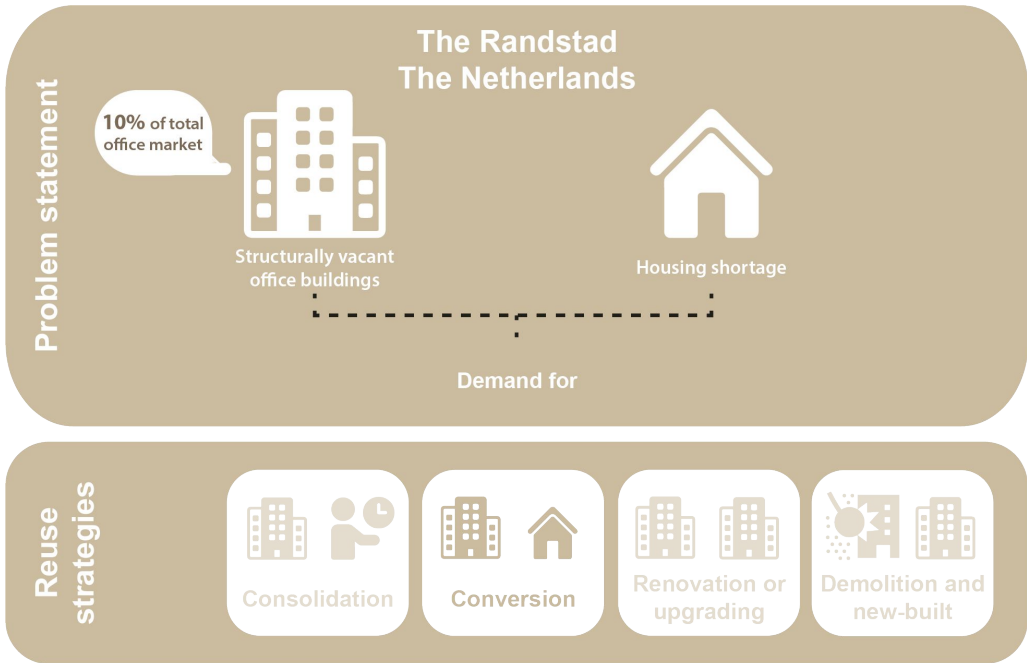
Available dwellings

The Netherlands: (2019)

-35%



Conceptual model



Types of reuse



Consolidation

Types of reuse



Consolidation

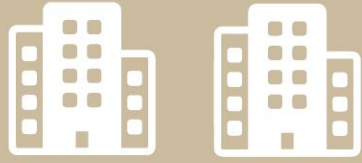


**Renovation or
upgrading**

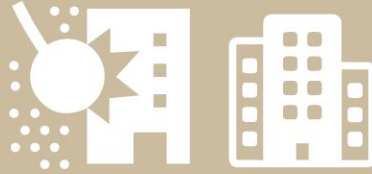
Types of reuse



Consolidation



**Renovation or
upgrading**

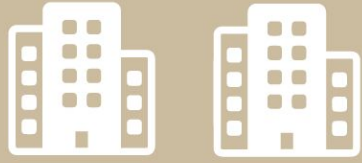


**Demolition and
new-built**

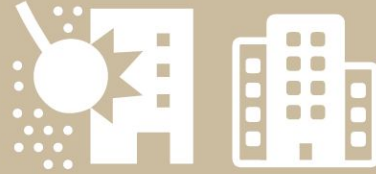
Types of reuse



Consolidation



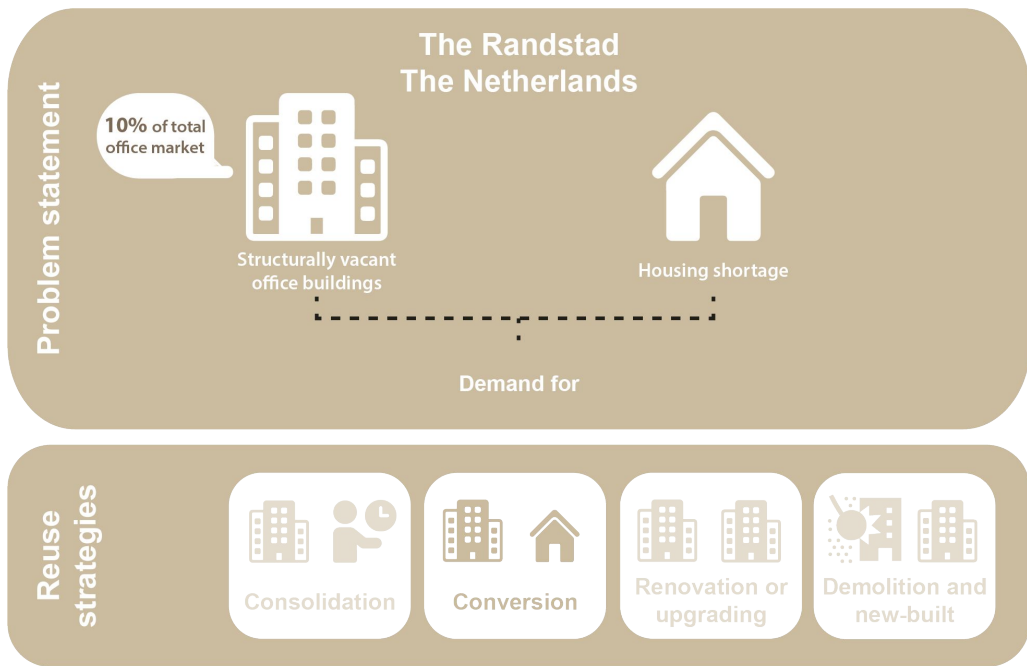
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upgrading**



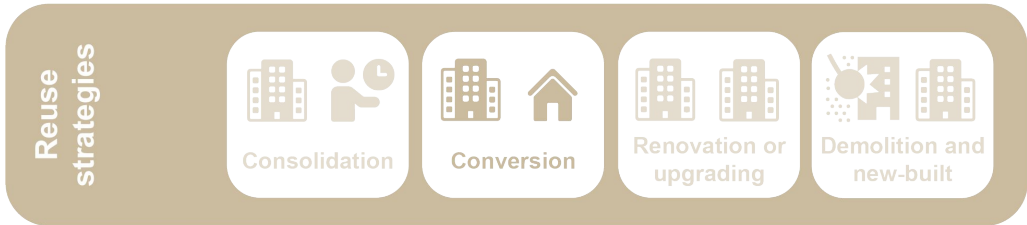
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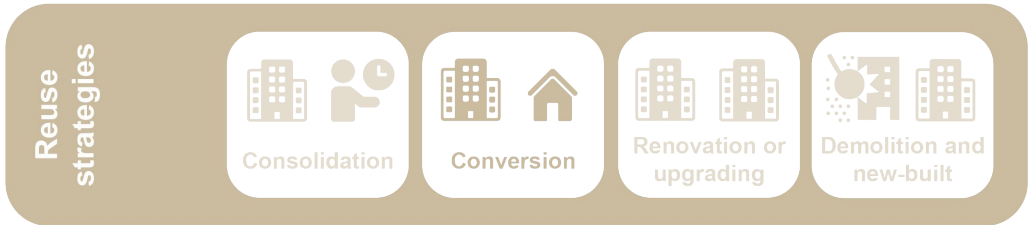
Conversion



Conceptual model



Conceptual model



Conceptual model

Tall building definition



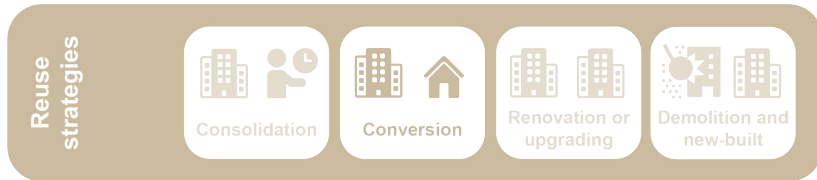
- Scale
- Density
- Surrounding area
- Legal

Top skylines

Top 10 skylines in the world		Top 10 skylines in Europe	
City	Buildings > 90 m	City	Buildings > 90 m
1. Hong Kong	2.939	1. Paris	112
2. New York	849	2. London	49
3. Tokyo	572	3. Frankfurt	38
4. Shanghai	549	4. Benidorm	35
5. Bangkok	382	5. Rotterdam	29
6. Chicago	321	6. Brussels	22
7. Singapore	296	7. Warchau	21
8. Sao Paulo	281	8. Vienna	20
9. Seoul	273	9. Warsaw	17
10. Dubai	268	10. Berlin	15

Tall building definition

Location	Aboslute Height	Contextual height	Limit	Remarks
The Netherlands	> 70m			
Amsterdam	> 30m	2x height	80 -100m / 60 - 80m / 40 - 60m	Limits due to air traffic around Schiphol Airport, Amsterdam is within three different height limit zones.
Utrecht	>30m	1,5x height	112m	Norm: not higher than the Dom, a landmark in Utrecht
Rotterdam	> 70m		200m	Limit can increase as city grows and densifies
The Hague	> 50m			Till 2017 there was a height limit of 140m



Comparison

Conceptual model

Main research question

What are the **challenges** and respective **solutions** for the **conversion** of **vacant tall office buildings** into **housing** in the **Netherlands**?

Research questions

Part I

Research - Theory



Research questions - Part I

1. What defines an **office** and what are the current **office sub-markets** in Amsterdam, Rotterdam & The Hague?
2. What are the causes and effects of **structural vacancy**?
3. What are the **challenges** of the conversion of office buildings to housing on **economical, legal, technical** and **social** level?
4. What are **possible solutions** to cope with the challenges of conversion of office buildings to housing?

Research questions

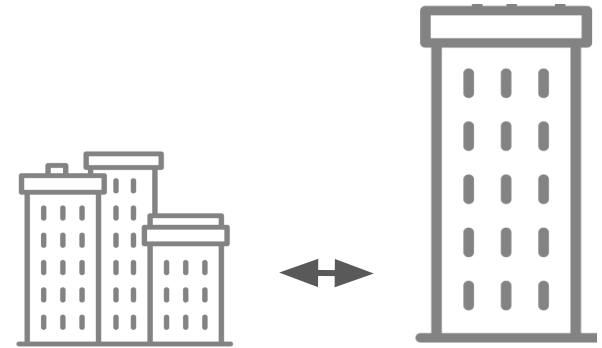
Part I

Research - Theory



Part II

Case study - Cases/Practice



Research questions - Part II

5. What are the **differences in challenges and possible solutions** of the conversion of tall office buildings to housing on **economical, legal, technical** and **social** level?

Relevance

Scientific relevance:

- follows up research regarding conversion from offices to housing
- hypotheses: tall building transformations can have different challenges and possible solutions

Social relevance:

- challenges → more attractive to re-develop
- create more safe and livable environment

Literature study

Literature study

Overview:

- Office buildings and environments
- High-rise and urban setting
- Dutch Building Code
- Structural vacancy
- Conversion

Office buildings

Office Plans *Type of lay-out*

Open Plan



Collaboration

Private offices




Confidentiality

Cubical offices



Space saving

Half partitions



Hybrid solution

Team enclosures



Creative spaces

Office Space *Type of study*

Coworking space

Executive suites

Traditional office space

Traditional office space

Coworking space

Contiguous office space

Creative office space

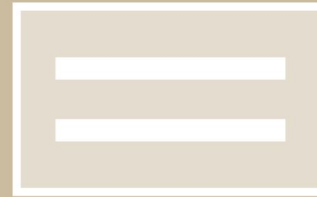
Office buildings



Center core



Single corridor



Double corridor



External core



Decentral core

High-rise and urban setting

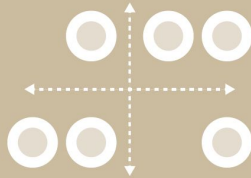
- Different highrise profiles
- Different highrise concentrations



Object



Axis



Cluster



Amsterdam
Highrise around the center



Rotterdam
River as the center



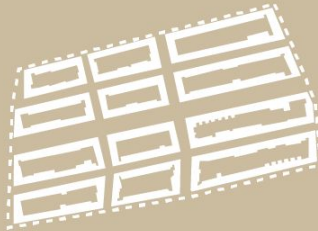
The Hague
Highrise in the center of the city

Highrise and urban setting



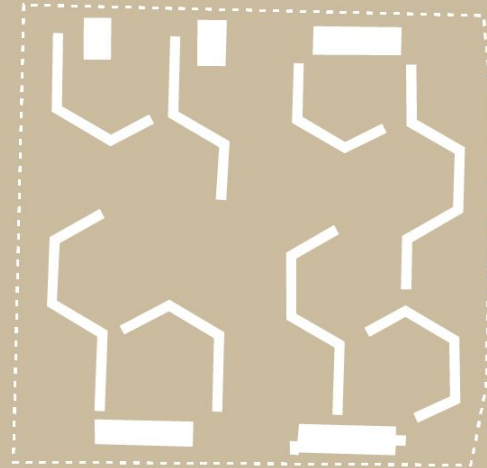
Zuidas

Footprint - 2,7 ha.
Area - 10,0 ha.
FSI - 4,0



De Pijp

Footprint - 6,0 ha.
Area - 15,3 ha.
FSI - 1,8

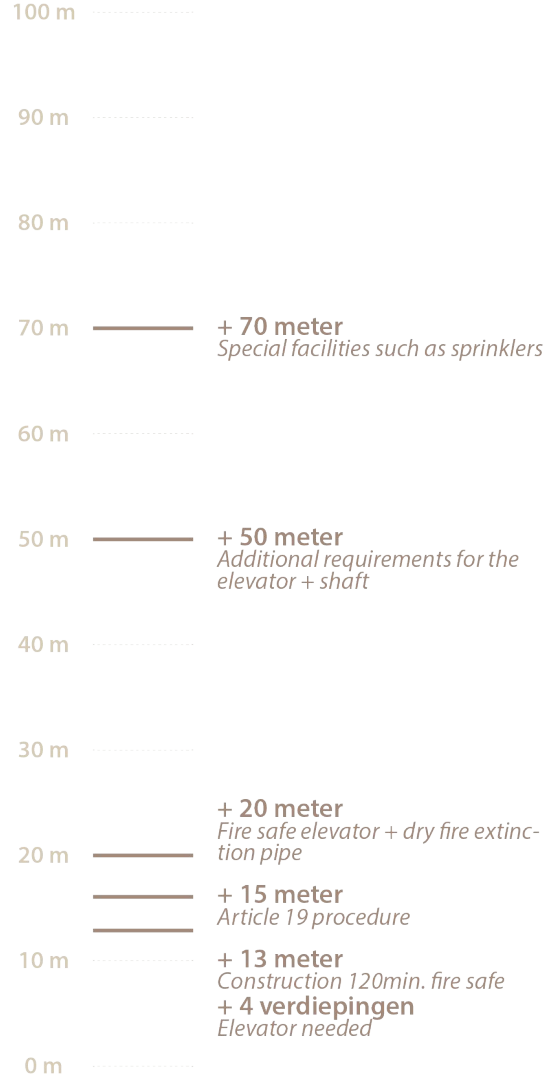


Bijlmermeer

Footprint - 7,8 ha.
Area - 67 ha.
FSI - 1,1

Dutch Building Code

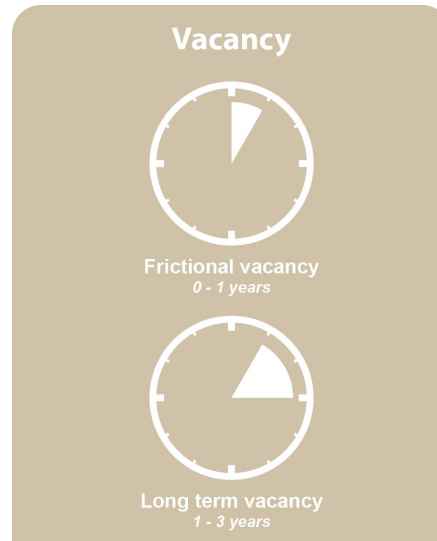
- Additional requirements
 - Fire safety
 - Escape routes



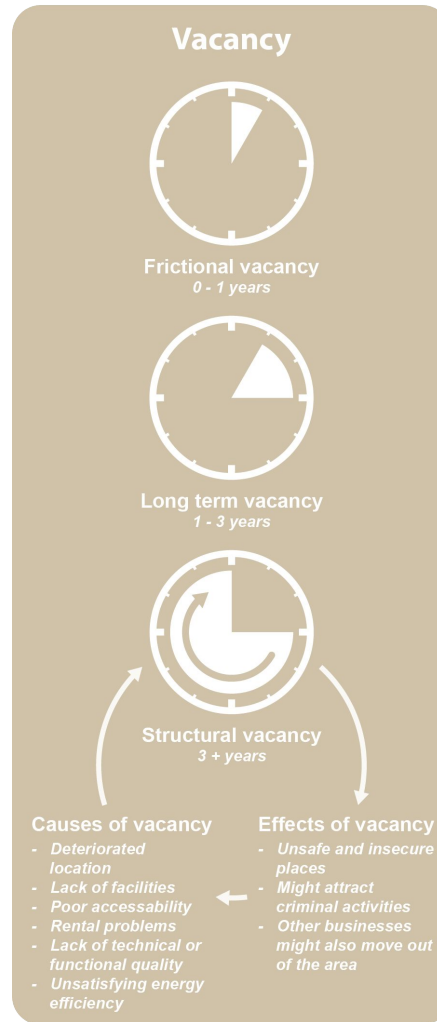
< 1 year vacant



1-3 years vacancy



> 3 years vacancy



Theoretical framework

Challenges



Legal

- *Lengthy permit procedures*
- *Dutch building code:*
 - *extra safety measures*
- *Change in zoning plan needed*

Challenges



Legal

- *Lengthy permit procedures*
- *Dutch building code:*
 - *extra safety measures*
- *Change in zoning plan needed*



Economic

- *Development*
- *Lack of profit*
- *Interruption in income stream*

Challenges



Legal

- Lengthy permit procedures
- Dutch building code:
 - extra safety measures
- Change in zoning plan needed



Economic

- Development
- Lack of profit
- Interruption in income stream



Technical

- Poor main structure or foundation
- Insufficient shafts available
- Inadequate thermal and acoustic insulation
- Insufficient daylight for housing

Challenges



Legal

- Lengthy permit procedures
- Dutch building code:
 - extra safety measures
- Change in zoning plan needed



Economic

- Development
- Lack of profit
- Interruption in income stream



Technical

- Poor main structure or foundation
- Insufficient shafts available
- Inadequate thermal and acoustic insulation
- Insufficient daylight for housing



Social

- Area not fit for housing
- Owners sometimes need stimulation from municipality for conversion

Opportunities



Legal

- *Initiative and/or collaboration of/with municipalities*
- *Dutch building code:*
 - *Existing building measures*

Opportunities



Legal

- *Initiative and/or collaboration of/with municipalities*
- *Dutch building code:*
 - *Existing building measures*



Economic

- *Increase profit*
- *Boost area*
 - *Transformations*
 - *Facilities*

Opportunities



Legal

- *Initiative and/or collaboration of/with municipalities*
- *Dutch building code:*
 - *Existing building measures*



Economic

- *Increase profit*
- *Boost area*
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 - *Facilities*



Technical

- *Over-dimensioned existing structure*
- *Columns structure*

Opportunities



Legal

- *Initiative and/or collaboration of/with municipalities*
- *Dutch building code:*
 - *Existing building measures*



Economic

- *Increase profit*
- *Boost area*
 - *Transformations*
 - *Facilities*



Technical

- *Over-dimensioned existing structure*
- *Columns structure*



Social

- *Area development*
- *Housing environment*
- *Sustainability*

	Location and Market aspects
Legal	<ul style="list-style-type: none"> - Zoning law - Land ownership - Soil pollution
Financial	<ul style="list-style-type: none"> - Purchasing costs of vacant office buildings - Housing market and revenues of the new function
Technical	<ul style="list-style-type: none"> - Stench pollution - Noise pollution
Functional / Architectonic	<ul style="list-style-type: none"> - Bad reputation, unsafe area - Amount of parking places - Amount of facilities in the area - Accessibility by public transport - Sustainability

	Building aspects
Legal	<ul style="list-style-type: none"> - Presence of asbestos - Monumental status - Dutch building decree, including fire regulation - Municipal building act
Financial	<ul style="list-style-type: none"> - Acquirement / purchasing costs - Initial phase investments - Financial feasibility
Technical	<ul style="list-style-type: none"> - Incorrect technical assessment - Inadequate pipes, ducts, electricity system and water supply - Inadequate acoustic insulation of the floors - Inadequate thermal insulation of facade, openings and roof - Damp / condensation in structure - Joints of brick walls in poor condition - Daylight < 10% of the appointed living-space - Sunlight; building is poorly situated - Inadequate / poor state of main structure or foundation
Functional / Architectonic	<ul style="list-style-type: none"> - Incorrect assessment of functional possibilities - Low recognisability of the building and its entrance - Building too slender or too deep - Too loose fit, too high floors - No basement - Windows not operable - Few or poor quality of interior walls, few points for attaching interior walls to the facade - No balconies or roof terraces - Not enough elevators and staircases

	List of possible challenges in transformation projects
Economic	<ul style="list-style-type: none"> - Acquirement / purchasing costs - Financial feasibility - Housing market and revenues of new function - Initial phase investments
Legal	<ul style="list-style-type: none"> - Dutch building decree - Land ownership - Monumental status - Municipal building act - Presence of asbestos - Soil pollution - Zoning law
Technical	<ul style="list-style-type: none"> - Building too slender, too high floors - Condensation in structure - Daylight < 10% of the appointed living space - Inadequate acoustic insulations - Inadequate pipes, ducts, electricity system and water supply - Inadequate technical assessment - Inadequate thermal insulations - Joints of brick walls in bad condition - No balconies or roof terraces - No basement - Noise pollution - Not enough elevators and staircases - Poor state of main structure - Poor quality of interior walls, few points for attaching interior walls to the facade - Stench pollution - Sunlight - Too loose fit, too high floors - Windows not operable
Social	<ul style="list-style-type: none"> - Accessibility by public transport - Amount of facilities - Amount of parking spaces - Bad reputation, unsafe area - Low recognisability of the building and entrance - Routing of the area

Methodology

Problem statement & context

Part I



Conversion

1. Structural vacancy
2. Stakeholders analysis
3. Challenges
 - a. Economical
 - b. Legal
 - c. Technical
 - d. Social
4. Opportunities / frontrunners

Methods



Literature
review



Research
tools



Interviews

Problem statement & context

Part I



Conversion

1. Structural vacancy
2. Stakeholders analysis
3. Challenges
 - a. Economical
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 - d. Social
4. Opportunities / frontrunners

Part II



Office building

Housing



Tall office building

Housing

1. Comparison cases
2. Differences challenges
 - a. Economical
 - b. Legal
 - c. Technical
 - d. Social
3. Differences opportunities

Methods



Literature review



Research tools



Interviews

Methods



Case studies



Research tools



Interviews

Problem statement & context

Part I



Conversion

1. Structural vacancy
2. Stakeholders analysis
3. Challenges
 - a. Economical
 - b. Legal
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Part II



Office building

Housing



Tall office building

Housing

1. Comparison cases
2. Differences challenges
 - a. Economical
 - b. Legal
 - c. Technical
 - d. Social
3. Differences opportunities

Methods



Literature review



Research tools



Interviews

Methods



Case studies



Research tools



Interviews

Findings

Problem statement & context

Part I



Conversion

1. Structural vacancy
2. Stakeholders analysis
3. Challenges
 - a. Economical
 - b. Legal
 - c. Technical
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Part II



Office building

Housing



Tall office building

Housing

1. Comparison cases
2. Differences challenges
 - a. Economical
 - b. Legal
 - c. Technical
 - d. Social
3. Differences opportunities

Methods



Literature review



Research tools



Interviews

Methods



Case studies



Research tools

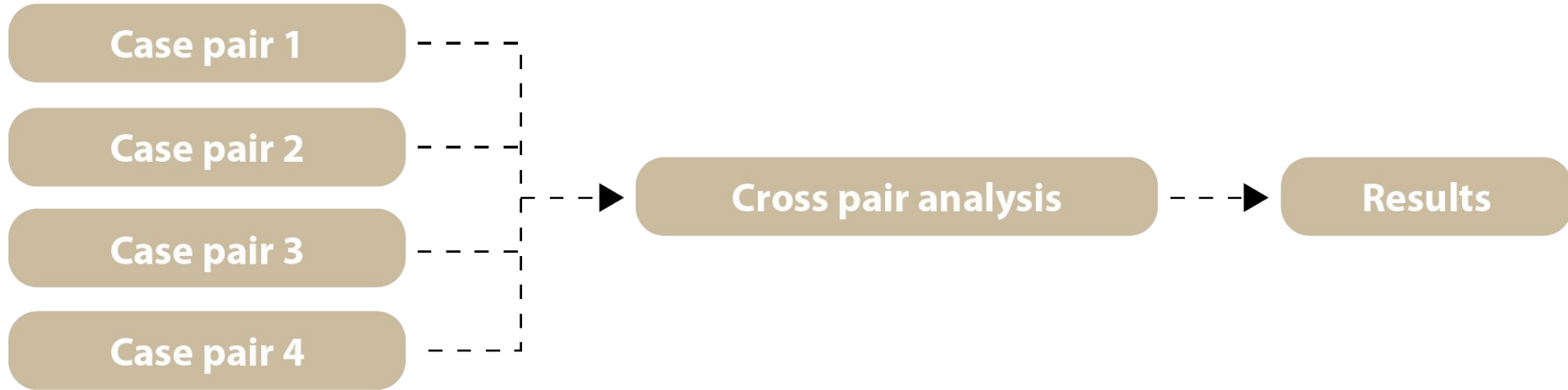


Interviews

Findings

Discussion & conclusion

Case study in pairs



Case pair



1. Control case
(not tall)



2. Case of
interest
(tall)

Interviews & data

Municipality
Contractor

Developer
Architect

Challenges & opportunities



Legal



Economic

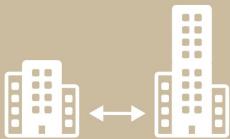


Technical



Social

Case & pair analysis



Comparison
perspectives on
challenges & opportunities

Case study method

Comparing criteria:

- location
- history
- vacancy
- stakeholders & contracts
- construction method
- former office typologies
- challenges (legal, economic, technical, social)
- opportunities & solutions used

Case study selection - Sampling method

Criteria to the pairs of cases are;

1. cases inside the Randstad area;
2. situated in the same type of office submarket;
3. the same main supportive structure;
4. changed from offices to the functions: housing, hotel or a mixed-use that includes either.

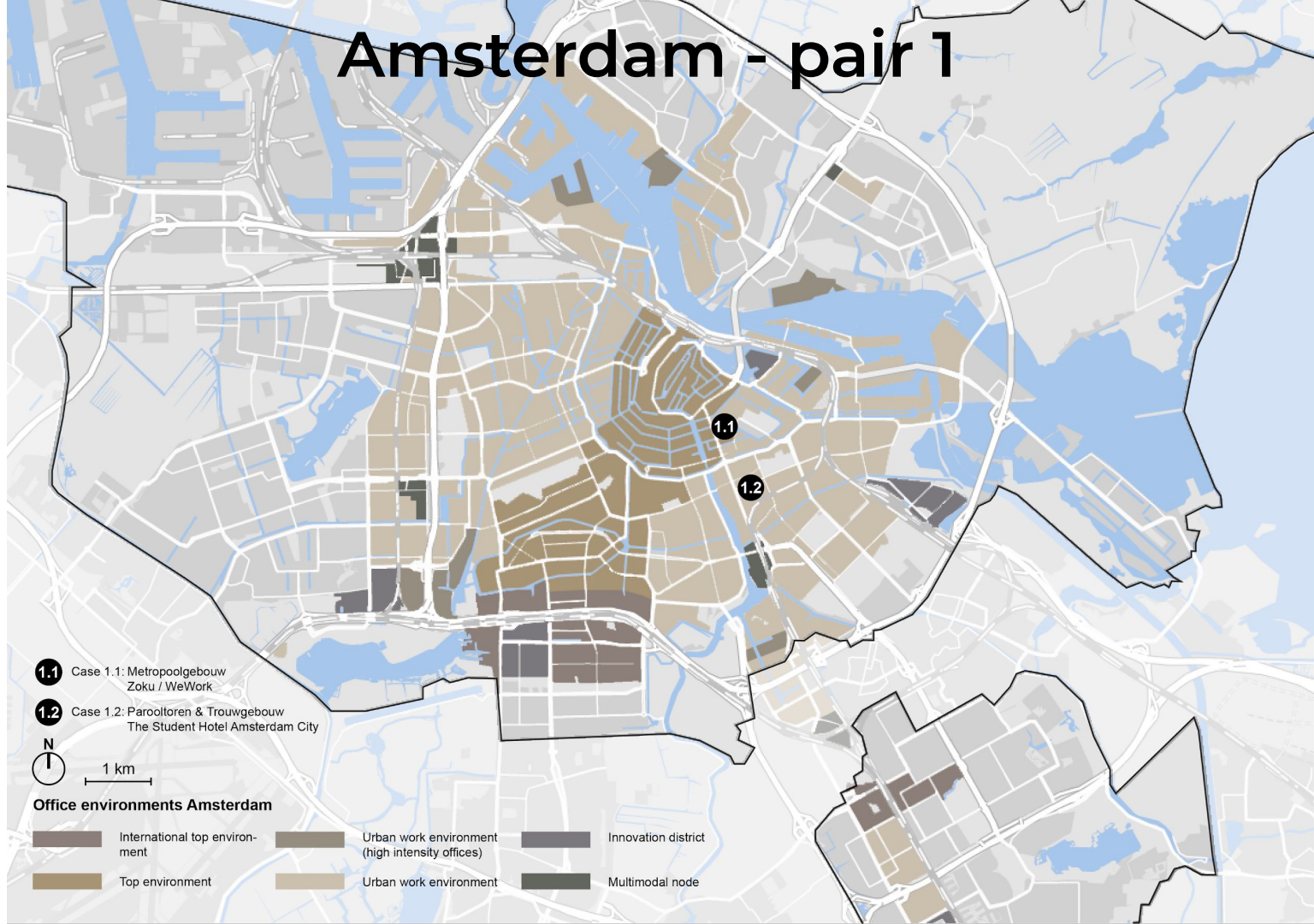
Case study selection - Sampling method

Preferred cases:

1. that have been built and transformed in the same time span (or same decade);
2. that have been structurally vacant.

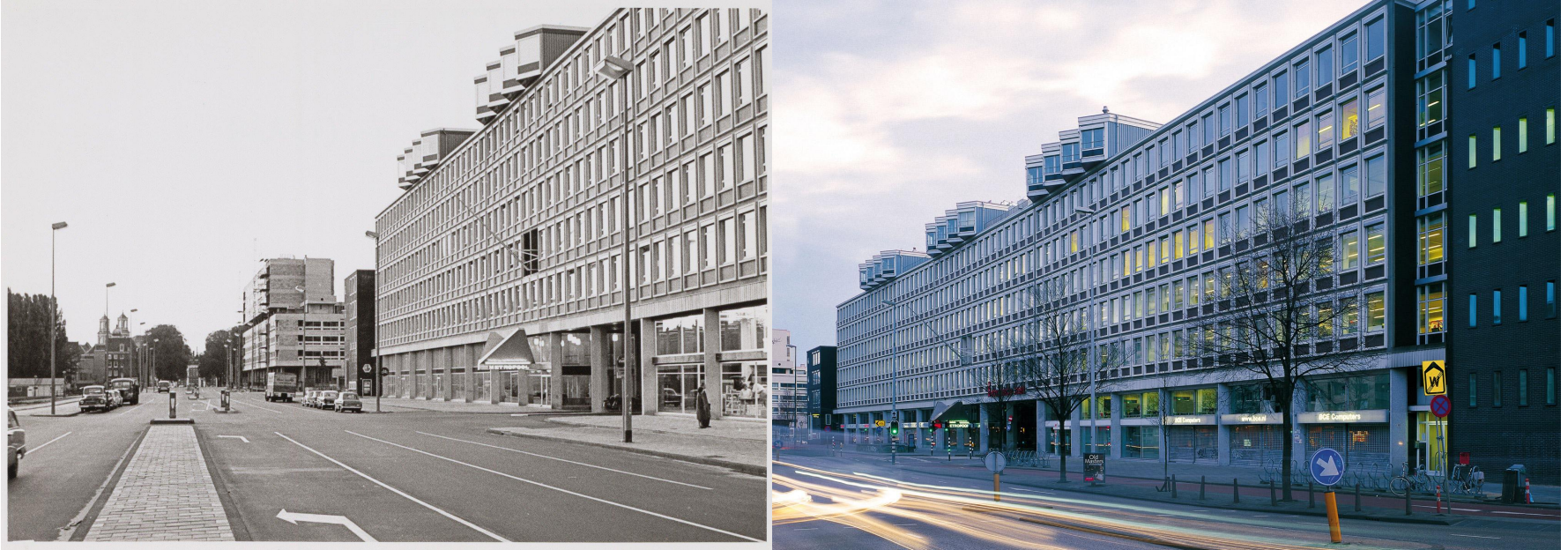
Case studies

Amsterdam - pair 1



Case 1.1

Metropoolgebouw (1964) - Zoku / We Work (2016)

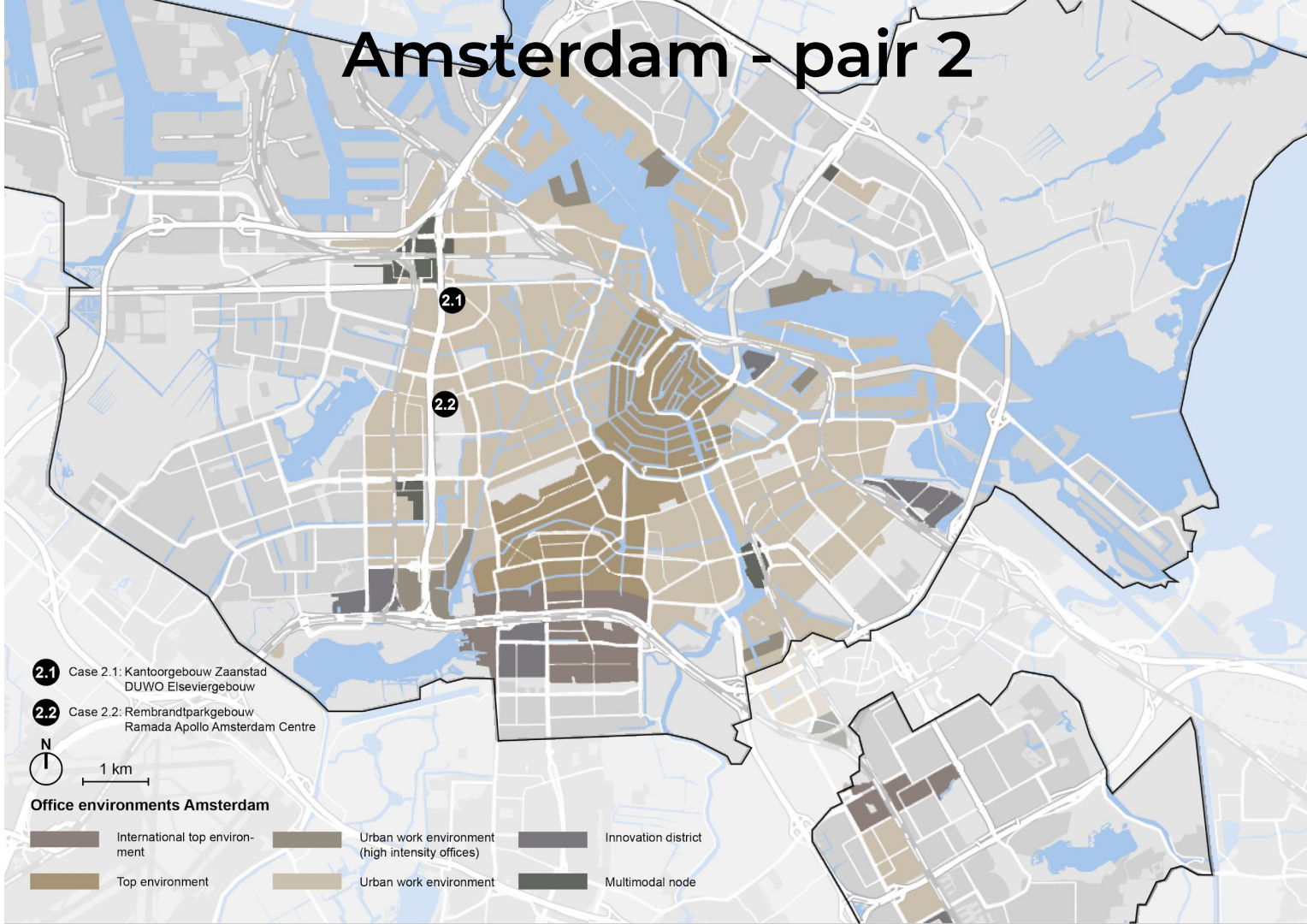


Case 1.2

Parooltoren (1976) & Trouwgebouw (1969) - The Student Hotel
Amsterdam City (2015/2016)



Amsterdam - pair 2



2.1 Case 2.1: Kantoorgebouw Zaanstad
DUWO Elseviergebouw

2.2 Case 2.2: Rembrandtparkgebouw
Ramada Apollo Amsterdam Centre



1 km

Office environments Amsterdam



International top environment



Urban work environment
(high intensity offices)



Innovation district



Top environment



Urban work environment



Multimodal node

Case 2.1

Kantoorgebouw Zaanstad / Elseviergebouw (1964) - DUWO
Elseviergebouw (2015)

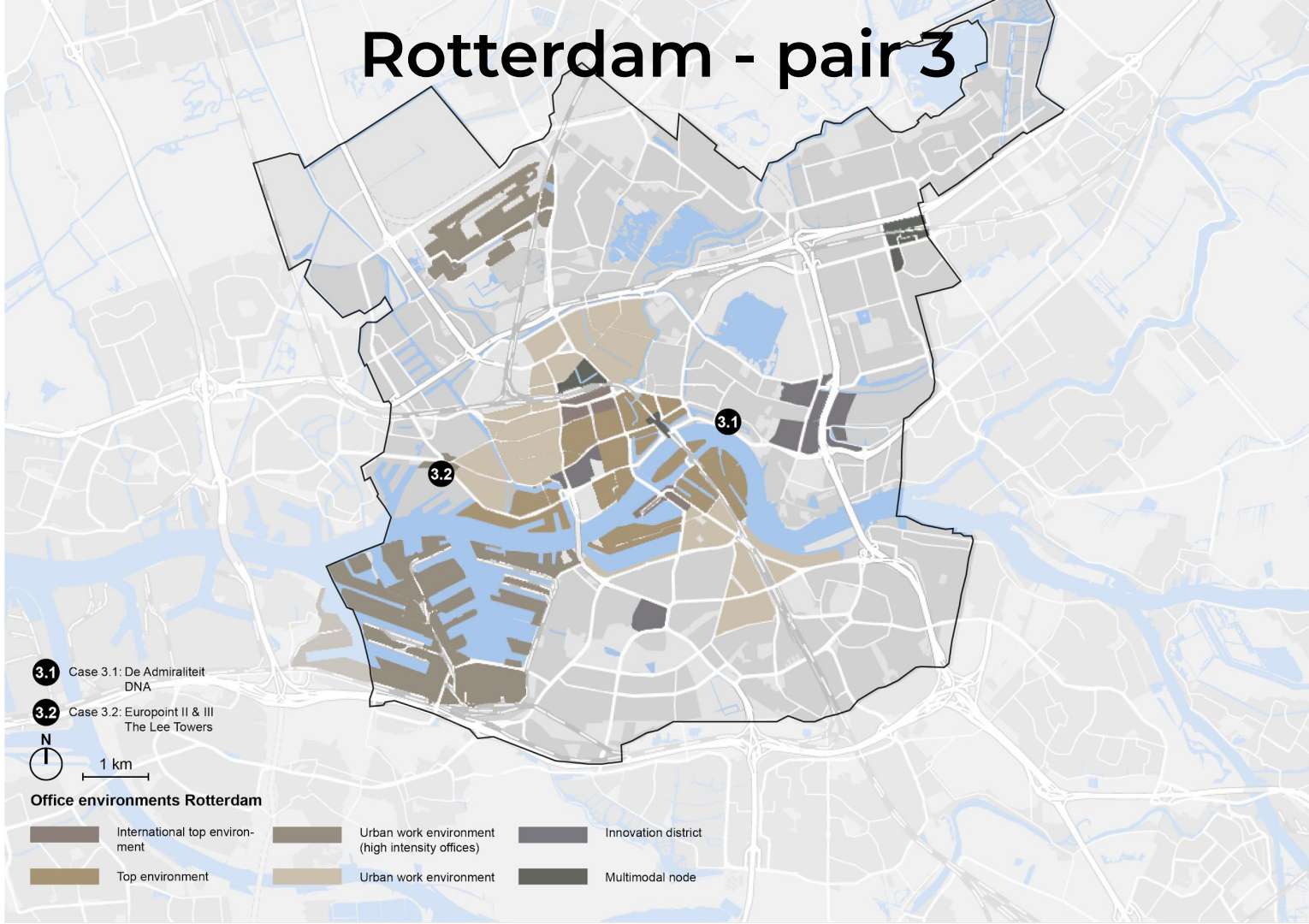


Case 2.2

Rembrandtparkgebouw (1973) - Ramada Apollo Amsterdam Centre / Leonardo Hotel Amsterdam Rembrandtpark (2012)



Rotterdam - pair 3



Case 3.1

De Admiraliteit (1989) - De Nieuwe Admiraliteit / DNA (2016)



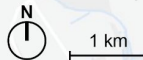
Case 3.2

Europoint complex / De Marconitoren (1975) - The Lee Towers (2019)

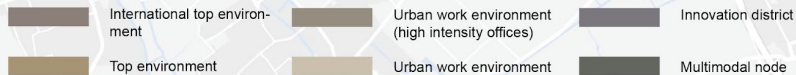


The Hague - pair 4

- 4.1 Case 4.1: Sophiestaete De Sophie
- 4.2 Case 4.2: Ministerie van Binnenlandse Zaken Wijnhavenkwartier



Office environments The Hague



Case 4.1

Sophiestaete (1981) - De Sophie (2019)



Case 4.2

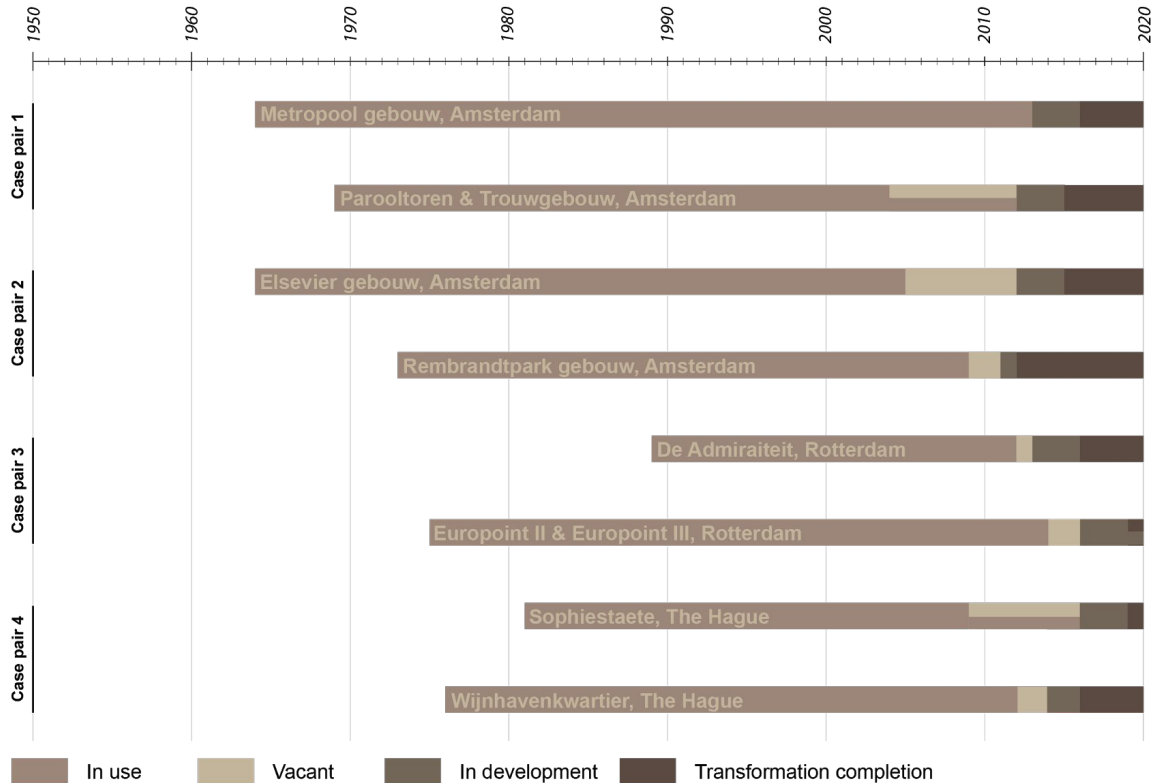
Ministerie van Binnenlandse Zaken (1975) - Wijnhavenkwartier
(2016)



Overview cases

	Case study pair 1		Case study pair 2		Case study pair 3		Case study pair 4	
Original building name	Metropool gebouw (1964)	Parooltoren (1976) & Trouwgebouw (1969)	Kantoorgebouw Zaanstad / Elsevier gebouw (1964)	Rembrandtpark gebouw (1973)	De Admiraliteit (1989)	Europoint II & III (Marconitoren) (1969)	Sophiestaete 120-130 (1981)	Ministerie Binnenlandse Zaken (1973)
Vacancy	<1 year	<1 year / 7 years	9 year	<1 year / 2 years	1 year	3 years		2 years
Location	11. De Omval	11. De Omval	1. Teleport / Sloterdijk	1. Teleport / Sloterdijk / 2. Westas	2. Center	4. Marconiplein / M4H	11. Bezuidenhout / Beatrixkwartier	1. CBD / Nieuw Centrum
Address	Weesperstraat 61-105, Amsterdam	Wibautstraat 129, Amsterdam	Krelis Louwenstraat, Amsterdam	Staalmeesterslaan 410, Amsterdam	Admiraliteitskade 40-60, Rotterdam	Galvanistraat 15, Rotterdam	Koningin Sophie-estraat 120-130, Den Haag	Turfhaven, Den Haag
Aver. office rent locat. (m2/year)	11. €250-400	11. €250-400	1. €100-210	1. €100-210 / 2. €95-195	2. €120-225	4. €100-125	11. €135-210	1. €145-195
Cur. office rent Street (m2/year)	Weesperstraat 61: €350 / Weesperstraat 105A: €250	James Wattstraat 100: €275	Bos en Lommerplein 303: €170	Delflandlaan 4: €185	Admiraliteitskade 62-73: €175	Marconistraat 2: €110	Wilhelmina van Pruisenweg 104: €165	Fluwelen Burgwal 56: €180
Transformed building	Zoku / WeWork (2016)	The Student Hotel Amsterdam City (2015)	DUWO Elsevier (2015)	Ramada Apollo Amsterdam Centre (2012)	De Nieuwe Admiraliteit (2016)	The Lee Towers (in development)	De Sophie (2019)	Wijnhavenkwartier (2016)
New function	Mixed-use	Mixed-use	Housing	Housing	Housing	Mixed-use	Housing	Mixed-use
Main construction	Concrete columns, beams and thin floors	Concrete	Concrete columns and floors	Concrete	Concrete columns and wide slab floors	Concrete	Concrete	Concrete
Height	36m	55m & 29m	47m	55m & 29m	50m	95m	26m	80m
Developer	Breevast	Boelens de Gruyter / The Student Hotel	Rochdale Projectontwikkeling	Boelens de Gruyter / The Student Hotel	ABB Ontwikkeling B.V. / U Vastgoed / City Pads	Foolen en Reijs / City Pads	Local	Heijmans Vastgoed B.V.
Contractor	Kondor Wessels Amsterdam	Heijmans Amersfoort	Bouwbedrijf M.J. De Nijs en Zonen	BAM Utiliteitsbouw	ABB Bouwgroep	Konder Wessels Amsterdam	Trebbe	Heijmans Woningbouw B.V.
Architect	Mulderblauw Architecten	Penta Architecten Harlingen	Knevel Architecten	<td>Klunder Architecten</td> <td>DierenDirrix</td> <td>Atelier Pro</td> <td>Geurst & Schulze Architecten</td>	Klunder Architecten	DierenDirrix	Atelier Pro	Geurst & Schulze Architecten

Timeline cases



Example outcomes (case 2.1 - Elseviergebouw)

Challenges				Opportunities
Economic <ul style="list-style-type: none">- Design choices- Asbestos	Legal <ul style="list-style-type: none">- Monumental status- Design choices- District heating	Technical <ul style="list-style-type: none">- District heating- Deteriorating existing structure	Social <ul style="list-style-type: none">- Local opposition	<ul style="list-style-type: none">- Reuse existing materials- Building orientation- Lay-out- Dimensions- Elevator & escape route capacity- Lean planning- Repetition of floors- Informed locals- Urban setting benefit

Comparison types of cases

- amount of cases
- similarities & differences
- example: technical challenges + fire safety

Challenges during the transformation of tall office buildings						
	nr.	Challenge	1.2	2.2	3.2	4.2
Economic	01	Asbestos				
	02	Delay				X
	03	Design choices				
	04	Rise in costs materials				
	05	Rise in costs human resources				
Legal	06	Aesthetics committee				
	07	Building permit				
	08	Delay				X
	09	Design choices				
	10	District heating				
	11	Monumental status	X			
Technical	12	Acoustic requirements	X			
	13	Asbestos				X
	14	Construction logistics	X			X
	15	Climate system				
	16	Daylight requirements		X		
	17	Design choices	X		X	
	18	Deteriorating existing materials			X	
	19	Deteriorating existing structure				
	20	District heating				
	21	Elevator capacity				
	22	Facade as supporting structure		X		
	23	Fire safety	X	X	X	
	24	Heating system			X	
	25	Installations & floor/ceiling height				X
	26	Integrating installation grid			X	
	27	Noise pollution		X		
	28	Non-accurate existing drawings				X
	29	Roof installations				X
	30	Shafts			X	
	31	Sound insulation				
32	Sustainability requirements		X			
33	Thermal insulation	X				
34	Ventilation system			X		
35	Weight capacity			X	X	
Social	36	In operation during construction				
	37	Local opposition				
	38	Need for area re-development	X			
	39	Noise pollution			X	

Comparison types of cases

- amount of cases
- similarities & differences
- example: fire safety

Challenges during the transformation of office buildings				
	nr.	Challenge	Control case	Case of interest
Economic	01	Asbestos	1	
	02	Delay (as effect of fire)		1
	03	Design choices	1	
	04	Rise in costs materials	1	
	05	Rise in costs human resources	1	
Legal	06	Aesthetics committee	1	
	07	Building permit	1	
	08	Delay (as effect of fire)		1
	09	Design choices	1	
	10	District heating	1	
	11	Monumental status	1	1
Technical	12	Acoustic requirements	1	1
	13	Asbestos	1	1
	14	Construction logistics	2	2
	15	Climate system	1	
	16	Daylight requirements		1
	17	Design choices		2
	18	Deteriorating existing materials	1	1
	19	Deteriorating existing structure	1	
	20	District heating	1	
	21	Elevator capacity	1	
	22	Facade as supporting structure		1
	23	Fire safety	1	3
	24	Heating system		1
	25	Installations & floor/ceiling height		1
	26	Integrating installation grid	1	1
	27	Noise pollution		1
	28	Non-accurate existing drawings		1
	29	Roof installations		1
	30	Shafts		1
	31	Sound insulation	1	
32	Sustainability requirements	1	1	
33	Thermal insulation		1	
34	Ventilation system	1		
35	Weight capacity	1	2	
Social	36	In operation during construction	1	
	37	Local opposition	2	
	38	Need for area re-development		1
	39	Noise pollution		1

Comparison theory + practice

nr.	Possible risks	Challenges																																													
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39							
A	Acquirement / Purchasing costs																																														
B	Financial feasibility	C	I	C	C	C			X	X			X				X																														
C	Housing market and revenues of new function																																														
D	Initial phase investments																																														
E	Dutch building decree							C				X	X			X	X					X	X	X					X					X	X	X	X	X					X				
F	Land ownership								X																																						
G	Monumental status							C	X			B																																			
H	Municipal building act							C	C	X		C																																			
I	Presence of asbestos	X								X				X																																	
J	Soil pollution									X																																					
K	Zoning law							C	C	X		C																																			
L	Building too slender or too deep		X								X																																				
M	Condensation in structure																																														
N	Daylight < 10% of the appointed living space																																														
O	Inadequate acoustic insulations												B																																		
P	Inadequate pipes, ducts, etc.															C																												X		X	
Q	Incorrect technical assessment																																														
R	Inadequate thermal insulation																																											X		I	
S	Joints of brick walls in bad condition																																														
T	No balconies or roof terraces																																														
U	No basement																																														
V	Noise pollution																																														
W	Not enough elevators and staircases																																														
X	Poor state of main structure																																														
Y	Poor quality of interior walls																																														
Z	Stench pollution																																														
AA	Sunlight																																														
AB	Too loose fit, too high floors		X								X																																				
AC	Windows not operable																																														
AD	Accessibility by public transport																																														
AE	Amount of facilities																																														
AF	Amount of parking spaces																																														
AG	Bad reputation, unsafe area																																														
AH	Low recognisability of the building and entrance																																														
AI	Routing of the area																																														

Comparison theory + practice

I = case of interest (tall)

C = control case (non-tall)

B = both types

X = not related/
mentioned in case,
but could have
been related

nr.	Possible risks	Challenges											
		01	02	03	04	05	06	07	08	09	10	11	
A	Acquirement / Purchasing costs												
B	Financial feasibility	C	I	C	C	C			X	X			
C	Housing market and revenues of new function												
D	Initial phase investments												
E	Dutch building decree							C				X	X
F	Land ownership								X				
G	Monumental status							C	X			B	
H	Municipal building act						C	C	X		C		
I	Presence of asbestos	X							X				
J	Soil pollution								X				
K	Zoning law						C	C	X		C		
L	Building too slender or too deep			X							X		

Conclusion, discussion & recommendations

Conclusion

Main challenges

- not necessarily new or other challenges
- some challenges occurred more/less often in tall cases
- technical level
- higher impact on tall buildings

List of possible challenges	
nr	Possible challenges
Economic	01 Acquisition / Purchasing costs
	02 Financial feasibility
	03 Housing market and revenues of new function
	04 Initial phase investment
	05 Unforeseen aspects causing delay
Legal	06 Dutch building decree
	07 Land ownership
	08 Ministry of Infrastructure and Water Management
	09 Monumental status
	10 Municipal building act
	11 Presence of asbestos
	12 Soil pollution
	13 Unforeseen aspects causing delay
	14 Zoning law
Technical	15 Building climate system (including heating & ventilation)
	16 Building too slender or too deep
	17 Condensation in structure
	18 Connection to district heating system
	19 Daylight < 10% of the appointed living space
	20 Inadequate pipes, ducts, etc.
	21 Incorrect technical assessment
	22 Inadequate thermal insulation
	23 Joints of brick walls in bad condition
	24 No balconies of roof terraces
	25 No basement
	26 Noise pollution
	27 Not enough elevators and staircases
	28 Poor state of main structure
29 Poor quality of interior walls	
30 Stench pollution	
31 Sunlight	
32 Too loose fit, too high floors	
33 Type of main supporting structure	
34 Windows not operable	
Social	35 In operation during construction
	36 Local opposition
	37 Need for area re-development
	38 Noise pollution

Conclusion

Main opportunities:

- inter-related
- existing building
- area

List of possible opportunities		
	nr	Possible opportunities
Ec.	01	Boost area (transformation and facilities)
	02	Financial feasibility
Legal	03	Collaboration stakeholders
	04	Dutch building code: existing building measures
	05	Municipality's initiative
Technical	06	Design consequences (lay-out, construction)
	07	Office type (corridor, center core)§
	08	Planning optimization
	09	Sustainability
	10	Technical consequences (construction, facade)
Social	11	Area redevelopment
	12	Housing environment
	13	Sustainability

Discussion

- Possible scenarios
 - Demand changes office space
 - Changes in ways of working
- Limitations to the research - the Netherlands
- Similarities and differences between cases
 - Criteria
 - Different cases

Recommendations

For further research:

- Possible scenarios
- Broader area / Specific city or area with a large portfolio of high-rise (transformations)
- Increase amount of cases researched and optimize criteria

For practice:

- Input future transformation projects
- Technical level

Thank you!

Challenges & opportunities to reuse of tall office buildings

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