SURVEY OF THE BEST PRACTICES

State-of-the-Art of implementation of roof-top extension retrofit for energy efficiency in social housing.

PART II/II

A SuRE-Fit Report of Deliverable 5 – 6 – 7

Project	Sustainable Roof Extension Retrofit for High-Rise Social Housing in Europe (SuRE-Fit)
Stage	Workpackage II
Report by	W/E consultants (WPII leader)
Date	June 2007

Table of contents

1. INTRODUCTION 3

1.1 General introduction 3
1.2 Scope 3
1.3 Target group 3
1.4 Outline 3

2. DELIVERABLE 5 – FACT SHEETS OF BEST PRACTICES 4

2.1 Introduction 4
2.2 Approach 4
2.3 Results 4

3. DELIVERABLE 6 – OVERVIEW OF BENEFITS AND BARRIERS 17

3.1 Introduction 17
3.2 Approach 17
3.3 Results – Benefits and Barriers 17
3.3.1 Benefits 17
3.3.2 Barriers 18
3.4 Results – Definition of Design Concepts 20

4. DELIVERABLE 7 – PROJECT GALLERY 23

4.1 Introduction 23
4.2 Results 23

5. CONCLUSIONS 24

APPENDIX B – Description of Case Studies

1. INTRODUCTION

2.2 General introduction

This report is the second out of in total two reports produced for Workpackage 2, "Survey of the best practices". It addresses the objectives of deliverables 5 and 6 and 7. Successively they are a review of national best practices, summarized in fact sheets (D5), a description of achieved benefits and barriers of the roof-top extension projects (D6) and finally a project gallery with selected projects (D7). Aim of the whole survey is to solve the existing problems that state-of-the-art knowledge and best practices of roof-top extension retrofit in Europe are fragmented and still limitedly applied on projects throughout Europe.

1.2 Scope

Solving problems in the social housing sector is a starting point for SuRE-Fit. However, during the survey of relevant case studies no strict distinction is made between projects executed in the social sector or the private sector. It means that state-of-the-art technologies were derived from both domains. Nevertheless, the further implementation of sustainable roof-top extension will be focussed on social housing.

As improved energy performance is one of the main objectives of SuRE-Fit, project analyses will serve the development of draft guidelines, not only regarding spatial, technical and architectural aspects but certainly also regarding measures needed to come to sustainable solutions.

1.3 Target group

The collection and analysis of case studies – the deliverables D5, D6 and D7 – can function as guide for architects and engineers. The project gallery is meant to disseminate all knowledge, not only among experts; it can also be a very useful mean to show reserved occupants what the opportunities of sustainable roof-top extension are.

1.4 Outline

The fact sheets of deliverable 5 are collected in chapter 2 of this report. Deliverable 6, the description of the benefits and barriers will be expounded in chapter 3. Furthermore, the project gallery (deliverable 7) can be found in chapter 4. Finally, chapter 5 gives the conclusions that were derived from the survey.

2. DELIVERABLE 5 – Fact sheets of best practices

2.1 Introduction

Deliverable 5 comprises descriptions of best practices. The best practices are the result of an inventory of relevant case studies throughout Europe[1]. Various roof-top extension projects have been analysed while considering different fields; First of all the context in which the projects has been developed was investigated. A collection of different motives for roof-topping, varying roles of all parties during the process and differences through diverged policies and regulations were expected to be found. Besides that, also architectural, engineering and design aspects played a key role during the inventory and analyses of the case studies. Social aspects, lastly, were expected to have a large influence on the success of projects too and have therefore been investigated as well. These aspects are closely related with the feelings and wishes of the current and future occupants of the involved building but also of those who live in the same neighbourhood.

All best practices will be discussed in the next chapters, 2.2 till 2.3. Fact sheets are made per project and are divided into 4 parts: an overview with general data about the project; a part about the original building in its original state and in its new appearance after the retrofit; a part about the new development.

2.2 Approach

A questionnaire was developed and distributed among all consortium members in March 2007. During the 2nd SuRE-Fit meeting[2] members had the opportunity to review the produced fact sheets and possibly suggest chances. After that, the fact sheets were made definite.

A total number of 9 questionnaires were filled out and returned. They included the following projects:

Project name	Location	Provided by
Schlierbacher Weg	Berlin Neukölln (DE)	IWU
Belssstrasse / Luedeckestrasse	Berlin-Steglitz (DE)	IWU
Troppauer	Giessen, land Hesse (DE)	IWU
Fortbo	Rødovre (DK)	VEL
Nevanova	Prague (CZ)	STÚ-K
Ovrucská	Bratislava (SK)	STB
Legerského	Bratislava (SK)	STB
Hollého	Bratislava (SK)	STB
Westerpark	Tilburg (NL)	SWH
Leeuw van Vlaanderen	Amsterdam (NL)	WEA
Complex 50	Amsterdam (NL)	WEA
Lage Land	Rotterdam (NL)	WEA

2.3 Results

This chapter contains the fact sheets. They can be found on the website too.

[1] During the inventory is focussed on projects executed in countries represented by consortium members.
[2] Prague June 2007, hosted by STU-k

Schlierbacher Weg, Berlin-Neukölln (DE)

Introduction

Name project	Schlierbacher Weg
City	Berlin-Neukölln (DE)
Stage of the project	In use
Inventoried by	IWU
Contact	r.greiff@iwu.de
Building type	Apartment building
Year of construction	In 1953
Function before	Social housing
Function after	Social housing
Number dwellings before	# 12
Number dwellings after	# 14
Owner	Housing associaion
Initiator	Stadt und Land Wohnbauten GmbH
Design	Baufrösische Kassel
Consultants/Engineers	_
Contractor	Stadt und Land Wohnbauten GmbH
Start project	In 1991
Year of completion	In 1994
Reason to retrofit the building	Upgrading of a low-standard shelter building to contemporary social housing Social improvement Retrofit cheaper than new development

Existing building

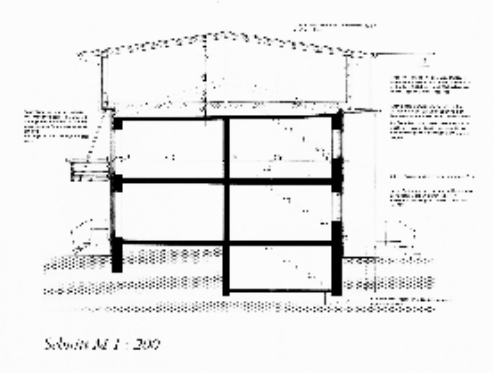
Urban matters	
Location of the building	Sub-urban area
Nearby facilities	School, market, green zone, medical services, public transport connection
Architecture	Building constructed in residential area for people with low-income. Typical design of the 1950ies: simple geometry, no balconies, slightly sloped roof
Construction	Concrete floors and load-bearing walls made of brickwork
Performance	
Maintainance before	No
Degradation of essential parts	_
Structural improvement of foundation	Yes
Energy	Single glazing
Functionality, Flexibility, Accessibility	
Surface of dwellings	_
Number of rooms	_
Storage space	_
Lifts	No
Parking space nearby (<50m)	Yes

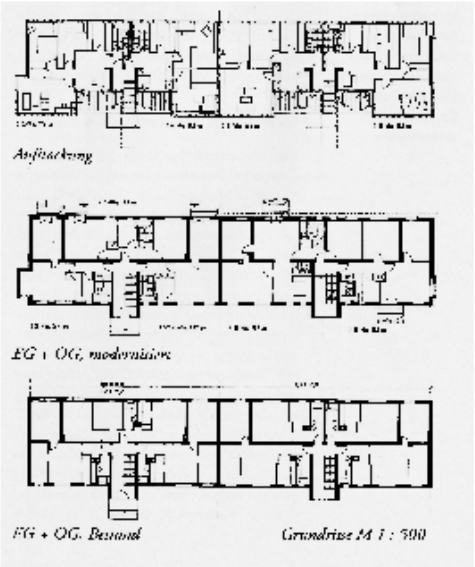
Evaluation of the existing building in new situation	
Energy saving measures	Extra insulation; Improvement thermal quality doors/windows; improved efficiency of installations
Other measures	Enlarging existing dwellings (balconies) Renewal of the existing facade
All negative aspects eliminated	_
Tenant's opinion	_

New roof-top dwellings

Policy matters	No obstructions; the roof-top extension was considered the best solution for up-grading this building (and its surrounding) by low-cost and simple means
Architecture	Though the architects followed specific aesthetics, the appearance of the building is comparable to the best new social housing
Construction	A concrete slab on top of the existing roofs forms the base. The timber-framed dwellings are built on top of the slab. Prefab, standardised elements
Energy	
Concept	Reduce of demand for energy (17mm wall insulation, 18mm for the roof). Efficient use of fossil energy sources.
Measures	HR++ glazing. Sun protection
Functionality, Flexibility, Accessibility	
Surface of dwellings	76-90 m2
Number of rooms	# 3
Storage space	_
Lifts	No
Grid	Different grid than the existing dwellings
Building process	Wooden elements were transported with mobile cranes, no need for much space at the site. Well-planned work flow
Evaluation	
Occupant's support, satisfaction	Valuate the process as 'good'; they wanted to stay and that could be achieved
Lessons learned	_

See: hhtp://www.baufroesche.de/umbau/berlin_lankwitz/





Belssstrasse / Luedeckestrasse, Berlin-Steglitz (DE)

Introduction

Name project	Belssstrasse / Luedeckestrasse
City	Berlin-Steglitz / Lankwitz (DE)
Stage of the project	In use
Inventoried by	IWU
Contact	r.greiff@iwu.de
Building type	Apartment building
Year of construction	In 1953
Function before	Housing
Function after	Housing
Number dwellings before	# 147
Number dwellings after	# 231
Owner	Housing associaion
Initiator	GSW Berlin
Design	Baufrösische Kassel
Consultants/Engineers	Lindschulte & Partner (structural frame-work), GSW (planning ground and outside facilities)
Contractor	_
Start project	In 1995
Year of completion	In 1995
Reason to retrofit the building	Upgrading of a low-standard shelter building to contemporary social housing Social improvement Retrofit cheaper than new development

Existing building

Urban matters

Location of the building	Sub-urban area
Nearby facilities	School, market, green zone, medical services, public transport connection
Architecture	Built as part of residential area for people with low income and without a home. Simple geometry, no balconies, sloped roof with asbestos cement tiles
Construction	Concrete floors and load-bearing walls made of brickwork

Performance

Maintainance before	No
Degradation of essential parts	_
Structural improvement of foundation	_
Energy	Single glazing, local tiled stoves for heating

Functionality, Flexibility, Accessibility

Surface of dwellings	_
Number of rooms	_
Storage space	_
Lifts	No
Parking space nearby (<50m)	Yes

Evaluation of the existing building in new situation

Energy saving measures	Extra insulation; Improvement thermal quality doors/windows; improved efficiency of installations
Other measures	Enlarging existing dwellings (balconies) Renewal of the existing facade
All negative aspects eliminated	_
Tenant's opinion	_

New roof-top dwellings

Policy matters	No obstructions; the roof-top extension was considered the best solution for up-grading this building (and its surrounding) by low-cost and simple means
Architecture	Though the architects followed specific aesthetics, the appearance of the building is comparable to the best new social housing
Construction	Timber-frame walls and prefabricated wooden floor elements Prefab, standardised elements

Energy

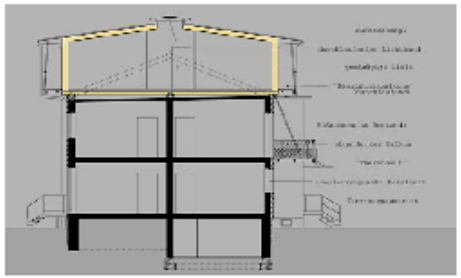
Concept	Reduce of demand for energy (optimal insulation of the building's envelope). Efficient use of fossil energy sources.
Measures	HR++ glazing. Sun protection Local gas heating station with combined heat and power cycle. Highly insulated subsurface ducts and separate electricity supply system Compact building form

Functionality, Flexibility, Accessibility

Surface of dwellings	60-75 and 76-90 m2
Number of rooms	# 3 And some very spacious dwellings with 6 and 7 rooms for bigger households and flat-sharing communities. Also some artiosts (studios with overhead light)
Storage space	_
Lifts	No
Grid	Different grid than the existing dwellings
Building process	Wooden elements were transported with mobile cranes, no need for much space at the site. Well-planned work flow. Tenants were given temporary dwellings designed to give them shelter during the construction works; 12-16 weeks

Evaluation

Occupant's support, satisfaction	Valuate the process as 'good';
Lessons learned	Light IFD construction
Extra	Architects have good reputation for both housing according tenant's requirements as well as for cheap constructions See: www.baufroesche.de/umbau



[Source: www.baufroesche.de/umbau]

Fortbo, Rødovre (DK)

Introduction

Name project	Fortbo
City	Rødovre (DK)
Stage of the project	In use
Inventoried by	VELUX
Contact	knud.overgaard@velux.com
Building type	Apartment building
Year of construction	In 1955
Function before	Residential
Function after	Residential
Number dwellings before	# 72
Number dwellings after	# 96
Owner	Private
Initiator	Association of owners
Design	Steen Pedersen
Consultants/Engineers	Bertel Gantriis
Contractor	Anonymous
Start project	In 1998
Year of completion	In 2001
Reason to retrofit the building	The roof had to be improved and roof-top extension was done to find financial support for it. Social improvement

Existing building

Urban matters

Location of the building	Sub-urban area
Nearby facilities	School, supermarket, green zone, public transport
Architecture	Three flat-roofed 3-storey blocks of yellow brickwork. A clearly visual separation of the floors by horizontal, contineous windows and room wide balconies. Common facilities in the 1/2-basement.
Construction	Reinforced concrete slabs and load-carrying transversal party walls (in situ) Floor: wooden beams (?)

Performance

Maintainance before	Yes, running maintainance
Degradation of essential parts	Yes, leakage of the roof
Structural improvement of foundation	No
Energy	Double glazing Collective high-effeciency heating

Functionality, Flexibility, Accessibility

Surface of dwellings	76-90m2
Number of rooms	# 2-3-4
Storage space	Yes
Lifts	No
Parking space nearby (<50m)	Yes

Evaluation of the existing building in new situation

Energy saving measures	Extra insulation; Improvement thermal quality doors/windows
Other measures	Addition of a lift for every block; creation of common playground
All negative aspects eliminated	No, responsibilities of all damages were not clearified from the beginning
Tenant's opinion	Happy because the significant achieve-ment is that the problem with the leaking roof is solved without cost for the property owner

New roof-top dwellings

Policy matters	No obstructions, there was a good cooperation between the municipality and the owner's association about the physical plan and requirements. 2/3 of the owners had to support the plan. The municipality described conditions for the dwellings (e.g. sloped roof, max 3,5 storeys.
Architecture	There are 24 new attic dwellings with open access balconies. The interiors have a open plan design. The design contains two storeys of which the upper one houses a bed-loft.
Construction	Wooden A-truss with high jamb struts (a two-level construction). Prefab.

Energy

Concept	Technical installations are separated from the host building completely. Supply of water comes directly from main runnings in the ground floor.

Functionality, Flexibility, Accessibility

Surface of dwellings	< 60 and 60-75m2
Number of rooms	# 2-3-4
Storage space	No
Lifts	Yes, one per block. Exterior.
Grid	–
Building process	Creation of a secuondary construction on top of the existing roof menas saved costs for disposal of the insulation material and temporary water proofing works.

Evaluation

Occupant's support, satisfaction	Valuated positively due to the elimination of the technical problems
Lessons learned	Spreading financial risks among all parties did not work well: the architect and contrac-tor did not get earnings on a sustainable level. The developer lost money. A later and similar project had better results.
Extra	No one took care of the dweller's situation during the works.

[Source: Steen Pedersen]

Giessen, Troppauer Straße

Introduction

Name project	Giessen, Troppauer Straße 34 - 36
City	Giessen, land Hesse, Germany
Stage of the project	in use / inhabited
Inventoried by	Rainer.Pauli@wohnbau-giessen.de
Contact	Rainer Greiff; r.greiff@iwu.de
Building type	Staircase access flat
Year of construction	1960
Function before	housing
Function after	housing
Number dwellings before	25
Number dwellings after	31
Owner	Wohnbau Giessen GmbH
Initiator	Wohnbau Giessen GmbH
Design	Dipl. Ing. Reimund Orth, Architekt
Consultants/Engineers	Thomas Weller, Ingenieurbüro
Contractor	Gebr. Bommhardt Bauunternehmen
Start project	2006
Year of completion	2006
Reason to retrofit the building	* economic advantages for company * creation of new dwellings * technical improvement: * connection to ditrict heating system * improvement functional standards (lifts) * adaptation of the layout of the dwellings to current demand; new balconies for every dwelling * social upgrading of the area, improvement of the general appearance of the building and its environment

Existing building

Urban matters

Location of the building	Urban area, close to the city centre
Nearby facilities	All necessary facilitiesare nearby
Architecture	The architecture is typical for the 1960ies blocks 4 storeys high with two dwellings on each storey, sloped roof and white plastered facades
Construction	* Outside walls are constructed in conventional brick work with 24 cm light concrete cavity bricks; concrete slabs; roofs and cellars were not insulated * sloped roof, plastic window frames, double glazing

Performance

Maintainance before	Gas ducts has been retrofitted Single glazed windows are replaced by double glazing with plastic frames
Degradation of essential parts	No special degradation
Structural improvement foundation	No
Energy	Thermal bridges and mould Heating & hot water provided by individual heaters stoked with coal/gas

Functionality, Flexibility, Accessibility

Surface of dwellings	60-75 m² Too little space, especially bathroom too small for potential new tenants
Number of rooms	# 3
Storage space	Inside and outside the dwelling
Lifts	No
Parking space nearby (<50m)	Garages and parking space <50m

Evaluation of the existing building in new situation

Energy saving measures	* additional insulation * thermically improved doors& indows * improved sun protection * more efficient heating system
Other measures	* enlargement / merging of dwellings, new balconies * new lifts, one with each access staircase; refurbishment of the staircases * refurbishment of the facade * retrofitting of all sanitary and electric installations.
All negative aspects eliminated	yes
Tenant's opinion	tenants are satisfied with the result

New roof-top dwellings

Policy matters	* Urban contract with the municipality as the intention of roof extension was not conform former planning regulation * Complete number required parking lots could not be created. Lacking parking lots compensated by payment
Architecture	* Same shape as existig building but different colour to optically reduce the height of the building. Modern appearance but not essentially altered.
Construction	Floors&interior walls: prefab concrete Outer walls: timber frame Sloped roof: traditional timber constr

Energy

Concept	* Reduce energy consumption and use fossil fuels efficiently * Retrofit of PV is intended (yet to realise) * District heating energy; individually reg. * Exhaust ventilation with two exhausting points per dwelling (no heat recovery). * Hot water by heat exchangers
Measures	High efficiency glazing, special air tightness, insulation of the facade, sun protection, compact building shape, noise protection. The value for energy efficiency is Rc > 4m²K/W

Functionality, Flexibility, Accessibility

Surface of dwellings	60 - 75 m²
Number of rooms	3
Storage space	both inside and outside
Lifts	There is one lift per staircase.
Grid	Different from the existing There are new central shafts
Building process	Building was unoccupied

Evaluation

Occupant's satisfaction	Good quality, the high standard interior equipment & layout. No problem to find tenants willing to pay the new higher rent
Lessons learned	It might have been better to realise the PV system together with the roof extension and not postpone it to a later stage

Nevanova, Prague (CZ)

Introduction

Name project	Nevanova
City	Prague (CZ)
Stage of the project	In use
Inventoried by	STÚ-K
Contact	info@stu-k.cz
Building type	Staircase access flat
Year of construction	Before 1980
Function before	Residential
Function after	Residential
Number dwellings before	# 32
Number dwellings after	# 52
Owner	Municipality
Initiator	Municipality Praha-Repy
Design	M. Hlavácek/J. Vránová
Consultants/Engineers	d plus
Contractor	REMIN s.r.o.
Start project	In 2001
Year of completion	In 2003
Reason to retrofit the building	Municipality's plan for creation of small apartments for starters/young families Technical improvement (leakage, poor insulation, thermal bridges) Social improvement Financial advantages

Existing building

Urban matters

Location of the building	Urban area
Nearby facilities	School, market, green zone, medical services, public transport, post office
Architecture	A 5-storey concrete panel building with a flat roof with elementary shapes (2 blocks). The building has two sections, each with two entrances. The facade is unicoloured. Outdoor stairs are not protected against rain.
Construction	Concrete floors and walls.

Performance

Maintainance before	Yes, reconstruction of sanitary & ducts
Degradation of essential parts	Yes, mainly the roof and windows
Structural improvement of foundation	No
Energy	Double window with single frame glass Overheating in summer. Draught. Thermal bridges. Collective heating system with high-temperature radiators.

Functionality, Flexibility, Accessibility

Surface of dwellings	76-90 m2
Number of rooms	# 4
Storage space	Yes
Lifts	No
Parking space nearby (<50m)	Yes

Evaluation of the existing building in new situation

Energy saving measures	Extra insulation; Improvement thermal quality doors/windows; improved efficiency of installations
Other measures	Replacement of the floor finish, new entry covers, replacement of banisters
All negative aspects eliminated	No, the efficiency could be improved
Tenant's opinion	Satisfied

New roof-top dwellings

Policy matters	No obstructions
Architecture	Partly single-storey and partly 2-storey extension. Uniformity is positively disturbed by maisonettes. Smooth continuance of the existing building. Entire renovation of the facades.
Construction	Brickwork walls with a Huris II cylindric roof system. The original roof was removed first to extend the staircases.

Energy

Concept	Reduce the demand for energy. Efficient use of fossil energy sources. HR++ glazing.
Measures	

Functionality, Flexibility, Accessibility

Surface of dwellings	< 60 m2
Number of rooms	# 2
Storage space	Yes
Lifts	No
Grid	Same grid
Building process	Disorder, not very well organised, noisy, dusty. Leakage of rain water.

Evaluation

Occupant's support, satisfaction	Good: they now have an up-graded building with high-level comfort. They even want to buy the appartments now.
Lessons learned	Better building process organisation Avoidance of leakage

Ovrucská, Bratislava (SK)

Introduction

Name project	Ovrucska
City	Bratislava
Stage of the project	Construction
Inventoried by	STU Bratislava
Contact	szekeres@svb.stuba.sk
Building type	Apartment building
Year of construction	1960ies
Function before	Residential
Function after	Residential
Number dwellings before	# 24
Number dwellings after	# 34
Owner	Private: Association of owners
Initiator	Private developer
Design	_
Consultants/Engineers	_
Contractor	_
Start project	In 2005
Year of completion	Expected 2008
Reason to retrofit the building	Technical improvement (leakage, poor insulation, thermal bridges) Creating financila resources for the repair of the existing roof, knowing there was demand for housing

Existing building

Urban matters

Location of the building	Urban area
Nearby facilities	School, green zone, public transport, police station
Architecture	A multi-family building from the 1950ies with a poor design of rectangular forms. The appearance is dominated by the large brickwork walls.
Construction	Concrete floors and brickwork walls.

Performance

Maintainance before	Yes, indoor's technical equipment
Degradation of essential parts	No
Structural improvement of foundation	No
Energy	Double glazing Draught. Thermal bridges. Collective heating system with high-temperature radiators.

Functionality, Flexibility, Accessibility

Surface of dwellings	<60m2
Number of rooms	# 2
Storage space	Yes
Lifts	No
Parking space nearby (<50m)	Yes

Evaluation of the existing building in new situation

Energy saving measures	Extra insulation; Improvement thermal quality doors/windows; improved efficiency of installations
Other measures	Renewal of the existing facade
All negative aspects eliminated	Yes
Tenant's opinion	_

New roof-top dwellings

Policy matters	Regulation according minimum amount of parking space: a new parking area had to be designed
Architecture	Addition of two floors in the same style as the existing building. Disposition of the new dwellings is flexible however.
Construction	Brickwork walls and concrete floors.

Energy

Concept	Reduce the demand for energy
Measures	Positive orientation towards the sun Compact building form

Functionality, Flexibility, Accessibility

Surface of dwellings	60-75 m2
Number of rooms	# 2
Storage space	Yes
Lifts	No?
Grid	Same grid
Building process	Not yet executed

Evaluation

Occupant's support, satisfaction	_
Lessons learned	_

Source: REB REALITY (http://www.reb.sk/index.php?ID=2881)

Hollého Street, Bratislava (SK)

Introduction

Name project	Hollého Street
City	Bratislava
Stage of the project	In use
Inventoried by	STU Bratislava
Contact	szekeres@svb.stuba.sk
Building type	Apartment building
Year of construction	1960ies
Function before	Residential
Function after	Residential
Number dwellings before	# 30
Number dwellings after	# 37
Owner	Private: Association of owners
Initiator	Owners
Design	IKS s.r.o.
Consultants/Engineers	_
Contractor	Association of owners "PREFA house"
Start project	In 1998
Year of completion	In 2002
Reason to retrofit the building	Technical improvement: costs of improving the roof covered by income through new dwellings

Existing building

Urban matters

Location of the building	Urban area
Nearby facilities	School, supermarket, public transport, medical services
Architecture	The building's style can be characterized as 'functional'.It's a 5-storey multi-family house that marks the corner of the street
Construction	Concrete floors and brickwork walls in a concrete frame

Performance

Maintainance before	Yes, reconstruction roof and balconies
Degradation of essential parts	Yes, cornice and roof
Structural improvement of foundation	No
Energy	Double glazing Draught

Functionality, Flexibility, Accessibility

Surface of dwellings	60-75 m2
Number of rooms	# 3
Storage space	No
Lifts	Yes
Parking space nearby (<50m)	Yes

Evaluation of the existing building in new situation

Energy saving measures	_
Other measures	Existing apartments were enlarged Two lifts were replaced by one other
All negative aspects eliminated	No, heating system and facade insulation still not optimal
Tenant's opinion	_

New roof-top dwellings

Policy matters	Technical standards for illumination
Architecture	It's a 2-storey addition. The first storey has concrete floors and brickwork walls. The second floor has a space truss construction. A shingle forms the roof. The architecture of the retrofit is similar to the surroundings.
Construction	First layer of concrete floors with brickwork walls in between. Second layer is a space truss.

Energy

Concept	Reduce the demand for energy Energy efficient ventilation
Measures	Positive orientation towards the sun Compact building form Extra air tightness Low temperature heating

Functionality, Flexibility, Accessibility

Surface of dwellings	76-90 m2
Number of rooms	# 3
Storage space	No
Lifts	Yes
Grid	Same grid
Building process	Good management made the process go smoothly

Evaluation

Occupant's support, satisfaction	Design and location very appreciated However, some owners still don't support the retrofit (why not?)
Lessons learned	Leasing public space was necessary to make this project affordable

Westerpark, Tilburg (NL)

Introduction

Name project	Westerpark
City	Tilburg (NL)
Stage of the project	Design
Inventoried by	SWH (van Hoogmoed architecten)
Contact	info@vanhoogmoedarchitecten.nl
Building type	Staircase access flat
Year of construction	In 1957
Function before	Housing
Function after	Housing
Number dwellings before	# 72
Number dwellings after	# 108
Owner	Housing association
Initiator	Housing association TIWOS
Design	van Hoogmoed architecten
Consultants/Engineers	Adviesbureau van Boxsel
Contractor	Bouwgroep Moonen
Start project	In 2003
Year of completion	In 2008
Reason to retrofit the building	Social improvement Dwellings did not meet changed requirements of the target group (elderly people); functional changes were necessary. Answering this demand elsewhere in the is hard due to restrictions for new development

Existing building

Urban matters

Location of the building	Sub-urban area
Nearby facilities	School, market, green zone, medical services, public transport
Architecture	Different building blocks of 4 storeys are situated in a park. The blocks represent the early post-war architecture: small dwellings, functional arrangement. Every block consists of 8 dwellings per floor and has 3 staircases.
Construction	Concrete floors and walls.

Performance

Maintainance before	Yes, new windows
Degradation of essential parts	No
Structural improvement of foundation	No
Energy	Uncomfortable indoor climate in winter Draught. Thermal bridges. Local stoves for heating

Functionality, Flexibility, Accessibility

Surface of dwellings	60-75 m2
Number of rooms	# 3
Storage space	Yes
Lifts	No
Parking space nearby (<50m)	Yes

Evaluation of the existing building in new situation

Energy saving measures	Extra insulation; Improvement thermal quality doors/windows; improved efficiency of installations. Sun protection Solar panels for common spaces
Other measures	Enlarging dwelling Addition of lifts Renewal of the existing facade
All negative aspects eliminated	Yes
Tenant's opinion	Positive

New roof-top dwellings

Policy matters	No obstructions
Architecture	Aim is to introduce present-day improvements and characteristic features respecting post-war architecture answering today's requirements: comfortable dwellings, large, sustainable and high-standard. The typical repetition is continued.
Construction	Timber frame, prefabricated elements and a floor of wooden beams

Energy

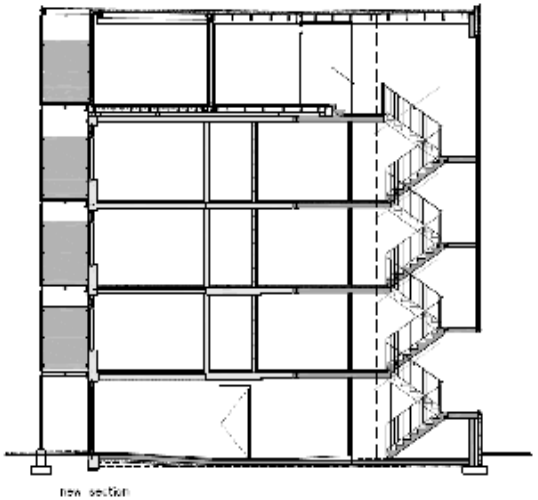
Concept	Reduce the demand for energy. Efficient use of fossil energy sources.
Measures	HR++ glazing Extra air tightness Sun protection Solar panels Positive orientation towards the sun Solar collector 5 m2 per dwelling

Functionality, Flexibility, Accessibility

Surface of dwellings	76-90 m2
Number of rooms	# 3
Storage space	Yes
Lifts	Yes
Grid	Same grid
Building process	Not yet executed

Evaluation

Occupant's support, satisfaction	_



Source: van Hoogmoed architecten

Nanterre Provinces Francaises

Introduction

Name project	Nanterre Provinces Francaises
City	Cité des Provinces Francaises
Stage of the project	Initiative
Inventoried by	APO
Contact	apogee_fr@compuserve.com
Building type	_
Year of construction	Between 1950-1960
Function before	Social housing
Function after	Social housing
Number dwellings before	_
Number dwellings after	_
Owner	OPHLM de Nanterre
Initiator	City of Nanterre
Design	_
Consultants/Engineers	_
Contractor	_
Start project	In 2007
Year of completion	Expected 2010
Reason to retrofit the building	Technical improvement (roof has to be renewed). Social improvement. Opportunity to create dwellings in an area where space is scarce. Part of bigger plan: refurbishment of an area where renovation will take place as well as new development (subway station) and demolishment

Existing building

Urban matters

Location of the building	Urban area
Nearby facilities	School, market, medical services, public transport, university, admin. Centre
Architecture	Prefabricated buildings form de 1950ies with heavy concrete components. Hight: 4 storeys. The facades are original and have been renovated before. The building has a roof made of zinc.
Construction	Concrete floors and load-bearing walls.
Performance	
Maintainance before	Yes, maintainance by the owner
Degradation of essential parts	_
Structural improvement of foundation	_
Energy	_
Functionality, Flexibility, Accessibility	
Surface of dwellings	_
Number of rooms	_
Storage space	_
Lifts	No
Parking space nearby (<50m)	Yes

Evaluation of the existing building in new situation

Energy saving measures	_
	Not executed and no plan
Other measures	_
All negative aspects eliminated	_
Tenant's opinion	_

New roof-top dwellings

The project is not yet executed, neither do they have a plan or design.

http://www.nanterre.fr/Citoyens/Lesquartiers/Universite/PRUS+université/La+réhabilitation.htm

Leeuw van Vlaanderen, Amsterdam (NL)

Introduction

Name project	Leeuw van Vlaanderen
City	Amsterdam (NL)
Stage of the project	In use
Inventoried by	WEA
Contact	wijsman@w-e.nl
Building type	Staircase access flat
Year of construction	In 1958
Function before	Social housing
Function after	Social housing and private rental
Number dwellings before	# 72
Number dwellings after	# 96
Owner	Housing association Far West
Initiator	Housing association Far West
Design	Heren 5 architecten
Consultants/Engineers	W/E (Building Physics), Atelier Bouwkunde (Building Technolgy), Pieters Bouwtechniek (construction)
Contractor	Coen Hoogendoorn Bouw
Start project	In 2003
Year of completion	In 2006
Reason to retrofit the building	Poor air quality and noise hindrance (situated along busy highway). Demolishment was no option because the building functions as a acoustic buffer for the area behind the block. Besides, people are devoted to their living area.

Existing building

Urban matters

Location of the building	Sub-urban area
Nearby facilities	School, market, green zone, medical services, public transport
Architecture	Long building block with 9 staircase entrances that lead to 5 storeys.
Construction	Concrete floors and walls.
Performance	
Maintainance before	?
Degradation of essential parts	Major acoustic hindrance
Structural improvement of foundation	No
Energy	No insulation of the walls Thermal bridges.

Functionality, Flexibility, Accessibility

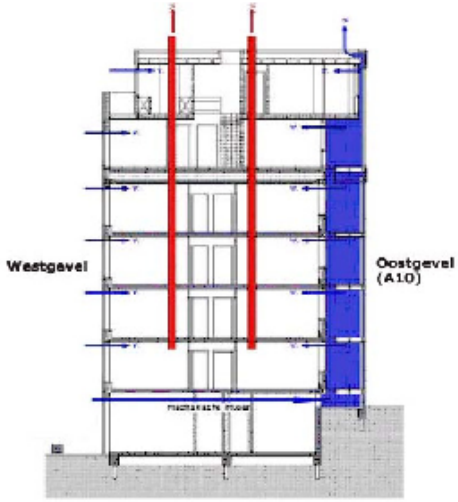
Surface of dwellings	60-75 m2
Number of rooms	# 3
Storage space	Yes
Lifts	No
Parking space nearby (<50m)	Yes

Evaluation of the existing building in new situation

Energy saving measures	Extra insulation; Improvement thermal quality doors/windows; improved efficiency of installations. Acoustic insulation (second skin facade and triple glazing). Total energy saving: 40%. Ventilation through the second skin.
Other measures	Enlargment of the dwellings (through renewed entrances; from staircase to gallery entrances) Addition of lifts (instead of 9 staircases there are 3 stairwells with lifts now). Renewal of the existing facade
All negative aspects eliminated	Yes
Tenant's opinion	?

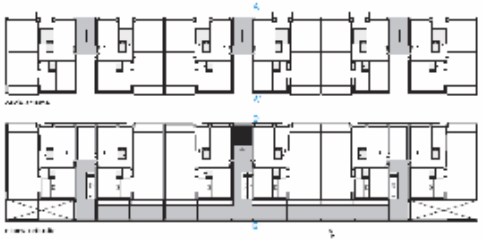
New roof-top dwellings

Policy matters	?
Architecture	Integral approach: the existing building is changed complete. A second skin facade is placed 2 meter before the existing one (at the side of the road); it's a buffer, both for thermal as well as for acoustic matters. Galleries lead to the appartments. Outdoor spaces were created on top of the second storey of the extension.
Construction	Steelframe panels attached to a steel construction fastened to the roof. Duct and pipes run through the area in between the old roof and this construction.
Energy	
Concept	Reduce the demand for energy. Efficient use of fossil energy sources.
Measures	HR++ glazing Extra air tightness Sun protection Ventilation takes place through the 2nd skin: natural flow running through the building.



Functionality, Flexibility, Accessibility

Surface of dwellings	76-90-100 m2
Number of rooms	#4, some have more rooms
Storage space	Yes
Lifts	Yes
Grid	Same grid



Building process

Evaluation

Occupant's support, satisfaction	Very pleased bacause they still live in their building but without the inconveniences.
Lessons learned	Hard to find buyers for new dwellings Integrate design: old & new function as one building.

http://www.dubocentrum.nl/projecten/leeuw_van_vlaanderen_een_gerenoveerd_flatgebouw_als_geluidsscherm_de_-/print/

Complex 50, Amsterdam (NL)

Introduction

Name project	Complex 50
City	Amsterdam (NL)
Stage of the project	In use
Inventoried by	W EA
Contact	wijsman@w-e.nl
Building type	Staircase access flat
Year of construction	?
Function before	Social housing
Function after	Social housing
Number dwellings before	#
Number dwellings after	#
Owner	Housing association Far West
Initiator	Housing association Far West
Design	van Schagen architecten
Consultants/Engineers	W/E (Building Physics)
Contractor	
Start project	In 1996
Year of completion	In 2001
Reason to retrofit the building	Urban design considerations. Creating financial support for the refurbishment of the whole area. Technical problems of the existing building (e.g. lack of insulation) but also other forms of problems: too little daylight, monotone living areas, lack of social cohesion). Retrofit to improve the quality of living by enlarging existing dwellings (by merging); extension on the roof ensured the amount of dwellings did not decrease.

Existing building

Urban matters

Location of the building	Sub-urban area
Nearby facilities	School, market, green zone, medical services, public transport
Architecture	Complex 50 consists of long building block with stair case entrances. They have concrete floors and a conrete grid for the facade; large window frame within this grid cause an uncomfortable indoor climate. All apartments have a very small balcony that is used rather for storage than for spending time there. On ground level interruptions in the blocks forms passage ways.
Construction	Concrete floors and walls.
Performance	
Maintainance before	
Degradation of essential parts	
Structural improvement of foundation	No
Energy	No insulation of the walls Thermal bridges. Uncomfotable indoor climate

Functionality, Flexibility, Accessibility

Surface of dwellings	60-75 m2
Number of rooms	# 3
Storage space	No
Lifts	?
Parking space nearby (<50m)	Yes

Evaluation of the existing building in new situation

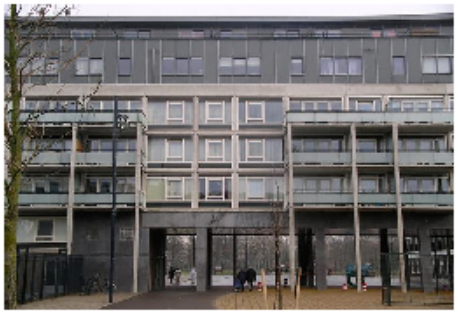
Energy saving measures	Extra insulation --> new facade; improved efficiency of installations --> collective heating system (6 systems). The system is designed to be extended with other energy efficient system (e.g. combined heat power) in the future.
Other measures	Enlargment of the dwellings (through vertical merging, larger balconies) A new facade has been placed in a new grid in front of the existing facade. Improved daylight entrance. Advanced technical equipment.
All negative aspects eliminated	Yes
Tenant's opinion	

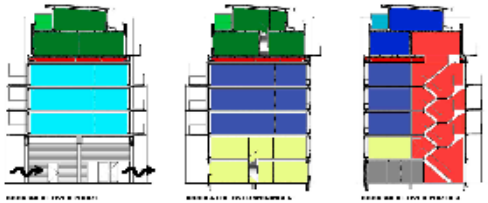
New roof-top dwellings

Policy matters / financial	Because creating the passage ways (a spatial condition) subsidies were given by the province. The city of Amsterdam contributed financially as the building was a good example of sustainable building. SEV (an organisation that supports innovation in the field of housing and urbanism) helped as well.
Architecture	Integral approach: the existing building was stripped completely. The orthogonal is maintained and emphasized in the new situation. The new dwellings, a 2-storey addition have different facade panels to distinguish them from the rest of the building. The upper roof-top layer houses an extra room and a terrace.
Construction	Prefab timber frames are attached to a steeel structure that is fastened to the existing roof.
Energy	
Concept	Reduce the demand for energy. Efficient use of fossil energy sources.
Measures	HR++ glazing Extra air tightness Sun protection Connection to the collective heating system of the entire building.

Functionality, Flexibility, Accessibility

Surface of dwellings	76-90 m2
Number of rooms	# 4
Storage space	Yes
Lifts	Yes
Grid	Existing dimension are copied
Building process	The construction time was long.
Evaluation	
Occupant's support	People had to be sheltered elsewhere for quite a long time. A total of 70% of the former occupants came back living in the building. They are satisfied about the improvements.
Lessons learned	Mixed groups of people (seniors, starters, families) now live together pleasantly due to the separate entrances and qualiltativ spaces. Different kind of problems are solved intergrate (social, technical etc). When renovation was executed *after* the new development the hindrance would have been much dominant for the tenants. Due to the (too) long process financing for building costs increased constantly.





Lage Land, Rotterdam (NL)

Introduction

Name project	Lage Land
City	Rotterdam (NL)
Stage of the project	In use
Inventoried by	WEA
Contact	wijsman@w-e.nl
Building type	Gallery apartment building
Year of construction	In 1961
Function before	Residential - social housing
Function after	Residential - social housing & Private
Number dwellings before	42 (per block)
Number dwellings after	51 (per block)
Owner	Housing Association PWS Rotterdam
Initiator	Housing Association PWS Rotterdam
Design	Kolpa Architecten Rotterdam
Consultants/Engineers	Adviesbureau Van den Berg Rotterdam
Contractor	MAT afbouw
Start project	In 2000
Year of completion	In 2007
Reason to retrofit the building	Upgrading the district and transformation of the existing stock into comfortable dwellings. Conservation of buildings with a good technical state.

Existing building

Urban matters

Location of the building	Sub-urban area in Rotterdam
Nearby facilities	Nearby a railway station, parks, shopping malls, schools; all facilities
Architecture	Building blocks of various heights and programmes are situated in an area with a lot of green zones, wide lay-out. They all have a repetitive division of the facade
Construction	Concrete floors and load bearing brickwork walls

Performance

Maintainance before	Yes, eventually
Degradation of essential parts	No
Structural improvement of foundation	No, but because of loss of detailed information they reinforced the foundation as a precaution

Energy

Functionality, Flexibility, Accessibility

Surface of dwellings	75m2
Number of rooms	#3 and #4
Storage space	Yes
Lifts	Yes, was added during a previous renovation
Parking space nearby (<50m)	Yes

Evaluation of the existing building in new situation

Energy saving measures	Nothing has been done to the supporting building
Other measures	
All negative aspects eliminated	
Tenant's opinion	Hard to convince them, the communication was not optimal.

New roof-top dwellings

Policy matters	Though in this area an addition of only 1 storey was permitted, the local government made an exception due to the function as stimulator of the project for similar projects.
Architecture	The simple, orthogonal image had to be remained (Policy Document Rotterdam). A steel structure that marks the shape emphasizes the orthogonal structure. On purpose contrasting materials have been chosen.
Construction	Light-weight steel construction, assembled on site. The construction is placed above the existing grid of 7.5m.

Energy

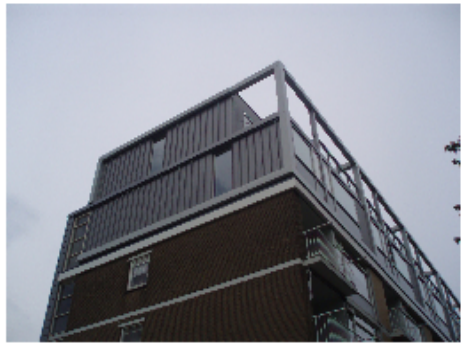
Concept	No special attention was paid to sustainability.
Measures	

Functionality, Flexibility, Accessibility

Surface of dwellings	130m2
Number of rooms	# 4 (divided over 2 storeys)
Storage space	Yes
Lifts	Yes, 1 per block
Grid	Same as existing
Building process	To minimise nuisance the building process kept as short as possible by using only prefab elements. Current tenants could remain seated. Sevage pipes are horizontally spread in the area between the existing roof and the new 'ground floor'. From there they're brought to a central point near the staircase.

Evaluation

Occupant's support, satisfaction	The dwellings are not occupated yet.
Lessons learned	Make sure you have detailed information about the supporting building.



Source:Bouwen met Staal

3. DELIVERABLE 6 – Overview of BENEFITS and BARRIERS

3.1 Introduction

After having collected various roof-top extension projects in deliverable 5, an analysis of the projects could be made. Deliverable 6 contains the analysis including an overview of achieved benefits and barriers. Describing the benefits and barriers automatically led to the composition of a list with DO's and DON'Ts. The DO's and DON'Ts form draft guidelines that facilitate decision-making in the roof-topping process. The draft guidelines are going to be tested and specified in the next stage of SuRE-Fit, namely workpackage 3.

3.2 Approach

Benefits and barriers that arose from the case studies were collected and compared. It appeared to be that some benefits and barriers occurred in all projects, other occurred in just some of the cases. The general consequences are not compliant of course. However, the outcome of some specific cases (both negative as well as positive results) can be dealt with. A matrix, developed around the results of the analysis, indicates what the consequences are of decisions made during the process.

3.3 Results – Benefits and Barriers

3.3.1 Benefits

General benefits

Sustainable development

In attractive areas in nearly all countries demand for affordable housing is an ever-ongoing phenomenon. Roof-top extension is considered to be a good measure to provide dwellings in and at the same time diminish the environmental impact of the new development by re-using existing structures and reducing the amount of waste.

Financial resources

Through rooftop extension it is possible to answer the demand for housing (both quantitative as well as qualitative) and at the same time create financial resources for investments in the existing building stock. The buildings that have potential to be vertically extended are located in attractive areas.

Investment energy performance

Investments in the existing building should include improvement of the energetic performance. Most of the buildings suitable for SuRE-Fit are built in between 1960 and 1980. This group of buildings is usually not insulated and that creates major opportunities in the field of reducing energy consumption.

Re-use and waste avoidance

Using the overcapacity of a building's construction, as SuRE-Fit does, avoids enormous flows of materials that would have appeared with new construction. The impact on the environment as a logical result of enlarging the building stock is much less extensive.

Upgrade of the neighbourhood

When a building is upgraded the whole area that the building is located in gets a boost. The physical support for new facilities and services is larger. The roof-top extensions may work as exemplar for further refurbishments.

Specific benefits

Addition qualitative spaces

By improving the whole building (i.e. intensive renovation of the original building) the quality of all existing dwellings can be improved. Where apartments used to have small balconies at first, they now have large outdoor spaces. For example, rearranging the façade can solve problems with the entrance of daylight. When these functional changes are applied to the building the refurbishment will have more effect since the building will have a longer lifespan, both technically as well as economically.

Differentiation and architectural/urban accents

Adding new dwellings opens opportunities for the creation of different programmes: often people who are raised and spent their whole lives in the same neighbourhood are desperate to stay in their homes. Differentiation in the supply of dwellings make moving within the same area possible. Architectural and even urban distinctions may influence the whole appearance of the building or the area the building is situated in.

3.3.2 Barriers

General barriers

Negative market conditions

If the demand for housing is not applicable for the location of the intended retrofit building it is hard to find investors.

DO: A good analysis of both the demand as well as the supply. It is important to be aware of what exactly are the requirements of home hunters. On the other hand it must be clear what potential the building, but also the area or neighbourhood the building is located in, has.

Occupant's worries

How to deal with current tenants? When do you inform them and how? Positive reactions of tenants might be the relief that 'their' building is not going to be demolished but negative feelings prevail. People are worried about the amount of green zones around the building that will be destroyed in favour of the development of new living spaces. Furthermore, they have their concerns about the capacity of the stairwells and lifts and above all, they scare all the construction works on top. In situations where associations of house owners are involved these problems can be dealt with by presenting them the advantages (e.g. improved value of the building) but for social housing projects the dwellers won't profit financially. Investment in improvement of (the development of) common areas should be considered as a solution. Another feeling that influences people is jealousy. This jealousy embraces the feeling that new dwellers, not even introduced to them, will have better housing. Still they will often have to use the same transportation routes and that might cause friction in the understanding of each other.

DO: The key to overcome those difficulties in support of the current and future occupants is good *communication* among all parties. Occupants should be informed about the project and its consequences for them in an early stage of the project. Besides that, fear also plays a role but when people are showed a good example of roof-top retrofit they might change their opinion easily. Support is also enlarged when the refurbishment has positive effects for the current tenants of the supporting building. For example: the creation of common spaces, improvement of the infrastructural elements of the building and an increase of green zones around the building. Support of occupants is more critical in case of social housing projects. Here, tenants don't share the benefits of the project financially. For buildings in the private sector, with an active association of housing owners, the profits will be in favour of the occupants of the current building as well.

Inconvenient information about the original building

In one of the studied cases the housing association could not find specific technical information about the foundation of the building that was going to be extended. Though

experiences show an addition of very lightweight steel frame units won't be critical for the foundation the building license was not provided; a secondary foundation had to be constructed.

DO: It is very important to have all information about the supporting building present before starting the design process. In the first stage of a project important decisions have to be made and limitations of the building might form a motive to choose a different concept than was originally planned.

Dissimilar laws

Law and regulation should not form an obstruction for SuRE-Fit. However, it turned out that, for example, in the Netherlands different standards are used by different municipalities which causes that similar projects will be executed in one city but won't be executed in another city.

DO: To come to a successful project does not mean that a project should only match national building codes, regional plans etcetera. Roof-top extension is not automatically 'new development' and therefore other strategies must be followed. The fact that construction works are executed on top of dwellings requires specific measures. For example: when existing gas pipelines are led through the new dwellings they must be of high quality. Often however, they are old-fashioned and restricted to be just extended. Renewal is inevitable. Requirements regarding Fire Safety are defined nation-wide. However, a developer can find himself doing a project in one city without any problems and having trouble implementing the same design in another city due to differences in application of regulations among cities.

Leakage during the execution

A frequent phenomenon during the execution stage is leakage. It occurs not only when the existing covering is removed but also when the existing roof is used as working base for the new construction. Often the roofs are brittle and not walk able.

DO: A solution to avoid nuisance can be to cover the roof with a thin layer of concrete and build up from here. In some cases the existing roofs must be removed anyway. In this situation it is necessary to work under good weather conditions. A temporary roof covering is an option.

Hindrance during the execution – temporary removal of occupants

A very unpleasant side effect of roof-top retrofit is hindrance. It is impossible to not have any nuisance during the construction works at all. In some cases, however, hindrance can be brought back to a minimum level. Hindrance and unexpected incidents during the execution may lead to immense expenses.

DO: To minimise nuisance for the occupants the building process should be as short as possible. Using IFD methods facilitates this idea. It is bases on systemised production with minimum work on site. Other positive features are that it reduces the amount of building materials, it reduces waste and it provides high-quality products. Apart from this, using IFD simultaneously solves another barrier of roof topping: limited workspace will not be such a dominant factor when all elements are only assembled on site.

Lack of parking spaces

Enlarging the amount of dwellings in an area requires an increase of parking spaces too. Often residential districts are already satisfied with cars.

DO: the area must support enlargement of parking spaces. An option is underground parking. More likely, considering costs, is to transform green zones into car storage areas.

Specific barriers

Limitations due to the original building

In one inventoried case the new dwellings had shafts at unexpected locations; that was the result of the requirement authorities had that the existing ducts had to be extended strictly vertically through the new dwellings.

DO: Boundaries set by the existing building can be avoided by integrating the new design. Literally extending a building's grid automatically means adopting its dimensions and also its distribution facilities.

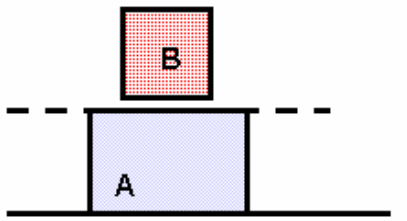
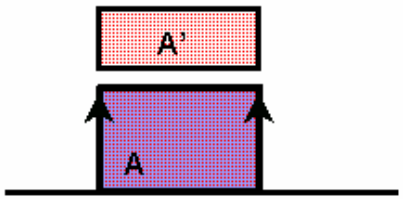
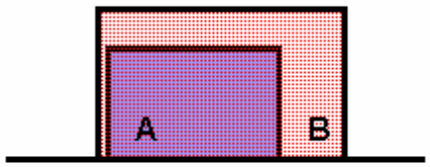
Uncomfortable indoor climate

Light-weight building constructions are sensitive regarding thermal and acoustic comfort. Overheating of the construction and noise nuisance are unwanted effects.

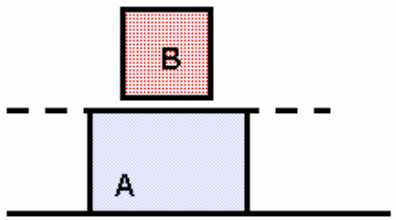
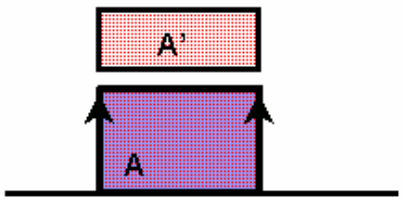
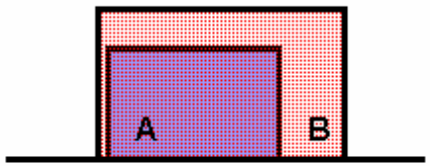
DO: When light building methods are used special attention must be paid to the following three themes: fire protection, acoustic performance and thermal performance.

3.4 Results – Definition of Design Concepts

Characteristics as construction method and appearance for example may differ from project to project. They are categorized in three groups. The categories can be found in the schedule on the following pages.

Type	1. CONTRAST A + B	2. EXTENSION A + A’	3. INTEGRATION A → B
			
Description	New development added on top	Vertically enlarging in the same style	Old and new become one
Motives	New, flexible dwellings	Creation of similar dwellings	High-level renovation
Architecture	Separation old–new: visual, infrastructure	Uniform appearance; looks like 1 new building afterwards	Building after retrofit resembles new development
Programme	Maximum freedom new dwellings; no limitations, start from scratch	Programme of new dwellings resembles the existing (same grid)	Large freedom for new programmes for both new and existing dwellings
Construction	Creation of new ‘ground level’	Simple, familiar techniques extended	Freedom regarding construction (usually building’s stripped)
Energy	New: maximum freedom Existing: no changes	Improvement of the energetic performance of the *whole* building (facade)	Integrated energy concept
IFD	Optimal starting point; completely prefab, only assembly on site	Existing building requires specific techniques; all work must be done on site	Prefab elements; still much work needs to be done on site

…

	1. CONTRAST A + B	2. EXTENSION A + A’	3. INTEGRATION A → B
			
Execution	Roof-topping while current occupants remain seated	Limited hindrance for occupants	Occupants of the supporting building must be moved temporarily
When	Existing building is in good condition. Need for maximum flexibility of the new dwellings	Supporting building needs technical improvement	Supporting building needs major improvements, both technical as well as functional
Examples[3]	Schlierbacher Weg (DE) Belssstrasse/Luedeckestrasse (DE) Fortbo (DK) Lage Land (NL)	Nevanova (CZ) Ovrucská (SK) Hollého (SK)	Westerpark (NL) Leeuw van Vlaanderen (NL) Complex 50 (NL)

[3] A description of the examples is given in deliverable D5 – Fact Sheets

4. DELIVERABLE 7 – Project gallery

4.1 Introduction

The project gallery aims to provide information about previous roof-top retrofit projects to architects and engineers, housing associations and (local) governments. The gallery shows what steps have to be taken to come to the final result. Various projects in different stages of their process will be demonstrated.

4.2 Results

The project gallery is going to be presented on the website. Input for the gallery is adjusted to the fact sheets. Together with a description and pictures of the selected projects they will form the basis for the gallery.

The descriptions are included in Appendix B.

5. CONCLUSIONS

Fact sheets are made for 12 projects so far. They are collected in deliverable 5. Though the intention was to gather information about roof-top extension projects executed in *all* countries represented by the consortium member, useful response came from Czech Republic, Denmark, Germany, the Netherlands and Slovakia only. Initiatives regarding the vertical extension of buildings are taken in Sweden and France but, as for the situation of Italy and Poland, there were no suitable examples.

In order to give an overview of achieved benefits and barriers – the objective of deliverable 6 – an analysis of the projects was made. Both benefits and barriers were divided in 'general' and 'specific':

- Benefits General: advantages over new development

  Specific: advantages depend on chosen concept

- Barriers General: consider other options if those problems occur

  Specific: can be dealt with, depending on project sometimes or capability of management and execution

A *specific* barrier suggests that it does not have to count for all projects. It is the same for the benefits; some benefits will appear only when a certain strategy is followed.

Although some problems occurred during execution of the studied cases, roof-top extension is absolutely practicable as far as technical aspects are concerned. Most striking barrier for SuRE-Fit is the complicated contact with the current dwellers. In case of buildings occupied by its owners or buildings with mixed ownership the process is complex due to the many involved parties. However, an advantage of this case is that people can be convinced easier because of the possibility to share the (financial) benefits. In social housing projects this will not be the case and therefore resistance of the tenants is harder. A solution to come over this problem is to create a better living environment for all dwellers. A common space and improvement of existing facilities can do so.

Case studies have shown that major improvements can be reached with SuRE-Fit. Using an existing building as base for new dwellings is a way of answering the demand for housing in specific areas without having a large impact on the environment. An exceptional energy concept has not been a starting point in most projects. In Central Europe the main reason to choose for roof-top extension was the technical deterioration of the roof. Considering the large demand in areas that the buildings are located in roof-topping seems a viable solution. The examples from the Netherlands were the result of major improvements for the whole building, not only technical but also functional problems had to solved.

Roughly 3 different approaches have been distinguished. The approaches are described as concepts in chapter 3.4 Depending on the context of a project the overview gives insight in what strategy is most favourable.

Input for the project gallery, deliverable 7, is supplied by the fact sheets in combination with pictures and descriptions of the projects. They will be exhibited at the website.