Upgradable Building Envelope System for Energy Reduction Renovation of Dutch Post-war Apartments

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Upgradable Building Envelope System for Energy Reduction Renovation of Dutch Post-war Apartments

Master of Science (MSc) thesis
Re-novate - Upgradable Building Envelope System for Energy Reduction Renovation of Dutch Post-war Apartments

Part of series of graduation projects aligned with the 2ndSkin Project.

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Fig. 9.2.9: Detail | 1:5 | Vertical | Foundation
Fig. 9.2.10: Detail | 1:5 | Vertical | Floor Connection

- **RENOVATED FACADE**
  - Bamboo Composite Panel (12 mm)
  - Air Cavity (9 mm)
  - MDF Panel (12 mm)
  - EPS Insulation (226 mm) \( (R_c = 7.7 \text{ m}^2/\text{W}^\circ\text{K}) \)
  - MDF Panel (12 mm)
  - Adaptation Layer (50 mm)
  - Existing Brick Facade (100 mm)
  - Air Cavity (70 mm)
  - Existing Concrete Wall (12 mm)
  - Stucco Finish (10 mm)

- **EXISTING FLOOR**
  - Finishing Floor (20 mm)
  - Existing Concrete Floor (150 mm)

- **Rubber Compression Band**
- **Plasterboard** (12 mm)
- **Setting Block** (100 x 153.5 mm)
- **Plasterboard** (12 mm)
- **Stucco Finish**
- **Vapour Barrier**

- **Aluminium extrusion profile (standard)**
- ** Aluminium extrusion profile (two-flange)**
- ** Aluminium Clamp Profile**
- **Customisable shape and material**
- **Rubber Intermodule Connection**
- **Steel Concrete Screw**
- **Attachment of evening lathe to floor**

- **Timber L-Profile**
  - Attached to extrusion profile
- **Rubber Interbox Connection**
- **Airtight connection between boxes**
- **Rubber Compression Profile**

- **Plastic Thermal Break**
  - Mounted in clamp profile
- **RT 72 Reflex Operable Window Frame**
  - Mounted in clamp profile
- **HR++ Double Glazing**
  - \( S-20-4 \ U = 1.1 \text{ W/m}^2\text{K} \)
R6

SOLAR PANEL MODULE CONFIGURATION

- Photovoltaic Panel
- Air Cavity (9 mm)
- MDF Panel (12 mm)
- EPS Insulation (226 mm) (Rc = 7.7 m²/W*K)
- Aluminium Clamp Profile (standard)
- Aluminium Clamp Profile (Chamfered)

Aluminium Clamp Profile
- Adjusted to guide water into gutter
- Corner Piece Thermal Break

Aluminium Gutter
- Sandwich Panel

Rubber Intermodule Connection
- Airtight connection profile
- Aluminium Finishing Cap
- Customisable shape and material
- Aluminium Clamp Profile

8.175
- Connected to T-slot with Insulated Stud
- 80/20 T-slot Profile 45X45L

8.120
- Aluminium extrusion profile
- 80/20 T-slot Profile 45X45L

Rubber Interbox Connection
- Airtight connection between boxes
- Rubber Compression Profile

Plastic Thermal Break
- Mounted in clamp profile
- RT 72 Reflex Operable Window Frame
- HR++ Double Glazing

STANDARD MODULE CONFIGURATION

- Bamboo Composite Panel (12 mm)
- Air Cavity (9 mm)
- MDF Panel (12 mm)
- EPS Insulation (226 mm) (Rc = 7.7 m²/W*K)
- MDF Panel (12 mm)
- Adaptation Layer (50 mm)
- Existing Brick Façade (100 mm)
- Air Cavity (70 mm)
- Existing Concrete Wall (12 mm)
- Stucco Finish (10 mm)

Steel Concrete Screw
- Attachment of evening lathe to floor
- Setting Block (100 x 153.5 mm)
- Plasterboard (12 mm)

Rubber Compression Band
Fig. 9.2.12: Detail | 1:5 | Horizontal | Module Connection

**STANDARD MODULE CONFIGURATION**

- **Stucco Finish**: (10 mm)
- **Existing Concrete Wall**: (12 mm)
- **Air Cavity**: (70 mm)
- **Existing Brick Facade**: (100 mm)
- **Adaptation Layer**: (50 mm)
- **MDF Panel**: (12 mm)
- **EPS Insulation**: (226 mm) \(\text{Rc} = 7.7 \text{m}^2/\text{W*K}\)
- **MDF Panel**: (12 mm)
- **Air Cavity**: (9 mm)
- **Bamboo Composite Panel**: (12 mm)

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**RT 72 Reflex Operable Window Frame**
Mounted in clamp profile
**Rubber Interbox Connection**
Airtight connection between boxes
**Rubber Compression Profile**

**Evening Lathe** (200 x 40 mm)
Support structure for modules
**Steel Connection Flat**
Screwed to support structure
**Steel Concrete Screw**
Attachment of evening lathe to floor

**80/20 T-slot Profile 45X45L**
Aluminium extrusion profile (two-flange)
**Aluminium Clamp Profile**
Connected to T-slot with Insulated Stud
**Aluminium Finishing Cap**
Customisable shape and material
**Plastic Thermal Break**
Mounted in clamp profile
**RT 72 Reflex Fixed Window Frame**
Mounted in clamp profile
**HR++ Double Glazing**
\((S-20-4) U = 1.1 \text{ W/m}^2/\text{K}\)
Fig. 9.2.14: Detail | 1:10 | Horizontal | Installation Box

**INSTALLATIONS MODULE CONFIGURATION**

- Stucco Finish (10 mm)
- Existing Concrete Wall (12 mm)
- Air Cavity (70 mm)
- Existing Brick Facade (100 mm)
- Adaptation Layer (50 mm)
- MDF Panel (12 mm)
- EPS Insulation (226 mm) ($R_c = 7.7 \text{ m}^2/\text{W}^*\text{K}$)
- MDF Panel (12 mm)
- MDF Panel (12 mm)
- Installation Space (710 mm)
- Integrated RT 72 Reflex Door (29 mm)
Fig. 9.4.1.2: Detail | 1:5 | Horizontal | Placeholder Frame

PLACEHOLDER MODULE CONFIGURATION

RT 72 Reflex Operable Window Frame
Mounted in clamp profile
80/20 T-slot Profile 45X45L
Aluminium extrusion profile (two-flange)
Aluminium Clamp Profile
Connected to T-slot with insulated Stud
Aluminium Finishing Cap
Mounted in clamp profile
Plastic Thermal Break
Mounted in clamp profile
RT 72 Reflex Fixed Window Frame
Mounted in clamp profile
HR++ Double Glazing
(5-20-4) U = 1.1 W/m*K
Rubber Interbox Connection
Air-light connection between boxes
Rubber Compression Profile
Evening Lathe
(200 x 40 mm)
Support structure for modules
Steel Connection Flat
Screwed to support structure
Steel Concrete Screw
Attachment of evening lathe to floor

Stucco Finish (10 mm)
Existing Concrete Wall (12 mm)
Air Cavity (70 mm)
Existing Brick Facade (100 mm)
Adaptation Layer (50 mm)
EPS Insulation (126 mm) (Rc = 4.2 m2/W*K)
MDF Panel (12 mm)
Air Cavity (43 mm)
Bamboo Composite Panel (12 mm)
Fig. 9.4.2.4: Detail | 1:5 | Horizontal | Installation Box
Fig. 9.4.3.4: Detail | 1:5 | Horizontal | Integrated Piping

**INTEGRATED PIPING MODULE**

Stucco Finish (10 mm)
Existing Concrete Wall (12 mm)
Air Cavity (70 mm)
Existing Brick Facade (100 mm)
Adaptation Layer (50 mm)
MDF Panel (12 mm)
Wood Fiberboard Insulation (226 mm) (Rc = 6.30 m²/W*K)
Ventilation Piping (80 mm)
MDF Panel (12 mm)
Air Cavity (9 mm)
Bamboo Composite Panel (12 mm)

**RT 72 Reflex Operable Window Frame**
Mounted in clamp profile

**Rubber Interbox Connection**
Airtight connection between boxes

**Rubber Compression Profile**

**Evening Lathe (200 x 40 mm)**
Support structure for modules

**Steel Connection Flat**
Screwed to support structure

**Steel Concrete Screw**
Attachment of evening lathe to floor

Air Inlet & Integrated Piping
Decentralised Ventilation

80/20 T-slot Profile 45X45L
Aluminium extrusion profile (two-flange)
Aluminium Clamp Profile
Connected to T-slot with Insulated Stud
Aluminium Finishing Cap
Customisable shape and material
Plastic Thermal Break

**HR++ Double Glazing**
(5-20-4) U = 1.1 W/m²*K
Fig. 9.4.4.4: Detail | 1:5 | Vertical | Integrated Single Heat Exchanger
Fig. 9.4.6.4: Detail | 1:5 | Horizontal | Nocturnal Ventilation

NOCT. VENT. MODULE CONFIGURATION

Stucco Finish (10 mm)
Existing Concrete Wall (12 mm)
Air Cavity (70 mm)
Existing Brick Facade (100 mm)

Adaptation Layer (50 mm)
MDF Panel (12 mm)
EPS Insulation (226 mm) (Rc = 7.7 m²K/W)
MDF Panel (12 mm)
Air Cavity (9 mm)
Bamboo Composite Panel (12 mm)

RT 72 Reflex Operable Window Frame
Mounted in clamp profile
Rubber Interbox Connection
Airtight connection between boxes
Rubber Compression Profile

Evening Lathe (200 x 40 mm)
Support structure for modules
Steel Connection Flat
Screwed to support structure
Steel Concrete Screw
Attachment of evening lathe to floor

80/20 T-slot Profile 45X45L
Aluminium extrusion profile (two-flange)
Aluminium Clamp Profile
Connected to T-slot with Insulated Stud
Aluminium Finishing Cap
Customisable shape and material
Plastic Thermal Break
Mounted in clamp profile

RT 72 Reflex Fixed Window Frame
Mounted in clamp profile
HR++ Double Glazing
(S-20-4) U = 1.1 W/m²K
Fig. 9.4.8.3: Detail | 1:5 | Vertical | Integrated Solar Shading Window
Fig. 9.4.9.3: Detail | 1:5 | Horizontal | Solar Comb

**SOLAR COMB CONFIGURATION**

- **Stucco Finish** (10 mm)
- **Existing Concrete Wall** (12 mm)
- **Air Cavity** (70 mm)
- **Existing Brick Facade** (100 mm)
- **Adaptation Layer** (50 mm)
- **MDF Panel** (12 mm)
- **EPS Insulation** (126 mm) \((R_c = 4.2 \text{ m}^2/\text{W}^\circ\text{K})\)
- **MDF Panel** (12 mm)
- **MDF Panel** (12 mm)
- **Rigid Insulation** (31 mm) \((R_c = 0.87 \text{ m}^2/\text{W}^\circ\text{K})\)
- **Solar Comb** (57 mm)
- **Air Cavity** (9 mm)
- **Single Glazing** (12 mm)

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**RT 72 Reflex Operable Window Frame**
- Mounted in clamp profile
- Rubber Interbox Connection
- Airtight connection between boxes
- Rubber Compression Profile

**Evening Lathe** (200 x 40 mm)
- Support structure for modules
- Steel Connection Flat
- Screwed to support structure
- Steel Concrete Screw
- Attachment of evening lathe to floor

**80/20 T-slot Profile 45X45L**
- Aluminium extrusion profile (two-flange)
- Aluminium Clamp Profile
- Connected to T-slot with Insulated Stud
- Aluminium Finishing Cap
- Customisable shape and material
- Plastic Thermal Break
- Mounted in clamp profile
- RT 72 Reflex Fixed Window Frame
- Mounted in clamp profile
- HR++ Double Glazing
- \((S-20-4) \ U = 1.1 \text{ W}/\text{m}^2/\circ\text{K}\)
Fig. 9.5.2: Fragment | Differing cap and panel color
Fig 9.5.4: Fragment 1:30 | Deeper extruded caps in combination with panel color variation.
Fig. 9.5.6: Fragment | 1:30 | Extruded static solar shading in combination with a steel finish
Fig. 9.5.8: Fragment 1:30 | Solar comb with glazing in front.