WP 4 Energy Supply

Report on Technical documentations (preparatory documents) for the individual projects in Jelgava target area

October 25, 2011

JELGAVA CITY COUNCIL

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Introduction

Latvia inherited a great deal from the Soviet Union, starting from cultural issues with which our society has had ingrained through the unique and practical architecture. Soviet-style constructions featured plans made according to standards, and they were well structured. Unfortunately, technical performance was sometimes surprisingly bad.

Moreover, the ideology was completely different. Before, natural resources were considered plentiful, if not infinite, and no thought was given to energy conservation. As we are living in a new century with a new political system, it is important to embrace new ideas and recognize and correct mistakes of the past. Results from the inspections of many buildings show that there are many weak points in our multi-story houses from which heat easily escapes. That is one of the reasons why this pilot project has been developed.

Our aim is to completely renovate the 103rd, 104th and 316th multi-apartment buildings, which can be adapted further to a specific series of high-rise buildings for greater energy-efficiency.

The pilot project is intended for the following series of dwelling houses:

104th Series - 12-story residential building at Pasta Street 38

103rd Series - 5-story residential building at Pasta Street, 55

316th Series - 5-story residential building at J.Čakstes Boulevard 11

Basic description

In the beginning of the project a professional assessment of the current situation for following multi-story apartment series was carried out.

The 103rd and 104th series buildings' substructure is made from reinforced blocks, suspended lightweight panels with analog concrete block, or a panel layer for doorway cladding. Mostly, inner load-bearing walls are made from clay or silicate blocks and precasted concrete hollow core slabs. Buildings are equipped with internal loggias; some examples have extra a technical floor in verytop.

The thickness of load-bearing walls is 510 mm while the middle part of the building blocks is 380mm wide. Lightweight panel thickness is 300mm, like in 316th series buildings. A similar solution was found in the 103rd and 104th series houses, but the design is modified with load-bearing walls made of silicate bricks. This type has lost the last technical floor and loggias.

Also, the 318th and 316th series have similar technical solutions, like in last example, but this type is modified with balconies and a gable roof structure with ventilated attic space covered with asbestos cement sheets. Sometimes, the top floors' roof slabs are constructed under angle, which is also used as roof. The 103rd and 104th series mostly are constructed with matched (flat) roof construction, ruberoid roll waterproofing and internal or external rainwater collection.

Main technical disadvantages

- Moisture-rich facade external walls
- Damaged substructure, flooding basements, dysfunctional rainfall collection systems •Weather-affected, damaged original wooden windows and doors
- Crumbled porch, roofs have damaged other parts (corroded pillars, disorganized rain water runoffs, etc.)
- Lack of heat resistance for all structural elements that are in contact with the outside air (outside buildings' heated volume)
- Outdated, inefficient and inadequate heating and hot water pipelines insulation; in some cases, stage pipes even lack insulation
- Damaged or non-existent anti-condensation insulation in some cases, which contributes to surface corrosion
- Inefficient heating system: discarded / inefficient heating radiators (especially steel-plate convection models), no valves or individual heat meters
- Ineffective ventilation system: blocked, dusty ventilation ducts; inadequate fresh air supply; elevated CO2 concentration in densely populated areas
- Brick walls in the 103rd and 104th series have micro-cracks, and frost-resistance limit is exceeded
- Damaged roof waterproofings and rainwater drainage systems in the 103rd and 104th series
- Spoiled asbestos cement sheets on the roofs, especially in the 316th series

Solutions and suggestions

•Increase the amount of insulation, which will increase wall thermal conductivity at least three times over. Plaster and paint will protect the building from adverse effects. Individually painted facades will integrate the building into the urban environment.
Approximate savings in thermal energy will be 20%.

•Add an extra 30mm of thick rock wool in the external walls, especially in openings, which will remove thermal bridges and decrease mold in corners.
Approximate heat savings will be 1%.

•Add foundation insulation with materials that have higher humidity resistance. This will extend the constructions' lifetimes, protect them from moisture and reduce the linear thermal bridge effect along the outer perimeter of the building.
Approximate heat savings will be 2%.

•Replace outdated wooden window frames with double glazing sashes and doors to prevent uncontrolled outdoor air circulation inside.
Approximate heat savings will be 8%.

•Add extra insulation in the basement, especially in the highest panels, to prevent condensation from forming.
Approximate heat savings will be 5%.

•Insulate the technical floor with brass or bulk insulation materials in the wooden beams' frames, or combine the roof design with additional insulation using rigid insulation panels.
Approximate reduction in heat loss will be 7%.

•Install heating and insulate the hot water pipes in the basement or the technical floor.
Approximate reduction in total building heat loss will be 5%.

•Flush the central heating radiator, replace defective / inefficient radiators, install thermostatic valves, and balance all heating systems. This will improve the

buildings' heating systems, equalize the distribution of heat in the buildings. **Approximate reduction of heat loss will be 10%, if the temperature was higher than necessary while our survey was conducted.**

•Clean and repair the ventilation shaft to ensure better circulation in kitchens and toilets. To ensure qualitative air supply, new ventilation system and air handling equipment is needed to provide better micro climate in the apartments.

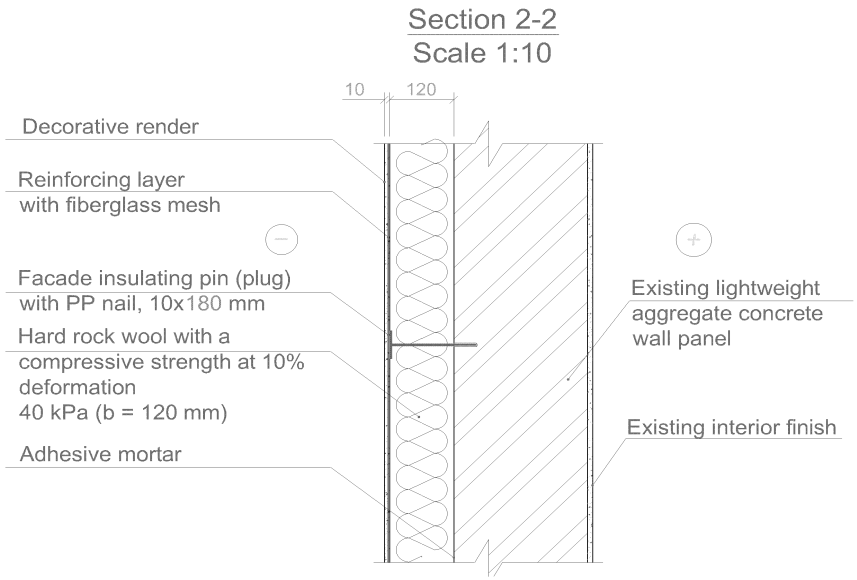
•In total, smart solutions, qualitative materials and professional installation could provide **total thermal energy savings up to 60%**, or approximately 60kWh/m2 per year.

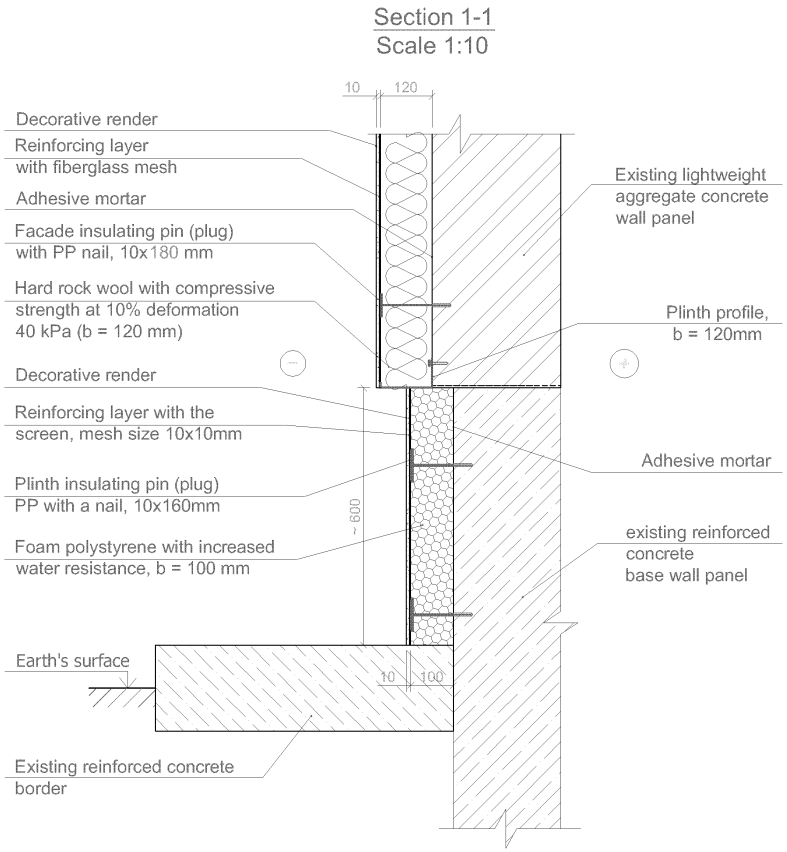
Of course, it is not so easy to evaluate a problem's importance. Sometimes, a problem can be solved by improving just small details, but cases certainly exist where complex improvements are necessary.

We have collected most important problems and sorted them in following sections.

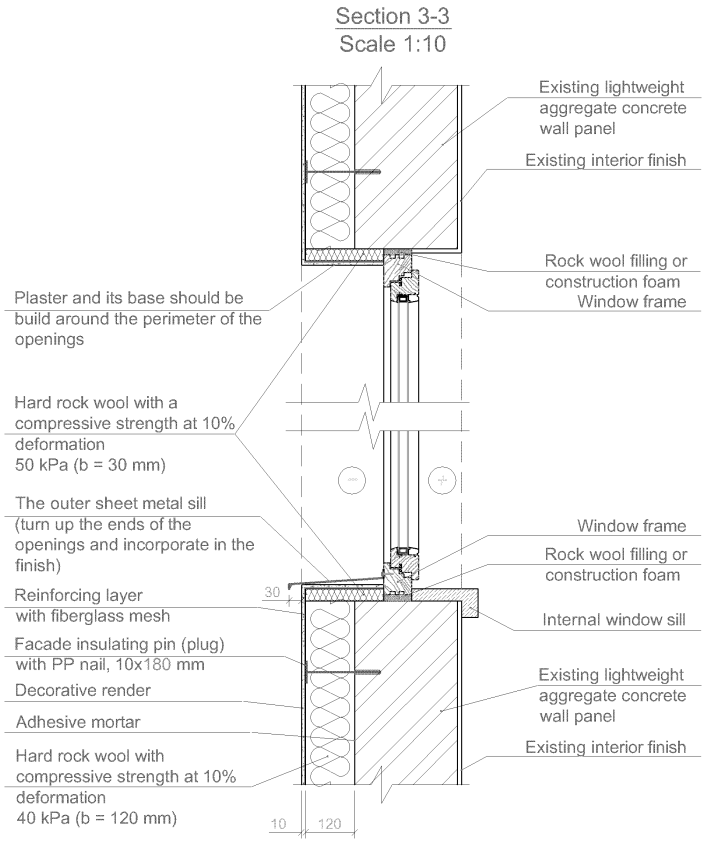
Facades

•Insulate walls with plastering method using solid front wool or expanded polystyrene.





•Replace windows.



•In all facades, insulation works recommended using of ETAG 004 - European Technical Approval of external thermal insulation composite.

Loggias, balconies

•Experts debate the most appropriate solution for balcony renovation.

•Add extra glass constructions in balconies with openings.

Balcony glazing solution
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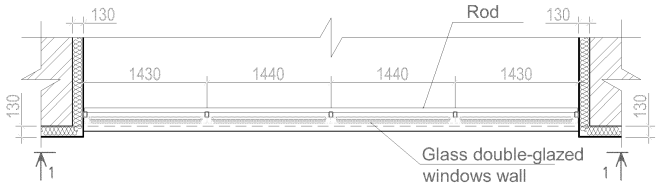

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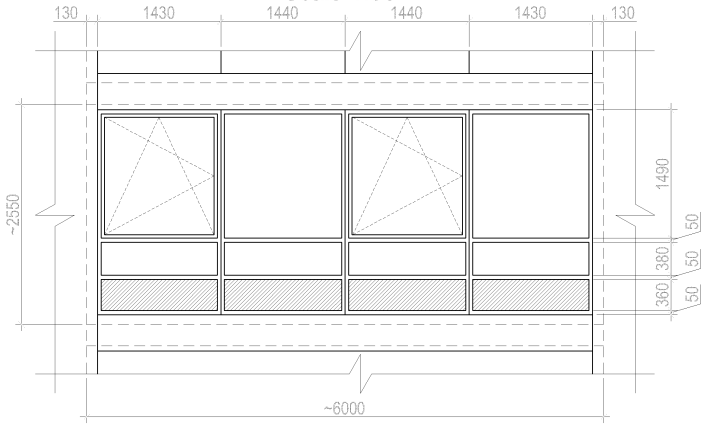

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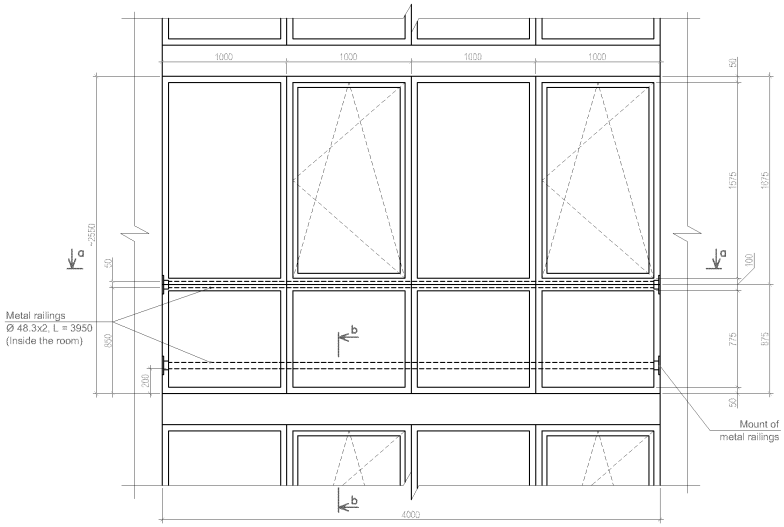

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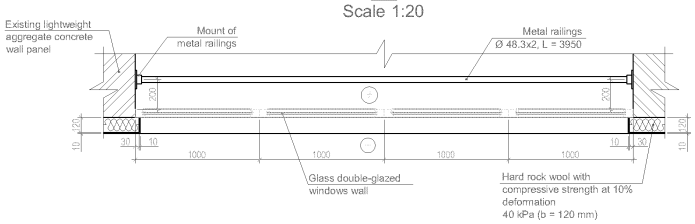
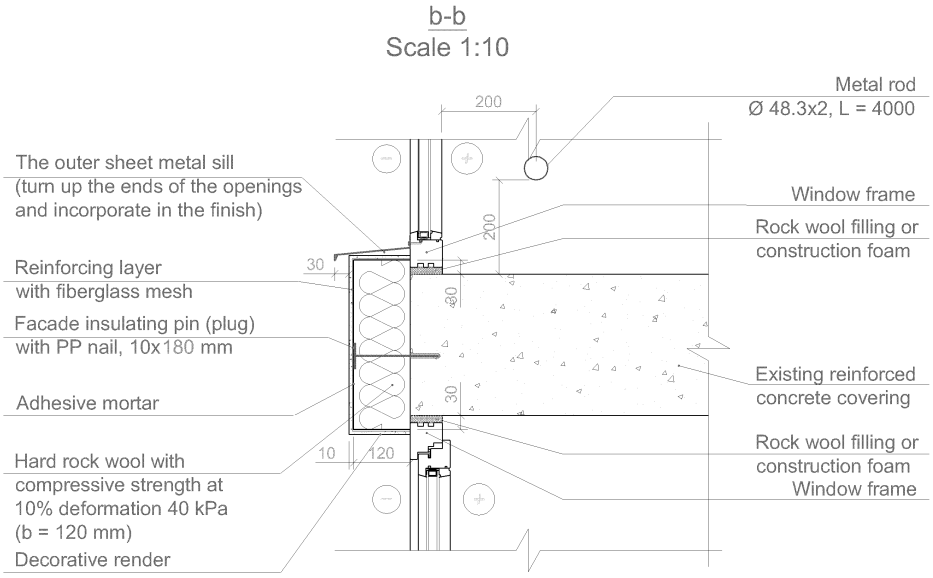
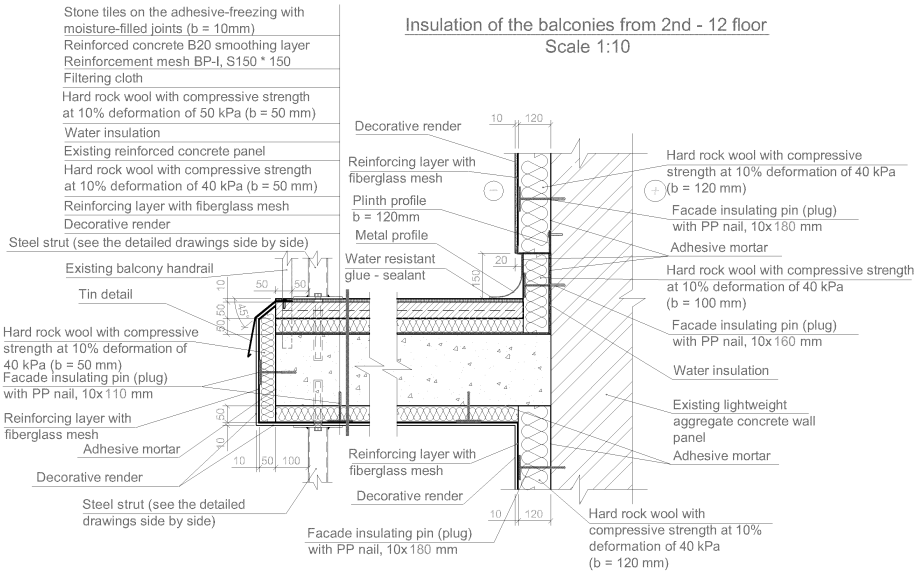
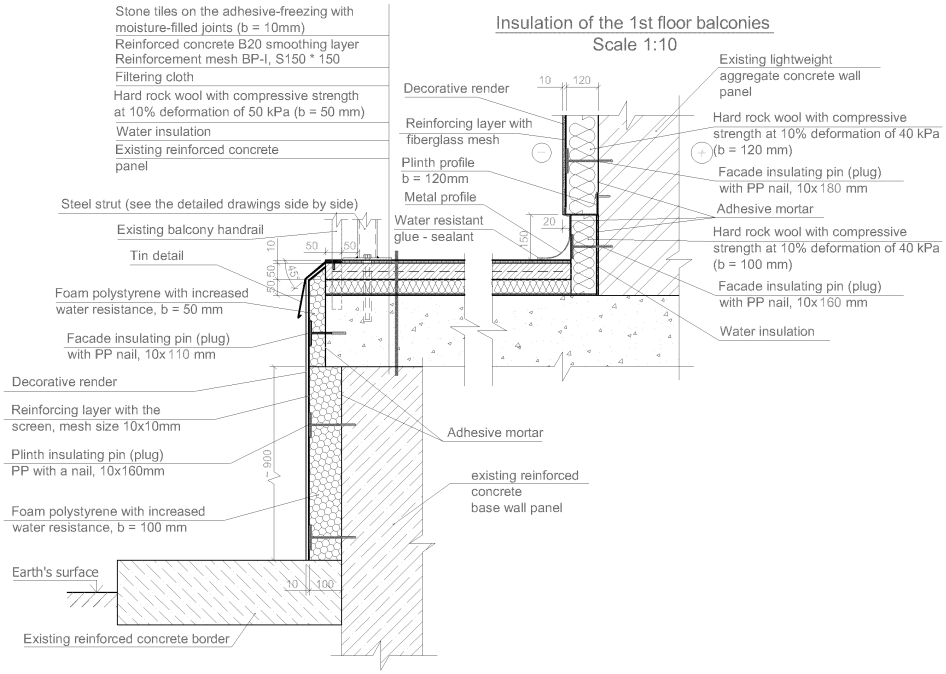




•If extra glass construction isn't available, then double insulation in floor and ceiling parts should be used.

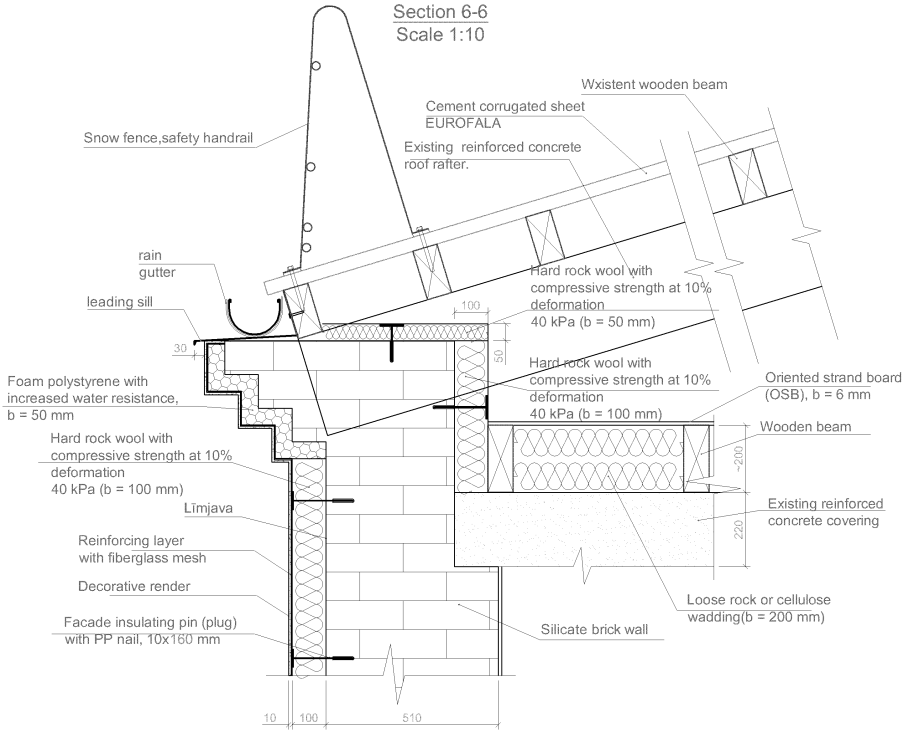




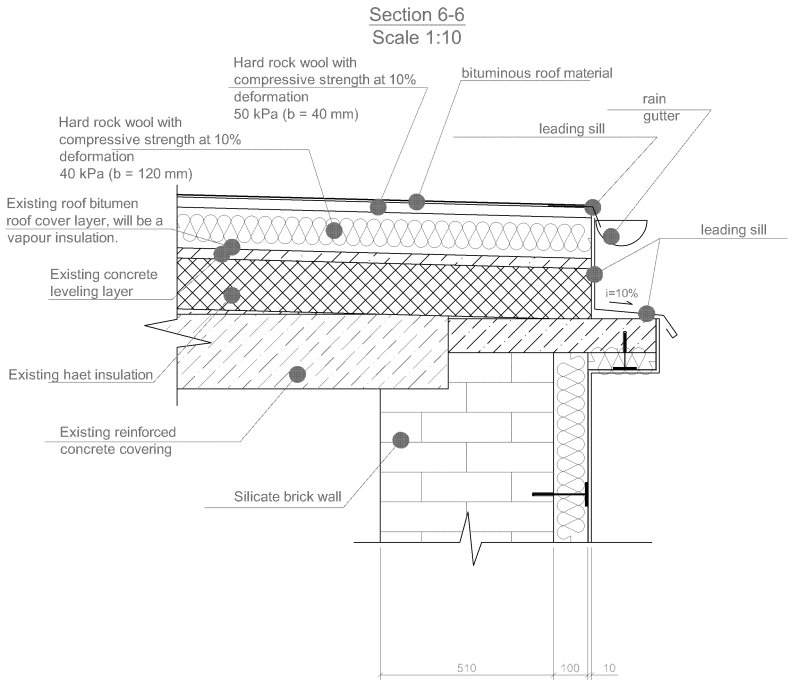
•Replace roofing materials and rainwater collection tray.

Roofs

•Asbestos containing roof sheets should be replaced.



•Extra insulation should be installed to build up flat roofs by installing it directly on the old ruberoid coat.



Networks

- Replace heating systems with new ones with higher thermal energy insulation.

- Two-pipe heating systems with lower horizontal division for each apartment would be the best solution in this case.

- Renovate ventilation systems to prevent mold development and provide better oxygen flow.

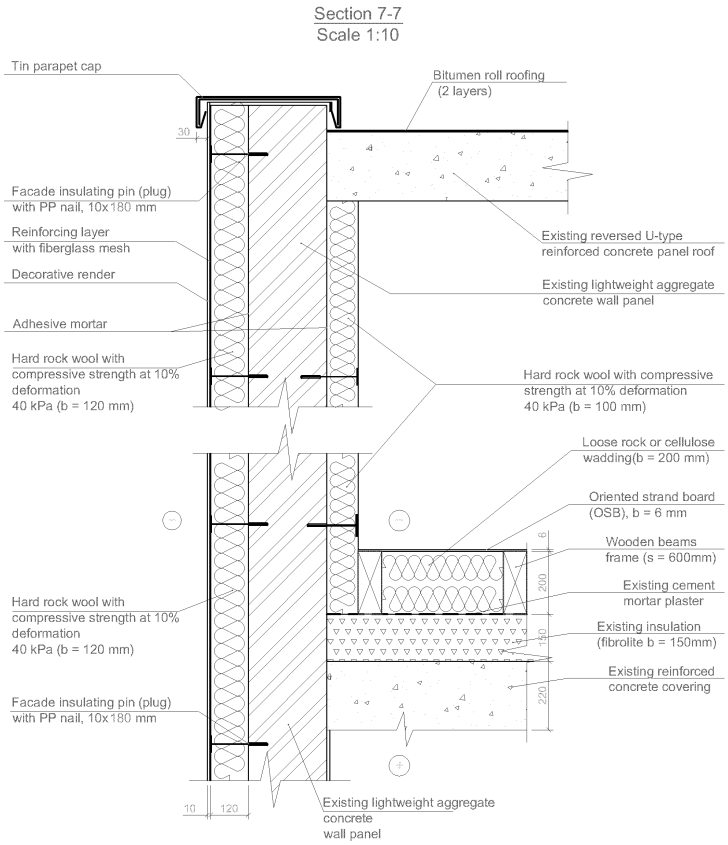
Efficiency improvement with environmentally friendly materials

In this project, we will use environmentally friendly construction materials, which correspond to Type 1 eco-label criteria, complying with ISO standard 14024.

We are going to use materials that do not contain dangerous substances. Technical design specifications exclude materials that contain hydrofluorocarbons (HFCs), sulfur hexafluoride (SF6), paints and varnishes that contain increased levels of volatile organic compounds, and emissions levels as defined by EN ISO16000-9 to -11.

An emphasis will be placed on insulating materials:

- The attic or technical floor could be insulated with sprayed cellulose fiber insulation in wooden beam frames.



Wood fiber cellulose wadding (Ecowool) is an effective and high-quality insulation material consisting of recycled cellulose fiber and additives. It is an ecologically clean, healthy material used for building walls, ceiling and floor insulation.

Cellulose fibers have many advantages. They are biologically healthy substances, and they prevent boric-acid decay processes.

The main disadvantage is the fact that Ecowool can only be purchased in bulk. The dry Ecowool could be embedded into horizontal surfaces or surfaces with a low slope, such as divisions and in the attic.

While managing this project, we have discovered many problems and spent a lot of time looking for the best solutions. Numerous observations have been made, and some doubts have arisen. Definitely, there is one idea with which everybody agrees: The project is worthwhile only when all problems are solved; it is worthless to optimize only a small section while other parts stay as they are. Only concurrent complex improvement systems can optimize these constructions, and it is a better long-term investment than making

small improvements one at a time. Our solutions would provide huge energy savings and invaluable life quality upgrades.

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