

## Sustainable Construction in the Conservation Area

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**Abstract.** Contemporary large cities have valuable historical centres from an architectural point of view, which are protected by the Heritage Offices. There can be found a lot of underused lofts under the roofs of those houses, and this is the place where we can find suitable premises for the recovery of the existing environment in its entire environmental context. A sensitive attic unit implemented into the existing generously built roofs in houses following the style Sorela is feasible. Sorela has been widely applied in newly emerging urban areas as for example Ostrava and its suburb Poruba which has been started to be built according to a building plan by Vladimír Meduna since 1951.

### Introduction

In most of our cities there were built the housing estates which have always been subject to criticism of professional and general public. In recent years the approach has changed and there are also positive feedbacks not only on the civic amenities, which correspond to the structure of the population, but also on the currently grown greenery. In urban areas, the interest in new housing units, especially in the historic centres of cities increased. However, these apartments must comply with the modern trends, this means that they should be dealt with using the latest technologies and materials that will ensure the internal environment prescribed by the legislation [6]. People prefer variability of disposition of their apartment, where possible even unusual solutions.

Today's common problem of historical town centres seems to be little room and the inability to enlargement of existing flats or creation of new flats. The solution can be found under the roofs of houses where much underused room can be found. The space under the sloping roof formerly did not used to be used for a permanent dwelling of people, but mostly served just as a completion of the construction and protection from the weather, or through their shape and structure shape it made the architectural expression of the building.

The implementation of loft conversions gives the opportunity to create unusual premises often in a very attractive environment without thickening of the existing development. In terms of strategies for sustainable urban development the renovation of the existing buildings and redevelopment of existing settlements is an essential aspect. The emphasis in the solution of the design of attic premises must be given to the technical state of the existing building being renovated, further on its capacities and the purpose of the future building works as well as on the technical conditions of existing pipelines and facilities.

A sensitive attic implemented into the existing roofs in houses in the style Sorela is a demanding engineering discipline. The first step to do this is carrying a detailed survey of the existing building including the available archival drawings. Residential buildings in the centre of the city district of Poruba usually have six floors, with a multifunctional parterre in the continuous urban row house. Conservationists shall ensure that the overall impact of the terraced houses and they shall not allow the use of any significant elements into the roof planes, such as skylights, terraces and large windows.

## History

After World War II there was the division of powers in Europe. Especially after the February power coup in 1948, the Communist Party came to power and so the former Czechoslovakia came under the influence of the USSR. The Soviet designs began to be enforced violently into all areas of life. The architecture pushed the style under the communist ideological dictate of the socialist realism, today called Sorela [3]. Architecture became a centrally managed art which must be understood by the working people and which must fulfil workers with pride of their victory, success at work and must reflect the love towards the Soviet Union. Following the example of the Soviet Union, the architectural work turned to historicist, classicist forms, emphasizing the monumentality of buildings in our environment.



Fig. 1, 2 Ostrava-Poruba, a set of residential buildings called Arc (Socialist Realist architecture)

## Sustainable Development

The sustainable development is targeted process involving a comprehensive set of procedures which comply with generally applicable environmental policies. Its basic principles incorporate broader aspects that can be summarized in three key environmental areas:

- the quality of the environment, friendly use of natural resources,
- economic efficiency and limitations,
- social and cultural context.

Even in the preparatory stage of the design of the building, selection of components and especially the choice of material [1], [2], it is important not to neglect the basic environmental principles. In terms of building materials we prefer recyclable materials. The general principles of sustainable building construction bring new requirements that especially include:

- reducing the overall energy performance of buildings from the implementation of the project until its demolition,
- reducing the material intensity with the possible use of recycled and raw materials,
- the impact of construction on the environment throughout its existence,
- dominance of modernization and refurbishment over demolition.

The environmental concept sees one of the major challenges of sustainable construction and sustainable development of settlements in the protection and preservation of open space and the structure of existing residential units. Better use of the existing premises, not only in the heritage city centres leads to:

- limiting urban sprawl and avoiding fragmentation of rural land
- remediation of the areas damaged by the demolitions involving new technology of soil cleaning,
- adaptation and regeneration of the existing environment.

In terms of strategies for sustainable urban development of urban buildings the reconstruction and redevelopment of existing settlements is an important aspect, which corresponds to the effort to use attic space for building new flats.

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## Implementation of a Loft Conversion

### The View of the Conservationists

In 2003 Ostrava-Poruba was declared an urban conservation area. Department of Monument Preservation of the Ostrava City Council provided a number of restrictions for implementation of a loft conversion.

Acting as the heritage supervision during the repairs and reconstructions of built-ins in terms of conservation care we especially pay the attention to the sensitive design and implementation, which will not allow the degradation of roof areas of buildings and protected monuments. There have always been put high aesthetic demands on the roof as a distinctive architectural element. For important buildings the roof became the culmination of a distinctive architectural expression.

The shape of the roof with the valuable truss preserved, type of covering and method of laying, above roof features such as dormers, chimneys and other accessories have always formed an impressive complex. Especially in the historic centres of cities is the roofing material the important means of expression [7].

### Preparation and Implementation

Built-ins into existing buildings are difficult engineering tasks. Only after assessing the investor's requirements, the building office and conservationists we can proceed to the first solution of the loft space design.

The first step was a thorough survey of the existing building, which was initiated by studying archival drawings. This was followed by a static on-site survey and assessment of the technical parameters [4], [5] of the existing building.

The realized residential house is located in the heart of the city district Poruba and it is designed as a multifunctional one with parterres, where the commercial premises are located. The basement house with six floors above ground is located in a contiguous urban row house. The building was built in the 50s of last century in the architectural style of "Sorela".

The conservationists only allowed skylights. On the other hand, it was necessary to keep all the currently unused chimneys and maintain the overall character of the terraced house.

At the same time it was not possible to choose the option where the thermal insulation would be placed over the rafters and thus gain more interior space. The terraced house situated in a conservation area does not allow even the slightest deviation from the height or shape of the roof planes of even one ordinary object, it would cause a significant disruption of the appearance of all the houses in the street. For this reason the more common option of installing the insulation between and under the rafters was chosen.

The structural system of the house: a modified skeleton of reinforced concrete (structural system T 15-52) with brick siding of brick blocks. The interior walls are made of solid and perforated clay bricks. The ceilings of a residential building are made of reinforced concrete prefabricated beams and ceramic inserts MIAKO.

The big advantage was the existing staircase that leads up to the attic and within the unchanged dimensions, the slope, the material, including window opening (for day lighting and natural ventilation of the staircase area) above the highest intermediate landing.

The construction works thus did not interfere with the existing common areas of the house and they were realized only in the loft, thus eliminating any nuisance of the lower levels residents by the noise and dust from the on-going conversions. This is very important when building works are carried out during the normal operation of the house.

The attic space is limited at the two longer opposite sides restricted by sloping roof planes on the two shorter opposite sides by brick gable walls. Due to the location of the object in the row houses it was not possible to use the gable wall to place the windows.

The roof is made up of wooden truss of purlin system with pillow block stools fully tied. Its saddle-shaped allowed relatively comfortable use of the loft space. The saddle-shaped roof over a

rectangular ground plan with an inclination of 35 °, is the oldest and most widely used roof shape in our region. The roof cladding is made of smooth metal roofing.

The wall plate of the roof truss is rather a kind of eaves beam placed on the columns. With this solution it was not difficult to meet the minimal headroom of 1300 mm in the residential rooms. With a width of almost 15 meters of the object and the existing slope of the roof planes it is not a problem to fulfil the requirement of minimum headroom of 2.3 m. For greater comfort and complexity of the suggestion of false ceiling there was actually designed the headroom of the room of 2.7 m.

To avoid overloaded existing ceiling and also not to cause the proposal to be unnecessarily tied up by supporting system of the building, the dry construction system using grating drywall structures was used. It was carefully designed and utilized the entire system including the floors of the same manufacturer, which guarantees the reliability of the structures and guaranteed by guarantees.

For horizontal ceiling design there was also used the drywall system, which was accompanied by a cassette ceiling with mineral square plates.

### **The Connection of the Technical Equipment**

There were considered individually the distribution of the drainage system, water supply systems and gas distribution, both in terms of capacitive and in terms of the technical condition of existing pipelines.

The connection of the drainage system was not the problem. The requirement to increase the total capacitive of the hydraulic flow of waste water in waste and the convergent pipe was satisfactory. For internal drains the ventilation of a convergent pipe must have been maintained. The ventilation pipes had to be taken out 0.5 m above the plane of the roof, minimum spacing of the vent pipe from the windows is 3.0 m, in the case it is not technically possible to lead the vent pipe through the roof into the open space, we design an air admittance valve.

Internal water supply was much more variable for the design of each distribution. For the management of individual pipes there were used plasterboard cavities of the wall structures on one hand and spaces below the grid floor on the other hand. An evaluation of the current status of water supply, that is, material and dimensions of the existing pipeline was performed.

Dimensions of pipes for cold water distribution were sufficient. The hot water supply was designed by local heating method, which was resolved within a heat source for the residential unit.

When using natural gas as the energy for local heating of hot water and heating it was chosen a closed gas combined boiler (group C) with the gas flue outlet and the combustion air above the roof plane.

A substantial part of the existing surrounding residential buildings are connected to district heating. One of the reasons for choosing the local heat source in this case was that the original building was designed and approved as a whole in relation to the existing heat source. After connecting any new radiators the violation of the existing hydraulic systems may appear.

### **Summary**

The roof conversions are important elements in the regeneration and reconstruction of residential units not only in heritage zones. Their implementation requires a conceptual and responsible approach from the first preliminary design phase of the construction. Construction works respecting the principles of sustainable construction in this case is a complex solution that meets the needs of today without weakening the ability of future generations to meet their own needs. The need to take into account the principles of sustainable development refers to our existing legislation, construction law, when we talk about the urban planning.

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