

HOUSING ROOF EXTENSION IN THE CZECH REPUBLIC

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Abstract

Rapid growth of requirements on realization of roof superstructures caught us little unprepared. Generally, their architectural effect was a bit underrated, mainly in relation to current environment. However, it seems like this period is slowly on the ebb and we can find constructions which give evidence of highly professional quality of their authors and investors.

Streszczenie

Gwałtowny wzrost wymagań dotyczących realizacji konstrukcji dachowych nastąpił w momencie gdy nie byliśmy na to przygotowani. Ich wpływ architektoniczny był trochę niedoceniany, zwłaszcza w odniesieniu do obecnego otoczenia. Wydaje się, że okres ten pomału dobiega końca i można już znaleźć konstrukcje świadczące o dużym profesjonalizmie zarówno ich autorów, jak i inwestorów.

Keywords: Housing roof extension; Housing, tenemental housing; Roof; Construction.

1. INTRODUCTION

After initial confused ways of the construction of roof extensions, obviously the right degree of confrontation of „old and new“ part of building was achieved and we can find many quality realizations.

2. ARCHITECTURAL FORMS OF HOUSING ROOF EXTENSIONS

2.1. For what reason and for what purpose is suitable to do roof extension?

In the last fifteen years a significant social and economic changes occurred in our country which in consequence substantially influenced the character and development of cities. In areas with high unemployment there is up requirement for number of new flats high and contrariwise in prosperous regions there is still apparent flow of inhabitants. In high unemployment areas the need for new flats decreases rapidly whereas in well prospering regions residents inflow is apparent. Demand for flats, rental administrative premises and civic amenities relate to these trends. Where the demand is higher than offer the ways of new construction of these premises are being searched.

One of the possibilities of how to face up with this issue is just at the moment roof extensions which assess already urbanized territory and increases its economic recovery factor. It is assumed that recovery of investment will be reliable because it is usually stabilized development of location regards population structure and urban infrastructure. It is also possible to react to new demographic conditions in the neighbourhood where, taking into account the age structure of inhabitants can result in changes of requirements for civic amenities and it is convenient to adjust current buildings to new purposes.

It is not just consideration of only block of flats where it is possible to do roof extension but also kindergartens, schools, sanitary centres, boilers plant, etc. In skeleton systems usually MS-OB series, it is easier to achieve variable disposition suitable for all types of premises.

It is important to specify in advance what the purpose and use of the new constructed extension is because its future function is related to other sequences for infrastructure and parking capacity. Connection between architectural and constructional form is clear. There can be more reasons for building a roof extension and it is a usually a matter of their combination.

The second area of reasons is usually related to constructional condition of the building. If the building is maintained in good technical condition and repairs were done continuously then there is no need to make radical changes of the structure.

In any case from the beginning of construction the changes in building code were made and therefore current structure of roofs and decks is already inconvenient with respect to value of thermal resistance. With regard to monitored issue a new value of thermal resistance of roof coating of flat roof $3.0 \text{ m}^2\text{KW}^{-1}$ (ČSN 73 0540) is very important to us. In the near future other restrictions on energy saving of construction will be expected.

For existing roof deck of panel building its poor humidity balance whose correct values are specified again in ČSN 73 0540 is still characteristic. In the construction of cladding a water steam accumulates more than it is able to evaporate and this constant humidity devalues the whole roof.

For the construction of roof extension planning permission has to be issued by appropriate building authority and the construction can be used after becoming effective under the certificate of practical completion.

Roof extension essentially increases bearing system and in a particular foundation construction of a building. Therefore, it is necessary to get an expert's static opinion which can be completed only by person with appropriate qualifications.

Fire regulations at additionally made roof extensions assess particularly parameters of emergency exits, fire resistance of bearing and non bearing constructions (particularly external walls, fire ceiling, roof cladding, fire walls), and changes of a building fire height. The expert's opinion concerning fulfilment of these requirements in the project documentation has to be issued by person with qualifications.

Within the surveys of existing condition of building it is important to analyze current condition of all distribution systems with respect to their capacity and technical condition. Ordinarily, the distribution systems have been or have to be replaced by today used materials which makes expanding new installation easier in premises of extension.

The issue of vertical infrastructure is solved primarily with regard to emergency fire exits and also in accordance with ČSN 73 4301 – Residential buildings. The problem of vertical infrastructure (elevators, installations) is mainly resolved with respect to fire escape roads safety and in accordance with CSN etc. The construction of new elevator must be done in existing buildings where the entrance into premises in extension

is done on fifth elevated storey. Possible option of its construction must be included in the design documentation. In the buildings with existing elevator extension into a new last storey does not need to be done.

Traffic access to original building has already been solved. It is important to survey existing parking spaces with respect to a new function of the building and/or only to newly operation in extension. If there are other units in the extension, the parking spaces are usually sufficient. The parking needs to be expanded if there is a change of existing town boiler plant to administrative building. It has to be verified if there is possibility to build the parking on relevant land.

2.2. Silhouette of current buildings of urban neighbourhood

One of the most important aspects of the successful realization is to understand building as a part of specific urbanistic unit. Block of flats was only exceptionally built without integration into the urbanistic structure of neighbourhood or town. It is block of flats silhouette which is strong point of distanced views on city district. Particular unity of cubic form, similarity of forms, colour harmony of buildings has at the end harmonic and aesthetic effect. This effect is not always definite and can give an impression on monotony as well as chaotic and non conceptual intervention in the various types of extension and coloured facades never leads to desired end. The whole districts of residential city parts were comprehensively designed and therefore it is necessary to agree with the adaptation.

This way it is very difficult to move ahead where the flats were sold out or the owners of the buildings changed. Municipality had limited possibilities to influence a new design of some of their city districts. We can see a lot of examples of good realization in the areas where the representatives of municipality realized this danger. Usually it is sufficient to keep similar concept of constructional finishings at least in the buildings of the same type series built in close vicinity or in particular unit.

It is a big mistake to want to radically change cubic form of block of flats. Multi-storey buildings and spacious buildings of civic amenities can never have picturesque of traditional suburban structure and in any case additionally applied elements of rustic architecture do not help it.

These efforts were apparent in the 90's and today we can see new trends which adequately reflect output state of architecture.



Figure 1.
Complex of block of flats in Fulnek

2.3. Architectural design of roof extension and its construction

When the extension has to be attached to existing building than it is possible to choose two different concepts. The first option is to leave existing roof cladding and the second option is to demolish it. Both options are being used and their advantages and disadvantages are in mutual contrary. In case of the decision to not to remove current roofing the costs for demolition work decreases and there is smaller risk of rainwater and technological water leaking to upper floors. This way we can continue at insufficient bearable ceiling above last floor because construction of bearing grate will spread out the load to external walls. There is no estimation for future problems that will bring destroyed original roof structure. Construction height of staircase to the new floor is increasing (new staircase space does not comply with its layout to the lower one) and it is difficult to make a logic coherence of architectural form with original building in vertical level.

Removal of existing cladding is very demanding on technological order. Removal of the existing cover is required from the method point of view (in terms of technical requirements) because the construction is usually hold during the whole operation of the building and there is certain risk of leaking. Construction of the roof is not expanded with original cladding so there is no need to solve issues with different constructional height of new storey.

Shape of the roof is subject to historic trends and radically influences character of the building and urbanistic unit. These are just the extensions that can significantly modify a new look of the building. The owners of block of flats are aware of this fact and mainly at the beginning of block of flats regeneration

extensions were used as tool for some kind of “humanization” of block of flats. After the years of “block of flats diet” these efforts were understandable and clients were refusing realistic architectural studies coming out from original concept of this type of architecture. Generally we can say that if the solution was more colourful and contrasting then it had bigger success and chance for realization.

Nowadays we are gradually getting into a next phase of block of flats regeneration that reacts to the mistakes of the past years.

During the analysis of roof extensions shapes and frequency of use we can evaluate progress of this issue and its perspective which is closely related to the progress of architectural forms of roofs. By searching for the best variant of roof extension together with external architectural form we are looking at connection with ground plan and high-rise layout of interior, which is important with respect to the future use.

2.3.1. Mansard roof

Popularity of mansard roof results from some kind of need to change an architectural expression of the building to lose its cubic form and is similar to traditional housing. The aim to modify clear functional facade has no effect and usually the result is hybrid awkward realization.

Second aspect of mansard roof selection is rather technical that is the resistance to flat roofs due to breakdowns and problems with leaking. Certainly draining water down out of inner ground plan of the building is convenient from the practical point of view. Interior disposition of the flat is the question that is very interesting.

Conception of flat interior is a question that interests us very much. The shape of mansard roof creates illusion of attractive attic space. However, we have to declare that in this case a demand is not fulfilled. Positive aspect of this option is maximum utilization of building ground plan. This fact leads us to designing typologically identical flats as they are in lower floors. Possible ledger board construction of the roof also allows completely new approach to variability of conception.

In this preferred variant we have to also mention about certain formalism because in this case we are talking about false mansard roof. Inclined covering of pitched walls of extension is only redundant cladding complying with aesthetic function which is unsuitable for the architecture of high quality.

The construction of mansard roof can be designed in many ways. For a housing development traditional

brick external bearing walls are used very often with a wooden or steel tie attached to them. Covering of vertical cladding by roofing is usually made with the use of wooden construction. Steel systems without inner bearing are usually used if there is a demand for free disposition of space. HARD company with its HARD-s and HARD-R systems occupies important position on the market in this specialization. Many options of steel constructions for specific building according to ideas of designer and client are being suggested. Traditional roof frame with respect to frequency of pillars and possible span of full bonds is not being used.

The right choice for roofing is very important for mansard roof whose selection is being complicated because of radical difference in an inclination of two roof levels. We can see sheet template, asphalt shingle, eternit corrugated plates, concrete tiles, etc.

This kind of roofs requires very often a complicated system of downpipe whose scheme depends on the type of roofing. If the roofing is able to continuously get over fault of two inclinations of roof and pouring water from upper surface will not “miss” drain on the edge of roof than the situation is perfect. Otherwise it is necessary to fix another drain preventing water penetration on both roof levels.

2.3.2. Saddle roof

Saddle roof is less seen however convenient with its voluminal form. The type with hip roof or half hip roof is with its features very similar to previous option.

Architectural form of saddle roof also very rapidly changes an original look of the building as the client usually requires. The form of saddle roof is more close to austerity of panel system look. Final effect especially at the proper selection of window opening whether dormer or roof and also the roofing is often



Figure 2.
Well done realization of mansard extension in Hranice na Moravě



Figure 3.
Complex of blocks of flats with sporadic realization of saddle roof extension



Figure 4.
Close up view on the same building – Blansko



Figure 5.
Suggestion of roof extension with flat roof – Vsetín

very good. If the unification of the whole complex extension succeeds, we can talk about new forms of housing estate.

The space under the roof construction corresponds to common interiors.

Buildings covered by roof are adequately deep and it is possible to rely on formation of one more storey under the roof. This way it is possible to design

demanded two-storey flats.

Saddle or hip roof extension is usually constructed by combination of traditional wooden spars, steel purling and brick bearing walls. In case of increased demands for variability of disposition and parameters of bearing elements light wooden I beam (SOLO Sušice producer), aluminium sections, steel sections, steel and wooden purlins are used. Steel structure can be a reason of thermal bridges and therefore it is important to design correctly composition of roof cladding according to currently valid standards. For this type of roof is practically suitable all kinds of roofing.

2.3.3. Segmental roof

This roof is according to housing and civil construction relatively new but still very frequent. Clients intuitively adopt this option as a particular compromise between a bit „rejected“ cubic form of block of flats and modern „face“ of present housing development.

Constructional system of these extensions is basically similar to mansard roofs. Bearing walls or construction system (steel, wooden, reinforced concrete) meet the bearing function. Roof construction can be single-layer or two-layers cladding whereas the choice depends on roof span and height in connection with function and surface area of the room in last floor.

Roof cladding is carried out by roof girders and joists. Roofing is usually made of titan-zinc because it is able to cover any curvature of roof. It is just progress of flexible covering which helped with expansion of this trend.

2.3.4. Aisle roof

During the whole history of architecture there are known various roof extensions and in some parts of the world the buildings are purposely built with assumption of further vertical construction. But it is usually where the climatic conditions allow construction of the building and the construction is compliant with this requirement.

The most fitting form of the block of roof extension flats is the one that corresponds to the original architectural form of the building. In this case it is again flat roof and various types of aisle roof. In the past years the aisle roofs were phenomenon which was perfect compromise between functionality and present architectural formation.

The construction of aisle roof belongs to the least

technically difficult and therefore belongs to the least defective. For common spans the supporting beams are placed on plates and bearing walls. We are facing roof girder at the buildings with bigger demands for a surface of the rooms and its proportionally dimensioned bearing system. The roof can be single-layer or two-layers cladding, which is common variant for additional adjustment of current defective roof to the preservation of original cladding. Drainage of roof area leads to the spout inside the building.

The roof parapet that in recent years usually copies drop of roof level can be done on remaining three walls. The option with roof overlap on all or just one side of the building is often used and it is good to use formatted shelters as a shade system.

Suitable roofings are all used for small inclination and especially at foreign realizations the aisle roof is being covered with greenery and creates so called green roof.

2.3.5. Flat roof

Huge inspiration for us can be functional buildings in historic housing development which are very often using receding upper floor for its good integration. Certain negative side of this variant is not using the whole area for living part of the flat but on the other hand there is possibility to get a spacious terrace. The value of the flat rapidly increases particularly with an application of grassed wear layer whether with the replantation of extensive or intensive greenery. Trend of using green roofs is not very spread out in the Czech Republic but in the foreign countries has many years tradition. In this way it is possible to revive and add completely new dimension to rather dull facades. The important thing is that this form of modification corresponds to original look of the building and as a whole fits in the silhouette of urban settlement and also at sporadic realizations.

Bearing construction of flat roof is made by means of traditional technology and the emphasis is put on the right composition of roof cladding. It is in the first place about sufficient thermal insulation and its ventilation. Technological discipline during the works on flat roof is basic condition for successful realization. A final layer of roof cladding is usually made of bituminous roofing paper that can be protected with gravel or grassed soil. Another option is many types of frost-proof tiles and recently used wooden grates.

3. DISPOSITION OF INTERIOR ROOF EXTENSION

Floor plan and high-rise disposition of newly created space must come out from the requirements as to its future function. Basically disposition can be divided into two types of rooms and those are large-area and common rooms of residential or administrative character.

For the first category it is important not to limit inner area by wall system. For this purpose the skeleton system is used or the construction of roof is carried out by the form of frame and grate mainly to outer external cladding.

Final look of extension markedly influences floor plan parameters of original building and its bearing system. The more the area is larger, the construction of the roof is more difficult but sometimes offers interesting possibilities of design but its width plays important role. The rooms with larger surface area include other rooms of common parameter which can be internally easily partitioned. The extensions used as schools, kindergartens, education and business centres, social and sport centres, restaurants, canteens, etc. have to be designed this way.

Extensions used for living, administrative, common health centres and similar civic amenities do not require open, large dispositions and sufficient area of common room is approximately 16 m². In these cases there is an option to build the construction basically without constructional restrictions and it is convenient to use current bearing constructional system. Another division is done by partition walls.

The use of skeleton gives possibility to design more attractive spaces. These are the interesting dispositions that make the flat attractive in extensions. Unfortunately floor plan of lower floors is being copied.

In bigger buildings, as mentioned earlier, it may happen that saddle extension covers, because of its height, two floors above.. The biggest complication is usually location of staircase and the height of staircase area. Ideal position is in the middle of the building, which is not very usual in the existing slab blocks. In case if, after lifting the building up, the number of floors increases, the problem of extending elevator lift needs to be resolved as well.

Easier option is two-storey flat whose inner staircase has adequate parameters and can be more reviving part of interior. Sublevels and demanded galleries can be designed in some of the areas.

4. WINDOWS

During the architectural design of extension we must keep in mind condition and shape of windows in existing building. It is not correct to carry over a shape and size of windows from lower floors to higher ones.

It is not possible to mechanically carry over a shape and sizes of windows from these floors to extension because the extension is not repetition of lower floors of the building. Extension has always specific character and original architectural look whose part are windows. Size, proportion and division of windows are prior. The choice of material is not decisive because if the building is not externally insulated one organic complex (block of flats beat the extension) will not usually arise.

Windows for segmental, aisle and flat roofs are usually fixed in outer external wall and therefore the technical details are not solved but only its shape and material is only being solved.

Saddle and mansard roofs are very demanding for the design of window opening. First wave of window roofs „modishness“ has already passed away and though the latest models of producers are technically on a very high level it good to realize specific closeness of space that is brightened only by these windows. For this reason we usually meet the combination of more ways of brightening as dormer windows, French windows, balconies and roof windows. Large-area openings in the roof are complicated either from technical or architectural point of view. The possible worst and unfortunately often seen variant are „tottery“ roofs that have different inclination of roof flats for the reason of classical windows placement on at least one side of façade.

Right mounting of windows in false mansard roof is possible to see truly sporadically. Reveal of mansard is very deep and significantly reduces light into the room.

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