SUITABLE AND UNSUITABLE ROOF COVERINGS FOR SMALL BUILDINGS IN THE LANDSCAPE

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Abstract
According to the Building Act, a minor building in the countryside can be, for example, shelters with one storey above ground, which serve public transport, and other publicly accessible shelters up to 40 square meters of built-up area and up to 4 m in height. Such small buildings may serve tourists or cyclists.
The paper focuses on the recommendation of suitable roofing materials for structures intended to enhance the attractiveness and recreational use of the landscape. Roofing materials should be selected mainly according to the slope of the roof. The roof, which terminates the building work, is an important architectural element. For buildings in the landscape, we require that they blend appropriately into the landscape. There is a large variety of roofing materials, but the choice needs to be given the necessary attention. Roofing made from natural materials should be the most appropriate, but a range of other roofing materials can be recommended to suit local conditions.

Keywords: buildings in the landscape, roof slope, natural roofing, vegetation roof

Introduction
To make certain locations more attractive, small buildings are built in the landscape where the roof can be quite a distinctive architectural element. And it is the roofing that can significantly influence how a building fits into a natural site. The roofing material is supposed to be the top waterproof layer of the roof covering, which protects the roof structure and the whole building from the adverse effects of weathering. The durability and impermeability of the roofing material is influenced by the pitch of the roof and the overlap of the components of the composite roofing material, which is made up of individual elements without their rigid interconnection. There are a large number of different roof coverings on the Czech market, and it can sometimes be difficult to choose the most suitable one for a particular building.

Materials and methods
Natural materials, especially stone and wood, should be used in the landscape. However, it is also possible to use some materials that are intended to imitate them.
A natural covering that was used in earlier times for human dwellings is thatch. These are bundles of beaten rye straw, preferably straw, which are tied to the roof battens with twine, rope or wire. At a slope of 30 to 35°, it has a high lifetime of up to 60 years on the sunny side and 30 to 40 years on the northern side. (Matějka, 2007) If the bundles are folded over the battens with the thicker end of the straw, a smooth covering is created. It will be stepped when the bundles are folded over the battens with the thinner end of the straw, see Figure 1. Similarly, reeds can be used to bind the stalks into bundles of greater length. This also makes the distance between the slats larger, up to 500 mm.
Shingle roofing consists of shingles made by splitting from logs or cutting from boards. Chipped shingles are more durable and the wood fibres are not disturbed. Hajek (1997) reports a minimum life of 40 years. These are planks fitted with an edge on one longitudinal side and a groove on the other. These are slid into each other and nailed to the roof battens. It can be implemented as a simple one with an inclination from 30°, but it is not tight enough. It is therefore recommended for watertightness requirements to lay as a double, where the second layer of joints overlaps the first layer, but it must be taken into account that the consumption is double. An imitation of wood shingles is the plastic shingle, see Figure 2. Plastic shingles are lightweight (7 kg/m^2), do not weigh down the roof structure and are made from recyclable materials, which can reduce the environmental impact.
Planks can be used for simple shelters or e.g. information boards. Plastered ones, but unplastered ones will look more natural. The boards are laid either parallel to the eaves or perpendicular to the eaves, i.e. along the roof slope. The boards should be laid right side up.
The bitumen roof shingles that are attached to the formwork are made up of templates made from strips of oxidised asphalt with mineral fillers, with a higher asphalt content and strong glass fibres or from SBS modified asphalt made from strong glass fibres. The shingles can be in different shapes,

e.g. beaver tile, rectangle, diamond or hexagon. The tiles are suitable for pitched roofs with an inclination of e.g. 15° to 90°. The surface of the shingle is made up of a slate sprinkle. Due to its low weight (9 kg/m^2), these shingles are suitable for use on roofs that cannot be loaded with high weight. In addition to the shingles, whole modified asphalt strips coated with sprinkles, so-called cardboard roofing, can also be used. Bituminous (asphalt) shingles and strips contain a reinforcing insert which prevents degradation at higher temperatures. Asphalt and polymer-modified asphalt are thermoplastic substances. Their hardness decreases with increasing temperature. The action of heat and UV radiation also reacts with oxygen in the air, causing ageing caused by the splitting of molecular chains. This has an effect on the hardening and embrittlement of bitumen. Both processes occur very slowly and especially at the surface. (SCHUNCK, 2003)
Suitable coverings, especially for hunting facilities, are panels of corrugated asphalt board, which is reinforced with cellulose fibres and hardened with resin. It can be used especially where low loads are required and where the covering will not be too visible. The cellulose fibres, derived from wood, add strength to the boards. It is a covering for low gradients (from 12°). They are made of 50% recycled material. The panels are extremely light (only 3.4 kg/m^2) flexible and easy to transport on site and on the roof.
The only natural hard roofing material is slate - chipped stone slabs, usually rectangular, square or square with an arch, 4 to 6 mm thick. The weight of the roof can be up to 25 kg/m^2 for a single covering and up to 33 kg/m^2 for a double covering. The slate templates are pre-fitted with nail holes.
An imitation of slate roofing is fibre cement roofing, which until almost the end of the 20th century was made with asbestos fibres, which has now been replaced by other materials. Today's fibre cement roofing is made from a mixture of ground cellulose, synthetic fibres, Portland cement and water. The fibres in the finished product form a uniform dense reinforcement which increases the flexural rigidity and toughness of the product. The roofing material also has a special double-sided coating, so it can be used in areas with extreme snow and wind stress. It is available in several colours and shapes, similar to the earlier slate roofing. It can be laid on battens or formwork, which must not be flexible.
For small slopes, metal sheeting is suitable. The basic material is galvanised steel sheet, copper sheet or aluminium alloy sheet, usually 0.6 mm thick. Nowadays, sheet metal with a thick protective layer of plastisol or polyester is used. This protective layer guarantees a high durability of the products. In addition to the straight sheets forming a folded sheet, where the strips are joined together by a double lying groove, tile sheets, which are strips of sheet that are profiled, can be used. The strips are most commonly laid in a gradient from ridge to eaves. The minimum slope can be 5°, but this depends on the height of the profiling, as well as the distance between the ridge and the eaves. Laying is started on the leeward side to prevent moisture entering the longitudinal joint. The strips have differently shaped bends at the edges which join them together. They are attached to the battens or formwork with screws, self-tapping screws and the hollow grooves are attached with screws with a pressure and cover cap, supplemented by a gasket. There are also profiled strips or small metal sheets that are laid horizontally - parallel to the eaves.
Sheet metal roofing can also be assembled from small-area, extremely lightweight aluminium rolled shingles, templates or tiles. Thanks to the "groove-in-groove" installation system and direct mounting or fixing with clips to the supporting structure, this roof can withstand even strong wind loads, even though it is a very light roofing material. The weight of the coated aluminium roof system ranges from 2,3 to 2,75 kg/m^2 (https://cz.prefa.com). These roof coverings can be installed on formwork, but also on battens. Minimum slopes are recommended depending on the type of roofing material and the length of the rafters.
Ceramic and concrete tiles have a high durability, strength, weather resistance, but also a higher weight. The tiles are laid on battens. The tiles are fitted with nosings for hanging.
Ceramic tiles can be uncoated, engobed or glazed. Concrete tiles are made from sand, Portland cement and water with the addition of mineral meal made from limestone and blast furnace slag. The surface is coated with acrylic paint to protect the concrete against weathering and mechanical stress. Metal oxides are used for colouring. Concrete tiles are currently produced in small formats, but also in large formats, where their double size reduces the weight of the roofing material.
Traditional beaver bags or groove bags are produced, where a system of grooves that fit together ensure a tight connection and a secure seal against water and wind. A pitch of over 20° is usually recommended for tile roofing. However, there are also tiles available from manufacturers for a 12° pitch.
Green extensive roofs can also be designed for small buildings in the landscape. For these, the thickness of the vegetation layer varies from 60 to 200 mm. It is mainly used for dry-loving plants such as stonecrops, succulents, etc. Thus, regular watering is not expected on these roofs. Green roofs can be flat with a slope of up to 5°, but also pitched with a slight slope of 5 to 35 %. For these roofs, it is

recommended to secure the substrate with an anti-slide barrier from a slope of 15 % onwards (Šimečková and Večeřová, 2010).
Currently, for example, synthetic palm leaf roofing is used for houses in the treetops, which is sometimes indistinguishable from real natural leaves, see Figure 3. The sheets are made of high density polyethylene, which is pressure-formed at high temperatures. 100% waterproof and 100% recyclable. The palm leaves are eye-catching and create an aesthetic effect even under the roof.

Fig. 1: Thatched roof on the right and shingle roof on the left

Fig. 2: Shelter with plastic shingles

Fig. 3: Tree house with synthetic palm leaf covering

Fig. 4: Information board with slate covering

Results

The thickness of the thatched roof does not let water through and at the same time insulates well in summer. Sitting under such a roof will be more pleasant, especially on hot days, than under thin-film roofing, especially of a dark colour. The ideal eco-friendly roofing material is wood shingles or board roofing. Plank roofing is advantageous because it does not need lathing or formwork. The boards are usually nailed directly to the rafters, but the covering is not reliable enough in terms of waterproofing. Due to volume changes, the boards often collapse, the joints may not be tight, or the knots may fall out. The durability of the boards is also low, but can be increased by impregnation.

Asphalt roofing shingles can be of different colours. Ridge, corner or gutter can be created with solid shingles without flashing. This allows this non-environmental roofing material to blend in better with the natural environment. Not just asphalt shingles, light colours are preferable on the sunny sides of roofs as they will reflect the sunlight better, thus not raising the temperature as much and causing damage.

Natural slate roofing is suitable for locations where slate was previously mined, e.g. near Budišov nad Budišovkou, so that the building or just the structure blends into the environment, see Figure 4. Roofing is relatively expensive and labour intensive. An imitation of this roofing material is fibre cement roofing, which is relatively light, yet strong, and can be used even in mountainous areas.

The disadvantage of metal roofing is its noise level in the rains, which is an important aspect in the landscape so that even wildlife is not disturbed. In buildings, the noise is eliminated with special underlay sheets, which are quite expensive and would probably not be used on small buildings in the countryside.

Fired ceramic tiles are a heavy roofing material, which is traditional in our territory, has a high durability. For open small buildings, even concrete tiles are less suitable due to the fact that the roofing is not firmly fixed and can fall off the roof without nailing during large gusts of wind.

One of the biggest advantages of vegetated areas is the lower temperatures under the roof during summer periods. On green roofs with a slope of up to 30°, the conditions for growing greenery are quite suitable. The design of the composition is based on the expected use of the roof, the slope and the load-bearing capacity of the structure under the roof.

Discussion

There are a large number of roofing materials, but not all are suitable for roofing in the countryside. We are leaning more towards natural materials even at the cost of lower durability. Plastic imitation slates or shingles are already common, cheaper than natural materials and often lighter and therefore do not put as much strain on the supporting roof structure.

Conclusion

Nowadays, in addition to traditional materials, a range of plastic or asphalt imitations are available, which are often more durable, lighter and cheaper. Obviously, they will often be preferred for these

reasons. Nevertheless, in some important recreational locations, only coverings made of natural materials would need to be used. The durability of roofing also depends on its maintenance, and this cannot usually be counted on in the landscape. Settled dirt, fallen leaves, and vegetation can degrade some coverings such as asphalt shingles or wood coverings.

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Souhrn

V příspěvku jsou představeny vhodné i méně vhodné střešní krytiny pro stavby, které mají zvýšit atraktivitu a rekreační využívání krajiny. Střešní krytiny je třeba vybírat zejména podle sklonu střechy. Je velké množství střešních krytin, ale výběru je potřeba věnovat potřebnou pozornost. Krytiny z přírodních materiálů by měly být nejvhodnější, ale je možné doporučit i řadu dalších krytin, které by měly vyhovovat lokálním podmínkám. Je tedy třeba zvážit, zda pro danou stavbu v určité lokalitě využijeme dražší přírodní nebo levnější plastové nebo asfaltové varianty.

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