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The House Roof Story

História da Cobertura de uma Casa



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Abstract: Due to decay, stone roof of an old vernacular house has been replaced with a brick tile roof. But, with heavy rains, leakage problems appeared. Several attempts to repair it failed. The first mistake was in underestimating the weather conditions, and afterwards new mistakes followed.

Eventually, the problem of leakage was solved.

Keywords: roof, stone, brick tile, renewal, Croatia,

1. INTRODUCTION

In the coastal area of the east Adriatic, Croatia, there are many old vernacular stone houses. Both walls and roofs are made of stone. Big stone chiseled blocks are used for external protective and load bearing walls, 60 cm or more thick. Slanted stone tiles are for the pitched roofs. Stone has been used on all houses in the southern Croatian province of



Fig.1 – Place of house, drawing toward north, by Giuseppe Santini, 1668.



Fig. 2 – View from the house toward south and Split, nowadays

Dalmatia, not only in the country but also in its medieval towns. (Only town with permanent brick tiles on the roofs during its long history was Dubrovnik.) In other towns stone tiles have been gradually replaced with red tiles so that these days an image of a traditional romantic authentic architecture is pale white, grey stone walls and red tile roofs. Traditional image is also emphasized by green window shutters.

The process of replacing the stone on the roof has been going on, first in towns and later in the country and rural areas. After WWI there have been no more new houses with stone tiles, and many of those older ones in some renovation have got red roofs. These days there are quite heritage of stone houses, but very often in bad condition. Many of these houses are deserted, and many lack contemporary comfort. On the other hand their expression of old craftsmen virtue, skill and hard work, signs of historical duration, produce some romantic feeling and show the attractiveness of this architecture.

2. OLD STONE ROOF DECAY

2.1 Location

Near city of Split, nowadays the second large Croatian city with the population of almost three hundred thousands of inhabitants, there is also a historic place Klis. (Split is particularly famous for its Palace built by the emperor Diocletian in between 295 and 305 AD.) My house is located there. Air distance from house to the Palace is 8 km. Topography of place is specific. It is located on the pass between the mountains of Mosor and Kozjak, 4km from the sea line and +180 m above sea level, on the 43.5° north parallel. Climate is mild enough to have fig and olive trees growing around, and harsh enough to demand a proper wood supply for the winter days – some might be even in white snow decoration.

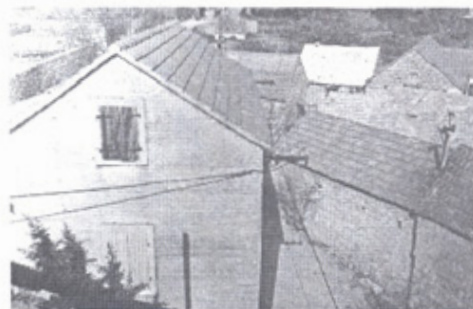


Fig. 3 – Stone and brick tile roofs in the neighborhood of house

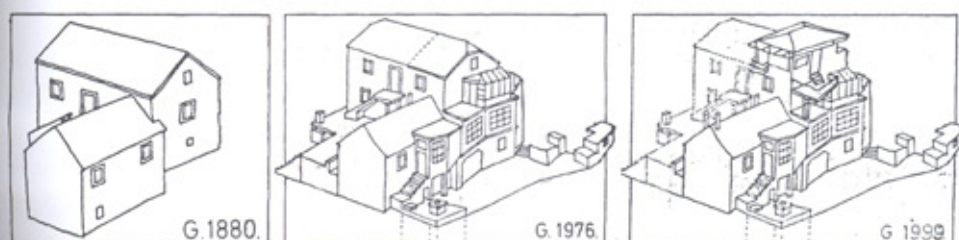


Fig. 4 – House when built in 1880. (as an addition to the northern house), in 1976 & 1999.

The house whose roof is subject of this story is the house that I inherited. It was built in 1880 by my great grandfather in the neighborhood of his brothers and relatives. This pitched roof house had a ground floor (utility) area, first floor (living) and attic (storage), measuring 5.8 by 3.8 meters in layout inside. It was an addition to an older house of his. In 1895, a big house and a couple of smaller houses were added. Later all cluster was divided among my grandfather and his two brothers. My father and mother lived there until 1970. I got this house in 1980., but I did not care for the house enough neither made any demanding maintenance. In 1997. I realized that the house was in critical condition.

2.2 Stone roof characteristic

Traditional stone roof was made of stone tiles inserted between wooden rods (split poplar tree) fixed with wrought nails on wooden rafters (axed poplar and pine wood), bonded with plenty of lime mortar. This sort of roof demands maintenance with lime-juice pouring every few years, so by the time color changed from the lime white to grey. In the case of this house, the roof has been neglected for more then thirty years, some pieces of mortar and some stone tiles fell out, cracks were noticeable, leakage appeared and some pieces of wooden construction were liable to collapse. Something had to be done.

2.3. Possible solutions

Dealing with stone tiles is an old craft and there are no more craftsmen of that kind. Neither was there the proper material to make it in an old way. There was the possibility to take the entire roof off, both stone tiles cover and the wooden construction, and then make a new reinforced concrete pitched slab, clean the tiles of mortar remains and use them for just mock-up over the concrete. It would have been a really very, very expensive enterprise. Also this might be considered as a sort of scenography more than architectural truth.

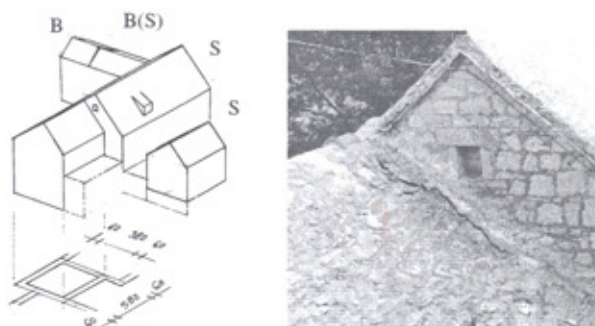


Fig. 5 – Cluster by the south side of the house - roofs: S-stone, B-tiles, B(S)-tiles (ex. stone)



Fig. 6 – Beginning of work-taking stone tiles from the roof down

Another, much cheaper solution was to replace the cover with brick tiles as many people in the neighborhood had done. The existing wooden construction was partially used or new rafters, sub-laths and tiles were put up. There was not any waterproof insulation, and the disused attic has served as a thermal insulation. There have not been some noticeable complaints about such roofs and I decided to renovate it in this way.

It sounded to me as a cheap, swift and customary solution. Without big investment and easily, I thought, I could have a better protected house, and later I would take care about the interior renovation.

3. RENOVATION WITH BRICK TILES

In August 1997, after St. Rocco's (local patron) Day, two laborers, the one trained for the roof work and his assistant, started working on the roof. Bigger stone tiles were saved and used later in some paving. Trash and small broken pieces were to be put later in the house foundation as a sub layer for the concrete slab, in the base of an entrance ramp, and some was put into the garden. Somehow, all material had been spread on the site.

Wooden split rods were taken down. Few rafters were torn; others lost their shape a bit but could be used, however. Over, new rafters 5/8 cm were laid and connected with the old ones. New eaves are made of existing stones with concrete fixation of both old and new rafters. Laths 3/5 were put for tile sub-layers, tiles were put, and connection of roof and neighboring walls were covered with mortar.

All this work was done in 5 days.

Cost of material and work was about 1200 €.



Fig. 7 – New rafters are added to the olds, new eave is reinforced by concrete



Fig. 8 – Roof is finished: it looked as a well-done job, but...!

4. PROBLEMS OF THE RENOVATED ROOF

Heavy autumn rains came and unexpected problems occurred. The beautiful roof did not resist, and some drops of water passed through. Leakage became my obsession in the following years.

The roof had a really fine slope, almost 45° , and tiles were laid very neatly, but anyway... I could not find out if the quality of tiles was bad, maybe made of porous material or the joints were poorly done. The tile manufacturer came into inspection, tried to get rid of his responsibility, and tried to buy the time. I rejected any idea of going to the court (to many nerves spending) hoping that I would find some elegant solution. I was not in a hurry because this house is a part of a bigger dwelling unit I used for vacation time only. That was the reason I did not act promptly. At one moment, the manufacturer was willing to change the tiles, but not to make new eaves and finish the connection with walls aside. Also in the time of their offer I started with my solution, and I gave up any demands towards the manufacturer.

I tested some left tiles on porous ness, and those were OK, but that didn't mean that all of them on the roof were good. If only some of them had been bad, the whole roof would have had the same problem, but at that time I thought that joints were not correct. Although I was warned that covering of joints was not good, without better idea at that time, I decided anyway to fill the slanted joints up with ceramic cement glue, while I left free the horizontal joints. Contrary to my expectations the problem was not solved. Then I decided to cover the joints from inside. The problem still persisted and water drops were in again.

Then I concluded, after the joints are filled with cement glue and cement mortar, that problem is the porosity of some tiles. I thought that spreading the silicon liquid over the tile would stop water from pouring in. It was made, but without any effect.

All those healing attempts increased the costs by 500 €.

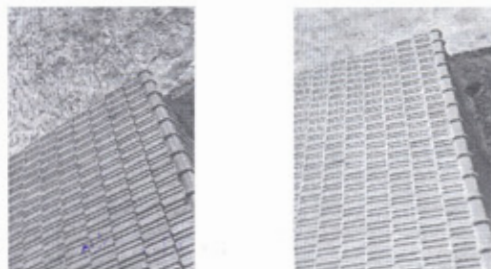


Fig. 9 – Sanative work with cement glue and mortar- from outside

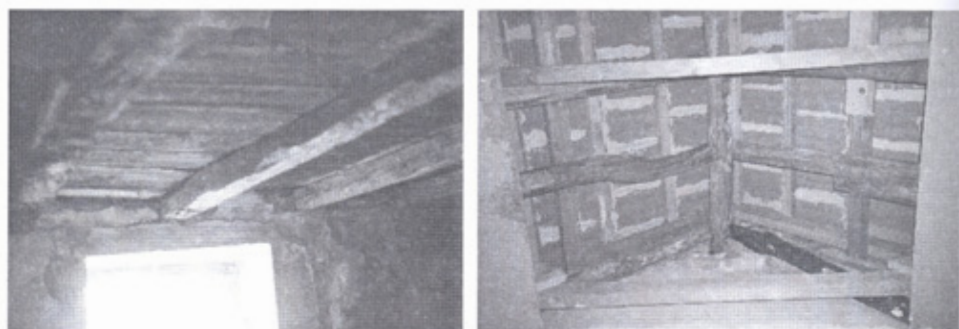


Fig. 10 – Sanative work from inside, attic board and joists are later removed

5. MISTAKES

Thinking about the problem, there were several mistakes that have been done.

5.1 Ignorance of the weather conditions

In this area dry weather can last for months, followed by heavy rains in autumn. Fierce thunder storms, when the water is pouring from the sky, sometimes occur in all seasons. This is an area where the strongest winds on the east Adriatic are blowing. North, dry wind called *bura* often whistling can achieve the speed of over 120 km/h. Southern wind *jugo* blowing from the sea is wet, bringing rain sometimes for days. The worst are storms with intense rain with strong wind, and then the rain falls horizontally. It is a real challenge for the roofs. My feeling was that all those roofs around are quite resistant towards weather conditions, but that was not really true. Many neighboring houses were deserted and special attention was not paid if some dampness appeared. Nice weather and dry wind following rainy days heals those houses making them dry again.

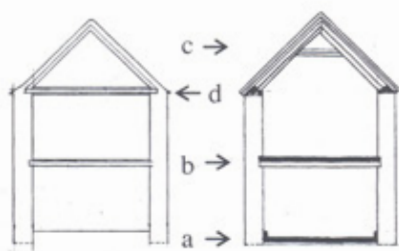


Fig. 11 – Old and new section & interior space

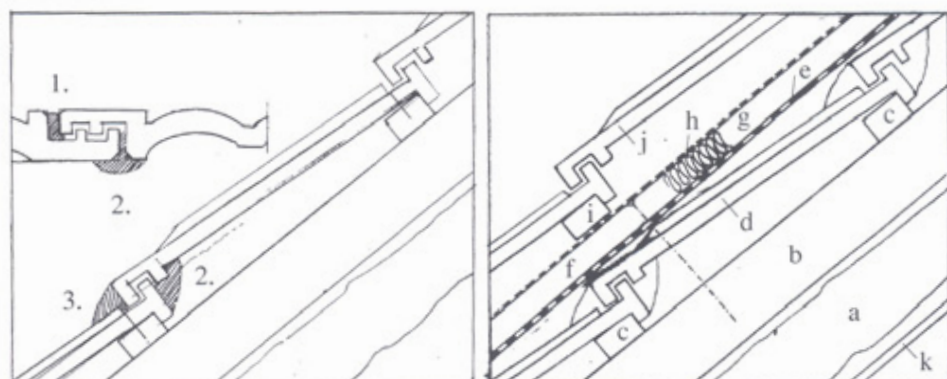


Fig. 12 – Tries to stop water in /1.2.3/ with cement glue + mortar & “roof over roof”
 a) old rafter, b) new rafter 5/8, c) lath 3/5, d) brick tile e) bitumen sheeting,
 f) counter-lath, g) thermal insulation, h) plastic foil, i) lath, j) brick tile, k) ceiling

5.2 Ignorance of contemporary standards

Contemporary standards do not let one drop of water to pass into the interior, and that was something I should have been aware of. If I had been, I should have made a proper roof construction that would have a proper waterproof insulation.

5.3 Bad attempt with cement glue and mortar

After making previous mistakes, and after the roof was not waterproof I had to take all tiles down. They were fixed with nails and it was not so difficult to get the tiles free from laths. Then one proper construction could be applied. Instead, filling the joints with cement glue and mortar, all roof surfaces became one monolithic slab, and it was almost impossible to take it down without significant ruining of the wooden construction and getting a lot of waste crash material. This mistake made me think about how to solve the problem without tearing down this failing roof.

5.4 None diagnosis

I made a bad inquiry, and I have never found out the proper cause of leakage. I had concentrated more on this problem. If I had cooperated more with roof specialists, I'd probably have had a better knowledge about the problem, and of course about the cure, too.

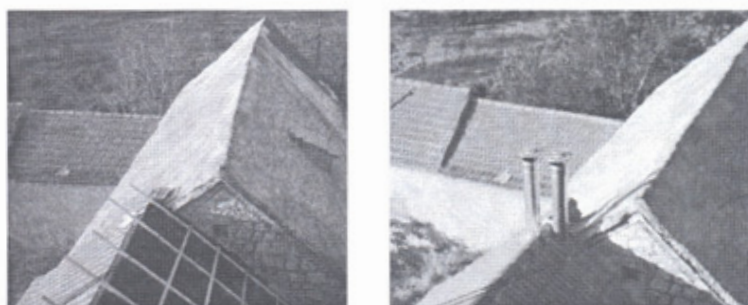


Fig. 13 – Bitumen sheeting with laths - later penetration of two chimney tubes (protected with 2 mm lead sheet, and so far it works perfectly)



Fig. 14 – The repair of the roof is finally done in proper way

6. POSSIBLE SOLUTIONS

Of course all the time there was the possibility to take down the entire roof and make it in a proper way from the beginning. It meant not only to tear down the already monolithic tile cover, breaking them in pieces, but quite probably ruining the wooden sub construction. I wanted to avoid this mass and a lot of work and expenses. The opposite solution was to cover the existing roof with something.

The first idea was to cover all roof with lime-cement mortar juice, and to create a visual impression similar to the previous roof. This demanded later care every few years, and that was not the solution. Also, thinking about expression, this would be a hybrid, very schematic, a bit fake, and not a proper, sincere texture of old stone roofs.

One idea was to cover the roof with some sort of waterproof fabric to create an impression of the Christo's wrappings work, but it seemed more alike a temporary than permanent solution.

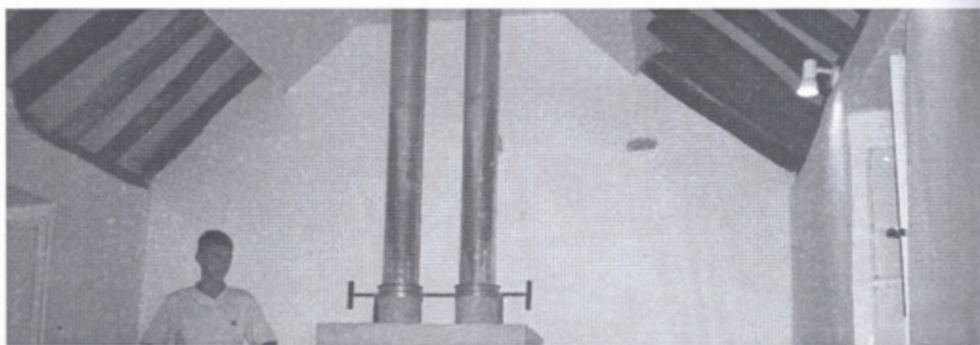


Fig. 15 – Space under the roof – living room

An idea to put the white corrugated aluminum over the roof looked fine to me. This solution would have been quite good, and I considered it very seriously. It would be a contemporary, modern solution. But, later I became a bit unsure, mostly because of its

expression in the neighborhood and eventually I gave up. (Sometimes afterwards I thought that it would be a proper solution)

7. FINAL CHOICE

The final decision was to put new brick tiles over the existing roof. Spatial idea of the interior was to enlarge the height of the inside space and that is why the joists of attic were removed (d). But before taking them off, the construction had been reinforced with concrete slab on the soil among the foundations (a), with reinforced slab between the ground and first floor (b) and with partial upper connections of rafters (c) – see fig.11. Previous stone tile load over the wooden construction was about 200 kg/m². New tile load was about 70 kg/m². It meant that new reinforced construction had quite a spare strength for new loads. They are: first, tar insulation sheet all over the roof, then laths 3/5 cm and counter laths 3/5 cm for new tiles. In between laths thermal insulation was laid and protected with vinyl foil. The problem how to fix new laths for the existing roof was solved with 20cm long nails. Holes were drilled on the positions of rafters underneath and nails were easily inserted. Two workers made this job in four days in February 2001. Almost three and a half year after the first beginning. (Luckily, I did not need this space badly, so I could take time to think about it and search the best solution).

Costs of material and work amounted to 1900€.

8. CONCLUSION

The story about this roof could have been avoided if, at the first reparation, I had made it in proper way. Only small additional work and investment would have saved me many worries, additional troubles and expenses. It meant that after the slanted stone tiles and split wooden rods had been removed from the roof and additional rafters reinforcements installed, all roof surfaces had to be covered with wooden boards, tar-sheet insulation, lath, counter-lath and tiles. In that case every drop of water passing through tile layer would be stopped by the insulation and poured out on the eaves exit.

This solution would have only prolonged the work for one day with small increase of cost for additional material. Instead of (1200+500+1900=) 3600 €, costs might be about 1600 €. Of course many lost days would have been avoided.

The morale for a similar enterprise is: think three times before you start. *Festina lente.*



Fig. 16 – ...after all roof troubles, it is time for rest.

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