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Limestone
as the common denominator of natural and cultural heritage
along the karstified part of the Adriatic coast

Supplement 3.III

CONSERVATION GUIDELINES FOR PLATY LIMESTONE IN ARCHITECTURAL CULTURAL HERITAGE

Ljubljana, 2015

The project is co-funded by the European Union
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WP4 – CONSERVATION GUIDELINES FOR PLATY LIMESTONE IN ARCHITECTURAL CULTURAL HERITAGE

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Project: RoofOfRock

Organization: Inštitut za dediščino Sredozemlja, Znanstveno raziskovalno središče, Univerza na Primorskem

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CONTENT

1 INTRODUCTION

The guidelines about the dealing with platy limestone that we have formed within the frame of the international project *RoofOfRock Limestone as the common denominator of natural and cultural heritage along the karstified part of the Adriatic coast*, are intended for the professional services and experts active in the field of managing the stone architectural heritage: limestone (grey/white) in the form of the quarry stone.

The use of stone is broad and covers many areas that are variously related to each other (connected, exclusive, complementary, independent). All these relations determine the actual management in all sectors, for example: the agricultural sector in connection with the cultural landscape; spatial planning and utilization of natural resources; outline of energy efficient buildings and consideration of architectural building elements; implementation of certain measurements to protect the architectural heritage in cooperation with the local government; education of the experts in the field of platy limestone buildings, enabling the new employment opportunities, etc.

In order to improve practices in the use of platy limestone we must define a wide circle of potential users of this document. The highest on the scale are individual professional services, bodies and state agencies, involved in the project, for example:

- Ministry of the Environment and Spatial Planning.
- Ministry of Culture.
- Ministry of Agriculture, Forestry and Food.
- Ministry of Infrastructure.
- Foundations for the protection of cultural heritage.

Readers will undoubtedly find some additional connections between the listed services or will point out an additional partner. Every problem, topic or research field about the occurrence of stone and its use is connected to several disciplines, listed in alphabetical order:

- Anthropology.
- Archaeology.
- Architecture.
- Biology.
- Civil engineering.
- Ethnology.
- Geography.
- Geology.
- History.
- Landscape architecture.
- Linguistics.

However, included in the list is also the range of the individual disciplines artificially set; it comprises technical and natural sciences and includes humanities. Despite mostly natural sciences themes, all previous researches link all three areas, as architecture is a combination of different factors.

Owners are the crucial target group in the elaborate titled *Conservation guidelines for platy limestone in architectural cultural heritage*. Without that target group the elaborate would serve merely as the supplemental collection of purposes, options and goals for the theoretical researches in the field of architectural heritage. We have to bear in mind the notion that in the process of cultural heritage protection the chain is as strong as its weakest link.

In the long-standing practice of the institutions for the heritage protection and own field researches of architectural heritage, has become quite clear that the ownership and the awareness of the importance of the owners of the immovable cultural heritage is of fundamental importance. During the 20th century integral cultural heritage protection, especially in the Eastern Adriatic coast, was neglected and ignored by the current state system and various disciplines. In the Elaborate II it has become clear that most of the stone architectural buildings on the countryside are not included in the cultural heritage register and are therefore not legally protected. The elaborate addresses also the building owners.

- Raising awareness of their property importance
- Providing better quality of living

The owners were often torn between two poles: the strict protection under the jurisdiction of the official services and the necessity of investing in property using the cheap and fast procurable material or inadequate constructions techniques, which are adjustable to modern times. The results are clear:

- Gradual loss of the fundus of cultural heritage objects.
- Growth of mistrust between disciplines and owners.
- Highly negative attitude of building owners towards the institutions for the protection of cultural heritage.
- Amateur interventions of owners (changes in the roofing, changes in the building's envelope, inadequate replacement of building elements)

We have to turn our attention to the long period when the following was in effect:

- The majority of architectural heritage was publicly-owned, in many cases without a proper owner.
- Lack of control over the state of architectural heritage.

- Frequent irregularities or extremely long litigations in the transfer of ownership rights of immovable property.
- Mortgage loan on immovable property.

The elaborate *Conservation guidelines for platy limestone in architectural cultural heritage* is set in the direction of providing the solutions for the stone architecture, linking the disciplines and building-owners and representing the possible solutions/guidelines in platy limestone handling. It is made on the basis of the publicly accessible written sources, online databases, and proprietary documentation and, last but not least, on the basis of the documentation in Elaborate I and Elaborate II which was collected through the interdisciplinary partners' cooperation within the WP 4 in the frame of the project RoofOfRock. The elaborate summarizes the current state on the field; it is made as an architectural technical overview. We bear in mind that this is only a small pebble in the mosaic and that one elaborate cannot comprise all the aspects of all architectural facilities. A very good starting point is the extensive documentation, collected and upgraded by Božidar Premrl at the outset of the 21st century. For the remaining part we have the experts' results within the RoofOfRock project.

The elaborate comprises the data about the platy limestone – the building material of which the elements in the architectural heritage are made. Let us stress that the data, whether a heritage object is listed in the national or local register of immovable cultural heritage or not, is not at all important. In some cases an object is not listed, although it is an integral part of the cultural or urban landscape.

The guidelines therefore appeal to all owners and building managers to undertake the responsibility in terms of identity, quality preservation and ultimately raising the market value. In the sense of social responsibility of architectural landscape the transmission of architecture values to our descendants is important.

The protection of architectural heritage; "stone house" and its primary building material – platy limestone, is also present in the discussed area of the Eastern Adriatic coast. The most prominent is its use in the architecture: roof that is the main topic of our elaborate. Roof is an important element in the construction of the architectural facilities: it protects from external factors, especially humidity, heat, cold, looks. Roof is the fifth façade of the building (Zupančič, Juvanec, 2013: 90). In the following section, the other architectural elements – windows, shelves, chimneys, wells, Karst ponds (*kal)*, memorials (*znamenja)* – are also represented.

2 THE ROLE OF EXPERTS IN THE FIELD OF ARCHITECTURE

2.1 GENERAL OVERVIEW

Ideas about the role of professional services, active in architectural heritage protection, are various and the public – especially owners, managers, investors and architects – often understands them completely diametrically. They often understand them in the sense that the institutions for cultural heritage protection bureaucratically obstruct the capitalization of location; that archaeological research slows down and raises the price of construction; or even that the project documentation represents a high cost; that the institution of building permits is merely a formalism for state administration, because investors will carry out their work *better and more thoughtfully.* The owners often do not know the distinction between the roles of the administrative units, departments for the space at the communities and land registry.

The laymen often understand the status of a cultural heritage protected monument in the terms that the state has to take care of those structures. Cultural heritage is the holder of past values, and different disciplines – through social organizations – want to transmit these values to the future generations. At this point the misunderstanding between the involved groups has become quite obvious. The financial frames of the protection are only one part of the problem. The fear of the owners is the good case between the reality and idealistic set heritage protection. They are a good example of mutual lack of cooperation between different disciplines, inadequate collaborating of disciplines, inadequate public information, lack of knowledge of the social role and the advantages of the expertise of these services.

Considering the successful protection is the main effect achieved through cooperation between various professional services with high standards of knowledge that is consistent with the common objectives and ethical codes. The introduction of the customary expertise, guidelines and research final reports are based on the references, taken from the enacted charters of the international "guild" associations (ICOMOS, CIAV, UNESCO, etc.).

In practice an interdisciplinary approach is only slowly enforced. There are many reasons; we will point out only the most obvious ones: vocational education instead of university; historical indoctrinated divisions and rivalry between disciplines; structure of working teams in a specific area impedes or promotes cooperation; comprehensive list of literature and simultaneous insufficiency of bibliographical links and obstructed/half-closed access to the databases made by other disciplines, lack of internationalization of work and knowledge.

Above-listed are only the most obvious obstacles; however, they are conquerable if only all involved parties could overcome the dividing point of comfort/closure in their discipline. Any cooperation requires an adaptation to different starting points, the ability of acceptance of different views, and leads often to decisions, which are in practice often pragmatic, what is a deviation from ideal line, set in the theory. The deviations are subject to the reality in practice, as are the contents and the financial capability of investor, specifics of locations, current spatial planning legislation, provisions of the spatial documents, available time within the project from planning to implementation etc.

For this reason a very important basis for the disciplines, dealing with vernacular architecture are general ideal directions lined in the international charters, agreements, conventions or declarations in the field of the architectural heritage. All those documents are in certain points related to the Peace Agreements; all rise through gradual consents and through great academic and political diplomacy.

Regarding the ethical cooperation between the disciplines we attach to the principles of those documents and summarize them merely in the chosen segments:

- Doctrine 1: International Charters ICOMOS (Slovenian translation 2003).
  Document comprises: Athens Charter (1931); Venice Charter (1964); Florence Charter (1982); The process of enactment the doctrinal texts (1984); Washington Charter (1987); Lausanne Charter (1990); Charter on the Protection and Management of Underwater Cultural Heritage (1996); Cultural Tourism Charter (1999); Charter on the Built Vernacular Heritage (1999).

- Doctrine 2: International Charters ICOMOS (Slovenian translation 2014).
  Document comprises: Principles for the Analysis, Conservation and Structural Restoration of Architectural Heritage (2003); Principles for the Preservation and Conservation/Restoration of Wall Paintings (2003); The Charter on Cultural Routes (2003); The Charter for the Interpretation and Presentation of Cultural Heritage Sites (2008); Guidelines for Education and Training in the Conservation of Monuments, Ensembles and Sites (1993); The Nara Document on Authenticity (1994); Principles for the Recording of Monuments Groups of Buildings and Sites (1996); Principles for the Preservation of Historic Timber Structures (1999); Ethical Commitment Statement for ICOMOS Members (2005); Xi'an Declaration on the Conservation of the Settings of Heritage Structures, Sites and Areas (2005).

- Burra Charter, Australia, 2013. Charter is designed for all, who work as the consultants on the heritage field; who decide about certain operations or carry out the works on the protected cultural monuments and sites; owners, managers or custodians of the heritage.

In the following section we summarize those parts of the documents that can be directly applied to the field of platy limestone and stone architecture. The selection will exemplify the guidelines for the platy limestone use in stone architecture in the sense of heritage protection as a whole, not only as protection of singular structure, but also its setting.

In the introduction to Doctrine 1 Peter Fister stresses out the importance of the holistic evaluation of cultural heritage: not only special features of the heritage, but also its influence on the environment, modes and financial possibilities for its preservation and especially its special substantive role (function) in the future have to be determined (2003, 11). To achieve that Fister points out the principle of equivalence of the integral protection; this has to be an inherent constituent of the living environment.
C. Alexander emphasizes similar points; he disproves of the so-called *iterative approach to planning* (step by step, each task is an autonomous and independent part of the project) and stresses the role of *integration planning* (inclusion, integrity, coherence), which is a part of sustainable development (2012, 82).

Achieving the principle of integral heritage protection is enabled through motivation, time and an active role of professional staff in the field of heritage management. Professional staff consists not only of humanists and engineers; economists are indispensable too. The motivation is a clearly determined strategy of spatial and economic planning of singular setting or state; in this context the time is intended for good preparation of project documentation; in those processes all the involved parties, who are well-aware of their responsibility in the scheme are included.

2.2 EXPERTS

In the field of architectural heritage the following experts are pivotal: architects, art historians, ethnologists, archaeologists and lately often geologists, landscape architects, historians, urbanists, civil engineers and also geographers, sociologists, anthropologists. Due to the high number of disciplines and legally defined conservation services is the field of architectural heritage a complex, but still manageable area.

Conservators from different disciplines are essential for architectural heritage, as they have recognized the basic, fundamental heritage aspects for more than a century. Their main task is the evaluation of the building as the whole. The evaluation is based on

inventory, documentation, selection of protection regimes, strategy of integral cultural heritage protection and making guidelines in the field of architectural heritage.

A broad group of disciplines is very important in quality interdisciplinary evaluation of heritage protection in concrete tasks as well as in theoretical research work on research projects or programme groups, held at the faculties. All disciplines have developed their own principles; they use different research methods and methodologies in the processing of documentation; the data and the results are represented in theoretical essays and in practical applicative projects.

Let as quote Peter Fister that on the field of architectural heritage in theory the most important role is played by quality analysis and assessments made by different disciplines. They should as little as possible depend on current political, economic and ideological influences. But the primary question, whether this is possible or desirable, still remains opened (2012, 9).

For a better understanding of architectural heritage protection good knowledge of technical terms used in the project documentation or during the process of constructing buildings is essential. A proper choice of technical terms enables mutual communication and a more effective decision-making in the integrated project implementation.

The initial document for architectural heritage protection is Burra Charter (passed 1990 and amended 2013) which defines key definitions (Table 1).

Table 1: Burra Charter.

Article 1. Definitions

1.4 Conservation means all the processes of looking after a place so as to retain its cultural significance.

1.5 Maintenance means the continuous protective care of a place, and its setting. Maintenance is to be distinguished from repair which involves restoration or reconstruction.

1.6 Preservation means maintaining a place in its existing state and retarding deterioration.

1.7 Restoration means returning a place to a known earlier state by removing accretions or by reassembling existing elements without the introduction of new material.

1.8 Reconstruction means returning a place to a known earlier state and is distinguished from restoration by the introduction of new material.

1.9 Adaptation means changing a place to suit the existing use or a proposed use.

1.10 Use means the functions of a place, including the activities and traditional and customary practices that may occur at the place or are dependent on the place.

1.11 Compatible use means a use which respects the cultural significance of a place. Such a use involves no, or minimal, impact on cultural significance.

Article 14: Conservation processes

Conservation may, according to circumstance, include the processes of: retention or reintroduction of a use; retention of associations and meanings; maintenance, preservation, restoration, reconstruction, adaptation and interpretation; and will commonly include a combination of more than one of these. Conservation may also include retention of the contribution that related places and related objects make to the cultural significance of a place.

The Charter is designed with parallel explanation of the articles, which is based on practical examples.

Figure 1: The Burra Charter Process. Stages in the planning and managing of a place of cultural significance

During the translating of declarations and other documents special attention has to be dedicated to technical terms. Recurring communication disorder between investors (owners), design engineers and administrative authorities has occurred just through different understanding of technical terms. Additional explanations of technical terms during the process of project work influence the timing and context dynamics of project implementation. Unanimous understanding of technical terms is a part of successful project:

- *Fabric* is in Slovenian professional language translated as material in the broadest possible sense (material, immaterial). In the field of architectural heritage is the word understood as material built structure (*materialna grajena struktura*). In some cases it is translated as *grajeno tkivo*, which is poetic, but is still understandable.

- *Place* is in Slovenian professional language translated as *kraj*. In the field of architecture the translation *lokacija območja* is possible, as the word *place* means something familiar, homely. On opposite the word *space* is used for any area, with an exception of domestic area.

- *Setting* is in Slovenian professional language translated as *okolica*. Not only architectural, but also any other heritage type can not exist without the setting in the view of the integral heritage protection and can not reasonably represent the memory on the cultural values of an era. Setting is the territorial frame of the structure.

2.3 CONSERVATION POINT OF VIEW

Conservation comprises all necessities for cultural heritage understanding, notion of its history and meaning, ensuring its material protection and, if appropriate, presentation, renovation and enhancement. Cultural heritage are the monuments, building assemblies and sites, as is defined in the 1st article of Convention Concerning the Protection of the Worlds Heritage.

In the paragraph Guidelines for Education and Training in the Conservation of Monuments, Ensembles and Sites (1993) of Doctrine 2 is described the main part of the conservation approach. Here we summarize it: " The object of conservation is to prolong the life of cultural heritage and, if possible, to clarify the artistic and historical messages therein without the loss of authenticity and meaning. Conservation is a cultural, artistic, technical and craft activity based on humanistic and scientific studies and systematic research. Conservation must respect the cultural context."

Conservation requires the ability to observe, analyse and synthesize. The conservationist should have a flexible yet pragmatic approach based on cultural consciousness which should penetrate all practical work, proper education and training, sound judgment and a sense of proportion with an understanding of the community's needs. Many professional and craft skills are involved in this interdisciplinary activity." (Doctrine 2, 2014: 58).

The confirmation of the pragmatic approach resulting from experiences and active interdisciplinary approach is substantially important for our elaborate. In that context we quote Božidar Premrl, who after analysing the state of Karstic building constructions stressed out that the best conservation interventions are those implemented in the minimal scale and are therefore cheap (2005). Let us add that that statement is doubtless true under the condition if the structure is ongoing and regularly maintained or is managed obeying the principles and evaluation. The old buildings have to be adjusted to the legislation and modern standards of quality living.

Architectural cultural heritage of national, local or private property should be under the supervision through regular field controls and regular maintenance. Seasonal inspection is recommended once per year in the spring or late autumn. Spring inspection is favourable due to the planning of the new interventions on the building (minor repairs, regular maintenance works, complementation of activities going on in the building), as those works can be done in the dry part of the year (late spring, summer and early autumn). Inspection in the late autumn serves to the state control before the winter and the control of previously carried out measurements (for example: after the roofing replacement has the roof-working partially changed, some condensing points may occurred) to see whether they function in line with the expectations. Autumn review is useful also for the planning of major intervention on architectural structures as these interventions (rehabilitation of walls, changes of the activities in the buildings) require more time, larger number of involved parties and more funding. Each major intervention has to have well-made documentation that enables suitable understanding of monuments, ensembles or sites and their setting (partially summarized from Doctrine 2, 2014: 62).

The above text is based on the understanding of the mission of the building owner or manager, who follows the example of good landowner. The legislation does not prescribe frequent maintenance and operational works. Handing over the new buildings to their purpose (operating permit), the project team makes the technical documentation that contains technical instructions and certificates. All these documents enable the building owner or manager the safe management and good maintenance of the building and its consisting parts.

Technical documentation is only scarce for the buildings, constructed few years ago. Owners and managers are less acquainted with the state of built-in materials and with the state of loadbearing and non-loadbearing structures. The most effective and inexpensive are constant inspection and recording of the current building state.

Close to mentioned periodic inspection of building, building parts and other structures, is an observational method - monitoring. This method is pointed out in the principles for analysis; preservation and renovation of the architectural heritage (see Doctrine 2, 2014: 18). Method is pragmatism in the architectural heritage management.

So-called incremental approach is applied because of the less accurate assessment of the level of solidity, seismic safety and potential benefits of the envisaged interventions on the constructions. We begin with a minimum level of intervention with the possible subsequent adoption of a series of supplementary or corrective measures. The frequency of these operations and order of size are incrementally defined, according to the measurements and observations of the construction. The observations have to be documented through photo material, measurements and other modes of data collecting; the data is analysed later (for example: digital construction model for verifying the solidity and seismic resistance; comparison with related examples).

Each guideline in architecture or civil engineering remains merely a wishful thinking, if it does not have a possibility of implementation in practice. The final step in the maintenance or rehabilitation is the execution of construction works, which has to be carried out quality and professional. A great professional assistance in Croatia is vocational school (IV level); the program Stone processing. Related program runs also at vocational school in Sežana: material processing with the stress on stone. More courses in development are possible: adjustable vocational school (constructional) with inclusion of specialized applicative professional courses or workshops. Those extra intensive courses have to comply with standards in building construction, adjustable quality of construction products and with conservational guidelines.

2.4 AUTHENTICITY

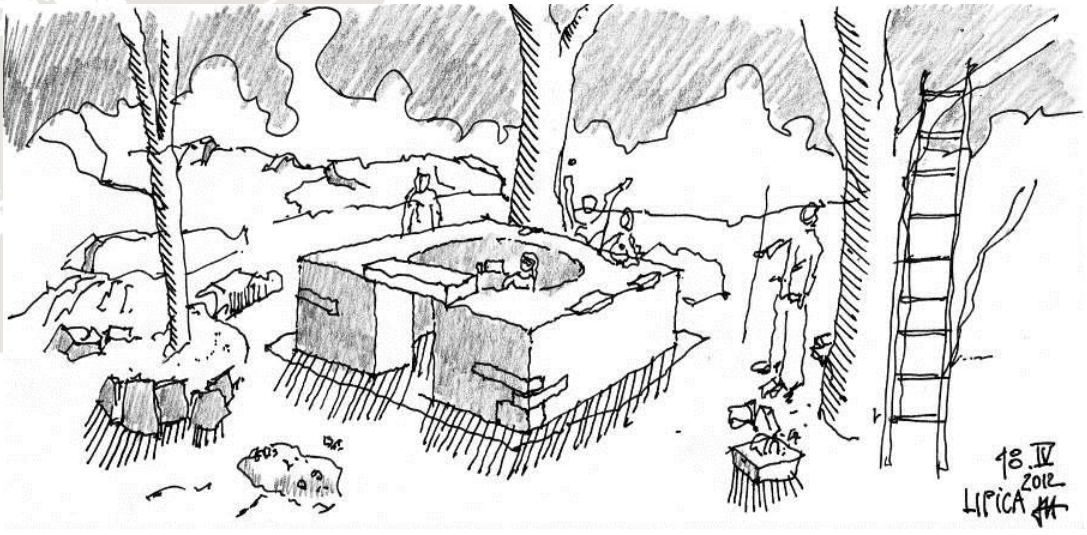
The Nara Document on Authenticity (1994) is intended for the question of authenticity. In that Elaborat we summarize singular chapters. A starting point is an idea about the cultural and hereditary variety that provides the framework for reflections about the authenticity care. Cultural heritage diversity exists in time and space, and demands respect for other cultures and all aspects of their belief systems. In cases where cultural values appear to be in conflict, respect for cultural diversity demands acknowledgment of the legitimacy of the cultural values of all parties Conservation of cultural heritage in all its forms and historical periods is rooted in the values attributed to the heritage. Our ability to understand these values depends, in part, on the degree to which information sources about these values may be understood as credible or truthful. Knowledge and understanding of these sources of information, in relation to original and subsequent

characteristics of the cultural heritage, and their meaning, is a requisite basis for assessing all aspects of authenticity (Doctrine 2, 2014: 66–67).

Only original and preserved structure is authentic; later interpretative works in the sense of renovation or reconstruction are merely authentic displays of the heritage meaning. The following question is reasonable here: what is authentic in the field of platy limestone use and to what extent.

The examples of heritage interpretation are shepherds' houses that are characteristic for Mediterranean vernacular architecture. In recent years they have gained on its meaning through renovations, restorations and new constructions after the same concept. They are built exclusively of platy limestone with simple construction technique: corbelling. The final result is graduated vault in the interior. The roof or roofing is made without binder; it is merely a placement of stone slates in the dry-wall technique.

The workshops where experimental vernacular buildings were built, were carried out for the purposes of heritage interpretation of Karst, Istria and for the education of the public and younger generation. Landscape authenticity was used as the setting for the placement of heritage structure and authenticity was provided through traditional dry–wall technique and through authentic local material – platy limestone. Projects were planned, construction was documented, and the proceeding was overviewed and published in the professional literature.



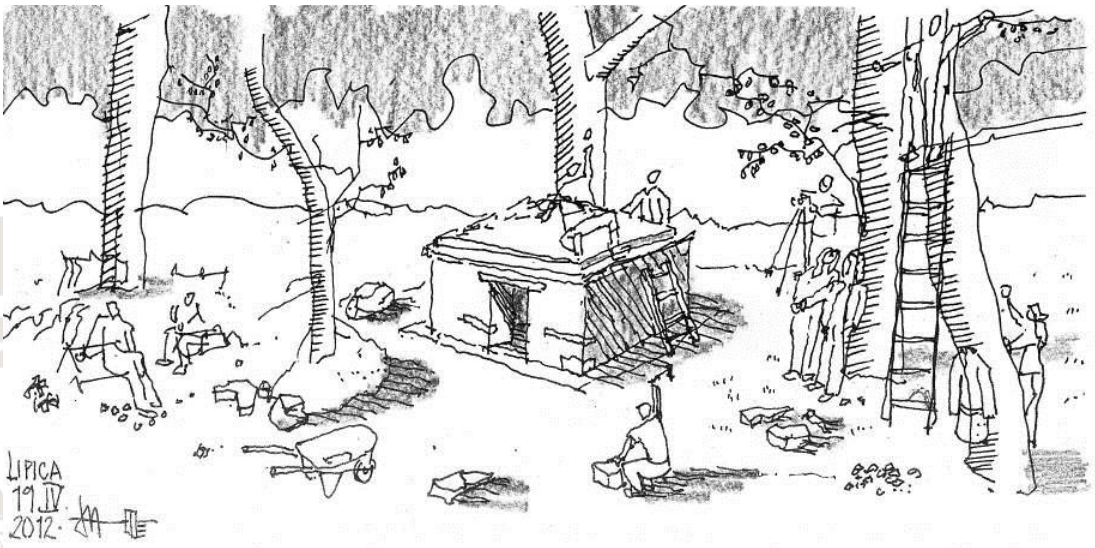


Figure 2: Sketch of construction of hiška at Lipica, Slovenia, 2012. Source: Domen Zupančič.

Figure 3: Photos of construction of hiska at Lipica, Slovenia, 2012. Source: Domen Zupančič.

2.5. VALUES OF THE ARCHITECTURAL HERITAGE

In the case of complex buildings on which several architectural periods are visible we have to determine which period should be stressed most.

If more architectural periods are visible on the buildings, we have to make a choice what is of the greater value considering the cultural heritage values and importance. Obvious interpretation of one period on the count of the other is justified only if the omitted elements are of smaller cultural significance and the pointed out elements are of greater importance (Premrl 2005, 94). English Heritage association stresses these general

principles, which can be applied also in the field of platy limestone in the Conservation Principles, Policies and Guidance (2008).

1. The historic environment is a shared resource.	Principle: availability
2. Everyone should be able to participate in sustaining the historic environment.	Principle: equality
3. Understanding the significance of places is vital.	Principle: selection of criteria
4. Significant places should be managed to sustain their values.	Principle: integral management
5. Decisions about change must be reasonable, transparent and consistent.	Principle: objectivity
6. Documenting and learning from decisions is essential.	Principle: revision

Table 2: Transcript of English Heritage Conservation Principles, Policies and Guidance in Slovenian Language. Source: EH Conservation Principles, Policies and Guidance, 2008.

The mission of an objective, holistic architectural heritage evaluation is the transmission of awareness, shared memory on the place and setting, to the public. The values show mutual cultural influences and have symbolic and spiritual value.

The architectural monument devaluation is detected through unprofessional interventions (without adequate projects, analysis, with infringed professional team, inadequate material selection).

2.6. SELECTION OF BUILDING MATERIAL

Platy limestone is in nature present on several findings, but its resources are often limited or are inadequate for the use in construction works. Providing the suitable local material for conservational interventions, adaptations and new constructions is today

almost disabled as the ancient quarries are closed, overgrown and also under the mining concession/act, which prescribes complex procedures for the opening of new quarries.

Due to several administrative provisions, subject to the rigorous legislation, is platy limestone often obtainable only as the recycled material. Because of the constant decay of the buildings (covered with platy limestone or possessing some architectural elements of platy limestone) that material is marked as reusable. Its adequacy and quality for the re-use have to be professionally ascertained through technical guidelines from Slovenian National Building and Civil Engineering Institute.

Reuse of stone roofing on the other building demands several phases:

- Obtaining owner's consent.
- Manual demolition of the structure.
- Slate selection according to the preservation and form (due to the current position on the roof).
- Transport of material to new location.
- Overlapping or constructing the new architectural elements on the new location.

The steps are time-consuming and physically demanding. Even if the new roof-surface is of the same dimension, only a partial use of old material will be possible, as the covering is old and has undergone its optimal life cycle of the embedded material on the building. The stone on the old roofs (or other architectural elements) was exposed to weather conditions, has inner (inert) tensions and other damages. The stone slates on the existing roofs are often thinner as original (layering or erosion). For that reason stone slate reuse is only a partial solution to the problem. It is estimated that only 20%-30% of the existing roof slates are adequate for reuse. For the new roof of the same dimensions we would therefore need 3-4 decaying buildings.

Therefore the availability of the material (old and decaying objects) for new constructions or in the renovation process represents heavy obstacle for the guidelines for the use of platy limestone in the architectural renovation. For the efficient use of old available material regular monitoring of the stored material is essential. Possible solution to the problematic stone architecture management on the discussed area is introduction of the bank of stone elements. The storage method is twofold:

- On the building location

  In the case if the building is listed as the cultural heritage and is registered in the basis (GIS and record sheet with description of the elements and their architectural plans).

If a building is not listed in the cultural heritage register, the building data should be included in the database similarly as if it was included in the cultural heritage register.

- In a specialized storage

  If a building is removed, is decaying or is reconstructed can the stone roof or other elements – in the consent with the owner – be stored or purchased in the organized storage. In these cases all the elements have to have adjustable documentation (building location, record sheet with the description of the elements and their architectural plans).

The purpose of the organized storage is not in the creation of the large stock of these elements (roof slates, ridges, stone frames, corbels …), but in the whole keeping of the element records in the area; all the elements are subject to the technical guideline. Technical guideline for each material assembly (for example: stone slates of platy limestone) enables the legality of trading of construction products and their installation in the building.

The meaning of the element origin in the bank is multifold. It enables the traceability and strengthens the identity in the terms of architecture. Its practical meaning lies in the fact that singular element from certain architectural setting cannot be transmitted to other architectural landscape (for example: *erta* from Slovenian Karst cannot be embedded in Istria). The stone elements bank introduces the standard of elements classification and enables the transparent management.

Knowledge of the characteristic and manners of dealing with traditional materials are essential for adequate holistic integration in the architectural heritage. The professional literature on that field is quite abundant. Less common is the analysis of the structure of natural materials in architectural assemblies or elements

We have to draw the attention to the fact that the field of building construction is strongly regulated in terms of safety (seismic adequacy, fire safety, use of health innocuous materials); energy efficiency (heating, heat-insulated building envelope, the integration of renewable energetic sources); providing accessibility (elderly, physically disabled, children); selection and installation of appropriate certified material or materials that have obtained technical consent.

In the architectural heritage the participants in the process of projecting (responsible authority, chief conservator, investor) have to put a lot of effort in finding the appropriate integral solution. That phase requires a lot of adjustments (specific from case to case) and testing of possible solutions (schemes, theoretic calculations, practical experiments). Change or renovation of the roof covering (*skrlje*) means not only the change of roof covering, frequent are also procedures on the supporting construction – roofing. So project work moves from so-called regular building maintenance to the project for obtaining a construction permit.

The maintenance of a cultural heritage building involves the implementation of planned and unplanned works in order to preserve a building in a good state and to enable its continued use. These works do not intervene in its construction (reconstruction), are not an individual building and are connected with the flooring or original building. If the latter condition is not fulfilled, that work is no longer described as construction and is therefore not under the jurisdiction of building permit. That regulation does not determine the maintaining works in public benefit that are usually governed by other acts and regulations.

"All countries have to maintain complete bodies of evidence concerning storing and safekeeping of building documentation and granted permits. Setups are different in different countries and are also tied to the responsibilities of the players in the procedure, i.e. the government body, concordance giver, responsible designer /engineer/project leader (directly responsible physical person) – the guarantor of a building's safety" (Stanič et al, WP6, 2015, 66)

Without maintenance buildings have no future. Adequate maintaining works extend the life expectancy of the architecture and enable its function (for example: ridge must lie on the covering sufficiently enough to enable the efficient water drainage). Unprofessional, amateur solutions excluding the project designer and chief conservator lead to irreversible interventions, which reduce the facility quality and loss of the character of the architectural structure.

Despite administratively correct procedures while projecting the interventions on the architectural monument or cultural heritage, an optimal and integral preservation of the building value has not been achieved yet. Integral projecting includes comprehensive multidisciplinary approaches to the issue. With observational method we prevent or at least limit the negative outcomes. Observational method has to be applied especially in the introduction of the new materials in existing structures. Here are listed some general

reasons for new materials: affordability; current sufficient availability on the market (in the case of short-term or temporary interventions on the construction); technically suitable alternative; consolidation with current applicable legal requirements (energetic efficiency, seismic stability, safety). However those general issues are not a grant for good interventions. In any case of changing construction you should consult an expert (architect or conservator at local or regional cultural heritage department).

Numerous, independent practical and theoretical research actions are of great importance in the introduction of new materials or in the improvement of accessibility in existing structures. Good reference examples are presented in professional educative publication like the book on architectural heritage that was written by Irish colleagues, who pointed out some new architectural elements as are installations of elevators for personal use and also for disabled persons (Guidelines for Planning Authorities, 2011: 239). An architect (responsible project designer) and in several cases also the chief conservator or regional office of the Institute for the Protection of Cultural Heritage, has to cooperate in all interventions regarding the construction, communication or integrity of the architecture. All participating organisations have to stride to solutions, which permit an inclusion of modern architectural elements that respect the building and its protection.

"The use of a building material for construction is tied to legislature concerning quality of the material and performance under stress, which have to be established before a material is recognised as a commodity on the market in procedures specified in standards." (Stanič et al, WP6, 2015, 73)

2.7 LEGISLATIVE AND ADMINISTRATIVE FRAMEWORK USING PLATY LIMESTONE

We have focused on some terms, which are verbally the same as the terms used by conservators and associations for cultural heritage protection, although their explanation varies, which causes the additional administrative complications and misunderstandings between participants (investor, regional offices of the Institute for the Protection of Cultural Heritage, project designers, conservators and public). We have not yet reached the common language of disciplines.

We have also included building removal, which is in the field of architectural heritage undesirable, but real. Building removal is an extreme measure that requires serious consideration before making the decision (Guštin, Jogan, 2014). Please refer listing of legal documents concerning cultural heritage used in the analysis, relevant for the use of platy limestone, as submitted by the project partners (**WP6: Comparative analysis of existing legislation and standards**).

"The legislative spatial planning framework of particular member states is within the responsibility of each particular state. The EU does nevertheless exercise indirect control over developments in particular countries through set frameworks in the Operational guidelines for particular programming periods, which directly correspond to EU financial perspectives. Such regulation does not directly influence the subjects of exploitation of natural resources, i.e. natural stone, either in the sense of mining or land use. In the field of construction, however, EU legislature focuses on construction products (materials), seen as marketable commodities, whereby the entire field is directly regulated by the EU and specified regardless of local (national) legislative frameworks." (Stanič et al., WP6, 2015, 57)

Construction of the buildings is subjected to Construction Act, for further information; please refer Guidelines of Common Legislation. Generally the Construction Act specifies the terms, which the project designers have to respect. "The main objective in building laws is the definition of a building and the safeguarded attributes of a building, which deem it safe for use. The stipulations directly apply to given three-dimensional physical structures." (Stanič et al, WP6, 2015, 63)

Definition of the project nature reasonably summarizes the planned interventions. On that basis the administrative authority verifies the compliance of the planned intervention with the descriptions in the legislation. Deviations from these descriptions cause delays in delivering the project conditions, consents to project solutions and granting a building permit. Interventions on architectural heritage are demanding; from that reason are provisions in legislation often complemented by responsible project designer or other participants in the construction process.

Professional concepts, defined and written in the construction standards and spatial legislation (state, regional and local), are meant for determination of certain work-types on the object or structure. The concepts are described and not prescribed, in the practice they are often combined and extrapolated to gain benefits for investor.

Permitting (building permit) is done by bodies at various levels of administration, whether national, regional or local, depending on the governmental setup of particular countries and the qualification of the development concerning governmental responsibility or the development's complexity. In any case at least two levels of permitting are proscribed, i.e. the 1st level, where the permit is issued and the 2nd where appeals are made possible. (Stanič et al., WP6, 2015, 64-65)

2.7.1 RECONSTRUCTION

Explanation of the term is taken from the legislation, as a complied terminology between disciplines, administrative authorities and investors is necessary.

2nd Article (Definitions)

7.2 Reconstruction is an alteration of technical characteristics of existing construction and adaptation of construction to changes in intended use or changed needs or execution of works, which do not substantially change the size. The construction elements and capacity are changed, some other improvements are carried out. Considering the buildings, the change in the size it is not essential, if its volume does not change by more than 10%

17th Article (Ensuring unimpeded movement of disabled persons)

(3) Considering the reconstruction of public buildings, which are protected in consolidation with cultural heritage regulations, the essential requirements may differ from otherwise prescribed, but only provided that the deviation does not threaten the security of the facility, life and health of people, transport, adjacent facilities or the environment.

2.7.2 CHANGE OF FUNCTION

Explanation of the term is taken from the legislation, as a complied terminology between disciplines, administrative authorities and investors is necessary.

2nd Article

(9) Change of function is the execution of works that are not construction and that do not require reconstruction, but it represents such a change of facility purpose or its parts thereof, that the facility's environmental impacts are increased.

2.7.3 REMOVAL OF THE CONSTRUCTION WORK

Explanation of the term is taken from the legislation, as a consolidated terminology between disciplines, administrative authorities and investors is necessary.

(ZGO-1A)

6th Article (Conditions for the beginning of facility maintenance)

(5) If during the execution of works, ordered by the municipality decree on the basis of independent expert assessments, is concluded that the damages identified at the facility

cannot be repaired solely through maintenance, the municipality can issue a new decree in which it orders the building reconstruction, if it is found, that the structure is in such a state that the damages can not be repaired even by the reconstruction, the municipality can order the building removal.

2.7.4 ALTERNATIVE CONSTRUCTION

Explanation of the term is taken from the legislation, as a consolidated terminology between disciplines, administrative authorities and investors is necessary.

Act Amending the Construction Act (*Zakon o spremembah in dopolnitvah Zakona o graditvi objektov* (Official Gazette RS, nr. 57/12))

123rd Article (consolidation of decrees about alternative constructions)

(1) From the date of application of this Act is for the purposes of issuing a building permit considered that the term alternative construction means the removal of the existing building and the construction of the new. If the Planning Act cites that only the alternative construction can be constructed that – disregarding the determination of the Planning Act – means that the existing building can be removed and on its site is constructed the new one of the same dimensions and function.

2.7.5 BUILDING MAINTENANCE

Explanation of the term is taken from the legislation, as a consolidated terminology between disciplines, administrative authorities and investors is necessary. Terms adaptation and renovation have within ZGO-1D obtained an alternative name and recent legislation does not use it.

29th Article (consolidation in meaning of terms)

From the date of application of this Act is considered that in prescriptions used terms "adaptation", "renovation", "maintenance", "regular maintenance," and "investment's maintenance works" mean the "building maintenance" under the provisions of this Act.

Maintenance of the structure (ZGO-1A)

6th article (Conditions for the beginning of facility maintenance)

(1) Maintenance of the facility is carried out without a building permit.

(2) If on the structure such damages that they – due to wear and tear, obsolescence, weather conditions or the effects of third party – very badly influence on the external appearance of the village and the landscape are visible and these damages are a result of the suspension of regular and proper use and maintenance, but after act it still is not a dangerous building, a municipality in order to protect public interest can commit the

owner to carry out all necessary maintenance work. The municipality passes a decree and sets out areas or facilities with the need for maintenance, decides which maintenance works are to be carried out and provides the criteria for their determination and an estimate of the cost. The decree can provide the amount of funding the municipality will contribute to cover part of the costs relating to planned maintenance. On the basis of that decree competent municipal authority ex officio issues a decree by which it orders the facility owner to undertake – within the prescribed period – the maintenance works, specified in the decree. If the object is protected in consolidation with cultural heritage protection regulations, it is necessary to carry out the works in cooperation with the authorities, responsible for cultural heritage protection.

(3) If the person that is subject to maintaining does not carry out the prescribed maintenance work within the period, specified in the decree, is carried out on a non-monetary obligation by other persons in consolidation with the prescriptions on general administrative procedure.

(4) If a municipality for enforcement (from the previous paragraph) lends itself means for execution of maintenance works, it acquires at the facility – at which were carried out maintenance works – legal mortgage in the amount of the costs for conducting maintenance works.

(5) If during the execution of works ordered by the municipality decree on the basis of independent expert assessments, is concluded that the damages identified at the facility cannot be repaired solely through maintenance, the municipality may issue a new decree in which it orders the building reconstruction, if it is found, that the structure is in such a state that the damages cannot be repaired even with the reconstruction, the municipality can order the building removal.

ZGO uses also other terms, useful for owners and for potential interventions on the buildings:

- EXTENSION

  In the case when a new room, part of the building or new architectural constructed element (roof, staircase, elevator,...) is adjointed.

- SUPERSTRUCTURE

  Reasonably summarizes the explanation of extension, only the ground plan is unchanged, but the height of the building is extended.

Quite frequent is also a further detailed definition of interventions on the cultural heritage sites as, for example Municipal Spatial Plan of Vrhnika Municipality (Official Gazette 27/14), 64th Article (integrated heritage conservation):

(4) On the facilities and cultural heritage sites are not allowed the construction of the new facility, superstructure, extension, reconstruction and the works that essentially change an outlook in a manner that could affect the protected values of the facility.

(7) Facilities on the cultural heritage sites have to be protected against damage or destruction during the construction. Construction site routes, detours, watercourses, irrigation systems, utility service, energetic and telecommunication infrastructure or storage rooms for excess material, etc. must not pass over cultural heritage facilities and sites.

2.7.6 WHEN SHOULD CONSTRUCTION WORKS COMMENCE?

3rd Article Construction of the new structure, its reconstruction and removal can start on the basis of legally binding construction permit.

The texts in this section are taken from the acts, decrees and regulations.

Searching for the data we have followed an online portal Legal Information System (*Pravno-informacijski sistem Republike Slovenije – PIS*), which enables free access to the legal and other public documents issued by the state authorities of the Republic of Slovenia and by European Union or Council of Europe:

http://www.pisrs.si/Pis.web/

For the building owners a website, which describes the procedure of obtaining a construction permit is useful:

http://e-uprava.gov.si/e-uprava/dogodkiPrebivalci.euprava?zdid=913&sid=865

2.7.7 AUTHENTICITY, LEGITIMACY AND LEGALITY OF THE PLATY LIMESTONE USE IN THE ARCHITECTURE

The core of the elaborate is not in commenting the current legislation, as it often changes and amends. Currently in the Republic of Slovenia we do not have official consolidated text (OCT) of Construction Act, what impedes the efficiency of administrative procedures. Apart from ZGO there are a lot of regulations, decrees, amendments, which hair-splitting determines the interventions in the space.

Circulation of material represents a possible proper solution to the problem of facilities maintenance. Several terms are used: *re-use of elements, recycling of the limestone plates or re-use of material*. Material is transferred from one facility and is built-in in the other. Executively that manner represents some troubles:

- Authenticity of an element in the new facility. In the architectural point of view it is a new element, a new compositional building block. Conservational point of view points out adequate removal from existing facility, proper storage, delivery and installation in new facility.
- Legitimacy of an element refers to the authenticity. An appropriate pre-study of handling has to precede each intervention or transfer of material (for example: pre-study of the removal of entrance portal on the facility A and the installation of the entrance portal on facility B). Legitimacy is a part of trust between disciplines and cannot be prescribed.
- Legality. Despite reasonable bridging solution through transferring material that instrument remains unclear:
    - Who oversees architectural elements, built into the facilities?
    - What is the legal status of the property *donor* and property *recipient* of that material?
    - What are the real possibilities of dealing with these elements? In the terms of physical distance between donor and recipient.

An architect (responsible project designer) and conservator have to be included in the circuit of material and elements. Both experts make a pre-study of elements/material transfer. The pre-study has to contain: inventarisation of state on both locations, estimate of available elements/material, estimate of necessary elements/materials, inclusion of possible alternative measures (installation of new modern material, conservation interventions), assessment of investment (cost comparison between different solutions), determination of the most adjustable solution and a proposal of its realisation.

We have to point out that the discipline offers the solutions and the investor choose the most appropriate reasonable solution. Exclusion of the property owner from the renovation process is not a part of integral planning and building maintenance.

2.8 MANAGEMENT IN ARCHITECTURE

Possessing of the property is connected with property rights and corresponding responsibilities. "Preventive conservation starts with the people who are the primary caretakers." (SPRECOMAH Guidelines November 2008). The more are owners and

property managers aware of the values of architectural heritage and cultural landscape identity, the more appropriate will be the communication between them and the experts. Raised awareness on the cultural heritage field will enable the proper transfer of these values to the future generations.

The dividing line between management and ownership has to be clearly defined with the contract on facilities management. Also the proper care for the heritage has to be defined, as it is the care for the culture of living. Corresponding offices (municipal administration – department for space, tax offices) have to transparently inform the facilities owners about the obligatory financial charges (NZUPSZ, real estate tax, insurance ...). Clearly defined obligations are a precondition of the good management in architecture and space.

Regarding owners' burdens (responsibilities) is crucial good awareness about the possibilities of potential financial stimulations, relief or other benefits. All that demand coordination of administrative offices and providing of good, transparent documentation about the property. The disciplines have to determine (risk analysis) the level of jeopardy of the facility and its architectural elements. All these factors influence on the property owners' or managers' decisions about potential measures for eliminating these shortcomings.

2.9 GENERAL PUBLIC AND USERS

Guidelines enable active inclusion of laymen in the process of preservation, protection and renovation of architectural cultural heritage. Users of the guidelines will be new project teams, consisting from the representatives of various disciplines (historians, economists, architects, ethnologists, anthropologists, art historians and other). The public is a part of cultural heritage as it through its awareness helps to create a common memory and identity.

Buildings are tangible media of the messages about the landscape management and creation of cultural landscape.

Entry into the Record of Protected Structures does not mean that a structure is forever frozen in time. Good conservation practice allows a structure to evolve and adapt to meet changing needs while retaining its particular significance. The challenge facing owners, planning authorities and all others involved in architectural conservation is to identify how and where change can occur and to ensure that the heritage is not damaged by inappropriate intervention. (Architectural Heritage Protection Guidelines for Planning Authorities, 2011: 105)

2.10 GENERAL ARCHITECTURAL SOLUTIONS FOR PLATY LIMESTONE

Methods of data collection, data processing and presentation of the information are different in the field of architecture. Important is the scope of data collection as it determines the working range of the sources selection and methods of work at the facility. We recommend the non-destructive methods of data collecting. In the architecture we use the terms project documentation and technical documentation. Project documentation is meant for the communication between owners, experts and administrative offices. Technical documentation serves the clarification of the installed devices (for example: scheme of the heating system), facility maintenance (for example: plan of maintenance works on the roof) and determination of the quantities, required for the official evidences (for example: project of executed works).

Table 3: Basic steps of integrative design and construction processes in vernacular architecture.

Inventory	Gaining general data about the facility or assembly of facilities. Checking the state of the facility in publicly accessible databases (archive sources, museum collections, publications in monograph, municipal web GIS applications, mapping data, other sources). Inspection on the field, photographing or sketching the integrity or singular elements. Processing of field data on the evidence sheet. **Result:** Inventory sheet with general data about the facility. General assessment of the facility state. General database. Classification of the facility regarding the plan and function – general historical analysis. Determination of the architectural elements on the location or on the facility.
Project team	An owner or investor chooses the responsible project leader or architectural office. Project designer and investor define project tasks and indicative the timeline of the project, as project process consists of several phases.

	Result: Defining the working team on the project. Timeline of the project. Intermediate phases of the project.
Architectural drawing of the structure	Measuring facility on the location in cooperation with geodesic engineer. **Result:** Technical report about the facility state. List of the area of rooms and area itself. Geodetic record of location. Maps, schemes, sketches of the facility state.
Historical analysis of the facility and its assemblies	Overview of the details on the facility and interpretation of possible structures in order to clarify the construction methods and possible rehabilitation measures. Analogies with relevant published sources. Conservator has to be included in that phase. **Result:** Comparisons with historical and architectural data about the facility. Archaeological collections and other historical classifications of architectural elements. Textual and graphical explanation of the changes in building's horizon line in the course of time.
Rough estimate of the quantities and rough estimate of intervention costs	Regarding the available data project designer makes a general rough cost estimate with regard on the planned interventions, defined in the project task. Cost estimate is informative, so that investor can plan financing of the project process. **Result:** Table of quantities of areas, volumes and other elements. Rough project list of quantities.
Variants of the spatial solution	Solutions are proposed regarding the conditions and guidelines made by different public offices and legislation on the field of facilities constructions.

	Result: Various solutions (floor rearrangements, construction solutions). Possible extensions of structure and placing of new building elements at location. Classification of the adequacy of individual proposed solutions. Selection of suitable spatial, technical and economical variant solution.
Project documentation	Creating integral project documentation for obtaining a building permit that provides legal and factual conditions for the start of construction works. **Result:** Obtaining the consents (community departments for cultural heritage, public infrastructure managers, easement of other location beneficiaries) to proposed project solutions. Integral project documentation by making the project to public tender (example of the facility in public ownership). Create a project for execution (PZI). Creating the detailed timeline and determination of financial frames (outcomes and incomes). Selection of the contractor regarding the references of the provider and conclusion of the contract about the execution of works. Determination of minimum participants in construction (investor, project designer, supervisor). The application for a building permit.
Building permit	After legally binding of building permit can the investor start with the implementation on the building (on the basis of the implementation plans). **Result:** The construction works with all preparatory work start on the basis of project for execution (PZI). Leading and coordination of the execution of works in the

	sense of resources (time, participants, finance). Smaller adjustments or project changes to new conditions on the facility.
Execution of technical and other documentation	Project of implemented work serves in obtaining the operating permit. **Result:** Proofs and certificates of built-in material. Integral technical documentation (Project of implemented work with some changes, project of facility maintenance). Technical overview of installed elements and whole facility. Obtaining operating permit. Costs recap. The handover of the facility to the owner or investor.
Facility management	**Result:** Supervision of the built-in material (warranty period). Measurement of the costs and energy resources for the operating. Preparation of reserve fund for ordinary and regular and exceptional facility maintenance.

2.11 INCLUDING BIODIVERSITY IN PLATY LIMESTONE ARCHITECTURE

Part of the integral architectural cultural heritage and monuments protection is also enabling the preservation, strengthening or establishment of autochthonous biodiversity in the area and on the building. In terms of project designing are these approaches very rare. However, we strongly believe that cooperation between disciplines and the public will intensify in the future. Biodiversity is regulated by Nature Conservation Act (official Gazette RS, nr. 96/04 – official consolidated text, 61/06 - ZDru-1, 8/10 - ZSKZ-B and 46/14) especially 36th Article (Agglomerations).

(1) In agglomerations biodiversity shall be conserved in such a way that:

- the connection between habitats in agglomerations and nature outside such areas is fostered if that is technically feasible and does not incur excessive costs;

- green areas, trees, groups of trees, still and running waters and other habitats are conserved;
- in the construction of plants and facilities such technical solutions are applied which do not present a trap or an obstacle to animals; and that technical solutions which after the construction turn out to present a trap or an obstacle to animals are eliminated by additional measures.

(2) For plant or animal species or habitats of their populations in agglomerations the minister shall, with the consent of the competent minister, prescribe the manner and conditions for an activity affecting nature which will comply with the requirements referred to in the preceding paragraph.

Regarding ZON we have to mention the role of roof openings in *skrile* roof. In the past roof was often a depository of occasionally used tools or storage for food (cured meat products, grains, flour) or granary. The purpose of roof openings in manifold:

- Air intakes and outlets.
- Bat access. Bat Conservation Trust in Great Britain has published a monograph about the renovation of the roof construction regarding the living habits of birds (owls, swallows, hawks...) and habits of bats. On the British market semi-finished products (nests, hatcheries, rooms), which are installed during the renovation are available. Coexistence with these animals has been useful in the past, as they have hunted insects that have caused damage on the building construction and on foods. Today they are useful in secondary outbuildings (toolbar, linden, barns, stables).
- Access for cats, pine martens and other small animals that have hunted smaller mammals (mice, rats).

Stone roofs and walls are because of uneven surface and strong indentation (shelves, pilasters, stone gutters, corbels and other) suitable for animals. Birds nest under the eaves of roof slates. In the gabled parts of the buildings are often built-in smaller niches – attic dovecots. Overhanging parts on the façade are good hiding spots for insects (spiders, wasps, bees). Some abandoned buildings offer a shelter for bigger birds, for example owls.

Design and implementation of these elements are interesting because of the construction simplicity, rhythmic repetition and clear appearance. Dovecot on the outbuilding in Benkovac is clearly constructed: stone plates (lintels), plates of the same thickness are vertically laid and build rectangular niches. Each line of rectangular niches is interrupted by the line of triangularly laid stone slates which creates the effect of

horizontal rhythm. The latter plates are regularly half as thick as vertical and horizontal plates. The design is not only spatial and formal interesting, but has – due to its structure – also attractive shading of the gabled wall.

Figure 4: Dovecote, Benkovac, Croatia. Source: ROR documentation sheet Čerina dvori.

Figure 5: Stone roof and roof openings, Kazlje, Slovenija. Source: Neža Čebron.

3 PLATY LIMESTONE AND ARCHITECTURAL GUIDELINES IN CULTURAL HERITAGE

3.1 STONE STRUCTURES

This part is more practical and is arranged as a set of practical examples with architectural applications of practical issues of legislative in the region. General groups of built structures are:

- Dwelling structures;
- Sacred structures;
- Auxiliary structures;
- Walls and
- Architectural Elements.

Any case of architectural heritage has special status in micro and macro location including era of origin; architectural typology and contemporary function. In architectural language we use the term genius loci alias spirit of location which is quite poetical expression. Renovation, reconstruction and other maintenance works at architectural structure should be aligned with the general doctrines as ICOMOS and other local cultural heritage organizations regulations. Protection criteria are basic tools setting plausible tools and policies for management in the field of architectural heritage. Authentic reconstruction plays main role transferring historical human solutions to new generations. Authentic should be structure and it surrounding, with unique character. Architecture without the context of place is just a structure in space, this is an issue of identity of place. The list of the most interesting topics of discussion in terms of architectural and conservation language:

- The size of structure (form of structure and ground floor, height of ridge, height of roof edge, inclination of roofs).
- Architectural elements (roof edge structure, window frames, door frames, shade shelves, balconies …).
- Modular mesh and axis of openings (façade), vertical entities of structure envelope.
- Relationship of origin and new addition in architectural view.
- Existing material and details along new material and contemporary details.
- New functions (transformability), shift of usage.

Renovating build structures with replacing existing materials is not an easy task. Replacing roof stone plates with tiles changes architectural characteristics of building itself (change of roof inclination, roof colour is changed, visual texture of roof is changed, new roof construction and roof composition is changed). Roof tiles have best performance at 30°incilination; stone roof plates need 45° roof inclination. Those changes may be observed at blind facades where a steep (45°) line remains as architectural memory of the past roof.

3.2 ARCHITECTURAL ELEMENTS

In terms of architectural composition the roof plays important role, it is the fifth façade of the building. Roof is exposed to the observers of cultural landscape and affects to architectural expression of the region. Tapestry of roofs is evident when using contemporary internet real time maps (aero photo). Roofs of the buildings are inseparable part of architectural landscape identity. From technical aspect roof covers all vertical and horizontal constructions of the house; it protects them from temporary and permanent humidity (rain, snow). House without the roof is not a house and will rapidly decay. Decay of the buildings is generally non-reversible process; only in rare examples renovation is plausible. The loss is double: loss of building and loss of cultural expression of the region.

Stone roof reconstruction is commonly tied with roof support construction changes (new beams, supplement wood with reinforced concrete and steel constructions). In some cases roof surfaces have inclinations up to 65°. Steep inclination from 45° and higher improves rainwater outflow. Additional benefit of 45° inclination is to be more adaptable as modular composition (square, diagonal of the square, length of elements) and easy to assemble wood joints (reduced probability of structural mistakes).

In previous decades (20th century) at reconstructions of stone roofs several architectural and structural mistakes have been done. Shell of reinforced plates and beams supporting stone roof were common solution when wood supporting structure was not in function anymore. Placing solid belt and rigid concrete inclined roof plate on the stone walls of the building implies higher share of wall cracks at earthquakes. Earthquake ground accelerations develop oscillating of the building. Increased heaviness of roof construction and rigid top cause higher amplitudes leading toward severe building construction damages. In some cases roof structure has fallen off the building and had minor damages, but the building lost the roof. The praxis of reinforced concrete fixation of the roof construction is not preferable and has negative outcomes.

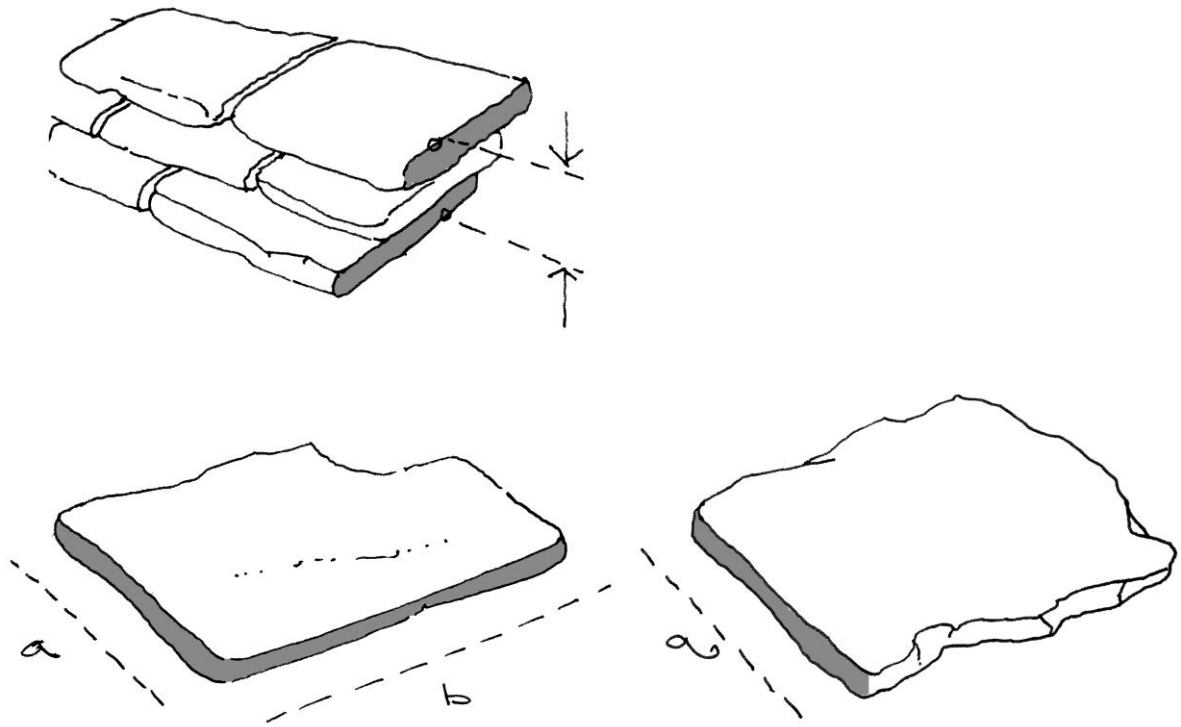


Figure 6: Stone roof plates are set in multi-layered composition. This prevents water penetration into inner part of the building. Minimum set is made of three layers. Roof plates are shaped only at the edges exposed to the sight.

3.2.1 ROOF

At the stone roof reconstruction we should take into account an exact and rough type of cladding. Exact cladding is found at houses and some auxiliary buildings close to the houses. Rough type is used for less important structures and sheds (hiska, kazun, pigpen, tool sheds and latrine). However this generalisation could not be extrapolated to all the regions in the project ROR. Roof cladding depends on several issues and last but not least: most valuable are the experiences of the dry-wall master and the time needed to build the structure.

Researching vernacular architectural heritage constantly exploits importance of relationship from general aspects to specific conditions. All architectural stone structures and stone roof have been built upon availability of the material and craftsman's experiences. Thickness of the limestone plates used for roof and walling are depending on the architectural tradition passed from generation to generation. Quite common we encounter the stone is modestly shaped with minimal interventions.

Limestone roof stone plates weight approximately from 2720 to **2791** kg/m^3. The weight of roof plates has important influence to roof supporting structure, therefore the type of cladding plays substantial role. Weight of roof structure is obligatory specification in the cultural heritage documentation. Along this data the amounts (areas,

volumes) of construction materials are obligatory specification of the execution plans (conservation project and architectural project). Without those specifications architectural management plan is truncated.

Roof weight approximation includes:

a. Weight of mortar in between of stone plates.
b. Weight of boards.
c. Weight of elevated battens.
d. Weight of secondary foil.
e. Weight of rafters with boards.
f. Weight of thermal insulations.
g. Weight of other roof supporting elements (steel plates, screws).
h. Weight of enclosing foil / plates.
i. Weight of the final layer of inner roof enclosure.

The listing is general and may vary from region to region depending on function of the building and regional legislative. Nevertheless roof renovation or reconstruction is in the field of experts in construction and it should be planned as any other architectural project. Inclusion of architect and architectural office in the project is a must and it is part of integral design process. Integral design process include several experts and investor in a team seeking for most effective and sustainable solution.

Table 4: General values of weight for structural seismic calculation. Source: Premrl, 2005.

5 kN/m^2 Stone plates 1,35 kN/m^2 Mortar 0,60 kN/m^2 Wood boards 0,60 kN/m^2 Roof construction 0,80 kN/m^2 Snow
Total: 8,35 kN/m^2

3.2.1.1 TYPOLOGY OF THE ROOFS

1. Step: Documentation

Stone roof plates are set in multi-layered composition. Stone roof is one of the heaviest per square meter in the world. Architectural documentation include graphics: plans, sections, views and details; and texts: technical description and spreadsheet of quantities of materials. Most important are accurate measurements of the elements and dimensions of the structure's global size. The most precise measurement is taken the most accurate calculations of quantities are. Good architectural documentation is a corner stone in the decision making processes in the field of architectural management. Here are some vital elements or steps preparing valuable architectural documentation:

a. Measurement and sketching of the ground floor of the structure (outline walling).

b. Schematic cross section of the structure revealing roof construction and supporting load structure (including scheme of roof edge composition). The purpose of the section is to examine roof inclination, type of cladding, exploring general and specific roof elements, examine roof thickness).
c. Schematic longitudinal (along the roof ridge) section, to present roof ending and gable.

2. Step: Calculation data

Using digital spreadsheets may save time. Measurements should be set in meters (m), inclination slope could be calculated using trigonometric functions (using measurements of the orthogonal triangle).
Precise CAD drawings may contribute to higher quality of final project (some quantities are easier to obtain from Cad drawing rather to calculate them). This is useful when part of the roof is combined with different cladding material (i.e. brick tiles).

3.2.1.2 SIMPLE ROOF (SHED ROOF)

Auxiliary buildings have simple roof constructions and in most cases roof is just a one-sided inclination plate (slope). Structures are simple in their composition and architectural elements are modest and rare.
Most common shape is rectangular or orthogonal, oval and other shape forms are merely exceptions. Bounding walls support wooden rafters, roof plates are rough or minimal shaped. Plates are layered with minimal overlapping.

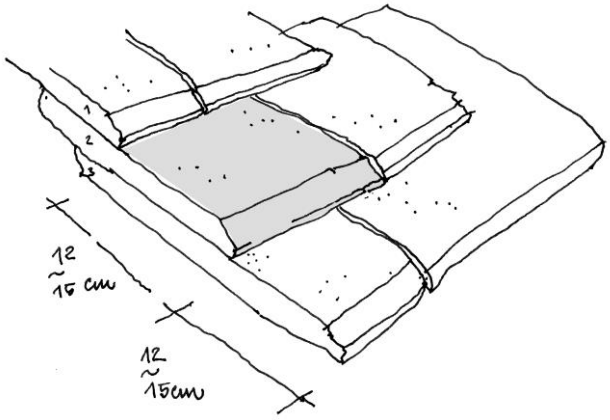


Figure 7: Overlapping stone plates and visual area of the stone plates.

3.2.1.3 GABLE ROOF

The most common roof type is gable roof. They tend to be symmetrical to avoid unequal weight reposition. As we mentioned, the weight of the roof plates reach 500 kg per square meter. Roof masters clad roof in bidirectional symmetrical way: several layers at on and several layers on other side of the roof. Along this smart cladding they select stone plates: bigger pieces are laid at the roof edge and small plates at the ridge ending. This reposition is vertical: heaviest plates are lower than lightest. Visually roof texture

expresses tectonics, too. Tectonics is one of the basic architectural expressions in composition (from big to small and from plain surface to detailed surfaces).

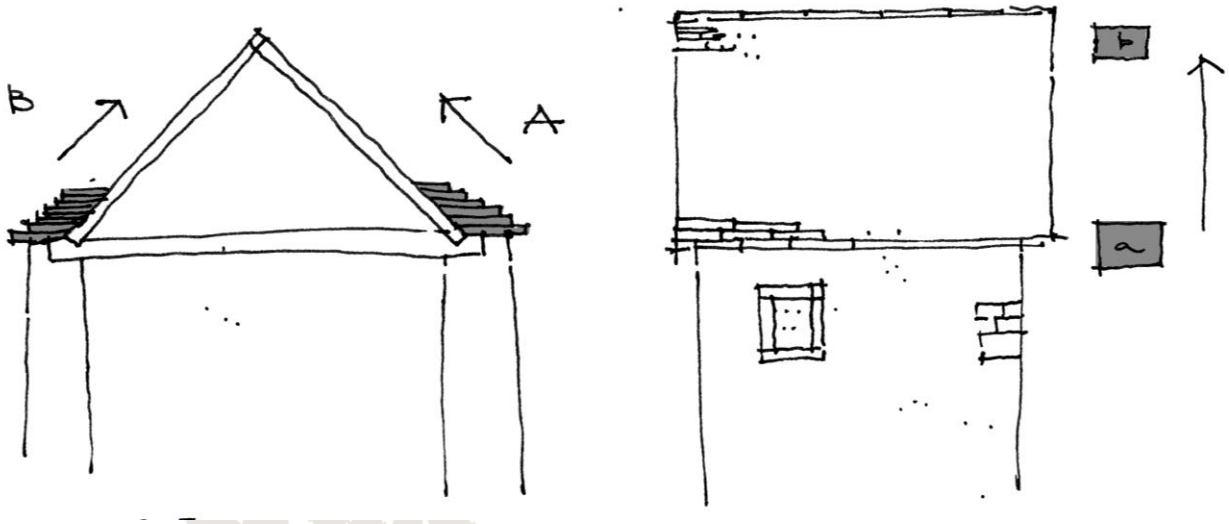


Figure 8: Symmetry of roof cladding and the tectonics of roof plates (big to small).

Figure 9: The size and thickness of roof plates downsizes from the edge to the top of the roof. Vrtujak, Korčula, Croatia. Photo: Domen Zupančič.

3.2.1.4 POLYGONAL ROOF FORMS

Platy limestone plates are roughly shaped elements. Shaping edges is the outmost scope of the detail at roof plates. The basic function of the roof plate is to drainage the rain water form drop to drop off and to have as best as it is possible setting to the other plate. Result of this naturally shaped plates and human ingenuity of forming spatial structures are myriad of oval drywall structures in the Adriatic basin (i.e. hiska, kažun, toreta, vrtujak …). Along several oval stone structures there are some eclectic forms: apsidal

(cylinder + cone) church extensions; house extensions of karstic houses (spahnjenca in Slovenia) and few other examples of roofing at the church entrances. Nevertheless of the type of the polygon structures remain symmetrical in two directions (ground floor and longitudinal section). Most frequent ground floor shape is octagonal with cut sides.

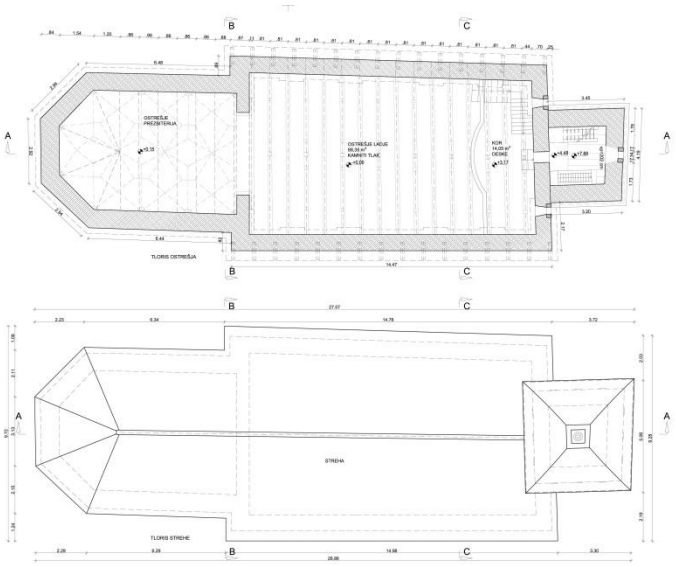


Figure 10: Presbytery has an octagonal shape (cut). Povir. Drawing: Katja Kosič.

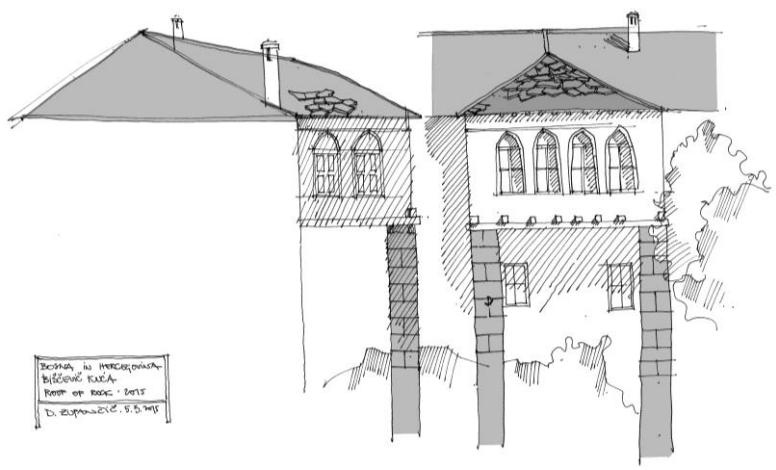


Figure 11: Addition to the Bišćević House in Mostar. Orthogonal addition to the main body of the house has a three-sided roof. Drawing: Domen Zupančič.

3.2.1.5 ROOF SUPPORTING STRUCTURES

Roof supporting structure plays a vital role and could not be separated from the stone roof solution. As we pointed out reinforced supporting structures are optimized for stone walling. Wooden roof structure seems to be more flexible and more efficiently reposition the forces earthquake impulses. Wooden rafters are assembled in a triangle structures using two rafters and connecting beam. The most important role play wooden joints (construction and architectural identity role).

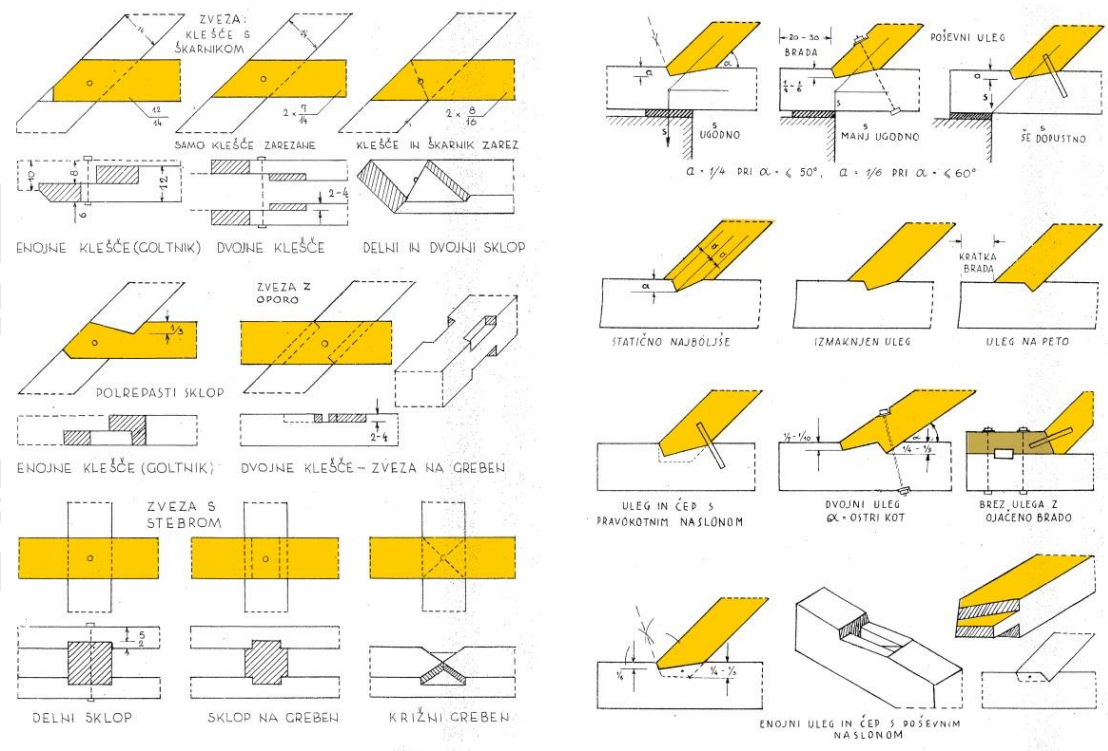


Figure 12: Wooden joints (Karlovšek, Mušič, 1951).

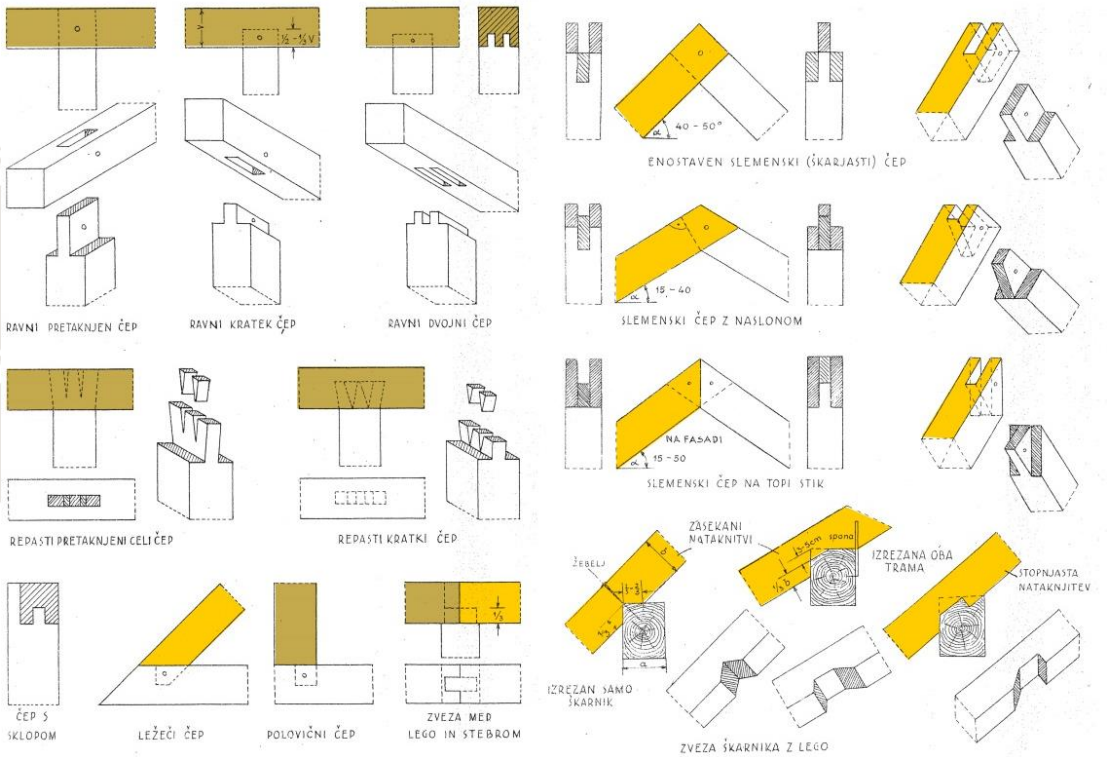


Figure 13: Wooden joints of beams and end fittings of rafters. (Karlovšek, Mušič, 1951).

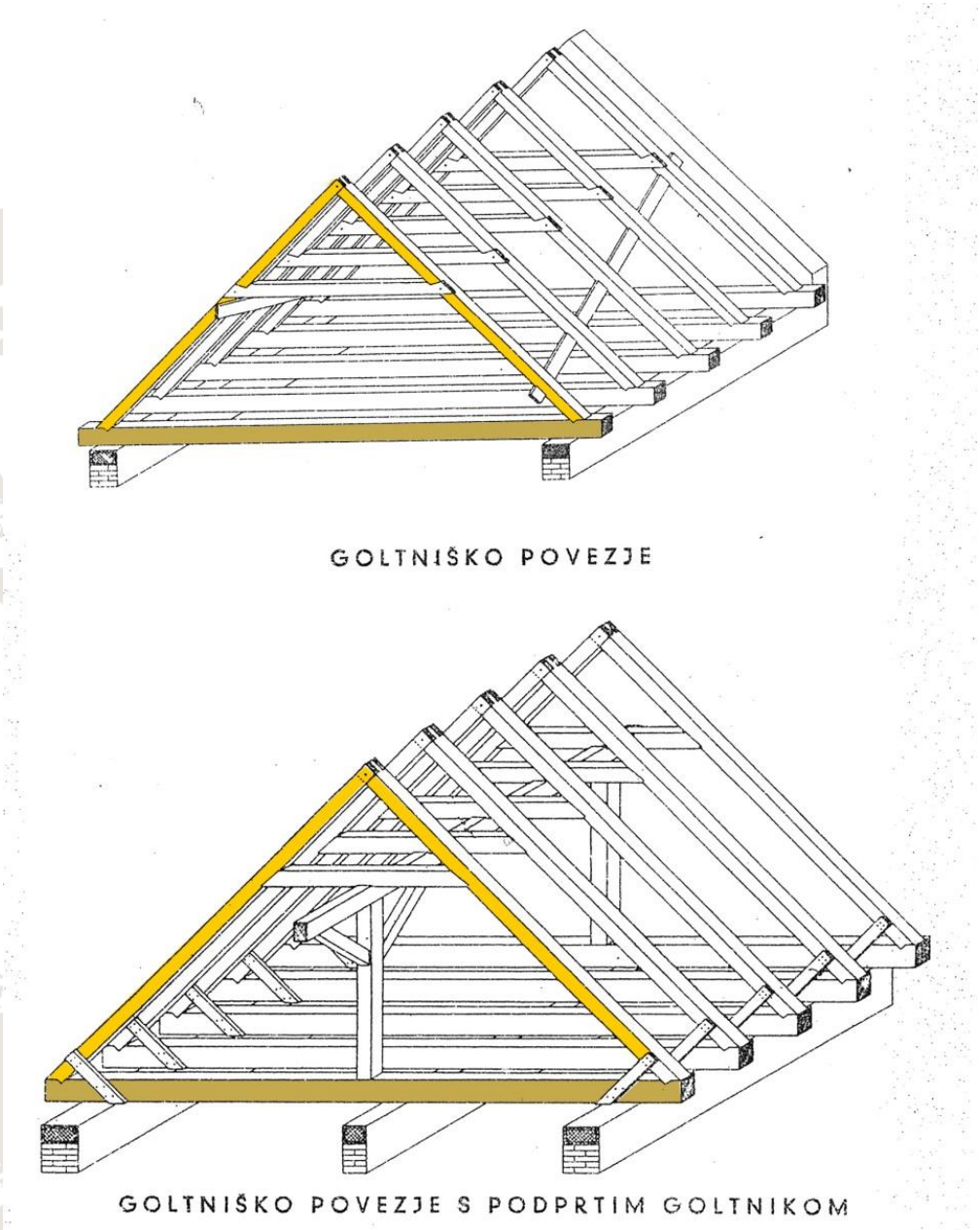


Figure 14: The most common wooden supporting structure of stone roofs (Karlovšek, Mušič, 1951).

3.2.1.6 PLATY LIMESTONE AND TYPES OF ROOF CLADDING

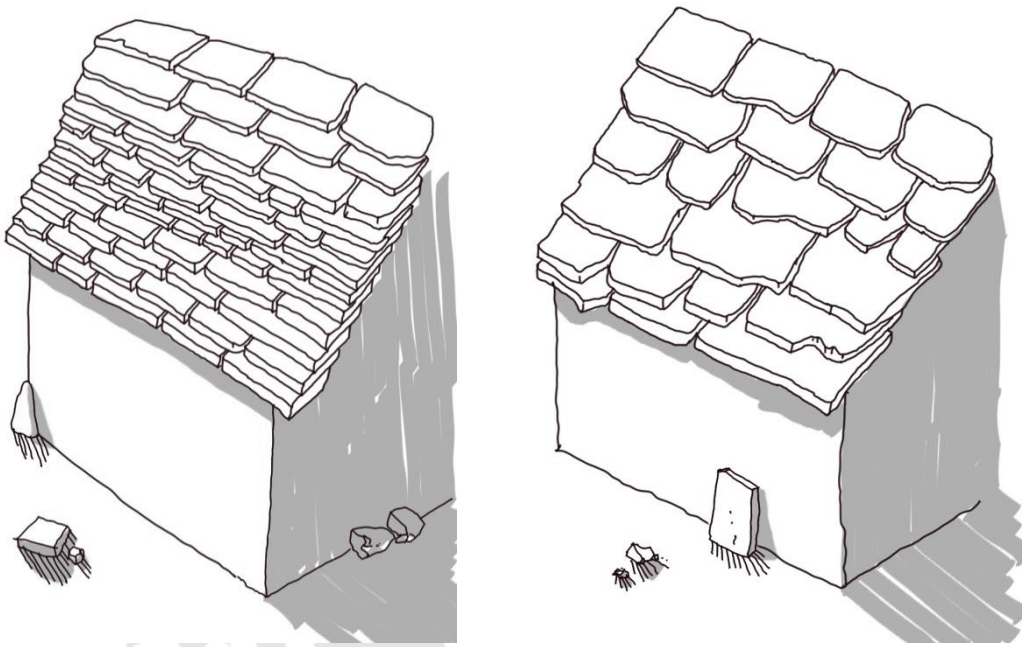


Figure 15: Two examples of roof cladding: exact and rough type of cladding. The denser stones are laid the thicker the roof is. Overlapping plates range from 3 up to 5 layers. Layers of stones may reach up to 25 cm (exact) or 10 cm (rough).

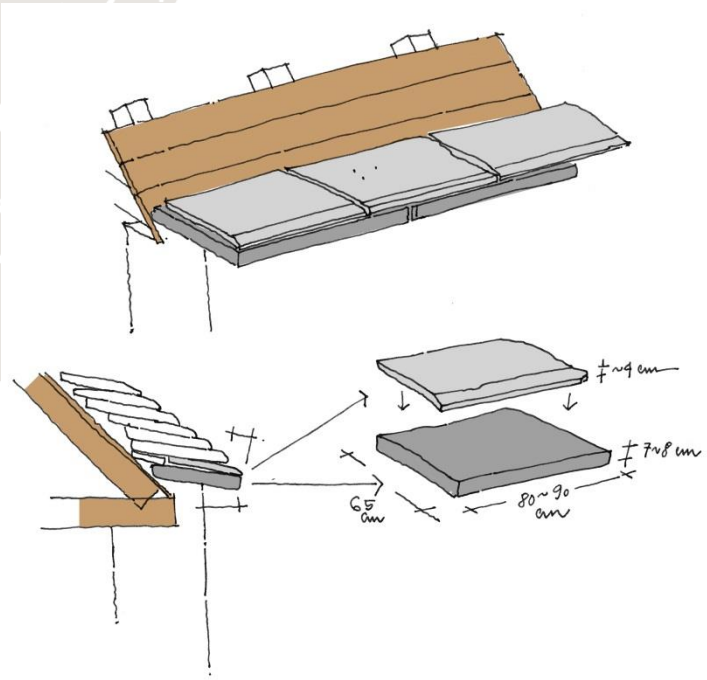


Figure 16: Sketch of most common roof cladding using boards across the rafters. Roof plates are 6 to 8 cm thick with the size of 50x70 cm. The ending edge combines two plates to improve water drainage.

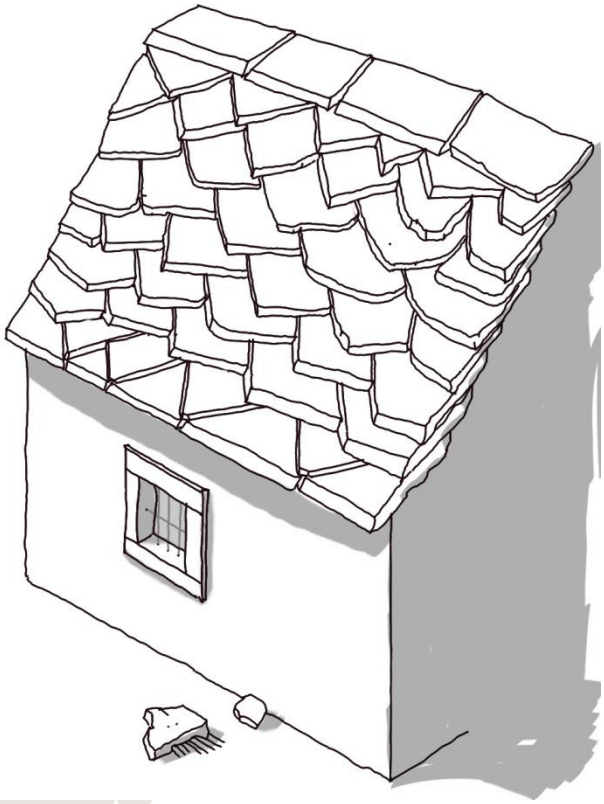


Figure 17: Sketch of roof cladding in Hercegovina and partly in Croatia. Roof plates are as much as 9 cm thick, layered in several layers. The stones are rotated (45°). Rain water flows down the corner edges.

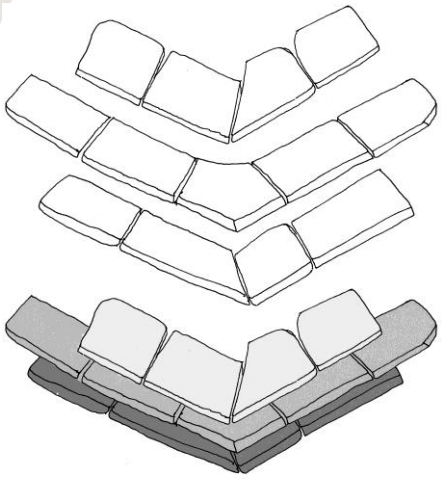


Figure 18: Sketch of roof cladding of multi-corner ground shape. Roof plates are tailored to fit in the roof line. There are up to four roof stone layers in vertical section.

Figure 19: Case of roof structure without additional roof supporting structure. Corbelling is building technique used for simple stone structures as hiška, kažun, vrtujak and other structures in this area. Vrtujak, Korčula, Croatia. Photo: Domen Zupančič.

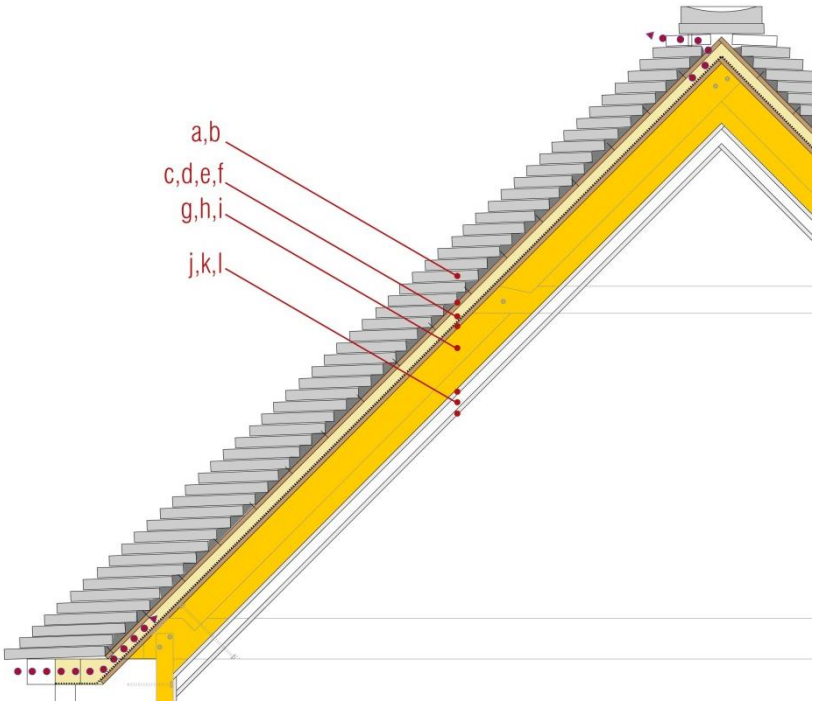


Figure 20: An example of roof construction using spiral screws partly nailed in roof boards. Stone plates are applied in mortar. Construction has air flow channel with secondary roof membrane, thick thermal insulation and air tight membrane. Light plaster boards with installation chamber. Drawing: Domen Zupančič.

a) Limestone roof plates
b) Mortar (calcium & cement mixture)
c) Roof boards with seemingly nailed spiral screws.
d) Air ventilation channel (4 cm).
e) Secondary roof membrane.
f) Roof boards.
g) Roof construction (rafters).
h) Thermal insulation.
i) Air tight membrane.
j) Light plaster boards.
k) Air installation chamber.
l) Finalized ceiling plates / boards.

3.2.1.7 ADDITONAL ROOF ELEMENTS

There are several architectural elements along the stone roof plates. Those elements are part of architectural expression and have functional role. Occasionally are fully decorated and their role is shifted behind those aesthetic add-ons.

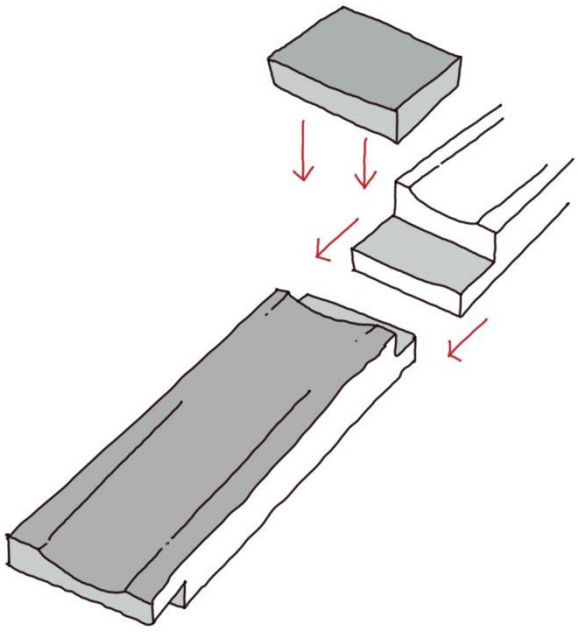


Figure 21: Sketch of roof ridge stones, combined in modular structure with simple joints.

Drainage of rain water is not merely an experiment. Architectural details are not to be overseen. Stone roof has rough surface and plates are assembled in the way to fit each other and keep flow of rain water off the roof. Karstic and Adriatic region have Mediterranean climate where dry, hot summer period is exchanged with rainy winter period. There are several rain water collecting structures (štirna, naplov ...) and are made of stone plates (platy limestone). Those paved surfaces are nor roofs of the buildings. Those collecting surfaces are found on the slopes (Vis, Korčula) or at streets (Lokev). Roof rain water is collected via stone gutter in underground cistern.

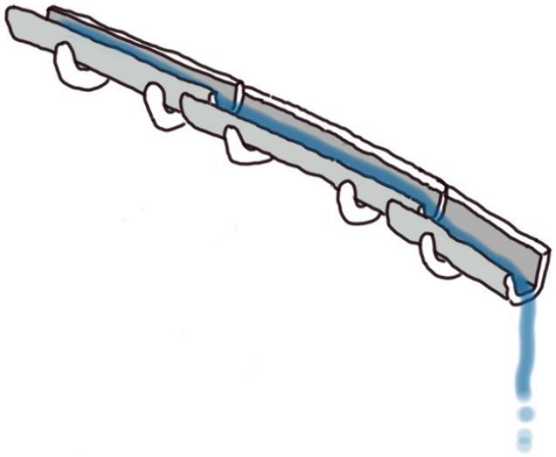


Figure 22: Special stone gutter made of stones holding rain water.

3.2.1.8 ROOF OPENINGS

Roof openings are embedded in the plate line, each opening is part of roof structural composition. Openings are rectangular and have a long, horizontal character. In case of the need for bigger openings gables are introduced.

3.2.2 BUILDING WALLING

Walls determinate building, they are barriers from in and out. In architectural theory they may be treated as a body membrane or envelope. A wall without openings is a barrier, inserting openings in the vertical surfaces is essential to set the character of the built structure. Most evident openings are: doors and windows. Along the openings there are wall add-ons which are used to improve function, prevent damages of the wall and set typology of architecture. Those elements are: stairs, niches (shrines), shelves, lintels, corner stones, corbels and wall columns.

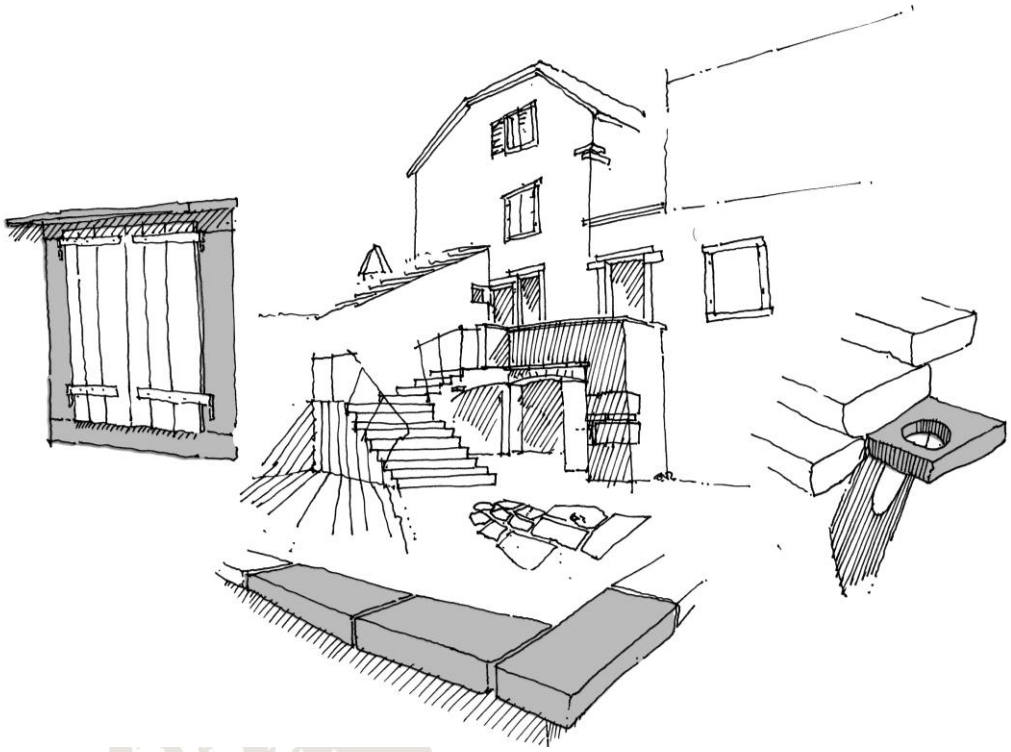


Figure 23: An example of interesting stone elements of stone house, Grohote, Šolta, Croatia.

3.2.2.1 OPENINGS

Openings in the walls have different roles, some have solely functional and others aesthetical role. Most commonly windows, niches and entrances are set in vertical lines one above other. Those lines are called axes and form the rhythm of a façade and shape the character of the building. Inserted stone frames, arches and consoles cast shadows on plain surface of the wall. Shades and shadows of those architectural elements introduce plasticity of the wall plain surface. Along those architectural aspects there are structural engineering needs to arrange openings in that manner. Aspect of repositioning construction weight from roof to ground is vital and could not be put aside. Set of vertical openings detour the forces to the side walls (along the windows and entrance). Small arch redirects the weight of the wall to the sides of the opening.

Figure 24: An example of stone houses with vertically set openings. Orebič, Croatia. Foto: Domen Zupančič.

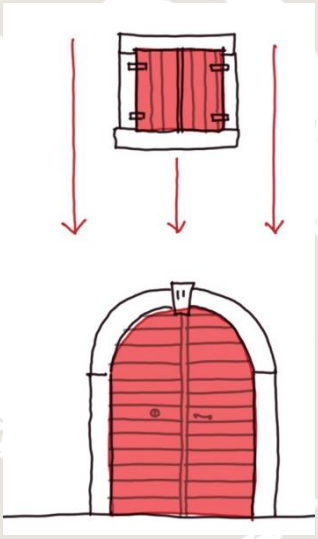


Figure 25: Explanation of weight reposition combined with wall openings. Small arch redirects the weight of the wall to the sides of the opening.

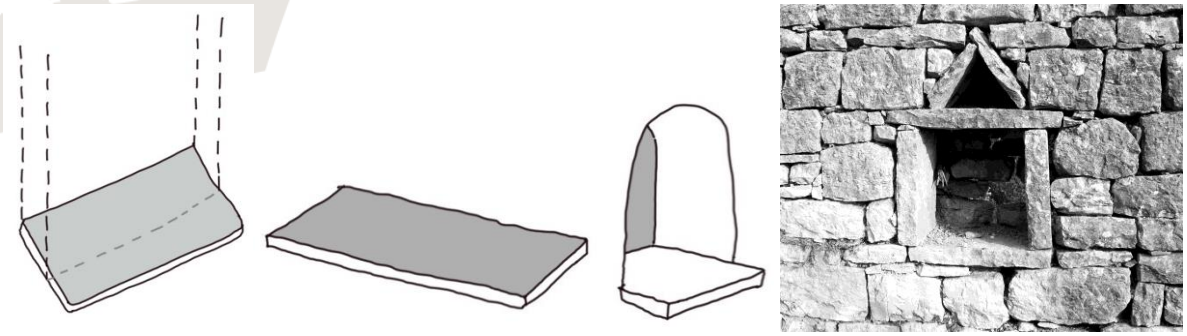


Figure 26: Window shelf and shading plate. Sketch and photo present two examples of niches in the wall. Stones in the shape of triangle redirect the weight along the vertical stone plates.

Figure 27: Combination of shades and stone elements of the facades. Split, Croatia. Photo: Domen Zupančič.

3.2.2.2 THERMAL INSULATION BUILDING ENVELOPE AND SOME INSTALLATION ISSUES

The issue of building energy consummation is a vital aspect of renovation or reconstruction. Installing thermal insulation is regulated using building codes and legislative decrees. Buildings should reduce thermal bridges and fossil fuel needs for heating and hot water production. Following those rigid codes may lead towards solely technical solutions excluding architectural character of cultural heritage. Stone wall house with stone roof has specific needs. Installing thermal insulation outside the wall is not acceptable: there are exposed architectural elements. Thermal insulation would cover them and keep them in hiding from the observer. Architectural expression of the building would be lost and damaged. Installing thermal installation on outside walls and leaving those architectural elements not covered with insulation is non tolerable solution. However those elements are exposed to the observers the façade character is radically changed: it is lost original plasticity of the building's envelope.

The only acceptable solution concerning thermal insulation is inner thermal insulation coating. Renovation with internal thermal coating is part of integrative architectural project. Along several benefits (new installation pipes, electricity, drying systems, ventilation, structural reinforcement, monitoring measurement systems) the internal thermal insulation affects to the size of the ambient.

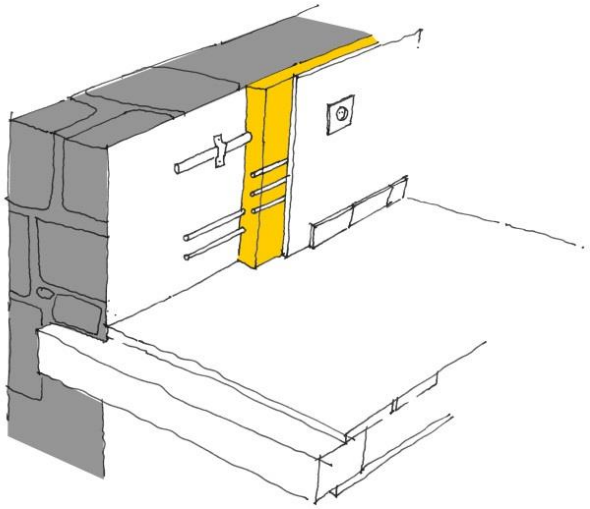


Figure 28: Scheme of possible solution of new plumbing and electricity in the indoor layer of thermal insulation.

Even if the outside thermal insulation is not preferable, there are some exceptions (less important, secondary buildings with no architectural importance). Nevertheless the project should be monitored by an architect and other experts depending on complexity of the renovation. Installing thermal coating at the outside affects to the remodelling roof ending, openings and other façade elements. In some cases those elements are extruded of repositioned from previous positions in the wall. Any those changes are pretentious tasks for engineering team and masons. Any building renovation shift building functionality in new position (technical aspects, heating system, hot-water production) and restructure used dwelling patterns. Along the thermal insulation coating of the building the issue of ground water wall penetration should be solved. Before thermal insulation of the building the drainage of the ground water should be solved. Here we provide a scheme of possible solution with the indoor layer of thermal insulation with excluded thermal bridges.

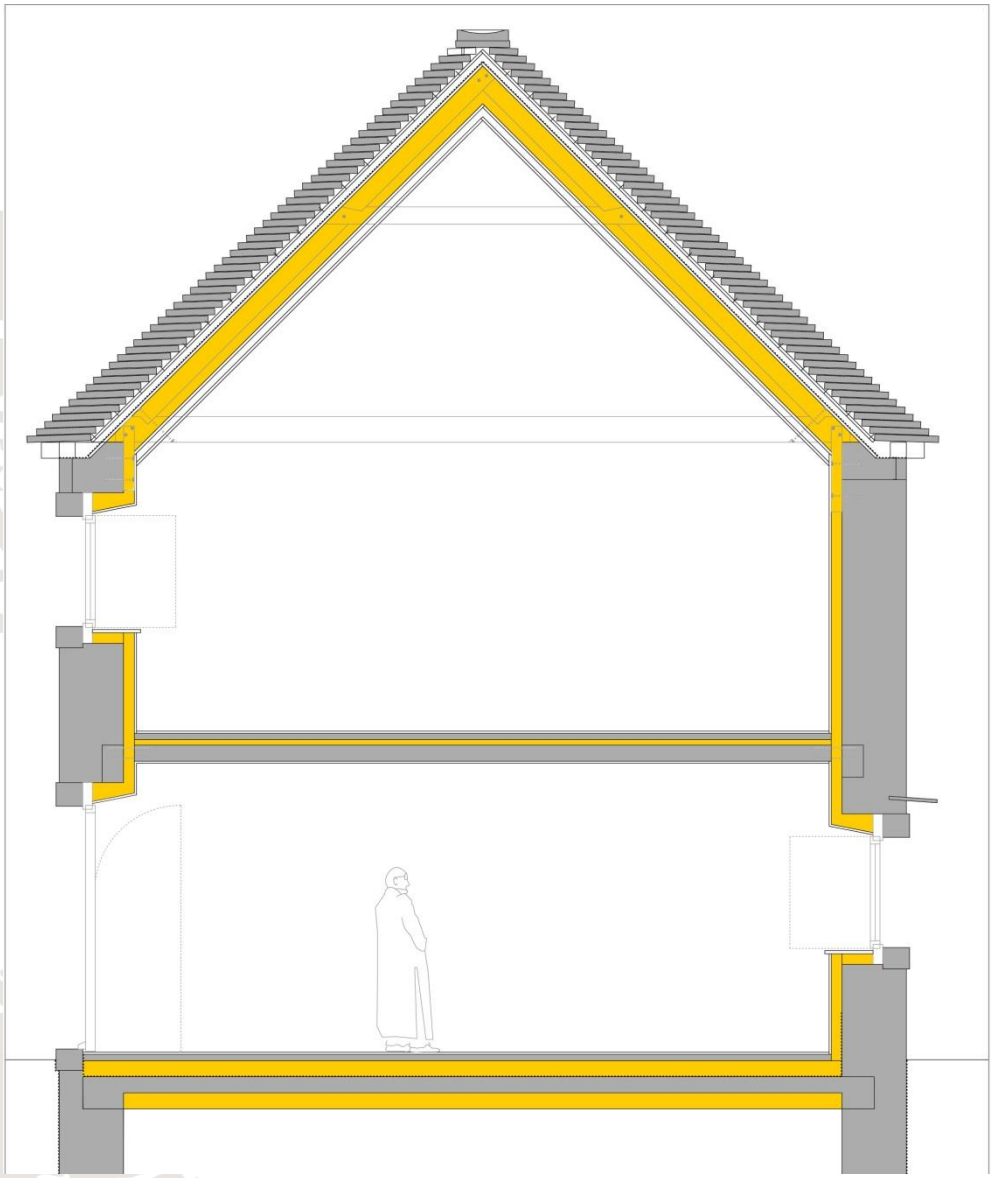


Figure 29: Scheme of possible solution with the indoor layer of thermal insulation with excluded thermal bridges.

The field of renovation and management of the building heritage are constantly shaping. There is no final answer or final solution. Architecture is part of artistic and engineering field, putting dwellers into museums is irrational premise and changing stone structures in trendsetting structures is irrational, too. Bivalence of inhabiting and dwelling is a most valuable issue in management of platy limestone structures.

3.2.2.2 STAIRWAYS, BALCONIES AND SHADING STRUCTURES

Karstic and Adriatic architecture are designed and built to meet the needs of dwellers and include climate conditions. As a rule: architectural heritage structures are fine examples of adapting architectural solutions using low energy resources exploiting human tacit knowledge at full scale. Mediterranean climate has long, dry summer period

and wet cold pert of the year. Those most general conditions are incorporated in the architectural typology of build structures in this region. Buildings have modestly positioned entrances with prevailing light structured shading structures in-front of the buildings. Those structures architecturally depend on functionality of the main building: villa, summer house, herdsman house, church… Villas and churches have more richly designed pergolas and aprons, expressing their importance in the urban tissue.

Figure 30: Shed at church, Gračišče, Croatia. Photo: Jaro Ješe.

Figure 31: Stairs made of stone, Dvigrad, Croatia. Photo: Jaro Ješe.

3.2.2.3 FIREPLACE AND CHIMNEY

In the past food preparation was inevitably tied with the fireplace. Where there is fire there is smoke, too. Placing fireplace and chimney in karstic or Mediterranean house plays an important role. Including climate conditions in design process is not a new invention in architecture. Fireplace and chimney are added to main building, therefore hot air is not kept in the house, instead is diverged through chimney.
Horizontal sections at chimney surfaces have at least dual function: catching rain drops (water nose) and aesthetically contribution to the vertical architectural element (margins of cross section changes). The plates change local air currents and improve smoke flow.

Figure 32: Chimney at the side facade, supported by corbel and arch. The element cross section changes are emphasized using additional horizontal plates. Buzet, Croatia. Photo: Domen Zupančič.

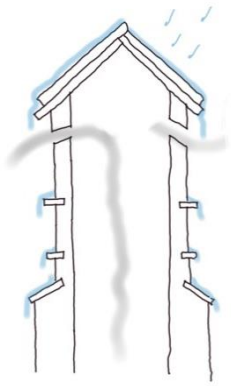


Figure 33: Section plates of the chimney organize better rain water flow and improve air movement.

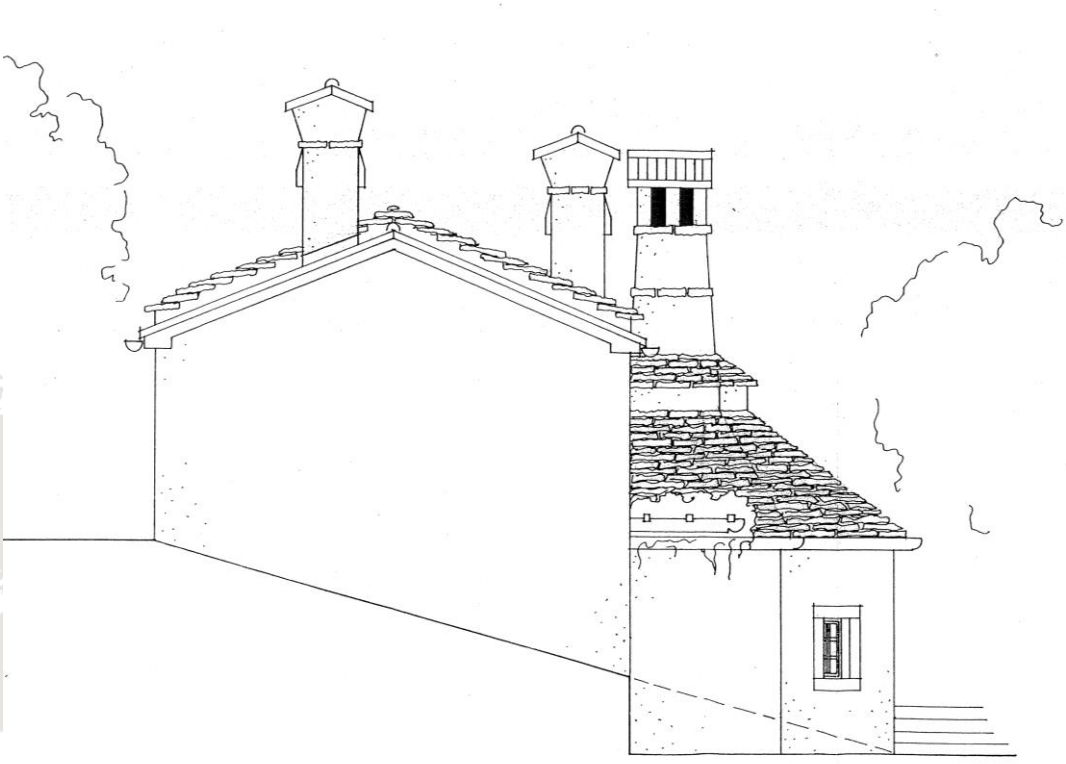


Figure 34: Side view of *spahjnjenca* in Matavun, Slovenija. Drawing: Stojan Lipot.

Figure 35: Open fireplace outside of the building. Corbel stone force smoke to detach from the smoke channel. Vidoviči, Cres, Croatia. Photo: Domen Zupančič.

3.2.2.4 SPECIAL ARCHITECTURAL ELEMENTS

Designing architectural elements and platy limestone architectural structures exceeds borders of walling and placing stone plates on the roof construction. Platy limestone may be used for several architectural elements depending on building's role in the architectural and urban context (i.e. sanctuary, rural shelter, border wall,…). The uniformity of material and great variety of architectural forms express how rich the human creativity is.

In urban contexts consoles are found at the windows: on top with the holes and at the bottom window opening are flat with stylized leaves. They were used for shading textile (curtain) and curtain-rod. Several other elements are made of stone. We strongly advise all participants at renovation project to prepare detailed documentation with the schemes and sketches with explanation of function of the element.

Figure 36: Stone console. Plates may be used as tough for flowers at the top of the border wall. Orebič, Croatia.


Figure 37: Driving stone for entrance door axis.

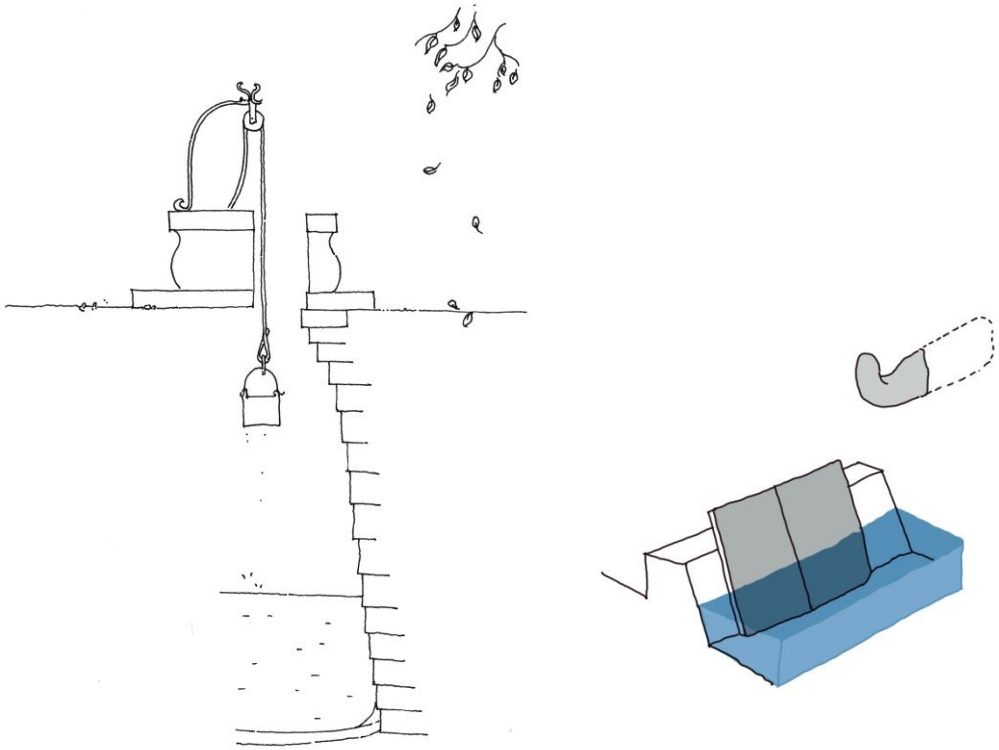


Figure 38: Water well and the section. Washing basin and wall console.

3.2.3 FLOORING AND PAVEMENT DESIGN

Stone used as pavement is a normal response to given circumstances. Stone plates are laid in sand bed. The role of pavement is important due to the location of the pavement. In urban context pavement of the square expresses importance of the city in the region, status of the buildings at the square (city hall, temple, church, public market, street). City squares have a regular grid of pavements and rural squares are more irregular in their pattern presence. Paving stone plates are more exact in the city rather in the village.

3.2.3.1 BACKYARD AND OTHER PUBLIC PAVEMENTS

Public pavement should meet several needs, one of the most important role is functionality and purpose of the paving (different users, seasonal climatic conditions, day/night cycle) combining other aspects like pattern structure, surface management and decay resistance (there are several issues, those are far most evident). .

Figure 39: Rectangular platy limestone plates with open gap with grass. Backyard combines interesting regular pattern using modular shapes of rectangular stones with green grass grid. Divača, Slovenija. Photo: Domen Zupančič.

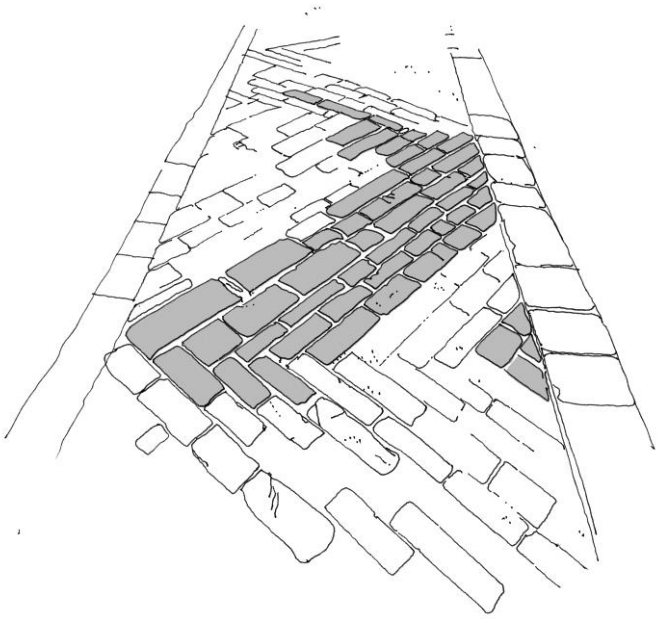


Figure 40: Street pavement with distinctive rectangular borderline and inner diagonal pavement. Combination of two directions includes floor irregularities and street changes of direction.

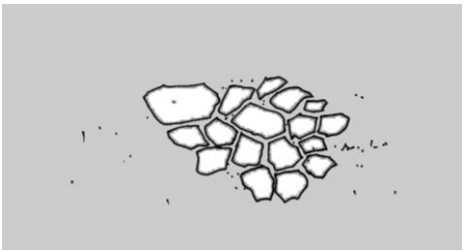


Figure 41: In the countryside stone pavements are rare. Stones are not shaped, just collected and set in the small groups.

3.2.3.2 INNER HOUSE FLOORING

Inner flooring has the same expression as streets or square pavements. Entrance in the house represents the social status of the owner and its aesthetical sense. In ground floor is mostly laid in the sand bed. Flooring plates are shaped or non-shaped in the relation to the building's typology. Rural herdsman shelters have rough stone pavements made of the rest of the plates.

Figure 42: Stone base flooring and its finalization at stone shelter in Slovenia. It is used only rest of stone of platy limestone plates. Photo: Domen Zupančič.

4 CONCLUSION

Platy limestone plates are part of cultural architectural heritage vocabulary in the Karst and Adriatic architecture of the past. Based on this short overview we may conclude there are several architectural elements made of this material. This stone alphabet should not remain in the book of historians and presented in the open air museums. The purpose of the guidelines is to promote this material at basic level aiming towards experts in the field of architecture and the owners of the structures.
Architecture is not still life expression; it is rather spatial response to the human dwelling needs. In last decades new legislative (spatial planning, energy consummation) and building codes were introduced. Changes of are the only constant of our life and may not be excluded from the empirical study in architecture. At the moment of ending project Roof of Rock we are at the turning point: how to establish sustainable use of fossil mineral resources (platy limestone) in architecture. There are several issues to deal with and put them in codes or standardize them. Simple question: how to renovate stone roof evolved into great debate aimed toward providing right material for roof, how to solve needs concerning heating energy, how to solve question of identity and how to manage architectural heritage without making new complex situations.

One of the expert proposals is establishing a bank of platy limestone materials and architectural elements with a data base of origins and possible future needs in the region. Along this we strongly advise to establish certification or providing technical directions for special platy limestone plates including architects at the starting point of any renovating project. Only organised experts may contribute better tailored solutions for owners and communities in the project regions.

5 REFERENCES

Alexander, C., Hansjoachim, N., Alexander, M. M., The Battle for the Life and Beauty of the Earth. A Struggle Between Two World-Systems. New York, Oxford UP, 2012.

Ambrosi A., Degano E., Zaccaria C. A. (ed.), Architettura in pietra a secco. Atti del 1 Seminario internazionale »Architettura in pietra a secco.«. Schena editore, Fasano 1990.

Architectural Heritage Protection, Guidelines for Planning Authorities. Department of the Environment Planning, Dublin, Ireland, 2011.

Bancalari G. 1895, Das lundliche Wohnhaus in den Sudalpen. Braunschweig.

Battaglia, R. 1926, Ricerche paleoetnologiche e folkloristiche sulla casa istriana primitiva. - Atti e memorie della Società Istriana di Archeologia e storia Patria 38/2, ...

Belamarić J., Kamen naš svagdašnji. JU RERA S.D. Split-Mostar 2012.

Belingar, E. (ur), Priročnik kraške suhozidne gradnje. JZ Park Škocjanske jame, Divača, 2014.

Benčič, M. E. (ur.), Priročnik za suhogradnjo. Čezmejno sodelovanje Operativni program IPA Slovenija Hrvaška 2007-2013. Zavod za varstvo kulturne dediščine Slovenije, Ljubljana, 2013.

Benčič, M. E., Priročnik za model revitalizacije naselbinske in stavbne dediščine. Čezmejno sodelovanje Operativni program IPA Slovenija Hrvaška 2007-2013. Zavod za varstvo kulturne dediščine Slovenije, Ljubljana, 2013.

Cumin G. Guida alla Carsia Giulia 1929.

Cvijić J., La péninsule balcanique, Librairie Armand Colin. Paris 1918.

Čeferin, P. (ed), Tektonika v arhitekturi. Frampton – Semper – Bötticher. ZRC SAZU, Ljubljana, 2014.

Deu, Ž., Lah, L., Kamen kot strešna kritina na Krasu. Raziskava. UL FA, Ljubljana, 2005.

Doehne, F. E. (ed), Stone conservation : an overview of current research. Getty Conservation Institute, Los Angeles, California, 2010.

Donnelly, J., A Guide to the Repair of Historic Roofs. The Department of the Environment, Heritage and Local Government, Dublin, Ireland, 2010.

Drempetić J., Zupančič V., Benčič Mohar E. Razvoj modela revitalizacije istrskega podeželja=Razvoj modela istarskog zaleđa. Zavod za varstvo kulturne dediščine Slovenije. Ljubljana 2012.

Fister P. Umetnost stavbarstva na Slovenskem. Ljubljana 1984.

Fister, P., Arhitekturne krajine in regije Slovenije. MOP RS, Urad za prostorsko planiranje RS, Ljubljana, 1993.

Freudenreich A. Narod gradi na ogoljenom Krasu. Zagreb-Beograd 1962.

Gabrovšek, S. F. (ed), Pirc, M. (ed), Roškar, S. (ed), Rotar, K. T. (ed), Brezmejna doživetja kulturne dediščine – stavbna dediščina in kultura bivanja v Karavankah, Priročnik. "CULTH:EX CAR-GOR", BSC, Poslovno podporni center, Kranj, 2012.

Golež, M., Raziskave kamnite kritine na Krasu. Zavod za gradbeništvo Slovenije, Ljubljana, 2004.

Gradimo u kamenu. Priručnik o suhozidnoj baštini i vještini gradnje. 4 GRADA DRAGODID,. Slobodna Dalmacija d. d. Split 2013.

Guštin M., Gradišča. Odsevi prazgodovinske poselitve = Hillforts. Reflections of prehistoric settlement. AR, Arhit. razisk. 3, 2011, 27-32.

Guštin, M. (ed), Nypan, T. (ed), Cultural heritage and legal aspects in Europe. Annales Mediterranea, Koper, 2010.

Guštin, M. (ed.), Volčji grad. Komen: Občina, 2012.

Guštin, M., Kalčić, H.,Volčji Grad: domačija Mržkovih nekdaj in jutri. V: Guštin, M. (ed.), Volčji grad. Komen: Občina, 2012.

Guštin, M., Jogan, S., The fate of cultural monuments : the gap between what is decreed and what is put into effect. V: Stokin, M., Ifko, S. (eds.), International legal standards for heritage protection in a period of economic recession and tools for safeguarding protection standards, (Monographic publications of ICOMOS Slovenia, 01). Ljubljana: ICOMOS/SI International Council on Monuments and Sites, Združenje za ohranjanje spomenikov in spomeniških območij, 2014, str. 39-47.

Hadžimuhamedović A., Naslijeđe – rat i mir. Ars Longa. Sarajevo 2015.

Harej Z., Semerani L., Križnar N., Galluzzo L., Sgubbi G., Černigoj A., Spacal L., Schumann G., Kamnita hiša. Tipi in oblike. Luigi Reverdito editore. Trento 1984.

Jejčič, N., Kritina iz kamna – skrle ali škrle. Primorske novice, Priloga Učinkovita energija, oktober 2014.

Jurkovšek, B., Cvetko, T. B., Kolar-Jurkovšek, T., Geologija Krasa. Geološki zavod Slovenije, Ljubljana, 2013.

Juvanec B., Arhitektura Slovenije 5. Vernakularna arhitektura, kraški svet=Architectureof Slovenia 5. Vernacular architecture, the karst. fakulteta za arhitekturo. Ljubljana 2012.
Juvanec B., Kamen na kamen. Založba i2. Ljubljana 2005.
Juvanec, B., Arhitektura Slovenije 5: Vernakularna arhitektura, Kraški svet. I2 in UL FA, Ljubljana, 2013.
Juvanec, B., Kamen na kamen. I2, Ljubljana, 2005.
Karlovšek, J., Mušič, V., Strešne konstrukcije, Gradbeni elementi VIII. Skripta za visoke in nizke gradnje, Gradbeni tehnikum LRS, DZS, Ljubljana, 1951.
Kolenc N., Torbica A. (ur.), Kraška hiša. Priročnik za prenovo. Občina Komen. Komen 2012.
Kolenc, N. (ed), Torbica, A. (ed), Kraška hiša. Priročnik za prenovo. Občina Komen, Komen, 2012.
Kosič K., M. Skubin, Katalog bistvenih elementov stavbne dediščine v Betanji, Matavunu in Škocjanu. Park Škocjanske jame. Škocjan 2014.
Kosič, K., Skubin, M., Katalog bistvenih elementov stavbne dediščine v Betanji, Matavun in Škocjanu. Park Škocjanske jame, Matavun, 2014.
Kranjc D. (ur.), Zid na suho. Zbornik strokovnih spisov o kraškem suhem zidu / Muro a secco. racolta di testi tecnici sui muri a secco del Carso. Park Škocjanske jame 2014.
Kregar R., Naš kmečki dom I. del. Hiša na vasi. »Naš dom« Gradbena strokovna založba. Ljubljana 1947.
Lago L. (ur.), Pietra d'Istria. Architetture e territorio. Mondadori Electa 2007.
Lah L. , Prenova stavbne dediščine na podeželju - Kras. Dolenjska založba 1994.
Marušič, I., Regionalna razdelitev krajinskih tipov v Sloveniji. MOP RS Urad za prostorsko planiranje RS, Ljubljana, Slovenija, 1998.
Miličević J., Primjer seoskog doma srednje Istre i njegovo funkcioniranje u užoj okolici. - Tradicionalna stambena kuća. 29. savjetovanje udruženja Arbeitskreises für Hausforschung. Zagreb 1980, xx-xx.
Mottola A., Ruzzier L., Umile Carso. La editoriale libreria. Trieste 1967
Murko M., Zur Geschichte des volkstumlichen Hauses bei den Sudslaven, Mitt. Anthr. Ges. in Wien, 1905 e 1906.
Mušič M., Obnova slovenske vasi. Družba sv. Mohorja. Celje 1947.
Pertot, I., Kamnita dediščina Krasa, obdelava in projektiranje kamna v kamnoseški obrti. Mladika, Trst, 1997.
Pickles, D. (ed), Brocklebank, I. (ed) , Wood, C. (ed), Energy Efficiency and Historic Buildings, Insulating roofs at rafter level. English Heritage, UK, 2012.
Pieri F., Biolchi S., Platy limestones. 10 case studies in the Classical Karst. Edizioni di Universita di Trieste. Trieste 2014.
Pieri, F. et al (ed), Platy limestones – 10 case studies in the Classical Karst. Dipartimento di Matematica e Geoscienze, Università degli Studi di Trieste. Trieste. (spletna izdaja: http://roofofrock.eu/media/platy-limestones/#/50/), 2014.
Premrl, B., Kamnita strešna kritina stavb na Primorskem II. Raziskava. Zavod za varstvo kulturne dediščine Slovenije, Restavratorski center, Ljubljana, 2005.
Premrl, B., Kamnita strešna kritina stavb na Primorskem in izvor gradiva zanjo. Raziskava. Uprava RS za kulturno dediščino, Ljubljana, 2003.
Premrl. B., Kamnita strešna kritina stavb na Primorskem in izvor gradiva zanjo. Zavod za varstvo kulturne dediščine Slovenije. Ljubljana 2004.
Renčelj S., Kras. Kamen in življenje. Založba Libris. Koper 2006.
Renčelj, S., Lah, L., Kraška hiša in arhitektura Krasa. Libris, Koper, 2004.
Renčelj S., Lah L., Kraška hiša in Arhitektura Krasa med očarljivostjo in vsakdanom. Založba Libris. Koper 2008.
Strempfl-Ledl, G., Luser, H., Enzinger, K. (eds.), Denkmalpflege Architektur Energieoptimierung. Internationale Städteforum Graz, Graz, 2010.
The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, 2013.
Valvasor J. V, Die Ehre dess Hertzogthums Crain: das ist, Wahre, gründliche, und recht eigendliche Belegen- und Beschaffenheit dieses Römisch-Keyserlichen herrlichen Erblandes; Laybach 1689.
Vergès-Belmin, V. (ed.), Illustrated glossary on stone deterioration patterns. ICOMOS International Scientific Committee for Stone (ISCS), Marne, France, 2008.
Zupančič V., Benčič Mohar E., Revitalizacija kulturne dediščine istrskega podeželja. Zavod za varstvo kulturne dediščine Slovenije. Ljubljana 2012.
Zupančič, D., Juvanec, B., Material in oblika. UL FA, Ljubljana, 2013.
Zupančič, D., Pastirska hiška v Lipici. Revija Kras, št. 118-119, julij, p. 28-31., 2012.

Zupančič, D., Suhi zid na Krasu. AR arhitektura, raziskave 2012/2+3, p. 80-83., 2012.
Zupančič, D., Suhozid in konstrukcije v suhem zidu. Revija Kras, št. 109, april, p. 16-19., 2011.
Zupančič, D., Tehnike in gradnje konstrukcij v tehniki suhi zid. JZ Park Škocjanske jame, Divača, 2014.
Zupančič, D., Vrednote vernakularne pastirske arhitekture Slovenije. AR arhitektura, raziskave 2012/1, p. 50-51., 2012.
Zupančič, D., Zid naj ne razmejuje: združuje naj ljudi z znanjem in kulturo. Revija Kras, št. 110-111, junij, p. 22-25., 2011.

Sprecomah EU
http://www.sprecomah.eu/site/
Slovenian CH organization, advices for heritage owners
http://www.zvkds.si/sl/zvkds/nasveti-za-lastnike/
Registry of culural heritage structures in Slovenia
http://rkd.situla.org/
Interactive map of cultural heritage GIS elements
http://giskd6s.situla.org/giskd/
Doctrine 1: ICOMOS
http://www.icomos.si/documents/pdf/doktrina.pdf
Doctrine 2: ICOMOS
http://www.icomos.si/index.php/sl/novice/zadnje-novice/57-doktrina-2-mednarodne-listine-in-dokumenti-icomos
Historical photo documentation, some Slovene locations
http://www.etno-muzej.si/sl/spletne-zbirke/lokacije/smarje-pri-sezani
Architectural Workshop, Hiska in Lipica
http://vimeo.com/41413185
Dry walling Documentary
http://www.vimeo.com/rbertoni/suhogradnja
ICOMOS Resolution 17GA 2011/38- Energy Conservation and sustainable development
whc.unesco.org/document/11677
Pravilnik o učinkoviti rabi energije v stavbah (Uradni list RS, št.52/10) (ENG: Rules on efficient use of energy in buildings with a technical guideline)
http://www.pisrs.si/Pis.web/pregledPredpisa?id=PRAV10043

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6 INDEX

6.1 TABLES

6.2 FIGURES

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