Funded by the European Union

REPUBLIKA E SHQIPËRISË
MINISTRIA E KULTURËS

UNOPS

EU4CULTURE

ARCHITECTURAL REPORT
KURCAJ BRIDGE

ATELIER 4
ARCHITECTURE • ENGINEERING • CONSULTING

TABLE OF CONTENTS

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

1. GENERAL

1.1 INRODUCTION

Kurcaj Bridge is located in the district of Kruja, which is one of the 36 districts of Albania, which is part of the Durres region. It has 67,686 inhabitants (according to 2009), an area of 372 sq km with capital Kruja. The district of Kruja includes under administration 2 municipalities and 4 communes and among them Nikël commune. Nikël commune has the following villages: Nikël, Tapize, Qereke, Rinasi, Verjon, Bara Mukaj, Kurcaj, Zeze. Kurcaj Bridge is located south of Kruja at the entrance of Kurcaj village on the Kruja side, above the Zeza River that originates from Qafa e Shtamës.

Kurcaj Bridge is an 18th century construction. Kurcaj Bridge has bën declared a cultural monument of Category I by the Ministry of Education and Culture (Directorate of Culture), with Decision no. 786/1, dated 15.11.1984.

The map below shows the position of the Kurcaj Bridge monument over the Zeze River, located in the Kruja Region at a distance of 28km away from the center of Tirana and about 54 minutes away. Distance from the main road Tirana - Kamëz - Fushë Krujë is 14.7 km.
Kurcaj Bridge is located 1.6 km away from Kurcaj village with geographical coordinates referring to the KRGJSH system: 485072.899; 4592813.329.

1.2 PURPOSE

Kruja has a year-round touristic activity going on, as it is favored by the values the city carries, as well as by its strategic location that connects it with the albanian capital or other strategic areas in the country. Consequently, Kruja can be considered to be an easily accessible city to tourists and locals, all the whille offering a wide range of points of interest to visit. Among them, Ura Kurcaj, a monument currently left at the mercy of time and the action of natural agents (water, vegetation). The bridge offers the opportunity to transform into a valuable attractive location in Kruja, integrating it with the landscape, to attract as many visitors as possible, while preserving the historical, traditional and monumental values it carries.

The project proposal to preserve the values of the Kurcaj bridge is an emergent need to preserve the architectural heritage, especially after the damages provenien from the earthquake of November 2019, which has highlighted the deeriorations developed and reinforced overtime. Judging by the current condition of this cultural monument of the first category, emergent interventions are required, so that the bridge of Kurcaj over the river Zerzë does not endanger the disappearance from the map of monuments of special historical values.

The proposed interventions will consist of preserving the original features of the building and restoring all its key components. The crucial purpose of this intervention is to intertwine its current

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

conditions, the necessary ones and the optimal functional conditions to convert the building into a contemporary museum , while approaching a modern perspective.

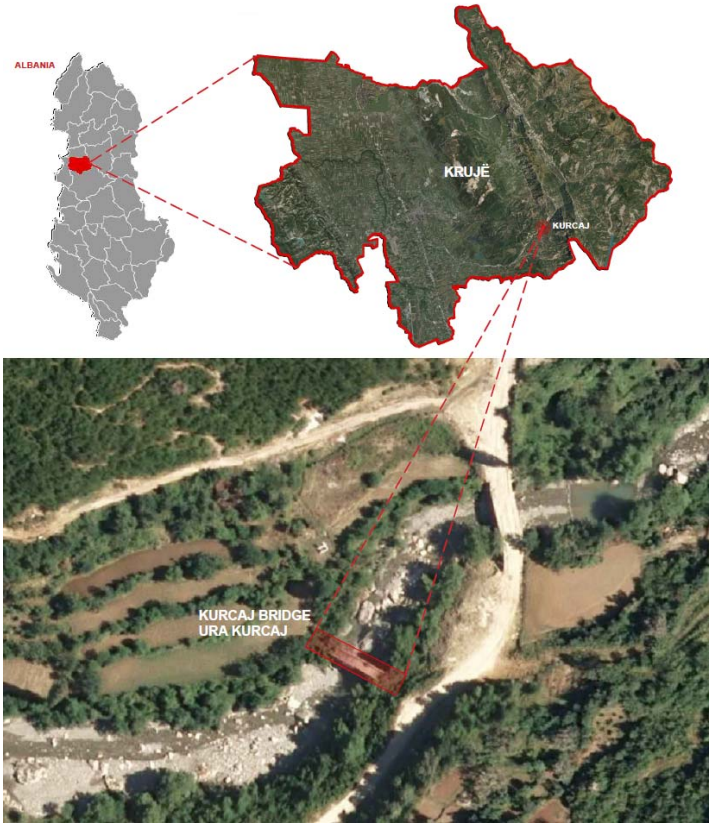

Fig. 1. Aerial photo of the Kurcaj bridge.

1.3 METHODOLOGY APPROACH

Since the bridge is entitled to Cultural Monuments, pursuant to Law 27/2018 "On Cultural Heritage and Museums", the whole project follows the instructions of the Ministry of Culture aimed at providing, protecting and conserving its features.

The methodological approach adopted for the architectural and restoration project and for the various interventions of the structural consolidation of the Monument, takes into account the criterion of minimum interventions, accepted both nationally and internationally (eg ICCROM, ICOMOS).

The first stage is the identification of the degradation phenomena, proceeding further with the selection of the most appropriate interventions for the conservation.

Regarding the restoration of the surfaces, the main forms of degradation are being identified, through a survey, detecting and sketching of all forms of chemical-physical deterioration and the selection of the most appropriate interventions to allow their improvement. This should be considered as the priority of the physical, structural and formal restoration of the monument as a prerequisite to improve its functional aspects and connection with the context.

After the last earthquake, there were identified particular damages of certain parts of the monument, for which, after diagnosing the materials and its structure and conducting careful surveys, the restoration and reconstruction plans are being prepared, while contemplating its original materials ad features.

The general methodology on which the study and restoration of the Kurcaj Bridge, a monument of the first category, is based is mainly organized accordig to these stages, as described below:

- ✓ Collection of existing data on the structure such as: geographical position and urban situation, the history of the monument to the date including restoration attempts over the years, to discuss about how they have affected the performance of the structure and to understand how the bridge has reached till these days, geometry, materials and its stability.
- ✓ Collection of data on seismic design criteria of the building (at the time of its design); Identification of geometric data characteristic for the relevant structure and details
- ✓ Identify the characteristics and condition of the bridge materials
- ✓ Collection of data on possible deteriorations of the bridge's structure, in addition to its materials, the geometrical configuration as well as the relationship it establishes with the terrain currently, taking into account the various previous repairs / attempts that have been carried overtime, which purpose was to protect the bridge from the river bank activity.
- ✓ Reassessment of the loads acting on the structure in cases when the bridge serves different purposes from those provided at the time of its design, considering the category of importance of the bridge as a cultural and heritage monument
- ✓ Capacity assessment of structural elements
- ✓ Findings on the final condition of the bridge after the restoration interventions and their impact on the bridge itself or even in the landscape, given the importance that the Kurcaj bridge is presumed to have in many aspects in Kruja.

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

2. HISTORY

The Kruja Highlands are rich in early constructions, among which are the medieval bridges. The river Zeza passes through Shkalë e Zeza, between the mountains of Dajti and that of Kruja, after the bridge of Abdyl Aga in Gryke, over the river Zeza, in the village of Kurcaj.

At the East of Kruja, there is a stone bridge with an arch, which in the Middle Ages connected Kruja with Tirana, through a caravan route. Kurcaj Bridge is thought to be a construction of the XVIII century, a period during which many new bridges were built in Albania, mainly along cobbled roads.

Kurcaj Bridge is located in the Kruja Region with a distance of 28km away from the center of Tirana (about 54mins. away). The distance from the main road Tirana-Kamëz-Fushë Krujë is 14.7 km. Kurcaj Bridge is located on the Zeza River in the village of Kurcaj. It used to be part of the early caravan route that connected Kruja with Tirana through Mukje and Zallherri. The bridge has its distinctive and identifying element: the large semicircular arch and wo side niches, the left closed with stones. In terms of typology, it seems to belong to a period during which the Droja bridge was built, currently dilapidated.

This bridge presents interest as an historical evidence. The Kurcaj Bridge is an 18th century construction. It has been declared a cultural monument by the Ministry of Education and Culture (Directorate of Culture), with Decision no. 786/1, dated 15.11.1984.

2.1 RESTORATION INERVENTIONS DURING DIFFERENT PERIODS OF TIME.

The Kurcaj Bridge over the Zeza River connected Kruja with the village of Kurcaj and further Nikël. Initially there were thrë circular vaults (according to the monument card). During the Second World War, the central vault also suffered damages which were restored after the war. The bridge has suffered damage and restoration interventions.

Around the 80s a restoration of the bridge was done, as in one window the transverse crack in its arch had started and ended at the end of the bridge arm near the foundations, as a result of the rains the sagging of the wing and its foundations on this side had become problematic . This restoration has not bën done properly, as closing the left window has made it more problematic instead of easing the force on the arm until it has resulted in the collapse of the left arm.

However, in its structure, except for the need of immediate reinforcing interventions in its left wing as well as consolidations and repairs of the "extinguisher", conservation of walls and arches and keeping the vegetation under control. Fortunately, no cracks in the outer part of the arch have been identified so far, although some detachments of its second vault should be repaired as soon as possible in order to avoid breaking the static balances of the structure. Referring to the photos from 2010, the right arm of the bridge was connected to the ground.

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

Fig. 2. Photo of 1982

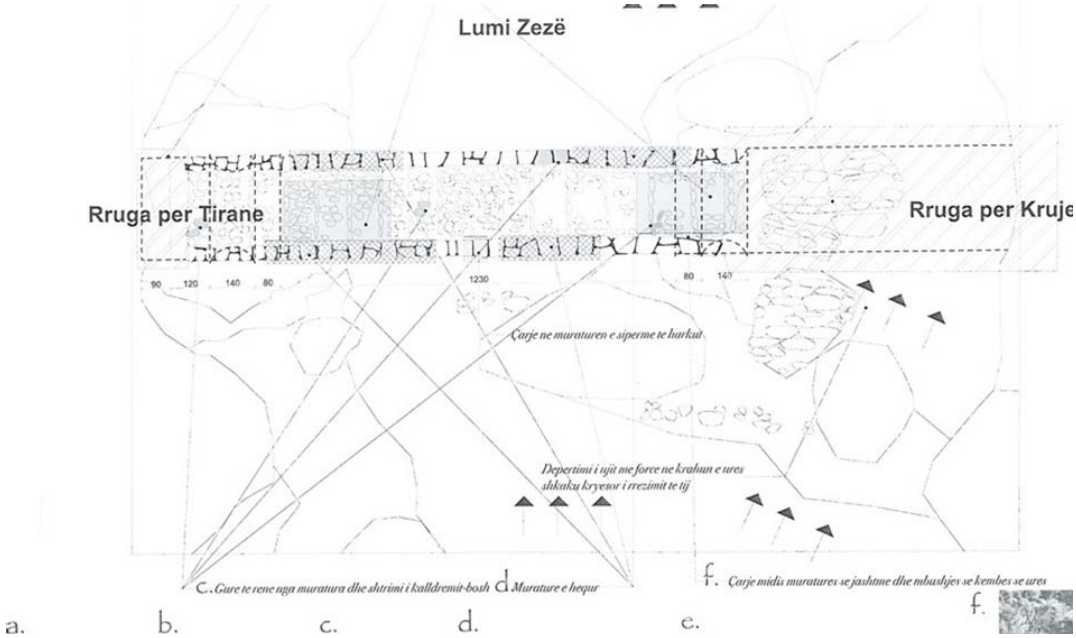

Fig. 3. Planimetry of previous interventions projects (extracted from the IMK Archive)

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

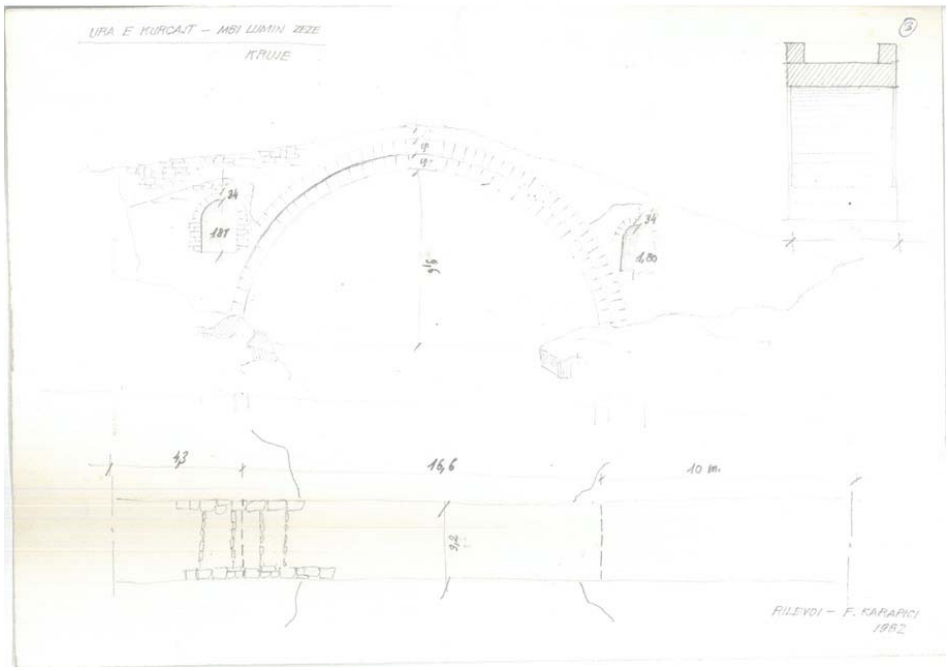

Fig. 4. Existing planimetry (extracted from the IMK Archive)

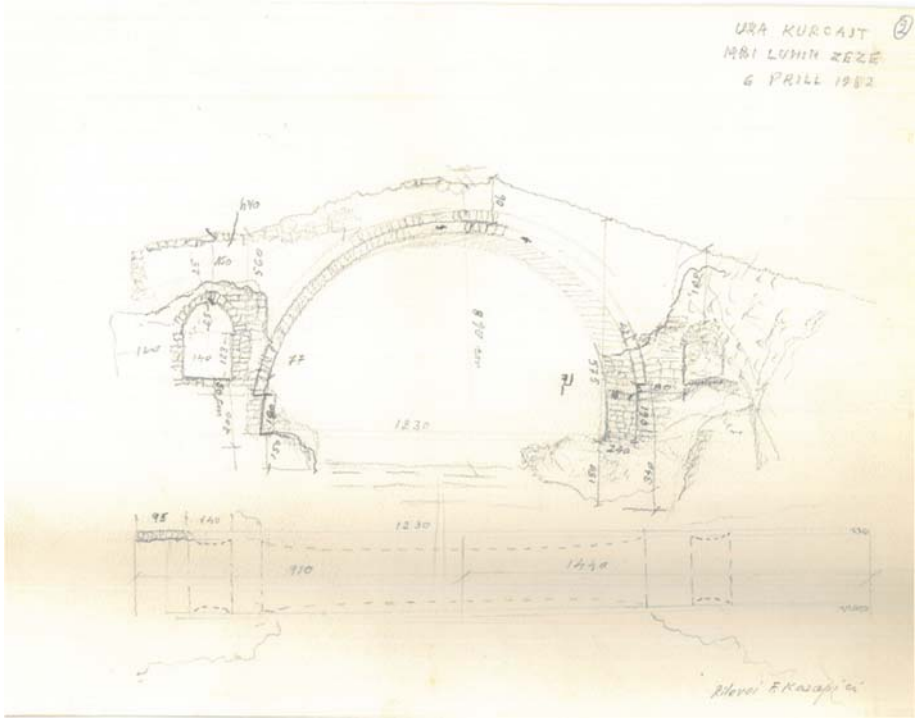

Fig. 5. Structural section (extracted from the IMK Archive)

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

Fig. 6. Photo from the damages found in the project of 2018 (extracted from the IMK Archive)

Fig. 7. Photo of the year 2010

3. CURRENT CONDITION ANALYSIS

3.1 THE URBAN CONDITION

• The Accessibility

The monument can be accessed by a partially damaged road which makes it difficult to access the bridge without the minimal infrastructural conditions. This is emphasized by the terrain, which also makes it difficult to access.

Currently access to the bridge is difficult because the terrain is sloppy, part of the bridge has collapsed and there is no ramp or access ladder from the existing road to the bridge. The terrain around the bridge is intact and there are some collapsed remains of the bridge around its foot. There are low and high greenery.

• The Views

During the visit to the area, it was noticed that the bridge is located in a terrain from which, not only it is difficult to access but also it can be viewed with the same difficulty when moving on the highway. Erosion and river activity have done their part in "hiding" the bridge from the visitor's eye. Currently, it is difficult for the bridge to be considered a point of interest, despite the sights it offers.

• The Protective Wall

Based on the data obtained, the river flows have caused damage to the foundation of the bridge, which has affected its structural stability. As mentioned above, the Kurcaj bridge showed problems in access, which is further reinforced by its lack of stability or the degradation of the essential reinforcing elements / wear over time.

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

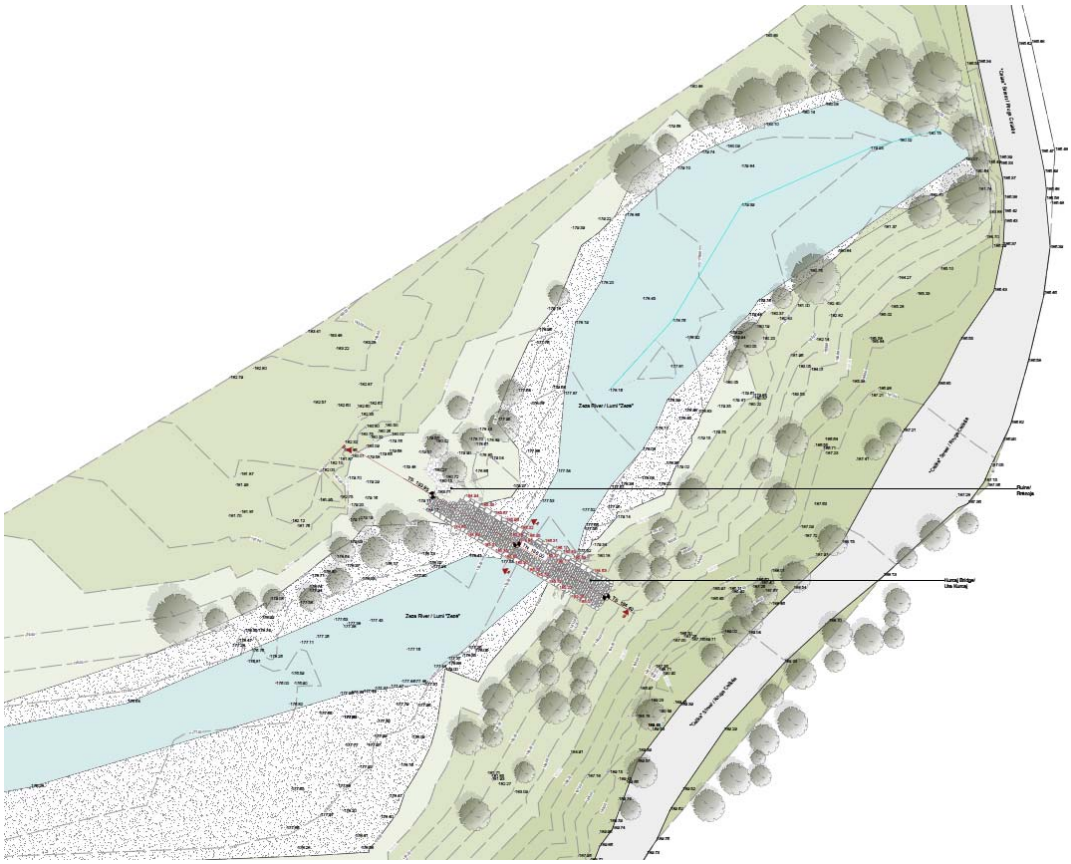

Fig. 8. General site plan-current condition

3.2 GEOMETRY AND MATERIALS

Kurcaj Bridge is an 18th century construction. The structure is a masonry object with stone retaining walls. It is a bridge with three circular vaults. The vault with light space about 6.3m wide was damaged during World War II and repaired afterwards.

Typologically it represents the bridge with a circular vault and two discharge windows between them. The main bridge's elements of the Kurcaj bridge are listed below:

a. foundations and retaining walls
b. arms
c. vaults
d. front walls with fillings between them
e. two discharge or relief windows
f. cobbled paving
g. parapet

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

This bridge represents a structure with a stone arch and a light space of about 6.3 m covered with cobblestones currently 17.5m long. This large bridge rises with a fairly high ridge at the ankle of the large arch above the course of the Zeza River, and with two relief windows on either side of it. The large arch with a space of 6.3m is made with a double arch of 90cm.

The arches of the discharge windows with a radius of about 70-75cm with a height of 180cm and a width of 110cm, with a stone arch worked on their entire perimeter, have made it possible to relieve the shock forces of water in moments of heavy rainfall.

According to the survey, the bridge is 17.15m long and 2.85m wide. The front walls of the bridges of this period were built with a thickness of 50 - 60cm and the internal volume betwën the front walls from the sides, the ridge of the arch and from below the cobblestone was filled from above with irregular stone wall in the form of concrete but sometimes with only stones and debris without binder mortar.

The two discharge windows on the shores are of the original phase of the bridge. The original cobblestone is preserved on the right side, with river stones with transverse stripes on the climbs. The cobblestones have safety parapets, with stone walls. Cobblestone surface 50m2 / length = 17.15m / width = 2.85m / Height of the main arch 6.3m. Above it there was a parapet with stone columns 0.4m high embedded in the masonry of the bridge, according to the direction parallel to the axis of the arch of the bridge, but today it is deteriorated.

Fig. 9. Photo of the Kurcaj bridge

Fig. 10. Photo of the Kurcaj bridge

The cobblestones are worked with cross stones with transverse strips every 0.80-1.0 m to facilitate the climb on the rather sloping ridge, which is created at the ankle of the large arch of the bridge. Ridge bridges are characterized by transverse safety belts as crossing with animal caravans and in wet conditions reduces the possibility of slipping. Cobblestone has been secured on both sides with stone parapet 0.40 m high. The way of solving the parapet of the crossing part of the bridge, is with columns, vertical blocks of stone embedded every 0.6-0.7 m in the wall of the bridge with spaces between, with vertical blocks of the same section supported on cobblestones.

The cobblestones are worked with cross stones with transverse strips every 0.80-1.0 m to facilitate the climb on the rather steep ridge, which is created at the ankle of the large arch of the bridge. Ridge bridges are characterized by transverse safety belts as crossing with animal caravans and in wet conditions reduces the possibility of slipping. The cobblestones were secured on both sides with stone parapets 0.40 m high.

The cobblestones of the bridge are partially deteriorated and need maintenance, although it can be said that it preserves well the composition and its basic elements. The slope of the cobblestone is at levels 10-20%.

The bridge's pathway's parapet is built with vertical blocks of stone embedded every 0.6-0.7 m in the wall of the bridge with spaces in between, with vertical blocks of the same section supported on cobblestones. The vault is built more carefully than the interior of the vault with carved stone slabs. The front parapets of the retaining walls are built with regular stones that create distinct horizontal joints.

Fig. 11. Photo of the bridge, visible elemens: the vault, the right niche, the parapet and the frontal retaining wall.

Fig. 12. Photos of the bridge wings.

Fig. 13. Photo of the bridge, current condition

Fig. 14. Photos of the bridge, current condition: damages on the bridge's wings; stone wall decay; moss and humidity; deterioration of the vault stones due to reaction between atmospheric agents+humidity+river bank activity; inappropriate added layers (lime mortar) in an attemp to preserve the bridge.

The current condition of the bridge is problematic as there are several considerable deteriorations visible. Thus these should be addressed as soon as possible, so as to maintain the static balance of the structure.

3.3 STRUCTURAL CONDITION

3.3.1 STRUCTURAL STABILITY

As mentioned in the chapters above, the left bridge window enclosure has incited the left wing of the bridge to collapse. Fortunately, there are no dangerous cracks in the structure, but there are some cracks in different parts that come from the deterioration of the walls materials over time and the longevity of the bridge. There are cracks in the facade, arches ad detachments of the integrity of the elements in the facades. The bridge's deteriorations are mainly caused from the abandonment and consumption of the structure over time, as well as major events such as earthquakes, floods, etc., which have contributed to the aggravation of the current situation.

3.3.2 LOCAL DETERIORATIONS OF THE BRIDGE

The Kurcaj Bridge is built with local stones and lime mortar, materials which have suffered many deteriorations over time. There can be visibly identified stone detachments in different sections of

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

the bridge, as well as the partial the collapse of the bridge parapet. The lime mortar layer has suffered deteriorations which will be explained in further details in the chapters below. LikewiseThe presence of vegetation on the bridge is noticed. Over the years, low and high greenery has sprouted on the cobblestones and on the sides of the bridge. There is a lack of cobblestones in a part of the bridge. There is generally a lack of elements and constant consumption of the material.

Fig. 15. Kurcaj Bridge view

Fig. 16. Detached stone wall on the right side of the Kurcaj bridge

Fig. 17. The unpaved road that connected the Kurcaj bridge in the south

Fig. 18. Detachment of the Kurcaj bridge from the ground in the northern part

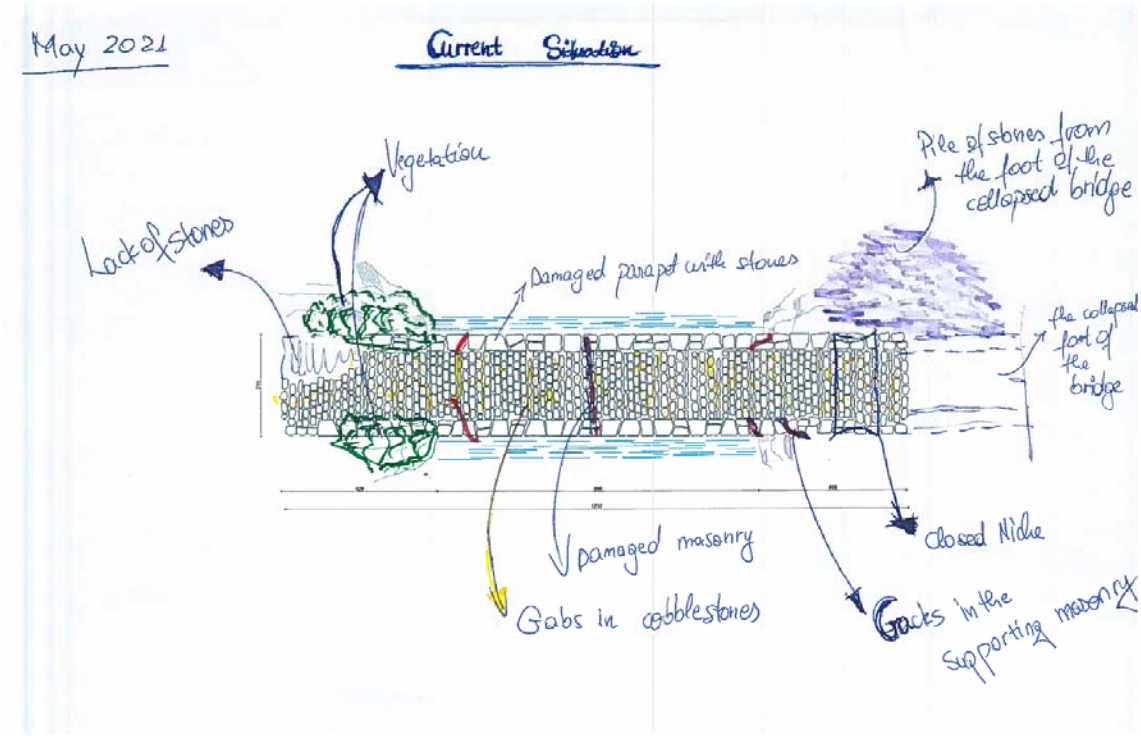

Fig. 19. Current condition of the Kurcaj bridge

The current condition of the bridge (plan wise) is not good due to the deterioration of the cobblestone, the parapet, the presence of low and high vegetation as well as the presence of biological patina. Also, comparing the current plan of the bridge with the plan extracted from the archive, one notices the collapse of the bridge on both its sides. On the left side, 6.11 m of the bridge collapsed and on the right side 0.68 m.

By observing the current condition of the bridge, there have been identified some problems due to the lack of maintenance over the years, the interaction between many agents such as: the atmosphere, the humidity, the river bank activity and the low and high vegetation, which have damaged the foundation of the right wing of the bridge, as well as the front walls and the fillings between them.

The basic element with which the contact of the building with the terrain is realized is the foundation of the bridge, which plays an important role in the stability of the bridge. In order to withstand the horizontal and vertical loads given by the arch during the construction of the bridge, it has been attempted to rest on a considerable part of it on the rock (left side foundation) as seen in the picture, but on the other side of the foundation. To the right it is detached from the structure with the wing altogether as a result of the shocks of the driving force of the water during the period of precipitation.

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

Fig. 20. Damage to the Kurcaj bridge

Fig. 21. Vegetation on the bridge and damaged parapet

Fig. 22. Cracking on the inner wall.

Fig. 23. Enclosure of the detached window.

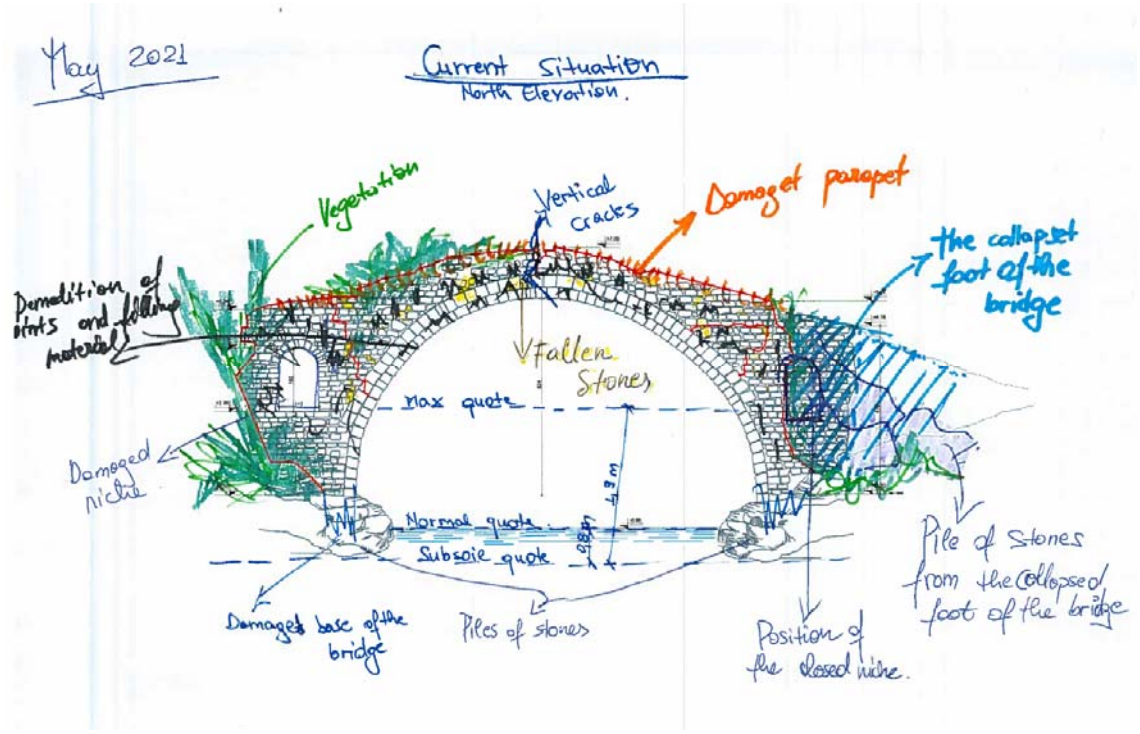

Fig. 24. Current Condition of the Bridge

The presence of moisture is noticed especially in the vault of the bridge. Decomposition of joints and filler material is observed on almost the entire surface of the bridge. In the upper parts on both sides of the bridge there is the presence of cement mortar in the joints between the stones, which is an unsuitable material for the bridge.

During the site visit, few cracks were found in the walls of the bridge and in the vault, as well as partial collapse of the walls or detachment of the integrity of the elements.
Damage to the building has come mainly as a result of successive degradations over time. Major events such as earthquakes, floods, etc. have contributed to the aggravation of the existing situation.

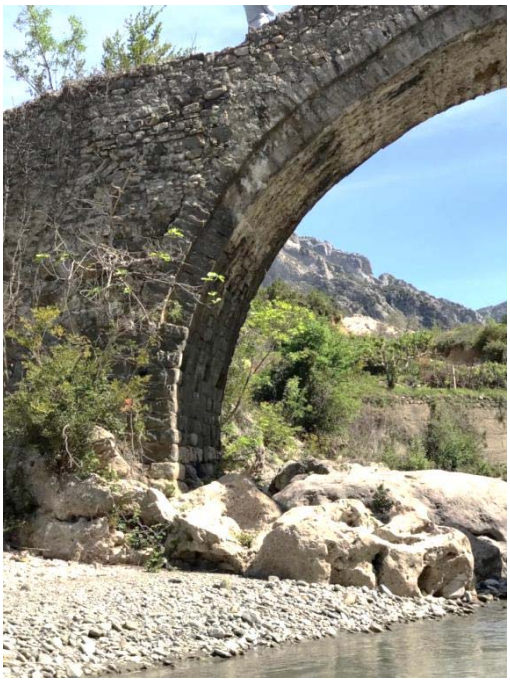

Fig. 25. The left arm of the bridge rests on the stone foundations

Fig. 26. Detached right wing of the bridge

Fig. 27. Calcification and leakage of the mortar layer

Fig. 28. Cracks on the vault

Fig. 29. Repairs during different periods of time adding inappropriate layers, which, by interacting with chemical and atmospheric agents have damaged the foundations of the Kurcaj bridge

By analyzing the current condition of the bridge there can be identified some problems as a result of the negligence shown towards this monument over the years. However, more specifically, there are other factors that have accelerated the degree of deterioration in the bridge such as:
-The river activity itself, which was modified at the moment when the left chamber was closed. The flow of the river meets the obstacle in it, exerting pressure on the structure, pressure which would normally be discharged symmetrically through the chambers.
-Low and high vegetation, aggressive plants, which have corroded the bridge materials by chemically interacting with them under the effects of atmospheric agents.
-Asymmetric discharge of the water pressure has damaged the foundation of the right wing of the bridge as well as the front walls or fillings between them, reducing the stability of the bridge.

The basic element with which the contact of the building with the terrain is realized is the foundation of the bridge, which has a special importance in the stability of the bridge. In order to withstand the horizontal and vertical loads given by the arch during the construction of the bridge, it has been attempted to support a considerable part of it on the rock (left side foundation) as seen in the picture, but on the other side of the foundation to the right it has fallen together with the arm as a result of the shocks of the driving force of the water in the period of precipitation.

Fig. 30. The right wing of the bridge over the sole of the Black River

Fig. 31. Greenery on the side walls

So, to summarize the mentioned above, the problems and deteriorations in the Kurcaj bridge over the years are as follows:

- The right foot of the bridge has collapsed
- Cracks between the retaining wall and the lime mortar fillings.
- Broken parapet frames / Detached frames on both sides of the bridge
- Gaps in the cobblestone paving of the bridge as well as the pathway on both sides of the bridge
- Decomposition of joints in the filler material
- Moss created at the bottom of the wall
- Presence of vegetation on both sides of the bridge and in the bridge structure.
- Water penetration at the foot of the bridge

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

- Cracks in the upper masonry of the arch
- Cracks of the supporting masonry at the wing of the bridge
- Horizontal cracks in the inner arch of the bridge (right wing)
- Piles of stones at the foot of the bridge
- Moisture in the arch part
- Lack of elements, open masonry, detached stones, gaps in the facades of the bridge
- Continuous consumption of the bridge materials.
- Damaged bridge pier
- Vertical cracks between the outer wall with relatively carved stones and the inner stone fills
- Niche closed on one side of the bridge.
- There is a phenomenon of calcification and dissolution of lime mortar in the inner part of the arch. This phenomenon not only aesthetically damages the surface but also damages the material of the stone itself by calcifying it.

4. RESTORATION INTERVENTIONS

4.1 SITE EVALUATION

Kurçaj Bridge is located south of Kruja at the entrance of Kurçaj village on the Kruja side, on the Zeza River that derives from Qafa e Shtamës.

Kurçaj Bridge served the short caravan route Tirana-Kruja according to this route: Tirana-Zall Herr-Rradhesh-Mukaj-Buronjë-Kurçaj-Barkanesh-Krujë, with a distance of 28km away from the center of Tirana about 54min. Distance from main Road Tirana - Kamez - Fushe Krujë is 14.7 km.

- Access

The monument is accessed by a damaged highway.
At the urban level, it is proposed to systematize the connecting infrastructure and place information boards close to monument.

- Bridge

Due to the geographical position of the bridge and its symbol as a short route of the Tirana-Kruja route, we propose the completion of the fallen part of it in order to connect both sides of the river bank.

- Viewpoint

During the visit to the site it was noticed that a suitable area to create a viewpoint, which serves as a parking area but also a viewing point for the monument.

- Protective walls

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

Based on the data obtained at the site of the facility, river inflows have caused damage to the bridge foundation. It is proposed to place on both sides of the bridge, without compromising the integrity of the monument, on its right side, protective stone walls.

4.2 GEOMETRY AND MATERIALS

The conservation and restoration interventions are related to restoring the bridge to its original state of construction. As it was found in the analysis of the existing condition, a part of the bridge has collapsed and will be rebuilt implementing to traditional techniques, using traditional materials such as local stones and hydraulic lime mortar. The 6.11 m bridge on the left side and 0.68 m on the right side will be rebuilt.

These restoration interventions on the bridge are proposed, in order to preserve the configuration and authenticity (both in structure and materials) of the Kurcaj bridge, as listed below:

- ✓ The cracks will be filled implementing the internal injection technique to avoid further disintegration of the mortar and detachment of bridge parts.
- ✓ Clean the vegetation and biological patina with a metallic brush.
- ✓ Clean the aggressive vegetation which has altered the structure of the bridge by means of herbicidal products.
- ✓ To restore the stone walls with the stitching technique using authentic materials: local stones.
- ✓ Replace any subsequent inappropriate material / additives / coatings with original and authentic materials to restore the bridge to its original condition. These materials should be local to be easily found (stones, cobblestones, etc.)
- ✓ The cracks in the surface of the retained walls will be filled with lime mortar. Keep in mind that the material will have as few additives as possible so as not to react with the material further damaging it.
- ✓ Reopen the closed left chamber to return to the initial state and to reorient the river current as it was in the initial original state.
- ✓ The stones and joints should be cleaned with a carbon sand compressor
- ✓ The stone walls should be refilled with natural stones where there are modifications / detachments
- ✓ Consider using traditional materials processing and restoration techniques as much as possible.

4.3 STABILIZATION OF THE BRIDGE'S STRUCTURE

According to the selected type of interventions (check the indications by the Technical Council 4.1 and 4.2) the bridge will be stabilized according to the requirements of invulnerability for a seismic event with a return period of 425 years. Thus, ensuring the stability of the bridge will be made possible through structural interventions which are proposed in order to fulfill the following purposes: strengthening the bridge wings, rebuilding the parapet of the retaining wall of the bridge, strengthening the foundation, rebuilding the collapsed wing, consolidation and restoration of the

arch and the facades, structural filling of the cracks and joints with lime mortar, cleaning of joints and stones so as to avoid the material's calcification, return of the enclosed niche to its original state, and finally, restoration of the upper cobblestone and the parapets of the bridge with natural stones and mortar, implementing traditional techniques.

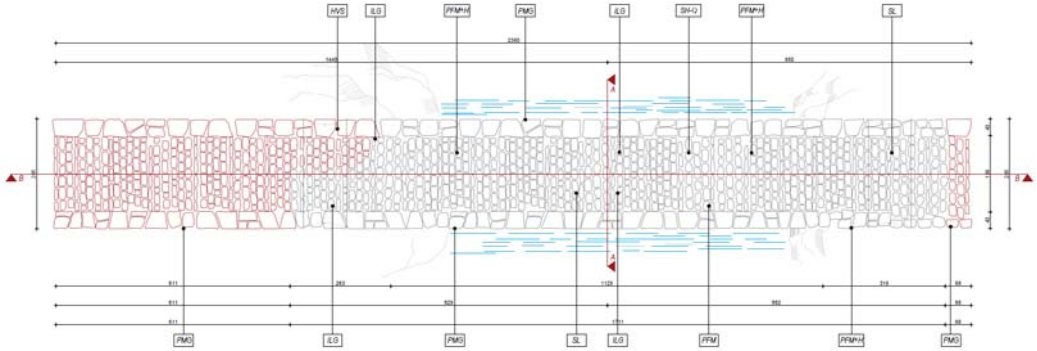

Fig. 32. Conservation plan of the Kurcaj Bridge

The restoration interventions consist of eliminating the bridge deteriorations ascertained and described in the chapters above, preserving the monument's originality, implementing traditional techniques.

In summary, the conservation interventions consist of:

- Restoration of the cracks by internal injection;
- Cleaning of the biological patina;
- Cleaning of the aggressive plants;
- Restoration of the stone wall with the stitching technique;
- Filling the joints with mortar;
- Removal of the innappropriately added volume/surfacess;
- Cleaning of stones and joints;
- Filling with stone wall;
- Consolidation of the parapet with local stones.

The reinforcement intervention in the structure will be executed according to the following stages:

- ✓ Clearing the square of vegetation and debris
- ✓ River bank protection
- ✓ Building sub-foundations in the areas where the bridge is supported.
- ✓ Temporary protective/insulating coating of the arch and sides.
- ✓ Molding the supporting structure of the whole bridge, the arch from the bottom and the side faces.
- ✓ Cleaning the filling masonry of the bridge without touching the sides and the lower arch.

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

- ✓ Consolidation and restoration of the arch and the sides. Structural filling of the cracks ans joints with mortar. This will happen by making partial openings of the formworks and its restoration by realizing structural scaffolding to so as to restore the arch and the facades.
- ✓ Cleaning of joints and stones from calcification and oxidation layers.
- ✓ Application of steel rods with partial upper opening, drilling and injecting in the stone material at the side face.
- ✓ Reinforcement of the arch with metallic cables.
- ✓ Reopening of the enclosed niche by stitching technique and the cracks will be sutured by internal injection of Mortar from the window sides.
- ✓ Removal of the structural scaffolding
- ✓ Systems for protection from the erosion on the foundations of the bridge.
- ✓ Upper paving of the bridge with cobblestone and filling the parapets of the bridge with local stones and mortar.
- ✓ Installation of monitoring benchmarks according to the project
- ✓ Removal of the construction site and return of the work area to its natural state according to the architectural landscape

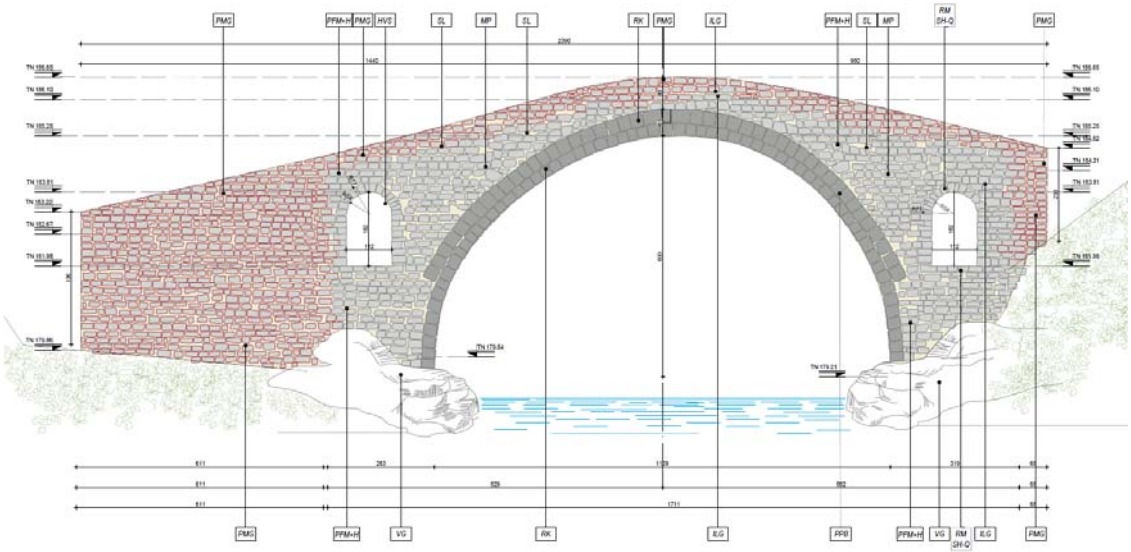

Fig. 33. Southern view of the Bridge

5. FINAL OUTLOOK OF THE RESTORATION PROPOSAL

First, in addition to the conservation of the bridge, it is proposed to supplement the systems with auxiliary elements for the access of the bridge by visitors. More specifically, a ramp to the east is proposed, with the intent to connect the existing bridge with the road. In addition to the connecting function in the urban situation where the bridge is located, the ramp will create opportunities for

UN House Skanderbeg Strët, Gurten Building 3rd Floor, Tirana, Albania, www.unops.org
Rr. "E Kosovarëve", Nd.35, H. 6,Ap.4/1,Njësia Administrative Nr. 5,1019, Tiranë, Shqipëri info@atelier4.al

access to the bridge by all visitors, including PWDs, to facilitate the discovery of the landscape, despite its sloppiness.

Secondly, a staircase is proposed on the west side of the bridge, adjacent to it, in order to make it possible or the visitors to descend to the ground towards the river. These field interventions aim to integrate the bridge with the landscape to give it the deserved importance as a first category heritage monument as well as to make it a part of the urban situation which obviously needed vitality. In this way, the area comes alive by creating some points of interest.

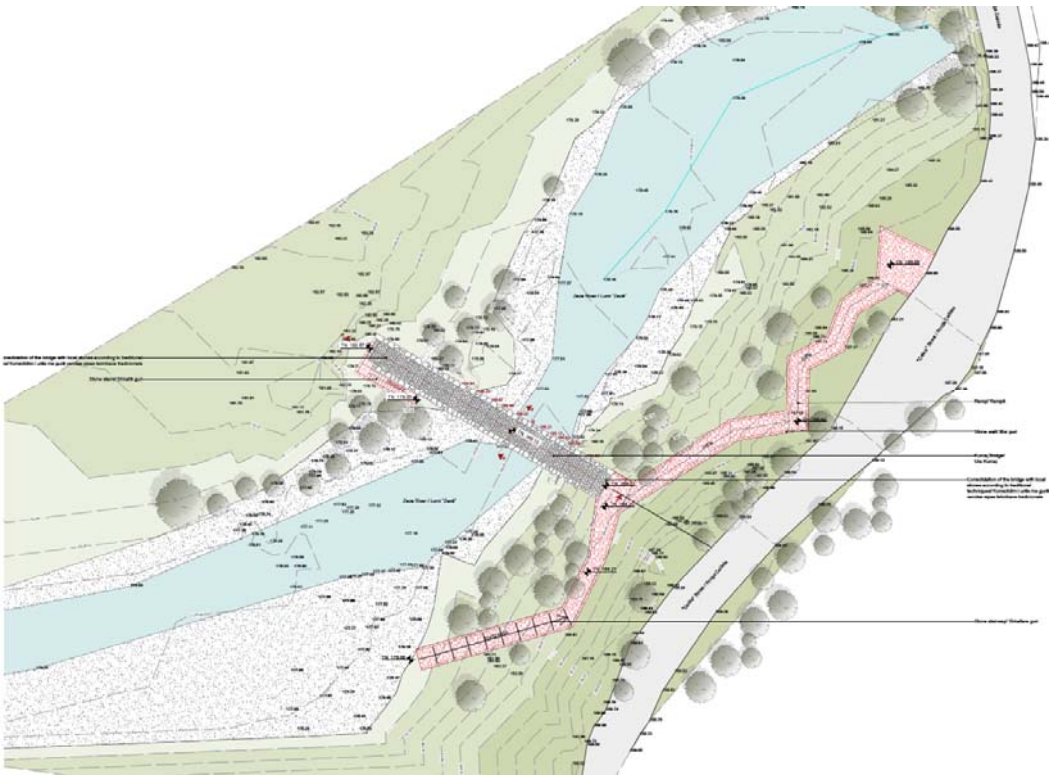

Fig. 34. General Site Plan, Final Outlook

It is proposed that the ramp will be built with local materials. It is specifically proposed the construction of side retaining walls with local stones that will serve as a parapet for the ramp, filled with kave stone, a layer of gravel above them. Afterwards, the final layer of the pathway will be with cobblestones.
The staircase in the west is proposed to be built with local stone while implementing traditional construction techniques which reminisce the original bridge.

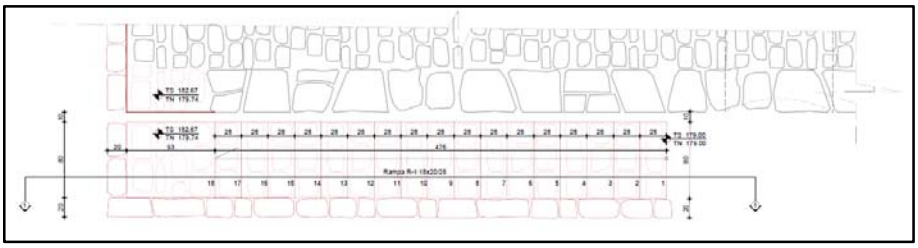

Fig. 35. Western Ramp Detail-Proposal

Fig. 36. Bridge's 3D Visualization

Fig. 37. Bridge's 3D Visualization

Fig. 38. Bridge's 3D Visualization

Fig. 39. Bridge's 3D Visualization

Fig. 40. Bridge's 3D Visualization

Fig. 41. Landscape visualization